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Distribution and conservation significance of endemic and subendemic species of Orobanchaceae, Plantaginaceae and Scrophulariaceae from Pakistan: Insights for the nomenclatural updates

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Abstract

In the present study, we shortlisted 71 endemic and subendemic plant species in three diverse families, Orobanchaceae, Plantaginaceae, and Scrophulariaceae from the political territory of Pakistan. Among them, Orobanchaceae has the highest number of species (47 spp., 66.20%), including four genera: *Pedicularis* and *Euphrasia*, each with (21 spp., 44.68%), followed by *Orobanche* with (4 spp., 8.51%), and *Christisonia*, which has one species (2.13%). Plantaginaceae contains (14 spp., 19.72%), including four genera: *Lagotis*, *Linaria*, and *Veronica*, each with (3 spp., 21.42%), followed by *Plantago* with (2 spp., 14.28%), and *Campylanthus*, *Chaenorhinum*, and *Picrorhiza*, each having a single species (7.14%). Scrophulariaceae includes only the genus *Scrophularia* with (10 spp., 14.08%). Some species-rich genera (e.g., *Euphrasia*, *Pedicularis*, and *Scrophularia*) are extensively distributed in the Himalayan region, which is regarded as a significant hotspot and a center of speciation for these genera. It is concluded that the species richness and proportion of these endemic plants are highly diversified in northern Pakistan due to altitudinal gradients, which show a response to altitude.

Keywords: Biodiversity, Biogeography, Conservation, Ecology, Endemism, Pakistan, Vascular flora

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Introduction

Endemics are defined as species that are restricted to a specified geographical area (Tiwari et al., 2024). Endemism refers to the state of a taxon that is restricted to a particular geographical region (Anderson, 1994). An area of endemism is a region that harbors a high number of endemic species (Crisp et al., 2001; Laffan & Crisp, 2003; Massoumi & Khajoei Nasab, 2023). The endemism of plant species is indicative of their evolutionary history (Morrone, 2008). In ecology and geography, areas of endemism have great significance and are considered fundamental units (Gomes-da-Silva et al., 2017). These biodiversity conservation units provide significant insights into the biogeographic and paleoecological history of endemic plant species (Hobohm, 2014; Morrone, 2008; Massoumi & Khajoei Nasab, 2023). The concept of areas of endemism has always been a significant and interesting topic for phytogeographers and biologists, raising interest in explaining why areas of endemism are important (Laffan & Crisp, 2003; Feng et al., 2016). The establishment of conservation priorities in light of environmental degradation requires sound knowledge of the distribution of plant biodiversity (Wulff et al., 2013; Qasim et al., 2016; Yousaf et al., 2022; Rozina et al., 2017; Nabila et al., 2022; Jabeen et al., 2024). The endemic plant species have a specific geographic range, habitat, and population size (Rabinowitz et al., 1986; Humphries & Parenti, 1999). Various studies have been conducted on the distribution patterns of endemic plant species (Bruchmann, 2011; Graham et al., 2006; Hobohm, 2003; Cowling & Lombard, 2002; Givnish, 2000; Rosenzweig, 1995; Huston, 1994; Hendrych, 1982). Endemic plant species are at high risk due to their narrow geographic range, low population density, and specific climatic conditions (Khan et al., 2022; Tiwari et al., 2024). It is believed that half of all endemic plant species are threatened and close to extinction in their natural environment (Bilz et al., 2011; Ozinga & Schaminee, 2005). Recent literature reveals that most endemic plant species have entered the extinction category due to various natural and anthropogenic activities (Lande, 1988; Schemske et al., 1994; Bizoux et al., 2004; Romero et al., 2004). In the last few decades, IUCN assessments have provided significant information for the assessment of the conservation status of narrowly endemic plant species (Betts et al., 2020). The IUCN database is a powerful tool for conservation planning, management, monitoring, and decision-making (Rodrigues et al., 2006). These assessments have been used by conservationists to establish lists of threatened taxa and to assess their population size, growth rate, population fluctuations, habitat fragmentation, and range size (Cody, 1986; IUCN, 2024). Here, we concentrate on the study area: Pakistan is a significant biodiversity hotspot, characterized by major mountain ranges, diverse geographic regions, varied landscapes, and different climatic conditions that have encouraged plant diversity in South Asia (Khan et al., 2020; Khan et al., 2022; Shah & Rozina, 2013; Qasim et al., 2015; Rozina, 2016; Ullah et al., 2015). Pakistan hosting approximately 7,000 native vascular plant species, of which 551 are endemic (Stewart, 1972; Ali, 1978; Ali & Qaiser, 1986). The most important reasons for Pakistan's high plant diversity and rich endemism are altitudinal gradients, climatological, and edaphic differences throughout its political territory (Sarwar & Qaiser, 2012). Plant diversity in Pakistan is distributed across four phytogeographical regions: Irano-Turanian, Sino-Japanese, Saharo-Sindian, and Indian (Ali & Qaiser, 1986). The Pakistani ecosystems were later recognized by Takhtajan (1969; 1986) into five floristic provinces: Sindian, Southern Iranian, Northern Baluchistan, Western Himalayan, and Tibetan Province (Ullah et al., 2015). Among them, the Western Himalaya is regarded as the richest and most dominant in terms of the number of plant species and endemism (Hara, 1966; Tiwari et al., 2024). These provinces represent a transition between the ancient Mediterranean and eastern Asiatic floras. The endemic species are mostly distributed in the mountainous regions of northern Pakistan (Kureshy, 1978). In Pakistan, most endemic plant species are recorded in Kashmir, followed by Northern Baluchistan, Gilgit-Baltistan, Chitral, and the Kurram Valley (Khan et al., 2022). The compilation of endemic plant species is a useful approach that provides roadmaps for the global conservation priorities of megadiversity hotspots (Qian & Ricklefs, 1999; Qian et al., 2006). In the present work, we shortlisted 71 endemic and subendemic plant species from three vascular families: Orobanchaceae, Plantaginaceae, and Scrophulariaceae, occurring in the Pakistani highlands. We focused on these families because several genera and species have been transferred among them. Consequently, these three families are nested within the well-supported Lamiids clade (order Lamiales) of the APG system (Bremer et al., 2002; APG II, 2003). The present review provides information on endemic plant species, including their native range, local distribution, and nomenclatural updates within the political boundaries of Pakistan.

Materials and Methods

We compiled a checklist of endemic and subendemic plant species in Orobanchaceae, Plantaginaceae, and Scrophulariaceae. The compilation of endemic and subendemic taxa were based on their association with phytogeographical regions within the political boundaries of Pakistan. The plant species were cross-checked with regional floras, focusing on the distribution of endemic and subendemic plants. For this study, we reviewed comprehensive literature, including the Flora of Pakistan (Stewart, 1972; Nasir & Ali, 1970-1985), Flora of British India (Hooker, 1904), Flora of China (Li, 2007), Flora of Afghanistan (Kitamura, 1960), the endemic flora of Afghanistan and Iran (Hedge & Wendelbo 1970, 1978), and Flora Iranica (Rechinger, 1963–2010). Additionally, we consulted Flora of Turkey (Davis, 1967–1985), Flora of the Russian Republics (Fedorov, 1971), and Field Guide to Afghanistan (Breckle & Rafiqpoor, 2010) to update taxonomic information. The study area map drawn using the shapefile of Pakistan (Figure 1). In addition, we analyzed herbarium specimens available online for this study from various virtual herbaria, including the Global Biodiversity Information Facility (GBIF, <https://www.gbif.org/>), Global Plants on JSTOR (<https://plants.jstor.org/>), and Kew Herbarium Catalogue (KHC, <https://data.kew.org/>). The authority and validity of genera and species were confirmed using online databases, including Plants of the World Online (POWO, www.plantsoftheworldonline.org), the World Checklist of Vascular Plants (WCVP, <http://wcvp.science.kew.org/>), and the International Plant Names Index (IPNI, <http://www.ipni.org>).



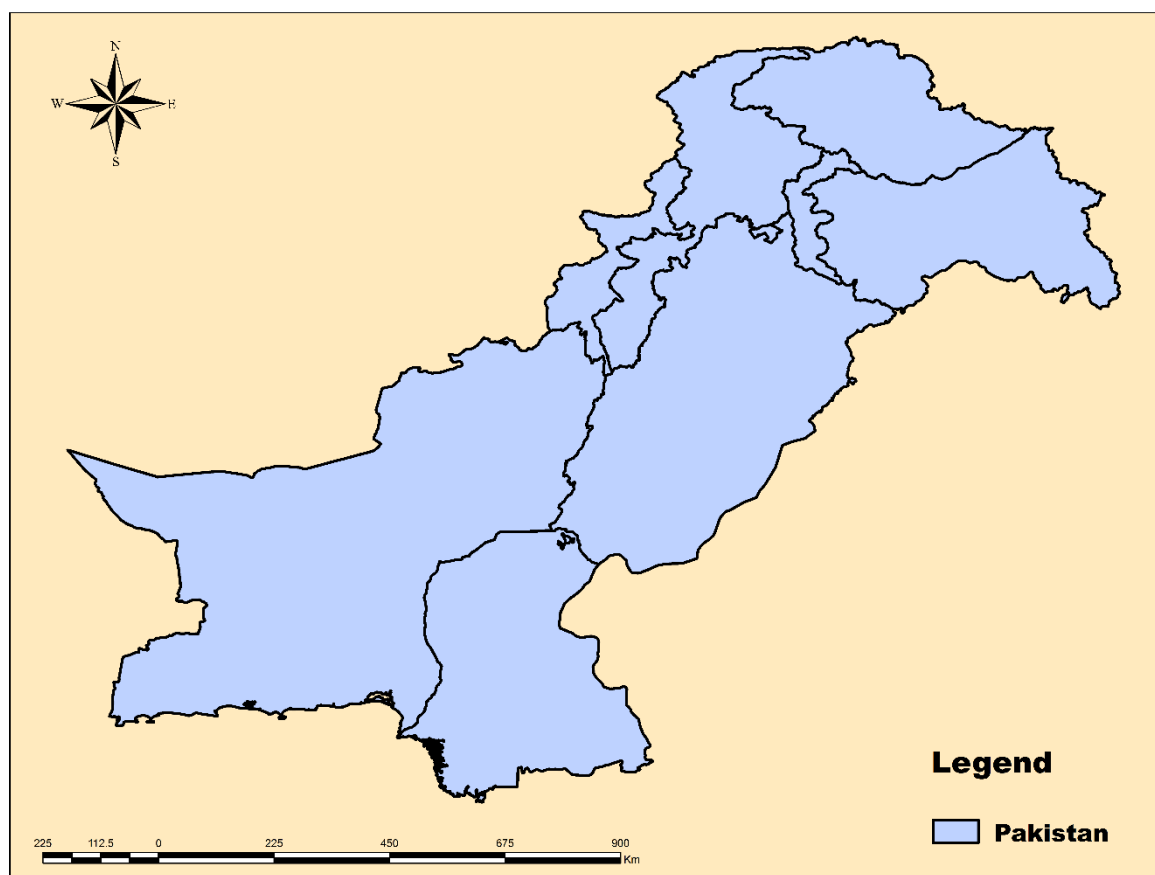


Figure 1. Map of the study area (Political boundary of Pakistan).

Results and Discussion

In the present study, we compiled a checklist by utilizing online sources as well as previous literature (Stewart, 1972; Nasir & Ali, 1970–1985; Rechinger, 1963–2010; Kazmi, 1974; Jafri, 1976). As a result, a total of 71 endemic species from 12 genera in three families were recorded (Figure 2). The nomenclatural updates, native range, and status of these species are presented in Table 1. Our results show that Orobanchaceae has the highest number of endemic species, with 47 species, followed by Plantaginaceae with 14 species, and Scrophulariaceae with 10 species (Figures 2–4 and Table 1).

Orobanchaceae

The family Orobanchaceae is represented by 99 genera and approximately 2,060 species worldwide; however, in Pakistan, it is represented by four genera and 22 species (Jafri, 1976; McNeal et al., 2013). Among these, *Pedicularis* is the largest genus, comprising 679 species, 270 of which are endemic, and it is highly diversified in the Himalayan Mountain region (Takhtajan, 1986; Liu et al., 2024). Based on molecular phylogenetic analyses, many genera and species previously classified under Scrophulariaceae have been transferred to Orobanchaceae (Young et al., 1999; Qaiser et al., 2011; McNeal et al., 2013; Ather et al., 2013; Wolfe et al., 2005; Mortimer et al., 2022; Schneeweiss et al., 2004; Manen et al., 2004; Morawetz et al., 2010). Most Orobanchaceae species (broomrapes) exhibit various levels of parasitic ability, ranging from nonparasitic (*Lindenbergia*) to facultative and obligate hemiparasites, and to obligate holoparasitic taxa (Wolfe et al., 2005). According to the IUCN Red List category (2022), several species within the genera *Orobanche* and *Pedicularis* are threatened (Kim et al., 2018; Declerck et al., 2013; Pavlova & Bani, 2019; Nishimura et al., 2020). In the present study, we identified 47 endemic and subendemic species across four genera, including *Euphrasia* L. and *Pedicularis* L., each with 21 species (44.68%), followed by *Orobanche* L. with 4 species (8.51%), and only one species (2.13%) recorded in *Christisonia* Gardner from mainland Pakistan (Figures 2–3, Plates 1–4, and Table 1). The listed endemic and subendemic species of this family are widely scattered throughout the country, with species of *Euphrasia* and *Pedicularis* being particularly diverse in northern Pakistan.

Euphrasia kurramensis Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 104 (1943).

Local distribution: Hazara, Naran, Kambajong, Kashmir, North slope Kamri Pass, Frasnag, Peer Panjal range, Karakoram and Hisper.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia multiflora Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 105 (1943).

Local distribution: Swat, Behrain, Muzaffarabad, Leepa valley, Kachoor Nullah and Skardu.

Status: Subendemic.

Native range: Nepal, Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia densiflora Pennell, Acad. Nat. Sci. Philadelphia 5: 112 (1943).

Local distribution: Swat, Kalam, Balakot, Between Hussain Abad village and Skardu, Gilgit, Rama, Babusar village, Sumbal, Jhelum valley, Deosai Plains, Shankargarh to Rattu, Kashmir, Kostorkut and Taubat.

Status: Subendemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia flabellata Pennell, Acad. Nat. Sci. Philadelphia 5: 112 (1943).

Local distribution: Gilgit, Rama rest house, Rattu upper Astore valley, Kashmir and Baltistan.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Table 1. List of endemic and subendemic species of Orobanchaceae, Plantaginaceae and Scrophulariaceae occurring in Pakistan.

Generic name	Species	According to POWO	Families (According to Fl. of Pak. and Iranica region)	Updated families	Status	Native range
<i>Campylanthus</i> (DC.) Rchb	<i>C. ramosissimus</i> Wight		Scrophulariaceae	Plantaginaceae	Endemic	Pakistan
<i>Chaenorhinum</i> (DC.) Rchb	<i>C. johnstonii</i> (Stapf) Pennell		Scrophulariaceae	Plantaginaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. kurramensis</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. multiflora</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Nepal, Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. densiflora</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. flabellata</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Euphrasia</i> L.	<i>E. omeri</i> Qaiser and Siddiqui		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. paghmanensis</i> Rech.f.		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. qaiseri</i> Siddiqui		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. foliosa</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. aristulata</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. alba</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Euphrasia</i> L.	<i>E. alii</i> Qaiser and Siddiqui		Scrophulariaceae	Orobanchaceae	Subendemic	India, Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. laxa</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Euphrasia</i> L.	<i>E. remota</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Euphrasia</i> L.	<i>E. secundiflora</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. incisa</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. platyphylla</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Nepal, Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. kashmiriana</i> Pugsley		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Euphrasia</i> L.	<i>E. paucifolia</i> Wettst		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Euphrasia</i> L.	<i>E. pseudopaucifolia</i> T.Siddiqui and Qaiser		Scrophulariaceae	Orobanchaceae	Subendemic	Pakistan, West Himalaya
<i>Euphrasia</i> L.	<i>E. microcarpa</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Euphrasia</i> L.	<i>E. secundiflora</i> Pennell		Scrophulariaceae	Orobanchaceae	SubEndemic	Afghanistan, Pakistan and West Himalaya
<i>Lagotis</i> Gaertn.	<i>L. blatteri</i> O.E.Schulz		Scrophulariaceae	Plantaginaceae	Subendemic	Afghanistan, Pakistan
<i>Lagotis</i> Gaertn.	<i>L. cashmeriana</i> (Royle ex Benth.) Rupr		Scrophulariaceae	Plantaginaceae	Endemic	Pakistan, West Himalaya
<i>Lagotis</i> Gaertn.	<i>L. blatteri</i> O.E.Schulz		Scrophulariaceae	Plantaginaceae	Subendemic	Afghanistan, Pakistan
<i>Linaria</i> Mill.	<i>L. unaiensis</i> Patzak		Scrophulariaceae	Plantaginaceae	Subendemic	Afghanistan, Pakistan
<i>Linaria</i> Mill.	<i>L. venosa</i> Lindl.		Scrophulariaceae	Plantaginaceae	Subendemic	Afghanistan, Pakistan



Generic name	Species	According to POWO	Families (According to Fl. of Pak. and Iranica region)	Updated families	Status	Native range
<i>Linaria</i> Mill.	<i>L. bamanica</i> Patzak		Scrophulariaceae	Plantaginaceae	Subendemic	Afghanistan, Pakistan
<i>Mimulus</i>	<i>M. karakormianus</i> T.Yamaz.	<i>Erythranthe karakormiana</i> (T.Yamaz.) G.L.Nesom	Scrophulariaceae	Phrymaceae	Endemic	Pakistan
<i>Pedicularis</i> L.	<i>P. purpurea</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Tibet, West Himalaya
<i>Pedicularis</i> L.	<i>P. svenhedinii</i> Paulsen		Scrophulariaceae	Orobanchaceae	Subendemic	Tibet, West Himalaya
<i>Pedicularis</i> L.	<i>P. brevifolia</i> D.Don		Scrophulariaceae	Orobanchaceae	Subendemic	Nepal, Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. tenuirostris</i> Benth		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. pectinata</i> Wall. ex Benth.		Scrophulariaceae	Orobanchaceae	Subendemic	Nepal, Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. bipinnatifida</i> (Pennell) R.R.Mill		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. staintonii</i> R.R.Mill		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. murreeana</i> R.R.Mill		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan
<i>Pedicularis</i> L.	<i>P. stewartii</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. caeruleoalbescens</i> Wendelbo		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan
<i>Pedicularis</i> L.	<i>P. pyramidata</i> Royle ex Benth.		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. kashmiriana</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. multiflora</i> Pennell		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. cyrtorhyncha</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. karakorumiana</i> T.Yamaz.		Scrophulariaceae	Orobanchaceae	Subendemic	Xinjiang
<i>Pedicularis</i> L.	<i>P. brevirostris</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. numeniicephala</i> T.Yamaz.		Scrophulariaceae	Orobanchaceae	Endemic	West Himalaya
<i>Pedicularis</i> L.	<i>P. elephantoides</i> Benth.		Scrophulariaceae	Orobanchaceae	Endemic	Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. bicornuta</i> Klotzsch		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Pedicularis</i> L.	<i>P. brevirostris</i> Pennell		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, Pakistan and West Himalaya
<i>Pedicularis</i> L.	<i>P. bicornuta</i> Klotzsch		Scrophulariaceae	Orobanchaceae	Subendemic	Afghanistan, Pakistan and West Himalaya
<i>Picrorhiza</i> Royle ex Benth.	<i>P. kurroa</i> Royle ex Benth.		Scrophulariaceae	Plantaginaceae	Endemic	Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. omeri</i> Khatoon and Qaiser		Scrophulariaceae	Scrophulariaceae	Endemic	Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. nudata</i> Pennell		Scrophulariaceae	Scrophulariaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. rodinii</i> Hamidullah		Scrophulariaceae	Scrophulariaceae	Endemic	Pakistan
<i>Scrophularia</i> Tourn. ex L.	<i>S. jafrii</i> Khatoon and Qaiser		Scrophulariaceae	Scrophulariaceae	Endemic	Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. polyantha</i> Royle ex Benth.		Scrophulariaceae	Scrophulariaceae	Endemic	Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. calycina</i> Benth.		Scrophulariaceae	Scrophulariaceae	Subendemic	Nepal, Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. stewartii</i> Pennell		Scrophulariaceae	Scrophulariaceae	Endemic	Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. stenothyrsa</i> Pennell		Scrophulariaceae	Scrophulariaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Scrophularia</i> Tourn. ex L.	<i>S. edelbergii</i> Rech.f		Scrophulariaceae	Scrophulariaceae	Subendemic	Afghanistan and Pakistan
<i>Scrophularia</i>	<i>S. cabulica</i> Benth.		Scrophulariaceae	Scrophulariaceae	Subendemic	Afghanistan and

Generic name	Species	According to POWO	Families (According to Fl. of Pak. and Iranica region)	Updated families	Status	Native range
Tourn. ex L.						
<i>Veronica</i> L.	<i>V. stewartii</i> Pennell		Scrophulariaceae	Plantaginaceae	Subendemic	Pakistan Afghanistan, Pakistan, West Himalaya
<i>Veronica</i> L.	<i>V. cachemirica</i> Gand		Scrophulariaceae	Plantaginaceae	Endemic	Pakistan, West Himalaya
<i>Veronica</i> L.	<i>V. undulata</i> Wall.		Scrophulariaceae	Plantaginaceae	Subendemic	Afghanistan, Pakistan, West Himalaya
<i>Plantago</i> L.	<i>P. himalaica</i> Pilg.		Plantaginaceae	Plantaginaceae	Subendemic	Nepal, Pakistan, West Himalaya
<i>Plantago</i> L.	<i>P. baltistanica</i> H.Hartmann		Plantaginaceae	Plantaginaceae	Endemic	West Himalaya
<i>Christisonia</i> Gardner	<i>C. calcarata</i> Wight		Orobanchaceae	Orobanchaceae	Subendemic	India, Pakistan, Sri Lanka
<i>Orobanche</i> L.	<i>O. hirtiflora</i> (Reut.) Burkill		Orobanchaceae	Orobanchaceae	Subendemic	Iran, Pakistan, Transcaucasus
<i>Orobanche</i> L.	<i>O. psila</i> C.B.Clarke		Orobanchaceae	Orobanchaceae	Endemic	West Himalaya
<i>Orobanche</i> L.	<i>O. kashmirica</i> C.B.Clarke ex Hook.f		Orobanchaceae	Orobanchaceae	Endemic	West Himalaya
<i>Orobanche</i> L.	<i>O. stocksii</i> Boiss.		Orobanchaceae	Orobanchaceae	Subendemic	Afghanistan, Iran, Pakistan

Euphrasia omeri Qaiser and Siddiqui, Pakistan J. Bot. 4: 1812 (2011).

Local distribution: Chitral, Harchin, Kashmir and Deosai plain near Murtaza top.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia paghmanensis Rech.f., Biol. Skr. 3: 113 (1959).

Local distribution: Chitral, Gangalwat, Vedinkot, Yarkhun Gol, Kaghan Valley between Balakot, Ladakh valley, Pananih and Nubra valley.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia qaiseri Siddiqui, Fl. Pakistan 220: 40 (2015).

Local distribution: Arkari Gol between villages Arkari and Avir, Kanavar, Kashmir and Nubra valley, Drummond, Kishtwar and Murree.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia foliosa Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 109 (1943).

Local distribution: Naltar valley, Lohan gali, Tilel valley, Kel to taubat, above Taubat Kishenganga valley, Korakhal to Badwan, Kishenganga, Gurez to Churwan, Gilgit road above Churwan Gilgit road, Minimarg to Burzil chowki, Karagbal to Badwan, North slope Kamri Pass, below Trashing, Rupal Nullah, above chillam upper Astore valley, Ladakh and Paskyum.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia aristulata Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 110 (1943).

Local distribution: Naltar, Utror, Gabral, Naan, Kashmir, Paghlaam, Sonamarg, Ferozpur, Nulla near Gulmarg, Balltal to Sonamarg, Paghlaam Churchyard, Aru, Lidder valley, Tulion above Paghlaam, Rama to Gurikot, Gurikot to Daskirim, Chillam upper Astore valley, Sonamarg, Shigar near guest house, Uri to Aliabad, Sind valley and Pir Panjal range.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia alba Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 107 (1943).

Local distribution: Bhagroata, Kashmir, Gandarbal, Sind valley, Paghlaam Island and Marposa above Dras.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia alii Qaiser and Siddiqui, Pakistan J. Bot. 4: 1815 (2011).



<http://dx.doi.org/10.22108/tbj.2025.144243.1298>

Local distribution: Gilgit, Bessar, Naltar valley, Chitral, Bombreial valley, Rama, Shonala, Thal, Kalam, Utror, Dir, Kohistan, Kashmir, Khanhajong, Tangmarg, Ferozpur Nulla below Gulmarg, Gadsar, Chunnian valley, Leepa valley and Muzzaffarabad.

Status: Subendemic.

Native range: India, Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia laxa Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 106 (1943).

Local distribution: Kashmir, Tang Marg, Above Rattu, Astore valley, Korakbal Badwan, Dras to Matayan, Ladakh, Raikot, near Hajipur and Kolohai.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Euphrasia remota Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 110 (1943).

Local distribution: Kashmir, Paghlam, Zojipass, below Tarshing rupul Nulla, Dass Khirim, Chillam, upper Astore valley, Deosai pass and Taubat.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Euphrasia secundiflora Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 105 (1943).

Local distribution: Gilgit and Mano Gah Nala.

Status: Subendemic.

Native range: Afghanistan and West Himalaya.

Habit: Herbaceous.

Euphrasia incisa Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 103 (1943).

Local distribution: Arkari Gol, between village Mogh and Rahimabad, Kaluli to Kalam, Godai above Astore, Gilgit road, Paghlam island in Drass, Rama to Burikot, Astore valley, Deosai pass, Dras Ladakh, Takshai, Upper Nubra, Hispar valley and Zanskar Padan.

Status: Subendemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

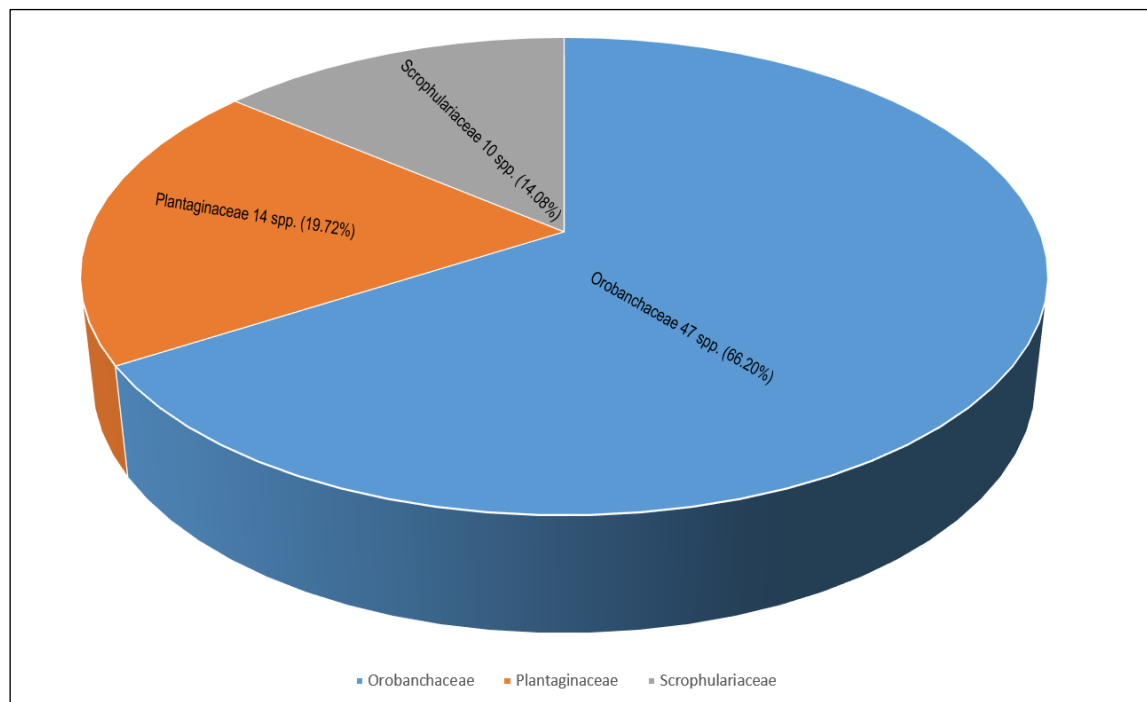


Figure 2. Percentage of species in the investigated families.

Euphrasia platyphylla Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 102 (1943).

Local distribution: Naran, Saiful Maluk, Tulion above Paghlam, Zur Nan above Paghlam, Sonamarg, Kamru, Basspa, Deosai pass, Gomba Thurgo, Doghani and Kachura Lake.

Status: Subendemic.

Native range: Nepal, Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia kashmiriana Pugsley, J. Bot. 74: 283 (1936).

Local: Kashmir, Bragang, Ladakh and Baltistan.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Euphrasia paucifolia Wettst., Monogr. 17: 198 (1896).

Local distribution: Gilgit, Gilgit road, Chhachor Pass, Arkari Gol, Sonamarg, Paghلام, Burzil pass ascent, Deosai Plains, Kamri Pass top, Burzil Pass, Ladakh, Matayan, Baltistan, Thalle La and Paskyum.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Euphrasia pseudopaucifolia T. Siddiqui and Qaiser, Candollea 2: 525 (1989).

Local distribution: Chitral, Gram Chashma on way to Kindjal and Avrik, Bamborat Gol, Kafirastan, Naran, Saiful Maluk, Sonamarg, Sorus above Paghلام, Tulion Paghلام, Vicinity of Paghلام, On east Liddar river, Islamabad, Vicinity of Kalahoi mountains and glacier, Vicinity of Sonamarg on the Sind river, Sri Nagar, Turnik Nulla, upper Bringhi and Gondala.

Status: Subendemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Euphrasia microcarpa Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 108 (1943).

Local distribution: Kashmir, Kamri Pass.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Euphrasia secundiflora Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 105 (1943).

Local distribution: Gilgit, Manu Gah Nala.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.





Plate 1. Herbarium specimens of *Euphrasia* species: (A) *E. aristulata*, (B) *E. densiflora*, (C) *E. foliosa*, (D) *E. flabellata*, (E) *E. incisa*, (F) *E. kashmiriana*.



Plate 2. Herbarium specimens of *Euphrasia*, *Campylanthus* and *Lagotis* species: (A) *E. laxa* (B) *E. pseudopaucifolia*, (C) *E. paucifolia*, (D) *E. remota*, (E) *C. ramosissimus*, (F) *L. cashmeriana*.

Habit: Herbaceous.

Pedicularis cheilanthifolia var. *purpurea* (Pennell) Arti Garg, *Taiwania* 3: 270 (2009).

Local distribution: Kargah valley, above Tilail, Shishnag, toward Amarnath, Upper Liddar, Zojpal and Karakoram Glaciers.

Status: Subendemic.

Native range: Tibet and West Himalaya.

Habit: Herbaceous.

Pedicularis chitralensis Pennell, *Monogr. Acad. Nat. Sci. Philadelphia* 5: 126 (1943).

Local distribution: Chitral, Bumboret, Kurram, above Makai village, Kagan valley below Balakot, Babusar Pass, Naran valley, Saifar Maluk, Saran river Basin, Deoli, Sarul, Kashmir, above Kishensar, Pass Shonthar Gali, Kishenganga, Musa, near Muzaffarabad, Kishenganga rivers, Gilgit, Astor, Chongra valley, Apharwat, above Gulmarg, Mir Panzil Pass, Deosai road, Burzil Pass and Chittakatha Sar.

Status: Subendemic.

Native range: Nepal, Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis tenuirostris Benth., *Scroph. Ind.* 422: 52. (1835).



Local distribution: Gilgit, Kala Pani, Hazara, Kagan valley, Naran valley, Muzaffarabad, Sinali, Leepa valley, Swat, Jhamra, above Utror, Kashmir, Shonthar valley, Kishenganga, Chorwan, Gadsar Nullah, Gadsar, Kostorkut, Kunzalwar, Liddar valley near Tanin, Pahlgam and upper Rajparyan Sanctuary.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis pectinata Wall., Numer. 16: 420 (1829).

Local distribution: Gilgit, Minapin Glacier, Zangia Harar, Hunza valley, Kashmir, Skardu, Gudai and Chilam, Hazara, Babusar village, Kaghan valley, Balakot and Babusar Pass, Mushkpuri, Nalikin Gali, Naran, Muzaffarabad, Bathwar Gali, Leepa valley road, Swat, Ushu, Udampur Chinab valley, Ajok valley, Kashmir; Sind valley, Butin Pankat, Wangal valley, Kirikama range, Nangmarg, Paghlam, Khushi valley, Baltistan Kapalan, Rawalpindi, Murree, Kashmir, Kishtawar and Bangas.

Status: Subendemic.

Native range: Nepal, Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis pectinata subsp. *bipinnatifida* Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 134 (1943).

Local distribution: Muzaffarabad, Chobsar, Hazara, Gali Musalla, Kagan valley, Musa Ka Musalla, Saran range, Saif ul Maluk, Saif ul Maluk, Sarul, Kashmir, Zanskar, Barai valley, Kishenganga, below Bedori, Gilgit, Rama, Nanga Parbat, Rama, Rama above Astore, Rama valley, Apharwat, above Gulmarg, Apharwat, near Gulmarg, Pir Panjal, above Tilputra forest near Ranpur, Jhelum valley, Gangabal, Gulmarg., Lolgul Sar, Sinthan Pass, Srinagar and Vishensar.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

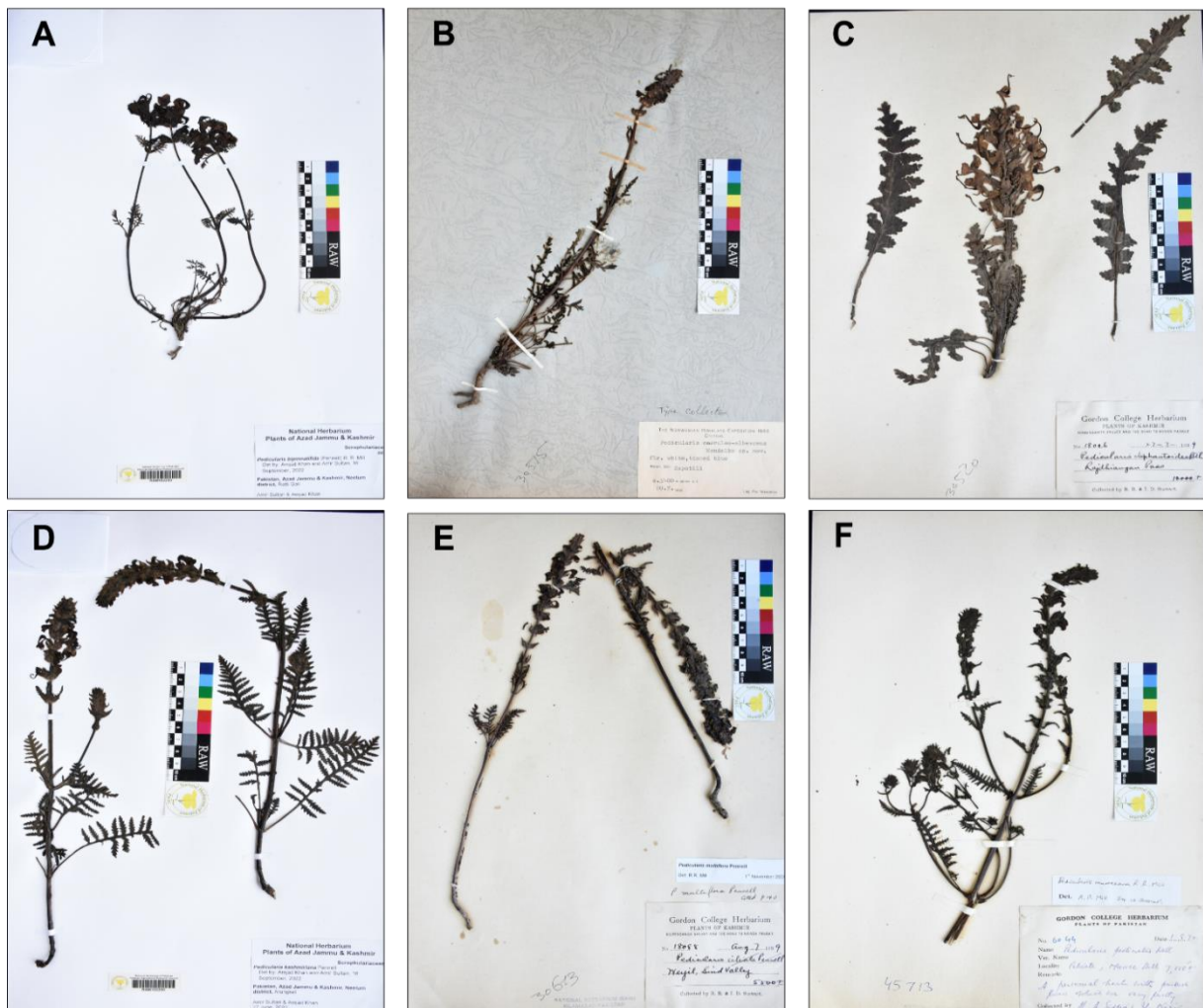


Plate 3. Herbarium specimens of *Pedicularis* species: (A) *P. bipinnatifida*, (B) *P. caeruleo-albescens*, (C) *P. elephantoides* (D) *P. kashmiriana* (E) *P. multiflora* (F) *P. murreana*.

Pedicularis staintonii R.R. Mill, Edinburgh J. Bot. 2: 187 (2010).

Local distribution: Chitral, Tirich valley, Chumarkhan Pass, Mastuj, Gilgit, Darkot and Ghareisa glacier.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis murreeana R.R. Mill and R. Bone, Edinburgh J. Bot. 2: 187 (2010).

Local distribution: Rawalpindi, Murree, Upper Topa, Ghora Gali and Changla Gali.

Status: Endemic

Native range: Pakistan.

Habit: Herbaceous.

Pedicularis stewartii Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 135 (1943).

Local distribution: Hazara, Shogran, Kashmir, Gagangir, Sind valley, Zaiwan, Baltal and Buttakandi.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis caeruleo-albescens Wendelbo, Nytt Mag. Bot. 17: 56 (1952).

Local distribution: Chitral, Zapotili, Barum Gol and Owir Gol.

Status: Endemic.

Native range: Pakistan.

Habit: Herbaceous.

Pedicularis jainii Aswal and Mehrotra, J. Econ. Taxon. Bot. 4(3): 1027 (1983).

Local distribution: Gilgit, Jutial Nullah, Kishenganga, Deosai plateau, Marpu Nullah, Suk Nullah, Dras valley, Hispar glacier, Turmun Makerum, Kero Lugma glacier, Makerum, Hispar glacier, Skardu, Hushe Tal, above Astan Marg, above Zalwan, Sind valley, Gadsar Nullah, Gandabal lake near Haramakh, Khelanmarg, Kolohoi valley, east of Panichar, Parkachik Pass, Suru valley, Ladakh, Rajparyan Sanctuary, near Sinthan Pass, Sonamarg, Tsurlat Pass, Tulion above Pahlgam, Yamharu Pass, Yambar Pass, Zojibal, Thale La to Bagmahardl, Shigar, Karakorum, Sokha glacier, Ladakh, east of Parkachick Pass, Golen Gol, Haramosh range, Kishenganga valley, Kagan valley, Zer Bhurj Bhonja Ka Kattha, Erin valley near Bandapur, Swat, Bishigram valley, above Utror, Zanskar and Barai valley.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis kashmiriana Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 137 (1943).

Local distribution: Gilgit, Belmar village on way to Gilgit, Hazara, Kagan valley, Bhimbal, Muzaffarabad, Kishenganga valley and road to Nanga Parbat, Keran to Rishna, Marpo La, Dras, Kolohoi valley, Kostorkut, Kukarnag, Baranginala, Minimarg to Burzil chowki, Burzil Pass, Pahlgam to Aru, Kero Lugma glacier and Baltal.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.





Plate 4. Herbarium specimens of *Pedicularis*, *Picrorhiza*, *Plantago* and *Veronica* species: (A) *P. staintonii*, (B) *P. stewartii*, (C) *P. tenuirostris* (D) *P. kurroa* (E) *P. baltistanica* (F) *V. cachemirica*.

Pedicularis jainii subsp. *multiflora* (Pennell) T. Husain, Arti Garg & P. Agnihotri, Dehra Dun 76 (2010).

Local distribution: Kashmir, near Kail, Swat, Belmar village on way to Gilgit, Chorwan, Goorai, Gund, Sind valley, Kunzalwar, Kashmir valley and lower Sind valley.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis cyrtorhyncha Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 136 (1943).

Local distribution: Chitral, Drosh Gol and Painogh.

Status: Subendemic.

Native range: Afghanistan and Pakistan.

Habit: Herbaceous.

Pedicularis karakorumiana T. Yamaz., J. Jap. Bot. 3: 142 (1993).

Local distribution: Gilgit, upper Baru Gah, south side of Panji Pass, above Holojust, Gilgit, Karakoram and Khunjerab.

Status: Subendemic.

Native range: West Himalaya and Xinjiang.

Habit: Herbaceous.

Pedicularis brevirostris Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 142 (1943).

Local distribution: Gilgit, Sai, Tanner, Baltistan, Dras valley, Suk Nullah, Matayan, Kashmir, Zoji La, Baltistan, Deosai Plains, Ladakh and Mitrahoi.

Status: Subendemic.

Native range: Afghanistan and West Himalaya.

Habit: Herbaceous.

Pedicularis numeniicephala T. Yamaz., J. Jap. Bot. 6: 397 (1994).

Local distribution: Kashmir, Rupshu, Startsa Puk and Salt Lake.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Pedicularis elephantoides Benth., Scroph. Ind. 422: 23 (1835).

Local distribution: Hazara, Kaghan valley, Nila, Batal, Saran range, Muzaffarabad, Bethwar Gali between Reshian and Leepa village, Gulmarg, above Gulmarg, above Tragbal, Tras Nag, Pir Panjal range, Poonch, Jarni and Haveli range.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis bicornuta Klotzsch, Bot. Ergebn. 3: 109 (1862).

Local distribution: Chitral, Hazara, Sarul, Erin valley near Bandapur, Gulmarg, Gangdal lake, Sonamarg, Srinagar, Lashpathri, Tsurlat Pass, Kurram, Shendotoi and upper chinab.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis brevirostris Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 142 (1943).

Local distribution: Gilgit, Sai, Tanner Baltistan, Suk Nullah, Dras valley, Matayan, Zoji La, Deosai Plains, Ladakh, Kanji and Mitrahoi.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Pedicularis bicornuta Klotzsch, Bot. Ergebn. 3: 109 (1862).

Local distribution: Swat and Kurram valley.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya

Habit: Herbaceous.

Pedicularis svenhedini Paulsen, Stockholm 3: 44 (1922).

Local distribution: Ladakh, Rungdum, Zuildo, opposite Ke La, Ladakh, Kishik Kumdan, Ladakh, between Da and Hanle, Rupshu, above Chortren Chen and Himis.

Status: Subendemic.

Native range: Tibet, West Himalaya

Habit: Herbaceous.

Christisonia lawii Wight, Pl. Ind. Orient. 4: 1427 (1849).

Local distribution: Sind valley.

Status: Subendemic.

Native range: India, Pakistan and Sri Lanka.

Habit: Herbaceous.

Phelipanche hirtiflora (Reut.) Soják, Čas. Nár. Mus., 4: 130 (1972).

Local distribution: Balochistan, Ziarat.

Status: Subendemic.

Native range: Iran, Pakistan and Transcaucasus.

Habit: Herbaceous.

Phelipanche psila (C.B. Clarke ex Hook.) Soják, Čas. Nár. Mus., 4: 130 (1972).

Local distribution: Kashmir and Manpanon.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Orobanche kashmirica C.B. Clarke ex Hook.f., Fl. Brit. India 11: 324 (1884).

Local distribution: Kashmir.

Status: Endemic.

Native range: West Himalaya.

Habit: Herbaceous.

Orobanche stocksii Boiss., Fl. Orient. 2: 505 (1879).

Local distribution: Quetta, Sultan, Hanna valley, Sibi, Ziarat and Shore Tore.



Status: Subendemic.

Native range: Afghanistan, Iran and Pakistan.

Habit: Herbaceous.

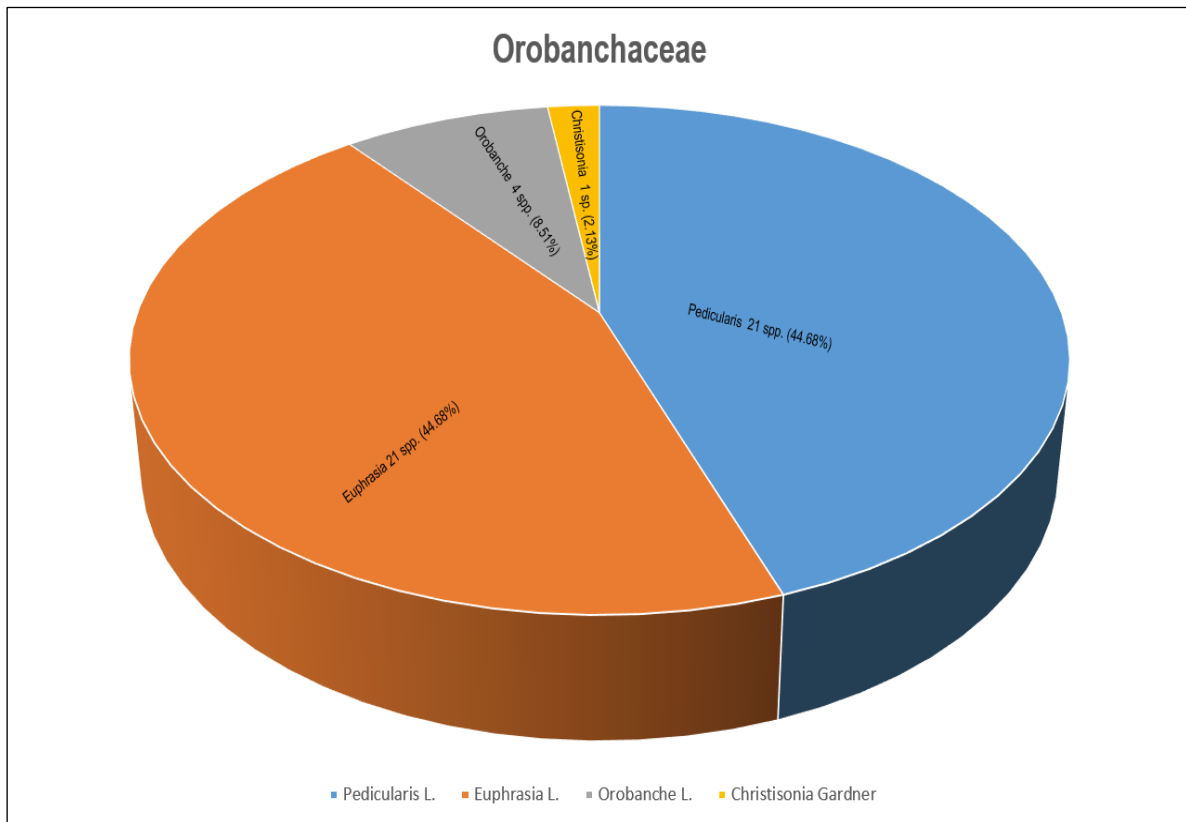


Figure 3. Percentage of genera in the family Orobanchaceae.

Plantaginaceae

The expanded family Plantaginaceae is a heterogeneous group with different evolutionary trends and is represented by 106 genera and more than 2,000 species worldwide (Xu et al., 2017; Albach et al., 2004; Shehata et al., 2023). In the Flora of Pakistan, Kazmi (1974) reported only the genus *Plantago*, which is represented by 20 species in Plantaginaceae. The concept of Plantaginaceae s. str. has changed considerably since the application of molecular approaches in plant systematics (Olmstead et al., 2001; Shehata et al., 2023). It has been greatly expanded in the Angiosperm Phylogeny Group classifications (APG II, 2003, APG III, 2009) to include many genera that were previously classified under Scrophulariaceae (Shehata et al., 2023), such as *Veronica* L. (Xue et al., 2019). Plantaginaceae has a diverse and cosmopolitan distribution, and its species are primarily diversified in the temperate zones of the world (Olmstead et al., 2001; Xu et al., 2017). Members of Plantaginaceae are mostly annual to perennial herbs and rarely subshrubs (Rahn, 1996; Dunbar-Co et al., 2008; Tay et al., 2010; Meudt 2012). As a result, we identified a total of 14 endemic and subendemic species across seven genera, including *Lagotis* Gaertn., *Linaria* Mill., and *Veronica* L., each with three species (21.42%), followed by *Plantago* L. with two species (14.28%), and *Campylanthus* (DC.) Rchb., *Chaenorhinum* (DC.) Rchb., and *Picrorhiza* Royle ex Benth., each with a single species (7.14%) (Figure 4, Plate 4, and Table 1). These species are found in diverse ecological regions but are predominantly distributed in northern Pakistan.

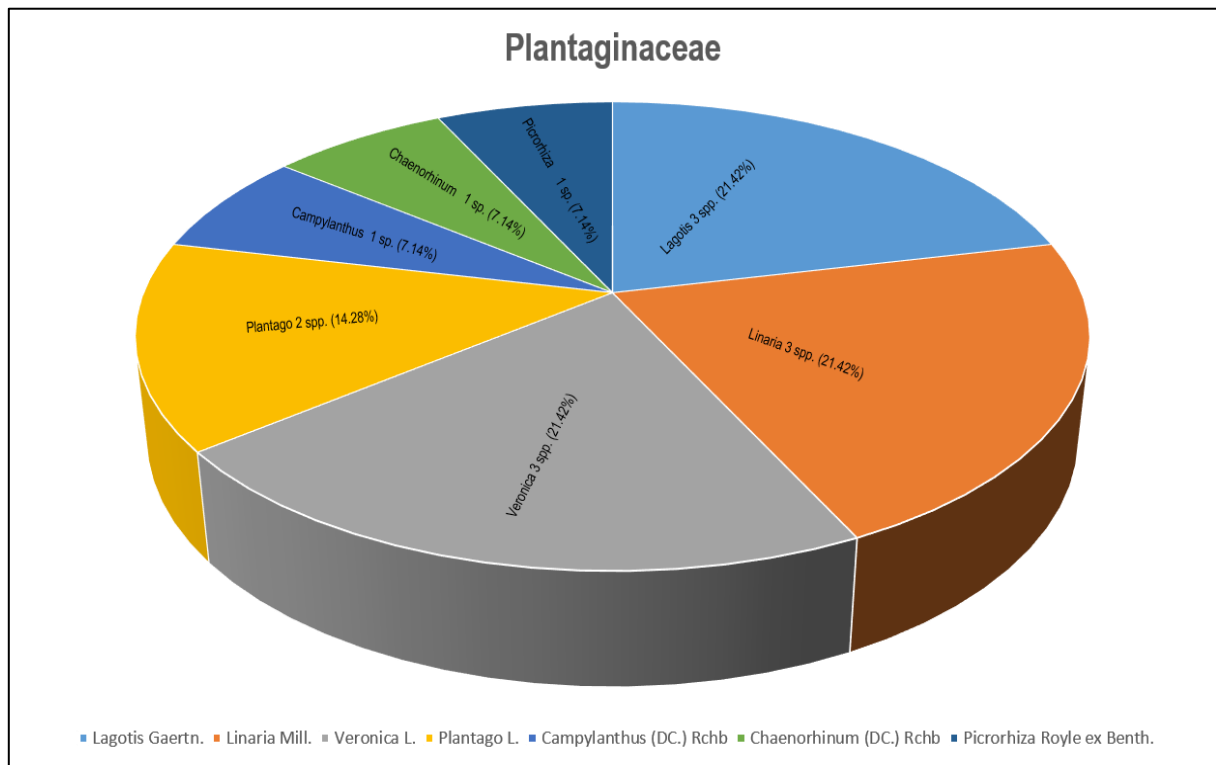


Figure 4. Percentage of genera in the family Plantaginaceae.

Campylanthus ramosissimus Wight, Pl. Ind. Orient. 4: 1416 (1849).

Local distribution: Sindh, Dadu, Jamshoro, Hyderabad, Kirthar Jabal and Kirthar National Park.

Status: Endemic.

Native range: Pakistan.

Habit: Herbaceous.

Chaenorhinum johnstonii (Stapf) Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 61 (1943).

Local distribution: Khyber, Shagai, Swat, Rustam, Baltistan, Chutrun, Chirat hill, Sillakhana, Attock, Khairi Murat, Rawalpindi, Manza Jaba Shahpur, Sohan river, Hussan, Sargodha, Salt range, Salin mountain, Moosakhail, Sibbi, Quetta to Sibbi between Bolan Pass and Mach.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Lagotis blatteri O.E. Schulz, Repert. 31: 161 (1933).

Local distribution: Kurram valley, Alikhel and Pekar Kotal.

Status: Subendemic.

Native range: Afghanistan and Pakistan.

Habit: Herbaceous.

Lagotis blatteri O.E. Schulz, Repert. 31: 161 (1933).

Local distribution: Kurram valley, Alikhel and Pekar Kotal.

Status: Subendemic.

Native range: Afghanistan and Pakistan.

Habit: Herbaceous.

Lagotis cashmeriana Rupr., Acad. Sci. St. Pétersb. 4: 64 (1869).

Local distribution: Hazara, Sari Hut, Kaghan valley, Kashmir, above Gulmarg, Zanskar, below Silrundi and Silrundi.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Linaria babensis Gilli, Feddes Repert. 63: 324 (1961).

Local distribution: Chitral, Rosh Gol, Molikho, Ojhore top between Karimabad and Parsan.

Status: Subendemic.

Native range: Afghanistan and Pakistan.



Habit: Herbaceous.

Linaria venosa Lindl., Edwards's Bot. 27: 69 (1841).

Local distribution: Chitral, Rosh Gol, Baluchistan, Khuri, Kanozar valley and Kurram valley.

Status: Subendemic.

Native range: Afghanistan and Pakistan.

Habit: Herbaceous.

Linaria bamianica Patzak, Biol. Skr. 3: 92 (1959).

Local distribution: Chitral, Shoghor on way to Gram Chasma, Gilgit, Hunza, Sher-e-Subz and Chauperson.

Status: Subendemic.

Native range: Afghanistan and Pakistan.

Habit: Herbaceous.

Picrorhiza lindleyana Wettst., Nat. Pflanzenfam 4: 84 (1891).

Local distribution: Hazara, Nila Kazan, Swat, Kaghan valley, Naran valley, Ganji Pahari, Sinthan Pass, Kolohoi valley, Gumbar valley, Nichinai north of Sonamarg, Tragbol, Mitzahoi and Kamri Pass.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Veronica stewartii Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 81 (1943).

Local distribution: Abbottabad, Swat, Bahrain, Mansehra, Below Durga Gully and Kashmir near Srinagar.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Veronica cachemirica Gand., Bull. Soc. Bot. 66: 219 (1919).

Local distribution: Mansehra, Kaghan valley, Saiful Maluk, Kharru Nilla, Makra, Malinger, Kaghan, Swat to Bishigram Lake, Sonamarg, Dras, Faras Nag, above Gulmarg Zojibal and Chosar.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Veronica undulata Wall., Fl. Ind. 1: 147 (1820).

Local distribution: Kashmir, Mondi beyond Poonch, Abbottabad, Kel to Taubat, Baltistan, Burzil Pass, Peshawar, Rawalpindi, Topi Park, Gobra, Kotli to Mirpur, Rawal Lake, Jhelum, Choa Saidan Shah, Zhob, Kila Ibrahim Khel, Faisalabad, Lahore, Bhai Pheru on way to Sargodha, Kala Shah Kakoo, Between Gujranwala and Sheikhpura and near Pattoki Sugar Mill.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Plantago brachyphylla Edgew. ex Decne., Prodr. 1: 696 (1852).

Local distribution: Swat, Bishgram, Hazara, Kaghan valley, Kashmir, Pahlgam, above Gulmarg, Rajdhiangan Pass and Tragbal Pass.

Status: Subendemic.

Native range: Nepal, Pakistan and West Himalaya.

Habit: Herbaceous.

Plantago baltistanica H. Hartmann, Bot. Jahrb. Syst. 3: 350 (1966).

Local distribution: Baltistan, West from Biafo-Base camp.

Status: Endemic.

Native range: Nepal, Pakistan and West Himalaya.

Habit: Herbaceous.

Scrophulariaceae

Scrophulariaceae is represented by 62 genera and approximately 830 species worldwide (Riahi & Ghahremaninejad, 2019). Its species have a cosmopolitan distribution but are most diversified in the temperate regions of the world (De-Yuan, 1983; Xu et al., 2017). In the Flora of Pakistan, Scrophulariaceae is represented by 37 genera and 187 species (Mill et al., 2015). However, several species within Scrophulariaceae still have unresolved taxonomic positions (Scheunert & Heubl, 2011). Recent phylogenetic studies have revealed that Scrophulariaceae does not represent a monophyletic entity (Oxelmann et al., 2005; Rahmazzadeh et al., 2004; Albach et al., 2005; Scheunert & Heubl, 2011). In molecular phylogenetic trees, Scrophulariaceae has been segregated into two monophyletic clades: Scroph I and Scroph II. The former includes *Buddleja* L., *Selago* L., *Verbascum* L., and the type genus *Scrophularia* L. (Olmstead & Reeves, 1995). Thus, the Scroph I clade was named Scrophulariaceae s. str. by Olmstead et al. (2001), while Scroph II taxa were transferred to Plantaginaceae (Scheunert & Heubl, 2011). Species in Scrophulariaceae are mostly herbs or shrubs and rarely trees (Tank et al., 2006). Among them, *Scrophularia* is the largest genus, comprising approximately 300 species, mostly distributed in the temperate zones of the Northern Hemisphere (Willis, 1973; Attar et al., 2011). The species of *Scrophularia* are primarily confined to South Asia, particularly the Himalayan region and the mountain ranges of western Tibet (Stiefelhagen, 1910; Makbul et al., 2006; Tojibaev et al., 2020). Here, we identified 10 endemic and subendemic species (14.08%) in *Scrophularia*, mostly distributed in the Western Himalaya of northern Pakistan (Figure 2, Plate 5, and Table 1).

Scrophularia omeri Khatoun and Qaiser, Willdenowia 2: 131 (1988).

Local distribution: Gilgit, from Naltar on way to Nomal and Sargodha (Sakesar).

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.



Plate 5. Herbarium specimens of *Scrophularia* species: (A) *S. stewartii*, (B) *S. polyantha*, (C) *S. rodinii*, (D) *S. nudata*, (E) *S. stewartii*, (F) *S. suffruticosa*.

Scrophularia nudata Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 49 (1943).

Local distribution: Gilgit, Jutial Nullah, Naltar valley, above Rattu, Astor, Rupal-Gurikot, Gurikot-Daskirin, Baltistan, Indus valley, Parkutta-Kiris, from Skardu on way to Satpura Lake, Ladakh, Kargil, Paskyum and Osmaston.

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya

Habit: Herbaceous.

Scrophularia rodinii Hamidullah, Pak. J. Bot. 1: 107 (1987).

Local distribution: Peshawar, Landikotal, Torkham, Warsack and Khyber Pass.



<http://dx.doi.org/10.22108/tbj.2025.144243.1298>

Status: Endemic.

Native range: Pakistan.

Habit: Herbaceous.

Scrophularia jafrii Khatoon and Qaiser, Willdenowia 2: 136 (1988)

Local distribution: Gilgit, Naltar, Mansehra, Kaghan and Baltistan (Khaplu).

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Scrophularia exserta Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 45 (1943).

Local distribution: Swat, Bahrein, Shangla hills, Hazara, Thandiani, Kawai on way to Naran valley, Kaghan valley, Malakandi, Changla Gali, Muzaffarabad, Leepa valley, Between Lamrian and Naeli on Leepa valley road, Sonamarg, Domel, Jhellum valley, Pahlgam, Gilgit, Tangmarg, Banihal, Rawalpindi, Murree hills and Shalimar garden.

Status: Endemic.

Native range: Pakistan and West Himalaya and Shalimar Garden

Habit: Herbaceous.

Scrophularia scabiosifolia subsp. *stewartii* (Pennell) Qaiser and Khatoon, Willdenowia 2: 140 (1988).

Local distribution: Baltistan, Satpara village on way to Deosai, Jhelum, Phullaren, Tilla Jogi, Tilla Jogiawala, Shahpur, Karaha (Sakesar and Saherar mountains), Drummond Sakesar, Zhob and Shenghar.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Scrophularia griffithii subsp. *latifolia* (Benth.) Grau, Fl. Iranica 147: 247 (1981).

Local distribution: Hazara, Thandiani, Changla gali, Bhurj Kaghan, Nila Kaghan, Makra, Nathia Gali, Ayubia on way to Murree, Patriata, Poonch, Mandi, Thana, Muzaffarabad, Barumgali, Ferozpur Nullah, below Gulmarg, Pahlgam, Gulmarg, Pir Panjal, Choorwan and Jhelum (Choha Saidan Shah).

Status: Subendemic.

Native range: Afghanistan, Pakistan and West Himalaya.

Habit: Herbaceous.

Scrophularia edelbergii Rech.f., Biol. Skr. 3: 103 (1959).

Local distribution: Kurram valley.

Status: Subendemic.

Native range: Afghanistan and Pakistan.

Habit: Herbaceous.

Scrophularia elegantissima Rech.f. and Wendelbo, Bot. Not. 117: 366 (1964).

Local distribution: Quetta, Gwal and Ziarat.

Status: Subendemic.

Native range: Afghanistan and Pakistan.

Habit: Herbaceous.

Scrophularia suffruticosa Pennell, Monogr. Acad. Nat. Sci. Philadelphia 5: 50 (1943).

Local distribution: Mangla, Bashahr and Shimla.

Status: Endemic.

Native range: Pakistan and West Himalaya.

Habit: Herbaceous.

Conclusions

This study highlights 71 endemic and subendemic species across 12 genera and three diverse families, including Orobanchaceae, Plantaginaceae, and Scrophulariaceae, in the Flora of Pakistan. Our results provide both global and local distribution data, as well as nomenclatural updates for these rare plant species, which may be significant in evolutionary and speciation studies aimed at understanding the environmental correlation with species diversity. These data can also be used in the conservation assessments of species for IUCN Red Listing. Our findings also reveal that most of the endemic and subendemic species of *Euphrasia*, *Pedicularis*, and *Scrophularia* are highly diversified in northern Pakistan, particularly in the Himalayan region, which is considered one of the most important global hotspots for species diversity. However, the present study recommends further field exploration and IUCN assessments for the investigated species, particularly for narrowly endemic species.

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Conflicts of interest statement

The authors declare that they have no conflict of interest.

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