

**FLORISTIC AND ETHNOBOTANICAL ENUMERATION OF
THAL DESERT, PUNJAB, PAKISTAN**



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**FLORISTIC AND ETHNOBOTANICAL ENUMERATION OF
THAL DESERT, PUNJAB, PAKISTAN**

by

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in

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Department of Botany

Faculty of Sciences

Pir Mehr Ali Shah

Arid Agriculture University Rawalpindi

Pakistan

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CERTIFICATION

I hereby undertake that this research is an original and no part of this thesis falls under plagiarism. If found otherwise, at any stage, I will be responsible for the consequences.

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Certified that the content and form of thesis entitled **“Floristic and Ethnobotanical Enumeration of Thal Desert, Punjab, Pakistan”** submitted by Miss Humaira Shaheen have been found satisfactory for requirement of the degree.

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DEDICATED

TO

My Parents

*To toil and sweet of affectionate
Parents as moral support,
Enshrined and grafted
In me untiring zeal
To get on the
Higher ideals
Of life*

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ABSTRACT

Thal Desert, Pakistan has unique flora with reference to xeric conditions. Like other desert ecosystems of the country, this desert has been ignored to document the plant biodiversity and its ethnobotanical uses. Keeping in view, the area was surveyed to record flora and ethnobotanical information during September, 2011 to August, 2014. A total of 248 species distributed across 166 genera and 38 families were identified during the survey period. Besides, *Heliotropium pakistanicum*, *H. crispum* var. *angulosum* and *H. europaeum* subsp. *thaliensis* are determined as addition to science, while *Themeda triandra* as new recorded for Pakistan. It includes one fern, 4 monocots and 33 dicots families were determined. The most dominating family was Poaceae that contributed 52 species (21.49%), followed by Fabaceae (34 spp., 13.05%) and Amaranthaceae & Asteraceae (17 spp., 7.02% each), Boraginaceae (11 spp., 4.5%), Brassicaceae, Cyperaceae, Euphorbiaceae, Solanaceae (8 spp., 3.31% each), while, rest of the families contributed few number of species. The flora comprised on nine life span in which 122 species (46.74%) were herbaceous nature, followed by grasses (51 spp., 19.54%), trees (28 spp., 10.73%), shrubs (27 spp., 10.34%), sedges (9 spp., 3.45%) and climbers (3.07%).

With reference to ethnobotanical study, local inhabitants utilize native flora to fulfill their eight use needs such as folk medicine, fuel, fruits, vegetable, fodder/forage, ethno veterinary, soil binder and others. Most of the species were recognized as palatable by the herders and used as fodder (234 spp., 35.62%), followed by folk medicine (120 spp., 18.26%), fuel (108 spp., 16.44%), others (64

spp., 9.74%), soil binder (48 spp., 7.31%), wild fruits (40 spp., 6.09%), vegetables (25 spp., 3.81%) and Ethno veterinary (18 spp., 2.74%). Compared to the medicinal literature, four species viz., *Limeum indicum*, *Launaea residifolia*, *Farsetia jacquemontii* and *Indigofera hochstetteri* possessed novel medicinal uses not earlier reported in the literature. Besides, 76 species possessed new uses in addition to the medicinal records. *Capparis decidua* (Kareh), *Moringa oleifera* (Suhanjna), *Prosopis cineraria* (Jand), *Salvadora oleoides* (Pilu) and *Ziziphus spinachristi* (Jhar beri) were highly utilized species and ranked first amongst all species which fulfilled six major use categories. This comprehensive study will provide a useful starting point for further ecological and bioprospective research of the study area. The findings of this study will be helpful to foresters, rangeland managers, medicinal plant growers & collectors, economic botanists, ecologists, physiologists, breeders, etc.

INTRODUCTION

1.1 THE STUDY AREA

Thal desert lies 31° 10' N and 71° 30' E in Punjab, Pakistan (Fig. 1.1). This is a subtropical sandy desert that covers 190 x 70 miles. The project area is bounded by the Salt Range in the north, the Indus River flood plains in the west and Jhelum and Chenab River flood plains in the east. This region is divided into the districts of Bhakkar, Khushab, Mianwali, Jhang, Layyah and Muzaffargarh. Geographically, Thal Desert possessed similar geomorphism like Thar and Cholistan (Anonymous, 2008).

1.2 TOPOGRAPHY AND CLIMATE

Thal desert majorly a barren land of sand dunes dominated by prickly shrubs. This desert is characterized by the high wind velocity, massive shifting and rolling of sand dunes; high diurnal variation of temperature; scanty rainfall; extreme solar radiation and high rate of evapo-transpiration. The predominantly this area is covered by sand along with plains and hills.

1.3 VEGETATION

The sporadic and outdated information is available about the vegetation of this desert. Monsi and Khan (1960) reported the natural vegetation of the few sites of Thal Desert. Their work serves as baseline information about the vegetation of the study area.

The area sustains stunted vegetation comprising on scattered thorny or prickly shrubs and perennial herbs having drought enduring properties. The ground possessed scattered few trees. Herbs are very majorly appearing seasonally called

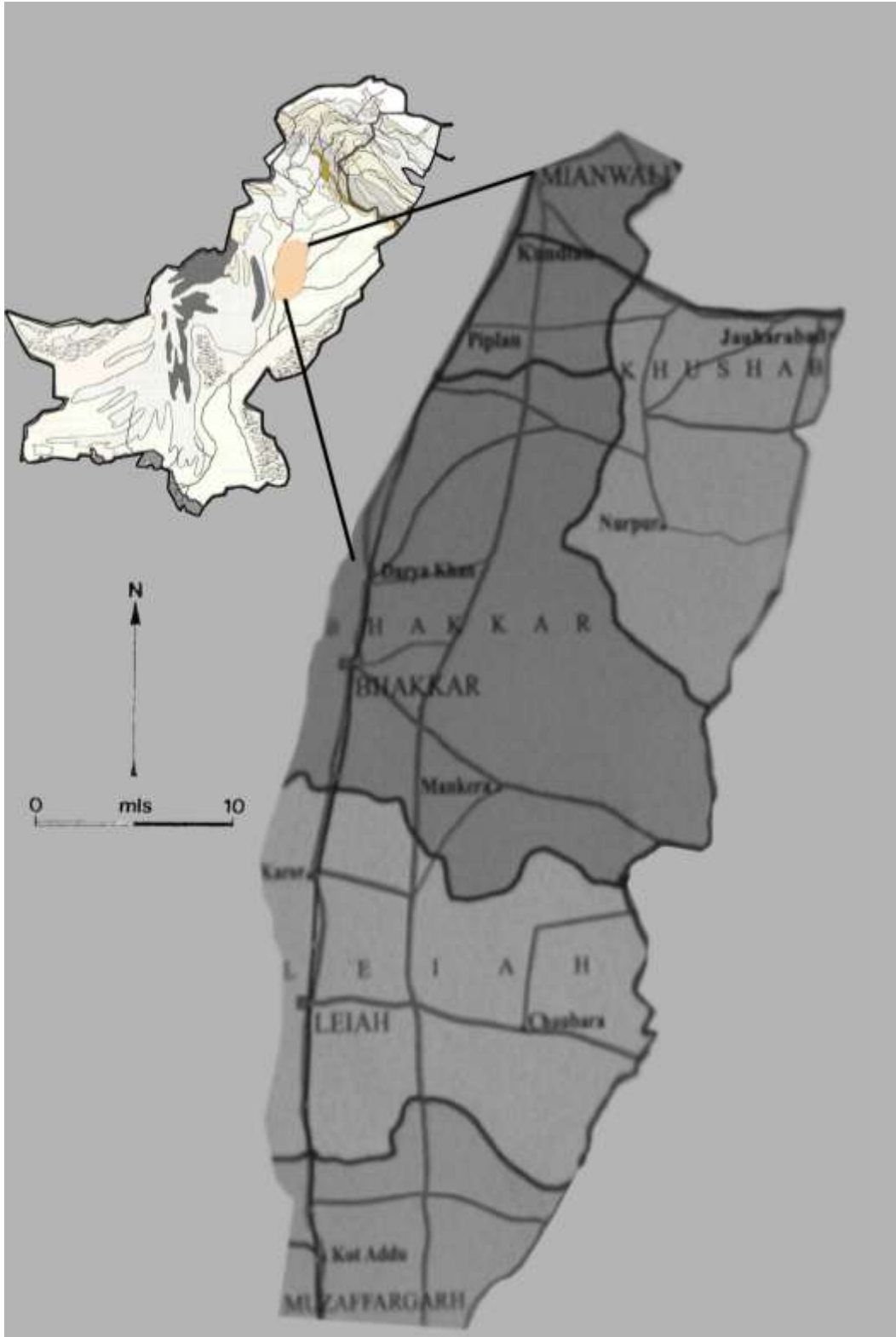


Fig. 1.1: Map showing location of Thal Desert, Punjab, Pakistan.

ephemerals which complete their life cycle within a couple of weeks and shading their seeds before appearance of summer that results most of the area into desolate and barren.

Uncontrolled grazing by the livestock and implacable cutting of trees and shrubs is the common phenomenon in this area that has resulted in environmental degradation. Shrubs and trees are indiscriminately cut for fuel, feed, fencing and construction of huts. This practice is causing gradual disappearance of some species.

There is sporadic information available on the flora and ethnobotany of the Thal Desert except a few papers published by the scholar (Shaheen *et al.*, 2012, 2014), therefore the present work was designed to record the flora and native use of such species from the study area. The objectives of the study were:

1. To collect and identify plant species including endemic and rare/threatened species from different localities of Thal Desert along with taxonomic descriptions.
2. To record native use of plants of the study area.

FLORISTIC SURVEY

2.1 INTRODUCTION

Plant species growing in a particular area is known as Flora. The knowledge of the floristic composition of an area is a prerequisite for any bioecological study and conservation management activities. The study of any particular piece of vegetation, from an ecological point of view based on the facts as they exist on the ground on the one hand and regarding the habitat on the other (Nicholes, 1930). If there is any one set of facts, which is more susceptible to direct study and exact characterization than any other, it is the floristic composition of the vegetation. Therefore, plant taxonomists are recording floras as a routine matter throughout the world for having information about plants. The flora refers listing of species growing in any specific geographical boundary. It comprised of dichotomous keys along with descriptions assisted by Herbarium specimens and collected localities. There is a range of floras ranging from Field Floras to Research Floras available in the world due to diverse climate. A Flora represent a work that may be used for identification of all plants which can be utilized based on a scientific ground. The identification therefore is very important as a key to the literature (van Steenis, 1957).

Various floras written from the world and neighbouring countries for instance Flora of Afghanistan, Flora of India, Flora of Iraq, Flora Iranica, Flora of Bhutan, Flora of Ceylon, etc. (Ali, 2008). Besides, some regional floras of the country are also written (for example, Flora of Karachi, Flora of Lahore District, Flora of Rawalpindi, etc.). Since deserts are difficult to access for being hostile

climatic conditions that resulted to receive less attention by the scientists to carry out floristic study in the country. The first work was carried out by Chudahry and Chutter (1966) on the range flora of Thar Desert (Sindh). Other baseline work was reported by Arshad and Rao (1994) on the flora of Cholistan Desert (Punjab). In connection with these studies, some papers were contributed Nara Desert (Bhatti *et al.*, 1998, 1999, 2001; Qureshi, 2002; Qureshi and Khan, 2001; Qureshi and Bhatti, 2005a, b; 2007a, b and c; 2008a, b and c; Qureshi, 2008a and b). The planned project area was not expedited and the flora is less known (Monsi and Khan, 1960). Because of unexplored area in terms of unavailability of systematic account of the flora, this research work was conducted to invent the plant wealth of this area.

The collected and identified specimens will serve as a reference library for different disciplines of plant sciences at PMAS-Arid Agriculture University, Rawalpindi. The gathered information will be published as “Flora of Thal Desert, Punjab, Pakistan and will be available to national and international institutions for sharing of information with the scientific community.

2.2 REVIEW OF LITERATURE

The information regarding flora and vegetation of the study area is sporadically known. While there is dire need to investigate the target area systematically to find the plant biodiversity, their economical, ecological and social uses by the local communities. Land hunger and anthropogenic manipulations and pressures are causing a great threat to natural flora of Thal desert. According to Ali (2008), the natural flora continues to change with the passage of time due to immigration of species, extinctions and evolution; more so with the current rapidly

changing environmental conditions. These factors necessitate revising the Flora of Pakistan.

A number of floristic studies have been reported from Pakistan. Chaudhary and Chuttar (1966) carried a preliminary floristic survey of Thar Desert, Sindh. They reported 122 species from the study area. Rajput *et al.* (1991) reported 40 plant species belonging to 23 families from Thar Desert, which are being used as medicinal plants for different ailments. A research project has been conducted by Bhatti *et al.* (1998-2001) for the floristic survey of the Nara desert, a Northeastern part of greater Thar Desert. They discovered 149 plant species belonging to 110 genera and 42 families. Subsequently, Qureshi (2004) brought into floristic knowledge and recorded 11 more species from the same area. Likewise, the floristic composition of Gorakh hill (Khirthar range) has been reported by Parveen and Hussain (2007). They recorded 74 species belonging to 62 genera and 34 families.

Ansari *et al.* (1993) published a Floristic list of district Khairpur. Their survey included 80 species belonging to 34 families. The same authors carried out survey of medicinal plants in District Khairpur and indicated that there are 35 species of 23 families. Their work serves as a checklist. Some other workers who contributed in this regard are Ahmed *et al.* (1992), Khan (1962), Malik (1985), Chaudhri (1960 and 1966).

Previously, Ali *et al.* (2001) stated that 12 studies have been carried out to explore the regional floras of Punjab province (Parker, 1956; Qureshi and Chaudhri, 1978, 1988; Stewart, 1952, 1961, 1982). These studies are carried out mainly from urban areas of Punjab. The deserts of this province (Thal and

Cholistan) could not get attention with reference to floristic studies till 80's. In 1987, Chaudhri and Arshad surveyed the Cholistan desert with reference to medicinal plants. They published a checklist of the valuable medicinal flora of the undertaken area. Later on, Arshad and Rao (1994) have recorded the Flora of Cholistan Desert (Systematic list of trees, shrubs and herbs). They also investigated plant-genetic resources of Cholistan desert and their utilization in 1993.

The Thal desert is not yet floristically known. Only, two vegetation studies from the study area are previously known (Monsi and Khan, 1960; Dasti and Agnew, 1994). They recorded monotypic vegetation stand from Cholistan and ThalDeserts of Pakistan. The authors did not describe the existing flora of this desert; therefore, a dire need was being felt amongst the scientific community to explore the area extensively for the floristic enumerations of this desert. The another reason for undertaking this study is due to the advanced technology and time passing there is possibility in successional change in the vegetation over time and more species seems to be recorded. Because Qureshi (2012) explored the Northeastern part of the greater Thar Desert (Nara Desert) and recorded 266 species, higher than the record of 1966 by Chaudhari and Chutter (122 species).

2.3 MATERIALS AND METHODS

The project area was explored thoroughly for collecting plant specimens with regular intervals covering all seasonal variations. The type of collections comprised on following three categories:

2.3.1. Plant collection of herbarium sheets:

During the survey, efforts were made to collect specimens with having a range of variation. The gathered specimens were pressed, dried and mounted on

standard herbarium sheets. These were described and matched with the available literature (Jafri, 1966; Nasir and Ali 1970-1989; Matthew, 1981-83; Batanouny, 1981; Bhandari, 1987; Shetty and Singh, 1987 and 1991; Ali and Nasir 1989-1991; Boulos, 1991; Ali and Qaiser, 1993-1995, 2000-2010; Qureshi, 2012) and identified. The determined voucher specimens were deposited in the herbarium of Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi.

2.3.2 Ancillary collection:

Besides collection of herbarium specimens, this collection was made to preserve flowers and seeds/fruits for description purpose. Similarly some succulent species make poor specimens and need to be preserved in liquid mixture. In all these cases, VX liquid (Spirit Collection) was used. This mixture is used at Kew Herbarium, London, i.e. Copenhagen Mixture: 70% alcohol (ethanol/methanol or IMS), 29% water and 1% glycerol). The presence of glycerol can make specimen to prevent the material from becoming too brittle (Bridson and Forman, 1992).

2.3.3 Carpological collection:

In some cases, dried portion of stem, bark, roots, tubers, fruits, seeds, etc., were preserved in boxes of various sizes. These objects sometimes kept when specimens were bulky nature and preserved in boxes with tight fitting lids. These materials were also cross-referenced to that of the herbarium sheet. In such cases, a dummy sheet possessing the data and cross-reference numbers was kept on the herbarium sheet. A data label indicating family, Plant species, collector and collector's number and other possible related information were attached to the lid of the boxes.

2.3.4 Deposition of specimens:

The identified species are deposited in the herbarium of the Department of Botany, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi for record.

2.3.5 Plan of flora:

The present work mainly deals with angiosperms. The families are arranged according to Cronquist system of classification (1981) except in the few cases in which Hooker's classification (1862-83) is followed for splitting of the families. The family and generic names are provided with the names of authors along with updated descriptions by various workers. The genera and subordinate taxa in the text are given in sequence as their number appeared in keys under each family.

2.3.5 Keys:

Dichotomous keys, based on macroscopic characters are provided for the identification of the rank of family to infra-specific taxa.

2.3.6 Nomenclature:

Naming of taxa is based according to the ICBN. The source of valid combination is that of Flora of Pakistan (Nasir and Ali 1970-1989; Ali and Nasir 1989-1991; Ali and Qaiser, 1993-2010) which was mostly consulted in correct specific name and their systematic affiliation. Wherever, the species is not included in aforesaid work, other regional floras or recent literatures (Cooke, 1903-1908; Jafri, 1966; Matthew, 1981-83; Batanouny, 1981; Boulos, 1991; Shetty and Singh, 1987 and 1991; Bhandari, 1987; Qureshi, 2012) have been cited.

2.3.7 Descriptions:

Most of the descriptions are based on author's own observations. In the case of inadequate material, the descriptions have been borrowed from recent authentic literature.

6.2.5 Specimens examined:

Some selected specimens out of the material examined by the author have been cited to indicate the distribution of the species in the project area.

2.4 RESULTS AND DISCUSSION

2.4.1 SYSTEMATIC ACCOUNT

2.4.1.1 Keys to families:

- 1a. Flowers arranged in cones. Ovules naked,
borne on the surface of megasporophylls.....1. Euphorbiaceae
- 1b. Flowers not arranged in cones. Ovules enclosed in ovary formed
by the stigma bearing carpels:
 - 2a. Embryo with 2 cotyledons; leaf venation usually reticulate; floral parts
4 or 5-merous or in multiple of these numbers, very rarely
in three or sixes.....III. Magnoliopsida
 - 3a. Flowers with both calyx and corolla, hypogynous; petals free:
 - 4a. Placentation parietal or ovules along the ventral suture:
 - 5a. Stamens more than 15:
 - 6a. Ovary borne on a long gynophores.....16. Capparidaceae
 - 6b. Ovary not borne on gynophores:
 - 7a. Carpels 2-many; fruit a capsule.....3. Papaveraceae
 - 7b. Carpel 1; fruit a berry or follicle.....2. Ranunculaceae
 - 5b. Stamens less than 10:

8a. Trees or shrub:

9a. Leaves decomposed; seeds winged.....18. Moringaceae

9b. Leaves simple, small and narrow; seeds

with tuft of hairs.....14. Tamaricaceae

8b. Herbs:

10a. Flower zygomorphic; leaves pinnately divided....4. Fumariaceae

10b. Flower actinomorphic; leaves not pinnately dissected:

11a. Flower cruciform; stamens tetradynamous....17. Brassicaceae

11b. Flowers not cruciform; stamens not tetradynamous:

4b. Placentation axile, basal or apical:

12a. Stamens more than twice the petals:

13a. Sepals imbricate in bud; leaves exsappexulate:

14a. Ovary deeply 2-3-lobed.....27. Zygophyllaceae

14b. Ovary not in lobular form:

13b. Sepals valvate leaves sapexulate:

15a. Stamens monadelphous, united at the base with the petals;

anthers 1-locular.....13.

Malvaceae

15b. Stamens free or connate at the base, free from the petals;

anthers 2-locular.....12. Tiliaceae

12b. Stamens as many or twice as many as the petals:

16a. Placentation free central, ovary 1-locular.....10. Caryophyllaceae

16b. Placentation axile, ovary 2-many-locular:

17a. Leaves digitate with 3 obcordate leaflets;

- stamens 10, united at the base.....28. Oxalidaceae
- 17b. Leaves simple; stamens less 10, free:
- 18a. Receptacle elongated and tapering into a point, the 5,
 1-seeded carpels coalescent round it, the style remaining as
 long twisted
 beak on each segment of the fruit.....29. Geraniaceae
- 18b. Receptacle not much elongated, the ovary apexed by a single
 style; fruit a schizocarpic.....27. Zygophyllaceae
- 19a. Stamens alternate with the petals; ovary 3-celled;
 fruit a capsule.....25. Euphorbiaceae
- 19b. Stamens opposite the petals; ovary 2-4-celled;
 fruit a drup or berry.....26. Rhamnaceae
- 5b. Flowers perigynous:
- 20a. Fruit a legume:
- 21a. Flowers actinomorphic.....20. Mimosaceae
- 21b. Flowers zygomorphic:
- 22a. Flowers papilionaceous; stamens diadelphous.....22. Fabaceae
- 22b. Flowers not papilionaceous; stamens
 notdiadelphous.....21. Caesalpinaceae
- 20b. Fruit various but not legume:
- 23a. Leaves often fleshy; stamens many.....6. Aizoaceae
- 23b. Leaves glaucous or tomentose; stamens definite,
 not more than 10.....9. Molluginaceae
- 4b. Petals united:

24a. Ovary superior:

25a. Corolla regular:

26a. Stamens as many as the corolla lobes:

27a. Stamens opposite the corolla lobes; style lobed or cleft:

28a. Calyx ebracteolate; style 1; fruit capsule.....19. Primulaceae

28b. Calyx bracteolate; styles various; fruit various:

27b. Stamens alternating with corolla lobes, style short...23. Celastraceae

29a. Carpel 2, free, united by their styles or stigma:

30a. Pollen in waxy masses; anthers adnate to the compound stigma.....31. Asclepiadaceae

30b. Pollen not in waxy masses; anthers free from stigma:

29b. Carpel united to form a single ovary:

31a. Ovary deeply 4-lobed; style gynobasic; fruit formed of 2 or 4 nutlets; flowers in helicoids cymes.....35. Boraginaceae

31b. Ovary not deeply divided 4-lobed; style terminal:

32a. Trees or shrubs; stamens 4; style 0; placentation basal.....24. Salvadoraceae

32b. Herbs; Stamens 5; Style 1; placentation parietal:

33a. Acaulescent herbs or rarely with leafy stems; corolla scarious.....38. Plantaginaceae

33b. Caulescent herbs or shrubs; corolla coloured:

34a. Fruit of 2-4 nutlets or drupaceous:

35a. Leaves opposite; corolla \pm zygomorphic...36. Verbenaceae

35b. Leaves alternate; corolla actinomorphic:

- 34b. Fruit a few to many-seeded capsule or berry:
- 36a. Sepals free or united only at the base, the free portion longer than the cup; styles more than 1 (if 1 then branched); ovules 1-2 in each cell.....33. Convolvulaceae
- 36b. Sepals united to form a cup or tube, the apex alone free; style 1; ovules numerous.....32. Solanaceae
- 26b. Stamens fewer than the corolla lobes:
- 37a. Stamens 4, didynamous, mostly shrubs:
- 38a. Corolla convolute in bud; capsule elastically or explosively dehiscent, throwing the discoid seeds from their retinacula.....41. Acanthaceae
- 38b. Corolla imbricate in bud; fruit of 2 or more bony nutlets or drupaceous.....6. Verbenaceae
- 37b. Stamens 2, herbs.....39. Scrophulariaceae
- 25b. Corolla irregular:
- 39a. Stamens 5:40a. Calyx 5-partite; some of the filaments woolly; capsule 2-valved.....39. Scrophulariaceae
- 40b. Calyx tubular-urceolate, closely surrounding the ovary; filaments not woolly; capsule not circumscissile.....32. Solanaceae
- 39b. Stamens 4 or less:
- 41a. Ovule 1 in each of the 1-4 locules:
- 42a. Style gynobasic; fruit achene like nutlets.....37. Lamiaceae
- 42b. Style terminal; fruit a drupe or berry.....36. Verbenaceae
- 41b. Ovules 2-many in each locule or in a 1-locular ovary:

- 43a. Ovary 1-locular; root parasites on higher plants; placentae parietal.....40. Orobanchaceae
- 43b. Ovary 2-locular; stem parasites; placentae axile.....34. Cuscutaceae
- 44a. Corolla lobes rolled up longwise in bud; capsule springing open elastically, often borne on a stalk.....41. Acanthaceae
- 44b. Corolla lobes not rolled up longwise in bud; capsule not springing open elastically, not stalked:
- 23b. Ovary inferior:
- 45a. Tendril bearing herbs; flowers in axillary cyme; fruit a berry.....15. Cucurbitaceae
- 45b. Herbs, shrubs or climbers without tendrils; flowers crowded in heads; fruit a sessile achene.....43. Asteraceae
- 3b. Flowers with one floral envelop (calyx):
- 46a. Flowers bisexual:
- 47a. Leaves with sheathing ochrear stipules.....11. Polygonaceae
- 47b. Leaves exstipulate:
- 48a. Perianth tubular, petaloid; fruits glandular.....5. Nyctaginaceae
- 48b. Perianth not tubular, bract like; fruits not glandular:
- 49a. Flowers bracteate; the bracts and sepals mostly scarious.....8. Amaranthaceae
- 49b. Flowers ebracteate or if bracteate the bracts notscarious.....7. Chenopodiaceae
- 24b. Ovary inferior:

- 50a. Flowers umbel; leaves usually dissected, sheathing at the base; fruit a schizocarp.....30. Apiaceae
- 50b. Flowers solitary to capitate; leaves simple without sheathing; fruit a capsule, berry or drupe..... 42. Rubiaceae
- 2b. Embryo with 1 cotyledon; leaf venation usually parallel; floral parts usually in three or sixes.....IV. Liliopsida
- 51a. Perianth absent. Flowers in the axil of dry, chaffy, usually imbricated bracts (glumes or scales) arranged in spikelets:
- 52a. Leaf sheath splitting (open); fruit a caryopsis.....45. Poaceae
- 52b. Leaf-sheath not splitting (closed); fruit an achene.....44. Cyperaceae
- 51b. Perianth petaloids. Flowers not in the axil of dry, chaffy, imbricated bracts:
- 53a. Flowers surrounded by thread-like or spatulate forked scales, arranged in spikes.....46. Typhaceae
- 53b. Flowers not as above; perianth usually petaloid.....47. Liliaceae

2.4.1.2 Descriptions:

1. EPHEDRACEAE

Ephedra ciliata Fisch. & Mey. ex C.A.Meyer, Monogr. Gatt. Eph. 100 (1846).

Syn: *E. foliata* Boiss., Fl. Or. 5: 716 (1884); *E. foliata* var. *ciliata* Stapf in Akad. Wiss. Wien, Math-Naturwiss. Kl. Denkschr, 56: 49 (1889).

A climbing shrub with many horsetail-like hanging branches up to 2.5 m high. Branches fascicled, slender, light green color, rounded, striate, light and dark green, light ridge and dark furrows, silica diposition on stem; internodes ca. 4-10

cm. Leaves ca. 0.2 x 0.3 cm, opposite, linear, apex acute, margin entire, strigose, deciduous, yellowish green in color.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2613/2437 (PMAS-AAUR)

Field remarks: A rare species mostly found associated with *Salvadora oleoides* and *Capparis decidua*.

Distribution: C. Asia, Iran, Afghanistan and Pakistan (Nasir, 1973).

2. RANUNCULACEAE

Key to species:

- 1a. All leaves entire to tripartite with broad, incised dentate segments.....1. *R. muricatus*
 1b. Basal leaves entire or trifid.....2. *R. arvensis*

1. *Ranunculus muricatus* L., Sp. Pl. ed. 1: 555 (1953); Boiss., Fl. Or. 1: 56 (1867); Hook.f. & Thoms in Hook.f., Fl. Brit. Ind. 1: 20 (1872); Stewart Ann. Catalogue Vasc. Pl. W. Pak. & Kashm. 271 (1972).

An annual small erect, glabrous herb up to 60 cm high. Stem much branched, smooth, rounded; internode ca. 1.2cm, light greenish in color, the basal upper branches dark green, succulent. Leaves rosette and clustered at base and upper alternately arrange, ca. 2.5 x 3.5 cm; 3-lobed, orbicular, each lobe deeply incised with triangular broadly acute apex, white long hairs at petiole, base glabrous, green, reticulate venation; petiole ca. 2-5.5 cm long. Inflorescences solitary, peduncles arised from base, ca. 1-3 cm. Flower complete, ca. 6-12 x 6cm, yellow; pedicle ca. 1.7-2 cm, rounded, glabrous, green. Sepals 5, polysepalous, ca. 9-10 x 3 mm, lanceolate, apex broadly acute, light green or hyaline at base and dark

green at apex sparsely setose. Petals 5, polypetalous, ca. 10 x 4 mm, ovate-obovate, apex and cunate at the base, margin entire, yellow. Stamens 10, free, spatulate, yellow; filament ca. 5-6 mm long; anther slightly curved, ca. 3 x 1mm. Ovary 15 ovules, ca. 0.4 x 0.2mm, syncarpous, ovate, pubescent, ovules oblique elliptic; style and stigma margin serrate and hyaline. Achenes ca. 5-6 mm long, ovate, arranged in a large globose head, inserted on a pubescent receptacle, compressed, with a broad sulcate border, beak sides spiny, tubercled or nearly smooth, beak broadly triangular, flat, usually straight.

Fl. Per.: March-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2182 (PMAS-AAUR).

Distribution: Atlantic and S. Europe, Asia, Crimea, Caucasus, S. Siberia, Pakistan, India (Nasir, 1973).

2. *Ranunculus arvensis* L., Sp. Pl. ed. 1: 555 (1753); Boiss., Fl. Or. 1: 57 (1867), Hook.f. & Thoms. in Hook.f., fl. Brit. Ind. 1: 20 (1872).

An annual erect herb up to 50 cm high. Stem much branched; internodes ca. 2-3cm, sparsely glandular hairy. Leaves alternately arrangement, ca. 2-3.5cm, obovate-spathulate to oblanceolate, base cuneate, apex incised or with a few irregular teeth, both surfaces slightly glandular hairy; petiole ca. 1-2.5cm long. Other leaves 3-partite to ternate with obovate-spathulate segments again deeply divided into linear, 3-toothed or entire lobes ca. 2-6 mm wide. Inflorescences solitary axillary; pedicel ca. 1-1.5cm long; hairy, apposite sessile at pedicel base. Flowers a. 5-12 mm in diameter, yellow to greenish-yellow. Sepals 5, patent, with long hairs outside, polysepalous, ca. 10 x 3 mm, obovate, indistinctly clawed, long hairs outer

surface. Petals 5, polypetalous, ca. 10 x 6 mm, ovate to spatulate, base narrow to cunate, apex rounded, yellow. Stamens 10-12; filament ca. 6 mm, free, smooth and slightly flat; anther linear and slightly curved, yellow, basifixed. Ovary 4-8-locular, ca. 4-6 mm long, obovate, strongly compressed with a broad sulcate border, prickly or tuberculate, pubescent, each have its own stigma and style; style long slightly curved; stigma cylindrical,

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2144 (PMAS-AAUR).

Fl. Per.: March-April.

Distribution: Europe through S. Siberia, Western and S. W. Asia to India and the Himalaya (Nasir, 1973).

3. PAPAVERACEAE

Key to genera:

- 1a. Stamens and carpels indefinite.....1. Argemone
1b. Stamens 4; carpels 2.....2. Hypecoun

1. *Argemone mexicana* L., Sp. Pl. 508 (1753); Jafri, Fl. Karachi 129 (1966); Fedde in Engler & Prantl, Nat. P flanzefam. ed. 2, 17b: 107 (1936).

An annual prickly herb upto 125 cm tall. Stem much branched, herbaceous, sub-angular with yellowish milky latex; internodes ca. 5-7cm, greenish yellow. Spines yellowish creamy; pointed tip and base broad, spines at upper branches small but long at lower branches, ca.1-1.3mm. Leaves alternate, ca. 5-10 x 4-4.5cm, semi-amplexicaul, 6-8 pinnatifid, elliptic, apex prickly acute, margin entire and prickly serrate, midvein prominent at lower side with spines, spine yellow to creamy, green. Inflorescences solatiry to racemose. Flower sometime sessile or

pedicelate, complete, ca. 2.5-3 x 4 cm, yellow, subtended by 2-3 foliaceous bracts; pedicle ca. 2.1cm; prickly. Sepals 6, polysepalous, ca. 1.5 x 0.6 cm, green yellow, prickly at outer surface, terete, horn below the apex, spines ca. 8 mm. Petals 6, polypetalous, alternating to sepals, ca. 2.5-3 x 1.5 cm, base cauline, apex rounded and serrate, margin entire, yellow. Stamens free, numerous, long and short, alternate to each other, long filament ca. 8-9 cm, small filament ca. 5-6 cm, long anthers yellow, ca. 3 x 1 mm. Ovary prickly ovate to elliptic; spines long and yellow, ca. 6-7 mm, perianth placentation; stigma red, 3-6 lobed, lobes usually broad. Capsule oblong or elliptic-oblong with rounded ribs, ca. 2.5-4 x 1.2-2 cm, covered with sharp erect prickles; valves 3-6. Seeds many, blackish brown to brown, \pm rounded, ca. 1.5-2 mm in diam, with fine, conspicuous tuberculae.

Fl.Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2153 (PMAS-AAUR).

Distribution: Native of West Indies and Mexico, but naturalized in most of the warm countries of the world as a weed (Nasir, 1973).

2. *Hypocoum leptocarpum* Hook. f. & Thoms., Fl. Ind. 1: 276 (1855).

An erect annual herb up to 20 cm high. Stems smooth, single branched emerged from rosette like cauline leaves, sometimes dichotomously branched emerged from the rosette leaves, sometimes these branches dichotomously branched above at flowering stage, glabrous, shiny, greenish yellow in color; internodes ca. 5.6-7cm. Leaves rosette at the cauline stem, lamina divided into numbers of leaflets, ca. 2-6cm long, smooth, shiny, glabrous; leaflets apex acute, margin entire, single midrib; petiole 4-5.5cm long. Inflorescence terminal or

solitary; peduncle 4-5cm. Bracts 4-5, unequal, ca. 1-1.7cm, encircled the floral axis. Sepals 2, conical, ca. 0.3-0.4 x 0.2-0.3mm, margin tooth like serrate, apex apiculate, whitish green in color. Petals 4, polypetalous, ca. 0.6-0.7 x 0.2-0.3mm, lanceolate, apex apiculate, margin smooth, yellow in color. Stamens 4, polyandrous; filament ribbon like, ca. 0.5-0.7mm; anther basifixed, apex acute orange to deep yellow, ca. 0.2-0.3mm. Ovary hypogynous, lanceolate, ca. 0.4-0.5mm, many ovuled; style short; stigma bifid. Fruit a cylindrical pod, ca. 5-6cm long, apex acute, ridges and furrows, many seeded; seeds brown in color and tear shape.

Fl.Per.: June-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2181 (PMAS-AAUR).

Distribution: Himalayas, West Pakistan, Turkestan, and Afghanistan (Nasir, 1973).

4. FUMARIACEAE

Fumaria indica (Hausskn.) H.N. Pugsley in Journ. L. Soc. Bot. 44: 313 (1919).

Syn: *F. vaillantii* Loisel var. *indica* Hausskn in Flora, 56: 443 (1873); *F. parviflora* auct. Non Lam.: Burkill, List. Fl. Pl. Baluch. (reprint ed.). 7 (1956); *F. parviflora* ssp. *Vaillantii* (Lois.) Hook. F. & Thomas., Fl. Ind. 1: 238 (1995).

A small erect herb ca. 20-35cm high; branchlets grooved, herbaceous, glabrous, green in color, 5-angular, greenish red lines sometime present at the mature stem, internodes ca. 3-5cm. Leaves alternate, ca. 4.5-5cm, 5-7 pinnatisect;

petiole ca. 1.5-6cm, green in color; pinna ca. 3.5cm, 3-5 leaflets, leaflets ca. 1cm, petiolule ca. 0.5cm, linear, flat, apex acute, slightly red in color, margin entire, glabrous. Inflorescence racemose, 7-15-flowered; peduncle ca.0.5-1.2cm, green, 5-angular, greenish red lines sometime present at maturity, glabrous. Flowers alternately arranged, pinkish white in color, petiole very small. Bract ca. 6 x 2 mm, linear-lanceolate, hyaline, midvein red and base green, apex acute and serrate. Sepals 2, ca. 2 x 2mm, ovate-subovate, apex acute, base amplexicaule, margin irregularly-serrate, glabrous, whitish in color. Petals 4(2+2) polypetalous, 1 free wing like; ca. 9-1 x 1-2mm, spatulate, pinkish white, margin inner color green, margin slightly wavy; spur white in color, dark pink at apex and margin, interiorly green in color, 2- keel ca. 9 x 2mm, jointed at upper apex to form crown; spatulate, margin wavy, apex dark pink, glabrous. Stamens 2, free; filament ca. 6-7mm, 1- outside free, base broad; anther basally attached, 1-innerside crown petal, white in color. ovary globose-elliptic, ca. 3 x 2mm, green in color; style long, slightly curved present inside the keel, ca. 0.5mm; stigma diffuse, yellow in color.

Flowering period: March-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2160 (PMAS-AAUR)

Field remarks: A common weed of wheat crop and waste places (Nasir, 1973).

5. NYCTAGINACEAE

Key to species:

1a. Branches slender, opposite and arising 2 per node; leaves lanceolate

or ovate-lanceolate or oblong; stamens 2.....1. *Boerhavia diandra*

1b. Branches alternate, 1 per node; leaves ovate, oblong to subcordate; stamens 2-3

2a. Flowers in strict axillary cymes, barely exceeding foliage...2. *Boerhavia repens*

2b. Flowers in diffuse terminal panicles, well exceeding the foliage:

3a. Anthocarp turbinate to broadly clavate.....3. *Boerhavia procumbens*

3b. Anthocarp fusiform.....4. *Boerhavia diffusa*

1. *Boerhavia diandra* L., Sp. Pl. 2: 1194 (1753).

A prostrate herb up to 55 cm high. Stem herbaceous, angular, brownish green, glabrous to slightly pubescent; internodes ca. 6-11.5cm. Leave decussate to opposite spirally arranged, exstipulate, ca. 0.6-3.5 x 0.5-3 cm, ovate-lanceolate, apex acute, base truncate, margin slightly serrate and tuberculate, venation arcuate, whitish powdey appearance; petiole ca. 0.5-2cm. Inflorescence simple umble, lateral axillary; peduncle ca. 2.5-4.5cm. Flowers tuberculate. Bracts 2, linear ca. 0.7-1mm, apex acute, midrib prominent, margins and upper surface tuberculate to slightly hairy. Perianth 5, Whitish pink, jointed. Stamens 2; filament curved, basifixed, anther ca. 1.2-1.5 mm, slit longitudinally open. Ovary epigynous, globose, hairy, unilocular, brownish; style long curved; stigma capitate head.

Fl. Per.: Nov.-Jan.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2307 (PMAS-AAUR).

Distribution: A new record for Pakistan (Nasir, 1973).

2. *Boerhavia repens* L., Sp. Pl. 3 (1753); Aschers. & Schweinf. in Schweinf. & Beitr. Zur Fl. Aethiop. 168 (1867).

A small prostate herb attaining to 45 cm tall. Stem herbaceous, much branched, fistular, purplish green; internodes ca. 3-8cm. Leaves opposite, ca. 0.7-

2.3 x 0.4-1.8cm, oblong, base rounded, apex mucronate, margins hairy and sinuate, venation arcuate, upper surface dark green lower surface light green; petiole ca. 0.1-1cm long. stipules at adaxial side of leaf, apex acute, stipules hairy; setose, 2-3 x 1mm. Inflorescence cyme; peduncle ca. 0.7-1cm. Bract ca. 2-3 x 1cm, lanceolate, apex acute, strigose, margin entire. Flowers in clusters, pinkish white in colour, campanulate; pedicel ca. 2 mm. Perianth 5, tubular, ca. 3-4 x 3mm; lobes lanceolate, apex acute, margin smooth to glandular hairy, papillate, purplish green in color. Stamens attached to the ovary disc; filament ca. 5 mm long; anthers basifixed, ca. 1mm across, brown in color. Ovary epigynous, glandular hairy, ca. 1-3 x 1mm, 4-chambered; style ca. 2-3mm long, straight-slightly curve; stigma capitate.

Fl. Per.: Mostly throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2560 (PMAS-AAUR).

Distribution: Tropical Africa and Asia (Nasir, 1973).

3. *Boerhavia procumbens* Banks ex Roxb., Fl. Ind. 1: 148 (1820).

Syn: *B. diffusa* auct. Mult., non L.; *B. coccinea* sensu R.R. Stewart, in Ann. Cat. Vasc. Pl. W. Pak. & Kashm, 233 (1972).

A procumbent brownish green herb up to 50 cm tall. Stem divergately branched, rounded, slightly hairy; internodes ca. 2.5-11.5cm. Leaves opposite, ca. 1-3.7cm x 0.9-2.5cm, ovate or oblong, apex cuspidate- apiculate, base cordate-rounded, margin broadly sinuate, venation arcuate adaxially, reddish brown in color, strigose, powdery appearance at dorsal side, hairy ventrally; petiole ca. 0.5-2.75cm. Inflorescences simple umbel, panicle ca. 3-6 cm, axillary and terminal, 3-10

flowered; peduncle ca. 2.5-3.75cm. Flowers ca. 3-4.5 mm long, pinkish to light purple in color; pedicel ca. 0.2-0.3 mm. Bracts and bracteoles ca. 1-3 mm long, ovate, apex acute-acuminate, bracts and bracteoles hairy, margin entire. Perianth campanulate-funnel form; lobes 5, ca. 3-3.5mm, hairy above, glabrous below, midrib prominent, pinkish to light purple. Stamens 5, exserted; filament ca. 3mm; anther ca. 1mm long. Ovary globose, ca. 3-5mm long; style 5mm, curved shaped style; stigma ca. 0.2mm long; capitate. Anthocarp club-shaped, ca. 3 mm, glandular-hairy, apex rounded, 1 seeded.

Fl. Per.: September-August

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2521 (PMAS-AAUR)

Distribution: Tropical Africa and Asia (Nasir, 1973).

4. *Boerhavia diffusa* L., Sp. Pl., ed. 1, 3 (1753); Nasir in Nasir & Ali., Fl. Pak., 115: 7-9 (1977).

Syn: *B. repens* L., Sp. Pl. 3 (1753); *B. repens* var. *diffusa* (L.) Hook. F. in FBI. 4: 709 (1885).

A perennial ca. 30-55cm long trailing, strigose herb. Stem divaricately branched, greenish white; internodes ca. 2-8.5cm, purplish brown in color. Leaves oppositely arranged, ca. 1.1-3.5 x 0.6-3cm, younger leaves apex broadly acute and older ones rounded, margin sinuate, strigose, base rounded-cordate, purplish brown; petiole ca. 0.5-1.5cm, strigose. Inflorescence a simple umbel; peduncle ca. 1-1.5cm, strigose. Bracts 4, ca. 1 x 0.5 mm, unequal, ovate, apex sharply acute, midrib prominent, strigose above, green brown in color. Bracteoles 3, ca. 0.5 x 0.4mm, unequal, jointed, apex acute, hairs on margin and apex. Perianth ca. 3 x

1mm; sparsely hairy above, midrib prominent, whitish green in color. Stamens 5, exerted; filament ca. 1.5mm, pink; anthers yellow. Ovary perigynous, ovate; style 1-1.2mm long; stigma capitate. Fruit ca. 3-3.5 x 1-1.5 mm, obovoid or subellipsoid, apex rounded, slightly cuneate below, broadly and bluntly 5-ribbed, very glandular throughout.

COMPARISON: Bracts and bractioles different from literature.

FL. Per.: Almost round the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2527 (PMAS-AAUR).

Distribution: S. Asia, India and Pakistan (Nasir, 1973).

6. AIZOACEAE

Key to genera:

- 1a. Style 1.....1. *Trianthema*
- 1b. Styles 2-5:
 - 2a. Raphides very distinct in leaves and sepals. Carpels free.....2. *Gisekia*
 - 2b. Raphides 0. Carpels united:
 - 3a. Plants usually viscid-glandular hairy. Ovary 2-seeded. Fruit a schizocarp.....3. *Limeum*
 - 3b. Plants papilose to glabrous. Ovary many seeded. Fruit a capsule:
 - 4a. Flowers glomerulate; lid of the capsule splitting into 2 valves; style 2; seeds 4.....4. *Zaleya*
 - 4b. Flowers solitary; lid of the capsule remaining in one piece; styles 2-5; seeds more than 4.....5. *Sesuvium*

Key to species:

- 1a. Flowers in clusters. Stamens 5.....1. *T. triquetra*
 1b. Flowers solitary. Stamens 10.....2. *T. portulacastrum*

1. *Trianthema triquetra* Rottl. & Willd. In ges. Naturfr. Berl., Schr. 4: 181 (1803);
 Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 235 (1972);
 Townsed in Nasir and Ali, Fl. Pak., 41: 6(1973).

Syn: *T. crystallina* (auct. plur) Roxb. Fl. Ind. 2: 444 (1832) & *sensu* FBI.
non. Forsk.; Vhla, Symb. Bot. 1: 32 (1790); *T. sedifolia* Visiani, Pl. Aeg. Et Nubia,
 19. t. 3. f. 1 (1836).

A prostrate halophytic herb up to 20-40cm. Stem herbaceous, succulent, light greenish to red colored, sticky glandular hairy, internodes ca. 2-2.9cm. Leaves clustered as roset at the node, unequal, much longer outside and smaller innerside; ca. 0.5-0.7 x 0.2cm, lanceolate-ovate, base semi-amplexicaul apex broadly acute, margin entire to wavy, succulent, green in color; petiole sheathing, ca. 0.3-0.4 cm. Inflorescence vertical; bracts 2, opposite, triangular to irregular in shape, hayline, ca. 3 x 1mm, apex acute. Flowers imperfect, sessile, greenish in color. Perianth tubular; tube ca. 4-5mm; lobes 5, ca. 2-3mm, ovate-triangular, apex acute to apiculate, venation prominent, sticky. Stamens 5, free, alternate to petals; filament ca. 1mm long; anthers dorsally attached, ca. 1mm. Ovary hypogenous, globose, 2 locular, each locule single ovuled; style ca. 0.5-1mm; stigma small. Seed ca. 2 x 1mm long, reniform, Brown in color, faintly ribbed.

FL. Per.: July-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2373 (PMAS-AAUR).

Distribution: Africa, Arabia, India and Pakistan (Nasir, 1973).

2. *Trianthema portulacastrum* L., Sp. Pl. 223 (1753); Jafri in Nasir and Ali, Fl. Pak., 41: 5-6 (1973).

Syn: *T. monogyna* L., Mant. 69 (1767); *T. obcordata* Roxb., Hort. Beng. 34 (1814).

An annual prostrate herb up to 30-55 cm long. Stem sparsely hairy. Leaves elliptic to obovate, ca. 2.5-3.6 x 2.6-3 cm, ovate, apex obtuse; petiole ca. 1-1.5 cm long, papillose, base dilated, clasping with 2 lateral appendages. Flower axillary solitary, sessile, regular. Bracts 2, sparsely hairy outside, hairs 1-celled, whitish in colour, ca. 2mm across. Extra tabular cover represented by 5-blunt projection at distal end; lower one tube closely sheathed by the leaf base; ca. 7-9cm wide. Sepals 5, 4-6cm long, oblong, entire, apex apiculate to shortly aristate, twisted, imbricate. Stamens 8-10, unequal, basifixed; anthers pinkish, ca. 1 x 0.8 mm; filaments ca. 4-7 mm long. Ovary cup-shaped, ca. 6 x 4.5 mm; style ca. 6 mm long, crystal, unicellular appendages on its dorsal side; stigma globose covered by crystal like unicellular appendages or trichomes. Capsule ca. 6 mm long, comprises of pyxidium at lower end and lid ca. 4 mm long. Seeds 7-11 in pyxidium, 1-3 in lid; reniform, rough with appendages, epidermal surface aculeate, ca. 2 mm broad.

FL. Per.: May- October

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2456 (PMAS-AAUR).

Distribution: Tropical America, Africa, W. Asia, Ceylon, India and W. Pakistan (Nasir, 1973).

3. *Gisekia pharancoides* L. Mantis. Alt. 2: 562 (1771); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W.Pak. & Kashm., 234 (1972); Y. Nasir in Nasir

and Ali, Fl. Pak., 41: 10 (1973).

Syn: *G. molluginoides* Wight, Calcutta J. Nat. Hist. 7: 162 (1847).

A procumbent or diffuse herb upto 35-40 cm high. Stem much branched, herbaceous, glabrous, yellowish green in color, rounded; internodes ca. 3.5 -10 cm. Leaves oppositely arranged, sometime two groups of leaves opposite to each other; lamina ca. 2-2.3 x 1.5-1.7 cm, elliptic- ovate, apex broadly acute, base acuminate, margin entire, glabrous on lower surface and slightly glabrous on upper surfaces, fleshy, midrib prominent on lower side; petiole ca.0.5 cm long. Inflorescence an axillary cyme, ca. 1-1.4 cm, 10-flowered. Flowers ca. 5 mm across, purplish pink in color, incomplete; pedicel ca. 0.5 -0.7 mm. Perianth 5, free, green in colour, glabrous, ca. 0.4 x 0.3 cm, elliptic, apex obtuse, margin membranous and hyaline. Stamens 5, free, ca. 5 mm; filament ca. 3 mm; anther alternate to perianth. Ovary 4 locular, globose, hypogynous, each locus 1-ovuled, each locule separated by filament; style small; stigma 4-partite. Seed reniform, brown in color, ca. 2mm.

FL. Per.: Aug.-Oct.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2324 (PMAS-AAUR).

Distribution: Africa, Arabia, India, Ceylon, Afghanistan and W. Pakistan (Nasir, 1973).

4. *Limeum indicum* Stocks ex T. Anders in Journ. L. Soc. Bot. 5 (suppl. 1): 30 (1860); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 234 (1972); Y. Nasir in Nasir and Ali, Fl. Pak., 41: 10-11 (1973).

A perennial prostrate herb ca. 11-15 cm high. Stem much branched at the base, herbaceous, rounded, shiny, greenish yellow sticky glandular; internodes ca.

2-4.5cm. Leaves opposite, ca. 0.7-1.4 x 0.5-0.9cm, ovate-elliptic, apex broadly acute, base cuneate, margin entire, sticky glandular hairs on lower and upper side; petiole ca. 0.2-0.3cm. Inflorescence verticillate. Flowers ca. 2 mm long, green in color, imperfect; pedicel ca. 3-5 mm, sticky in nature. Perianth 5, free, ca. 0.5 x 0.3cm, ovate, apex acute, base attenuate, margin entire and hairy, green colored, sticky outer side. Stamens 7-8, connate; filament small, ca. 3mm, broad at the base, sticky in nature, hairy; anthers dorsally attached with filaments, ca. 0.3-0.5 mm, globose, yellow. Ovary hypogynous, globose, ca. 2mm across, bilocular, syncarpous, 2-ovular, pinkish brown; style ca. 1mm; stigma 2, small. Fruit ca. 2 mm, globose, 2-seeded. Seeds ca. 2 x 1 mm, concavo-convex, black brown, globose, sticky surface.

FL. Per.: March-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2415 (PMAS-AAUR).

Distribution: Less common in the Punjab plains (Nasir, 1973).

5. *Zelya pentandra* (L.) Jeffrey in Kew Bull. 14(2): 238 (1960); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W.Pak. & Kashm., 235 (1972); Y. Nasir in Nasir and Ali, Fl. Pak., 41: 2-3 (1973).

Syn: *Zelya govindia* (G. Don) Nair, Bull. Bot. Surv. Ind. 8: 86 (1966); *Trianthema govindia* Buch-Ham. Ex G. Don in Gen. Syst. 3: 72 (1834); *T. pentandra* L., Mant. 1: 70 (1767).

A perennial, prostrate ±succulent herb up to 30-55 cm. Stem herbaceous above or sometime woody at the base, slightly glaucous, angular, fleshy, papillate, green in color; internodes ca. 2-4cm. Leaves simple; lamina ca. 2.3 x 2cm,

elliptical to ovate, hairy covering at base, apex broadly acuminate, base broadly attenuate, margin entire, fleshy glabrous, papillate projection on margin and veins and midrib; petiole ca. 0.6-0.7cm. Inflorescence verticillate, 4-8 flowered. Bracts 2, opposite, hairy ca. 2-3 x 2mm, lanceolate, base rounded, apex acute. Flowers campanulate, imperfect, greenish brown in color; pedicel ca. 3mm. Perianth 5, tubular, ca. 9 x 3 mm, hairy margin, apex 2-lobed of beak shape, papillate outside, greenish. Stamens 5, attached to perianth, alternate to perianth lobes; anthers dorsally attached to filament, 2-lobed, \pm equal, pink in colour. Ovary 2-celled, ca. 2-2.5 mm long, conical-oblong, syncarpous, 2-ovular; style 2; stigma bifid. Capsule ca. 5 mm, subterete, circumscissile with a truncate operculum, pinkish in colour; beak 2-lobed (consisting of 2-lanceolate portion), margin mitriform, upper parts 1-2 seeded, basal parts membranous. Seeds 3-4 in each capsule, ca. 2 mm across, sub-reniform, concentrically ribbed, blackish coloured, dotted.

FL. Per.: July-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2374 (PMAS-AAUR).

Distribution: Africa, India, Iran and W. Pakistan.

6. *Sesuvium sesuvioides* (Fenzl) Verdc. In Kew Bull. 12: 349 (1957); Y. Nasir in Nasir and Ali, Fl. Pak., 41: 2(1973).

Syn: *Diplochoum sesuvioides* Fenzl, Nov. Stirp. Dec: 7.58 (1839);

Trainthema hydasypica Edge. In Journ. L. Soc. Bot. 6: 203 (1862); Jafri, Fl.

Kar. 117 (1966); *T. polyspera* Hochst. Ex Oliv., Fl. Trop. Afr. 2: 588 (1871).

A herbaceous succulent, halophytic herb up to 40 cm long. Stem rounded,

much branched, terete and densely papilose with crystalline papillae, succulent, greenish yellow in color; internodes ca. 3-4.5cm. Leaves opposite and decussate, ca. 2-4 mm long, elliptic-lanceolate, apex broadly acute, base cuneate, margin slightly wavy, lateral nerves obscure, densely papilose, fleshy; petiolar sheath dilated, clasping, yellowish green in color. Inflorescence solitary or sometimes clustered, adaxial side of leaves. Flower imperfect, sessile. Perianth tubular; tube ca. 7mm; lobes 6, ca. 10 mm, cup shaped, apex apiculate, margin hyaline, papilose on outer side, light yellowish white in color, venation prominent. Stamens 6, attached to perianth; filament ca. 3mm long; anther dorsally attached, ca. 2 mm, dark pink or red. Carpels 2; ovary ca. 1.2 x 0.8 mm, 2-lobed, oval, hypogynous; styl 2, ca. 1-2 mm; stigma very small and globose shaped. Seeds 6-9 in each locule, reniform, brownish in color.

FL. Per.: December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2408 (PMAS-AAUR).

Distribution: Africa, India and W. Pakistan (Nasir, 1973).

7. CHENOPODIACEAE

Key to genera:

1a. Flowers monoecious:

2a. Plants with dense stellate-dendroid indumentum..... 1. *Krascheninnikovia*

2b. Plants glabrous to glaucous..... 2. *Atriplex*

1b. Flowers bisexual:

3a. Leaves and branches alternate:

- 4a. Leaves fleshy, terete; fruiting perianth not winged..... 3. Suaeda
- 4b. Leaves minute, subglobose or spine-tipped;
 fruiting perianth transversely winged..... 4. Salsola
- 3b. Leaves and branches opposite..... 5. Haloxylon
1. ***Krascheninnikovia ceratoides*** (L.) Guldenst. in Nov. Comm. Acad. Petrop.
 16: 555 (1772).

Syn: *Axyris ceratoides* L., Sp.pl. 979. 1753; *Diotis ceratoides* (L.) Willd.,
 Sp. Pl. ed. 4: 368. 1805; *Eurotia ceratoides* (L.) C.A.Mey. in Ledeb., Fl.
 Alt. 4: 239. 1833.

A hoary profusely branched shrub up to 125 cm tall. Stem herbaceous above, woody below, circular, stellate-dendroid hairy; internodes ca. 1.5-3cm long, glaucous, whitish green, 1-celled hairy. Leaves ca. 0.3-0.9 cm, spirally arranged, linear, apex acute, margin entire, sessile, 1-celled stellate-dendroid hairy. Inflorescence terminal and axillary clusters, forming spike-like. Flowers minute, monoecious, imperfect, greenish white, glaucous. Male flowers: stamens 4; filaments ca. 0.1mm long; anthers ca. 0.2mm in diameter. Female flower: perianths 5, ca. 0.3 x 0.2mm, ovate, apex acute, margin hairy, 1-celled cottony stellate hairs at ventral side; hairs white or finely rufescent. Ovary globose, 0.1 mm in diameter, unilocular and uni-ovular, hairy; styles 2, ca. 0.2mm. Fruit obovoid, apparently 4-angled and 2-horned, ca. 3 mm long, covered with simple appressed and scattered stellate hairs.

FL. Per.: June - September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2361 (PMAS-AAUR).

Distribution: C. & S. Europe, N.Africa & Asia.(Nasir, 1973).

2. *Atriplex dimorphostegia* Kar. & Kir. in Bull. Soc. Imp. Naturalistes Moscou. 15: 47. 38 (1842).

Syn: *A. dimorphostegia* Kar. & Kir. var. *sagittiformis* Aellen in Bot. Jahrb. 70: 36. 1939.

An annual, monoecious, herbaceous herb up to 100 cm high. Stem rounded, whitish greenish, smooth, glabrous; internodes ca. 1.5-3cm. Leaves simple, alternate, ca. 0.5-1.5 x 1cm, apex acuminate to obtuse or retuse, base arcuate, margin entire to sub-irregularly sinuate-dentate; pedicel 0.25cm long. Inflorescence an axillary cluster or in terminal spicate. Flower monocious, sessile, green. Male: perianth tubular, 5-lobed, ca. 0.7-0.9 x 0.5mm, lanceolate, apex acute to obtuse, margin entire, green. Stamens 5, filament ca. 0.3mm long; anther ca. 0.2-0.3mm. Female: perianth triangular-ovate, 1-3-toothed with crested back, green, sessile. Ovary globose, monocarpary, hypogynous; style 2, long; seeds ca. 2-2.3 mm, shiny, dark brown.

FL. Per.: April-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2359 (PMAS-AAUR).

Distribution: Central (Kirghizstan, Uzbekistan, Kazakhstan, Sinkiang, Turkemenistan, Afghanistan) and southwest Asia and North Africa.(Nasir, 1973).

3. *Suaeda fruticosa* (L.) Forsk., Fl. Aegypt-Arab., 70 (1775).

Syn: *Chenopodium fruticosum* L.; *Salsola lana* Edgew.; *Suaeda vermiculata* sensu Boiss.; *S. nudiflora* sensu Burkill; *S. mesopotamica* Eig.; *S. baluchistanica* Akhani & Podlech.

A perennial shrub up to 2 m high. Stem much branched, angular, herbaceous above, woody below, glabrous, greenish brown in color; internodes ca. 4-6cm. Leaves opposite, ca. 1-2 x 3 mm, sessile, apex broadly acuminate, linear, margin entire, succulent, glaucous. Inflorescence a spike, adaxial to leaf, 2-5-flowered. Bractioles ca. 1.5 mm long, ovate, apex acute, margin entire to slightly denticulate, hayline in color. Flowers bisexual, green in color, sessile. Perianth 5, tubular, ca. 6-9 x 4mm, concave, apex acute, margin hayline, glaucous, green in color. Stamens 5, versatile; filament small, ca. 3mm; anther ca. 5 mm across. Ovary globose, 1-locular and 1-ovuler; styles 3, short; stigmas 3, fimbriate, short. Seeds ca. 1 mm across, obliquely ovoid, somewhat beaked, slightly compressed, smooth, shining and black when ripe.

FL. Per.: November-July.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2358 (PMAS-AAUR).

Distribution: Cape Verde and Canary Islands, N. Africa, the Arabian Peninsula, Jordan, Iraq, S and Iran, Afghanistan to India, Kenya and Ceylon.(Nasir, 1973).

4. *Salsola imbricata* Forssk., Fl. Aegypt.-Arab. 57 (1775).

var. *imbricata*

An erect to semi-erect shrub, up to meter high. Stem diffusely branched, succulent, greyish green to reddish green, 2 cm in diameter, hairy. Leaves ca. 2-7.5 x 0.7-1.3 mm, broadly ovate to circular, narrowly triangular to linear at lower parts but scale-like at upper, cucullate, apex obtuse, leaf axils of long shoots with small rosulate scaly, leaves at young stage reddish brown but green at maturity, succulent, flat to convex, leaves densely covered with warty ca. 1.2-1.5mm long

hairs. Inflorescence in terminal parts milky wistish grey, with regular arrangement of lateral catkin like spikes; spikes ca. 8-30 x 3-4mm. Bracts and bracteoles subequal in similar to upper leaves, ca. 0.5-1.5 x 0.5-1.4 mm, glabrous, shorter than perianth. Perianth ovate to ligulate, ca. 0.5-2 x 0.5-1.2 mm, obtusely triangular, apex obtuse, margin crenulate, midveine prominent, transverse line at 1/2, green blotch small, outer margins ciliate; almost smooth curved hairs, ascending warty hairs sometimes at blotch area. Anthers ca. 0.5-1 mm including obtuse appendage of ca. 0.1-0.15 mm; filaments ca. 1.5-2 x mm. Style cylindrical, ca. 0.3-0.7 x 0.2 mm; stigmas 2, ca. 0.4-0.7 mm long; apex flat, revolute, outer surface papillose. Fruit perianth ca. 3-5 mm in diameter, wings silky and translucent, subequal or the 2 inner narrower, upper part of perianth suberect or incurved, forming obtuse cone or a semi-globular dome. Seed semi-globular, flattened at top, 1-1.2 mm diameter.

FL. Per.: August-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2362 (PMAS-AAUR).

Distribution: From W. and S.W. Sahararian countries throughout the hot desert belt to tropical E Africa, the Arabian Peninsula, S. Iran, Pak. Baluchistan, S. and E. Afghanistan, N.W. India. (Nasir, 1973).

5. *Haloxylon*

Bunge, Reliq. Lehm. 292 (1851), Mem. Sav. Etr. Petersb. 7: 468

(1851); Jafri & Rateeb in Jafri & El-Gadi, Fl. Libya 95 (1978);

Kassel et al. in Ali & Qaiser, Fl. Pak. 204: 188 (2001).

Archrocnemum acutt. P.p. non Schrenk in Bull. Cl. Phys.-Math.
Acad. Imp. Sc. Petersb. 3: 211 (1845); *Hammada* Iljin in Bot.
Zhurn. 33 (6): 582 (1948).

Key to species:

- 1a. Leaves distinct..... 1. *H. stocksii*
1b. Leaves reduced to dilated tips of the joints.....2. *H. salicornicum*

1. *Haloxylon stocksii* (Boiss.) Benth. & Hook., Gen. Pl. 3: 70 (1883); Kassel *et al.*
in Ali & Qaiser, Fl. Pak., 204: 193 (2001).

Syn: *Caroxylon recurvum* Moq. in Dc., Prodr., xiii (2): 175(1849); *Salsola stocksii* Boiss., Diagn. Ser. 2 (4): 75 (1859); *Haloxylon recurvum* (Moq.)
Bunge ex Boiss., Fl. Or., iv: 949 (1897).

A perennial, straggling bushy undershrub, turning black after drying, glabrous, pruinose up to 1 m high. Stem fairly branched, woody at the base; branches divaricately spreading, straight or recurved, glaucous-green. Leaves ca. 3-8 x 2-3 mm in size, fleshy, trigonous or half terete, ovate-subulate or ellipsoid, apex obtuse or rounded, margin entire. Flowers ca. 5 mm; floral leaves ca. 2.5 mm long, rotund-ovate, fleshy, with membranous margins; bracteoles 2.5-3 mm long, elliptic-oblong, concave, fleshy, with membranous margins. Perianth-segments fleshy, ca. 4-5 mm long, ovate, apex subobtuse, closing over the utricle; wing membranous, finely veined, ca. 2 mm long, orbicular, attached at the middle of the back of the segment. Seeds ca. 2 mm across, orbicular, flattened.

FL. Per.: November-December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 194, 197, 631, 890, 895, 908, 969, 1014, 1194 (PMAS-AAUR).

Field remarks: A common shrub of calcareous and gravelly soils.

Distribution: Pakistan, Afghanistan, W. India (Punjab, Rajasthan) (Kassel *et al.*, 2001).

2. *Haloxylon salicornicum* (Moq.) Bunge ex Boiss., Fl. Or. 4: 849 (1879); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 224 (1972).

Syn: *Caryoxylon salicornicum* Moq. in DC., Prodr. 13 (2): 174 (1849);

Hammada salicornica (Moq.) Iljin in Bot. Zhurn. 33: 583 (1948).

Undershrub or shrub, pale, much branched, almost leafless, 25-60 cm tall, with woody stem; shoots \pm ascending rigid, light coloured to white or waxy yellowish when dried. Leaves reduced to minute, short-triangular scales, connate into a short cup, membranous at margins, woolly within. Inflorescence consisting of short, 3-6 cm long, scattered spikes, mostly at the ends of pale greenish, main or lateral shoots of the current season. Bracteoles 2, ovate-concave, woolly at base. Stamens alternating with linear ovate staminodes, papillose at tips; styles short, stigmas 2, strongly papillose on inner side. Fruiting perianth including wings usually 7-8 mm across, somewhat brownish.

FL. Per.: October-November.

Herbarium specimens examined: THAL DESERT: Chundko, Humaira Shaheen, 1334 (PMAS-AAUR).

Field remarks: A common shrub of calcareous soils.

Distribution: Egypt, Palestine, Jordan, Iraq, Kuwait, C. & E. Arabian Peninsula, Iran, Afghanistan and Pakistan (Kassel *et al.*, 2001).

8. AMARANTHACEAE

Key to genera:

- 1a. Anthers 1-celled..... 1. *Alternanthera*
- 1b. Anthers 2-celled:
 - 2a. Ovary many-ovuled.....2. *Celosia*
 - 2b. Ovary single ovuled:
 - 3a. Ovule erect; leaves alternate:
 - 4a. All flowers fertile; polygamous or dioecious..... 3. *Amaranthus*
 - 4b. Two flowers of the cluster sterile; 1 fertile..... 4. *Digeria*
 - 3b. Ovules pendulous; leaves opposite:
 - 5a. Flowers 1-3 perfect, surrounded by deformed ones..... 5. *Pupalia*
 - 5b. Flowers all perfect:
 - 6a. Sepals woolly-hairy.....6. *Aerva*
 - 6b. Sepals not woolly-hairy, spinescent.....7. *Achyranthes*

1. *Alternanthera pungens* Kunth in H.B.K., Nov. Gen. Sp. 2: 206 (1817).

Prostrate herb, densely villous white hairs, glabrous, rounded, internode distances ca. 2-4 cm, mych branches at base, also rooting at lower nodes, green. Leaves oppositely arrange, petiole length ca. 5-8 mm; sheath like structure at petiole base; glandular hairs. Leaves lamina ca. 2-2.5 x 0.6-0.8 cm, elliptic, pepillate hairs at margin and both surface, greenish brown. Axillary solitry 2-3 togeather in a inflorescences, sessile. Bracts ca. 5 x 2 mm, membranous, lanceolate, acute apex, green. 5-Parienth, ca. 4 x 2 cm, jointed, sharp beak shape apex, lanceolate, hyaline margin, glandular to papilete hairs on margina apex. 5-Stamens, free, ventrally attached to filament, ca. 3 cm length of filament, 2-chambers anther

sac. 2-stigma and style, stigma cylindrical, ca. 2 mm long style, ovary triangular, glandular hairs outer surface of the ovary, ovary bilocular, each locule have 2-ovules. Fruit orbicular, rounded or retuse above, ca. 2 mm. Seed discoid, ca. 1.25 mm, brown, shining faintly reticulate.

FL. Per.: Feb.-April

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2511 (PMAS-AAUR).

Distribution: A native of tropical America and distributed in the tropics and subtropics of both Old and New Worlds. (Nasir, 1973).

2. *Celosia argentea* L., Sp. Pl. ed.1: 205 (1753); Stewart, Ann. Cat. Vasc. Pl. W. Pak : 231 (1972); Townsend in Nasir and Ali, Fl. Pak., 71: 5-6 (1974).

Annual, erect, much branched herb upto ca. 3 ft. tall. Stem erect, ridged, glabrous. Leaves lanceolate-oblong to narrowly linear, acute to obtuse, shortly mucronate with the excurrent midrib, glabrous; lamina of the leaves from the centre of the main stem 2-15 x 0.1-3.2 cm, tapering below into an indistinctly demarcated, slender. petiole; upper and branch leaves smaller, markedly reducing; leaf axils often with small-leaved sterile shoots. Inflorescence a dense (rarely laxer below) many-flowered spike, 2.5-20 x 1.5-2.2 cm, silvery to pink, conical at first but becoming cylindrical in full flower, terminal on the stem and branches, on a long, sulcate peduncle up to c. 20 cm long, which often lengthens during flowering. Bracts and bracteoles lanceolate or towards the base of the spike deltoid, 3-5 mm, hyaline, ± aristate with the excurrent midrib, persistent after the fall of the flower. Perianth segments 6-10 mm, narrowly elliptic-oblong, acute to rather blunt, shortly

mucronate with the excurrent midrib, with 2-4 lateral nerves ascending more than halfway up the centre of each segment, margins widely hyaline. Filaments very delicate, free part subequaling or exceeding the staminal sheath, sinuses rounded with no or very minute intermediate teeth; anthers and filaments creamy to magenta. Stigmas 2-3, very short, the filiform style 5-7 mm long; ovary 4-8-ovulate. Capsule 3-4 mm, ovoid to almost globular. Seeds ca. 1.25-1.5 mm, subreniform, black, shining.

FL. Per.: August-October.

Herbarium specimens examined: THAL DESERT: weed of cotton crop, Humaira Shaheen, 1336 (PMAS-AAUR).

Field remarks: A common weed of sandy soil.

Distribution: A pantropical weed, in Pakistan as elsewhere on waste ground, in cultivated fields, along roadsides on sandy or stony soils (Townsend, 1974).

3. *Amaranthus*

L., Sp. Pl. ed. 1: 989 (1753); Gen. Pl. ed. 5: 427 (1754); Boiss.,

Fl. Or. 4: 988 (1879); Hook. f., Fl. Brit. Ind. 4: 718 (1885);

Townsend in Fl. Pak. 71: 7 (1974).

Key to species:

- 1a. Prostrate herb. Flowers in axillary clusters.....1. *A. graecizans*
 1b. Erect or ascending herbs. Flowers in terminal and axillary clusters.....2. *A. viridis*

1. *Amaranthus graecizans* subsp. *thellungianus* (Nevski) Gusev in Bot.

Zhurn. 57: 462 (1972); Townsend in Nasir & Ali., Fl. Pak., 71: 18 (1974).

subsp. *graecizans*

Syn: *A. polygonoides* sensu Roxb., Fl. Ind. ed. 2,3: 602 (1832); *A. blitum* L. var. *polygonoides* Moq. in DC., Prodr. 13(2): 263 (1849); *A. polygamus* sensu Hook. f., Fl. Brit. Ind. 4: 721 (1885); *A. thellungianus* Nevski in Act. Acad. Sc. U.R.S.S. 1(4): 311 (1937); *A. lividus* sensu Stewart, Ann. Cat. W. Pl. W. Pakistan. 230 (1972); *A. tenuifolius* sensu Stewart, ibid.: 231 (1972); *A. graecizans* L. var. *polygonoides* (Moq.) Aellen in Rech. F., Fl. Iranica Lf. 91: 11 (1972).

An annual semi-erect to decumbent herb upto 30-40cm tall. Stem angular, much branched, ridged and furrowed, papillate, yellowish green; internodes ca. 1-2.5cm. Leaves alternate, ca. 1.2-2cm, obovate to elliptic, apex mucronate, base cuneate, margin entire and hairy, venation arcuate, glabrous but inflorescence leaves ca. 4-5 x 3cm, base cuneate to long-attenuate, apex mucronulate, glandular hairy; petiole ca. 1.5-2 cm long. Inflorescence an axillary cyme. Flower incomplete, monoecious, sessile, green. Bracts and bracteoles narrowly lanceolate to oblong, apex acuminate, midvein green, pale to reddish, membranous. Perianth 5-segmented, ca. 2 x 1mm, hairy. Male flower: perianth ca. 4 x 1 mm, lanceolate to oblong, apex acute, margin hairy and papillate, midvein green. Stamens 3; anther ca. 2mm, dorsally attached to filament. Female flower: perianth ca. 4 x 2mm, narrowly oblong, midvein often bordered with green vitta, margin hairy pale to whitish green, papillate. Ovary hypogynous, trilobular, uniovular; style 3, slender; stigmas 3, usually pale, flexuous, ca. 0.5 mm. Seed brown, round, rough, shiny, depression on the lower side.

FL. Per.: Throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).

Distribution: Indian sub-continent and Middle Asia (Towsend, 1974).

2. *Amaranthus viridis* L. Sp. Pl. ed. 2, 1405 (1762); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 231 (1972).; Townsed in Nasir and Ali, Fl. Pak., 71: 14-16 (1974).

Syn: *A. gracilis* Desf., Table Ecole Bot.: 43 (1804); *Chenopodium caudatum* Jacq., Collect. Bot. 2: 325 (1788); *Albersia caudata* (Jacq.) Boiss., Fl. Or. 4: 992 (1879).

An erect, perennial herb up to 50 cm tall. Stem much branched, herbaceous, angular, greenish, ridges and furrows; internodes ca. 2.5-4cm. Leaves ca. 2-2.5cm, rounded base, apex mucronate, margin slightly wavy and hayline, venation arcuate and pinnate, tuned pinkish green at the margin and venation on maturity, rough, glabrous below; petiole ca. 1-1.9cm long. Inflorsence spike. Bracts 2, outer and bractioles 2 inner, ca. 2-2.5x1-mm, linear, apex acute, margin hayline, midvein green. Flower imperfect, green. Male flowers: perianth 3, free, ca. 1-1.5x 1mm, linear to lanceolate, apex acute, margin hayline, midvein green. Stamens 3; anthers dorsifixed. Female flower: perianth 3, free, ca. 2-1mm, apex acute, green at midvein and hayline at margin. Ovary elliptic to ovate, smooth but slightly glaucous at base; style 3, ca. 3-5mm, straight. Seeds brown, round, depression at base.

FL. Per.: Throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2385 (PMAS-AAUR).

Distribution: Distributed throughout the tropical and subtropical regions of the world, and penetrating further into the temperate regions than most of the tropical species (Townsend, 1974).

4. *Digera muricata* (L.) Mart. in Nov. Act. Acad. Caes. Leop.-Carol. 13(1): 285 (1826); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 232 (1972); Townsend in Nasir and Ali, Fl. Pak., 71: 21-23 (1974).
Syn: *Achyranthes muricata* L. Sp. Pl. ed. 2: 295 (1762); *A. alternifolia* L. Mant.: 50 (1767); *Digeria arvensis* Forssk., Fl. Aeg.- arab.: 65 (1775); *D. alternifolia* (L.) Aschers. in Schweinf., Beitr. Fl. Aethiop.: 180 (1867).

An annual herb up to 50 cm high. Stem much branched at the base, herbaceous, ridge and furrows; internodes ca. 1.5-2cm, greenish red. Leaves alternate, ca. 2-2.5X1.5cm ovate, base attenuate, apex acuminate, margin slightly wavy, venation arcuate, rough, glabrous-glaucous, greenish, midvein prominent; petiole ca. 0.5-1cm long. Inflorescence racemose spike; peduncle ca. 3-5cm. Bract ca. 4-2 x 1 mm, cupular, apex acute. Bracteoles 2, ca. 6 x 4mm, cupular, apex acute, greenish yellow. Flowers sessile, pink- reddish green, 3-flowered, middle one fertile, ca. 4 x 2mm; lateral flowers appressed, 1-bracteole silicle to fertile flower, smaller than central flowers. Perianth 3, outer ones ca. 5 x 4mm, ovate to oblong, apex acute, 7-12-nerved. Inner perianth 3-segmented, 2-3 nerved, hairy, center darker at margin, slightly shorter, delicate. Stamens 5; filament ca. 5mm long; anther basifixed, ca. 0.2 mm. Ovary hypogynous, ca.3mm, globose, unilocular, uniovular; style ca. 4mm; stigma bifid and at maturity recurved. Ovule horse shoed, ca. 3 mm across. Fruit subglobose, slightly compressed, ca. 2-3 x 2mm, bluntly keeled from one side.

FL. Per.: Throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2326 (PMAS-AAUR).

Distribution: Asia from tropical Arabia and the Yemen to Afghanistan, India, Ceylon, Malaysia and Indonesia, S., C. and E. tropical Africa and Madagascar.

5. *Pupalia lappacea* (L.) Juss., Ann. Mus. Hist. Nat. Paris. 2: 132 (1803); Boiss., Fl. Or. 4: 995 (1879); Hook. f., Fl. Brit. Ind. 4: 724 (1885); Stewart, Ann. Cat. Vasc. Pl. W. Pakistan: 232 (1972).

Syn: *Achyranthes atropurpurea* Lam.; *A. lappacea* L.; *Desmochaeta atropurpurea* (Lam.) DC.; *D. flavescens* DC.; *Pupalia atropurpurea* (Lam.) Moq.; *P. lappacea* var. *velutina* Hook. f.

A perennial, erect, bushy herb or sprawling, or sub-scandent and scrambling up to 1 meter high. Stem much-branched and swollen at the nodes, quadrangulato-terete, thinly pilose to densely tomentose. Leaves narrowly ovate-elliptic to oblong or orbicular, apex acuminate to apiculate, ca. 2-12 x 1-6 cm, base shortly or more longly cuneate; petiole ca. 2-25 mm long; subsericeous or tomentose to subglabrous with a few hairs running vertically along the lower surface of the primary venation, commonly moderately pilose with the hairs along the nerves divergent. Spikes terminal, ± dense to elongated to 0.5 m in fruit, axis subglabrous to tomentose; peduncle ca. 1-10 cm. Bracts lanceolate, ca. 1.5-2.5 mm, persistent, ± deflexed after the fall of the fruit, subglabrous or pilose, sharply mucronate with the percurrent midrib; hermaphrodite flowers mostly in ± sessile clusters of 3, upper often solitary; bracteoles of hermaphrodite flowers broadly cordate-ovate, 2.75-5 mm, conspicuous, sharply mucronate with the percurrent midrib. Perianth

oblong, ca. 3.5-6 mm, glabrous \pm pilose dorsally, 3-nerved, lateral nerves of the 2 outer perianth strong throughout, joining the shortly excurrent midrib just below the apex. Spines of modified flowers glabrous except sometimes near the base, yellowish to purple, ca. 3-4 mm. Filaments ca. 2-3 mm. Style slender, 1.25-2 mm. Capsule ovoid, 2-2.5 mm. Seed oblong-ovoid with a prominent radicle, 2 mm long, dark brown, shining, testa at first faintly reticulate but finally smooth or punctulate.

FL. Per.: July-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2301 (PMAS-AAUR).

Distribution: A widespread species of the tropics and subtropics of the Old World.

6. *Aerva javanica* (Burm. f.) Juss. ex J.A. Schultes, Syst. Veg. ed 15. 5: 565 (1819); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 228 (1972); Townsend in Nasir & Ali., Fl. Pak., 71:26 (1974).

var. *javanica*

Syn: *Celosia lanata* L., Sp. pl. ed. 1: 205 (1753); *Iresine javanica* Burm.f., Fl. Ind., 212 (1768); *I. persica* Burm. f., Fl. Ind. : 212 (1768); *Illecebrum javanica* (Burm. f.) Murr., Syst. Veg. ed. 13: 206 (1774); *Aerva tomentosa* Forsskal, Fl. Aegypt.-Arab. cxxii: 170 & Florula 122 (1775); *Achyranthes javanica* (Burm. f.) Pers., Syn. 1: 259 (1805); *Aerva wallichii* Moq. in DC., Prodr. 13(2): 300 (1849); *A. persica* (Burm. f.) Merrill in Phil. Journ. Sc. 19: 348 (1921).

A perennial erect to scandent undershrub to shrub up to 1 m high. Stem much branched, terete, herbaceous above and woody below, whitish, hoary-tomentose to floccose hairy, internodes ca. 3-3.5 cm. Leaves ca. 2-6 x 1.2-7 cm,

simple, alternate, sessile, linear to oblanceolate-spathulate, apex broadly acunrate, margin entire, midrib prominent, whitish grey, densely floccose or tomentose. Inflorescence terminal spikes or panicle, ca. 4-4.9 cm. Bracts and bracteoles ovate, ca. 3-4 x 1-3.5 mm, apex acute, margin hairy, floccate white hairy. Flower unisexual, dense, incomplete, sessile, whitish green. Male flower: perianth ca. 3 mm across, ovate, apex acute, free, dense whitish floccate hairs on above. Female flower: perianth 3 mm across, obovate to oblanceolate, apex acute, tomentose hairs without, outer 2 larger, 3 inner small and thick green midrib. Stamens 5; filament ca. 0.2 mm; anther ca. 2mm, basally attached to filament. Ovary ca. 0.4-0.7 mm; style ca. 1-1.6mm, straight, stigma deeply forked equal to style. Seeds lenticular, shining, brownish black.

FL. Per.: July-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2308/2158 (PMAS-AAUR).

Distribution: Tropics and subtropics of the Old World, from Burma, India and Ceylon westwards through SW Asia, N. Africa to Morocco and south to Cape Verde Islands and Cameroon through Uganda and Tanzania to Madagascar (Townsend, 1974).

7. *Achyranthes*

L., Sp. Pl. ed. 1: 204 (1753); Gen. Pl. ed. 5: 96 (1754);

Boiss., Fl. Or. 4: 993 (1879); Hook. f., Fl. Brit. Ind. 4:

729 (1885).

Key to species:

1a. Bracteoles ovate, half as long as their spine or longer; staminodes fimbriate. 1.A.

aspera

1b. Bracteoles reduced to a spine; staminodes toothed..... 2. *A. bidentata*

1. *Achyranthes aspera* L., Sp. Pl. ed. 1: 204 (1753); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 228 (1972); Townsend in Nasir & Ali., Fl. Pak., 71:33-37 (1974).

var. *aspera*.

A perennial erect-semi-erect subshrub to herb up to 120 cm high. Stem much branched at the base, angular, herbaceous above woody below, green at young stage but greenish red after maturity; internodes ca. 5-9.5cm, strigose, hairs 1-celled. Leaves opposite; ca. 3.5-4 x 2.5cm, obovate, base cunate, apex apiculate, margin wavy and hairy, midvein prominent, venation arcuate, greenish red, strigose, hairs 3-celled; pedicel ca. 5-7mm. Inflorescence spike; peduncle ca. 5-7cm. Flowers greenish red, sessile. Bracts 2, lanceolate, ca. 4 x 3mm, midvein prominent, pale to brown, base winged, long hairs at base and margin. Bracteoles 2, ca. 7 x 2mm, midvein prominent, long hairs at the base, hairy, apex acute, long sharp spine like. Perianths 5, in two whorls, two outer long and 3 inner short, ca. 5-8 x 3mm, narrowly lanceolate to lanceolate or elliptic, apex acute, green at midvein, margin hairy, hair at the base. Stamens 5; pseudo-staminodes, wing between each filament forming crown shape structure; filament ca. 2mm long; anther ca. 2mm. Ovary globose, uniovular, unilocular; style long slender, ca. 0.3mm; stigma small. capsule 1-3mm; seed smooth, cylindrical.

FL. Per: Feb. June

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2381 (PMAS-AAUR).

Distribution: Pakistan, throughout the Indian sub-continent and the tropical regions of the world.(Nasir, 1973).

2. *Achyranthes bidentata* Blume, Bijdr. Fl. nederl. Ind. 545 (1826).

An erect annual to biennial herb up to 1 meter high. Stem much branched, above herbaceous below woody, quadrangular, cottony tomentose; hairs multicellular; internodes ca. 2.5-3cm, dark green, angular. Leaves ca. 1-1.5 x 0.9 cm, opposite, elliptic to ovate, base rounded, apex acuminate, margin entire, midrib prominent, venation arcuate, dark green in color, densely tomentose to appressed-hairy at dorsal and sparsely hairy at ventral side; petiole ca. 0.5-1mm. Inflorescence dense clustered spike at mature stage lax; peduncle ca. 1-5.8mm. Flower brownish yellow, 3 flowers in a group. Bracteoles ca. 0.7-1.5 x 0.3mm. Basal spiny wings ca. 3-5 x 1mm curving outwardly around the flower, apex beak acute with multicellular hairs at the base. Perianth 5 segments in two whorls, ca. 0.9-1 x 0.4mm, 2 outer and 3 inner, lanceolate, apex acute, margin narrowly pale, midrib prominent, cluster of hairs at base. Stamens 5; pseudo-staminodes ca. 2mm; filament ca. 2-3.4 mm, anthers ca. 1-1.3 mm. Ovary hypogynous, globose, unilocular, uni-ovular; style 4mm long, straight; stigma capitate. Ovule ca. 0.1 mm diameter, reniform. Capsule ca. 2-3 mm; seed filling the capsule, cylindrical, smooth.

FL. Per.: Throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2102 (PMAS-AAUR).

Distribution: Ceylon eastwards to China, Japan, Indonesia and the Solomon Islands also in east and west tropical Africa, Pakistan India and Malaysia.(Nasir, 1973).

9. MOLLUGINACEAE

Key to genera

- 1a. Flowers in axillary fascicles. Seeds appendaged.....1. *Glinus*
 1b. Flowers in terminal paniculate cymes. Seeds not
 appendaged.....2. *Mollugo*

1. *Glinus*

L., Sp. Pl. 463 (1753); Gen. Pl. ed. 5, 537 (1753); Nasir in
 Fl. Pak. 40: 1 (1973).

Radically spreading annual procumbent herb up to 60 cm high. Stem much branched, herbaceous, slender; branchlets densely covered with stellate and dendromorphic hair. Leaves ca. 0.5-2 x 0.4-1.5 cm, obovate, suborbicular or spatulate, unequal, base subacute-cuneate, apex obtuse to slightly apiculate, margin entire, chartaceous, densely stellate-tomentose; petiole, ca. 0.3-0.8 cm, slender, densely stellate-hairy; trichomes ca. 0.5 mm, 7-9 limed, each limb unicellular. Stipules ca. 1 mm, linear, apex acute. Flowers ca. 1 cm across, 5-10 in a cluster, greenish white; pedicel ca. 0.3-0.5 mm. Sepals ca. 6 x 3 mm, elliptic-oblongate, apex mucronate, basally connivent, erecto-patent, stellate-hairy on above. Stamens 5, subequal; filaments 4-5 mm long, filiform; anthers ca. 0.8 mm. Ovary ca. 4 mm, ovoid; styles ca. 1.5 mm. Capsule ca. 0.8-1 cm, globose. Seeds ovoid-subreniform, ca. 0.5 mm, faintly tuberculate, dark brown to black.

Fl. Per.: Febr.-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2124 (PMAS-AAUR).

Distribution: Most tropical parts of the world; Ceylon, Africa, India, W. Pakistan (Nasir, 1973).

2. *Mollugo*

L., Gen. Pl. ed. 5(1754); C.B. Clarke in Hook. f., Fl. Brit. Ind. 2: 662 (1879); Jafri, Fl. Kar. 118 (1966); Nasir in Fl. Pak. 40: 3 (1973).

Key to species:

- 1a. Leaves radical only1. *M. nudicaulis*
- 1b. Leaves both radical and cauline:
- 2a. Stem almost filiform; branches umbellate. Seeds smooth
or nearly so.....2. *M. cerviana*
- 2b. Stem rigid; branches dichotomously arranged. Seeds prominently
tuberculate.....3. *M. pentaphylla*

- 1. *Mollugo nudicaulis*** Lamk. Encycl. 4:234 (1797); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 236 (1972). Nasir in Nasir & Ali., Fl. W. Pak., 40:5 (1973).

Syn: *Pharnaceum spathulatum* Spreng., Syst. Veg. I: 948 (1824).

An erect, annual herb up to 6 cm long. Leaves radical, spatulate-oblong, ca.1-2 cm long and ca. 0.5-20 mm broad, membranous, glabrous, base attenuate, apex obtuse-retuse, margin entire, petiole ca. 0.5-1 cm long, green. Cyme terminal, scapes slender, glabrous, peduncle erecto-patent 5-10, ca. 4 cm. Bracts 2, ovate-oblong, ca.1-2 x 1 mm across, scarious. Flowers bisexual, white,

glabrous, ca. 5 x 2.5 mm across; pedicel up to 1.4 cm long. Sepals white, elliptic-oblong to lanceolate, base acute-cuneate to mucronate, margin entire, imbricate, persistent, glabrous, ca. 5 x 2-3 mm. Stamens 3-4; filament ca. 1 mm long, persistent, anther sub-globose, ca. 0.5 x 0.3 mm, versatile, free, dehiscent longitudinally. Ovary 3-locular, oblong, 3-lobed, 3-celled, ca. 3 x 2 mm, style 3; stigma 3, short, curved. Fruit ca. 4-5 x 2-3 mm, ellipsoid-subglobose, dehiscent by 3-valves longitudinally, glandular and sticky. Seeds ca. 25-30, ca. 1 mm across, muricate, black to brown in colour, shiny, glandular.

FL. Per.: October-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1912 (PMAS-AAUR).

Distribution: S. America, tropical Africa, Ceylon, India and W. Pakistan. (Nasir, 1973).

2. *Mollugo cerviana* (L.) Seringe in DC. Prodr. 1: 392 (1824); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 236 (1972). Nasir in Nasir & Ali., Fl. W. Pak., 40:5-6 (1973).

Syn: *Pharnaceum cerviana* L. Sp. Pl. 272 (1753); *M. umbellata* Ser. in DC. Prodr. 1. 393 (1824).

Annual erect herb up to 15 cm long. Stem branched in whorls of ca. 8 from the rootstock, nodes thickened, herbaceous; branchlets filiform, glaucous, brownish. Radical leaves rosulate, spatulate or linear-spatulate, apex apiculate, ca. 0.5-1 x 0.2-0.3 cm, cauline leaves 5-8 in a cluster, narrowly linear or acicular, base attenuate, apex obtuse-apiculate, margin entire, ca. 1-1.5 cm long, chartaceous, glaucous below; petioles obscure. Cymes terminal, trichotomously

branched; peduncle ca. 1.5 cm, slender. Bracts ca. 0.5 mm long, subulate, glabrous. Flowers ca. 2.5 mm across; pedicels ca. 5 mm long. Sepals ca. 1.5-2 mm, subequal, elliptic-oblong, apex obtuse, margin membranous and white. Stamens 5-8; filaments ca. 1 mm. Ovary 3-lobed, 3-celled, ca. 1 mm; styles 3, ca. 0.3 mm. Capsule broadly ellipsoid, ca. 2 mm, glabrous. Seeds ca. 30, minutely granular, blackish brown.

FL. Per.: September-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2117 (PMAS-AAUR).

Distribution: S. Europe, Greece, Rumania, S. Russia, Siberia, Arabia, Tropical Africa, Galapagos Islands, Australia, Ceylon, India and Pakistan.(Nasir, 1973).

3. *Mollugo pentaphylla* L., Sp. Pl. 89 (1753); Stewart in Nasir & Ali., Ann.

Cat. Vasc. Pl. W. Pak. & Kashm., 236 (1972). Nasir in Nasir & Ali., Fl. W. Pak., 40: 6 (1973).

Annual, erect, herb up to 24 cm tall. Stem numerous, with many more or less 4-angular leafy dichotomously arranged branches, glabrous. Radical leaves obovate-spathulate; cauline ones 3-5 in a whorl, linear or elliptic, base cuneate-attenuate, apex obtuse-subacute, margin entire, ca. 1-2.5 x 0.4-0.7 cm, chartaceous; petiole ca. 2 mm. Cymes up to 5 cm; peduncle up to 8 cm, filiform. Bracts ca. 1 mm, linear-lanceolate, scarious. Flowers ca. 2 mm across, white; pedicel ca. 5-8 mm, filiform, recurved. Sepals ca. 2 mm, elliptic-oblong, apex obtuse, glabrous, parallel veined. Stamens 3; filaments ca. 1.5 mm. Ovary ca. 1.8 mm, ellipsoid, 3-celled; styles 3, short, linear. Capsule ca. 2 mm, oblong, glabrous. Seeds ca. 15-20, roundish-reniform, covered with raised tubercular points, dark brown in colour.

FL. Per.: September-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2214 (PMAS-AAUR).

Distribution: Malayan Peninsula, Fiji, Ceylon, China, Japan, India and W. Pakistan.(Nasir, 1973).

10. CARYOPHYLLACEAE

Key to genera:

- 1a. Leaves opposite and decussate; capsule descing by valves;
 seeds with appendages.....1. *Stellaria*
- 1b. Leaves radical and cauline; capsule dehiscing by teeth;
 seeds without appendages.....2. *Silene*

1. *Stellaria media* (L.) Vill, Dist. Pl. Dauph. 3: 615 (1789).

Annual prostrate herb up to 10-290cm, herbaceous, sometime red lines present on stem, glabrous, 1-celled strigose deciduous hairs, nodes slightly swollen, internode ca. 1.5-2.4cm, green. Leaves decasate arrangement, sessile or small petiole with slightly setose hairs, lamina length ca. 1.5-1.9 x 1.1cm, ovate, tip apiculate base rounded, margin smooth and hyaline, succulent, glabrous shine, smooth, midvein prominent. Inflorescences terminal. Flowers in lax panicles, Pedicels filiform; Flower white, companulate. Pedicle ca. 1-1.4cm, smooth glabrous shiny, green, ovate, apex apiculate, base rounded, margin smooth and hyaline lamina succulent glabrous shine smooth midrib prominent. 5 polysepalous, ca. 3-4 x 3cm, oblanceolate, hyaline margin, acute apex, glabarous. 5-polypetalous, ca. 5-6 x 3-4mm, ca. 2mm jointed and ca. 3mm, deeped lobed, narrow based and acute apex, oblanceolate, white. Stamens 5, alternate to petals, ca. 5-6mm anther

filament, anther sac ca. 0.3 x 0.2mm; deep purple, vertically attached to filament. Ovary ca. 5 x 3mm large, globose, many ovules, unilocular, hypogynous, tridistegmated yellow, sticky stigma, style is absent. Seeds ca. 2mm across, ovate, papillate surface, perisperm to brown, attached with a small ca. stalk 0.1-0.2cm.

FL. Per.: April-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2182 (PMAS-AAUR).

Distribution: Cosmopolitan (Nasir, 1973).

2. *Silene*

L., Sp. Pl. 416 (1753); Gen. Pl. ed. 5. 194 (1954); Boiss., Fl. Or. 1: 567 (1867).

Key to species:

- 1a. Carpophore ca. 1 mm, glabrous.....1. *S. conoidea*
 1b. Carpophore ca. 11-12 mm, pubescent.....2. *S. staintonii*

1. *Silene conoidea* L., Sp. Pl. 418 (1753).

Annual upto ca. 40cm tall herb, glandular sticky hairs, swollen nodes, rounded, internode distances ca. 1-2.5cm. Leaves decussate, sessile, ca. 2-3.2 x 1-1.3cm, having dense sticky glandular hairy on upper, lower and margin, lanceolate, apex acute, base rounded, margin reticulate, lanceolate; petiole ca. 2-2.2 cm long, glandular sticky hairs, broader at lower side and narrow at upper side, purple. Bracts similar to leaves, but smaller. Inflorescences terminal cymose. Sepals 5, gamosepalous; tube funnel form, ca. 2.5cm; lobes ca. 0.4cm, apex claw, alternate ridge and furrows having glandular hairs at outer surface, green. Petals 5, polypetalous, ca. 2.2-3.4 x 0.9-1.2cm, narrow tubular at base and broad at apex,

few glandular hairs at outer side, lanceolate, ovate, dentate and slightly divided bilobed, purple. Stamens 10 (5+5), alternate to petal, apipetalous, all equal, ca. 2.2cm long, anther ca. 1-2 x 1mm, basely attached to filament, white, filament having sticky glands. ovary funnel shape ovate at lower side and narrow at upper, ca. 6-7 x 2mm, hypogynous, axarily attachment, ovary tip slightly red, multilocular yellowish green, style absent, stigma ca. 1.5-1.7cm long smooth and have sticky at apex. Seed ovate ca. 1.1mm long, reniform having small stalk attachment, brown.

FL. Per.: March-April, **FL. Per.:** May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2443 (PMAS-AAUR).

Distribution: Common in Pakistan from 1520-2130 m. (Nasir, 1973).

2. *Silene staintonii* S.A. Ghazanfar, Pak. J. Bot. 14(2): 112-116; f.2 (1982).

Perennial up to ca. 15-30cm tall herb, slightly swollen nodes, yellowish green in color, glandular hairs surface, mucus realized from stem, internode distance ca. 1.5-2.5cm, herbaceous, rounded stem. Leaves cauline oppositely arrangement, sessile, lamina ca. 1-1.9 x 0.5cm, glandular hair surface at outer and upper and also at margin, apex broadly acute, margin smooth, lansulate, green, midveins prominent. 2- leafy Bracts 0.9-2 x 0.5 cm, linear; glandular white hairs, tip broadly acute, margin smooth, lanceolate, green, midvein prominent. Inflorescences terminal, solitary, Flower petiole length ca. 4cm. 5 gamoseplous, ca. 1-1.2cm long; ca. 0.8cm jointed and 0.2cm free, tooth sepals, glandular hair surface at outer surface, tubular, green. 5-gamopetalous, teeth apex slightly large or equal to sepals, petals 10-11 limb, ca. 0.6-0.7cm, white in color. Stamens 10, apipetalous at base; 5 large and 5 small both alternate to each other, large stamen

ca. 6mm and smaller anther ca. 4mm, anthe sac vertically attached to filament. Ovary slightly pubescent; ca. 3-4 x 1mm flat liner ovary, carophore 11-12mm, uniloculer, multiovuler, hypogynous, stigma divided three tristigmate each cylindrical, style absent.

FL. Per.: May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2604 (PMAS-AAUR).

Distribution: Pakistan, Chitral, Drosh.(Nasir, 1973).

11. POLYGONACEAE

Key to genera:

- 1a. Shrub; leaves subulate, minute, soon deciduous; stamens 10-16...1. *Calligonum*
- 1b. Herbs, leaves of various shapes, persistent; stamens 4-8:
 - 2a. Leaves rosette, up to 15 cm long; stamens 6..... 2. *Rumex*
 - 2b. Leaves alternate less than 15 cm long; stamens 4-8.....3. *Polygonum*

- 1. *Calligonum polygonoides* L., Sp. Pl. 530 (1753); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 201 (1972); Qaiser in Fl. Pak., 205: 177 (2001).

A rigid much branched tall shrub up to 2 m high. Stem hard, woody, profusely branched; branches terete, pale, glabrous; flowering branchlets slender; internodes ca. 3-4 cm long. Stipules short, membranous, cup-shaped, obliquely truncate and produced upwards at one side. Flowers ca. 4 mm long, fascicled in the axils of ochreae, pinkish; pedicel ca. 0.5-1.5 cm long. Perianth tube ca. 1 mm; segments ca. 2-3 x 1.5-2 mm in size, subobovate, base cuneate, reflexed in fruit. Ovary tuberculate; style 4, slightly connate at the base; stigma capitate. Fruit ca. 1-

1.5 x 1-1.2 cm in size, oblong, densely clothed with reddish-brown bristles; bristles (setae) 2-3 times or more dichotomously branched, dilated at base, arising on 4 pairs of longitudinal wings. Nut oblong, slightly coiled, winged; wings ca. 1-2 mm broad.

FL. Per.: March-April

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 638, 641, (PMAS-AAUR).

Distribution: Iran, Iraq, Pakistan, Russia, Turkey, Palestine and Syria (Qaiser, 2001).

2. *Rumex dentatus* subsp. *klotzschianus* (Meisn.) Rech. f. in Beih., Bot. Centrbl. 49 (1932); Qaiser in Ali & Qaiser., Fl. Pak., 205: 158-160 (2001).

Syn: *R. klotzschianus* Meisn. in DC., Prodr. 14 (1856); *R. dentatus* sensu Hook.f., Fl. Brit. Ind. 5: 59 (1890); *R. nipponicus* Franch. & Savat, Pl. Japan. 2: 471 (1879); *R. dentatus* subsp. *halacsyi* (limosus x pulcher) Rech., Pat., Verh. Zool. Bot. Ges. Wien 49: 105 (1899).

An erect herb upto ca. 50 cm high. Stem sparsely branched from middle. Leaves mostly rosette, ca. 10-15 x 4.5-5.5 cm, lanceolate, base attenuate, apex broadly acuminate, margin slightly wavy to dentate, midvein prominent, pinnate venation, greenish, glabrous; petiole ca. 4.5-5.5cm long, amplexicaule with hairy sheath, redish green at base. Inflorescence verticillated spike, 3-9-flowered; peduncle ca. 1-1.3cm, angular, ridges and furrows, green, papillate hairy; pedicel ca. 5-6mm. Bracts brown. Sepals 3, gamosepalous, ca. 4 x 2-3mm, lanceolate, apex subacute, margin hyaline succulent, green. Petals 3, polypetalous, ca. 5 x 3mm, alternate to sepal whorls, ovate to elliptic, apex acute to subacute, margin slightly dentate and hyaline, midvein prominent, greenish white. Stamens 6, white;

filaments ca. 1mm; anther ca. 4-5 x 1-2mm basifixed. Ovary triangular, hypogynous, unilocular and uniovuler, 3-cornered, ca. 1mm across, green; style and stigma three, ca. 1-2mm; stigma diffuse and dentate.

FL. Per.: March-April

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2116 (PMAS-AAUR).

Distribution: Afghanistan, Pakistan, India, East Asia. (Nasir, 1973).

3. Polygonum

L., Sp. Pl. 539 (1753); Gen. Pl. ed. 2: 116 (1754); Hook. f., Fl.

Brit. Ind. 5: 23 (1886); Chaudhary, Fl. Kingd. Sadi Arab. 1: 305

(1999); Qaiser in Fl. Pak. 205: 76 (2001).

Key to species:

1a. An annual prostrate herb up to 45 cm high; leaves alternate..... 1. *P. plebejum*

1b. A perennial erect herb up to 130 cm high; leaves in whorl.... 2. *P. molliaeforme*

- 1. *Polygonum plebejum*** R. Br., Prodr. 420 (1810); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 208 (1972); Qaiser in Fl. Pak., 205: 103 (2001).

Syn: *Polygonum herniarioides* Spreng. Syst. Veg. 2: 256. 1825.

An annual to biennial prostrate herb up to 45 cm high. Stem angular, herbaceous, ridge and furrows, papillate; internodes ca.1-2cm; nodes hairy appendages (Ochraea). Leaves alternate, sessile, ca.1-1.2 x 0.4-0.5cm, linear to lanceolate, base undulate, apex rounded to acuminate, margin entire, midvein prominent, green. Inflorescence lateral clusters, adaxil side of the leaves, sometime solitary, 3-5-flowers in a cluster. Flowers pinkish white in color; pedicel ca. 3-

9mm. Perianth 5, ca. 4-5 x 3 mm; tube 1mm; lobes 3mm, ovate, pinkish, midvein dark green. Stamens 5, epiperianth; filament ca. 2 mm long; anther ca. 1mm, brown in color, ventrally attached to filament. Ovary hypogynous, triangular, ca. 3 x 2 mm; style very minute; stigma trifid.

FL. Per.: September-December

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2163 (PMAS-AAUR).

Distribution: Afghanistan, Pakistan, India, Bangladesh, Nepal, Tropical East Africa, Madagascar Bhutan, Australia through Indonesia and Malaysia (Qaiser, 2001).

Herbarium Note: Some of the characters such as: stem angular, ridge and furrows, papillate; leaves alternate, apex rounded to acuminate are recorded first time from own collection not reported in the literature.

2. *Polygonum molliaeforme* Boiss., Diagn. Pl. Or. Nov., Ser. 1. 7: 84 (1846).

Syn: *Polygonum acaule* Boiss., Fl. Or. 4: 1043. 1879 non Hook. f. (1890).

A perennial erect herb up to 130 cm high. Stem much branched, herbaceous, hepta-angular, ridges and furrows, papillate, solid, nodes swollen; internodes ca. 3-6.5cm, glaucous. Leaves in whorl, 7-foliate in each whorl, sessile, ca. 10-12 x 1-1.2 cm, linear to lanceolate, apex acute, margin entire and papillate, leaf sheathing whitish at base, midvein prominent and parallel venation, papillate at mid rib and veins. Inflorescence in axils at the adaxial side of leaves, 3-4-flowered; peduncle ca. 0.9-1mm long. Flower hermaphrodite, actinomorphic, yellowish green; pedicel unequal, ca. 1.2-1.4mm, green. Perianths 5, fused; tube ca. 3mm; lobes 3mm. Stamens 5, epipetalous; filament ca. 2mm long; anther ca. 3

x 2mm. Ovary perigynous, one ovule in each ovary, ovate; style short and stright; stigma cylindrical.

FL. Per.: June-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2589 (PMAS-AAUR).

Distribution: Iran, Afghanistan, Pakistan, India, China and Pamir-Alai. (Nasir, 1973).

Herbarium Note: Stem hepta-anugalar. Leaves arranged in whorls and stigma cylindrical.

12. TILIACEAE

Key to species:

1a. Beak of capsule straight, entire:

2a. Prostrate perennial herb; capsule 7-17 mm long; beak 2 mm long.....1. *C. depressus*

2b. Erect annual herb; capsule 30-70 mm long; beak 5 mm long.....2. *C. trilocularis*

1a. Beak of capsule 3-fid; tips spreading:

3a. Capsules short, angular, winged.....3. *C. aestuans*

3b. Capsule long, slender, without wings.....4. *C. tridens*

1. *Corchorus depressus* (L.) Stocks in Proc. Linn. Soc. 1: 367 (1848).

An annual to biennial prostrate herb up to 60 cm high. Stem densely branched, herbaceous above and woody below, rounded lower side rough, slightly papillate and glandular hairy at young branches; internodes ca. 0.7-1cm, brownish green in color. Leaves opposite and alternate, ca.1.4-1.8 x 0.7-1cm, elliptic to

ovate, base rounded, apex apiculate, margin serrate, revolute, venation arcuate, midrib prominent, hairy on the veins, green in color, venation sparsely hairy and papillate; petiole ca. 0.5-0.6 x 0.2-0.3mm, greenish brown in color,. Inflorescence cymose; peduncle ca. 0.9-1cm long. Flower yellow, complete, hypogynous; pedicel ca. 0.4-0.5mm long. Bracts 3, ca. 0.3-0.4 x 0.1mm, brownish green in color, slightly papillate. Sepals 5, polysepalous, ca. 0.8 x 0.3mm, apex abrupt acuminate, margin entire, green in color. Petals 5, ca. 0.9-1 x 0.4-0.5mm, spatulate, apex rounded, base cuneate, brown in color. Stamens 8, free; filament 0.7-0.8mm long; anthers basifixed, ca. 0.1mm. Ovary cylindrical, ca. 0.3 x 0.2mm, 4-locular, many ovules, papillate glandular hairy, brown in color; style 0.3mm long; stigma capitate. Fruit a silique, curved, moon shaped, papillate glandular hairy, ca. 1-1.2 x 0.3mm.

FL. Per.: February-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2577 (PMAS-AAUR).

Distribution: Central and North West India and Pakistan to north and tropical Africa and Cape Verde Islands. (Nasir, 1973).

2. *Corchorus trilocularis* L., Mant. 77 (1767).

An annual erect herb up to 2 feet high. Stem much branched, woody below herbaceous above, angular, glabrous to slightly glandular hairy; internodes ca. 2.5-3cm. Stipules 2, ca. 0.3-0.5 x 0.2mm, lanceolate, base slightly wide apex sharply acute, deciduous. Leaves spirally arranged, ca. 0.4 x 0.2mm, elliptic, base cordate, apex narrowly obtuse, margin serrate, at the base lower serrate part converted into long thread like appendage, venation arcuate, green in color, glabrous but veins hairy; petiole 0.8-1cm long, strigose. Inflorescence terminal to axillary cyme, few-

flowered; peduncle ca. 0.1mm. Bracts 2, ca. 0.3 x 0.1mm. Stamens 12-15, free; filament 0.3mm long; anther basifixed, yellowish green in color, ca. 0.1mm. Ovary lanceolate, ca. 0.3mm, trilocular, strigose; style ca. 0.2mm; stigma trifid with capitate head. Fruit a silique, ca. 3.5-4 x 0.4cm, stigma and style persistent, green in color at young stage and brownish at old stage, many-seeded.

FL. Per.: June-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2412 (PMAS-AAUR).

Distribution: Pakistan, Afghanistan, India (Punjab, Utter Pradesh, Bihar, Bengal, Peninsular India), Sri Lanka (Ceylon), Sikkim, Bhutan, Australia, tropical and north Africa.(Nasir, 1973).

3. *Corchorus aestuans* L., Syst. Nat. ed. 10. 1:1079 (1758).

An annual erect to semi-erect herb up to 50 cm high. Stem dichotomously branched, herbaceous above woody below, angular, green, 1-celled unequal hairy; internodes ca. 2-3.5cm long. Leaves alternate, ca. 4.5-5 x 2-3cm, elliptic to ovate, base rounded, apex acuminate, margin serrate, venation arcuate, hairy on veins and margin; petiole ca. 1.5-3cm long, long one celled hairs present on petiole. 2-4 stipules form whorl; apex sharp acute long beak, broad base 0.8-1mm x 0.3mm, green in color present at abaxil side of the leaf. Inflorescence solitary or two opposite to each other at adaxil side of the leaf. Flower hermaphrodite, actinomorphic; pedicel 0.4mm long, 1-celled hairy. Bracts 3-4, ca. 0.2-1mm, green in color, 1-celled hairy, apex acute/beak shaped. Sepals 5, polysepalous, greenish in color, spatulate to lanceolate, apex caudate, ca. 0.8-1 x 0.2mm, few hairs on the outside of the sepals. Petals 5, polypetalous, yellow in color, ovate to elliptic,

margin entire, base brown in color, ca. 0.8 x 0.3mm. Stamens 10-12, unequal, filament ca. 0.4-0.6mm, smooth; anther basifixed, ca. 0.2mm. Ovary ca. 0.4mm long, 3-locular, syncarpous, 3-ovuler, green in color, triangular hairy; style 3; stigma capitate at young stage and trifid at older stage. Fruit pod shape ca. 3cm long, three stigmated persistent.

FL. Per.: August-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).

Distribution: Pakistan, India, Sri Lanka (Ceylon), Bangla Desh, Burma, Malaya, Indo-China, Australia, tropical Africa, West Indies and Central America. (Nasir, 1973).

4. *Corchorus tridens* L., Mant. 566 (1767).

An annual, erect herb up to 45 cm high. Stem much branched, herbaceous, angular, woody below herbaceous above, glabrous but young branches sparsely hairy, green in color, smooth; internodes ca. 2-3cm long. Stipules 2, ca. 0.9-1 x 0.2mm, lanceolate, apex sharply acute like long beak, base slightly truncate. Leaves spirally arranged, ca. 2-3.2 x 0.5cm, lanceolate, base cordate, at the base lower serrate part converted into thread like appendage, apex narrowly obtuse, margin serrate to double serrate, green in color, venation arcuate, glabrous but veins hairy; petiole 0.8cm-1cm long, hairy. Inflorescence terminal and axillary cyme, 2-3-flowered; peduncle ca. 0.3mm long. Bracts 2, ca. 0.2-0.3 x 0.1mm, lanceolate, base slightly wide, apex sharply acute long beak, margin entire. Flower yellow, conical; pedicel ca. 0.3-0.4mm long. Sepals 5, polysepalous, ca. 0.5 x 0.3mm, lanceolate, base flat, apex abruptly acute, margin entire. Petals 5, polypetalous, yellow in

color, ovate, base narrowed, apex rounded, margin entire. Stamens 10, free; filament 0.3mm long; anther basifixed, yellowish green in color, ca. 0.1mm. Ovary lanceolate, trilocular, hairy, ca. 0.3mm; style ca. 0.2mm; stigma trifid and further bifurcated. Fruit a siliqua, ca. 3.5-4 x 0.4cm, stigma and style persistent, green in young stage and brownish in old stage, many seeded.

FL. Per.: July-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378, 2411 (PMAS-AAUR).

Distribution: Africa, Asia and in North Australia (Nasir, 1973).

13. MALVACEAE

Key to genera:

- 1a. Epicalyx segments 3; mericarp indehiscent.....1. *Malvastrum*
 1b. Epicalyx absent; mericarp usually 2 or more seeded.....2. *Abutilon*

1. *Malvastrum coromendelianum* (L.) Garcke in Bonplandia. 5: 297 (1857).

An erect herb up to 60 cm tall. Stem terete, more or less woody at the base, herbaceous above, much branched, clothed with stellately hairs, trichomes ca. 0.5-1 mm long. Stipules 2, ca. 5-6 x 0.5-1 mm, ovate-rhombic, margin ciliate. Leaves simple, alternate, ca. 2.5-8 x 2-5 cm, broadly ovate-elliptic, base cuneate, apex acute-slightly apiculate, margin dentate, lateral nerves ca. 6-pairs, prominent below, stellate hairs on nerves and surface granulate; petiole ca. 0.5-4.5 cm, filiform, base clasping, pinkish-green, densely stellate-pubescent. Inflorescence axillary, solitary or 2-3 in fascicles; pedicle ca. 8 mm long. Bracts ca. 6-7 x 1-1.5 mm, elliptic-rhombic. Flowers ca. 1 cm across, yellow. Calyx-tube ca. 4 mm; lobes ca. 4-5 x 3 mm. Petals ca. 5-6 x 2-3 mm, obovate, apex rounded, base cuneate,

margin entire, glabrous. Mericarps 5-10, reniform, ciliate, with 3 spines on the margins. Fruit glabrous, enclosed in enlarged calyx.

FL. Per.: Jan.- Jun.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2157 (PMAS-AAUR).

Distribution: Tropical regions of both New and Old Worlds. It widely occurs in Pakistan. (Nasir, 1973).

2. *Abutilon pakistanicum* Jafri & Ali in Jafri, Fl.Kar. 220 (1966).

Erect undershrub upto 20-1m tall, woody below and herbaceous above, glaucous, internode ca. 6-7cm, greenish grey, tomentose simply hairy, young branches densely tomentose but in mature stage hairs less dense, muciligenous. Oppositely arrange, petiole ca. 9-13cm; pubescent, greenish grey, each petiole have stipules 2, ca. 4-5 x 1mm, linear, indumentum strellet hairy, acute apex slightly downward curved, greenish grey and succulent. Lamina ca. 11-12 x 11cm, apiculate tip, cordate, powdery white lower surface and upper surface green, margin double serrate having small indumentum strellet hairs at margin, indumentum and strellet hairs at lower surface, venation reticulate, midvein prominent. Inflorescences axillary solitary or terminal. Pedicle ca. 6.5-7cm, glaucous, greenish grey with small indumentum. Flowers yellow, companulate, pedicel 6-6.6 cm; before joint 5.6-6cm and 0.9-1cm length after joint, pubescent. Gamopetalous 5, ca. 1.3 x 0.6cm, 0.6cm tube and 0.7cm free, companulate, cuspidate, acute tip, lanceolate to ovate, indumentum and strellet hairs at both surfaces, greenish yellow. Gamopetalus 5, ca. 1.2 x 1.4cm, each petal slightly lobed at mid, many parallel venation prominent, margin smooth, narrow at base

and broad at apex, yellow. Many stamens, attachment to petals, filaments joint to form riben like appendages and epipetalous, filament 1-celled stellate hairs, free at upper side, filament length ca. 3-4 mm; free 2 mm and 1 mm jointed, anthers sac basily attached. Ovary hypogynous, globose, whitish powdery setose hairs, 2-3 mm across, stellate pubescent, many ovules, many loculed, each ovule small hairs on it ovule ovuler shape, pointed apex, ovary many chambers yellow. Style long ca. 7-8 mm, capitate head stigma, yellow. Seeds: triangular cordat, brown, smooth shiny surface, furfuraceous, dotted.

FL. Per.: Feb.-Apr. and Sep.- Nov.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen 2564-2372 (PMAS-AAUR).

Distribution: Endemic to Pakistan (Nasir, 1973).

Herbarium Notes: New characters are recorded from own collection such as lamina apex apiculate and margin double serrate, pairs of stipules at node, stellate and setose hairs present on staminal column and ovary.

14. TAMARICACEAE

Tamarix aphylla (L.) Karst., Deutsche Fl. 641 (1882).

Tree or tall shrub upto ca. 13m, reddish brown, internode distance ca. 8-9.5cm, few glandular hairs. Leaves spiral arrangement, lamina ca. 1.5-3 x 2mm, acute apex, succulent, ovate, sessile, abruptly acuminate apex, hoary due to salt deposition, entire margin. Inflorsecences racemose, simple or compound, ca. 2-6 x 5mm, spirally curved, bract small, ca. 1.5 x 0.5mm, ovate, sessile abruptly acuminate apex, glabrous, smooth margin, green. 5-polypetalous, ca. 3 x 2mm (2outer somewhat smaller than 3-inner), acuminate apex, margin smooth and

hyaline, oblanceolate, glabrous, slightly obtuse- broadly ovate to elliptic, succulent, green. Polypetalous 5, ca. 4 x 3mm, whitish pink, ovate to lanceolate. Stamens 5, free, pinkish, deeply 5 lobed; green, filament inserted between lobes of disc, anther filament length ca. 1-2mm, anther sac cordate, pointed end, cordate at base, pinkish. of ovary ca. 1.7-2 x 1 mm, oblong capsular whitish pink, ovary present at disk, hypogynous. Stigma tristrigmate, style absent. Capsule pyramidal, rounded apex, ca. 1.2mm long lanceolate. Seed 3-3.5 x 1.5mm ovate, sterile long hairs, whitish.

Fl. Per.: June-October

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2585 (PMAS-AAUR).

Distribution: Africa (Morocco, Algeria, Tunisia, Libya, Egypt, Senegal, Sudan, Abyssinia, Eritrea, Somaliland, Kenya), Middle East (Israel, Jordan, Saudi Arabia, Yemen, Iraq, Kuwait, Iran), Pakistan, India and Afghanistan (Nasir, 1973).

Herbarium Note: Lamina abruptly acuminate, calyx hyaline and apex acuminate. Ovule possesses long white hairs.

15. CUCURBITACEAE

Key to genera:

- 1a. Stamens 3:
 - 2a. Anthers conduplicate or sigmoid:
 - 3a. Connective produced beyond the anther loculi.....1. Cucumis
 - 3b. b. Connective not produced beyond the anther loculi.....2. Citrullus
 - 2b. Anthers thecae arcuate straight or apically hooked.....3. Mukia
- 1b. Stamens 5.....4. Momordica

1. *Cucumis melo* L., Sp. Pl. 1011 (1753).

Syn: *Cucumis melo* subsp. *agrestis* var. *agrestis* Naudin, Ann. Sc. Nat. 4, Ser. 11: 73 (1859).

An annual or biennial, trailing, prostrate or climbing, rigid hairy herb. Stem 5-angular, winged, much branched, main branch hoary; branchlets thickly villous; trichomes up to 3 mm, 5-9-celled; internode ca. 2-11.5 cm long, villous. Leaves ca. 3-10 x 2.5-12 cm, suborbicular-ovate, base cordate, apex rounded, margin dentate, deeply 5-lobed; lobes obtuse, both surface scabrous or punctate; petiole ca. 0.5-5 cm long, hispid. Tendrils simple, hispid. Male flowers in axillary few-flowered clusters, peduncle ca. 3-5 cm long; flowers ca. 1 cm across, yellow. Calyx-tube ca. 4-5 mm, densely hairy above, glabrous within; lobes 5, free, subulate, apex obtuse-rounded, densely hirsute above, ca. 3-4 mm long. Petals ca. 0.4-0.5 x 0.3-0.4 cm, ovate- obovate, base cuneate, apex mucronate, margin undulate, sparsely pubescent within, densely hairy above, 4-5 nerved, prominent above, yellow. Stamens 3, ca. 3 mm long; anthers flexuous, connectives apically prolonged; pistillode globose, 3-fid, ca. 2 mm. Female flower: Calyx and corolla as in male. Ovary ca. 10 x 5 mm, oblong, densely hairy; style ca. 1 mm; stigma ca. 2 mm long. Fruit ca. 2.5-4 x 1-2.5 cm, globose or obovoid, rounded, smooth, longitudinally variegated with 7-11 green stripes; pulp bitter when immature but mature one edible. Seeds α , ca. 3.5-4 x 2-2.5 mm, oblong or ellipsoid, white, margined.

FL. Per.: July-Nov.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2568 (PMAS-AAUR).

Distribution: Throughout the Old-World tropics, adventive in neotropics. (Nasir, 1973).

2. *Citrullus colocynthis* (L.) Schrad. in Linnaea. 12: 414. (1838).

Trailing, scabrid herb, with a long tap root up to 2 m long. Stem diffuse, angular, hirsute; internode ca. 1-4.5 cm. Trichomes ca. 1 mm long, 3-5-celled, double walled. Leaves ca. 2.5-7 x 2-5 cm, ovate or narrowly triangular, deeply 3-5-lobed, chartaceous, rigid, densely villous-hirsute below; trichomes 3-5-celled; lobes pinnatifid-sinuous, terminal lobe larger, acute; sinuous ones obtuse; petioles ca. 1.5-3.5 cm, hirsute; probracts lanceolate-elliptic, ca. 4-5 x 1.5 mm, caduous. Tendril simple or bifid, slender, sparsely villous. Flowers yellow, axillary, solitary, unisexual. Male flower: ca. 1 cm across, campanulate; pedicel ca. 0.5 cm. Calyx-tube ca. 3 mm long; lobes ca. 3-6 mm, linear, apex acute, margin entire, hirsute without, greenish in colour. Petals ovate, apex acute, hirsute, ca. 8 x 4 mm, yellow or greenish yellow in colour. Stamens 3; filaments ca. 6-7 mm, filiform, dilated at the base, glabrous, greenish; anthers ca. 5-6 x 3-4 mm. Female flower: ca. 1.5 cm across; pedicel ca. 2.5 cm long, recurved. Ovary ca. 12 x 8 mm, obovate, densely villous; trichome ca. 3-6-celled; style ca. 4 mm; stigma 5. Fruit ca. 5-8 cm in diameter, globose, slightly depressed at the top, variegated and green when young, yellow when ripe; epicarp thin, filled with a dry spongy very bitter pulp. Seeds α , ca. 6 x 3 mm, obovate or ovate-oblong, compressed, smooth, pale brown, with 2 oblique grooves one on each surface near the slightly narrowed base.

FL. Per.: Jan.-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2582 (PMAS-AAUR).

Distribution: Northern Tropical Africa, Atlantic Islands, North-West India, Pakistan and Australia (Nasir, 1973).

3. *Mukia maderspatana* (L.) M.J. Roem., Syn. Monogr. 2: 47 (1846).

An annual or perennial, monoecious, scandent climbing or trailing herb up to 4 cm long. Stem herbaceous, pentagonal, rigid, green, bristly hairy; bristle upward directed, up to 2 mm long, ca. 5-7-celled; internode ca. 3-14 cm long. Leaves ca. 2.5-8 x 2.5-10 cm, simple, alternate, subtriangulate-ovate, base sagittate, hastate, apex acute-acuminate, margin denticulate, basal sinus 1-3 cm deep, hispid below. Tendrils simple, opposite to leaves. Flowers small, yellow, unisexual in axillary cymes. Calyx-tube villous; lobes linear. Corolla yellow; petals ovate, villous without. Stamens 3; anthers oblong. Ovary villous. Fruit an ovoid or globose berry, juicy, smooth, ca. 1 x 0.8 cm, green when young and red when ripe.

FL. Per.: April-October

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2503 (PMAS-AAUR).

Distribution: India, Pakistan, China, Malaya, Africa and Australia (Nasir, 1973).

4. *Momordica balsimina* L., Sp. Pl. 1009 (1753).

An annual wild climber herb up to 1 meter high. Stem much branched, angular, herbaceous, light green, internodes ca. 1.4-2 cm; tendril opposite to leaves. Leaves simple, 3-5 palmi-lobed; ca. 0.8-2.5 x 0.6-3.8 cm, middle lobed broadly ovate to rhombic ovate, base cordate, wavy to dentate margin, palmate venation multicistate, exstipulate, green, glabrous at older stage but sparsely hairy at young stage; tendrils ca. 1.4-8.6 cm long, opposite to leaves; petiole ca. 0.6-1.7cm long, pubescent. Male flowers solitary axillary; peduncle ca. 1-1.5cm, bracteate, sessile.

Sepals 5, gymosepalous; ca. 4-6 x 2-3 mm, entire with small hairs at margin, apex sharp acute, ovate, oblong to obovate, slightly hairy to glabrous, light green. Petals 5, gymopetalous; ca. 4-6 mm x 2-3 mm, alternate to sepals, ovate, cuspidate, entire margin, Pale. Stamens 5, diadelphous (4+1); anther star curved shape, length (0.5-1.5 mm) and width is (almost 1 mm). Female flower Campanulate; ca. 5-15mm, ebracteate, solitary, 5-gymosepalous, ca. 7-8 x 2-3 mm, small hairs at margin, sharp acute apex, entire margin, ovate or oblong to obovate, light Green. 5-gymopetalous, alternate to sepals, ca. 6-8 x 2-3 mm, ovate to oblong, cuspidate apex, entire margin, pale green colour. Ovaries fusiform; ca. 5-7 x 1-1.5 mm, puberulous, star shape sticky stigma, 2-opposite styles. Fruit broadly ovoid, narrowed at ends, 2-7 cm long, 1-2.5 cm broad, orange-red, tuberculate. Seeds elliptic-ovate, 1-1.2 cm long, 6-7 mm broad.

FL. Per.: Aug.-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).

Distribution: South Africa and Tropical Africa, Arabia, Tropical Asia and Australia. (Nasir, 1973).

16. CAPPARIDACEAE

Key to genera:

- 1a. Plants annual or perennial herbs; fruits siliquiform, linear capsule
 separated by 2-valves from a persistent replum..... 1. Cleome
- 1b. Plants perennial herbs, shrubs or climbers; fruits not siliquiform capsule usually
 indehiscent:

- 2a. Plants armed with stipular spines; stamens indefinite; fruit a globose berry.....2. *Capparis*
- 2b. Plants unarmed; stamens 4-6; fruit compressed.....3. *Dipterygium*

2. *Cleome*

L., Sp. Pl. 671 (1753); Gen. Pl. ed. 5: 302 (1754); Benth. & Hook. f., Gen. Pl. 1: 105 (1862); Boiss., Fl. Or. 1: 410(1867); Jafri in Kew Bull., 173-175 (1957); Jafri in Fl. Pak. 34: 20 (1973).

Key species:

- 1a. Leaves simple, setose-papilose.....1. *C. scaposa*
- 1b. Leaves compound, 3-5 foliate, not setose-papilose:
- 2a. Stamens 6. Capsule not more than 16 mm long.....2. *C. brachycarpa*
- 2b. Stamens more than 11-21. Capsule more than 16 mm long.....3. *C. viscosa*

1. *Cleome scaposa* DC., Prodr. 1: 239 (1824).

An annual erect to perennating herb up to 40cm tall. Stem dicotomously branched, glaucous, light green, glandular or eglandular hairs with rounded and sharp apex. Leaves spirally arranged, mature leaves long petiolated with glandular hairs, younger ones sessile, ca. 0.5-1.5 x 0.3-1cm, base rounded, apex apiculate, margin entire, midvein prominent, venation cuneate, succulent, densely glandular hairy; petiole 2mm long. Inflorescence racemose. Bract ca. 2 x 1mm, linear, hayline green and hairy glandular hairy. Flower Yellow; pedicel ca. 6-7mm long. Sepals 4, polysepalous, ca. 4 x 2mm, lanceolate to elliptic, apex acute, glandular hairy, reddish brown. Petals 4, polypetalous, ca. 7 x 3mm, ovate to oblonge, apex apiculate, base attenuate, margin entire, slightly glandular at outer surface. Stamens

6, polyandrous, ca. 4-5 mm, glandular hairy. Ovary elliptic to lanceolate, hypogynous, glandular hairy; style small; stigma capitate. Capsule linear ca. 10-30 x 1mm, sessile, slender, often arcuately curved, glabrous or slightly glabrous, many seeded. Seed up to ca. 0.6mm, glandular hairy, apex capitate, ovules reniform, brown in colour.

FL. Per.: Feb. Jun.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).2591

Distribution: North and Tropical Africa, Egypt, Arabia, West Pakistan and India.(Nasir, 1973).

2. *Cleome brachycarpa* Vahl ex DC., Prodr. 1: 240. 1824; Hook. f., Fl. Brit.

Ind. 1: 169 (1872).

An annual small herb upto 15-40cm, herbaceous, greenish yellow stem, interinternodes ca. 1.5-2cm, angular stem, muricate glandular surface. Leaves 3-foliate, linear to lanceolate, base attenuate, apex cuneate, venation arcuate, glandular hairy, color dull green, ca. 1-1.2 x 0.3-0.5cm; petiole ca. 0.7-1cm long, glandular hairy. Inflorescence lateral racemose. Flower complete, yellow; pedicel ca.1.2-1.4cm long, glandular hairy. Sepals 4, polysepalous, ca. 6 x 2mm long, lanceolate, base attenuate, apex apiculate, green in color, glandular hairy above, glabrous below. Petals 4, polypetalous, ca. 7-8 x 4-5mm, ovate to lanceolate, base attenuate, apex broadly acuminate, margin wavy and glandular hairy, venation prominent, yellowish. Stamens 6, polyandrous; filament ca. 0.4mm long; anther basifixed, ca. 0.5mm, brown. Ovary ca. 4 x 2mm, cylindric, syncarpous, 2-loculer, many ovuled, glandular hairy; style long and persistent; stigma large capitate,

persistant, sticky glandular. Fruit siliqua, glandular hairy, ca. 6cm long; pedicel ca.1cm long.

FL. Per.: Feb. Jun.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2592 (PMAS-AAUR).

Distribution: Trop. and N. Africa, Egypt, Arabia, Iran, Afghanistan, W. Pakistan and India (Nasir, 1973).

3. *Cleome viscosa* L., Sp. Pl. 672. (1753). Hook. f., Fl. Brit. Ind. 1: 170 (1872).

A small erect, annual herb ca. 15-40cm tall. Stem much branched, herbaceous, angular, glandular hairy; internodes ca. 2-3cm, glaucous, light green. Leaves 3-5-foliolate, alternate; leaflets unequal, ca. 1.9-3.2 x 0.1-1.3 cm, ovate, base attenuate, apex apiculate, margin slightly undulated, densely glandular hairy, midvein prominent, venation pinnate; petiole ca. 3cm long, glandular hairy. Inflorescence lateral racemose. Flower yellowish; pedicel ca. 2.5-3cm long, glandular hairy. Sepals 4, polysepalous, ca. 1-1.2 x 0.2- 0.3cm, lanceolate, long glandular hairs present at margin and outer surface, reddish yellow. Petals 4, polypetalous, ca. 1.8-2 x 0.8-0.9 cm, ovate to elliptic, base attenuate, apex rounded, margin entire, glandular hairy. Stamens 10-12, all equal, polyandrous; filament ca. 1-1.3mm long; anther cylindrical, ca. 0.4 mm, at maturity become cup shape. Ovary hypogenous, ovary cylindrical, ca. 0.5-0.6mm, greenish, glandular hairy; placentation marginal; style long cylindrical; stigma capitate. Pod siliqua with persistent stigma, hairy, seeds reniform, many in a single pod, pod curve shaped.

FL. Per.: Feb. Jun.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2524 (PMAS-AAUR).

Distribution: Almost throughout the tropical regions of the world.(Nasir, 1973).

2. *Capparis decidua* (Forssk.) Edgew. in J. Linn. Soc. 6:184 (1862).

A tall shrub to small tree up to 5 meter high. Stem much branched, woody below and herbaceous above, rounded, smooth, glaucous, greenish; internodes ca. 3-5cm. Stipular crooked spines 2, unequal, ca. 1-5mm, green. Leaves deciduous, ca. 4-20 x 1-3 mm, sessile to subsessile present on young branches, linear, apex acute to spiny, margin entire, succulent. Inflorescence solitary or sometime in cluster (corymbose), 6-flowered in a cluster. Flower complete, reddish brick, ca. 1-3mm; pedicel ca. 1.5-1.7cm long. Sepals 4, petaloid, one sepal form beak like structure (saccate), ca. 1.4-1.5x 1-1.2cm, apex sharply acute and slightly curved, ovate to oblong, margin floccose, margin entire; other sepals ca. 0.9-1 x 0.3-0.4cm, powdery appearance inside. Petals 4, outer pair ovate, apex broadly acute, ca.1-1.2 x 0.7cm, nob like inward appearance at the base, floccose hairs at margin; inner pair lanceolate, ca. 0.9-1 x 0.3-0.4cm. Stamens 10-12, unequal, ca. 0.9-2cm, slightly curved at the top, reddish orange; anther ca. 0.3mm long, ventrally attach to filament. Gynophore ca. 2-2.2cm long, smooth, cylindrical, greenish yellow. Ovary globose to conical, floccose hairy, chambered, many ovules, syncarpous; stigma and style short. Fruit globose, 10-15 mm in diameter, slightly beaked, glabrous, smooth, deep red when ripe and with thin pericarp; seeds reniform, 2-5 mm in diameter.

FL. Per.: March- August

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2590 (PMAS-AAUR).

Distribution: N. and Tropical Africa, Arabia, eastward to India (Nasir, 1973).

4. *Dipterygium glaucum* Decne. in Ann. Sc. Nat. Ser. 2. (4): 66 (1835).

A small erect, undershrub upto 70 cm tall. Stem densely branched from the base, rounded, glaucous, woody below, herbaceous above, slight hairy; hairs 1-celled, slightly papillate; internodes ca. 0.5–1 cm, light green. Leaves deciduous, spirally arranged, ca. 1- 1.2 x 0.5 cm, linear to elliptic, apex broadly acuminate, margin entire to slightly undulated, midvein prominent, green to light green; petiole 3mm. Inflorescence raceme; pedicel ca. 0.7cm, papillate, yellowish. Sepals 4, gamosepalous, ca. 3 x 1-2mm, elliptic to lanceolate, apex acute, papillate at outer side, light greenish yellowish. Petals 4, polypetalous, ca. 8–9 x 4- 5 mm, ovate to elliptic, base attenuate, apex rounded, margin irregular. Stamens 1-6, polyandrous; filaments ca. 4mm, papillate; anthers ca. 1mm, ventrally attached, longitudinal splitting. Ovary hypogynous, unilocular, globose, papillate, two wings at two sides (star shaped); style long, papillate; stigma capitate. Fruit 2-6 x 2.5- 5.5mm, elliptic, slightly winged; seed ellipsoidal, 1-seeded.

FL. Per.: Feb. Jun. and Sep.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2580 (PMAS-AAUR).

Distribution: North and Tropical Africa, Egypt, Arabia, West Pakistan and India (Nasir, 1973).

17. BRASSICACEAE

Key genera:

1a. Fruit a salicula:

2a. Perennial glabrous shrub up to 1 meter high; salicula
biarticulated.....1. *Physorrhynchus*

2b. Annual subglabrous to pubescent herb less than 1 meter high;

salicula not biarticulated:

3a. Fruit ovate to sub-orbicular.....2. *Cardaria*

3b. Fruit obtriangular or obcordate-triangular.....3. *Capsella*

1b. Fruit a saliqua:

3a. Hoary herbs with bipartite appressed white hairs; leaves simple,

linear to oblong4. *Farsetia*

3b. Subglabrous or sparsely hairy herbs with simple hyaline hairs;

leaves pinnatipartite.....5. *Sisymbrium*

1. *Physorrhynchus brahuicus* Hooker f., Icon. P1., ser. 2: 821 (1852).

A perennial erect, glabrous herb ca. 50-95 cm tall. Stem woody below herbaceous above, solid but sometime hollow, smooth, shiny, glaucous green. Leaves ca. 2-4.5 x 1-2.9 cm, ramal or cauline, sometime rosset at the base, spiral arranged at upper branches, elliptical to ovate, apex broadly acute, base broadly cuneate, succulent; petiole ca. 1-1.5cm long. Inflorescences racemose; flowers cruciform, complete, purple; pedicel ca. 0.5cm long. Sepals 4, polysepalous, ca. 1 x 3-5 mm long, greenish purple, apex acute, parallely veined. Petals 4, polysepalous, ca. 1.4 x 0.3 cm, purple, spatulate. Stems 6, free, 2 smaller outside, 4 long inner side; filament ca. 5-9mm long; anther ca. 2.5-3 cm, dorsally attached with filament.

Ovary hypogynous; stigma capitate, style ca. 1.2 cm long. Fruit siliqua, ca. 2-4.5 cm long. Seeds ca. 2mm, oblong-elliptic, glabrous, brownish in color.

FL. Per.: March-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2441 (PMAS-AAUR).

Distribution: W. Pakistan, Iran and Afghanistan (Nasir, 1973).

2. *Cardaria draba* (L.) Desv., Journ. Bot. Appl. 3:163. 1814. Hedge in Davis, l.c. 285; in Rech.f., l.c. 75.

An annual erect herb up to 20-30 cm. Stem herbaceous, rounded, fistular above and woody below, greenish, glabrous, young branches sparsely hairy; internode 3-7cm. Leaves opposite and spirally arranged, ca. 9.5 x 2.5 cm, lanceolate, apex obtuse, base amplexicaule, margin undulate to sinuate, veins prominent below, hairy at midrib and margin. Inflorescence terminal and axillary racemose, ca. 25-40-flowered, ca. 8 cm; peduncle ca. 3.7-4 cm long. Flower white, ca. 4-4.5 cm; pedicel ca. 1-1.2 cm, rounded. Sepals 4, free, ca. 0.2×0.1 cm, ovate, apex acute and hyaline, lanceolate, glabrous, shiny, green. Petals 4, free, alternate with sepals, ca. 0.3-0.4 x 0.1 cm, spatulate, apex rounded, base cuneate, margin entire and ± undulate near apex, white. Stamens 6, didynamous, positioned differently; anthers ca. 0.1 mm, 2-thicous, dorsifixed, yellowish; filament ca. 0.3 mm. Ovary hypogynous 2-locular, elliptic to ovate, ca. 3.4-3.8cm, color greenish yellow, style erect, stigma diffuse ca. 3mm.

FL. Per.: April-July

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2121 (PMAS-AAUR).

Distribution: Chiefly European species, now widely spread in C. and W. Asia, introduced elsewhere, widely present in Pakistan (Nasir, 1973)

3. *Capsella bursa-pastoris* (L.) Medik., Pflanzengatt. 1: 85 (1792).

Syn: *Thlaspi bursa-pastoris* L.

An annual erect herb up to 60 cm tall. Stem rarely branched, glabrous or hairy with simple or branched hairs. Basal leaves rosulate, very variable, usually pinnatifid (lyrate to almost entire), 5-8-jugate, shortly stalked, usually up to 8 cm long, 2 cm broad; cauline leaves smaller, sessile. \pm auricled and clasping the stem. Racemes many flowered, up to 30 cm long in fruit. Flowers ca. 2.5 mm across, white; pedicels up to 18 mm long in fruit, spreading. Sepals ca. 1.5 mm long, 1 mm broad. Petals ca. 2.5 mm long, 1 mm broad, obovate-oblong, cuneate. Stamens ca. 1.5: 2 mm long. Siliculae obcordate- triangular, 5-9 mm long, 4-6 mm broad; valves usually with straight margins; apical notch wide, V-shaped ; style ca. 0.5 mm long, hardly or not exceeding the notch; septum c. 1 mm broad, seeds 6-12 in each locule, ca. 1 mm long, oblong-elliptic, pale brown.

FL. Per.: March June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2100 (PMAS-AAUR).

Distribution: Cosmopolitan in cooler climates (Nasir, 1973).

4. *Farsetia*

Turra, Diss. Farsetia, 1, t. 1. (1765); Benth. & Hook. f., Gen. Pl.

1: 140(1862); Boiss., Fl. Or. 1: 157(1867); Jafri in Notes Roy.

Bot. Gard. Edin., 22: 209-216 (1957); Jafri in Nasir & Ali, Fl.

Pak. 55: 108 (1973).

Key to species:

1a. Flowers ca. 4.5-5 mm across, white or pink;

siliqua ca. 11-32 x 0.3-0.4 cm.....1. *F. hamiltonii*

1b. Flowers 1 cm across, orange-yellow to pale purple;

siliquae 20-48 x 3-4.5 mm.....2. *F. jacquemontii*

1. *Farsetia hamiltonii* Royale, Ill. Bot. Himal. 1: 71 (1834); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 316 (1972); Jafri in Nasir & Ali, Fl. Pak., 55: 111 (1973).

Syn: *F. linearis* Decne.; *Erysimum remotiflorum* O.E. Schulz in Notizblat. Bot. Gart. Berlin, 11: 226 (1931).

An annual ca. 29-32cm highte, Stem glaucous, appressed whitish hair; 1-celled hair, stem solid, herbaceous above and wood below; internodes ca. 1.5-2cm. Leaves linear, sessile, ca. 4-5.2 x 2-3cm, apex narrowly acute, margin smooth, mid vain prominent dorsal side, appressed whitish hairs present on both surfce. Inflorescence ebracteate recemose peduncale covered with hyaline 1-celled hairs. Flower ca. 4.5-5 mm across,white or pink in colour, small pedicel ca. 2mm. Sepals 4, polysepalous, ca. 3.5-4.5 x 1-1.5mm, linear to lanceolate, apex acute, base cuneate, whistish green in color, whitish appressed hairs on outer surface. Petals 4, polypetalous, ca. 3.5-4 x 1.5-2mm, spathulate, base cuneate, apex rounded, glabrous, whitish pink. Stamens 6, free, 2 small outer whorl and longer; filament ca. 1.5-3.5mm; pollen sac ca. 1-1.5, dorsifixed, obtuse. Ovary ca. 1.5 x 1mm, hairy, 1-celled, adpressed; style ca. 1mm, covered with whitish hairs; stigma capitate. Fruit siliqua; seeds orbicular, ca. 3 mm across; septum membranous with distinct midveins.

FL. Per.: March-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2393 (PMAS-AAUR).

Distribution: Endemic to the desert area of India and Pakistan (Nasir, 1973).

2. *Farsetia jacquemontii* Hook. f. & Thoms. in Journ.L. Soc. Bot. 5:148 (1861); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 316 (1972); Nasir in Nasir and Ali, Fl. Pak., 71: 21-23 (1974).

Syn: *Arabis heliophila* DC.; *Farsetia macrantha* Blatter & Hallb.; *Heliophila incana* Burm.f.

subsp. *Jacquemontii*

A small erect herb ca. 15-40 cm tall, usually with woody base. Stem much branched, herbaceous, rounded, glabrous, whitish green in color; trichomes horny 1-celled appressed hairs tapering at both ends; internodes ca. 3-5 cm. Leaves alternate, sessile, ca. 2-5 cm, linear-lanceolate, horny hairs on upper and lower surface, margin entire, apex broadly acute. Inflorescence racemose, peduncle ca. 0.5 mm. Flower yellowish white; pedicel covered with whitish horny tapered end hairs. Sepals 4, polysepalous, ca. 8 x 3 mm, lanceolate, apex acute, margin entire, horny, greenish white in color. Petals ca. 0.7 x 0.2 mm, spatulate, yellow white in color. Stamens 6; anther 2 small outer whorl and 4 large in inner whorl; filament ca. 2-3 mm long; anther ca. 3 mm, versatile. Ovary elongate covered with horny hairs; stigma capitate; style ca. 1 mm or less long. Seeds sub-biseriate, orbicular, ca. 2.5-3 mm in diam.

Fl. Per.: March-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2399 (PMAS-AAUR).

Distribution: India, Pakistan and Afghanistan (Nasir, 1973).

5. *Sisymbrium*

L., Sp. Pl. 657 (1753); Gen. Pl. ed. 5: 296 (1754); Schulz in Engler, Pflanzenr. 86(IV. 105): 46 (1924).

Key to species:

- 1a. Cauline leaves almost entire, terminal lobe oblong or sub lanceolate.....1. *S. orientale*
 1b. Cauline leaves pinnately lobed, terminal lobe hastate.....2. *S. irio*

1. *Sisymbrium orientale* L., Cent. Pl. 2: 24. (1756).

An annual herb upto 40-59 cm. Stem angular woody below herbaceous above, solid to hollow, greenish to light green covered with 1-celled simple hairs. Leaves ramal and culaine, petole long ca. 5.5cm or sometime sessile, lanceolate to oblong, margin lacerate, venation arcuate, lower surface and veins hairy; hairs simple 1-celled. Leaves ca. 15-25 x 4-5 cm, Inflorescence racemose, 15 to 20-flowered. Flower cruciform, yellow, ca. 4-6mm across, pedicel ca. 1.5mm long. Sepals 4, polysepalous, ca. 4 x 2 mm, linear to lanceolate, apex broadly acute, greenish yellow, margin entire. Petals 4, polypetalous, ca. 12 x 3 mm, spatulate, yellow. Stemens 6, free, 2 smaller outside, 4 long inside; filament ca. 5mm long; anther ca. 2 x 3mm dorsally attached to filament, yellowish. Ovary hypogynous, ca.10 mm, cylindrical, slightly hairy but glabrous at maturity; style ca.1-2 mm long, straight; stigma capitates to coronate. Fruit siliquae, ca. 4-5.5 x 1cm, greenish yellow, linear, septum rigid, 30-45-seeded; seeds elliptic, brown.

FL. Per.: April-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2175 (PMAS-AAUR).

Distribution: Europe, C and S.W. Asia, Pakistan and Kashmir (Nasir, 1973).

2. *Sisymbrium irio* L., Sp. Pl. 659. (1753).

An annual erect herb up to 20-50cm, Stem woody below herbaceous above, rounded, glabrous, shiny hairy, 1-celled. Leaves petiolate, sometime sessile, radical and cauline, ca. 10-20cm, reticulate, margin deeply undulate, broadly acuminate, slightly hairy at lower surface smooth at upper surface. Inflorescences racemose; flower complete, yellowish green, pedicel ca. 0.2-0.5 cm. Sepals 4, polysepalous, ca. 0.3 x 0.2 cm, linear to lanceolate, apex broadly acute, margin entire, yellowish green, slightly hairy at outer surface; hairs 3 celled. Petals 4, polypetalous, ca. 0.5 x 0.2 mm, spatulate, yellowish. Stamens 6, free, 4 smaller outside 2 long innerside; filament 3mm long; anther ca. 0.3-0.6mm, longitudly split open, dorsally attached. Ovary hypogynous, clusterd, style small. Fruit siliquiform, yellowish brown, 10-35- seeded; seeds blackish brown, smooth shiny, oblong to ellipsoidal.

FL. Per.: March-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2062 (PMAS-AAUR).

Distribution: Europe, Asia and N. Africa (Nasir, 1973).

18. MORINGACEAE

Moringa oleifera Lamk. Encycl. 1: 389 (1785); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 332 (1972); M. Qaiser in Nasir & Ali., Fl. Pak., 38: 1 (1973).

Syn: *Gualandinia moringa* L.; *Moringa edulis* Medic.; *M. parviflora* Noronha; *M. pterygosperma* Gaertn.; *Hyperanthera moringa* Roxb.; *Moringa polygona* DC.; *M. zeylanica* Pers.

A medium tree ca. 5-8 m high, younger branches tomentose. Leaves alternate, 3-pinnate; rachis thickened and articulated at the base; pinnae and pinnules opposite, deciduous, rachis articulated and with solitary gland at each articulation. Leaflets 6-9 pairs, ca. 12-25 x 6-12 mm, the lateral elliptic, the terminal obovate, slightly larger than the laterals; petiole short. Flowers yellowish in large, puberulous, spreading panicles; bracts linear, ca. 3 mm long. Sepals 5-cleft, cup-shaped; lobes ca. 13-15 x 4 mm, linear-lanceolate, reflexed, puberulous above. Corolla ca. 15-20 x 7-10 mm, spatulate, unequal, veined. Stamens 5, fertile; staminodes 5, alternating with stamens; filaments dilated and villous at the base. Ovary oblong, villous; style cylindrical. Capsules ca. 15-30 x 1.5-2 cm, 3-gonous, 9-ribbed, many-seeded, beaked. Seeds ca. 2.5 cm long, globose, 3-angled, with 3 lateral wings which unite at the apex.

FL. Per.: Jan.-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2381 (PMAS-AAUR).

Distribution: Europe, N. Africa, S. W. Asia (Nasir, 1973).

19. PRIMULACEAE

Anagallis arvensis L., Sp. Pl. ed. 1.148 (1753).

var. *arvensis*

Herb, up to 10-24.5 cm in length, winged, glabrous, weak. Leaves simple, opposite, obovate, amplexicaule, entire at margin, bluntly obtuse at apex, ca. 1.8x1

cm. Flower ca. 8 mm across, actinomorphic, complete, bisexual, pedicel ca.2- 4.3 cm long. Sepal 5, united below, lanceolate – linear, dotted at margin, apex acuminate, imbricate, persistent ca.3.5x 1mm. Petal 5, red color at base, rest blue, margin uneven, ciliate with glandular hairs, glandular reddish, in color, spherical ca. 5x3.2mm. Stamens 5, epipetalous, hairy(monoliform) from base to anther, basal hair whitish upper reddish in color, stamen born on disc which cover basal part of ovary attached with lower part of petals filament ca.1.5-2 mm, anther ca. 0.5mm, Ovary globose, with few glandular hairs, ca.0.7 mm in diameter, style ca. 2x0.2 mm, stigma papillose, ca. 0.4 mm in length, Seed brown.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2143 (PMAS-AAUR).

Distribution: N.W. Africa, the Mediterranean, Europe to W. Asia, Australia, N. America, temperate and E. tropical South America (Nasir, 1973).

20. MIMOSACEAE

Key to genera:

- 1a. Stamens 10; anthers gland-tipped.....1. *Prosopis*
 1b. Stamens indefinite, more than 10; anthers not
 gland-tipped.....2. *Acacia*

1. *Prosopis*

L., Syst. Nat. ed. 12. 2: 282, 293 (1767); Mant. 10, 68
 (1767); S.I. Ali, Fl. Pak. 36: 1-41 (1973).

Keys to species:

- 1a. Internodes with conical prickles. Petals and ovary glabrous. Pods
 cylindrical, torulose.....1. *P. cineraria*

1b. Internodes without prickles. Petals and ovary villous within. Pods

compressed.....2. *P. juliflora*

1. *Prosopis cineraria* (L.) Druce in Rep. Bot. Club. Brit. Isles., 1913; Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 383 (1972); Ali in Nasir & Ali., Fl.Pak., 36: 29 (1973).

Syn: *Mimosa cineraria* L., Sp. Pl., 2:1500 (1763).

A large tree up to 14 cm tall; bark grey, rough with deep fissures or cracks. Branches slender, glabrous, armed with somewhat compressed, straight, conical, scattered prickles, ca. 3-8 mm long. Leaves 5.5-7 cm long; petiole ca. 3-10 mm long; pinnae usually 4-6; leaflets 11-14, ca. 0.4-1.2 x 0.2-0.3 cm, elliptic-oblong, base oblique, apex obtuse-mucronate, margin subentire and sparsely ciliate, 1-nerved below, puberulent on both surfaces; petiolule ca. 0.5-1 mm long, pulvinous, green, glabrous. Stipular spines alternate to subopposite, ca. 3-5 mm long, apex tapering, base truncate and pinkish in colour. Inflorescence ca. 5 x 0.6-0.7 cm, peduncle ca. 5 mm long. Flowers yellow, ca. 4 x 2 mm. Calyx-tube campanulate, ca. 1-1.2 mm, yellowish. Corolla-lobes ca. 3.5 x 0.8 mm, elliptic, base cuneate and hyaline, apex acute, margin subentire, 1-nerved, yellow. Stamens 10; filaments ca. 2.5-3.5 mm long, filiform, papillose, yellowish; anthers ca. 1 x 0.8, oblong, dorsifixed, tipped with deciduous glands. Ovary ca. 3.5 mm long, cylindrical or terete, recurved, greenish, papillose; style ca. 0.5 mm, curved, glabrous. Pods ca. 6-11 x 0.5 cm, linear-moniliform, straight-curved, apex apiculate, pendulous, pale green when unripe, brown when ripened, 10-15-seeded.

FL. Per.: April-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1264, 1270, 1287, 1293 (PMAS-AAUR).

Distribution: West Pakistan (Punjab, Sindh & Baluchistan), India (Punjab, Pajputana, Bombay, Madras), Afghanistan, Persia and Arabia (Ali, 1973).

2. *Prosopis juliflora* (Swartz) DC., Prodr., 2:447 (1825); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 383 (1972); Ali in Nasir & Ali., Fl.Pak., 36: 31 (1973).

Syn: *Mimosa juliflora* Swartz, Prodr. Veg. Ind. Occ. 85 (1788).

A tall shrub 3-4 m tall. Stem hard, woody, fairly branched; branchlets erect to spreading, solid, angular, puberulous, greyish green; internode ca. 1-5.5 cm. Stipular spine 1 on each node, ca. 0.5-5 cm, straight, falcate, apex sharp and brown, younger one puberulous. Leaves 2-pinnate, ca. 9-16 cm long; petiole pulvinous, ca. 1-2.5 cm, glabrous; petiole ca.1-2 cm, base swollen and brown. Leaflets 11-14 pairs, ca. 1-2.5 x 0.5-1 cm, oblong-lanceolate, base oblique, apex apiculate, margins entire-slightly undulate, ciliate; cilia multicellular, lateral nerves 9-pairs, prominent above with sparse dots, densely puberulous below; stipel 1, ca. 6 x 2 mm, ovate, apex acuminate and brown, base truncate, margin entire, glaucous, greenish, on lower side 1 gland is present; petiolule ca. 2 mm. Inflorescence ca. 5.5-6 cm; peduncle ca. 1 cm. Flowers ca. 11 x 2 mm. Sepals campanulate (gamosepalous), cup shaped; tube ca. 1.5, glabrous; lobes free, ca. 1 mm, ovate, apex acute, pubescent; trichomes multicellular, slightly deflexed. Petals 5, free, ca. 6 x 2 mm, elliptic, base cuneate, apex acute, margin entire with multicellular hairs, lateral nerves obscure, yellow. Stamens 10, free; filaments filiform, 6-10 mm; anthers versatile, 2-lobed, ca. 1.8-2 x 1 mm, oblong, base auriculate, apex retuse,

margin entire, yellow. Ovary ca. 2 x 1 mm, linear, densely hairy; styles ca. 0.5 mm long; stigma rounded. Pods ca. 10-15 x 0.5-0.7 cm, 12-18-seeded, linear, straight, base cuneate, slightly curved; beak empty, ca. 1.5-1.7 cm long, recurved. Seeds ca. 11 x 6 mm, elliptic-oblong, shiny, brown, glabrous.

FL. Per.: March June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2153 (PMAS-AAUR).

Distribution: Indigenous to West Indies and Mexico, naturalized in Sindh and Punjab (Nasir, 1973).

2. *Acacia*

Mill, Gard. Dict. Arb. ed. 4: (1754); S.I. Ali, Fl. Pak. 36: 2

(1973).

Key to species:

1a. Flowers in pedunculate spikes.....1. *A. modesta*

1b. Flowers in globose heads:

2a. Heads generally terminal, paniculate..... 2. *A. leucophloea*

2b. Heads axillary, pedunculate:

3a. Plants cupressiform in appearance.....3. *A. nilotica* ssp. *cupresiformis*

3b. Plant not cupressiform in appearance:

4a. Tree; pods moniliform, compressed.....4. *A. nilotica* ssp. *indica*

4b. Shrub; pods flat, straight.....5. *A. jacquemontii*

1. *Acacia modesta* Wall., Pl.As.Rar. 2: 27.t. 130 (1831).

A medium sized deciduous tree, brownish green, rough, internodal distance ca. 1.5-3cm, slightly angular, at each node a pair spine, spine ca. 5 x 1mm, wedge

at base but sharp at apex. petiole ca. 0.9-1.5cm, Rachis ca. 1.9-2.9cm, with a small gland near the base and sometimes one between the uppermost pair of pinnae, pinnae divided in to 2-3 pairs leaflets; ca. 9-10 x 5-6 mm, sessile, ovate, base oblique rounded, apex ovate and broad then base, slightly succulent, veins prominent, midvein prominent, margin smooth sometime light redish. Inflorescences Axillary spike, spike ca. 3.7-7.5 cm long, peduncle ca. 1.3-2.5 cm; pedicel ca. 1 mm. Calyx ca.1.5 mm long, broadly campanulate, glabrous, green. Corolla ca. 2-2.5 mm. Stamens indefinite, filaments ca. 5 mm long. pod flat straight and striptate; stipe ca. 4-6.5 x 8-10 mm, brown, apex appiculate, rough, having black dote, 4-6 seeded. Seed ca. 3-5 3-4 mm, seed pedicle brown curved, rounded, brown.

FL. Per.: March-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2196 (PMAS-AAUR).

Distribution: W. Pakistan (N.W.F. Province, Punjab, Baluchistan); India (Punjab, Uttar Pradesh) and Afghanistan (Nasir, 1973).

2. *Acacia leucophloea* (Roxb.) Willd. Sp. Pl. 4: 1083 (1806).

Syn. *Mimosa leucophloea* Roxb. Cor. Pl. 2:27.t.150. (1789).

A medium erect woody tree, internode distance ca. 3.5-4.5cm, greenish brown, young branches velvety pubescent, rough at mature stage, a pair of spirally arrange spine at each node, ca. 2.9-3.1cm, woody with white powdery apperences; spin tip sharp prickled, pubescent, straight, spines present at abaxil side of leaves. spiral arrangement leaves, rachis 2.5-10 cm long, peliole ca. 2.2cm, 2-3 pinna length ca. 2.2-3.8 cm; have many 30-40 leaflets, sessile, leaflet ca. 7 x 2mm,

linear to oblong, obtuse, base rounded oblique, margin smooth hyaline, green, slightly succulent, midrib prominent, brownish yellow. Inflorescences Axillary solitary, pedunculate, peduncle ca. 1.3-1.5cm(before joint 0.7cm after joint 0.4cm), 1-celled small hairs on peduncle, length of, mid of peduncle bracts whorled and fused basally present at joint; fuse bracts 4-pointed tips; bract ca. 2mm long brown, small hairs at outer surface of bract and peduncle. Flower sessile and in large number, yellow. Each flower has a small single sessile bract; ca. 3-2 x 2 mm, ovate, having hairs on outer surface, hyaline margin sepals, brown. 5-gamosepalous, campanulate; ca. 2 mm long, crown in shape, hyaline margin, brownish green, tomentose hairs at outer surface. Petals 5, gamopetalous, ca. 6mm long, tomentose hairs at outer surface, lanceolate, tip broadly acute, midvein prominent, yellow. Stamens have many anther which move out to flowers, yellow, filament length ca. 5 mm long and thin, small yellow anther sac, basally attached to filament. Ovary have many ovules, single locule, pubescent ovary, stigma cylindrical, style curled ca. 2mm long, brown. Pod 10-15 cm long, 7-10 mm broad, flat, sessile, brown velvety when young, semi-dehiscent. Seeds 10-20.

FL. Per.: August-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2605 (PMAS-AAUR).

Distribution: W. Pakistan, India (Punjab, Rajasthan, U.P., Madhya Pradesh, Bengal, Bombay, Madras); Ceylon, Burma, Siam, Indonesia, Java (Nasir, 1973).

3. *Acacia nilotica* ssp. *cupressiformis* (J.L. Stewart) Ali & Faruqi, l.c. 4

Syn: *Mimosa cineraria* L., Sp. Pl., 2:1500 (1763).

A large tree up to 14 cm tall; bark grey, rough with deep fissures or cracks.

Branches slender, glabrous, armed with somewhat compressed, straight, conical, scattered prickles, ca. 3-8 mm long. Leaves 5.5-7 cm long; petiole ca. 3-10 mm long; pinnae usually 4-6; leaflets 11-14, ca. 0.4-1.2 x 0.2-0.3 cm in ca., elliptic-oblong, base oblique, apex obtuse-mucronate, margin subentire and sparsely ciliate, 1-nerved below, puberulent on both surfaces; petiolule ca. 0.5-1 mm long, pulvinous, green, glabrous. Stipular spines alternate to subopposite, ca. 3-5 mm long, apex tapering, base truncate and pinkish in colour. Inflorescence ca. 5 x 0.6-0.7 cm in ca.; peduncle ca. 5 mm long. Flowers yellow, ca. 4 x 2 mm. Calyx-tube campanulate, ca. 1-1.2 mm, yellowish. Corolla-lobes ca. 3.5 x 0.8 mm, elliptic, base cuneate and hyaline, apex acute, margin subentire, 1-nerved, yellow. Stamens 10; filaments ca. 2.5-3.5 mm long, filiform, papillose, yellowish; anthers ca. 1 x 0.8, oblong, dorsifixed, tipped with deciduous glands. Ovary ca. 3.5 mm long, cylindrical or terete, recurved, greenish, papillose; style ca. 0.5 mm, curved, glabrous. Pods ca. 6-11 x 0.5 cm, linear-moniliform, straight-curved, apex apiculate, pendulous, pale green when unripe, brown when ripened, 10-15-seeded.

FL. Per.: April-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1270 (PMAS-AAUR).

Distribution: West Pakistan (Punjab, Sindh & Baluchistan), India (Punjab, Pajputana, Bombay, Madras), Afghanistan, Persia and Arabia (Ali, 1973).

4. *Acacia nilotica* subsp. *indica* (Benth.) Brenan in Kew Bull. 12: 84 (1957); Ali in Pak. J. Bot., 1:1-8 (1969); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 380 (1972); Ali in Nasir & Ali., Fl. Pak., 36: 9-11 (1973).

Syn: *A. arabica* (Lam.) Willd. var. *indica* Benth. in Hook. f., Lond. J. Bot. 1: 500 (1842); *Acacia nilotica* var. *indica* (Benth.) A. F. Hill in Bot. Mus. Leaflet. Harvard. Univ. 8: 99 (1940).

A large tree with dark brown or black bark. Stem branched; branches slender, terete, pubescent when young; bark on trunk fissured, grey or brown. Leaves ca. 5-10 cm long; pinnae 4-10 pairs, ca. 1.8-5 cm long; main rachis downy, often furnished with glands. Stipular spines ca. 1.5-5 cm long, smooth, whitish, straight, sharp. Leaflets sessile, 10-25 pairs, ca. 3-6 x 1.5-2 mm, linear-oblong, apex subobtusate, glabrous. Inflorescence globose head, ca. 6-15 mm across; peduncle axillary, in fascicles of 2-6, terete; bracteoles 2, above the middle of peduncle, broadly ovate, apex acute, pubescent. Flowers yellow. Calyx-tube ca. 1 mm long; teeth ca. 2 mm. Corolla ca. 3 mm long; lobes triangular. Pods ca. 5-15 x 1.2-1.5 cm, moniliform, compressed, constricted at sutures between seeds, densely and persistently grey-downy. Seeds 8-12, ca. 7-8 mm across, suborbicular, compressed, black brown.

FL. Per.: March-May and August-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2192 (PMAS-AAUR).

Distribution: West Pakistan (Sindh, Punjab), India (Madhya Pradesh, Uttar Pradesh, Bengal, Madras, Bombay, Punjab), Tanganyika (Ali, 1973).

5. *Acacia jacquemontii* Benth. in Hook., Lond. J. Bot. 1: 499 (1824); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 379 (1972); Ali in Nasir & Ali., Fl. Pak., 36: 13 (1973).

An erect shrub up to 2 m high. Stem fairly branched at the base; branches smooth, stiff, zigzag, brown in colour. Stipular spines ca. 2-5 cm long, white,

connate at the base. Leaves ca. 2-5 cm long; pinnae 1-4 pairs, ca. 6-12 mm long, petiole ca. 2.5-5 cm long; with a gland between the upper pair of pinnae. Leaflets 5-10 pairs, ca. 1.5-3 x 0.5-1.5 mm, linear-oblong, apex obtuse, glabrous. Inflorescence ca. 12-16 cm across, globose head; peduncle 2-3, slender, axillary, fascicled. Flowers yellow, sweet-scented, ca. 3 mm. Bracts 2, inserted in the middle of the peduncle. Calyx-tube ca. 1 mm long; teeth ca. 0.3 mm long, deltoid. Corolla ca. 3 mm long; lobes ovate-oblong, apex acute. Pods ca. 3-6 x 1.2-1.5 cm, ovate-oblong, base rounded, flat, straight, transversely or reticulately veined, glabrous. Seeds 5-8, compressed.

FL. Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2046 (PMAS-AAUR).

Distribution: West Pakistan (Sindh, Punjab & Baluchistan), India i.e. Madhya Pradesh, Punjab, Rajasthan (Ali, 1973).

21. CAESALPINIACEAE

Senna italica Mill., Gard. Dict., ed. 8, no. 2 (1768); Boulos in Fl. Egypt 1: 359 (1999).

Syn. *Cassia aschrek* Forssk., Fl. Aegypt.-Arab. 86 (1775); *C. obovata* Collad., Hist. Nat. Méd. Casses 92 (1816), *nom. illegit.*; *C. obtusa* Roxb. Hort. Beng. 1814 (*nom. illegit.*) ex Wt. & Arn. Prodr. 228 (1834); *C. italica* (Mill.) F. W. Andrews, Fl. Pl. Anglo-Egypt. Sudan 2: 117 (1952).

A diffuse perennial erect herb upto 2.5 ft high. Stem \pm woody, fairly branched; branches spreading, obtusely angular, striate, pale-green, adpressedly pubescent. Leaves ca. 6-10 cm long; rachis glabrous, glaucous, without glands

between the leaflets; petioles ca. 1-3.5 cm long; stipules ca. 0.6 mm long, obliquely lanceolate, apex acute. Leaflets 3-6-pairs, ca. 2-2.5 x 0.9-1.3 cm, broadly oblong or obovate, apex mucronate, base obtuse, glaucous beneath. Flowers axillary; racemes peduncled, ca. 8-16 cm long, usually longer than the leaves; pedicels ca. 5-9 mm long. Calyx ca. 5-9 mm long, divided at the base; lobes oblong, apex obtuse, membranous, greenish in colour. Corolla ca. 6.5-8.2 mm long, obovate-oblong, shortly clawed, yellow, reticulately veined with darker veins. Stamens 7, unequal; staminodes minute; filaments short. Ovary densely pubescent. Pods ca. 3-4 cm long, flat, thin, papery, glabrous, rounded at the both ends, much recurved, transversely veined with a line of prominent, longitudinal crests down the middle of pods over the seeds, sutures very thin. Seeds 6-12, ca. 6 x 4.5 mm, wedge-shaped, truncate or retuse at the apex, finely reticulo-rugose, with a transverse ridge across the middle of each face, dark brown, shiny.

FL. Per.: October- December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2414 (PMAS-AAUR).

Field remarks: A common herb of calcareous soil.

Distribution: W. Pakistan (Sindh, Punjab, N.W.F.P. Province); India (Punjab, Bombay, Madras); Ethiopia, Somalia Republic; Uganda; Kenya; Tananyika; Bechuanaland; South Africa (Ali, 1973).

22. FABACEAE (PAPILIONACEAE)

Key to genera:

1a. Stamens 10, 1-delphous:

2a. Styles bearded. Pods turgid.....1. *Crotalaria*

- 2b. Stiles not bearded. Pods various:
- 1b. Stamens 9+1, 2-delphous:
- 3a. Plants spiny. Leaves simple.....2. Alhagi
- 3b. Plants not spiny. Leaves digitaley divided or compound:
- 4a. Joints of pods turgid, if compressed then corolla not
or hardly exserted.....3. Alysicarpus
- 4b. Pods not jointed:
- 5a. Rachis ending in a tendril.....4. Vicia
- 5b. Rachis not ending in a tendril:
- 7a. Fruit spirally coiled.....5. Medicago
- 7b. Fruit not spirally coiled:
- 8a. Climbing or twining herbs:
- 9a. Leaves gland-dotted beneath; pods 1-2-seeded.....6. Rhynchosia
- 9b. Leaves not gland-dotted beneath; pods more than 2-seeded:
- 8b. Erect or prostrate herbs, undershrubs or shrubs:
- 10a. Hairs medifixed. Anthers apiculate.....7. Indigofera
- 10b. Hairs not medifixed. Anthers muticous or obtuse.....8. Tephrosia
- 11a. Leaves paripinnate; pods 10-20 cm.....9. Sesbania
- 11b. Leaves imparipinnate; pods less than 10 cm:
- 12a. Calyx deeply 2-lipped; pods linear-oblong:
- 13a. Keel 5 mm long..... 10. Trigonella
- 13b. Keel 9 mm long.....11. Astragalus
- 12b. Calyx campanulate; pods ovoid or globose.....12. Melilotus

1. *Crotalaria*

L., Sp. Pl. 714 (1753); Gen. Pl. ed. 5: 320 (1754); Baker in Hoo.
f., Fl. Brit. Ind. 2: 65 (1876); Ali in Fl. Pak., 100: 40 (1977).

Key to species:

- 1a. Leaves simple; pods ovoid.....1. *C. burhia*
1b. Leaves 3-foliolate; pod globose.....2. *C. medicaginea*

1. *Crotalaria burhia* Ham. ex Benth. in Hooker, London Journ., v (2):
474 (1843); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. &
Kashm., 401 (1972).; S. I. Ali in Nasir & Ali., Fl. Pak., 100: 45
(1977).

Syn: *C. burhia* Buch-Ham. Ex Benth. var. *tomentosa* Boiss., Fl. Or. 2:
26 (1872).

Herb to under shrub up to 10-30cm tall, erect, solid, numerous branched, internodal distance ca. 0.5-1.5 cm, green, tapering end appressed densely hairy; 1-celled whitish hairs. Leaves Simple, deciduous, alternate, sessile, pubescent on sides, prominent midvein, attenuate venation, and lamina ca. 0.6-2.5 x 3-10 cm, oblong, obtuse, cuneate base. Inflorescence 4-12 flowers Racemose. Papilionaceous flower, complete, hermaphrodite, zygomorphic, yellow, very short pedicels. Bract ca. 5 x 2 mm, hairy, lanceolate, acute apex and rounded base, green. 2-bracteoles ca. 4-6x 2 mm. 5-gamosepals; ca. 9 x 3 mm (4 mm tube and ca. 5 mm free), pubescent, acute tip teeth lanceolate, yellowish green. Petals 5, papilionaceous, Vexillum ca. 9 x 8 mm, 2-wings ca. 9 x 4 mm, 2-keel ca. 9 x 4 mm, yellow. 10-stamens (9+1), 9 anthers fused to form staminal tube and 1-free; slightly exserted, basifixed anthers, anther sac length ca. 4 mm, staminal tube length ca. 11

mm. Ovary hypogynous; ca. 6 x 3 mm, cylindrical, pubescent, greenish white, style curved slightly; ca. 12 mm, slightly curved, Fruit c. 8-9 mm long, c. 4 mm or less wide, hairy, 3-4-seeded.

FL. Per.: January-February.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2614 (PMAS-AAUR).

Distribution: Pakistan (Punjab, Sind, Baluchistan), India and Afghanistan.

2. *Crotalaria medicaginea* var. *medicaginea* Lamk., Encycl. Meth. 2: 201 (1786); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 401 (1972); S. I. Ali in Nasir & Ali., Fl. Pak., 100: 41 (1977).

var. *medicaginea*

Syn: *Crotalaria luxurians* Benth. in Hook. Lond. J. 2: 578 (1843).

Annual much branched herb up to 45 cm tall. Leaflets ca. 0.6-2 x 0.2-1 cm, obovate or obovate-oblong, retuse or obtuse, apiculate; stipules ca. 2 mm long, filiform, pubescent. Racemes terminal and leaf-opposed, 2- 12 flowered. Bracts linear-subulate, ca. 1 mm long. Calyx-teeth longer than the tube; sepals ca. 3 x 6 mm, lobes acute, persistent. Petals yellow; standard ovate, ca. 5.5 x 3 mm, pubescent on outer side; wings ca. 4.5 x 1.2 mm, keel single, incurved, beaked, ca. 4 x 2 mm. Stamens up to 4 mm long; staminal tube ca. 4 x 6 mm; anthers dimorphic. Ovary ca. 1 x 0.5 mm, sessile, ovate, having trichomes; style ca. 3 mm long, incurved, bearded; stigma small. Fruit globose, ca. 4 mm in diameter, pubescent, beaked with persistent stylar base. Seeds 2, brown- dark brown, smooth, shiny, reniform.

Fl.Per.: March-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).

Distribution: Pakistan (Punjab, Sindh & Baluchistan), India and Afghanistan (Ali, 1977).

2. *Alhagi maurorum* Medic. in Vorles, Churpf. Phys. Oek. Ges., 2: 397 (1787); Stewart in Nasir & Ali., Ann.Cat. Vasc.Pl.W.Pak. & Kashm., 383 (1972); S.I. Ali in Nasir & Ali., Fl.Pak., 100: 319 (1977).

Syn: *Hedysarum alhagi* L., Sp. Pl. 745 (1753); *H. pseudalhagi* M.Bieb., Fl. Taur.-Cauc. 2: 174 (1808); *A. camelorum* Fisch. ex DC., Prodr. 2: 352 (1825); *A. persarum* Boiss & Buhse in Mem. Soc. Nat. Mosc. 12: 779 (1860).

A perennial, deep rooted thorny under shrub up to 100 cm tall. Stem hard, woody at the base, herbaceous above, terete, glabrous to more or less glaucous or puberulent, green; internode ca. 0.5-1.5 cm long, much longer in fruiting stage. Stipular spines ca. 1.2-5 cm long, much longer in fruiting stage, alternate, acicular, pubescent, apex sharp pointed and brown in colour. Leaves simple, alternate, stipulate, ca 0.5-1.2 x 0.3-0.6 cm, obovate, base cuneate, apex mucronate, margin entire, puberulous on both surfaces, lateral nerves obscure, green in colour; petiole ca. 1.5-3 mm long, pubescent. Stipules 2, ca. 1 mm long, ensiform, pubescent. Inflorescence an axillary raceme, rachis ca. 1-2 cm long, ending in spine. Flowers irregular, zygomorphic, complete, alternately arranged, purplish, ca. 1 x 0.5 cm, pedicel ca. 2-4 mm long, curved, cylindrical. Bracts 2, ca. 1-1.5 mm across, ovate. Sepals united, campanulate, tube ca. 4-5 mm long; teeth 2+3, unequal, ca. 1.5-2 x 1-3 mm, valvate, obsolete-triangular, apex acute-apiculate, margin entire, glabrous, green. Petals 5, exserted, papilionaceous, dark pink or reddish-violet, irregular,

imbricate-descending (vaxillary); standard ca. 1 x 0.5 cm, obovate, base cuneate, apex cleft, margin entire, lateral nerves arise from mid nerve and dark pink in colour, claw ca. 2 mm long; wings 2, ca. 20 x 5 mm, elliptic-oblong, apex rounded, base oblique, margin entire, glabrous; keels 2, ca. 20 x 6 mm, united, elliptic, base cuneate, apex obtuse, margin entire, lateral nerves prominently visible. Stamens 9+1, diadelphous; staminal sheath ca. 1.1 cm long, glabrous; filament ca. 0.3-1.1 cm long, glabrous; anthers ca. 1.5 mm across, dorsifixed, oblong, yellow in colour. Ovary monocapellary, ca. 13 x 1 mm, linear, glabrous, green; style ca. 10 mm. long, filiform, glabrous, apex incurved; stigma capitate. Fruit ca. 1-3 x 0.3 cm, linear falcate or straight, moniliform, constricted between the seeds, divided by septa, indehiscent, glabrous, brown in colour, 1-9 seeded; beak ca. 5-6 mm long, empty, pointed. Seeds ca. 5 x 3 mm, elliptic-reniform, blackish brown, glabrous.

FL. Per.: April-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2034 (PMAS-AAUR).

Distribution: Pakistan, Kashmir, Iran, Afghanistan, Russia, Turkey, Iraq, Syria, Palestine, Cyprus & N. Africa (Ali, 1977).

4. *Vicia*

L., Sp. Pl. 734 (1753); Gen. Pl. ed. 5. 327 (1754); Baker in

Hook.f., Fl.Brit. Ind. 2: 176 (1876); Ali, Fl.Pk., 100: 265 (1977).

Key to species:

1a. Leaflets entire, glabrous, inflorescence 1-6-flowered1. *V. faba*

1b. Leaflets ciliated, inflorescence 2-flowered.....2. *V. sativa*

1. *Vicia faba* L., Sp. Pl. 737 (1753).

An annual climbing herb u30-80cm, glabrous, solid, branched, internodes ca. 3-4.5cm. Leaves paripinnately compound, 8-12 leaflets, petiole length ca. 2-3cm, leaflets ca. 2-2.5 x 0.4-0.5cm, broad shiny, elliptic to oval, margin entire, hairs at lower side, mucronate, base attenuate, venation arcuate, unicostate, midvenation prominent, 2 stipules at each node ca. 10-15 x 3mm, opposite, slightly falcate, leaf tip modify in to tendril at upper side, length of tendril ca. 2-2.5cm. Inflorescence axillary, 1-6-flowered. Flower complete, whitish, zygomorphic; pedicle ca. 2mm. 5-gamosepalous, ca. 1.1-1.5 x 0.3cm, 0.7cm free and ca. 0.4cm tube, light yellow, tubeuler shape, acute apex, hairs at margin. 5-papilionaceous petals, whitish yellow in colour, Vexillum ca. 1.6 x 0.6cm, 2-keels length ca.1.5 x 0.2cm width, 2-wings length ca. 1.5 x 0.2cm, white with dark violet wings. 10-stamens (9+1), filament length ca. 8mm. ovary hypogynous ca.10 x 3mm, cylindrical, pubescent, many ovuler, placentation marginal, curve style. Pods, ca. 1.8 x 0.4cm, 6 seeded, densely pilose. Seeds ca. 2-3cm, ovoid to oblong, shiny, smooth, golden brown.

FL. Per.: August-February.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen,2137 (PMAS-AAUR).

Distribution: Pakistan and Europe (Nasir, 1973).

Herbarium Note: Studied sample of *Vicia faba* has 8-12 leaflets which differs from the literature. Similarly elliptic to lanceolate leaf shape differ from oval to elliptic, mucronate leaves apex. Description of Stamens and gynoecium is not mentioned in the Flora of Pakistan.

2. *Vicia sativa* L., Sp. Pl. 736 (1753); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 425 (1972); S.I. Ali in Nasir & Ali., Fl.Pak., 100: 269 (1977).

Syn: *V. notata* Gilib.; *V. globosa* Retz.; *V. cosentinii* Guss.; *V. torulosa* Boreauv.

Annual herb, 15-70 cm, glabrescent to hairy. Stem erect to ascending or procumbent, branched, winged. Stipules ca. 4-8 mm, triangular, deeply dentate; unicellular hairs present on margin. Leaves ca. 3-7 cm long; petiole ca. 0.5-1 cm long. Leaflets 4-8 pairs, 1-3 x 0.25-1.2, oblong-obovate, linear or lanceolate, apex mucronate-obtuse, base rounded or truncate, margin ciliate; tendrils 2-3 branched, ca. 5.7 cm long. Flowers 1-2, axillary, ca. 15 x 7 mm in ; pedicel ca. 5 mm long. Calyx ca. 7 x 6 mm, pubescent; teeth subequal, with unicellular hairs on margin. Corolla purplish to white; vexillum ca. 14 x 6 mm; wings ca. 11 x 3.5 mm; keel ca. 10 x 3.5 mm. Stamens diadelphous, dorsifixed, ca. 1 x 0.2 mm; anthers uniform. Ovary stipitate, 9 x 1.5 mm in ; style ca. 1 x 0.25 mm, terete with tuft of unicellular hairs towards distal end; stigma papillose, ca. 0.5 mm across. Pods linear, ca. 2-6 x 0.5-0.7 cm, torulose or not, pubescent, glabrous when mature. Seeds ca. 2.5-6 mm, sub-globose, brown to black.

FL. Per.: December-February.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2137 (PMAS-AAUR).

Distribution: Pakistan, Kashmir, India, Orient, Europe, Russia, Far East (Ali, 1977).

5. *Medicago polymorpha* L., Sp. Pl. 779 (1753); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 413 (1972); S. I. Ali in Nasir & Ali., Fl. Pak., 100: 302 (1977).

Syn: *Medicago denticulata* Willd., Sp. Pl. 3: 1414 (1802).

Annual, somewhat spreading. Petiole 1.2-4 cm long, leaflets 10-20 mm long, 7-15 mm broad, obovate to cuneate, obtuse, truncate to retuse, slightly toothed; stipules laciniate. Inflorescence a 2-8-flowered peduncled raceme, peduncle 5-15 mm long. Pedicel c. 5 mm long. Calyx 2.5 mm long, teeth subequal to the tube. Corolla c. 4 mm long, yellow. Fruit 2-12 mm high, with 2-4 (-6) spirals, glabrous, spines hooked in 2 rows, oriented almost parallel to the surface of the disc.

FL. Per.: March-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1364 (PMAS-AAUR).

Distribution: Pakistan; widely distributed throughout the world, except for tropical regions and desert (Ali, 1977).

6. *Rhynchosia minima* (L.) DC., Prodr. 2: 385 (1825).

Prostrate or climbing herb, triangular stem or angular, pubescent, internode distance ca. 2.5 -5cm, solid. Imparipinnately compound leaves, trifoliolate, petiole length ca. 2-10mm, leaf length ca. 1-3.5 x 1.5-4.5cm, obovately cordate, broadly acute, base cuneate, uncostate, midvein prominent, reticulate venation pubescent below; glands orange to black; strigose red colour hairs at margin, stipules up to 3.5 mm long. Inflorescence lax axillary Raceme, pedicle length ca. 5mm, papilionaceous flower, complete, zygomorphic, hermaphrodite, yellow. 5-

gamosepalous, lanceolate, acute tip, unequal in length, middle one larger than others, length of middle sepal ca. 1.5 x 1mm, length sepal ca.1 x 1mm, pubescent, teeth longer than tube. Papilionaceous petals, Vexillum ca. 1.1 x 0.8cm, 2-wing ca.1.2 x 0.2cm, 2-keel 1 x 0.2cm, pubescent outer surface. 10 Stamens (9+1), 9 stamens united to form staminal tube; unequal in length, 1-stamen free, length of free stamen is 1cm, length of staminal tube ca. 1.2 x 2mm; curve slightly. Ovary length ca. 1.2 x 0.3cm, cylindrical, monocarpellary, densely hairy, curved style, capitate stigma. Fruit 1.2-2 cm long, 6-6.5 mm broad, glabrous, 2-seeded.

Fl.Per.: January-March.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2512 (PMAS-AAUR).

Distribution: Pakistan, India, Ceylon, Lower Burma, Tropical Africa, West Indies, U.S.A and Australia (Nasir, 1973).

Herbarium Note: Studied sample of *Rhynchosia minima* have large hairs on stem. Lamina obovately cordate leaf shape, Description of gynoecium is not mentioned in Flora of Pakistan.

7. Indigofera

L., Sp. Pl. 751 (1753); Ali in Bot. Notiser 111: 543 (1958); Ali in Fl. Pak., 100: 65 (1977).

Key to species:

1a. Plants annual:

2a. Pods quite flat, falcate, papery, 6-8-seeded.....1. *I. hochstetteri*

2b. Pods cylindric, turgid, 3-4-seeded.....2. *I. sessiliflora*

1b. Plants perennial.....3. *I. oblongifolia*

1. *Indigofera hochstetteri* Baker in Oliver, Fl. Trop. Afr. 2:101. 1871. Ali in Bot. Notiser 11: 552 (1958).

Annual herbs upto ca. 15-20 herb, prostrate to erect, solid, hairy, green, branched, internode distance ca. 3-4.1cm. Leaves imparipinnately compound, petiole length ca. 1cm - 1.5cm, lamina ca. 2.5 - 3.8cm long, 3-5 leaflets; ca. 1.2 - 7 x 2 - 3 mm; opposite, leaf shape oblanceolate, apex apiculate, unicostate, midrib prominent, green, pubescent on both sides, stipulated, length ca. 4.5 mm. Inflorescence racemose, peduncle length ca. 1-9 mm; pubescent, complete, hermaphrodite, hairy, papilionaceous flower, bisexual, zygomorphic, pedicel 2-3mm. gamosepalous 5; length ca. 3mm, ca. 1mm fused and ca. 2mm free teeth like tip, in two groups, two sepals in one group, three sepals in second group, covered with long hairs, green. Papilionaceous petals, 5 clawed, longer than sepals, Standard or vexillum 3-4mm across, 2-Wings 2 x .5-1mm, Keel ca. 2-3 x 1.5mm pinkish purple. stamens 10 (9+1), 9 form staminal tube, 1 stamen free, anther sac ca. 2-1mm. Papilionaceous ovary ca. 1 x 0.4cm, flat, pubescent, curved style, stigma simple to small capitate. fruit ca. 1-2-2 x 3.5mm, pubescent, flat, appressedly pubescent, with a raised longitudinal ridge along the centre of each flattened face and a transverse ridge between the seeds; 5-9-seeded.

FL. Per.: August-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2559 (PMAS-AAUR).

Distribution: Pakistan (Sind, Punjab), Afghanistan, India, Arabia, Somali Republic, Ethiopia, Eritrea, Sudan, Nigeria, Kenya, Uganda, Tanganyika and Congo (Nasir, 1973).

2. *Indigofera sessiliflora* DC. Prodr. 2: 228 (1825); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 408 (1972); S. I. Ali in Nasir & Ali., Fl. Pak., 100: 74-75 (1977).

Syn: *I. tribuloides* Boiss., Fl. Or. 2: 189 (1872); *I. trigonelloides* auct nonJaub. & Spach) Baker in Hook. f. FBI. 2: 94 (1876).

A caespitose, annual, canescent herb up to 30 cm long. Stem prostrate, procumbent or rarely sub-erect, diffusely branched from the base, teret, angular, densely covered with adpressed silvery hairs mixed with a few spreading ones. Leaves ca. 1-4.5 cm long, 5-7-foliolate; petiole ca. 1-1.5 cm long, hairy; leaflets alternate, ca. 0.5-1.5 x 3-5 mm in size, elliptic or oblanceolate, apex obtuse-mucronulate, margin entire, densely clothed with medifixed, adpressed, silvery hairs on both surfaces; petiolule ca. 1-2 mm long; stipules 3 mm long, linear, base broad, apex acute-acuminate, hairy out side. Inflorescence a dense, sessile, axillary, villous heads, ca. 5-6 mm across; bracts 2 mm long, ovate-lanceolate, apex acute, hairy. Calyx ca. 3.5-4 mm long; teeth linear, hairy. Corolla as long as calyx, pale-rose in colour. Pods linear-cylindric, torulose, straight, apex acute, densely clothed with medifixed hairs, up to 1 cm long, 3-6-seeded. Seeds 1 mm across, quadrangular globose, pale-brown, shining, glabrous.

FL. Per.: February-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1024, 1038 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Punjab), Arabia, Eritrea, Sudan, Nigeria, Senegal (Ali, 1977).

- 3. *Indigofera oblongifolia*** Forssk., Fl. Aegypt.-Arab. 137 (1775); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 408 (1972).; S. I. Ali in Nasir & Ali., Fl. Pak., 100: 71-72 (1977).

Annual Shurb upto ca. 10-34cm tall, erect, much branched, glabrous, solid; internodes ca. 1.7- 2.8cm. Leaves imparipinnately compound, 3-5 leaflets, Petiole ca. 1-1.2cm; 1-celled hairy, leaflets ca. 2 – 2.5 x 6-13mm, alternate, glabrous, green, oblanceolate, mucronate, base cuneate, pinnate venation, margin smooth to hyaline, broad unicostate, midrib prominent. 3 stipules in a whorl, ca. 3-3.5mm, margin hairy, base broad, apex acute, reddish brown. Inflorescence raceme upto 10cm long pedicel, papilionaceous flower, purple and white. Gamopetalous 5; ca. 2-3 x 1-1.5mm, ca. 1.5mm tube and free 1.5 mm, hairs at outer surface, at margin and teeth apex. papilionaceous petals, Vexillum ca. 1.2 x 0.8cm, 2-wings ca. 1 x 0.2cm, 2-keel ca.1.2 x 0.2cm, pubescent externally. 10-stamens (9+1), 9 jointed to form staminal tube and 1 free, filament length ca. 2mm, anther sac attached vertically. Long ovary pubescent, ovule marginal placentation, bifid stigma, style curve. Fruit: Fruit pod like, ca. 1.2-2 x 0.4mm , slightly curved, hoary at young stage, 6-8 seeded.

FL. Per.: September-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2590 (PMAS-AAUR).

Distribution: Pakistan, (Sind, Baluchistan, Punjab), India, Ceylon, Java, Jordan, Yemen, Hejaz, Bahrein, Socotra, Eritrea, Somaliland, Egypt, Sudan, Senegal, Angola and Nigeria (Nasir, 1973).

8. *Tephrosia*

Persoon, Syn. Pl. 2: 328 (1807), *nom. cons.*; Baker in Hook. f.,
Fl. Brit. Ind. 2: 110 (1867); Ali in Biologia 10: 23 (1964); Ali in
Fl. Pak., 100: 58 (1977).

Key to species:

1a. Stigma penicillate; claw of the keel less than half the blade. 2. *T. uniflora* ssp. *petrosa*

1b. Stigma not penicillate; claw of the keel more than half the blade. 2. *T. purpurea*

1. *Tephrosia uniflora* ssp. *petrosa* (Blatter & Hallberg) Gillett & Ali in Kew Bull. 13:114. 1958; Ali in Biologia 10:33. (1964).

Erect to semi-erect up to 80cm to 1m tall, densely branched, internode distance ca. 3.5-6.5 cm, angular, villous long velvety whitish grey hairy. Leaves alternately arranged, imparipinnate compound, petiole length ca. 0.9-2 cm, leaflets 7-9, leaflets oppositely arrangement, leaflets petiulos length ca. 2-5 mm, leaflet ca. 4.3-7 x 4-5.5 mm, completely covered with long velvety whitish grey hairs, ovate to elliptic, mucronate apex and cuneate, midrib prominent, entire hairy margin, pinnate venation. 2 stipulates opposite, stipule length ca. 5 x 2 mm, lanceolate, broad base, sharp acute apex, green. Inflorescence: Racemose inflorescence, 10-14 flowered, peduncle length ca. 1.4-3.5 cm peduncle covered with long whitish grey hairs. Papilionaceous flower, complete, hermaphrodite, zygomorphic, hypogynous, purple, pedicel length ca. 3 mm; hairy. bract ca. 4 x 2 mm, linear, broad base and narrowly acuminate apex, whitish hairy, greenish grey. 5-gamosepalous; ca. 6 x 4 mm (4 mm free and 2 mm tube), whitish densely hairy, narrowly acute tip, green.

polypetalous 5, Vexillum ca. 9 x 8 mm, 2-keel ca. 9 x 7 mm, 2-wing ca. 6 x 4 mm, purple, hairy. Stamens 10 (9+1), staminal tube hairy at base, basifixed anthers, filament ca. 12 mm, anther sac length ca. 2 mm. Ovary hypogynous, ca. 5 x 1-2 mm, curve slightly, style ca. 3-4mm; slightly curved, sticky stigma, 7-8 seeded fruit; ca. 2.3-4.7 x 0.3-0.5 cm; hairy pod, fruit curved at tip and tip pointed. Reniform seeds, golden brown, smooth, shiny.

FL. Per.: February-March, August-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2544 (PMAS-AAUR).

Distribution: Cape Verde Islands, Kenya, Tanganyika, Somali Republic, Mozambique, Rhodesia, Angola, N. Transvaal (Nasir, 1973).

2. *Tephrosia purpurea* (L.) Pers., Syn. Pl. 2:329. 1807; Baker in Hook. f., Fl. Brit. Ind. 2:113. 1876; Cooke, Fl. Bomb. Pres. (reprint. ed.) 1:347 (1958).

A much branched, erect, perennial herb up to 3 feet high. Stem ± hairy with adpressed hairs. Leaves ca. 10-13 cm long; stipules ca. 7-9 mm long, lanceolate, linear-subulate, erect or reflexed, hairy; leaflets ca. 7-13, ca. 1.8-2.5 x 0.5-2 cm, oblanceolate, apex mucronate, subcoriaceous, both sides grey-green, glabrous above, adpressedly pubescent beneath. Flowers in leaf-opposed racemes, reddish purple or bright pink; bracts linear, ca. 2-4 mm long. Calyx ca. 4 mm long; tube ca. 1.5 mm long, teeth ca. 2-3 mm long, lanceolate, apex acuminate. Corolla much exserted, ca. 8 mm long, deep purple; standard pubescent on the back. Style flattened, glabrous; stigma penicillate. Pods ca. 3-4 x 0.4-0.5 cm, slightly recurved, glabrescent to softly pubescent, 5-9 seeded.

FL. Per.: October January.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2543 (PMAS-AAUR).

Distribution: Southern Asia, Australia, Tropical Africa, southwards to Natal; introduced in Tropical America (Nasir, 1973).

9. *Sesbania bispinosa* (Jacq.) W. F. Wight in U. S. Dept. Bur. Pl. Ind. Bull.no. 137: 15 (1909); S.I. Ali in Nasir & Ali., Fl.Pak., 100: 90-91 (1977).

Syn: *Aeschynomene aculeata* Schreb. in Nov. Act. Cur. 4:134. 1770;
Sesbania aculeata (Willd.) Poir. in Lam. Encycl. Meth. 7: 128 (1806).

Annual or biennial, erect herb up to 3 m tall, semi-woody. Stem terete, glabrous or sparsely pubescent. Leaves paripinnate, rachis up to 25 cm long, aculeate; leaflets up to ca. 20 x 4 mm, oblong, base sub-oblique, apex obtuse-truncate, mucronate. Stipules ca. 8 mm long, membranous, caducous. Inflorescence 3-6 flowered raceme. Peduncles slender; pedicel ca. 6 mm long. Calyx ca. 6 x 4 mm, glabrous, teeth deltoid. Corolla yellow; vexillum ca. 10.6 x 12 mm, suborbicular; wings ca. 9 x 2.8 mm; keel ca. 10 x 3 mm. Stamens ca. 9 mm long, anthers 0.8 mm long. Ovary ca. 5.2 x 0.6 mm; style 2 mm long. Fruit up to ca. 20 cm long, with ca. 30-38 seeds, falcate, glabrous.

FL. Per.: June-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2407 (PMAS-AAUR).

Distribution: Cosmopolitan in tropics of the Old World (Nasir, 1973).

10. *Trigonella monantha* ssp. *incisa* (Benth.) Ali comb. & stat. nov

Prostrate to ascending annual herb, setose hairs, internode ca. 2-3.5cm, node pairs of stipules, ca. 5-6 x 1mm, stipules broader, acute apex, setose,

semisagittate and winged persistent. Petiole ca. 0.9-1.1cm, setose hairs, trifoliate leaflets; leaflet ca. 9-11-5 mm, each leaflet cordate to base cunate and apex apiculate, serrate, midrib prominent. Inflorescences Racemose, peduncle length 1-1.2cm; dens setose hairs at peduncle, pedicle ca. 2-4mm, lanceolate bract at base of flower; ca. 2 x 1cm, acute apex, green. 1-3-flowered at leaf axils. 5-gamosepalous, ca. 5-6 mm long; ca. 3mm tube and ca. 2 mm free, campanulate. Teeth apex, setos hairs at outer surface, green. Vexillum ca. 4-5 mm x 4-5 mm, apex rounded, undulate margin, 2-wings 5 x 2 mm, 2-keel ca. 5 x 2 mm, hairs at outer surface at petals, yellow. Stamens: 11(10+1) 10 stamens jointed and one free, 10 stamens form staminal tube ca. 4-5 mm form staminal tube; free stamens ca. 6 mm, anther sac ventrally attached to filament. Ovary ca. 3-4 x 1mm, brown, hypogynous, multiovuler, capitate head stigma, style 2 mm long, slightly curve. Pod ca. 4-4.2 x 0.3cm, stipules are persistent, brown, curved, placentaion axail, 14-15 seeds, pod pointed end, seeds brown, cylindrical having depression at one side near to mid of seed.

FL. Per.: January-April.

Specimen citation: THAL DESERT: Humaira Shaheen, 2182 (PMAS-AAUR).

Distribution: Pakistan; India; Afghanistan (Nasir, 1973).

11. *Astragalus amherstianus* Royle ex Benth. in Royle, Illustr.Bot.Himal. Mount. 199 (1835); Baker in Hook.f., Fl.Brit.Ind.2: 119 (1876); Ali in Biologia 7: 12 (1961).

Prostate herb, greenish grey; internodes ca.1.5-3cm, densely pilose appressed hair, angular, stipules 2; ca. 7 x 3mm, densly tomentose hairs, lanceolate acute to acuminate apex, greenish grey. Imparipinnately compound, petiole ca. 3-17 mm,

rachis; 1-15 leaflets, ca. 8-1 x 3-4mm, elliptic to lanceolate, small petiole, grey densely tomentose hairs on both surface, and margin, margin slightly serrate, greyish green, apex mucronate, base rounded. Inflorescences terminal racemose. peduncle ca. 3-3.5cm long; greyish hairy, pedicle length ca. 1.5-3.5cm, flowers 3-5, purple, bracts at pedicle, ca. 2-3 x 1mm, whitish tomentose hairs, acute sharp apex, margin smooth, lanceolate to linear, greenish grey. Gamosepalous 5, ca. 7-8 x 1-2mm, ca. 5mm tube and ca. 3mm free, sharp acute apex, dens grey hairs on outer surface, greenish grey. Vexillum ca. 9-1 x 8mm lobed and slightly wavy, 2-wings ca. 8mm with ca. 1mm small stalk, keel ca. 9 mm, wings and keel slightly dentate at tip. Stamens 10 (9+1), 9 stamens form staminal tube and upper ends free; slightly curved, anther sac vertically attached to filaments, filaments unequal in ca. 5mm tube, 3-4mm free stamens, anther sac ca. 2 x 1mm orange yellow, one of them free with ovary ca. 6-7mm. ovary hypogynous, unilocular, long pod ca. 7-8 x 3 mm, brown with dense greyish tomentose hairs, style slightly curves ca. 5 mm long, stigma capitate head. Fruit curved pod siliqua having dense hairs, axile placentation, pod, pod apex acuminate, half moon shape curved, seeds shiny brown; reniform having depression at one side ca. 4 x 3mm, 10-12-seeded.

FL. Per.: April-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2149-2025 (PMAS-AAUR).

Distribution: Pakistan (Punjab, N.W.F. Province, Baluchistan); Kashmir; India, (Kumaun, Tehri Garhwal, N. Punjab), 6000-13000 ft (Nasir, 1973).

Herbarium Note: Stem have tomentose hairs, leaves have dens tomentose hairs, leaflets margin slightly serrate.

12. *Melilotus indica* (L.) All, Fl. Pedem. 1: 308 (1785); S.I. Ali in Nasir & Ali., Fl.Pak., 100: 308-309 (1977).

Syn: *Trifolium M. indica* L., sp. Pl. 765 (1753); *Melilotus parviflorus* Desf., Fl. Alt. 2: 192 (1799); *M. bonplandii* Ten., Index Sem. Hort. Neapol. 14 (1833); *M. tommasinii* Jord. Mém, Acad. Roy. Sci. Lyn. Sect. Sci., ser 2, 1: 266 (1851).

Annual erect herb, up to 60 cm tall, glabrous, hairy when young. Stem fairly branched, quadrangulate, grooved; stipules ca. 3-6 mm, lanceolate, entire or denticulate, acuminate. Petiole ca. 3 cm long; leaflets ca. 0.8-2.4 x 0.3-1.2 cm, obovate-oblong, base cuneate, margin sharply serrate-dentate, apex truncate-apiculate. Racemes ca. 1-2.5 cm, 20 to 30-flowered. Bract ca. 2.5 mm long. Flower ca. 3 x 1 mm; pedicel 2-3 mm. Calyx ca. 1-1.5 x 3 mm in . Corolla yellow; standard ca. 2.5 x 1 mm, wings ca. 2.5 x 0.5 mm; keel ca. 2.5 x 1 mm. Stamens 9+1; anthers ca. 1.5 x 0.5 mm. capitates head stigma. Pods ca. 1.5-3 mm, subglobose with reticulate ridges. Seed globose, minutely tuberculate, ca. 1.5-2 mm.

FL. Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2032 (PMAS-AAUR).

Distribution: Pakistan, India, Orient, Europe, introduced in warm temperate regions (Ali, 1977), Eurasia (Boulos, 1999).

23. CELASTERACEAE

Maytenus royleanus (Wall. ex Lawson) Cufodontis in Senck.Biol. 43:313 (1962).

A spiny shrubby, rounded, brownish green, woody below and herbaceous, internode distance ca. 3.5-4cm. long greenish brown spines, spirally arranged; ca.

2.5-2.7cm, acute apex and broad base, straight, slender. Leaves spirally arranged, small petiolated ca. 2-3 mm, lamina ca. 1.5-1.7 x 1.2cm, ovate, apex acute, base cordate, slightly serrate margin, midvein prominent, rough or slightly pubescent, green. Flower peduncle ca. 7 mm. small bract at base of peduncle, ca. 2 x 2 mm, lanceolate to obovate, acute apex, base broad, margin serrate and hairy, hairs also on outer surface. Pedicle ca. 2-3 mm, 2-4 opposite bractioles at base of pedicle. 5-gamoseplous, ca. 2 x 3mm, triangular, acute apex and serrate to stigose hairs at margin. 5-polypetalous, alternate to seples, ca. 0.5-0.6 x 0.2mm broadly acute apex, margin smooth, broad base, lanceolate. 5-stamen, free, basely attached to filament, brown, around ovary grove, filament length ca. 5-6mm, anther sac yellowish brown. ovary rounded sunkin fleshy disc, ca. 3 x 3mm, hypogynous, placentaion pariental, small stigma and 3 stle jointed, stigma cylindrical or slightly bifurcated.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2127 (PMAS-AAUR).

FL. Per.: Throughout the year but more generally during the cold season.

Distribution: E. Afghanistan, Pakistan, India (Nasir, 1973).

24. SALVADORACEAE

Salvadora oleoides Decne. in Jacq. Voy. Inde., 140-144 (1844); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 550 (1972); Saida in Nasir & Ali., Fl. W. Pak., 29:3 (1972).

A shrub or small tree ca.5-8 m tall with a short twisted or bent trunk; branches numerous, stiff and woody, divergent, whitish. Leaves ca. 1-7.5 x 0.4-1.5 cm, linear or ovatelanceolate, or elliptic-lanceolate, apex acute or mucronate, margin entire, pale or whitishgreen, coriaceous and somewhat fleshy when mature,

glabrous, main nerves indistinct; petiole ca. 2.5-1.6 cm. Inflorescence axillary panicles or branched spikes, ca. 2-4.5 cm long. Flowers greenish-white, sessile, ca. 2-3 mm across; pedicel ca. 1 mm or 0. Sepals ca. 1.5-2 mm long, cleft about half way down; lobes 4, rounded, apex obtuse, margin wavy, glabrous. Petals ca. 2.5 mm long, deeply cleft; lobes obovate-oblong, apex subacute and recurved. Stamens 4, inserted at the base of the petals tube. Style absent' stigma peltate. Drupe ca. 5 mm across, globose, yellow when ripe.

FL. Per.: December-March.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1023 (PMAS-AAUR).

Distribution: West Pakistan, India (Gujrat, Junagarh, Rajputana) and Aden (Qureshi, 1972).

25. EUPHORBIACEAE

Keyto genera:

1a. Flowers naked, arranged in flower-like cyathia, milky latex present...1.

Euphorbia

1b. Flowers with Perianth, not arranged in cyathia, milky latex absent:

2a. Petals present, at least in male flower:

3a. Filaments fused into a column, erect in bud.....2. Chrozophora

3b. Filaments free, incurved in bud.....3. Croton

2b. Petals absent:

4a. Leaves palmately 5 to 9-lobed, peltate; stamen numerous;

fruit softly echinate.....4. Ricinus

4b. Leaves entire, not peltate; stamens 2-6; fruit smooth.....5. *Phyllanthus*

1. *Euphorbia*

L., Sp. Pl. 450 (1753); Gen. Pl. ed. 5: 208 (1754); Benth. & Hook. f., Gen. Pl. 3(1): 258 (1880); Hook. f., Fl. Brit. Ind. 5: 224 (1887); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 447 (1972); Radcliffe-Smith in Fl. Pak., 172: 88 (1986).

Tithymalus [Tourn.] Trew, Herb. Blackw. 1: t. 123 (1754); *Euphorbium* Hill, Fam. Herb. ed. 2: 136 (1755); *Anisophyllum* Haw., Syn. Pl. Sauc. 159 (1812); *Chamaesyce* [diosc.] S.F. Gray, Nat. Ann. Brit. Pl. 2: 260 (1821); *Poinsettia* Grah. in Edin. New Phil. J. 20: 412 (1836); *Agaloma* Raf., Fl. Tell. 4: 116 (1838).

Key to species:

- 1a. All leaves linear to linear-lanceolate.....1. *E. dracunculoides*
- 1b. Leaves variable, the upper differing from the stem-leaves:
- 2a. Plants puberulous or pubescent.....2. *E. indica*
- 2b. Plants glabrous.....3. *E. hypericifolia*
- 3a. Plant rooting at the nodes; stipules fused to form a triangular scale.....4. *E. serpens*
- 3b. Plant not rooting at the nodes; stipules all free:
- 4a. Leaves entire or almost so.....5. *E. granulata*
- 4b. Leaves minutely denticulate, serrulate, or serrate:
- 5a. Fruits glabrous except on the keels;

seeds sharply transversely-ridged.....6. *E. prostrata*

5b. Fruits adpressed-pubescent; seeds shallowly transversely-

ridge.....7. *E. thymifolia*

1. *Euphorbia dracunculoides* subsp. *dracunculoides* Lam., Encycl. Meth. Bot. 2: 428 (1788).

Erect glabrous annual to perennate herb up to 17-30cm tall, angular, greenish yellow, internode ca. 1-1.5cm, herbaceous, glabrous, nodes slightly much branches at base. Leaves oppositely arranged but lower branched leaves alternately arranged, sessile leaves and apmlaxicaule, leave lamina ca. 1-1.3 x 0.3-0.4cm, apex acuminate, linear, glandular surface margin, upper and lower surface also glandular, hairs at lamina base, leaf base ligules yellow. Inflorescences solitary, cathyea formation, ca. 5mm , male and female flower in cyathium, sterile hairs inside, pedicel ca. 0.5mm; 4-lobed, between lobes fringes like appendages which usually branch and hyaline. 4-6 male flower, greenish, all unequal, before joint filament ribbon like after joint solid green, filament ca. 2-4mm, anther sac basally attached to filament, 2-chamber anther sac, anther sac ca. 1-2mm. Female flower long pedicel ca. 4-8mm, at maturity female flower emerge out from cyathea, ca. 2mm across globose hypogynous ovary, trilocular, syncarpous, stigma and style tristigmated each bifid style erect 1mm long. Seed trilocular, ovate, greenish brown, ca. 2.5 x 3mm. Stigma and style persistent.

FL. Per.: Nov. - April; **FL. Per.:** Feb. - May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2059 (PMAS-AAUR).

Distribution: Egypt, Iraq, Kuwait, Arabia, Afghanistan, India, Tropical Africa and the Mascarenes (Nasir, 1973).

2. *Euphorbia indica* Lam., Encycl. Meth. Bot. 2: 423 (1788); Boiss. in DC., Prodr. 15(2): 22 (1862); Hook. f., Fl. Brit. Ind. 5: 250 (1887); Stewart, Ann. Cat. Vasc. H. W. Pak. & Kashm. 450 (1972).

Syn: *Euphorbia hypericifolia** sensu Hook. f.

A decumbent-ascending, suberect or erect sparingly puberulous or pubescent annual herb up to 60 cm; hairs small, mostly unicellular, white. Petioles 1-2 mm long. Leaf-blades elliptic-oblong, (0.5-) 1-3 x (0.3-) 0.5-1.5 cm, obtuse, obliquely rounded at the base, senulale except at the base on the inner margin, subtriplinerved, green above, paler beneath. Stipules interpetiolar, triangular, often fimbriate or lacinate, 1.5 mm long. Cyathia aggregated together into loose clusters terminating short axillary shoots; cyathial glands purplish, with white or pale pink orbicular petaloid appendages. Fruits trigonous, 1.5 x 2 mm, smooth, sparingly pubescent or glabrous. Seeds 1 x 0.8 mm, ovoid, roundly-quadrangular, shallowly rugulose to almost smooth, grey, ecarunculate.

FL. Per.: Feb.-May

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2159 (PMAS-AAUR).

Distribution: Africa, Arabia, Iran, Afghanistan, India, China (Nasir, 1973).

3. *Euphorbia hypericifolia* Lam., Encycl. Meth. Bot. 2: 423 (1788); Boiss. In DC., Prodr. 15(2): 22 (1862); Hook. f., Fl. Brit. Ind. 5: 250 (1887); Stewart, Ann. Cat. Vasc. H. W. Pak. & Kashm. 450 (1972).

Erect annual upto 30-60cm, tomentose powdery hairy surface, 1-2celled hairs and tapering apex, internodal distance ca. 1-1.5cm much branched, brownish green. oppositely arrangement, petiole ca. 0.5-2mm; tomentose powdery hairy; brownish green, lamina ca. 1-3 x 0.6-1.5cm elliptic to oblong, serrate margin at leaves upper half of oblique side, stigmatic hairs margin and venation of lower side, acute apex, base oblique and rounded, attenuate venation midvein prominent. Stipules interpetiolar, triangular, often fimbriate or lacinate, 1.5 mm long. Axillary cluster inflorescences, incomplete, imperfect, peduncle 3cm; tomentose powdery hairy surface; hairs 1-2celled tapering tip; brownish green, cyathia have male and female flowers, cyathia pedicel ca. 3mm, cyathia ca. 0.3mm long having 4-lobed having appendages between lobes hyaline, purplish. Male flower perianth absent, 6-7anthers, ca. 3mm long anther filament; ca. 2mm before joint ribbon like flat and hyaline, ca. 1mm after joint pale green, anther sac basally attached, two lobes sac; ca. 1 x 2mm. Female flower perianth absent, trilobular ovary, syncarpous, whitish tomentose hairs, globose, stigma and style tristigmatic, bifid, ovary pedicel ca. 0.3-2mm sometime emerges out from cyathia at mature. Fruit trilobular, seed cylindrical, seed coat hairy, ca. 1 x 0.8mm, ovoid, grey, smooth, shiny.

FL. Per.: Feb.-May

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2602 (PMAS-AAUR).

Distribution: Africa, Arabia, Iran, Afghanistan, India, China, Karachi Pakistan.

4. *Euphorbia serpens* Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. Pl. 2: 52 (1817).

Annual herb upto ca. 25cm long, angular, whitish tomentose hairs, at young stem dens tomentose hairs as compare to mature, internodes distance ca. 0.5-1.5cm. Swollen nodes sometime roots at the stem, stipules covering at nodes of ca. 2 x 1mm, hyaline, acute tip. Leaves opposite arrangement, ca. 3mm petiole length, tomentose hairs, lamina ca. 5-7 x 3-4mm, strigose whitish hairs at lower surface; tip and margin, ovate, margin serrate, base slightly oblique to rounded, tip obtuse with hyaline layer, venation arcuate. Inflorescences terminal or laterally solitary. Male and female flower in cyathea, cyathea lobes tip pink, 4-lobes, between cyathea lobs fringes like appandages which usually branch and hyaline at tip, cyathea ca. 3-4mm. Petiole length is 0.3mm, 5-6 male flower in single cyathea, ca. 2mm filament before joint ca. 2-2.5mm length, basely attached to filament, anther sac ca.1mm , filament slightly whitish hairy. Female flower triloculer oblong to ovate ovary, whitish green appendages, dens tomantose white hairs, tristigmated each bifurcated and at maturity stigma become minute and fid off. Seed coat with tomatoes hairs, ca. 0.3-0.8 x 0.5mm, seeds pinkish brown, ovate

FL. Per.: Sept.-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2419 (PMAS-AAUR).

Distribution: America, Mediterranean, S.W. Asia and Africa, Rawalpindi and Mangla, Jhelum, Faisalabad and Lahore.

Herbarium Note: Angular stem having dense white tomantose hairs, sometime lower node swollen. Leaves opposite in arrangement, tomentose hairs also present on lamina, lamina ca. 5-7 x 3-4mm, dense tomantose white hairs also presnt on ovary. Stipule absent.

5. *Euphorbia granulata* Forssk., Fl. Aegypt-Arab. 94 (1775).

Perennial herb upto 15-25cm, internode distance ca. 0.5-1cm, slightly angular, swollen nodes sometimes roots at the stem. Leaves petiole ca. 0.2-0.5mm, long white hairs, lamina ca. 4-5 x 0.5-4mm, glabrous, obovate to oblong, margin wavy to slightly serrate at upper half, oblique and cordate base, apex rounded mid venation not prominent, succulent. Stipules covering at nodes of ca. 2 x 1mm, hyaline, acute tip. Inflorescences terminal or laterally solitary. In cyathia male and female flowers present, cyathia pedicel ca. 0.2-0.3mm, 4 lobes cyathia of cyathia ca. 2-3 mm, between lobes fringes like present appendages which usually branch and hyaline at tip; equal to lobes green at mid, lobes are light pink at tip. Male flower no perianth, unequal filament ca. 1-2mm before joint after node ca. 4mm, 2-chambered anther sac. Female flower perianth absent, filament length ca. 2-5mm, filament curves out at maturity from cyathia, globose trilocular ovary, syncarpous, hypogynous, whitish hairs on ovary and filament, only one female ovary emerges out from single cyathia, each ovule its own stigma and style, each stigma bifurcated, Seed: seed coat has velvety white hairs, 3-seed ca. 0.3-0.8mm, shiny brown, cylindrical, stigma style persistent.

FL. Per.: More or less continuously throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2517 (PMAS-AAUR).

Distribution: Canaries and N. Africa to Tropical Africa and eastwards to Central Asia and Northern India.

Herbarium Note: Dens white hairs on both side of lamina, margin wavy to slightly serrate at upper half, apex rounded.

6. *Euphorbia prostrata* Ait., Hort. Kew, ed. 1, 2: 139 (1789). Boiss. in DC., Prodr. 15(2): 47 (1862); Hook. f., Fl. Brit. Ind. 5: 266 (1887); Stewart, Ann. Cat. Vasc. Pl. W. Pak. & Kashm. 452 (1972).

Small prostrate herb, brownish green, white long hirsute hairs, nodes swollen, internode distance ca. 0.5-1cm, slightly angular, densely branched, stipules at nodes which fuse to cover node, stipule ca. 2 x 1mm; apex acute. Leaves opposite in arrangement, petiole ca. 3mm with whitish hirsute hairy surface, lamina ca. 9-10 x 5-7mm, ovate to slightly elliptic, oblique cordate base, lightly serrate at upper half of leaves, apex apiculate, succulent, midrib prominent, whitish hirsute hairs at mid rib. Inflorescences terminal or laterally, Flower cyathia formation with male and female, cyathia pedicle length ca. 2-4mm, cyathia 4 lobed, between lobes fringes like appendages usually branch and hyaline at tip, cyathia ca. 2mm, lobes light pink at tip. Male flower small, without perianth, numerous in numbers, 1-2mm filament length before joint, ca. 0.5-1mm after joint, anther sac two chambers. Female flower perianth absent, filament length ca. 2-5mm, at maturity filament curves out from the cyathia (only one female ovary emerges out from the single cyathia), globose trilocular ovary, each ovule has its own stigma and style, stigma bifurcated, syncarpous, hypogynous ovary, whitish hairs present at globose ovary and filament. Seed coat velvety white hairs, seed ca. 0.3mm, shiny brown color, 3 in number, cylindrical, stigma style persistent.

FL. Per.: More or less continuously throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2518 (PMAS-AAUR).

Distribution: Native to tropical and subtropical America, the Old World.

Herbarium Note: long white hirsute hairs on stem, nodes slightly swollen. Lamina apex apiculate and succulent. Ovary hairy and fruit also hairy.

7. *Euphorbia thymifolia* L., Sp. Pl., 454 (1753); Jafri in Fl. Kr., 200 (1966); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 453 (1972); Radcliffe-Smith in Nasir & Ali., Fl. Pak., 172: 107 (1986).

Syn: *Chamaesyce thymifolia* (L.) Millsp. Publ. Field Columbian Mus. Bot. Ser. 2: 412 (1916).

Annual, prostrate, pale green herb up to 15 cm long. Stem divericately branched, slender, cylindric, more or less hairy. Leaves ca. 3-6 x 2.5-4 mm in size, opposite, obliquely oblong or elliptic-oblong, apex rounded, base unequal, margins crenulate, glabrous above, glaucous and usually slightly pubescent below; petiole ca. 0.5 mm; stipules fimbriate. Involucres axillary, solitary or 2-3 together in an axil, campanulate; stalk short; glands minute or 0. Male florets: 1-4, ebracteolate; stalk ca. 0.5 mm; anthers ca. 0.2 mm, dehiscence vertical. Female floret: lateral pendulous. Ovary ca. 0.8 x 0.7 mm in size, tomentose; styles 3, forked from the base, erect, ca. 0.7 mm long. Capsule ca. 1.5 mm across, obtusely keeled, adpressed hairy.

FL. Per.: December-February.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 938, 1212 (PMAS-AAUR).

Distribution: It is widespread in Tropical Asia and America and introduced into East Tropical Africa (Radcliffe-Smith, 1986).

2. *Chrozophora tinctoria* (L.) Raf., Chlor. Aetn. 4 (1813). Muell. Arg. in DC., Prodr. 15. 2: 748 (1866); Hook. f., Fl. Brit. Ind. 5: 408 (1887); Stewart, Ann. Cat. Vasc. Pl. W. Pak. & Kashm. 446 (1972).

Syn: *C. hierosolymitana* Spreng., *C. obliqua* (Vahl) Adr. Juss. ex Spreng.,
C. oblongifolia sensu auctt. plur., non (Del.) Adr. Juss. ex Spreng., *C.*
verbascifolia (Willd.) Adr. Juss. ex Spreng., *Croton tinctorius* L.

An erect-ascending annual herb up to 75 cm, sparingly, evenly or densely stellate-pubescent. Petioles 2-10 cm long. Leaf-blades broadly ovate-rhombic to ovate-lanceolate, (2-) 3-7 x (1-) 2-6 cm, obtuse, subacute or acute at the apex, cuneate or rounded or rarely subtruncate at the base, subentire to repand-dentate, 3 (-5)-nerved from the base, basal glands fairly prominent, sparingly, evenly or densely pubescent above and beneath. Stipules filiform, 1-3 mm long. Inflorescences 1-4 cm long, often produced above a stem di- or trichotomy. Male flowers subsessile; sepals lanceolate, 3-4 mm long, stellate-pubescent; petals elliptic-lanceolate, 4 mm long, lepidote without, yellowish-green; disc thick, ca. 1 mm diam.; stamens (3-) 4-10 (-12), the filaments variously united into a column 3.5 mm high, anthers biseriate, 1.5 mm long. Female flowers: pedicels 5 mm long, extending to 3 cm in fruit and becoming deflexed, often upto 4 on a short peduncle; sepals and petals narrowly linear, sepals; ovary 2 mm diam., densely silvery-lepidote; styles stellate-pubescent and papillose, deeply bipartite, 2-3 mm long. Fruit rounded-trilobate, 5-6 x 8-9 mm, often somewhat tuberculate, stellate-lepidote, tinged with reddish-purple. Seeds triangular-ovoid, ca. 4-5 x 3-4 mm, tuberculate, grey.

FL. Per.: Jan: Sept.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1078 (PMAS-AAUR).

Distribution: From Spain and N.W. Africa eastwards to Arabia and N.W. India.

3. *Croton bonplandianus* Bat., Adansonia. 4: 339 (1863).

Erect woody herb upto 20-40cm, solid, herbaceous above and woody below, whorled branches, internodes distance ca. 1.8-3.4 cm, whitish gray floccose hairy stem. Leaves alternate to whorled arrangement, simple, Petioles ca. 1.3-1.5 cm long. Lamina ca. 3-5.5 x 0.5-2.5cm cm, acute, cuneate, with 2 small sessile discoid basal glands beneath, crenate-serrate, membranous, penninerved, glabrous above, sparingly stellate-lepidote beneath, dark green. Stipules subulate, ca. 0.5 mm long. Racemes terminal Racemose thyris; upto ca.15 cm long, Monoecious flowers, male flower upper side of branch and female flower at lower side of same branch, axis sparingly stellate-lepidote to subglabrous; bracts triangular lanceolate; ca. 1 mm long. Male flowers: pedicels ca. 1-1.5 mm long, glabrous; buds globose, subglabrous; calyx 5-lobed, the lobes elliptic-ovate, 1.5-1 mm, subacute, greenish-yellow; 5-petals, oblong, recurved, ca. 2 x 0.5 mm, obtuse, subglabrous, whitish; disc-glands free, subglobose, apiculate; stamens 13-16, filaments ca.2 mm long, anthers 0.3 mm long; receptacle glabrous. Female flowers subsessile; calyx-lobes 5, triangular-ovate, ca.1 x 1 mm, subacute, not accrescent, subglabrous; petals 0; disc annular; ovary ellipsoid-subtrilobate, ca. 1.5 x 1 mm, densely stellate-lepidote; 3-styles, free, ca.1.5 mm long, spreading, glabrous, bifid, the arms filiform. Fruit ellipsoid-trigonous, ca. 5-6 x 4 mm, septically dehiscent, sparingly stellate-lepidote. Seeds compressed-ellipsoid, ca. 4 x 2 mm, grey, slightly roughened; caruncle bilobate.

FL. Per.: April-July.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2548 (PMAS-AAUR).

Distribution: S. Bolivia, Paraguay, S.W. Brazil, N. Argentina, widespread in the Palaeotropics.

4. *Ricinus communis* L., Sp. Pl. 1007 (1753); Stewart, Ann. Cat. Vasc. Pl. W. Pak. & Kashm. 456 (1972).

Large erect, shrubs or small trees up to 4 m high, with fistular stem and glaucous-grey or reddish, smooth bark. Young shoots often pruinose.. Leaf-blades commonly 7-9-lobed, the median lobe usually 10-20 cm long and 2-5 cm wide, sometimes larger, the lateral lobes progressively smaller; lobes lanceolate, acutely acuminate, coarsely glandular-serrate or biserrate, lateral nerves c. 10-20 pairs, running to the margins, dark green above, paler beneath; petioles 5-20 cm long; petiolar glands variously-shaped. Stipular sheath ovate, ca. 1-2 cm long, leaving a circular scar when fallen. Inflorescence 10-25 cm long; bracts ca. 1 cm long, the bracteoles smaller. Male flowers; pedicels c. 1 cm long; calyx-lobes elliptic-ovate, ca. 6-8 x 3-4 mm, acute, yellowish-green; stamens 7 mm long, anthers 0.5 mm. long, pale yellow. Female flowers: pedicels 3-5 mm. long, extending to 2 cm or more in fruit; sepals lanceolate, 5 mm long, acuminate, purplish; ovary trilobate-subglobose, 2 x 2 mm; styles 3-7 mm long. Fruit trilobate, ca. 1-1.8 x 1-1.5 cm, smooth or sparingly to densely covered with narrowly cylindrical bristle-tipped fleshy processes 3-5 mm long. Seeds ca. 7-12 x 5-8 x 4-6 mm, shiny, greyish, silvery or beige generally streaked and flecked with brown; caruncle depressed-conic, ca. 1-2 x 2-3 mm.

FL. Per.: Almost seasons.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2601 (PMAS-AAUR).

Distribution: Sub-Himalayan tract and in the plains.

5. *Phyllanthus maderaspatensis* L., Sp. Pl. 982. 1753; Stewart, Ann. Cat. Vasc. Pl. W. Pak. & Kashm. 455 (1972).

Erect annual or perennial herb upto 50-60cm, glabrous, woody below and herbaceous above, intercodal distance ca. 1-1.5cm, greenish brown. Leaves spirally arrangement, petiole ca. 0.4-1 mm, lamina ca. 0.7-3 x 0.2-1 cm, elliptic to lanceolate, smooth margin, apex appiculate, tapered at base, lateral nerves 4-8 pairs, geryish green. 2-stipulates at both side of petiole; ca. 2mm across, pinkish brown, lanceolate, acuminate apex, margin serrate. Inflorences solitry axial, Flower: dieacous but on same branch, male flower at upper side and female flower on lower side, male flower pedicle ca. 0.4-0.5mm, 6-parienth, jointed, ca. 0.2-1 x 0.6mm, spatulate, smooth hyaline margin, green, 3-anther, filament united with 6-glandular dic into a short column but at top free, anther sacvertically attached and londitudincally dehiscent; yellow. Female flower pedicale length ca. 1.5-2mm; glabrous, 6 parienth (3 outer and 3 inner), ca. 2-4 x 2mm, jointed, spatulate-ovate, smooth hyaline margin, green. Ovary globous; 3 ovuler, ca. 1mm across, each divded 2-ovules, sessile, overy present at ovary dic, stigma and style persistent. bifid stigma, ca. 0.5mm style, errect. Fruit depressed-rounded trilobed, pinkish brown, shiny. Seeds 1.3x 1mm, brown having 14 rows of shiny black tubercles at back and 12 concentric rings of tubercles .

FL. Per.: May-January.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).2135

Distribution: Africa, Arabia, Pakistan, India, Sri Lanka, China, Java and Australia.

Herbarium Note: slightly angular stem. Leaves spirally arrange, leave shape elliptic to lanceolate, tip apiculate. Female flower sepals spatulate.

26. RHAMNACEAE

Key to species:

1a. Leaves 1-2 cm x 0.5-2 cm, orbicular to elliptic, flowers 3-4...1. *Z. nummularia*

1b. Leaves 2-6 x 1-4 cm ovate-elliptic or suborbicular,
flowers 4-6 mm.....2. *Z. spina-christi*

1. *Ziziphus nummularia* (Burm. f.) Wight & Arn., Prodr. Fl. Penins. Ind. Or.
162 (1834).

A medium d diffuely branched shrub up to 4 meter high. Stem much branched, rounded, greenish brown, glaucous, tomentose hairy on younger branches; internodes ca. 2.5-4cm. Stipular spines in paired; one spine ca.3mm long and straight, the other ones ca. 5mm curved, arranged at leaves abaxial side, spirally arranged. Leaves spirally arranged, ca. 1.9-2 x 1.5cm, ovate, base attenuate, apex acuminate, margin dentate to serrate, reticulate veined, whitish powdery appearance at lower surface, upper surface dark green with tomentose hairs; petiole ca. 1.2mm, tomentose hairy. Inflorescence lateral cymes; 3-4 flowers in each group, green; pedicel ca. 0.5cm. Bract ca. 3 x 1mm, tomentose hairy at outer surface, lanceolate, apex acute, margin entire. Sepals 5, gamosepalous; tube ca. 2 mm; lobes 5, ca. 5 mm, lanceolate to broadly lanceolate, margin smooth, powdery tomentose, greenish grey. Petals 5, polypetalous, alternate to sepals, rounded to spatulate, ca. 4 x 2mm, spirally tomentose hairy. Stamens equal to petals, epipetalous, ca. 4 mm long; filament ca. 3mm. Ovary epigynous,

syncarpous, 2-locular 2-ovuler, ovary attached with disc, disc rounded ridges and furrows; style ca. 1-1.5mm, straight, stigma bifid.

FL. Per.: March-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2403 (PMAS-AAUR).

Distribution: Palestine, Iraq, Iran, Afghanistan, Pakistan and India.

HerbariumNote: Bract at pedicle ca. 3 x 1mm, tomentose hairy at outer surface, lanceolate, apex acute, margin entire and anther equal to petals.

2. *Ziziphus spina-christi* (L.)Willd., Sp. Pl. 1: 1105 (1798).

A straggling shrub with zigzag branches up to 3 meter high. Stem densely branched, woody and zigzag stem, whitish powdery surface; internodes ca. 2.5-4.5cm. Stipular spines ca. 6 mm long; spirally arranged at adaxial of leaf. Leaves spirally arranged, ca. 2-2.7 x 2-2.6 cm, ovate, base rounded, apex broadly retuse to mucronate, margin slightly serrate, upper surface dark green with waxy layer, ventral side powdery surface, veins prominent on ventral side, venation reticulate; petiole ca. 0.5-1cm long. Inflorescence cymose condensed at adaxial side of leaves. Bract ca. 3 x 1mm, linear, apex acute, margin entire, slightly tomentose, greyish green. Flowers pediclate, complete, green; pedicel ca. 4mm long, powdery surface. Sepals 5, gamosepalous, ca. 3 cm across; tube 1cm; lobes ca. 3cm, apex acute, powdery appearance, greenish white. Petals 5, polypetalous, ca. 2 cm across, alternate to sepals, spatulate, whitish green. Stamens 5, larger than petals; filament ca. 0.2cm; anthers basifixed. Ovary epigynous, 2-locular, biovuler; style ca. 1-1.7mm; stigma bifid; ovary attached inside to the disc, disc grooved. Seed rounded, young green in color and golden brown at maturity.

FL. Per.: February-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2421 (PMAS-AAUR).

Distribution: N. & E. Africa, Arabia, Egypt, Syria, Palestine, Lebanon, Iraq, S. Iran, Eastern Afghanistan, Pakistan, and N.W. India.

HerbariumNote: Each flower has bract at pedicle and anther larger than petals.

27. ZYGOPHYLLACEAE

Key to genera:

- 1a. Plants spinous, subwoody; fruits pyramidal opening into 5, 1-seeded cocci, tipped with persistent style.....1. *Fagonia*
- 1b. Plants not spinous, usually not subwoody:
- 2a. Leaves simple, alternate, multifid; stamens more than 10 (12-15); fruit 4-gonous.....2. *Peganum*
- 2b. Leaves compound, opposite; stamens 10 or less.....3. *Tribulus*

1. *Fagonia*

L., Sp. Pl. 386 (1753); Gen. Pl. ed. 5. 182 (1754); Benth. & Hook. f., Gen. Pl. 1: 267 (1862); Edgeworth & Hook f. in Hook. f., Fl. Brit. Ind. 1: 425 (1874); Hutch., Gen. Fl. Pl. 2: 620 (1967); A. Ghafoor in Fl. Pak. 76: 9 (1974).

Key to species:

- 1a. Lower leaves 3 and upper 1-foliate.....1. *F. indicavar. schweinfurthii*
- 1b. All leaves 1-foliate.....2. *F. bruguierivar. rechingeri*

1. *Fagonia indica* Burm.f., Fl. Ind. 102 (1768) var. *schweinfurthii* Hadidi in Rech.f., Fl. Iran. 98:6. t. 6 (1972); Ghafoor in Nasir & Ali., Fl. W. Pak., 76:19 (1974).

Annual to perennial prostrate herb, herbaceous above woody below, branches procumbent to erect, internode distance ca. 2 - 2.5 cm, whitish glandular hairs, solid, greyish green. Leaves oppositely arranged, petiole length ca. 0.5-1cm, lamina ca. 4-13 x 2-3 cm, entire, elliptic to lanceolate, Lower leaves 3-foliate, upper 1-foliate; leaflets ca. 4-6 x 3-4 mm, broadly acute tip, ovate to elliptic, oblong, broadly acuminate to apiculate apex, attenuate base, white 1-celled hairs at entire surface & margin. Stipular spines; ca. 0.5- 2.5 cm long, sharp tip needle, green. Inflorescence Racemose, Flower Pinkish purple, hermaphrodite, actinomorphic, complete, perfect, pedicel ca. 4-6 mm long, flower ca. 4-6 x 4-5 cm. 5-polysepalous ca. 2-4 x 2-3 cm, ovate, sharp acute tips, broad base, entire, sticky glandular outside, green. 5-polypetalous ca. 4-6 x 3-4 cm, dentate margin, elliptic to spatulate, obtuse, oblique, pinkish to purple. 10-stamens, anthers dorsifixed, filaments ca. 3-5 mm long. Ovary globose, 5-locular each locule have two ovules pubescent, five fid stigma, cylindrical style. Capsule ca. 1-5cm long, pubescent, pedicel equal to twice as long as fruit, yellowish.

FL. Per.: January-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2592 (PMAS-AAUR).

Distribution: Indo-Pakistan subcontinent westwards to North and East tropical Africa in arid and semi-arid regions.

2. *Fagonia bruguieri* DC., Prodr. 1:704 (1824); Ghaffoor in Nasir & Ali., Fl. Pak., 76: 13 (1974). var. *bruguieri*

Perennial upto 15-30cm Prickly herb, erect to prostrate branches, 4-angled, internode distance ca. 2.3-4.5 cm, green, glabrous, unicellular minute hairs.

Leaves oppositely arrange, ca. 1-1.4 x 0.2- 0.4 cm, deciduous, succulent, mostly trifoliate basal leaves, sessile to subsessile, linear, acute apex, oblique to attenuate base, lamina wide, parallel venation, green. Stipule spines, length ca.1.1-2.1 cm, recurved, acute tipped needle like, green. Inflorescence racemose. Flower, pedicel ca. 0.4 -0.6 mm, regular, hermaphrodite, perfect, actinomorphic, pale-pink. Sepals lanceolate-ovate, 2-2.5 mm long, c. 1 mm broad, acute-acuminate, pubescent, persistent. . Petals spatulate, 3.5-4 (-6) mm long, obtuse. Stamens polyandrous, anthers dorsifixed, filaments 3-6 mm long. Ovary globose, 5-locular ovary each locule have 5ovules. Capsule up to ca. 4 mm long, 3-4 mm broad, pubescent.

FL. Per.: February-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).2601

Distribution: Pakistan westwards to North and tropical Africa in arid and semiarid regions.

2. *Peganum harmala* L., Sp. Pl. 444 (1753).

Perennial upto 15-60 cm tall herb to subshurb, herbaceous above and woody below, erect, glabrous, much branched, internodes distance ca. 1.4-2 cm, solid, green. Alternate arrangement, Leaves sessile to subsessile, lamina 3.2-3.4 x 0.2-0.3 cm, irregularly and pinnatisectly dissected into ca. 3-5 cm x 2-5mm long, linear-lanceolate or subelliptic, acute segments ;stipules setaceous, 1.5-2.5 mm long, green, entire. Solitary flower, yellowish white, pedicel 10-12mm; flower 1.3-1.4 x 0.5-1.1 cm, campanulate, bisexual, complete, perfect. 5-polysepalous, ca. 1-1.2 x 0.1-0.2 cm, linear, sharp acute apex, glabrous, entire margin, green. 5-polypetalous ca. 1.5 x 0.5-0.6 cm, oblong to elliptic, obtuse apex, yellowish white.

15-stamens, free, dorsifixed, filaments ca. 4-5 cm long, anthers sac ca. 5-6 cm x 1-2 cm, anthers usually longer than filaments. Ovary with 8-10 mm, long style, triangular; each chamber of ovary had 2 ovules, syncarpous, maginal placentation, persistant style ca. 1-1.5cm. Capsule 6-10mm across, trigonous, depressed or retuse at apex, persistant style. Seeds ca. 2-3 mm x 1-2 mm, blackish brownin, triangular.

FL. Per.: April-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2615 (PMAS-AAUR).

Distribution: India, Tibet, Pakistan westwards to North Africa, Europe and Russia.

3. *Tribulus*

L., Sp. Pl. 386 (1753); Gen. Pl. ed. 5. 183 (1754); DC., Prodr. 1: 703 (1824); Benth. & Hook. f., Gen. Pl. 1: 264 (1862); Edgeworth & Hook f. in Hook. f., Fl. Brit. Ind. 1: 423 (1874); Hutch., Gen. Fl. Pl. 2: 618 (1967); A. Ghafoor in Fl. Pak. 76: 21 (1974).

Key to species:

- 1a. Cocci broadly winged, not spinose.....1. *T. longipetalus*
1b. Cocci not winged but spinose.....2. *T. terretris*

- 1. *Tribulus longipetalus* subsp. *longipetalus* Viv., Pl. Egypt. Dec. 10.2.f. 5 (1831); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak. & Kashm., 435 (1972); Ghafoor in Nasir & Ali., Fl.Pak.,76: 23 (1974).**

Prostate grayish white annual to biennial herb, herbaceous at young stage and woody below, internodal distance ca. 1-1.5 cm, solid, densely greyish white villous, hairs ca. 2-4 mm. Leaves compound, petiolate ca. 4-6 mm, lamenia 1-4.5cm broadly ovate, acute; peripinnate, 4-6 leaflets pairs, leaflet ca. 6-7 x 3-4 mm,

sessile to subsessile, ovate to elliptic, acute to broadly apiculate tips, oblique base, hairy, tomentose both surface cover with densely hairs but lower surface have much densely hair, slightly succulent. Stipule foliaceous. Inflorescence solitary flower, ca. 4-5 x 5-6 mm, pedicellate ca. 1.2- 1.3 cm with whitish grey tomentose hairs, hermaphrodite, actinomorphic, yellow. 5-polysepalous, ca. 4-5 x 1-2 cm, margin large bordered hairy line, lanceolate, acute apex, narrowly oblique tip, waxy appearance due to tomentose hairs. 5-polypetalous; ca. 5-6 x 3-4 mm, ovate, reticulate venation prominent, narrow base, broader acute tip, margin smooth to slightly wavy at apex side, hairs present at dorsal side, petals alternate to sepals, yellow. 5-Stamens, epipetalous, dorsifixed, filament ca. 1-3 mm long. Ovary globose; ca. 1.5-2mm, bulbous base, covered with tuft of tomentose sharp tipped hairs, bilocular, style short, stigma papillose. Fruit globose round, prickly, green to greyish white, covered with 2 mericarps or wing like structure, 2-3 seeded, dentate to serrate margin, wing upto 15mm broad.

FL. Per.: Almost throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2566 (PMAS-AAUR).

Distribution: Afghanistan, S.W. Asia, Arabia, Sudan, Somalia and North Africa.

2. *Tribulus terrestris* L., Sp. Pl. 387 (1753); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak. & Kashm., 435 (1972); Ghafoor in Nasir & Ali., Fl.Pak., 76: 26 (1974).

Annual hirsute, decumbent herb up to 60 cm long. Stem woody below, herbaceous above, branched, spreading, terete, hirsute to scabrous, greyish in colour; internode ca. 1-4 cm long. Leaves paripinnate, opposite, ca. 2.5-3 cm long;

petiole ca. 0.5-0.8 cm long; leaflets 4-6 in pairs, opposite, almost sessile or short petiolule, ca. 1 mm long, oblique, oblong-ovate, base obtuse-cuneate, apex acute to mucronate, margin entire, ca. 0.5-1 cm, villous. Stipule ca. 2-3 in clusters, lanceolate, or subulate, apex acute, base rounded, margin entire, green, dandromorphic hairs on upper side, ca. 7-8 x 3 mm, trichomes ca. 2-4 mm. long. Flowers ca. 1-1.5 cm across, solitary and axillary, pedicel ca. 1.5 cm long. Sepals 5, free, imbricate, ovate, lanceolate, base obtuse, apex acute, margin entire, ca. 8-10 x 2-3 mm, appressedly hairy on above, green in color. Petal 5, free, imbricate, obovate, base cuneate, apex obtuse, ca. 7-8 x 3-4 mm, golden yellow in colour. Disc annular, fleshy, 10-lobed. Stamens 5+5, subtended by 5-glandular scales, antipetalous; filaments 5-6 mm long; anthers 2-lobed, versatile, globose, yellow, ca. 0.9 mm across. Ovary 5-celled, ovoid, sessile, hirsute, ca. 4 mm across; style ca. 1.5 mm long; stigma 5-lobed, decurrent. Schizocarp ca. 1 cm in diam., 5-angled, woody, mericarp densely crested and tuberculate on dorsal side, densely hairy, each with pair of unequal downwardly directed spines, ca. 3-5 mm long, separating into 5-cocci. Seeds solitary per coccus.

FL. Per.: Almost throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2596 (PMAS-AAUR).

Distribution: Tropical and subtropical countries in Asia, Africa, S. Europe and North Australia.

28. OXALIDACEAE

Oxalis corniculata L., Sp. Pl. 435 (1753); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 431 (1972).

Syn: *Oxalis foliosa* Blatter; *Oxalis repens* Thunb.; *Oxalis villosa* M. Bieb.

Creeping and pubescent herbs mostly rooting at the nodes. Leaflets 4-15 x 8-32 mm across, obcordate, pilose-tomentose. Flowers solitary to 2-5 flowered axillary umbels. Pedicel 5-15 mm long, deflexed in fruit. Bracts 3-5, linear. Sepals 5, linear lanceolate, pilose. Petals 5, yellow. Filaments glabrous. Carpels 5, pubescent; styles longer than the shorter stamens. Capsule 1-2.5 cm long, subcylindric, pubescent. Seeds 1.5 mm long, brown, transversely ribbed.

FL. Per.: March December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2184 (PMAS-AAUR).

Distribution: A cosmopolitan weed (Nasir, 1971).

29. GERANIACEAE

Geranium rotundifolium L., Sp. Pl. 683. 1753.

Annual diffuse small herb, mature branch, internode distance ca. 2-3.5cm, green to light green above and reddish at the node, hirsute hairs, rounded. Leaves oppositely arrange, petiole length ca. 2-5cm, leaves ca. 1.3 x 2.6cm, reniform; 5 deeply lobes crenate, white setose hairs at margin and at lower surface hirsute hairs, upper surface smooth, reticulate venation, green. 2-4 stipule at node, ca. 5 x 2-3mm, wedge shaped, acuminate apex, margin smooth, hirsute hairs at both surfaces, reddish brown. 2-flowers at each infloresces. Peduncle ca.1.2-7 mm; green to light green above and reddish at the base, glandular. Flowers pedicle ca. 5-6 cm; 4 bracts at each petiole like stipule. Flower complete. 5-polysepalous, ca. 8 x 3 mm, lanceolate, caspidate apex, hirsute hairs at margin and outer surface, parallel venation, broader base, green. 5-polypetalous, ca. 5-7 mm, spathulate, apex ovate

or sometime mid depression, purple at upper surface and light white at lower surface. 10-12 Stamens, free at upper side but jointed at base, hairs at filaments, filaments broad at base but narrow at apex, anther filament ca. 8-9 mm, anther sac ca. 1mm across; basily attached to filament, creamy color. ovary ca. 5 mm, unilocular to pantalocular, white hairy, lanceolate irragualr, green. Stigma perpul, 5 finger shape, hairy stigma, style long hairs hastate hairs. Fruit 8-10 mm long beak, hairy, ovate base, seed ca. 1.3-1.5mm broad ovate.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2179 (PMAS-AAUR).

FL. Per.: March-April.

Distribution: W. & C. Europe, Siberia, Turkey, Iran, W. & E. Mediterranean area, Africa, Afghanistan.

30. APIACEAE

Key to genera:

- 1a. Plant perennial up to 3 meter tall.....1. Conium
- 1b. Plants annual, less than 100 cm tall:
 - 2a. Leaf segments filiform to linear..... 2. Scandix
 - 2b. Leaves 1-2-pinnate.....3. Psammogeton

1. *Conium maculatum* L., Sp. Pl. 243 (1753).

Annual to perineal plant upto 1-3 m tall, internode distance ca. 7-10.5cm, setose hairs, glabrous. Leaves alternate, petiolated, bipinnate; segments oval, deeply serrate. Involucre of 5-8 minute, linear to oval bracts ca. 6-8 x 1-1.5 mm. Rays 8-20, unequal, glabrous. Involucel of 3-5, 1-2 mm long, linear to ovate bractlets ca. 5 x 1-1.5 mm. Inflorescences umble. Flower peduncle ca. 1-2cm. 5-

Parienth, free, ca. 1-1.5 x 1 mm, ovate to deeply lobed at lob tip move inward and heart shape, serrate margin, white. 5-Stamens, free, ca. 1-2mm filament, anther sac yellow. Ovary epigynous, ca. 3 x 2 mm, elliptic, smooth, bilocular, multiovular, densely hairs, green. 2-stigma and style, small stigma cylindrical, style rounded flat cupshape.

FL. Per.: June to August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2480 (PMAS-AAUR).

Distribution: North and South America, Europe, Middle East, Central Asia, Afghanistan, India, W. Pakistan, China.

2. *Scandix pecten-veneris* L., Sp. Pl. 256 (1753).

Annual plant upto 25 cm tall, slightly angular, pubescent or glabrescent, dichotomously branched, internode distance ca. 3.5-4.5 cm, light green to dark green. Leaves alternately arrange, long petiole ca. 3-5 cm, Leaves tripinnatisect; segments 1-4 mm long, linear; leaf bases sheathing; sheath margin ciliate or entire. Umbels terminal and lateral. Involucre of 1 linear bract or lacking. Rays 1-3, 1-2 (-4.) cm long. Involucel of several lanceolate, oval or ovate, ciliate bractlets, entire or incised at the apex. Infloresences Umbel terminal and lateral. Flower peduncle ca. 0.4-1cm; pubescent, petioles ca. 2-3 mm. 5-Parienth color ca. 3 x 2 mm, free, obovate, narrow base, white. 5-Stamens, free, filament ca. 1-3 mm, basily attached. Ovary epigynous, elliptic, brown, smooth, bilocular, multiovular. 2-stigma small, cylindrical apex, style style 1 mm long, twice as long as the stylopodium; furrows I-vittate; commissure 2-vittate; vittae minute, Fruit long pod ca. 2.8-3 cm, apex long beak, stegose hairs, brown.

FL. Per.: Feb.-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2173(PMAS-AAUR).

Distribution: Europe, Asia, and in Australia, North and South America as an alien.

3. *Psammogeton canescens* (DC.) Vatke in App. ad Ind. Sem. Hort. Berol. 3 (1876).

Small upto 10-45 cm tall herb, rounded, pubescent, greenish white. Leaves petiole ca. 4-5 mm and young sessile; pubescent; greenish white, lamina ca. 2-3 cm long, lamina divided in 3-5 leaflets, leaflets 1-3 segmented, lanceolate, small hirtellous hairs on both surface. Involucre 5 linear bracts, ca. 4-6 x 3 mm, pubescent, long hairs at outer surface and margin, acute tip, parallel venation, yellow to hyaline. Umbel groups of flowers 6-8 bractioles, ca. 1.4-1.5 cm, hyaline to yellow, broadly lanceolate broadly acute apex, hairs on outer surface and margin. Inflorescences terminal umbel. Flower peduncle length ca. 4-6 cm long, each inflorescence 6-8 flowers, pedicel length ca. 3 mm. 5-Parienth, ca. 1 x 1 mm, free, ovate to deeply lobed at lobe tip move inward and heart, serrate margin, white. 5-Stamens, free, ca. 1-2 mm, anther sac yellow. ovary 3 x 2 mm, elliptic, villous hairs, epigynous bilocular and each locule uniovular, syncarpous. stigma bifurcated at maturity, stigma curl backward, style cylindrical long ca. 1 mm.

FL. Per.: March-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2057 (PMAS-AAUR).

Distribution: Iran, Afghanistan, W. Pakistan.

31. ASCLEPIADACEAE

Key to genera:

1a. Erect shrubs:

2a. Leaves ovate; flowers more than 1.5 cm across;

follicles in pairs.....1. *Calotropis*

2b. Leaves linear; flowers less than 1.5 cm across; yellowish;

follicles solitary:

3a. Anthers bearded; pollen masses granular.....2. *Periploca*

3b. Anthers not produced into a membranous tip, pollen masses waxy.....3. *Leptadenia*

1b. Twining or climbing plants.....4. *Pentatropis*

1. *Calotropis procera* (Ait.) Ait. f., Hort. Kew ed. 2.2: 78 (1811); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W.Pak. & Kashm., 566 (1972); Ali in Nasir & Ali., Fl. Pak. 150: 7-9 (1983).

subsp. *hamiltonii* (Wight) Ali, l.c. 289.

Syn. *Asclepias procera* Willd., Sp. Pl., I:1263 (1798); *Calotropis hamiltonii* Wight, Contrib. Bot. Ind. 53 (1834); *C. procera* auct. non (Ait.) Ait. f.: Hook. f., Brit. Ind. 4: 18 (1883).

A tall shrub or small tree up to 3 m tall with milky latex. Stem woody below, herbaceous above, branched, tomentose, fleshy, terete; internode ca. 3.5-9.5 cm long. Leaves sessile, opposite and decussate, ca. 4.5-7.5 x 2.5-4.5 inches, elliptic or obovate-oblong, apex apiculate-cuspidate, base slightly cordate or amplexicaule, margin entire, chartaceous, thick, glaucous-green, lateral nerves alternately arranged. Inflorescence a long peduncled umbellate panicle,

subterminal. Flowers pedicellate, complete, regular, bisexual, hypogynous, pentamerous except pistil, ca. 1.5 cm across. Sepals 5, slightly connate at the base; lobes free, quincuncialis, inferior, lobes ovate, apex acute, base rounded, ca. 11-12 x 6-7 mm; a ring of scales are present inside the sepals, lanceolate. Petals 5, gamopetalous, lobes erect, inferior, valvate, ovate, ca. 1.5 x 0.8 cm, pink or whitish with purple spots within, pale silvery out side, lathery; corona 5, fleshy, laterally compressed, radiating from the staminal column, base terminating in an up-curving spur, apex of the corona bifid, without auricles, ca. 0.7 x 0.4 cm. Stamens (Pollinia) 5, epipetalous; pendulous, filaments connate in a fleshy tube around the ovary (staminal tube), the apex of the staminal tube united with the much-dilated stigmatic disc, to which the anthers are also coherent forming the pentagonal gynostegium (gynandrous); anthers short, broad lipped with inflexed membranous flaps, 2-celled, the pollen of each cell agglutinated in small ovoid pendulous waxy pollen mass (Pollinia), the pollinia of the adjacent cells of the neighbouring anthers connected by means of short stalks or caudicles to a distinct dark coloured dot-like glands, the corpusculum, which lies at the angle of gynostegium. Ovary 2-celled, apocarpous, unilocular, ca. 3 mm; styles 2, free, meeting up in stigmas which are united to form angular disc, 0.9 cm long. Follicle ca. 8 x 4 cm, oblong, recurved. Seeds numerous, broadly ovoid, flat, ca. 9 x 6 mm ; coma tuft of silky hairs.

FL. Per.: All the year round.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2028 (PMAS-AAUR).

Distribution: Pakistan, India and Afghanistan.

2. *Periploca aphylla* Dcne. in Jacquem., Voy. Inde. 109. t. 116 (1844).

Erect shrubs upto 1-2.5m, internodes ca. 4.5 x 5 cm, glabrous, solid, milky latex, green. Leaves decedus, ca. 6-7 mm long, sessile, ovate-oblong, acute, succulent, nerve obscure. Inflorescence Flowers axillary, hermaphrodite, actinomorphic, pedicle ca. 4 x 6 mm, 2-opposite bracts; ca. 6 x 4mm, glabrous, ovate, acute apex, green. 5- gymosepalous, ca. 2-2.5 x 2mm; ca.1mm tube and ca. 1.5 mm free, hairs at margins, hispid, green. 5- gymopetalous, alternated to sepals, hairy greenish, succulent ca. 3-5mm long; 3mm free and ca. 2mm tube, oblong, obtuse, densely hairy near the tip, greenish outside, dark purple within. Stamens 10-lobed Corona, ca 6mm, filiform, glabrous, Anthers sac curve at tip, 5- pollinia Large capitate head with grooved stigma, 2-style with jointed each other, 2-ovaries at base bicarpellery, hypogynous. Follicles 5-10 cm x 5-6 mm, rigid woody, widely divergent, pointed. Seeds 6-6.5 mm long, oblong, compressed, coma ca. 2.5 cm long.

FL. Per.: March-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2082 (PMAS-AAUR).

Distribution: Pakistan, India, Afghanistan, Iran, Iraq, Jordan, Arabia and Egypt.

3. *Leptadenia pyrotechnica* (Forssk.) Decne. in Ann. Sci. Nat. Ser. 2. 9: 269 (1839).

An erect, rush-like, often leafless green shrub, attaining 3-4 m height. Stem fairly branched, woody at the base, herbaceous above, cylindric, green, glabrous, with watery sap. Leaves when present ca. 2-25 x 2-6 mm, subsessile, narrowly

linear to linear-lanceolate, apex acute, glabrous, caduous. Flowers in lateral umbellate cymes, ca. 1 cm long; flower ca. 3 mm across, greenish-yellow; pedicel ca. 1.5 mm. calyx-tube ca. 1 mm; lobes valvate, hairy above; trichomes moniliform. Corolla-tube funnel-shaped, ca. 1 mm, glabrous within green; lobes ovate, apex acute, ca. 2 x 1 mm, hairy above; trichomes unicellular. Outer corona of 5 small scales; staminal corona of raised, undulate, fleshy ring. Follicles ca. 7-14 x 0.5-0.8 cm, terete, lanceolate, tapering to a slender beak, glabrous. Seeds ca. 5-8 mm long, ovate-lanceolate, glabrous; coma ca. 2.5-3.5 cm long.

FL. Per.: December-January.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2574 (PMAS-AAUR).

Distribution: Pakistan, India, Iran, Arabia, Egypt, Sudan, Somalia, Chad, Libya and Algeria.

4. *Pentatropis nivalis* Weight, contrib.. Bot. Ind. 53 (1834).

A much branched climber with rough corky bark. Leaves 1.2-3.8 x 6-18 cm, linear, oblong, ovate or elliptic, acute or obtuse, mucronate, fleshy; petiole 2.5-13 mm long. Peduncle up to 5 mm long. Pedicel 5-12.5 mm long, bracts minute. Calyx lobes c. 1.5 mm long. Corolla lobes 8-13 mm long, glabrous outside, minutely puberulous inside. Corona lobes c. 1.5 mm long. Follicles 5-7.5 cm x 8 mm. Seeds c. 4.5 mm long, ovate, flattened, minutely irregularly crenate at the lower end, coma 1.8-2.5 cm long.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2536 (PMAS-AAUR).

32. SOLANACEAE

Key to genera:

- 1a. Fruit a capsule..... 1. *Datura*
- 1b. Fruit a berry:
- 2a. Fruiting calyx inflated, enclosing the berry:
- 3a. Flowers solitary, pedicellate..... 2. *Physalis*
- 3b. Flowers clustered, sessile..... 3. *Withania*
- 2b. Fruiting calyx not inflated; berries not enclosed in the persistent calyx..... 4. *Solanum*

1. *Datura fastuosa* L., Syst., Nat. ed. 10, 2: 932 (1759); Nasir in Nasir & Ali, Fl. Pak., 168: 44-45 (1985).

Syn: *D. metel* L., Sp. Pl. ed. 1: 179 (1753), *nom. confusum*; *D. alba* Rumphius ex Nees., Trans. L. Soc. London 17: 53 (1837); *D. fastuosa* var. *alba* (Nees) C. B. Clarke in Hook.f. Fl. Brit. Ind 4: 243 (1883).

An erect subshrub up to 85 cm. Stem woody below, herbaceous above, terete, softly pubescent, greyish-green; internode ca. 2.5-7 cm. long. Leaves ca. 3-14 x 2-10 cm size, elliptic-ovate to angulate, base obliquely truncate-cordate, apex acute to apiculate, margin frequently lobed, rarely entire, sparsely hairy or puberulous on dorsal side, densely hairy on above; lateral nerves ca. 6-9 pairs; petiole ca. 2-7 cm long, greyish green, softly pubescent; trichome ca. 1.5 mm long, greyish green. Inflorescence solitary and axillary cyme. Flower bisexual, actinomorphic, complete, white, ca. 1.6-1.7 x 2 cm in size; pedicel ca. 1-1.3 cm long, densely hairy. Sepals 5-lobed, tubular; lobes free, ca. 1.3-2 x 0.3-0.5 cm in size, lanceolate, base rounded, apex acute, margin entire, glaucous within, hairy

above, greenish in colour; tube ca. 7.5 cm long. Petals trumpet-shaped, white above, greenish below; tube ca. 15 cm long; limb 4 cm long; teeth 5, ca. 1 cm long, spreading, lanceolate, apex acute-acuminate. Stamens 5, adnate to the base of petals tube; filaments ca. 13.5 cm long, filiform, base decurrent, greenish; anthers ca. 1 x 0.3 cm in size, basifixed, elliptic-oblong, apex retuse, margin more or less hairy, dehiscing longitudinally, white. Ovary ca. 0.5 cm across, conical, echinate, 2-locular; style ca. 12 cm long, elongated; stigma ca. 0.2 cm across, bilobed. Capsule ca. 3-4 cm across, globose, thickly armed with spines, irregularly bursting; spines short, stout, ca. 1 cm, blunt; calyx base persistent, pericarp thick. Seeds ca. 0.4-0.5 x 0.3 cm in size, reniform, compressed, rugose.

FL. Per.: September-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1258, 1311 (PMAS-AAUR).

Distribution: Tropical and subtropical regions of Asia, Mediterranean, Africa and America (Nasir, 1985).

2. *Physalis divaricata* D. Don, Prodr. Fl. Nep. 97 (1825).

Syn. *Physalis minima* auctt. non L.; Roxb.

A diffuse annual from 15-45 cm tall, subglabrous to pubescent. Leaves 3-8 5 (-11) x 1.5-4 (-7) cm, ovate. sinuate, repand or sinuate-dentate to subentire, acute or acuminate, base cordate to oblique. Petiole up to 40 mm long, slender. Flowers solitary axillary. Pedicel less than 10 mm long, somewhat elongating in fruit. Calyx c. 2.5 mm long, campanulate. inflated, globular-avoid, membranous and up to 25 mm in fruit, pubescent. Corolla 5 mm long, shortly tubular, yellow; lobes acute, pubescent. Stamens subincluded. Anthers c. 1 mm long; filaments \pm 2 mm long.

Ovary 1.1 mm long. ovoid. Style linear, stigma subcapitate. Berry globose, 10 mm broad, orange. Seeds c. 2 mm long, subreniform, compressed; minutely reticulate-undulate. brownish-yellow.

FL. Per.: August-October, later in the plains.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1225 (PMAS-AAUR).

Distribution: Afghanistan and eastward to Nepal.

3. *Withania*

Pauquy, Diss. Bellad. 14 (1825), nom. cons.; Boiss., Fl. Or. 4: 287 (1879); Clarke in Hook f., Fl. Brit. Ind. 4: 239 (1883); Cooke, Fl. Bomb. Pres. reprinted ed. 2: 340 (1906); Jafri in Fl. Kar., 298 (1966); Nasir in Fl. Pak., 168: 28 (1985).

Syn: *Physaloides* Moench, Meth. 473 (1794).

Key to species:

1a. Plant mealy tomentose; leaves elliptic-lanceolate or oblanceolate;

flowers unisexual; berry with accrescent calyx.....1. *W. coagulans*

1b. Plant hoary tomentose; leaves ovate, obovate or oblong;

flowers bisexual; berry loosely enclosed in the persistent calyx.....2. *W. somnifera*

1. *Withania coagulans* (Stocks) Dunal in DC., Prodr. 13, 1: 685 (1852); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W.Pak. & Kashm., 645 (1972); Nasir in Nasir & Ali, Fl. Pak., 168: 28 (1985).

Syn: *Puneeria coagulans* Stocks, J. Roy

A densely packed shrub up to 1 m tall. Shoots rigid, greyish-green, stellate-tomentose. Leaves 3-8 x 1.4-3.5 cm, elliptic-ovate to elliptic-lanceolate, obtuse or acute, cuneate, leathery, nerves faint. Petiole 5-10 mm long. Bisexual flowers: calyx cupular-campanulate, stellate-tomentose; lobes 1.5-2.5 mm long, acute. Corolla exceeding calyx, campanulate, stellate-tomentose outside, yellowish within. Stamens included. Stigma subexserted. Male flowers: stamens \pm subexserted. Anthers ca. 3.5 mm long; filaments 2.0 mm long. Female flowers: stamens included. Anthers smaller than in male flowers. Style glabrous. Berry globose, 10-12 mm broad, red, included in fruiting calyx. Seeds ca. 2.5 mm broad. reniform, brown, minutely rugose-reticulate to \pm smooth.

FL. Per.: Jan.-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1262 (PMAS-AAUR).

Field remarks: A rare species of sandy soils.

Distribution: Iran, Afghanistan, Pakistan and India (Nasir, 1985).

2. *Withaniasomnifera* (L.) Dunal in DC. Prodr. 13(1) 453 (1852); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 645 (1972).

A perennial erect undershrub up to 2 m high. Stem hard, woody at the base, herbaceous above, terete, branched, branchlets greyish green, hoary-tomentose; internode ca. 2-4.5 cm long. Leaves cauline and ramal, ca. 3-8 x 1.5-5 cm, elliptic-ovate, base truncate-acute, apex acute-subacute, margin entire, chartaceous, softly appressed pubescent, lateral nerves ca. 6-8 pairs; petiole ca. 1-3 cm long, softly hairy. Inflorescence in axillary, solitary or in few flowered fascicles umbellate cyme. Flowers hypogynous, bisexual, complete, actinomorphic, campanulate, ca. 1

cm long; pedicel ca. 0.5 cm. Calyx-tube ca. 4 mm long, puberulous without; lobes 5, free, lanceolate, apex acute, softly tomentose, ca. 4-5 mm, accrescent and inflated in fruit, persistent, green in colour. Petals 5-lobed, ca. 6 mm; lobes triangular-oblong, base truncate, apex acute, margin entire and appressedly pubescent, valvate, connate below the middle, puberulous without, greenish yellow in colour. Stamens included, alternate with petals; filament ca. 5 mm across; anthers ca. 2 mm, dorsifixed, bilobed, oblong. Ovary ca. 3 mm, ovoid or globose, glabrous; style ca. 5 mm long, filiform; stigma capitate. Berry ca. 0.8 cm across, orange red when ripe. Seeds (sub) trigonous; testa pitted.

FL. Per.: September-December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2626 (PMAS-AAUR).

Field remarks: A less common species of moist soils.

Distribution: Canary Islands, Mediterranean, Africa, Iraq, S. Iran, Syria, Turkey, Palestine, Arabia, Pakistan and India (Nasir, 1985).

Key to species:

- 1a. Plants prostrate and armed with prickles; sepals prickly; berries yellow, more than 1 cm across.....1. *S. surattense*
- 1b. Plants erect and unarmed; sepals not spiny; berries black, 5-7 mm across.....2. *S. nigram*

1. *Solanum surattense* Burm.f., Fl. Ind., 57 (1768); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak. & Kashm.,644 (1972); Yasin in Nasir & Ali., Fl.Pak., 168:10 (1987).

Syn: *S. xanthocarpum* Schrader & Wendl. Sert. Hannov. 1: 8. T. 2 (1795);

S. jacquini Willd. Sp. Pl. 1: 1041 (1798); *S. diffusum* Roxb. Fl. Ind. 1: 568 (1832).

A perennial, procumbent, diffuse prickly herb up to 60 cm. Stem woody at the base, herbaceous above, terete, zigzag, stellate tomentose when young, greenish-brown, straight yellow prickles all around the stem; internode ca. 2.5-7 cm long. Leaves ca. 3.5-8 x 3.5 cm in size, sub-opposite, ovate-oblong, pinnately 5-11 sub-equal lobed, base obliquely truncate-attenuate, apex obtuse-subacute, chartaceous, lateral nerves ca. 5-11, stellate hairy, and armed with long, sharp prickles on midrib and nerves, ca. 0.5-2 cm long; petiole ca. 2.5-5.5 cm long, prickly. Inflorescence 4-5-flowered, extra-axillary cymes, ca. 4.5 cm long; peduncle ca. 2.5-3 cm long; pedicel ca. 1-1.2 cm long. Flower complete, bisexual, actinomorphic, bluish purple in colour. Sepals 5-lobed, free above, fused at the base, ca. 8 x 1-2 mm in size, imbricate, linear-lanceolate, base acute-obtuse, apex acuminate, margin entire, herbaceous, prickly and densely stellately hairy, reticulately veined, green, persistent. Petals rotate, shallowly 5-lobed, tube ca. 5 mm long; lobes ca. 1.7 x 1 cm in size, bluish purple, broadly ovate-triangular, base rounded, apex acute, margin dentate, stellately pubescent on dorsal side, puberulent within. Stamen 5; filament ca. 2-5 mm long; anther ca. 0.9 x 0.2 cm in size, linear-oblong, basifixed, yellow in colour, opening by apical pores. Ovary ca. 4.5 x 4 mm, obliquely globose; style ca. 1.4 cm long, glabrous; stigma acute, incurved. Berry ca. 1.5 cm across, spherical-globose, smooth, drooping when unripe, variegated with green and white, yellow when mature. Seeds smooth compressed, reniform.

FL. Per.: March-April and July-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 84, 973, 996, 1209, 1254 (PMAS-AAUR).

Distribution: N. Africa, S. & S.E. Asia, Australia and Polynesia (Nasir, 1985).

2. *Solanum nigrum* L. var. *atriplicifolium* (Desp.) G. Mey. L. Sp. Pl. 186 (1753); Yasin J. Nasir in Nasir & Ali., Fl. Pak., 168: 6-7 (1985).

An annual erect herb up to 60 cm high. Stem much branched, \pm woody below and herbaceous above, angular, purplish green in color, strigose, hairs 1-celled; internodes ca. 1-2.8cm. Leaves ca. 3.5-4 x 3.3-4cm, ovate, base attenuate, apex narrowly acuminate, margin deeply dentate, venation arcuate, veins purplish green, 1-celled hairs present on the venation and margin, shiny; petiole ca. 1-1.9cm long, purplish green, 1-celled hairy. Inflorescence an axillary umbel, 3-5-flowered; peduncle 0.9-2.8 cm long, strigose hairy, hairs 1-celled. Flower complete, actinomorphic, campanulate; pedicel ca. 0.5-0.6cm, purplish green in color, 1-celled hairs present. Sepals 5, gamosepalous; tube 0.4mm long; lobes ca. 0.2mm, ovate, apex acute, greenish purple in color, strigose hairy surface. Petals 5, gamopetalous; tube 0.5mm long; lobes ca. 0.7mm, ovate to lanceolate, apex acuminate, sparsely hairy above, whitish in color. Stamens 5, epipetalous, alternate to petals; filament ca. 0.3mm, hairy; anthers ca. 0.3-0.5mm long, basifixed. Ovary syncarpous, globose, glabrous, ca. 0.3mm, bilocular, 2-ovuler; style ca. 0.4mm long, hairy; stigma capitate.

FL. Per.: Mostly throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1225 (PMAS-AAUR).

Distribution: Cosmopolitan.

33. CONVULVACEAE

Key to genera:

- 1a. Styles 2, free or more or less united at the base.....1. *Cressa*
 1b. Style 1.....2. *Convolvulus*

1. *Cressa cretica* L., Sp. Pl. 223 (1753).

Biennial to perennial small herb upto 15-20 cm high, internode distance ca. 1.5–4.5mm, herbaceous stem, much branched, cylindric, green, densely appressed hairy; trichomes ca. 0.2-0.6 mm long, unicellular, hyaline, solid. Leaves spirally arranged or closely alternate, length ca. 6 x 3mm, sessile, 1-celled hairs on both sides, ovate, leaf apex broadly acute, base ovate to rounded, hairy, exstipulate. . Flowers in racemes of 1-3-flowered, alternately arranged, ca. 0.5 x 0.2 cm, white; bracts 2, ca. 1.5 x 0.5 mm, oblong-lanceolate, apex acute, base clasping, margin entire, densely hairy. Calyx-lobes free, imbricate, ca. 2.5 x 1.6 mm, obovate, apex acute, base cuneate, margin entire and incurved, green, glabrous within, hairy outside. Corolla-tube ca. 3 mm long; lobes 5, ca. 1.5-2 x 0.6-1 mm, imbricate, elliptic-oblong, apex subacute and hairy, glabrous within, hairy above, reflexed, white. Stamens alternate to petals, adnate to corolla-tube, exserted; filaments ca. 4-5 mm long; anthers ca. 2 x 0.8 mm, apex apiculate, granulate (pusticulate). Ovary ca. 2 x 1 mm, globose, pubescent above, slightly greenish; styles 2, ca. 3.5 mm long, sparsely hairy below; stigma ca. 0.5-0.6 mm across, capitellate. Capsule ellipsoid-globose, ca. 5 x 3 mm, 2-4-valved. Seeds glabrous.

FL. Per.: Almost throughout the year

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2112 (PMAS-AAUR).

Field remarks: A common species of saline soils.

Distribution: Widely distributed in the xeric tropical zones of both the hemispheres (Austin and Ghazanfar, 1979).

3. *Convolvulus*

L., Sp. Pl. 153 (1753); Gen. Pl. ed. 5: 76 (1754); Boiss., Fl. Or. 4: 84 (1879); Clarke in Hook. f., Fl. Brit. Ind. 4: 217 (1883); Austin & Ghazanfar in Fl. Pak. 126: 7 (1979).

Key to species:

1a. Leaves long petioled, glabrous to sparsely pubescent;

seeds tuberculate..... 1. *C. arvensis*

1b. Leaves sessile, villous; seeds not tuberculate:

2a. Stigma 2-3 times the length of the style 2. *C. prostrate*

2b. Style as long as the stigma.....3. *C. pilosellifolium*

1. *Convolvulus arvensis* L., Sp. Pl. 153 (1753).

A climbing or prostrate annual or perennial herb upto 60 cm high. Stem woody at the base, much branched, twining or trailing and twisted, angular, glabrous or hairy. Leaves ca. 1-6 x 0.5-4 cm, ovate-lanceolate to oblong, apex obtuse to apiculate (mucronate), base hastate or sagittate; petioles ca. 0.5-2.5 cm long. Flowers in axillary, 1-3-flowered cymes; peduncles ca. 1.5-8 cm long, slender; pedicels ca. 0.8-2 cm long. Bracts linear. Calyx-lobes ca. 5-6 mm long, broadly elliptic-oblong, base obtuse to truncate, apex mucronate. Corolla ca. 1.5-2 cm long, funnel-shaped, pink or nearly white, glabrous within, with hairy mid-petaline bands outside. Stamens unequal. Ovary glabrous; stigmas ca. 2.5 mm,

filiform. Capsules ca. 5-6 mm across, ovoid-globose, glabrous. Seeds subtrigonus, brown, tuberculate.

FL. Per.: All year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2593 (PMAS-AAUR).

Distribution: Throughout the temperate and tropical regions of the world except Australia.

2. *Convolvulus prostrates* Forssk., Fl. Aegypt. Arab. 203 (1775).

A perennial prostrate or procumbent herb up to 45 cm high. Stem suffruticose at the base, often floriferous from the base, hairy or ferruginously pilose. Leaves sessile, ca. 1-2.5 x 0.3-0.8 cm, linear-oblong or elliptic-lanceolate, apex subulate to obtuse, base tapering, margin entire, villous on both surfaces, lower leaves usually larger and spatulate. Flowers sessile or subsessile, axillary or on short lateral branches, 1-4-flowered; peduncles up to 2 cm long. Bracts ca. 3-3.5 mm long, linear-oblong or lanceolate, apex acuminate, hairy. Calyx-lobes ca. 6.5 mm long, ovate-lanceolate, apex acute, hairy on both sides, green. Corolla ca. 10-12 mm long, pink-white, funnel-shaped, with hairy bands outside; limb shallowly 5-lobed, deltoid, apex acute, with tuft of hairs at the apex of each. Stamens unequal. Ovary glabrous, seated on a cup-shaped disk; stigmas ca. 4 mm long, filiform. Capsules ca. 3.5 mm long, ellipsoid or subglobose, somewhat scarious, glabrous. Seeds 2-4, ca. 2.5 mm long, brown or black, pubescent.

FL. Per.: Jan.-April **Fr. Per.:** April-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2575 (PMAS-AAUR).

Distribution: Egypt to Pakistan and India.

3. *Convolvulus pilosellifolium* Desr. in Lam., Encycl. 3: 551 (1789); Boiss., Fl. Or. 4: 103 (1879).

Perennial prostrate herb, herbaceous, internodes ca. 0.9-2.3cm, 1-celled hairs, green. Leaves spirally arranged, lamina ca. 1.5–2.5 x 0.3-0.4 cm, sessile, Simple, elliptic to spatulate, apex apiculate, margin slightly serrate, 1-celled hairs at margin and lower side of leaves, unicostate, midrib prominent, exstipulate, Bracts ca. 3-3.5 mm long, linear-oblongate or lanceolate, apex acuminate, hairy. Flower pedicel length ca. 3–5mm; with 2-bracts, funnel shaped flower, complete, perfect, hermaphrodite, white. 5-polysepalous, ca. 5 x 1mm, incurve to each other, halim margin with hairs at margin and base of sepals, broadly acute, dark green at tip and light green at base. 5-Petals, length ca. 6–7 x 5mm, large hairs on outer surface, white. 5 Stamens, epipetalous, hairs on filament, anthers ventrally attached filament, filament length 4mm, anther ca. 3 x 1mm. Ovary ca. 6 mm across, hairy, bilocular, syncarpous, stigma bifid, style ca. 3mm long, straight.

Distribution: Turkey, Iran, Afghanistan, Pakistan, USSR, SW & C. Asia.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).

34. CUSCUTACEAE

Key to species:

- 1a. Leaves ca. 1.3-2 x 1-2 mm, triangular.....1. *C. gigantea*
 1b. Leaves ca. 3-4 x 1.5-2.5 mm, oblong-elliptical.....2. *C. monogyna*

1. *Cuscuta gigantea* Griff. in Not. Plant. Asiat. 1: 243 (1847).

Stem thick, yellowish brown, twing, attached to host by mean historea, succulent, shiny, smooth fiberous. Leaves sessile, ca. 1.3-2 x 1-2 mm yellowish brown, triangular, margin smooth tip slightly pointed. Inflorescences racemose. Flower sessile, ca. 6-9 mm long, companulate, yellow, bracts; leaf-like. 5-gamosepalous; ca. 2-3 x 1-2 mm; 1-2 mm tube and 1 mm free, yellow, compactly encircle corolla, triangular shap, ovate, apex rounded, entire. 5- gamopetalous, ca. 3-6 x 1-12 mm; 3.5 mm tube and 2.5 mm free, companulate, yellow, ovate, broadaly acute apex. 5-Stamens, sessile, fused filament with petals prominent, free, anther sac ca. 1-1.6 mm, oblong, rounded base and apex. Ovary globose, 2 ovules, rough, yellowish brown, fleshy, 2 stigma; oblong, style small absent, seeds shiny, reniform or orbicular, brownish black, ca. 1.5-1.7mm.

FL. Per.: Throughout year

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2197 (PMAS-AAUR).

Distribution: Afghanistan, Pakistan and Russia.

2. *Cuscuta monogyna* Vahl, Sym. Bot. 2: 32 (1791).

Stem thick, yellowish brown, twing, attached to host by mean historea, succulent, shiny, smooth fiberous. Leaves ca. 3-4 x 1.5-2.5 mm, sessile, oblong-elliptical, fleshy, papillate, obtuse, yellowish brown. Inflorescences cymes ca. 4-6 mm, pedicel ca. 3-5 mm long, companulate, yellowish green, bracts leaf-like. 5-lobes Calyx ca. 2-3 x 1.5-2.5 mm; 1-2mm tube, fleshy margin slightly serious, with 1-2 folds in the middle, papillate, overlapping each other, dark brown, after drying ca. 1.5-2.0 mm long. Sepals 5-lobes, oblong-elliptical, spotted, light brown, obtuse, granulate, Petals: yellow in color, companulate in shape, 7mm in length 3mm free

and 4mm jointed scales short scarios, fringed. Stamens 5, filaments 2-4 mm long; anther oblong, basifixed, attached below the sinuses, epipeatulous, anther sac ca. 0.3 x 0.1mm. Ovary globular to conical; ca. 0.2- 0.4 x 0.1-0.2 mm fleshy, 4-Ovuler, reniform. Style mostly obsolete, rarely 1, 0.2 mm long, 2-stigmas, dark brown, ca. 0.2 mm long. Seeds 4, usually one remains immature, dark-brown to black, mostly non-glossy, bell-shaped, triangular, with depression, papillate, 2.5-3.0 x 2-2.2 mm.

FL. Per.: Throughout year

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2176(PMAS-AAUR).

Distribution: Europe and Central Asia to Sungaria, Afghanistan and Persia and Pakistan.

35. BORAGINACEAE

Key to genera:

- 1a. Ovary not lobed; Style simple, entire.....1. Heliotopium
- 1b. Ovary deeply 4-lobed; style gynobasic or subterminal:
 - 2a. Calyx large, accrescent in fruit; anthers connivent into a cone;
 - the connectives much produced and twisted at the ape.....2. Trichodesma
 - 2b. Calyx small, not accrescent in fruit; anthers not connivent into a cone:
 - 3a. Corolla appendages below throat..... 3. Nonea
 - 3b. Corolla glabrous, without any appendage:
 - 4a. Adaxial surface of nutlet joined to gynobase.....4. Heterocaryum
 - 4b. Adaxial surface of nutlet free from gynobase.....5. Lappula

2. *Heliotropium*

L., Sp. Pl. 130 (1753); Gen. Pl. ed. 5.63 (1754); Jafri in Fl. Kar.,
276 (1966); Nasir in Nasir & Ali, Fl. Pak. 191: 18 (1989).

Key to species:

- 1a. Plants glabrous to glabrescent.....1. *H. curassavicum*
- 1b. Plants villous-scabrid:
- 2a. Leaves linear-lanceolate; stigma simple.....2. *H. strigosum*
- 2b. Leaves various, stigma 2 to 4-fid:
- 3a. Stigma 2-fid
- 4a. Stigma elongated, deeply 2-cleft at apex.....3. *H. europaeum*
- 4b. stigma short, slightly 2-fid.....4. *H. crispum*
- 3b. Stigma 4-fid:
- 5a. Stem sub-angular, tomentose, leaves elliptic to ovate....5. *H. biannulatum*
- 5b. Stem circular, densely villous, leaves linear-lanceolate or
oblong.....6. *H. pakistanicum*
- 6a. leaves lanceolate; anthers 8 mm long; stigma glabrous.....7. *H. ulophyllum*
- 6b. Leaves ovate to obovate; anthers 2 mm long;
stigma densely hairy.....8. *H. daysicarpium*

1. *Heliotropium curassavicum* L. Sp. Pl. 130 (1753); Jafri in Fl. Kar., 278
(1966); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak. & Kashm., 589
(1972); Nasir in Nasir & Ali, Fl. Pak. 191: 23 (1989).

Syn: *H. glaucum* Salisb., Prodr. 113 (1796); *H. glaucophyllum* Moenich,
Meth. Suppl. 147 (1802); *H. curassavicum* var. *obovatum* and *virens* (E.
Mey. ex. DC.) DC., Prodr. 9: 538 (1845).

An annual to biennial prostrate, succulent herb up to 50 cm high. Stem woody below and herbaceous above, slightly angular, brownish color; internodes ca. 5-7 mm, sparsely hairy on young branches and older ones smooth. Leaves 2.5-2.9 x 0.5-0.7 cm, sessile, spirally arranged, densely aggregated, alternate to sub-opposite, lanceolate to spatulate, margin entire to slightly undulate, apex rounded, base cuneate. Inflorescences terminal forked cyme, 15-16 flowered; peduncle 2 cm. Flower sessile, campanulate hypogynous, white, group into two in 2-ranked spike. Sepals 5, gamosepalous, ca. 4 x 3 mm, lanceolate, apex acute, margin smooth, brownish. Petals 5, yellow, gamopetalous; lobes ca. 5-6 mm, apex rounded, margin slightly undulate. Stamens 5, epipetalous, ca. 3 mm across, cordate, base rounded, apex acute, yellow. Ovary globose, style rudimentary, stigma conical, glabrous. Nuts 4, ca. 3 mm across, brown, glabrous, shiny.

FL. Per.: January.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2571, 2170 (PMAS-AAUR).

Distribution: America, Europe, Africa, Pakistan, India and Australia (Nasir, 1989). **Herbarium Notes:** our description has some variations from the Flora of Pakistan such as: stem sparsely hairy on young branches, leaves densely aggregated, lanceolate to spatulate, nuts 3 mm.

2. *Heliotropium strigosum* subsp. *Strigosum* Willd., Sp. Pl. 1: 743 (1798).

An annual, prostrate, herbaceous herb up to 40-50 cm high. Stem rounded, tender, herbaceous, green densely covered with strigose hairs; trichomes 1-celled; internodes ca. 3-5 cm. Leaves spirally to decussate; lamina ca. 3-4 x 1-2 cm, linear-lanceolate, base attenuate, apex broadly acute, margin entire, subsucculent,

venation obscure, densely strigose; petiole 3 cm. Inflorescences terminal or axillary cyme. Flower campanulate, complete, ca. 2-3 mm. Sepals ca. 3-4 x 3mm, brownish green; lobes 5, elliptic, apex broadly acute, margin smooth, densely strigose above. Petals ca. 3-4 mm, yellowish white; apex acute, lanceolate, strigose above. Stamens 5 epipetalous, hairy; anther 3 x 2 mm, cordate, apex acute, yellow; filaments filiform, ca. 3 mm long. Ovary globose, strigose; style 2 mm, hairy; stigma simple, conical. Fruit drupe, ca. 2 mm cross, ovoid, 4 seeded. Nutlet 4, conical, sparsely strigose hairy.

FL. Per.: July-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2537 (PMAS-AAUR).

Distribution: Afghanistan, Pakistan eastward to Nepal, Burma, Malya (Nasir, 1989).

3. *Heliotropium europaeum* L., Sp. Pl., 130 (1753); Jafri in Fl. Kar., 277 (1966); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak. & Kashm., 590 (1972); Nasir in Nasir & Ali, Fl. Pak. 191: 39 (1989).var. nova *angulosum*

An annual erect herb up to 45 cm tall. Stem much branched, angular, brownish green, herbaceous, setose; trichomes whitish grey colored, 1-celled; internode ca. 1.5-4 cm. Leaves 3-3.7 x 1-1.4 cm, alternate, spirally arranged, elliptic to lanceolate, base attenuate, apex broadly acuminate, margin slightly undulate to minutely serrate at maturity, younger ones serrate, midrib prominent, greenish brown in color, densely setose on both sides; hairs white with pointed ends, 1-celled; petiole ca. 1.5-1.8 cm. Inflorescence helicoid cyme; peduncle 3-3.2 cm, setose with whitish grey hairs. Flower sessile, 10-14 in two rows. Sepals 5;

lobes 8-9 x 2 mm, lanceolate, apex acute, margin entire, light green at the base, dark green on the tip, setose above; tube ca. 2 mm, glabrous within. Petals 5; lobes 4-5 x 2 mm, obovate, margin undulate, yellowish white, veins prominent. Stamens 5, epipetalous; filament 0; anther ca. 3 x 1 mm, greenish yellow. Ovary 3 mm across, globose, brownish; stigma conical, bi-fid, strigose; style gynobasic.

FL. Per.: November-January.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2584 (PMAS-AAUR).

Distribution: Trans Jordan, Syria, Iraq, Iran, Russia, Afghanistan, Pakistan, India (Nasir, 1989).

Herbarium Note: This variety is different from *lasiocarpum* ((F. & M.) Kazmi with prominent angular stem with setose hairs, leaves with broadly acuminate apex and margin undulate to minutely serrate, petiole less than 2 cm, sepals more than 8 mm long, elliptic to lanceolate, petal lobes 4-5 mm, obovate, anthers 3 mm.

4. *Heliotropium crispum* Desf., Fl. Atlant., 1:151-4 (1798); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak. & Kashm., 589 (1972); Nasir in Nasir & Ali, Fl. Pak. 191: 42 (1989). subspecies nova *thaliensis*

Syn: *Lithospermum hispidum* Forsk. Fl. Aegypt.-Arab. 39 (1775); *Heliotropium undulatum* auct. non Vahl (1790); *H. undulatum* Vahl, var. *ramosissimum* Lehm. Asperif. 24. t. 40 (1831); *H. ramosissimum* (Lehm.) DC. Prodr. 9: 536 (1845); Clarke in Hook. f. Fl. Brit. India 4: 150 (1883).

An biennial to perennial erect to ascending herb up to 20 cm high. Stem herbaceous, circular, strigose; hairs recurved, bulbous based, 1-celled; internodes ca. 1-1.5 cm, glaucous. Leaves 0.5-1 x 0.2-0.3 cm, sessile, spiral arrangement,

elliptic, base cuneate, apex broadly acute, margin deeply undulated, brownish green, midrib prominent, densely strigose,. Inflorescences axillary and terminal, 1-seriate, ca. 0.5-1 cm, 6-7-flowered. Flower sessile, hypogynous; broad based strigosely hairy, slightly recurved, 1-celled. Sepals 5, tubular, greenish; lobes ca. 4-5 x 3mm, lanceolate, apex acute adaxial surface strigose. Petals 5, gamopetalous, creamy; lobes 2 mm, apex acute and dentate, adaxially strigose, hairs decurved; tube ca. 3mm. Stamens epipetalous; anthers ca. 2 x 1 mm, elliptic, dorsifixed. Ovary ca. 2 x 1 mm, ovate to elliptic, stigma slightly bifurcated, unequal.

FL. Per.: Januar-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2344 (PMAS-AAUR).

Distribution: Senegal, N. Africa, Arabia, Iraq, Trans Jordon, Iran, Ifghaniatan, Pakistan & India (Nasir, 1989).

Herbarium Note: Comparing with the flora of Pakistan p. 42, Nasir, 1989), the collected species possess following distinguishing characters: Less than 20 cm erect herb; leaves less than 2 cm, elliptic apex broadly acute; inflorescence up to 1 cm, axillary and terminal; calyx more tha 2.5 mm long; lobes lanceolate; anthers ca. 2 x 1 mm, elliptic, ovary ca. 2 x 1 mm, ovate to elliptic.

5. *Heliotropium biannulatum* Bunge in Bull. Soc. Nat. Moscou. 12 (2): 300 (1869).

A perennial erect herb up to 25 cm high. Stem herbaceous, sub-angular, tomentose, greenish brown; hairs hyaline; internode ca. 1-1.5 cm. Leaves 1-1.5 x 0.4 cm, spirally arranged, succulent, sessile, elliptic to ovate, basecuneate, apex acute, margin sub-entire to undulate, strigose. Inflorescences terminal and axillary

forked racemes, ca. 0.5-1.5 cm long; peduncle ca. 1-1.7 cm, greenish brown, tomentose. Flowers sessile, complete, creamy, hypogynous. Sepals 5; lobes ca. 4 x 3 mm, lanceolate, apex acute, greenish brown, tomentose, hairy on adaxial side and margin; tube ca. 2 mm. Petals 5; lobes 4 mm, ovate, margin undulate, strigose at adaxial side; tube ca. 1 mm. Stamens 5, epipetalous; anthers ca. 1 x 0.3 mm, ovate-oblong, apex obtuse, greenish yellow; filaments ca. 0.5 mm. Ovary ca. 1 mm, globose; style 0.4 mm; stigma ca. 1 mm, conical, 4-fid, yellow, sparsely hairy. Nutlets 4, ca. 1.5 mm long.

FL. Per.: April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2603 (PMAS-AAUR).

Distribution: Pakistan and Afghanistan.

6. *Heliotropium pakistanicum* sp. nova

A perennial semi-erect herb about 60 cm high. Stem much branched at the base, woody below and herbaceous above, circular, green, densely villous, internodes ca. 1.5-2.5 cm. Leaves alternate, spirally arranged, succulent, ca. 1-3 x 0.3-0.5 cm, linear-lanceolate or oblong, apex broadly acute, base cuneate, margin dentate-undulate, midrib prominent, diffusely strigose; hairs 1-celled, bulbose based, ca. 1mm long; petiole ca. 1 mm, densely strigose. Inflorescence ca. 0.5-2.5 cm long, forked, each having 6-15 flowered; peduncle ca. 0.5-1.5 cm, circular, green, villous. Flowers sessile, complete, campanulate, creamy. Sepals ca. 4 x 3 mm, green, persistent; lobes 5, elliptic, apex obtuse, margin entire, densely villous on the margin, upper and lower side. Petals lobes 5, yellow, ovate-oblong, apex obtuse, margin undulate, ca. 1-1.5 mm long, abaxially sparsely hairy; tube ca. 3

mm. Stamens 5, epipetalous, ca. 3 mm; anthers elliptic-lanceolate, base rounded, apex subacute; filaments small. Ovary globose, ca. 1mm across; style filiform, ca. 2 mm; stigma 4-fid, conical, glabrous. Nutlets 4, whitish grey, hairy, depression on the inner side, ca. 3 mm across.

FL. Per.: April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2065 (PMAS-AAUR).

Distribution: endemic to Thal desert, Punjab Pakistan.

Herbarium Note: A perennial, semi-erect herb up to 60 cm tall. Leaves distinctly lanceolate, deeply undulate, villous. anthers elliptic, apex acute, 3 mm across. Ovary globose style filiform, ca. 2 mm, nutlets whitish grey, hairy, depression on the inner side.

7. *Heliotropium ulophyllum* Rech. f. and Riedl in Rech. f., Fl. Iran. 48: 31 (1967).

Stem slightly angular, tomentose, greenish; hairs 1-celled; internodes ca. 1.5-2.5cm. Leaves succulent, alternate to spiral arranged; lamina ca. 1-1.3 x 0.3-0.4cm, lanceolate, base attenuate, apex broadly acute, margin undulate, midrib prominent, setose; petiole ca. 3-4mm. Inflorescences a terminal forked raceme, branches unequal each one 10-14 flowered; peduncle ca. 6-8 mm, greenish brown, tomentose, hairs 1-celled. Flower hypogynous, sessile. Sepals 5, gamosepalous, ca. 5-6 x 3 mm, lanceolate, apex broadly acute, greenish brown, tomentose. Petals 5, tubular; lobes ca. 2 mm, apex rounded, margin wavy, yellowish whitish, midrib prominent, tomentose; hairs on adaxial side; tube ca. 4mm. Stamens 5, epipetalous; anther ca. 8 x 2 mm, cordate; filament ca. 2 mm. Ovary globose, glabrous; style ca.

2-3 mm; stigmaslightly 2-fid, smooth, equal to style, sparsely tomentose. Nuts 4, brownish in color.

FL. Per.: May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2600 (PMAS-AAUR).

Distribution: Endemic.

8. *Heliotropium dasycarpium* var. *gymnostomum* Ledeb. in Eichw. Pl. Nov. Iter-Carp. Cauc. 11 (1831-1833) .

Stem angular, herbaceous above and woody below, green, glaucous and strigose to tomentose; hairs 1-celled, internodes ca. 2-4 cm. Leaves opposite to spirally arranged, light green; lamina ca. 1.2-1.6 cm, ovate to obovate, apex rounded, margin undulate, venation prominent, strigose and tomentose on the abaxial and adaxial surface; hairs 1-celled; petiole ca. 0.8-1.2 x 0.7 cm. Inflorescences terminal, forked cyme; peduncle ca. 5-8 mm, green to glaucous, strigose to tomentose; hairs 1-celled. Flower sessile, hypogynous. Sepals 5, gamosepalous, greyish green; lobes 3-4 x 2-3mm, adaxial surface densely strigose and tomentose; hairs hyaline. Petals 5, tubular, yellow; lobes ca. 2 mm, hairy above; tubes 3 mm. Stamens 5, epipetalous; anthers ca. 3 x 2 mm, cordate, dorsifixed. Ovary 3 mm across, 4-ovuled, brown; stigma conical, densely hairy. Nutlet 4, pepilate.

FL. Per.: April-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2019 (PMAS-AAUR).

Distribution: Gilgit, Waziristan (Pakistan).

2. *Trichodesma indicum* (L.) R. Br., Prodr. Fl. Nov. Holl. 149 (1810).

An annual to biennial herb up to 50 cm high. Stem much branched, subangular, herbaceous, brownish in color, densely setose; hairs 1-celled internodes ca. 2-3 cm. Leaves ca. 2-3.8 x 1.6-1.8 cm, sessile, opposite, subsucculent, ovate to oblong, margin entire, apex acute, midrib prominent, base subamplexicaule, brownish green, densely strigose; hairs 1-celled, having powdery appearance above. Inflorescence a terminal cyme, few flowered. Flower purplish white in color; pedicle ca. 1.5-2.5 cm, circular, brownish, densely strigose. Sepal lobes 5, ovate, apex acute, base segittate, ca. 1-1.2 x 0.6 cm, green, margin and midveins densely setose; hairs hayline, 1-celled with prominent ridges and furrows. Petal lobes 5, ca. 4 mm long, ovate, apex mucronate, midrib prominent, purplish white; tube ca. 1 cm, hairy above and glabrous within. Stamens 5, epipetalous; anthers ca. 1-1.2 x 0.2-0.3 cm, cordate, apex narrow ribbon like fiber twisted together to form cone like structure, densely setose on the anther tip. Ovary rounded; style ca. 0.9-1 cm long, brown; stigma cylindrical.

FL. Per.: Mostly throughout the year. Sporadic, but normally from March-August

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2166 (PMAS-AAUR).

Distribution: Afghanistan, Pakistan, India, Philippines, Mauritius.

3. *Nonea*

Medicus, Philos. Bot. 1: 31 (1789). C. B. Clarke in Hook. f., Fl.

Brit. Ind. 4: 169 (1883).

Key to species:

1a. Leaves more than 2 cm long; corolla glabrous within..... 1. *N. edgeworthii*

1b. Leaves less than 2 cm long; corolla with 1 ring of hairs (annulus)

within.....2. *N. caspica*

1. *Nonea edgeworthii* A. DC. in DC., Prodr. 10: 30 (1846).

An annual erect herb up to 25 cm high. Stem much branched, rounded, herbaceous, densely strigose and setose, brownish green; internodes ca. 1-2.5 cm. Leaves sessile, spirally arranged, ca. 2.6-4.5 x 0.6-1 cm, ovate-lanceolate, base wedge shape, apex acute, margin entire, midrib prominent, brownish green, strigose. Bract leafy, ca. 1-1.5 cm, lanceolate, base broad and apex acute, margin entire, midrib prominent, strigose hairy, brownish green in color. Flower creamy white; peduncle ca. 2-2.5 cm, rounded, densely strigose and setose, brownish green. Sepal lobes 5, ca. 3 mm, linear, apex acute, brown, hairy above and below; tube ca. 6 mm. Petal lobes 5, creamy white, densely strigose above, glabrous within, ca. 4 mm long; tube ca. 5 mm long. Stamens 5, ca. 3 x 2 mm, epipetalous. Ovary 4-locular, nuts hypogynous; style filiform, ca. 5-6 mm long; stigma capitate, sticky with glandular hairs, brown head. Seeds transversely arch shaped, depressed at one side, brown, ca. 4 x 3 mm.

FL. Per.: March-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2181 (PMAS-AAUR).

Distribution: Pakistan, India, Widely distributed. Found as a weed in the plains and hills up to 1800 m.

2. *Nonea caspica* (Willd.) G. Don, Syst. 4:336. 1838. Riedl in Rock. Iran. 48: 250 (1967).

Stem much branched, herbaceous, circular, brownish green, densely strigose and setose; internodes ca. 1-2.5 cm. Leaves sessile, spirally arranged, ca. 1.5-1.8 x 0.6-0.8 cm, ovate-lanceolate, base wedge shape, apex acute, margin entire, midrib prominent, brownish green, strigosely hairy. Flower complete; peduncle ca. 1.5-2 cm, densely strigose and setose, brownish green. Bracts leafy, ca. 5-7 mm, lanceolate, base broad, apex acute, margin entire, midrib prominent, brownish green, strigosely hairy. Sepal lobes 5, claw like clift, densely strigose, apex acute, ca. 2 mm across, brown, persistent; tube ca. 3 mm long. Petals creamy white; lobes 5, densely strigose above, ca. 2 mm long; tube ca. 3 mm long; ring of hairs present at the basal portion, 1-celled. Stamens 5, epipetalous, ca. 3 x 1 mm; anthers basifixed; filaments small. stigma capitate, glandular hairy, brown; style 3-4 mm long. Nut ca. 4 x 3 mm, transversely ovoid or arch shaped, depressed on one side, brown.

FL. Per.: March-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2111 (PMAS-AAUR).

4. *Heterocaryum szovitsianum* (Fisch. & C.A. Mey.) DC., Prodr. 10: 145 (1846).

Stem circular, yellowish green, sericeous and glaucous; hairs greyish white; internodes ca. 1.5-2.5 cm. Leaves sessile, ca. 2-3.2 x 0.5-0.9 cm, basal leaves alternate, become spiral at upper side, lanceolate to oblanceolate, base cuneate, apex broadly acute, margin entire, midrib prominent, sericeous and glaucousat upper and lower surface and margin strigose; hairs 1-celled. Inflorescence terminal and axillary cyme; peduncle ca. 2-2.3 cm, rounded, sericeous. Flower

sessile, bracteate, off white, pedicel ca. 0.5-0.6 cm, erect. Sepals deeply 5-cleft, 6-8 x 3 mm lanceolate, apex acute, green, strigose; hairs long, 1-celled on upper and lower surface, hirsute on the margin. Petals 5, tubular, bluish purple, grey hairs on upper surface; lobes ca. 2 mm, margin glabrous; tube ca. 0.5 cm long. Stamens 5, epipetalous; filament small; anthers ca. 4 x 2 mm, yellow, elliptic, apex acute, base cuneate, ventrally attached to the filament. Ovary smooth; stigma diffuse head; style 3 mm, smooth.

FL. Per.: April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2109 (PMAS-AAUR).

Distribution: Turkey, Syria, Iraq, Iran, South & S.W. URSS, Afghanistan, Pakistan and Kashmir. Fairly common and widespread, from 760-1800 m.

5. *Lappula barbata* (M. Bieb.) Gurke in Engl. & Prantl, Nat. Pflanzenfam. iv. 3a: 107 (1893).

An annual erect herb up to 25 cm high. Stem herbaceous, greenish brown, hairy; hairs hayline, 1-celled, hairs pinnate; internodes ca. 2-4.5 cm. Leaves spiral arranged at lower and decussate towards floral branches, sessile, ca. 2-3.1 x 0.4-0.5 cm, lanceolate, apex acute to broadly acute, midrib prominent, margin entire, greenish, hairy and much longer at the base of leaves. Inflorescence terminal cyme; peduncle, 1-2 cm, greenish brown, hairy. Flower ca. 0.6 x 0.2-0.3 cm; pedicle ca. 2-4 mm, sometime sessile; bracts lanceolate, apex acute to broadly acute, hairy and much longer at the base, greenish. Sepals lobes 5, ca. 2 x 1 mm, lanceolate, midrib prominent, green, hairs on margin and tip; tube ca. 2 mm. Petals lobes 5, ca. 4 mm long, yellow in color, margin entire, apex rounded; tube ca. 1 mm. Stamens 5,

epipetalous; filaments small, attached ventrally to the anther; anthers triangular, brownish yellow. Ovary globose, ca. 2 x 3 mm, yellowish green; style ca. 3 mm, long, straight, smooth; stigma diffuse to crested head. Seeds 4, ca. 5 x 4 mm conical, tuberculate.

FL. Per.: May-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).

Distribution: Turkey, Syria, Armenia, Iraq, Iran, URSS, Afghanistan, Pakistan, Kashmir.

Herbarium Note: first reported from Punjab.

36. VERBENACEAE

Phyla nodiflora (L.) Greene., Pittonia 4:46 (1899); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak. & Kashm., 607 (1972).

Syn. *Verbena nodiflora* L., Sp. Pl. 20 (1753); *Zapania nodiflora* (L.) Lam., Tab. Encyc., i, 59 (1791); *Lippia nodiflora* (L.) L.C. Rich. ex Michaux, Fl. Bor. Amer., ii: 15 (1803).

Widely creeping perennial herb up to 60 cm high. Stem prostrate, rooting at the nodes; branches slender, ± clothed with adpressed, medifixed white hairs. Leaves opposite, thick textured, spatulate, oblanceolate or obovate, sometimes elliptic or cuneiform, ca. 5-25 x 3-15 mm, apex rounded or obtuse, base cuneate, decurrent into a petiole, margin rather regularly sharply serrate above the middle with sharply acute or acuminate teeth, entire at the base, 2-4-nerved minutely strigose-puberulent on both surfaces. Flowers sessile, densely packed in long, pedunculate, axillary heads, the latter at first globose, afterwards elongate and

becoming spicate and oblong in fruits; peduncles solitary in each axil, ca. 1-2 cm long; stalk 5 cm long, sparsely adpressed-peberulent; bracts closely imbricate, obovate or rhomboid, base cuneate, apex mucronate, acuminate, concave, glabrous or finely ciliate. Calyx ca. 2 mm long, hyaline-membranous, copular, deeply 2-lobed, slightly 2-carinate; keels puberulent; lobes lanceolate. Corolla purplish white, ca. 2-2.5 mm across; salver-form, slightly strigose outside, 2-lipped; tube ca. 1.5 mm; lobes 5, spreading, sub-orbicular, apex obtuse, 2+3, ca. 1-1.2 mm; upper lip 2-fid, erect; lower lip 3-fid; mid lobe the largest. Stamens 4, attached in 2 pairs at the throat of tube; filaments ca. 0.4 mm, curved; anthers ca. 0.2 mm, ovate. Ovary globose, ca. 0.5 mm, 2-celled; ovule solitary per cell, basal; style ca. 0.5 mm; stigma su-capitate, oblique. Fruit ca. 1.5 mm long, globose-oblong, dry splitting into 2, 1-seeded, plano-convex, glabrous pyrenes.

FL. Per.: Almost round the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2547 (PMAS-AAUR).

Distribution: Throughout tropical and subtropical regions (Jafri and Ghafoor, 1974).

37. LABIATE (LAMIACEAE)

1a. Undershrub with 2 perfect stamens:

2a. Anther cells bearded.....1. *Lamium*

2b. Anther cells glabrous.....2. *Salvia*

1b. Herbs with 4 stamens.....3. *Mentha*

1. *Lamium amplexicaule* L., Sp. Pl. 579 (1753).

Annual erect herb upto 10-40 cm, angular, ridge and ferrows, internode distances ca. 2-9cm, much brached at base, appressed 1-celled hairs, greenish

brown. oppositely arrange, petiole ca. 0.5-1cm; densely downward appressed hairs, greenish brown, upper young leaves sessile, lamina ca. 1.4 x 1.7cm, stigose hairs on both surface, ovate, reniform, crenate to lobed, obtuse, rounded or cordate base, green to dark green. Inflorescences Vertilaster, 16-flowers at the each group, at each group a pairs of sessile amplexicaul leaves, amplexicaul leaves ca. 2.1-1.3 x 2.5-3, crenate to lobed, obtuse, rounded or cordate at base, ovate, stigose hairs on both surface, green to dark green. flowers sessile. 5-gamosepalous, ca. 5-6 x 1-2mm, ca. 3mm free and 3mm tube, tubular, densely pubescent with eglandular hairs; teeth narrow triangular, acuminate, about as long as tube, equal, converging in fruit. Corolla purple-pink, 15-20 mm; upper lip pubescent to vinous, straight; lower lip reflexed, shorter than upper; tube slender, straight, ca. 0.8 mm in width, exannulate. Stamens included under corolla upper lip. Nutlets ca. 2-2.5 x 1-1.5 mm, smooth, with a short broad-based stipe, dearily trigonous below, brown, apically rounded, usually with numerous white raised blotches, not mucilaginous on wetting.

FL. Per.: December-April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2172 (PMAS-AAUR).

Distribution: Europe and Asia.

2. *Salvia santolinifolia* Boiss., Diagn. Pl. Or. Nov. 1, 5: 13 (1844).

Dwarf, suffruticose much branched undershrub up 30 cm. Stems with an often gnarled woody base, eglandular below with often retrorse long hairs, glandular above. Leaves borne \pm erect to erect-spreading linear in outline with a sinuate-convolute margin and apparently or indeed pinnatifid, 5-13 x 1.5-3.5 mm,

white canescent below with glandular and eglandular hairs and sessile oil globules, petiolate. Inflorescence with usually several, 1-2-flowered distant or approximating verticillasters. Bracts and bracteoles present. Pedicels in flower 1.5 mm elongating to 2.5 mm and recurved in fruit. Calyx tubular-campanulate, 3-4 mm in flower and ca. 5 mm in fruit, with a dense indumentum of very long white spreading eglandular hairs, shorter capitate glandular hairs and sessile oil globules; upper lip of \pm connivent acuminate-spinulose teeth. Corolla mauve, pink to lilac often with darker markings, 5-6 mm; upper lip straight much shorter than lower. Lower theca fertile; staminodes prominent. Nutlets smooth, black, ovoid-trigonous, ca. 1.5 x 1 mm.

FL. Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2098 (PMAS-AAUR).

Distribution: Iran, Afghanistan, Pakistan.

3. *Mentha longifolia* (L.) L., Fl. Monspel. 19. 1756. Amoen. Acad. 4: 485 (1759).

Perennial aromatic herb, erect to prostrate up to 30-60 cm, tetra angular, glaucous, soft pilose, internodal distance ca. 1.5-2.5cm, much branched, glandular hairs, dark green. Oppositely arrangement, petiole length ca, 5-7 mm; glabrous, lamina ca. 1.9-2.2 x 0.8cm, elliptic, glaucous outer surface, veins prominent on outer surface, densely to lightly gland-dotted on abaxial surface, leaf margin serrate, apex acute, base cunate to slightly oblique. Inflorescences terminal verticillaster, numerous flower, white, tubular, flowers are present in groups having a pair of opposite bracts abaxial side of the flower group, Bracts linear to linear-

subulate. 5-gamosepalous; ca. 1.5-3mm, 1mm free and 2mm tube, tomentose hairs on outer surface, tooth, having dots on outer surface. 5-gamopetalous, ca. 5 x 2mm, 3 mm tube and 2 mm free, hairs on outer side, 3 petals are deeply lobed and two petals are jointed not much deeply lobed, white to violet or mauve or white. 4-Stamens, epipetalous, filament ca. 4mm long, alternative to petals, long filament which emerge out from petals, filament reddish brown, hairy, filament vertically attached to anther sac, 2-chambers, reddish brown. Ovary cylindrical, 4 nuts, syncarpous ovary, hypogynous bifurcated stigma, style longer than flower ca. 5-6mm. Stigma and style reddish brown, Nutlets c. 0.8 x 0.6 mm, ovoid, apically rounded, pale to dark brown, delicately reticulate, slightly mucilaginous on wetting.

FL. Per.: May-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2608 (PMAS-AAUR).

Distribution: Europe and Asia and southern Africa.

38. PLANTAGINACEAE

Key to species:

1a. capsule 4-8-seeded.....1. *P.*

major

1b. Capsule 2-4-seeded:

2a. Leaves 3-nerved; corolla lobes obtuse.....2. *P.*

ovata

2b. Leaves 5-nerved; corolla lobes acute.....3. *P.*

amplexicaulis

1. *Plantago major* L., Sp. Pl. 112 (1753).

A perennial erect herb up to 20 cm high. Stem rounded, glaucous, whitish green, multicellular villous haired. Leaves rosette at the base and spirally arranged on the top; lamina ca. 4.6-5 cm, elliptic to broadly lanceolate, apex acute, margin smooth to undulate, multicelled vilouse on venations, glabrous below, greenish white; petioleca. 4-6 cm. Inflorescence terminal dense spike; peduncle ca. 4-6 cm, multicellular villous hairy. Flower sessile, greenish brown. Bracts larger than sepals, ca. 3-5 x 2-3 mm, lanceolate, apex broadly acute, long hairs at the hayline margin and apex. Sepals 4, polyseplous, ca. 4 x 2 mm, broadly elliptic, oblong to rounded, base obtuse or subacute, apex obtusely keeled broadly acute, hairy, margin broadly scarios, greenish or yellow. Petals 5, gamopetalous; tube ca. 3 mm flong; lobes ca. 3 mm, elliptic to ovate, apex acute, greenish or yellowish white, hairs at dorsal side. Stamens 4, epipetalous, alternate to petals; filament ca. 5 mm; anthers basifixed. Ovary 2-locular, 2-ovuler, hypogynous, globose, glabrous; style curl long, ca. 5mm, pubescent; stigma sticky. Capsule ca. 2-3mm, 8-10-seeded; seeds minute, ca. 1-1.4 x 0.5 mm, ellipsoidal, brown.

FL. Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2064 (PMAS-AAUR).

Distribution: Mediterranean regions to the deserts of Kizil Kum, Afghanistan and Pakistan.

2. *Plantago ovata* Forssk., Fl. Egypt-Arab. 31 (1775).

Subacaulescent annual herb upto 5-9cm tall. Stem glabrous to sparsely hairy, greenish white. Leaves rosette at the base; lamina ca. 2.5-3 cm, narrowly

linear, apex acute, base attenuate and hairy, mucicelled appressed and wooly hairy; petiole ca. 2-4 cm long. Inflorescence a spike; peduncle ca. 4-4.5 cm. Flowers dense capituliform or short cylindrical. Bract one, ca. 3-6 x 4 mm, ovate and concave, apex acute, margin hairy, sparse hairs on the margin. Sepals ca. 5 x 3 mm, obovate to elliptic, apex acute, margin hairy, midrib prominent, glabrous. Petals ovate to cordate, ca. 5-8 x 3 mm, glabrous. Ovary ellipsoidal, ca. 3-4mm; style ca. 5mm; stigma sticky. Capsule ca. 8mm, elliptic to obtuse, glabrous. Seeds 2, brown ca. 7 x 3mm elliptical to boat shaped, yellowish brown.

FL. Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2178 (PMAS-AAUR).

Distribution: From Mediterranean regions to the deserts of Kizil Kum, Afghanistan and Pakistan.

3. *Plantago amplexicaulis* subsp. *Bauphilla* (Edgew.) Rech. f., Fl. Iran. 15: 11 (1965).

An annual semi-erect herb up to 20-25cm tall. Stem herbaceous, much branched at the base, sparsely hairy, hairs 1-celled. Leaves rosette at the base and spirally arranged on the top; lamina ca. 4-6 x 0.4 cm, lanceolate, margin entire and sparingly toothed, base broadly cuneate to attenuate, apex acuminate, multi parallel veined, unicellular hair present on veins; petiole ca. 1.6-2 cm. Scapes many, axillary, erect to arcuate, ca. 9-18cm. Bracts oblanceolate, equalling to sepals. Sepals 4, ca. 4.5-6 cm, broadly ovate to oblong, glabrous. Petals 4, narrowly lobed, ca. 1-2.2 mm. Stamens 4, epipetalous, alternate to petals; filament ca. 3-5mm;

anther basifixed. Ovary elipsoid, ca. 4-6mm; style curl long, 5mm; stigma sticky.

Seeds ca. 2- 4 x 0.3mm, black.

FL. Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2177 (PMAS-AAUR).

Distribution: From Algeria, Tunisia and Spain, north Africa, Egypt and Arabia.

39. SCROPHULARIACEAE

Key to genera:

1a. Calyx 4-lobed..... 1.

Veronica

1b. Calyx 5-lobed:

2a. Upper 2 stamens with perfect anthers; lower 2 reduced to staminodes.....2. Bacopa

2b. Stamens all perfect, didynamous.....3.

Schweinfurthia

Veronica persica Poiret

Prostrate erect annual to biennial small herb, ca. 10-20cm tall, much branched at base, stem have runners, rounded, internode distances ca. 0.8-1cm, lepidote to papillated multicelled hairs, green, shiny. oppositely arrange, petiole ca. 2-8mm; small strigose hairs, lamina length ca. 8-10 x 7-8 mm, ovate to lanceolate, margin lobed, entire with small strigose hairs at margin and both surface, margin flat, apex acuminate, base tuncate to oblique, 3 veins, green. Inflorescences terminal, pedicle ca. 6-7 mm; lepidote to papillated or small strigose, green. bract at base ca. 1.5-4 x 3mm, lanceolate, margin smooth, multicelled densely hairy. 4-

polysepalous, ca. 6 x 3mm elliptic, acute apex, ovate to lanceolate, small strigose hairs at outer surface. smooth margin, venation parallel, greenish yellow. 4-Polypetalous, ca. 8-12 x 3 mm, throat sparsely hairy, ovate to orbicular. Stamens slightly shorter than corolla; ca. 3-4 mm filament length, filament flat and anther sac rounded, volit. Capsule obcordate, strongly compressed, 4-6 x 6-9mm, apically notched at right to obtuse angle; lobes obtuse, glandular hairy, venation conspicuously reticulate, hairy, brown. Style 2-3 mm, exserted. fruit two locules each locule 3 seeds, seeds brown, concave, papillate, seed ca. 3 x 3mm, seed coat deeply rugos dorsally.

FL. Per.: Feb.- March.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2487 (PMAS-AAUR).

Distribution: widespread in North America and eastern Asia, including Japan and Taiwan.

3. *Bacopa monnieri* (L.) Wettstein in Engl. & Prantl. Pflanzenfan. 5 (36): 77 (1891).

Syn: *Lysimachia monnieri* L.; *Gratiola monnieri* L.; *Monniera cuneifolia* Michaux; *Herpestris monnieri* (L.) HB. & K.; *Bacopa monnieri* (L.) Wettst.; *Brami monnieri* (L.) Pennell.

A glabrous, somewhat succulent, creeping herbs, rooting at the nodes with numerous prostrate branches, each 10-30 cm long, leaves obovate-oblong, obtuse, sessile, decussate, 1-2.5 x 0.3-0.8 cm, ± fleshy, entire, punctuate, obtuse. Flower axillary, solitary, pale violate; peduncles 1-1.5 cm long, often much longer and deflexed in fruiting stage; bracteoles 5 mm long, linear, obtuse. Calyx divided to

base; posticous segment broadly ovate, ca. 6 x 3-4 mm, obtuse, the other 4 segments slightly shorter than the anticous segments acute, slightly narrower. Corolla gamopetalous, funnel like, white or pinkish with purple blotches, 10-12 mm long, lobes subequal, rounded and glabrous. Stamens 4, didynamous, included. Ovary 2-chambered.

FL. Pre.: January-June

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2431, 2546 (PMAS-AAUR).

Field remarks: A common herb found in wetland habitat.

Distribution: W. Pakistan and Afghanistan (Jafri, 1966), Ceylon, India, Rajputana, (Bhandari, 1978).

3. *Schweinfurthia papilionacea* (Burm. f.) Boiss., Fl. Or. Iv: 387 (1879); Jafri in Fl. Kar. 304 (1966).

Syn: *Antirrhinum papilionaceum* Burm. f., Fl. Ind., 121, t. 39, f. 2 (1789);

A. glaucuma Stocks in Wight, Icon. T. 1459 (1850). *Linaria sphaerocarpa*

Benth. in DC., Prodr. X: 287 (1846); *Schweinfurthia sphaerocarpa* (Benth)

A. Braun. in Montsb. Akad. Wiss. Berl., 875 (1866).

A glaucous glabrous sub-succulent, erect herb up to 30 cm long, from a perennial root. Stem ascending, succulent, glaucous, much branched at the base. Leaves ca. 1-3 x 0.5-2.5 cm, ovate-spathulate, or orbicular-obovate, apex subacute-apiculate, margin entire, attenuated at the base into a short petiole, sparsely clothed on both sides with very minute hairs, rarely glabrous. Flowers axillary, ca. 12 mm, deflexed in fruit. Calyx 5-partite; upper segments broadly ovate-subcordate, apex acute, veined; rest lanceolate, apex acute, margin entire. Corolla-tube ca. 5 mm

long, white, with purple veins; upper lip 2-lobed, oblong, apex obtuse, ca. 4-5 mm long; lower lip 3-lobed, spreading, the lobes oblong, apex obtuse, ca. 7 mm long. Capsule obliquely globose, 2-celled, lower cell many seeded, upper cell few-seeded. Seeds obconic, truncate at both ends, acutely winged, pale.

FL. Per: November-February

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2486 (PMAS-AAUR).

Field remarks: A less common shrub found in calcareous soils.

Distribution: Rajputana, W. Pakistan and Afghanistan (Jafri, 1966).

40. OROBANCHACEAE

Cistanche tubulosa (Schrenk) Hook. f., Fl. Brit. Ind. 4: 324 (1884); Jafri in Fl. Pak., 98: 4 (1976).

Syn: *Phelipaea tubulosa* Schrenk, Pl. Spec. Aegypt-Arab. 23 (1840); *C. lutea* auct. non Hoffmg. & Link: Wight, Illust., 2: 180, t. 158b., f. 4 (1831); *C. tubulosa* var. *tomentosa* Hook., l.c.

A fleshy, glabrous-puberulous, yellowish to yellow-brown, erect herb with a purple tinge. Underground part much swollen, tuberous and attached to the root of the host plant. Stem up to 1 m high, mostly broader (up to 6 cm) at the base, unbranched, furrowed. Scales ca. 2-3.5 x 1-1.7 cm in , triangular-broadly linear, apex acute. Bracts ca. 1-1.5 cm long, oblong-lanceolate, apex acuminate, margin membranous, often purplish; bracteoles ca. 5-8 mm long, linear-sublanceolate, margin membranous. Calyx ca. 1.5-1.8 cm long, including lobes ca. 1/3 as long as the tube; lobes laterally overlapping, subequal, apex rounded, margins membranous. Corolla ca. 3-5 x 1.5-2 cm in , the lower half tubular, erect, the upper

half campanulate, bent outwards from the base middle, yellowish with purplish or rarely whitish lobes; limb shortly 5-lobed, the lobes rounded, reflexed. Filaments woolly at the base; anthers subexserted, woolly, rounded or blunt at the apex. Placentae 4, subequidistant; style exserted, curved below the stigma. Capsules ca. 2-2.5 cm long, ovoid-oblong, laterally compressed, beaked, many seeded. Seeds ca. 1-1.2 mm long, subglobose, deeply pitted, dark coloured.

FL. Per.: December-January.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2390 (PMAS-AAUR).

Distribution: N. Africa, Arabia, W. Asia to Pakistan, India and C. Asia.

41. ACANTHACEAE

Key to genera:

- 1a. Calyx deeply 4-lobed, bracts ciliate or spinescent.....1. *Barleria*
 1b. Calyx 5-lobed, bracts small and inconspicuous.....2. *Strobilanthes*

1. *Barleria*

L., Sp. Pl. 636 (1753); Gen. Pl. ed. 5. 283 (1754); Nees in DC., Prodr. 11: 223 (1847); Benth. & Hook. f., Gen. Pl. 2: 1091 (1876); Clarke in Hook. f., Fl. Brit. Ind. 4: 482 (1884).

Key to species:

- 1a. Flowers more than 4 cm long:
 2a. Capsule upto 1.2 cm long.....1. *B. acanthoides*
 2b. Capsule 1.5-2 cm long.....2. *B. prionitis*
 1b. Flowers less than 4 cm long.....3. *B. cristata*

1. *Barleria acanthoides* Vahl, Symb. Bot. 1: 47 (1790).

Prickly, rigid, perennial subshrub to shrub up to 2 ft high. Stem much branched, branches hoary or velvety-tomentose. Leaves ca. 7 x 3 cm in , obovate-oblong or obovate, obtuse or emarginated, mucronate, base attenuate, margin entire, pubescent. Spines up to 17 mm long, inter-petiolar, simple or branched. Flowers solitary or in 1-8-flowered, unilateral racemes. Bracts straw-colored, spinous-tipped. Outer calyx-lobes reticulately veined. Corolla infundibuliform; tube ca. 7.5 cm long, pubescent outside. Filaments bearded at the base only. Capsules up to 1.5 cm long, ellipsoid, glabrous, brown. Seeds ca. 3.5 mm in , broadly ovoid, compressed, silky hairy, brownish.

FL. Per.: October-March.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2627 (PMAS-AAUR).

Distribution: Egypt, Sudan, Ethiopia, Somalia, Djibouti, Pakistan (NWF Punjab, Sind) and N.W. India.

2. *Barleria cristata* L., Sp. Pl. 636 (1753).

An erect spiny diffusely branched shrub up to 1 meter high. Stem solid, much branched from the base, hard and woody at the base, herbaceous above, circular, hairy to glabrescent, whitish green in color; internodes ca. 4-4.5cm. Leaves opposite, ovate, ca. 1.2 x 0.6 mm, base oblique, venation pinnate, margin entire, glabrescent to glaucous, spine-apexed; spines present on the abaxil side of leaves, 5 to 6 in number, ca. 1.5-1.9 cm long, pale yellow; petiole ca. 0.3mm, glaucous, small valvate hairs present on the upper and lower surface.

FL. Per.: November-February.

Distribution: S. China, Nepal, Burma, Indo-China, Philippines, Bangladesh, India, Sri Lanka and Pakistan.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2437(PMAS-AAUR).

3. *Barleria prionitis* L., Sp. Pl. 636 (1753).

subsp. *prionitis*

Small shrub upto 1-1.5m tall, internode distance ca. 2-6 cm, white hairy, angular, greenish white, long spines 7-15 mm. Leaves oppositely arrange, petiole ca. 0.8-1.2cm, lamina ca. 1.8-2 x 1.5 cm obovate to ovate, leaf margin slightly wavy, tip mucronate, mid vination prominent, base rounded inflorescences solitary, terminal and axillary. Pedicle flower very small, whitish yellow, long narrow at base and broad at tip, cluster bracteoles 10-15 mm long covers flowers. 5-polyseplous, ca. 4-5 x 1 cm, dens tomentose white hairs at margin and both surface, acute apex, greenish white. 5-gamopetalous, ca. 2-2.5 cm, narrow at base and broad rounded at apex, white hairs at outer surface of the petals. 4-stamens, epipetalous, ventrely attachment to filament, filament length ca. 5-6 mm. long cueve stigma, long curved style length ca. 2-2.3 cm, style white hairs, ovary cylindrical, epigynous, white pubescent, globose.

FL. Per.: Throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2628 (PMAS-AAUR).

Distribution: Pakistan eastwards to Indo-China and Malesia.

2. *Strobilanthes glutinosus* Nees in Wall., Pl. Asiat. Rar. 3: 86 (1832);

Stewart in Nasir & Ali, Ann. Cat. Vasc. Pl. W. Pak. & Kashm. 676 (1972).

Erect 1-1.5m tall, 1-celled glutinous hispid hairy; rounded tip, internodal distance ca. 3-4cm, rounded, brownish green, densely branched. opposite arrangement, petiole length ca. 1.5-2cm; unicelled hispid hairs; rounded tip, lamina ca. 1.5-2 x 0.6-0.7cm, elliptic to ovate, serrate with hispid hairs at margin and upper surface and on the lower surfaces, apex acute, base cuneate, venation reticulate, greenish brown. Inflorescences terminal solitary, Flower pinkish blue, ca. 2.5-3cm across. Bracts ca. 7-8mm, ovate, persistent, densely glutinose villose; bracteoles oblong, densely villous, smaller than bracts. 5-gamosepalous, ca. 7mm , ca. 4mm free and ca. 5mm jointed, greenish at lower side and brownish at tip, linear, unequal bilimb, tubular, acute tip, hispid hairs at outer surface. 5-gamopetalous, spurred, divided into two groups, 2-petals in one group ca. 1.5cm in and 3 in other group jointed; ca. 2cm, pinkish brown at upper side and yellow at lower side. 4-Stamens, apipetalous, filament jointed at base free at top, each anther filament divided in to two anther sac, before joint anther filament length ca. 6mm and after joint ca. 4mm, anther sac bean shape, yellow, basely attached to filament, anther sac ca. 3 x 2mm. Ovary ca. 1.5-1.8mm, ovate, unicovuler, uniloculer, glandular hairy, hypogynous brown. Style ca.1-1.2mm; straight slightly pale hairy, reflex head stigma, ca[sule 1.4-1.7cm long, pubescent; 4-seeded, seeds ovate 3-4mm long hairy.

FL. Per.: November-March.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2599

(PMAS-AAUR).

Distribution: Pakistan, India and Nepal.

Herbarium Notes: Stem have hispid hairy surface, hairs have rounded tip on stem.

Hispid hairs at outer surface of sepals and petals.

42. RUBIACEAE

Galium aparine L., Sp. Pl. 108. 1753.

Annual climber herb, reflexed hairs or prickles; white hairs, tatra-angular, hollow, internode distance ca. 2-6cm, green. Leaves arranged in whorl; 6-8 leaves in each whork, lamina length ca. 2.8-3.9 x 0.3cm, sessile, strigose hairs at margin, lanceolate, mucronate or cuspidate apex, midrib prominent. Cymose axillary Inflorescences. long peduncle; stigose white hairy. 4-Parienth ca. 2 x 1mm, jointed, abovate to oblong, broadly acute apex, smooth margin, white. 4-Stamens: epipetalous, alternate to parienth, white, anther filament length ca. 1mm, anther sac basily attached to anther filament. 2-stigma and 2-style, stigma cylindrical and light yellow, style cylindrical, ovary cordate, ca. 2 x 2 mm; hooked hairs, two ovules, bilocular synacarpous. Seed long peduncle, stigose hairs on pedicle, white hooked hairs ca. 3 x 3mm, brown.

FL. Per.: March-July.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2138 (PMAS-AAUR).

Distribution: Europe, North Africa, Asia minor, Siberia, Iran, Afghanistan, Pakistan and India.

43. ASTERACEAE

Key to genera:

1a. Involucral bracts spinescent or aristate:

2a. All florets bisexual; achenes elongate, subterete or 4-gonous.....1. Echinops

- 2b. Ray florets neuter; disc florets bisexual; achenes striate and
 pitted between ribs..... 2. *Amberboa*
- 3a. Heads dioecious or polygamo-dioecious; purple or greenish yellow:
- 4a. Heads solitary, leaves all radical.....3. *Taraxicum*
- 4b. Heads not solitary; leaves various:
- 3b. Heads bisexual:
- 5a. florets orange yellow.....4. *Carthamus*
- 5b. Florets whitie.....5. *Conyza*
- 1b. Involucral bracts neither spinescent, nor aristate:
- 6a. Heads homogamous, either male or female or bisexual:
- 7a. Achenes with concentric ridges:
- 8a. Achenes columnar, truncate at both ends; heads cylindric.....6. *Launaea*
- 8b. Achenes compressed at both ends; heads ovoid,
 campanulate or cylindric.....7. *Sonchus*
- 7b. Achenes without concentric ridges..... 8. *Centurea*
- 6b. Heads heterogamous, outer florets usually female, inner ones
 bisexual or male:
- 9a. Involucral bracts broad; shrubs or undershrubs.....9. *Pluchea*
- 9a. Involucral bracts narrow; herbs..... 10. *Blumea*
- 10a. Pappus hairs barbellate..... 11. *Pentanema*
- 10b. Pappus not barbellate:
- 11a. Pappus hairs 2-3-seriate12. *Pulicaria*
- 11b. Pappus hairs 1-seriate13. *Iphiona*
- 1. *Echinops echinatus* DC. in Wight, Contrib., 24 (1834); Jafri in Fl. Kar.,**

342 (1966); Stewart in Nasir & Ali., Ann.Cat. Vasc. Pl. W.Pak. & Kashm.,
742 (1972).

Annual rigid, spiny, white-wooly herb up to 130 cm high. Stem woody below, 7-13-angled, white-tomentose. Leaves simple, alternate, lanceolate, coriaceous, pinnatifid base decurrent, sometimes auriculate, sessile, ca. 9-46 x 1-8 cm in size; lobes alternate-subopposite, triangular or oblong, spine-tipped, apex acute. Capitula 1-flowered, aggregated in dense, globose, axillary or terminal or leaf-opposed; sessile or pedunculate glomerules. Receptacle minute; involucre tubular or oblong. Phyllaries 1-seriate; outer filiform, ca. 10 mm, barbellate; inner ones obovate, usually connate into a hard tube, ca. 12 mm, with unequal, dentate spiny tips, sometimes with 1 rigid spine. Florets white or bluish-white, disciform, bisexual, each floret with a single up to 4 cm long spine, with double spines of which one is 4 cm and other is 2 cm or with triple spines each about 4, 3.5 and 2.5 cm long. Pappus 1-seriate, equal, barbellate, ca. 2 mm. Corolla ca. 7 mm across; tube cylindrical, ca. 5 mm, pubescent; lobes deeply cleft, oblong, ca. 6.5 x 1 mm, curled back, apex acute. Stamens 5, exserted; anthers linear, ca. 4.5 mm, base auricled, tails imbricate; connectives acute. Ovary linear, broadened above, ca. 6 x 1 mm in size, pubescent; style ca. 1.2 cm, shortly 2-fid; stigma stout, acute, with a thick, pubescent basal ring. Achenes elongated, more or less angled, ca. 5 mm long, densely silky, surrounded by the connate hardened inner involucre bracts.

FL. Per.: August-October.

Herbarium specimens examined: THAL DESERT, Humaira Shaheen, 1289 (PMAS-AAUR).

Distribution: India, Pakistan, Afghanistan (Jafri, 1966).

2. *Amberboa ramosa* (Roxb.) Jafri in Scientis III: 29 (1959); Jafri in Fl. Kar., 344 (1966).

Syn: *Centaurea divaricata* Wall. Cat. 2984 (1831), *nom. nud.*; *Carduus ramosus* Roxb., Fl. Ind. III:107 (1832); *Tricholepis procumbens* Wt. Icon. Pl. ind. Or. 3. pt. IV: 12. t. 1139 (1846); *Volutarella divaricata* Benth. in Benth. et Hook. Gen. Pl. 2: 476 (1873), *pro parte*; *Amberboa divaricata* (DC.) O. Kuntze, Rev. Gen. Pl. 1: 305 (1891); *Volutarella ramosa* (Roxb.) Santapau, P. Saur. 22 (1953); *Oligochaeta ramosa* (Roxb.) Wargenitz in Verroffent. Geobot. Inst. 37: 323 (1962).

Annual, forkedly branched, straggling or prostrate or sub-erect herb up to 75 cm high. Stem dichotomously branched, longitudinally striate, angled, glabrous or with a few, scabrous points, produced by the dried glands. Leaves ca. 1.5-5 x 0.5-2 cm in size, sessile, lobed to subentire, often with basal rosette; lower leaves oblong or obovate or lyrate; upper sinuately pinnatifid, entire or toothed with mucronate lobes, crisped, pubescent. Heads ca. 1-2.5 x 0.5-1.5 cm in size, ovoid-oblong; peduncles grooved, pubescent, scabrous with a few, small, foliaceous bracts. Involucral bracts upto 1.7 cm long, elliptic-oblong, spinescent; outer bracts smaller, recurved; inner longer, erect. Corolla pale-purple, ca. 1.2-1.5 cm long; lobes ca. 3 mm long, linear, apex acute. Achenes ca. 5 x 1.7 mm in size, acutely angled, pitted between the angles, base narrow. Pappus hairs numerous, unequal, silvery-brown, upto 10 mm long; inner 3 or 4 flattened, upto 15 mm long.

FL. Per.: January-February.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 265 (PMAS-AAUR).

Distribution: India, West Pakistan and Afghanistan (Jafri, 1966).

3. *Taraxicum officinalis* F.H. Wigg

Aperennial solitary branched herb up to 45 cm tall. Branches rosette and leave at base, glabrous, smooth, green. Leaves rosette at stem base, ca. 2.5-3cm petiolated, semi-amplexicaul lamina ca. 18.5 x 2-4cm, thick midvein, pinnately lobed having deep, serrate margin of lobes, lyrate, hyaline to redish margin, each lobe acute apex, glabrous shiny smooth, milky latex secretion. Inflorescences solitary terminal. Peduncle length ca. 18-20cm; thick flashy light green to redish traces color and hollow, slightly hairy having milky latex. Flower ca. 2 x 0.6-0.7cm, 3-whorls Phyllaries, 2-outer whorls thin lanceolate and broad at base, green and curved outward, 2 tips one outer apex redish green; main apex slightly curved, phyllaries in 2-whorls, ca. 1.1-1.2 x 1.2cm, smooth, hyaline red and strigose hairs at margin, inner most whorl tunuler ca. 1.5-1.6 x 0.2cm; jointed at base and free at apex, apex acute slightly curved redish green, thick fleshy green. Disc floret having large numbers of ca. 0.5-0.6cm coma hairs at base; white smiple hairs without cilia. 5-gamopetalous ca. 1.3-1.4cm; ca. 0.4cm tubuler and ca. 0.8-0.9cm slightly broad, light yellow, 5-tooth like apex. 5-anther form synergenaeous tube, ca. 0.2-0.3cm, at upper side and at lower side form brown, anther epipetalous, stigma and style length ca. 0.9-1cm long, stigma ca.1mm long; bifurcated form fork, dark yellow. Ovary globose, ca. 2-2 mm, greenish white with slightly hairy. Seed cylindrical, ca. 5 x 2 mm, brown, long linging having serrate outer surface ridge flate triangular, narrow base flat apex, pappus ca. 7-8 mm with cilia, white.

FL. Per.: November-Februry

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2550 (PMAS-AAUR).

Distribution: cosmopolitism

4. *Carthamus oxycantha* Bieb. Fl. Taur. Cauc. 2: 283 (1808); Stewart in Nasir & Ali., Ann.Cat. Vasc. Pl. W.Pak. & Kashm., 728 (1972).

Thistle-like erect, annual herb up to 2 feet high. Stem corymbosely branched, circular, glaucous. Leaves alternate to somewhat opposite, sessile, oblong or oblanceolate, base semi-amplexicaul, apex acute, margin spinulose-toothed, curved toward midrib; cauline leaves ca. 7-14 x 2.5-3 cm in ca.; ramal leaves ca. 1-3 x 0.5-1.2 cm in ca., turned yellow after drying; each leaf bears 17-20 spines on margin; spines ca. 5-20 mm long. Involucre 5-seriate, 14-22 in number, ca. 1.5-2.5 x 0.5-1.5 cm in ca.; outer bracts foliaceous, ovate-oblong, exceeding the head, white below the contracted portion, green above it, spine-tipped, spine yellow, ca. 10-18 mm long; inner most lanceolate. Heads ca. 1.5-2 cm long, somewhat campanulate, orange-yellow. Florets bisexual, tubular, homogamous, yellow. Corolla-tube ca. 18 mm, campanulate; lobes 5, ca. 8 mm, narrowly lanceolate, apex acute-obtuse, margin entire, glabrous. Stamens epipetalous, ca. 12 mm long. Ovary ca. 2 mm, obovoid; style elongate. Achenes ca. 7-10 x 4-5 mm in ca., obovoid, apex truncate, smooth, shining. Seeds white gray to dark brown with black streaks and spots.

FL. Per.: May-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaaheen, 857 (PMAS-AAUR).

Distribution: Baluchistan, NWFP; Swat, Lower Hanza, Punjab and Jammu

(Stewart, 1972).

5. *Conyza* Less (1832).

Key to species:

1a. An erect, biannual herb, upto 150 cm tall, branches hirsute.....1. *C. candensis*

1b. Small erect annual herb up to 60 cm high, branches glaucous.....*C. squamatus*

1. *Conyza candensis* (L.) Cronq. Bull. Tprrey. Bot. Club. 70: 632 (1943);
Stewart in Nasir & Ali, Ann. Cat. Vas. Pl. W. Pak. & Kashm., 734 (1972);
Syn: *Erigeon canadensis* L., Sp. Pl. 863 (1953); *E. myriocephalus* Rech. F.
& Edelb. in Dan. Biol. Skr. 8, 2:6 (1995).

Erect biannual herb, upto 150cm tall, branched at top, hirsute, internodes ca. 1-1.5cm. Alternately arranged leaves; ca. 6.5-11 x 0.3-1.5cm, sessile, shallowly lobed, 3-4 lobed, elliptic-linear, apex narrow, base dilated and cuneate, margin sub-entire to dentate, multicelled hairs. Peduncle ca. 1-2 mm long, Flower numerous, campanulate to hemispherical, multicelled hirsute hairs, 2-screas phyllaries, outer phyllarie whorl ca. 1.9-0.3 mm, narrow ovate, apex acute, margin cernate, dark green with yellow brown midrib, inner one ca. 3.1 x 0.3mm, linear, acute, margin scerious greenish white with paler margin and light brown midrib, receptical flat or slightly convex, smppth pitted ca. 1-1.2mm, Ray floret: florets barely exceeding the pappus, legulate 2-3 dentate, pale white ca. 3.5mm long, short hairs are present in upper part of petals tube ca. 0.2mm long, 19-pappus, bristly pale white in color. Disc floret: bisexulay, tubular, 4-lobed, pale yellow, ca. 3.3mm long, short hairs are present in upper part of petals tube, 0.1mm long, 22-pappus, bristly, pale whits ca. 2.6 mm ling, achenes oblong, light brown ca. 1.2 x

0.3 mm, slightly flattened, base narrow with sparsely upper direction, ca. 1 mm long hairs, seeds are easily carried by wind.

FL. Per.: July-November

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2612 (PMAS-AAUR).

Distribution: Pakistan, North America, Canada, S. Europe, Turkey, Iraq, India, Nepal and Kashmir.

2. *Conyza squamatus* (Spreng.) Tamamsch., Fl. URSS.25:186 (1959).

Small erect herb up to 60 cm high. Stem slightly angular, glaucous, herbaceous above and slightly woody below, internodes ca. 2-2.5 cm. Leaves rosette arrangement at base and spirally at branches, ca. 3.5-4.5 x 0.3-0.4 cm, sessile, midvein prominent, hairy and glaucous, apex acute, greenish white. Inflorescences terminal cymose. peduncle ca. 1-2 cm; glaucous. bract ca. 0.9-1 x 0.2 cm, lanceolate, and mid of pedicle bractioles of ca. 5-6 x 1-2 mm, lensualate, bracts and bractioles both have sharp pointed acute apex, both have small hairs on margin and outer surface. pedicle length ca. 1.4-1.6 cm, whitish and creamy with reddish brown traces, at base flower 2-bractioles ca. 5-6 x 1-2 mm, lensualate, acute apex, small hairs on margin and outer surface. 4-whorls phyllaries, small outer whorl phyllaries and larger at inner whorl phyllaries, ca. 4-8 x 2-2.5 mm, acute pointed apex, lanceolate, smooth margin, small hairs at margin, light green at margin and dark green at mid. Ray floret have large numbers of coma hairs around petals, ca. 0.4-0.5 mm of coma hairs, smooth white. petals ca. 8-10 mm, curved backed, brownish red. Stigma bifurcated and long style, stigma and style ca. 4 mm. Ovary ca. 3 x 1-2 mm, pointed base and broad apex, small hairs, brown. Disc floret

coma hairs larger in numbers, coma hairs ca. 8-9 mm, white. 5 gamopetalous; ca. 6-7mm, triangular acute apex, tubular at base and broad at apex. stigma and style 8 mm, stigma fork bifurcate. Ovary ca. 4 x 1-2 mm, pointed at base and broad at apex, hairs, brown. Anthers form synergenious tubuler; ca. 4-5mm, epipetalous.

FL. Per.: July-November

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2434 (PMAS-AAUR).

Distribution: Pakistan, North America, Canada, S. Europe, Turkey, Iraq, India, Nepal and Kashmir.

6. *Launaea*

Gassini, Dic. Sci. Nat. 25: 61, 321 (1822); Cooke, Fl. Pers.

Bomb. reprint ed. 2: 112 (1905); Jafri in Fl. Kar., 347 (1966).

Key to species:

1a. Heads terminal, on paniculately branched flowering stem.

Achenes 6-7 mm long.....1. *L. resedifolia*

1b. Heads in clusters on the nodes of branches.

Achenes 2-4 mm long.....2. *L. procumbens*

1. *Launaea resedifolia* (L.) Kuntze, Rev. Gen. Pl. 1: 351 (1891); Stewart in

Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 763 (1972).

Syn: *Scorzonera resedifolia* L., Sp. Pl. 1198 (1753); *Zollikaferia*

chondrilloides DC. Prodr. 7: 183 (1838); *Launaea chondrilloides* (DC.)

Hook. f., Fl. Brit. Ind. 3: 415 (1881).

Perennial herbs with milky sap up to 2 ft high. Stems dichotomously branched, terete, sulcate, woody at the base. Radical leaves sub-rosulate, ca. 4-15 x

2-5 cm, lanceolate, runcinate-pinnatifid, spinulose-toothed; cauline leaves sessile, semi-amplexicaul, narrow, pinnatifid; pedunculate leaves ovate or deltoid, entire, bract-like. Heads on sub-divaricate, bracteates peduncles, 1-2 cm long, yellow. Outermost involucral bracts 3 to 4-seriate, much smaller and deltoid-ovate, inner ones oblong-lanceolate with ciliolate tips. Achenes 6-7 mm long, cylindric, 3 to 4-toothed at the base, ribbed, scabrous on ribs. Pappus white.

FL. Per.: Almost throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2489 (PMAS-AAUR).

Distribution: Sindh, Baluchistan and Punjab (Stewart, 1972).

2. *Launaea procumbens* (Roxb.) Ramayya & Rajagopal, Kew Bull. 23(3): 463 (1969); Stewart in Ali and Nasir, Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 762 (1972).

Syn. *Chondrilla nudicaulis* L.; *L. fallax* (J. & S.) O. Ktze.; *L. procumbens* (Roxb.) Amin; *L. nudicaulis* (L.) Hk.f.; *Microrhynchus fallax* (J. & S.) Ill.; *Prenanthes procumbens* Roxb.; *Paramicrorhynchus procumbens* (Roxb.) Khir.

A prostrate perennial herb upto 50 cm high. Stem branched from the base, slender, glabrous, greenish with yellow latex. Leaves ca. 5-15 x 2-3 cm in , mostly rosette; lower leaves obovate-oblong, pinnatifid with rounded or obtuse segments, spinulose on the margins with white cartilaginous teeth; cauline leaves distant, few sessile, narrowly oblong, pinnatifid. Flowering stem decumbent or spreading, irregularly branched. Heads ca. 1 cm long, cylindric, remotely subracemose along the branches. Involucral bracts 3-seriate, ca. 0.5-1.2 x 0.2-2.5 cm long, all with

membranous margins; the outer very short, ovate, apex acute, with strong midrib, subcordate; the inner most thrice as long as the outer, linear-lanceolate, apex subacute, longer than pappus, the midrib thickened in front. Flowers yellow, all ligulate. Pappus-hairs subequal, ca. 10 cm, soft, white, copious. Achenes ca. 2-4 mm long, polymorphous; inner sometimes as if composed of 4 thick ribs; outer slightly curved and flattened with a thick ventral and several thick dorsal ribs, smooth or obscurely uneven.

FL. Per.: January-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2548/2119 (PMAS-AAUR).

Distribution: India, W. Pakistan to the Atlantic (Jafri, 1966).

7. *Sonchus asper* (L.) Hill. Herb. Brit. 1: 47. t. 34 (1769); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 784 (1972).
Syn: *S. oleraceus* L. var. *asper* L., Sp. Pl. 794 (1753).

Erect, glabrous, annual herbs up to 2 ft high. Basal leaves petioled in rosette, spatulate-oblong, entire or pinnatifid, spinously dentate; cauline leaves semi-amplexicaule with rounded basal auricles. Heads in terminal, sub-umbellate corymbs, ca. 1-1.2 cm long, yellow. Involucral bracts 2-3 seriate, lanceolate. Achenes obovoid-oblong, 3-ribbed on lateral faces. Pappus hairs white.

FL. Per.: February-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2610 (PMAS-AAUR).

Distribution: Wide spread in cooler climates and many tropical countries (Jafri, 1966).

8. *Centaurea iberica* Treviranus ex Sprengel, Syst. Veg., ed. 16. 3: 406 (1826).

Syn: *Calcitrapa iberica* (Treviranus ex Sprengel) Schur.

Small annual to biannual prostrate to semi-erect herb, papillate hairs, not much densely hairy, greenish white, slightly angular with ridge and furrows, internodes ca. 3-7cm, glaucous. Leaves alternate, sessile, ca. 2.2-3.9 x 0.9cm, deeply lobed with irregular serrate margin, lobes having acute sharp prickly apex, glaucous at both sides, midrib prominent, elliptic to lanceolate. Inflorescences Solitary axillary. flower ca. 2-2.5 x 3.5cm whitish creamy large prickly flower, small pedicel with papillate hairs. 4 whorls phyllaries around the thalamus, range ca. 1.2-2.6 x 0.2-0.3cm, midvein prominent, greenish yellow. 6-8 prickly phyllaries and each whorl alternate other whorl, linear and sharp acute apex, yellowish brown. Disc florets have dense coma hairs, ca. 3-7 mm long, white, 5-gamopetalous, one petal deeply lobed and slightly separated to other petals which not deeply lobed, tubular narrow at base and broad upper side, apex curved acute slightly curved, ca. 2.3mm, 1mm-1.1mm tube and 1.2 mm broad, small cilia at coma hairs, creamy to white. 5-anther filaments, epipetalous, base fused and free at upper side. Ovary ca. 4-2mm epigynous broadened at tip and narrow at base, flat. stigma bifid yellow, style long and curved, stigma and style emerge out from petals, stigma+style ca. 2.7-2.8 mm. Seeds small coma hairs, seeds brown, flat and having ridge and furrows.

FL. Per.: March-June

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2141 (PMAS-AAUR).

Distribution: Afghanistan, Kashmir, Kazakhstan, Kyrgyzstan, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; SW Asia, Europe.

9. *Pluchea*

Cass., Bull. Soc. Philom. 31 (1817); Hook. f., Fl. Brit. India 3: 272 (1881); Cooke, Fl. Pers. Bomb. reprint ed 2: 81 (1905); Shetty & Singh, Fl. Ind. in: Fl. Rajasthan, 1: 428 (1987); Jafri in Fl. Kar., 335 (1966).

Key to species:

- 1a. Outer involucral bracts oblong, rounded.....1. *P. lanceolata*
 1b. Outer involucral bracts lanceolate, acute.....2. *P. arguta*

1. *Pluchea lanceolata* (DC.) Oliv. & Hiern, Fl. Trop. Afr., V:329 (1877); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W. Pak. & Kashm., 768 (1972).
 Syn: *Berthelotia lanceolata* DC. Prodr., V: 376 (1836).

An erect undershrub upto 90 cm tall. Stem much branched, woody below, herbaceous above, terete, slender, softly ashy-pubescent. Leaves sessile, ca. 1.5-5 x 0.5-1 cm, oblong or oblanceolate, apex obtuse to apiculate, base cuneate, margin entire, main nerves prominent, finely ashy-pubescent on both sides. Heads in compound corymbs, ca. 6-7 mm long, oblong. Florets campanulate, pinkish purple. Involucral bracts contracted at the mouth; outer bracts 2-5-seriate, ca. 2.5-4 x 1.5-2 mm in , oblong, apex obtuse, silky-pubescent, tinged with purple outside at the apex; inner ones few, longer, linear, apex subacute, scarious. Receptacle flat, naked. Pappus-hairs connate at the base. Achenes minute, oblong.

FL. Per.: December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2402 (PMAS-AAUR).

Distribution: India, W. Pakistan, Afghanistan and N. Africa (Jafri, 1966).

2. *Pluchea arguta* Boiss., Diagn. Pl. Or. Nov. Ser. 2, 3: 5 (1856).

subsp. *arguta*

Erect plant having dens branches and leaves at the base, stem rounded at old stage but tert in younger stage, glandular and tuberculate hairs, hairs dens at young stage and less at old stage, woody below and herbaceous above, internode ca. 5-7mm, succulent having pungent smell, yellowish to green. Leaves spirally arrange, petiole ca. 5-6mm or sometime sessile at young stage, lamina ca. 2.3X1-1.3cm, apex broadly acute to subacute and base cunate, midvein prominent, venation attenuate, spathulate, succulent, pungent smell glandular and tuberculate hairs on both surfaces and margin, 9-10 teeth, margin smooth and thick. Inflorescences: axillary to terminal solitary. Flower pedicle length increases as the flower mature at seed stage of flower petiole length is much long as compare to mature flower, Flower pedicle ca.0.9-3cm; glandular and tuberculate hairs, 2-opposite bracts at base; ca. 3-4 x 1-2mm lanceolate, glandular hairs on surface and stigose hairs at apex acute, succulent, having 4-6 whorls of phyllaries small in lower whorls and sequencely increases, ca. 4-12 x 2-3mm, acute apex, margin smooth having strigose and glandular hairs, larger one have hyaline margin and midvein green, lanceolate phyllaries, each phyllaries alternate to other whorl. 9 disc florets inside the flower, disc florets ca. 0.9-1cm, white, 9-10 comose hairs outside, ca. 6-7mm, ciliate hiars at comose hairs. Female flower, 5-gamospealous, ca. 7-8 mm, acute to subacute triangular apex, yellowish white. 5 –anthers in form of

syngnaious. 5-gamopetalous, ca. 3 mm tube and free ca. 3 mm, full length of anther ca. 7 mm, anther synergenous ca. 3 mm, stigma bifurcated yellowish orange, 7 mm style, stigma + style ca. 10 mm, cilia ovary at surface, ca. 3 mm, Florets pink or violet,. Ray florets many in numbers, ray florets present at periphery of disc florets, white, each ray florets 9-10 coma hairs, ca. 5 mm, 5- gamopetalous; ca. 6 mm, bifid stigma, style ca. 6-7 mm, slightly yellowish to white, acute triangular to subacute apex, ovary epigynous

FL. Per.: Almost all the year round.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2534 (PMAS-AAUR).

Distribution: Guangdong, Guangxi, Hainan, Yunnan, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam.

Herbarium Notes: Glandular dens hairs at stem, spirally arranged, lamina 9-10 pinnatisect, spatulate, base cunate.

10. *Blumea membranacea* Candolle, Prodr. 5: 440 (1836).

An annual prostrate herb upto 60 cm tall. Stem simple, circular, much branched, herbaceous above and woody below, densely villous with few glandular hairs; hairs 1-celled and yellowish white, internodes ca. 0.5-1cm. Leaves spirally arranged, ca. 1.9-2.3 x 0.9-1cm, obovate or lyrate, apex acute base cunate, margin serrate, villous on both surface and margin, greenish brown; petiole to 3 cm. Inflorescences terminal cymose; peduncle ca. 2-2.3cm; densely villous; hairs 1-celled and yellowish white, pedicel ca. 1.2-2.3cm; densely villous 1-celled hairs; yellowish white. Phyllaries 3-6 whorls, each whorl phyllaries numerous and alternate to other whorl, ca. 8-12 x 2-3 mm, lanceolate, acute apex, outer whorl

dark green and inner most light green, setose on outer surface, midvein prominent and dark green. Disc florets greater than ray-florets, yellow: petals 5, gamopetalous; tube ca. 4 mm; lobes ca. 5 mm, triangular, apex acute, coma ciliated, 18-20; stamens 5, syngeneceious; filaments ca. 4 mm long; anthers free at upper side, ca. 4 mm long; ovary ca. 2 mm, cylindrical, hairy; style ca. 12-14 mm long, smooth; stigma bifurcated; papillated and cilia. Ray florets: petals 5, gamopetalous, narrow tubular, ca. 9 mm; coma 14-17, ca. 7-8 mm, white; ovary cylindrical, ca. 1-2 mm, having small cilia; style, ca. 1-11mm, smooth; stigma bifurcated fork and longer than disc florets. Seeds ca. 8 mm pappus white, cylindrical, ca. 2-3 mm, brown.

FL. Per.: Almost all the year round.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2113 (PMAS-AAUR).

Distribution: Reported from India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam.

11. *Pentanema vestitum* (Wallich ex Candolle) Y. Ling, Acta Phytotax. Sin.

10: 180 (1965).

Small prostrate annual to biennial herb, densely velutinous hairs, white hairs unicelled, rounded or slightly ridged and farrows, greenish white, internodes ca. 2.5-3.5cm. Leaves alternately arrange, sessile, semi-amplexicaul, ca. 2.9-3.2 x 1cm leaves, elliptic to lanceolate, serrate margin, multi-cellular bland end hairs at surfaces and margin, whitish green, apex apiculate, midvein prominent. Inflorescences terminal cymose, pedunculate ca. 3-6 mm ; dens velutinous whitish unicelled hairs. sessile semi-amplexicaul leaves at base of flower pedicle, 3-4

Phyllaeries whorls, lanceolate. acute tip and narrow, densely long hairs, hairs longer at upper tip half and smaller lower side, yellowish green, sometime curved outerward, varies between 9-14 x 1-2.5mm, outer small and inner longer with wooly unicelless hairs. Ray floret at outer boundaries of flower, 3 lobed petals; ca. 15 x 2 mm; narrow tube at lower side ca. 6-7mm and upper side wide ca. 9 mm, long hairs at outer surface, yellow. 10-15 coma hairs unequal in length varies between ca. 4-6 mm, white. stigma bifid short fork, long style of stigma and style ca. 6mm. Ovary ca. 2-3 x 1mm, light brown, hairy. Disc floret having 10-12 coma hairs, hairs length ca. 5-6 mm, petals narrowly tube ca. 10 mm, triangular acute tip, pale yellow, 5-anther from synegenous tube of ca. 7-8mm, 5mm from synegenous tube and 3mm attached to petals, ovary thin ca. 2-3 x 1mm, style long and as Ray floret, both ray and disc coma hairs are simple coma hairs. Achenes brown, ca. 0.8 mm, sparsely pubescent. Pappus barbellate, usually 10, yellowish white, 2.5-3.5 mm.

FL. Per.: April-July

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2118 (PMAS-AAUR).

Distribution: Riverbeds, stony places; ca. 1500 m. W Xizang Afghanistan, India, Nepal, Pakistan.

12. *Pulicaria* Gaertn.

13. *Pulicaria glaucescens* (Boiss.) Jaub. & Spach.

Erect to suberect upto 20-50 cm tall herb, angular, herbaceous above and woody below, internodes ca. 1.5-1.6 cm, smooth to slightly papillate hairy surface, yellowish green. Alternate leaves, sessile, lamina ca. 1.5-2 x 0.6-0.7cm, linear, acute apex, midrib prominent, setose hairs at base, slightly papillate, succulent,

smooth margin. Inflorescences terminal, petiole length ca. 6-9 mm; smooth to slightly papillate; yellowish green. 2- bracts at capitulum; ca. 5 x 1-2 mm, lanceolate, setose hairs at apex, slightly serrate and papillose hairs at margin. 2-3 whorls Phyllaries, each whorls have numbers of phyllaries, ca. 4-9 mm, outer whorls have small in and inner one have large in , lanceolate, acute apex, serrate to papillose at margin and outer surface. Bisexual flower, disc florets have 20-22 coma hairs, cilia on the coma hairs, ca. 10-11mm, white. 5-gamopetalous, ca. 1.2 cm, triangular acute apex, yellow. anther syngenous at upper side forming arrow tube like structure around stigma and style at lower side upper side free, anther filament ca.13-14 mm, ovary stigma bifurcated, dark yellowish orange, style long stigma+style ca. 14-15mm, large numbers of dens cila 3mm at ovary surface, epigynous ovary.

FL. Per.: March-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2100 (PMAS-AAUR).

Distribution: Iran, Afghanistan, Pakistan and India.

Pulicaria angustifolia DC. Prodr. 5: 479 (1836).

Small erect to semi-erect, pantagular stem, herbaceous above and slightly woody below, glandular and echinate hairs; broad at base like echinate hairs, greenish yellow. Spirally arrange leaves, sessile leaves, lamina ca. 3.5-3.6 x 1.2cm, apex apiculate to acute, lanceolate to oblanceolate, midvein prominent, margin lacerate to double serrate and stigose glandular hairs, base rounded, and stigose glandular hairs at both surface, green. Inflorescence terminal solitary. Peduncle ca. 1.2cm; pantagular with glandular and echinate hairs of broad base. capitulum

yellow, ca. 1 x 0.5cm. 2-whorls phylleries, outer whorl thick ca. 6-7 x 2 mm, having glandular and echinate hairs at outer surface and margin, acute apex. Inner whorl ca. 9-10 x 3 mm, acute to acuminate apex, lanceolate, hyaline margin and hirsute hairs, midvein green. Ray floret at periphery of flowers, yellow, coma hairs absent. 5-petals teeth apex, form tube, ca. 7 mm; ca. 2-3 mm tube form and 5 mm free, dense strigose hairs. stigma fork and small style, stigma and style ca. 3 mm. ovary 3 x 2 mm, broad at tip and narrow at base, brown, strigose hairs at upper apex. Disc floret at center of flower, brownish yellow, 5-gametalous, ca. 7-8 mm, triangular acute apex, glabrous, shiny smooth. 4-synechaous anther tube ca. 6 mm and epipetalous, ovary ca. 3 x 1 mm, brown, smooth. stigma and style long and ca. 7 mm capitate head stigma.

FL. Per.: Almost all the year round

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2494 (PMAS-AAUR).

Distribution: Pakistan and India.

14. *Iphiona grantioides* (Boiss.) Anderb. in Nord. J. Bot. 5: 184 (1985).

Syn: *Inula grantioides* Boiss., Diagn. Ser. 2, 3: 14 (1856).

Erect annual plant up to 25-40 cm, glandular hairs, angular, glandular hairs on ridge and furrows, internodal ca. 5-6 mm, stem succulent having pungent aroma, greenish yellow. Leaves spiral arrangement, ca. 2.5-2.7 x 0.5cm, sessile, spatulate; 3-lobes acute to subacute apex, succulent pungent aroma, green yellow, flat, midvein prominent, glandular hairs at both surfaces and margin, margin smooth, thick succulent, dark green. Inflorescences Axillary. Flower: absent in my sample.

FL. Per: Throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2535(PMAS-AAUR).

Distribution: Pakistan and Iran.

44. CYPERACEAE

Key to genera:

- 1a. Nuts with flat face towards spike axis.....1. *Cyperus*
 1b. Nuts with edge facing spike axis:
 2a. Inflorescence a multiple spike.....2. *Pycneus*
 2b. Spikes solitary.....3. *Fimbristylis*

1. *Cyperus*

L., Sp. Pl. 1: 44 (1753); Gen. Pl. ed. 5: 26 (1754); Boiss., Fl. Or.
 54: 363 (1882); C.B. Clarke in Hook. f., Fl. Brit. Ind. 6: 597
 (1893); Kukkonen in Fl. Pak. 206: 82 (2001).

Key to species:

- 1a. Stigma 2.....1. *C. alopecuroides*
 1b. Stigmas 3:
 2a. Spikes slightly compressed, subterete, at right angles to rachis when rip;
 glumes muticous or apiculate.....2. *C. digitatus*
 2b. Spikes distinctly compressed, from suberect to right angle from rachis when
 rips;
 glumes with short but distinct mucro:
 4 (3) Distal partial inflorescence sessile or peduncle very short; completely hiding
 rachis of partial inflorescences3. *Cyperus imbricatus*

+ Partial inflorescences up to 30mm and partial Inflorescence; right angle to 4-angled rachis: 5

5a. Perennial plant, bi-nerved glume like prophyll longer than wide.....4. *Cyperus rotundus*

5b. Annual plant, 1-nerved glume like prophyll wider than longer...5. *Cyperus difformis*

1. *Cyperus alopecuroides* Rottb., Descr. Pl. Rar. 20 (1772); Boiss., Fl. Or. 5: 367 (1882); R.R. Stewart, l.c. 86 (1972); Kukkonen in Rech.f., l.c. 92.

Syn: *Juncellus alopecuroides* (Rottb.) C.B. Clarke, Fl. Brit. Ind. 6: 595 (1893).

A perennial sedge ca. 70-120 cm high. Stem ca.5-7 mm, 3-gonous, glabrous, green; internodes ca. 0.5 mm. Leaves equal or larger than stem, stiff below and flattened above, sheaths ca. 5-20 cm x15mm, brown or greyish, base turgid, somewhat keeled, margins smooth, apex long tapering, 3-gonous, scabrous, nerved at apex, 3-gonous. Inflorescence ca. 35 cm; bracts 5-7, foliose 2-4 longer than inflorescence, ca. 50 cm or more than, primary branches ca. 5-15, to 30 cm, secondary branches ca. 12 cm, tubular prophyll ca. 35 mm, smaller leaf blades ca. 15 mm. . Spikes in 25 cluster, spirally arranged ca. 5 x 3 mm, ovoid, flattened, spreading, flat side upwards, glume-like bract ca. 2.5 mm, acute, prophyll 2-nerved, rachis flat, ca. 0.3 mm wide, quadrangulate, narrowly winged; glumes ca. 2-2.5 mm, cymbiform, blunt or mucronate, edges with raised nerves, yellowish or grey, margins scarious and yellowish or pale along with reddish-brown stripes.. Stamens 2 or 3, ca. 0.5 mm, yellowish brown, bi-convex, slightly flattened, finely reticulate or almost smooth, shiny.

FL. Per.: April to September, however, it's flowering and fruiting in Indian Desert is October to March (Bhandari, 1990). .

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2426 (PMAS-AAUR).

Distribution: N. and tropical Africa, Madagascar, Micronesia; West Indies, Guadeloupe; Pakistan, India, Malaysia, NE Australia (Put reference)

2. *Cyperus difformis* L., Cent. Pl. 2: 6 (1756); Boiss., Fl. Or. 5: 370 (1882); C.B. Clarke, l.c. 599; R.R. Stewart, l.c. 88; Holm et al., World's Worst Weeds fig. 93 (1977).

An annual sedge of 25-60 cm high. Stem ca. 3 mm wide, sharply 3-gonous, smooth; internodes ca. 0.8 mm. Leaves shorter than stem; sheaths ca. 10 cm, green or yellow-brown with reddish tint, mouth oblique; ligule ca. 1 mm, papery, arch of attachment higher than wide; blades up to 50 cm x 3-5 mm, keeled, margins smooth, apex 3-gonous, scabrous. Inflorescence 1-7, globose Inflorescence, nearly sessile or peduncles to 30 mm; partial Inflorescence 7-15 mm in diam., axis tightly digitately branched with more than 100 sessile spikes. Bracts 2-3, lowest two foliose, to 20 cm or more, sheathless. Spikes ca. 2-5 x c. 1 mm, flowers 5-20; glumes ca. 0.7 mm, deeply cymbiform, blunt, wider than long, midnerve strong, sides brown or dark brown, margins narrowly scarious; rachis compressed, slightly zigzag. Stamens 2. Nut ca. 0.5 mm, obovoid, sharply 3-gonous, papillose, yellowish.

FL. Per.: July – October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2432 (PMAS-AAUR).

Distribution: Common weed of tropical and subtropical areas of all continents; from S. Europe to Turkey, Iraq, Caucasus, Uzbekistan, Tajikistan, Pakistan and India.

3. *Cyperus digitatus* Roxb., Fl. Ind. 1: 209 (1820); Kukkonen in Rech. f., l.c. 91; C.B. Clarke in Hook. f., Fl. Brit. Ind. 6: 618 (1893).

A perennial tufted plant up to 150 cm tall. Stem ca. 2-8 mm, 3-gonous, edges obtuse below, smooth, sides in upper part often concave. Leaves basal, shorter than stem; sheaths ca. 20 cm, soft, one side scarious, yellowish or brown, mouth margin concave; blades ca. 50 cm long and ca. 6-12 mm broad, flat or folded, keeled, margins narrowly revolute, smooth or distally scabrous, apex long-attenuate, 3-gonous, scabrous. Inflorescence compound, ca. 10-25 cm long; bracts like lowermost leaf, ca. 6-9, longest bract more than ca. 50 cm; primary branches mostly 6-9, ca. 15 cm, with tubular prophyll ca. 20 mm; secondary antheridia ca. 4-10 cm; cluster of spikes 30-60, ca. 30-50 mm long, spirally arranged, reflexed, ca. 7-13 x 2 mm, glume-like bract ca. 1.5-2 mm, acute, glume-like prophyll ca. 1.6-2 mm, binerved; rachis rigid, flat, reddish brown, internodes ca. 1 mm; glumes ca. 2.5-2.8 mm, acute, midnerve green, 2-3 sides conspicuous veins and often with reddish-brown zone, margins widely scarious, basal edges extending down to next node. Nut ca. 1.3-1.5 x 0.4-0.5 mm, ovoid, 3-gonous, grey-brown, very finely reticulate.

FL. Per.: July-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2426 (PMAS-AAUR).

Distribution: This plant is fairly distributed in SE Asia ranging from Pakistan, India and Sri Lanka to S. China, Philippines, Malaysia and SE Australia.

4. *Cyperusim bricatus* Retz., Obs. Bot. 5: 12. 1789; Kukkonen in Rech.f., l.c. 93.

Syn: *Cyperus radiatus* Vahl, Enum. Pl. 2: 369 (1805).

Perennial plant up to 30-60 cm, much branched. Stem ca. 2-3 mm broad 3-gonous, smooth, lower edges obtuse. Leaves shorter than or equaling to stem; sheaths to 20 cm, soft, brown or dark brown, often reddish, mouth margin slightly concave; blades ca. 40 cm long, ca. 5.5 mm broad, flat or folded, keeled, margins narrowly recurved, apex 3-gonous, acute, scabrous. Inflorescence 5-15 cm with a conical or rounded anthelodium; 4 or 5 lowermost bracts leafy natured, more than 40 cm; primary branches commonly 5-8, to 80 mm, tubular prophyll ca. 10 mm, bi-nerved; secondary anthelodia ca. 40 mm, of 5-8 spreading clusters of spikes; sometimes small tertiary anthelodia by 2-3 clusters of spikes, ca. 7 mm; cluster of spikes 10-35 x 3-8 mm, with c. 20 to over 100 spikes closely imbricating, spirally, some at cluster base often digitately arranged; cluster rachis reddish brown, angular, narrowly winged; spikes not reflexed, 4-8 x ca. 1.5 mm, glume-like bract, ca. 0.8 mm, bi-nerved glume-like prophyll, ca. 0.6 mm, rachis ca. 0.3 mm wide, flat, quadrangular, internodes ca. 0.25 mm; glumes ca. 1.5 mm, cymbiform, slightly keeled, mucronate, sides obscurely nerved, reddish brown, margins widely scarious, slightly inrolled. Nut 0.6 x 0.3 mm, ellipsoid, obtusely 3-gonous, yellowish brown, very finely reticulate, almost smooth.

FL. Per.: June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2152

(PMAS-AAUR).

Distribution: India, Tamil Nadu, Rajasthan, Pakistan, Afghanistan (Kandahar, Arghandab).

5. *Cyperus rotundus* L., Sp. Pl. 1: 45 (1753); Boiss., Fl. Or. 5: 376 (1882); C.

B. Clarke in Hook. f., Fl. Brit. Ind. 6: 614 (1893); R.R. Stewart, l.c. 91;

Kukkonen in Rech.f., l.c. 99.

Syn: *Chlorocyperus rotundus* (L.) Palla, Allg. Bot. Zeitschr. 6: 61 (1900);

Schoenus tuberosus Burm. f., Fl. Ind.: 19 (1768); Holm & al., World's

Worst weeds: fig. 1 (1977).

A Perennial sedge up to 60 cm tall. Rhizome woody; long-creeping, dark brown with several stolons, , ca. 1-1.5 mm diam., producing tubers, ca. 20 x 9 mm, dark brown. Stem ca. 1-2.5 mm diam., 3-gonous, green, smooth. Leaves shorter than stem; sheaths to 10 cm, wide, acute, grey-brown or brown, sometimes with reddish tint, mouth margin lingulate; blades to 30 cm, 1-4.5 mm wide, grey-green or green, flat or folded, slightly keeled, margins smooth or towards the apex barbed, apex long-attenuate, acute, 3-gonous, scabrous. Inflorescence an anthelodium, 40-100 mm; 2-3 lowermost bracts foliose, longer than inflorescence; primary branches 5-8, to more than 50 mm long; secondary anthelodia 25-50 mm; clusters of spikes ca. 15-40 mm, of 5-7 spikes arranged on slightly elongated axis; spikes ca. 10-40 x 1.5-2 mm, with 11-51 glumes, glume-like bract ca. 2 mm, glume-like prophyll 1.9-2.4 mm, bi-nerved, sterile; spike rachis 4-angled, ca. 0.5 mm wide, internodes ca. 0.7-1 mm, winged; glumes 2.7-3.7 mm, cymbiform, rather closely imbricate, obtuse, dark reddish brown, or grey-brown, sides with two distinct nerves, nerveless area wide, margin narrowly or sometimes widely

scarious, towards apex embracing nut. Nut ca. 1.3-1.8 x 0.7-1 mm, ellipsoid or obovoid, 3-gonous, brown to blackish brown, clearly or obscurely reticulate papillose.

FL. Per.: April-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2301 (PMAS-AAUR).

Distribution: Tropical and subtropical areas of all continents.

FIMBRISTYLIS

1. *Fimbristylis quinquangularis* (Vahl) Kunth, Enum. Pl. 2: 229 (1837); C.B. Clarke in Hook. f., l.c. 644; R. R. Stewart, l.c. 96.

Syn: *Scirpus quinquangularis* Vahl, Enum. Pl. 2: 279 (1805).

A tufted annual plant ca. 5-15 cm tall. Stem ca. 1mm, glabrous, with five sharp edges. Leaves numerous, longer than stem; lower sheaths open, with widely scarious margins, almost completely scarious, veins prominent at lower side, mouth wide, oblique, margins scarious; blades of basal leaves ca. 1-1.5 mm wide, flat, barbed at apex. Inflorescence ca. 4-6 cm and 10-50 solitary spikes; bracts ca. 0.2-0.5 mm wide, shorter than inflorescence, involute, apex barbed; branches 3-angular3-angular or compressed, scabrous. Spikes ca. 2-4 x 1-1.5 mm, 5-20 glumes, pedunculate, ellipsoid, angular, broadly acute, greenish to dark brown; rachis yellowish to brown with prominent castaneous wings; glumes widely ovate, keeled, midrib green to pale green, mucronate. Stamens 2, ca. 1.5 mm; anthers ca. 0.5 mm. Style ca. 0.5 mm, upper part slightly ciliate, stylopodium small; stigmas 3, longer than style. Nut 0.5-0.6 mm, globular or widely obovoid, 3-gonous, papillose, pale yellow to pale brown.

FL. Per.: August-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2477 (PMAS-AAUR).

Distribution: Tropics of SE Asia from Pakistan and India to S. China, Taiwan, Australia and Malaysia; recently, probably, introduced to America, Puerto Rico.

PYCREUS

1a. Loosely tufted plants with 10-30cm , leaves greyish brown, stamens 3, glumes margin smooth.....1. *Pycreus sanguine*.

1b. Tightly tufted plants with more than 30 cm , leaves yellowish brown or brown, stamens 2. glumes margin scarious.....2. *Pycreus flavidus*

1. *Pycreus flavidus* (Retz.) T. Koyama, Journ. Jap. Bot. 51: 316 (1976).

Syn: *Cyperus flavidus* Retz., Observ. Bot. 5: 13 (1788); *C. globosus* All., Auct. Fl. Pedemont. 47 (1789), *Pycreus globosus* (All.) Reichenb., Fl. Germ. Excurs. 140 (1830); *Cyperus nilagiricus* Hochst. ex Steud., Syn. Pl. Cyperac. 2 (1855).

Culms ca. 40-45 cm tall, hard and stiff, glabrous, basal stem, reddish brown. Leaves short than stem, ca. 14-16 x 0.2 cm, midrib prominent, yellowish green, succulent, margin smooth, apex sharply acute, 3-angular, smooth. Inflorescence cluster of flowers in 2-3 folioose bracts, each having ca. 14-17 cm, acute, green, 3-angular glabrous, primary branches length ca. 3 cm, 5-8 spikelets in each Inflorescence, spikelets length ca. 1.2 x 0.2-0.3 mm, sessile, reddish brown. Inflorescence Flower ca. 2.5 x 1.5mm, bracts ca. 2 x 1mm, ovate to concave, apex broadly acute, brownish hyaline apex. Prophyll ca. 2.5 x 1mm, concave, mucronate

apex, margin hyaline, greenish brown . Glumes ca. 2.5 x 1-1.2 mm, midrib prominent. Anthers 3; stigma 2.

FL. Per.: (March) July - August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2506 (PMAS-AAUR).

Distribution: S. Europe, Algeria, Israel, Iraq, Turkey, Pakistan, India, China, Japan, Taiwan, Malaysia and Australia.

2. *Pycreus sanguin* (Vahl) Nees, Linnaea. 9: 283 (1835).

Syn: *Cyperus sanguinolentus* Vahl, Enum. 2: 351 (1805), *nom. illeg.*; *C. albidus* Lamarck, Tabl. Encycl., 146 (1791), non Retz. Jul.-Nov. (1791); *C. erythraeus* Schrad., in Schult., Mantissa 2: 477 (1824).

Small annual or perennial plant up to 40 cm tall in small tufts. Stem ca. 1-3 mm broad, 3-gonous, smooth. Leaves shorter than stem; Leaf-sheaths ca. 50 mm, soft, grey brown, sometimes slightly reddish, margin almost straight and smooth; blades ca. 12 cm x 1-3 mm, green, flat or folded, keeled, straight or falcate, margins narrowly recurved, smooth, apex obtuse, flat or 3-gonous. Inflorescence a single digitate, rather loose cluster of 3-12 spikes, or with 1-2 primary branches. Bracts ca. 15 mm; bracts 1-3, ca. 10 cm x 3 mm; spikes ca. 5-15 x 2.5-3 mm, glumes 8-18, glume-like bracts ca. 2.2 mm, glume-like prophyll ca. 1.6 mm; rachis ca. 1-1.3 mm, internodes 1.1-1.5 mm, margins scarious, 3-angular ; glumes 1.5-2 mm, cymbiform, mucronate, midrib area green or yellowish brown, on both sides wide reddish marginal zone, sides nerve-less or with 1-2 inconspicuous nerves. Stamens 3. Nut ca. 1.3-1.6 x 0.9-1 mm, lenticular, ellipsoid or obovoid, brown or dark brown, finely reticulate and often papillose, glossy.

FL. Per.: July - September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2148 (PMAS-AAUR).

Distribution: Turkey, Caucasus, Japan, Malaysia, India, Pakistan, Tajikistan, Kazakhstan and China.

45. POACEAE

ACRACHNE

Acrachne racemosa (Heyne ex Roem. & Schult.) Ohwi in Bull. Tokyo Sci. Mus. no. 18: 1 (1947).

An annual grass up to 60 cm tall, glabrous, green to yellowish, internodes ca. 6.5-9 cm. leaf blades ca. 10-13 x 0.5 cm, parallel veined, midrib prominent, apex acute, green turned reddish brown on maturity, margin hyaline thin with serrulate projection; ligule membranous, ca. 1-1.5mm, yellow. Leaf sheath ca. 4.5-6cm, parallel veined. Inflorescence ca. 10 cm, divided into 4-6 spikes, oppositely arranged, spike to spike distance ca. 0.5-1.5cm, rachilla straight, spikelet cone contains 10-11 flowers; peduncle ca. 25 cm. Inflorescence, rachilla Outer glumes unequal, ca. 1.5-2.5 x 0.5-1 mm, linear to lanceolate, apex acuminate, opposite, midrib green, margin hyaline with serrulate projections, flowers oppositely arranged. Lemma ca. 3 x 2-2.5 mm, aristate, 3-veined, green, margin hyaline, deep at the base, apex narrow with long awn having serrulate projection. Palea ca. 1.5-2 x 1-1.5 mm, apex acuminate, hyaline to light green, margin green with small hairs. Stamens 3; anther sac ca. 0.2 x 0.1 mm, white, two anther sacs chambered; filaments rudimentary. Stigma feathery, fimbriate, brown, ca. 0.5-1 mm; style ca. 1-1.5 mm long; ovary ovate to

oblong. Seed ca. 1-1.6 x 1-1.3 mm, reddish, cylindrical, projection at upper side and rounded at base.

FL. Per.: March- May and again August-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2489 (PMAS-AAUR).

Distribution: Pakistan (Punjab, N.W.F.P. & Kashmir); tropical Africa, Southeast Asia and Australia.

Aeluropus lagopoides (L.) Trin. ex Thw., Enum. Pl. Zeyl. 374 (1864).

A perennial stoloniferous grass, culms ca. 15-30 cm long, glaucous, glaucousherbaceous, nodes ca. 0.5-1 mm, greyish green; internodes internodesinternodes ca. 2-2.5 cm, greenish grey. Leaf-blades ca. 9-10 x 2 mm, upper leaf surface have powdery white appearance (glaucous), lower surface sparsely hairy, multi-veined, apex acute, greenish grey, margin hyaline with serrulate projections. Ligule membranous, ca. 0.7-1 mm, margin sparsely hairy. Leaf sheath ca. 5-6 cm, hairy at leaf-sheath on upper surface at the base, greyish green, glaucous, powdery appearance, multi-veined, margin hyaline. Inflorescence a panicle, ca. 9-10 x 6 mm, spikelets densely arranged, 4-8 flowered, ovate-oblong, greyish green, ca. 3 x 3mm;peduncle ca. 3.5-4 cm; follower ca. 2 x 1 mm. Outer glume ca. 1.5 x 0.5 mm, lanceolate,apex acute, , white dense hairs on the upper surface. Lower glumes ca. 2 x 1mm, membranous, ovate, acuminate apex, densely hairy at upper surface, whitish green, margin hyaline. Lemma ca. 2-2.2 x 1 mm, lanceolate, acuminate apex, multi-veined, dense hairs on upper surface, greenish white. Palea ca. 2 x 0.5 mm, lanceolate, apex acute, keels two hairy, green,

hyaline. Anthers 3, ca. 1 x 0.2 mm, yellow; filaments vertical. Ovary ca. 0.3 x 0.2 mm, ovate; stigma and style ca. 0.5 mm.

FL. Per.: April-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, & Rahmatullah Qureshi 2134 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan & Punjab), northern Africa from Morocco to Somalia, Sicily and Cyprus through the Middle East to Central Asia and India.

ARISTIDA

1a. Tufts up to 100 cm, panicle 30 cm long, spikelets green or purple.....1. *A. adscensionis*

1b. Tufts less than 100 cm, panicle 12-20 cm long, spikelets grey or pallid.....2. *A. mutabilis*

1. *Aristida adscensionis* L., Sp. Pl. 1: 82 (1753).

An annual grass up to Culmsca. 40-70cm, internodes ca. 7-6 cm, yellowish grey, smooth, mature stem hard and stiff than younger ones. Leaf-blade ca. 7.5-10 x 0.3 cm, projected venations, hard. Ligule ca. 0.5-1 m, membranous with fringes of hairs, yellowish grey. Leaf-sheath ca. 5.5-6 cm, multi-veined, hard, yellow to grey. Inflorescence a panicle, to 12-17 cm, spikelet ca. 4-4.5 cm, purplish green; peduncle ca. 20 cm; rachila to rachila distance ca. 0.5-2 cm, pedicel length ca. 0.5-1cm rachila. Lower glumes ca. 7 x 0.5 mm, linear, apex acute, purplish, prominent projected midrib. Upper glume ca. 0-10 x 0.5-0.7 mm, light purple to hyaline, midrib with projections. Lemma 3-awned; awns ca. 20 mm, ciliated, greenish grey, midrib prominent with projections, 3-membranous. Palea ca. 0.5-1 x 0.3 mm,

ovate, hyaline. Anthers 3, ca. 1 mm, 2-chambered, yellow; filament length ca. 1mm and vertically attached. Ovary 1.5mm, cylindrical.

FL. Per.: March-December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2572 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab, N.W.F.P., Gilgit & Kashmir) and tropics.

Herbarium Note: Plant 40-70cm, leave blade is 7.5-10 x 0.3cm, ligule a fringe of hairs, yellowish grey, leave sheath yellowish grey, pubescent.

2. *Aristida mutabilis* Trin. & Rupr., Sp. Gram. Stip. 150 (1842).

An annual grass with culms ca. 70-80 cm, multi-veined, the mature plant parts hard and stiff, glabrous, internodes ca. 5-5.7 cm, nodes ca. 0.5-1 mm long. Leaf-blade ca. 5-7 x 0.3 cm, apex acute, margin hyaline and serrulate, green. Ligule a fringe of hairs, yellowish green; ca. 0.5-0.7 mm. Leaf-sheath ca. 5-7.3 cm long, multi-veined, serrulate projections at venations. Inflorescence a racemose panicle, ca. 13-15cm, rachila to rachila distance ca. 1.5-2.5cm, spikelet ca. 2-3 x 0.3 cm, grey or pallid; peduncle ca. 21-24 cm. rachila Lower glumes ca. 5 x 0.5 mm, margin and midrib with projections; awn ca. 0.2 mm long; upper glume ca. 7 x .5 mm, awn ca. 0.2 mm, both have toothed apices, both glumes lanceolate, scaberulous keel. Lemma 3-awned, two side lemma small d, ca. 0.5-0.cm and middle one larger in , ca. 1.3-1.5 cm, cilia at lemma awns. Palea ca. 0.5 x 0.3 mm, hyaline. Anther sac ca. 1.5-1.7 mm; two chambers; filament ca. 0.5mm, vertically attached. Ovary ca. 0.5 mm. cylindrical, pointed at base and broader at apex.

FL. Per.: June –September

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2352 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab N.W.F.P. & Kashmir), Mauritania to India and also East Africa.

ARUNDO

Arundo donax L., Sp. Pl. 1: 81 (1753).

A tall erect, woody, creeping rhizomatous, green perennial grass, up to 4 meter high. green, lower mature part hard and stiff; nodes internodes ca. 20-50 cm, nodes ca. 5-10mm, yellowish green. Leaf-blades ca. 30-65 x 2.5-5 cm, distichous, linear-lanceolate, base rounded or cordate, apex long-attenuate, glabrous. Inflorescence: Panicle ca. 30.60 x 5.8 cm. Spikelets ca. 12-14 mm, greenish yellow; glumes subequal, lower glumes ca. 8.5-13 x 3 mm, upper glumes ca. 10-13 x 3-4 mm, both lanceolate to narrowly lanceolate, green, midrib prominent. lemmas 6-8 x 3 mm, lanceolate, 3-5 nerved, 3 nerves produced as short aristae, 7 mm long hairy at the back side of the lemma below the middle, palea 2-keeled, densely ciliate. Stamens 3.

FL. Per.: June-December.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2424 (PMAS-AAUR).

Distribution: Pakistan (Baluchistan, Punjab, N.W.F.P. & Kashmir), Mediterranean region eastwards to Burma and North Africa.

Herbarium Note: A fairly common grass mostly found near river channels and sometimes cultivated for making hedges around the settlements.

AVENA

Avena fatua subsp. *fatua* L., Sp. Pl. 1: 80 (1753).

An annual glabrous grass up to 55 cm tall; internodes ca. 5-7 cm, nodes ca. 0.5-0.6 mm, dark brown. Leaf-blade ca. 11.5-20 x 0.5-0.7 cm, green, hairy above, multi-veined, midrib prominent, margin serrulate, projections hyaline; ligule ca. 0.5-0.7 mm, yellow, white membranous. Leaf-sheath ca. 6-10.5 cm, multi-veined, midrib prominent, hyaline hairs at sheath inner surface. Inflorescence: panicle ca. 9-17 cm, spikelet loosely arranged, spikelet ca. 2.3-2.5 x 0.3 cm, 2-flowered; pedicel ca. 1-1.2 cm, awn ca. 2-5 cm, peduncle ca. 19 cm. Lower glume ca. 3 x 0.4 cm, lanceolate, apex acute, margin hyaline, green to hyaline, 9-membranous. Upper glumes ca. 3-3.4 x 0.5 cm, lanceolate, apex acute, green to hyaline 9-membranous. Lower lemma ca. 1.2 x 0.3 cm, upper lemma ca. 1.4 x 0.3 cm, greenish yellow, awn ca. 1.7 cm, attached from the middle of the lemma, yellowish green, lemmas awn hairs ca. 0.5-1 cm and small hairs on lemmas surface, yellowish brown, apex toothed. Palea ca. 1.2 x 0.3 cm, lanceolate, apex broadly acute or scarcely toothed, margin membranous keels; hairs hyaline. Anthers 3, ca. 2-2.5 x 0.5 mm; two chambered, vertically attached with filament, yellow. Ovary cylindrical to lanceolate, ca. 0.5-0.7 x 3 mm, hairs brown, to ca. 3 mm; stigma feathery, ca. 2 mm, stigma ca. 1 mm.

FL. Per.: March-August

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2581 (PMAS-AAUR).

Distribution: Pakistan (Baluchistan, Punjab, N.W.F.P., Gilgit & Kashmir),

Europe, western and Central Asia.

BRACHIARIA

1a. Upper lemma readily deciduous, smooth, shiny, obtuse.....1. *B. eruciformis*

1b. Upper lemma granulose to rugulose, subacute to mucronulate2. *B. ovalis*

1. *Brachiaria eruciformis* (J.E. Smith) Griseb. in Ledeb., Fl. Ross. 4: 46. (1853); Bor, Fl. Assam 5: 274 (1940); Sultan & Stewart, Grasses W. Pak. 1: 31 (1958); Bor, Grasses Burma Ceyl. Ind. Pak. 283 (1960); Bor in Towns., Guest & Al-Rawi, Fl. Iraq 9: 472 (1968); Bor in Rech.f., Fl. Iran. 70: 477 (1970).

An annual grass up to 60 cm tall, internodes ca. 6-17 x 0.2-0.5 cm. Leaf-blade ca. 7-20 x 0.6 cm, linear, apex narrowly acute, margin hyaline, sometime red veins at margin and serrulate upper half leaf; papillate on above leaves, green to dark green; ligule ca. 2-3 mm long, hairs on both sides of ligules, single or in pairs, hairs white, ca. 0.5 cm. Leaf-sheath ca. 6-9 cm long, multi-veined, rough, greenish to yellow. Inflorescence racemose panicle, ca. 6-15 cm, 6-9 segmented, each segment ca. 2-3 cm; spikelet elliptic, spikelet oppositely arranged, spike segment to segment distance ca. 0.5-1.5 cm, long, short hairs present at segment base, hairs paired longer than that of emerged from brown bud like projection; hairs ca. 0.3-0.5 cm, 1-celled, tapering end, white; rachilla ca. 0.1-0.2 cm long; peduncle ca. 14-17 cm. Lower glume ca. 1-1.5 x 1.5-2 mm, ovate, apex apiculate, hairs on outer surface and margin of lower glume, lower glume encircle upper spikelet; upper glume ca. 3-1.5 mm, ovate, apex apiculate, membranous, hairs on upper surface or outer surface also on veins, greenish hyaline at young stage but at older stage turned to purplish green. Lower lemma like upper glume; lower palea ca. 3-1.5 mm long, elliptic, apex rounded, thin membranous and hyaline to light green; upper palea ca. 2-2.5 x 1 mm, apex cuspidate, cartilaginous, sometime smooth or with

papillate projections, hyaline to light green. Anthers 3, 2-celled, ca. 3-4 x 1 mm, brown, filaments vertically attached; filaments ca. 2-2.5 mm long. Ovary ca. 0.5-1 x 0.5 mm, ovate; stigma 2, feathery, ca. 1-1.5 mm; style 2, ca. 1 mm; lodicules two, petals shape and hyaline. Seed ca. 2 x 1 mm, elliptic, glabrous, shiny with persistent style appendages.

FL. Per.: July-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2313 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab, N.W.F.P. & Kashmir), South Africa to the Mediterranean and India.

Herbarium Note: On rachis along and short hairs present in internodal region, hairs in pairs, longer emerged from brown bud like projection, hairs ca. 0.3-0.5 cm, 1-celled, tapering end, white in color. Lower glume apex apiculate.

2. *Brachiaria ovalis* Stapf in Prain, Fl. Trop. Afr. 9: 546 (1919).

An annual grass up to 40 cm tall, Culms ca. 30-40 cm, ridges and furrows, glabrous, greenish yellow; nodes internodes ca. 5-7.5 cm, nodes regions swollen, nodes sparsely hairy. Leaf-blades ca. 5.5-9 x 1.2 cm, linear-lanceolate, broader from the base, apex acute, margin hyaline with serrulate projections, mid rib prominent; multi-veined, dark green; hairs on outer and inner side of ligule; hairs ca. 1.2 mm, ligule hairs ca. 2-4 mm. Leaf-sheaths ca. 3.5-4 cm long, Leaf-sheath multi-veined, white hairs of ca. 0.5-1 mm on sheath margin. Inflorescence a loosely arranged panicle, spikelet singly or oppositely arranged, distance between each spike segment ca. 1-3 cm, rachilla ca. 2-5 mm long, wedge shaped, mid rib 3-angular, serrulate hairy projections along the midrib and long hairs at the middle,

midrib yellow; peduncle ca. 18-12cm, „Flower elliptic, ca. 0.4 x 0.1-0.2 cm, greenish yellow; pedicel ca. 1-2 mm, hairy; hairsca. 3-5 mm 1-3-partite, white, 1-celled with tapering end. Lower glume ca. 2 x 2-2.5 mm; ovate, apex cuspidate, margin sub-undulate, mid rib prominent. Upper glume ca. 2-2.2 x 1-1.5 mm, elliptic, apex acute, margin entire and glabrous, membranous. Lower lemma ca. 2-2.2 x 1-1.5 mm, elliptic, apex acute, margin entire and glabrous, membranous. Upper lemma ca. 1.5-2 x 1-1.5 mm, oblong, apex cuspidate, rugulose to cartilaginous with papillose projection or smooth. Palea ca. 1.5-2 x 1-1.5 mm, oblong, apex cuspidate, cartilaginous with papillose projection. Anthers 3, 2-chambered, ca. 3-4 x 1 mm, brown, vertically attached; filament ca. 2-2.5 mm long. Ovary ovate, ca. 0.5-1 x 0.5mm, tapering at apex with pin like projection; styles 2, ca. 1mm ; stigma 2, ca. 1-1.5 mm, feathery, brown; lodicules 2, petal shaped.

FL. Per.: March-December

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2505/2109 (PMAS-AAUR).

Distribution: Pakistan (Sindh), Kenya and Sudan to southern Arabia.

Herbarium Note: Leaf-sheath margin with ca. 0.5-1 mm white hairs Leaf-sheath, wedge shaped rachilla covered with serrulate hairy projections along midrib sides and long hairs on the middle corner.

BROMUS

1a. Panicle up to 10 cm long, loosely or densely arranged, spikelets parallel in clusters,

usually all turned to one side, narrowly wedge-shaped.....1. *B. sericeus*

1b. Panicle longer than 10 cm, lax, spikelets erect and straight

not turned to one side, lanceolate.....2. *B. pectinatus*

1. *Bromus sericeus* Drobov in Fedde, Repert. 21: 39 (1925).

A small d grass up to 25 cm high. Culms ca. 20-25 cm, glabrous; internodes ca. 4-4.5 cm, nodes ca. 0.5-0.7 mm, yellowish green. Leaf-blade ca. 5-7 x 0.4 cm, wedge shape apex acute, strigose on upper and lower sides and margin, midrib prominent, multi-veined, ligule membranous, ca. 1mm. Leaf-sheath ca. 3-4 cm long, margin hyaline, multi-veined, pubescent, Inflorescence a racemose panicle, ca. 6-7cm; peduncle ca. 3-5 cm; rachila to rachila distance ca. 1-1.5 mm, spikelet ca. 1 x 0.2 cm, 5-6 flowered, awn ca. 0.8mm, lower flower awn broader than upper one; spikelet pedicel ca. 0.4-0.6 cm. Lower glume ca. 5 x 1-1.5 mm, lanceolate, apex acute, margin silvery-hyaline, 3-veined; upper glume ca. 7-8 x 3 mm, lanceolate, apex acute, margin silvery-hyaline, 5-veined. Lemma ca. 9 x 4 mm, elliptic, 7-veined, margin greenish and hyaline, awn ca. 5 mm long, small projections at midrib and at awns. Palea ca. 5 x 1 mm, spatulate, hyaline, keels ciliate, apex rounded; anthers ca. 0.5-0.6 mm.

FL. Per.: April-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2378 (PMAS-AAUR).

Distribution: Pakistan (Baluchistan), Turkey, Central Asia, Tibet, and Northwest India.

Herbarium Note: Plant 20-25, leaf blade is 5-7 x 0.4cm, flowers in a spikelet are 5-6.

2. *Bromus pectinatus* Thunb., Prodr. Fl. Cap. 1: 22 (1794).

A small grass up to 30 cm high. Culms ca. 26-30 cm green to light green; internodes ca. 3.5-6 cm, nodes ca. 0.5 mm, dark brown, multi-veined glandular hairy. Leaf-blade ca. 3-7 x 0.3 cm, apex acute, margin brownish and hairy, multi-veined, densely hairy; hairs 1-celled; ligule membranous. Leaf-sheath ca. 5.5-6 cm, multi-veined, yellow to grey, hairs 1-celled at margin and sparsely towards inner side. Inflorescence a racemose panicle, rachilla to rachilla length ca. 0.5-1.5 cm, spikelet ca. 2 x 0.5 cm, elliptic, 10-12 flowered, greenish yellow, small hairs are on pedicel and peduncle, pedicel ca. 1.2-1.5 cm, peduncle ca. 10.5-13 cm. Lower glumes ca. 6-6.5 x 1-1.5 mm, lanceolate, apex sharply acute, margin hyaline, 3-membranous, greenish; upper glumes ca. 8-9 x 3-3.2 mm, elliptic, margin hyaline, 5-membranous, green, 1-celled hairs on upper surface. Lemma ca. 0.9 x 0.3 cm, elliptic to oblanceolate, apex 2-toothed, acute, 7-membranous, margin hyaline, midrib prominent, green, densely hairy on upper side and the margin; awn ca. 0.7 cm. Palea ca. 0.5-0.7 x 0.2-0.3 cm, lanceolate, apex acute, green, hyaline, keels hairy on margin. Anthers 2-lobed, ca. 1 mm, yellow. Ovary cylindrical, ca. 1 mm, light brownish; stigma and style ca. 1 mm each, stigma feathery.

FL. Per.: April-August

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2383 (PMAS-AAUR).

Distribution: Pakistan (Baluchistan, Punjab, N.W.F.P., Gilgit & Kashmir), Sudan Republic, through Ethiopia to Egypt, Sinai and Arabia, south to South Africa, Iran and Afghanistan, India, China and Europe.

Herbarium Note: Plant is shorter than the given literature, leaves blade 1-celled densely hairy, 10-12-flowers in each spikelet.

CENCHRUS

- 1a. Annual plants, involucre ovoid, inner spines flattened:
- 2a. Connate at the base to form an ovoid or diamond-shaped disc...1. *C. biflorus*
- 2b. Connate at the base to form cup-shaped disc.....2. *C. pennisetiformis*
- 1b. Perennial plants, involucre cup-shaped, inner spines shorter and flattened:
- 3a. Connate at the base to form disc shaped, panicle grey,
purple or straw-colored.....3. *C. ciliaris*
- 3b. Connate at the base to form cup shaped,
panicle usually green or sometime dark purple.....4. *C. setigerus*
1. ***Cenchrus biflorus*** Roxb., Fl. Ind. 1: 238 (1820).

An annual weedy nature erect grass up to 55 cm high. Culms ca. 45-55 cm, light green to green, internodes ca. 5-8.5 cm, nodes ca. 0.1-0.3 cm, hairy at nodes, nodes yellow colored and shiny. Leaf-blades ca. 16-23 x 0.3 cm, multi-veined, greenish to yellow color with dense white hairs; hairs ca. 0.3-0.5 cm; much longer on upper surface, serrulate projection at margin and venation. Ligule upwardly membranous, ca. 2-3 mm; yellow, hairy; trichomes ca. 4-5 mm, 1-celled with pointed end. Leaf-sheath ca. 4.5-7.2 x 0.5 cm, multi-veined, light green to green, hairy on margin and upper side, hairs 1-celled, serrulate projection at each vein. Inflorescence a racemose panicle, ca. 9-12 x 0.5-0.8 cm, greenish yellow, spikelets sessile, rachilla zigzag with small hairs, each spikelet 3-flowered, male sterile, lemma and palea with fertile flower; peduncle ca. 9-12cm. Flower lanceolate, ca. 3.5 x 1.4 mm. Outer spines ca. 0.5-0.6 cm, straight, ciliated; greenish yellow. Inner spines ca. 0.7-0.8 cm, broader at the base and narrowed toward apex, yellowish green; below the middle hairy along the cilia, slightly wavy. One longer spine ca.

0.9-1.1cm, having broader base more broader than inner spine and narrowed at the apex; cilia at both sides and also hairs at lower middle side, long spine slightly wavy, yellowish green, curved outer side. Lower glumes ca. 2 x 1 mm and upper glumes ca. 3 x 1 mm, lanceolate, apex acute, greenish, hyaline, midrib green, small projections on outer surface and margin. Lemma ca. 4 x 1.2-1.5 mm, conical to lanceolate, apex acute, serrulate projection on outer surface, 9-10-veined, margin hyaline. Palea ca. 3-3.5 x 1-1.4 mm, conical to lanceolate, apex acute, two green, parallel veined, margin hyaline, green. Male flowers sterile. Fertile flower: stamens 3, anthers vertically attached; anther ca. 2.5-3 x 1 mm, yellow. Stigma feathery, ca. 1.6-2 mm; white to brown colored; style ca. 2-2.5 mm, thin; ovary globose, very small d. Seed ca. 2 x 1 mm, cylindrical, apex rounded, yellow to golden yellow, shiny.

FL. Per.: January-April and again September-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2504/2429 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Punjab & Kashmir), tropical Africa, extending through Arabia to India.

1. *Cenchrus pennisetiformis* Hochst. & Steud. ex Steud., Syn. Pl. Glum. 1: 109 (1854). Boiss., Fl. Or 5: 448 (1884); Sultan & Stewart, Grasses W. Pak. 1: 58 (1958); Bor, Grasses Burma Ceyl. Ind. Pak. 289 (1960); Bor in Rech. f., Fl. Iran. 70: 505 (1970).

An annual semi-erect grass up to 60 cm high. Culms ca. 30-60 cm long, light green, internodes ca. 5-8.5 cm; nodes ca. 0.1-0.3 cm, hairy, yellow and shiny. Leaf-blade ca. 16-23 x 0.3 cm, multi-veined, green to yellow with white hairs, hairs

ca. 0.3-0.5 cm, upper surface with serrulate projection on margin and veins. Ligule ca. 2-3 mm, upwardly membranous, yellow, hairy; hairs ca. 4-5 mm long, white, 1-celled with pointed end. Leaf-sheath ca. 4.5-7.2 x 0.5 cm, margin light green, multi-veined, hairy at margin, each vein with serrulate projection. Inflorescence a racemose panicle, ca. 7-10 cm x 0.5-0.8 cm, spikelets arranged zigzag in manner, rachilla zigzag with small hairs, each spikelet 3-flowered, greenish yellow color; peduncle ca. 8-9 cm. Flower conical, ca. 3.5 x 1.4 mm. Outer spines ca. 0.5-0.7 cm, cilia in opposite manner; greenish yellow color, outer most spines very thin and smaller, curved outward in cup like structure. Inner spines ca. 1.2-1.3 cm long, broader at the base and narrowed at apex, hairy at lower the middle along the cilia, yellowish green in color. Lower glumes ca. 2 x 1 mm, greenish hyaline; upper glumes ca. 3 x 1 mm, lanceolate, apex acute, midrib green, small projections on outer surface and margin. Lemma ca. 4 x 1.2-1.5 mm, conical to lanceolate, apex acute, margin hyaline, serrulate projection at outer surface, 9-10-parallel veined. Palea ca. 3-3.5 x 1-1.4 mm, conical to lanceolate, apex acute, margin hyaline, 2-parallel veined, green. Stamens 3, filaments vertically attached with anther; anther ca. 2.5 x 0.5 mm, 2-chambered, apex rounded, yellow. Stigma feathery, ca. 1.6-2 mm, white to brown; style ca. 2-2.5 mm, thin, thread like; ovary globose. Seed ca. 2 x 1 mm, cylindrical, apex rounded, shiny, yellowish golden colored.

FL. Per.: February-April and again August-October

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2349 (PMAS-AAUR).

Distribution: Pakistan (Sindh & Baluchistan), tropical East Africa through Arabia to India.

Herbarium Note: Upper and lower glumes and lemma, palea description not present in the previous literature.

2. *Cenchrus ciliaris* L., Mant. 2: 302 (1771); Bor, Grasses Burma Ceyl. Ind. Pak. 289 (1960); Bor in Towns., Guest & Al-Rawi, Fl. Iraq 9 :474 (1968); Ramaswamy, Raman & Menon in J. Indian Bot. Soc. 48: 102 (1969); Bor in Rech. f., Fl. Iran. 70: 504 (1970); Clayton in Tutin et al., Fl. Eur. 5: 264 (1980).

An annual to biennial, erect to semi-erect grass up to 40 cm tall. Culms ca. 30-40 cm, greenish, internodes ca. 5-7.5cm, nodes ca. 1-3 mm, hairy, yellow and shiny. Leaves blade ca. 10-15 x 0.3 cm, green to yellow color, densely hairy; trichomes ca. 0.3-0.5 cm. Ligule upwardly membranous, yellow, ca. 2-2.5 mm, hairs ca. 4-5 mmlong, 1-celled. Leaf sheath ca. 3.5-4.2 x 0.5 cm, light green, hairy; hairs prominent on leaf sheath margin and ligules upper side. Inflorescence a racemose panicle; ca. 4-6 x 0.3-0.5 cm, greenish yellow; peduncle ca. 4-6 cm, spikelets zigzag, rachilla zigzag with small hairs, each spikelet 3-flowered; male flower sterile with same lemma and palea as fertile flower; flower lanceolate, ca. 3.5 x 1.4 mm. Outer spines ca. 0.5-0.6 cm with cilia and hairs, reddish purple color, straight; inner spines ca. 0.7-0.8 cm long, 9-11 spines jointed to cup shape; broader at the base but thin from upper side, reddish purple at upper half and yellowish green at lower half; at lower middle side hairs along with cilia, bristles slightly wavy; one longer than the rest ca. 0.9-1 cm, broader connate at the top to form disc, densely ciliated, flexuous, slightly wavy, yellowish green. Lower glume ca. 2 x 1 mm, upper ones ca. 3 x 1 mm, lanceolate, both greenish hyaline at immature stage and hyaline with reddish brown venation at mature stage, apex acute, midrib green

at young stage and turns reddish brown at maturity, small projections on outer surface and margins. Lemma ca. 4 x 1.2-1.5 mm, conical to lanceolate, apex acute, 9-10 green-reddish brown venations, margin hyaline,. Palea ca. 3-3.5 x 1-1.4mm, conical to lanceolate, apex acute, two green parallel venations, margin hyaline. Male flower: stamens 3, filaments small; anther sac vertically attached; ca. 2.5-3 x 1mm, yellow. Bisexual flower: stamens 3; anther ca. 2 x 1 mm, vertically attached; yellow; filaments ca. 3 mm long,; apex rounded. Stigma Feathery, ca. 1.9-2 mm, reddish brown; style ca. 2-2.5 mm, filiform; ovary globoseglobose. Seed ca. 2 x 1 mm, cylindrical, apex rounded, shiny, yellow to golden yellow colored ,.

FL. Per.: February-March

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2058 (PMAS-AAUR).

Distribution: The plant is distributed throughout Africa, extending through Arabia and the Middle East to India and Pakistan.

2. *Cenchrus setigerus* Vahl, Enum. Pl. 2: 395(1806); Sultan & Stewart, Grasses W. Pak. 1: 60 (1958); Bor, Grasses Burma Ceyl. Ind. Pak. 290 (1960); Ramaswamy, Raman & Menon in J. Indian Bot. Soc. 48: 102 (1969); Bor in Rech. f., Fl. Iran. 70: 506 (1970).

An annual to biennial grass up to 75 cm high. Culms ca. 54-75 cm long, greenish to light green colored, internode nodes ca. 9-12cm, nodes ca. 1 mm, multi-venation, shiny, yellowish brown, sparsely hairy. Lef-blade ca. 40-47 x 0.5 cm, apex acute, multi-veined, green to yellow, densely white hairy; ca. 0.3-0.5cm, hairs long on dorsal side, serrulate projection at margin and venation. Ligule upwardly membranous, ca. 1.5-2 mm, yellow colored, densely hairy; hairs ca. 4-5 mm long,

white, 1-celled with pointed end. Leaf-sheath ca. 7-9 x 0.5-1 cm, margin hairy, near ligule, green to light green, multi-veined, each vein with serrulate projection, hairs very thin, 1-celled. Inflorescence a racemose panicle; panicle ca. 10-12 x 0.3-0.5 cm, greenish yellow; spikelets sessile, spikelets zigzag, rachila zigzag with small hairs, each spikelet ca. 0.5 x 0.5cm, 3-4 flowered, spikelet cupular, green colored; peduncle ca. 14-17 cm. Bristles cupular, green colored, outer ones yellowish orange, inner ones ca. 4 mm, fringe like shape jointed at base and free from upper side. Outer glume ca. 2x 1mm, ovate, apex acute, midrib present projections at outer surface. Inner glume ca. 2.5 x 1.5mm, apex acute-acuminate, midrib prominent, projections at outer surface. Outer lemma ca. 3 x 2mm, ovate, apex mucronate, 5-parallel veined, projections on outer surface, hyaline green in color. Outer palea: ca. 2 x 1mm, apex mucronate, 2-veined, projections on outer surface. Inner lemma ca. 4.5 x 1.5 mm, lanceolate, apex acute, 5-veined, green hyaline color, projections on outer surface . Inner palea: ca. 4 x 1 m, 2-veined, apex acute, hyaline, very thin. Stamens 3, anther ca. 3 x 1 mm, apex rounded, yellow, filament small. Stigma feathery, ca. 2 mm, brownish red; style ca. 2-2.5 mm, smooth; ovary globose, very small, hyaline to light yellow. Seed ca. 2.5 -3 x 2 mm, cylindrical, apex and base rounded, skin colored, , glabrous, shiny.

FL. Per.: August-January and again in April.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2514 (PMAS-AAUR).

Distribution: The plant is distributed from tropical East Africa, Arabia to India and Pakistan (Sindh, Punjab & N.W.F.P).

CHLORIS

Chloris gayana Kunth, Rev. Gram. 1: 293, t. 58 (1830); Blatter & McCann, Bombay Grasses 258 (1935); Bor, Fl. Assam 5: 123 (1940); Sultan & Stewart, Grasses W. Pak. 2: 270 (1959); Bor, Grasses Burma Ceyl. Ind. Pak. 466 (1960); Bor in Towns., Guest & Al-Rawi, Fl. Iraq 9: 452 (1968); Bor in Rech. f., Fl. Iran. 70: 447 (1970).

A biennial grass up to 120 cm high. Culms ca. 90-110 cm long, internodes ca. 6-9 cm, smooth, yellowish green, multi-veined, nodes dark yellow to brown. Leaf-blade ca. 12-14 x 0.4 cm, apex acute, margin hyaline with projections, rough, midrib prominent, yellowish green, multi projected veined,. Leaf-sheath ca. 6-9 cm, multi-veined, internally whitish yellow. Ligule membranous with white fringes of hairs. Inflorescence digitately divided into 10, each d ca. 6.5 x 0.2-0.3 cm, yellowish green, each spikes 2-flowered, spikelets densely arranged, lanceolate; peduncle ca. 16.5-17cm; glumes persistent. Lower glumes ca. 1.5 x 1 mm, lanceolate, apex acute, greenish hyaline, midrib prominent with projections. Upper glume ca. 3 x 1.5 mm including awns, apex sharply acute, midrib prominent with projections, hyaline green and grey. Sessile fertile flower: lower lemma ca. 2.5-3 x 2 mm, awn ca. 5-7 mm, lanceolate to concave, apex rounded, scabrid, , lemma 2-keeled, margin hairy , hyaline green; awnsca. 4 mm, ciliated; 2nd lemma ca. 1.5-3 x 2 mm, lanceolate; awn ca. 2.5-4 mm, projected from lower lemma marginally ciliated, apex rounded; 3rd lemma ca. 1-2.3 x 1.7 mm, lanceolate to oblong, reduce to scabrid, sometime cleft at the apex; 4th lemma like 3rd ones. Palea ca. 2.5 x 1.5 mm, keels hairy, apex acute, cleft at the apex, margin hyaline green. Anther 3; ca. 1.5 x 0.3 mm, curved shape, yellow. Ovary very small; style and stigma ca. 0.5 mm

long. Pediculate sterile flower: lemma ca. 1-2 x 1.5 mm d, awn ca. 3 mm, lanceolate, greyish green. Palea ca. 2.5 x 1.5mm, apex acute and cleft, hyaline green with two keels. Anther 3, ca. 1 x 0.3 mm, curved shape, yellow.

FL. Per.: March-May and again September-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2088 (PMAS-AAUR).

Distribution: This species is native to open grassland and Savannah and distributed from Senegal eastwards to the Sudan and south to South Africa and Pakistan (Sindh & Punjab).

CYMBOPOGON

Cymbopogon jwarancusa subsp. *jwarancusa* (Jones) Schult., Mant. 2: 458 (1824); Stapf. in Kew Bull. 1906: 313, 354 (1906); Blatter & McCann, Bombay Grasses 102 (1935); Bor in J. Bombay Nat. Hist. Soc. 52: 178 (1955); Sultan & Stewart, Grasses W. Pak. 1: 114 (1958); Bor, Grasses Burma Ceyl. Ind. Pak. 128 (1960); Bor in Rech. f., Fl. Iran. 70: 542 (1970); Soenarko in Reinwardtia 9: 305 (1977).

A perennial erect, aromatic grass up to 1 meter high. Culms ca. 50-160 cm, yellowish green, multi-veined; internodes ca. 7.5-10.5 cm, node ca. 0.5-1 mm, yellow. Leaf-blade ca. 12-17 x 0.6-0.7 cm, lanceolate, apex broadly acute, multi-veined, midrib prominent, upper surface glaucous, greenish yellow, margin hyaline with serrate hairs, hairs hyaline. Ligule 2 mm; membranous. Leaf-sheath ca. 4-5.5 cm, multi-veined, glaucous inside. Inflorescence: axillary and terminal raceme, false panicle ca. 9-12 cm; spatheoles lanceolate; rachilla to rachilla distance ca. 1-1.3 cm, hyaline hairs at rachilla nodes, each rachilla without leaf; leaf-blade ca. 1.7-3 x 0.5 cm, elliptic, apex acute, multi-veined. Spikelet ca. 5 x 1-1.5 mm, paired,

one sterile and one fertile, sessile, lanceolate to elliptic. Fertile spikelet: small hairs at spikelet base, glumes cartilagenous, convolute, green, both glume ca. 5 x 1 mm, apex acute, 4-veined, hyaline hairs ca. 1-1.5 mm at outer surface. Lemma ca. 3 x 0.5 mm, lanceolate, hyaline, awn ca. 0.5 cm. . Palea ca. 3.5 x 0.5 mm, lanceolate, hyaline. Anther 3, ca. 2 x 0.5 mm; filament ca. 2 mm, vertically attached. Ovary globose to elliptic; style ca. 1 mm; stigma ca. 2 mm. Sterile spikelet: pedicel ca. 3 mm; densely hairy, hairs ca. 0.5 cm; glume convolute, ca. 5 x 1 mm, elliptic to lanceolate, apex acute, green to hyaline, 8-9-veined; venation with serrulate projections, hairs on margin. Lemma ca. 5 x 1 mm, lanceolate, apex acute, hyaline to light green, 3-veined, Palea ca. 5 x 1 mm, lanceolate, apex acute, membranous, hyaline. Anther 3, ca. 2 mm, yellow, two lobed.

FL. Per.: Almost throughout the year

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2356 (PMAS-AAUR).

Distribution: The grass is distributed mainly in India, Nepal and Pakistan (Sindh, Baluchistan, Punjab, N.W.FP., Gilgit & Kashmir).

CYNODON

Cynodon dactylon (L.) Pers., Syn. Pl., 1:85 (1805); Cope in Nasir & Ali., Fl.Pak., 143:117 (1982).

Syn: *Panicum dactylon* L., Sp.Pl., 1: 85 (1753).

A perennial grass with creeping by rhizome and rooting at nodes up to 45 cm high. Culm creeping and finally erect, color greenish yellow, internodes ca. 6-12 cm, node swollen or sometime red color, hollow, multi-veined, ridges and furrows, swollen node glabrous, green at above and light green at the base. Leaf-

blade ca. 3-4.9 x 0.3 cm, linear, base broad, apex acute, subglabrous, margin serrulate hyaline, green, multi-parallel veined; leaf sheet ca. 2.3-3 cm, green to light green, subglabrous; ligule a fringe of white hairs, ca. 0.5mm, auricle ca. 0.5 mm, yellow. Raceme 3-4 digitate; spike ca. 3-4 cm, rachilla 26-30 spikelet, rachilla distance from one to other spikelet ca. 0.1-0.2cm; peduncle ca. 2.5-5 cm long; rachis slender, flat, green color; mid rib yellow with hairs and hyaline outer side, compressed or angled, scaberulous. Glumes 2, linear; lower glume ca. 1.5 x 0.3 mm, lanceolate, apex narrowly acute to mucronate, hyaline to light green color, margin with reddish purple lines, small hairs on outer surface. Lemma broader, subulate-lanceolate, apex mucronate. Palea ca. 3-4 x 2 mm, lanceolate, apex mucronate, small hairs on outer midrib and margin, hyaline to light green color. Grain ca. 1 mm long, oblong.

FL. Per.: Throughout the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, & Rahmatullah Qureshi 2093 (PMAS-AAUR).

Distribution: It is distributed ranging from southern India to southeast Asia and northern Australia to Pakistan.

DACTYLOCTENIUM

- 1a. Inflorescence open, spikes ca. 1.2-6.5 cm, linear to narrowly oblong, ascending or radiating from the culm apex; lemmas acute, cuspidate or mucronate; grains coarsely transversely rugose.....1. *D. aegyptium*
- 1b. Inflorescence compact, spikes ca. 0.8-1.8 cm, oblong to broadly oblong, clustered in dense head; lemmas conspicuously acuminate-mucronate; grain finely granular.....2. *D. aristatus*

1. *Dactyloctenium aegyptium* (L.) Willd., Enum. Hort. Berol. 1029 (1809).

A semi-erect grass up to 70 cm high. Culm ca. 50-65 cm, internodes ca. 12-14 cm, multi-veined, green to yellow, smooth, node ca. 0.7-1 mm, greenish yellow. Leaf-blade ca. 25-30 cm, midrib prominent, apex acute, green to yellow. Ligule ca. 0.5-0.7 mm; membranous, yellow. Leaf-sheath ca. 6-7.8 cm multi-veined, margin thin and hyaline, green. Inflorescence digitately 3-9, each digitate ca. 4.5-5 x 0.6-0.7 cm, linear to narrowly oblong, greenish yellow, spikes ca. 1.2-6.5 cm long, 3-4-flowered; peduncle ca. 12 cm,.. Lower glumes ca. 1.5-2.2 mm long, broadly ovate to lanceolate, mid keel thickly scabrid, apex acute. Upper glume ca. 3.5-4.5 mm, elliptic to narrowly obovate, midkeel extended to form scabrid awn, awn half or twice as long as glume. Lemmas ca. 2.6-4 mm long, narrowly ovate to ovate, keel smooth to scabrid extend to form concave and scabrid awn, ca. 1 mm long. Palea ca. 3-3.2 x 3 mm, midkeel smooth; keels winged or wingless. Anthers sac ca. 0.25-0.8 mm, yellow; filament short, vertically attached. Grain ca. 1 x 0.3 mm long, 3-angular to broadly obovate, rugose.

FL. Per.: July-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2419/2509 (PMAS-AAUR).

Distribution: Widely distributed in tropical and warm temperate regions of the Old World and Pakistan (Sindh, Punjab, N.W.F.P. & Kashmir). It is introduced in America.

2. *Dactyloctenium aristatum* Link, Hort. Berol. 1: 59 (1827).

Culms ca. 30-40 cm, multi-veined, green and rough, internode ca. 5-6.4 cm, nodes color yellow to brown, node length ca. 1 mm, stem emerge from rosette like

cluster leaves. Basal leaves without Leaf-sheath directly emerge from soil; ca. 16-18cm, nodes leaves blade ca. 6-9cm x 0.3-0.4cm, green color, multi-veined, hairs on upper surface, lower surface and margin; hairs color white, hairs emerge bud like projection, hairs 1-celled hispid, leaf apex acute to acuminate. Ligule ca. 1-2mm, ligule membranous, Leaf-sheath ca. 3.4-3.6cm, at maturity hairs, leaf sheath multi-veined, hyaline margin; each venation small serrulate projection. Inflorescence racemose, peduncle ca. 12-14cm long, inflorescence fan like 4 fragments, white hairs at fragments emerges base, each segment 14-18 spikelets, each spikelet ca. 1.4-1.6cm, spikelet sessile, each spikelets 2-3 flowers, each rachilla converted awn at apex, rachilla serrulate projections color green. Two glumes around 2-3 flowers, both glumes acuminate apex deep base and narrow apex, glume ca. 1.5 x 2mm shape ovate, awn ca. 1mm; mid vein form awn with serrulate projections, glumes serrulate margin, hyaline green, lower glume covers whole spikelet, upper glume ca. 3 x 1.5-2mm including awn, awn ca. 1mm; mid vein form awn with serrulate projections, glumes serrulate margin, hyaline green. Lemma ca. 3 x 2-3mm, lemma overlaps palea, acuminate apex and shape like glume small awn by mid vein, lemma margin wing like structure, hyaline green color, palea ca. 1.5-2 x 1mm, lanceolate, apex acute, rachilla serrulate projections. 3-Anther, anther sacca. 2mm x 0.5mm, filaments very small, anther apex rounded, color yellowish brown. Ovary rounded hyaline, small stigma ca. 0.5mm; feathery yellowish color and style straight ca. 0.5mm.

FL. Per.: July-September

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2510 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan & Punjab), Kenya north to Sudan and eastwards Arabia to India.

DESMOSTACHYA

Desmostachya bipinnata (L.) Stapf in Thiselt.-Dyer, Fl. Cap. 7: 632. 1900.

Culmsca. 40-80cm, internodes ca. 10-17cm, nodesca. 1mm; greenish yellow, very small hairs at nodes, stem hard at maturity than young one and color turn yellowish brown from green. Leaves bladeca. 13-20 x 3-11mm, leaves role at mature, apex acute, margin hyaline and projected, multi-veined, green. Ligule membranous,ca. 1-1.5mm, yellowish green. Leaf-sheathca. 10-17cm, greenish yellow in color, hyaline margin, multi-veined. Inflorescence: peduncleca. 40-44cm, each panicle divided in to groups or each branch have large number of spikelet, rachila to rachila distance ca. 1.5-2cm, spikelet group ca. 1-1.5cm long, spikeletca. 3-5mm, spikelets arranged oppositely, 4-12 flowers in each spikelet, spikelet sessile, flowerca. 2 x 1mm. Lower glumeca. 1 x 0.5mm and upper glume ca. 2 x 1-1.2m, both greenish yellow, both have small awns, midrib serrulate projection, and midrib very prominent, Hyaline to light green, lanceolate. Lemmaca. 2-2.2 x 1-1.2mm, lanceolate, apex acute, hyaline green, midrib prominent and projections at midrib. Paleaca. 1.5 x 1mm, inside folded margin, hyaline, midrib not prominent. 3-antherca. 1.5-1.7 x 0.2mm, 2 chambers, small filament attached vertically, ovary ovate and small, stigma ca. 0.5mm and style ca. 0.5mm.

FL. Per.: July-October or November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2579 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab, N.W.F.P. & Kashmir), Middle East to Indo-China, North and tropical Africa.

DICHANTHIUM

Dichanthium annulatum (Forssk.) Stapf. in Oliver, Fl. trop. Africa 9: 178 (1917); Stewart in Nasir & Ali., Ann. Cat. Vasc. Pl. W.Pak. & Kashm., 108 (1972); Cope in Nasir & Ali., Fl.Pak., 143: 280 (1982).

Syn: *Andropogon annulatus* Forssk., Fl. Aegypt.-Arab. 173 (1775); *A. scandens* Roxb., Fl. Ind.. 1: 262 (1820); *Dichanthium nodosum* Willemet in Usteri, Ann. Bot. 18: 11 (1796); *Andropogon nodosus* (Willemet) Nash, N. mer. Fl. 17: 122 (1912).

Perennial grass densely hairy; ca. 50-86cm, Yellowish green young stage and brownish yellow at maturity, internodes ca. 7-9.5cm, nodes region swollen some time grey color; whitish hairs at nodes region with dens hairs; hairs ca. 1-2mm. leaf blade ca. 9-10 x 0.1-0.4cm, lanceolate, apex acute, sparsely hairy on upper and lower side; hairs color white; ca. 2-4mm and 1-celled, multi-veined and parallel veined, glaucous, margin hyaline and serrulate as move towards apex, leaf mature dark reddish brown. Ligule ca. 1-3 mm long, color yellowish white, upward growing membranous; ca. 3-6mm long hairs. Leaf sheath ca. 5.2-5.5cm, sheath multi-veined, outer structure is rough. Inflorescence: racemose, peduncle ca. 25-35cm, 3-4 digitate, each digitate ca. 3-5.5cm, greenish reddish brown color, on rachilla spikelet to distances ca.1mm, rachilla dens white hairs ciliate, rachilla slightly rounded to flat; prominent midrib. Sessile spikelets, ca. 3-4 x 2mm, outer side and margin ciliate, apex pointed acute, elliptic. Sessile spikelet: lower glume involucre ca. 2-3mm, oblong, 3-9-nerved, color greenish hyaline, apex is pointed

acute, margin keel and midrib densely white ciliated, margin hyaline. Upper glume ca. 3-4 x 2mm, 3-nerved, lanceolate to slightly elliptic, apex acute, margin hyaline, color green to hyaline, midrib prominent, keel short ciliate. Lower awned lemma reddish brown to purple color; ca. 2.3-2.6cm, pointed apex, rough tinsel awn. Upper awn 3-5mm. Pedicelled spikelets 2.5-5 mm long, male sterile, usually darker; lower glume involucre ca. 3 mm long, 7-13-nerved; keel bristly, elliptic-oblong, obtuse. Upper glume involucre ciliate; upper floral glume small or obsolete. Seed ca. 2 x 1 mm, obovate to oblong shape, seed yellowish brown color, surface slightly hairy to glabrous, apex rounded.

FL. Per.: March-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2028 (PMAS-AAUR).

Distribution: Pakistan, Kenya, Tanzania and Senegal, through the Middle East to Indonesia.

DIGITARIA

1a. Culms 20-100 cm; lemma smooth; fruit ellipsoid.....1. *D.ciliaris*

1b. Culms 20-60 cm, lemma with minute spines; fruit lanceolate...2. *D.sanguinalis*

1. *Digitariaciliaris* (Retz.) Koel, Descr. Gram. 27 (1802).

Culms ca. 60-69cm, stem rounded, multi-veined, internodes ca. 4-6cm, color greenish yellow, node width ca.0.5-1.5mm. Leaf blade ca. 3.5-5.5 cm x 3-5mm, apex acute, lanceolate shape, midrib prominent and multi-veined, margin hyaline serrulate margin, leaf lower half margin smooth and wavy or curl at maturity, rough surface, green color, white long ca. 0.3-0.5 cm hairs ligule both sides, ligule upward membranous, ligule ca. 1mm, hairs beneath ligule membrane, leaf sheath

long; sheathca. 4-9.5cm, multi-veined, hyaline to green, margin hyaline and thin, white ca. 3-5 mm long thin hairs outer side leaf sheath at node attachment, leaf sheath midribs yellow color and thick, Inflorescence: racemose, peduncleca. 14-32 cm, 3 digitate; ca. 9.5-10 cm, zigzag rachila; wedge shape; yellow 3-angular serrulate margin each angle, spikeletca. 3-4 x 1cm, spikelet paired and alternate, one spikelet sessile and other pediculate; pedicel length ca. 0.2 cm, pedicel shape like rachila. Lower glume ca. 1.5-2 x 1mm, lanceolate, long hairs at both margin, apex acute, hairs at outer surface. Upper glumeca. 3 x 1.3mm, parallel veined, long hairs are present at outer margin; hairs thread like white and long and dens; encircle lemma. Lemma thin membranousca. 3 x 1.3 mm, elliptic to lanceolate, apex acute, green to hyaline. Palea membranousca. 3 x 1.3mm, elliptic, apex acute, smooth, hyaline, like lemma but thinner than lemma. Anther 3; sac length ca. 1 x 0.5 mm, color brown; two anther sac chambers, anther filament length ca. 0.5mm. Stigma feathery brown color;ca. 0.5-1mm and style ca. 1-1.5mm long, elliptic to oblong in shape ovary.

FL. Per.: July-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2513 (PMAS-AAUR).

Distribution: Pakistan and commonly distributed throughout the tropics.

Herbarium Note: peduncle 14-32cm, each digitate ca. 9.5-10cm.

2. *Digitaria sanguinalis* (L.) Scop., Fl. Cam., ed. 2, 1: 52 (1772).

Culms ca. 60-69 cm. Stem rounded; multi-veined, internodes ca. 4-6 cm, greenish to yellow, nodes 0.5-1.5 mm. leaf blade ca. 3.5-5.5cm x 3-5mm, lanceolate, apex acute, midrib prominent and multi-veined, margin hyaline;

serrulate margin, leave lower half margin smooth-wavy, revolute at maturity, rough surface, green color; hairs white, thin, ca. 3-5mm long on leaf sheath at outer side node attached; midribs yellow and thick. Hairs white on ligule, ca. 3-5mm long, ligule upward membranous; ca. 1mm, hairs beneath ligule membrane. Long sheath ca. 4-9.5cm, multi-veined hyaline to green, margin hyaline and thin. Inflorescence: racemose, peduncle ca. 14-32cm, 6 digitate and each have ca. 9-9.3 cm; rachila straight, yellow, midrib 3-angular, wedge shape, margin serrulate, rachila distance ca. 1.5-2mm; spikelets ca. 0.3-0.4 x 1mm, elliptic, sessile. Both glumes oppositely arranged and equal in , ca. 1.5-2 x 1mm, lanceolate, base slightly deep, apex acute, glabrous, midrib prominent. Lemma ca. 3 x 3-3.5 mm, membranous, boat shaped, long hairs, apex acute, greenish to hyaline. Palea like lemma, much thinner than lemma. Anther 3; sac ca. 1 x 0.5mm, brown; filament ca. 0.5 mm long. Stigma brown, feathery, ca. 0.5-1mm; style 1-1.5 mm long; ovary elliptic to oblong, small d.

FL. Per.: July-September

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2189 (PMAS-AAUR).

Distribution: Pakistan and warm temperate regions of the World.

ELEUSINE

Eleusine indica (L.) Gaertn., Fruct. Sem. Pl. 1: 8 (1788).

Culms ca. 87-100cm, woody at base and herbaceous above, greenish to yellow; internodes ca. 12-17 cm; nodes ca. 3mm, dark yellow to brown. Leaves blade ca. 30-40 x 0.4-0.5cm, apex acute, margin hyaline, green, midrib prominent, multi-veined, roled at maturity, hairy at upper surface and margin. Ligule ca. 2-3

mm, membranous and white hairs at margin. Leaf-sheath ca. 10.5-12 cm, margin hyaline, 1-celled white hairs on the margin of ligule. Inflorescence 6-digitate, ca. 11-12.5 x 0.3-0.4 cm, green; spikelet dense, oppositely arranged, ca. 0.5 -0.6 x 0.4cm, lanceolate, 3-9-flowered, rachilla flat with serrulate projections at hyaline margin, persistent. Lower glume ca. 2 x 1mm, lanceolate, mid-vein prominent, outer side serrulate projection, apex acute, hyaline to light green. Upper glume ca. 3 x 1-1.2 mm, lanceolate, apex acute, mid-vein prominent, serrulate projection, hyaline to light green. Lemma ca. 3 x 2mm, 3-membranous, apex acute, lanceolate, hyaline, green, midrib green with projection. Palea ca. 2-2.2 x 1mm, apex acute, lanceolate, hyaline, midrib green with projections. Anther 3, ca. 1-1.3 x 0.3 mm, yellow. Ovary ca. 0.3 x 0.2mm, round; stigma and style ca. 0.5mm. Seed ca. 1.2-1.5 x 1mm, brown to dark brown, elliptic to oblong, covered in 2 maricarp, obtusely trigonal in cross section.

FL. Per.: June-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2049 (PMAS-AAUR).

Field remarks: A common grass of desert habitat.

Distribution: Pakistan and tropical and subtropical regions of the world.

ENNEAPOGON

Enneapogon persicus Boiss., Diagn. 1(5): 71 (1844).

Culms ca. 28-40cm, internodes ca. 3-7.5cm, and yellowish green, multi-veined. Nodes ca. 1mm; nodes yellow, hairs at nodes. leaf blade ca. 3.5-7.5cm x 3mm, stiff. Leaves blade rolled upward after maturity, powder white appearance at leaves surface, multi-veined, projections at membranous, apex dark brown and

pointed, projection at hyaline margin, greenish. Ligule ca. 1-1.5mm small hairy yellow at ligule, thick ligule, small hairs at ligule margin. White Leaf-sheath ca. 5-6.5cm, hyaline margin, multi-veined, venation green, light green, small hairs at margin. Inflorescence a panicle, ca. 10-13 x 1cm, yellowish green, spikelet loosely arranged at panicle branches to form groups, each 4-5 spikelets, rachila to rachila distance ca. 1.5-2mm; peduncle ca. 11.5-17cm; spikelets ca. 10 x 1mm, 3-flowered, lanceolate, hairs at rachila and pedicel; pedicel ca. 1-3mm. Outer glume ca. 7 x 3mm, 9-membranous, lanceolate, apex tooth like, small hairs at outer side, hyaline, apex minutely toothed, base broader. Upper glume ca. 9-10 x 3mm, lanceolate, hairs at outer surface, 9- membranous, midrib prominent, apex \pm toothed, green to hyaline. Lemma ca. 9-9.4 x 3mm, awns 9, unequal, alternately arranged, ciliated, light green to yellow; palea ca. 1.5 x 0.7 mm, 2-keeled, oblong, narrow at base and brown, two cleft at apex, hairs at keel; anther ca. 0.5-1.3mm long.

FL. Per.: May-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2527 (PMAS-AAUR).

Distribution: Pakistan, Egypt and Arabia northwards to Turkmenistan and eastwards to India.

Herbarium Note: Hairs at the margin of the Leaf-sheath, small hairs at the peduncle and rachila.

ERAGROSTIS

1a. Loosely tufted annual; culms 6-90 cm high:

2a. Caryopsis broadly oblong, dark brown.....1. *E. cilianensis*

2b. Caryopsis subglobose rarely oblong, dark reddish brown....2. *E. cilianensis*

1b. Caespitose perennial; culms 20-120 cm high.....3. *Eragrostis superba*

3a. Panicle spike-like, woolly,

Spikelets 6-12-flowered, purplish.....4. *Eragrostis ciliaris*

3b. Panicle elliptic to ovate, few long white hairs, 4-14-flowered, purplish-green.....5. *Eragrostis pilosa*

1. *Eragrostis cilianensis* (All.) Lut. ex F.T. Hubbard in Philipp. J. Sci. C, Bot. 8: 159 (1913).

Culms ca. 11-13cm; greenish yellow, internodes ca. 0.7-2.5cm; reddish brown; nodes ca. 1-2mm, mostly leaves clustered at the culm base; cilia ca. 2-4 mm at leaf-blade, 1-celled. Leaves blade ca. 1.6-2 x 0.4-0.5 cm, glaucous, multi-veined, greenish yellow; cilia hyaline, 1-celled at upper leaves blade. Ligules densely fringes of hairs inner side and outer margin. Leaf-sheath ca. 1.5-2cm, light green, multi-veined. Inflorescence a racemose panicle, ca. 3-6 cm; peduncle ca. 3-5.2 cm; rachila branched, branch to branch distance ca. 0.6-1cm, spikelet to spikelet distance ca. 0.3-0.7cm, spikelet ca. 0.5-1cm x 0.2-0.3cm, lanceolate, 6-16 flowered, greyish green, spikelet pedicel ca. 0.3-0.5 cm. Lower glumes ca. 2 x 1mm; upper glume ca. 2-2.5 x 1-1.5mm, both lanceolate, apex acute, greenish purple and hyaline, midrib prominent with serrulate projection. Lemma ca. 1.7-2.1 x 1mm, ovate to elliptic, apex acute, green to light green or purplish, 3-veined, margin smooth. Palea ca. 2 x 1mm, 2-keeled with hairy projections, lanceolate, apex rounded, hyaline green. Anthers 3, ca. 0.3 x 0.2 mm, brown; filament ca. 0.2mm, vertically attached. Ovary very small d, elliptic to ovate, apex pointed, light yellow to white; style ca. 0.2 mm; stigma feathery, ca. 0.3 mm. Seed ca. 1.5 x 1mm, ovate, shiny brown, apex rounded.

FL. Per.: May-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2388 (PMAS-AAUR).

Field remarks: A less common grass of flat habitat.

Distribution: Pakistan to tropical and warm temperate regions of the Old World.

2. *Eragrostis pilosa* (L.) P. Beauv., Ess. Agrost. 162, 175 (1812).

Culms ca. 45-55cm, nodes length ca. 6-9.5cm, stem color green, multi-veined, node color dark brownish purple, and nodesca. 1-1.5 mm. Leaf blade narrow, ca. 7-11cm x 0.3-0.4cm, apex acute, projection multi-veined, green, margin greenish brown, serrulate margin. Leaf sheathca. 5-6.5 cm, fringes of white hairs at leaf sheath, margin hyaline at young stage later small hairs at old stage, multi-veined; ligule ca. 3-3.5mm; hairs white at the margin. Inflorescence a racemose panicle, branched; panicle ovate to elliptic, spikelet pedicel ca. 0.4-0.6 cm; spikelet to spikelet rachila length ca. 0.4-0.6cm, green, cilia small at pedicel and rachila, green; spikelet ca. 3 x2 mm, lanceolate, 5-flowered, greenish to purple green; peduncleca. 5-15.5cm. Outer glumeca. 0.5 x 0.2 mm and upper glume ca. 0.7-0.9 x 0.5mm, both glumes lanceolate, apex acute, margin smooth, midrib slightly prominent, slightly green to hyaline. Lemma ca. 1-1.2 x 1mm, oblanceolate, 3-veined; serrulate projected midrib, slightly green to hyaline, apex \pm toothed. Paleaca. 1 x 0.5-0.7mm, lanceolate, apex \pm toothed, 2-veined, small hairs at keel. Anthers 3,ca. 0.3 x 0.2mm, brown; filament ca. 0.2 mm, vertically attached. Ovary cylindrical to lightly globose, 0.2mm; style and stigma ca. 0.3mm.

FL. Per.: July-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2382

(PMAS-AAUR).

Field remarks: A common grass very commonly found in interdunal areas.

Distribution: Pakistan to tropical and warm temperate regions of the Old World.

Herbarium Note: lemma wing like margin; oblanceolate shape, apex tooth like.

Palea apex tooth like, lanceolate shape.

3. *Eragrostis ciliaris* (L.) R.Br. in Tuckey, Narr. Exp. Congo App. 478 (1818).

Culms ca. 30-40 cm, green, multi-veined; internodes ca. 4-6cm, node ca. 0.5-1mm; brown in color, shiny. Leaves blade ca. 8.4-9 x 0.3-0.4cm, multi-veined, glaucous, apex acute, green. Ligule ca. 0.5-1mm with fringe of hairs, ligule yellow. Leaf-sheath ca. 2.6-5cm, sparsely hairy with watery glands, multi-veined. Inflorescence a racemose panicle, ca. 11-14 cm, branched, rachila to rachila branch distance ca. 0.5cm; spikelet pedicel ca. 3-4.5mm; spikelet ca. 3 x 1mm, 5-flowered; peduncle ca. 2.5-3cm, rachila and peduncle ciliated. Lower glume ca. 0.5-0.8 x 0.5 mm, upper glume ca. 1-1.2 x 0.5 mm, both lanceolate, hyaline green in color, apex acute, midrib ciliated. Lemma ca. 1-1.3 x 0.5-0.8 mm, ovate, apex acute, hyaline green, 3-veined. Palea ca. 1 x 0.5-0.7 mm, apex rounded, margin hairy. Anther 3, sac ca. 0.3-0.5mm; filament ca. 0.3 mm long, vertically attached. Ovary very small, elliptic to obovate, apex pointed, light yellow to white; style ca. 0.2mm, straight; stigma ca. 0.3 mm. Seed ca. 0.3-0.5 x 0.2 mm ovate to obovate, golden brown.

FL. Per.: Through-out most of the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2573 (PMAS-AAUR).

Field remarks: A very common grass of sandy soil.

Distribution: Pakistan to tropical and South Africa, Arabia, the Mascarene Islands to India and tropical America.

4. *Eragrostis minor* Host, Gram. Austr. 4: 15 (1809).

Culms ca. 14-16cm; internodes ca. 0.7-2.5cm, greenish yellow; nodes ca. 1-2mm, reddish brown, leaves clustered at the base; hairs white, ca. 2-4mm at the base of leaf blade, 1-celled. Leaves blade ca. 1.6-2 x 0.4-0.5 cm, multi-veined, glaucous, densely hairy at upper surface, green; veins with serrulate projections, margin greenish yellow, watery glandes at upper surface; ligules with long dense fringes of white hairs at outer margin. Leaf sheath ca. 1.5-2 cm, light green, multi-veined, few hairs on leaf sheath and watery glands on venation. Inflorescence a racemose panicle, ca. 4-5cm; peduncle ca. 4.5-5 cm; rachila to rachila branched distance ca. 0.3-1cm. Spikelet ca. 0.7-0.8 x 0.2-0.3 cm; liner to lanceolate, 11-12-flowered, pinkish green to grey, spikelet pedicel ca. 0.3-0.4cm. Lower glume ca. 1.5-1.7 x 0.5 mm, upper glume ca. 2-2.2 x 1 mm, both glumes lanceolate, apex acute, pinkish to brown, midrib prominent, projected, few glandular dots at midrib. Lemma ca. 1.5-1.7 x 1mm, ovate, apex acute, 3-veined, hyaline to pinkish grey, few glandular dots at midrib inner and outer side. Palea ca. 1-1.5 x 1mm, narrow at base, apex broader, hairs small at both keel sides. Anther 3, sac ca. 0.3-0.5mm; filament ca. 0.3 mm long, vertically attached. Ovary elliptic to ovate, very small, light yellow to white color, ca. 0.2mm; style stright; stigma ca. 0.3mm. Seed cylindrical to obovate, color golden brown, ca. 0.3-0.5 x 0.2mm.

FL. Per.: May-September

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2375 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab, K.P.K., Gilgit & Kashmir); warm temperate and subtropical regions of the Old World.

5. *Eragrostis superba* Peyr. in Sber. Akad. Wiss. Wien. Math. Nat. 38: 584 (1860).

Culms ca. 30-40cm, shiny, multi-veined, green; internodes ca. 4-6cm, nodes ca. 0.5-1mm, brown. Leaves blade ca. 8.4-9 x 0.3-0.4cm, multi-veined, glaucous, apex acute, green color, margin hyaline and serrulate projected. Leaf-sheath ca. 2.6-5cm, few small hairs at sheaths, multi-veined. Ligule ca. 0.5-1mm, hair in fringes inner side and small hairs at margin, yellow. Inflorescence a racemose panicle, ca. 11-14cm, branched; peduncle ca. 5-7cm; rachila to rachila distance ca. 0.5-4cm, rachila and peduncle ciliated. Spikelet ca. 3 x 1mm, 5-flowered, obovate; spikelet pedicel ca. 3-4.5mm. Lower glume 1, ca. 0.5-0.8 x 0.5mm, upper glume ca. 1-1.2 x 0.5mm, lanceolate, hyaline to green, apex acute, midrib prominently ciliated. Lemma ca. 1-1.5 x 0.5-0.8mm, ovate, apex acute, hyaline to purple, 3-veined. Palea ca. 1 x 0.5-0.7mm, apex rounded, hairs small at margin. Anther 3, sac ca. 0.3-0.5mm; filament ca. 0.3mm long, vertically attached. Ovary elliptic to ovate, very small, light yellow to white; style ca. 0.2mm; stigma ca. 0.3mm, brown. Seed ovate to obovate, color golden brown, ca. 0.3-0.5 x 0.2 mm, shiny.

FL. Per.: Throughout the year

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2097 (PMAS-AAUR).

Distribution: Pakistan (Sindh) to tropical and South Africa.

IMPERATA

Imperata cylindrica (L.) Raeuschel., Nom. Bot., ed. 3, 10 (1797).

Culm ca. 30-45cm, yellowish green in color, shiny, glabrous; leaves mostly crowded at the base; internodes ca. 5-6cm; nodes hairy; hairs ca. 1-2mm. Leaf sheath ca. 2-3cm; basal leaf blade ca. 5.8-8.5cm; ligule membranous and upwardly directed, ca. 1-1.3mm, nodal leaf blade ca. 3-3.8 x 0.2-0.3cm, apex broadly acute, margin smooth, hyaline slightly serrulate, midrib prominent and yellow in color, multi-veined. Inflorescence a racemose panicle, ca. 4-5cm x 0.5-0.7cm; peduncle ca. 16.5-22.5 cm, each spikelet awned, ca. 1-1.2cm. Glumes 2, lanceolate apex acute, base broad, hyaline, ca. 3 x 1mm. Lemma 2, unequal, lower lemma acuminate, ca. 2-2.5 x 1.5mm, hyaline; upper lemma ca. 1-1.5 x 1mm hyaline. Palea undulated, apex pointed, palea cover the ovary from the lower side, ca. 1 x 1mm, hyaline. Anthers 2, ca. 2-3mm long; anther and filament ca. 1.5-2.5 x 1mm, yellow. Ovary ca. 1mm x 0.4mm, cylindrical, brown in color; stigma 2, ca. 3-2mm, yellowish to brown in color; style 2, 1mm.

FL. Per.: April-June.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2092 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab, N.W.F.P., Gilgit & Kashmir) and Old World tropics, extending to the Mediterranean and the Middle East as well as Chile.

LASIURUS

Lasiurus scindicus Henr. in Blumea. 4: 514. 1941.

Culmsca. 40-90 cm, greenish yellow, internodes ca. 7.5-9cm, small hairy stem, nodesca. 1mm, small hairs on node, nodes color brown. Leaves blade ca. 9-12 x 0.5cm, , apex acute, near ligule leaf blade margin brown and setose hairs, hairs

base brown rounded and apex pointed, multi-veined, midrib prominent, venations have serrulate projection. Liguleca. 0.3-0.4mm, ligule have fringes of white 1-celled hairs and also margin, leaf sheathca. 4-6cm, smooth leaf sheath, multi-veined, green to light green. Inflorescence: racemose panicle, peduncleca. 20-30cm, panicleca. 6.5-9.5 x 0.5cm, yellowish green, 3 types of spikelets at each node, 2 sessile and one pedicel spikelet, one Peduncle flower and 2 sessile flower. Pedicel flower: two sterile male flowers in pedicel flower, pedicel length ca. 0.4cm, spikeletca. 0.8cm x 0.3cm, one of two flowers have large anthers sac than other, lanceolate, greenish yellow, apex acute. Lower glume ca. 0.7-0.8 x 0.3cm, having two keels structure subcoriaceous, creamy, silky hairs outer surface, upperca. 0.5-0.6 x 0.2cm, glume thin and hyaline, lanceolate, apex acute. both flowers have same lemma ca. 6-6.5 x 2-3mm. paleaca. 4 x 2 mm, both flower have same palea but small anther flower palea have small hairs on keel than other, both lanceolate and apex acute, both have two keels at margin. Anther sacca s large one ca. 3mm and small one ca. 2mm, small filaments. Sessile flower: flowers same lemma and palea as pedicel flower, have one sterile flower and fertile flower, fertile flower have anther sacca. 4mm and very small filament, stigma bushyca. 4mm and style ca. 3mm ovary very smallca. 1-1.5 x 1mm, globose. Sterile flower antherca. 3mm with small filament, small hairs at palea keels.

FL. Per.: March-May and September-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2542 (PMAS-AAUR).

Distribution: Pakistan to Northwest India, Iraq, tropical Arabia, Egypt, Ethiopia, Somalia and Mali.

Herbarium Note: Small hairs present at outer side of the leave sheaths at the node joint. Small hairs on the palea keel.

LEPTOCHLOA

Leptochloa panicea (Retz.) Ohwi in Bot. Mag., Tokyo. 55:311. 1941.

Plant annual, culms ca. 60-80cm; yellowish green, internodes is 4.6-5cm, nodes color brownish red. Leaves blade thin lanceolateca. 14.5-18cm, long hairs at upper leaf side but very few hairs at margin, apex acute, margin hyaline with projection multi-veined, glaucous surface. ligule, ligules membranous; ca. 0.5-3mm long. leaf sheath length ca. 6-7cm, long thin hair 1-celled,ca. 3-4mm at margin, multi-veined and each venation serrulate projects, greenish yellow, hairs gradually dens toward near ligule. Inflorescence: racemose, having segmented, each segment length ca. 6.5-7cm long, peduncle length ca. 11-14cm, Inflorescenceca. 25-26cm, segments cluster oppositely, rachila weged shape with serrulate projections. Spikelet: each spikelet in paired flowers, small pedicel, elliptic. both flowers are in same glumes, both glumes ca. 1-1.3 x 0.5-1mm , upper glume broader than lower, apex acute to acuminate, liner to lanceolate, both serrulate projected midrib, hyaline to green. Lower floret smaller pedicel than upper flower. lemmaca. 1x1.2mm, elliptic, projected green midrib, minutely hairs at margin and surface, seeds 0.5 x0.3 mm broadly elliptic, long, brown.

FL. Per.: March-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2288 (PMAS-AAUR).

Distribution: Pakistan, Sudan to Transvaal and Natal, West Africa and tropical Asia.

OCHTHOCHLOA

Ochthochloa compressa (Forssk.) Hilu in Kew Bull. 36: 000 (1981).

Culmsca. 25-30cm, green, stiff, internodes ca. 3.5-5cm, nodesca. 1mm; yellow and multi-veined. Leaves blade ca. 2-2.5 x 0.2cm, white spiny hairs at leaves blade near ligule, hairsca. 2mm, apex acute, stiff structure, hairs dens near ligule side but less on whole leaves blade, midrib prominent, leaf blade outer surface midrib glandular, margin hyaline and serrulate projections, green young stage but at maturity margin turn brown. Ligule have fringes of hairs, hairs one-celled white color, Leaf-sheath ca. 2-4.2cm, midrib prominent, multi-veined, margin hyaline sometime turn brownish. Inflorescence: racemose panicle, peduncle ca. 8.5-10cm, Inflorescence divided to 4 digitate, each digit length ca. 3.4 x 0.4cm, greenish brown, on rachilla spikelet alternatively arranged, 3 flowers in each spikelet, spikeletca. 4.5-5 x 2mm, each flowerca. 3-3.5 x 1-1.5mm. outer glume small ca. 2 x 1-1.5mm and upper glume ca. 3 x 2mm, both lanceolate, midrib brown, projections at midrib, apex brown and acute, hyaline green and smaller than lemma. Lemmaca. 3.5-4 x 2mm with small awns, lanceolate, apex acute, 3-veined; hairs at venations, brownish green to hyaline, stiff to semi coriaceous. Paleaca. 3 x 1-1.5mm, two hairy keels, elliptic, hyaline green, apex acute. anther 3,ca. 1.5 x 0.3mm, yellow, small filament, ovary smallca. 2 x 1mm, ovate to oblong. 1mm stigma, style ca. 0.5mm.

FL. Per.: March-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2530 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab & N.W.F.P.); Northwest India to North Africa.

PANICUM

Panicum psilopodium Trin., Gram. Pan. 217 (1826).

Culms ca. 15-75cm long, internodes distance ca. 8-14cm, nodeca. 1-3mm, small feathery hairs at nodes; node color yellow, ridge and furrows. leaf bladeca. 12-16.5 x 1.6-1.8cm, green color, parallel venation and whitish yellow color, linear to lanceolate shape, apex acute, rough texture, margin hyaline with serrulate margin. ligule membranous, leaf sheath have multiveined, liguleca. 1-1.5mm, small hairs on ligule outer surface. Leaf sheathca. 5-7cm, hairs at leaf sheath outer surface at node attachment; also leaf sheath margin, leaf sheath margin hyaline. Inflorescence: branched panicle racemose, Peduncleca. 9-12cm, Inflorescenceca. 18.5-20cm, rachilla branched to branched distance; rachilla serrulate hairs and angular shape, spikelet pedicelca. 0.5-1mm, spikelet is 2-2.5 x 1mm. lower glume smallca. 1 x 1-1.5mm; $\frac{3}{4}$ to upper glume, apex acute to capitate, cup shape encircle whole spikelet; membranous midrib prominent, margin smooth and hyaline, serrulate margin and serrulate projection on midrib. upper glumeca. 2-2.5 x 1-1.5mm lanceolate to elliptic, apex acute to caspidate, green to hyaline, 8-9 parallel veined, margin thin and hyaline. Male lemma same as upper glume, male Paleaca. 2-1mm; sidewise covered by lemma; hyaline to light green, thin texture, elliptic – lanceolate shape. 3-anther and yellow, anther sacca. 1-1.3 x .3mm, very small anther filament, vertically attached, anther sac two chambers, each chamber apex acute and base. Female lemmaca. 1.5-2 x 1mm, hard texture but smooth and shiny whitish hyaline color, apex acute mid vein slightly

visible, oblong to elliptic, palea same as lemma, ovary brown color; 2 stigma and style, stigma small feathery, style is straight, ovary globose ca. 1 x 1mm .

FL. Per.: August-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2155 (PMAS-AAUR).

Distribution: Pakistan, India, Burma, Ceylon and Malaysia.

PASPALUM

Paspalum dilatatum Poir. in Lam., Encycl. Meth. Bot. 5:35. 1804.

Culmsca. 40-60cm, internodes ca. 7-12cm, greenish yellow, older part hard and young part herbaceous, multi-veined, nodes 0.5-1mm; nodes reddish brown. Leaves bladeca. 12.5 x 0.4cm, ligule near leaves blade margin hairs have; hairs emerge from brown rounded buds, multi-veined, margin hyaline projection. leaves ligule membranous and hairs at ligule margin, Leaf-sheathca. 6.5-8.5cm, white hairs ca. 3-4mm long at margin leaf sheath, margin hyaline, multi-veined, greenish yellow. Inflorescence: peduncleca. 12-15cm, Inflorescence divide in two digitate, each digitateca. 6-8 x 3mm. rachila flat and wedge shape, margin hyaline and slightly serrulate. Spikelets arranged rachila one side, spikelets densely attached to rachila, Spikeletsca. 3 x 1.5-2mm, spikelet sessile, elliptic, glabrous, greenish yellow. Outer glumeca. 2.5 x 1mm, lanceolate, 3-membranous, apex acute, green, smooth margins. Upper glumeca. 3.5 x 2mm, 3-membranous, concave to elliptic, apex acute, outer surface have small hairs at maturity and glabrous at mature stage. Lower lemma like glume, ca. 3 x 2-2.1mm, 3-membranous, apex acute, concave to elliptic, green. Upper lemmaca. 3 x 2mm, greenish white concave to elliptic hard coriaceous, apex acute. Paleaca. 2 x 1.5mm like upper lemma. 3-Anther sacca. 1-

1.2 x 0.7mm, both chambers rounded at the apex and narrow at the base, dark brown, filament length ca. 1.5-2mm, stigmata. 1-1.2mm, feathery dark brown, styleca. 1mm brown. Ovary cylindricalca. 0.5 x 0.2mm.

FL. Per.: August-October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2438 (PMAS-AAUR).

Distribution: Pakistan, South America.

PHALARIS

Phalaris minor Retz., Obs. Bot. 3:8. 1783.

Culmsca. 30-40cm, internodes distance ca. 6-11cm, yellowish green, multi-veined, nodesca. 0.7-1mm. Leaf bladesca. 7-12 x 0.5-0.6cm, multi-veined, greenish brown, margin hyaline, smooth on upper surface and serrulate projection on lower surface venations, margin hyaline and projections, ligule large hyaline membranous. Leaf sheath ca. 5cm, multi-veined, greenish yellow, margin hyaline. Inflorescence: peduncle ca. 10.5-12cm, panicle densely packed panicleca. 4 x 1.5cm, greenish yellow, spikeletca. 4-4.5 x 2mm, lanceolate-ovate, apex acute, hyaline green color, small hairy pedicel, 3-flowers at each spikelet, glumes persistent. Fertile spikelet: Both glumes sameca. 4.5-5 x 2.5mm, 4-membranous wings at midrib, apex mucronate, pubescent. Lemma: 3-3.2 x 2mm, grey to light green, broadly lanceolate, greenish hyaline, apex acute. Palea: 2.7-3 x 1.7mm, lanceolate, apex acute, hyaline. 3-Anther,ca. 1.5-1.7 x 0.3mm, yellow in color. Sterile spikelet:ca. 1.1-1.8 mm, long or very short and only 0.2-0.3 mm long, glabrous.

FL. Per.: March-May.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2125 (PMAS-AAUR).

Distribution: Pakistan, Mediterranean region and eastwards to Baluchistan and the Northwest Himalayas.

PHRAGMITES

Phragmites karka (Retz.) Trin. ex Steud., Nom. Bot., ed. 2, 2:324. 1841.

Culm ca. 9-10cm long, Perennial long green, stiff plant, internodes ca. 15-30cm, young part have small internodes internodes than older one, become harder at maturity. Leaves blade ca. 19-8.5 x 2-5cm, stiff and hard, apex acute, margin hyaline with serrulate projection, lanceolate, ligule yellowish brown. Ligule 1-3.5mm, auricle is present, ligules long white ca. 2-3mm long hairs at inner side and margin ligule, leaf sheath ca. 11-30cm, multi-veined, yellowish green. Inflorescence: peduncle ca. 20-45cm long, hard and stiff, panicle ca. 20-35 x 10cm, rachilla internodes ca. 4-3cm, spikelet lanceolate, brownish green, 3 flowers at each spikelet, Spikelets ca. 9-12 mm long. Lower glume ca. 2-3 x 2mm, elliptic, apex acute, greenish yellow color. Upper glume 4-6x2-2.3 mm, narrowly elliptic to very narrowly elliptic, acute to narrowly acute. lowest lemma 7.5-12 mm long, narrowly elliptic, green to hyaline. Fertile lemmas 8.5-11 mm long, very narrowly lanceolate, green. Palea: 4-6 x 3mm long, narrowly lanceolate, green to hyaline.

FL. Per.: April-November.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2476 (PMAS-AAUR).

Distribution: Pakistan, tropical Africa, Polynesia, northern Australia and tropical Asia.

POA

Poa annua L., Sp. Pl. 1: 68. 1753.

Culmsca. 23-30cm, multi-veined, herbaceous, internodes ca. 9-11cm, nodesca. 3mm; greenish yellow. Leaves blade ca. 6-10 x 0.3cm, multi-veined, small hairs outer surface, green, apex broadly acute, margin hyaline with projections, midrib prominent. Ligule ca. 1-1.5mm; yellowish brown, fringes of hairs inner side of ligule; hairs yellowish white. Leaves sheath ca. 4-6cm, multi-veined, hyaline hairy margin, light green. Inflorescence: peduncle ca. 5-6cm, racemose, spikelet arranged in form of branches groups, one branch to other branch distance ca. 2.3-2.5cm, each branch length ca. 1.5-2.8cm, each branch 5-8 spikelets, branches loosely arranged in pair form. Spikelet: spikelet is 6 x 3-3.5mm, green in color, pedicel spikelet ca. 3mm, flowerca. 2 x 1mm, 5 flowers at each spikelet, flowers sessile, outer glume ca. 2.5 x 1mm, one membranous, apex broadly acute, margin hyaline, elliptic, green. Upper glume ca. 3 x 2mm, ovate, hyaline margin, apex broadly acute, 3-membranous, elliptic, and green. Lemma 3 membranous, hairs at membrane, hyaline margin, apex rounded, oblong to elliptic. Palea has two keels have hairs on the keel, apex acute and cleft at the apex, elliptic, hyaline green in color. Anther small ca. 0.5 x 0.3mm, yellowish white, stigma ca. 0.5mm, style ca. 0.3mm, ovary ca. 2 x 1mm, cylindrical, seeds brownish, shiny, apex acute.

FL. Per.: Throughout most of the year, especially March-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2380 (PMAS-AAUR).

Distribution: Pakistan (Baluchistan, Punjab, N.W.F.P. & Kashmir)

SACCHARUM

1a. Panicle 20-75 cm long; peduncle glabrous.....1. *S. bengalense*

1b. Panicle 25-40 cm long, peduncle hairy.....2. *S. spontaneum*

1. ***Saccharum bengalense*** Retz., Obs. Bot. 5:16. 1789.

Culmsca. 80cm-4m, hard at base and herbaceous at young stage, yellowish to brown, cluster of leaves at young stage at the base, nodesca. 30-38cm x 1cm, yellowish green, midrib hard thick and yellow, glabrous, apex narrowly acute, margin sharp serrulate hyaline or at maturity sometime reddish. Ligule ca. 0.5-1mm, membranous, white fringes of hairs at ligule at inner side and margin, leaf sheath is multi-veined, at maturity leaf sheath become reddish brown at inner side, leaf sheathca. 17.5-20cm. Inflorescence: peduncleca. 62-70cm, peduncle glaucous, panicle elliptic to oblanceolate, panicleca. 25-50cm, rachilla to rachilla length ca. 1-2cm, branch length ca. 5-10cm, spikelets in pairs, spikelets equal both reddish. Spikelets heteromorphous slightly, spikelets length ca. 3.8-5.5x3.5 mm long, pedicelled spikelet: glumes equal; both glumes have whitish or greyish hairs ca. 2.5 mm long, membranous, sessile spikelet lower glume have 4 mm hairy at surface and upper glume glabrous, the hairs at least long, lower lemma oblong-elliptic; ca. 9 mm hairy at outer surface. Upper lemma ovate-lanceolate, ciliate at margins, awn acute or small. Palea. 3-3.2x2.8mm, hyaline, lanceolate, apex acute.

FL. Per.: October-January

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2374 (PMAS-AAUR).

Distribution: Pakistan, North and Northwest India and Afghanistan.

Herbarium Note: At maturity hyaline serrulate margin converted in to reddish hyaline, Leaf-sheath reddish brown at inner side.

2. *Saccharum spontaneum* L., Mant. 2:183. 1771.

Tall Perennial grass; culms ca. 2-4 m high or more, yellowish green, harder at base and herbaceous at above, nodesca. 0.7-1.2mm; greenish brown, internodes and pedicels hirsute. Leaf-blades ca. 0.5-2m x 3-7.5mm, tapered at apex and towards the base narrow wing at margin of petiole, glaucous. Panicle ca. 25-40 (-60) cm long. Inflorescence: racemes 3-15 cm , peduncle usually hairy; usually much longer than other branches. Spikelets in pairs, Spikelets alike, 2.5-5(-7) mm long, glumes equal; bearded with silky white hairs 2-3 times as longer as spikelet, subcoriaceous at lower third, glabrous outer side. Lower lemma often ciliate margins; lanceolate to elliptic. Upper lemma ciliate at margins; very narrow with short awn.

FL. Per.: October-January.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2377 (PMAS-AAUR).

Distribution: Pakistan and warmer regions of the Old World.

SPOROBOLUS

Sporobolus arabicus Boiss., Diagn. ser. 1, 13: 47 (1853).

Culms ca. 30-44cm, stem color yellowish green, multi-veined, internodes ca. 7.5-10.5cm, nodes color yellow, node ca. 0.5-1mm. Leaves bladeca. 7 x 0.6-0.7cm, apex broadly acute, lanceolate, hard and stiff, multi-veined, midrib prominent, glaucous at upper side, greenish yellow, hyaline margin with serrate hairs, hairs hyaline. hard texture, ligule membranous;ca. 2mm. Leaf-sheathca. 4-

5.5cm, multi-veined, glaucous inside, Inflorescence: racemose panicle, peduncleca. 15-20cm, panicleca. 12 x 3cm; elliptical, rachila branched, and each branched further divided, small hairs at rachila and pedicel, spikelet pedicelca. 1.5mm, spikelet ca.1.5 x 0.5mm, smooth or scaberulous, spikelets are desly cluster at the panicle base. Glumes: outer glume ca. 1x0.5-0.7mm, elliptical, broadly apex acute, hyaline. upper glumeca. 1.3-1.5 x 0.7mm, elliptical, hyaline brownish, small serrate hairs at outer midrib of upper glumes and at apex, apex broadly acute, lanceolate to elliptical. Lemma:ca. 1.5 x 1.7mm greenish hyaline brown color, liner to lanceolate, apex obtuse to broadly acute. paleaca. 1.5 x 1.7mm, hyaline and delicate, liner to lanceolate, apex obtuse to broadly acute. 3-Anther ca. 1mm long, yellow, small filament, vertically attachment. Ovary small globose, stigma and style small and feathery light brown in color, Grain ellipsoid, 0.8-1.2 mm long.

FL. Per.: March - October.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2531 (PMAS-AAUR).

Distribution: Pakistan (Sindh, Baluchistan, Punjab & K.P.K.); Arabia, Iran and India.

SCHISMUS

Schismus arabicus Nees, Fl. Afr. Austr. 1: 422 (1841).

Culms ca. 7-10cm, plant form cluster of branches and leaves at base plant, herbaceous, greenish, internodes ca. 1.5-2.5cm. Leaves bladeca. 1.5-1.7cm x 0.2cm, leaves role up at plant mature, leaves margin hyaline with projection, apex acuminate dark, green. fringes of white 1-celled hairs on ligule and small hairs at margin, hairs 3-4mm. Leaf-sheathca. 1-1.2cm, dark to light green, multi-veined,

hyaline margin, Inflorescence: racemose, peduncleca. 2-3cm, yellowish green, panicleca. 1.5 x 0.5cm, rachila to rachila distance ca. 0.2-0.3cm, spikelet small padicle ca. 0.1-0.2cm, small hairs on rachila, spikelet lanceolate, presistent glumes, 4-10 flower in each spikelet. lower glumesca. 4-4.5 x 1.5mm, 8 membranous, apex acute, lanceolate, margin hyaline, upper glumeca. 5 x 1mm, lanceolate, 3- membranous, green, hyaline margin. Lemmaca. 2-2.5 x 1-1.5mm, den hyaline to white hairs outer surface and at margin, lemma tooth like apex, shape 3-angular, hyaline green, 2-membranous. Palea ca. 2 x1mm, wing like hyaline margin and lanceolate, sparsely hairy. ovary ovates;ca. 0.7-1 x 0.2mm, having two small small stigma. Seed ca. 0.7-0.8mm x 0.3mm, ovate to oblong, apex rounded and broad base, shiny brown in color, embryo prominent at base.

FL. Per.: February-May; up to July in the mountains.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2492 (PMAS-AAUR).

Distribution: Pakistan from greece and Libya eastwards through Arabia to Central Asia.

Herbarium Note: Lower glumes 7-8 membranous, Spikelets have 6-10-flowered

SETARIA

1a. Panicle cylindrical, rhachis tomentellus, spikelets ovate.....1. *S. pumila*

1b. Panicle lanceolate, rhachis scaberulous to puberulous,

spikelets broadly elliptic.....2. *S. intermedia*

1. *Setaria pumila* (Poir.) Roem. & Schult., Syst. Veg. 2:891. 1817.

Culms ca. 60-80cm, lower stem hard after maturity, mature stem yellowish brown, internodes ca. 8.5-12.5cm, stem smooth, shiny. leaves bladeca. 15-20cm x

0.7cm, apex acute, margin reddish purple and small serrulate projections, mid-veins prominent, multi-veined, venations smooth, leaf glabrous. leaf sheath color yellowish green at young stage yellow at maturity, shiny surface, ligule membranous; ca. 1mm. Leaf-sheath is 11-15cm, multi-veined, mid-vein yellow color; prominent and very hard. Inflorescence: racemose, peduncle ca. 40-45cm, panicle ca. 15-17 x 0.7cm, spikelet pedicel ca. 0.5-1mm, spikelet ca. 2 x 1mm, 2 flowers at each spikelet, small hairs at rachilla, spikelet spines 8 numbers; cilia on spines, all unequal ca. 5-8mm, jointed at base all form crown, outer and inner glumes ovate, apex broadly acute, three veined, hyaline to light yellow, margin smooth, outer glume ca. 1-1.5 x 1mm and inner glume ca. 2 x 1mm. male flower: Lower and sterile, lemma ca. 2-2.5 x 1mm, lanceolate, lemma venations 5-9 numbers, apex acute, purple pigment outer surface, palea ca. 2-2.5 x 1mm, very thin covered by lemma, hyaline, apex acute, have 2-3 venations. 2 lodules, 3-anther, anther sacca. 1.5 x 0.5mm, brown, small filaments vertically attached, Female flower: lemma ca. 2 x 1mm, acuminate apex, ovate to oblong, projection catenous structure, light yellow to white in color, palea same as lemma slightly rugose to corrugate, inward to lemma, acuminate apex, ovary cylindrical ca. 1-1.5 x 0.5mm, yellowish brown color, stigma feathery ca. 1mm, style 1mm long.

FL. Per.: June-October

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2149 (PMAS-AAUR).

Distribution: Pakistan and tropical and warm temperate regions of the Old World.

2. *Setaria intermedia* Roem. & Schult., Syst. Veg. 2: 489. 1817.

Culms ca. 25-30cm, stem multi-veined, greenish to light yellow in color, internode ca. 4-6cm, reddish brown nodes color. Leaves: leaf blade length ca. 8-9 x 2.6cm, lanceolate, midrib prominent, strigose hairs at both leaves surface, margin hyaline serrulate margin, midrib prominent, green to dark green. Ligule membranous, yellow, ligule ca. 2-3mm, leaf apex acute. Leaf sheath ca. 3-4.5cm, multi-veined, green, strigose hairs at outer surface, mid-vein prominent, strigose hairs at venation. Inflorescence: panicle racemose, peduncle length ca. 7cm, panicle length ca. 3.5-4.5cm, panicle color greenish yellow, spikelet ca. 2-2.5 x 1mm, elliptic, yellowish green one spine at each spikelet with cilia, small pedicels, spine ca. 5-7cm; sticky. Lower glume ca. 0.5 x 0.6-1mm, cup shape that circle whole spikelet, green mid rib, broadly apex acute, hyaline to green, upper glume ca. 2 x 1mm, 5 veined, elliptic, apex broadly acute, hyaline to green. Lemma: lower lemma ca. 2-2.5 x 1mm, elliptic, 5 veined, hyaline to green, apex acute, deep at base, rugose, acute to acuminate apex, apex brown, elliptic, palea like upper lemma but thin memberous than upper lemma, both color whitish yellow apex acute, elliptic, ca. 2-2.5 x 1mm. anther: anther ca. 1 x 0.2-0.3mm, yellow, very smooth anther filament, vertically attached with filament, ovary cylindrical ca. 0.3-0.4 x 0.1mm, two lodules, ovary stigma feathery brown, ca. 0.5mm, style ca. 0.5mm.

FL. Per.: September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2399 (PMAS-AAUR).

Distribution: Pakistan, India, Burma and Sri Lanka.

Note: Leave sheath venation have strigose hairs and strigose hairs on the leaf blade upper and lower surface.

Herbarium Note: Female flower description not present in literature.

SAPEXAGROSTIS

Sapexagrostis plumosa (L.) Munro ex T. Anderss. in J. L. Soc., Bot. 5, suppl. 1: 40. 1860.

Culmsca. 40-45cm, greenish white, hard at maturity but soft at younger stage, nodes length ca. 4-6cm and node length ca. 0.5mm; yellow. Leave blade ca. 6.3-10 x 0.3cm, at maturity leaves curls upward, whitish green, multi-veined, venation serrulate projected, apex acute. Ligule ca. 1mm, membranous, yellow. Leave sheath is 4-7cm in has hard at maturity, multi-veined, at young leaf sheath inner side have white hairs. Inflorescence: racemose panicle, peduncle length ca. 6.5-13cm, panicle ca. 9-13cm, rachilla to rachilla length ca. 0.5-1.5cm, spikelet length ca. 2.8cm-3cm, spikelet color greyish purple, pedicel length ca. 0.5cm. Lower glume ca. 6 x 0.3mm long, greenish purple color, lanceolate shape, apex acute, upper glume ca. 7 x 0.3mm, lanceolate shape, apex acute, greyish purple. Lemma 2.5-4 mm long, lemma have three awns; larger one at middle and other two on sides, middle one ca. 3.4cm and other two ca. 1.5cm, side two awns have cilia on awns and middle one have wings like white hairs on awn, palea absent sample, seed ca. 0.5cm, cylindrical, whitish golden, pointed at the base and broader at the apex.

FL. Per.: Throughout much of the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2375 (PMAS-AAUR).

Distribution: Pakistan, Mediterranean region and the Middle East.

TRAGUS

Tragus roxburghii Panigrahi in Kew Bull. 29: 495 (1974).

Culms plantca. 8-10cm, internodes ca. 1-2cm, herbaceous, green to light green, glabrous, nodeca. 0.3-0.5cm, dark brown to purple. leaf bladeca. 1.4-1.5 x 0.3-0.4cm, multi-veined, apex acute, margin hyaline with 1-celled hyaline setose hairs, pointed apex and base broad, mid rib prominent, green to light green. Ligule membranous, ca. 0.5-0.7mm. leaf sheathca. 1cm, glabrous, multi-veined, green to light. Inflorescence: peduncleca. 1-1.4cm, panicleca. 2-2.4cm x 0.6cm, greenish yellow, panicle cylindrical, spikelets opposite in arrangement, rachila wedge shape, small hairs on each corner, spikelets lanceolate, spikeletca. 0.4 x 0.1cm, greenish yellow, hooked hairs at spikelet, flower opposite in each spikelet. Lower glume 2.5-2.7 x 1mm, upper glumeca. 3-3.5 x 1mm, lanceolate, 5-membranous; each membranous hooked hyaline hairs, glumes color green to light green, apex acute. Lemmaca. 2.5 x 0.5-0.7mm, hyaline but midrib yellow, hairs like projection on midrib, apex acute, lanceolate. Paleaca. 2.5 x 0.5-0.7mm, midrib not prominentca. 2-0.5mm, small, apex acute. 3-anthers, antherca. 0.5 x 0.3mm, ovate, yellow. ovary ca. 0.7-1 x 0.2mm, cylindrical, hyaline to light yellow. small two small stigma and styles.

FL. Per.: Most of the year.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2528 (PMAS-AAUR).

Distribution: Pakistan, South-east Asia and East Africa.

THEMEDA

Themeda triandra Forsskål, Fl. Aegypt.-Arab. 178. 1775.

A perennial tussock-forming grass; culms ca. 1 m high, turning hard at maturity, glabrous, yellowish brown; internode ca. 20-25 cm, nodal diameter ca. 4-5mm, yellow to brown and farinose. Leaf blades ca. 39 x 0.5cm, apex acute to acuminate, adaxially rough, veins 10-20, midrib prominent, margin with brown serrulate projections; ligule 1.5-2.5 mm, membranous, ciliate. Leaf sheath ca. 15-23 cm long, hispid with tubercle-based hairs, greenish brown. Peduncle ca. 20-25 cm; panicle ca. 10-28 x 5-7 cm; lax, open, nodal distance 4-5cm, racemes in spatulate fascicles; spathes and spatheoles narrowly lanceolate, ca. 4-5 x 0.5 cm in , glabrous to densely tuberculate-hispid. Raceme composed of a triad of 1 sessile and 2 pedicelled spikelets above involucre of 2 homogamous pairs, green to reddish yellow gradually turned at maturity. Homogamous spikelets sessile, arising from the same level, both glumes ca. 9-10 x 1-1.5mm, lanceolate with lateral scarious wings, margins hyaline, apex acute, tubercle-based hispid hairs towards tip, with 3 membranous veins. Lemma ca. 5-6 x 1-1.3 mm, marginal keels two covered with hyaline hairs, tip of both lemma and palea rounded. Sessile spikelet staminate, 6-7 x 2mm; callus 2-3 mm, brown bearded; lower glume dorsally rounded, brown, glossy, hispidulous in upper 1/3, smooth below, lanceolate, hard to membranous; awn 5-7 cm, brown, twisted and pointed at apex, persistent. Anther sac ca. 3 x 0.5mm, brown; filament small vertically attached to anther sac; ovary globose, ca. 0.5 x 0.5 mm; style ca. 1.2-1.3 mm, brown; stigma brush type, ca. 0.2mm. Pedicellate spikelets ca. 7-14 x 2mm, male sterile, green, emerging from brown bearded callus with single glume, ca. 1cm; green, spatula membranous, apex acute; lemma ca. 0.6-0.7 x 0.2 cm, palea ca. 0.5 x 0.1cm; same as homogamous spikelets. Fruit an awned caryopsis, ca. 1 x 0.2 cm, elliptic, brown.

FL. Per.: December

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2348 (PMAS-AAUR).

Distribution: Australia to Africa, Asia and the Pacific (Liles, 2004).

Herbarium Note: This grass first time reported from Pakistan. Glumes single and brown hairs present at center of the Homogenous flowers are different from other literature.

TRISETUM

Trisetum clarkei (Hook.f.) R. R. Stewart in Brittonia. 5:431. 1945.

Culmsca. 23cm, ascending appressed hairs, yellow to green, multi-veined, node distance ca. 2.5-4cm, dens hair at nodes. Leaves blade ca. 3-7cm x 0.3cm, apex acute, hyaline stigose hairs at upper and lower surface, also at margin, midrib prominent, multi-veined, greenish white. Ligule membranous;ca. 1.1mm, dens stigose hairs at ligule margin. Leaf-sheathca. 3.4-8cm, dens stigose hairs at Leaf-sheath, greenish yellow. Inflorescence: peduncleca. 5-6cm, panicleca. 5-6 x 0.5cm, each spikelet 3-4 flowers, spikeletca. 5 x 3.5mm, spikelet sessile but flowers white hairy small pediculate, shape liner, greenish grey color. Lower glume densely hairs grey color,ca. 3-3.3 x 1mm, apex form small awn, 3 parallel veined, lanceolate, greyish green. Upper glumeca. 3 x 1mm, single midrib, hairs at outer midrib, apex acute from small awn, lanceolate. flowerca. 1mm white hairs ca. 1mm long, lemmaca. 3 x 1-1.5mm, awnca. 1-1.5mm, green, midrib prominent small hairs at awn and midrib, margin hyaline, green center. paleca. 2x 0.5mm, apex of both lemma and palea acute and tooth shape, lanceolate. 3-Anther, yellow, smallca. 1mm, small filament, ovary ca. 0.3 x 0.2mm ovate, small stigma and style.

FL. Per.: July-September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2373 (PMAS-AAUR).

Distribution: Pakistan (N.W.F.P. & Kashmir); Nepal and Northwest India.

Herbarium Note: Flowers white hairy small pediculate.

VETIVERIA

Vetiveria zizanioides (L.) Nash in Small, Fl. Southeast U.S. 67. 1903.

Culm ca. 1-3 m tall, woody and hard at old stage and herbaceous at young stage, yellowish green in color, leaves clustered at base; internodes ca. 10-15cm; nodesca. 0.7-1mm. Leaves blade ca. 20-25 x 0.5-0.6 cm, midrib yellow and leaves stiff after maturity, multi-veined, hairs on upper surface, apex acute, light green. Ligule membranous with white hairs inner side and margin. Leaf-sheathca. 7-12cm, margin hyaline, multi-veined, yellowish green. Inflorescence: peduncleca. 10-22cm, racemose, rachilla internodes ca. 1-3cm, at each branches 1-6 spikelets, branch pedicel ca. 1.5cm, each spikelet in pairs, one spikelet sessile and other pediculate, spikelet to spikelet at node distances ca. 0.4cm, spikelet color ca. purplish green, lanceolate, serrate pointed hairs at spikelet. Fertile spikelet: Outer glumeca. 4.5-5 x 1-1.2mm, lanceolate, apex acute, serrate hairs outer surface, greenish purple and hairs color dark purple, both glumes are stiff coriaceous. Upper glume is 4.5-5 x 1-1.2mm, hyaline margin, lanceolate, apex acute, serrulate hairs, hairs color dark purple, glume color greenish purple. Lemmaca. 4 x 1mm, hyaline to light green, midrib prominent, lanceolate, hairs at the margin, palea hyaline to light green, of palea is 2-2.5 x 0.5mm, apex acute, lanceolate. Seedca. 3 x 1mm, yellowish brown, lanceolate to oblong, apex acute, shiny. Pediculate sterile

spikelet: pedicel ca. 2-2.2mm; small hairs on pedicel, outer glume ca. 3.7-4 x 0.9-1mm, lanceolate, apex acute, serrate hairs, greenish purple and hairs color dark purple, both glumes stiff coriaceous. Upper glume ca. 4-4.2 x 0.8-1mm, hyaline margin lanceolate, apex acute, glume greenish purple., serrulate hairs at the midrib, hairs dark purple, Lemma ca. 3.7 x 1mm, lanceolate, hairs at margin, hyaline to light green, midrib prominent palea hyaline to light green. palea ca. 1.9-2.1 x 0.3mm, lanceolate, apex acute, hyaline.

FL. Per.: September.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2449 (PMAS-AAUR).

Distribution: Pakistan (Punjab), India, Nepal, Burma, Ceylon and Southeast Asia.

46. TYPHACEAE

Typha elephantine Roxb., Fl. Ind., 3:566 (1832); Stewart in Nasir & Ali., Ann.Cat.Vasc.Pl.W.Pak.& Kashm., 28 (1972); Omer & Hashmi in Nasir & Ali., Fl.Pak.,177: 5 (1987).

A tall aquatic perennial herb up 4 m high. Leaves linear or broadly linear; trigonous above the sheath, angularly keeled dorsally, 3-angled; lamina 25-40 mm broad. Upper part flat, usually as long as inflorescence; male and female parts separate; axis of the male spike covered with hairs; female spike cylindrical, blackish brown or brown; pistillodes absent; female flowers bracteate; bracts spatulate and longer than the hairs; stigma lanceolate.

FL. Per.: March-August.

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 1400 (PMAS-AAUR).

Distribution: Africa, Asia (Bangladesh, India, Nepal, Pakistan, Iran and Turcomania) (Omer & Hashmi, 1987).

47. LILIACEAE

Asphodelus tenuifolius Cav., Anal. Cienc. Nat. 3: 46 (1801).

An annual herb up to 30 cm high. Leaves ca.10-28 x 0.5-3.1 mm, semi-terete, linear, apex acute, puberulous, sheathing at the base. Flowers laxly or densely racemose, jointed at lower middle; bract ca. 2.5 mm x 1.5-2mm, broadly ovate, margin scarious and brownish keel. Pedicel 4-6 mm; perianth 6, petaloid ca. 5-6 mm, lanceolate to oblanceolate, apex broadly acute, dark pink at the mid of keel, margin entire, white to pale-pink colored. Stamens 6, ca. 3-3.5 mm in ; anther sac 0.5 mm, yellowish orange to brown, filament ca. 1-1.5 mm, white, broader at base and narrow at the upper side. Style ca. 2 mm; white; stigma minutely 3-lobed, capitate to subcapitate, light pinkish white. Capsule ca. 3-4 mm, globose. 3-Seeds ca. 3 mm, sharply 3-gonous, rugos, brownish black.

FL. Per.: November-April

Herbarium specimens examined: THAL DESERT: Humaira Shaheen, 2313 (PMAS-AAUR).

Field remarks: Commonly present in cultivated area.

Distribution: North Africa, S. W. Europe, South West Asia, Pakistan and India.

2.5 CONCLUSION

The Thal desert was not earlier botanized and it was felt worthwhile to record the flora of this area. The area possesses some interesting endemic and rare species which were not previously reported from deserts of Pakistan. Thus this comprehensive study will provide a useful starting point for further ecological and

bioprospective research of the area under study. This fragile ecosystem is mostly deteriorated due to anthropogenic activities such as expansion of lands for cultivation and human settlement that resulted into environmental degradation and desertification. Such activities resulted into replacement of natural vegetation by perennial non palatable grasses. This study could be used as reference material to ethnopharmacobotanical studies, since several of the recorded species have medicinal uses (Shaheen *et al.*, 2012). Further research is required to study intrinsic ecological values of native species (Zhao *et al.*, 2010).

**PRELIMINARY PHYLOGENETIC STUDY OF *CENCHRUS* BY
USING RPL16 AND TRNLF PRIMERS**

3.1 INTRODUCTION

Phylogenetics is the study of evolutionary relationships. Phylogenetic analysis is the means of inferring or estimating these relationships. The evolutionary history inferred from phylogenetic analysis is usually depicted as branching, treelike diagrams that represent an estimated pedigree of the inherited relationships between molecules (“gene trees”), organisms, or both. Phylogenetics is sometimes called cladistics because the word “clad,” a set of descendants of a single ancestor, is derived from the Greek word for branch. However, cladistics is a particular method of hypothesizing about evolutionary relationships. (Brinkman and Leipe, 2001).

Chloroplast DNA (cpDNA) sequence variant is now widely used to investigate the interspecific relationship among angiosperms and other plants (Palmer *et al.*, 1988, Clegg *et al.*, 1991). These zones tend to evolve more rapidly than do coding sequences, by the accumulation of insertions/deletions at a rate at least equal to that for nucleotide substitutions (Curtis and Clegg 1984; Wolfe *et al.*, 1987; Zurawski and Clegg 1987; Clegg and Zurawski 1991) and therefore they can become very useful below the family level. CpDNA is an extremely valuable molecule for studying phylogenetic relationships between closely related species (Palmer 1987; Palmer *et al.*, 1988; Clegg *et al.*, 1991). The low evolutionary rate of

this molecule is a serious limitation on the interspecific level. However, some studies have shown that restriction fragment length polymorphism (RFLP) also occurs at the interspecific level (Soltis *et al.*, 1989, Rieseberg *et al.*, 1988). Therefore, by amplification and direct sequencing of these non-coding regions the resolution of cpDNA can be increased both for evolutionary studies and for identifying intraspecific genetic markers (Saiki *et al.*, 1988). Despite its conservative mode of evolution, numerous cases of intraspecific variation have been reported (reviewed by Soltis *et al.*, 1991). Accordingly, sequences of noncoding regions should display more phylogenetically informative sites than do *rbcL* sequences. Mostly universal primers for the amplification of non-coding regions of cpDNA (Taberlet *et al.*, 1991).

The universal primers of Kocher *et al.*, 1989 do for mitochondrial DNA, our three pairs of primers amplify cpDNA over a wide taxonomic range. The primers offer opportunities to study the population and evolutionary biology of various plant species. The sequences of the two intergenic spacers could be very useful for evolutionary studies of related species and probably of populations of the same species, the *trnL* (UAA) intron is probably less variable due to the fact that it has catalytic properties and form secondary structures (Kuhnel *et al.*, 1990). Therefore, it could be more useful for evolutionary studies at higher taxonomic levels.

Pennisetum Rich. and *Cenchrus* L. are grasses belonging to the tribe Paniceae of the subfamily Panicoideae (Clayton and Renvoize, 1986). *Pennisetum* includes 80-140 species from the tropics and subtropics of both hemispheres

(Brunken, 1977; Clayton and Renvoize, 1986) and occupies a wide range of habitats: savannas, woodlands and woody places in warmer regions of America, Africa and Asia; the genus is particularly diverse in Africa (Türpe, 1983; Clayton and Renvoize, 1986).

Pennisetum shows differences in genome size (Martel *et al.*, 1997), ploidy level (from diploid to octoploid), and basic chromosome numbers ($x = 5, 7, 8, 9$) (Jauhar, 1981; Wipff, 2003). Martel *et al.* (2004) pointed out that chromosome numbers based on $x = 5, 7$, or 8 could have occurred via structural mutations and loss of centromeres from an ancestral basic number $x = 9$ during evolution.

The genus *Cenchrus* consists of 16–22 species that inhabit bush-lands, open grasslands, disturbed areas, and sandy soils in warmer regions of both hemispheres (DeLisle, 1963; Clayton and Renvoize, 1986; Webster, 1988; Crins, 1991; Stieber and Wipff, 2003). Most of the species are considered undesirable and noxious weeds such as *C. echinatus* L., but some, such as *C. ciliaris*, are important forage grasses (Correll and Johnston, 1970; Clayton and Renvoize, 1986; Stieber and Wipff, 2003). Species of *Cenchrus* mainly distributed in Africa and Asia are $x = 9$, while species with $x = 17$ are excluded from the New World (DeLisle, 1963; Crins, 1991).

Pennisetum and *Cenchrus* are closely related genera (Türpe, 1983; Clayton and Renvoize, 1986; Crins, 1991), characterized by the presence of a highly modified inflorescence, with contract and specifying panicles, whose spikelets are subtended by sterile bristles that fall together with the spikelets at maturity (Clayton and Renvoize, 1986). Additional characters of inflorescence development

support the relationship between the genera: the reduction of the internode on the secondary axis and on other axes, differential elongation of the bristles at maturity, and a change from equal numbers to more bristles than the spikelets being initiated in early development (Doust and Kellogg, 2002). The two genera differ in the morphology of the involucre bristles; bristles in *Cenchrus* always show some degree of fusion at the base while in *Pennisetum* they are usually free (Hitchcock, 1951; DeLisle, 1963; Gould, 1975; Clayton and Renvoize, 1986; Crins, 1991). Moreover, the involucre bristles in *Cenchrus* are generally flat, stiff, spiny and retrorsely barbed while *Pennisetum* has filiform, and introrsely scabrous bristles. Nevertheless *Pennisetum* and *Cenchrus* are not clearly defined (Türpe, 1983; Crins 1991; Wipff, 2001, 2003) due to variability in the basal fusion of the bristles (Hitchcock, 1951; DeLisle, 1963; Gould, 1975; Clayton and Renvoize, 1986), in the shape and stiffness of the bristles (Chippendale, 1955), in the basic chromosome number, and in the spiny nature and type of scabrosity of bristles. As a result, some authors (e.g., Correll and Johnston, 1970) have treated *Pennisetum* as part of *Cenchrus*.

Our aim here is to clarify the phylogenetic relationships of *Pennisetum* and *Cenchrus* based on two non-coding chloroplast DNA markers (rpl16, trnL-trnF intergenic spacer), using a larger taxonomic sampling, and considering cytological and morphological variability of both genera.

3.2 Review of Literature

The traditional classification of plants into respective classes, orders, families, genera and species has until recently been based on shared morphological,

cytological, biochemical and ecologic traits. The development of techniques in molecular hybridization, cloning, restriction endonuclease digestions and protein and nucleic acid sequencing have provided many new tools for the investigation of phylogenetic relationships. At the molecular sequence level, the most fundamental comparison possible is of the primary nucleotide sequences of homologous genes in different populations or species (Hamby and Zimmer, 1992).

According to Mathews *et al.* (2000), molecular sequence data have become increasingly used for examining the evolutionary history of plants at scales ranging from relationships among the major lineages of land plants to relationships within individual genera. Phylogenetic systematics have progressed in part through the development of new molecular markers suited to particular classes of phylogenetic problems (Clayton and Renvoize, 1986; Watson and Dallwitz, 1992).

Poaceae is one of the largest and most diverse families in the angiosperms, consisting of approximately 10,000 species and 600–700 genera. The first molecular phylogenetic trees of the grasses were reported by Hamby and Zimmer (1988) and Doebley *et al.* (1990) by using the *rbcL* plastid gene. They supported the monophyly of a group containing Panicoideae, Arundinoideae, Centothecoideae and Chloridoideae (the PACC clad). However, only nine grass species (without groups) from three recognized subfamilies were sequenced. A larger sample with a total of 47 species representing 26 tribes and six subfamilies was included by Clark *et al.* (1995), who used the plastid gene *ndhF*. They recovered a tree with two major groups, the PACC and the BEP (containing Bambusoideae, Ehrhartoideae and Pooideae) clades and two isolated clades that were successive sisters to the

rest: *Anomochloa* Brong and *Streptochaeta* Schrad. in one clade and *Pharus* P. Browne on the other. The most significant combined data analysis consisted of DNA sequences (plastid and nuclear), plastid restriction site data and morphological data and included 61 genera, but it represented only 8% of all grass genera (GPWG, 2001). A relatively robust and well-resolved topology was obtained, supporting a PACCAD group (PACC plus Aristidoideae and Danthonioideae), a BEP group and the same two isolated clades plus a third isolated clade, subsequently recognized as Anomochlooideae, Pharoideae and Puelioideae. Finally, Sanchez-Ken *et al.* (2007) by including 31 taxa representing 27 grass genera, recognized another subfamily, Micrairoideae (comprising *Eriachne*, *Isachne* and *Micraira*), and hence expanded the PACCAD clade to the PACCMAD clade.

Pennisetum and *Cenchrus* are distributed throughout tropical and subtropical regions of the Old and New World and contain 80-140 and 20-25 species, respectively (Tu̇rpe, 1983; Watson and Dallwitz, 1992). Some species of *Pennisetum* are cultivated as cereal and forage grasses (e.g. *P. purpureum* Schumach. ‘elephant grass’, *P. glaucum* (L.) R.Br. ‘pearl millet’, *P. clandestinum* Hochst. ex Chiov. ‘kikuyu grass’) or ornamentals (e.g. *P. setaceum* (Forssk.) Chiov. ‘tender fountaingrass’, *P. alopecuroides* (L.) Spreng. ‘foxtail fountain grass’), and some species of *Cenchrus* and *Pennisetum* are considered important weeds (e.g. *C. ciliaris* L. ‘buffel grass’, *C. echinatus* L. ‘southern sandbur’, *C. myosuroides* Kunth ‘big sandbur’ and *P. polystachion* (L.) Schult. ‘mission grass’) (Ru’ golo de Agrasar and Puglia, 2004).

Pennisetum is not clearly distinguished from Cenchrus, and several species that are now included in the Cenchrus have previously been assigned to Pennisetum. For example, *P. ciliaris* is accepted by Chase (1921), Pohl (1980), Judziewicz (1990) and Wipff (2003), whereas it is treated under Cenchrus by DeLisle (1963), Clayton (1989), Pohl and Davidse (1994), Zuloaga and Morrone (2003), and Chen and Phillips (2006). Pennisetum under Cenchrus and presented several diagnostic features for the combined genus.

Sang *et al.*, (1997), Mason-Gamer *et al.*, (2002) and Xu and Ban (2004) worked on the chloroplast DNA (cpDNA) sequences, particularly the noncoding regions such as the intron of trnL (UAA) and the intergenic spacer of trnL (UAA)–trnF (GAA) are also a valuable source of markers for identifying the maternal donors of polyploids with additional capacity to reveal phylogenetic relationships of related species.

Recent phylogenetic studies with morphological and molecular data provided evidence for the monophyly of the genera Cenchrus, Pennisetum and Odontelytrum (Gutiérrez and Morrone, 2012). Therefore, these studies propose the unification and transfer of species of *Pennisetum* and *Odontelytrum* to the genus Cenchrus, which has priority by using trnF and trnL but *Pennisetum* and *Cenchrus* tree intermingled each other.

3.3 Materials and methods

3.3.1 Taxonomic sampling

The plant material of *Cenchrus pennisetiformis*, *Cenchrus biflorus*, *Cenchrus ciliaris* and *Cenchrus setigerus* were collected from voucher specimens

for DNA extraction and other DNA samples were got from Gen Bank. The DNA was extracted from leaf tissue using a CTAB protocol modified for small amounts of plant material (Doyle and Doyle, 1987; Murray and Thompson, 1980; Saghai-Marooif *et al.*, 1984). D Neasy Plant Mini Kits (Qiagen, Hilden, Germany) were used to extract DNA from herbarium material.

Two non-coding chloroplast DNA markers were amplified via the polymerase chain reaction (PCR): the intron and partial exon 2 of the gene encoding *rpl16*, and the *trnL-F* region, including *trnL* (UAA) intron, *trnL* (UAA) partial 3'exon, and the intergenic spacer between the *trnL* (UAA) 3'exon and the *trnF* (GAA) gene (*trnL-F* region). The *rpl16* intron was amplified using primers F71, 5'-GCTATGCT TAGTGTGTGTCTC-3' and R1661, 5'-CCAKATTTTTC CACCACGAC-3' as that of Jordan *et al.* (1996) and Kelchner and Clark (1997), respectively. For difficult taxa like *Pennisetum*, the marker was amplified in smaller fragments using the following combination of primers: F71/R584 (R584: 5'-TTCCGCCATCCCACCCAATGAA-3') and F584/R1661 (F584: 5'-TTCATTGGGTGGGATGGCGAA-3'). For sequencing reactions, two additional internal primers were used: F80, 5'-C/TTATTGCTTCGTATTGTCG-3', and R270, 5'-TCATCCCTCCTTTTATCC-3' as mentioned by Giussani *et al.* (2009) and Zhang (2000), respectively. The *trnL-F* region was amplified by using primers C, D, E and F as described by Taberlet *et al.* (1991); for difficult taxa in which primers C and F failed to amplify, two other primers (Cii, 5'-TAGACGCTACGGACTTGATTG-3' and Fdw, 5'-CAGTCCTCTGCTCTACCAGC-3') were used (Giussani *et al.*, 2009).

PCR amplifications were performed in a 25 ml reaction volume containing 20–40 ng, a final concentration of 1× PCR Buffer minus Mg, 5 mM MgCl₂, 0.025 mM dNTP each, 0.2 μM each primer, 0.2% BSA as a PCR additive, and 1.25–3 units Taq Polymerase (Invitrogen Life Technologies, São Paulo, Brazil). PCR was carried out in a thermal cycler (Eppendorf Mastercycler personal) using the following parameters: trnL-F: 1 cycle of 94°C for 5 min, 34 cycles of 94°C for 30 s, 48°C for 1 min, and 72°C for 1 min 30 s, and a final extension cycle of 72°C for 7 min; rpl16: 1 cycle of 94°C for 4 min, 34 cycles of 94°C for 1 min, 55°C for 1 min, and 72°C for 2 min 30 s, and a final extension cycle of 72°C for 7 min. The PCR products were quantified by comparison to a low mass (20–30 ng/ml) DNA ladder on 1% agarose electrophoresis gel using 1× TBE buffer and stained with ethidium bromide.

Primer	Sequence	Source
F71	5'-GCTATGCT TAGTGTGTGTCTC-3'	Jordan <i>et al.</i> (1996)
R1661	5'-CCAKATTTTTC CACCACGAC-3'	Jordan <i>et al.</i> (1996)
R584	5'-TTCCGC CATCCCACCCAATGAA-3'	Giussani <i>et al.</i> (2009) and Zhang (2000)
R270	5'-TCATCCCTCCTTTTATCC-3'	Giussani <i>et al.</i> (2009) and Zhang (2000)
F584	5'-TTCATTGGGTGGGATGGCGAA-3'	Giussani <i>et al.</i> (2009) and Zhang (2000)
Cii	5'-TAGACGCTACGGACTTGATTG-3'	Giussani <i>et al.</i> (2009)
F80	5'-C/TTATTGCTTCGTATTGTCG-3'	Giussani <i>et al.</i> (2009)
Fdw	5'-CAGTCCTCTGCTCTACCAGC-3'	Giussani <i>et al.</i> (2009)

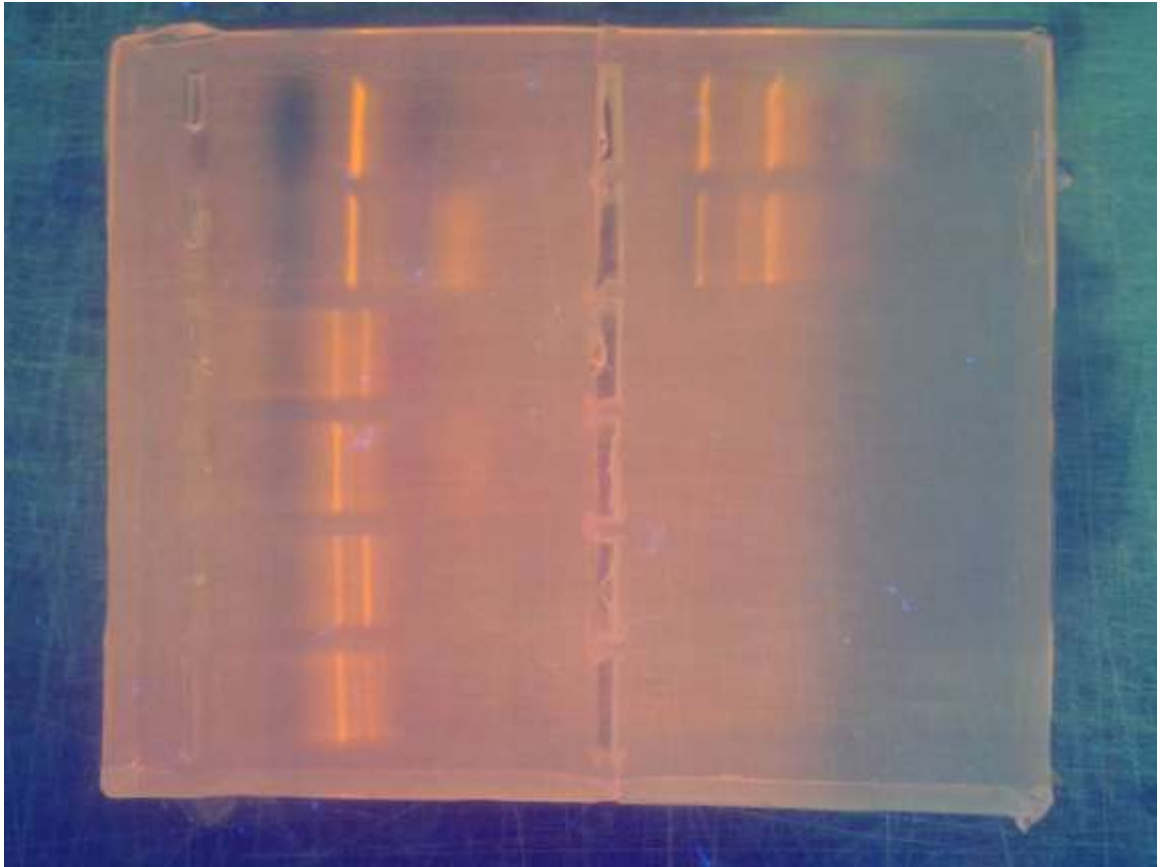


Fig. 3.1: tranl and primer run with *Cenchrus pennisetiformis*, *Cenchrus biflorus*, *Cenchrus ciliars* and *Cenchrus setigerus* DNA samples.



Fig. 3.2: rpl 16 running result with *Cenchrus pennisetiformis*, *Cenchrus biflorus*, *Cenchrus ciliars* and *Cenchrus setigerus* DNA smples

3.4 Results and Discussion:

3.4.1 rpl16 analyses and trnL-F analyses for *Cenchrus*

Cenchrus is the most important genus in terms of the common flora of Thal desert which contributed maximum species. *Cenchrus* are the most dominating grasses in the Thal desert and from which *Cenchrus pennisetiformis* and *Cenchrus biflorus* were the species whose sequences are not present in the GenBank. Keeping in view, this work is not only new addition sequences in GenBank but also marked new clades in the evolutionary Tree. The parsimony analysis of the trnL-F and rpl16 region combinely used in tree yielded 90 most parsimonious trees (L = 119 steps, CI = 0.9677, RI = 0.9815). Analyses of both markers, whether including or excluding idles, offered no contradictory information, so we assumed partitions to be congruent and hence combined both datasets.

Based on the DNA sequences, *Cenchrus* and *Pennisetum* ancestors are the same that's why both genera are intermixed in Evolutionary tree as shown in Fig. 3.4.

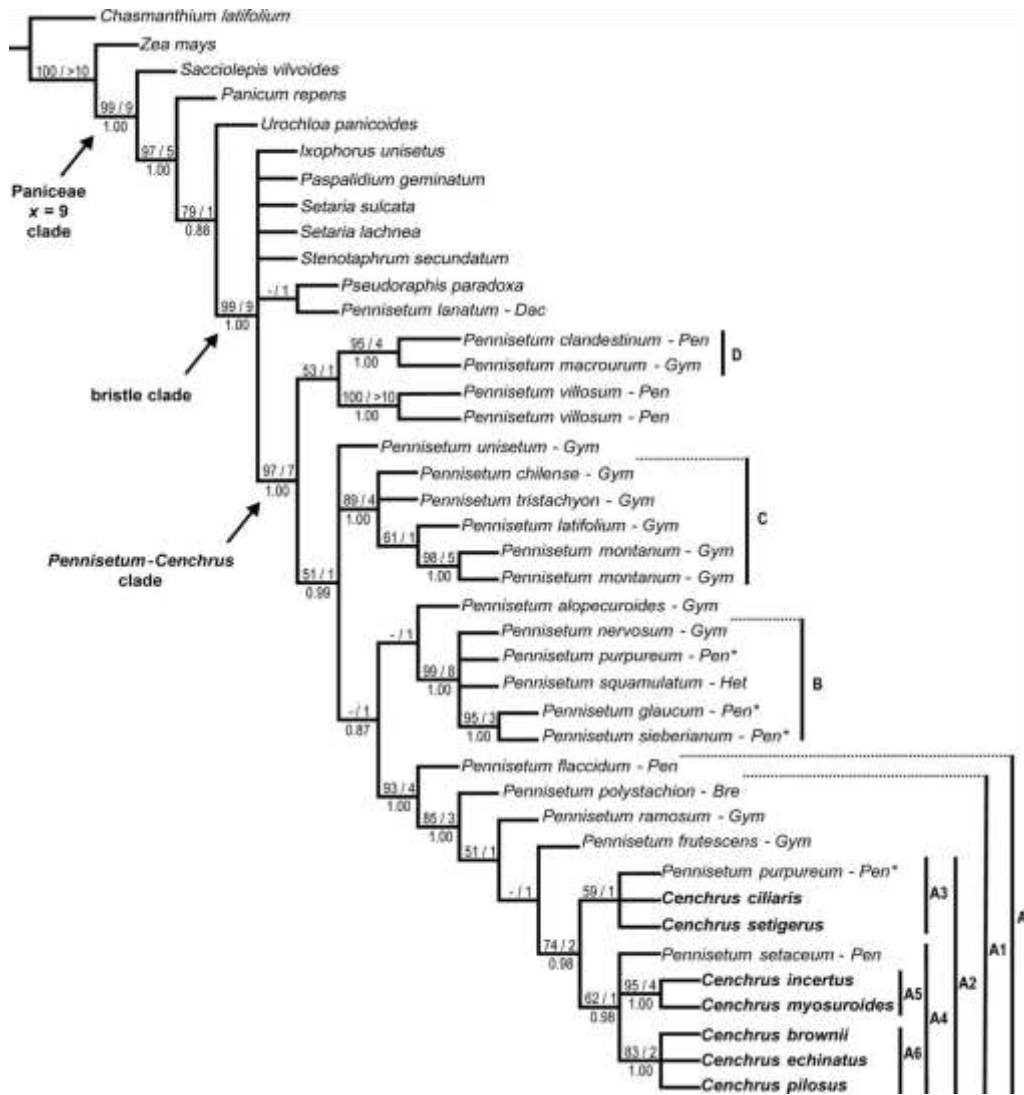


Fig 3.3: Evolutionary phylogenetic tree from GenBank

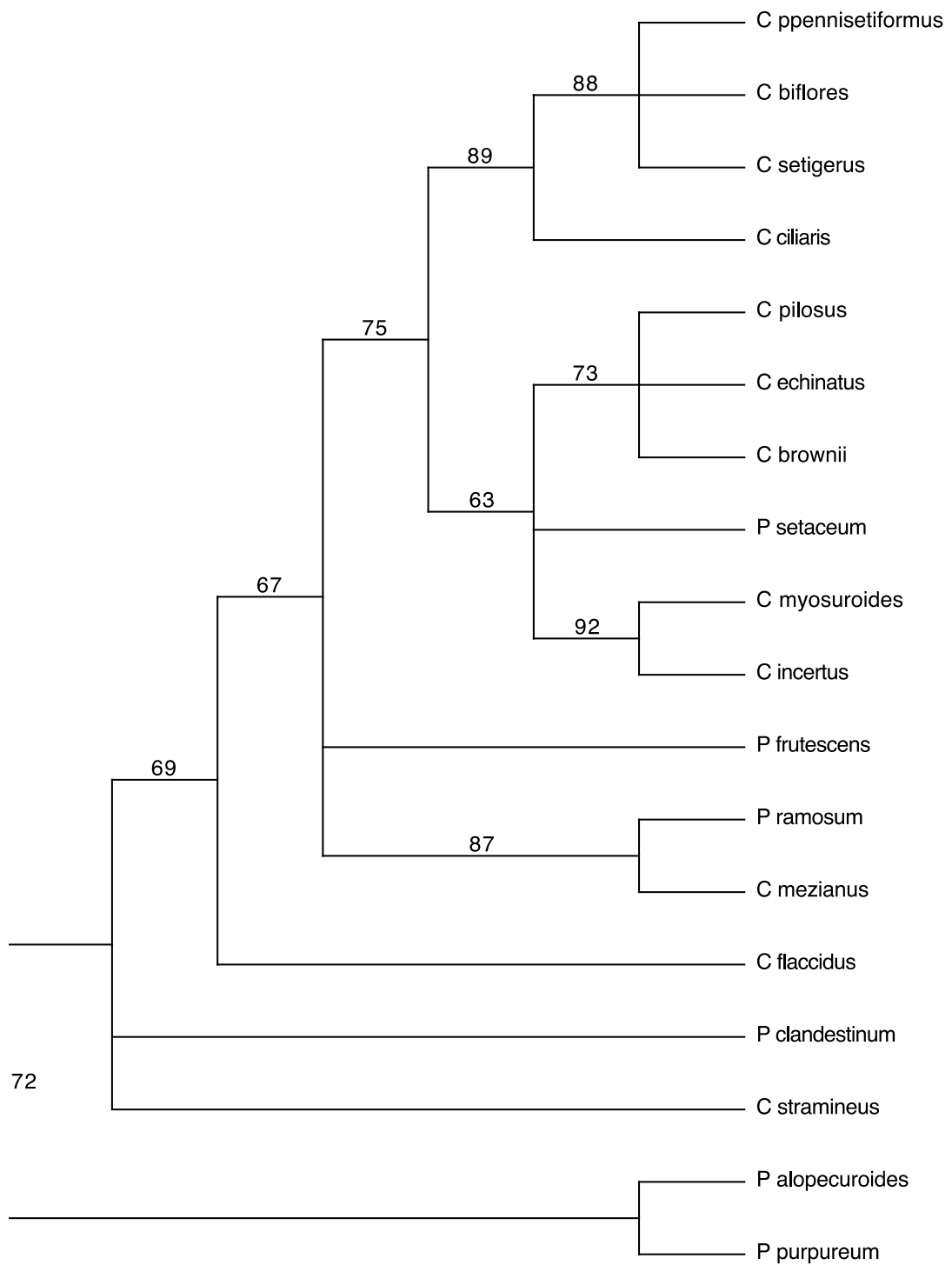


Fig 3.4: Evolutionary phylogenetic tree from after putting *Cenchrus pennisetiformis*, and *Cenchrus biflorus*.

In the Fig 4 shows that new clads species *Cenchrus pennisetiformis* and *Cenchrus biflorus* are very close to each other in the 88 clade branch number. The

chloroplast Gene sequence of the *Cenchrus pennisetiformis* is (5'-

TTCCGCCMTCCCMCCCAATGAAGTGTTAGGATTYTTTTCAATAAAATCC

GATGTYGTCATAGGTTTTGTYGTTCCACAGCTTCTCCTTTAATGGTTAG

GTTTGAATCCTGCAATGGAGCTTCCAAAAAATTTCTTTYCGAGTCAATT

T

TYTCAGTTTTATTGACGCGGGSTGCTCTTTTTTATTTCTTTAAATTTGA

TTTGTTATTTCAAAGTTACGATTTYGAATTCTCTCTTTTTTTTATTATT

TTATTATATTGATGCTTTATCMCATTGCTTTTTTTTTATGATGTAATTCA

TARACCATACACATTGRAATTCTATATCTTTCTTATTCTTGTTCCCTTCTA

TCTATCATCCCTCCTTTTATCCACATCCCTTTAKTTTTGCTTCACAGCCT

AAAATCAGGTTTCTTTTGTAARAAAAAAAHGCAGTTGCTACAACCTATA

T

GATARATCCACTCATTTTTTATAGATGTATTTATTACATAGKGACKGG

T

TCTTAGTTAGGATCTCGACAATACRAAGCAATAGGTKGGTTATTAGTTA

A

TTTTCTAGAATTA CTAAGTTTTTTCTATTTTTAGTAGGGTTCAGCCAATT

TTTTTTATAAWTCCTCATT TTTTCGCCCTAAAGAAAAACTAACGAGACA

C-3') by using rpl16 primer and the chloroplast Gene sequence is

(5'-

ACTTGCTAAGTGWAACTTCCAATTCAGAGAAACCCTGGAATGAAAAAT

G

GGCAATCCTGAGCCAAATCCCTTTTTTGAAAAACAAGTGGTTCTAACTA

G

AACCCAAAGGAAAAGGATAGGTGCAGAGACTCAATGGAAGCTGTTCTA

AC

GAATCGAAGTAATTACGTTGTGTTGGTAGGGGAACTCCCTCGAAATACT

A

GAAAGAGGGGCTTTATACATTTAATACACACGTATAGATACTGACATA

GC

AAACGATTAATCACAGAACCCCTATCATAATATAGGTTCTTTATTTTTTA

TTTTTTTCTARAATGAAATTAGGAATGATTATGAAATAGAAAATTCTGA

A

TTTTTTTAKAATTATTGTGAATCCATTCCAATCGAATATTGAGTAATCAA

ATCCTTCAATTCATTGTTTTGAAATCAAAAGTGGATTAATCSAMMGAGG

A

TAAAGAKAGAGTCCCATTCTACATGCCAATACTGACWACAATGAAATT
TC

TAGTAA-3') by using the primre trnLF. *Cenchrus biflorus* chloroplast gene
sequence by using the primer using rpl16 primer

(5'CCMKATTTTCCMCCMCGTCGKGCMTTATCGKGRWMMMTMVDTR
MWYTTTCRTCCTGCTTCTATYTGTCYTGCGGDGATCCAAGCGGGTTCAA
GTACTTGAAGAGCVTATYTWCCAAAACAAATACRRTTGCCTCGGCMGG
ATTTTCCCY

TCMTTYTTCCTYTATGTTGTTTACGAAATYAKTTCTTTTTGGGKTAYAG
TBGMCGGTTCTTTBTTAGTCCATYTYTMCTGCAAAACTGGACAWGRG
AG

TTYTTYTGMTCCARCTCCTCKCGAATTAATGAGAAAGCGKGSAAATT
T

CTSTAATTCCATAATATTTTGGAAATCTCCTTMTTTTTATTMTTATTGAAT
YGTGGKAAAGTATTYTAATCCAATAAGGATTCGCGGGSGRATATTTAC
T

CYTTCCCTGTMBTATTTGYTAATTTAGAATCTTRTCAMAYAAAGCCMMV
YY

BRATTTTTTTGGTTTGTTCGCCATCCCACCCAARKRAAA-3') *Cenchrus*
biflorus chloroplast gene sequence by using the primer using trnLF primer

(5'ACTTGCTAAKTGWAACCTCCAATTCAGAGAAACCCTGGAATGAAAA
ATGGGCAATCCTGAGCCAAATCCCTTTTTTGAAAAACAAGTGGTTCTAA
CTAGA

ACCCAAAGGAAAAGGATAGGTGCAGAGACTCAATGGAAGCTGTTCTAA
CG

AATCGAAGTAATTACGTTGTGTTGGTAGGGGAACTCCCTCGAAATACTA
G

AAAGAGGGGCTTTATACATTTAATACACACGTATAGATACTGACATARC
A

AACGATTAATCACAGAACCCCTATCATAATATAGGTTCTTTATTTTTAT
TTTTTCTAGAATGAAATTAKGAATGATTATGAAATAGAAAATTCTGAA
T

TTTTTTAKAATTATTGTGAATCCATTCCAATCG-3'). These sequences used together in Mega software for alignment of chloroplast DNA sequence and then used these sequences in Fig Tree software for developing the Evolutionary tree.

ETHNOBOTANICAL SURVEY

4.1 INTRODUCTION

The indigenous knowledge is as old as human civilization but the term “Ethnobotany” was first applied by an American Botanist Harshberger (1896) to study the plants used by the primitive and aboriginal people. It is derived from words “ethnology”-study of culture and Botany the study of plants. So ethnobotany is the scientific study of the relationship that exists between people and plants. This discipline offers an opportunity that how people of a culture and region make use of indigenous plants. Ethnobotanists explore how plants are used as food, shelter, medicine, clothing, hunting and religious ceremonies. Collecting information about the use of natural resources is not only important for the recording of local cultural traditions and the richness of this heritage, but also gives us some of the information necessary to protect our natural habitat in the long term (Trivedi, 2006).

Currently, ethnobotany experienced a shift from the raw compilation of data to a greater methodological and conceptual reorientation. Ethnobotany requires a variety of skills: botanical training for the identification and preservation of plant specimens; anthropological training to understand the cultural concepts around the perception of plants and linguistic training at least enough to record local terms and understand native morphology, grammar, etc. Today, ethnobotanists are focusing on: 1) food and medical ethnobotanical traditional knowledge, 2) Traditional medicines use and perceptions and 3) Ethnoveterinary: Traditional knowledge on

plants used as fodder, for healing animals or for improving the quality of dairy products (Anonymous, 2008).

Pakistan is divided into 9 major ecological zones, which are endowed with about 6000 plant species. The country has a varied climate and quite rich in economic plants. These plants are growing in the wild and no systematic attempt has been made to collect and cultivate them (Anonymous, 2008b). Since, 80% of the population lives in villages in Pakistan. (Ikram *et al.*, 1978), the people of rural areas mostly depend on wild resources. The rich source of ethnobotanical information is mostly recorded from remote areas. According to Goodman and Ghafoor (1992), the people of arid and mountainous regions utilize local plants as fodder for domestic animals as nutritional and vitamin supplements for human beings constituents of many indigenous medicines; components in utilitarian devices and as indicators of seasonal change. In ethnobotanical research, many cultural aspects such as folk tales, rituals and taboos associated with plant species are also studied (Qureshi, 2002). Young generations are paying least interest in existing traditional uses of plants. With the passage of time, this information is diminishing. Therefore, it is important to highlight the precious information about the indigenous knowledge of plants.

Globally, This field is well recognized and lots of work have been done in different parts of the world (Weckerle *et al.*, 2009; Neves *et al.*, 2009; Leduc *et al.*, 2009; Novais *et al.*, 2004; Long and Li., 2004; Vitalini *et al.*, 2009; Parade *et al.*, 2009; Grade *et al.*, 2009; Zheng and Xing 2009; Nguta *et al.*, 2010; Kamalakannan and Balakrishnan 2009; Luczaj 2010; Mohan *et al.*, 2008; Namsa *et al.*, 2009; This discipline is quite popular in Pakistan and various studies have been conducted in

different parts of the country, (Wazir *et al.*, 2007; Qureshi 2009; Hazrat 2010; Ahmad and Husain, 2008; Qureshi *et al.*, 2009; Abbasi *et al.*, 2010; Shinwari and Khan, 2000). The study area has never been botanized before. Therefore this study was designed to record the indigenous knowledge of plants of Thal Desert, Punjab, Pakistan.

4.2 REVIEW OF LITERATURE

A good amount of work has been done with reference to ethnobotany from outside the country. Chinsebu and Hedimbi (2010) identified a total of 71 plants from 28 families used to manage opportunistic infections of HIV/AIDS in Katima Mulilo, Caprivi region, Namibia. These plants treated conditions such as herpes zoster, diarrhea, malaria, coughing, tuberculosis and meningitis. Idowu *et al.* (2010) an ethnobotanical survey of herbal medicine used for treatment of malarial fever in 17 communities in Ogun state, Southwest Nigeria. According to results, 38 plant species belonging to 24 families were used in herbal antimalarial recipes. Among the plants mentioned the most frequently used were *Morinda lucida* (7.87%), *Lawsonia inermis* (7.41%), *Citrus medica* (6.48%), *Sarcocephalus latifolius* (6.48) and *Morinda morindiodes* (6.48%).

Ajaib *et al.* (2010) gathered ethnobotanical data on the shrubs of District Kotli, Azad Jammu and Kashmir, Pakistan. They reported 38 species of 36 genera and 25 families which were found useful in day life requirement of local inhabitants as medicinal, fuel, shelter, fodder/forage and in making agricultural tools. On the other hand, Assefa *et al.* (2010) explored ethnomedicinal uses of plants among rural communities of Ethiopia. They reported that different parts of *Hagenia abyssinica* are used against several human and livestock diseases,

including intestinal, circulatory, respiratory, digestive and nervous disorders. Jan *et al.* (2010) reported 26 weeds belonging to 16 families which were ethnobotanically used by the people of Dir Kohistan Valley, Pakistan. Simbo (2010) recorded 107 plants species from 54 plants families 98 genera in Babungu, Cameron which are being used by the local people for treating diseases, and insect repellent along with some mystifying use like evil spirit away, etc.

Medicinal plants used for ethnoveterinary purpose has also been explored throughout the world. Shen *et al.* (2010) described the ethnoveterinary medicinal uses of 45 plant species by Nu peoples in New Yunnan of china. The most common animal diseases treated were skin condition diarrhea, heat, fever and cold and parasite attacks.

Yaung (1988) reported 2294 traditional Tibetan medicine in China from 1106 plant species. Bhattacharyya (1991) undertook ethnobotany of Jammu and Kashmir State, India. He reported that numerous plants were used by local people to meet daily requirements. Norscia (2006) reported 45 plant species as medicine from Kirindy and Pluvial forest of Serinate Luce, Madagascar. He reported various uses of plants to treat diarrhea, abdominal pain, parasitic infections, malaria, rheumatism, cold, skin illness and inflammation. Ozbuck *et al.* (2006) carried out a research on wild edible plants from Black Sea region of Turkey. They investigated 52 plant species belonging to 26 families as wild edible plants. Albert *et al.* (2008) carried out an ethnobotanical survey in the District of North Cachar Hills, Assam. They reported multifarious uses of reported 206 species. Pradhan and Badola (2008) reported 118 species belonging to 71 families and 108 genera, under ethnomedicinal utility by the Lenchas (tribe) of Dzongu Valley, India. These are

used for curing approximately 66 ailments, which could be grouped under 14 broad categories. As per use pattern, maximum of 30.50% species were used to cure stomach related disorders followed by 19.49% for curing cut, wounds, inflammation, sprains and joint pains. Since there is no systematic information available about the floristic study of the Thal Desert, therefore the present work was planned to record the flora of this area.

The field of Ethnobotany in Pakistan is now not that virgin as it was in early 90's. A lot of papers have been published and more work has to be done in the future. Farooq (1990) reviewed 52 medicinal plants belonging to 25 Angiospermic families from Pakistan. Hajra and Rao (1990) studied the vegetation type, Phytogeography and floral resource conservation in North West Himalayas. During the survey they pointed out uses of these plants as wild edible, medicinal, aromatic, fodder and bamboos. Bukhari (1994) worked on Ethnobotany and vegetation analysis of Machyara National Park Muzafarabad AJK. He reported 10 plant communities in along with detail of the medicinal plants in the park. Zandial (1994) worked on the Ethnobotany of the National Park Machyara, AJK, Pakistan. He reported 104 important species of plants including tree, shrub and herb species used ethnobotanically by the local people. Shinwari and Khan (2000) described 50 species of herbs belonging to 27 families from Margala Hills National Park, Islamabad being used medicinally by the local people of the park.

Various other studies showed significant contributions towards ethnobotany. Qureshi and Khan (2001) studied and recorded 26 species of herbs belonging to 18 families used medicinally by the local people of Kahuta. They reported plants which were being used for the treatment of various diseases like

cholera, dyspepsia, fever, herpes, eczema, jaundice and liver complaints and cure of mad dogs. Ahmed *et al.* (2003) studied the economically important plants of Chuch region Tehsil Attock, Pakistan. They recorded 226 plant species which are found ethnobotanically important. Among them 16 were medicinal, 45 fuel wood, 16 timber yielding, 73 fodder species and 56 vegetables. Khan *et al.* (2003) conducted a survey to document the ethnobotanical potential of Gokand Valley, District Buner, Pakistan. They reported 138 plants species including 40 cultivated species. The local population used 50 as fodder and forage, 46 for fuel wood purposes, 17 as vegetables, 17 as pot herb, 14 as timber wood, 5 for making hedges and fences, 34 serve as fruits, 2 as fish poison, 3 soil builders and 2 as honey bee attractant.

Zafar *et al.* (2003) carried an ethnobotanical study of different areas of Rawalpindi district. They recorded 15 plant species belonging to 13 different families for their therapeutic potential. These plants were used for treatment of snake bite, night blindness, chronic rheumatism, vomiting, cough other different diseases. Ahmed *et al.* (2004) recorded 41 wild plant species belonging to 40 genera of 33 families used medicinally by local inhabitants of Galliyat Areas of KPK, Pakistan. They reported that these plants were used for the treatment of various diseases like asthma, liver complaints, toothache, dysentery, bone fracture and healing of wounds. Similarly, Ashfaq and Arshad (2004) recorded the ethnomedicinal data from Fateh Jang. They identified 29 plant species belonging to 28 genera and 18 families used by local people of remote village for treatment of various diseases. Ahmad *et al.* (2006) worked on herbal cosmetics. Their work

revealed that the local communities especially women extensively used these herbal cosmetics for enhancing their beauty and out look in Pakistan.

Athar and Bokhari (2006) conducted a survey to annotate some traditional and commonly used vegetables in Pakistan. About 63 species were grown and consumed as summer and winter vegetables distributed in 44 genera and 19 families. Hussain *et al.* (2006) reported 67 species belonging to 40 families from 30 villages of Ladha, South Waziristan, Pakistan. The criteria for ranking the species generally included as carminative property, sedative nature and anti lice activity. Islam *et al.* (2006) reported 49 weed species used medicinally from Shawar Valley, District Sawat, Pakistan. Out of them 30 plants were used as traditional medicines. They classified plant species into herbs, shrubs, trees and climbers. They stated that in primary health care system, these folk medicinal plants have significant role for the people of Shawar valley.

Shah and Khan (2006) reported 80 plant species belonging to 49 families during field trips of Siran Valley Mansehra, Pakistan. Cultivated medicinal plants consisted of 21 species used for the treatment of skin disease rheumatism and diabetes and while others were used as laxative, diuretic, antiseptic and anti-inflammatory. Qureshi *et al.* (2006) recorded the detailed ethnobotany of Tehsil Gujar Khan, District Rawalpindi. They recorded 271 used by the locals to fulfill their different requirements.

Ahmad (2008) studied 81 plants belonging to 44 families. These plants were collected from Lahore Islamabad Motorway, Pakistan. They are used for the treatment of various diseases like fever, skin diseases, snake bite, jaundice and dysentery. Ahmed *et al.* (2007) recorded the medico-ethnobotany of District

Attock. They reported 25 species belonging to 25 genera used for common ailments such as abdominal pain and worms, asthma, cough and bronchitis, cold, flu, diabetes, diarrhea, dysentery, digestive disorders, ear infections and eye complaints by traditional methods.

Another study carried out by Qureshi *et al.* (2007) from the district (Attock) which reported the indigenous knowledge of some wild plants for medicinal purposes. They recorded 50 plant species belonging to 46 genera in 27 families. Ibrar *et al.* (2007) collected and classified 97 species of plants from Ranyal hills, District Shangla, Pakistan, for their traditional, medicinal and economic use. Khan and Khatoon (2007) reported 48 species of trees and shrubs from Haramosh and Burgrote Valley in Gilgit, Pakistan. Sher and Hussain (2007) reported 50 plant species belonging to 33 families as ethnobotanically important from Mallam Jabba valley, District Swat, Pakistan.

Shinwari *et al.* (2007) compiled a list of 160 medicinal plants (including 34 trees, 32 shrubs, 87 herbs and 7 climbers) which were used by the folks in surrounding areas of Margalla Hills. They described their uses along with photographs from the study area. Hussain *et al.* (2008) presented study conducted in Morgah Biodiversity Park, Rawalpindi during 2006. They reported 40 plant species belonging to 39 genera and 32 families were recorded which were used for medical purposes by dwellers of the area. Khan and Khatoon (2008) studied 98 herbaceous plants from Haramosh and Burgrote Valley in Gilgit Northern Areas, Pakistan. They reported these herbs for the treatment of rheumatism, asthma, diabetes, blood pressure, stomach problems and abdominal problems.

Since the people of desert areas live isolated from the urban areas, therefore they are naturally dependant on plant resources. Furthermore, the main livelihood of these nomads is livestock keeping and herding therefore, they remains attach with vegetation. Hocking (1958-62) wrote a series of papers on medicinal plants of Pakistan including some information on Baluchistan. Chaudhri and Arshad (1987) surveyed Cholistan desert with reference to medicinal plants. They listed valuable medicinal flora from the study area. Ethnobotanical study of north eastern Baluchistan was carried out by Shinwari and Malik (1989) indicating plant utilization by local people. Malik *et al.* (1990) have done preliminary ethnobotanical review from six districts of Baluchistan. Rajput *et al.* (1991) reported about 40 species belonging to 23 families from Thar Desert, which are used as medicinal plants for different ailments.

Various studies were carried out from different parts of Baluchistan pertaining to ethnobotanically important species. Goodman and Ghafoor (1992) conducted an ethnobotanical study in Baluchistan province and collected information for about 114 plant species used by nomads and village dwellers for mutational, utilitarian and medicinal purposes. They reported that 56 plants are prescribed or dispensed by herbalists in curing different diseases of the local population. Leporatti and Lattanzi (1994) carried out ethnobotanical study focusing on 27 medicinally important plants in Makran. They reported their traditional medicinal uses in the area in question. Shinwari *et al.* (1995) reported the ethnobotanical information of Kharan district of Baluchistan. Bhatti *et al.* (1998) evaluated *Calotropis procera*, used to cure various ailments in Nara Desert, Pakistan as well as for other purposes. Their comprehensive literature survey suggested wider usage of this plant in Unani and

Ayurvedic system of medicine. Arshad *et al.* (2002) stated that the dwellers of the Cholistan desert extensively utilize medicinal plants to cure various diseases. They also discussed the possible conservational strategies. They stressed on the conservation of precious wealth of medicinal plants of Cholistan desert, so that the pharmacists and scientists were able to discover new medicinal compounds that could be used in various diseases. Qureshi and Bhatti (2008) reported 51 plant species belonging to 28 families and 43 genera having medicinal properties used by the local dwellers of Nara Desert, Pakistan. They recorded 21 species having new uses not recorded in the Indo-Pak folk herbal medicinal literature. There are few other practical studies conducted from the adjoining area as Awan (2002) and Shinwari and Khan (1998) described in their studies.

Precisely there is enormous scope of ethnobotany in arid areas of the country. This field is very rapidly declining due to anthropogenic activities. Therefore, efforts were taken to record the folk wisdom prior to its extinction.

4.3 MATERIALS AND METHODS

4.3.1 QUALITATIVE ETHNOBOTANICAL DATA COLLECTION

The study area was surveyed to record ethnobotanical data by employing the designed semi-structured questionnaire (*Annexure-1*) after Qureshi (2004) and Qureshi and Bhatti (2008). Natives including older people, herbal practitioners (*Hakeems*) and midwives (*Daai*) were interviewed to get ethnobotanical information about the plants which are being used by these nomads (migratory) for food, medicine, fodder/forage, fuel and timber, etc. In all, 150 people were interviewed. Besides, written was consulted to determine any novel use and authenticity of the medicinal use from the study area. All species were arranged

alphabetically and presented. Using excel spreadsheet, the data were statistically analyzed and certain graphs were made. Literature survey was done in order to check the validity and authenticity of medicinal record after Qureshi and Bhatti (2008) and Qureshi and Shaheen (2013).

4.3.2 QUANTITATIVE ETHNOBOTANICAL DATA COLLECTION

4.3.2.1 Direct matrix ranking:

In order to establish various human needs or use categories as well as which plants were used for that, 15 plants were selected and the informants were asked to rank them on a scale from 1 to 10. The species with the highest score was ranked the most valuable species in the study area.

4.3.2.2 Fidelity level percentage (FL%):

The fidelity level (FL%) is used to calculate the most frequent diseases coupled with the the use of a certain plant for the same major purpose by using the following formula:

$$FL (\%) = (N_p / N) \times 100$$

Where N_p is the number of informants reported a use of a plant species to treat a particular disease, and N is the number of informants used the plants as a medicine to treat any disease (Alexiades 1996).

4.3.2.3 Informant consensus factor (ICF):

The ICF was used to determine the uniformity of knowledge among the informants regarding each of the diseases treated in the various disease categories (Heinrich *et al.* 1998). The purpose of the ICF was to seek agreement among the informants regarding the reported cures for each group of diseases. Thus, the following formula was used:

$$\text{ICF} = \frac{Nur - Nt}{Nur - 1}$$

where *Nur* is the number of use-reports in each disease category and *Nt* is the number of species used.

4.3.2.4 Preference ranking:

Preference ranking was conducted to check each plant's degree of effectiveness in its most common medicinal uses and to identify certain threats. For this purpose, informants ranked the species on a scale from 1 to 10 (1 for the least important and 10 for the most important species) based on their personal preference. The ranking was calculated by summing up each value. The category with the highest score was considered to be the most important among the community (Martin *et al.*, 1995).

4.4 RESULTS AND DISCUSSION

4.4.1 QUALITATIVE ETHNOBOTANICAL ENUMERATION

4.4.1.1 Ethnobotanical inventory:

The study area basic divided in to four sub-study areas Rakhghulaman Form (cattle form), Rakhmani Form (Camel form), Sandy dunal area and Cultivated area. Altogether 261 species belonged to 183 genera and 56 families are identified which are being used by the natives for fulfilling daily life requirements. The ethnobotanical inventory is arranged alphabetically by family and consists of Vernacular, Parts utilized; Voucher specimen number, and flowering period, folk medicinal as well as other multifarious uses. The data are appended as follows.

- Family:** Acanthaceae
- 1 **Plant species:** *Barleria prionitis* L.
- Vernacular:**
- Parts utilized:** Whole plant
- Specimen No:** 2030
- Flowering period:** Throughout the year.
- Multifarious use:** This small spiny herb used for fodder in young stage.
- Family:** Agavaceae
- 2 **Plant species:** *Agave sisilana* Perr. Ex Engelm.
- Vernacular:** Shirin
- Parts utilized:** Whole plant, pulp
- Specimen No:** 2099
- Flowering period:** March-April
- Medicinal use:** Pulp of plant is taken for jaundice. The same is also supposed a tonic for liver. Pulp is processed into sweet dish commonly called as *Halwa* (mixed with sugar and flour and browned in oil) and is given for stomach problem like constipation, Hemorrhoids and acidity. The same is used as blood purifier to remove boils and pimples. The pulp is externally used to itching of the skin.
- Multifarious use:** The plant is also grown for fencing/hedge purpose.
- Family:** Aizoaceae
- 3 **Plant species:** *Limeum indicum* Stocks ex T. Anders.

- Vernacular:** Patar
- Parts utilized:** Leaves
- Specimen No:** 2415
- Flowering period:** March-September.
- Medicinal use:** Paste of leaves use for the treatment of burning wounds
- Multifarious use:** Plant is used as a fodder to livestock
- 4 **Plant species:** *Sesuvium sesuvioides* (Fenzl) Verdc
- Vernacular:** --
- Parts utilized:** Aerial parts
- Specimen No:** 2408
- Flowering period:** December
- Multifarious use:** The plant is favorite fodder for camel and goat.
- 5 **Plant species:** *Trianthema portulacastrum* L.
- Vernacular:** Itsit
- Parts utilized:** Roots, aerial parts
- Specimen No:** 2456
- Flowering period:** September
- Medicinal use:** The decoction of roots is given to treat jaundice.
- Multifarious use:** Aerial parts are used as a fodder to livestock.
- 6 **Plant species:** *Trianthema triquetra* Rottl. and Willd.
- Vernacular:** Itsit
- Parts utilized:** Whole plant, shoots
- Specimen No:** 2373
- Flowering period:** September

- Multifarious use:** Shoot parts are used, as a fodder for livestock. The plant is good soil binder.
- 7 **Plant species:** *Zaleya pentandra* (Linn.) Jeffrey
- Vernacular:** Itsit
- Parts utilized:** Whole plant
- Specimen No:** 2374
- Flowering period:** April-August
- Medicinal use:** The juice of plant is given as diuretic to remove kidney stones.
- Multifarious use:** Aerial parts are used as fodder.
- 8 **Plant species:** *Gisekia pharnaceoides* L.
- Vernacular:** Manjhatra
- Parts utilized:** Whole plant
- Specimen No:** 2405
- Flowering period:** Aug.- October
- Medicinal use:** Juice and extract of plant is given to expel abdominal worms.
- Multifarious use:** Plant used as a fodder to livestock
- Family:** Alloaceae
- 9 **Plant species:** *Aloe vera* L.
- Vernacular:** Kunwar gandal
- Parts utilized:** Pulp
- Specimen No:** 2366
- Flowering period:** January-April
- Medicinal use:** Pulp of plant is taken orally to treat jaundice. The same is

given as a tonic for liver. Pulp of the plant is used to remove pimples.

Multifarious use: The plant is used for ornamental purpose.

Family: Amaranthaceae

10 **Plant species:** *Achyranthes aspera* L.

Vernacular: Puth Kanda

Parts utilized: Ash, Whole herb

Specimen No: 2381

Flowering period: September-December

Medicinal use: Ash of the plant is mixed with honey and given to treat asthma and cough. The decoction of plant is used for the treatment of skin irritation. Fruits/inflorescence mixed with half quantity of *Datura* seeds and made into powder and given as an aphrodisiac. The seeds are ground in water to make pills which is given in joints pain.

Multifarious use: The whole plant is used as fodder/forage. The dried branches are used as fuel source.

11 **Plant species:** *Aerva javanica* (Burm. f.) Juss ex J. A. Shultes.

Vernacular: Boi

Parts utilized: Leaves, inflorescence, whole plant, roots

Specimen No: 2328/2308

Flowering period: July-September

Medicinal use: Leaves are crushed and applied on boils and pimples. Decoction of roots is given as purgative to livestock.

- Multifarious use:** The inflorescence/fruit is used for stuffing pillows. Goat browses leaves. The plant is used as fuel wood source.
- 12 **Plant species:** *Alternanthera pungens* Kunth.
- Vernacular:** Ludhri
- Parts utilized:** Whole, roots
- Specimen No:** 2511
- Flowering period:** October- November
- Medicinal use:** The decoction of roots is used to treat jaundice.
- Multifarious use:** Goat and sheep graze plant leaves; dried parts are used as fuel.
- 13 **Plant species:** *Amaranthus graecizans* L.
- Vernacular:** Cholai
- Parts utilized:** Aerial parts, leaves
- Specimen No:** 2382
- Flowering period:** October- November
- Medicinal use:** The leaves are used as cooked as vegetables given to constipating patients.
- Multifarious use:** The aerial parts are used as fodder.
- 14 **Plant species:** *Amaranthus ovalifolius* L.
- Vernacular:** Kalga
- Parts utilized:** Aerial parts, leaves
- Specimen No:** 2382
- Flowering period:** October- November
- Medicinal use:** Leaves are cooked as vegetable and given to treat

- constipation.
- Multifarious use:** Aerial parts are used as fodder for livestock.
- 15 **Plant species:** *Amaranthus viridis* L.
- Vernacular:** Cholai
- Parts utilized:** Aerial parts, leaves
- Specimen No:** 2385
- Flowering period:** October- November
- Medicinal use:** Leaves are cooked as vegetable and given to treat constipation.
- Multifarious use:** Aerial parts are used as fodder for livestock.
- 16 **Plant species:** *Celosia argentea* (L.) Schinz.
- Vernacular:** Kalga
- Parts utilized:** Leaves, flowers, seeds
- Specimen No:** 2593
- Flowering period:** June-November
- Medicinal use:** The poultice of flower and seed is applied on boils. The powder of seeds is given to treat diarrhea, bleeding dysentery, uterine bleeding and leucorrhoea.
- Multifarious use:** Leaves are given as fodder to livestock.
- 17 **Plant species:** *Digera muricata* (L.) Mart.
- Vernacular:** Tandla
- Parts utilized:** Leaves, aerial parts
- Specimen No:** 2326
- Flowering period:** September-October

- Medicinal use:** The leaves are cooked as vegetable and eaten for treat constipation.
- Multifarious use:** The aerial parts are used as fodder.
- 18 **Plant species:** *Pupalia lappacea* (Linn.) Juss.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2102
- Flowering period:** February-March
- Multifarious use:** The plant is used as fodder.
- Family:** Apiaceae
- 19 **Plant species:** *Anethum graveolens* L.
- Vernacular:** Soya
- Parts utilized:** Whole plant, seed
- Specimen No:** 2376
- Flowering period:** February-March
- Medicinal use:** The powder of seed is given to females to increase milk production acting as lactagogue. Powder (*Phakki*) obtained from the seeds along with *Terminalia chebula* and black saltis prescribed in gas troubles acting as antifatulence. The seeds are also used in making pickles acting as an appetizer.
- Multifarious use:** The seeds are also used in making pickles. This plant is used as potherb.
- Family:** Apocynaceae
- 20 **Plant species:** *Rhazya stricta* Decne.

- Vernacular** Vinraan
- Parts utilized:** Whole plant, leaves, aerial parts
- Specimen No:** 2555
- Flowering period:** September-October
- Medicinal use:** Shade dried leaves are grind to make powder (*phakki*), which is prescribed to relieve stomach pain due to digestive problem like acidity. Aerial parts are soaked in water and boiled till get viscous extract. Pills of Chick pea size are made and given to treat digestive problems, Hemorrhoids, constipation and skin problems.
- Multifarious use:** Plant is a good soil binder and ornamental.
- Family:** Arecaceae
- 21 **Plant species:** *Phoenix sylvestris* L.
- Vernacular:** Khaji
- Parts utilized:** Fruit, nuts, stem, leaves, whole plant
- Specimen No:** 2359
- Flowering period:** Almost throughout the year
- Medicinal use:** Dried hard dates (*Choohara*) are boiled in milk and used as an aphrodisiac and tonic.
- Multifarious use:** Dried hard dates (*Choohara*) are boiled in milk and used as tonic. Nuts/seeds are used as beads in religious ceremony. Young green leaves are used to make different types of mats, recreational items, ropes (*Vaan*). The stem is used in building material. Leaves are used in roof thatching, hand

fan (*Pakha*), matrices (*Chatai*), bread pan (*Chhabe*). The whole plant is used as source of fuel.

- Family:** Asclepiadaceae
- 22 **Plant species:** *Calotropis procera* (Willd.) R. Br.
- Vernacular:** Aak
- Parts utilized:** Leaves, latex, flowers, whole plant
- Specimen No:** 2028
- Flowering period:** Throughout the year
- Medicinal use:** Latex is ground with sugar in 1:10 ratio and is used to treat asthma. The latex is poured on the snakebite till stop to absorb. The powder of the leaves is dusted on wounds to heal. Flowers (3-5 No) are given to the patients suffering from jaundice. If the person felt sweet taste, it authenticates the presence of jaundice and the same treatment is given to cure the disease. The leaves coated with sesame oil and warmed over fire that is applied externally to remove pain and inflammation. Dried flowers in powdered form are used for abdomen pain. Internal part of flower are boiled thrice then used as pot herb for gastric problems, joints pain and abdominal pain.
- Multifarious use:** Leaves are browsed by goat and sheep. The dried plant is used as fuel as well as fumigant for mosquito repellent.
- 23 **Plant species:** *Leptadenia pyrotechnica* (Forssk.) Decne.
- Vernacular:** Barda/Barira

- Parts utilized:** Whole plant, aerial parts
- Specimen No:** 2574
- Flowering period:** August-October
- Multifarious use:** The aerial tender branches are twined to make ropes. Stems are used for roof thatching and huts formation. The plant is used as fuel wood source.
- 24 **Plant species:** *Pentatropis nivalis* (J.F.Gmel.) D.V.Field and J.R.I.Wood
- Vernacular:** Wehra
- Parts utilized:** Whole plant
- Specimen No:** 2536
- Flowering period:** September
- Multifarious use:** The plant is used as fodder for goat.
- 25 **Plant species:** *Periploca aphylla* Dcne.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2536
- Flowering period:** April-May
- Multifarious use:** The plant is favorite fodder to livestock. The dried plant is used as fuel wood.
- 26 **Family:** Asphodeloideae
- Plant species:** *Asphodelus tenuifolius* Cavan.
- Vernacular:** Bokat
- Parts utilized:** Whole plant, leaves, pulp
- Specimen No:** 2313

- Flowering period:** November – April
- Medicinal use:** The powder of seeds is given with milk of cow to cure hemorrhoids. The paste of leaves is applied to scorpion bite. The juice obtained from root and leaves is given in jaundice. The *Guggal* (*Commiphora stocksii*) is soaked in its extract and then pills are made that is given in constipation and bleeding hemorrhoids. Fresh pulp of the plant is applied on the ringworm (*Dhadhar*).
- Multifarious use:** The plant is used as fodder and fuel.
- Family:** Asteraceae
- 27 **Plant species:** *Amberboa ramosa* (Roxb.) Jafri
- Vernacular:** Tirkanda/Birhami buti
- Parts utilized:** Whole plant
- Specimen No:** 2118
- Flowering period:** July-October
- Medicinal use:** The plant along with few seeds of *Piper nigrum* is ground in water and the juice is given to treat skin disease such as boils, pimples, skin irritation acting as blood purifier.
- 28 **Plant species:** *Blumea membranacea* Candolle
- Vernacular:** ---
- Parts utilized:** Whole plant
- Specimen No:** 2113
- Flowering period:** Feb-Jun.
- Medicinal use:** The plant is use and fodder for cattle and dried plant is used

- for fuel.
- 29 **Plant species:** *Carthamus oxycantha* M.B.
- Vernacular:** Pohli
- Parts utilized:** Whole plant, seed, leaves
- Specimen No:** 2099
- Flowering period:** April – May
- Medicinal use:** Seeds are likely to prevent cancer and seeds are slightly brown into fire and orally used as popcorns (*Phulay*).
- Multifarious use:** Seeds are slightly brown into fire and orally used as *Phulay*.
The plant is grazed in juvenile stage and is a good source of fodder for cattle. The dried plants are used as fuel source.
- 30 **Plant species:** *Centaurea iberica* Trev.
- Vernacular:**
- Parts utilized:** Aerial parts, root
- Specimen No:** 2141
- Flowering period:** April-July
- Medicinal use:** The root is ground in water and the extract is given to expel kidney and bladder stones.
- Multifarious use:** The aerial parts are used as fodder during juvenile stage.
- 31 **Plant species:** *Cnicus benedictus* L.
- Vernacular:**
- Parts utilized:** Aerial parts
- Specimen No:** 2353
- Flowering period:** April – June

- Multifarious use:** The aerial parts are used for fodder.
- 32 **Plant species:** *Conyza bonariensis* (L.) Cronquist.
- Vernacular:** Gidar Buti
- Parts utilized:** Aerial parts
- Specimen No:** 2612
- Flowering period:** April – June
- Multifarious use:** The aerial parts are used as fodder.
- 33 **Plant species:** *Conyza squamatus* (Spreng.) Hieron.
- Vernacular:** Gidar Buti
- Parts utilized:** Aerial parts
- Specimen No:** 2434
- Flowering period:** April – June
- Multifarious use:** The aerial parts are used as fodder.
- 34 **Plant species:** *Echinops echinatus* Roxb.
- Vernacular:** Unt Katara/Kandiara
- Parts utilized:** Root, aerial parts
- Specimen No:** 2611
- Flowering period:** October – January
- Medicinal use:** Roots are ground in water and given to patients suffering from chronic fever. The powdered roots are taken with milk to treat joints pain.
- Multifarious use:** Aerial parts are browsed best by camel and other livestock. The plant is good soil binder.
- 35 **Plant species:** *Iphiaea grantioides* (Boiss.) Anderb.

- Vernacular:**
- Parts utilized:** Leaves
- Specimen No:** 2535
- Flowering period:** May–June
- Medicinal use:** The paste of leaves is applied on boils to heal.
- 36 **Plant species:** *Launaea procumbens* (Roxburgh) Ramayya and Rajagopal
- Vernacular:** Dudkal
- Parts utilized:** Whole plant
- Specimen No:** 2548/2119
- Flowering period:** April – May
- Multifarious use:** The plant is used as favorite fodder for livestock and supposed to increase milk production.
- 37 **Plant species:** *Launaea residifolia*L.
- Vernacular:** Bhattal
- Parts utilized:** Whole plant, latex
- Specimen No:** 2489
- Flowering period:** April – May
- Medicinal use:** Paste/latex of plant is applied on boils and pimples.
- Multifarious use:** The plant is used as favorite fodder for livestock and supposed to increase milk production.
- 38 **Plant species:** *Parthenium hysterophorus* DC.
- Vernacular:** Chatak chandni
- Parts utilized:** Whole plant
- Specimen No:** 2611

- Flowering period:** Throught the year
- Multifarious use:** Leaves are browsed by goats at just young condition.
- 39 **Plant species:** *Pluchea arguta* subsp *arguta* Boiss.
- Vernacular:** Jhao
- Parts utilized:** Whole plant
- Specimen No:** 2534
- Flowering period:** Throughout the year
- Medicinal use:** Plant extract and its smoke are used as a Bedbug (*Khatmal*) repellent.
- Multifarious use:** It is usually eaten by goats.
- 40 **Plant species:** *Pluchea lanceolata* (DC.) C. B. Clarke
- Vernacular:** Jal buti
- Parts utilized:** Whole plant, leaves
- Specimen No:** 2402
- Flowering period:** March-August
- Multifarious use:** Leaves are browsed by goats. It is good soil binder and ornamental.
- 41 **Plant species:** *Pulicaria glaucescens* (Boiss.) Jaub. and Spach
- Vernacular:** ----
- Parts utilized:** Whole plant
- Specimen No:** 2100
- Flowering period:** October - January
- Multifarious use:** Leaves are browsed by goats. It is good soil binder and ornamental.

- 42 **Plant species:** *Sonchus asper* (L.) Hill
Vernacular: Dudkal
Parts utilized: Whole plant
Specimen No: 2610
Flowering period: March-Junrary
Multifarious use: Plant use as ornamental purpose and act as soil binder.
- 43 **Plant species:** *Taraxicum officinalis* F.H. Wigg
Vernacular: Dudkal
Parts utilized: Whole plant
Specimen No: 2550
Flowering period: November-April
Multifarious use: Plant use as ornamental purpose and act as soil binder. Plant use as fodder.
Family: Bombacaceae
- 44 **Plant species:** *Bombax malabaricum* DC.
Vernacular: Sumbul
Parts utilized: Whole plant, roots, fiber,
Specimen No: 2183
Flowering period: December-March
Medicinal use: The decoction of root is given orally to kill the abdominal worms. A 10 gm powder of roots is soaked in 100 ml of water for overnight and the purified water sweetened with sugar is given daily early in the morning for 40 days as sexual and general tonic.

- Multifarious use:** The fiber obtained from fruit is used in stuffing pillows. The stem is used as fuel source.
- Family:** Boraginaceae
- 45 **Plant species:** *Cordia gharaf* (Forssk.) Ehren. ex Asch.
- Vernacular:** Lasura
- Parts utilized:** Stem, leaves, fruits, pulp, whole plant
- Specimen No:** 2193
- Flowering period:** March-April
- Medicinal use:** The ripened dried fruits are boiled in water and used to treat throat pain.
- Multifarious use:** Unripe fruits are made into pickle. The ripened fruits are eaten raw. The pulp is used as substitute of gum acting as adhesive material. The leaves are used as fodder. The stem is used for making agricultural implements and fuel wood source.
- 46 **Plant species:** *Cordia myxa* L.
- Vernacular:** Lesuri
- Parts utilized:** Stem, leaves, fruits, pulp, whole plant
- Specimen No:** 2188
- Flowering period:** March-April
- Medicinal use:** The ripened dried fruits are boiled in water and prescribed in throat pain.
- Multifarious use:** Unripe fruits are used in pickle. The ripened fruits are eaten raw. The pulp is used as substitute of gum acting as adhesive

material. Leaves are used as fodder. The stem is used for making agricultural implements and fuel wood source.

- 47 **Plant species:** *Heliotropium calcareum* Stocks
- Vernacular:** Jatia
- Parts utilized:** Aerial parts
- Specimen No:** 2600
- Flowering period:** January-April
- Multifarious use:** Camel and goat browse aerial parts of the plant. The dried branches are used as fuel source.
- 48 **Plant species:** *Heliotropium crispum* Desf.
- Vernacular:** Jatti Mussag
- Parts utilized:** Aerial parts, whole plant
- Specimen No:** 2605
- Flowering period:** January-April
- Multifarious use:** This is highly palatable and preferred plant species to camel. According to the indigenous communities this plant is going toward decline due to its heavy use. It is also a good soil binder and source of fuel.
- 49 **Plant species:** *Heliotropium curassavicum* L.
- Vernacular:** Loni buti
- Parts utilized:** Whole plant
- Specimen No:** 2511
- Flowering period:** March-April
- Multifarious use:** The plant is favorite fodder to camel.

- 50 **Plant species:** *Heliotropium europeum* L.
- Vernacular:** Hathi sunda
- Parts utilized:** Whole plant, leaves
- Specimen No:** 2584
- Flowering period:** January-April
- Medicinal use:** Leaves are burnt in sesame oil and externally applied to treat skin diseases such as boils, pimples and irritation. Juice of leaves applied on wounds of animals to remove insects and for healing purpose.
- Multifarious use:** The plant is used as fodder.
- 51 **Plant species:** *Heliotropium strigosum* Willd.
- Vernacular:** Gorakh paan
- Parts utilized:** Whole plant
- Specimen No:** 2537
- Flowering period:** July-September.
- Medicinal use:** The whole plant is dried under shade and soaked water using earthen pot fortnightly. it is then ground along with sugar (candy) and filtered. This juice is given to treat jaundice and used as cooling agent. It is also used as a tonic. Plant soaked overnight in water and is given early morning as cooling agent to liver diseased patient.
- Multifarious use:** Shoot parts are used, as a fodder for livestock Plant is good soil binder.
- 52 **Plant species:** *Lappula patula* (Lehm.) Asch. ex Gurke

- Vernacular:** ---
- Parts utilized:** Whole plant
- Specimen No:** 2139
- Flowering period:** March-April
- Multifarious use:** Plant used as a fodder for livestock. Plant used for ornamental purpose.
- 53 **Plant species:** *Nonea caspica* subsp. *caspica*(Willd.) G. Don
- Vernacular:** ---
- Parts utilized:** Whole plant
- Specimen No:** 2111
- Flowering period:** March-April
- Multifarious use:** Plant used as a fodder for livestock. Plant used for ornamental purpose.
- 54 **Plant species:** *Nonea edgeworthii* A. DC.
- Vernacular:** Kangher
- Parts utilized:** Leaves
- Specimen No:** 2181
- Flowering period:** March-April
- Medicinal use:** Leaves juice effective in curing cough and other respiratory ailments.
- Multifarious use:** Plant used as a fodder for livestock. Plant used for ornamental purpose.
- 55 **Plant species:** *Trichodesma indicum* (L.) R. Br.
- Vernacular:** Handusi

- Parts utilized:** Leaves, whole plant and root
- Specimen No:** 2166
- Flowering period:** Mostly throughout the year. Sporadic, but normally from March-August
- Medicinal use:** Juice of leave externally used for ear pain and ear wounds. The whole plant is used for treating vomiting and urinary problems. The roots are used for the treatment of joint pain, cough, cold, fever and dysentery.
- Multifarious use:** The plant is a good source of fodder to livestock.
- Family:** Brassicaceae
- 56 **Plant species:** *Brassica compestris* L.
- Vernacular:** Sarson
- Parts utilized:** Leaves, Whole plant, seed oil
- Specimen No:** 2188
- Flowering period:** March-April
- Medicinal use:** Leaves are used as potherb to expel abdominal worm and to treat constipation. The oil obtained from the seed is applied to the body as antimicrobial and anti-lice agent. The *Brassica* oil mixed with *Lawsonia alba* (*Mehndi*) is applied to relieve athlete foot. The oil is poured in brass pot and kept on head of jaundice patient. The oil is mixed/shaken with the leaves of *Saccharum grifithii* and prescribed to treat jaundice.
- Multifarious use:** The plant is a good source of fodder to livestock. The

- harvested plant is also used as the source of fuel.
- 57 **Plant species:** *Capsella bursa-pastoris* (L.) Medik.
Vernacular: --
Parts utilized: Whole plant, leaves
Specimen No: 2633
Flowering period: February- April
Multifarious use: Goat and sheep graze plant leaves, dried parts are used as fuel.
- 58 **Plant species:** *Cardaria draba* (L.) Desv.
Vernacular: --
Parts utilized: Whole plant, Aerial part
Specimen No: 2121
Flowering period: April-July
Multifarious use: Aerial part of plant use as salad. Goat and sheep graze plant leaves.
- 59 **Plant species:** *Coronopus didymus* (L.) Sm.
Vernacular: Jangli Haloon
Parts utilized: Aerial parts
Specimen No: 2340
Flowering period: March – June
Multifarious use: The aerial parts are used as fodder. It is growing as weed of Rabbi crops.
- 60 **Plant species:** *Eruca sativa* Miller
Vernacular: Jamaya

- Parts utilized:** Whole plant, leaves, flowers, seeds, oil
- Specimen No:** 2152
- Flowering period:** April-June
- Medicinal use:** The oil of the seed is applied to the body as antimicrobial and anti-lice agent. The seeds are taken in 1gram dose early morning before breakfast to treat bleeding Hemorrhoids. Oil is used as moisturizer for dryness and itching of skin. The oil is slightly warmed over fire and poured into ears to relieve earache.
- Multifarious use:** Flowers and unripe pods are used as potherb especially by *Rajput* tribe. The oilcake and fresh plants are favorite fodder for cattle. The harvested plants are used as fuel wood source.
- 61 **Plant species:** *Farsetia hamiltonii* Royal.
- Vernacular:** Lathia
- Parts utilized:** Whole plant
- Specimen No:** 2393
- Flowering period:** June-July
- Medicinal use:** Whole plant is dried under shade and powder is made which is used as a *phakki* for constipation, relieving pain from stomach due to the digestive problems. It is also reported by the indigenous community that it is highly effective against the Hemorrhoids.
- Multifarious use:** The young twigs are used as fodder to livestock.
- 62 **Plant species:** *Farsetia jacquemontii* Hook.f. and Thomson

- Vernacular:** Lathia
- Parts utilized:** Whole plant
- Specimen No:** 2399
- Flowering period:** June-July
- Medicinal use:** Same as previous species.
- Multifarious use:** As previous species.
- 63 **Plant species:** *Physorrhynchus brahuicus* Hk.
- Vernacular:** Phatkari
- Parts utilized:** Aerial parts
- Specimen No:** 2383
- Flowering period:** March-May.
- Multifarious use:** The aerial parts are used as fodder to livestock.
- 64 **Plant species:** *Sisymbrium irio* L.
- Vernacular:** Khoob Kalan
- Parts utilized:** Whole plant, seeds
- Specimen No:** 2175
- Flowering period:** March-May
- Medicinal use:** Seeds are boiled in water along with sugar (*Gur*) and given to treat typhoid fever.
- Multifarious use:** Shoot parts are used, as a fodder for livestock.
- 65 **Plant species:** *Sisymbrium orientale* L.
- Vernacular:** Khoob Kalan
- Parts utilized:** Whole plant, seeds
- Specimen No:** 2175

- Flowering period:** April-June
- Medicinal use:** Seeds are boiled in water along with sugar (*Gur*) and given to treat typhoid fever.
- Multifarious use:** Shoot parts are used, as a fodder for livestock.
- Family:** Caesalpiniaceae
- 66 **Plant species:** *Cassia fistula* L.
- Vernacular:** Girrad Nalli
- Parts utilized:** Whole plant, pulp
- Specimen No:** 2443
- Flowering period:** April June.
- Medicinal use:** The pulp is ground in water and warmed over fire that is given in small quantity to infants to treat constipation acting as laxative.
- Multifarious use:** Planted for ornamental, shade as well as for fuel purpose.
- 67 **Plant species:** *Cassia italica* (Mill.) F.W.Andr.
- Vernacular:** ---
- Parts utilized:** Root, flowers, seeds
- Specimen No:** 2414
- Flowering period:** April-June.
- Medicinal use:** Root is in water for overnight then its water is used for the treatment of diarrhea, Pod and seeds are used in form of powder for constipation and Hemorrhoids, immature pods use as vegetable for relief constipation and Hemorrhoids. Boil flowers water is use for constipation.

- Multifarious use:** Leaves use as vegetable as well as fodder forage and woof use for fuel purpose.
- Family:** Capparidaceae
- 68 **Plant species:** *Capparis decidua* (Forssk.) Edgew.
- Vernacular:** Kareenh/Kari
- Parts utilized:** Leave, fruit, twig, whole plant
- Specimen No:** 2590
- Flowering period:** March - April and August–September
- Medicinal use:** The unripe fruits are used in pickle/potherb to treat gas trouble and constipation. The aerial parts are slightly warmed and made into poultice (*Lupri*), applied on boils. The twigs are used as a tooth stick (*Miswak*) to treat pyorrhea. The seeds are made into paste and applied on athlete foot (*Chambal*). The twig is used as a tooth stick (*Miswak*).
- Multifarious use:** Ripened fruit is used in making Murabbah (fruits preserved in sugar solution) and unripe fruits are used in pickle/potherb. The young twigs are used as fodder to livestock. Plant is used as fuel source.
- 69 **Plant species:** *Capparis spinosa* L.
- Vernacular:** ---
- Parts utilized:** Whole plant
- Specimen No:** 2591
- Flowering period:** May- September
- Multifarious use:** Fodder for goat and sheep. Plant is a good soil binder.

- 70 **Plant species** *Cleome brachycarpa* Vahl ex DC.
Vernacular Ganduli
Parts utilized: Whole plant
Specimen No: 2592
Flowering period: December-March
Medicinal use: The powder of plant is given in abdominal pain.
Multifarious use: Plant is a good soil binder.
- 71 **Plant species** *Cleome scaposa* DC.
Vernacular ---
Parts utilized: Whole plant
Specimen No: 2591
Flowering period: December-March
Multifarious use: Plant is a fodder of the goat and plant is a good soil binder.
- 72 **Plant species:** *Cleome viscosa* L.
Vernacular: Loot buti
Parts utilized: Aerial parts, whole plant
Specimen No: 2524
Flowering period: March-April
Multifarious use: Plant is fodder for the goat. The dried plant is used as a fuel.
- 73 **Plant species:** *Dipterygium glaucum* Decne.
Vernacular: ---
Parts utilized: Whole plant
Specimen No: 2580
Flowering period: March-May to August-September

- Multifarious use:** The plant is used as fuel source.
- Family:** Caryophyllaceae
- 74 **Plant species:** *Silene conoidea* L.
- Vernacular:** Lonak
- Parts utilized:** Whole plant
- Specimen No:** 2443
- Flowering period:** March-April
- Multifarious use:** The plant act as soil binder, the plant indicate salinity in the soil. Plant use as fodder.
- 75 **Plant species:** *Spergula arvensis* L.
- Vernacular:** Lonak
- Parts utilized:** Aerial parts
- Specimen No:** 2420
- Flowering period:** March-April.
- Multifarious use:** Aerial parts are used as fodder to goat, camel.
- Family:** Chenopodiaceae
- 76 **Plant species:** *Atriplex schugnanica* Iljin
- Vernacular:** Surakha
- Parts utilized:** Aerial parts, leaves
- Specimen No:** 2359
- Flowering period:** July-October.
- Multifarious use:** Young leaves are cooked as vegetable. Aerial parts are used as fodder to goat, cow and camel.
- 77 **Plant species:** *Chenopodium album* L.

- Vernacular:** Bathu
- Parts utilized:** Aerial parts, leaves
- Specimen No:** 2195
- Flowering period:** January – September
- Medicinal use:** Aerial parts mixing with spinach (*Spinacia oleracea*) and *Brassica* leaves are cooked as vegetables to treat constipation. The leaves paste mixed with flour and fried in sesame oil which is called *Lupri* and applied on boils (*Barori*).
- Multifarious use:** Aerial parts mixing with spinach (*Spinacia oleracea*) and *Brassica* leaves are cooked as vegetables. Aerial parts are used as fodder.
- 78 **Plant species:** *Chenopodium murale* L.
- Vernacular:** Bathu
- Parts utilized:** Aerial parts
- Specimen No:** 2054
- Flowering period:** January – September
- Medicinal use:** As *Chenopodium album* L.
- Multifarious use:** As *Chenopodium album* L.
- 79 **Plant species:** *Haloxylon salicornicum* (Moq.) Bunge ex Boiss.
- Vernacular:** Lana
- Parts utilized:** Whole plant
- Specimen No:** 2030
- Flowering period:** October-November

- Multifarious use:** It is favorite fodder to camel and goat. The plant is burnt into fire and obtained ash is used for washing clothes. The dried plant is used as fuel wood. This plant is good soil binder.
- 80 **Plant species:** *Haloxylon stocksii* (Boiss.) Benth. and Hook.
- Vernacular:** ---
- Parts utilized:** Whole plant
- Specimen No:** 2154
- Flowering period:** October-November
- Multifarious use:** It is favorite fodder to camel and goat. The plant is burnt into fire and obtained ash is used as soap for washing clothes. The dried plant is used as fuel wood. This plant is good soil binder.
- 81 **Plant species:** *Salsola imbricata* Forssk.
- Vernacular:** Lana
- Parts utilized:** Whole plant
- Specimen No:** 2362
- Flowering period:** August-October
- Multifarious use:** This halophyte is favorite food of camel. The plant is good soil binder.
- 82 **Plant species:** *Spinacia oleracea* L.
- Vernacular:** Palak
- Parts utilized:** Leaves
- Specimen No:** 2377
- Flowering period:** February-May.

- Medicinal use:** Leaves are boiled in water and mixed with other herbs to make *Saag* that is given to constipating and iron deficient patients.
- Multifarious uses:** Leaves are cooked as vegetable. The same is used as fodder to livestock.
- 83 **Plant species:** *Suaeda fruticosa* Forssk. ex J. F.
- Vernacular:** ---
- Parts utilized:** Leaves
- Specimen No:** 2358
- Flowering period:** April-Sept.
- Medicinal use:** Leaves are used as a poultice for the treatment of ophthalmia, Leaves and stem are used for the urination problems. Leaves as raw use for treatment of kidney problems.
- Multifarious uses:** Plant act as soil binder in salt and sand soil. Use as fodder for lifestocks.
- Family:** Convolvulaceae
- 84 **Plant species:** *Convolvulus arvensis* L.
- Vernacular:** Wand vehri
- Parts utilized:** Vegetative parts
- Specimen No:** 2593
- Flowering period:** Throughout the year
- Medicinal use:** The whole plant is dried under shade and made into powder (*Phakki*) and is given to domestic animals to increase

appetite. Leaves are used for digestive problem of cattle.

- Multifarious uses:** The plant is used fodder to livestock.
- 85 **Plant species:** *Convolvulus microphyllus* Sieb. ex Spreng.
- Vernacular:** Sankha pushpin
- Parts utilized:** ---
- Specimen No:** 2501
- Flowering period:** February- May
- Medicinal use:** The powder of plant with equal amount of candy (*Misri*) is taken with milk to treat leucorrhoea.
- Multifarious use:** The plant is used as favorite fodder to cattle.
- 86 **Plant species:** *Convolvulus prostratus* Forssk.
- Vernacular:** Dharbari
- Parts utilized:** Aerial parts
- Specimen No:** 2575
- Flowering period:** Trough out the year
- Multifarious use:** The plant is used as favorite fodder to cattle.
- 87 **Plant species:** *Cressa cretica* L.
- Vernacular:** Rudranti
- Parts utilized:** Leaves, Aerial parts
- Specimen No:** 2112
- Flowering period:** Throughout the year
- Medicinal use:** The paste of leaves applied on sores and boils.
- Multifarious use:** Aerial parts are used as fodder to cow, goat and camel.
- 88 **Plant species:** *Evolvulus alsinoides* L.

- Vernacular:** ---
- Parts utilized:** Aerial parts
- Specimen No:** 2121
- Flowering period:** December-March
- Multifarious use:** The plant is a favorite fodder for livestock.
- 89 **Plant species:** *Ipomoea carnea* ssp. *fistulosa* (Mart. ex Choisy) D. Austin
- Vernacular:** *Gul-e-Abbasi*
- Parts utilized:** Leaves
- Specimen No:** 2500
- Flowering period:** July to November, perhaps longer
- Medicinal use:** The paste of leaves is applied on boils to hasten.
- Multifarious use:** The plant is used as hedge and ornamental purpose.
- Family:** Cucurbitaceae
- 90 **Plant species:** *Citrullus colocynthis* (L.) Schrad.
- Vernacular:** Kaur Tuma
- Parts utilized:** Roots, fruits
- Specimen No:** 2582
- Flowering period:** January-April
- Medicinal use:** Roots are used as tooth brush for relieving toothache. Seeds (3-5) are taken to cure constipation. The fruit is forcefully administered to cattle to treat digestive trouble and better growth. A sweet dish locally known as *Murabba* is made from the ripened fruit and is taken in constipation, gas troubles and liver diseases as well as to remove abdominal

worms. The fruit is cut into pieces and rubbed on bare feet to treat the Bars. The dried fruit mixed with the equal quantity of *Aelwa* (*Aloe vera* dried exude), *Haldi* (*Curcuma domestica*) and *Harr* (*Termenalia chebula*) and ground with water to make pills of 250mg. Two pills are given twice a day to treat Hemorrhoids. Few *harr* (*Termenalia chebula*) are inserted into *Citrullus* fruit and kept in wooden box for 8 days. After that, the same is dried under sun light. This mixture is ground along with black peeper to make powder. One pinch is given after meal to cure joints and abdominal pain. Unripe fruits are rubbed on soles of feet of diabetic patients till felt bitterness in mouth. Animal prickle (*Wanda*) is made from the fruits of *Citrullus* which is used for digestive problems of for this purpose, he ripened fruits in 40 kg quantity along with 40 kg black salt is placed in a drum and left for few days. When *Citrullus* expressed water then 5 kg sonf/ Fennel (*Foeniculum vulgare*) was added. After 24 hours, 20 kg sarson/ Mustered seeds (*Brassica campestris*) and 5 kg noshader (Ammonium chloride) are added. Throughout the whole period, the mixture is regularly stirred. This animal percale is prepared within 20 days and given to domestic animals to treat most of diseases and as tonic.

Multifarious use: The plant is a good soil binder. The fruit is given to all

domesticated animals for improving milk quality. The fruit is used as fodder by cattle.

- 91 **Plant species:** *Cucumis melo* subsp. *agrestis* var. *agrestis* Naudin
- Vernacular:** Chibar
- Parts utilized:** Fruits
- Specimen No:** 2568
- Flowering period:** July-November
- Multifarious uses:** Fruits are use as fruit, fruits use as pot herb.
- 92 **Plant species:** *Momordica balsamica* L.
- Vernacular:** Jangli Karela
- Parts utilized:** Fruit
- Specimen No:** 2621
- Flowering period:** August-October
- Medicinal use:** Fruit (*Karaila*) is prescribed to sugar patients as a potherb to treat diabetes. Cut is made in fruit and dusted salt on it which is kept open in night and given early morning to treat diabetes. The same is given to treat gas trouble and constipation. The juice of fruit is used in flatulence and obesity. It is given as blood purifier to treat boils and pimples. It is also supposed that by using its extract or as a vegetable, it improves the liver functioning and kill the abdominal worms. The unripe fruit is dried under shade and made into powder mixing with brown sugar. This compound is given to treat asthma. The powder of fruit is given in

diabetes.

Multifarious uses: The indigenous people used it as a vegetable.

93 **Plant species:** *Mukia maderaspatana* (L.) M.J. Roem.

Vernacular: Jangli kareli

Parts utilized: Aerial parts

Specimen No: 2503

Flowering period: April-October

Multifarious use: The plant is used as fodder.

Family: Cuscutaceae

94 **Plant species:** *Cuscuta reflexa* Roxb.

Vernacular: Amar bel

Parts utilized: Whole plant

Specimen No: 2197

Flowering period: August – September

Medicinal use: The fresh plant is made into paste and applied on hairs as shampoo acting as antidandruff. The same is applied on nail and finger infection. Plant extract is orally given to treat boils.

Multifarious use: The goat grazes the plant only.

95 **Plant species:** *Cuscuta monogyna* Vahl, Sym.

Vernacular: Amar bel

Parts utilized: Whole plant

Specimen No: 2176

Flowering period: August – September

- Medicinal use:** The fresh plant is made into paste and applied on hairs as shampoo acting as antidandruff. The same is applied on nail and finger infection. Plant extract is orally given to treat boils.
- Multifarious use:** The goat grazes the plant only.
- Family:** Cyperaceae
- 96 **Plant species:** *Cyperus alopecuroides* Rottb.
- Vernacular:** ---
- Parts utilized:** Aerial parts
- Specimen No:** 2426
- Flowering period:** January- April.
- Multifarious use:** The plant is highly palatable and is favorite fodder to livestock.
- 97 **Plant species:** *Cyperus difformis* L.
- Vernacular:** Sowe/Bhudde
- Parts utilized:** Aerial parts
- Specimen No:** 2426
- Flowering period:** July – October.
- Multifarious use:** The plant is highly palatable and is favorite fodder to livestock.
- 98 **Plant species:** *Cyperus digitatus* Roxb.
- Vernacular:** Sowe/Bhudde
- Parts utilized:** Inflorescence, whole plant
- Specimen No:** July-August

- Flowering period:** 2672
- Multifarious use:** The rabbits graze its inflorescence. The plant is highly palatable and is favorite fodder to livestock. Plant is a good soil binder.
- 99 **Plant species:** *Cyperus imbricatus* Retz.
- Vernacular:** ---
- Parts utilized:** Aerial parts, inflorescence
- Specimen No:** 2152
- Flowering period:** June
- Multifarious use:** The rabbits graze its inflorescence. The plant is highly palatable and is favorite fodder to livestock. Plant is a good soil binder.
- 100 **Plant species:** *Cyperus rotundus* L.
- Vernacular:** Dela
- Parts utilized:** Aerial part, root, Leaves
- Specimen No:** 2301
- Flowering period:** April - October
- Multifarious use:** Aerial part is used as a fodder for livestock. Roots are eaten by the porcupine. Leaves are eaten by rabbit. Plant is a good soil binder.
- 101 **Plant species:** *Fimbristylis quinquangularis* (Vahl) Kunth
- Vernacular:** Murrakh
- Parts utilized:** Aerial parts, inflorescence
- Specimen No:** 2477

- Flowering period:** August-October.
- Multifarious use:** The rabbits graze its inflorescence. The plant is highly palatable and is favorite fodder to livestock. Plant is a good soil binder.
- 102 **Plant species:** *Pycreus flavidus* (Retz.) T. Koyama
- Vernacular:** Sayyar Ghaah
- Parts utilized:** Aerial parts, inflorescence
- Specimen No:** 2506
- Flowering period:** July – August
- Multifarious use:** The rabbits graze its inflorescence. The plant is highly palatable and is favorite fodder to livestock. Plant is a good soil binder.
- 103 **Plant species:** *Pycreus sanguin* (Vahl) Nees
- Vernacular:** Ghaa
- Parts utilized:** Aerial parts
- Specimen No:** 2149
- Flowering period:** July – September
- Multifarious use:** Aerial parts are used as a fodder to livestock in its juvenile form.
- Family:** Equisetaceae
- 104 **Plant species:** *Equisetum ramosissimum* Desf.
- Vernacular:** Bhunj
- Parts utilized:** Aerial parts
- Specimen No:** 241

- Strobili period:** May-September
- Flowering use:** The plant is soil binder.
- Family:** Euphorbiaceae
- 105 **Plant species:** *Chrozophora tinctoria* (L.) Juss.
- Vernacular:** Nil buti
- Parts utilized:** Whole plant, aerial parts, leaves
- Specimen No:** 2613/2437
- Flowering period:** March-July
- Medicinal use:** The leaves are boiled in water and orally given to relieve chest burning. The plant is ground in water and given as cooling agent.
- Multifarious use:** The aerial part is used as fodder and whole plant as fuel source.
- 106 **Plant species:** *Euphorbia clarkeana* Hook.f.
- Vernacular:** Kheer buti
- Parts utilized:** Aerial parts
- Specimen No:** 2382
- Flowering period:** November - May.
- Multifarious use:** The aerial parts are used as favorite fodder.
- 107 **Plant species:** *Euphorbia dracunculoides* Lam.
- Vernacular:** Hermali booti/Sabuni booti
- Parts utilized:** Whole plant
- Specimen No:** 2059
- Flowering period:** Throughout the year

- Medicinal use:** The plant is given to cattle for increasing milk production.
- Multifarious use:** Seeds of plant are used for making soap. The plant is used as fodder.
- 108 **Plant species:** *Euphorbia granulata* Forssk.
- Vernacular:** Dudhi
- Parts utilized:** Whole plant
- Specimen No:** 2318
- Flowering period:** Almost throughout the year.
- Medicinal use:** The plant is dried under shade and made into powder that is given to treat diabetes. The plant is given to cattle for increasing milk production.
- Multifarious use:** The plant is used as fodder.
- 109 **Plant species:** *Euphorbia hirta* Forssk.
- Vernacular:** Dudhi Kalan
- Parts utilized:** Aerial parts
- Specimen No:** 2376
- Flowering period:** July-Dec.
- Multifarious use:** The aerial parts are used as fodder.
- 110 **Plant species:** *Euphorbia prostrata* Ait.
- Vernacular:** Dudhi
- Parts utilized:** Whole plant
- Specimen No:** 2518
- Flowering period:** December-March
- Multifarious use:** The plant is dried under shade and made into powder that is

given to treat diabetes.

Multifarious use: Fodder for goat and sheep. Plant is a good soil binder.

111 **Plant species:** *Euphorbia thymifolia* L.

Vernacular: Hazar Dani

Parts utilized: Whole plant

Specimen No: 2602

Flowering period: Throughout the year

Medicinal use: The plant is dried under shade and made into powder that is given to treat diabetes. Plant ground with water and given for diarrhea and dysentery.

Multifarious use: Fodder for goat and sheep. Plant is a good soil binder.

112 **Plant species:** *Ricinus communis* L.

Vernacular: Harnoli

Parts utilized: Stem, whole plant, seeds

Specimen No: 2601

Flowering period: Thought out the year

Medicinal use: The small quantity of oil is used orally to treat constipation mostly given to newborn baby and the women after a few days of childbirth. Leaves coating with *Brassica* oil are warmed over fire and applied to treat pain and inflammation.

Multifarious use: Seeds are brown like maize and eaten by human as a *Phullay* especially by the children. The dried branches are used as fuel wood source.

Family: Fabaceae

- 113 **Plant species:** *Alhagi maurorum* Medic.
Vernacular: Jwanha/Goghi dhaman
Parts utilized: Whole plant
Specimen No: 2323
Flowering period: April-September
Medicinal use: The whole plant is boiled in water treat skin allergy. If sugar would be added in the plant material, then it is reported as sedative. The extract of the plant is use as cooling agent purification of blood and to remove pimples (*Phory/Phunsi*). Dried parts of the plants are used to make powder (*Phakki*), which is given to treat gastric problems.
Multifarious use: The whole plant is used as fodder to camel and goat. The dried plant is used as fencing as well as fuel wood.
- 114 **Plant species:** *Alysicarpus longifolius* (Rottler ex Spreng.) Wight and Arn.
Vernacular: --
Parts utilized: Aerial parts, leaves
Specimen No: 2300
Flowering period: October- November
Multifarious use: The foliage used as cooking vegetables that is given to constipating patients.
Multifarious use: The aerial parts are used as fodder.
- 115 **Plant species:** *Cicer arietinum* L.
Vernacular: Chhana / Chholay
Parts utilized: Whole plant, leaves, seeds

- Specimen No:** 2400
- Flowering period:** February-March
- Medicinal use:** Black seeds are ground to make flour and bread is made, which is given to treat diabetes.
- Multifarious use:** Fresh green leaves are used as salad (*Palli*) along with chilly and salt; potherb, fodder for the animals. Seeds are used in cooked as well as in raw form by the human. Grain flour is used to prepare sweet dish like *Dhodha* and *Pateesa*. Dried plant is also used as fodder and fuel purpose.
- 116 **Plant species:** *Cicer microphyllum* Royle ex Bentham
- Vernacular:** Rat phuli
- Parts utilized:** Aerial parts
- Specimen No:** 2349
- Flowering period:** June-August
- Multifarious use:** Aerial parts are used as fodder.
- 117 **Plant species:** *Crotalaria burhia* Ham ex Bentham
- Vernacular:** Khapra
- Parts utilized:** Whole plant
- Specimen No:** 2014
- Flowering period:** September-October
- Multifarious use:** Camel, goat and sheep browse the plant. The dried plants are used for thatching of roofs, which is supposed to keep cool the covered area. The same is used as fuel wood source. The plant is a good sand binder.

- 118 **Plant species:** *Crotalaria medicaginea* Lamk.
Vernacular: ---
Parts utilized: Aerial parts
Specimen No: 2540
Flowering period: March-August
Multifarious use: It is called as goat food because it is favorite fodder of goat.
It is also used for hatching to protect wood from termites.
- 119 **Plant species:** *Cyamopsis tetragonoloba* (Linn.) Taubert
Vernacular: Guara
Parts utilized: Whole plant
Specimen No: 2149
Flowering period: Throughout the year, depending on the sowing time.
Multifarious use: Plant is used in cosmetic industry for making creams, lipsticks and lotions. The unripe fruits are cooked as vegetable. Leaves are used as favorite fodder. The plant is used as green manure.
- 120 **Plant species:** *Indigofera hochstetteri* Baker
Vernacular: Kano/Raari
Parts utilized: Aerial parts, fruits
Specimen No: 2559
Flowering period: August-October.
Medicinal use: The powder of fruits is mixed with wheat flour, sugar and milk and cooked to get sweet dish, locally called *Halwa*, which is given as sexual tonic to males.

- Multifarious use:** The aerial parts are used as fodder.
- 121 **Plant species:** *Indigofera oblongifolia* Forsk.
- Vernacular:** ---
- Parts utilized:** Whole plant
- Specimen No:** 2590
- Flowering period:** July-October
- Multifarious use:** Shoot parts are used, as a fodder for livestock.
- 122 **Plant species:** *Lathyrus aphaca* L.
- Vernacular:** Jangli Matar
- Parts utilized:** Whole plant
- Specimen No:** 2000
- Flowering period:** February – April
- Multifarious use:** The plant is used as fodder.
- 123 **Plant species:** *Medicago polymorpha* L.
- Vernacular:** Maina
- Parts utilized:** Aerial parts, foliage, leaves
- Specimen No:** 2035/2594
- Flowering period:** March – April
- Multifarious use:** Leaves collected in juvenile stage and cooked as vegetable especially by *Pakhtoon* tribe. The aerial parts are used as fodder.
- 124 **Plant species:** *Melilotus alba* Desr.
- Vernacular:** Sinjhi
- Parts utilized:** Whole plant

- Specimen No:** 2031
- Flowering period:** February-March
- Multifarious use:** The whole plant is used as fodder to livestock.
- 125 **Plant species:** *Melilotus indica* (L.) All.
- Vernacular:** Sinjhi
- Parts utilized:** Whole plant
- Specimen No:** 2032
- Flowering period:** December – May
- Multifarious use:** The plant is used as fodder to livestock.
- 126 **Plant species:** *Pithecolobium dulce* Bth.
- Vernacular:** Jangle jalebi
- Parts utilized:** Whole plant, Leaves, fruits
- Specimen No:** 2672
- Flowering period:** March-April
- Multifarious use:** The livestock browses leaves. The ripened fruit is eaten as raw. The branches are used as good fuel source. The plant is grown for ornamental and shade purposes.
- 127 **Plant species:** *Pongamia pinnata* (L.) Merril.
- Vernacular:** Sukh chain
- Parts utilized:** Stem, leaves, fruit
- Specimen No:** 2400
- Flowering period:** April-May
- Medicinal use:** The decoction of equal quantity of fruit and leaves is given to treat gas trouble.

- Multifarious use:** The plant is grown on roadside as fencing/shade purpose.
The leaves are used as fodder. The dried stem is used as fuel wood source.
- 128 **Plant species:** *Rhynchosia minima* (L.) DC.
Vernacular: Wand vehri
Parts utilized: Aerial parts
Specimen No: 2512
Flowering period: January-March
Multifarious use: The plant is used as fodder.
- 129 **Plant species:** *Rhynchosia pulverulenta* Stocks
Vernacular: Wand vehri
Parts utilized: Whole plant
Specimen No: 2409
Flowering period: January-July
Multifarious use: The plant is used as fodder.
- 130 **Plant species:** *Sesbania sesban* (L.) Merrill
Vernacular: Manjantari
Parts utilized: Leaves, stem
Specimen No: 2407
Flowering period: August-February
Multifarious use: Leaves are used as fodder. Stem is used in roof thaching and fuel source.
- 131 **Plant species:** *Tephrosia purpurea* (L.) Pers.
Vernacular: Sarphooka

- Parts utilized:** Roots
- Specimen No:** 2578
- Flowering period:** October January
- Medicinal use:** Roots are boiled in water and the extract is given in diarrhea.
The root is used as tooth stick to relieve toothache and pyorrhea.
- Multifarious use:** Pods in young form use as vegetable. Plant use as fodder and dry form use for fuel.
- 132 **Plant species:** *Tephrosia uniflora* Pers.
- Vernacular:** Sarphooka
- Parts utilized:** Root
- Specimen No:** 2544
- Flowering period:** February-March and August-November
- Medicinal use:** Same as *T. purpurea*
- Multifarious use:** Pods in young form use as vegetable. Plant use as fodder and dry form use for fuel.
- 133 **Plant species:** *Tephrosia uniflora* var. *petrosa*
- Vernacular:** Sarphooka
- Parts utilized:** Root
- Specimen No:** 2578
- Flowering period:** February-March and August-November
- Medicinal use:** Same as *T. purpurea*
- Multifarious use:** Pods in young form use as vegetable. Plant use as fodder and dry form use for fuel.

- 134 **Plant species:** *Vicia faba*
Vernacular: Gandli mater
Parts utilized: Pod, whole plant
Specimen No: 2137
Flowering period: August-February
Multifarious use: Pods are used as a vegetable. The plant is favorite fodder of livestock.
- 135 **Plant species:** *Vicia sativa* L.
Vernacular: Jangli matri
Parts utilized: Pod, whole plant
Specimen No: 2407
Flowering period: July-August
Multifarious use: Pods are used as a vegetable. The plant is favorite fodder of livestock.
- 136 **Plant species:** *Vigna trilobata* (L.) Verdc.
Vernacular: Jangli Paneer
Parts utilized: Aerial part
Specimen No: 2100
Flowering period: October
Multifarious use: Aerial parts are given as fodder.
Family: Gentianaceae
- 137 **Plant species:** *Enicostemma hyssopifolium* (Willd.) Verd.
Vernacular: Sabri
Parts utilized: Aerial parts

- Specimen No:** 2061
- Flowering period:** Thought out the year
- Multifarious use:** Aerial parts are used as fodder.
- Family:** Lamiaceae
- 138 **Plant species:** *Mentha longifolia*(L.) L.
- Vernacular:** Chita podina
- Parts utilized:** Leaves
- Specimen No:** 2608
- Flowering period:** May-November
- Medicinal use:** Leaves are crushed with red chili and used in chatni formation that is given as digestive. Equal quantity of dried leaves and sonf/Funnel (*Foeniculum vulgare*) are boiled in water and given to treat nausea, vomiting and abdominal pain. Leaves are used for digestive problems.
- Multifarious use** Plant is less palatable.
- Family:** Lathyraceae
- 139 **Plant species:** *Lawsonia inermis* L.
- Vernacular:** Menhdi
- Parts utilized:** Leave, branches
- Specimen No:** 2310
- Flowering period:** October-November
- Medicinal use:** Leaves paste made into rap seed oil is externally applied to treat athlete foot. Leaves extract is used as mouth wash to treat throat pain. The leaves powder is given with milk to

cattle after mating acting as cooling agent. Leaves paste is applied on head to alleviate excessive heat of body and as natural hair dye.

Multifarious use: The branches are used as fuel source.

Family: Malvaceae

140 **Plant species:** *Abutilon pakistanicum* Jafri and Ali

Vernacular: Kanghi buti

Parts utilized: Leaves, stem, seeds

Specimen No: 2372

Flowering period: March-April

Medicinal use: Seeds are soaked in water and mucilage obtained is given as cooling agent.

Multifarious use: Leaves are browsed by goat. Stem is used in roof thatching and fuel source.

141 **Plant species:** *Malva parviflora* L.

Vernacular: Sonchal

Parts utilized: Aerial parts, fruits

Specimen No: 2157

Flowering period: February-June

Multifarious use: The unripe fruits are consumed by children as raw. Aerial parts of the plant are favorite fodder to livestock.

Family: Meliaceae

142 **Plant species:** *Azadirachta indica* (L.) A. Juss.

Vernacular: Neem

- Parts utilized:** Leave, fruit, whole plant
- Specimen No:** 2564
- Flowering period:** April-May
- Medicinal use:** Leaf extract is used for blood purification to treat boils, pimples, skin irritation and as cooling agent. The paste of leaves is externally applied to remove cattle skin allergy and itching. The paste is also applied on heads as anti-lice agent. Leaves are kept in wheat grain stores as insecticidal agent. The leaves are burnt in sesame oil and applied to body to treat skin diseases. The juice of leaves is used for washing wounds. The ripened fruit is eaten supposed as a tonic for liver and stomach. Seed paste is applied on Hemorrhoids.
- Multifarious use:** The ripened fruit is eaten supposedly as a tonic. Bunch of leaves is made and used to wash earthen pots (specially used for butter extraction). The plant is grown for shade purpose. The dried branches are used as fuel wood source. Leaves are used as fodder.

- 143 **Plant species:** *Melia azedirach* L.
- Vernacular:** Dharek
- Parts utilized:** Leave, fruit, whole plant
- Specimen No:** 2311
- Flowering period:** March – April
- Medicinal use:** Leaves are boiled in water and given as blood purification to remove pimples and boils (*Musaffi-e-Khoon*) and cooling

agent. The same is given to treat jaundice, allergies (*Malli badi*). The pulp obtained from fruit is supposed to be a tonic for liver and stomach. The leaves paste is externally applied to treat skin itching and allergy. The same is also externally applied to kill lice.

Multifarious use: The foliage is used as fodder to goat. The plant is cultivated for shade. The stem is used for making ploughing instrument called *Panjali*. The dried plant is used as fuel wood source.

Family: Mimosaceae

144 **Plant species:** *Acacia nilotica* subsp. *cupressiformis* (T.L. Stewart) Ali

Vernacular: Kabli kikar

Parts utilized: Gum, leaves, pods, wood,

Specimen No: 2611

Flowering period: March-May

Medicinal use: Gum is used in making sweet dish called *Halwa* that is prescribed as tonic and good for male sexual problems.

Multifarious use: Leaves and unripe pods are good fodder to goat, sheep and camel. The wood is used for furniture, agricultural tools and building material as well as fuel source. The plant also provides a shade to the livestock and human.

145 **Plant species:** *Acacia jacquemontii* Benth.

Vernacular: Kanda

Parts utilized: Branches, leaves, flowers, fruits, whole plant

Specimen No: 2046

Flowering period: February-May

Medicinal use: Foliage or leaves (*lung*) is ground to make powder given to the livestock to solve their blockage of the urine problem.

Multifarious use: The livestock browses the leaves, flowers and fruits. The branches are used as hedges around the huts to keep away thieves and wild animals. The dried branches are used as fuel wood. Foliage is also used as a fodder. Plant is a good source of fuel for the native community. Wood is also used as a building and roof thatching material. In the Deserted habitat it provides a shade to the livestock and human. The animals especially donkeys eat the pod.

146 **Plant species:** *Acacia nilotica* (L.) DeL. subsp. *indica* (Benth.) Brenan

Vernacular: Kikar

Parts utilized: Whole plant, bark, gum, leaves, pods, branches

Specimen No: 2192

Flowering period: March – May

Medicinal use: The roots bark is boiled in water to yield juice and is taken to treat jaundice. Five plant parts such as leaves, bark, flowers, gum and unripe pods are powdered that is recommended in spermatorrhoea and premature ejaculation. The twigs are used as tooth brush for strengthening of gums. The pods are boiled in water and given to treat stomach and urinary bladder problem. Leaves (*lung*) are powdered and used in blockage of the urine problem for the livestock.

- Multifarious use:** The branches are used as tooth stick. The vegetative parts are used as fodder. The wood is a good source of timber and building material. The unripe pods are used to made pickles. Foliage is also used as a fodder. Plant is a good source of fuel for the native community. Wood is also used as a building and roof thatching material. In the desert habitat it provides a shade to the livestock and human. The animals eat pod especially the sheep and goats.
- 147 **Plant species:** *Albizzia lebeck* (L.) Bth.
- Vernacular:** Shirin
- Parts utilized:** Leaves, Bark
- Specimen No:** 2153
- Flowering period:** March – May
- Medicinal use:** Bark is boiled in water and used as gargle to strengthen gums. The powder of seeds is snuffed to treat headache and influenza.
- Multifarious use:** The plant is grown for wind breaker and shade. Leaves are used as a fodder. Wood is as fuel; however, some people avoid using since they believe that the plant is abode of evil spirits.
- 148 **Plant species:** *Prosopis cineraria* (L.) Druce.
- Vernacular:** Jand
- Parts utilized:** Whole plant, gum, leaves, fruits, pods
- Specimen No:** 2377

- Flowering period:** Dec.-March
- Medicinal use:** The gum is mostly sold in market processed for making indigenous recipes used as tonic. Gum is used to make *Halwa* used to increase semen production. The coal ground in mustered oil and is applied on wounds.
- Multifarious use:** The gum is mostly sold in market processed for making indigenous recipes. Unripe pods are cooked as vegetable. The ripened fruits are eaten as raw. The branches are lopped for providing forage to domestic animals. The lopped branches are employed for fencing purpose. The trunk/wood is used as timber purpose mostly employed for making furniture, building as supportive material. The plant has a good fuel wood source.
- 149 **Plant species:** *Prosopis glandulosa* Torr.
- Vernacular:** Gul kanda
- Parts utilized:** Leaves, whole
- Specimen No:** 2375
- Flowering period:** March-May
- Medicinal use:** Leaves decoction is used to cure urine blockage of donkeys.
- Multifarious use:** Whole plant is used as a source of fuel and fence purpose.
- 150 **Plant species:** *Prosopis juliflora* (Swartz) DC.
- Vernacular:** Kikri
- Parts utilized:** Whole plant, gum, leaves, fruits
- Specimen No:** 2143

- Flowering period:** March-June
- Medicinal use:** Paste of the leaves is applied to treat ringworms.
- Multifarious use:** Gum is used in preparing sweet dish. The ripened pods are used as fodder to goat. The wood is used as supporting material and fuel source. The branches are used for fencing.
- Family:** Molluginaceae
- 151 **Plant species:** *Glinus lotoides* L.
- Vernacular:** Baphara
- Parts utilized:** Whole plant
- Specimen No:** 2124
- Flowering period:** February-April
- Multifarious use:** Plant is good soil binder.
- 152 **Plant species:** *Mollugo cerviana* (L.) Seringe
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2117
- Flowering period:** September-November.
- Multifarious use:** The plant is used as fodder.
- 153 **Plant species:** *Mollugo nudicaulis* Lamk.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 1912
- Flowering period:** October-November.
- Multifarious use:** The plant is used as fodder.

- 154 **Plant species:** *Mollugo pentaphyla* L.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2214
- Flowering period:** October-November.
- Multifarious use:** The plant is used as fodder.
- Family:** Moraceae
- 155 **Plant species:** *Ficus bengalensis* L.
- Vernacular:** Barghad
- Parts utilized:** Fruit, whole plant, leaves, buds
- Specimen No:** 2380
- Flowering period:** March-June
- Medicinal use:** Equal quantity of buds, fruits and hanging roots are shade dried and made into powder which is prescribed in spermatorrhoea and leucorrhoea. Juvenile leaves are dried under shade and made into powder. One tablespoon full powder boiled in water mixing with sugar that is given for flu and tonic for memory. The hanging roots are dried under shade and used as tea for flu, spermatorrhoea and as tonic. The buds are ground in water along with sugar and given to stop diarrhea. The equal quantity of fruits, buds (*Konpal*), hanging roots (*Darhi*) and milky latex (*sheer bargad*) is made into powder and is given for spermatorrhoea and leucorrhoea. This recipe is also claimed by Hakeem given as

tonic to conceive pregnancy. Two drops of milky latex is poured in sugary candy (*Batasha*) and given to treat spermatorrhoea and premature ejaculation and as stimulant. The extract of hanging root is given to male to treat enhance sexual desire.

Multifarious use: Fruit of the plant is eaten by Cuckoo (*koil*). Plant provides good shade. Plant is a good source of fuel.

156 **Plant species:** *Ficus carica* L.

Vernacular: Injir

Parts utilized: Leaves, branches, fruits

Specimen No: 2199

Flowering period: May – November

Medicinal use: The ripened dried fruits are roasted in milk and applied as poultice on boils to hasten. The fruit is eaten daily twice a day to cure constipation and Hemorrhoids.

Multifarious use: Goat browses leaves. The dried branches are used as fuel.

157 **Plant species:** *Ficus religiosa* L.

Vernacular: Peepal

Parts utilized: Whole plant, bark, fruit

Specimen No: 2618

Flowering period: April-June

Medicinal use: The paste of bark is applied on inflamed parts. The ash of bark is given with water to heal diarrhea and dysentery. The bark is soaked in water and the juice is given twice a day as

cooling agent. The fallen fresh leaves are boiled in water and given to treat nausea and vomiting. The powder of shade dried fruit is given with water to treat asthma.

Multifarious use: The wood is used as fuel wood.

158 **Plant species:** *Morus alba* L.

Vernacular: Shehtoot

Parts utilized: Whole plant, leave, root, fruit

Specimen No: 2610

Flowering period: April – September

Medicinal use: Fruit is given to treat sour throat. The decoction of fruit is used in cough due to throat infection. The leaves are boiled in water (*Joshanda*) and given for the same purpose. Extract of root and bark are used to kill abdominal worms.

Multifarious use: The wood has good value of wood and building material. The plant provides shade to the locals. Leaves are used as forage for goat. Fruit is eaten by the human.

159 **Plant species:** *Morus nigra* L.

Vernacular: Toot

Parts utilized: Whole plant, leave, fruit

Specimen No: 2617

Flowering period: March – July

Medicinal use: Fruits are used to treat sour throat. The decoction of fruit is used in cough due to throat infection. The decoction of leaves (*Joshanda*) was taken also for the same purpose. The

root and bark are boiled in water to yield extract and given to kiexpel abdominal worms.

Multifarious use: The wood has good value of wood and building material. This plant provides shade to the locals. Leaves are used as forage for goat. Fruit is eaten by human.

Family: Moringaceae

160 **Plant species:** *Moringa oleifera* Lamk.

Vernacular: Suhanjna

Parts utilized: Branches, leaves, flowers, fruits, pods, roots

Specimen No: 2616

Flowering period: January-April

Medicinal use: The roots are boiled in water and used as gargle for sore throat. Leaves extract is used for skin allergic conditions (*Malli baadi*). Paste of fresh leaves along with wheat flour is fried in sesame oil, called *Lupri* that is applied on carbuncle (*Ghamair*), boils (*Phorey*) and pimples (*Phunsy*). Flowers are cooked as vegetable and given to treat joints pain and inflammation. Unripe pods are pickled and used as an appetizer and to heal joints pain. Seeds are grind to make powder, which is used as a tonic. It is also reported as tonic to enhance sexual desire if one teaspoon is given early in the morning before breakfast. Leaves are boiled in water and given to livestock for their digestive problems.

Multifarious use: Flowers are cooked as vegetable. Unripe pods and roots are

pickled and used as an appetizer. Foliage is used as fodder. The dried branches are used as fuel wood source. The plant is grown as ornamental purpose.

Family: Myrtaceae

161 **Plant species:** *Eucalyptus camaldulensis* Dehnh.

Vernacular: Sufeda

Parts utilized: Leaves, Whole plant

Specimen No: 2670

Flowering period: April-May

Medicinal use: The decocotion of leaves is used as *Joshanda* to relieve flue. Leaves are used as condiment.

Multifarious use: Leaves are used as condiment. Wood is used as supporting material and fuel source. Leaves are a favorite fodder to goat.

162 **Plant species:** *Psidium guajava* L.

Vernacular: Amrood

Parts utilized: Whole plant, leaves, fruit

Specimen No: 2623

Flowering period: September-October

Medicinal use: Ripened fruit is used to treat constipation and as a general tonic. The same is orally given to children to expel abdominal worms. Unripe fruit is slightly roasted in ash and given to cure fluand cough. The leaves powder is given to increase appetite of human and livestock.

Multifarious use: Goats graze young leaves. The branches are used as fuel

- wood source. The human eats fruit.
- 163 **Plant species:** *Syzygium cumini* (L.) Skeels
- Vernacular:** Jaman
- Parts utilized:** Leave, fruit, whole plant
- Specimen No:** 2652
- Flowering period:** May-July
- Medicinal use:** The bark is boiled in water and given to treat fever (*Taap*). It is also used to relieve pain and inflammation of cattle The ripened fruit is eaten to meet iron deficiency. Leaves are given as fodder to domesticated animals for diarrhea. The powder of seeds is used in diarrhea, spermatorrhoea and leucorrhoea.
- Multifarious use:** The plant is used as building material, shade and fuel source. Leaves are used as forage for goats. The human eats ripened fruit as tonic.
- Family:** Nyctaginaceae
- 164 **Plant species:** *Boerhavia diffusa* L.
- Vernacular:** Tangri
- Parts utilized:** Roots
- Specimen No:** 2527
- Flowering period:** November-January
- Medicinal use:** Roots are ground in water and given to patients suffering from kidney/gall bladder stones. Roots are made into pieces and tied as necklace to cure jaundice.

- Multifarious use:** The whole plant is a favorite fodder for sheep and goat.
- 165 **Plant species:** *Boerhavia pentandra* Burch.
- Vernacular:** Koor tangri
- Parts utilized:** Aerial parts
- Specimen No:** 2560
- Flowering period:** November-January
- Multifarious use:** Tender aerial parts are used as fodder.
- 166 **Plant species:** *Boerhavia procumbens* Banks ex Roxb.
- Vernacular:** Koor tangri
- Parts utilized:** Whole plant
- Specimen No:** 2521
- Flowering period:** August – September
- Medicinal use:** Roots are ground in water and given to patients suffering from kidney/gall bladder stones. Roots are made into pieces and tied as necklace to cure jaundice. The plant paste is applied externally to cure paralysis.
- Multifarious use:** The whole plant is a favorite fodder for sheep and goat.
- Family:** Orobanchaceae
- 167 **Plant species:** *Cistanche tubulosa* (Schrenk) Hook.f.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2645
- Flowering period:** March-April
- Multifarious use:** The plant is root parasite found growing on *Acacia*

jacquimontii, *Calotropis procera*; however it is used as an ornamental.

- 168 **Plant species:** *Orabanche aegyptica* Pers.
Vernacular: Muthar
Parts utilized: Whole plant
Specimen No: 2644
Flowering period: April- September
Multifarious use: Root parasite of the crop yield.
Family: Oxalidaceae
- 169 **Plant species:** *Oxalis corniculata* L.
Vernacular: Khati booti
Parts utilized: Whole plant
Specimen No: 2184
Flowering period: March-December
Medicinal use: The plant is chewed to increase appetite.
Multifarious use: Plant is also used as fodder.
Family: Papaveraceae
- 170 **Plant species:** *Hypocoum leptocarpum* Hook. f. and Thoms.
Vernacular: --
Parts utilized: Aerial parts
Specimen No: 2181
Flowering period: June-August
Multifarious use: Leaves/aerial parts are used as fodder to goat and sheep.
- 171 **Plant species:** *Argemone mexicana* L.

- Vernacular:** Sawi pohli
- Parts utilized:** Aerial parts, roots, seeds
- Specimen No:** 2153
- Flowering period:** December-March
- Medicinal use:** Seeds are given to treat skin irritation. The roots are ground in water and made into paste that is applied on Hemorrhoids. Seeds are crushed in water to make paste that is applied on boils to heal.
- Medicinal use:** Leaves/aerial parts are used as fodder to goat and sheep.
- Family:** Papilionaceae
- 172 **Plant species:** *Trigonella monantha* subsp. *incisa* C.A. Meye
- Vernacular:** Teen pati
- Parts utilized:** Whole plant
- Specimen No:** 2182
- Flowering period:** April.
- Multifarious use:** Aerial Parts utilized as potherb in some areas. It is used as fodder to goat and sheep.
- 173 **Plant species:** *Dalbergia sissoo* Roxb.
- Vernacular:** Talhi, Shesham
- Parts utilized:** Whole plant, leaves
- Specimen No:** 2644
- Flowering period:** March-May
- Medicinal use:** The fresh stem is set into fire from one side and exude is obtained from the opposite side, which is applied on

ringworm and athlete foot (*Chambal*) to heal.

Multifarious use: The wood is a good source of timber that is used for furniture, agricultural implements and building material. The plant is used as shade tree and foliage for fodder/forage. The branches are used as fodder.

Family: Plantaginaceae

174 **Plant species:** *Plantago lanceolata* L.

Vernacular: Jangli isapghol

Parts utilized: Aerial parts, seeds

Specimen No: 2178

Flowering period: June–September

Medicinal use: Seeds are soaked in water overnight and given early morning as cooling agent.

Multifarious use: Aerial parts are used as fodder to goat and sheep.

175 **Plant species:** *Plantago major* L.

Vernacular: Janghli Isapghol

Parts utilized: Aerial parts

Specimen No: 2064

Flowering period: June–August

Medicinal use: The same as previous species.

Multifarious use: As previous species.

Family: Poaceae

176 **Plant species:** *Acrachne racemosa* (Heyne ex Roem. and Schult.) Ohwi

Vernacular: ---

- Parts utilized:** Whole plant
- Specimen No:** 2489
- Flowering period:** March- May, August- October.
- Multifarious uses:** Plant use as fodder and forage as well as fuel purpose.
- 177 **Plant species:** *Aeluropus lagopoides* (L.) Trin. ex Thw.
- Vernacular:** Kalar ghaa
- Parts utilized:** Whole
- Specimen No:** 2134
- Flowering period:** March-December
- Multifarious uses:** The plant is used as fodder.
- 178 **Plant species:** *Aristida adscensionis* L.
- Vernacular:** Lamb ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2572
- Flowering period:** March-December
- Multifarious uses:** The plant is used as fodder. Leaves are eaten by rabbit.
- 179 **Plant species:** *Aristida mutabilis* Trin. and Rupr.
- Vernacular:** Lamb ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2352
- Flowering period:** June-September
- Multifarious uses:** The plant is used as fodder.
- 180 **Plant species:** *Arundo donax* L.
- Vernacular:** Narr

- Parts utilized:** Whole plant
- Specimen No:** 2424
- Flowering period:** June – December
- Multifarious uses:** The plant is used as fodder and hedge around huts. The stem nodes are used as an inkpot pen locally known as *Qalam* are made from it to write on the tablet with ink in the rural areas to improve writing especially urdu. They also used its long hollow stem to recite the Call for prayer (*Aazaan*) in the ear of newly born baby.
- 181 **Plant species:** *Avena fatua* subsp. *fatua* L.
- Vernacular:** ---
- Parts utilized:** Aerial parts
- Specimen No:** 2581
- Flowering period:** March-August
- Multifarious uses:** The plant is used as fodder.
- 182 **Plant species:** *Brachiaria ovalis* Stapf
- Vernacular:** Ghaa
- Parts utilized:** Aerial parts
- Specimen No:** 2505/2109
- Flowering period:** March-December
- Multifarious uses:** The plant is used as fodder.
- 183 **Plant species:** *Brachiaria eruciformis* (J.E. Smith) Griseb
- Vernacular:** Ghaa
- Parts utilized:** Aerial parts

- Specimen No:** 2313
- Flowering period:** July-September
- Medicinal use:** The plant is favorite fodder for the livestock.
- 184 **Plant species:** *Bromus pectinatus* Thunb.
- Vernacular:** --
- Parts utilized:** Aerial parts
- Specimen No:** 2383
- Flowering period:** April-August
- Medicinal use:** The plant is favorite fodder for the livestock. Plant use for fuel.
- 185 **Plant species:** *Bromus sericeus* Drobov
- Vernacular:** --
- Parts utilized:** Aerial parts
- Specimen No:** 2378
- Flowering period:** April-August
- Multifarious uses:** The plant is favorite fodder for the livestock. Plant use for fuel.
- 186 **Plant species:** *Cenchrus biflorus* Roxb.
- Vernacular:** Mohabbat buti/Ludri
- Parts utilized:** Aerial parts
- Specimen No:** 2504/2429
- Flowering period:** January-April and again September-November
- Multifarious uses:** The plant is used as fodder in juvenile stage.
- 187 **Plant species:** *Cenchrus ciliaris* L.

- Vernacular:** Drahman/Dhaman ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2058
- Flowering period:** February – March
- Multifarious uses:** The plant is used as favorite fodder to cattle.
- 188 **Plant species:** *Cenchrus pennisetiformis* Hochst. and Steud. ex Steud.
- Vernacular:** Dhamni
- Parts utilized:** Whole plant
- Specimen No:** 2346
- Flowering period:** February-April and again August-October
- Multifarious uses:** The plant is used as favorite fodder to cattle.
- 189 **Plant species:** *Cenchrus setigerus* Vahl
- Vernacular:** Talra
- Parts utilized:** Whole plant
- Specimen No:** 2514
- Flowering period:** August-January and again in April
- Multifarious use:** Plant is a good soil binder and fodder for livestock.
- 190 **Plant species:** *Chloris gayana* Kunth
- Vernacular:** Chitta ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2088
- Flowering period:** March-May and again September-November.
- Multifarious use:** The plant is good fodder to livestock especially in juvenile stage.

- 191 **Plant species:** *Cymbopogon jwarancusa* subsp. *jwarancusa* (Jones) Schult.
- Vernacular:** Khavi
- Parts utilized:** Whole plant, root, seeds, stem
- Specimen No:** 2356
- Flowering period:** Almost throughout the year
- Medicinal use:** The smoke of plant is used as fumigant that is supposed useful to treat measles. The matrices (*Chatai*) made up of stems is prescribed to the patient of typhoid fever. Roots extract mixed with molasses (*Gurr*) and used for the treatment of typhus fever and cough. Seeds of plant called *kaksi* they spread on the bed of chicken pox patient for hell up soon.
- Multifarious uses:** Stems are used as floor mates (*Chatai*), which give pleasant odor. The aerial parts are grazed by the livestock only during scarcity of forage. The aerial part of plant is given to cattle for fragrance in milk. The stem of the plant is also used for roof thatching having insulating effects. Besides, this practice will protect wood form termites. Its roots are used as substitute of *Khass* used for washing domestic pots/utensils.
- 192 **Plant species:** *Cynodon dactylon* (L.) Pers.
- Vernacular:** Talla
- Parts utilized:** Whole plant, roots
- Specimen No:** 2092
- Flowering period:** Almost round the year

- Medicinal use:** The person having burning sensation of feet is recommended to walk early morning on the lawn of *Cynodon dactylon*. Dewdrops are used to remove pimples of the face. The decoction of roots is used to remove fever.
- Multifarious uses:** The aerial parts are used as favorite fodder to cattle.
- 193 **Plant species:** *Dactyloctenium aegyptium* (L.) Willd.
- Vernacular:** Madhana ghaa
- Parts utilized:** Aerial parts, whole plant
- Specimen No:** 2419/2509
- Flowering period:** July-October
- Multifarious use:** The plant is used as a fodder for livestock. It is also a good soil binder.
- 194 **Plant species:** *Dactyloctenium aristatum* Link
- Vernacular:** Madhana
- Parts utilized:** Aerial parts, whole plant
- Specimen No:** 2510/2096
- Flowering period:** July-September
- Multifarious use:** Same as previous species.
- 195 **Plant species:** *Desmostachya bipinnata* (L.) Stapf.
- Vernacular:** Dab Ghaa
- Parts utilized:** Whole plant, leaves, culm
- Specimen No:** 2579
- Flowering period:** July – October or November
- Multifarious use:** Leaves are used as fodder. The culms are used for broom

making. The plant is used as fuel. It is also a good soil binder.

- 196 **Plant species:** *Dichanthium annulatum* (Forssk.) Stapf.
Vernacular: Murgha ghaa
Parts utilized: Whole plant
Specimen No: 2028
Flowering period: March-November
Multifarious uses: The plant is used as fodder. The plant is used as fuel. It is also a good soil binder.
- 197 **Plant species:** *Digitaria ciliaris* (Retz.) Koel
Vernacular: ---
Parts utilized: Aerial parts, whole plant
Specimen No: 2513
Flowering period: July-September
Multifarious uses: Aerial parts are used as fodder. The plant is used as fuel. It is also a good soil binder.
- 198 **Plant species:** *Eleusine indica* (L.) Gaertn.
Vernacular: Gandel ghaa
Parts utilized: Whole plant, aerial parts
Specimen No: 2049
Flowering period: June-August
Multifarious uses: The aerial parts are used as fodder. The plant is a good soil binder.
- 199 **Plant species:** *Enneapogonpersicus* Boiss.

- Vernacular:** --
- Parts utilized:** Aerial part
- Specimen No:** 2527
- Flowering period:** May-June
- Multifarious uses:** The aerial parts are used as fodder.
- 200 **Plant species:** *Eragrostis cilianensis* (All.) Lut. ex F.T. Hubbard
- Vernacular:** Ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2388
- Flowering period:** May-October
- Multifarious uses:** The plant is used as favorite fodder to goat, sheep, cows and buffalos.
- 201 **Plant species:** *Eragrostis pilosa* (Linn.) P. Beauv.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2382
- Flowering period:** July-October
- Multifarious uses:** The plant is used as favorite fodder to goat, sheep, cows and buffalos.
- 202 **Plant species:** *Eragrostis ciliaris* (L.) R. Br.
- Vernacular:** Ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2573
- Flowering period:** through-out year

- Multifarious uses:** The plant is used as fodder.
- 203 **Plant species:** *Eragrostis minor* Host
- Vernacular:** Ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2375
- Flowering period:** May-September
- Multifarious uses:** The plant is used as fodder.
- 204 **Plant species:** *Imperata cylindrica* (L.) Raeuschel.
- Vernacular:** Dab Ghaas
- Parts utilized:** Aerial parts, whole plant
- Specimen No:** 2092
- Flowering period:** March-December
- Multifarious uses:** Aerial parts are used as fodder at the juvenile stage and during drought period.
- 205 **Plant species:** *Lasiurus indicus* Henr.
- Vernacular:** Karera
- Parts utilized:** Aerial parts
- Specimen No:** 2542
- Flowering period:** September-October
- Multifarious uses:** This is preferred species for grazing goat, sheep, cows and buffalos. It is a good soil binder.
- 206 **Plant species:** *Leptochloa panicea* (Retz.) Ohwi
- Vernacular:** --
- Parts utilized:** Whole plant

- Specimen No:** 2288
- Flowering period:** March-September.
- Multifarious uses:** Plant is used as a fodder for livestock and fuel.
- 207 **Plant species:** *Ochthochloa compressa* (Forssk.) Hilu
- Vernacular:** Juth Madhaana/Chhimbar/Buchri ghaa
- Parts utilized:** Aerial parts, whole plant
- Specimen No:** 2530
- Flowering period:** March-September.
- Multifarious use:** Aerial parts are used as a fodder for livestock. It is also a good soil binder.
- 208 **Plant species:** *Panicum psilopodium* Trin.
- Vernacular:** ---
- Parts utilized:** Aerial parts, whole plant
- Specimen No:** 2155
- Flowering period:** June-October
- Multifarious use:** Aerial parts are used as a fodder for livestock. It is also a good soil binder.
- 209 **Plant species:** *Paspalum dilatatum* Poir.
- Vernacular:** Ghaa
- Parts utilized:** Aerial parts
- Specimen No:** 2438
- Flowering period:** July-October
- Multifarious uses:** The plant is used as fodder. It is a good soil binder.
- 210 **Plant species:** *Phalaris minor* Retz.

- Vernacular:** Dumbi sitti
- Parts utilized:** Whole plant
- Specimen No:** 2125
- Flowering period:** March-May
- Multifarious uses:** The plant is used as fodder.
- 211 **Plant species:** *Phragmites karka* (Retz.) Trin. ex Steud.
- Vernacular:** Narr
- Parts utilized:** Leaves, whole plant
- Specimen No:** 2476
- Flowering period:** April and August-September
- Multifarious uses:** The livestock browses its leaves. The culm is used in making traditional writing pen (*Qalam*) trunk, thatching of roof, and fuel source.
- 212 **Plant species:** *Poa annua* L.
- Vernacular:** Machhar ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2380
- Flowering period:** throughout most of the year, especially March-September
- Multifarious use:** The plant is used as fodder.
- 213 **Plant species:** *Saccharum bengalense* Retz.
- Vernacular:** --
- Parts utilized:** Aerial parts
- Specimen No:** 2374
- Flowering period:** September-October

- Multifarious use:** The leaves are used as fodder to cows and buffalos. The culms are used for making matrices, chairs (*Morrhe*), cages (*Pinjra*), brooms (*Jhaaru*). Leaves are used for making matrices (*Chatai*). Leaf sheaths are beaten to make strong ropes (*Rassi*). The plant is a good soil binder.
- 214 **Plant species:** *Saccharum spontaneum* L.
- Vernacular:** Saroo
- Parts utilized:** Whole plant, leaves, culm
- Specimen No:** 2377
- Flowering period:** June-September
- Multifarious use:** Leaves are boiled in water and given in stoppage of urination (Micturition).
- Medicinal use:** Leaves are used as fodder. The plant is used as fuel. The culm is used for making cages, roof thatching (*Patalan*) and ornamental goods. Leaves are woven to make matrices. It is also a good soil binder.
- 215 **Plant species:** *Sporobolus arabicus* Boiss.
- Vernacular:** Ghaa
- Parts utilized:** Aerial parts, whole plant
- Specimen No:** 2492
- Flowering period:** March - October
- Multifarious uses:** Aerial parts are utilized as fodder. The plant is a good soil binder.
- 216 **Plant species:** *Setaria intermedia* Roem. and Schult

- Vernacular:** --
- Parts utilized:** whole plant
- Specimen No:** 2399
- Flowering period:** September
- Multifarious uses:** The plant is used as fodder. It is also a good soil binder.
- 217 **Plant species:** *Setaria pumila* (Poir.) Roem. and Schult.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2149
- Flowering period:** June-October
- Multifarious use:** The plant is used as fodder. It is also a good soil binder.
- 218 **Plant species:** *Sorghum bicolor* (Linn.) Moench.
- Vernacular:** Milo
- Parts utilized:** Whole plant
- Specimen No:** 2452
- Flowering period:** March-October
- Multifarious use:** The plant is used as fodder and fuel.
- 219 **Plant species:** *Sorghum* Sect. *Sorghum* Subsect. *Arundinacea* Moench.
- Vernacular:** Milo
- Parts utilized:** Whole plant
- Specimen No:** 2076
- Flowering period:** March-October
- Multifarious use:** The plant is used as fodder and fuel.
- 220 **Plant species:** *Sporobolus arabicus* Boiss.

- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2531
- Flowering period:** March – October
- Multifarious use:** The plant is used as fodder and fuel.
- 221 **Plant species:** *Stipagrostis plumosa* (L.) Munro ex T.
- Vernacular:** Chita gah
- Parts utilized:** Whole plant
- Specimen No:** 2375
- Flowering period:** throughout much of the year
- Multifarious uses:** The plant is used as fodder. It is also a good soil binder.
- 222 **Plant species:** *Tragus roxburghii* Panigrahi
- Vernacular:** Ghaa
- Parts utilized:** Whole plant
- Specimen No:** 2528
- Flowering period:** throughout much of the year
- Multifarious uses:** The plant is used as fodder.
- 223 **Plant species:** *Themeda triandra* Forsk.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2349
- Flowering period:** December
- Multifarious uses:** The plant is used as fodder and fuel.
- 224 **Plant species:** *Trisetum clarkei* (Hook.f.) R. R. Stewart

- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2373
- Flowering period:** July-September
- Multifarious uses:** The plant is used as fodder and fuel. Plant acts as soil binder.
- 225 **Plant species:** *Vetiveriazizanioides* (Linn.) Nash
- Vernacular:** --
- Parts utilized:** Aerial part
- Specimen No:** 2449
- Flowering period:** September
- Multifarious uses:** Aerial part use as fodder.
- Family:** Polygonaceae
- 226 **Plant species:** *Calligonium polygonoides* L.
- Vernacular:** Phog
- Parts utilized:** Branches, leaves, flowers
- Specimen No:** 2666
- Flowering period:** April-June
- Multifarious use:** Dried branches are used as fuel wood source. Livestock browses the leaves. Flowers are eaten raw. The plant is good sand binder.
- 227 **Plant species:** *Polygonum molliaeforme* Boiss.
- Vernacular:** Buti
- Parts utilized:** Aerial parts
- Specimen No:** 2633

- Flowering period:** February- March
- Multifarious use:** The aerial parts are used as fodder to cattle.
- 228 **Plant species:** *Polygonum plabejum* var. *effusum* Meisn.
- Vernacular:** Buti
- Parts utilized:** Aerial parts
- Specimen No:** 2632
- Flowering period:** February-March
- Multifarious use:** The aerial parts are used as fodder to cattle.
- 229 **Plant species:** *Rumex dentatus* subsp. *klotzschianus* (Meisn.) Rech. f.
- Vernacular:** Jangli palak
- Parts utilized:** Whole plant
- Specimen No:** 2116
- Flowering period:** March-January, August-October
- Medicinal use:** Use as potherb to release constipation.
- Multifarious use:** Cook as Potherb and used as fodder to cattle.
- Family:** Primulaceae
- 230 **Plant species:** *Anagallis arvensis* var. *coerulea* (L.) Gonan.
- Vernacular:** Billi Buti
- Parts utilized:** Whole plant
- Specimen No:** 2143
- Flowering period:** March-April
- Multifarious use:** The plant is used as fodder.
- Family:** Punicaceae
- 231 **Plant species:** *Punica granatum* L.

- Vernacular:** Anar
- Parts utilized:** Branches, leaves, fruit, root bark
- Specimen No:** 2651
- Flowering period:** August – December
- Medicinal use:** The root bark is boiled in water and given to children to kill abdominal worm. The fruit bark is boiled in water and used as gargle to treat bleeding from gums (*Pyorrhoea*). The dried bark of fruit mixed with old pickles is given to the sheep and goat to treat digestive problem such as flatulence (*Aphara/Bandish*), a condition in which their belly swelled like balloon and animals cry with pain due to stoppage of excretory system.
- Multifarious use:** The branches are used as fuel. Goats and sheep browse the plant. The human eats fruit.
- Family:** Rhamnaceae
- 232 **Plant species:** *Ziziphus mauritiana* Lam.
- Vernacular:** Beri
- Parts utilized:** Leave, fruit, whole plant
- Specimen No:** 2523
- Flowering period:** July – September
- Medicinal use:** The fruit is prescribed for sugar patients. The unripe fruits (*Kacha beri*) dried under shade and made into powder mixing with *misri* (sugar) that is prescribed in spermatorrhoea. The leaves mixed with turmeric, wheat flour and oil is slightly

warmed over fire to get poultice (*Lupri*) and is applied externally to remove spines and pain as well as inflammation. Leaves are poured in water along with salt and boiled which is taken as bath to remove pain from the body. The hairs are washed from the boiled water of leaves for shining. The leaves are boiled in water and bath is given for dead bodies (*Ghussal*).

Multifarious use: The fruit is very delicious and eaten raw by the human and also by the sheep, goat and jackals. The foliage is good source of fodder for goat and sheep. The plant provides shade, wood for agricultural implements and building material.

233 **Plant species:** *Ziziphus nummularia* (Burm.f.) Wight and Arn.

Vernacular: Jhar beri

Parts utilized: Branches, leaves, fruits, whole

Specimen No: 2403

Flowering period: March-June

Medicinal use: The ripened fruits are edible and regarded as blood purifier. Fruit is useful in joints pain. Leaves are made into poultice and applied to remove spine/thorn from the body. Leave extract is very useful in dandruff and hair fall.

Multifarious use: The ripened fruits are used as wild delicious fruits. The foliage and unripe fruits are good source of fodder for goat and sheep. The plant is used as fencing and fuel purpose.

- 234 **Plant species:** *Ziziphus spina-christi* (L.)Willd.
- Vernacular:** Jhar beri
- Parts utilized:** Branches, leaves, fruits, whole
- Specimen No:** 2421
- Flowering period:** March-June
- Medicinal use:** The ripened berries are edible and regarded as blood purifier. Fruit is useful in joints pain. Leaves are made into poultice and applied to remove spine/thorn from the body. Leave extract is very useful in dandruff and hair fall.
- Multifarious use:** The ripened fruits are used as wild delicious fruits. The foliage and unripe fruits are good source of fodder for goat and sheep. The plant is used as fencing and fuel purpose.
- Family:** Rubiaceae
- 235 **Plant species:** *Galium aparine* L.
- Vernacular:** Kori buti
- Parts utilized:** Whole plant
- Specimen No:** 2138
- Flowering period:** March-July
- Multifarious use:** The plant is used as fodder.
- Family:** Rutaceae
- 236 **Plant species:** *Citrus grandis* (L.) Osbeck
- Vernacular:** Kinu
- Parts utilized:** Whole plant, fruit, fruit pericarp
- Specimen No:** 2653

- Flowering period:** September-October
- Medicinal use:** Fruit is used as a tonic and appetizer and given to the constipating patients. The pericarp of fruit is rubbed and snuffed to stop vomiting, a common complaint happened during road journey.
- Multifarious use:** Fruit is used as a tonic. The fruit pericarp is cooked in preparation of sweet dishes (*Mutanjan and Zarda*), due to their fragrance. The pericarp of fruit is rubbed and snuffed to stop vomiting, a common complaint happened during road journey. Green leaves are used as a fodder. The dried plant is also used as fencing and fuel.
- 237 **Plant species:** *Citrus medica* var. *acida* Brandis
- Vernacular:** Gilgan
- Parts utilized:** Whole plant, fruit
- Specimen No:** 2654
- Flowering period:** Sept.-October
- Medicinal use:** Fruit is given to cure diabetes. The same is given to the livestock for treating their digestive problem.
- Multifarious use:** The plant is used as fencing around their huts and fuel source. The women use fruit juices.
- 238 **Plant species:** *Citrus sinensis* (L.) Osbeck
- Vernacular:** Malta
- Parts utilized:** Whole plant, fruit, fruit pericarp
- Specimen No:** 2651

- Flowering period:** September-October
- Medicinal use:** Fruit is used as a tonic and appetizer and given to the constipating patients. The pericarp of fruit is rubbed and snuffed to stop vomiting, a common complaint happened during road journey.
- Multifarious use:** Fruit is used as a tonic and appetizer. The fruit pericarp is cooked in preparing of sweet dishes (*Mutanjanand Zarda*) due to their fragrance. The pericarp of fruit is rubbed and snuffed to stop vomiting, a common complaint happened during road journey. The dried plant is also used as fencing and fuel wood source.
- Family:** Salvadoraceae
- 239 **Plant species:** *Salvadora oleoides* Decne.
- Vernacular:** Peelu
- Parts utilized:** Branches, roots, leaves, Fruits
- Specimen No:** 2089
- Flowering period:** December-March
- Medicinal use:** The ripened fruit is used preparing *Murabbah* (a sweet dish). The unripe fruits are pickled and used to treat constipation. The root is used as a tooth stick (*Miswak*) which heal bleeding from gums (*Pyorrhoea*). The oil obtained from seeds is externally applied on athlete foot (*Chambal*).
- Multifarious use:** The wood is occasionally used as supporting material. The leaves are favorite fodder for camels.

- Family:** Scrophulariaceae
- 240 **Plant species:** *Bacopa monnieri* (L.) Wettstein
- Vernacular:** Jalunim
- Parts utilized:** Leaves
- Specimen No:** 2431
- Flowering period:** January –July
- Multifarious use:** Leaves of plant are used as pot herb, leaves are boiled twice in water then eaten as a dish. Leaves are burnt in sesame oil and externally applied to treat skin irritation, boils and pimples. Aerial parts in 5 gm are grind in water with 6 seeds of *Piper album*. The obtained juice is orally given to treat skin infections.
- Multifarious use:** It is not often used for fodder forage.
- 241 **Plant species:** *Schweinfurthia papilionacea* (Burm. f.) Boiss.
- Vernacular:** Akri
- Parts utilized:** Whole plant
- Specimen No:** 2486
- Flowering period:** November-February.
- Multifarious use:** Plant often used for fodder forage and fuel.
- 242 **Plant species:** *Veronica persica* Poir.
- Vernacular:** --
- Parts utilized:** Whole plant
- Specimen No:** 2487
- Flowering period:** January-May

- Multifarious use:** Plant often used for fodder forage.
- Family:** Solanaceae
- 243 **Plant species:** *Datura fastuosa* L.
- Vernacular:** Dhatura
- Parts utilized:** Leaves, seeds, root
- Specimen No:** 2683
- Flowering period:** September-May
- Folk use:** Leaves are smoked to relieve asthma. The paste of leaves is applied to hairs to expel lice (antilice). Leaves are slightly coated with oil and warmed over fire that is applied externally for removing swellings and also on boils (*Ratgari*). The plant is boiled in water and is sprinkled in home to expel insects (insect repellent). The juice of leaves obtained through grinding and squeezing is applied on insect bite.
- Multifarious use:** Plant use as fuel.
- 244 **Plant species:** *Solanum amricanum* Miller
- Vernacular:** Katch Match
- Parts utilized:** Leaves, fruits
- Specimen No:** 2685
- Flowering period:** March – May
- Medicinal use:** The decoction of plant is used for digestive problems. Juice of the leaves is given in hiccough and inflammation of eye. Leaves are cooked as vegetable to remove swelling, dropsy

and digestive problems. Leaves are soaked in water and are kept overnight. These leaves are squeezed and extract is used against jaundice.

Multifarious use: Plant is used as fodder. Its fruit is edible. Berries are eaten raw as fruit

245 **Plant species:** *Solanum incanum* L.

Vernacular: Kori wal / Mahora

Parts utilized: Fruit, whole plant

Specimen No: 2613

Flowering period: Throughout the year

Medicinal use: The fruit is crushed and mixed with wheat flour that is given for digestive problems of animals (*Malli baadi*).

Multifarious use: Plant is used as fodder. Its fruit is edible. Berries are eaten raw as fruit

246 **Plant species:** *Solanum nigrum* L.

Vernacular: Mako/Peelan

Parts utilized: Whole plant, fruit

Specimen No: 2593

Flowering period: March – May

Medicinal use: Fruit is eaten to treat jaundice. The juice obtained from plant is used to remove obesity and jaundice. The equal quantity of *Foeniculum vulgare* (fruit), *Cichorium intybus* (seeds and roots), *Violoa odorata* (flowers), *Zizyphus sativa* fruit and *Solanum nigrum* (leaves) are boiled in water and the juice in

5ml quantity is given twice a day to treat leucorrhoea and as uterine tonic.

- Multifarious use:** Goats and buffalos graze the plant.
- 247 **Plant species:** *Solanum surattense* Burm.f.
- Vernacular:** Mahori/Kandiari wal
- Parts utilized:** Whole plant
- Specimen No:** 2689
- Flowering period:** March – May
- Medicinal use:** The whole plant dried under shade and burnt into fire. The obtained ash in 2-4 pinches are taken with honey to treat cough and asthma. The juice of leaves mixed with black pepper (*Piper nigrum*) is prescribed to treat joints pain. The ripened fruit is made into powder and snuffed to treat headache and migraine. The unripe fruits mixed with flash and cooked as vegetable to treat phlegmatic cough and asthma. Powder of the flower is made and given to the female to maintain their pregnancy. Equal quantity of flower of *Solanum surattense*, Ravend cheeni (*Rheum emodi*), Daar cheeni (*Cinnomomum zeylanicum*), Majeth (*Rubia cordifolia*) and flowers of mahokri (*Solanum incanum*) are made into powder and given to regulate the menstrual period. Fruit is poured in uterus to conceive pregnancy in cattle. The fruit powder/extract is given to cattle for digestive problems.

- Multifarious use:** The plant is a good soil binder.
- 248 **Plant species:** *Solanum villosum* (L.) Mill.
- Vernacular:** Kaachmach
- Parts utilized:** Whole plant
- Specimen No:** 2657
- Flowering period:** March – May
- Medicinal use:** Fruits are eaten to treat jaundice. The juice obtained from plant is used to remove obesity and jaundice.
- Multifarious use:** Goats and buffalos graze the plant.
- 249 **Plant species:** *Withania coagulans* (Stocks.) Dunal
- Vernacular:** Paneer/Akri
- Parts utilized:** Whole plant, leaves, Fruits
- Specimen No:** 2677
- Flowering period:** September-December
- Medicinal use:** The paste of leaves is applied on boils and pimples. Fruits are soaked in water overnight night and the resultant juice is drunken early morning before breakfast to treat boils, pimples and skin irritation. It is considered as cooling agent. Leave mixed with equal quantity of black salt and made into powder (*Phakki*) which is given in indigestive (*Bad hazmi*), flatulence (*Aphara*) and constipation (*Qabz*) and abdominal pain. Leaves powder is mixed with boll of wheat flour and given to cattle for digestive problems (*Malli baadi*). Fruits in 2-3 number are given with water to treat boils, pimples and

abdominal pain. Fruit of *Withania coagulans*, *Emblica officinalis* (Amla), *Foeniculum vulgare* (Sonf) and *Piper nigrum* (Black piper) are ground to make powder (*Phakki*) and given to treat digestive problems. The powder of fruit (100 gm), *Foeniculum vulgare* (100 gm), *Anethum sowa* (100 gm) and molasses (500 gm) is given with water as single dose to cattle and camel to treat abdominal pain and as digestive especially.

Multifarious use:	The plant is a good soil binder.
250 Plant species:	<i>Withania somnifera</i> (L.) Dunal
Vernacular:	Aksan/Ratkan
Parts utilized:	Whole plant, leaves, root, fruit
Specimen No:	2626
Flowering period:	September-December
Medicinal use:	The powder of roots mixed with sugar (<i>Misri</i>) and given to treat spermatorrhoea. The leaves are slightly roasted on fire and tied on wounds to remove pain and inflammation. The ripened fruits are soaked in water overnight and given early morning to treat diabetes. The paste made of leaves (200 gm), <i>Alium sativum</i> (100 gm) and black salt (100 gm) is given as a single dose to cows for mouth infection and indigestion (<i>Malli badi</i>). Plant extract + sugar is use as digestive tonic. The root powder is mixed with wheat flour and made into thick paste that is given to domesticated

animal for flatulence (*Gas*). Black salt combined with lassion and root of plant extract is use for cow disease.

Multifarious use: The dried branches are used as fuel wood source. Animals milk production and milk nutritive value increases if it is use as fodder.

Family: Tamaricaceae

251 **Plant species:** *Tamarix aphylla* (L.) Karst.

Vernacular: Khaggal

Parts utilized: Whole plant, Leaves

Specimen No: 2347

Flowering period: June-October

Medicinal use: The smoke of the leaves is given to the measles patients. The powder of galls is dusted on wounds to heal.

Multifarious use: Young and small branches of tree cut them then dry them after totally drying place them in water for a week after then use for make them baskets. The plants are planted on the canal side to protect the soil and irrigated land from the windstorm and also for soil binder. In the desert it is planted on the commercial basis for the production of wood. The wood of the plant is used for building purpose, fuel and also as a supporting material for different purpose.

Family: Tiliaceae

252 **Plant species:** *Corchorus aestuans* L.

Vernacular: Phalli

- Parts utilized:** Aerial parts
- Specimen No:** 2565
- Flowering period:** August-October.
- Multifarious use:** Aerial parts are used as a fodder to livestock.
- 253 **Plant species:** *Corchorus depressus* (L.) Stocks
- Vernacular:** Boophali
- Parts utilized:** Whole plant
- Specimen No:** 2577
- Flowering period:** February-November.
- Medicinal use:** The dried plant is soaked in water using earthen pot fortnightly and then ground mixing with the candy (sugar) and filtered. It is supposed as highly effective for liver problems, jaundice and as cooling and demulcent drink. The plant is ground with equal quantity of *Asparagus demusus* (*Musli sufaid*) and mixed with ispagol husk (*Plantago ovata*). This powder is given to increase sperm and spermatorrhoea. It is also prescribed to increase the semen quantity. Dried plant, few fruits of *Elitteriacadamomum* (*Ilaichi*) and *Carum carvi* (*Safad zera*) are made into powder and is used to treat kidney and stomach problems.
- Multifarious use:** Aerial parts are used as a fodder for livestock. The plant is good soil binder.
- 254 **Plant species:** *Corchorus tridens* L.
- Vernacular:** Phali

- Parts utilized:** Aerial parts, fruits
- Specimen No:** 2411
- Flowering period:** July-November
- Medicinal use:** The fruiting branches are soaked in water overnight and the obtained juice is given as cooling agent for jaundice and spermatorrhea.
- Multifarious use:** Shoot parts are used as a fodder for livestock. Plant is good soil binder.
- Family:** Verbenaceae
- 255 **Plant species:** *Phyla nodiflora* (L.) Greene
- Vernacular:** Bukkan buti
- Parts utilized:** Whole plant
- Specimen No:** 2547
- Flowering period:** Throughout the year
- Medicinal use:** Plant is dried and ground in the fresh juice of *Asphodelus tenuifolius* to make pills which are given to treat Hemorrhoids.
- Multifarious use:** The plant is a good soil binder.
- Family:** Typhaceae
- 256 **Plant species:** *Typha elephantina* Roxb.
- Vernacular:** Kundar
- Parts utilized:** Aerial parts, leaves, whole plant
- Specimen No:** 2682
- Flowering period:** September-October

- Medicinal use:** Burned ash of plant is mixed in fresh butter to form a paste which is applied on the tits and other skin problems of cattle especially for cows and buffaloes.
- Multifarious use:** Leaves are used for making matrices. Leaf sheaths are beaten to make strong ropes. Plant is used as a roof thatching material. Leave are soaked in water and ropes (*Vaan*) are made which is used to knit the bed (*Charpi*), sitting chairs (*Morha*). The leaves are woven to make matrices that are used in Masjids and domestic purpose. The leaves are used as fodder to cows and buffalos. The plant is harvested and used as fuel especially for bricks burning industry.
- Family:** Zygophyllaceae
- 257 **Plant species:** *Fagonia indica* var. *schweinfuthii* Hadidi.
- Vernacular:** Dhaman
- Parts utilized:** Whole plant
- Specimen No:** 2592
- Flowering period:** Almost throughout year.
- Medicinal use:** The plant is dried under shade and made into powder, which is given orally to treat skin diseases like itching, pimples, boils, etc. The plant is boiled in water and taken as bath to treat aforementioned diseases. Indigenous people also claimed that it is highly effective for cancer. The plant is soaked in water overnight and given in hepatitis, stomach disorders and as cooling agent.

- Multifarious use:** The aerial parts are used as fodder to livestock at young stage. Plant use as fodder in dry form.
- 258 **Plant species:** *Fagonia bruguieri* DC.
- Vernacular:** Dhaman
- Parts utilized:** Whole plant
- Specimen No:** 2601
- Flowering period:** Throughout the year
- Medicinal use:** Same as previous species.
- Multifarious use:** The aerial parts are used as fodder to livestock at young stage. Plant use as fodder in dry form.
- 259 **Plant species:** *Peganum harmala* L.
- Vernacular:** Harmal
- Parts utilized:** Whole plant, seeds
- Specimen No:** 2615
- Flowering period:** April – October
- Medicinal use:** The plant is burnt and smoke is used to treat boils and pimples. Seeds mixing with linseed (*Linum usitatissimum*) are made into powder and given with honey to heal asthma. Seeds in 4-5 numbers are given after meal as digestive. Smoke of plant is given to children to eradicate bad evils (*Nazar bad*). Extract of plant is given to treat snake bite. The plant is mixed with table salt and burnt to fire. This compound is given to cattle to increase appetite and to expel abdominal worms. Seeds mixed with equal quantity of

ammonium chloride (*Noshader*) and black salt are ground to make powder and is given to cattle for all kinds of digestive problems.

Multifarious use: The smoke of the plant is given to the patients to remove evil spirits from the house.

260 **Plant species:** *Tribulus longipetalous* Viv.

Vernacular: Bhakhra

Parts utilized: Aerial parts

Specimen No: 2566

Flowering period: Throughout the range of the species

Multifarious use: The aerial parts are used as favorite fodder to livestock

261 **Plant species:** *Tribulus terrestris* L.

Vernacular: Bhakhra

Parts utilized: Whole plant, fruit, seeds

Specimen No: 2596

Flowering period: Almost throughout the year

Medicinal use: The powder of fruits mixed with honey is given as a stimulant. The seeds are ground in water and given to treat urinary problems like stones and micturition. The powder of seeds is mixed with starch (*Sujji*) and sugar that is fried in Desi ghee to obtained called *Halwa*. This recipe is given as tonic and stimulant especially for women after delivery. The powder of seeds is given to males for semen production. The fruits mixed with *Foeniculum vulgare*, *Piper nigrum*,

Ellateria cardamommum are ground in water (*Ghota*) along with misri (sugar) and used as a demulcent drink (*Thandai*).

Multifarious use: The plant is used as fodder for goat, sheep and camel.

4.4.1.2 Family value index (FVI)

The present study reveals that there were 261 plant species belonging to 183 genera and 56 families which served to the natives for fulfilling daily life requirement. Poaceae was found to be the most dominant family that contributed 50 species (19.16%) from the total flora of the area. Grasses act as soil binders in the desert and are the major part of the vegetation in the sandy desert. Fabaceae was the second largest plant family that contributed 24 plants species (9.20%), followed by Asteraceae (17 spp., 6.51%), Boraginaceae (11 spp., 4.21%), Brassicaceae (10 spp., 3.83%), Amaranthaceae (9 spp., 3.45%), Chenopodiaceae, Cyperaceae, Euphorbiaceae and Solanaceae (8 spp., 3.07% each), Mimosaceae (7 spp., 2.68%), Aizoaceae, Capparidaceae and Convolvulaceae (6 spp., 2.30% each), Moraceae and Zygophyllaceae (5 spp., 1.92%), while rest of 40 families shared 1-4 species (Table 4.1).

4.4.1.3 Life/growth form of the ethnoflora

In the study area nine life forms of flora exist as shown in Fig. 4.1. It reveals that herbs were the most common habit/forms with 122 species (47.13%) in the study area. It was followed by grasses (50 spp., 19.16%), trees (28 spp., 10.73%), shrubs (27 spp., 10.34%), subshrub (11 spp., 4.21%), sedges (9 spp., 3.45%), climbers (8 spp., 3.07%), parasites (4 spp., 1.53%) and fern (1 sp., 0.38%).

4.4.1.4 Use value index (UVI) of ethnobotanical taxa

Overall, eight use categories such as fruits, vegetable, medicinal, ethno veterinary, fuel, fodder, soil binder and others were identified from 261 species. The use categories for all plants are provided in the Table 4.2. The table revealed that *Capparis decidua*, *Citrus grandis*, *Moringa oleifera*, *Prosopis cineraria*, *Salvadora oleoides* and *Ziziphus spina-christi* were ranked first amongst all which fulfilled six major use categories. Besides, 25 species such as *Acacia jacquemontii*, *Acacia nilotica*, *Aerva javanica*, *Azadirachta indica*, *Calligonum polygonoides*, *Calotropis procera*, *Cicer arietinum*, *Citrullus colocynthis*, *Citrus medica* var. *acida*, *Citrus sinensis*, *Cordia gharaf*, *Cordia myxa*, *Cymbopogon jwarancusa* subsp. *Jwarancusa*, *Ficus bengalensis*, *Leptadenia pyrotechnica*, *Morus nigra*, *Phoenix sylvestris*, *Psidium guajava*, *Punica granatum*, *Syzygium cumini*, *Tamarix aphylla*, *Withania coagulans*, *Ziziphus mauritiana* and *Ziziphus nummularia* fulfilled five use categories.

The summary of ethnobotanical categories is given in Fig. 4.2. Most of the species were recognized as palatable by the herders and used as fodder (234 Sep., 35.62%). This is a rangeland, therefore the local inhabitants mostly dependent on livestock rearing to earn their livelihood. The second most important use of plants was found to be used as medicinal one and 120 plants (18.26%) are used for medicinal purpose in treating their different diseases. It was followed by fuel (108 spp., 16.44%), others (64 spp., 9.74%), soil binder (48 spp., 7.31%), wild fruits (40 spp., 6.09%), potherb (25 spp., 3.81%) and Ethno-veterinary (18 spp., 2.74%).

4.4.1.5 Direct Matrix ranking

According to the use value index (UVI), 15 species were found highly useful in different usages categories, based upon rank by the dwellers. According to

the Table 4.3, *Cappris decidauwas* ranked first that scored 24 points, followed by *Acacia nilotica* subsp. *Indica*, *A. nilotica* subsp. *cupressiformis*, *Melia azedirach*, *Prosopis cineraria*, *Azadirachta indica*, *Acacia jacquemontii*, *Moringa oleifera*, *Salvadora oleoides*, *Prosopis juliflora*, *Cymbopogon jwarancusa* subsp.. *jwarancusa*, *Aerva javanica*, *Tribulus terrestris*, *Citrullus colocynthis* and *Solanum nigrum*.

Table 4.1: Contribution of plant Families in ethnobotanical flora of Thal desert.

S. No.	Family	No. of spp.	Percentage
1	Poaceae	50	19.16
2	Fabaceae	24	9.20

S. No.	Family	No. of spp.	Percentage
3	Asteraceae	17	6.51
4	Boraginaceae	11	4.21
5	Brassicaceae	10	3.83
6	Amaranthaceae	9	3.45
7	Chenopodiaceae	8	3.07
8	Cyperaceae	8	3.07
9	Euphorbiaceae	8	3.07
10	Solanaceae	8	3.07
11	Mimosaceae	7	2.68
12	Aizoaceae	6	2.30
13	Capparidaceae	6	2.30
14	Convolvulaceae	6	2.30
15	Moraceae	5	1.92
16	Zygophyllaceae	5	1.92
17	Asclepiadaceae	4	1.53
18	Cucurbitaceae	4	1.53
19	Molluginaceae	4	1.53
20	Polygonaceae	4	1.53
21	Myrtaceae	3	1.15
22	Nyctaginaceae	3	1.15
23	Rhamnaceae	3	1.15
24	Rutaceae	3	1.15

S. No.	Family	No. of spp.	Percentage
25	Scrophulariaceae	3	1.15
26	Tiliaceae	3	1.15
27	Caesalpiniaceae	2	0.77
28	Caryophyllaceae	2	0.77
29	Cuscutaceae	2	0.77
30	Malvaceae	2	0.77
31	Meliaceae	2	0.77
32	Orobanchaceae	2	0.77
33	Papaveraceae	2	0.77
34	Papilionaceae	2	0.77
35	Plantaginaceae	2	0.77
36	Acanthaceae	1	0.38
37	Agavaceae	1	0.38
38	Alloaceae	1	0.38
39	Apiaceae	1	0.38
40	Apocynaceae	1	0.38
41	Arecaceae	1	0.38
42	Asphodeloideae	1	0.38
43	Bombacaceae	1	0.38
44	Equisetaceae	1	0.38
45	Gentianaceae	1	0.38
46	Lamiaceae	1	0.38

S. No.	Family	No. of spp.	Percentage
47	Lathyraceae	1	0.38
48	Moringaceae	1	0.38
49	Oxalidaceae	1	0.38
50	Primulaceae	1	0.38
51	Punicaceae	1	0.38
52	Rubiaceae	1	0.38
53	Salvadoraceae	1	0.38
54	Tamaricaceae	1	0.38
55	Typhaceae	1	0.38
56	Verbenaceae	1	0.38
		261	100.00

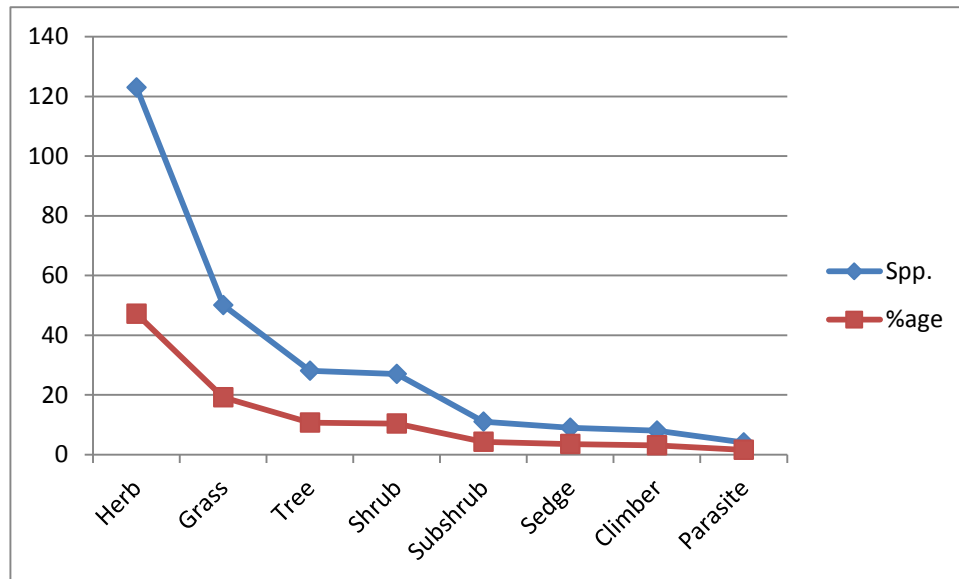


Fig. 4.1: Life span of the native plants used ethnobotanically.

Table 4.2: Use value index (UVI) of the ethnobotanical plants of study area.

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
1	<i>Abutilon pakistanicum</i> Jafri and Ali	Kanghi Buti	Malvaceae	0	0	1	0	1	1	0	0	3
2	<i>Acacia jacquemontii</i> Benth.	Kanda	Mimosaceae	0	0	1	1	1	1	0	1	5
3	<i>Acacia nilotica</i> (L.) DeL. subsp. <i>indica</i> (Benth.) Brenan	Kikar	Mimosaceae	0	0	1	1	1	1	0	1	5
4	<i>Acacia nilotica</i> subsp. <i>cupressiformis</i> (T.L. Stewart) Ali	Kabli kikar	Mimosaceae	0	0	1	0	1	1	0	1	4
5	<i>Achyranthes aspera</i> L.	Puth Kanda	Amaranthaceae	0	0	1	0	1	1	0	0	3
6	<i>Acrachne racemosa</i> (Heyne ex Roem. and Schult.) Ohwi		Poaceae	0	0	0	0	0	1	0	0	1
7	<i>Aeluropus lagopoides</i> (Linn.) Trin. ex Thw.	Kalar ghaa	Poaceae	0	0	0	0	0	1	1	0	2
8	<i>Aerva javanica</i> (Burm. f.) Juss ex J. A. Shultes.	Boi	Amaranthaceae	0	0	1	1	1	1	0	1	5
9	<i>Agave sisilana</i> Perr. Ex Engelm.	Shirin	Agavaceae	0	0	1	0	1	0	0	1	3
10	<i>Albizia lebbeck</i> (L.) Bth.	Shirin	Mimosaceae	0	0	1	0	1	1	0	0	3
11	<i>Alhagi maurorum</i> Medic.	Jwanha/Goghi dhaman	Fabaceae	0	0	1	0	1	1	0	0	3
12	<i>Aloe vera</i> L.	Kunwar gandal	Alloaceae	0	1	1	1	0	0	0	1	4
13	<i>Alternanthera pungens</i> Kunth in H.B.K.	Ludhri	Amaranthaceae	0	0	1	0	0	1	0	0	2
14	<i>Alysicarpus longifolius</i> (Rottler ex Spreng.) Wight and Arn.		Fabaceae	0	0	1	0	0	1	0	0	2
15	<i>Amaranthus graecizans</i> L.	Choleri	Amaranthaceae	0	1	1	0	0	1	0	0	3
16	<i>Amaranthus ovalifolius</i> L.	Kalga		0	0	1	0	0	1	0	0	2
17	<i>Amaranthus viridis</i> L.	Choleri	Amaranthaceae	0	1	1	0	0	1	0	0	3
18	<i>Amberboa ramosa</i> (Roxb.) Jafri	Tirkanda/Birham i buti	Asteraceae	0	0	1	0	0	1	1	0	3

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
19	<i>Anagallis arvensis</i> var. <i>coerulea</i> (L.) Gonan.	Bili buti	Primulaceae	0	0	0	0	0	1	0	0	1
20	<i>Anethum graveolens</i> L.	Soya	Apiaceae	0	1	1	0	0	1	0	1	4
21	<i>Argemone mexicana</i> L.	Sawi pohli	Papaveraceae	0	0	1	0	1	1	0	0	3
22	<i>Aristida adscensionis</i> L.	Lamb ghas	Poaceae	0	0	0	0	0	1	0	0	1
23	<i>Aristida mutabilis</i> Trin. and Rupr.	Lamb ghas	Poaceae	0	0	0	0	0	1	1	0	2
24	<i>Arundo donax</i> L.	Narr	Poaceae	0	0	0	0	1	1	1	1	4
25	<i>Asphodelus tenuifolius</i> Cavan.		Asphodeloideae	0	0	1	0	1	1	0	0	3
26	<i>Atriplex schugnanica</i> Iljin		Chenopodiaceae	0	1	0	0	0	1	0	0	2
27	<i>Avena fatua</i> subsp. <i>fatua</i> L.		Poaceae	0	0	0	0	1	1	0	0	2
28	<i>Azadirachta indica</i> (L.) A. Juss.	Neem	Meliaceae	1	0	1	0	1	1	0	1	5
29	<i>Bacopa monirii</i> L.		Scrophulariaceae	0	0	1	0	0	1	0	0	2
30	<i>Barleria prionitis</i> L.		Acanthaceae	0	0	0	0	0	1	0	0	1
31	<i>Blumea membranacea</i> Candolle	Tangri	Asteraceae	0	0	0	0	0	1	0	0	1
32	<i>Boerhavia diffusa</i> L.		Nyctaginaceae	0	0	1	0	0	1	0	0	2
33	<i>Boerhavia pentandra</i> Burch.	Koor tangri	Nyctaginaceae	0	0	0	0	0	1	1	0	2
34	<i>Boerhavia procumbens</i> Banks ex Roxb.		Nyctaginaceae	0	0	1	0	0	1	0	0	2
35	<i>Bombax malabaricum</i> DC.	Sumbul	Bombacaceae	0	0	1	0	1	1	0	1	4
36	<i>Brachiaria eruciformis</i> (J.E. Smith) Griseb		Poaceae	0	0	0	0	0	1	1	0	2
37	<i>Brachiaria ovalis</i> Stapf	Ghaah	Poaceae	0	0	0	0	0	1	1	0	2
38	<i>Brasica compestris</i> L.	Sarson	Brassicaceae	0	1	1	0	0	1	0	0	3
39	<i>Bromus pectinatus</i> Thunb.		Poaceae	0	0	0	0	0	1	0	0	1
40	<i>Bromus sericeus</i> Drobov		Poaceae	0	0	0	0	0	1	0	0	1
41	<i>Calligonum polygonoides</i> L.	Phog	Polygonaceae	0	1	0	0	1	1	1	1	5
42	<i>Calotropis procera</i> (Willd.) R. Br.	Ak	Asclepiadaceae	0	0	1	1	1	1	0	1	5
43	<i>Capparis decidua</i> (Forssk.) Edgew.	Kareenh/Kari	Capparidaceae	1	1	1	0	1	1	0	1	6
44	<i>Capparis spinosa</i> L.		Capparidaceae	0	0	1	0	1	1	1	0	4

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
45	<i>Capsella bursa-pastoris</i> (L.) Medik.		Brassicaceae	0	0	1	0	0	1	0	0	2
46	<i>Cardaria draba</i> (L.) Desv.		Brassicaceae	0	0	0	0	0	1	0	0	1
47	<i>Carthamus oxycantha</i> M.B.	Pohli	Asteraceae	0	0	1	0	1	1	0	0	3
48	<i>Cassia fistula</i> L.	Girrad Nalli	Caesalpiniaceae	0	0	1	0	1	1	0	1	4
49	<i>Cassia italica</i> (Mill.) F.W.Andr.		Caesalpiniaceae	0	0	1	0	1	0	0	0	2
50	<i>Celosia argentea</i> L.	Kalga	Amaranthaceae	0	1	1	0	0	1	0	0	3
51	<i>Cenchrus biflorus</i> Roxb.	Mohabbat buti/Ludri	Poaceae	0	0	0	0	0	1	1	0	2
52	<i>Cenchrus ciliaris</i> L.	Drahman/Dhama n ghaa	Poaceae	0	0	0	0	0	1	1	0	2
53	<i>Cenchrus pennisetiformis</i> Hochst. and Steud. ex Steud.	Dhamni	Poaceae	0	0	0	0	0	1	1	0	2
54	<i>Cenchrus setigerus</i> Vahl	Talra	Poaceae	0	0	0	0	0	1	1	0	2
55	<i>Centaurea iberica</i> Trev.		Asteraceae	0	0	1	0	0	1	0	0	2
56	<i>Chenopodium album</i> L.	Bathu	Chenopodiaceae	0	1	1	0	0	1	0	0	3
57	<i>Chenopodium murale</i> L.	Bathu	Chenopodiaceae	0	0	1	0	0	1	0	0	2
58	<i>Chloris gayana</i> Kunth		Poaceae	0	0	0	0	0	1	1	0	2
59	<i>Chrozophora tinctoria</i> (L.) Juss.	Neel buti	Euphorbiaceae	0	0	1	0	1	1	0	0	3
60	<i>Cicer arietinum</i> L.	Chhana / Chholay	Fabaceae	1	1	1	0	1	1	0	0	5
61	<i>Cicer microphyllum</i> Royle ex Bentham	Rat phuli	Fabaceae	0	0	0	0	0	1	1	0	2
62	<i>Cistanche tubulosa</i> (Schrenk) Hook.f.	-	Orobanchaceae	0	0	0	0	1	0	0	1	2
63	<i>Citrullus colocynthis</i> (L.) Schrad.	Kaur Tuma	Cucurbitaceae	0	0	1	1	0	1	1	1	5
64	<i>Citrus grandis</i> (L.) Osbeck	Kinu	Rutaceae	1	1	1	0	1	1	0	1	6
65	<i>Citrus medica</i> var. <i>acida</i> Brandis	Gilgan	Rutaceae	1	0	1	0	1	1	0	1	5
66	<i>Citrus sinensis</i> (L.) Osbeck	Malta	Rutaceae	1	0	1	0	1	1	0	1	5
67	<i>Cleome brachycarpa</i> Vahl ex DC.	Ganduli	Capparidaceae	0	0	1	0	0	1	0	0	2

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
68	<i>Cleome scaposa</i> DC.		Capparidaceae	0	0	0	0	0	1	0	0	1
69	<i>Cleome viscosa</i> L.	Loot buti	Capparidaceae	0	0	0	0	0	1	0	0	1
70	<i>Cnicus benedictus</i> L.		Asteraceae	0	0	0	0	0	1	1	0	2
71	<i>Convolvulus arvensis</i> L.	Wand vehri	Convolvulaceae	0	0	1	1	0	1	0	0	3
72	<i>Convolvulus microphyllus</i> Sieb. ex Spreng.		Convolvulaceae	0	0	1	0	0	1	1	0	3
73	<i>Convolvulus prostratus</i> Forssk.	Dharbari	Convolvulaceae	0	0	0	0	0	1	1	0	2
74	<i>Conyza bonariensis</i> (L.) Cronquist.	Gidar Buti	Asteraceae	0	0	0	0	0	1	0	0	1
75	<i>Corchorus aestuans</i> L.	Gidar Buti	Tiliaceae	0	0	0	0	0	1	0	0	1
76	<i>Corchorus depressus</i> (L.) Stocks	Phali	Tiliaceae	0	0	1	0	0	1	1	1	4
77	<i>Corchorus tridens</i> L.	Boophali	Tiliaceae	0	0	1	0	1	1	0	0	3
78	<i>Cordia gharaf</i> (Forssk.) Ehren. ex Asch.	Lesuri	Boraginaceae	1	0	1	0	1	1	0	1	5
79	<i>Cordia myxa</i> L.	Lasura	Boraginaceae	1	0	1	0	1	1	0	1	5
80	<i>Coronopus didymus</i> (L.) Sm.		Brassicaceae	0	0	0	0	0	1	1	0	2
81	<i>Cressa cretica</i> L.		Convolvulaceae	0	0	1	0	0	1	0	0	2
82	<i>Crotalaria burhia</i> Ham ex Bentham		Fabaceae	0	0	0	0	1	1	0	1	3
83	<i>Crotalaria medicaginea</i> Lamk.	Khapra/Kali boi	Fabaceae	0	0	1	0	1	1	0	0	3
84	<i>Cucumis melo</i> subsp. <i>agrestis</i> var. <i>agrestis</i> Naudin		Cucurbitaceae	1	0	1	0	0	1	0	1	4
85	<i>Cuscuta monogyna</i> Vahl, Sym.	Chibar	Cuscutaceae	0	0	1	0	0	1	0	0	2
86	<i>Cuscuta reflexa</i> Roxb.	Amar bel	Cuscutaceae	0	0	1	0	0	1	0	0	2
87	<i>Cyamopsis tetragonoloba</i> (Linn.) Taubert	Amar bel	Fabaceae	0	1	0	0	1	1	0	1	4
88	<i>Cymbopogon jwarancusa</i> subsp. <i>jwarancusa</i> (Jones) Schult.	Guara	Poaceae	0	0	1	0	1	1	1	1	5
89	<i>Cynodon dactylon</i> (L.) Pers.	Khavi	Poaceae	0	0	1	0	0	1	0	1	3
90	<i>Cyperus alopecuroides</i> Rottb.	Talla	Cyperaceae	0	0	0	0	0	1	1	0	2
91	<i>Cyperus difformis</i> L.		Cyperaceae	0	0	0	0	0	1	1	0	2

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
92	<i>Cyperus digitatus</i> Roxb.	Sowe/Bhudde	Cyperaceae	0	0	0	0	0	1	1	0	2
93	<i>Cyperus imbricatus</i> Retz.	Sowe/Bhudde	Cyperaceae	0	0	0	0	0	1	1	0	2
94	<i>Cyperus rotundus</i> L.		Cyperaceae	0	0	1	0	0	1	1	0	3
95	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Dela	Poaceae	0	0	0	0	1	1	0	1	3
96	<i>Dactyloctenium aristatus</i> Link	Madhana ghaa	Poaceae	0	0	0	0	1	1	0	1	3
97	<i>Dalbergia sissoo</i> Roxb.	Madhana	Papilionaceae	0	0	1	0	1	1	0	1	4
98	<i>Datura fastuosa</i> L.	Talhi	Solanaceae	0	0	1	0	1	0	0	1	3
99	<i>Desmostachya bipinnata</i> (L.) Stapf.		Poaceae	0	0	0	0	1	1	1	1	4
100	<i>Dichanthium amulatum</i> (Forssk.) Stapf	Dab Ghaah	Poaceae	0	0	0	0	1	1	1	0	3
101	<i>Digera muricata</i> (L.) Mart.		Amaranthaceae	0	1	1	0	0	1	0	1	4
102	<i>Digitaria ciliaris</i> (Retz.) Koel	Tandla	Poaceae	0	0	0	0	1	1	1	0	3
103	<i>Dipterygium glaucum</i> Decne.		Capparidaceae	0	0	0	0	1	0	1	0	2
104	<i>Echinops echinatus</i> Roxb.		Asteraceae	0	0	1	0	1	1	1	0	4
105	<i>Eleusine indica</i> (L.) Gaertn.	Unt Katara	Poaceae	0	0	0	0	0	1	1	0	2
106	<i>Enicostemma hyssopifolium</i> (Willd.) Verd.	Gandel ghas	Gentianaceae	0	0	0	0	0	1	1	0	2
107	<i>Enneapogon persicus</i> Boiss.	Sabri	Poaceae	0	0	0	0	0	1	1	0	2
108	<i>Equisetum ramosissimum</i> Desf.		Equisetaceae	0	0	0	0	0	0	1	1	2
109	<i>Eragrostis cilianensis</i> (All.) Lut. ex F.T. Hubbard		Poaceae	0	0	0	0	0	1	1	0	2
110	<i>Eragrostis ciliaris</i> (L.) R. Br.	Ghaah	Poaceae	0	0	0	0	0	1	1	0	2
111	<i>Eragrostis minor</i> Host	Ghaah	Poaceae	0	0	0	0	0	1	0	0	1
112	<i>Eragrostis pilosa</i> (L.) P. Beauvois		Poaceae	0	0	0	0	0	1	1	0	2
113	<i>Eruca sativa</i> Miller		Brassicaceae	0	1	1	0	0	1	0	1	4
114	<i>Eucalyptus camaldulensis</i> Dehnh.	Jamaya	Myrtaceae	0	0	1	0	1	1	0	1	4
115	<i>Euphorbia clarkeana</i> Hook.f.	Sufeda	Euphorbiaceae	0	0	0	0	0	1	1	0	2
116	<i>Euphorbia dracunculoides</i> Lam.	Kheer buti	Euphorbiaceae	0	0	0	1	0	1	0	1	3

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
117	<i>Euphorbia granulata</i> Forssk.	Hermali booti/Sabuni booti	Euphorbiaceae	0	0	1	1	0	1	0	0	3
118	<i>Euphorbia hirta</i> Forssk.		Euphorbiaceae	0	0	0	0	0	1	0	0	1
119	<i>Euphorbia prostrata</i> Ait.	Dudhi Kalan	Euphorbiaceae	0	0	1	0	0	1	1	0	3
120	<i>Euphorbia thymifolia</i> L.	Dudhi	Euphorbiaceae	0	0	1	0	0	1	1	0	3
121	<i>Evolvulus alsinoides</i> L.	Hazar Dani	Convolvulaceae	0	0	0	0	0	1	1	0	2
122	<i>Fagonia bruguieri</i> DC.		Zygophyllaceae	0	0	1	0	1	1	0	1	4
123	<i>Fagonia indica</i> var. <i>Schweinfuthii</i> Hadidi.		Zygophyllaceae	0	0	1	0	1	1	0	1	4
124	<i>Farsetia hamiltonii</i> Royle	Dhaman	Brassicaceae	0	0	1	0	0	1	0	0	2
125	<i>Farsetia jacquemontii</i> Hook.f. and Thomson	Lathia	Brassicaceae	0	0	1	0	0	1	0	0	2
126	<i>Ficus bengalensis</i> L.	Lathia	Moraceae	1	0	1	0	1	1	0	1	5
127	<i>Ficus carica</i> L.	Barghad	Moraceae	1	0	1	0	1	1	0	0	4
128	<i>Ficus religiosa</i> L.	Injir	Moraceae	0	0	1	0	1	1	0	0	3
129	<i>Fimbristylis quinquangularis</i> (Vahl) Kunth	Peepal	Cyperaceae	0	0	0	0	0	1	1	0	2
130	<i>Galium aparine</i> L.	Murrakh	Rubiaceae	0	0	0	0	0	1	1	0	2
131	<i>Gisekia pharnaceoides</i> L.	Kori buti	Aizoaceae	0	0	1	0	0	1	0	0	2
132	<i>Glinus lotoides</i> L.	Manjhatra	Molluginaceae	0	0	0	0	0	0	1	0	1
133	<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.	Baphara	Chenopodiaceae	0	0	0	0	1	1	1	0	3
134	<i>Haloxylon stocksii</i> (Boiss.) Benth. and Hook.	Lana	Chenopodiaceae	0	0	0	0	1	1	1	1	4
135	<i>Heliotropium calcareum</i> Stocks		Boraginaceae	0	0	0	0	1	1	1	0	3
136	<i>Heliotropium crispum</i> Desf.	Jatia	Boraginaceae	0	0	0	0	1	1	1	0	3
137	<i>Heliotropium curassavicum</i> L.	Jatti Mussag	Boraginaceae	0	0	0	0	0	1	1	0	2
138	<i>Heliotropium europeum</i> L.		Boraginaceae	0	0	1	0	0	1	0	0	2
139	<i>Heliotropium strigosum</i> Willd.		Boraginaceae	0	0	1	0	0	1	1	0	3
140	<i>Hypocoum leptocarpum</i> Hook. f. and Thoms.	Gorakh paan	Papaveraceae	0	0	0	0	0	1	1	0	2
141	<i>Imperata cylindrica</i> (L.) Raeuschel.		Poaceae	0	0	0	0	1	1	1	0	3

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
142	<i>Indigofera hochstetteri</i> Baker	Dab Ghaas	Fabaceae	0	0	1	0	0	1	1	0	3
143	<i>Indigofera linifolia</i> (L.f.) Retz.		Fabaceae	0	0	0	0	0	1	1	0	2
144	<i>Indigofera oblongifolia</i> Forsk.	Kano	Fabaceae	0	0	0	0	1	1	1	0	3
145	<i>Iphiona grantioidea</i> (Boiss.) Anderb.		Asteraceae	0	0	1	0	0	0	1	0	2
146	<i>Ipomoea cornea</i> ssp. <i>fistulosa</i> (Mart. ex Choisy) D. Austin		Convolvulaceae	0	0	1	0	1	0	0	1	3
147	<i>Lappula patula</i> (Lehm.) Asch. ex Gurke		Boraginaceae	0	0	0	0	0	1	0	1	2
148	<i>Lasiurus indicus</i> Henr.	Karera	Poaceae	0	0	0	0	1	1	1	0	3
149	<i>Lathyrus aphaca</i> L.	Jangli Matar	Fabaceae	0	0	0	0	0	1	0	0	1
150	<i>Launaea procumbens</i> (Roxburgh) Ramayya and Rajagopal	Dudkal	Asteraceae	0	0	0	1	0	0	1	0	2
151	<i>Launaea residifolia</i> (L.) O. Kuntze.	Bhattal	Asteraceae	0	0	1	1	0	1	0	0	3
152	<i>Lawsonia inermis</i> L.	Menhdi	Lathyraceae	0	0	1	0	1	0	0	1	3
153	<i>Leptadenia pyrotechnica</i> (Forssk.) Decne.		Asclepiadaceae	0	1	0	0	1	1	1	1	5
154	<i>Leptochloa panicea</i> (Retz.) Ohwi		Poaceae	0	0	0	0	0	1	0	0	1
155	<i>Limeum indicum</i> Stocks ex T. Anders.	Patar	Aizoaceae	0	0	1	0	0	1	0	0	2
156	<i>Malva parviflora</i> L.	Sonchal	Malvaceae	0	1	0	0	0	1	0	0	2
157	<i>Medicago polymorpha</i> L.	Maina	Fabaceae	0	1	0	0	0	1	0	1	3
158	<i>Melia azedirach</i> L.	Dharek	Meliaceae	0	0	1	0	1	1	0	1	4
159	<i>Melilotus alba</i> Desr.	Sinjhi	Fabaceae	0	0	0	0	0	1	0	0	1
160	<i>Melilotus indica</i> (L.) All.	Sinjhi	Fabaceae	0	0	0	0	0	1	0	0	1
161	<i>Mentha longifolia</i> (L.) L.	Chita podina	Lamiaceae	0	0	1	1	0	0	0	0	2
162	<i>Mollugo cerviana</i> (L.) Seringe		Molluginaceae	0	0	0	0	1	0	0	0	1
163	<i>Mollugo nudicaulis</i> Lamk.		Molluginaceae	0	0	0	0	1	0	0	0	1
164	<i>Mollugo pentaphyla</i> L.		Molluginaceae	0	0	0	0	1	0	0	0	1
165	<i>Momordica balsamica</i> L.	Jangli Karela	Cucurbitaceae	0	1	1	0	0	1	0	1	4
166	<i>Moringa oleifera</i> Lamk.	Suhanjna	Moringaceae	0	1	1	1	1	1	0	1	6

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
167	<i>Morus alba</i> L.	Shetoot	Moraceae	1	0	1	0	1	1	0	0	4
168	<i>Morus nigra</i> L.	Toot	Moraceae	1	0	1	0	1	1	0	1	5
169	<i>Mukia maderaspatana</i> (Linn.) M.J. Roem.	Jangli kareli	Cucurbitaceae	0	0	0	0	0	1	0	0	1
170	<i>Nonea caspica</i> subsp. <i>caspica</i> (Willd.) G. Don		Boragenaceae	0	0	0	0	0	1	0	0	1
171	<i>Nonea edgeworthii</i> A. DC.	Kangher	Boragenaceae	0		1	0	0	1	0	0	2
172	<i>Ochthochloa compressa</i> (Forssk.) Hilu	Jut Madhaana	Poaceae	0	0	0	0	0	1	1	0	2
173	<i>Orabanche aegyptica</i> Pers.	Muthar	Orobanchaceae	0	0	0	0	0	0	0	1	1
174	<i>Oxalis corniculata</i> L.	Khati booti	Oxalidaceae	0	0	1	0	0	1	0	0	2
175	<i>Panicum psilopodium</i> Trin.		Poaceae	0	0	0	0	0	1	1	0	2
176	<i>Parthenium hysterophorus</i> DC.			0	0	0	0	1	1	1	1	4
177	<i>Paspalum dilatatum</i> Poir.		Poaceae	0	0	0	0	0	1	1	0	2
178	<i>Peganum hermala</i> L.	Harmal	Zygophyllaceae	0	0	1	1	1	0	0	1	4
179	<i>Pentatropis nivalis</i> (J.F.Gmel.) D.V.Field and J.R.I.Wood	Wahra	Asclepiadaceae	0	0	0	0	0	1	0	1	2
180	<i>Periploca aphylla</i> Dcne.		Asclepiadaceae	0	0	0	0	1	1	1	1	4
181	<i>Phalaris minor</i> Retz.		Poaceae	0	0	0	0	0	1	0	0	1
182	<i>Phoenix sylvestris</i> L.	Khaji	Arecaceae	1	0	1	0	1	1	0	1	5
183	<i>Phragmites karka</i> (Retz.) Trin. ex Steud.	Narr	Poaceae	0	0	0	0	1	1	0	1	3
184	<i>Phyla nodiflora</i> (Linn.) Greene		Verbenaceae	0	0	1	0	0	1	1	0	3
185	<i>Physorrhynchus brahuicus</i> Hk.	Phatkari	Brassicaceae	0	0	0	0	0	1	1	0	2
186	<i>Pithecolobium dulce</i> Bth.	Jangle jalebi	Fabaceae	1	0	0	0	1	1	0	0	3
187	<i>Plantago lanceolata</i> L.	Janghli Isapghol	Plantaginaceae	0	0	1	0	0	1	0	0	2
188	<i>Plantago major</i> L.		Plantaginaceae	0	0	1	0	1	1	0	0	3
189	<i>Pluchea arguta</i> subsp. <i>arguta</i> Boiss.	Jhao	Asteraceae	0	0	1	0	1	0	0	1	3
190	<i>Pluchea lanceolata</i> (DC.) C. B. Clarke	Jal buti	Asteraceae	0	0	0	0	1	1	1	1	4
191	<i>Poa annua</i> L.		Poaceae	0	0	0	0	0	1	1	0	2

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
192	<i>Polygonum molliaeforme</i> Boiss.	-	Polygonaceae	0	0	0	0	0	1	1	0	2
193	<i>Polygonum plabejum</i> ver. <i>Effusum</i> Meisn.		Polygonaceae	0	0	0	0	0	1	1	0	2
194	<i>Pongamia pinnata</i> (L.) Merrill.	Sukh chain	Fabaceae	0	0	1	0	1	1	0	1	4
195	<i>Prosopis cineraria</i> (L.) Druce.	Jand	Mimosaceae	1	1	1	0	1	1	0	1	6
196	<i>Prosopis glandulosa</i> Torr.	Gul kanda	Mimosaceae	0	0	0	0	1	1	0	1	3
197	<i>Prosopis juliflora</i> (Swartz) DC.	Kabli kihar	Mimosaceae	0	0	0	0	1	1	0	1	3
198	<i>Psidium guajava</i> L.	Amrood	Myrtaceae	1	0	1	0	1	1	0	1	5
199	<i>Pulicaria glaucescens</i> (Boiss.) Jaub. and Spach		Asteraceae	0	0	0	0	0	1	1	0	2
200	<i>Punica granatum</i> L.	Anar	Punicaceae	1	0	1	0	1	1	0	1	5
201	<i>Pupalia lappacea</i> (Linn.) Juss.		Amaranthaceae	0	0	0	0	0	1	1	0	2
202	<i>Pycreus flavidus</i> (Retz.) T. Koyama	Sayyar Ghaah	Cyperaceae	0	0	0	0	0	1	1	0	2
203	<i>Pycreus sanguin</i> (Vahl) Nees	Ghaa	Cyperaceae	0	0	0	0	0	1	1	0	2
204	<i>Rhazya stricta</i> Decne.	Vinraan	Apocynaceae	0	0	1	0	1	0	1	1	4
205	<i>Rhynchosia minima</i> (L.) DC.	Wand vehri	Fabaceae	0	0	0	0	0	1	0	0	1
206	<i>Rhynchosia pulverulenta</i> Stocks		Fabaceae	0	0	0	0	0	1	0	0	1
207	<i>Ricinus communis</i> L.	Harnoli	Euphorbiaceae	0	0	1	0	1	0	0	1	3
208	<i>Rumex dentatus</i> subsp. <i>klotzschianus</i> (Meisn.) Rech. f.	Jangli palak	Polygonaceae	0	1	1	0	1	1	0	0	4
209	<i>Saccharum bengalense</i> Retz.		Poaceae	0	0	0	0	1	1	1	1	4
210	<i>Saccharum spontaneum</i> L.		Poaceae	0	0	0	0	1	1	1	1	4
211	<i>Salsola imbricata</i> Forssk.	Lana	Chenopodiaceae	0	0	0	0	1	1	1	0	3
212	<i>Salvadora oleoides</i> Decne.	Peelu	Salvadoraceae	1	0	1	0	1	1	1	1	6
213	<i>Schismus arabicus</i> Nees		Poaceae	0	0	0	0	1	1	1	0	3
214	<i>Schweinfurthia papilionacea</i> (Burm. f.) Boiss.	Akri	Scrophulariaceae	0	0	0	0	0	1	1	0	2
215	<i>Sesbania sesban</i> (L.) Merrill	Manjantri	Fabaceae	0	0	0	0	1	1	0	0	2
216	<i>Sesuvium sesuvioides</i> (Fenzl) Verde		Aizoaceae	0	0	0	0	0	1	1	0	2

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
217	<i>Setaria intermedia</i> Roem. and Schult		Poaceae	0	0	0	0	0	1	0	0	1
218	<i>Setaria pumila</i> (Poir.) Roem. and Schult.		Poaceae	0	0	0	0	0	1	0	0	1
219	<i>Silene conoidea</i> L.	Lonak	Poaceae	0	0	0	0	0	1	0	0	1
220	<i>Sisymbrium irio</i> L.	Khoob Kalan	Brassicaceae	0	0	1	0	0	1	0	0	2
221	<i>Sisymbrium orientale</i> L.	Khoob Kalan	Brassicaceae	0	0	1	0	0	1	0	0	2
222	<i>Solanum amricanum</i> Miller	Katch Match	Solanaceae	0	1	1	0	0	1	0	0	3
223	<i>Solanum incanum</i> L.	Kori waal / Maahora	Solanaceae	0	1	1	0	0	1	0	0	3
224	<i>Solanum nigrum</i> L.	Mahori	Solanaceae	1	1	1	0	0	1	0	0	4
225	<i>Solanum surattense</i> Burm.f.	Mahokari/Kandi ari	Solanaceae	0	1	1	1	0	0	1	0	4
226	<i>Solanum villosum</i> (L.) Mill.	Kaachmach	Solanaceae	0	1	1	0	0	1	0	0	3
227	<i>Sonchus asper</i> (L.) Hill	Dudkal	Asteraceae	0	0	0	0	0	1	1	0	2
228	<i>Sorghum bicolor</i> (Linn.) Moench.	milo	Poaceae	0	0	0	0	1	1	0	1	3
229	<i>Sorghum</i> Sect. <i>Sorghum</i> Subsect. <i>Arundinacea</i> <i>Moench.</i>	milo	Poaceae	0	0	0	0	1	1	0	0	2
230	<i>Spergula arvensis</i> L.	Lonak	Caryophyllaceae	0	0	0	0	0	1	1	0	2
231	<i>Spinacial oleracea</i> L.	Palak	Chenopodiaceae	0	1	1	0	0	1	0	0	3
232	<i>Sporobolus arabicus</i> Boiss.		Poaceae	0	0	0	0	0	1	1	0	2
233	<i>Stipagrostis plumosa</i> (Linn.) Munro ex T.	Chita gah	Poaceae	0	0	0	0	0	1	1	0	2
234	<i>Suaeda fruticosa</i> Forssk. ex J. F.		Chenopodiaceae	0	0	1	1	0	1	1	0	4
235	<i>Syzygium cumini</i> (L.) Skeels	Jaman	Myrtaceae	1	0	1	0	1	1	0	1	5
236	<i>Tamarix aphylla</i> (L.) Karst.	Khaggal	Tamaricaceae	0	0	1	0	1	1	1	1	5
237	<i>Taraxicum officinalis</i> F.H. Wigg	Dudkal	Asteraceae	0	0	0	0	0	1	1	0	2
238	<i>Tephrosia purpurea</i> (L.) Pers.	Sarphonka	Fabaceae	0	0	1	0	1	0	1	0	3
239	<i>Tephrosia uniflora</i> Pers.	Sarphonka	Fabaceae	0	0	1	0	1	0	1	0	3
240	<i>Tephrosia uniflora</i> var. <i>petrosa</i>	Sarphonka	Fabaceae	0	0	1	0	1	1	1	0	4

S. No.	Plant species	Vernacular	Family	Fr	Ve	Me	Et	Fu	Fo	So	Ot	UVI
241	<i>Themeda triandra</i> Forsk.	Ghaa	Poaceae	0	0	0	0	1	1	1	1	4
242	<i>Tragus roxburghii</i> Panigrahi		Poaceae	0	0	0	0	0	1	1	0	2
243	<i>Trianthema portulacastrum</i> L.	Itsit	Aizoaceae	0	0	1	0	0	1	0	0	2
244	<i>Trianthema triquetra</i> Rottl. and Willd.	Itsit	Aizoaceae	0	0	0	0	0	1	1	0	2
245	<i>Tribulus longipetalous</i> Viv.	Bhakhra	Zygophyllaceae	0	0	0	0	0	1	1	0	2
246	<i>Tribulus terrestris</i> L.	Bhakhra	Zygophyllaceae	0	1	1	0	0	1	0	1	4
247	<i>Trichodesma indicum</i> (L.) R. Br.	Handusi	Boragaceae	0	0	1	0	0	1	1	0	3
248	<i>Trigonella monantha</i> sp. <i>Incise</i> C.A. Meye	Teen pati	Papilionaceae	0	1	0	0	0	1	1	0	3
249	<i>Trisetum clarkei</i> (Hook.f.) R. R. Stewart		Poaceae	0	0	0	0	0	1	1	0	2
250	<i>Typha elephantina</i> Roxb.	Kundar	Typhaceae	0	0	1	0	1	0	0	1	3
251	<i>Veronica persica</i> Poir.		Scrophulariaceae	0	0	0	0	0	1	1	0	2
252	<i>Vetiveria zizanioides</i> (Linn.) Nash		Poaceae	0	0	0	0	0	1	1	0	2
253	<i>Vicia faba</i>	Gandli mater		0	1	0	0	0	1	0	0	2
254	<i>Vicia sativa</i> L.	Jangli mati	Fabaceae	0	1	0	0	0	1	0	0	2
255	<i>Vigna trilobata</i> (L.) Verdc.	Jangli matar	Fabaceae	0	0	0	0	0	1	0	0	1
256	<i>Withania coagulans</i> (Stocks.) Dunal	Paneer	Solanaceae	0	0	1	1	1	1	0	1	5
257	<i>Withania somnifera</i> (L.) Dunal	Aksan/Ratkan	Solanaceae	0	0	1	1	1	0	0	0	1
258	<i>Zaleya pentandra</i> (L.) Jeffrey		Aizoaceae	0	0	1	0	0	1	0	0	2
259	<i>Ziziphus mauritiana</i> Lam.	Beri	Rhamnaceae	1	0	1	0	1	1	0	1	5
260	<i>Ziziphus nummularia</i> (Burm.f.) Wight and Arn.	Jhar beri	Rhamnaceae	1	0	1	0	1	1	0	1	5
261	<i>Ziziphus spina-christi</i> (L.) Willd.	Jhar beri		1	0	0	1	1	1	1	1	6

Legend: Fr: fruits; Ve: vegetable; Me: medicinal; Et: ethno-veterinary; Fu: fuel; Fo: fodder; So: soil binder; Ot: others

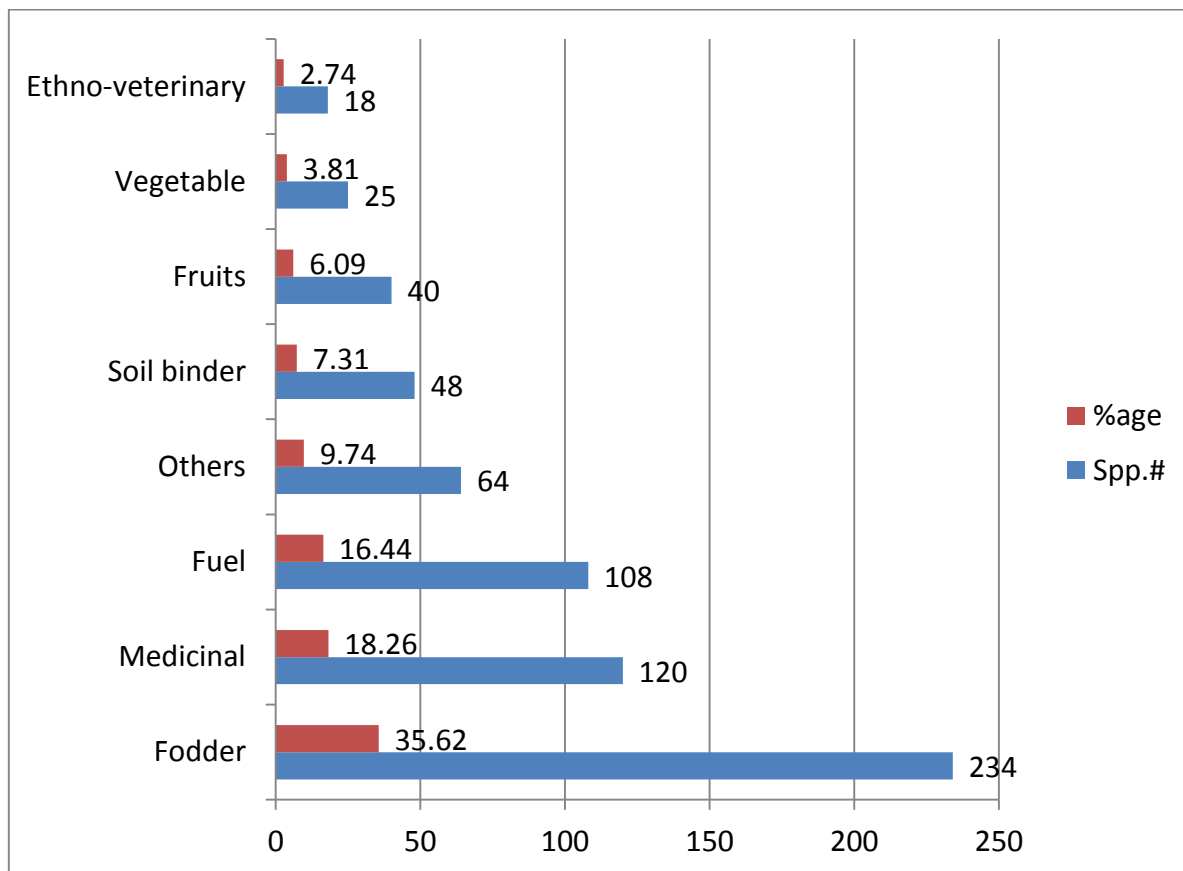


Fig. 4.2: Census of major use categories recorded from the study area.

Table 4.3:Direct matrix ranking of species having multipurposeuse.

S. No.	Plant species	Medicinal	Fodder	Fuel	Construction	Roof thatching	Total	Rank
1	<i>Capparis decidua</i> (Forssk.) Edgew.	5	4	5	5	5	24	1
2	<i>Acacia nilotica</i> (L.) DeL. subsp. <i>indica</i> (Benth.) Brenan	4	5	5	5	4	23	2
3	<i>Acacia nilotica</i> subsp. <i>cupressiformis</i> (T.L. Stewart) Ali	4	5	5	5	4	23	3
4	<i>Melia azadirach</i> L.	5	4	4	4	5	22	4
5	<i>Prosopis cineraria</i> (L.) Druce.	3	5	5	5	4	22	5
6	<i>Azadirachta indica</i> (L.) A. Juss.	5	3	4	5	4	21	6
7	<i>Acacia jacquemontii</i> Benth.	3	5	5	3	4	20	7
8	<i>Moringa oleifera</i> Lamk.	5	3	4	2	2	16	8
9	<i>Salvadora oleoides</i> Decne.	2	4	4	2	3	15	9
10	<i>Prosopis juliflora</i> (Swartz) DC.	2	2	5	3	3	15	10
11	<i>Cymbopogon jwarancusa</i> subsp. <i>jwarancusa</i> (Jones) Schult.	4	1	4	0	3	12	11
12	<i>Aerva javanica</i> (Burm. f.) Juss ex J. A. Shultes.	1	3	4	0	3	11	12
13	<i>Tribulus terrestris</i> L.	4	5	0	0	0	9	13
14	<i>Citrullus colocynthis</i> (L.) Schrad.	5	3	0	0	0	8	14
15	<i>Solanum nigrum</i> L.	5	3	0	0	0	8	15

4.4.1.5 Medicinal usage:

Out of 261 species, 120 plants belonged to 88 genera and 44 families are used as medicinal purpose by the natives. The inventory is provided in Table 4.4. The present findings are in agreement of the work carried out by Qureshi and Bhatti (2008), who reported 51 plant species belonging to 43 genera and 28 families which were used for curing various human diseases by the natives of the Nara Desert. This work supports the way of usage of the present findings in addition to some more knowledge about the medicinal plants from this area. Besides, from the northern part of Nara desert, Pakistan. Qureshi *et al.* (2010) reported 63 plant species belonging to 50 genera and 29 families which are highly effective in different diseases.

4.4.1.6 Nobility of medical record

The review of all medicinal plants is compiled and provided in Appendix 1. Compared to the medicinal literature (Dalziel, 1948; Lust, 1959; Watt and Breyer-Brandwijk, 1962; Niebuhr, 1970; Bouquet and Debray, 1974; Triska, 1975; Singh and Kachroo, 1976; Emboden, 1979; Weiner, 1980; Launert, 1981; Parmar and Kaushal, 1982; Lust, 1983; Baquar and Tasnif, 1984; Chiej, 1984; Coburn, 1984; Dafni *et al.*, 1984; Duke and Ayensu, 1985; Grieve, 1984; Sahu, 1984; Manandhar, 1985; Yeung, 1985; Chopra *et al.*, 1986; Polunin and Huxley, 1987; Srivastava, 1989; Foster and Duke, 1990; Joshi and Edington, 1990; Phillips and Foy, 1990; Bhattarai, 1993; Colunga-Garciamarin and May-Pat, 1993; Tsarong and Tsewang, 1994; Bown, 1995; Chevallier, 1996; Usmanghani *et al.*, 1997; Ali-Shayeh *et al.*, 1998; Bhatti *et al.*, 1998; Moerman, 1998; Istanbul, 2000; Nedhal and Al-douri, 2000; Shanwari and Khan, 2000; Ali *et al.*, 2001; Giday, 2001; Matin *et al.*, 2001; Bnouham *et al.*, 2002; Fernandez *et al.*, 2003; Giday *et al.*, 2003; Hebbbar *et al.*, 2004; Jain *et al.*, 2004; Kala *et al.*, 2004; Katewa *et al.*, 2004; Koné *et al.*, 2004; Qureshi, 2004, Katewa and Galav 2006; Stella *et al.*, 2004; Uzun *et al.*, 2004; Natarajan *et al.*, 2005;

Ahmad *et al.*, 2006; Muthu *et al.*, 2006; Zabihullah *etal.*, 2006; Agra *et al.*, 2007; Ahmad, 2007; Senthikumar *et al.*, 2006; Anisuzzaman and Rahman, 2007; Braga, 2007; Canales *et al.*, 2007; Raju *et al.*, 2007; Savithramma *et al.*, 2007; Shinwari *et al.*, 2007; Tene *et al.*, 2007; Wazir *et al.*, 2007; Ignacimuthu *et al.*, 2008; Ugurlu and Secmen, 2008; Ahmad *et al.*, 2009; Choudhary *et al.*, 2009; Jabeen *et al.*, 2009; Khan, 2009; Qureshi *et al.*, 2009, Rahmatullah *et al.*, 2011; Giday *et al.*, 2010; Gupta *et al.*, 2010; Marashdah and Al-Hazimi, 2010; Panghal *et al.*, 2010; Singh *et al.*, 2010; Qureshi *et al.*, 2010; Ahmad and Eram, 2011; Iqbal *et al.*, 2011; Kavishankar *etal.*, 2011; Murad *et al.*, 2011; Padmavathy and Anbarashan, 2011; Qureshi *et al.*, 2011; Saluja and Shrivastava 2011; Mushtaq *et al.*, 2012, Qureshi, 2012 and Qureshi and Shaheen, 2013), four species viz., *Limeum indicum*, *Launaea residifolia*, *Farsetia jacquemontii* and *Indigofera hochstetteri* possessed novel medicinal uses not reported in the literature (Table 4.5). Besides, 76 species had new uses in addition to the medical record, while the rest of the species contained similar use. In addition, the way of uses was also found different compared with the literature.

4.4.1.7 Diseases treated:

There was high diversity of medicinal plants in the study area compared to Cholistan and Nara Desert (Arshad *et al.*, 2002, Qureshi *et al.*, 2010). In all, 45 different diseases treated by 120 medicinal plants (Table 4.6). Like Nara desert, this area is facing drought and dryness resulted in creating constipation amongst the inhabitants. However, the area is blessed with good diversity of plants which are largely used to treat constipation with 27 species (7.87%), followed by abdominal/stomach problem (24 spp., 7%), boils (23 spp., 6.71%), jaundice and pain (18 spp., 5.25% each), pimples, skin problems (17 spp., 4.96% each), digestive problems, sexual problems (14 spp., 4.08% each), cooling agent (13 spp., 3.79%) and Hemorrhoids (11 spp., 3.21%), other diseases were treated by less plant species (Table 4.6).

4.4.1.8 Parts utilized for making recipes:

Overall, 13 plant parts were utilized for making anecdotal recipes by the native (Fig. 4.3). The leaves were heavily used (27.46%) for the preparation of recipes, followed by fruits (17.61%), whole plant (14.50%), roots (12.95%), Seeds (10.36%), aerial parts (3.62%), stem (3.6%), flowers (3.1%), oil (2.07%), pulp (1.55), gum (1.55%), latex (1.03%), while preparing in few remedies, inflorescence (0.51%) was used. Various other studies reported similar type of results like Quresh and Shaheen (2013), Qureshi *et al.*, (2012), Shaheen *et al.*, (2012), Shaheen *et al.* (2010), Jain *et al.* (2009), Kumar *et al.* (2009), Rout and Thatoi (2009), Ahmad *et al.* (2008) and Qureshi and Bhatti (2008).

4.4.1.9 Method of preparation/formulation:

For treating 45 different diseases 21 different formulations were used by the inhabitants of the area (Fig. 4.4). Amongst them, most of recipes were given in the form of powder (15.7%), followed by extract (12.6%), raw fruits (9.2%), potherb, (8.81%), etc. Various other studies reported similar type of results like Qureshi and Shaheen (2013), Rauf *et al.* (2012), Pradhan and Badola (2008) and Qureshi and Bhatti (2008).

Table 4.4: The inventory of medicinal plants along with family, Parts utilized, method of preparation and diseases treated.

S. No.	Plant species	Family	Parts utilized	Method of preparation	Disease treated
1	<i>Agave sisilana</i> Perr. Ex Engelm.	Agavaceae	Pulp	Potherb, Pulp	Jaundice, blood purifier, acidity, constipation, Hemorrhoids, boils, pimples, skin problems
2	<i>Limeum indicum</i> Stocks ex T. Anders.	Aizoaceae	Leaves	Paste	Wounds
3	<i>Gisekia pharmaceoides</i> L.	Aizoaceae	Whole plant	Juice	Abdominal/stomach problem
4	<i>Trianthema portulacastrum</i> L.	Aizoaceae	Roots	Decoction	Jaundice
5	<i>Zaleyia pentandra</i> (L.) Jeffrey	Aizoaceae	Whole plant	Juice	Kidney stones
6	<i>Aloe vera</i> L.	Alloaceae	Pulp	Potherb, Pulp	Jaundice, Pimples
7	<i>Achyranthes aspera</i> L.	Amaranthaceae	Whole plant	Decoction, Ash, Powder	Asthma, cough, aphrodisiac, pain
8	<i>Aerva javanica</i> (Burm. f.) Juss ex J. A. Shultes.	Amaranthaceae	Leaves, Whole plant, inflorescence	Paste, Decoction	Constipation, boils, pimples
9	<i>Alternanthera pungens</i> Kunth in H.B.K.	Amaranthaceae	Roots	Decoction	Jaundice
10	<i>Amaranthus graecizans</i> L.	Amaranthaceae	Leaves	Potherb	Constipation

11	<i>Amaranthus ovalifolius</i> L.	Amaranthaceae	Leaves	Potherb	Constipation
12	<i>Amaranthus viridis</i> L.	Amaranthaceae	Leaves	Potherb	Constipation
13	<i>Celosia argentea</i> L.	Amaranthaceae	Seeds, Flowers	Powder, Poultice	Boils, dysentery, uterine problems, leucorrhoea, diarrhea
14	<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	Leaves	Potherb	Constipation
15	<i>Anethum graveolens</i> L.	Apiaceae	Seeds	Powder	Constipation, abdominal/stomach problem
16	<i>Rhazya stricta</i> Decne.	Apocynaceae	Leaves, Aerial parts	Powder	Hemorrhoids, abdominal/stomach problem
17	<i>Phoenix sylvestris</i> L.	Arecaceae	Fruits	Raw fruits	Aphrodisiac
18	<i>Calotropis procera</i> (Willd.) R. Br.	Asclepiadaceae	Leaves, Whole plant, Fruits, Latex	Powder, Extract, Latex, Flowers	Jaundice, boils, wounds, abdominal/stomach problem, asthma, pain, inflammation
19	<i>Amberboa ramosa</i> (Roxb.) Jafri	Asteraceae	Whole plant	Juice	Blood purifier, boils, pimples, skin problems
20	<i>Carthamus oxycantha</i> M.B.	Asteraceae	Leaves, Whole plant, Seeds	Rosted seeds	Cancer
21	<i>Centaurea iberica</i> Trev.	Asteraceae	Roots, Aerial parts	Extract	Kidney stones
22	<i>Echinops echinatus</i> Roxb.	Asteraceae	roots, Aerial	Powder, Extract	Pain, Fever

			parts		
23	<i>Iphiona grantioides</i> (Boiss.) Anderb.	Asteraceae	Leaves, Aerial parts	Paste	Boils
24	<i>Launaea residifolia</i> (L.) O. Kuntze.	Asteraceae	Latex	Paste	Boils, Pimples
25	<i>Bombax malabaricum</i> DC.	Bombacaceae	Roots	Decoction, Powder	Abdominal/stomach problem, sexual problems
26	<i>Cordia gharaf</i> (Forssk.) Ehren. ex Asch.	Boraginaceae	Pulp, Fruits	Raw fruits	Pain
27	<i>Cordia myxa</i> L.	Boraginaceae	Fruits	Raw fruits	Pain
28	<i>Heliotropium europeum</i> L.	Boraginaceae	Leaves	Juice, Ash	Boils, pimples, skin problems, wounds
29	<i>Heliotropium strigosum</i> Willd.	Boraginaceae	Whole plant	Juice, Powder, Extract	Jaundice, liver disease
30	<i>Nonea edgeworthii</i> A. DC.	Boraginaceae	Leaves	Juice, Extract	Respiratory problems, cough
31	<i>Trichodesma indicum</i> (L.) R. Br.	Boraginaceae	Leaves, whole plant, root	Juice, Extract, D ecoction	Ear wounds, pain, vomiting, urinary, joint pain cough, cold, fever and dysentery
32	<i>Brasica compestris</i> L.	Brassicaceae	Leaves, oil	Potherb, Oil	Jaundice, constipation, Abdominal/stomach problem, Anti-lice, Athlete foot
33	<i>Eruca sativa</i> Miller	Brassicaceae	Seeds, oil	Rosted seeds, Oil	Jaundice, Hemorrhoids, skin problems, abdominal/stomach problem, anti-lice,

					earache
34	<i>Farsetia hamiltonii</i> Royle	Brassicaceae	Whole plant	Powder	Constipation, Hemorrhoids, abdominal/stomach problem, pain
35	<i>Farsetia jacquemontii</i> Hook.f. and Thomson	Brassicaceae	Whole plant	Powder	Constipation, Hemorrhoids, abdominal/stomach problem
36	<i>Sisymbrium irio</i> L.	Brassicaceae	Seeds	Powder	Fever
37	<i>Sisymbrium orientale</i> L.	Brassicaceae	Seeds	Powder	Fever
38	<i>Cassia fistula</i> L.	Caesalpiniaceae	PULP	Pulp	Constipation
39	<i>Cassia italica</i> (Mill.) F.W.Andr.	Caesalpiniaceae	Leaves, roots, Seeds, Flowers	Potherb, Juice, Decoction, Extract, Raw fruits, Raw seeds	Jaundice, constipation, Hemorrhoids
40	<i>Capparis decidua</i> (Forssk.) Edgew.	Capparidaceae	Seeds, Aerial parts, Flowers, Fruits	Paste, Poultice, Raw fruits, Tooth stick	Constipation, athletefoot, toothache, earache
41	<i>Chenopodium album</i> L.	Chenopodiaceae	Leaves, Aerial parts	Potherb, Paste	Constipation
42	<i>Chenopodium murale</i> L.	Chenopodiaceae	Leaves, Aerial parts	Potherb, Paste	Constipation
43	<i>Spinacia oleracea</i> L.	Chenopodiaceae	Leaves	Potherb	Constipation
44	<i>Suaeda fruticosa</i> Forssk. ex J. F.	Chenopodiaceae	Leaves	Raw leaves	Ophthalmia, kidney stones, uterine

					problems
45	<i>Convolvulus arvensis</i> L.	Convolvulaceae	Leaves, Whole plant	Potherb, Powder	Abdominal/stomach problem
46	<i>Convolvulus microphyllus</i> Sieb. ex Spreng.	Convolvulaceae	Whole plant	Powder	Leucorrhoea
47	<i>Ipomoea cornea</i> ssp. <i>fistulosa</i> (Mart. ex Choisy) D. Austin	Convolvulaceae	Leaves	Paste, Tooth stick, Raw seeds	Boils
48	<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	Roots, Seeds, Fruits	Raw fruits, Pickled	Constipation, skin problems, abdominal/stomach problem, pain, digestive problems, toothache, diarrhea
49	<i>Momordica balsamica</i> L.	Cucurbitaceae	Fruits	Potherb, Juice, Powder, Extract, Raw fruits	Constipation, blood purifier, boils, pimples, abdominal/stomach problem, asthma, diabetes, obesity
50	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Whole plant	Paste, Extract	Skin problems, Antidandruff
51	<i>Cuscuta monogyna</i> Vahl, Sym.	Cuscutaceae	Whole plant	Paste, Extract	Skin problems, Antidandruff
52	<i>Chrozophora tinctoria</i> (L.) Juss.	Euphorbiaceae	Leaves	Juice, Poultice	Acidity
53	<i>Euphorbia granulata</i> Forssk.	Euphorbiaceae	Whole plant	Powder	Diabetes
54	<i>Euphorbia prostrata</i> Ait.	Euphorbiaceae	Whole plant	Powder	Diabetes
55	<i>Euphorbia thymifolia</i> L.	Euphorbiaceae	Whole plant	Powder, Extract	Dysentery, diabetes, diarrhea
56	<i>Ricinus communis</i> L.	Euphorbiaceae	Leaves, oil	Poultice, Oil	Constipation, pain, inflammation
57	<i>Alhagi maurorum</i> Medic.	Fabaceae	Whole plant	Decoction, Powder,	Blood purifier, pimples, skin problems,

				Extract	abdominal/stomach problem
58	<i>Alysicarpus longifolius</i> (Rottler ex Spreng.) Wight and Arn.	Fabaceae	Leaves	Potherb	Constipation
59	<i>Cicer arietinum</i> L.	Fabaceae	Seeds	Powder	Diabetes
60	<i>Dalbergia sissoo</i> Roxb.	Fabaceae	Stem	Ash	Ringworm, athletefoot
61	<i>Indigofera hochstetteri</i> Baker	Fabaceae	Fruits	Powder	Sexual problems
62	<i>Pongamia pinnata</i> (L.) Merril.	Fabaceae	Leaves, Fruits	Decoction	Abdominal/stomach problem
63	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	Roots	Extract, Tooth stick	Toothache, diarrhea
64	<i>Tephrosia uniflora</i> Pers.	Fabaceae	Roots	Extract, Tooth stick	Toothache, diarrhea
65	<i>Tephrosia uniflora</i> var. <i>petrosa</i>	Fabaceae	Roots	Extract, Tooth stick	Toothache, diarrhea
66	<i>Mentha longifolia</i> (L.) L.	Lamiaceae	Leaves	Potherb, Powder, Extract	Hemorrhoids, Abdominal/stomach problem, pain, digestive problems, nausea
67	<i>Lawsonia inermis</i> L.	Lathyraceae	Leaves	Paste, Decoction, Powder	Pain, cooling effect, athletefoot, antidandruff
68	<i>Abutilon pakistanicum</i> Jafri and Ali	Malvaceae	Seeds	Raw seeds	Cooling effect
69	<i>Azadirachta indica</i> (L.) A. Juss.	Meliaceae	Leaves, Seeds, Fruits	Juice, Paste, Ash, Extract, Raw fruits, Infusion	Hemorrhoids, boils, pimples, skin problems, wounds, abdominal/stomach problem, anti-lice, cooling effect
70	<i>Melia azedirach</i> L.	Meliaceae	Leaves,	Juice, Paste, Extract,	Jaundice, blood purifier, boils, pimples,

			Fruits	Infusion	skin problems, anti-lice, cooling effect
71	<i>Acacia jacquemontii</i> Benth.	Mimosaceae	Leaves	Powder	Uterine problems
72	<i>Acacia nilotica</i> subsp. <i>cupressiformis</i> (T.L. Stewart) Ali	Mimosaceae	Gum	Potherb	Sexual problems
73	<i>Acacia nilotica</i> (L.) DeL. subsp. <i>indica</i> (Benth.) Brenan	Mimosaceae	Leaves, roots, Flowers, Stem, Fruits, Gum	Juice, Powder, Extract, Tooth stick	Jaundice, uterine problems, toothache, sexual problems
74	<i>Albizia lebeck</i> (L.) Bth.	Mimosaceae	Seeds, Stem	Powder, Tooth stick, Infusion	Toothache, headache, influenza
75	<i>Prosopis cineraria</i> (L.) Druce.	Mimosaceae	Gum	Potherb, Ash	Wounds, Sexual problems
76	<i>Prosopis glandulosa</i> Torr.	Mimosaceae	Leaves	Decoction	Uterine problems
77	<i>Prosopis juliflora</i> (Swartz) DC.	Mimosaceae	Leaves	Paste	Sexual problems
78	<i>Ficus bengalensis</i> L.	Moraceae	Leaves, roots, Flowers	Powder, Extract, Infusion	Ringworm, leucorrhoea, flue, diarrhea
79	<i>Ficus carica</i> L.	Moraceae	Fruits	Poultice, Raw fruits	Constipation, Hemorrhoids
80	<i>Ficus religiosa</i> L.	Moraceae	Leaves, Stem, Fruits	Juice, Paste, Ash, Powder, Infusion	Asthma, inflammation, cooling effect, nausea, diarrhea
81	<i>Morus alba</i> L.	Moraceae	Leaves,	Decoction, Infusion,	Sore throat, abdominal/stomach problem,

			Fruits, roots	Extract, Raw fruits	cough, fever
82	<i>Morus nigra</i> L.	Moraceae	Leaves, roots, Fruits	Decoction, Extract, Raw fruits, Infusion	Sore throat, abdominal/stomach problem, cough, fever
83	<i>Moringa oleifera</i> Lamk.	Moringaceae	Leaves, roots, Seeds, Flowers	Potherb, Paste, Powder, Extract, Infusion	Sore throat, boils, pimples, skin problems, pain, digestive problems, inflammation, sexual problems
84	<i>Eucalyptus camaldulensis</i> Dehnh.	Myrtaceae	Leaves	Pickled, Infusion, Raw leaves	Digestive problems, flue
85	<i>Psidium guajava</i> L.	Myrtaceae	Leaves, Fruits	Powder, Raw fruits	Constipation, abdominal/stomach problem, cough, digestive problems, flue
86	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Leaves, Stem	Decoction, Powder, Raw leaves	Pain, leucorrhoea, fever, sexual problems, diarrhea
87	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Roots	Powder, Raw root	Jaundice, kidney stones
88	<i>Boerhavia procumbens</i> Banks ex Roxb.	Nyctaginaceae	Roots	Paste, Infusion, Raw root	Jaundice, paralysis
89	<i>Argemone mexicana</i> L.	Papaveraceae	Roots	Paste, Raw seeds	Hemorrhoids, boils, skin problems
90	<i>Plantago lanceolata</i> L.	Plantaginaceae	Seeds	Raw seeds	Cooling effect
91	<i>Plantago major</i> L.	Plantaginaceae	Seeds	Raw seeds	Cooling effect
92	<i>Cymbopogon jawarancusa</i> (Jones) Schult.	Poaceae	Roots, Whole plant, Seeds	Potherb, Powder, Raw seeds, Smoke	measles, cough, chicken pox, fever

93	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Roots, Whole plant	Decoction	Pimples, Fever
94	<i>Saccharum spontaneum</i> L.	Poaceae	Leaves	Infusion	Uterine problems
95	<i>Punica granatum</i> L.	Punicaceae	Roots, Stem, Fruits	Decoction, Raw fruits, Pickled, Infusion	Abdominal/stomach problem, digestive problems, toothache
96	<i>Rumex dentatus</i> subsp. <i>klotzschianus</i> (Meisn.) Rech. f.	Polygonaceae	Whole plant	Potherb	Constipation
97	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	Leaves, Fruits	Powder, Poultice, Raw fruits, Infusion	Pain, inflammation, diabetes, antidandruff, sexual problems
98	<i>Ziziphus nummularia</i> (Burm.f.) Wight and Arn.	Rhamnaceae	Leaves, Fruits	Poultice, Extract, Raw fruits	Blood purifier, pain, antidandruff
99	<i>Ziziphus spina-christi</i> (L.) Willd.	Rhamnaceae	Leaves, Fruits	Poultice, Extract, Raw fruits	Blood purifier, pain, antidandruff
100	<i>Citrus grandis</i> (L.) Osbeck	Rutaceae	Fruits	Raw fruits	Constipation, nausea
101	<i>Citrus medica</i> var. <i>acida</i> Brandis	Rutaceae	Fruits	Raw fruits, Raw leaves	Digestive problems, diabetes
102	<i>Citrus sinensis</i> (L.) Osbeck	Rutaceae	Fruits	Raw fruits, Raw leaves	Constipation, nausea
103	<i>Salvadora oleoides</i> Decne.	Salvadoraceae	Fruits, roots, oil	Oil, Tooth stick, Pickled	Constipation, athletefoot, toothache
104	<i>Bacopa monirii</i> L.	Scrophulariaceae	Leaves, Aerial parts,	Potherb, Juice, Ash, Infusion	Boils, pimples, skin problems

			Fruits		
105	<i>Datura fastuosa</i> L.	Solanaceae	Leaves	Paste, Ash, Raw leaves, Smoke	Boils, asthma
106	<i>Solanum amricanum</i> Miller	Solanaceae	Leaves	Potherb, Decoction, Extract, Infusion	Jaundice, abdominal/stomach problem, inflammation
107	<i>Solanum incanum</i> L.	Solanaceae	Fruits	Raw fruits	Digestive problems
108	<i>Solanum nigrum</i> L.	Solanaceae	Leaves, roots, Fruits	Juice, Raw fruits, Infusion	Jaundice, uterine problems, leucorrhoea, obesity
109	<i>Solanum surattense</i> Burm.f.	Solanaceae	Leaves, Whole plant, Flowers, Fruits	Juice, Ash, Powder, Extract, Raw fruits	Asthma, cough, pain, digestive problems, sexual problems, headache
110	<i>Solanum villosum</i> (L.) Mill.	Solanaceae	Fruits	Juice, Raw fruits	Jaundice, Obesity
111	<i>Withania coagulans</i> (Stocks.) Dunal	Solanaceae	Leaves, Fruits	Paste, Powder, Raw fruits	Constipation, boils, pimples, skin problems, abdominal/stomach problem, pain, digestive problems, cooling effect
112	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Leaves, Fruits, roots	Paste, Powder, Poultice	Digestive problems, inflammation, diabetes, sexual problems
113	<i>Tamarix aphylla</i> (L.) Karst.	Tamaricaceae	Leaves	Powder, Smoke	Wounds, measles
114	<i>Corchorus depressus</i> (Linn.) Stocks	Tiliaceae	Whole plant	Powder, Extract	Jaundice, abdominal/stomach problem, cooling effect, sexual problems

115	<i>Corchorus tridens</i> L.	Tiliaceae	Fruits	Juice	Jaundice, sexual problems
116	<i>Phyla nodiflora</i> (Linn.) Greene	Verbenaceae	Whole plant	Juice	Hemorrhoids
117	<i>Fagonia bruguieri</i> DC.	Zygophyllaceae	Whole plant	Poultice, Extract, Infusion	hepatitis, boils, pimples, skin problems, digestive problems, cancer, cooling effect
118	<i>Fagonia indica</i> var. <i>Schweinfuthii</i> Hadidi.	Zygophyllaceae	Whole plant	Poultice, Extract, Infusion	hepatitis, boils, pimples, skin problems, digestive problems, cancer, cooling effect
119	<i>Peganum harmala</i> L.	Zygophyllaceae	Whole plant, Seeds	Powder, Extract, Raw seeds, Smoke	Boils, pimples, abdominal/stomach problem, asthma, digestive problems
120	<i>Tribulus terrestris</i> L.	Zygophyllaceae	Seeds, Fruits	Potherb, Powder, Extract	Cooling effect, sexual problems

Table 4.5: Novel use of medicinal plants recorded from the study area.

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
1	<i>Acacia jacquemontii</i> Benth.	Kanda	Leaves	Powder	Blockage of the urine (animal)
2	<i>Acacia nilotica</i> (L.) DeL. subsp. <i>indica</i> (Benth.) Brenan	Kikar	Leaves	Powder	Blockage of the urine (animal)
3	<i>Agave sisilana</i> Perr. Ex Engelm.	Guwar Phara	Pulp	Halwa, poultice	Jaundice, liver tonic, constipation, Hemorrhoids, acidity, boils, pimples
4	<i>Albizzia lebeck</i> (L.) Bth.	Shirin	Bark, seeds	Gargle, powder	Gums strengthening, headache, influenza
5	<i>Alternanthera pungens</i> Kunth in H.B.K.	Ludhri	Whole plant	Ash, decoction, powder	Asthma, cough, skin irritation, joints pain, aphrodisiac
6	<i>Amaranthus graecizans</i> L.	Choleri	Leaves	Potherb	Constipation
7	<i>Azadirachta indica</i> (L.) A. Juss.	Neem	Ripened	Paste	Tonic for liver and stomach,

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
			fruit, seed		Hemorrhoids
8	<i>Boerhavia diffusa</i> L.	Tangri	Root	Juice, pieces tied	kidney/gall bladder stones, jaundice
9	<i>Boerhavia procumbens</i> Banks ex Roxb.		Whole plant	Paste	Paralysis
10	<i>Bombax malabaricum</i> DC.	Sumbul	Root	Decoction, juice	Abdominal worms, general tonic
11	<i>Brasica compestris</i> L.	Sarson	Leaves, oil	Potherb,	Abdominal worm, relieve athlete foot
12	<i>Capparis decidua</i> (Forssk.) Edgew.	Kareenh/Kari	Aerial parts, stem, seed	Poultice, paste	Boils, athlete foot, pyorrhea
13	<i>Carthamus oxycantha</i> M.B.	Pohli	Seeds	Roasted	Cancer
14	<i>Cassia italica</i> (Mill.) F.W.Andr.		Root, flower	Juice, decoction	Diarrhea, constipation
15	<i>Celosia argentea</i> L.	Kalga	Leaves		Constipation

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
16	<i>Centaurea iberica</i> Trev.		Root	Juice/extract	Kidney and bladder stones
17	<i>Chenopodium album</i> L.	Bathu	Leaves		Boils
18	<i>Chenopodium murale</i> L.	Bathu	Leaves		Boils
19	<i>Cicer arietinum</i> L.	Chhana / Chholay	Seeds	Powder	Diabetes
20	<i>Citrullus colocynthis</i> (L.) Schrad.	Kaur Tuma	Root	Tooth stick, animal percale	Toothache, Bars, digestive diseases, tonic (animals)
21	<i>Citrus grandis</i> (L.) Osbeck	Kinu	Pericarp of fruit	Snuff	Vomiting
22	<i>Citrus medica</i> var. <i>acida</i> Brandis	Gilgan	Fruit	Eaten raw	Diabetes, digestive problem (livestock)
23	<i>Citrus sinensis</i> (L.) Osbeck	Malta	Fruit, Pericarp of fruit	Eaten raw, snuff	Tonic, appetizer, constipation vomiting
24	<i>Convolvulus arvensis</i> L.	Wand vehri	Whole plant	Powder	Appetizer
25	<i>Convolvulus microphyllus</i> Sieb. ex		Whole plant	Powder	Leucorrhoea

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
	Spreng.				
26	<i>Corchorus depressus</i> (L.) Stocks	Boophali	Whole plant	Juice, powder	Jaundice, kidney and stomach problems.
27	<i>Corchorus tridens</i> L.	Phali	Aerial parts	Juice	Cooling agent, jaundice, spermatorrhea
28	<i>Cuscuta monogyna</i> Vahl, Sym.	Amar bel	Whole plant	Paste, extract	Antidandruff, boils, nail and finger infection
29	<i>Cymbopogon jwarancusa</i> subsp. <i>jwarancusa</i> (Jones) Schult.	Khavi	Whole plant, root, seed	Smoke, extract	Measles, chicken pox, typhoid fever, cough
30	<i>Cynodon dactylon</i> (L.) Pers.	Talla/Khabbal	Dewdrops	Topical	Pimples
31	<i>Dalbergia sissoo</i> Roxb.	Talhi	Stem	Juice	Athlete foot
32	<i>Datura fastuosa</i> L.	Dhatoora	Leaves	Paste, roasted, juice	Antilice, swellings, boils, insect bite
33	<i>Echinops echinatus</i> Roxb.	Unt Katara	Root	Juice, powder	chronic fever, joints pain

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
34	<i>Eruca sativa</i> Miller	Jamaya	oil	Externally applied	Earache
35	<i>Eucalyptus camaldulensis</i> Dehnh.	Sufeda	Leaves	Extract	Flu
36	<i>Euphorbia granulata</i> Forssk.		Whole plant	Powder	Diabetes, lactagogue (animal)
37	<i>Euphorbia prostrata</i> Ait.	Dudhi	Whole plant	Powder	Diabetes
38	<i>Euphorbia thymifolia</i> L.	Hazar Dani	Whole plant	Juice	Diarrhea
39	<i>Fagonia bruguieri</i> DC.	Dhaman	Whole plant	Juice	Skin diseases, hepatitis, cooling agent, cancer
40	<i>Fagonia indica</i> var. <i>Schweinfuthii</i> Hadidi.	Dhaman	Whole plant	Decoction, Juice	Skin diseases, hepatitis, cooling agent, cancer
41	<i>Farsetia hamiltonii</i> Royle	Lathia	Whole plant	Powder	Constipation, stomach pain, Hemorrhoids
42	<i>Farsetia jacquemontii</i> Hook.f. and Thomson	Lathia	Whole plant	Powder	Constipation, stomach pain, Hemorrhoids

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
43	<i>Ficus bengalensis</i> L.	Barghad	Bud, fruit, hanging root	Powder, extract, latex	Spermatorrhoea, premature ejaculation, leucorrhoea, fluand tonic
44	<i>Ficus religiosa</i> L.	Peepal	Bark, fruit	Paste, ash, powder	Inflammation, diarrhea, dysentery, asthma
45	<i>Heliotropium strigosum</i> Willd.	Gorakh paan	Whole plant	Juice	Jaundice, cooling agent, liver tonic
46	<i>Indigofera hochstetteri</i> Baker	Kano	Fruit	Powder	Sexual tonic
47	<i>Ipomoea carnea</i> ssp. <i>fistulosa</i> (Mart. ex Choisy) D. Austin		Leaves	Paste	Boils
48	<i>Launaea residifolia</i> (L.) O. Kuntze.	Bhattal	Leaves/latex	Paste/latex	Boils and pimples
49	<i>Lawsonia inermis</i> L.	Menhdi	Leaves	Decoction, powder	Throat pain, cooling agent
50	<i>Limeum indicum</i> Stocks ex T. Anders.	Patar	Leaves	Paste	Burnt wounds
51	<i>Mentha longifolia</i> (L.) L.	Chita podina	Leaves	Decoction	Nausea, vomiting

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
52	<i>Momordica balsamica</i> L.	Jangli Karela	Fruit	Potherb, juice, powder	Diabetes, gas trouble, constipation, flatulence, obesity, abdominal worms, asthma
53	<i>Moringa oleifera</i> Lamk.	Suhanjna	Fruit, seed, leaves	Pickle, powder, extract	Joints pain, tonic, digestive problems (livestock)
54	<i>Plantago major</i> L.		Seed	Juice	cooling agent, dysentery
55	<i>Prosopis cineraria</i> (L.) Druce.	Jand	Gum, coal	Maceration	Tonic, wounds
56	<i>Prosopis glandulosa</i> Torr.	Gul kanda	Leaves	Decoction	Urine blockage (donkeys)
57	<i>Prosopis juliflora</i> (Swartz) DC.	Kabli kikar	Gum	Gum	Tonic
58	<i>Psidium guajava</i> L.	Amrood	Fruit, leaves		Abdominal worms, flue, cough, appetizer
59	<i>Punica granatum</i> L.	Anar	Bark of fruit	Powder	digestive problem such as flatulence, constipation (goat and sheep)

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
60	<i>Rhazya stricta</i> Decne.	Vinraan	Leaves, aerial parts	Powder, pills	Stomach pain, acidity, Hemorrhoids, constipation, diabetes, skin problems
61	<i>Rumex dentatus</i> subsp. <i>klotzschianus</i> (Meisn.) Rech. f.	Jangli palak	Leaves	Potherb	Constipation
62	<i>Saccharum spontaneum</i> L.		Leaves	Extract	Stoppage of urination (Micturition)
63	<i>Salvadora oleoides</i> Decne.	Peelu	Fruit, root, oil	Murabbah (a sweet dish), pickle, tooth stick, oil (topical)	Constipation, pyorrhea, athlete's foot
64	<i>Solanum incanum</i> L.	Kori waal / Maahora	Fruit	Powder	Digestive problems (livestock)

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
65	<i>Solanum surattense</i> Burm.f.	Mahokari/Kandiari	Flower, fruit	Powder, poured	Amenorrhoea, to conceive pregnancy (cattle)
66	<i>Solanum villosum</i> (L.) Mill.	Kaachmach	Whole plant, fruit	Juice, eaten raw	Obesity, jaundice
67	<i>Suaeda fruticosa</i> Forssk. ex J. F.	Lana	Leaves	Juice	Kidney problems
68	<i>Syzygium cumini</i> (L.) Skeels	Jaman	Bark, seed	Decoction, powder	Fever, diarrhoea, spermatorrhoea, leucorrhoea
69	<i>Tamarix aphylla</i> (L.) Karst.	Khaggal	Leaves	smoke	Measles
70	<i>Tephrosia purpurea</i> (L.) Pers.	Sarphonka	Root	Tooth stick	Toothache, pyorrhoea
71	<i>Tephrosia uniflora</i> Pers.	Sarphonka	Root	Tooth stick	Toothache, pyorrhoea
72	<i>Tephrosia uniflora</i> var. <i>petrosa</i>	Sarphonka	Root	Juice, tooth stick	Diarrhoea, toothache, pyorrhoea
73	<i>Tribulus terrestris</i> L.	Bhakhra	Seed	Halwa	Tonic and stimulant especially for women after delivery.

S. No.	Plant species	Vernacular	Parts utilized	Preparation	Diseases treated
74	<i>Typha elephantina</i> Roxb.	Kundar	Leaves	Ash paste	Tits and other skin problems (livestock)
75	<i>Withania coagulans</i> (Stocks.) Dunal	Paneer	Leaves, fruit,	Paste, juice, powder	Boils, pimples, abdominal pain and as digestive (livestock too)
76	<i>Withania somnifera</i> (L.) Dunal	Aksan/Ratkan	Root	Powder	Flatulence (livestock)
77	<i>Zaleya pentandra</i> (L.) Jeffrey		Whole plant	Juice	Kidney stones
78	<i>Ziziphus mauritiana</i> Lam.	Beri	Fruit, leaves	Powder, decoction, extract	Diabetes, spermatorrhoea, body pain
79	<i>Ziziphus nummularia</i> (Burm.f.) Wight and Arn.	Jhar beri	Leaves	Poultice, extract	To remove the spine / thorn, dandruff
80	<i>Ziziphus spina-christi</i> (L.) Willd.	Jhar beri	Leaves	Extract	Dandruff

Table 4.6: Inventory of diseases treated by medicinal plants in the study area.

S. No.	Diseases	No. of plants	Percentage
1	Constipation	27	7.87
2	Abdominal/stomach problem	24	7.00
3	Boils	23	6.71
4	Jaundice	18	5.25
5	Pain	18	5.25
6	Pimples	17	4.96
7	Skin problems	17	4.96
8	Digestive problems	14	4.08
9	Sexual problems	14	4.08
10	Cooling effect	13	3.79
11	Hemorrhoids	11	3.21
12	Fever	9	2.62
13	Toothache	9	2.62
14	Diarrhea	9	2.62
15	Cough	8	2.33
16	Urine problems	8	2.33
17	Diabetes	8	2.33
18	Blood purifier	7	2.04
19	Wounds	7	2.04
20	Asthma	7	2.04
21	Inflammation	7	2.04
22	Antidandruff	6	1.75

S. No.	Diseases	No. of plants	Percentage
23	Leucorrhoea	5	1.46
24	Anti-lice	5	1.46
25	Athlete foot	5	1.46
26	Nausea	5	1.46
27	Kidney stones	4	1.17
28	Dysentery	4	1.17
29	Flue	4	1.17
30	Sore throat	3	0.87
31	Cancer	3	0.87
32	Earache	3	0.87
33	Obesity	3	0.87
34	hepatitis	2	0.58
35	measles	2	0.58
36	Ringworm	2	0.58
37	Acidity	2	0.58
38	Aphrodisiac	2	0.58
39	Headache	2	0.58
40	Respiratory problems	1	0.29
41	Ophthalmia	1	0.29
42	Paralysis	1	0.29
43	chicken pox	1	0.29
44	Liver disease	1	0.29
45	Influenza	1	0.29
	Total	343	100.00

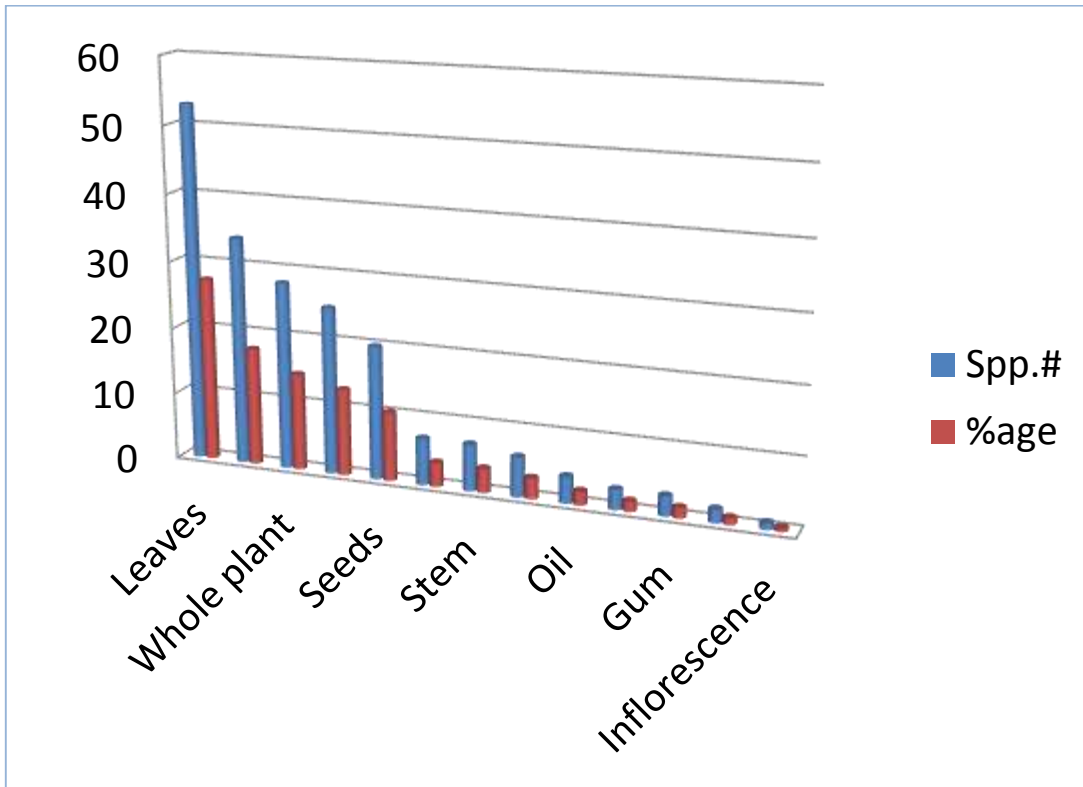


Fig. 4.3: Parts utilized for the preparation of different herbal recipes.

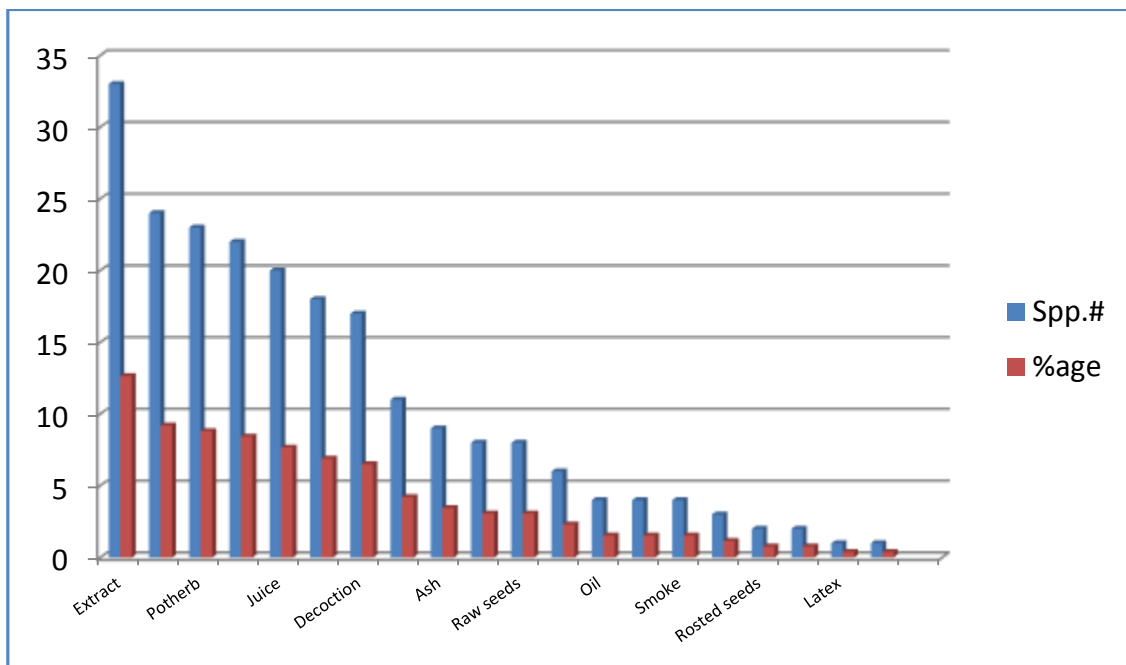


Fig. 4.4: Mode of application of recipes from the Thal desert Punjab, Pakistan.

4.4.1.2 QUANTITATIVE ETHNOBOTANICAL ENUMERATION

4.4.1.2.1 Consensus for disease categories:

Informant Consensus factor (ICF) establishes the even distribution of informants' knowledge about the use of medicinal plants that confirm that all the people in the study area use plants for curing same disease in same or different methods. There was the existence of consensus factor ranged from 0.85 to 0.90, with an average across all data from 0.90, which strongly indicated that the peoples in the study area are dependent on the plants for treating their various ailments. This also shows that plants are still used as a medicine in the study area. The reasons for using medicinal plant instead of medicine include: lack of modern medicine and basic health facilities in this remote area and/or people having strong beliefs that they can be cured by their plant knowledge. Many people in urban areas also still use plants as a medicament to avoid side effects of modern medicines. This result indicates that people living in the area are well aware of the plants in the study area and in this connection, highest number of usage reports (Nur) were recorded for constipation (241), followed by abdominal/stomach problems (230 reports), boils (224 reports), digestive problems (220), jaundice (200), however rest of diseases were also reported considerably (Table 4.7).

4.4.1.2.2 Informant Consensus (ICF) for human diseases:

In order to calculate the informant consensus factor (ICF) for human diseases, diseases were divided into 10 different categories on the basis of use reports and tax utilized. Results are compiled in Table 4.8. It revealed that in the majority of cases, gastrointestinal disorders were treated by the highest number of species. It was followed by pain and inflammation. The ICF ranged between 0.91 to 0.96 on an average of 0.901, which clearly depicted that there was highest consensus of information between informants (Table 3.8). Singh *et al.*, (2012) and Mesfin *et al.*, (2009) reported more than

0.9 FIC values that highlighted the significant degree of consensus amongst the informants.

4.4.1.2.3 Medicinal plants ranking

From the preference ranking point of view on the basis of interviews, *Rhazya stricta* was the first ranked species in the area and people use them in curing of different diseases. People gave second highest ranking to *Aloe vera*, followed by *Citrullus colocynthis*, *Momordica balsamica*, *Heliotropium strigosum*, *Moringa oleifera*, *Tribulus terrestris*, *Withania coagulans*, *W. somnifera* and *Azadirachta indica* with the 3rd to 10th rank respectively (Table 4.9). Similar results were reported by Ishtiaq *et al.* (2013), Mesfin *et al.* (2009).

4.4.1.2.4 Preference ranking (PR) of disease

Altogether 121 medicinal plants were found useful against 45 different diseases, But the most common diseases are jaundice, constipation, hemorrhoids,boils, pimples,skin problems, abdominal/stomach problem,pain,digestive problems,cooling effect andsexual problems in the study area by which the peoples are suffering and getting cure by use of local plants. People interviewed gave high rank to constipation which can be cured by most of the plants in the study area. People gave second rank to boil, then third rank to pimples and so on as shown in the Table 4.10. Similar results were described by Ahmad *et al.* (2013) in their study on Neelum Valley, Azad Jammu and Kashmir.

Table 4.7: Diseases Consensus factor (ICF) by the use of number of taxa and reports.

S. No.	Diseases	Nt	Nur	ICF
1	Constipation	27	241	0.89
2	Kidney stones	4	98	0.969
3	Cough	6	90	0.943
4	Digestive problems	14	220	0.94
5	Inflammation	7	100	0.939
6	Cooling effect	13	199	0.939
7	Diabetes	8	102	0.93
8	Diarrhea	8	89	0.92
9	Pimples	17	200	0.919
10	Fever	6	63	0.919
11	Nausea	4	37	0.916
12	Jaundice	18	200	0.914
13	Wounds	6	61	0.91
14	Boils	23	224	0.91
15	Athlete foot	5	46	0.91
16	Pain	17	180	0.91
17	Abdominal/stomach problem	23	230	0.903
18	Skin problems	17	160	0.899
19	Hemorrhoids	11	100	0.898
20	Toothache	8	69	0.897
21	Asthma	7	50	0.877
22	Blood purifier	6	40	0.871

S. No.	Diseases	Nt	Nur	ICF
23	Sexual problems	13	100	0.868
24	Antidandruff	5	30	0.862
25	Uterine problems	7	42	0.85
26	Leucorrhoea	5	20	0.789
27	Anti-lice	5	19	0.777
28	Others	36	90	0.629

Table 4.8: Diseases Consensus factor (ICF) for human diseases groups.

S. No.	Aliment categories	Biomedical term	Nt	Nur	Fic
1	Gastro intestinal disorder	Constipation, acidity, diarrhea, dysentery, indigestion, intestinal worms, abdominal pain, Hemorrhoids	65	780	0.91
2	Skeleto-muscular pain and swelling	Body ache, muscular pain, rheumatism, arthritis, headache, joint pain, swellings, inflammation, paralysis	35	349	0.902
3	Dermatological disorder and cosmetics	Cut, wounds boils, ringworm, pimples, inflammations, athlete foot, swellings, hair problems, chicken pox	120	1200	0.9
4	Fevers	Fever, jaundice	24	232	0.9
5	Urino-genital problems	Sexual debility, leucorrhoea, aphrodisiac	20	100	1.01
6	Ear, Nose, Throat problems	Earache, sore throat. nausea, flue, asthma, cough	25	250	0.905
7	Cardio-vascular disorder	Blood pressure	6	63	0.91
8	Uterine problems	Uterine problems, kidney stones	11	120	0.91
9	Other	Diabetes, hepatitis, measles, obesity, cancer	18	200	0.914
	Total		324	3294	0.901

Table 4.9: Preference ranking (PR) of medicinal plants based on the interviews from resource persons.

S. No.	Medicinal plants list	Key informants (coded A to J) with the ranks they gave (highest 10)										Total score	Rank
		A	B	C	D	E	F	G	H	I	J		
1	<i>Rhazya stricta</i> Decne.	9	10	10	9	8	10	8	9	10	9	92	1
2	<i>Aloe vera</i> L.	9	10	10	9	8	10	7	9	10	9	91	2
3	<i>Citrullus colocynthis</i> (L.) Schrud.	8	9	9	10	10	9	8	9	8	8	88	3
4	<i>Momordica balsamica</i> L.	7	6	8	10	9	10	7	9	10	8	84	4
5	<i>Heliotropium strigosum</i> Willd.	9	10	8	9	10	6	4	8	10	8	82	5
6	<i>Moringa oleifera</i> Lamk.	8	7	6	5	9	8	9	6	10	9	77	6
7	<i>Tribulus terrestris</i> L.	6	8	7	6	8	7	9	6	8	8	73	7
8	<i>Withania coagulans</i> (Stocks.) Dunal	8	7	9	10	6	8	5	5	6	8	72	8
9	<i>Withania somnifera</i> (L.) Dunal	10	7	5	8	7	6	7	7	6	9	72	9
10	<i>Azadirachta indica</i> (L.) A. Juss.	6	7	8	9	9	6	8	6	5	7	71	10
11	<i>Ricinus communis</i> L.	4	5	3	8	9	8	7	9	8	8	69	11
12	<i>Solanum surattense</i> Burm.f.	8	6	4	9	8	5	6	8	6	9	69	12
13	<i>Calotropis procera</i> (Willd.) R. Br.	8	8	7	5	7	9	5	6	5	8	68	13
14	<i>Cassia fistula</i> L.	7	8	6	5	6	7	8	6	7	8	68	14

S. No.	Medicinal plants list	Key informants (coded A to J) with the ranks they gave (highest 10)										Total score	Rank
		A	B	C	D	E	F	G	H	I	J		
15	<i>Achyranthes aspera</i> L.	4	5	3	7	8	7	6	9	8	7	64	15
16	<i>Morus nigra</i> L.	9	6	4	8	5	9	6	4	6	7	64	16
17	<i>Fagonia bruguieri</i> DC.	4	6	3	7	8	4	7	5	8	6	58	17
18	<i>Fagonia indica</i> var. <i>Schweinfuthii</i> Hadidi.	5	3	7	4	5	8	7	5	6	7	57	18
19	<i>Amberboa ramosa</i> (Roxb.) Jafri	4	5	4	7	6	8	4	8	5	3	54	19
20	<i>Echinops echinatus</i> Roxb.	3	4	6	5	6	7	5	7	5	6	54	20
21	<i>Cymbopogon jawarancusa</i> (Jones) Schult.	3	6	4	5	9	2	6	3	7	5	50	21
22	<i>Capparis decidua</i> (Forssk.) Edgew.	8	5	4	7	9	4	3	2	2	5	49	22
23	<i>Syzygium cumini</i> (L.) Skeels	4	6	3	2	6	4	3	7	5	9	49	23
24	<i>Aerva javanica</i> (Burm. f.) Juss ex J. A. Shultes.	3	0	4	5	3	4	2	3	4	5	33	24
25	<i>Peganum harmala</i> L.	6	5	3	4	2	1	1	1	3	5	31	25

Table 4.10: Preference ranking (PR) of disease cured by the plants.

Plant species	Scores given by informenets (highest 5)										
	Jaundice	Constipation	Hemorrhoids	Boils	Pimples	Skin problems	Abdominal /stomach problem	Pain	Digestive problems	Cooling effect	Sexual problems
<i>Agave sislana</i> Perr. Ex Engelm.	4	5	2	3	4	5	0	0	0	0	0
<i>Gisekia pharnaceoides</i> L.	0	0	0	0	0	0	3	0	0	0	0
<i>Aloe vera</i> L.	3	0	0	0	3	0	0	0	0	0	0
<i>Aerva javanica</i> (Burm. f.) Juss ex J. A. Shultes.	0	4	0	5	3	0	0	0	0	0	0
<i>Rhazya stricta</i> Decne.	0	2	3	0	0	0	2	0	0	0	0
<i>Calotropis procera</i> (Willd.) R. Br.	2	0	0	3	0	0	3	3	0	0	0
<i>Amberboa ramosa</i> (Roxb.) Jafri	0	0	0	3	3	4	0	0	0	0	0
<i>Launaea residifolia</i> (L.) O. Kuntze.	0	0	0	2	2	0	0	0	0	0	0
<i>Heliotropium europeum</i> L.	0	0	0	2	4	3	0	0	0	0	0
<i>Brasica compestris</i> L.	2	4	0	0	0	0	2	0	0	0	0
<i>Eruca sativa</i> Miller	3	0	2	0	0	5	3	0	0	0	0
<i>Farsetia hamiltonii</i> Royle	0	5	3	0	0	0	1	5	0	0	0
<i>Farsetia jacquemontii</i> Hook.f. and Thomson	0	4	5	0	0	0	3	2	0	0	0
<i>Capparis decidua</i> (Forssk.) Edgew.	0	5	0	3	0	0	0	0	0	0	0
<i>Chenopodium album</i> L.	0	3	0	2	0	0	0	0	0	0	0
<i>Chenopodium murale</i> L.	0	5	0	1	0	0	0	0	0	0	0
<i>Citrullus colocynthis</i> (L.) Schrad.	0	4	0	0	0	2	3	1	3	0	0

Plant species	Scores given by informenets (highest 5)										
	Jaundice	Constipation	Hemorrhoids	Boils	Pimples	Skin problems	Abdominal /stomach problem	Pain	Digestive problems	Cooling effect	Sexual problems
<i>Momordica balsamica</i> L.	0	4	0	3	4	0	4	0	0	0	0
<i>Ricinus communis</i> L.	0	2	0	0	0	0	0	2	0	0	0
<i>Alhagi maurorum</i> Medic.	0	0	0	0	3	3	3	0	0	0	0
<i>Mentha longifolia</i> (L.) L.	0	0	4	0	0	0	2	4	5	0	0
<i>Azadirachta indica</i> (L.) A. Juss.	0	0	5	2	4	2	3	0	0	4	0
<i>Melia azedirach</i> L.	5	0	0	3	2	1	0	0	0	3	0
<i>Acacia nilotica</i> (L.) DeL. subsp. <i>indica</i> (Benth.) Brenan	2	0	0	0	0	0	0	0	0	0	5
<i>Moringa oleifera</i> Lamk.	0	0	0	3	2	5	0	2	2	4	2
<i>Psidium guajava</i> L.	0	3	0	0	0	0	2	0	4	0	0
<i>Syzygium cumini</i> (L.) Skeels	0	0	0	0	0	0	0	3	0	0	2
<i>Argemone mexicana</i> L.	0	0	3	3	0	3	0	0	0	0	0
<i>Cynodon dactylon</i> (L.) Pers.	0	0	0	0	2	0	0	0	0	0	0
<i>Punica granatum</i> L.	0	0	0	0	0	0	5	0	4	0	0
<i>Ziziphus mauritiana</i> Lam.	0	0	0	0	0	0	0	2	0	0	3
<i>Ziziphus nummularia</i> (Burm.f.) Wight and Arn.	0	0	0	0	0	0	0	4	0	0	0
<i>Bacopa monirii</i> L.	0	0	0	3	3	5	0	0	0	0	0
<i>Solanum amricanum</i> Miller	4	0	0	0	0	0	2	0	0	0	0

Plant species	Scores given by informenets (highest 5)										
	Jaundice	Constipation	Hemorrhoids	Boils	Pimples	Skin problems	Abdominal /stomach problem	Pain	Digestive problems	Cooling effect	Sexual problems
<i>Solanum surattense</i> Burm.f.	0	0	0	0	0	0	0	3	2	0	5
<i>Withania coagulans</i> (Stocks.) Dunal	0	5	0	2	5	3	4	4	3	4	0
<i>Withania somnifera</i> (L.) Dunal	0	0	0	0	0	0	0	0	3	0	5
<i>Corchorus depressus</i> (Linn.) Stocks	3	0	0	0	0	0	2	0	0	5	2
<i>Corchorus tridens</i> L.	4	0	0	0	0	0	0	0	0	0	4
<i>Fagonia bruguieri</i> DC.	0	0	0	3	2	5	0	0	4	3	0
<i>Fagonia indica</i> var. <i>Schweinfuthii</i> Hadidi.	0	0	0	2	3	2	0	0	3	5	0
<i>Peganum hermala</i> L.	0	0	0	3	1	0	3	0	3	0	0
<i>Tribulus terrestris</i> L.	0	0	0	0	0	0	0	0	0	5	5
TOTAL	32	55	27	51	50	48	50	35	36	33	33
RANKING	8th	1st	9th	2nd	3rd	4th	3 rd	6th	5th	7th	7th

4.4.1.2.5 Fidelity level (FL%):

Fidelity level determines that any species that more preferably used in the treatment of any particular ailment (Friedman *et al.*, 1986). *Citrullus colocynthis* was the most important medicinal plant in the study area which was particularly used to treat constipation determined by 45 informants with 100% fidelity (Table 4.11). This species was also reported to be used in other diseases. Three species viz., *Momordica balsamica*, *Moringa oleifera* and *Withania somnifera* were found second most important plants having 97.78% used in diabetes, joint pain and sexual problems respectively. It was followed by *Psidium guajava* (97.50%), *Azadirachta indica*, *Melia azedirach*, *Tribulus terrestris* (95.56% each), *Tamarix aphylla* (93.33%), *Cymbopogon jawarancusa* *Fagonia* spp.(92.86% each), *Syzygium cumini* and *Withania coagulans* (91.11% each), while the rest of the species were within the fidelity range of 55.56 to 88.89%. Musa *et al.* (2011) reported the same kind of study.

4.4.1.2.6 Fodder/forage:

Out of 261 species, 236 species were used by the natives as fodder/forage to feed their livestock, while 25 species were found nonplatable (Table 4.12). However, selectivity of species was varied in the range of animals.

4.4.1.2.7 Palatability:

With reference to palatability, out of 236 species, 136 were found highly palatable with 52.11% of the total flora, followed by moderately palatable (62 spp., 23.75%) and less palatable(38 spp., 15.56%), while very few species (25 spp., 9.58%) were recorded as non palatable (Fig 4.5).

Table 4.11: Fidelity Level (FL) for ethnobotanical information given by Informants.

S. No.	Preferred species	Application	Np	N	FL (%)
1	<i>Citrullus colocynthis</i> (L.) Schrad.	Constipation	45	45	100.00
2	<i>Momordica balsamica</i> L.	Diabetes	44	45	97.78
3	<i>Moringa oleifera</i> Lamk.	Joints pain	44	45	97.78
4	<i>Withania somnifera</i> (L.) Dunal	Sexual problems	44	45	97.78
5	<i>Psidium guajava</i> L.	Flue, cough	39	40	97.50
6	<i>Azadirachta indica</i> (L.) A. Juss.	Skin problems, blood purifier	43	45	95.56
7	<i>Melia azedirach</i> L.	Blood purifier	43	45	95.56
8	<i>Tribulus terrestris</i> L.	Spermatorrhoea	43	45	95.56
9	<i>Tamarix aphylla</i> (L.) Karst.	Measles, swelling, diarrhea	42	45	93.33
10	<i>Cymbopogon jawarancusa</i> (Jones) Schult.	Measles, chicken pox	39	42	92.86
11	<i>Fagonia bruguieri</i> DC.	Cancer	13	14	92.86
12	<i>Fagonia indica</i> var. <i>schweinfuthii</i> Hadidi.	Hepatitis	13	14	92.86
13	<i>Syzygium cumini</i> (L.) Skeels.	leucorrhoea, diabetes, diarrhea	41	45	91.11
14	<i>Withania coagulans</i> (Stocks.) Dunal	Stomach problem	41	45	91.11
15	<i>Morus nigra</i> L.	Throat pain	40	45	88.89
16	<i>Rhazya stricta</i> Decne.	Skin allergy, diabetes	40	45	88.89
17	<i>Capparis decidua</i> (Forssk.) Edgew.	Earache, athlete foot	38	45	84.44
18	<i>Solanum surattense</i> Burm.f.	Headache, body pain	38	45	84.44

S. No.	Preferred species	Application	Np	N	FL (%)
19	<i>Pluchea arguta</i> Boiss.	Cockroach repellent	25	30	83.33
20	<i>Ricinus communis</i> L.	Pain, inflammation	37	45	82.22
21	<i>Eruca sativa</i> Miller	Antidandruff	12	15	80.00
22	<i>Heliotropium strigosum</i> Willd.	cooling agent, jaundice	35	45	77.78
23	<i>Calotropis procera</i> (Willd.) R. Br.	Wounds	31	40	77.50
24	<i>Lawsonia inermis</i> L.	Athlete foot, antidandruff	34	45	75.56
25	<i>Indigofera hochstetteri</i> Baker	Sexual tonic	28	40	70.00
26	<i>Sisymbrium irio</i> L.	Typhoid fever	28	40	70.00
27	<i>Amberboa ramosa</i> (Roxb.) Jafri	Boils, pimples	28	45	62.22
28	<i>Brasica compestris</i> L.	Anti-lice	3	5	60.00
29	<i>Convolvulus microphyllus</i> Sieb. ex Spreng.	Leucorrhoea	25	45	55.56
30	<i>Launaea residifolia</i> (L.) O. Kuntze.	Boils, Pimples	25	45	55.56

4.4.1.2.8 Animal preference through parts use:

Various animals such as cows, goat, sheep, buffaloes, camels, and donkeys were domesticated by the inhabitants of the area to earn their livelihood and transportation respectively. Most of the area occupied by herbaceous and grassy vegetation, whereas, goat and sheep were the most preferred animals for the livestock rearing. Due to the herbaceous vegetation 54.68% (140 spp.) plants were used as whole plants, 29.29% (75 spp.) plants were used by aerial parts and in very few cases, 16% (41 spp.) plants were used by leaves (Fig. 4.6).

Table 4.12: Inventory of fodder/forage species of Thal Desert.

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
1	<i>Barleria prionitis</i> L.	Acanthaceae	-	-	+	-	+	-	-	-	-	+
2	<i>Agave sisilana</i> Perr. Ex Engelm.	Agavaceae	-	-	-	+	-	-	-	-	-	+
3	<i>Limeum indicum</i> Stocks ex T. Anders.	Aizoaceae	+	-	-	-	-	-	+	+	-	-
4	<i>Sesuvium sesuvioides</i> (Fenzl) Verdc	Aizoaceae	-	+	-	-	-	+	-	-	+	-
5	<i>Trianthema portulacastrum</i> L.	Aizoaceae	+	-	-	-	-	-	+	+	-	-
6	<i>Trianthema triquetra</i> Rottl. and Willd.	Aizoaceae	+	-	-	-	-	-	+	-	+	-
7	<i>Zaleya pentandra</i> (L.) Jeffrey	Aizoaceae	+	-	-	-	-	-	+	-	+	-
8	<i>Gisekia pharnaceoides</i> L.	Aizoaceae	+	-	-	-	-	-	+	-	+	-
9	<i>Aloe vera</i> L.	Alloaceae	-	-	-	+	-	-	-	+	-	-
10	<i>Achyranthes aspera</i> L.	Amaranthaceae	-	+	+	-	+	-	-	-	+	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
11	<i>Aerva javanica</i> (Burm. f.) Juss ex J. A. Shultes.	Amaranthaceae	-	+	+	-	+	-	-	-	+	-
12	<i>Alternanthera pungens</i> Kunth in H.B.K.	Amaranthaceae	-	+	+	-	+	-	-	+	-	-
13	<i>Amaranthus graecizans</i> L.	Amaranthaceae	+	-	-	-	-	-	+	-	+	-
14	<i>Amaranthus ovalifolius</i> L.	Amaranthaceae	-	+	-	-	-	-	+	+	-	-
15	<i>Amaranthus viridis</i> L.	Amaranthaceae	+	-	-	-	-	+	-	-	+	-
16	<i>Celosia argentea</i> L.	Amaranthaceae	-	+	-	-	-	+	-	+	-	-
17	<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	-	-	+	-	-	+	-	-	+	-
18	<i>Pupalia lappacea</i> (Linn.) Juss.	Amaranthaceae	+	-	-	-	-	+	-	+	-	-
19	<i>Anethum graveolens</i> L.	Apiaceae	-	-	+	-	+	-	-	+	-	-
20	<i>Rhazya stricta</i> Decne.	Apocynaceae	-	-	-	+	-	-	-	-	+	-
21	<i>Phoenix sylvestris</i> L.	Arecaceae	-	-	-	+	-	-	-	-	+	-
22	<i>Calotropis procera</i> (Willd.) R. Br.	Asclepiadaceae	-	-	+	-	+	-	-	-	+	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
23	<i>Leptadenia pyrotechnica</i> (Forssk.) Decne.	Asclepiadaceae	-	-	-	+	-	-	-	-	+	-
24	<i>Pentatropis nivalis</i> (J.F.Gmel.) D.V.Field and J.R.I.Wood	Asclepiadaceae	-	+	+	-	-	+	-	+	-	-
25	<i>Periploca aphylla</i> Dcne.	Asclepiadaceae	-	-	+	-	+	-	-	-	-	+
26	<i>Asphodelus tenuifolius</i> Cavan.	Asphodeloideae	-	-	-	+	-	-	-	-	+	-
27	<i>Amberboa ramosa</i> (Roxb.) Jafri	Asteraceae	-	-	-	+	-	-	-	-	-	+
28	<i>Blumea membranacea</i> Candolle	Asteraceae	+	-	-	-	+	-	-	+	-	-
29	<i>Carthamus oxycantha</i> M.B.	Asteraceae	-	+	+	-	+	-	-	+	-	-
30	<i>Centaurea iberica</i> Trev.	Asteraceae	-	+	-	-	-	+	-	+	-	-
31	<i>Cnicus benedictus</i> L.	Asteraceae	-	-	+	-	-	+	-	-	-	+
32	<i>Conyza candensis</i> (L.) Cronqist	Asteraceae	-	-	+	-	-	+	-	-	+	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
33	<i>Conyza squamatus</i> (Spreng.) Hieron.	Asteraceae	-	+	-	-	-	+	-	-	+	-
34	<i>Echinops echinatus</i> Roxb.	Asteraceae	-	+	-	-	-	-	+	-	+	-
35	<i>Iphiaea grantioides</i> (Boiss.) Anderb.	Asteraceae	+	-	-	+	-	-	-	+	-	-
36	<i>Launaea procumbens</i> (Roxburgh) Ramayya and Rajagopal	Asteraceae	-	-	-	+	-	-	-	-	+	-
37	<i>Launaea residifolia</i> (L.) O. Kuntze.	Asteraceae	-	-	-	+	-	-	-	-	+	-
38	<i>Parthenium hysterophorus</i> DC.	Asteraceae	-	-	+	-	+	-	-	-	+	-
39	<i>Pluchea arguta subsp arguta</i> Boiss.	Asteraceae	-	-	+	-	-	+	-	+	-	-
40	<i>Pluchea lanceolata</i> (DC.) C. B. Clarke	Asteraceae	-	-	+	-	-	+	-	+	-	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
41	<i>Pulicaria glaucescens</i> (Boiss.) Jaub. and Spach	Asteraceae	-	-	+	-	+	-	-	+	-	-
42	<i>Sonchus asper</i> (L.) Hill	Asteraceae	+	-	-	-	+	-	-	+	-	-
43	<i>Taraxicum officinalis</i> F.H. Wigg	Asteraceae	+	-	-	-	-	-	+	+	-	-
44	<i>Bombax malabaricum</i> DC.	Bombacaceae	-	-	-	+	-	-	-	-	+	-
45	<i>Cordia gharaf</i> (Forssk.) Ehren. ex Asch.	Boraginaceae	-	+	-	-	-	-	+	-	+	-
46	<i>Cordia myxa</i> L.	Boraginaceae	-	+	-	-	-	-	+	-	+	-
47	<i>Heliotropium calcareum</i> Stocks	Boraginaceae	+	-	-	-	-	-	+	-	+	-
48	<i>Heliotropium crispum</i> Desf.	Boraginaceae	+	-	-	-	-	-	+	-	+	-
49	<i>Heliotropium curassavicum</i> L.	Boraginaceae	+	-	-	-	-	-	+	-	+	-
50	<i>Heliotropium europeum</i> L.	Boraginaceae	+	-	-	-	-	-	+	-	+	-
51	<i>Heliotropium strigosum</i> Willd.	Boraginaceae	+	-	-	-	-	-	+	-	+	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
52	<i>Lappula patula</i> (Lehm.) Asch. ex Gurke	Boraginaceae	+	-	-	-	-	+	-	+	-	-
53	<i>Nonea caspica</i> subsp. <i>caspica</i> (Willd.) G. Don	Boraginaceae	+	-	-	-	-	+	-	+	-	-
54	<i>Nonea edgeworthii</i> A. DC.	Boraginaceae	+	-	-	-	-	-	+	-	-	+
55	<i>Trichodesma indicum</i> (L.) R. Br.	Boraginaceae	+	-	-	-	-	-	+	+	-	-
56	<i>Brasica compestris</i> L.	Brassicaceae	+	-	-	-	-	-	+	-	+	-
57	<i>Cardaria draba</i> (L.) Desv.	Brassicaceae	-	+	-	-	-	-	+	-	-	+
58	<i>Capsella bursa-pastoris</i> (L.) Medik.	Brassicaceae	+	-	-	-	-	-	+	+	-	-
59	<i>Coronopus didymus</i> (L.) Sm.	Brassicaceae	+	-	-	-	-	-	+	+	-	-
60	<i>Eruca sativa</i> Miller	Brassicaceae	+	-	-	-	-	+	-	-	+	-
61	<i>Farsetia hamiltonii</i> Royle	Brassicaceae	+	-	-	-	-	-	+	-	+	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
62	<i>Farsetia jacquemontii</i> Hook.f. and Thomson	Brassicaceae	+	-	-	-	-	-	+	-	+	-
63	<i>Physorrhynchus brahuicus</i> Hk.	Brassicaceae	+	-	-	-	-	-	+	+	-	-
64	<i>Sisymbrium irio</i> L.	Brassicaceae	-	+	+	-	-	+	-	-	+	-
65	<i>Sisymbrium orientale</i> L.	Brassicaceae	-	+	+	-	-	+	-	-	+	-
66	<i>Cassia fistula</i> L.	Caesalpiniaceae	+	-	-	-	-	+	-	-	+	-
67	<i>Cassia italica</i> (Mill.) F.W.Andr.	Caesalpiniaceae	+	-	-	-	-	-	+	+	-	-
68	<i>Capparis decidua</i> (Forssk.) Edgew.	Capparidaceae	+	-	-	-	-	-	+	-	+	+
69	<i>Capparis spinosa</i> L.	Capparidaceae	-	-	+	-	-	-	+	-	+	+
70	<i>Cleome brachycarpa</i> Vahl ex DC.	Capparidaceae	-	-	-	+	-	-	-	-	+	-
71	<i>Cleome scaposa</i> DC.	Capparidaceae	+	-	-	-	+	-	-	-	+	-
72	<i>Cleome viscosa</i> L.	Capparidaceae	-	+	-	-	-	+	-	-	+	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
73	<i>Dipterygium glaucum</i> Decne.	Capparidaceae	-	-	-	+	-	-	-	-	+	+
74	<i>Silene conoidea</i> L.	Caryophyllaceae	+	-	-	-	-	+	-	-	-	+
75	<i>Spergula arvensis</i> L.	Caryophyllaceae	-	+	-	-	+	-	-	+	-	-
76	<i>Atriplex schugnanica</i> Iljin	Chenopodiaceae	-	+	-	-	+	-	-	+	-	-
77	<i>Chenopodium album</i> L.	Chenopodiaceae	+	-	-	-	-	-	+	-	+	-
78	<i>Chenopodium murale</i> L.	Chenopodiaceae	+	-	-	-	-	-	+	-	+	-
79	<i>Haloxylon stocksii</i> (Boiss.) Benth. and Hook.	Chenopodiaceae	+	-	-	-	-	-	+	-	-	+
80	<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.	Chenopodiaceae	+	-	-	-	-	-	+	-	-	+
81	<i>Salsola imbricata</i> Forssk.	Chenopodiaceae	+	-	-	-	-	+	-	-	+	-
82	<i>Spinacia oleracea</i> L.	Chenopodiaceae	+	-	-	-	-	-	+	-	+	-
83	<i>Suaeda fruticosa</i> Forssk. ex J. F.	Chenopodiaceae	+	-	-	-	-	+	-	+	-	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
84	<i>Convolvulus arvensis</i> L.	Convolvulaceae	+	-	-	-	-	-	+	-	+	-
85	<i>Convolvulus microphyllus</i> Sieb. ex Spreng.	Convolvulaceae	+	-	-	-	-	+	-	-	-	+
86	<i>Convolvulus prostratus</i> Forssk.	Convolvulaceae	+	-	-	-	-	+	-	-	-	+
87	<i>Cressa cretica</i> L.	Convolvulaceae	+	-	-	-	+	-	-	-	-	+
88	<i>Evolvulus alsinoides</i> L.	Convolvulaceae	-	+	-	-	+	-	-	+	-	-
89	<i>Ipomoea cornea</i> ssp. <i>fistulosa</i> (Mart. ex Choisy) D. Austin	Convolvulaceae	+	-	-	-	-	-	+	-	+	-
90	<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	-	-	+	-	+	-	-	-	+	-
91	<i>Cucumis melo</i> subsp. <i>agrestis</i> var. <i>agrestis</i> Naudin	Cucurbitaceae	+	-	-	-	-	-	+	-	+	-
92	<i>Momordica balsamica</i> L.	Cucurbitaceae	+	-	-	-	+	-	-	-	+	-
93	<i>Mukia maderaspatana</i> (Linn.) M.J. Roem.	Cucurbitaceae	+	-	-	-	+	-	-	-	+	-

S. No	Plant species	Family	Parts utilized			Palatability				Availability		
			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
94	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	+	-	-	-	-	+	-	-	+	-
95	<i>Cuscuta monogyna</i> Vahl, Sym.	Cuscutaceae	+	-	-	-	-	+	-	-	+	-
96	<i>Cyperus alopecuroides</i> Rottb.	Cyperaceae	+	-	-	-	-	-	+	+	-	-
97	<i>Cyperus difformis</i> L.	Cyperaceae	+	-	-	-	-	-	+	+	-	-
98	<i>Cyperus digitatus</i> Roxb.	Cyperaceae	+	-	-	-	-	-	+	+	-	-
99	<i>Cyperus imbricatus</i> Retz.	Cyperaceae	+	-	-	-	-	-	+	+	-	-
100	<i>Cyperus rotundus</i> L.	Cyperaceae	+	-	-	-	-	-	+	+	-	-
101	<i>Fimbristylis quinquangularis</i> (Vahl) Kunth	Cyperaceae	+	-	-	-	-	-	+	+	-	-
102	<i>Pycreus flavidus</i> (Retz.) T. Koyama	Cyperaceae	+	-	-	-	-	-	+	+	-	-
103	<i>Pycreus sanguin</i> (Vahl) Nees	Cyperaceae	+	-	-	-	-	-	+	+	-	-
104	<i>Equisetum ramosissimum</i> Desf.	Equisetaceae	-	-	-	+	-	-	-	+	-	-

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			Whole plant	Aerial part	Leaves	NP	LP	MP	HP	Common	V.C.	Rare
105	<i>Chrozophora tinctoria</i> (L.) Juss.	Euphorbiaceae	+	-	-	-	-	+	-	-	-	+
106	<i>Euphorbia clarkeana</i> Hook.f.	Euphorbiaceae	-	+	-	-	-	-	+	+	-	-
107	<i>Euphorbia dracunculoides</i> Lam.	Euphorbiaceae	-	+	-	-	-	-	+	-	+	-
108	<i>Euphorbia granulata</i> Forssk.	Euphorbiaceae	-	+	-	-	-	-	+	-	+	-
109	<i>Euphorbia hirta</i> Forssk.	Euphorbiaceae	-	+	-	-	-	+	-	+	-	-
110	<i>Euphorbia prostrata</i> Ait.	Euphorbiaceae	+	-	-	-	-	+	-	-	+	-
111	<i>Euphorbia thymifolia</i> L.	Euphorbiaceae	+	-	-	-	-	+	-	-	+	-
112	<i>Ricinus communis</i> L.	Euphorbiaceae	-	-	+	-	+	-	-	-	+	-
113	<i>Alhagi maurorum</i> Medic.	Fabaceae	-	+	-	-	+	-	-	+	-	-
114	<i>Alysicarpus longifolius</i> (Rottler ex Spreng.) Wight and Arn.	Fabaceae	-	+	-	-	+	-	-	-	+	-
115	<i>Cicer arietinum</i> L.	Fabaceae	+	-	-	-	-	-	+	-	+	-

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116	<i>Cicer microphyllum</i> Royle ex Bentham	Fabaceae	+	-	-	-	-	-	+	-	-	+
117	<i>Crotalaria burhia</i> Ham ex Bentham	Fabaceae	-	+	-	-	-	-	+	-	+	-
118	<i>Crotalaria medicaginea</i> Lamk.	Fabaceae	-	+	-	-	-	-	+	+	-	-
119	<i>Cyamopsis tetragonoloba</i> (Linn.) Taubert	Fabaceae	-	-	+	-	-	+	-	-	+	-
120	<i>Indigofera hochstetteri</i> Baker	Fabaceae	-	+	-	-	+	-	-	-	-	+
121	<i>Indigofera linifolia</i> (L.f.) Retz.	Fabaceae	-	+	-	-	-	+	-	-	-	+
122	<i>Lathyrus aphaca</i> L.	Fabaceae	+	-	-	-	-	+	-	+	-	-
123	<i>Medicago polymorpha</i> L.	Fabaceae	+	-	-	-	-	-	+	+	-	-
124	<i>Melilotus alba</i> Desr.	Fabaceae	+	-	-	-	-	-	+	+	-	-
125	<i>Melilotus indica</i> (L.) All.	Fabaceae	+	-	-	-	-	-	+	+	-	-
126	<i>Pithecolobium dulce</i> Bth.	Fabaceae	-	+	-	-	+	-	-	+	-	-

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127	<i>Pongamia pinnata</i> (L.) Merril.	Fabaceae	-	+	-	-	-	-	+	-	+	-
128	<i>Rhynchosia minima</i> (L.) DC.	Fabaceae	+	-	-	-	-	+	-	-	+	-
129	<i>Rhynchosia pulverulenta</i> Stocks	Fabaceae	+	-	-	-	-	+	-	+	-	-
130	<i>Sesbania sesban</i> (L.) Merrill	Fabaceae	-	+	-	-	-	-	+	-	+	-
131	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	-	+	-	-	-	-	+	-	+	-
132	<i>Tephrosia uniflora</i> var. <i>petrosa</i>	Fabaceae	-	+	-	-	-	-	+	-	+	-
133	<i>Tephrosia uniflora</i> Pers.	Fabaceae	-	+	-	-	-	-	+	-	+	-
134	<i>Vicia faba</i>	Fabaceae	+	-	-	-	-	-	+	-	-	+
135	<i>Vicia sativa</i> L.	Fabaceae	+	-	-	-	-	-	+	-	+	-
136	<i>Vigna trilobata</i> (L.) Verdc.	Fabaceae	+	-	-	-	-	-	+	-	+	-
137	<i>Enicostemma hyssopifolium</i> (Willd.) Verd.	Gentianaceae	-	-	+	-	+	-	-	-	-	+

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138	<i>Mentha longifolia</i> (L.) L.	Lamiaceae	-	-	+	-	+	-	-	-	+	-
139	<i>Lawsonia inermis</i> L.	Lathyraceae	-	-	-	+	-	-	-	+	-	-
140	<i>Abutilon pakistanicum</i> Jafri and Ali	Malvaceae	+	-	-	-	-	+	-	+	-	-
141	<i>Malva parviflora</i> L.	Malvaceae	+	-	-	-	-	+	-	+	-	-
142	<i>Azadirachta indica</i> (L.) A. Juss.	Meliaceae	-	+	+	-	+	-	-	+	-	-
143	<i>Melia azadirach</i> L.	Meliaceae	-	+	+	-	+	-	-	-	+	-
144	<i>Acacia jacquemontii</i> Benth.	Mimosaceae	-	+	-	-	-	-	+	-	+	-
145	<i>Acacia nilotica</i> (L.) DeL. subsp. <i>indica</i> (Benth.) Brenan	Mimosaceae	-	+	-	-	-	-	+	-	+	-
146	<i>Acacia nilotica</i> subsp. <i>cupressiformis</i> (T.L. Stewart) Ali	Mimosaceae	-	+	-	-	-	-	+	-	+	-

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147	<i>Albizia lebbek</i> (L.) Bth.	Mimosaceae	-	+	-	-	-	-	+	+	-	-
148	<i>Prosopis cineraria</i> (L.) Druce.	Mimosaceae	-	+	-	-	-	-	+	-	+	-
149	<i>Prosopis glandulosa</i> Torr.	Mimosaceae	-	+	-	-	-	-	+	-	+	-
150	<i>Prosopis juliflora</i> (Swartz) DC.	Mimosaceae	-	+	-	-	-	-	+	-	+	-
151	<i>Glinus lotoides</i> L.	Molluginaceae	-	-	-	+	-	-	-	-	-	+
152	<i>Mollugo cerviana</i> (L.) Seringe	Molluginaceae	-	-	-	+	-	-	-	-	+	-
153	<i>Mollugo nudicaulis</i> Lamk.	Molluginaceae	-	-	-	+	-	-	-	+	-	-
154	<i>Mollugo pentaphyla</i> L.	Molluginaceae	-	-	-	+	-	-	-	+	-	-
155	<i>Ficus bengalensis</i> L.	Moraceae	-	+	+	-	-	-	+	-	+	-
156	<i>Ficus carica</i> L.	Moraceae	-	+	+	-	-	-	+	-	+	-
157	<i>Ficus religiosa</i> L.	Moraceae	-	-	+	-	-	-	+	-	+	-
158	<i>Morus alba</i> L.	Moraceae	-	+	+	-	-	-	+	-	+	-

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159	<i>Morus nigra</i> L.	Moraceae	-	+	+	-	-	-	+	-	+	-
160	<i>Moringa oleifera</i> Lamk.	Moringaceae	-	+	+	-	-	+	-	+	-	-
161	<i>Eucalyptus camaldulensis</i> Dehnh.	Myrtaceae	-	-	+	-	+	-	-	+	-	-
162	<i>Psidium guajava</i> L.	Myrtaceae	-	+	-	-	-	-	+	+	-	-
163	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	-	+	-	-	-	+	-	+	-	-
164	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	+	-	-	-	-	+	-	-	-	+
165	<i>Boerhavia pentandra</i> Burch.	Nyctaginaceae	+	-	-	-	-	+	-	-	+	-
166	<i>Boerhavia procumbens</i> Banks ex Roxb.	Nyctaginaceae	+	-	-	-	-	+	-	-	+	-
167	<i>Cistanche tubulosa</i> (Schrenk) Hook.f.	Orobanchaceae	-	-	-	+	-	-	-	+	-	-
168	<i>Orabanche aegyptica</i> Pers.	Orobanchaceae	-	-	-	+	-	-	-	+	-	-
169	<i>Oxalis corniculata</i> L.	Oxalidaceae	+	-	-	-	-	-	+	-	+	-
170	<i>Hypocoum leptocarpum</i> Hook. f. and Thoms.	Papaveraceae	+	-	-	-	-	-	+	-	-	+

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171	<i>Argemone mexicana</i> L.	Papaveraceae	-	-	+	-	+	-	-	-	-	+
172	<i>Trigonella monantha</i> sp. <i>Incise</i> C.A. Meye	Papilionaceae	+	-	-	-	-	+	-	+	-	-
173	<i>Dalbergia sissoo</i> Roxb.	Papilionaceae	-	+	-	-	-	-	+	-	+	-
174	<i>Plantago lanceolata</i> L.	Plantaginaceae	+	-	-	-	-	-	+	+	-	-
175	<i>Plantago major</i> L.	Plantaginaceae	+	-	-	-	-	-	+	+	-	-
176	<i>Acrachne racemosa</i> (Heyne ex Roem. and Schult.) Ohwi	Poaceae	+	-	-	-	-	+	-	+	-	-
177	<i>Aeluropus lagopoides</i> (Linn.) Trin. ex Thw.	Poaceae	+	-	-	-	-	-	+	+	-	-
178	<i>Aristida adscensionis</i> L.	Poaceae	+	-	-	-	-	-	+	+	-	-
179	<i>Aristida mutabilis</i> Trin. and Rupr.	Poaceae	+	-	-	-	-	-	+	+	-	-
180	<i>Arundo donax</i> L.	Poaceae	+	-	-	-	-	-	+	-	+	-

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181	<i>Avena fatua</i> subsp. <i>fatua</i> L.	Poaceae	+	-	-	-	-	-	+	-	+	-
182	<i>Brachiaria ovalis</i> Stapf	Poaceae	+	-	-	-	-	-	+	+	-	-
183	<i>Brachiaria eruciformis</i> (J.E. Smith) Griseb	Poaceae	+	-	-	-	-	-	+	+	-	-
184	<i>Bromus pectinatus</i> Thunb.	Poaceae	-	+	-	-	-	+	-	+	-	-
185	<i>Bromus sericeus</i> Drobov	Poaceae	-	+	-	-	-	+	-	+	-	-
186	<i>Cenchrus biflorus</i> Roxb.	Poaceae	+	-	-	-	-	-	+	-	+	-
187	<i>Cenchrus ciliaris</i> L.	Poaceae	+	-	-	-	-	-	+	-	+	-
188	<i>Cenchrus pennisetiformis</i> Hochst. and Steud. ex Steud.	Poaceae	+	-	-	-	-	-	+	-	+	-
189	<i>Cenchrus setigerus</i> Vahl	Poaceae	+	-	-	-	-	-	+	-	+	-
190	<i>Chloris gayana</i> Kunth	Poaceae	+	-	-	-	-	-	+	+	-	-
191	<i>Cymbopogon jwarancusa</i> subsp.	Poaceae	-	+	-	-	-	-	+	-	+	-

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	<i>jwarancusa</i> (Jones) Schult.											
192	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	+	-	-	-	-	-	+	-	+	-
193	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Poaceae	+	-	-	-	-	-	+	+	-	-
194	<i>Dactyloctenium aristatum</i> Link	Poaceae	+	-	-	-	-	-	+	-	-	+
195	<i>Digitaria ciliaris</i> (Retz.) Koel	Poaceae	+	-	-	-	-	-	+	-	-	+
196	<i>Desmostachya bipinnata</i> (L.) Stapf.	Poaceae	+	-	-	-	-	-	+	-	+	-
197	<i>Dichanthium annulatum</i> (Forssk.) Stapf	Poaceae	+	-	-	-	-	-	+	-	+	-
198	<i>Enneapogon persicus</i> Boiss.	Poaceae	+	-	-	-	-	-	+	+	-	-
199	<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	+	-	-	-	-	-	+	-	+	-
200	<i>Leptochloa panicea</i> (Retz.) Ohwi	Poaceae	+	-	-	-	-	-	+	-	+	-
201	<i>Eragrostis cilianensis</i> (All.) Lut. ex F.T. Hubbard	Poaceae	+	-	-	-	-	-	+	-	+	-
202	<i>Eragrostis ciliaris</i> (L.) R. Br.	Poaceae	+	-	-	-	-	-	+	-	+	-
203	<i>Eragrostis minor</i> Host	Poaceae	+	-	-	-	-	-	+	-	+	-
204	<i>Eragrostis pilosa</i> (L.) P. Beauvois	Poaceae	+	-	-	-	-	-	+	-	+	-
205	<i>Imperata cylindrica</i> (L.) Rauschel.	Poaceae	+	-	-	-	-	-	+	+	-	-
206	<i>Lasiurus indicus</i> Henr.	Poaceae	+	-	-	-	-	-	+	+	-	-

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207	<i>Ochthochloa compressa</i> (Forssk.) Hilu	Poaceae	+	-	-	-	-	-	+	+	-	-
208	<i>Panicum psilopodium</i> Trin.	Poaceae	+	-	-	-	-	-	+	-	+	-
209	<i>Paspalum dilatatum</i> Poir.	Poaceae	+	-	-	-	-	-	+	-	+	-
210	<i>Schismus arabicus</i> Nees	Poaceae	+	-	-	-	-	-	+	-	+	-
211	<i>Phalaris minor</i> Retz.	Poaceae	+	-	-	-	-	-	+	+	-	-
212	<i>Phragmites karka</i> (Retz.) Trin. ex Steud.	Poaceae	+	-	-	-	-	-	+	+	-	-
213	<i>Poa annua</i> L.	Poaceae	+	-	-	-	-	-	+	-	+	-
214	<i>Saccharum bengalense</i> Retz.	Poaceae	-	+	+	-	-	-	+	-	+	-
215	<i>Saccharum spontaneum</i> L.	Poaceae	-	+	+	-	-	-	+	-	+	-
216	<i>Setaria intermedia</i> Roem. and Schult	Poaceae	+	-	-	-	-	-	+	-	+	-
217	<i>Setaria pumila</i> (Poir.) Roem. and Schult.	Poaceae	+	-	-	-	-	-	+	-	+	-
218	<i>Sorghum bicolor</i> (Linn.) Moench.	Poaceae	-	+	-	-	-	-	+	-	+	-

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219	<i>Sorghum</i> Sect. <i>Sorghum</i> Subsect. <i>Arundinacea</i> Moench.	Poaceae	+	-	-	-	-	-	+	-	+	-
220	<i>Themeda triandra</i> Forsk.	Poaceae	+	-	-	-	-	-	+	-	+	-
221	<i>Sporobolus arabicus</i> Boiss.	Poaceae	-	+	-	-	-	-	+	+	-	-
222	<i>Stipagrostis plumosa</i> (Linn.) Munro ex T.	Poaceae	+	-	-	-	-	-	+	+	-	-
223	<i>Tragus roxburghii</i> Panigrahi	Poaceae	-	+	-	-	-	-	+	+	-	-
224	<i>Trisetum clarkei</i> (Hook.f.) R. R. Stewart	Poaceae	+	-	-	-	-	+	-	-	+	-
225	<i>Vetiveria zizanioides</i> (Linn.) Nash	Poaceae	+	-	-	-	-	+	-	-	-	+
226	<i>Calligonium polygonoides</i> L.	Polygonaceae	+	-	-	-	-	+	-	-	+	-
227	<i>Polygonum molliaeforme</i> Boiss.	Polygonaceae	+	-	-	-	-	+	-	+	-	-
228	<i>Polygonum plabejum</i> var. <i>Effusum</i> Meisn.	Polygonaceae	+	-	-	-	-	+	-	+	-	-
229	<i>Rumex dentatus</i> subsp. <i>klotzschianus</i> (Meisn.) Rech. f.	Polygonaceae	+	-	-	-	-	-	+	+	-	-
230	<i>Anagallis arvensis</i> var. <i>coerulea</i> (L.) Gnan.	Primulaceae	+	-	-	-	+	-	-	+	-	-

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231	<i>Punica granatum</i> L.	Punicaceae	-	+	-	-	-	-	+	-	+	-
232	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	-	+	+	-	-	-	+	-	+	-
233	<i>Ziziphus nummularia</i> (Burm.f.) Wight and Arn.	Rhamnaceae	-	+	+	-	-	-	+	-	+	-
234	<i>Ziziphus spina-christi</i> (L.) Willd.	Rhamnaceae	-	+	+	-	-	-	+	-	+	-
235	<i>Galium aparine</i> L.	Rubiaceae	+	-	-	-	-	+	-	-	+	-
236	<i>Citrus grandis</i> (L.) Osbeck	Rutaceae	-	+	-	-	-	+	-	-	+	-
237	<i>Citrus medica</i> var. <i>acida</i> Brandis	Rutaceae	-	+	-	-	-	+	-	-	+	-
238	<i>Citrus sinensis</i> (L.) Osbeck	Rutaceae	-	+	-	-	-	+	-	-	+	-
239	<i>Salvadora oleoides</i> Decne.	Salvadoraceae	+	-	-	-	-	-	+	-	-	+
240	<i>Bacopa monirii</i> L.	Scrophulariaceae	-	-	+	-	+	-	-	-	-	+

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241	<i>Schweinfurthia papilionacea</i> (Burm. f.) Boiss.	Scrophulariaceae	-	+	-	-	-	+	-	+	-	-
242	<i>Veronica persica</i> Poir.	Scrophulariaceae	+	-	-	-	-	+	-	-	-	+
243	<i>Datura fastuosa</i> L.	Solanaceae	-	-	-	+	-	-	-	-	+	-
244	<i>Solanum amricanum</i> Miller	Solanaceae	+	-	-	-	-	-	+	-	+	-
245	<i>Solanum incanum</i> L.	Solanaceae	+	-	-	-	-	+	-	-	+	-
246	<i>Solanum nigrum</i> L.	Solanaceae	+	-	-	-	-	-	+	-	+	-
247	<i>Solanum surattense</i> Burm.f.	Solanaceae	-	-	-	+	-	-	-	-	-	+
248	<i>Solanum villosum</i> (L.) Mill.	Solanaceae	-	+	-	-	-	+	-	+	-	-
249	<i>Withania coagulans</i> (Stocks.) Dunal	Solanaceae	-	+	-	-	-	-	+	-	+	-
250	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	-	+	-	-	-	-	+	-	+	-
251	<i>Tamarix aphylla</i> (L.) Karst.	Tamaricaceae	-	+	-	-	-	-	+	-	+	-

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252	<i>Corchorus aestuans</i> L.	Tiliaceae	+	-	-	-	-	+	-	-	+	-
253	<i>Corchorus depressus</i> (L.) Stocks	Tiliaceae	+	-	-	-	-	+	-	-	-	+
254	<i>Corchorus tridens</i> L.	Tiliaceae	+	-	-	-	-	+	-	-	+	-
255	<i>Typha elephantina</i> Roxb.	Typhaceae	-	-	+	-	+	-	-	+	-	-
256	<i>Phyla nodiflora</i> (Linn.) Greene	Verbenaceae	-	-	-	+	-	-	-	+	-	-
257	<i>Fagonia bruguieri</i> DC.	Zygophyllaceae	-	+	-	-	+	-	-	-	-	+
258	<i>Fagonia indica</i> var. <i>Schweinfuthii</i> Hadidi.	Zygophyllaceae	-	+	-	-	+	-	-	-	-	+
259	<i>Peganum harmala</i> L.	Zygophyllaceae	-	-	-	+	-	-	-	+	-	-
260	<i>Tribulus longipetalous</i> Viv.	Zygophyllaceae	+	-	-	-	+	-	-	-	+	-
261	<i>Tribulus terrestris</i> L.	Zygophyllaceae	+	-	-	-	+	-	-	-	+	-

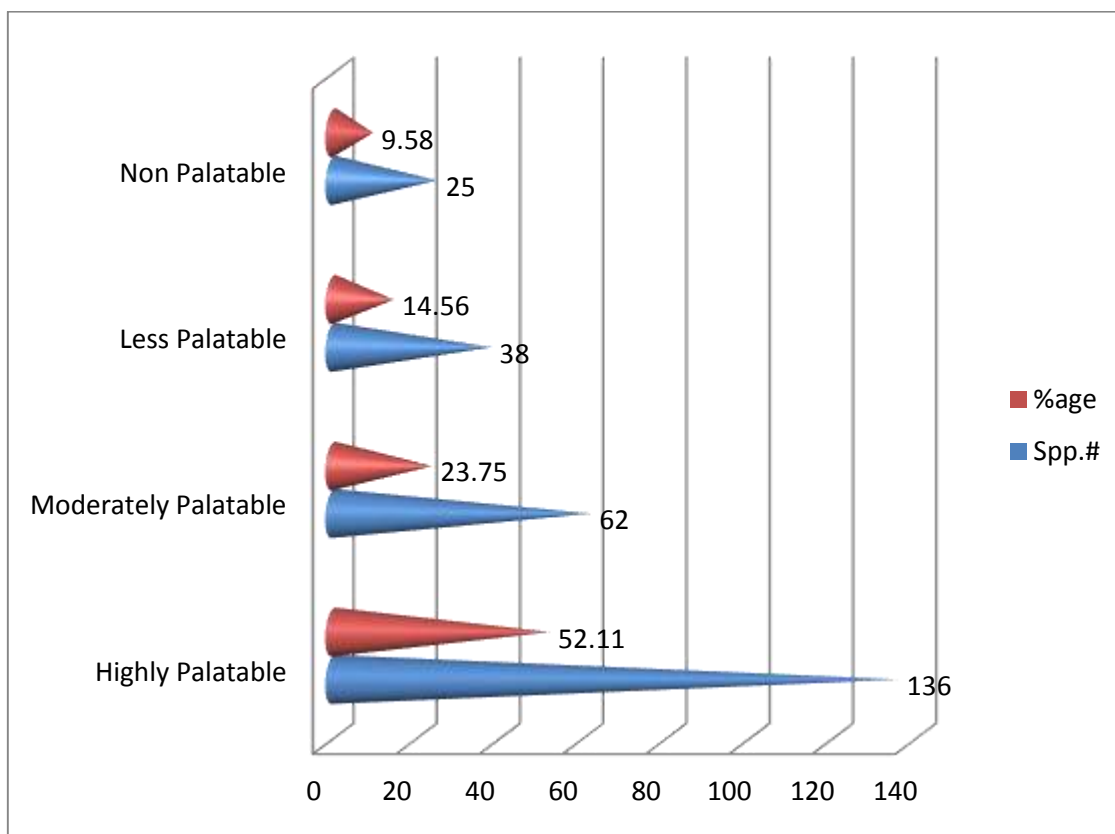


Fig. 4.5: Palatability of species in the study area.

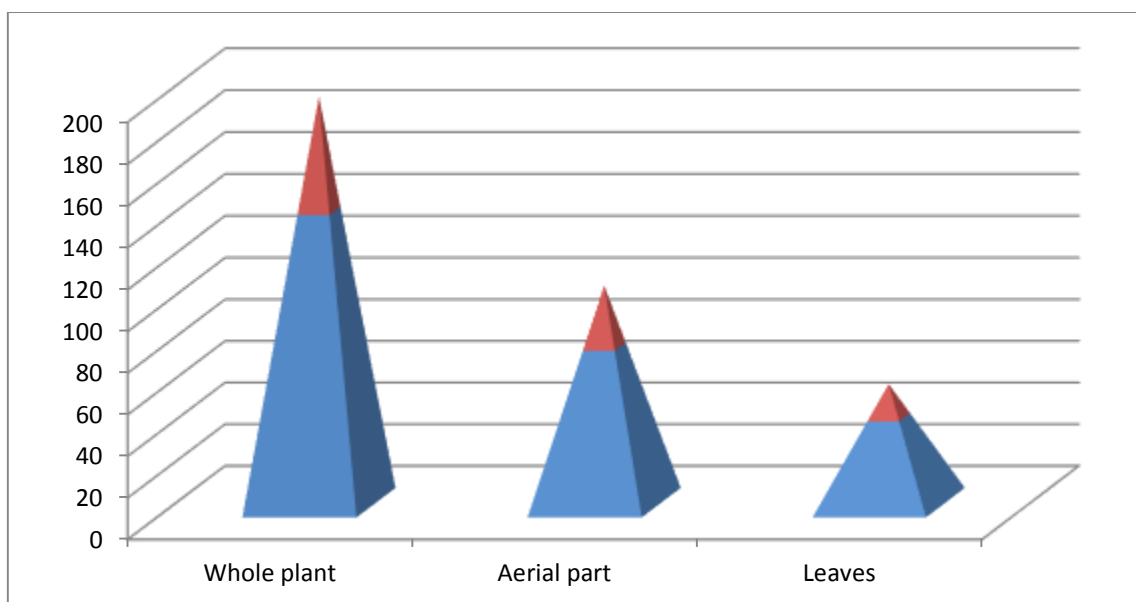


Fig. 4.6: Animal preference of plant parts for grazing/browsing in the study area.

4.4.1.2.9 Preference ranking for fodder/forage species:

The natives are utilizing local plants for feeding their livestock. Since the area is desert and camel is preferred animal for domestication purpose. This animal is used as sole for transportation purpose. In order to feed this animal, *Haloxylon* spp. Are mostly preferred and likewise ranked as first and second. It was followed by *Ziziphus mauritiana*, *Z. nummularia*, *Withania coagulans*, *Cenchrus biflorus*, *C. ciliaris*, *C. pennisetiformis*, *C. setigerus*, *Acacia nilotica*, *Crotalaria medicaginea*, *Dactyloctenium aristatum*, *D. aegyptium*, *Eragrostis ciliaris*, *E. minor*, *E. pilosa* and *Imperata cylindrica* (Table 4.13)

Table 4.13: Preference ranking matrix for fodder/forage species by the natives.

Plant species	Family	Respondents										Total score	Rank
		1	2	3	4	5	6	7	8	9	10		
<i>Haloxylon stocksii</i>	Chenopodiaceae	5	5	5	4	5	4	5	5	5	5	48	1
<i>Haloxylon salicornicum</i>	Chenopodiaceae	5	5	4	5	5	5	4	5	4	5	47	2
<i>Ziziphus mauritiana</i>	Rhamnaceae	4	5	5	4	5	5	5	4	5	5	47	2
<i>Ziziphus nummularia</i>	Rhamnaceae	4	5	5	5	4	5	5	4	4	5	46	3
<i>Withania coagulans</i>	Solanaceae	4	4	4	5	4	5	5	4	5	5	45	4
<i>Datyloctenium aegyptium</i>	Solanaceae	4	4	4	4	5	4	5	5	4	5	44	5
<i>Cenchrus biflorus</i>	Poaceae	5	5	4	4	4	5	4	5	4	4	44	5
<i>Cenchrus ciliaris</i>	Poaceae	4	4	4	5	4	4	5	4	4	5	43	6
<i>Cenchrus pennisetiformis</i>	Poaceae	5	4	4	3	4	5	5	4	3	5	42	7
<i>Cenchrus setigerus</i>	Poaceae	4	4	3	4	4	4	5	4	4	5	41	8
<i>Acacia nilotica</i> subsp. <i>indica</i>	Mimosaceae	4	4	5	4	3	4	4	4	4	5	41	8
<i>Crotalaria medicaginea</i>	Fabaceae	4	4	5	4	4	3	4	4	4	5	41	8
<i>Moringa oleifera</i>	Moringaceae	3	4	4	4	4	5	3	4	5	5	41	8
<i>Dactyloctenium aristatus</i>	Poaceae	3	3	4	5	4	4	4	5	4	4	40	9
<i>Eragrostis ciliaris</i>	Poaceae	3	4	4	4	3	3	4	5	5	4	39	10
<i>Eragrostis minor</i>	Poaceae	3	4	4	5	4	4	4	3	4	3	38	11
<i>Eragrostis pilosa</i>	Poaceae	3	4	3	4	5	4	3	4	4	4	38	11
<i>Imperata cylindrica</i>	Poaceae	3	4	4	4	3	4	3	4	4	5	38	11
<i>Eleusine indica</i>	Poaceae	4	4	5	4	4	3	4	4	3	3	38	11
<i>Leptochloa panicea</i>	Poaceae	3	4	3	3	4	4	4	5	3	3	36	12
<i>Eragrostis cilianensis</i>	Poaceae	3	4	4	4	3	4	3	3	4	4	36	12
<i>Acacia nilotica</i> subsp. <i>cupressiformis</i>	Mimosaceae	4	3	3	4	4	4	4	3	4	3	36	12

Plant species	Family	Respondents										Total score	Rank
		1	2	3	4	5	6	7	8	9	10		
<i>Albizzia lebbek</i>	Mimosaceae	3	3	4	4	4	3	4	3	3	4	35	13
<i>Prosopis cineraria</i>	Mimosaceae	3	4	4	3	4	3	4	3	3	4	35	13
<i>Prosopis glandulosa</i>	Mimosaceae	2	3	3	4	4	3	4	5	3	3	34	14
<i>Prosopis juliflora</i>	Mimosaceae	3	4	3	3	4	3	3	3	4	3	33	15
<i>Cynodon dactylon</i>	Poaceae	2	3	4	3	4	4	3	3	3	4	33	15
<i>Medicago polymorpha</i>	Fabaceae	3	3	3	3	3	3	4	3	3	4	32	16

4.5 CONCLUSION

Like various remote areas of the country, the people of the study area have a rich heritage in terms of utilization of native flora for their well being. Besides, richness of species was found to decrease with the increase of depth of the desert, while use of plants was found rich in the highest areas. This might be due to far away such areas of cities, no alternate choice, poverty coupled with believing in herbal medicines that compelled local inhabitants to search their needs from native plants. So there is a need of hours to conserve/preserve traditional knowledge about valuable plants that may be used in future to improve the lives and living beings of poor people.

The present study revealed that local communities are utilizing native plants to meet their basic requirement. They have empirical knowledge about plants of the area and fulfill their needs from such resources.

The present study is first attempt from the study area to not only document the plants of the area but also to record the indigenous knowledge of plants particularly recipes used for the treatment for various ailments. There is also need to authenticate the recipes documented in the research through ethnopharmacological researches. The present research would serve as baseline for further researches as follows:

- ❖ Molecular and palynological study of the flora of Thal Desert.
- ❖ Plant composition of the project study area.
- ❖ Study of carrying capacity and biomass of fodder/forage species.
- ❖ Nutritional and mineral analysis of fodder/forage species of the area.
- ❖ Pharmacological activity of the medicinal plants.
- ❖ Conservation measures of ethnobotanically important species.

GENERAL DISCUSSION

The flora of the Thal Desert, Punjab, Pakistan was not recorded earlier and with the passage of time, the native flora are vanishing; therefore it was felt worthwhile to record the flora before its disappearance from the project area. Keeping in view, a study was designed to explore the area for floristic survey and 248 species belonged to 166 genera and 38 families were recorded from the study area during September, 2011 to August, 2013. Out of them, one fern, 4 monocots and 33 dicot families were identified. The present enumeration includes about 20% new to desert habitat and few are new to Pakistan.

Poaceae was recorded as the leading family that shared 52 species (21.49%), followed by Fabaceae (34 spp., 13.05%), Amaranthaceae & Asteraceae (17 spp., 7.02% each), Boraginaceae (11 spp., 4.5%), Brassicaceae, Cyperaceae, Euphorbiaceae and Solanaceae (8 spp., 3.31% each).

Boraginaceae was found to be a complex family from the study area that represented three new genera (viz., *Nonea*, *Heterocaryum* and *Lappula*), which are determined as new to desert habitat and not reported before from any study (Chaudhry and Chutter, 1966; Arshad and Rao, 1992; Qureshi, 2012; Wariss *et al.*, 2014)).

Heliotropium pakistanicum is identified as a new species from Pakistan. This species was found closely related to *H. biannulatum* for having 4-fid stigma, however, it differs in its habit having semierect herb up to 60 cm tall, leaves lanceolate, deeply undulate, villous. The anthers were elliptic, and ovary globose as well as nutlets whitish grey, hairy and depressed on the inner side.

A new subspecies has been delineated from *Heliotropium crispum* and named as *thaliensis* endemic to the Thal desert. It is different from the former species in having some distinct characters such as an erect herb with less than 20 cm; leaves less than 2

cm, elliptic in shape with apex broadly acute apex; inflorescence axillary and terminal, up to 1 cm; calyx more than 2.5 mm long; lobes lanceolate; anthers ca. 2 x 1 mm, elliptic; ovary ca. 2 x 1 mm, ovate to elliptic.

Heliotropium europaeum possessed another variety that is different from *lasiocarpum* (F. and M.) Kazmi with a prominent angular stem with setose hairs, leaves with broad acuminate apex and a margin undulate to minutely serrate, petiole less than 2 cm, sepals more than 8 mm long, elliptic to lanceolate, petal lobes 4-5 mm, obovate, anthers 3 mm.

Themadatriandra Forsskal (Poaceae) has been recorded for the first time from Pakistan. The species was collected from Noorpur Thal and its surrounding areas during 2012. Earlier only one species of the genus *Themeda* (i.e. *T. anathera*) had been recorded by Cope (1982) from Pakistan. The two species can easily be distinguished from one another. The plant height of *T. triandra* is larger than *T. anathera*, the spikelets with 5-7cm long awns and the racemes arranged in dense clusters.

This study reported ethnobotanical information of the existing flora. Out of 261 species, 120 plants belonged to 88 genera and 44 families are used as medicinal purpose by the natives. The inventory is provided in Table 3.4. Qureshi and Bhatti(2008) endorsed the present findings. Likewise present study, earlier Qureshi *et al.* (2010) reported 63 plant species belonging to 50 genera and 29 families from the Nara desert, which are being used by the natives to treat various diseases. There was high diversity of medicinal plants in the study area compared to Cholistan and Nara Desert (Arshad *et al.*, 2002, Qureshi *et al.*, 2010).

The review of all medicinal plants is compiled and provided in Table 3.5. Compared to the medicinal literature (Dalziel, 1948; Lust, 1959; Watt and Breyer-Brandwijk, 1962; Mankind, 1969; Niebuhr, 1970; Bouquet and Debray, 1974; Triska, 1975; Singh and Kachroo, 1976; Emboden, 1979; Weiner, 1980; Launert, 1981; Parmar

and Kaushal, 1982; Lust, 1983; Baquar and Tasnif, 1984; Chiej, 1984; Coburn, 1984; Dafni *et al.*, 1984; Duke and Ayensu, 1985; Grieve, 1984; Sahu, 1984; Manandhar, 1985; Yeung, 1985; Chopra *et al.*, 1986; Polunin and Huxley, 1987; Srivastava, 1989; Foster and Duke, 1990; Joshi and Edington, 1990; Phillips and Foy, 1990; Bhattarai, 1993; Colunga-Garciamarin and May-Pat, 1993; Tsarong and Tsewang, 1994; Bown, 1995; Chevallier, 1996; Usmanhani *et al.*, 1997; Ali-Shayeh *et al.*, 1998; Bhatti *et al.*, 1998; Moerman, 1998; Istanbul, 2000; Nedhal and Al-douri, 2000; Shanwari and Khan, 2000; Ali *et al.*, 2001; Giday, 2001; Matin, 2001; Maroyi 2001; Bnouham *et al.*, 2002; Fernandez *et al.*, 2003; Giday *et al.*, 2003; Hebbar *et al.*, 2004; Jain *et al.*, 2004; Kala *et al.*, 2004; Katewa *et al.*, 2004; Koné *et al.*, 2004; Qureshi, 2004, Katewa and Galav 2006; Stella *et al.*, 2004; Uzun *et al.*, 2004; Natarajan *et al.*, 2005; Ahmad *et al.*, 2006; Muthu *et al.*, 2006; Zabihullah *et al.*, 2006; Agra *et al.*, 2007; Ahmad, 2007; Senthikumar *et al.*, 2006; Anisuzzaman and Rahman, 2007; Braga *et al.*, 2007; Canales *et al.*, 2007; Chitra and Nithyanandhi, 2007; Raju *et al.*, 2010; Savithramma *et al.*, 2007; Shinwari *et al.*, 2007; Tene *et al.*, 2007; Wazir *et al.*, 2007; Ignacimuthu *et al.*, 2008; Ugurlua and Secmen, 2008; Ahmad *et al.*, 2009; Choudhary *et al.*, 2009; Elizabeth, 2009; Jabeen *et al.*, 2009; Khan, 2009; Qureshi *et al.*, 2009, Rahmatullah *et al.*, 2009; Giday *et al.*, 2010; Gupta *et al.*, 2010; Marashdah and Al-Hazimi, 2010; Panghal *et al.*, 2010; Singh *et al.*, 2010; Qureshi *et al.*, 2010; Ahmad and Eram, 2011; Iqbal *et al.*, 2011; Kavishankar *et al.*, 2011; Murad *et al.*, 2011; Padmavathy and Anbarashan, 2011; Qureshi *et al.*, 2011; Saluja and Shrivastava 2011; Mushtaq *et al.*, 2012, Qureshi *et al.*, 2012 and Qureshi and Shaheen, 2013), four species viz., *Limeum indicum*, *Launaea residifolia*, *Farsetia jacquemontii* and *Indigofera hochstetteri* possessed novel medicinal uses not reported in the literature (Appendix-1). Besides, 76 species had new uses in addition to the medical record, while the rest of the species

contained similar use. In addition, the way of uses was also found different compared with the literature.

In all, 45 different diseases treated by 120 medicinal plants (Table 4.6). Like Nara desert, this area is facing drought and dryness resulted in creating constipation amongst the inhabitants. However, the area is blessed with good diversity of plants which are largely used to treat constipation with 27 species (7.87%), followed by abdominal/stomach problem (24 spp., 7%), boils (23 spp., 6.71%), jaundice and pain (18 spp., 5.25% each), pimples, skin problems(17 spp., 4.96% each),digestive problems, sexual problems (14 spp., 4.08% each), cooling agent (13 spp., 3.79%) and Hemorrhoids (11 spp., 3.21%), while other diseases were treated by less plant species (Table 4.6).

Overall, 13 plant parts were utilized for making anecdotal recipes by the native (Fig. 4.3). The leaves were heavily used (27.46%) for the preparation of recipes, followed by fruits (17.61%), whole plant (14.50%), roots (12.95%), Seeds (10.36%), aerial parts (3.62%), stem (3.6%), flowers (3.1%), oil (2.07%), pulp (1.55), gum (1.55%), latex (1.03%), while preparing in few remedies, inflorescence (0.51%) was used. Various other studies reported similar type of results like Quresh and Shaheen (2013), Qureshi *et al.*, (2012), Shaheen *et al.*, (2012), Shaheen *et al.* (2010), Jain *et al.* (2009), Kumar *et al.* (2009), Rout and Thatoi (2009), Ahmad *et al.* (2008) and Qureshi and Bhatti (2008).

For treating 45 different diseases 21 different formulations were used by the inhabitants of the area (Fig. 4.4). Amongst them, most of recipes were given in the form of powder (15.7%), followed by extract (12.6%), raw fruits (9.2%), potherb, (8.81%), etc. Various other studies reported similar type of results like Qureshi and Shaheen (2013), Rauf *et al.* (2012), Pradhan and Badola (2008) and Qureshi and Bhatti (2008).

In order to calculate the informant consensus factor (ICF) for human diseases, diseases were divided into 10 different categories on the basis of use reports and taxa utilized. Results are compiled in Table 4.8. It revealed that in the majority of cases, gastrointestinal disorders were treated by the highest number of species. It was followed by pain and inflammation. The ICF ranged between 0.91 to 0.96 with an average of 0.901. It clearly depicted that there was highest consensus of information between informants (Table 4.8). Singh *et al.* (2012) and Mesfin *et al.* (2009) reported more than 0.9 FIC values that highlighted the significant degree of consensus amongst the informants.

From the preference ranking point of view, *Rhazya stricta* ranked first species by the natives since they use it in curing different diseases. People gave second highest rank to *Aloe vera*, followed by *Citrullus colocynthis*, *Momordica balsamica*, *Heliotropium strigosum*, *Moringa oleifera*, *Tribulus terrestris*, *Withania coagulans*, *Withania somnifera* and *Azadirachta indica* with the 3rd to 10th rank respectively (Table 4.9). Similar results were reported by Ishtiaq *et al.* (2013) and Mesfin *et al.* (2009).

Altogether 120 medicinal plants were found useful against 45 different diseases. The most common diseases are jaundice, constipation, hemorrhoids,boils, pimples,skin problems, abdominal/stomach problem,pain,digestive problems andsexual problems in the study area and people accordingly using native plants to cure such diseases. According to the survey, constipation was 1st and the most prevalent disease in the area and the people accordingly used maximum species to cure it. People ranked boils and pimples as 2nd and 3rd common diseases as shown in the Table 4.10. Similar results were explained by Ahmad *et al.* (2013) from the Neelum Valley, Azad Jammu and Kashmir.

Fidelity level (FL) determines a species which are more preferably used in treating any particular ailment (Friedman *et al.*, 1986). *Citrullus colocynthis* was the

most important medicinal plant in the study area, which was particularly used to treat constipation confirmed by 45 informants with 100% FL (Table 4.11). This species was also reported to be used in other diseases. Three species viz., *Momordica balsamica*, *Moringa oleifera* and *Withania somnifera* were found the 2nd most important plants having 97.78% FL, which are used in diabetes, joint pain and sexual problems respectively. It was followed by *Psidium guajava* (97.50% FL), *Azadirachta indica*, *Melia azedirach*, *Tribulus terrestris* (95.56% FL each), *Tamarix aphylla* (93.33% FL), *Cymbopogon jawarancusa* *Fagonia* spp. (92.86% FL each), *Syzygium cumini* and *Withania coagulans* (91.11% FL each), while rest of species were within the FL range of 55.56 to 88.89%. Musa *et al.* (2011) reported the same kind of results.

The Thal desert is severely eroded through the anthropogenic activities such as expansion of land for cultivation and human settlement that resulted in desertification. Natural vegetation is replaced by perennial grasses, which might be a response to the anthropogenic pressure on the flora. With the passage of time, the native floras are vanishing; therefore it was felt worthwhile to record the flora before its disappearance from the project area. The comprehensive study may serve as a reference work for ethnopharmacobotanical research, since an ample number of recorded species possessed medicinal uses.

SUMMARY

Thal Desert, Pakistan has not been explored before for floristic and ethnobotanical point of view. Keeping in view, the whole study area was surveyed during 2010 to 2014 and plant specimens were collected with regular intervals along with folk knowledge of plants through using semi-structured questionnaire. For the floristic enumeration, the collected specimens were morphologically described, identified and systematically treated. Based on the observations, dichotomous keys were developed for the identification and valid nomenclature incorporated.

A total of 248 species distributed across 166 genera and 38 families were identified during the survey period. Besides, *Heliotropium pakistanicum*, *H. crispum* var. *angulosum* and *H. europaeum* subsp. *thaliensis* are determined as addition to science, while *Themeda triandra* as new record for Pakistan. It includes one fern, 4 monocots and 33 dicots families. The most dominating family was Poaceae that contributed 52 species (21.49%), followed by Fabaceae (34 spp., 13.05%), Amaranthaceae and Asteraceae (17 spp., 7.02% each), Boraginaceae (11 spp., 4.5%) and Brassicaceae, Cyperaceae, Euphorbiaceae and Solanaceae (8 spp., 3.31% each), while, rest of the families had few number of species. In the study area, 9 life forms of the flora exist, in which 46.74% (122 spp.) were herbs, followed by grasses (51 spp., 19.54%), trees (28 spp., 10.73%), shrubs (27 spp., 10.34%), sedges (9 spp., 3.45%) and climbers (3.07%).

During the survey, ethnobotanical data for local flora was also collected. Overall, 8 use categories such as fruits, vegetable, medicinal, ethno veterinary, fuel, fodder, soil binder and others were identified. *Capparis decidua*, *Citrus grandis*, *Moringa oleifera*, *Prosopis cineraria*, *Salvadora oleoides* and *Ziziphus spinachristi* were ranked 1st amongst all species which fulfilled 6 major use categories. Most of the species were recognized as palatable by the herders that are used as

fodder (234 spp., 35.62%), followed by folk medicine (120 spp., 18.26%), fuel (108 spp., 16.44%), others (64 spp., 9.74%), soil binder (48 spp., 7.31%), wild fruits (40 spp., 6.09%), vegetables (25 spp., 3.81%) and Ethno veterinary (18 spp., 2.74%). Out of 261 species, 120 plants belonged to 88 genera and 44 families were used as medicinal purpose by the natives. There was high diversity of medicinal plants in the study area compared to Cholistan and Nara Desert. Compared to the medicinal literature, four species viz., *Limeum indicum*, *Launaea residifolia*, *Farsetia jacquemontii* and *Indigofera hochstetteri* possessed novel medicinal uses not reported earlier in the literature. Besides, 76 species had new uses in addition to the medicinal record, while the rest of the species contained similar use.

In all, 45 different diseases were treated by using 120 medicinal plants. Like Nara desert, this area is facing drought and dryness that resulted in causing constipation amongst the inhabitants. Fortunately, the area is blessed with good diversity of plants which are largely used to treat constipation with 27 species (7.87%), followed by abdominal/stomach problem (24 spp., 7%), boils (23 spp., 6.71%), jaundice and pain (18 spp., 5.25% each), pimples, skin problems (17 spp., 4.96% each), digestive problems, sexual problems (14 spp., 4.08% each), cooling agent (13 spp., 3.79%) and Hemorrhoids (11 spp., 3.21%), while rest of diseases were treated by less number of plant species.

Leaves were heavily used (27.46%) for the preparation of recipes, followed by fruits (17.61%), whole plant (14.50%), roots (12.95%), Seeds (10.36%), aerial parts (3.62%), stem (3.6%), flowers (3.1%), oil (2.07%), pulp (1.55), gum (1.55%), latex (1.03%) and inflorescence (0.51%). For treating 45 different diseases, 21 different formulations were used by the inhabitants of the area. Amongst them, most of the recipes were given in the form of powder (15.7%), followed by extract (12.6%), raw fruits (9.2%), potherb (8.81%), etc.

With reference to fidelity level (FL), *Citrullus colocynthis* was found the most important medicinal plant in the study area, which was particularly used to treat constipation confirmed by 45 informants (100% FL). Three species viz., *Momordica balsamica*, *Moringa oleifera* and *Withania somnifera* were found the 2nd most important plants having 97.78% FL used in diabetes, joints pain and sexual problems respectively. It was followed by *Psidium guajava* (97.50% FL), *Azadirachta indica*, *Melia azadirach*, *Tribulus terrestris* (95.56% FL each), *Tamarix aphylla* (93.33% FL), *Cymbopogon jawarancusa* *Fagonia* spp.(92.86% FL each), *Syzygium cumini* and *Withania coagulans* (91.11% FL each), while the rest of the species were within the fidelity range of 55.56 to 88.89%.

Informant Consensus factor (ICF) establishes the distribution of informants' knowledge about the use of medicinal plants that confirm that all the people in the study area use plants for curing same disease in the same or different methods. There was the existence of consensus factor ranged from 0.85 to 0.90 with an average across all data from 0.90, which strongly indicated that the peoples in the study area are dependent on the plants for treating their various ailments. This also shows that plants are still used as a medicine in the study area. The reasons for using medicinal plant instead of medicine would be because of non-availability of allopathic drugs and health facilities in the study area and/or people having strong beliefs that they can be cured by their plant knowledge. Many people in urban areas also still use plants as a medicament to avoid side effects of modern medicines. This result indicates that people living in the area are well aware of the plants in the study area and in this connection, the highest number of use reports (Nur) were recorded for constipation (241), followed by abdominal/ stomach problems (230 reports), boils (224 reports), digestive problems (220), jaundice (200), however rest of diseases were also reported considerably

From the preference ranking point of view, *Rhazya stricta* ranked 1st in the area and people use it in curing different diseases. People gave 2nd highest ranking to *Aloe vera*, followed by *Citrullus colocynthis*, *Momordica balsamica*, *Heliotropium strigosum*, *Moringa oleifera*, *Tribulus terrestris*, *Withania coagulans*, *Withania somnifera* and *Azadirachta indica* with the 3rd to 10th rank respectively.

From this study it can be concluded that Thal Desert possessed some unique/endemic/rare species which were not recorded before from any desert of Pakistan. In addition, there are ample numbers of species which are reported to have remarkable medicinal and other multifarious uses. So efforts should be made to conserve and preserve native flora and likewise their indigenous knowledge.

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