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Chasmophyte *Cymbalaria muralis* (*Plantaginaceae*), a new distribution record for Kashmir Himalaya

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Abstract

Cymbalaria muralis G.Gaertn., B.Mey. & Scherb., Ivy-leaved toadflax a creeping perennial herb native to southern and central Europe, is reported for the first time from the Kashmir Himalaya. The plant specimens were collected from Srinagar growing on wall crevices and roadside drains. This new record highlights the need for urban floristic surveys to monitor the spread of naturalized species in the region.

Keywords Alien, Creeping, Europe, Occurrence, Ivy-leaved toadflax

1 Introduction

, The family *Plantaginaceae* commonly known as the plantain family belongs to the order Lamiales [1]. The family, comprises of ~ 100 genera with nearly 2000 species. The family has a cosmopolitan distribution but occurs particularly in temperate regions [2, 3]. In this family, the genus *Cymbalaria* Hill, commonly called toadflax, is native to southern Europe, especially the Mediterranean region. The toad flaxes are typically trailing creeping herbaceous annuals or perennials with elliptic leaves and spikes bearing tiny flowers [4]. These chasmophytic plants are well-adapted to grow in crevices of rocks and walls, often forming mats. In India, the genus is represented by a single species [5, 6].

During recent botanical surveys in Kashmir—a region located in the Western Himalaya, the authors collected the plant specimens of *Cymbalaria*, previously unreported from the region. After critical investigation of morphological features and perusal of taxonomic literature [4, 7, 8], the collected plant specimens were identified as *Cymbalaria muralis* G.Gaertn., B.Mey. & Scherb., which was hitherto unreported from Kashmir. To validate this new distribution record of this species, the present study therefore provides a detailed morphological account including taxonomic description and photographic illustrations of diagnostic characters to facilitate its proper identification.



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2 Materials and methods

2.1 Study area

The present study was conducted in Kashmir (Fig. 1) falling within the biogeographic province of the North-Western Himalaya in India [9]. The study region, stretching between 32° 22'–34° 43' N latitude and 73° 52'–75° 42' E longitude, covers an area of ~ 15,000 km² with two broad physiographic divisions: the valley zone and the montane zone [10, 11]. Elevation ranges from ca. 1600 to 5420 m asl [12]. The climate in the region is characterised by four seasons: the spring (March–May), summer (June–August), autumn (September–November), and winter (December–February) [13]. The temperature in the region ranges from an average daily maximum of 31 °C and minimum of 15 °C during summer and an average daily maximum of 4 °C and minimum of – 4 °C during winter. The region receives an average annual precipitation of 1055 mm, mostly in the form of winter snow [14, 15]. The natural vegetation at higher elevations in the region mostly consists of alpine meadows and coniferous forests [11]. The region exhibits the characteristics of a semi-closed landscape and is drained by the river Jhelum, a tributary of the mighty Indus.

2.2 Floristic methods

Standard methods were used for collection, processing and preparation of the herbarium specimens [16]. Voucher specimens have been deposited at the University of Kashmir Herbarium (KASH). Identification was carried out by consulting relevant literature [17–19], images of the plant species available at POWO 2025 (ID: 1469787; ID: 1433981) and herbarium specimen (K000806708). The micromorphological characters were analyzed and photographed using a trinocular S9D stereo microscope integrated with 10 MP CMOS-camera and LASX image processing software (Leica, Wetzlar, Germany). The geo-coordinates were recorded with the Google Earth Version 10.79.0.2 [20].

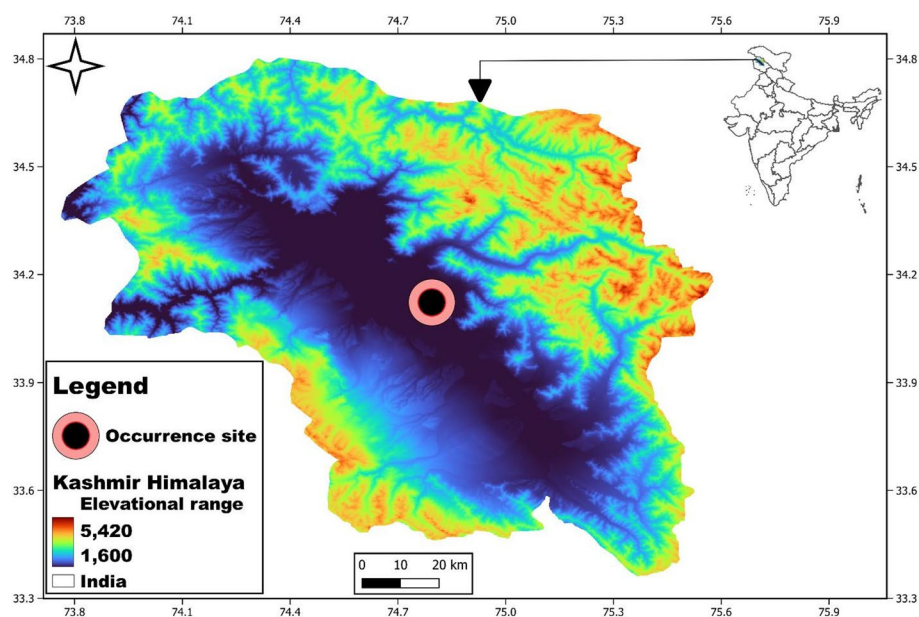


Fig. 1 Map showing the occurrence site of *Cymbalaria muralis* in Kashmir Himalaya

3 Results

3.1 Taxonomic treatment

Cymbalaria muralis G.Gaertn., B.Mey. & Scherb. Oekon. Fl. Wetterau 2: 397. 1800.

Common names: Ivy-leaved Toadflax, Kenilworth Ivy, Pennywort.

3.2 Description

Perennial herb, chasmophytic. Stem mostly creeping, glabrous, occasionally villous, reddish-brown trailing up to 80 cm long. Roots thin, fibrous, anchored into rock cracks, also develop on nodes. Cauline leaves simple, alternate, (opposite at base), petiole long, 1.5–4 cm, abaxially greenish, adaxially purplish or green, glabrous, reniform to semicircular, basally cordate, 1–4 cm broad, palmately veined, 5–9 shallow lobes, apex acute or mucronate. Flowers are solitary, axillary, lilac with yellow throat, ebracteate, pedicel slender, 3 cm long, hermaphrodite. Sepals 5, almost equal, 1.4–4 × 0.3–1.2 mm, apex acute, basally connate, radially symmetric, lobes linear to lanceolate, glabrous. Petals fused, light purple, lilac or violet, with two distinct lobes, personate, tubular, 6.5–8 mm long, 2 adaxial and 3 abaxial lobes, posterior petal spurred, 0.6–0.8 mm long. Stamens 4, epipetalous, didynamous, filaments incurved. Pistil syncarpous, bicarpellary, ovary superior, style glabrous, single and slender, 1.3–6.5 mm, base persistent in the fruit, stigma straight, moderately clavate. Fruit capsule, 0.4–0.6 × 0.3–0.5 cm, globose, glabrous, mature capsule stalk up to 4.3 cm long. Seeds, cristate-tuberculate, 0.3 mm long and 0.2 mm broad, seeds adhere to form clumps (Fig. 2).

Specimens examined: INDIA, Kashmir, Srinagar district, 34.077 N, 74.816 E, 1607 m a.s.l., 05-05-2025, Anzar A. Khuroo and Shabir. A. Zargar 42,322-KASH, Kashmir, Srinagar district, 34.077 N, 74.816 E, 1607 m a.s.l., 05-05-2025, Anzar A. Khuroo and Shabir. A. Zargar 42,323-KASH.

Habitat: *Cymbalaria muralis* was found on moist brick-walls with roots in crevices. Its flowering and fruiting were recorded from April to June.

Native range: *Cymbalaria muralis*, is actually native to parts of central and southern Europe including Austria, France, Italy, the northwestern Balkan Peninsula, and Switzerland. The species has widely naturalised in temperate areas (Sutton, 1988) and recognised as invasive in several countries, such as Poland, Korea, the USA, and UK [7, 8, 21, 22].

Pathway of introduction: The plant species has been reported from Srinagar (Kashmir), a major city with high tourist influx from across the country, indicating that its introduction to the region may have occurred as contaminant with transport.

3.3 Ecological aspect

A diverse assemblage of plant species has been observed growing with *Cymbalaria muralis*; these include, *Erigeron canadensis* L., *Ailanthus altissima* (Mill.) Swingle, *Stellaria media* (L.) Vill., and *Ficus carica* L. Other associated species were *Sisymbrium loeselii* L., known for its tolerance to disturbed soils; *Persicaria lapathifolia* (L.) Delarbre typically found in moist habitats; *Urtica dioica* L. *Morus alba* L. and *Plantago major* L., which are species that thrive in disturbed habitats and wastelands.



Fig. 2 Photoplate of *Cymbalaria muralis*: (a) population, (b) habit, (c) root at axil of leaf, (d) leaves, (e) flower in axil of leaf, (f) flower, (g), (i) sepals, (j-m) petals, (n) epipetalous condition, (o) stamen, (p) carpel, (q) fruit, (r) seeds with seed coat, (s) seed

4 Discussion

The present study reports the first valid distribution record of *Cymbalaria muralis* in the Kashmir Himalaya, specifically from the urban centre of Srinagar. This report significantly extends the known distributional range of the species and marks its introduction and naturalisation into this Himalayan region. The taxonomic identification was supported through detailed morphological examination and comparison with authenticated specimens. The report of this species in Kashmir aligns with its known adaptability to anthropogenic and disturbed habitats [23, 24]. Its presence on wall crevices and shady urban sites underscores its ability to colonize niches typically associated with human activities [25]. Such ruderal habitats provide favorable conditions for the establishment of such taxa [26]. The plant's reproductive strategy, including the formation of numerous seeds and its capacity for vegetative propagation, enhances its colonization potential [27]. Ecologically, *C. muralis* was found associated with a wide variety of weedy species which are characteristic of wastelands and disturbed sites [28]. The coexistence of this plant species with the local flora indicates its potential to establish within the existing plant communities of the region. However, it may also affect the growth of co-occurring

species, and its long-term ecological consequences remain to be studied [29]. The plant species has been already reported from the tropical regions of India, including Tamil Nadu [29] and Odisha [24]. Its recent detection in the temperate region of the Kashmir Himalaya underscores the need for monitoring to assess its further spread. The plant species is found on rock, wall crevices, footpaths, and urban structures, and its presence on walls has been associated with structural damage, as its roots can accelerate weathering and compromise mortar integrity [30–31].

In conclusion, this report not only documents a new floristic record for Kashmir but also underscores the importance of urban floristic surveys in detecting early-stage alien species' introduction. It provides a baseline for future ecological assessments and potential management strategies in the face of increasing incidences of plant invasions in the rapidly warming Himalaya.

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Author contributions

AAK conceptualized the research idea and first collected the plant species. The original draft was written by SAZ with key inputs from AAK. SAS prepared the photo plate. Writing–review, editing and revision by SAZ and AAK. All the authors reviewed and approved the final draft for submission.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

No permission was required for sample collection, as the species occurs as a common weed, is locally abundant, and is not listed as restricted by any government authority.

Consent for publication

Not applicable.

Plant guidelines

The collection of plant material complied with relevant institutional, national, and international guidelines and legislation.

Clinical trial

Not applicable.

Competing interests

The authors declare no competing interests.

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