

DISTRIBUTION PATTERN AND ECOLOGY OF *LACTUCA* L. AND ITS ALLIED GENERA (*LACTUCINEAE* – *CICHORIEAE*) IN PAKISTAN AND KASHMIR

ROOHI ABID AND M. QAISER

Center for Plant Conservation, University of Karachi, Pakistan
*Corresponding author's email: rbanoabid@gmail.com

Abstract

Distribution pattern and ecological preference for habitat including altitude and soil of *Lactuca* L. (s. str.) and allied genera viz. *Steptorrhampus*, *Cephalorhynchus* and *Melanoseris* have been studied in Pakistan and Kashmir. All the taxa belonging to these genera are mostly confined to high mountain ranges in Pakistan and Kashmir. Out of 33 taxa, two taxa belonging to *Lactuca* are subcosmopolitan. The seven taxa are Irano – Turanian (Central Asian) elements of which 2 belong to *Lactuca* and 2 to *Steptorrhampus* and 3 belong to *Cephalorhynchus*. There are 8 Sino – Japanese elements of which one belongs to *Lactuca* and 7 belong to *Melanoseris*. However, 3 more taxa viz. *M. rapunculoides*, *M. decipiens* var. *decipiens* and *M. decipiens* var. *multifida* are also tentatively recognized as Sino – Japanese elements. Beside these 4 taxa are biregional, of which 3 *Lactuca* species are Mediterranean – Irano – Turanian elements whereas *L. tatarica* is an Irano-Turanian - Euro-Siberian element. There are 13 taxa which are endemic to subendemic, most of these are endemic to Pakistan (Western Himalayas and mostly known from type locality). However, *M. gilgitensis* seems to be confined to Karakorum Mountains and 2 species viz. *M. alii* and *M. astorensis* occur in Western Himalayas and Karakorum. It is difficult to classify these taxa into definite phytogeographical elements until more information is available.

Key words: *Phytogeographical analysis, Ecology, Lactuca, Cichorieae, Pakistan, Kashmir*

Introduction

Tribe Cichorieae (Lactuceae) is predominantly distributed in Europe, Africa, Asia and North America (Kilian *et al.*, 2009). The *Lactuca* alliance comprises of approximately 200 species and the main Centres of diversity are South-West Asia – East Mediterranean region and the others are China and the adjacent Himalayan region (Wang *et al.*, 2013; Kilian *et al.*, 2017) and its origin is estimated at around 26 (23.2-30.3 mya) (Tremetsberger *et al.*, 2012).

The majority of the *Lactuca* L. (s.str.) species and its allied genera are xerophytes, found in dry climatic conditions or moderately humid areas with a preference of montane habitat. They are almost absent from the humid tropics and aquatic habitats (Stebbins, 1937; Dethier, 1982; Bremer, 1994; Lack, 2007) and the main areas of concentration are Southwest Asia including Central Asian region (Irano – Turanian), eastern Mediterranean, Sino – Himalayan and Sino Japanese regions.

Phytogeographical studies play a significant role in tracing the origin, range of distribution and evolution. However, the phytogeographical terms which are in use for the last 5–6 decades are quite subjective as they have been used by different authors in different ways. For instance the highlands of South West Asia are recognized as Irano – Turanian phytogeographical region and the upper belt of the mountainous area is recognized as Central Asian region. Similarly Saharo Sindian region recognized by the previous workers (Boissier, 1867; Eig, 1931), is a huge region stretching from the Atlantic coast of North Africa to Sindh (Pakistan) and Rajahastan (India) through entire Sahara, Sinai and Arabia. However, Zohary (1973) and some other workers did not consider it as a single entity and recognized 2 or 3 regions Saharo-Arabian and Sudanian region based on climate, phasiognomy and some key species.

There are few general reports on the phytogeographical studies and floristic analysis of Pakistan and Kashmir flora. For instance, Takhtajan (1986) recognized 5 floristic provinces of Pakistan namely Sindian, Southern Iranian, Northern Baluchistan, Western Himalayan and Tibetan Province. Ali & Qaiser (1986) in their phytogeographical analysis of Phanerogams of Pakistan and Kashmir recognized 4 phytogeographic regions viz., Irano Turanian, Saharo Sindian (Western and Eastern subregions), Sino Japanese and Indian. They also showed that highest floristic elements in flora of Pakistan and Kashmir were Irano Turanian (45.6%) and the lowest were Indian (4.5%).

Some reports are available on the geographical distribution and ecology of some taxa belonging to Asteraceae particularly Lactuceae (Cichorieae) from different regions of the world. Jeffrey (1975) discussed the taxonomy and distribution pattern of all the members of the tribe Lactuceae and also prepared distribution maps of most of the taxa. Prince *et al.*, (1985) studied the geographical distribution of Prickly lettuce i.e., *Lactuca serriola* L. indicating the distribution limit of *Lactuca serriola* L. in Britain. Tomb (1977) studied the systematics and phylogeny of the tribe Lactuceae and also discussed geographical distribution and species richness of the tribe Lactuceae. He recognized 3 centers of distribution of the tribe Lactuceae viz., Central Asia (22 genera), the Mediterranean Basin (23 genera) and Western North America (18 genera). Bremer (1994) also studied the geographical distribution and ecology of the tribe Lactuceae. Rao & Dutt (1996) studied the diversity, endemism and phytogeographical affinities of the some Indian compositae along with the biogeographical regions of India. Lebeda *et al.*, (2001) studied the geographical distribution, ecology and biodiversity of wild *Lactuca* L. species from 7 countries of Europe namely Austria, Czech Republic, France, German, Italy, Netherlands and Switzerland. They found maximum diversity in France. The most characteristic habitats with a high density of wild

Lactuca L. species were observed along the roads, highways, grassy ditches, ruderal communities and desert heaps. Lebeda *et al.*, (2004) also provided an outline of the distribution pattern of all the Wild *Lactuca* L. species based on available literature along with species richness viz., in Europe (17 species), in Asia (51 species), in Africa (43 species) and in America (12 species) mostly in the North America. Lebeda *et al.*, (2009) divided the genus *Lactuca* into 7 sections based on taxonomic and biogeographic criterion. Recently Wang *et al.*, (2013) constructed a phylogenetic tree based on molecular data of the *Lactuca* alliance with focusing Chinese centre of diversity. Kilian *et al.*, (2017) provided the nine well supported clades of *Lactuca* alliance based on phylogentic (nrITS and plastid DNA) and biogeographical analysis.

There are no comprehensive reports available on the distribution pattern and phylogeographical analysis of the genus *Lactuca* and its allied genera viz., *Steptorrhampus*, *Cephalorhynchus* and *Melanoseris* for Pakistan and Kashmir. In the absence of any comprehensive report on the distribution pattern of *Lactuca* L. (s.str.) and its allied genera of Pakistan and Kashmir, the present work was undertaken to fill this gap. Hence, detailed distribution pattern and ecology of *Lactuca* and allied genera *Steptorrhampus*, *Cephalorhynchus* and *Melanoseris* in Pakistan and Kashmir was traced with the help of herbarium specimens, literature and field observations.

Material and Methods

The local (Pakistan and Kashmir) and worldwide distribution pattern of all the taxa belonging to *Lactuca* L.

(s.str.) and its allied genera were traced and the distribution maps for each species were drawn with the help of herbarium specimens housed in different herbaria namely, BM, E, KUH, M, RAW (codes following to Thiers, 2016). The information was also taken from the relevant literature including various Floras, Monographs and online database namely Global Biodiversity Information Facility (GBIF) and International Plant Names Index (IPNI). For ecological information of habitat and habit, in addition to the information from herbarium sheets excursion trips were also undertaken to study the taxa in their natural habitat.

Results and Discussion

In Pakistan and Kashmir, taxa belonging to *Lactuca* and its allied genera are mostly confined to high mountains of Pakistan particularly northern regions. Their distribution ranges varied from 1000 to 5000 m, distributed in Hindukush (Chitral, Tirichmir, Swat Valley), Western Himalayas (Hazara, Kaghan, Murree Hills, Nanga Parbat and Kashmir), Karakorum ranges (Gilgit, Astore, Skardu), Sulaiman ranges (Quetta, Chaman, Ziarat, Loralai, Kalat, Zhob, etc. and few were also reported from Trans Himalayan ranges (Potohar, Salt range and Sakesar). However, no species is reported from Sindh except *Lactuca sativa* L., a cultivated species.

In the present study distribution pattern of 33 taxa belonging to the genera *Lactuca* L. (s.str.), *Steptorrhampus* Bunge, *Cephalorhynchus* Boiss. and *Melanoseris* Decne. was traced. Detailed phylogeographical analysis, local and worldwide distribution is given in Tables 1-2 and Figs. 1-9.

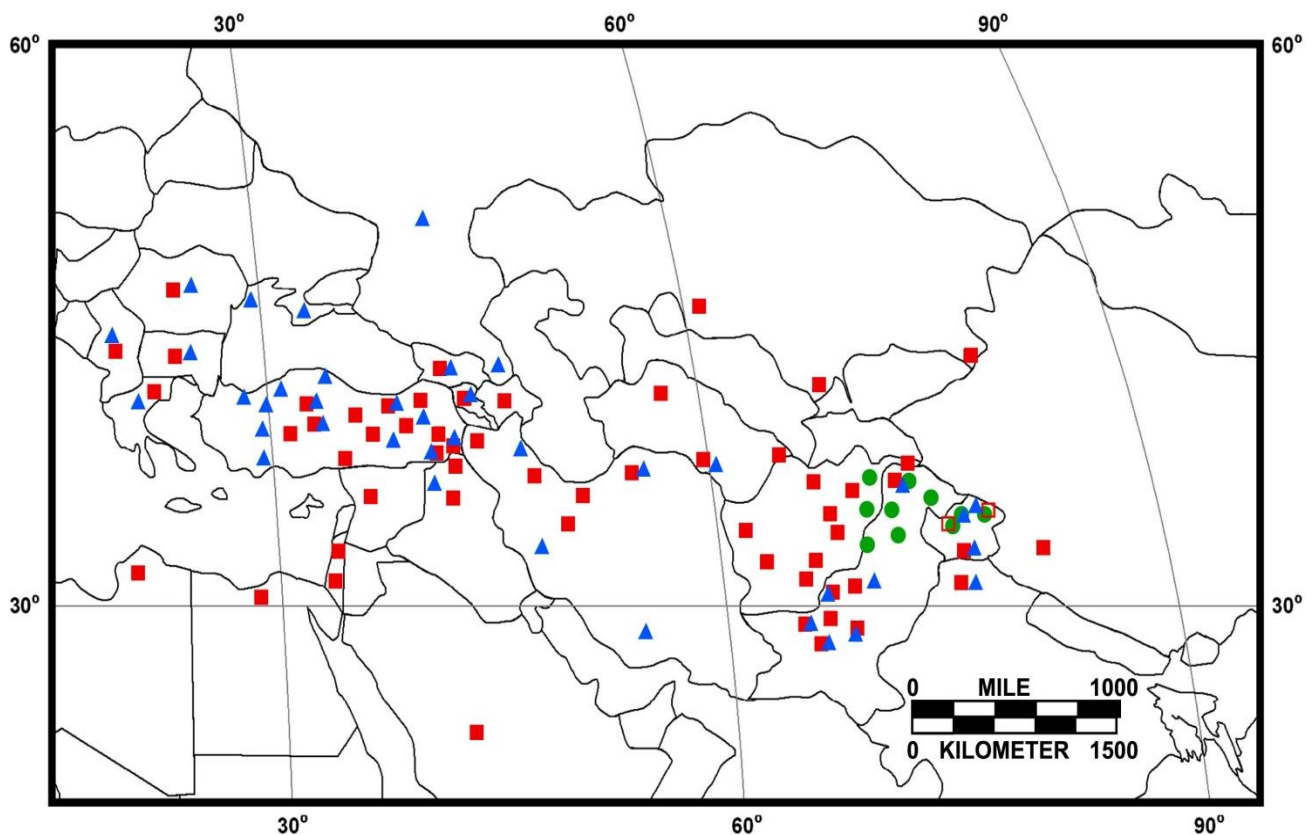


Fig. 1. Distribution pattern of *Lactuca orientalis* subsp. (■), *L. orientalis* subsp. nuristanica (●), *L. viminea* (▲) and *L. erostrata* (□).

Table 1. Phytogeographical analysis of *Lactuca* L. and its allied genera.

Name of taxa	Distribution	Floristic element
<i>Lactuca undulata</i>	Cyprus, Egypt (Sinai), Lebanon, Syria, Palestine, Turkey, Iraq, Iran, Transcaucus (Armenia, Azerbaijan), Turkmenistan, Uzbekistan, Kazakhstan, Kyrgyzstan, Afghanistan, Pakistan, China (Sinkiang) and Mongolia	Mediterranean - Irano Turanian
<i>L. orientalis</i> ssp. <i>orientalis</i>	Egypt, Syria, Lebanon, Armenia, Turkey, Iran, Iraq, S. Arabia, Central Asia, Afghanistan, Pakistan, Tibet and India	Mediterranean - Irano Turanian
<i>L. orientalis</i> ssp. <i>nuristanica</i>	Afghanistan and Pakistan	Irano-Turanian Partim endemic
<i>L. viminea</i>	Europe, Mediterranean regions, Armenia, Kurdistan, Turkey, Iraq, Iran, Saudi Arabia, Central Asia, Afghanistan, Pakistan, China, Tibet and India	Mediterranean - Irano Turanian
<i>L. erostrata</i>	Pakistan	Endemic (Astore)
<i>L. dissecta</i>	Turkey, Jordan, Iraq, Iran, Russia, Turkmenistan, Afghanistan, Pakistan, Tibet and India; Introduced in Australia	Mediterranean –Irano Turanian
<i>L. glaucifolia</i>	Central Asia, Iran, Afghanistan and Pakistan	Central Asian (Irano Turanian)
<i>L. dolichophylla</i>	Afghanistan, Pakistan, China, Tibet, India, Nepal and Myanmar	Sino-Japanese
<i>L. serriola</i>	Europe, Siberia, Mediterranean regions, Turkey, Iraq, Iran, Central Asia, Afghanistan, Pakistan, China and India; Introduced in Australia	Sub cosmopolitan
<i>L. sativa</i>	Native of East Mediterranean region, widely cultivated all over the world	Mediterranean? – cultivated all over the world
<i>L. clarkei</i>	Pakistan and India	Western Himalayas
<i>L. tatarica</i>	Europe, Caucasus, Siberia, Afghanistan, Pakistan, India, China, Tibet and Mongolia	Euro-Siberian – Irano -Turanian
<i>Steptorrhampus crambifolius</i>	Armenia, Azerbaijan, Kazakhstan, Kyrgyzstan, Tadzhikistan, Turkmenistan, Iran, Afghanistan and Pakistan	Central Asian (Irano -Turanian)
<i>S. persicus</i>	Central Asia, Iran, Afghanistan and Pakistan	Central Asian (Irano - Turanian)
<i>Cephalorhynchus chitralensis</i>	Afghanistan and Pakistan	Irano – Turanian (subendemic)
<i>C. picridiformis</i>	Afghanistan and Pakistan	Irano – Turanian (subendemic)
<i>C. polycladus</i>	Central Asia, Iran, Afghanistan and Pakistan	Central Asian (Irano - Turanian)
<i>M. gilgitensis</i>	Pakistan, Gilgit, Haramosh	Karakorum (endemic)
<i>M. kashmiriana</i>	Pakistan (Kashmir)	Dagwan, Kashmir (Type locality) endemic
<i>M. stewartii</i>	Pakistan (Kashmir)	Western Himalayas Rampur Jhelum valley, Kashmir (Type locality) endemic
<i>M. astorensis</i>	Pakistan, Kashmir, Gilgit, Baltistan	Western Himalayas – Karakorum (endemic)
<i>M. alii</i>	Pakistan, Kashmir, Gilgit, Baltistan	Western Himalayas (endemic)
<i>M. macrorrhiza</i>	Iran, Afghanistan, Pakistan, India, China, Bhutan and Nepal	Sino – Japanese
<i>M. lessertiana</i> var. <i>lessertiana</i>	Pakistan, Kashmir, India, Nepal and China	Sino – Japanese
<i>M. lessertiana</i> var. <i>lyrata</i>	Pakistan, Kashmir, India, Nepal and China	Sino – Japanese
<i>M. lessertiana</i> var. <i>dentata</i>	Pakistan, Kashmir, India, Nepal and China	Sino – Japanese
<i>M. rapunculoides</i>	Eastern Afghanistan, Pakistan, Kashmir, India and Nepal	Western-Eastern Himalayas -extending to Nepal (Sino – Japanese)
<i>M. decipiens</i> var. <i>decipiens</i>	Afghanistan, Pakistan, Kashmir, India and Nepal	Himalayas (Sino-Japanese)?
<i>M. decipiens</i> var. <i>multifida</i>	Afghanistan, Pakistan, Kashmir, India and Nepal	Himalayas (Sino-Japanese)?
<i>M. brunoniana</i>	Iran, Afghanistan, Pakistan, India, Bhutan and Nepal	Eastern Himalayas – Western Himalayas extending to Afghanistan (Sino - Japanese)
<i>M. aitchisoniana</i>	Afghanistan, Pakistan, Kashmir, India	Western Himalayas
<i>M. violifolia</i>	Pakistan, North India (NW and Eastern Himalaya), China, Bhutan, Nepal, Myanmar and Sikkim	Sino – Japanese
<i>M. cyanea</i>	Pakistan, Kashmir, India, China, Bhutan, Nepal and Myanmar	Sino – Japanese

Table 2. Ecological parameters of the taxa belonging to *Lactuca* L. (s. str.) and its allied genera from study area.

Name of taxa	Altitudinal range (m)	Microhabitats	* Soil types
<i>Lactuca undulata</i>	1500-2200	Dry rubbly or stony slopes, steppes and ditches	More or less saline
<i>L. orientalis</i> ssp. <i>orientalis</i>	1650-3000	Dry rubbly or stony slopes, screes and dry ravines	Clayey and loamy
<i>L. orientalis</i> ssp. <i>nuristanica</i>	1000-3500	Rock, crevices, cliff and along stream bank	Sandy and gravelly
<i>L. viminea</i>	1000-2700	Dry rubbly or stony slopes, screes, roadside and field margins	Sandy and gravelly
<i>L. erostrata</i>	2300-3300	Dry sandy slopes and along stream bank	Sandy
<i>L. dissecta</i>	1200-3300	Rocky hills slopes, dry river beds, irrigation canals and wet ditches	Sandy, clay and alluvial
<i>L. glaucifolia</i>	1000-2700	Dry mountains, crevices of granite rocks, roadside and sandy places	Sandy and gravelly saline substrata
<i>L. dolichophylla</i>	1800-3200	Rocky slopes, walls hedges, irrigation land, cultivated fields and waste ground	Clay and loamy
<i>L. serriola</i>	1000-3600	Undulating and grassy slopes, cultivated and irrigated fields, shady moist areas, along road side	Sandy and loamy
<i>Lactuca sativa</i>		Widely cultivated as a salad plant	
<i>L. clarkei</i>	2400-3100	Stream banks, ponds and cultivated fields	Clayey and loamy
<i>L. tatarica</i>	2800-5000	Stony exposed slopes, meadows, stream banks, irrigation canals and cultivated fields	Clayey, sandy and loamy or saline
<i>Steptorrhampus crambifolius</i>	1500-3000	Dry rubbly, stony (gravel) slopes, in crevices of granite and lime stones	Sandy – loamy
<i>S. persicus</i>	1000-2500	Dry rubbly, stony (gravel) mountains, screes, calcareous hills and rock crevices or steep	Clayey, calcareous
<i>Cephalorhynchus picridiformis</i>	1500-2776	Dry rocky slopes, crevices, river beds, clumps and near stream banks	Sandy and clayey
<i>C. chitralensis</i>	1600-2500	Dry slopes and seasonal river beds	Sandy and gravelly
<i>C. polycladus</i>	2100-3500	Dry mountain slopes, bank of stream, lakes, near edges of glacier and grasslands	Sandy and clayey
<i>Melanoseris astorensis</i>	2600-4000	Open meadow (pasture) and near water channels	Sandy
<i>M. alii</i>	3300-4500	Open meadow (pastures), cliff faces, river banks, and shady places	Sandy and humus rich
<i>M. gilgitensis</i>	3500-4900	Grassy slopes	Humus rich sandy - clayey
<i>M. macrorhiza</i>	1800-3900	Moist and shady places, slopes or rocks crevices and on banks	Sandy and clayey
<i>M. lessertiana</i> var. <i>lessertiana</i>	3300-4500	Open grassland or meadow, hilly slopes or screes, scrubland and near glaciers	Sandy loam
<i>M. lessertiana</i> var. <i>lyrata</i>	1400-4000	Grassy meadows, stony ridges or hill sides and river beds	Sandy loam
<i>M. lessertiana</i> var. <i>dentata</i>	3000-3900	Sunny places, stony grounds or common in rocks crevices	Humus rich
<i>M. rapunculoides</i>	2500-4200	Grassy and moist shady slopes, along ditches, river banks and irrigation canals	Sandy and loamy
<i>M. decipiens</i> var. <i>decipiens</i>	2500-4000	Open moist shady places, meadows (pastures) rocky ravine beds and along stream	Sandy and humus rich
<i>M. decipiens</i> var. <i>multifolia</i>	2500-4000	Partial shady, open moist places, water channels, crevices and woodlands	Sandy and loamy
<i>M. brunaniana</i>	2000-3000	Forest shady or moist places, water channels and hedges	Sandy loam and silt
<i>M. aitchinsoniana</i>	upto 1500	Forest margins	Granite sandy – clayey
<i>M. stewartii</i>	upto 1200	Shady or moist places	Sandy
<i>M. cyanea</i>	2150-3350	Grassy banks among trees and exposed shady places	Sandy and humus rich
<i>M. violifolia</i>	3000-4500	Forest margins and open meadows (pastures)	Sandy - clayey and humus rich
<i>M. kashmiriana</i>	2500-4500	Moist shady places	Sandy

* Based on the information obtained from herbarium sheets and field observation

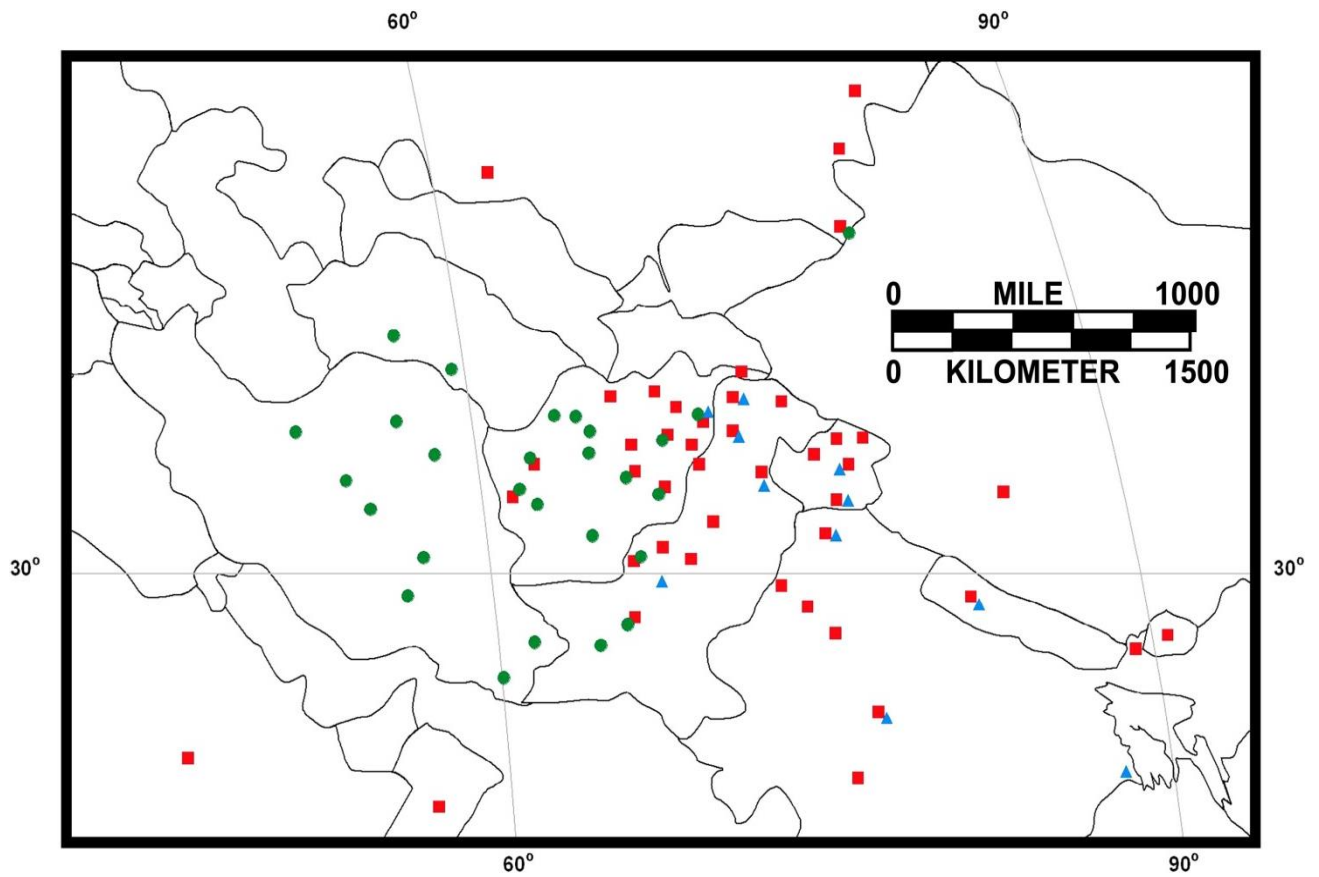


Fig. 2. Distribution pattern of *Lactuca dissecta* (■), *L. glaucifolia* (●) and *L. dolichophylla* (▲).

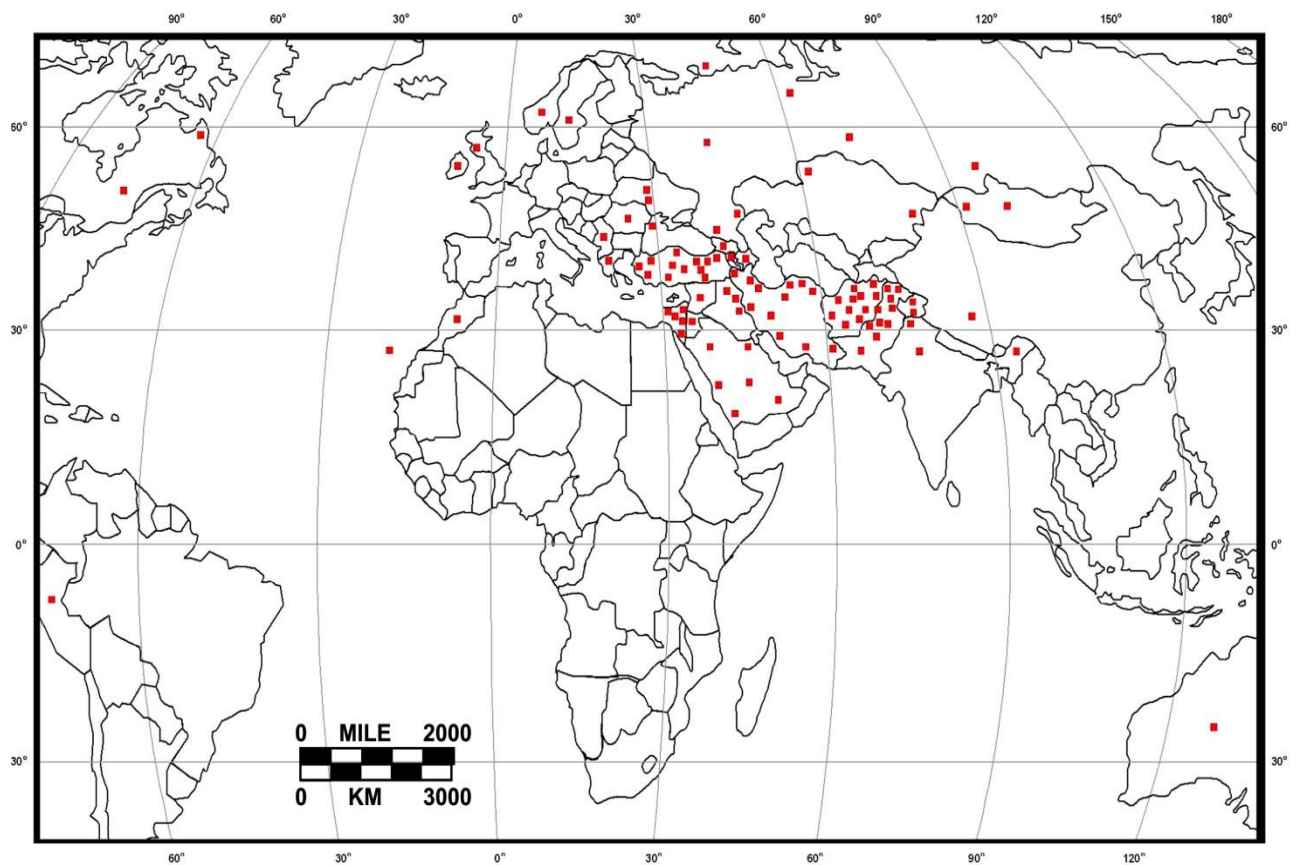


Fig. 3. Distribution pattern of *Lactuca serriola* (■).

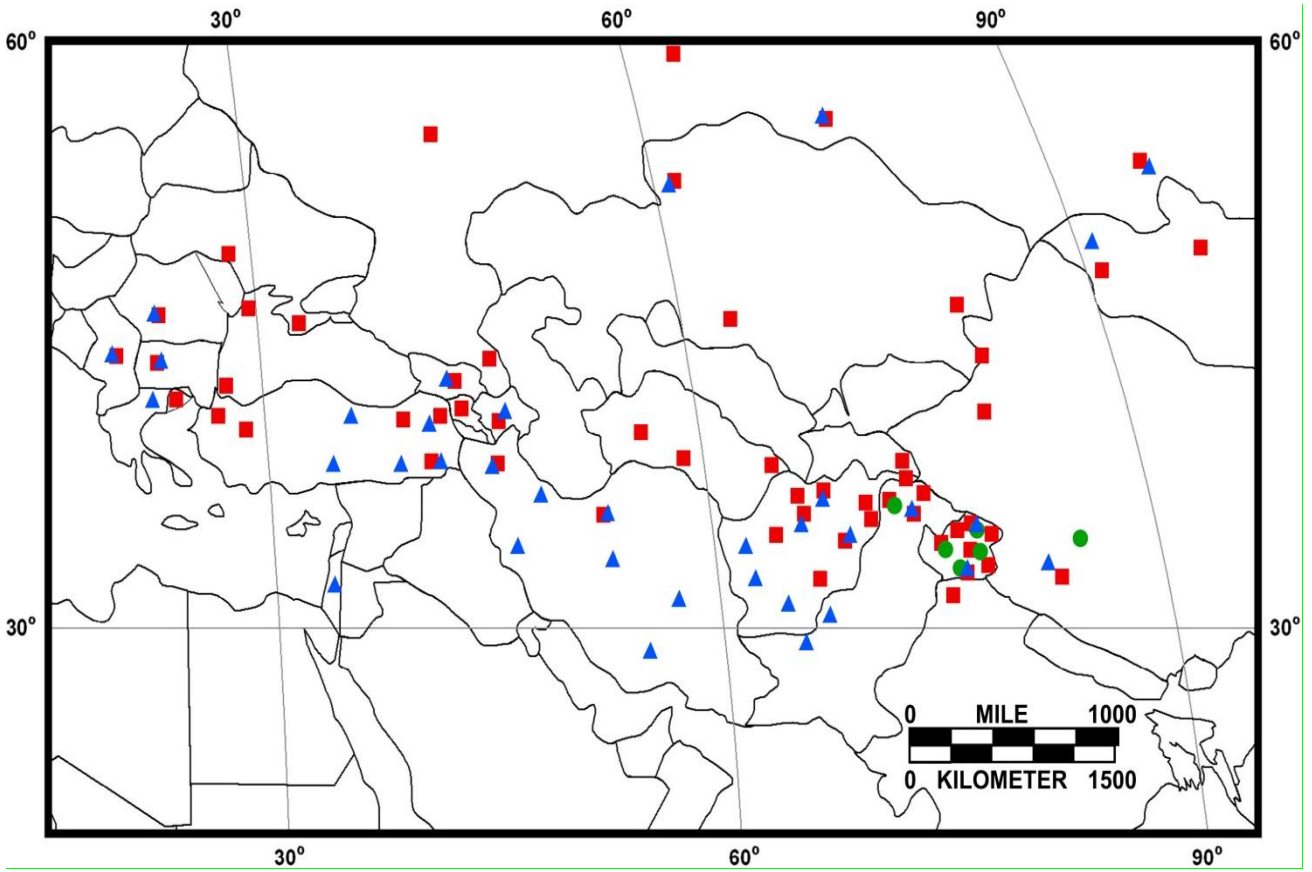


Fig. 4. Distribution pattern of *Lactuca tatarica* (■), *L. clarkei* (●) and *L. undulata* (▲).

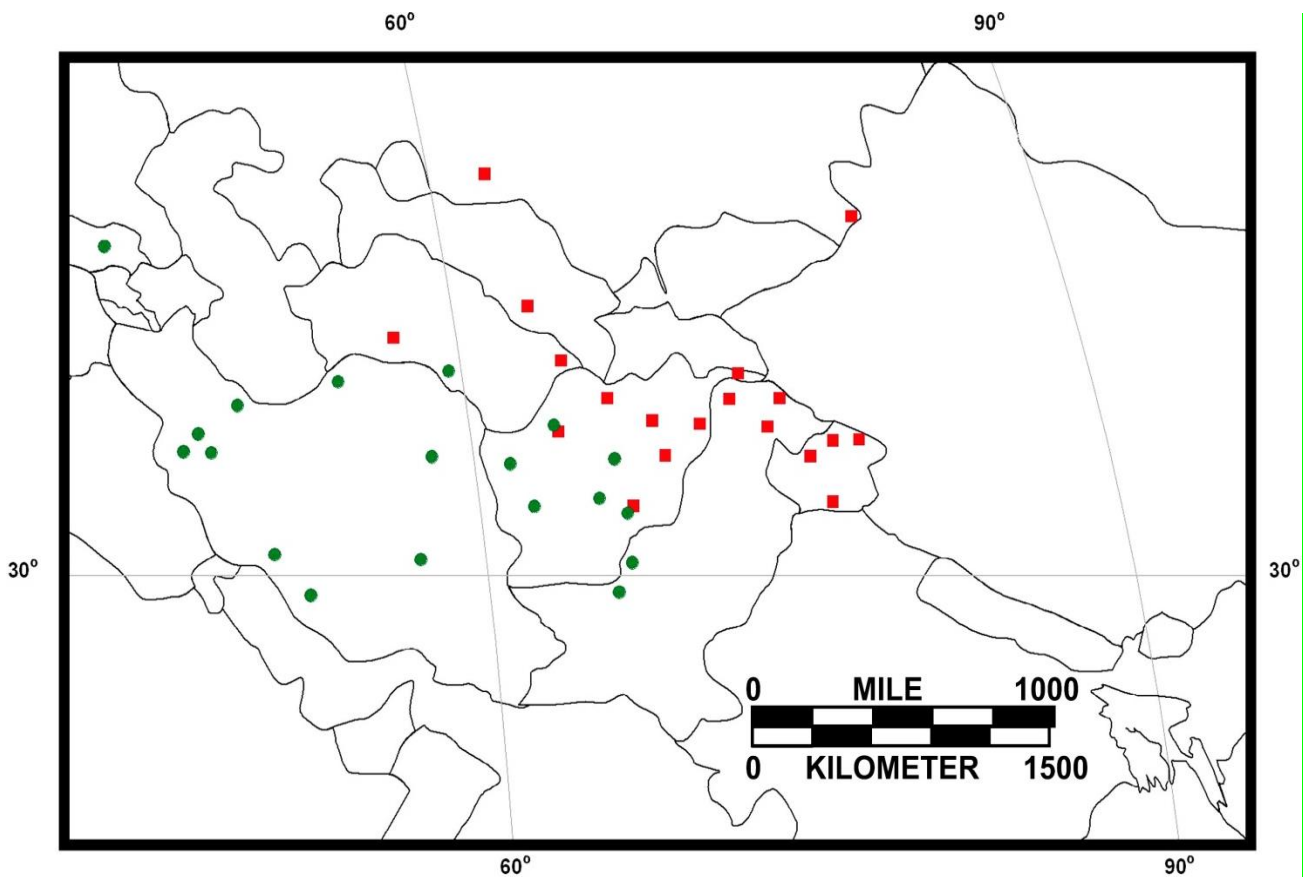


Fig. 5. Distribution pattern of *Steptorrhaphus crambifolius* (■) and *S. persicus* (▲).

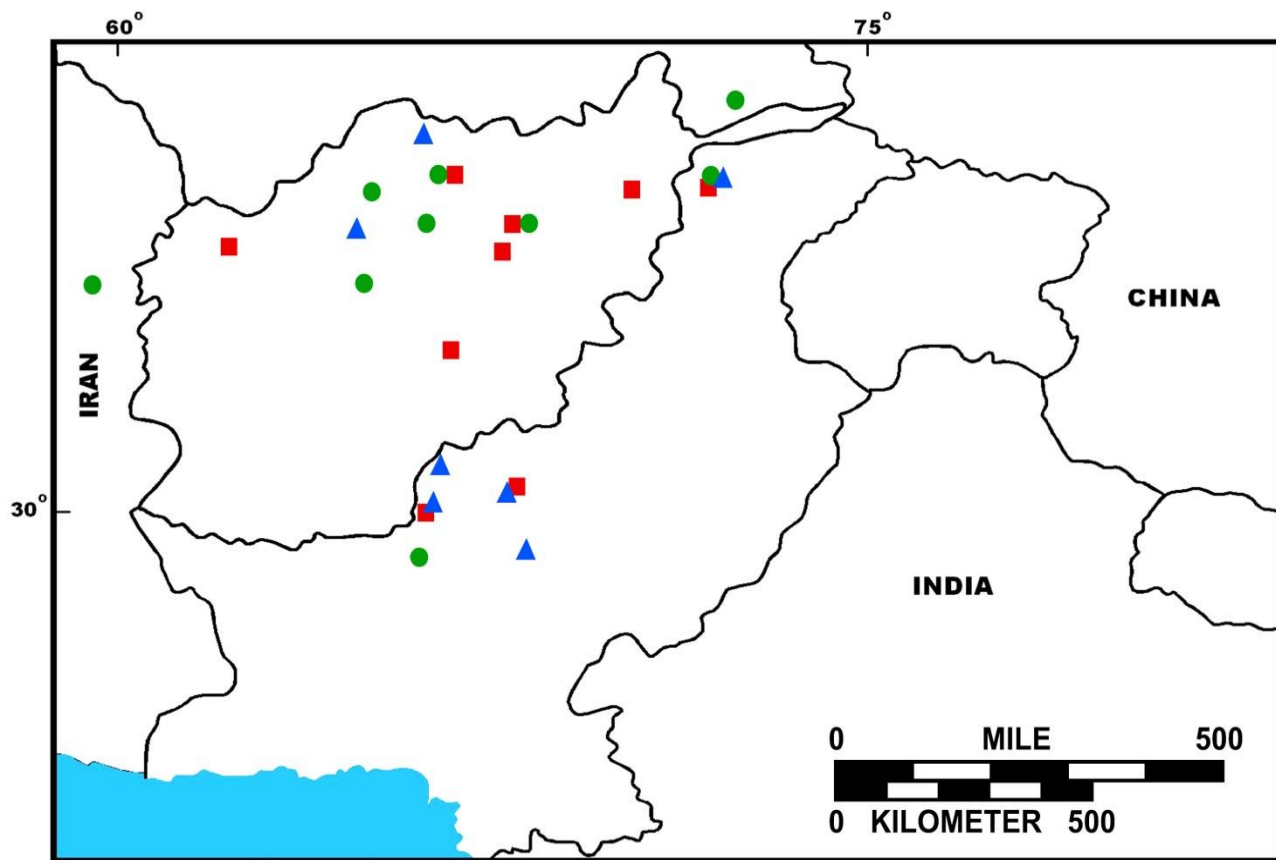


Fig. 6. Distribution pattern of *Cephalarhynchus picridiformis* (■), *C. chitralensis* (●) and *C. polychaldus* (▲).

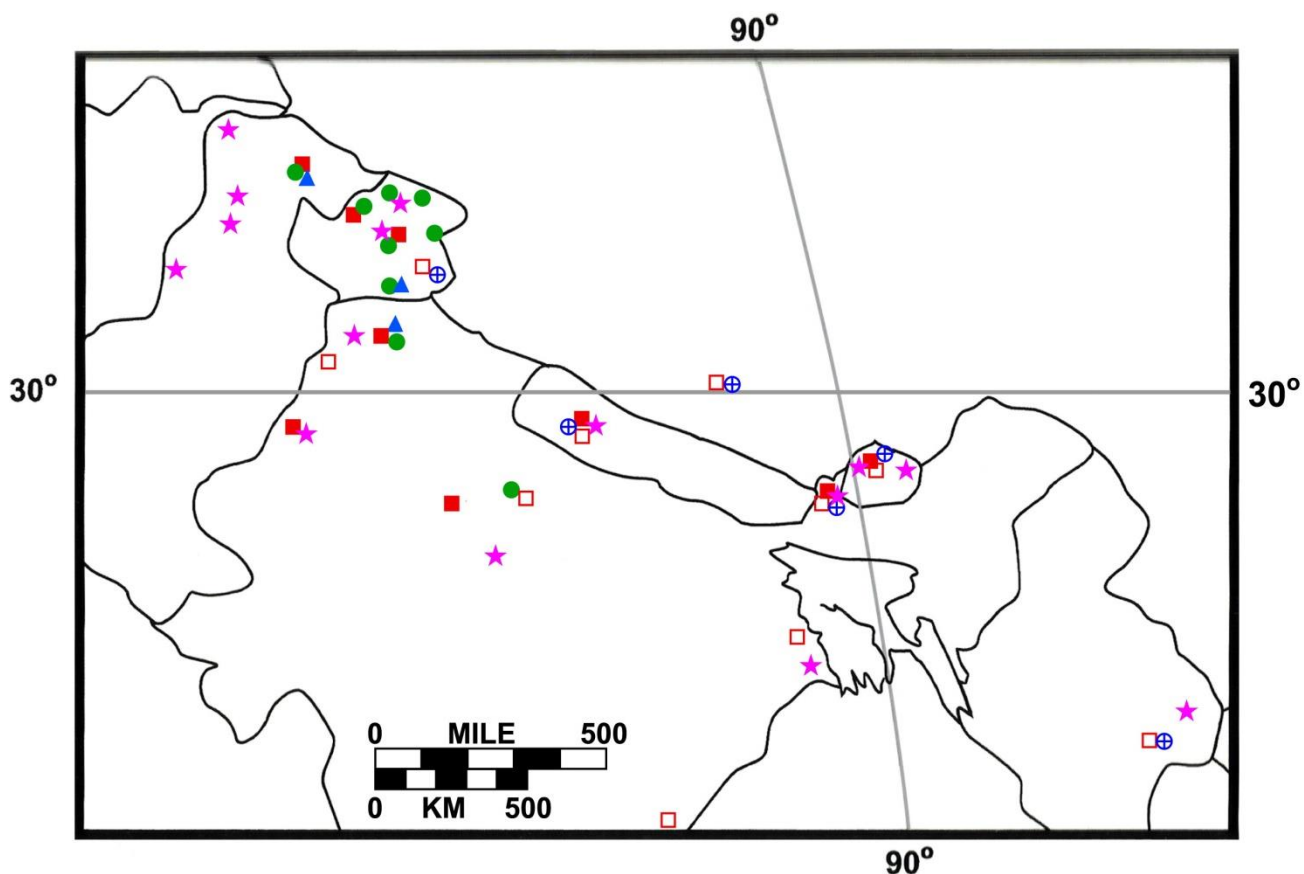


Fig. 7. Distribution pattern of *Melanoseris lessertiana* var. *lessertiana* (■), *M. lessertiana* var. *lyrata* (●), *M. lessertiana* var. *dentata* (▲), *M. macrorhiza* (★), *M. violifolia* (⊕) and *M. cyanea* (□).

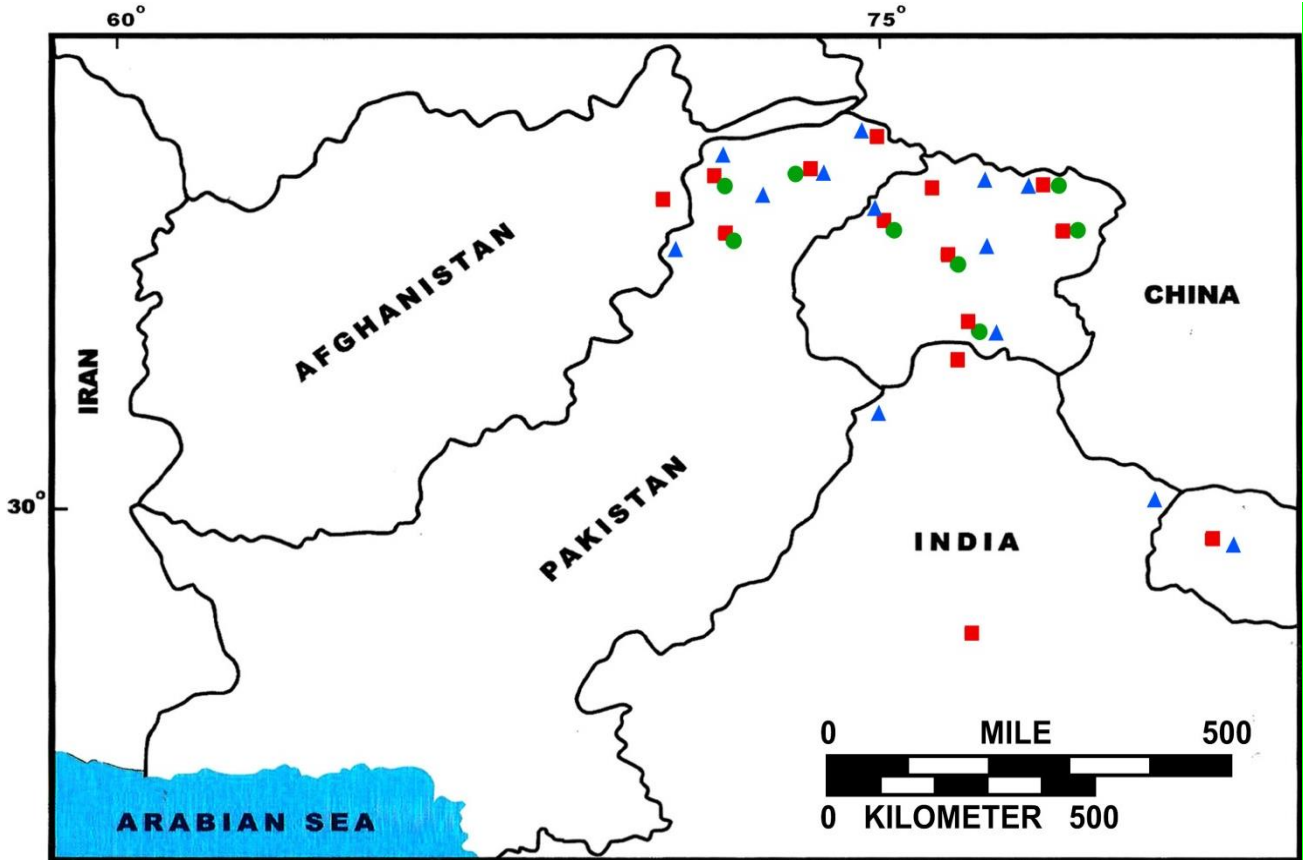


Fig. 8. Distribution pattern of *Melanoseris decipiens* var. *decipiens* (■), *M. decipiens* var. *multifida* (●) and *M. rapunculoides* (▲).

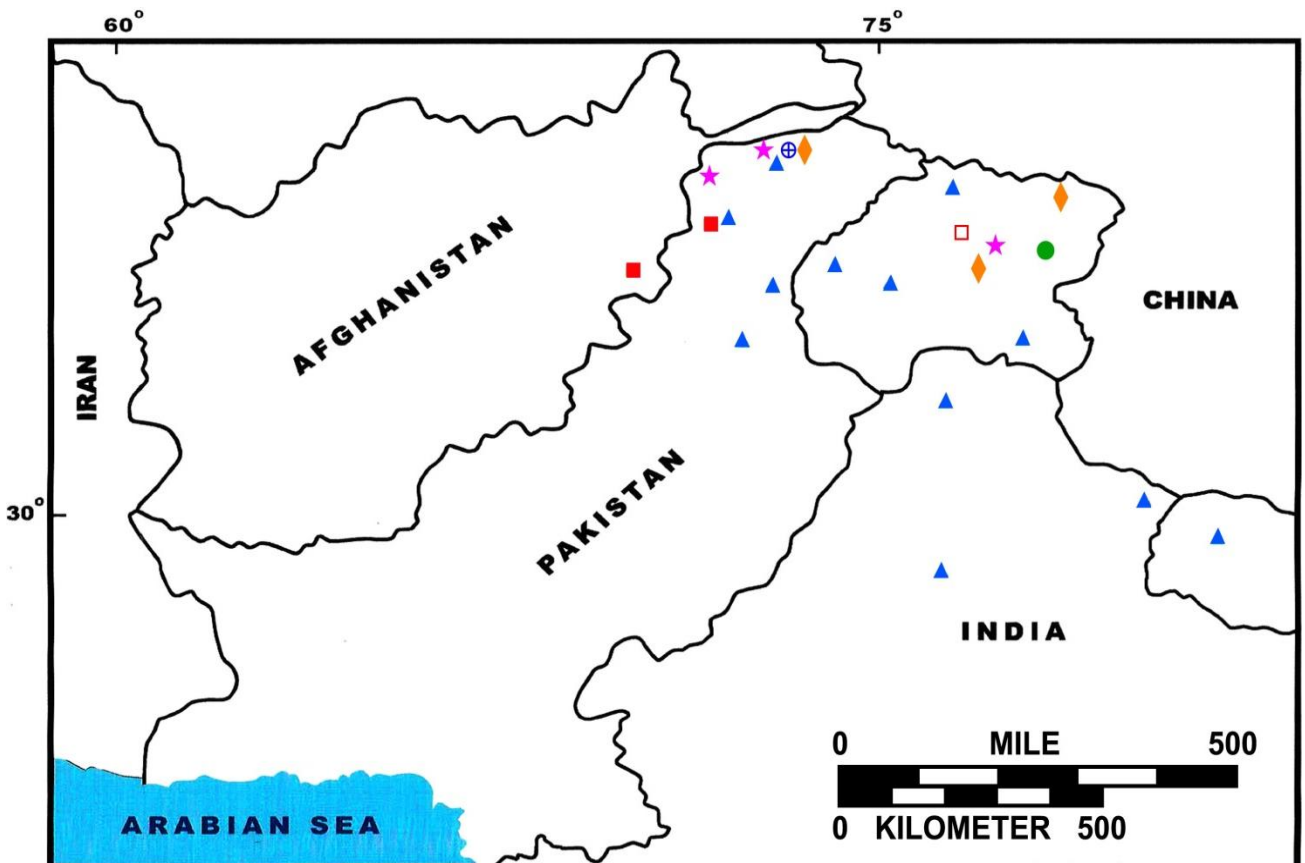


Fig. 9. Distribution pattern of *Melanoseris astorensis* (★), *M. alii* (◆), *M. aitchisoniana* (■), *M. stewartii* (●), *M. brunoniana* (▲), *M. gilgitensis* (⊕) and *M. kashmiriana* (□).

***Lactuca* L. (s. str.):** The genus *Lactuca* L. (s. str.) is widely distributed in Europe, Asia, Africa and North and Central America (Lebeda *et al.*, 2004; Lack, 2007; Abid *et al.*, 2017). Kilian *et al.*, (2017) indicated that *Lactuca* lineage diversified mainly in the SW Asian – S. European region and its diversification seemed to have been more affected by drier climatic conditions. In the area under consideration 11 species of *Lactuca* L. were recognized and most of these were mainly distributed in Himalayas, Karakorum and Hindukush ranges (Abid *et al.*, 2017; Abid & Qaiser, in press). Of these 11 species, *L. sativa*, probably a native of Mediterranean region and a popular salad crop, is grown as leafy vegetable throughout the world, its distribution pattern was not considered being a cultivated species. *L. serriola* (wild-lettuce or prickly lettuce) a meridional-temperate and western Eurasian species, is a subcosmopolitan element (Table 1). It has a synanthropic worldwide distribution (Lebeda *et al.*, 2004). Its synanthropic distribution has also been recorded from Australia including Tasmania and New Zealand (Burbidge & Gray, 1970; Webb *et al.*, 1988). This prickly lettuce has also been established as a weed in North America, southern Africa and Argentina (Strausbaugh & Core, 1978; Boukema *et al.*, 1990; Zohary, 1991; Zuloaga & Morrone, 1999). It is found almost everywhere from the plains to mountainous regions in Europe upto 1560 m, in Turkey upto 1750 m, in Afghanistan upto 3100 m and in the northern Himalayas upto 3600 m (Hegi, 1978; Meusel & Jäger, 1992). In Pakistan, this taxon is also widely distributed in Northern areas, mountainous region of Khyber Pakhtoonkhawa, Punjab and Baluchistan (Fig. 3), between 1000-3600 m on grassy slopes, irrigated lands, in cultivated fields and also as a roadside weed (Stewart, 1972; Abid *et al.*, 2017). *L. glaucifolia* Boiss. is an uniregional element, comparatively less common than the other species of *Lactuca* L. (s.str.) and seems to be localized in Baluchistan (Western Irano – Turanian subregion) reaching up to 1000 - 2700 m on gravel slopes, sandy places and roadside edges (Table 2; Fig. 2). *L. undulata* Ledeb. is a biregional element, equally distributed in Mediterranean – Irano Turanian regions. It is centered in eastern Mediterranean region extending to Central Asia in the east and to Europe in the west (Kilian *et al.*, 2017). While in our area it grows in the northern mountainous regions of Pakistan between 1500–2200 m on steppes, in semi-arid areas, on stony slopes and saline plains (Table 2; Fig. 4). The other species *L. dissecta* (L.) D. Don is another biregional element Irano-Turanian - Mediterranean distributed from SW to Central Asia to Mediterranean region (Kilian *et al.*, 2017). This species is reported from Turkey, Jordan, Iraq, Iran, Pakistan, Afghanistan, India, China and the Central Asia (Rechinger, 1977; Lebeda *et al.*, 2004; Abid *et al.*, 2017) as a fairly common semi-desert annual weed. In Pakistan it is widely distributed in almost all the regions of Pakistan except Sindh (Fig. 2), grows in different habitats such as on stony slopes, rock crevices, as a weed in cultivated fields, along irrigation canals, on stream banks, ascending upto 3300 m (Table 2). While *L. dolichophylla* is also another biregional element distributed from SW Asia (Irano – Turanian) to Sino Himalayan region (Kilian *et al.*, 2017) from Nepal (Eastern Himalayas) to eastern Afghanistan via Kashmir and northern Pakistan (Western Himalayas). In our region it grows on rocky slopes, walls and hedges, around cultivated fields on clayey loamy soil, ascending from 1200 to 3200 m

on mountainous areas of Gilgit, Baltistan, Kashmir, Chitral, Dir, Swat and Hazara (Tables 1 & 2; Fig. 2). Kilian *et al.*, (2017) opined that the origin of *L. dissecta* and *L. dolichophylla* was SW Asian and were diversified during 4.6–5.1 mya (median ages) while extending eastwards into Himalayas. Surprisingly, two morphologically closely related species *L. clarkei* Hook. f. and *L. tatarica* (L.) C. A. Meyer showed very distinct distribution pattern. The former species is partim endemic to Kashmir, Karakorum and Hindukush range (Chitral valley) and grows between 2400-3100 m on stream banks and ponds (Table 2; Fig. 4). Whereas the later species is a biregional element i.e., Euro-Siberian - Irano-Turanian element occurring in Europe, Siberia extending to China, Mangolia through Afghanistan. In Pakistan it is commonly distributed in Chitral, Gilgit, Hunza, Baltistan, Skardu, Karakorum and Kashmir at an elevation between 2800-5000 m on clayey soil, sandy slopes, in moderately damp soil along irrigation channels, stream banks and as a weed of different cultivated crops (Tables 1 & 2; Fig. 4). Feráková (1977) and Clement & Foster (1994) reported that *L. tatarica* commonly grew in sandy (usually saline) substrata in semiarid regions, as well as in steppe and littoral communities. Likewise *L. viminea* and *L. orientalis* are also classified as biregional elements i.e., Mediterranean–Irano Turanian, predominantly distributed in the SE European- Mediterranean- SW Asian regions (Irano–Turanian) stretching to India (Kilian *et al.*, 2017). In Pakistan *L. viminea* is commonly found in Astore, Baltistan, Peshawar, Kurram, Quetta, Loralai, Kalat and Nushki (Fig. 1), growing between 1000 – 2700 m on rocky slopes, stony and gravels areas (Table 2). While *L. orientalis* subsp. *orientalis* is fairly common in Northern Baluchistan Western Himalayas (Swat and Murree Hills), Chitral, Kurram, Baltistan reaches upto Ladakh, grows on clayey and loamy soil, and stony places, on slopes, on gravels and in dry ravines between 1650–3800 m (Table 2; Fig. 1). While *L. orientalis* subsp. *nuristanica* is a partimendemic, occurring in Pakistan and Afghanistan – eastern and western part of Irano – Turanian region. In Pakistan it occurs from 1000-3500 m on rocky slopes and crevices, along stream bank, on wet places and in sandy clay loam (Tables 1 & 2, Fig. 1). The remaining species *L. erostrata* is presently known from type locality (Astore, Gilgit – Baltistan) and at present may be considered as endemic until reported from the other localities (Tables 1 & 2; Fig. 1).

***Steptorrhampus* Bunge:** The genus *Steptorrhampus* Bunge, a close ally of *Lactuca*, sometimes treated as congeneric with *Lactuca* (Kilian *et al.*, 2009; Bano & Qaiser, 2011; Abid *et al.*, 2017). It is distributed in Southeast Europe, Turkey, Caucasus, Iran, Middle East, C. Asia, Afghanistan and Pakistan (Bremer, 1994; Mabberley, 1997; Lack, 2007). The genus seems to be restricted to SW and Central Asian mountain ranges (Kilian *et al.*, 2017). In Pakistan the genus is represented by two species *S. crambifolius* Bunge and *S. persicus* (Boiss.) O. & B. Fedtsch. Both the species are typical Central Asian (Irano-Turanian) elements distributed from Central Asia to Pakistan via Afghanistan (Table 1). In our area *S. crambifolius* grows in Chitral, Gilgit, Baltistan, Skardu and Hunza at the altitude between 1200 – 3000 m on stony and gravel slopes. Whereas, in Pakistan the distribution of *S. persicus* is rather narrow and confined to

Northern Baluchistan, grows among rocks crevices, stony and calcareous hills reaching up to 1000 – 2500 m (Table 2; Fig. 5). The distribution pattern suggests that *S. crambifolius* is an Eastern Irano-Turanian element whereas *S. persicus* is a Western Irano-Turanian element.

Cephalorhynchus Boiss: The genus *Cephalorhynchus* Boiss. (s. str.) another close ally of *Lactuca*, until recently it was treated as congeneric with *Lactuca* (Bano & Qaiser, 2011; Abid *et al.*, 2017). However, recent molecular phylogenetic studies established its separate generic status (Kilian *et al.*, 2017). It is mainly distributed in South Eastern Europe to China (Bremer, 1994; Mabberley, 1997; Lack, 2007). Three species belonging to this genus viz., *C. picridiformis*, *C. chitralensis* and *C. polyclada* are reported from our region. All the three species are typical Irano-Turanian elements. *C. picridiformis* and *C. chitralensis* are subendemic having a narrow distribution, mainly occurring in Afghanistan and Pakistan (Fig. 6). In Pakistan both the species are found in Chitral and Northern Baluchistan (Quetta, Ziarat and Chaman). The former species grows on rocky areas (such as on crevices, steep and slope) and near streams bank at the elevation of 1500 – 2776 m. Where as the later species grows on river bed and dry slopes between 1600-2500 m (Table 2; Fig. 6). However, *C. polyclada* is more widely distributed in C. Asia, Iran, Afghanistan and Pakistan (Table 1). In Pakistan, this species is restricted to Chitral on dry slopes, ascending upto 2100 m (Rech., f. 1977; Abid *et al.*, 2017)).

Melanoseris Decne: The genus *Melanoseris* Decne., spans its distribution from tropical Africa across SW and Central Asia to E and SE Asia (Wang *et al.*, 2013; Kilian *et al.*, 2017). In Pakistan, the genus is represented by 16 taxa, mainly distributed in Himalayas, Karakorum and Hindukush ranges. Among them, *M. gilgitensis* (Roohi Bano & Qaiser) A. Ghafoor, Qaiser & Roohi Bano, *M. kashmiriana* (Mamgain & Rao) N. Kilian and *M. stewartii* (Roohi Bano & Qaiser) A. Ghafoor, Qaiser & Roohi Bano are known from type localities only. *M. gilgitensis* is reported (Haramosh, Gilgit) grows on open grassy and shady slopes between 3500- 4900 m. *M. kashmiriana* is known from the type locality, Degwan, Kashmir, growing on moist shady slopes between 2500 – 4500 m and *M. stewartii* is also known from type locality, Rampur, Jhelum Road Kashmir at c.1200 m (Western Himalayan element). *M. astorensis* and *M. alii* are distributed in Western Himalayas (Kashmir, Gilgit, Deosai) and Karakorum ranges (Haramosh).. *M. astorensis* grows in moist open areas and near water canal between 2690 -3600 m while *M. alii* is reported from Kashmir and Karakorum, grows on cliff faces, in alpine pastures, slopes, open areas at the elevation between 3300-4500 m (Tables 1 & 2; Fig. 9). All these 5 species are reported from type locality or nearby area, they are provisionally considered as endemic until reported from other localities/ area. The other higher altitude species is *M. lessertiana*, Sino – Himalayan (Sino – Japanese) element, widely distributed in China, Sikkim, Bhutan, Nepal, India, Kashmir and Pakistan (Table 1). The western most limit of this species is north-eastern Afghanistan. Three varieties were recognized under the aforementioned species and all the varieties showed more or less similar distribution (Table 1; Fig. 7). In Pakistan *M.*

lessertiana grows between 1400 – 4500 m in open grassy alpine pastures, stony ridges, and melting snow (Table 2). Other Sino-Japanese element is *M. brunoniana* (Wall. ex DC.) N. Kilian & Z. H. Wang, a moisture- loving, highly variable and common species, widely distributed from Eastern to Western Himalayas and reaches up to North-eastern Afghanistan in the West and up to Nepal in the east via Himachal Pradesh (India). In Pakistan it grows between 1500-4400 m on alpine meadows, along stream or forest shady slopes (Tables 1 & 2; Fig. 9). Whereas *M. macrorrhiza* is an Eastern Himalayan species (Sino-Japanese element) distributed from Maynamar, Nepal, Bhutan, China, India – Pakistan, reaches up to eastern Afghanistan. In our area this species grows on rock crevices, in moist and shady places of Kashmir, Chitral, Swat and Peshawar between 1800 -3900 m (Tables 1 & 2; Fig. 7).

There are three more taxa which are tentatively recognized as Sino-Japanese element. All the three taxa are distributed from Nepal to eastern Afghanistan, via Himachal Pradesh (India) and Pakistan. In our area the first taxon *M. rapuncooides* is mostly reported from Kashmir (Zoji Pass, Pir Panjal range etc.) grows in open grassy and shady slopes at high elevations between 2500 – 4200 m (Tables 1 & 2; Fig. 8). The other two taxa *M. decipiens* var. *decipiens* and var. *multifida*, as both the varieties are distributed from Nepal to Afghanistan via Kashmir. In Pakistan both are distributed in Swat, Kashmir, Ladakh and Baltistan. In our area both the varieties stretch from 2500 – 4000 m on open moist shady slopes, crevices, rocky ravine beds and bank, along streams (Table 2).

M. aitchisoniana is subendemic to Afghanistan and Pakistan. In our region it is known only from Khyber Pakhtunkhawa (Swat: Kalam, Ushu and Utror) on forest margins, near streams, granite sandy-clay mountains reaching upto 1000 - 2500 m (Tables 1 & 2; Fig. 9).

Conclusion

The present phytogeographical analysis of *Lactuca* L. (s. str.) and allied genera suggests that 5 species belonging to *Melanoseris* are endemic to Pakistan and 2 species viz., *Cephalorhynchus chitralensis* and *C. polycladus* are subendemic occurring in Pakistan and eastern Afghanistan. There is one subcosmopolitan species viz., *L. serriola* and there are 7 Irano – Turanian elements of which two belong to *Lactuca* and two to *Steptorrhynchus* and three to *Cephalorhynchus*. *L. dolichophylla* is the only Irano - Turanian - Sino - Japanese element in the genus *Lactuca* whereas there are 7 taxa of *Melanoseris* which are typical Sino-Japanese element beside this three taxa are tentatively recognized as Sino-Japanese elements. There are quite a few taxa which are biregional, 3 taxa of *Lactuca* show this type of distribution i.e., Mediterranean – Irano-Turanian, 5 taxa are known from type locality or from nearby vicinities and are tentatively recognized as endemic. Therefore to determine the nature of exact distribution of these five taxa is rather difficult until more material available or reported from other areas.

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