Koulium Genus nov. and Koulium psammogetifolium Sp. nov. (Apiaceae; Pimpinelleae) from Jammu, India

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Abstract

Koulium, a newly discovered monotypic genus of the family Apiaceae from the south-west of Jammu, Jammu and Kashmir, India, is described and illustrated. It thrives in open areas, wastelands along rivers, and sandy beds. The new genus is related to Aphanopleura, Psammogeton, and Pimpinella but differs from them in that it has a thick, deep yellow root, fruits with intermixed hairs that are simple and T-shaped, petals sparsely pubescent on the outside, small vittae that are one under each furrow, ridges obscure, and fruits that have a subpentagonal cross section, oblong or elliptic, broader above, gradually narrow below. A diagnostic key, photos, illustrations, a distribution map, comparative characteristics (Table 1), and its closely related genera are provided.

Introduction

Approximately 466 genera and 3820 species comprise up the Apiaceae, which are widely spread in temperate Eurasia and North America (Plunkett et al. 2018). According to Mukherjee and Constance (1993), there are 240 species and 68 genera in the genus in India. India is home to seven endemic genera of the family Apiaceae, including Karnataka P. K. Mukh. & Constance, Kedarnatha P. K. Mukh. & Constance, Polyzygygus Dalzell, Sivadasania Mohanan & Pimenov, Varasashava P. K. Mukh. & Constance, Shrirangia Gosavi, Madhav & Chandore and Pinda P. K. Mukh. & Constance. Fruit and petal hairiness are unique characteristics worthy of special mention. These morphological characters are unknown to any other genus in combination.

One of the authors (BLB) gathered a few intriguing Apiaceae specimens while doing a floristic study of Jammu and Kashmir. These specimens resembled Psammogeton species in appearance. These specimens were discovered to be distinct from their sister taxa, namely Psammogeton, Aphanopleura, and Pimpinella, after rigorous examination in the Government College for Women’s Life Sciences Research Lab in Parade Ground, Jammu. However, the unidentified genus had some similarities to other genera such as Pimpinella, Psammogeton, and Aphanopleura of the tribe Pimpinelleae of Apiaceae. Based on the characteristics of fruit form, indumentum and its variants, carpophore, stigmas, fruits straw coloured, sparsely hairy, shining fruit, and sparsely hairy petals. The shape of fruit elliptic, oblong, and oblongate, with the ridges being obscure. Additionally, considering some more overall points of difference (Table 1), it is proven that we had discovered a new genus.

Material and Methods

One of the authors discovered some intriguing specimens in Jammu and Kashmir in 2022 while conducting a field study that were remarkably similar to Psammogeton. These specimens were discovered to be very distinct from Psammogeton species after thorough analysis in the Life Science Research Lab of the Government College for Women, Parade Ground. The specimens were mounted on the herbarium sheets using the accepted technique (Jain and Rao 1977). The pictures were produced with the help of a binocular stereoscope. Parts of the specimens, particularly the blooms, were cooked in warm water for a minute to enable stereoscopic observations. All measurements are from herbarium and live specimens. According to descriptions in the taxonomic literature (Boissier 1872, Clarke 1879, Hiroe and Constance 1958, Kitamura 1960, Nasir 1972, Babu 1977, Sharma and Kachroo 1981, Hedge et al. 1987, Assadi et al. 2008, Ghazanfar and Edmondson 2013, Pimenov et al. 2019) and comparison with the herbarium specimens in POWO 2023 and different herbaria including K, RRLH, and E, following Thiers (2015) revealed that specimens indeed represent new taxa both genus as species. The terminology is used following (Kljuykov et al. 2004, Hickey and King, 2007).

Taxonomy

Koulium Gen. nov.

Type species: Koulium psammogetifolium sp. nov.

Description of the genus

Annual, glabrous or pubescent, small herbs. Leaves usually 1-pinnate, pinnae toothed or lobed. Inflorescence terminal or axillary leaf-opposed umbels. Peduncles glabrous or pubescent. Rays 3-10, glabrous or pubescent. Bracts 3-5, margins scarious, ciliate; bracteoles 5-6, papery, margins ciliate. Flowers white or pale purple. Calyx-teeth reduced, adnate to ovary wall. Corolla with 5 petals, obovate or obcordate, emerginate with long pointed tip. Stamens 5, filaments long, anthers bithecous, hairy at base. Fruits oblong, oblanceolate, pubescent or glabrescent, ridges obscure, unwinged furrows, vittae usually one carpophore, bifid, mericarps dorsally compressed, hairs simple intermixed with a few T-shaped.

Etymology

The generic name honours Prof. A. K. Koul, FNASC an eminent Indian botanist for his contribution in taxonomy, cytotaxonomy and biodiversity conservation.

Table 1. Morphological comparison between the genus Koulium and its closely allied Psammogeton and Aphanopleura

<table>
<thead>
<tr>
<th>Character</th>
<th>Koulium</th>
<th>Psammogeton</th>
<th>Aphanopleura</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit</td>
<td>Annual</td>
<td>Annual</td>
<td>Annual</td>
</tr>
<tr>
<td>Root</td>
<td>Thick, deep yellow</td>
<td>Thick, white to pale</td>
<td>Thin, white to pale</td>
</tr>
<tr>
<td>Bracteoles (number)</td>
<td>bracts 3-5</td>
<td>Bracts 5-8</td>
<td>Bracts 2-5</td>
</tr>
<tr>
<td>Petiole base</td>
<td>Narrowly sheathy</td>
<td>Conspicuously sheathy</td>
<td>Narrowly sheathy</td>
</tr>
<tr>
<td>Rays (number)</td>
<td>Rays 3-10</td>
<td>Rays 2-20</td>
<td>Rays 5-10</td>
</tr>
<tr>
<td>Petals (indumentum)</td>
<td>margins and outside hairy</td>
<td>margins and outside hairy</td>
<td>Glabrous</td>
</tr>
<tr>
<td>Stigma</td>
<td>linear or nearly so</td>
<td>Capitate</td>
<td>Capitate</td>
</tr>
<tr>
<td>Carpophore</td>
<td>Bifid</td>
<td>Bifid</td>
<td>Bifid</td>
</tr>
<tr>
<td>Fruit (upper portion)</td>
<td>Conspicuously broader</td>
<td>Slightly narrow</td>
<td>Slightly narrow</td>
</tr>
<tr>
<td>Vittae (furrow of fruit)</td>
<td>One</td>
<td>One</td>
<td>One</td>
</tr>
<tr>
<td>Fruit ridges</td>
<td>Obscure</td>
<td>Winged or elevated</td>
<td>Rounded or obscure</td>
</tr>
<tr>
<td>Mericarp (outer face)</td>
<td>Dorsally compressed</td>
<td>Dorsally compressed</td>
<td>Laterally compressed</td>
</tr>
<tr>
<td>Fruit hair type</td>
<td>Simple with few T-shaped</td>
<td>T-shaped</td>
<td>T-shaped</td>
</tr>
</tbody>
</table>
Key to *Koulium* and to its related Asian genera

1. Calyx-teeth conspicuous

   - Calyx-teeth reduced

   *Cuminum*

2. Primary ridges of fruits eight

   - Primary ridges of fruits five

   *Turgenia*

3. Fruits clothed with spiny bristles

   - Fruits clothed with soft pubescence, bristles or T-shaped hairs

   *Torilis*

4. Plants 1-3 m tall

   - Plants smaller

   *Demavendia*

5. Leaves all radical, unipinnatisect

   - Leaves radical and cauline

   *7*

6. Plants glabrous, 2-3 m tall

   - Plants pubescent 1-2 m tall

   *Haussknechtii*

   - Zeravschania

8. Plants perennial; fruit furrow with 2-3-vittae

   - Plants annual; fruit furrow usually with 1-vittae

   *Pimpinella*

9. Roots thin; mericarps laterally compressed; fruit hair clavate

   - Roots thick; mericarps dorsally compressed; fruit hair straight

   *Aphanopleura*

10. Petiole conspicuously sheathed, distinctly hairy; petals glabrous; fruits narrow on both ends, swollen in the middle; fruit hair dense, T-shaped

    *Psammogeton*

    - Petiole narrowly sheathed, sparsely hairy; petals sparsely hairy on margins and on outside; fruits oblanceolate, narrow below gradually broader above, hair sparse, simple usually simple hairy, intermixed with few T-shaped hair

    *Koulium*

Affinities

The petals are obcordate and emerginate, the stamens are inflexed in the bud, and the calyx attaches to the ovary wall. The corpophore is bifid, the commissure is slightly constricted, and the fruits are laterally or dorsally compressed, but they differ in size, shape, and indumentum. Due to the large number of species,
Pimpinella’s fruits might be elliptic, oblong, ovoid, cylindrical, or obovoid in form. The forms are ovoid, oblong, and ovoid-oblong because Psammogeton and Aphanopleura have fewer species than other genera.

Psammogeton, Aphanopleura, and Pimpinella are the closely related genera that exhibit affinities with one another. In contrast to Aphanopleura and Psammogeton, which are annuals and Pimpinella, Demavendia, Haussknechtii, Zeraveschonia are perennials. The leaves of Psammogeton and Aphanopleura species closely resemble to the genus Koula, and all these three genera are annuals. Additionally, the new genus is closely related to Psammogeton by virtue of its thick root while as the root is considered as thin in Aphanopleura. The fruits the genus Koulium progressively get narrower below and wider above that share some characters with the genus Pimpinella. The genus Koulium is allied to Psammogeton, Aphanopleura and Pimpinella but distinguished from them as in Table 1 and key below. The new genus is annual which is distinct from other genera being perennial such as Demavendia, Haussknechtii, Pimpinella and Zeraveschonia. The study we conducted revealed that Aphanopleura and Psammogeton both retain 46% of genus’s similarity with Koulium while as Pimpinella shares 30%.

Koulium psammogetifolium sp. nov. (Fig. 1-5)

**Type:** India, Jammu and Kashmir, district Jammu, south-west, Mandal, 32° 6795 N 74° 7460 E, 285 m a.s.l. 27 Apr 2022, B. L. Bhellum 15784 (holotype – –)

The specific epithet ‘psammogetifolium’ refers to leaves of the new species that resemble with Psammogeton species.

**Description of species**

Annual, erect, 3-10 cm tall herbs. Root thick at base gradually narrow towards apex, slightly angular, deep yellow. stem much branched from the base, branches hollow, hollow, nodes prominent, glabrous. Radical leaves numerous, leaf-base sheathy, minutely hairy, 1-2-pinnate, leaf-segments 3-5 mm long, ternately lobed, sparsely pubescent, drying at anthesis; cauline leaves similar, smaller, petiole short, narrowly sheathy-base, sparsely short hairy on margins, usually 1-pinnate, each segment ternately lobed, pubescent. Inflorescence terminal and axillary leaf-opposed umbels. umbellets — flowered. Peduncle ribbed, glabrous. Rays 3-7, unequal, peripheral longer than the inner ones. Involucre of 5, 2.5-3.5 mm long bracts broader in the middle and narrow at tip, long pointed, margin scarious, ciliate, minutely hairy green midrib. Involucel of 2-2.4 mm long, obovate, oblong, transparent, membranous bractlets, pubescent along midrib, distinctly ciliate along margins. Flower pedicellate, pedicel 2.0-3.1 mm long, bisexual, 2.7-3.2 mm long, white tinged pale purple. Calyx-teeth reduced. Corolla polypetalous, petals 5, obovate to obcordate, emerginate, sparsely hairy on margins and outside, outer petal slightly rotate, 2.7-3.2 mm long, white tinged pale purple, inflexed, tip long pointed. Stamens 5, free, filament 3-4 mm long, alternipetalous, inflexed in bud, slightly longer than petals; anthers bithecous, adnate, yellow, hairy near the base, dehiscence longitudinal; pollen grains subrectangular, rugulate at the equatorial region, exine thicker at the equatorial zone. Ovary bicipellar syncarpous, inferior, bilocular, sparsely hairy: styles two, 1-1.4 mm long, persistent; stigmas two, slightly swollen, not capitate. stylopodium swollen at base, progressively become thin upwards, crowning the ovary, persistent. Fruit a schizocarp, 2-3 mm long, 0.5-1.2 mm wide, elliptic oblong, narrow at base, gradually turning wide above, persistent, mericarps two, dorsally compressed, primary and secondary ribs obscure, sparsely hairy with simple hair and a few intermixed with T-shaped hair with conspicuous thick base, green, turning straw-coloured, shining.

**Phenology**

Flowering and fruiting period from March to May

**Habitat, distribution and ecology**

A species grows on an admixture of sandy and clayey soil. The species is found in association with Argyrolobium roseum (Camb.) Jaub. & Spach., Alternanthera pungens H. B. & K. Artemisia capillaris Thunb., Calotis hispidula F. Muell., Cypereus rotundus L., Evolvulus alsinoides (L.) L., Heterolobium strigosum
Koulium psammogetifolium occurs on sandy places and somewhat disturbed habitat along the river bank. The species is known from the type locality Jammu, Jammu and Kashmir, India. According to IUCN (2022) guidelines, the recommended IUCN status is data deficient (DD).

Discussion and Conclusion
Due to the presence of a yellow tap root, sheathed leaf base, calyx reduced, petals sparsely pubescent, anthers hairy at base, stigmas linear, fruits intermixed with simple and T-shaped hair, the new taxon is classified as belonging to the genus Koulium section Pimpinelleae of the Apiaceae family. Membranous, scabrous, and with ciliate edges, bracts and bracteoles. Stipules are missing, and the bases of the petioles are narrowly sheathed. Reduced and joined to the ovary wall are the calyx. White or pinkish-purple petals. The form seems obcordate and emergent. The fruits are compressed dorsally. Furrows in the pericarp typically include vittae. Fruits have hairy primary and secondary ridges are obscure. Carpels have a subpentagonal cross section, bifid carpophores, and modestly constrained commissures. On the simple, T-shaped fruits of this species, which also have wider bases, we discover hair admixture. The fruit hairs of Aphanopleura and Psammogeton have a T shape. The shape of the fruit being oblong-cylindrical becoming gradually narrow towards base which are to some extent similar to Pimpinella species, however, it differs from them in sparsely hairy petals on outside and on margins and annual in habit.

Additional specimens examined (Paratype)
India, Jammu and Kashmir, District Jammu, Mandal, 32°6795 N 74°7460 E, 285 m a.s.l. 27 Apr 2022, B. L. Bhellum 15786 (——).

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Conflict of interest statement
The authors declare no any potential source of conflict of interest.

References


