

# *Psammogeton hirsuta* (Apiaceae; Pimpinelleae), a new species from India

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## Abstract

*Psammogeton hirsuta* sp. nov. (Apiaceae), a novel species collected from specifically the lowlands of Jammu and Kashmir, north-west India's subtropical region, is described and illustrated. *Psammogeton hirsuta* resembles one of its close relatives, *P. canescens*, and *P. shivalikense*; however, it differs significantly in terms of the plant being hirsute, sheaths of leaf bases, ciliate peduncle degree of pubescence, bracts and bracteoles, and fruit shape. Additionally, we provide phenology, a distribution map, a comparison of species with comparable morphologies, and a key to closely related species.

## Introduction

*Psammogeton* Edgew. (Apiaceae), a small genus particularly confined to Asia, has a native range from Iran and Iraq to Central Asia and India. The species have not yet been determined to be monophyletic (Mousavi et al. 2022). *Psammogeton* Edgew. comprises of fourteen species distributed in Afghanistan, Bangladesh, China, India, Iran, Iraq, Kazakhstan, Kyrgyzstan, Laos, Malaysia, Myanmar, Moluccas, Nepal, New Guinea, Pakistan, Phillipines, Syria, Tajikistan, Turkmenistan, Uzbekistan, and other parts of Central Asia (Hassler 2004–2022, POWO 2023). *Psammogeton anethifolia*, *P. biternatum*, *P. canescens*, *P. diffusus*, *P. involucratum*, and *P. shivalikense* are the species that comprise the genus in India (Bhellum and Magotra 2023a,b). In Jammu and Kashmir, *Psammogeton anethifolia*, *P. biternatum*, *P. canescens*, and *P. shivalikense* one of the authors (BLB) gathered some fascinating specimens from the lowlands of the Jammu region, the new species' sole home range, (Fig.1), between 2018 and 2022.

Perusal of floristic literature Boissier (1872), Clarke (1879), Hiroe and Constance (1958), Kitamura (1960), Nasir (1972), Babu (1977), Ahmed and Koul (1980), Sharma and Kachroo (1981, 1983), Mukherjee (1983), Mukherjee and Constance (1986), Hedge et al. (1987), Rechinger (1987), Mohanan and Pimenov 2007, Ghazanfar and Edonson (2014), Pimenov (2017), Ajani and Mozaffarian (2019), Pimenov et al. (2019), and Kljuykov (2019), reveal that the species has not yet been named. The accuracy of the species and description has been verified by consulting floristic literature ( Nasir 1972, Mukherjee 1983, Hedge et al. 1987, Rechinger 1987, Hamal and Koul 1989, Mukherjee and Constance 1993, Khatoon and Ali 1993, Pimenov and Leonov 1993, Downie et al. 2000, Assadi et al. 2008, Pimenov et al. 2019, Kljuykov 2019, Gosavi et al. 2020, 2022). Additional corroboration was obtained from herbarium specimens kept in several domestic and international herbaria. It was established by comparing these specimens and consulting pertinent literature that the species had gone unreported, possibly as a result of its modest size and patchy distribution in the sandy beds. Therefore, considering the unique attributes and comparative morphological analyses, we identified and exhibited the new species under the proposed appellation *Psammogeton hirsuta* (Fig. 1). Additionally, other information about phenology and ecology, floral components, and fruit morphology is also discussed. The Himalaya, the sub-Himalayan region, and the lowlands of the Jammu region of Jammu and Kashmir are home to the species *Psammogeton*. Andhra Pradesh, Bihar, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Sikkim, Tripura, Uttarakhand, Uttar Pradesh,

and West Bengal are the other states that include *Psammogeton* species. The species of *Psammogeton* exhibit similarities with the genus *Aphanopleura*, which is differentiated from closely related genera of this group (Downie et al. 2010).

## Material and Methods

Based on the field data gathered between 2018 and 2022 from natural populations on the river's sandy banks close to Jammu, the herbarium sheets were prepared using prescribed methods (Jain and Rao 1977; Bridson and Gorman 1999). The Indian Institute of Integrative Medicines (IIIM) Janaki Ammal Herbarium has the voucher specimens of the new species with the abbreviation RRLH indexed in Thiers 2018. Different herbaria's closely related species were consulted, including the Royal Botanic Gardens, Kew (K), the Plants of the World Online with nos. K000695495, and K000695496, Natural History Museum Vienna (W0054043), and the Harbier Museum Paris (P00834467). The herbarium and live specimens were used in part for the study of plant morphology. With the aid of a blade, the mericarp sections were generated for stereographic examination. For a description and a glossary of terms for the new species, Vogel (1980), Hickey 1973, Harris and Harris (2001) were consulted. All measurements were taken from the fresh and dried material.

## Taxonomic Treatment

*Psammogeton hirsuta* — (Fig. 2, 3, 4)

### Diagnosis

The new species is closely related to *Psammogeton canescens* and differs from it in having

A species similar to *P. canescens* and *P. shivalikense* but differing from these by 3–6 cm height; stem Zig-zag, leaves densely hirsute, bracts, 5–7 mm long, hairy both abaxially and adaxially including margins; obovate, oblong, 3–5 bracteoles, 4–7 mm long; 3–6 unequal rays, ca 1 cm long. The peduncle is hirsute; 1–6 flowers per umbellet; pollen grains are sub-ractangular to ractangular, rugulate at the equatorial region; fruits differing in shape, being oblong; hairs are up to 1.7 mm long.

### Type

India, Jammu and Kashmir, District Jammu, Jammu river beds near Mandal, 320. 6799 N 740. 7462 E. 280 m a.s.l. 26 Apr. B. L. Bhellum 15566 (RLLH– holotype).

### Etymology

The specific epithet *hirsuta* refers to hirsute indumenta on leaves and stem.

### Description

Annual, erect, 3–6 cm tall, densely hirsute herb. Root with a tap root system. Stem branched, hollow, slender, striate; internodes shorter, nodes prominent. Radical leaves numerous, arising with a sheathy base, nerves prominent, margin hyaline, ciliate; basal leaves petiolate, 2-ternate, base sheathy, upper surface somewhat glabrous, densely hirsute underneath, lobes cuneate; cauline leaves shortly petiolate, similar, rather smaller. Inflorescence axillary, terminal, leaf-opposed, compound umbel, umbellet 4–6 flowered. Peduncle ribbed, shortly to densely hirsute. rays unequal, the peripheral longer than the central ones. Pedicels 2–4 mm long. Involucre of five bracts, base cuneate, obovate, hirsute all over, green, foliaceous, acuminate, persistent. Involucel of five bracteoles, oblanceolate or obovate, transparent, membranous, margins ciliate. Flowers bisexual, pentameous, white tinged with light purple. Corolla polypetalous, petals five, obovate, emarginate, subequal, outer petal rotate,  $\pm 1.4$  mm long, white tinged purple, margin slightly irregular, inflexed, acuminate, tip slightly curved. Stamens five, free,  $\pm 2.3$  mm long, glabrous, alternipetalous, inflexed in buds, longer than the petal, anthers bithecous, yellow, dehiscence longitudinal. Pollen grains sub-ractangular to ractangular, rugulate at the equatorial region, exine thicker at the equatorial zone; Ovary bicarpellary syncarpous, inferior, bilocular, hairy, styles two, dark purple, persistent, crowning ovary, swollen disc present at the base of styles forming stylobodium, dark purplish; stigmas two, capitate. Fruit a schizocarp, ellipsoid

or oblong, slightly broader in the middle, tapering at both ends, mericarps two, laterally compressed, dorsally constricted at commissures, primary and secondary ridges slightly winged, variable, primary ridges more prominent, densely hairy than the secondary ridges.

**Phenology**

Flowering and fruiting in early summer from end of March to early May.

**Distribution**

So far known from the type locality in small patches.

**Habitat and Ecological note**

The plants of the new species grow in dry places along sandy beds along river. The species is found in association with *Ageratum conyzoides* L., *Allium roylei* Stearn, *Alternanthera pungens* L., *Argyrolobium roseum* (Camb.) Jaub. & Spach., *Chenopodium abrosoides* L., *Crotalaria prostrata* Rattl. ex Willd., *Cyperus rotundus* L., *Evolvulus alsinoides* (L.) L., *Cynodon dactylon* (L.) Pers., *Heliotropium strigosum* Willd., and *Lathyrus aphaca* L.

**Conservation status**

The species is classified as critically endangered because the number of individuals in its population is less than 250, scattered in small patches in an area of about 2 km<sup>2</sup>. Based on the data, according to IUCN guidelines (version 15.1), it should be considered critically endangered.

Table 1. Morphological comparison among *Psammogeton hirsuta* and its closely allied *P. cansescens* and *P. shivalikense*

<b>Chracter</b>	<i>Psammogeton hirsuta</i>	<i>P. Canescens</i>	<i>P. Shivalikense</i>
Plant (cm tall)	3–6, hirsute	(5-) 8–30, pubescent	1–3, pubescent
stem	distinctly Zig-zag	Straightened	Straightened
Leaves	densely hirsute	softly pubescent	softly pubescent
Flowers	upto 6 per umbellet	upto 12 per umbellet	upto 5 umbellet
Peduncle (cm)	upto 1.2	upto 9	upto 1
Rays	±5	±12	±4
Bracts	±3, densely hairy on both surfaces & margins	±4, hairy on midribs and margins	±2, hairy on midribs and margins
Bracteoles	Obovate oblong	Oblong	Obovate or oblong
Stylopodium	conical	narrowly conical	conical
Style	0.8 – 1.0	1–1.5 mm long	1–1.2 mm
Fruit hair	± 1.7 mm	±1.5 mm	±1.4 mm
Fruit	Oblong	Ellipsoid oblong	Ovoid oblong

**Keys to Indian species of *Psammogeton* Edgew.**

1. Plants 2–3 cm tall; stem usually unbranched; involucre of ± 2 ovate–lanceolate bracts; involucel of 1–5 bractlets —————

*P. shivalikense*

– Plants 5–40 cm tall; stem branched; involucre of ± 5 linear lanceolate bracts; involucel of 5–8 bractlets ————— 2

2. Umbels with reduced peduncle —————

*P. suchaniense*

– Umbels with well developed peduncles ————— 3

3. Stem zig-zags, sparsely to densely hirsute; leaves sparsely to densely hirsute underneath; bracts densely hairy all over; hairs longer than double the width of fruits ——— *P. hirsuta*

– Stem never zig-zags glabrous or pubescent; leaves glabrous to pubescent with soft hairs underneath; bracts hairy on margins; hairs equal to or shorter than double the length of width —————

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2. Basal branches widely divergent; leaves 2- or 3-pinnatisect, with segments cuneate, glabrous schizocarps ovoid —————

*P. biternatum*

– Basal branches dichotomously branched, not divergent; leaves 1- or 2-ternatisect, with segments obcuneate, pubescent, or glabrescent; schizocarps ellipsoid-oblong —————

*P. canescens*

## Discussion and Conclusion

Despite achieving general uniformity in a variety of vegetative and floral features, *Psammogeton* still exhibits a substantial degree of variation in fruit morphology, which explains the significance that fruit has in the opinion of umbellifer taxonomists. Although the fruit type across all umbellifers is the same, there are differences in the mericarp, fruit surface texture, and fruit appendages. Therefore, in systematics, these traits play a significant role. Different scientists including Drude (1898), Dhakre (1964), Holtum (1968), Arora (1976), Heywood and Dakshni (1971), and Katz-Downie (1999), have developed taxonomic delimitations using a variety of fruit traits. Among these features, the anatomy and morphology shine out. Although anatomical features and external morphology are more conservative, this does not diminish the value of morphology research because surface characters are easier to spot than deeply embedded internal traits. Keeping this in view, the current authors have made an attempt to distinguish different species in the genus *Psammogeton* in the north-west of India. The results show that surface traits of fruit have enough potential for genus and sometimes even species delimitation, taking into account the potentiality of umbellifer taxa and their assessment of surface architecture. Analyses of morphology show that *Psammogeton hirsuta* should be considered a new species (North-West, India). In the majority of the qualitative and quantitative traits shown in Table 1, it is comparable to the normal species of *P. canescens*. The plant, which favours subtropical climates, grows in arid, sandy areas close to Jammu. The new species appears to be in the process of extending its geographic range from Jammu and the surrounding areas westward. There are several species of *Psammogeton* that are thought to call this region of Jammu and Kashmir home.

Additional specimens examined (Paratype)

India, Jammu and Kashmir, District Jammu, Mandal, 320. 6799 N 740. 7462 E. 280 m a.s.l. 26 Apr. B. L. Bhellum 15667 (JUBH).

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## Conflict of interest statement

The authors declare that there is no potential source of conflict of interest.

## Authors Contribution

————— :Conceptulization — lead, Investigation — lead, Methodology — equal, Resources — equal, Validation — equal, Writing original draft — lead, Writing review and editing — equal

—————: Conceptulization — supporting, Investigation — supporting, Methodology — equal, Resources — equal, Validation — equal, Writing original draft – supporting, Writing review and editing — equal

## Data availability statement

The article contains data relevant to current investigation. There are no additional data available for this research.

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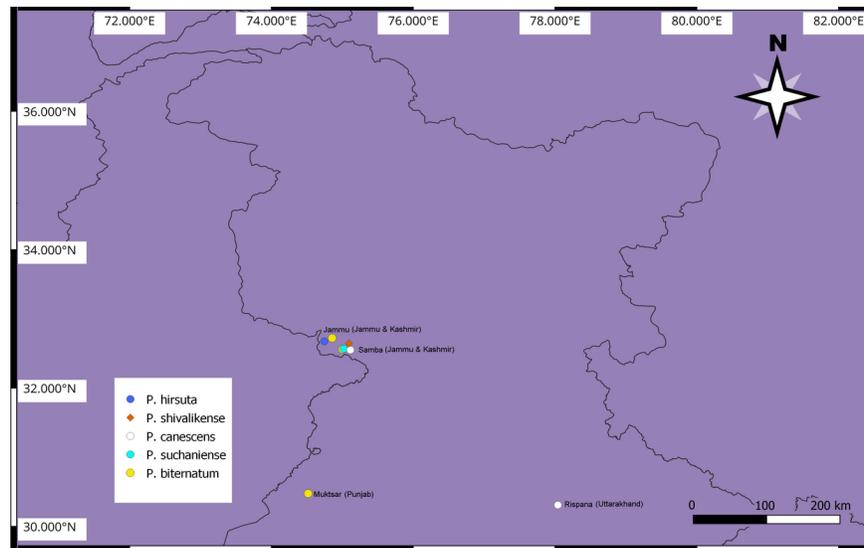
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