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DISTRIBUTION PATTERN OF *INULA* L. (S.STR.) AND ITS ALLIED GENERA FROM PAKISTAN AND KASHMIR

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Abstract

Distribution pattern and ecology of 22 taxa belonging to *Inula* L. (s.str.) and its allied genera viz., *Pentanema* Cass., *Duhaldea* DC., *Dittrichia* Greuter and *Iphiona* Cass., has been analyzed from Pakistan and Kashmir. Five species of *Inula* and 2 species of *Pentanema* are typically Irano-Turanian element, *P. indicum* is Indian element, both the species of *Iphiona* are Saharo-Sindian elements, while *Inula racemosa* and 3 species of *Duhaldea* are Sino-Japanese elements. *I. acuminata* and *I. obtusifolia* are distributed in transitional zone between Irano-Turanian and Sino-Japanese regions. Three species of *Inula* are classified as biregional elements, from which *I. clarkei* and *I. orientalis* equally distributed in Irano Turanian and Sino-Japanese regions, whereas *I. britannica* is distributed in Euro-Siberian and Irano-Turanian regions. *P. divaricatum* and *P. vestitum* are also biregional elements, former species found in Saharo-Sindian and Irano-Turanian regions and latter species extends to Saharo-Sindian and Indian region. However, *Dittrichia graveolens* is also considered as a biregional element distributed in Irano-Turanian and Mediterranian regions.

Introduction

The genera *Inula* L., *Pentanema* Cass., *Duhaldea* DC., *Dittrichia* Greuter and *Iphiona* Cass., belong to the tribe Inuleae of the family Compositae, are mainly Eurasian in distribution while some species also occur in North Africa and Arabia. However, *Dittrichia* has also been introduced in North and South America and Australia (Willis, 1973; Merxmuller *et al*., 1977; Anderberg, 1994; Qaiser & Abid, 2003). Relating to distribution pattern of these taxa very little work has been done from some parts of the world. Anderberg (1991) studied the taxonomy and phylogeny of the tribe Inuleae in which he also discussed general distribution of these taxa. Similarly, Rao & Dutt (1996) studied the diversity, endemism and phytogeographical affinities of some Indian Compositae along with the biogeographical regions of India. Apart from the above reports on distribution pattern of these taxa, no information is available on the phytogeography and ecology of various species belonging to above said genera occurring in Pakistan and Kashmir. In order to fill this gap the present study was carried out.

Materials and Methods

Twenty two species belonging to genera *Inula* L. (s.str.), *Pentanema* Cass., *Duhaldea* DC., *Dittrichia* Greuter and *Iphiona* Cass., were studied for their distribution pattern with the help of herbarium specimens present in various herbaria viz., B, BM, C, E, ISL, K, KUH, LIV, M, NY, PMNH, RAW, US, W and WU (abbreviated as in Holmgren *et al*., 1990) and literature. Information on their ecology and habitat has also been taken from the data on herbarium sheet. However, the data is also supplemented with field observations wherever possible.

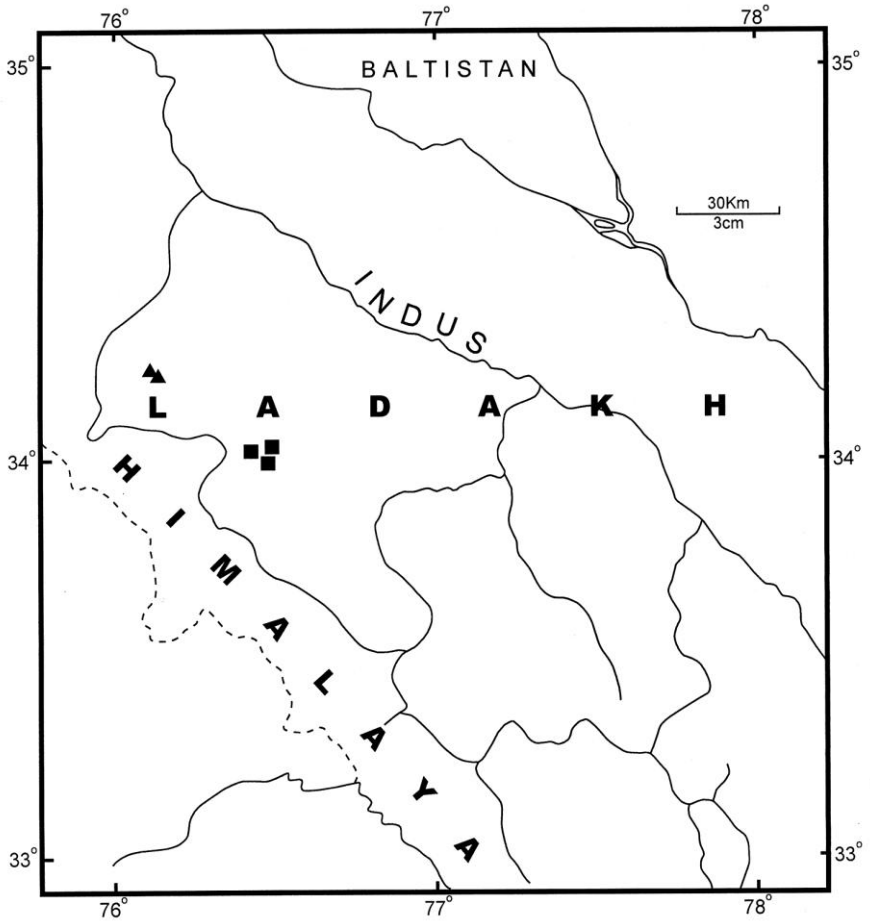

Fig. 1. Distribution pattern of *Inula koelzii* (■) and *I. stewartii* (▲).

Results and Discussion

The genus *Inula* L. (s.str.), is widely distributed in Europe, Asia, Africa (Anderberg, 1994; Qaiser & Abid, 2003), Eastern Mediterranean region, (Asia minor including Turkey), Tropical Africa and Himalayas seem to be three important centers of distribution of this genus. The genus is represented by 11 species in Pakistan and Kashmir. Most of these are mainly distributed in Himalayas, Karakorum and Hindukush ranges. The distribution of two newly described species is not completely known. At present they are known from type locality only. *I. koelzii* Dawar & Qaiser is a narrow endemic known from Ladakh only. This species grows on slopes and river beds between 3300–3900m. Similarly, *I. stewartii* Abid & Qaiser, is another narrow endemic known from higher altitude of Kashmir in alpine meadows. Phytogeographically both the type localities of *I. koelzii* and *I. stewartii* are the western most limit of eastern Irano-Turanian subregion (Fig. 1). The other two species *I. falconeri* Hook.f. and *I. rhizocephala* Schrenk, are also Irano-Turanian element. The former species is a typical eastern Irano-

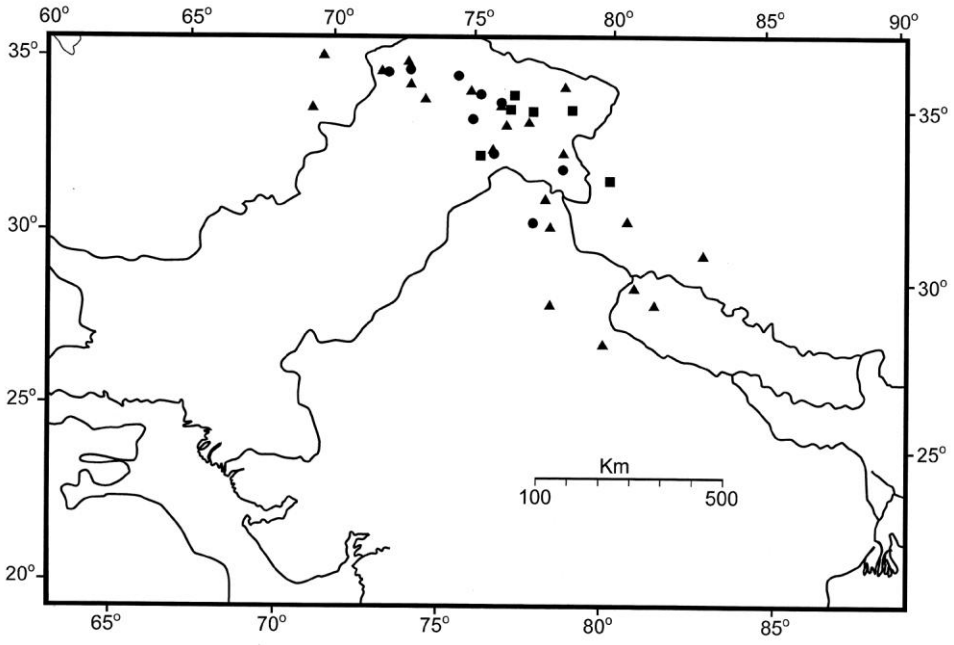

Fig. 2. Distribution pattern of *Inula acuminata* (●) , *I. obtusifolia* (▲)and *I.falconeri* (■).

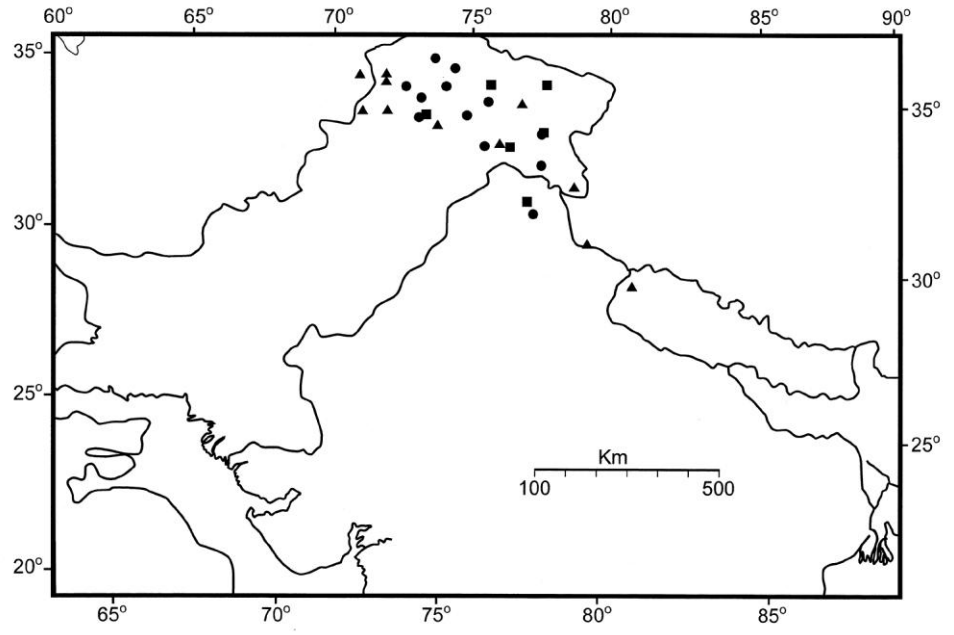

Fig. 3. Distribution pattern of *Inula clarkei* (■) , *I. royleana* (●) and *I. racemosa* (▲).

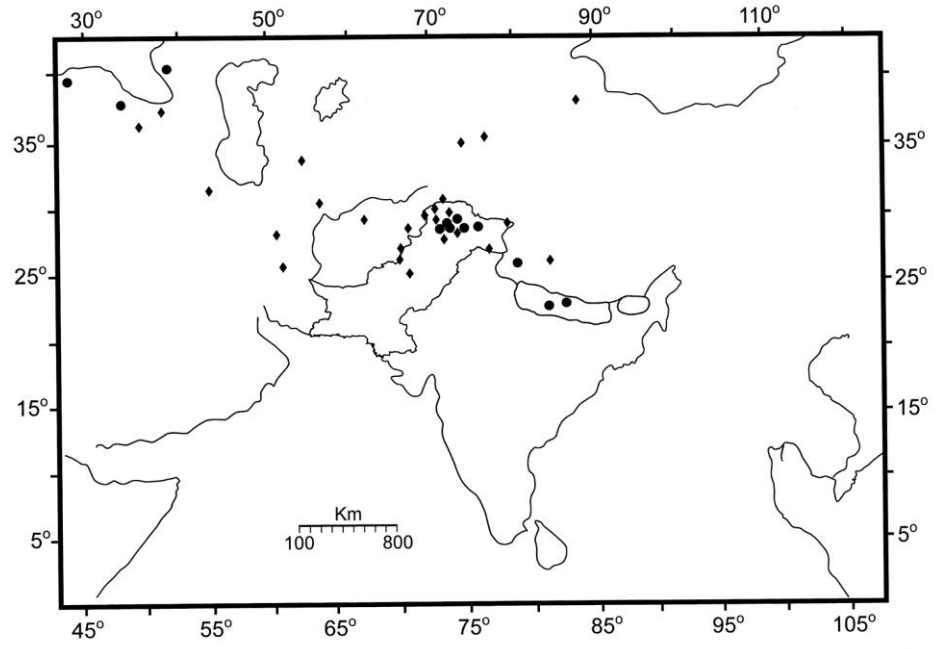

Fig. 4. Distribution pattern of *Inula rhizocephala* (♦) and *I.orientalis* (●).

Turanian element and partim endemic (Fig. 2), distributed in Baltistan (Karakorum) and W. Tibet (type locality), between 2300-2400 m. *I. rhizocephala* Schrenk, is another Irano-Turanian (Central Asian) element distributed between 2100-3800 m in eastern Iran, Afghanistan, Uzbakistan, Eastern China and extends further east to India through Pakistan (Fig. 4). *I. clarkei* (Hook.f.) R.R.Stewart, has narrow distribution, mainly occurring in Karakorum ranges between 2400-3500 m but extend to Kashmir (Himalayan range) in Neelum (Kishenganga) valley (Fig. 3). *I. royleana DC.*, is probably one of the most medicinally important species and it is a western Himalayan element extending in the moist parts of Karakorum range, grows in alpine meadows between 2000-3500 m (Fig. 3). *I. acuminata* Royle ex DC., and *I. obtusifolia* Kern., are more widely distributed than the previous two species. *I. acuminata* Royle ex DC., grows on damp places between 1600-2700 m, in Himalaya (Hazara and Kashmir), Karakorum and Hindukush ranges, which are western most limits of Sino–Japanese region (Fig. 2). *I. obtusifolia*, a common species, of rock crevices, dry cliffs, slopes and sandy grounds, grows between 2400-4500 m. It is sympatric in N.W. Himalayas, Karakorum and Hindukush ranges and extend further west to Eastern Afghanistan and eastward to China. This region of north eastern Afghanistan (Hindukush range) may be considered as a transitional zone between Irano-Turanian region and true Sino-Japanese region. The phytogeographical position of this region (Eastern Afghanistan, Hindukush range) is rather debatable. A number of workers viz., Kitamura (1960), Hara (1966), Zohary (1973), Ali & Qaiser (1986), consider N. Eastern Afghanistan as the western most limit of Sino Japanese region due to its high rainfall and occurrence of a number of Himalayan species. Contrary to that a number of workers do not recognize any Sino-Japanese territory in Afghanistan (Good, 1947; Takhtajan, 1969). The distribution pattern of several taxa also do not completely supports its inclusion in Sino-Japanese region (Qaiser, 2005). *I. racemosa* Hook.f., is the

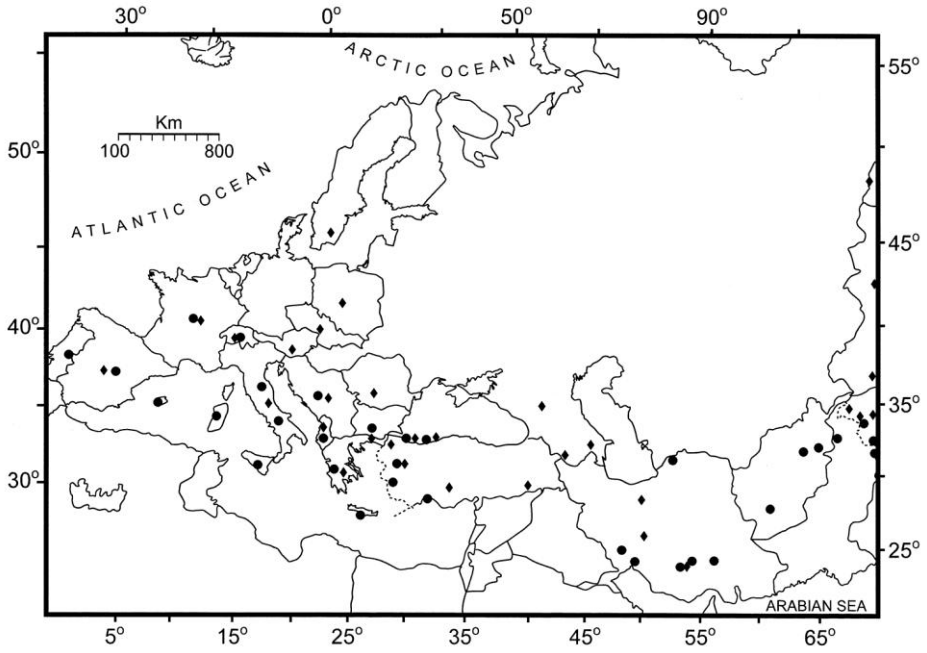

Fig. 5. Distribution pattern of *Inula britannica* (♦) and *Dittrichia graveolens* (●).

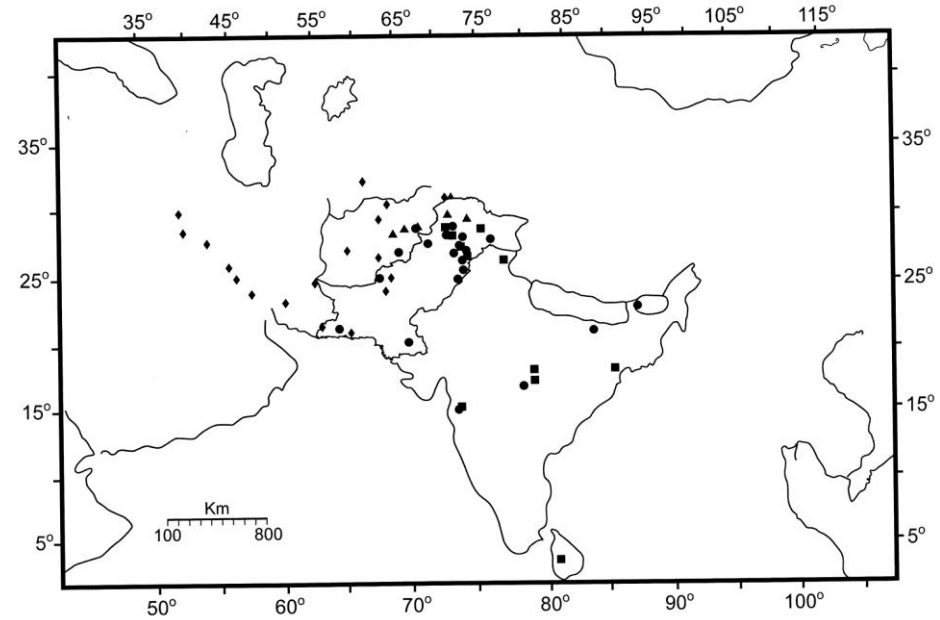

Fig. 6. Distribution pattern of *Pentanema glanduligerum* (▲), *P. indicum* (■) *P. divaricatum* (♦) and *P. vestitum* (●).

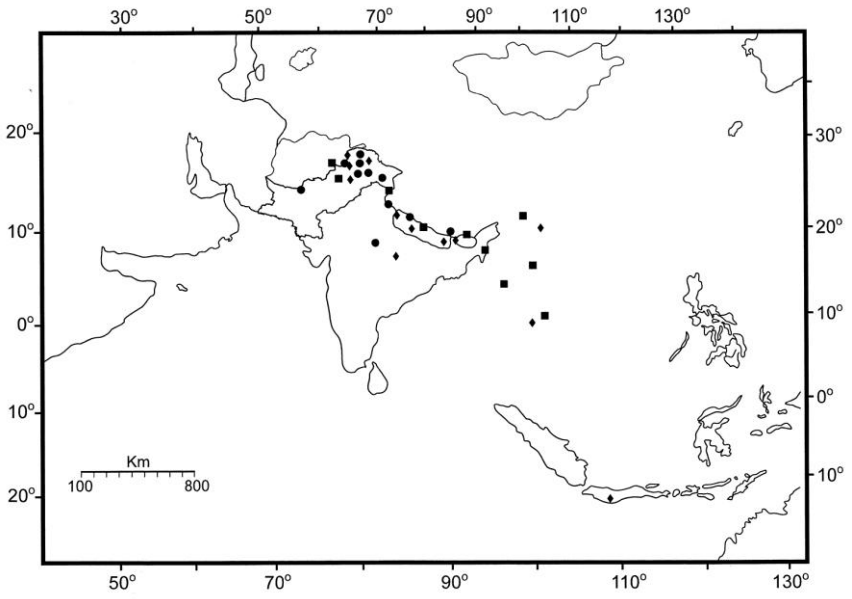

Fig. 7. Distribution pattern of *Duhaldea cappa* (♦), *D. eupatorioides* (■) and *D. cuspidata* (●).

only species which extends from Eastern Afghanistan to Nepal (Eastern Himalayas) through N.W. Himalayas and may be considered as partim endemic in Sino-Japanese region, grows between 1500-2500 m (Fig. 3). The last two species *I. orientalis* Lam., and *I. britannica* L., are more widely distributed. The former species is distributed from Nepal to Balkan-Asia minor through Pakistan, Caucasus and may be considered as biregional element occurring in Irano-Turanian and Sino-Japanese regions. In our area this species grows between 2000-3600 m (Fig. 4). *I. britannica* is also another biregional element (Euro-Siberian and Irano-Turanian regions) widely distributed in W.Europe, Turkey extending eastward to China through Iran and Pakistan. This species also occupies the similar habitat of 1800-2500m in wet places (Fig. 5).

The genus *Pentanema* Cass., is distributed from African Mediterranian region to Central Asia and Himalayas extending further east to Sri Lanka (Willis, 1973; Anderberg, 1994; Qaiser & Abid, 2003) . Out of 5 species occurring in Pakistan and Kashmir, *P. glanduligerum* (Krasch.) Gorschk., and *P. nematolepis* Rech.f., are Irano-Turanian elements (Fig. 6).The former species is more widely distributed and grows in western and eastern Irano-Turanian sub regions between 1500-2800 m, among rocks crevices, whereas, the latter species is almost sympatric in the western part of Irano-Turanian region but does not reach to eastern part of Irano-Turanian subregion. *P. indicum* (L.) Ling, is typically an Indian element and reach up to Myanmar in the east, Srilanka in the south and Pakistan (Mardan and Abbottabad) in west which seems to be its western most limit. It grows between 600-2000m (Fig. 6). The remaining two species viz., *P. divaricatum* Cass., and *P. vestitum* (Wall. ex DC.) Ling, may also be classified as biregional elements, former species seems to be equally distributed in Saharo-Sindian and Irano-Turanian region and in Pakistan it grows from plains to 1700m among crevices and stony slopes. The latter species extends to Saharo-Sindian and Indian region (Fig. 6). In our region it is distributed from plains to 400-1500m, among dry river beds and stony rocks.

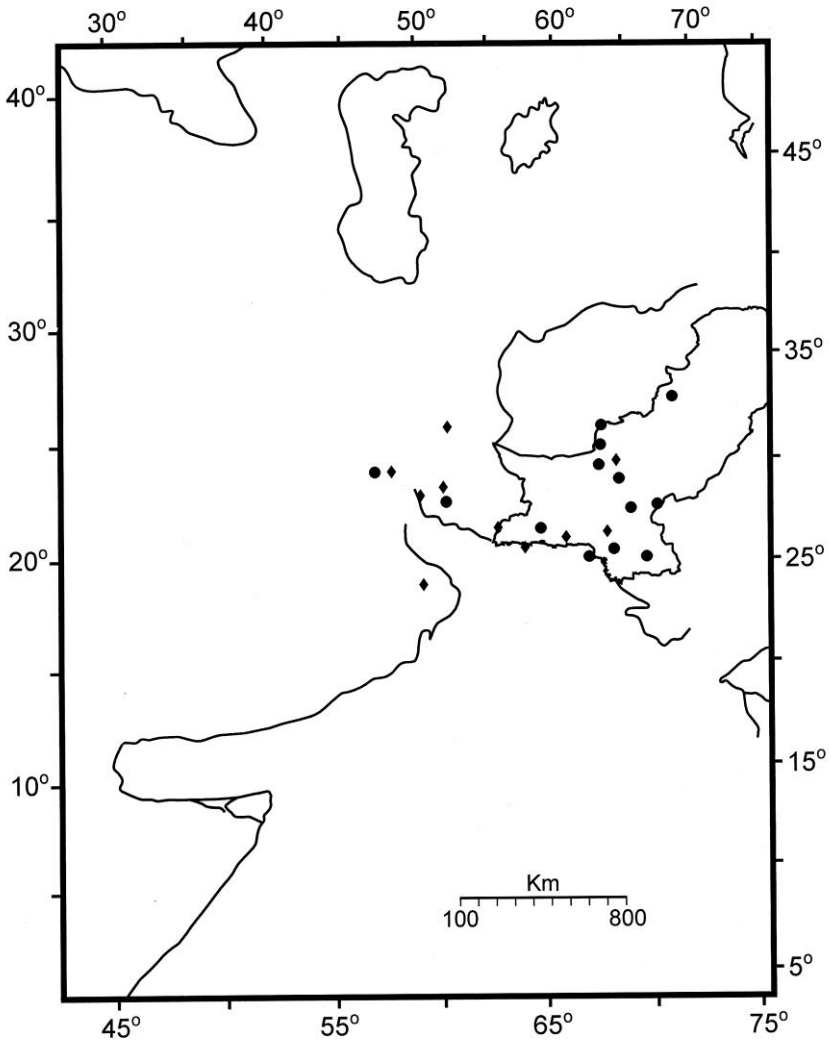

Fig.8. Distribution pattern of *Iphiona grantioides* (♦) and *I.aucheri* (●).

The distribution pattern of *Duhaldea* DC., is quite interesting as it shows typical disjunct distribution in Africa and Central to East Asia (Anderberg, 1994; Qaiser & Abid, 2003). Among the 4 species, one species i.e., *D. latifolia* (*DC.*) Dawar & Qaiser could not be analyzed due to scarcity of material and as the authors could see only one gathering collected from Kashmir without any precise locality. However, the remaining 3 species viz., D. *cappa* (Ham. ex D.Don) A. Anderb., grows between 900-4000m among rocks and steep grassy banks, *D. eupatorioides* (Wall. ex DC.) A. Anderb., found at the altitude between 700-1500m and *D. cuspidata* (wall. ex DC.) A. Anderb.,grows along river banks and among rock crevices from 900-2000m. All the three species are typically Sino-Japanese elements (Fig. 7).

The small genus *Dittrichia* Greuter with two species is distributed in Mediterranean region to South West Asia (Anderberg, 1994; Qaiser & Abid, 2003). The only species *D. graveolens* (L.) Greuter, grows in our region on waste grounds. It is basically Mediterranean element but extending further east to Pakistan via Irano-Turanian region also (Fig. 5).

The genus *Iphiona* Cass., is widely distributed in Mediterranian-Tropical and South Africa, Mascrene Islands, Arabia extending to Central Asia (Anderberg, 1994; Qaiser & Abid, 2003). Both the species of *Iphiona* viz., *I. aucheri* (Boiss.) A. Anderb. and *I. grantioides* (*Boiss.*) A. Anderb., grow in our region on hilly slopes, stony grounds, dry river beds in the arid plains of Sindh and Balochistan. They are clearly Saharo-Sindian elements and may be classified as partim endemics confined to Pakistan, Iran and Oman (Fig. 8).

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