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Study Of Phyto-Geographical Distribution Patterns And Endemism Of Genus Psychrogeton (Asteraceae) From Pakistan (Including Kashmir), Iran And Afghanistan

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ABSTRACT

Study of distribution patterns and endemism of 19 species of Psychrogeton Boiss.of the tribe Astereae, (Asteraceae) have been carried out. A total of 19 species are recognized from the region. Out of which, 6 species are recognized from Pakistan & Kashmir, (Fl. of Pakistan, 224, 2021) while 13 from Afghanistan and 11 are recognized from Iran. Out of 6 taxa reported from Pakistan, 3 elements are strictly Sino-Japanese, 3 taxa are reported from both regions Sino-Japanese and Eastern Irano-turanian. From Afghanistan out of 13 species, seven are reported in both Sino-Japanese and Irano-Turanian phytochorions, while five are restricted to Irano-Turanian and two species are found in Sino-Japanese only. Iran and Afghanistan both countries consist mainly of Irano-Turanian phytochorion while Iran has small Saharo-Sindian area in its Sistan & Balochistan province and Afghanistan has Saharo-Sindian region extended to Qandhar, Helmund and Nimruz and Sino-Japanese region includes the provinces of Lougar, Nangarhar, Kabul, Kunar, Nurestan, Kapisa, Laghman and Panjsher. Phytogeographically, there are 21.05 % species which are pluri-regional, (four species) and found in all the three countries, only these four species are shared by Iran and Pakistan. 15.78 % taxa (1 species), are bi-regional, found in two countries e.g. Pakistan and Afghanistan, two species are shared by Iran and Afghanistan. There are 60 % species (12) which are uniregional, 6 species are endemic to Afghanistan, 5 species are endemic to Iran, one species is endemic to Pakistan.

Key Words: Pakistan, Iran, Afghanistan, Phytogeography, Psychrogeton, Astereae,

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Asteraceae.

Introduction

As we put a glance on the world map, the region comprises of Pakistan, Iran and Afghanistan lies nearly in the SW of Oriental world and in the mid of Old world. Different climatic and phyto-geographical regions join in this area, thus the region shows a great biodiversity. The region is at the union of northern temperate, colder mountainous area and regions having climate of hot dry western deserts of Arabian Peninsula and Africa as well as eastern plains and rivers of India, Bangladesh and Burma. The genus is restricted to hilly and mountainous regions of these countries.

This genus is not studied in Pakistan yet. Pakistan shares almost 70% flora with that of Iran, Afghanistan and Central Asia. Grierson (1982) has reported 19 species in Flora Iranica (1982). Therefore a comprehensive study was needed in this area. This study will also help taxonomists working on the floras of adjoining areas.

Boissier has reported *Psychrogeton cabulicum* first time from Hajigak Pass Afghanistan (1875). O.Hoffman mentioned one species from Pamir (1903). Flora of USSR does not include *Psychrogeton* as a whole genus but it is a section under genus *Erigeron,* (Komarov, 1990). Their distribution is given as Soviet Central Asia, Pamiro-Alai, Tien Shan, Turkmenia, Iran, Dzhungaria, Tarbagatai, Afghanistan, India, Pamiro-Kashgaria. Kirgizistan, Transcaucasia, Balkash region, Armenia and Kurdistan. Komarov included these species in *Erigeron* but later Grierson placed them under genus *Psychrogeton.*

Grierson (1967) described 16 species. From Iran he described 7 species, from Afghanistan 12 and from Pakistan 4 species were described. Stewart reported 5 species of *Psychrogeton* from Pakistan, (1972). These species are mentioned with the distribution of Chitral, Gilgit, Swat, Astore and Ladakh. In flora of Afghanistan *Psychrogeton* is not included but in Flora Iranica 14 species are mentioned with the distribution of Afghanistan.

Grierson (1975), in Flora of Turkey mentioned *Psychrogeton nigromontanus* and *P. amorphoglossus* with the distribution of South East Anatolia, Hakkari, N.Iraq, Iran, Afghanistan, Central Asia Iran-Turan element.

Grierson (1982) reported 19 species in Flora Iranica, from different parts

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of this region, e.g 2 species from Anatolia, 5 from Iraq, 1 from Assyria, 2 from Kazakhstan, 6 from Tadjikistan, 3 from Uzbekistan, 3 from Turcomania, 2 from Kirghizstan, 1 from Central Asia, 5 species from Pakistan (including all 3 varieties of *P andryaloides)*, 19 from Iran (with 1 variety of *P andryaloides*) and 14 from Afghanistan (with 2 varieties of *P andryaloides*).

Bremer (1994) has mentioned that the tribe Astereae is worldwide in distribution especially frequent in South-western North America, along the Andes in South America, in Southern Africa, Australia New Zealand and in Central Asia but *Psychrogeton* is found in Central and SW Asia only.

In Flora of India (1995) only 1 species *P.andryaloides* is reported which is also reported by Grierson. Distribution of the genus is given as follows: India, Pakistan. Afghanistan, Persia, Turkistan, Pamir-Hindukush region.

In 2007 Nesom and Robinson discussed distribution of *Psychrogeton* which is Central Asia and W.China. Funk, Susanna, Stuessy and Bayer (2009) have mentioned distribution of Astereae worldwide with major centres of diversity in Africa, N. America & Australia.

Noroozi has mentioned *P. amorphoglossus and Psychrogeton alexeenkoi* as Irano-Turanian element in Hezar-Lalehzar Mountains in alpine and subnival zone at high altitude. (Comp. Newsl. 48, 2010). Breckle (2010) has mentioned the distribution of *Psychrogeton* in E, NE Afghanistan, East Iran, Pakistan, Kashmir NW India and Central Asia at the altitude of 2700 - 5200 m, in mountainous region at the hilly slopes and crevices. In flora of China (2011), 20 species are mentioned with the distribution of SW Asia and Central Asia. 2 out of them are also reported from China.

All the information discussed in the literature tell us the genus is mostly restricted to Iran, Central and S.W. Asia, West China, Anatolia, Turcomania, Afghanistan, (Kabul, Bamian), Tadjikistan, Kirgizstan, Pakistan, Kashmir, India, Iraq, Uzbekistan, Kazakhstan, Kurdistan and Assyria.

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Fig.1: Distribution of species of *Psychrogeton*

MATERIALS & METHODS

The distribution of all nineteen species of genus *Psychrogeton* has been traced and maps have been drawn with the help of comprehensive literature survey and study of the herbarium material housed in the following herbaria; BM, E, KUH & NHI. Online access was provided by a number of herbaria i.e, NMNH (USNH), K, E, BM, LE, G, W and MPU.

RESULT

According to the phyto-geographical division of the region, Iran has been divided into two regions Western Irano-Turanian and small Saharo - Sindian, which is in the South East sharing the border with Pakistan (Baluchistan). Afghanistan has been divided into three regions, Saharo-Sindian in the South of Afghanistan consists of small area, Western Irano-Turanian consists of most of the country, its Western, Northern, Central and upper North Eastern Region. Only Lower Eastern Afghanistan has a small continuation of Sino-Japanese region coming from Pakistan (Ali & Qaiser 1986). Only Wakhan corridor is occupied by Eastern Irano-Turanian region, which is independent, small area is under the control of Russia and rest is controlled by local tribes.

The land of Pakistan contains a blend of following regions; Saharo-

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Sindian region entering from Baluchistan, occupy most of Sindh, Punjab and lower KPK. Second largest region is the Eastern, Western Irano-Turanian region which occupies extreme North of Pakistan and a small Western area of KPK and Baluchistan. Third is Sino-Japanese region occupies Kashmir, Swat, Chitral and adjoining area. A very small eastern region of Punjab and Sindh constitutes Indian Region.

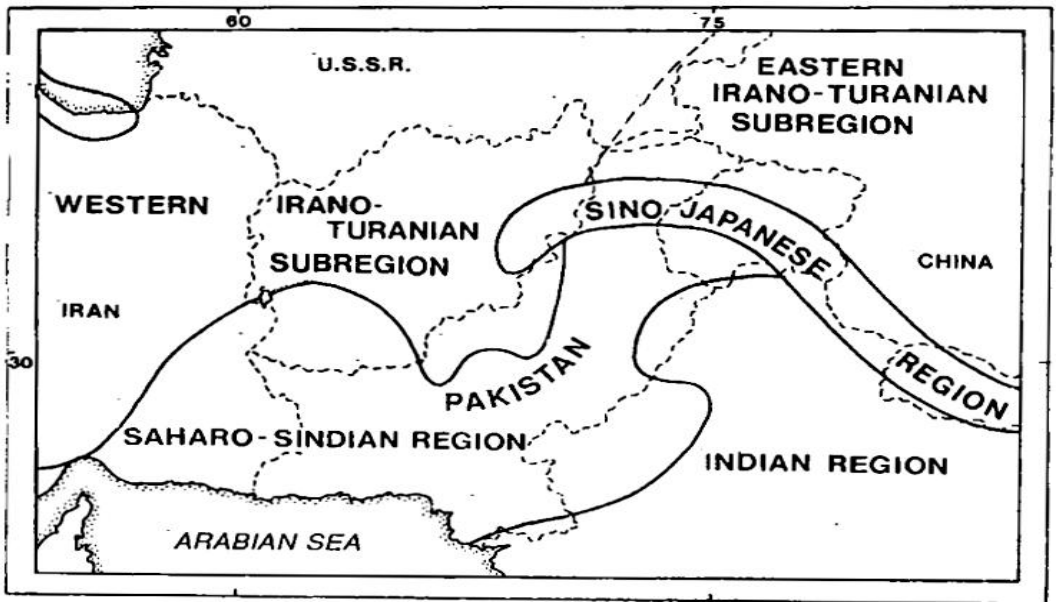


Fig. 2: Phyto-geographical Distribution (Ali & Qaiser, 1986)

In Pakistan, the genus is restricted to hilly and mountainous regions which cover the north and north west of the country. The genus is reported from Province Khyber-Pakhtunkhwah (KPK), Province Baluchistan and Gilgit–Baltistan. Sindh and Punjab are the two provinces devoid of this genus. But areas which are located in the north of Punjab and touch Kashmir may have the population of this genus. In this scenario, *Psychrogeton* has been reported from Sino-Japanese, Eastern Irano-Turanian and as well as Western Irano-Turanian Range. So the species occupies Northern and North western region of Pakistan and most of Afghanistan and Iran.

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S#	Name of species	Pakistan	Afghanistan	Iran
1	*P. aellenii*	-	-	+ IT Endemic
2	*P. alexeenkoi*	+ SJ IT	+ SJ IT	+ IT
3	*P.amorphoglossus*	+ SJ IT	+ SJ IT	+ IT
4	*P.andryaloides*	+ SJ IT	+ SJ IT	+ IT
5	*P.aucheri*	+ SJ	+ SJ IT	+ IT
6	*P. cabulicum*	-	+ IT	+ IT
7	*P. candidissimus*	-	+ SJ Endemic	-
8	*P.chionophilus*	-	-	+ IT Endemic
9	*P. chitralicus*	+ SJ Endemic	-	-
10	*P. drabiformis*	-	+ SJ IT Endemic	-
11	*P. lumbricoides*	-	+ SJ IT Endemic	-
12	*P. nigromontanus*	-	+ IT	+ IT
13	*P. obovatus*	-	-	+ IT
14	*P. olgae*	+ SJ	+ SJ	-
15	*P. persicus*	-	-	+ IT
16	*P. pseudoerigeron*	-	-	+ IT
17	*P. rotundifolius*	-	+ IT Endemic	-
18	*P. shehrestanicus*	-	+ IT Endemic	-
19	*P. sphaeroxylus*	-	+ IT Endemic	-
		6	13	11

Table 1: Phytogeographical Distribution of *Psychrogeton* in the Region under study

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SJ--- Sino-Japanese region IT--- Irano-Turanian region

(1) *Psychrogeton aellenii* (Rech. f.) Grierson: This species is only found in Iran but the region where it is reported is near the border of Turkmenistan so it may exist there. This species is not reported from Afghanistan and Pakistan. The species is reported at the height of 2800 m-3900 m on rocky slopes and crevices.

(2) *Psychrogeton alexeenkoi* Krasch.: The species is pluri-regional, reported from Iran, Pakistan and Afghanistan, (Uzbekistan & Tadzhikistan). In Pakistan, it is found in Chitral and adjoining areas. In Afghanistan it is found in the region near the border of Pakistan (Chitral). It may also be found in Tadjikstan as we observe its occurrence in Badakhshan, adjoining province of Afghanistan to Tadjikistan. It is reported at the height of 3200--4000m from sea level.

(3) *Psychrogeton amorphoglossus* (Boiss.) Novopokr.: This species is pluri-regional and wide in distribution. It is reported from Chitral, Gilgit- Baltistan and Kashmir, so it may be found in Northern India hence not reported yet. In Afghanistan, its occurrence can be observed in all areas of Afghanistan, near the borders of Pakistan, Central Afghanistan and area near Iran - Turkmenistan border. In Iran, it is found in areas adjoining Tehran, near Turkmenistan border, areas near Persian Gulf and Central Iran. Thus it may exist in Turkmenistan also. The species has wider geographical occurrence as compared to other species therefore it is found all the 3 countries including Iraq, Turkey, Tadjikistan, Uzbekistan and Kazakhstan. It is reported at the height of 2100--4100m.

(4) *Psychrogeton andryaloides* (DC.) Novopokr.ex Krasch: This species has a wide range of the reported area including Afghanistan, Iran, Pakistan, (Kashmir), India, Tajikistan, Central Asia and China. There are three varieties of the species, *P.andryaloides var. andryaloides; var. poncinssi*, and *var. denudatus* with different distribution patterns. The species is reported at the 2300--4900 m.

(i) *P.andryaloides var. andryaloides*: Under this study this variety is reported from Pakistan, Iran and Afghanistan. In Pakistan it has been found in Gilgit, Baltistan, Kashmir and extreme Northern region adjoining to China. It has a wide range of the reported area including Afghanistan, Iran, Pakistan, (Kashmir), India, Tajikistan, Central Asia and China. In Afghanistan, its existence can be observed in all the area

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from Kabul to Pakistan, hence is also reported from India. The variety is reported at the 2300--4500 m.

(ii) *P.andryaloides* var. *denudatus*: is reported from Pakistan, (Kashmir and Chitral) so it may found in some areas of Afghanistan, along Pakistani border and Northern area of India. It is reported at the height of 2500—4900 m.

(iii) *P.andryaloides var. poncinsii*: The fact reveals that there is some geographical obstacle like mountains so it is not reported from there or that area needs a combing expedition for collection.

One of its three varieties.

(5) *Psychrogeton aucheri* (DC) Grierson: The species has a wide range of geographical distribution. It is a pluri-regional species, reported from Afghanistan, Iran, Tajikistan, Turkmenistan and Uzbekistan. In Pakistan, it was found in Chitral. In Afghanistan, it was found in Kabul, Bamian, Parvan, Kapisa, Paktia, Ghazni and Takhar, province near Tadjikstan border. So it may be found in Tadjikstan. In Iran, its occurrence has been observed from Isfahan which is near Central Iran; it may also be reported from other areas of Iran.

It is reported at the height of 1900--3000 m, which is the widest range in the genus *Psychrogeton.* The specimens collected from Pakistan have been taken from Chitral only, they may also be found in other areas of Northern region of Pakistan.

(6) *Psychrogeton cabulicum* Boiss.: The species is reported from Kabul and Takhar in Afghanistan, which is near the border of Tadjikistan, so it may be found in Tadjikistan. This species is reported at the height of 3200--4000m, at the rocky slopes and crevices of the mountains. Grierson did not report the species from Iran (1982), but Emadzadeh & Joharchi reports the species from Iran in 2004, so it is also a bioregional species.

(7) *Psychrogeton candidissimus* (Rech. f. & Edelb.) Grierson: The species is uni-regional and reported from Afghanistan only. This species is more hairy and tomentose than the other species of *Psychrogeton.* Leaves have white tomentum. Cypsela are also densely tomentose. The attributes show that the species may flourish in areas at further higher altitudes than those where they are reported. The species is reported at the height of 1800--2900m. In Afghanistan it is reported from Laghman.

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(8) *Psychrogeton chionophilus* (Boiss.) Krasch.: The species of *Psychrogeton* is not reported from Afghanistan, but found in southern Iran. Its geographical range is ±3600 m from the sea level.

(9) *Psychrogeton chitralicus* Grierson: The species is relatively a new species reported from Pakistan by Grierson, it is endemic to Pakistan. It is found at the height of 3400-3600m. In Pakistan it is reported from Chitral, which is along the border of Afghanistan. It may exist in Afghanistan too.

(10) *Psychrogeton drabiformis* Grierson: The species is found in Bamian (Afghanistan). This species is not reported from Iran or Pakistan. It is found at the height of 2600-3000m.

(11) *Psychrogeton lumbricoides* (Gilli) Grierson: From Afghanistan it is reported in Parvan, Maidan and Panjsher valley. All these areas are along the border of Pakistan so we can say that it will also be found in chitral and other Pakistani areas. It is found at the height of 1900-3200 m. It is not reported from Iran. Its type specimen was collected at 2480 m from Kabul, Afghanistan.

(12) *Psychrogeton nigromontanus* (Boiss. & Buhse) Grierson: *P.nigromontanus* is reported from Persia. It is reported from Koh-e-Daena, which is in the south of Iran. In Afghanistan it is not reported but it may be present there. It is reported at the height of 1700--3070 m.

(13) *Psychrogeton obovatus* (Benth.) Grierson: Type material of this species is collected from Iraq. It is reported from Persia. This species may or may not be present in Pakistan, because Kerman is next to Zahidan which shares the border with Pakistan. It is not reported from Afghanistan also. It is endemic, and found in Iraq, Kurdistan, Assyria, Persia (Tehran). Its geographical range is 1100-2800 m.

(14) *Psychrogeton olgae* (Regel & Schmalh.) Novopokr. ex Nevski: The species is reported from Afghanistan, Kirgizstan, Turkmenistan, Tadjikistan, In Pakistan, it is found in Kashmir, Hunza and Gilgit. It is also reported from Afghanistan, Kabul and Badakhshan which shares the border with Pakistan. It is reported at the height of 3700-4900 m. This species is not reported from Iran.

(15) *Psychrogeton persicus* (Boiss.) Grierson: This species is reported from southern Iran, Koh-e-Delu and Mount. Daena. It is reported from 3200--3800 m, from

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mountainous slopes and crevices.

(16) *Psychrogeton pseudoerigeron* (Bunge) Novopokr. ex Nevski.: The species is uni-regional and found in Khorasan (Iran). If we look at the map, Khorasan is not very much far away from Afghanistan. Surely may be found in adjoining and amidst areas. This species is reported at the height of 2300--2600 m.

(17) *Psychrogeton rotundifolius* Grierson: The species is found in Afghanistan, near the border of Turkmenistan at the height of 1900 m. It will be found in Turkmenistan most probably. It is not reported from Pakistan or Iran. The species is less hairy and glandular; its leaves are rounded and have wider lamina than that of the other species of *Psychrogeton.* Its morphology exhibits mesophytic nature of plant, it is a fact that it grows in hilly region not more than 2000 m.

(18) *Psychrogeton shahrestanicus* Rech. f.: The species is uni-regional and reported only from Afghanistan, deh- Kundi. Its range is 2200 m. It has not yet been reported from Pakistan and Iran.

(19) *Psychrogeton sphaeroxylus* (Gilli) Grierson.: In Iran, Kerman is the province where the species is found; while in Afghanistan its distribution occupies north western region. These areas share the borders with Turkmenistan, Uzbekistan and some area of Tadjikistan. So it may be resulted that the species may be found in all these above mentioned countries. Although, it is reported from Pakistan only. It is reported at the height of 2300--3700 m.

Conclusion:

The number of species is the highest in Afghanistan (13 species), as compared to the other two countries. Iran has 11 species reported and Pakistan has 6 species. The number of species from Pakistan may increase with the passage of time. Out of 6 taxa reported from Pakistan, 3 elements are strictly Sino-Japanese, 3 taxa are reported from both regions Sino-Japanese and Eastern Irano-turanian From Afghanistan out of 13 species, seven are reported in both Sino-Japanese and Irano-Turanian phytochorions, while five are restricted to Irano-Turanian and two species are found in Sino-Japanese only.

In Pakistan, six species are reported, all of them are sino-japanese elements, while rest of the three are also found in Irano-turanian phytochorion. In Afghanistan,

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6 species are reported from Irano-turanian and Sino-Japanese both phytochorions and five species are restricted to Sino-Japanese region only and three from Irano-Turanian only. In Iran 11 species are reported, all are Irano-Turanian elements.

We also did not have enough access to the collection from Iran and Afghanistan, otherwise number of species may increase. Both countries are located in Western Irano-Turanian Region. The genus natively belongs to this region, while Pakistan has a blend of Eastern Irano-Turanian Region, Western Irano-Turanian Region, Saharo-Sindian region, Sino-Japanese and Indian Region. There are entirely different climatic conditions in these regions that support a large variety of different plants in Pakistan. The number of species may increase further because few species are excluded due to single number of herbarium sheets. If there would be a combing expedition throughout northern and northwestern region of Pakistan, the number of species of *Psychrogeton* may increase.

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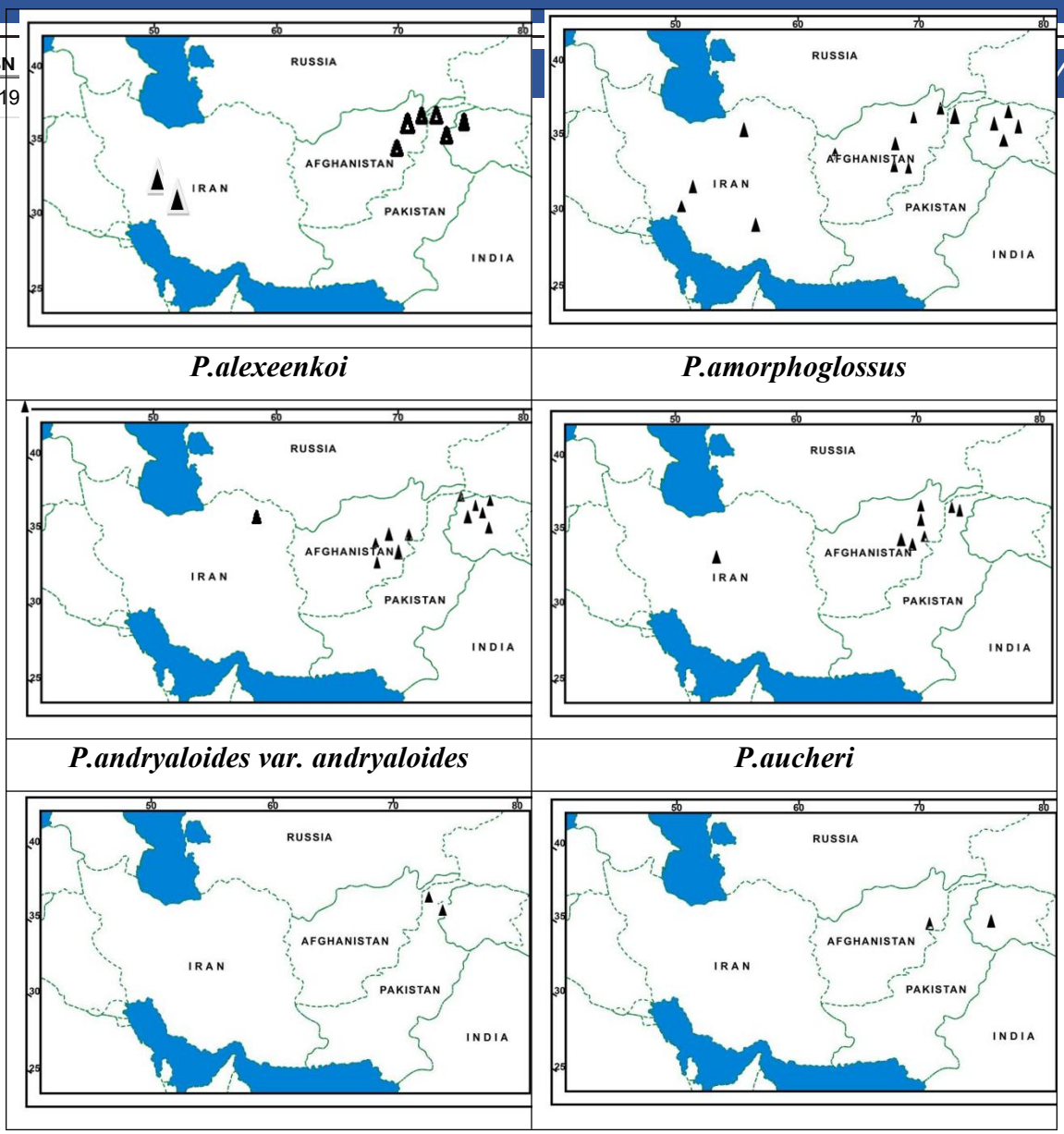
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P.alexeenkoi	*P.amorphoglossus*
P.andryaloides var. andryaloides	*P.aucheri*

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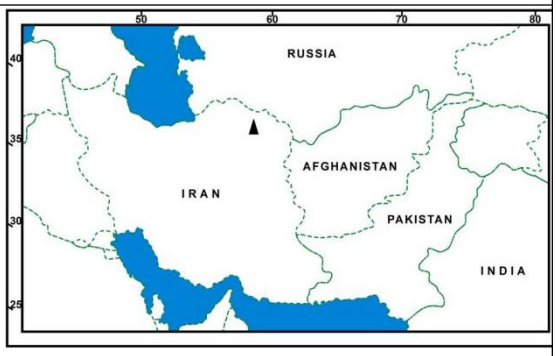
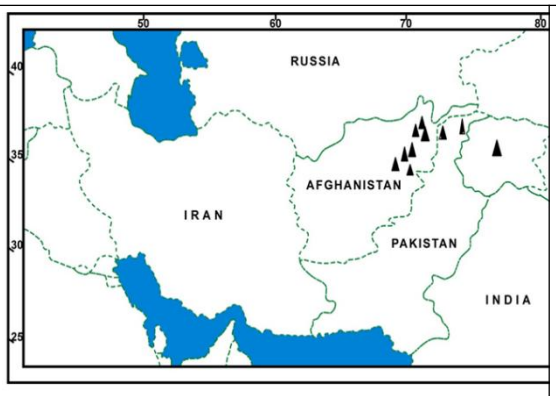
P.chitralicus	*P.olgae*
	
P.sphaeroxylus	*P.aellenii*

Table 2: Distribution Patterns of genus *Psychrogeton* Boiss.

	
Psychrogeton andryaloides var. poncinsii	*P.cabulicum*

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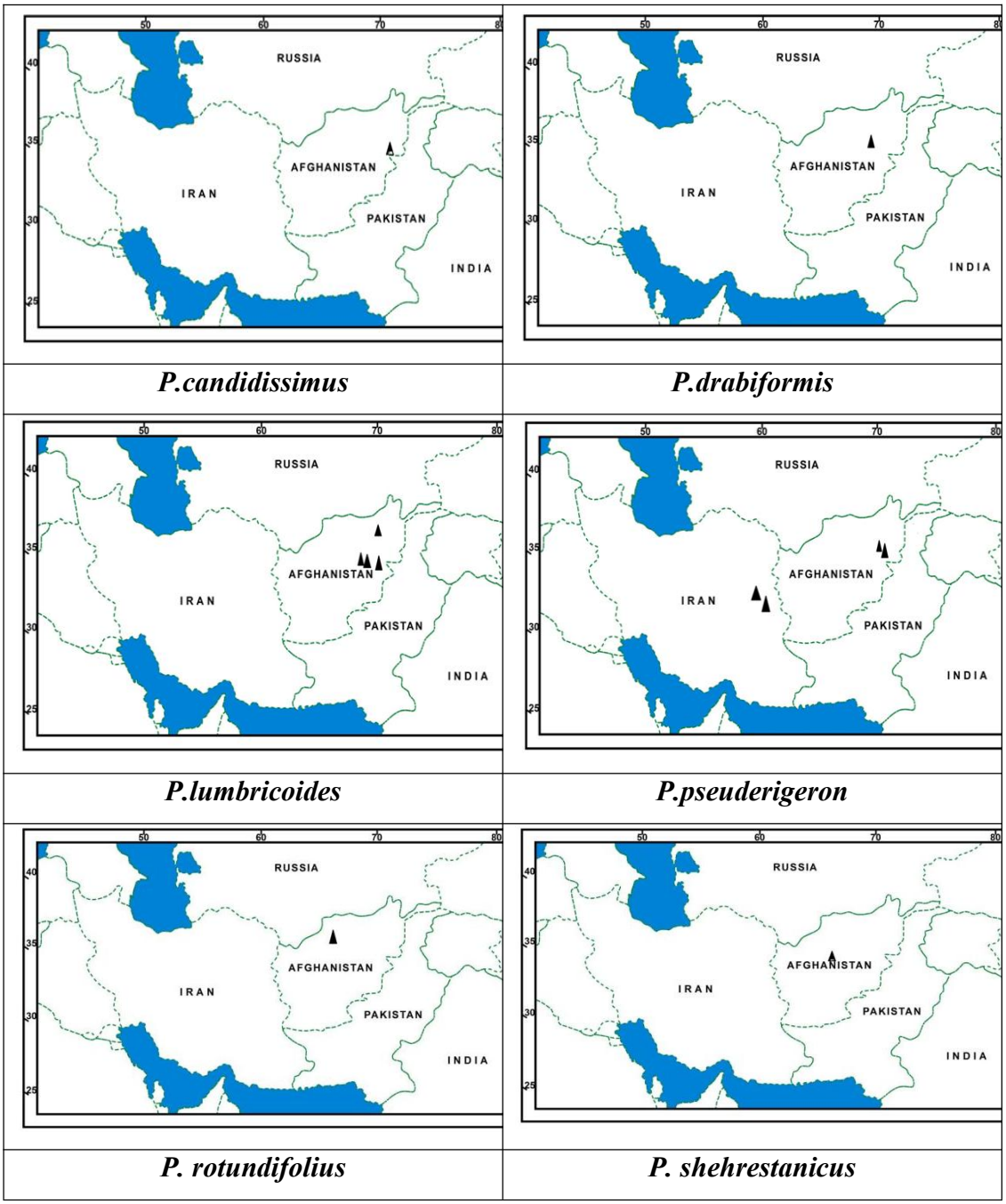


Table 3: Distribution Patterns of genus *Psychrogeton* Boiss.