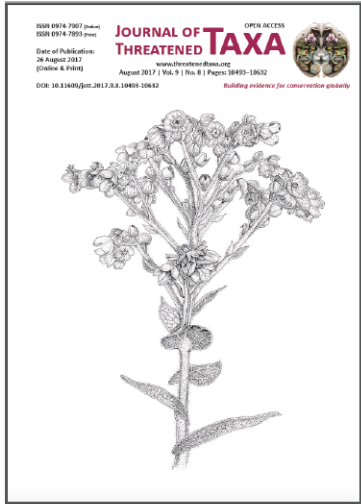


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## ANGIOSPERM DIVERSITY IN DOABA REGION OF PUNJAB, INDIA

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**Abstract:** The angiosperms diversity was studied in Doaba region of Punjab, India. A total of 464 species belonging to 337 genera and 99 families were recorded during this study. Of these, 88% are dicots and the remaining (12%) are monocots. The data contain wild, cultivated and ornamental species. Fabaceae is the most dominant family with 60 species followed by Asteraceae (33), Poaceae (29), Euphorbiaceae (20), Amaranthaceae (18), Cucurbitaceae and Solanaceae (17 each). Amongst all the recorded species, 255 were herbs, 65 shrubs, 85 trees and 59 climbers. Six species have been added to the flora of Punjab. Present investigation has indicated that, Doaba region of Punjab has rich angiosperm diversity and need of the hour is its documentation and conservation.

**Keywords:** Angiosperms, diversity, Doaba, flora, Punjab, species.

**DOI:** <http://doi.org/10.11609/jott.2748.9.8.10551-10564>

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**Competing interests:** The authors declare no competing interests.

**Author Details:** KULJINDER KAUR worked as research scholar and has interest in plant taxonomy, ethnobotany and biodiversity assessment and is presently working as Technical officer in Punjab Biodiversity Board, Chandigarh. M.C. SIDHU worked as supervisor and presently working as Associate Professor. A.S. AHLUWALIA serving the Department of Botany, Panjab University, Chandigarh as Professor.

**Author Contribution:** KK carried out the floristic study, collected the data and wrote the manuscript. MCS and ASA identified the species, interpreted the data and designed the manuscript. All authors have read and approved the final manuscript.

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ज्ञान-विज्ञान विमुक्तये

## INTRODUCTION

India has one of the richest floras in the world with over 2991 genera of flowering plants (Karthikeyan 2009). Out of these, 49 genera are endemic to India that belongs to 22 families and 80 taxa (Irwin & Narasimhan 2011). Earlier researchers have studied the flora of different regions of Punjab (Aitchison 1868; Bamber 1916; Parker 1918; Sabnis 1941; Stewart 1977; Nair 1978; Meenakshi & Sharma 1985; Sharma & Khosla 1989; Sharma 1990; Sharma & Rajpal 1995; Tiwana et al. 2005; Jerath et al. 2006). Santapau (1958) recommended district and provincial floral studies for compilation of regional floras, so that information on Indian flora could be updated. Punjab is one of the agriculture rich states of India; 84% area of the state is under agriculture and only six percent is covered by the forests. Due to afforestation and agroforestry practices, the forest area in Punjab increases from 3.72% in 1966 to 6.07% in 2012 (Jerath et al. 2014a); however, the continuous urbanization and industrialization in the state has their own impact on natural vegetation. Similarly, the intensive cultivation practices, to feed the overgrowing population have decreased the natural habitat of plant species. Because of these reasons, some new exotic species are introduced and many existing native species are threatened. Keeping these facts in mind, the present study has been undertaken in Doaba region of Punjab to enlist the Angiosperms. Based on the findings, further studies can be planned for sustainable use and conservation of plant diversity.

## MATERIALS AND METHODS

### Study area

Punjab State, spread over an area of 50,362km<sup>2</sup> is situated in the North West of India. It constitutes 1.54% of the country's total geographic area. The area selected for the present investigation is Doaba region (8,915km<sup>2</sup>) of Punjab. The name "Doaba" literally means "land between the two rivers" (Do = two, Ab = water). It is one of the most fertile regions and centre of Green Revolution in India (Jerath et al. 2014b). It lies between 30.998–32.053 N and 75.069–76.347 E and is surrounded by Shivalik Hills on the east, Beas River on the north and west and Sutlej River on the south (Fig. 1). It consists of four districts namely Jalandhar, Hoshiarpur, Nawanshahar (now known as Shahid Bhagat Singh Nagar) and Kapurthala. Doaba region lies between the rivers Beas and Sutlej and is densely populated region with 24 towns and 5,580 villages. It has a sub humid climate and there is a great variation in winter and summer temperature. Like rest of northwestern India, it receives 80% of its rainfall from the southwest monsoons during June to September.

### Study of angiosperm flora

To enlist plant species of the study area, 30 field visits were undertaken during different seasons of the year. More than 40 sites were visited throughout the study area. During the floristic study, botanical name of plants, family, habit, habitat, location, date of collection and other characters were recorded in the field notebook. Depending upon the availability,

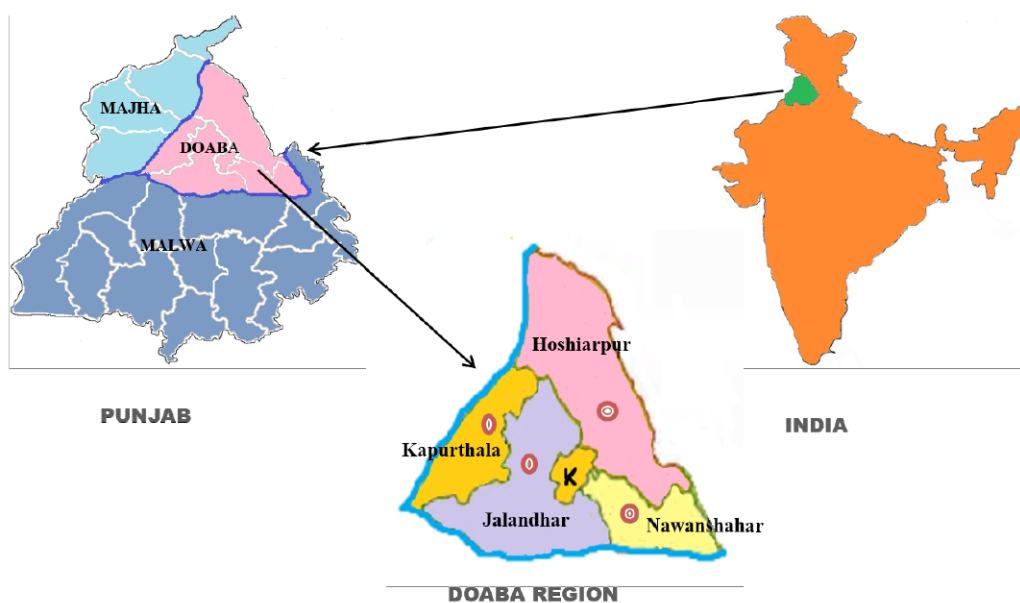


Figure 1. Study area

status and requirement of a particular plant species, plant specimens preferably from fertile individuals (i.e., those bearing fruit or flowers), were collected. The plant species were identified using local and regional floras (Nair 1978; Sharma 1990), online herbaria (The Janaki Ammal herbarium and Herbarium Kerala Forest Research Institute) and various internet sites ([www.ars-grin.gov/cgi-bin/npgs/html](http://www.ars-grin.gov/cgi-bin/npgs/html); [www.theplantlist.org](http://www.theplantlist.org); [www.efloras.org](http://www.efloras.org); [www.ipni.org](http://www.ipni.org)). Identification was confirmed by comparing the specimen with the authenticated specimen from herbarium of Panjab University, Chandigarh. The herbarium sheets were prepared and deposited in the PAN herbarium of Botany Department, Panjab University, Chandigarh, India.

## RESULTS AND DISCUSSION

The present investigation has been carried out from 2011 to 2014 and a total number of 464 species of angiosperms belonging to 337 genera and 99 families were recorded from the study area. The study area has 316 native species (Images 1–24) whereas 148 species were non-native. The non-native species may be introduced accidentally or deliberately. A list of both native and non-native plant species with their families, habit and source is presented in Table 1 and Table 2 respectively. Sharma (1990) while listing the flora of Punjab, reported 1843 species of Angiosperms belonging to 940 genera and 165 families. So the species (464) recorded from the present study area comprised approximately 25% of the flora of Punjab State. Fifty-five species belonging to 49 genera and 16 families were monocots while the rest (409 species) belonging to 288 genera and 83 families were dicots. Fabaceae is the dominant family with 60 species followed by Asteraceae (33), Poaceae (29), Euphorbiaceae (20), Amaranthaceae (18), Cucurbitaceae and Solanaceae (17 each), Malvaceae (16), Brassicaceae and Convolvulaceae (15 each). Seventeen families were credited with only two species each, whereas forty five families were monospecific (Table 3; Fig. 2). A Comparison of dominant families of the study area with Punjab (Sharma 1990) and Haryana (Kumar 2001) shows slight variation in their ranks. Poaceae was the largest family of Punjab and Haryana floras, now ranked third in Doaba region. Fabaceae is the largest family of the study area but stands third and second in Punjab and Haryana floras, respectively. Asteraceae and Euphorbiaceae hold the second and fourth position, respectively in Punjab as well as the study area but hold third and fifth rank in Haryana. Dominance of family Fabaceae in the study

area may be due to its high degree of diversity in habit and habitat. This family includes all life forms like herbs, shrubs, trees and climbers. The genera which have contributed large number of species includes *Euphorbia* (11), *Ipomoea* (8), *Solanum*, *Ficus* and *Brassica* (7 species each), *Trifolium*, *Sida*, *Portulaca*, *Acacia* and *Alternanthera* (4 species each). Kumar (2001) also recorded *Euphorbia* (10 species) and *Ipomoea* (15 species) as the dominating genera of Haryana.

Amongst all species, 255 were herbs, 65 shrubs, 85 trees and 59 climbers (Fig. 3). The documented species included 273 wild, 111 cultivated, 59 ornamental and 19 both wild as well as cultivated (Fig. 4). The voucher specimens of 252 plant species were prepared and deposited at PAN, Herbarium of Botany Department, Panjab University, Chandigarh (PAN No. 19992-20232; 20508-20518).

The vegetation cover was different in all four Districts of Doaba region. Natural forests were common in District Hoshiarpur but in Jalandhar and Kapurthala Districts, private forests or plantation of *Populus*, *Eucalyptus*, *Dalbergia* was dominant. The Districts Kapurthala and Jalandhar have more or less similar vegetation but herbs and grasses are the major constituents. On the other hand, vegetation and composition of species of Hoshiarpur and Nawanshahar districts were more or less similar and dominated by shrubs and grasses. This may be due to geographical variations in the four Districts. The less diversity in Jalandhar and Kapurthala Districts is likely to be due to more urbanization, industrialization and land leveling for different purposes. The Angiosperm diversity of the area under investigation has been further described as follow:

### Vegetation of aquatic and marshy places

The main aquatic species growing in the study area are *Eichhornia crassipes*, *Hydrilla verticillata*, *Ipomoea aquatica*, *Lemna minor*, *Nymphaea stellata*, *Nelumbo nucifera*, *Nymphoides cristata* and *Trapa natans* var. *bispinosa*. Most of the water bodies are thickly covered by *Eichhornia crassipes*, commonly known as water Hyacinth. *Nymphoides cristata* has been reported only from one site, Dasuya block of Hoshiarpur District. Previously, Nair (1978) and Kumar (2001) reported this species from Ferozepur and Kurukshetra, respectively. The marshy places around the water body has *Alternanthera philoxeroides*, *Cyperus difformis*, *Cyperus rotundus*, *Veronica anagallis-aquatica*, *Polygonum glabrum*, *Polygonum lapathifolium*, *Polygonum plebeium*, *Ranunculus sceleratus*, *Rumex dentatus*, *Saccharum munja* and *Typha angustata*. *Caesulia*

Table 1. List of native plant species of the study area

Botanical name	Family	Habit	Source
<i>Abelmoschus esculentus</i> (L.) Moench.	Malvaceae	H	C
<i>Abelmoschus ficulneus</i> (L.) Wt. et Arn.	Malvaceae	S	W
<i>Abrus precatorius</i> L.	Fabaceae	Cl	W
<i>Abutilon indicum</i> (L.) Sweet.	Malvaceae	S	W
<i>Acacia catechu</i> Willd.	Fabaceae	T	W
<i>Acacia modesta</i> Willd.	Fabaceae	T	W/C
<i>Acacia nilotica</i> (L.) Delile	Fabaceae	T	W
<i>Achyranthes aspera</i> L.	Amaranthaceae	H	W
<i>Adina cordifolia</i> Benth. & Hook.f	Rubiaceae	T	C
<i>Aegle marmelos</i> (L.) Corr. ex Roxb.	Rutaceae	T	C
<i>Aerva javanica</i> Juss. ex Schult.	Amaranthaceae	H	W
<i>Albizia lebbek</i> Benth.	Fabaceae	T	W/C
<i>Alhagi pseudalhagi</i> (Bieb.) Desv.	Fabaceae	S	W
<i>Allium cepa</i> L.	Amaryllidaceae	H	C
<i>Alstonia scholaris</i> R. Br.	Apocynaceae	T	O
<i>Alternanthera sessilis</i> DC.	Amaranthaceae	H	W
<i>Alysicarpus rugosus</i> DC.	Fabaceae	H	W
<i>Amaranthus spinosus</i> L.	Amaranthaceae	H	W
<i>Amaranthus tricolor</i> L.	Amaranthaceae	H	W/O
<i>Amaranthus viridis</i> L.	Amaranthaceae	H	W
<i>Anagallis arvensis</i> L.	Primulaceae	H	W
<i>Anethum graveolens</i> L.	Apiaceae	H	C
<i>Anisomeles indica</i> L.	Lamiaceae	H	W
<i>Argemone ochroleuca</i> Swet.	Papaveraceae	H	W
<i>Arnebia hispidissima</i> (Sieber ex Lehm.) DC.	Boraginaceae	H	W
<i>Artemisia scoparia</i> Waldst. & Kit.	Asteraceae	H	W
<i>Artocarpus heterophyllus</i> Lam.	Moraceae	T	C
<i>Arundo donax</i> L.	Poaceae	H	W
<i>Asparagus racemosus</i> Willd.	Asparagaceae	H	W
<i>Asphodelus tenuifolius</i> Cav.	Xanthorrhoeaceae	H	W
<i>Avena fatua</i> L.	Poaceae	H	W
<i>Azadirachta indica</i> A. Juss.	Meliaceae	T	W/C
<i>Bacopa monnieri</i> L.	Scrophulariaceae	H	W
<i>Bambusa bambos</i> (L.) Voss	Poaceae	S	W
<i>Barleria cristata</i> L.	Acanthaceae	S	W
<i>Basella alba</i> L.	Basellaceae	Cl	W
<i>Bauhinia acuminata</i> L.	Fabaceae	T	C
<i>Bauhinia variegata</i> L.	Fabaceae	T	C
<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	Cl	C
<i>Blumea membranacea</i> Wall.	Asteraceae	H	W
<i>Blumea mollis</i> (Don.) Merr.	Asteraceae	H	W
<i>Boerhavia diffusa</i> L.	Nyctaginaceae	H	W
<i>Bombax ceiba</i> L.	Bombacaceae	T	C

Botanical name	Family	Habit	Source
<i>Bothriochloa pertusa</i> (L.) A. Camus	Poaceae	H	W
<i>Brachiaria ramosa</i> (L.) Stapf	Poaceae	H	W
<i>Brassica napus</i> L.	Brassicaceae	H	C
<i>Brassica nigra</i> (L.) Koch.	Brassicaceae	H	C
<i>Brassica oleracea</i> var. <i>botrytis</i> (L.) Alef.	Brassicaceae	H	C
<i>Brassica oleracea</i> var. <i>capitata</i> (L.) Alef.	Brassicaceae	H	C
<i>Brassica rapa</i> var. <i>rapa</i> L.	Brassicaceae	H	C
<i>Butea monosperma</i> (Lam.) Taub.	Fabaceae	T	C
<i>Caesulia axillaris</i> Roxb.	Asteraceae	H	W
<i>Cajanus cajan</i> (Linn.) Millsp.	Fabaceae	S	C
<i>Calotropis gigantea</i> (L.) R. Br.	Apocynaceae	S	W
<i>Calotropis procera</i> (Ait.) R. Br.	Apocynaceae	S	W
<i>Campanula pallida</i> Wall.	Campanulaceae	H	W
<i>Cannabis sativa</i> L.	Cannabaceae	H	W
<i>Cardiospermum halicacabum</i> L.	Sapindaceae	Cl	W
<i>Carica papaya</i> L.	Caricaceae	T	C
<i>Carissa carandas</i> L.	Apocynaceae	S	W/C
<i>Carissa spinarum</i> L.	Apocynaceae	S	W
<i>Cassia fistula</i> L.	Fabaceae	T	O
<i>Cassia glauca</i> Lam.	Fabaceae	T	O
<i>Casuarina equisetifolia</i> L.	Casuarinaceae	T	O
<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	H	O
<i>Cayratia trifolia</i> (L.) Domin	Vitaceae	Cl	W
<i>Celosia cristata</i> L.	Amaranthaceae	H	O
<i>Centaurium pulchellum</i> (Sw.) Krause	Gentianaceae	H	W
<i>Centella asiatica</i> (L.) Urb.	Apiaceae	H	W
<i>Cestrum nocturnum</i> L.	Solanaceae	T	O
<i>Chenopodium album</i> L.	Chenopodiaceae	H	W
<i>Chrysanthemum indicum</i> L.	Asteraceae	H	O
<i>Chukrasia tabularis</i> A. Juss.	Meliaceae	T	W/C
<i>Cicer arietinum</i> L.	Fabaceae	H	C
<i>Cirsium arvense</i> (L.) Scop.	Asteraceae	H	W
<i>Cirsium falconeri</i> (Hook. f.) Petr.	Asteraceae	H	W
<i>Citrullus fistulosus</i> Stocks	Cucurbitaceae	Cl	C
<i>Citrullus vulgaris</i> Schrad.	Cucurbitaceae	Cl	C
<i>Citrus aurantifolia</i> (Christm) Sw.	Rutaceae	S	C
<i>Citrus reticulata</i> L.	Rutaceae	S	C
<i>Citrus sinensis</i> (L.) Osbeck.	Rutaceae	S	C
<i>Cleome viscosa</i> L.	Capparidaceae	H	W
<i>Clerodendrum inerme</i> (L.) Gaertn.	Verbenaceae	S	O
<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Cl	W
<i>Colebrookea oppositifolia</i> Sm.	Lamiaceae	S	W
<i>Colocasia esculenta</i> (L.) Schott.	Araceae	H	C

Botanical name	Family	Habit	Source
<i>Commelina benghalensis</i> L.	Commelinaceae	H	W
<i>Commelina nudiflora</i> L.	Commelinaceae	H	W
<i>Convolvulus arvensis</i> L.	Convolvulaceae	Cl	W
<i>Convolvulus prostratus</i> Forssk.	Convolvulaceae	H	W
<i>Corchorus aestuans</i> L.	Tiliaceae	H	W
<i>Cordia dichotoma</i> G. Forst.	Boraginaceae	T	W
<i>Coriandrum sativum</i> L.	Apiaceae	H	C
<i>Coronopus didymus</i> (L.) Smith Fl. Brit.	Brassicaceae	H	W
<i>Cotula hemisphaerica</i> Wall. ex Benth. & Hook. f.	Asteraceae	H	W
<i>Crataeva religiosa</i> Hook.f. & Thoms.	Capparidaceae	T	C
<i>Crotalaria medicaginea</i> Lam.	Fabaceae	H	W
<i>Crotalaria spectabilis</i> Roth.	Fabaceae	H	C
<i>Croton bonplandianum</i> Baill.	Euphorbiaceae	H	W
<i>Cryptolepis buchanani</i> Roem. & Schult.	Apocynaceae	Cl	W
<i>Cucumis collosus</i> (Rottl.) Cogn.	Cucurbitaceae	Cl	W
<i>Cucumis melo</i> L.	Cucurbitaceae	Cl	C
<i>Cucumis melo</i> var. <i>utilissimus</i> (Roxb.) Duthie & J. B. Fuller	Cucurbitaceae	Cl	C
<i>Cucumis sativus</i> L.	Cucurbitaceae	Cl	C
<i>Cucurbita maxima</i> Duchesne.	Cucurbitaceae	Cl	C
<i>Cucurbita pepo</i> L.	Cucurbitaceae	Cl	C
<i>Curcuma longa</i> L.	Zingiberaceae	H	C
<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	Cl	W
<i>Cyathula tomentosa</i> (Roth.) Moq.	Amaranthaceae	S	W
<i>Cynodon dactylon</i> Pers.	Poaceae	Cl	W
<i>Cynoglossum lanceolatum</i> Forssk.	Boraginaceae	H	W
<i>Cyperus rotundus</i> L.	Cyperaceae	H	W
<i>Dalbergia sissoo</i> Roxb.	Fabaceae	T	W/C
<i>Datura innoxia</i> Mill	Solanaceae	S	W
<i>Datura metel</i> L.	Solanaceae	S	W
<i>Daucus carota</i> L.	Apiaceae	H	C
<i>Desmodium triflorum</i> DC.	Fabaceae	H	W
<i>Desmostachya bipinnata</i> Stapf.	Poaceae	H	W
<i>Dicliptera roxburghiana</i> Nees.	Acanthaceae	H	W
<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	H	W
<i>Digitaria longiflora</i> (Retz.) Pers.	Poaceae	H	W
<i>Dioscorea belophylla</i> (Prain) Voigt ex Haines	Dioscoreaceae	Cl	W
<i>Diospyros cordifolia</i> Roxb.	Ebenaceae	T	W/C
<i>Diplocyclos palmatus</i> (L.) C. Jeffrey	Cucurbitaceae	Cl	W
<i>Dodonaea viscosa</i> Jacq.	Sapindaceae	S	W
<i>Echinochloa colona</i> (L.) Link.	Poaceae	H	W
<i>Eclipta prostrata</i> (L.) L.	Asteraceae	H	W
<i>Ehretia laevis</i> Roxb.	Boraginaceae	T	W
<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	H	W

Botanical name	Family	Habit	Source
<i>Epipremnum aureum</i> (L.) Engl.	Araceae	Cl	O
<i>Eranthemum pulchellum</i> Andr.	Acanthaceae	S	O
<i>Erigeron bonariensis</i> L.	Asteraceae	H	W
<i>Eruca sativa</i> Mill.	Brassicaceae	H	C
<i>Erythrina indica</i> L.	Fabaceae	T	C
<i>Euphorbia esula</i> M. Bieb.	Euphorbiaceae	H	W
<i>Euphorbia helioscopia</i> L.	Euphorbiaceae	H	W
<i>Euphorbia neriifolia</i> L.	Euphorbiaceae	S	W
<i>Euphorbia royleana</i> Boiss.	Euphorbiaceae	S	W
<i>Ficus benghalensis</i> L.	Moraceae	T	W/C
<i>Ficus carica</i> L.	Moraceae	T	W
<i>Ficus elastica</i> Roxb.	Moraceae	T	O
<i>Ficus glomerata</i> Roxb.	Moraceae	T	C
<i>Ficus infectoria</i> Roxb.	Moraceae	T	W/C
<i>Ficus palmata</i> Forsk.	Moraceae	S	W
<i>Ficus religiosa</i> L.	Moraceae	T	W/C
<i>Foeniculum vulgare</i> Mill.	Apiaceae	H	C
<i>Fumaria indica</i> Pugsf.	Fumariaceae	H	W
<i>Galium aparine</i> L.	Rubiaceae	H	W
<i>Geranium mascatense</i> Boiss.	Geraniaceae	H	W
<i>Geranium rotundifolium</i> L.	Geraniaceae	H	W
<i>Gossypium arboreum</i> L.	Malvaceae	S	C
<i>Heliotropium ellipticum</i> Ledeb.	Boraginaceae	H	W
<i>Heliotropium strigosum</i> Willd.	Boraginaceae	H	W
<i>Hemigraphis latebrosa</i> Nees.	Acanthaceae	H	W
<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.	Poaceae	H	W
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	S	O
<i>Holoptelea integrifolia</i> (Roxb.) Planch.	Ulmaceae	T	W/C
<i>Hydrilla verticillata</i> (L.f.) Royle	Hydrocharitaceae	H	W
<i>Hygrophila auriculata</i> (Schum.) Heyne.	Acanthaceae	H	W
<i>Hypericum cernuum</i> Roxb.	Hypericaceae	H	W
<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	Cl	W
<i>Ipomoea batatas</i> (L.) Lam.	Convolvulaceae	Cl	C
<i>Ipomoea nil</i> (L.) Roth.	Convolvulaceae	Cl	W
<i>Ipomoea palmata</i> Forssk.	Convolvulaceae	Cl	W
<i>Jasminum multiflorum</i> (Burm. f.) Andr.	Oleaceae	Cl	W
<i>Justicia adhatoda</i> L.	Acanthaceae	S	W
<i>Justicia procumbens</i> L.	Acanthaceae	H	W
<i>Lablab purpureus</i> (L.) Sweet	Fabaceae	Cl	C
<i>Lactuca dissecta</i> D. Don	Asteraceae	H	W
<i>Lactuca serriola</i> L.	Asteraceae	H	W
<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	Cl	C
<i>Lagerstroemia indica</i> L.	Lythraceae	S	O

Botanical name	Family	Habit	Source
<i>Lamium amplexicaule</i> L.	Lamiaceae	H	W
<i>Lathyrus aphaca</i> L.	Fabaceae	H	W
<i>Launaea nudicaulis</i> (L.) Hook. f.	Asteraceae	H	W
<i>Lawsonia inermis</i> L.	Lythraceae	S	C
<i>Lemna minor</i> L.	Lemnaceae	H	W
<i>Lens culinaris</i> Medik.	Fabaceae	H	C
<i>Leucas cephalotes</i> Spreng.	Lamiaceae	H	W
<i>Lindenbergia macrostachya</i> Benth.	Scrophulariaceae	H	W
<i>Linum usitatissimum</i> L.	Linaceae	H	C
<i>Loranthus falcatus</i> L. f.	Loranthaceae	Cl	W
<i>Luffa acutangula</i> (L.) Roxb.	Cucurbitaceae	Cl	C
<i>Luffa cylindrica</i> (L.) M. J. Roem.	Cucurbitaceae	Cl	C
<i>Lycopersicon esculentum</i> Mill.	Solanaceae	H	C
<i>Malcolmia africana</i> R. Br.	Brassicaceae	H	W
<i>Mallotus philippensis</i> (Lam.) Muell. Arg.	Euphorbiaceae	T	W
<i>Malva rotundifolia</i> L.	Malvaceae	H	W
<i>Mangifera indica</i> L.	Anacardiaceae	T	W/C
<i>Mazus pumilus</i> (Burm. f.) Steenis	Scrophulariaceae	H	W
<i>Medicago monantha</i> (C. A. Mey.) Trautv.	Fabaceae	H	W
<i>Medicago polymorpha</i> L.	Fabaceae	H	W
<i>Melia azedarach</i> L.	Meliaceae	T	W/C
<i>Melilotus indicus</i> (L.) All.	Fabaceae	H	W
<i>Mentha arvensis</i> L.	Lamiaceae	H	C
<i>Merremia hederacea</i> (Burm. f.) Hallier f.	Convolvulaceae	Cl	W
<i>Mollugo cerviana</i> (L.) Seringe	Aizoaceae	H	W
<i>Momordica charantia</i> L.	Cucurbitaceae	Cl	C
<i>Moringa oleifera</i> Lamk.	Moringaceae	T	C
<i>Morus alba</i> L.	Moraceae	T	W
<i>Morus indica</i> L.	Moraceae	T	W
<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	Cl	W
<i>Mukia maderaspatana</i> (L.) Cogn.	Cucurbitaceae	Cl	W
<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	S	W
<i>Musa paradisiaca</i> L.	Musaceae	H	C
<i>Nasturtium officinale</i> R. Br.	Brassicaceae	H	W
<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	H	W
<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Rubiaceae	T	O
<i>Nerium indicum</i> Mill.	Apocynaceae	S	O
<i>Nymphaea stellata</i> Willd.	Nymphaeaceae	H	W
<i>Nymphoides cristata</i> (Roxb.) Kuntz.	Menyanthaceae	H	W
<i>Ocimum sanctum</i> L.	Lamiaceae	H	C
<i>Oenothera laciniata</i> Hill.	Onagraceae	H	W
<i>Oplismenus burmannii</i> (Retz.) P. Beauv.	Poaceae	H	W

Botanical name	Family	Habit	Source
<i>Orobanche indica</i> Buch. Ham. ex Roxb.	Orobanchaceae	H	W
<i>Oryza sativa</i> L.	Poaceae	H	C
<i>Panicum virgatum</i> L.	Poaceae	H	W
<i>Pennisetum typhoides</i> Rich.	Poaceae	H	C
<i>Pentanema vestitum</i> (Wall.) Ling	Asteraceae	H	W
<i>Pergularia daemia</i> (Forsk.) Chiov.	Apocynaceae	Cl	W
<i>Phalaris minor</i> Retz.	Poaceae	H	W
<i>Phoenix dactylifera</i> L.	Arecaceae	T	W
<i>Phyllanthus emblica</i> L.	Euphorbiaceae	T	C
<i>Phyllanthus niruri</i> L.	Euphorbiaceae	H	W
<i>Phyllanthus virgatus</i> G. Forst.	Euphorbiaceae	H	W
<i>Physalis angulata</i> L.	Solanaceae	H	W
<i>Pimpinella major</i> (L.) Huds.	Apiaceae	H	W
<i>Pisum sativum</i> L.	Fabaceae	H	C
<i>Plumbago zeylanica</i> L.	Plumbaginaceae	H	W
<i>Pogostemon benghalensis</i> (Burm. f.) O.Kuntz.	Lamiaceae	S	W
<i>Polyalthia longifolia</i> (Sonn.) Thw.	Annonaceae	T	O
<i>Polygonum glabrum</i> Willd.	Polygonaceae	H	W
<i>Polygonum lapathifolium</i> L.	Polygonaceae	H	W
<i>Polygonum plebeium</i> R. Br.	Polygonaceae	H	W
<i>Polypogon monspeliensis</i> (L.) Desf.	Poaceae	H	W
<i>Pongamia pinnata</i> Pierre	Fabaceae	T	C
<i>Portulaca grandiflora</i> Hook.	Portulacaceae	H	O
<i>Portulaca pilosa</i> L.	Portulacaceae	H	W
<i>Pouzolzia pentandra</i> (Roxb.) Benn.	Urticaceae	H	W
<i>Prosopis cineraria</i> (L.) Druce	Fabaceae	T	W
<i>Psidium guajava</i> L.	Myrtaceae	T	C
<i>Pterospermum acerifolium</i> Willd.	Sterculiaceae	T	C
<i>Punica granatum</i> L.	Punicaceae	S	C
<i>Pupalia lappacea</i> (L.) Juss.	Amaranthaceae	H	W
<i>Putranjiva roxburghii</i> Wall.	Euphorbiaceae	T	C
<i>Ranunculus muricatus</i> L.	Ranunculaceae	H	W
<i>Ranunculus sceleratus</i> L.	Ranunculaceae	H	W
<i>Raphanus sativus</i> L.	Brassicaceae	H	C
<i>Rhynchosia capitata</i> DC.	Fabaceae	Cl	W
<i>Rhynchosia minima</i> (L.) DC.	Fabaceae	Cl	W
<i>Ricinus communis</i> L.	Euphorbiaceae	T	W
<i>Rosa alba</i> L.	Rosaceae	S	O
<i>Rosa indica</i> Hook. f.	Rosaceae	S	O
<i>Rosa moschata</i> Herrm.	Rosaceae	Cl	W
<i>Rumex dentatus</i> L.	Polygonaceae	H	W
<i>Rungia pectinata</i> (L.) Nees	Acanthaceae	H	W
<i>Saccharum bengalense</i> Retz.	Poaceae	H	W
<i>Saccharum officinarum</i> L.	Poaceae	H	C



Botanical name	Family	Habit	Source
<i>Salvia plebeia</i> R. Br.	Lamiaceae	H	W
<i>Saraca asoca</i> (Roxb.) De Wilde	Fabaceae	T	O
<i>Saussurea heteromalla</i> (D. Don) Hand.-Mazz.	Asteraceae	H	W
<i>Schleichera oleosa</i> (Lour.) Oken.	Sapindaceae	T	C
<i>Senna siamea</i> (Lam.) Irwin et Barneby	Fabaceae	T	C
<i>Sesamum indicum</i> L.	Pedaliaceae	S	C
<i>Sesbania bispinosa</i> (Jacq.) W. Wight	Fabaceae	S	W/C
<i>Setaria viridis</i> (L.) P. Beauv.	Poaceae	H	W
<i>Sida cordifolia</i> L.	Malvaceae	S	W
<i>Sida ovata</i> L.	Malvaceae	H	W
<i>Sida veronicaefolia</i> Lamk.	Malvaceae	S	W
<i>Silene conoidea</i> L.	Caryophyllaceae	H	W
<i>Sisymbrium irio</i> L.	Brassicaceae	H	W
<i>Smilax aspera</i> L.	Smilacaceae	Cl	O
<i>Solanum melongena</i> L.	Solanaceae	H	C
<i>Solanum torvum</i> Sw.	Solanaceae	S	W
<i>Solanum tuberosum</i> L.	Solanaceae	H	C
<i>Solanum virginianum</i> L.	Solanaceae	H	W
<i>Sorghum halepense</i> (L.) Pers.	Poaceae	H	W
<i>Sphenoclea zeylanica</i> Gaertn.	Sphenocleaceae	H	W
<i>Spinacia oleracea</i> L.	Amaranthaceae	H	C
<i>Stellaria media</i> (L.) Vill.	Caryophyllaceae	H	W
<i>Sterculia alata</i> Roxb.	Sterculiaceae	T	C
<i>Syzygium cuminii</i> (L.) Skeels.	Myrtaceae	T	W/C
<i>Tabernaemontana divaricata</i> (L.) R. Br.	Apocynaceae	S	O
<i>Tagetes erecta</i> L.	Asteraceae	H	O
<i>Tamarix dioica</i> Roxb.	Tamaricaceae	S	W
<i>Tectona grandis</i> L. f.	Verbenaceae	T	C
<i>Tephrosia purpurea</i> Pers.	Fabaceae	H	W

H - Herb; S - Shrub; T - Tree; Cl - Climber; C - Cultivated; W - Wild; O - Ornamental

*axillaris* is found in wet fields.

### Vegetation of arid and sandy area

The rivers and *cho* infested areas of Hoshiarpur and Nawanshahar Districts have vegetation that varies in different seasons, i.e., when there is flood or water, aquatic and marshy species dominate the flora and during dry conditions, the drought resistant species constitute the main vegetation. The species like *Saccharum spontaneum*, *Tamarix dioica*, *Cyprus spp*, *Verbascum thapsus*, *Verbesina encelioides*, *Datura innoxia*, *Polygonum spp.*, *Arnebia hispida*, *Argemone mexicana*, *Argemone ochroleuca*, *Alhagi pseudalhagi*,

Botanical name	Family	Habit	Source
<i>Terminalia arjuna</i> (Roxb. ex DC.) Wt. & Arn.	Combretaceae	T	C
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	T	C
<i>Terminalia chebula</i> Retz.	Combretaceae	T	C
<i>Tinospora cordifolia</i> (Wild.) Hook. f. et Thoms.	Menispermaceae	Cl	W
<i>Toona ciliata</i> M.Roem.	Meliaceae	T	W/C
<i>Trapa natans</i> var. <i>bispinosa</i> (Roxb.) Makino	Lythraceae	H	W
<i>Trianthema portulacastrum</i> L.	Aizoaceae	H	W
<i>Trichodesma indicum</i> R. Br.	Boraginaceae	H	O
<i>Trichosanthes cucumerina</i> L.	Cucurbitaceae	Cl	W
<i>Trigonella corniculata</i> (L.) L.	Fabaceae	H	C
<i>Trigonella foenum-graecum</i> L.	Fabaceae	H	C
<i>Triticum aestivum</i> L.	Poaceae	H	C
<i>Triumfetta tomentosa</i> Bojer.	Tiliaceae	S	W
<i>Vallis solanacea</i> (Roth.) O. Ktze.	Apocynaceae	Cl	W
<i>Verbascum chinense</i> (L.) Santapau	Scrophulariaceae	H	W
<i>Verbascum thapsus</i> L.	Scrophulariaceae	H	W
<i>Vernonia cinerea</i> Less.	Asteraceae	H	W
<i>Veronica agrestis</i> L.	Scrophulariaceae	H	W
<i>Veronica anagallis-aquatica</i> L.	Scrophulariaceae	H	W
<i>Vicia hirsuta</i> L.	Fabaceae	Cl	W
<i>Vicia sativa</i> L.	Fabaceae	Cl	W
<i>Vigna mungo</i> (L.) Hepper	Fabaceae	H	C
<i>Vigna radiata</i> (L.) R. Wilczek	Fabaceae	H	C
<i>Vitex negundo</i> L.	Verbenaceae	T	W/C
<i>Withania somnifera</i> Dunal.	Solanaceae	S	W
<i>Woodfordia fruticosa</i> Kurz.	Lythraceae	S	W
<i>Zingiber officinale</i> Rosc.	Zingiberaceae	H	C
<i>Zizyphus jujuba</i> Lam.	Rhamnaceae	T	W
<i>Zizyphus nummularia</i> (Burm. f.) Wt. & Arn.	Rhamnaceae	S	W

*Tephrosia purpurea*, *Calotropis procera*, *Alternanthera sessilis*, *Citrullus colocynthis* are growing in these areas. *Saccharum bengalense* is found in arid areas. Similarly, *Verbesina encelioides* was common in arid sandy areas of District Kapurthala.

### Vegetation of Kandi area (hilly tract)

Parts of Hoshiarpur and Nawanshahar Districts along the Shivalik Hills have rich and dense vegetation. The main tree species of this area include *Acacia catechu*, *A. modesta*, *A. nilotica* *Holoptelea integrifolia*, *Grevillea robusta*, *Melia azedarach*, *Mangifera indica*, *Toona ciliata*, *Albizia lebbek*, *Leucaena leucocephala* etc.

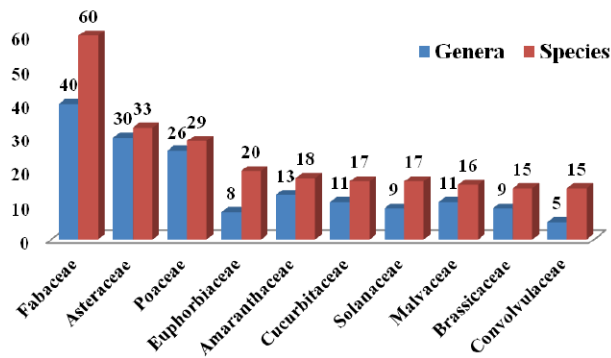


Figure 2. Dominant families with number of genera and species

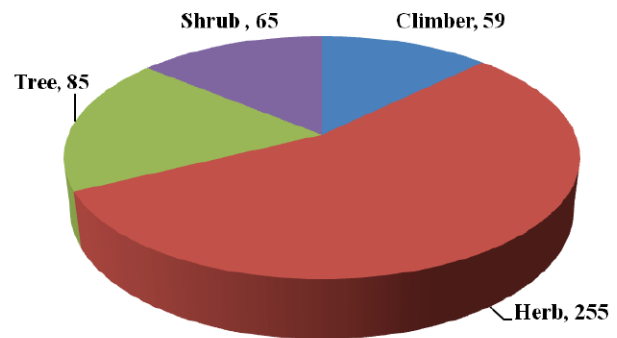


Figure 3. Different life forms of recorded species

Similarly, *Carissa spinarum*, *Lantana camara*, *Jatropha curcas*, *Zizyphus nummularia*, *Murraya koenigii*, *Pogostemon benghalensis*, *Solanum aculeatissimum*, *Justicia adhatoda*, *Barleria cristata*, *Senna occidentalis* are the major shrubs. The herbs are comprised of *Ageratum conyzoides*, *Xanthium strumarium*, *Aerva japonica*, *Geranium rotundifolium*, *Achyranthes aspera*, *Silybum marianum*, *Saussurea heteromalla*, *Withania somnifera*. Some climbers included *Cuscuta reflexa*, *Tinospora cordifolia*, *Vallaris solanacea*, *Bougainvillea spectabilis*, *Cissampelos pareira*, *Convolvulus arvensis*, *Mucuna pruriens* and *Ipomoea palmata*. *Loranthus falcatus* and *Abrus precatorius* are the two climbers reported only from the Hilly tract or Kandi area. *Bougainvillea spectabilis* is a very common woody climber in this area. Previously, 526 species of angiosperms were reported from the Shivalik region of Punjab by Jerath et al. (2006).

#### Vegetation of agriculture fields

Punjab is an agriculture State where two main types of crops, i.e., 'Kharif' and 'Rabi' are cultivated. Besides these, some fruits, vegetables and spices are also grown in the State. The Kharif crops included *Oryza sativa*, *Pennisetum typhoides*, *Sorghum vulgare*, *Zea mays* etc. Major weeds of this season are *Commelina benghalensis*, *C. diffusa*, *Physalis angulata*, *Anisomeles indica*, *Trianthema portulacastrum*, *Caesulia axillaris*, *Cucumis callosus*, *Phyla nodiflora*, *Portulaca* spp., *Triumfetta tomentosa* and *Cleome viscosa*. *Basella rubra*, *Mukia maderaspatana*, *Ipomoea nil*, *Coccinia indica*, etc. are some of the climbers.

*Triticum aestivum*, *Hordeum vulgare*, *Brassica campestris*, *Linum usitatissimum*, *Lens culinaris*, *Pisum sativum*, *Trigonella foenum-graecum*, *Trifolium alexandrinum*, *T. resupinatum* etc. are the Rabi crops. The main weeds of these crops are *Fumaria indica*, *Coronopus didymus*, *Lathyrus aphaca*, *Silene conoidea*,

*Tribulus terrestris*, *Trifolium tomentosum*, *Cichorium intybus*, *Cirsium arvense*, *Melilotus alba*, *M. indicus*, *Medicago polymorpha*, *Vicia sativa*, *Stellaria media*, *Phalaris minor*, *Anagallis arvensis*, *Gnaphalium indicum*, *Sisymbrium irio*.

The vegetables like *Allium cepa*, *A. sativum*, *Daucus carota*, *Brassica rapa*, *Brassica oleracea* var. *botrytis*, *Brassica oleracea* var. *capitata*, *Raphanus sativus*, *Coriandrum sativum*, *Spinacia oleracea*, *Curcuma longa*, *Solanum tuberosum*, *Pisum sativum* etc. are grown in winter whereas the summer vegetables include *Momordica charantia*, *Luffa cylindrica*, *Citrullus fistulosus*, *Lagenaria vulgaris*, *Cucurbita pepo*, *C. moschata*, *Abelmoschus esculentum*, *Capsicum annum*, *Lycopersicon esculentum*, *Solanum melongena* etc. In addition to *Dalbergia sissoo*, *Toona ciliata*, *Melia azedarach*, *Tectona grandis*, *Populus* and *Eucalyptus* species are also grown as agroforestry trees.

#### Fruit species

The orchards of *Mangifera indica*, *Psidium guajava*, *Litchi chinensis*, *Prunus persica* and many *Citrus* species are grown in the study area. *Mangifera indica* and *Citrus reticulata* (Kinnow) Orchards are very common in Hoshiarpur District. Besides this, *Psidium guajava*, *Syzygium cuminii*, *Prunus persica*, *Phyllanthus emblica*, *Carica papaya*, *Punica granatum*, *Citrus* spp, *Eriobotrya japonica*, *Zizyphus jujuba*, *Vitis vinifera* and *Musa paradisiaca* are also grown in kitchen gardens, farm houses and on the boundaries of the agriculture fields.

#### Avenue trees

These are grown along the road sides, canals, parks, gardens, institutes, industries, government organizations, hospitals. The common avenue trees are *Delonix regia*, *Polyalthia longifolia*, *Roystonea regia*, *Jacaranda mimosifolia*, *Bauhinia acuminata*, *B. variegata*, *Cassia*

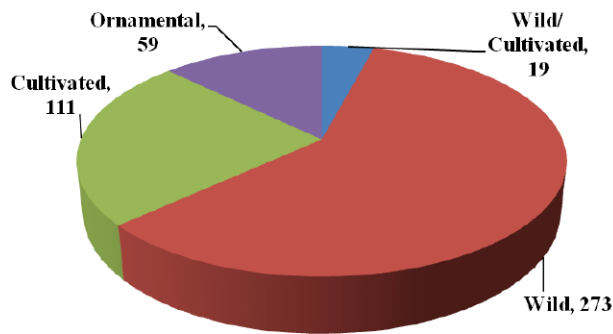


Figure 4. Source of documented species

*fistula*, *Casuarina equisetifolia*, *Crataeva religiosa*, *Albizia lebbeck*, *Azadirachta indica*, *Dalbergia sissoo*, *Grevillea robusta*, *Leucaena leucocephala*, *Terminalia arjuna*, *Melia azedarach*, *Eucalyptus spp*, *Vitex negundo*, *Butea monosperma*, *Callistemon lanceolatus*. Some species like *Calliandra haematocephala*, *Nerium indicum*, *Thevetia nerifolia*, *Agave americana* are also grown as road dividers.

#### Grasses

Most of the land is under agriculture practices. The common species of grasses are *Bothriochloa pertusa*, *Brachiaria ramosa*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Digitaria longiflora*, *Eleusine indica*, *Heteropogon contortus*, *Oplismenus burmannii*, *Setaria viridis*, *Polypogon monspeliensis*, *Echinochloa colona*, *Paspalum paspaloides*, *Panicum virgatum* and *Poa annua*.

#### Medicinal plant species

The Angiosperms recorded from the Doaba region include several species of medicinal importance. Most of these species are used in traditional home remedies and also in ayurvedic preparations for the treatment of various ailments. Some common species include *Achyranthes aspera*, *Aegle marmelos*, *Calotropis procera*, *Azadirachta indica*, *Cuscuta reflexa*, *Datura innoxia*, *Eclipta prostrata*, *Euphorbia hirta*, *Euphorbia prostrata*, *Justicia adhatoda*, *Terminalia sp.*, *Phyllanthus emblica*, *Murraya koenigii*, *Ricinus communis*, *Solanum nigrum*, *Tinospora cordifolia*, *Tribulus terrestris*, *Vitex negundo* and *Withania somnifera*.

#### Widespread species

These species were recorded from all the sites and present in abundance. The main species under this category are *Achyranthes aspera*, *Arundo donax*, *Cynodon dactylon*, *Lantana camara*, *Parthenium*

*hysterophorus*, *Ricinus communis*. These species remain available almost throughout the year and spread in the whole study area. Some other species like *Ageratum conyzoides*, *Anagallis arvensis*, *Cannabis sativa*, *Chenopodium album*, *Cirsium arvense*, *Coronopus didymus*, *Fumaria indica*, *Malva rotundifolia*, *Senna occidentalis*, *Silene conoidea*, *Sisymbrium irio* and *Stellaria media* were present in abundance but only during their respective growing seasons.

#### Common species

The species of this category were also growing at most of the sites but less in number. These species are *Amaranthus viridis*, *Anisomeles indica*, *Argemone mexicana*, *Artemisia scoparia*, *Boerhavia diffusa*, *Bougainvillea spectabilis*, *Calotropis procera*, *Canna indica*, *Chenopodium ambrosioides*, *Cichorium intybus*, *Coccinia grandis*, *Commelina benghalensis*, *Convolvulus arvensis*, *Coronopus didymus*, *Eclipta alba*, *Erigeron bonariensis*, *Euphorbia helioscopia*, *E. hirta*, *E. prostrata*, *Galium aparine*, *Gnaphalium indicum*, *Ipomoea carnea*, *Mazus rugosus*, *Medicago polymorpha*, *Melilotus indica*, *Oxalis corniculata*, *Peristrophe bicalyculata*, *Phalaris minor*, *Physalis angulata*, *Polygonum plebeium*, *Ranunculus sceleratus*, *Rumex dentatus*, *Sida acuta*, *Solanum nigrum*, *Sonchus oleraceus*, *Trifolium tomentosum*, *Urena lobata*, *Vicia sativa* and *Xanthium strumarium*.

#### Rare species

The species which were reported only from one or two site are placed in this category. Only one plant of *Arnebia hispidissima* was observed at single site each in Nawanshahar and Kapurthala Districts. *Euphorbia esula* and *Oenothera laciniata* were reported only from a single site in Jalandhar District whereas, *Emex spinosa* from two places in Districts Jalandhar and Kapurthala. Other species such as *Lactuca dissecta*, *Lindenbergia macrostachya*, *Loranthus falcatus*, *Rhynchosia tomentosa*, *Solanum verbascifolium*, *Cyathula tomentosa*, *Mollugo cerviana* and *Campanula pallida* were reported only from the Kandi area.

#### CONCLUSION

During present study, 464 species of angiosperms belonging to 337 genera and 99 families have been documented and identified. The family Fabaceae contain maximum number of species (60) followed by Asteraceae (33) and Poaceae (29). More than 50% of

Table 2. List of non-native plant species naturalized in the study area

Botanical name	Family	Habit	Source
<i>Acacia auriculiformis</i> A. Cunn.	Fabaceae	T	W/C
<i>Agave americana</i> L.	Agavaceae	H	O
<i>Ageratum conyzoides</i> L.	Asteraceae	H	W
<i>Allamanda cathartica</i> L.	Apocynaceae	Cl	O
<i>Allium sativum</i> L.	Amaryllidaceae	H	C
<i>Aloe vera</i> Tourn. ex Linn.	Xanthorrhoeaceae	H	O
<i>Alternanthera brasiliana</i> (L.) O. Kuntze	Amaranthaceae	H	O
<i>Alternanthera philoxeroides</i> Griseb.	Amaranthaceae	H	W
<i>Alternanthera pungens</i> H. B. & K.	Amaranthaceae	H	W
<i>Althaea rosea</i> Cav.	Malvaceae	H	O
<i>Arachis hypogaea</i> L.	Fabaceae	H	C
<i>Argemone mexicana</i> L.	Papaveraceae	H	W
<i>Bassia scoparia</i> (L.) A. J. Scott.	Amaranthaceae	H	O
<i>Bidens pilosa</i> L.	Asteraceae	H	W
<i>Bignonia capreolata</i> L.	Bignoniaceae	Cl	O
<i>Boerhavia chinensis</i> L.	Nyctaginaceae	Cl	W
<i>Bougainvillea spectabilis</i> Willd.	Nyctaginaceae	Cl	W/O
<i>Brassica rapa</i> L.	Brassicaceae	H	C
<i>Broussonetia papyrifera</i> Vent.	Moraceae	T	W
<i>Bryophyllum pinnatum</i> (Lam.) Kurz.	Crassulaceae	H	O
<i>Calliandra haematocephala</i> Hassk	Fabaceae	T	O
<i>Callistemon lanceolatus</i> DC.	Myrtaceae	T	O
<i>Calyptracarpus vialis</i> Less.	Asteraceae	H	W
<i>Canna indica</i> L.	Cannaceae	H	W
<i>Capsicum annum</i> L.	Solanaceae	H	C
<i>Chenopodium murale</i> (L.) S. Fuentes, Uotila & Borsch	Amaranthaceae	H	W
<i>Cichorium intybus</i> L.	Asteraceae	H	W
<i>Cinnamomum camphora</i> (L.) J. Presl.	Lauraceae	T	C
<i>Cissampelos pareira</i> L.	Menispermaceae	Cl	W
<i>Clerodendrum splendens</i> G. Don.	Verbenaceae	Cl	O
<i>Consolida ajacis</i> (L.) Schur	Ranunculaceae	H	O
<i>Crassula</i> sps.	Crassulaceae	S	O
<i>Cuscuta campestris</i> Yuncker	Convolvulaceae	Cl	W
<i>Cyperus difformis</i> L.	Cyperaceae	H	W
<i>Dactyloctenium aegyptium</i> (L.) Willd.	Poaceae	H	W
<i>Delonix regia</i> (Boj.) Raf.	Fabaceae	T	O
<i>Dombeya cayeuxii</i> Hort.	Sterculiaceae	T	C
<i>Duranta repens</i> L.	Verbenaceae	S	O
<i>Dysphania ambrosioides</i> (L.) Mosy. & Clem.	Amaranthaceae	H	W
<i>Eichhornia crassipes</i> Solms.	Pontederiaceae	H	W

Botanical name	Family	Habit	Source
<i>Emex spinosa</i> (L.) Campd.	Polygonaceae	H	W
<i>Emilia sonchifolia</i> DC.	Asteraceae	H	W
<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Rosaceae	T	C
<i>Eucalyptus</i> sps.	Myrtaceae	T	W/C
<i>Eupatorium cannabinum</i> L.	Asteraceae	H	W
<i>Euphorbia cyathophora</i> Murray	Euphorbiaceae	H	W
<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	H	W
<i>Euphorbia hirta</i> L.	Euphorbiaceae	H	W
<i>Euphorbia hypericifolia</i> L.	Euphorbiaceae	H	W
<i>Euphorbia milii</i> var. <i>splendens</i> (Bojer ex Hook.)	Euphorbiaceae	H	O
<i>Euphorbia prostrata</i> Ait.	Euphorbiaceae	H	W
<i>Euphorbia pulcherrima</i> Willd. ex Klotz.	Euphorbiaceae	S	O
<i>Evolvulus alsinoides</i> L.	Convolvulaceae	H	W
<i>Evolvulus nummularius</i> L.	Convolvulaceae	H	W
<i>Glycine max</i> Merrill.	Fabaceae	H	C
<i>Gnaphalium indicum</i> L.	Asteraceae	H	W
<i>Gomphrena celosioides</i> Martius.	Amaranthaceae	H	W
<i>Gossypium hirsutum</i> L.	Malvaceae	S	C
<i>Grevillea robusta</i> A. Cunn.	Proteaceae	T	C
<i>Helianthus annuus</i> L.	Asteraceae	H	C
<i>Hippeastrum</i> sps.	Amaryllidaceae	H	O
<i>Hordeum vulgare</i> L.	Poaceae	H	C
<i>Indigofera linifolia</i> (L.f.) Retz.	Fabaceae	H	W
<i>Indigofera tinctoria</i> L.	Fabaceae	S	W
<i>Ipomoea carnea</i> Jacq.	Convolvulaceae	S	W
<i>Ipomoea grandifolia</i> (Dammer) O' Donell	Convolvulaceae	Cl	W
<i>Ipomoea pes-tigridis</i> L.	Convolvulaceae	Cl	W
<i>Ipomoea quamoclit</i> L.	Convolvulaceae	Cl	O
<i>Jacaranda mimosifolia</i> D. Don	Bignoniaceae	T	C
<i>Jasminum mesnyi</i> Hance	Oleaceae	Cl	C
<i>Jatropha curcas</i> L.	Euphorbiaceae	S	W
<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	T	C
<i>Lantana camara</i> L.	Verbenaceae	S	W
<i>Lepidium sativum</i> L.	Brassicaceae	H	W
<i>Lepidium virginicum</i> L.	Brassicaceae	H	W
<i>Leucaena leucocephala</i> (Lamk.) de Wit.	Fabaceae	T	W
<i>Litchi chinensis</i> Sonn.	Sapindaceae	T	C
<i>Ludwigia perennis</i> L.	Onagraceae	H	W
<i>Malvastrum coromandelianum</i> (L.) Garcke.	Malvaceae	S	W
<i>Malvaviscus arboreus</i> Cav.	Malvaceae	S	O
<i>Matthiola incana</i> R. Br.	Brassicaceae	H	W
<i>Melaleuca linariifolia</i> Sm.	Myrtaceae	T	C

Botanical name	Family	Habit	Source
<i>Melilotus albus</i> Medik.	Fabaceae	H	W
<i>Melochia corchorifolia</i> L.	Malvaceae	S	W
<i>Mentha piperita</i> L.	Lamiaceae	H	C
<i>Mirabilis jalapa</i> L.	Nyctaginaceae	H	O
<i>Misopates orontium</i> (L.) Raf.	Plantaginaceae	H	W
<i>Nicotiana plumbaginifolia</i> Viv.	Solanaceae	H	W
<i>Nicotiana tabacum</i> L.	Solanaceae	H	W
<i>Oligomeris linifolia</i> (Vahl ex Hornem.) J. F. Macbr.	Resedaceae	H	W
<i>Opuntia dillenii</i> Haw.	Cactaceae	S	W
<i>Oxalis corniculata</i> L.	Oxalidaceae	H	W
<i>Oxalis debilis</i> var. <i>corymbosa</i> (DC.) Lourteig	Oxalidaceae	H	W
<i>Papaver rhoeas</i> L.	Papaveraceae	H	O
<i>Parkinsonia aculeata</i> L.	Fabaceae	T	W
<i>Parthenium hysterophorus</i> L.	Asteraceae	H	W
<i>Paspalum paspaloides</i> (Michx.) Lams.	Poaceae	H	W
<i>Pedilanthus tithymaloides</i> Poit.	Euphorbiaceae	H	O
<i>Peristrophe bicalyculata</i> (Retz.) Nees.	Acanthaceae	H	W
<i>Petunia hybrida</i> Vilm.	Solanaceae	H	O
<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	H	W
<i>Plumeria alba</i> L.	Apocynaceae	T	O
<i>Poa annua</i> L.	Poaceae	H	W
<i>Populus angustifolia</i> James	Salicaceae	T	C
<i>Portulaca oleracea</i> L.	Portulacaceae	H	W
<i>Portulaca quadrifida</i> L.	Portulacaceae	H	W
<i>Prunus persica</i> Batsch.	Rosaceae	T	C
<i>Rhamnus cathartica</i> L.	Rhamnaceae	T	W
<i>Rhynchosia tomentosa</i> (L.) Hook. & Arn.	Fabaceae	H	W
<i>Roystonea regia</i> O. f. Cook.	Arecaceae	T	O
<i>Saccharum spontaneum</i> L.	Poaceae	H	W
<i>Salix babylonica</i> L.	Salicaceae	T	C
<i>Sansevieria trifasciata</i> Prain	Asparagaceae	H	O
<i>Senna occidentalis</i> (L.) Link.	Fabaceae	S	W
<i>Senna tora</i> (L.) Roxb.	Fabaceae	S	W

Botanical name	Family	Habit	Source
<i>Sida acuta</i> Burm. f.	Malvaceae	S	W
<i>Silybum marianum</i> Gaertn.	Asteraceae	H	W
<i>Solanum aculeatissimum</i> Jacq.	Solanaceae	S	W
<i>Solanum nigrum</i> L.	Solanaceae	H	W
<i>Solanum verbascifolium</i> L.	Solanaceae	S	W
<i>Sonchus asper</i> Hill.	Asteraceae	H	W
<i>Sonchus oleraceus</i> L.	Asteraceae	H	W
<i>Sorghum bicolor</i> (L.) Moench.	Poaceae	H	C
<i>Spergula arvensis</i> L.	Caryophyllaceae	H	W
<i>Swietenia macrophylla</i> King.	Meliaceae	T	C
<i>Tamarindus indica</i> L.	Fabaceae	T	C
<i>Tecoma capensis</i> Lindl.	Bignoniaceae	Cl	O
<i>Tecoma stans</i> (L.) H. B. & K.	Bignoniaceae	S	O
<i>Thevetia peruviana</i> (Pers.) K. Schum.	Apocynaceae	T	O
<i>Torenia cordifolia</i> Roxb.	Scrophulariaceae	H	W
<i>Tradescantia pallida</i> (Rose) D. R. Hunt	Commelinaceae	H	O
<i>Tribulus terrestris</i> L.	Zygophyllaceae	H	W
<i>Tridax procumbens</i> L.	Asteraceae	H	W
<i>Trifolium alexandrinum</i> L.	Fabaceae	H	C
<i>Trifolium campestre</i> Schreb.	Fabaceae	H	W
<i>Trifolium resupinatum</i> L.	Fabaceae	H	C
<i>Trifolium tomentosum</i> L.	Fabaceae	H	W
<i>Tropaeolum majus</i> L.	Tropaeolaceae	Cl	O
<i>Typha angustata</i> Bory & Chaub.	Typhaceae	H	W
<i>Urena lobata</i> L.	Malvaceae	S	W
<i>Verbesina encelioides</i> (Cav.) Benth. & Hook. f. ex A. Gray	Asteraceae	H	W
<i>Vicia faba</i> L.	Fabaceae	H	C
<i>Viola wittrockiana</i> Gams.	Violaceae	H	O
<i>Vitis vinifera</i> L.	Vitaceae	Cl	C
<i>Xanthium strumarium</i> L.	Asteraceae	S	W
<i>Youngia japonica</i> (L.) DC.	Asteraceae	H	W
<i>Zea mays</i> L.	Poaceae	H	C
<i>Zephyranthes rosea</i> Lindl.	Amaryllidaceae	H	O

H - Herb; S - Shrub; T - Tree; Cl - Climber; C - Cultivated; W - Wild; O - Ornamental

these species (255) were herbs followed by trees (85), shrubs (65) and climbers (59). The documented species included 273 wild, 111 cultivated, 59 ornamental and 19 both wild as well as cultivated. Out of the four Districts (Hoshiarpur, Nawanshahar, Jalandhar and Kapurthala) of Doaba region of Punjab, two districts, i.e., Hoshiarpur and Nawanshahar have more angiosperm diversity than the remaining two Districts. This is likely be due

to geographical variations prevailing in the concerned areas. The reason for lesser Diversity in Jalandhar and Kapurthala Districts may be due to more urbanization, industrialization and land leveling for various other purposes. *Ageratum*, *Lantana* and *Parthenium* are exotic weeds thus require immediate attention to conserve the floristic diversity. Some species like *Alhagi pseudalhagi*, *Asphodelus tenuifolius* and *Tribulus terrestris* are need

Table 3. Distribution of species among different families

Family	Species	Family	Species	Family	Species	Family	Species
Acanthaceae	9	Casuarinaceae	1	Menispermaceae	2	Resedaceae	1
Agavaceae	1	Chenopodiaceae	1	Menyanthaceae	1	Rhamnaceae	3
Aizoaceae	2	Combretaceae	3	Moraceae	11	Rosaceae	5
Amaranthaceae	18	Commelinaceae	3	Moringaceae	1	Rubiaceae	3
Amaryllidaceae	4	Convolvulaceae	15	Musaceae	1	Rutaceae	5
Anacardiaceae	1	Crassulaceae	2	Myrtaceae	5	Salicaceae	2
Annonaceae	1	Cucurbitaceae	17	Nelumbonaceae	1	Sapindaceae	4
Apiaceae	6	Cyperaceae	2	Nyctaginaceae	4	Scrophulariaceae	8
Apocynaceae	14	Dioscoreaceae	1	Nymphaeaceae	1	Smilacaceae	1
Araceae	2	Ebenaceae	1	Oleaceae	2	Solanaceae	17
Arecaceae	2	Euphorbiaceae	20	Onagraceae	2	Sphenocleaceae	1
Asparagaceae	2	Fabaceae	60	Orobanchaceae	1	Sterculiaceae	3
Asteraceae	33	Fumariaceae	1	Oxalidaceae	2	Tamaricaceae	1
Basellaceae	1	Gentianaceae	1	Papaveraceae	3	Tiliaceae	2
Bignoniaceae	5	Geraniaceae	2	Pedaliaceae	1	Tropaeolaceae	1
Bombacaceae	1	Hydrocharitaceae	1	Plantaginaceae	1	Typhaceae	1
Boraginaceae	7	Hypericaceae	1	Plumbaginaceae	1	Ulmaceae	1
Brassicaceae	15	Lamiaceae	9	Poaceae	29	Urticaceae	1
Cactaceae	1	Lauraceae	1	Polygonaceae	5	Verbenaceae	7
Campanulaceae	1	Lemnaceae	1	Pontederiaceae	1	Violaceae	1
Cannabaceae	1	Linaceae	1	Portulacaceae	4	Vitaceae	2
Cannaceae	1	Loranthaceae	1	Primulaceae	1	Xanthorrhoeaceae	2
Capparidaceae	2	Lythraceae	4	Proteaceae	1	Zingiberaceae	2
Caricaceae	1	Malvaceae	16	Punicaceae	1	Zygophyllaceae	1
Caryophyllaceae	3	Meliaceae	5	Ranunculaceae	3		

to be conserved. Present study has highlighted concerns that require immediate attention to conserve the floristic diversity.

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Images 1–8. Native plant species of Doaba region of Punjab: 1 - *Abrus precatorius*; 2 - *Alhagi pseudalhagi*; 3 - *Argemone ochroleuca*; 4 - *Centaurium pulchellum*; 5 - *Cirsium falconeri*; 6 - *Ehretia laevis*; 7 - *Erythrina indica*; 8 - *Euphorbia esula*. © Authors.



Images 9–16. 9 - *Geranium rotundifolium*; 10 - *Heliotropium ellipticum*; 11 - *Heliotropium strigosum*; 12 - *Hemigraphis latebrosa*; 13 - *Holoptelea integrifolia*; 14 - *Leucas cephalotes*; 15 - *Lindenbergia macrostachya*; 16 - *Mallotus philippensis*. © Authors.



Images 17–24. 17 - *Merremia hederacea*; 18 - *Mukia maderaspatana*; 19 - *Nymphoides cristata*; 20 - *Oenothera laciniata*; 21 - *Pogostemon benghalensis*; 22 - *Sphenoclea zeylanica*; 23 - *Trichosanthes cucumerina*; 24 - *Veronica agrestis*. © Authors.

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