A new species of Fimbristylis (Cyperaceae) from central India

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Abstract

The present study reports the discovery of Fimbristylis pachmarhiensis (Cyperaceae) as a new species from central India. The specimens were collected from the Pachmarhi hills located in Madhya Pradesh.To aid in the accurate identification of this species, an extensive taxonomic description, accompanied by photographic illustrations, a comparative analysis with similar species, and supplementary notes have been included. These comprehensive details serve to enhance our understanding and recognition of this newly discovered plant species.

Introduction

Fimbristylis Vahl is a large genus within the Cyperaceae family, comprising approximately 316, (Govaerts *et al* ., 2018) and recent information indicates that the genus now includes around 320 species (POWO, 2020). These species are predominantly found in tropical and subtropical regions, with a few occurring in warm temperate areas. Notably, within India, Karthikeyan *et al* . (1989) documented 90 species (102 taxa) of *Fimbristylis* , while Wadoodkhan (2015) reported 102 species (123 taxa) from the Western Ghats, West Coast, and Maharashtra. Additionally, Prasad & Singh (2002) recorded 115 species from India. In recent decade, nine new species viz., *Fimbristylis matthewii* Murugesan *et al* .(2010), *F.velliangiriensis*Murugesan *et al* .(2010), *F.clarkei* Kumar *et al* .(2013), *F.pokkudaniana* Sunil *et al* .(2016),*F.tuckeri* Viji *et al* .(2016), *F. pandeyana* Mujaffar, Wad. Khan & A.P. Tiwari (2017), *F.murthyi* Yarrayya&Kumar (2018),*F. agasthyamalaensis* Viji & Preetha (2018) and*Fimbristylissunilii,* Sanilkumar& Nithya (2021) have also been described. Presently, India is home to a total of 123 species. In central India, particularly in Madhya Pradesh, the genus is represented by 38 taxa (Khanna *et al* . 2001, Mujaffar *et al* . 2017, Mujaffar *et al* ., 2019).

During an exploration of the Cyperaceae family in Madhya Pradesh, India, the authors collected an interesting species of *Fimbristylis* in the rocky areas of Pachmarhi hills, located in the Hoshangabad district, Madhya Pradesh. Through careful examination of the collected specimens and extensive review of relevant literature, including work by Clarke (1893), Fischer (1931), Karthikeyan *et al* . (1989), Kern (1974), Koyama (1985), Prasad & Singh (2002), Shuren *et al.,* (2010) Wadoodkhan (2015), and Viji and Preetha (2018), the authors confirmed that this species is distinct from others in the genus. This distinct species, closely related to *F. aestivalis* (Retz.) Vahl and*F. griffithii* Boeckeler, is described and illustrated in this study. Key differentiating characteristics are summarized in Table 1.

Materials and Methods

Fresh specimens collected from the field were used to create Herbarium sheets, adhering to the established protocols of Bridson & Forman (1989). Additionally, specimens were preserved in FAA solution to facilitate microscopic investigations. The general structure of the newly discovered species was examined with a stereo

binocular microscope. To ensure accurate morphological comparisons, we consulted the digital type material housed in CAL, K, G and P collections (acronyms according to Thiers 2020). In accordance with the IUCN criteria (IUCN 2017), we present an assessment and rationale for the conservation status of the species. The International Code of Nomenclature for algae, fungi, and plants (The Shenzhen Code, Turland*et al.* 2018) has been used for the nomenclature of a new species.

Taxonomic Treatment

Fimbristylis pachmarhiensis Mujaffar, A.P. Tiwari & R.L.S. Sikarwar sp. nov. **(Fig 1 & 2)**

Diagnosis: *Fimbristylis pachmarhiensis,* is closely similar to *F. aestivalis* (Retz.) Vahl, by the hairy nature of the plant but differs from it in having few, slender culms (vs. densely tufted culms), inflorescence simple to compound, very loose, bearing 10–20 spikelets (vs. inflorescence decompounds corymb, loose, bearing numerous spikelets), spikelets terete, 8-14-flowered (vs. angular, to 40-flowered spikelets), glume distichous or lower 2 or 3 spiral, 3-nerved (vs. all glume spiral, nerveless), style triquetrous, pubescent throughout (vs. style flat, ciliate towards the top) and achenes obovate, 3.0–5.0 × 2.5–3.0 mm, sparsely tuberculate, apex depressed (vs. achene obovate-elliptic, 0.5–0.8 × 0.2–0.3 mm, brownish, smooth, apex rounded). The new species also shows resemblance with *F. griffithii* Boeckeler in its eligulate leaf and biconvexed achenes. However, it is quite distinct in having hairy nature of plant (vs. glabrous nature of plant), inflorescence simple to compound, very loose, 4–6 cm long, bearing 10–20 spikelets (vs. inflorescence decompounds corymb, loose, 4–10 long, bearing 70–90 spikelets), spikelets terete, 8-14-flowered (vs. spikelets angular, 6–19-flowered), glume distichous or lower 2 or 3 spiral, 3-nerved (vs. all glume spiral, nerveless), style triquetrous, pubescent throughout (vs. flat, glabrous throughout) and achenes sparsely tuberculate, depressed at apex (vs. smooth, rounded at apex).

Type: India, Madhya Pradesh: Hoshangabad district, Pachmarhi Biosphere Resereve, Panarpani area (22°25'24."N; 77° 22' 56"E), 750 m, 17 November 2015, *Mujaffar & Tiwari* 2514 (holotype CAL!, isotypes BSA!).

Description: Annual herb, 10–25 cm tall, with fibrous roots. Culms slender, trigonous, glabrous or pubscent at the top. Leaves mostly basal, shorter than culm; sheath brown, 1–4 cm long, pubescent, obliquely truncate at apex; ligule absent; leaf blade 10–20 cm long, 0.5–0.7 mm wide, pubescent on both surfaces, margin sometimes slightly involute. Inflorescence simple to compound, large, 4–6 × 2–5 cm, loosely, bearing 10–20 spikelets; involucral bracts 2–5, foliar, 10 cm long, lowest 2-3 leafy, shorter than inflorescence, brownish, pubescent; rays 3–8, primary rays, slender, pubescent, filiform. Spikelets solitary, terete, oblong, elliptic to lanceolate, 3-4 × 0.5–1.0 mm, acute at apex, yellow to brownish, 8-14-flowered; rhachilla narrowed, winged, brownish. Glumes membranous, distichous or lower 2 or 3 spiral, oblong-ovate, 1.5–2 × 1–1.3 mm, acute at apex, glabrous (lower 2 or 3 puberulent), keeled with the prominent midvein excurrent into a mucro, 3-nerved, hyaline towards margins. Stamen 1 or 2; anther oblong-linear, 0.3-0.4 mm long, brownish, apiculate, spurred at base; filament 1-1.2 mm long, hyaline. Style slender, triquetrous, pubescent throughout, dilated at base 0.8–1 mm long; stigma 2, hairy, shorter than style, exserted,*c* . 0.5 mm long, recurved. Achenes whitish or brownish, biconvex, obovate, 0.8–1 × 0.5–0.6 mm, narrowed towards base with shortly stipitate, depressed at apex, apiculate, sparsely tuberculate, shining, surfaces of achenes reticulate, hexagonal or elliptic to rectangular epidermal cells.

Etymology: The specific name of this species is derived from its type locality, which is the Pachmarhi Hills situated in the state of Madhya Pradesh, India.

Phenology: The phenological period for this species occurs between September and November.

Habitat and Associated species: This species is found in forests on rocky areas at elevations ranging from 528 to 609 m. It grows alongside associated species such as *Bulbostylis barbata* (Rottb.) C.B. Clarke, *Cyperus castaneus* Willd., *Cyanotis fasciculata* (B.Heyne ex Roth) Schult. & Schult.f., and *Oropetium thomaeum* (L.f.) Trin.

Distribution: This species is known only from a single locality of Pachmarhi Biosphere Resereve, Hoshangabad district in Madhya Pradesh (Central India).

Conservation status : Based on the available information, this plant has been tentatively classified as Data Deficient (DD) in accordance with the IUCN Red List Categories and criteria (IUCN, 2017). The existing data is insufficient to evaluate the risk factor associated with this species. Currently, the plant is known solely from its type locality. To comprehensively assess its distribution, population numbers, subpopulation numbers, the count of mature individuals across its entire range, and the percentage of population decline in recent years, further investigations are required in similar habitats adjacent to the known areas.

Taxonomic note : *Fimbristylis pachmarhiensis* closely resembles *F. aestivalis* (Retz.) Vahl due to its hairy characteristics. However, there are several distinguishing characteristics that set it apart. Firstly, *F. pachmarhiensis* has fewer slender culms compared to *F. aestivalis* , which has densely tufted culms. The inflorescence of *F. pachmarhiensis* is simple to compound and very loose, bearing 10-20 spikelets, whereas *F. aestivalis* has decompound corymbs that are loose and bear numerous spikelets. In terms of spikelet morphology, *F. pachmarhiensis* has terete spikelets with 8-14 flowers, while *F. aestivalis* has angular spikelets with up to 40 flowers. Another distinguishing feature is the arrangement of the glumes: F. pachmarhiensis has glumes that are distichous or the lower 2 or 3 are spiral and 3-nerved, while in F. aestivalis, all the glumes are spiral and nerveless. The style of*F. pachmarhiensis* is triquetrous and pubescent throughout, while F. aestivalis has a flat style that is ciliate towards the top. Additionally, the achenes of *F. pachmarhiensis* are obovate, measuring 3.0–5.0 × 2.5–3.0 mm, sparsely tuberculate, and have a depressed apex. In contrast, *F. aestivalis* has obovate-elliptic achenes that are much smaller, measuring 0.5–0.8 × 0.2–0.3 mm.*F. aestivalis* achenes are brownish, smooth, and have a rounded apex.

While *F. pachmarhiensis* shares some similarities with *F. griffithii* Boeckeler, such as the eligulate leaf and biconvexed achenes, there are distinct differences as well. *F. pachmarhiensis* exhibits a hairy nature, while *F. griffithii* is glabrous. Additionally, the inflorescence of *F. pachmarhiensis* is simple to compound, very loose, and measures 4–6 cm in length, bearing 10–20 spikelets. On the other hand, *F. griffithii* has a decompound corymb inflorescence that is loose and measures 4–10 cm, bearing 70–90 spikelets. The spikelets of *F. pachmarhiensis* are terete and 8-14-flowered, while those of *F. griffithii* are angular and 6–19-flowered. Furthermore, *F. pachmarhiensis* has distichous or lower 2 or 3 spiral, 3-nerved glumes, a triquetrous and pubescent style throughout, and sparsely tuberculate achenes with a depressed apex. In contrast, *F. griffithii* has all glumes spiral and nerveless, a flat style that is glabrous throughout, and achenes that are smooth and rounded at the apex.

Table 1 The key diagnostic characteristics to distinguishing*Fimbristylis aestivalis* , *F. pachmarhiensis* , and*F. griffithii* .

Characters	F. aestivalis
Culm	Densely tufted, 8–15 cm long, hairy.
Leaves	Hairy on both surfaces
Inflorescence	Decompounds corymb, loose, to 5 cm long, few to numerous spikelets.
Spikelets	Solitary, angular, ovoid or oblong-lanceolate, 2–5 × 1–1.5 mm, acute at apex, greenish-brown, densely to 40-
Glumes	Membranous, spiral, ovate, 1.2-1.5x ca. 0.7 mm, acute at apex, glabrous, keeled, nerveless.
Stamen	One
Style	Flat, ciliate towards the top
Achene	Obovate-elliptic, 0.5–0.8 × 0.2–0.3 mm, brownish, smooth, rounded at apex.

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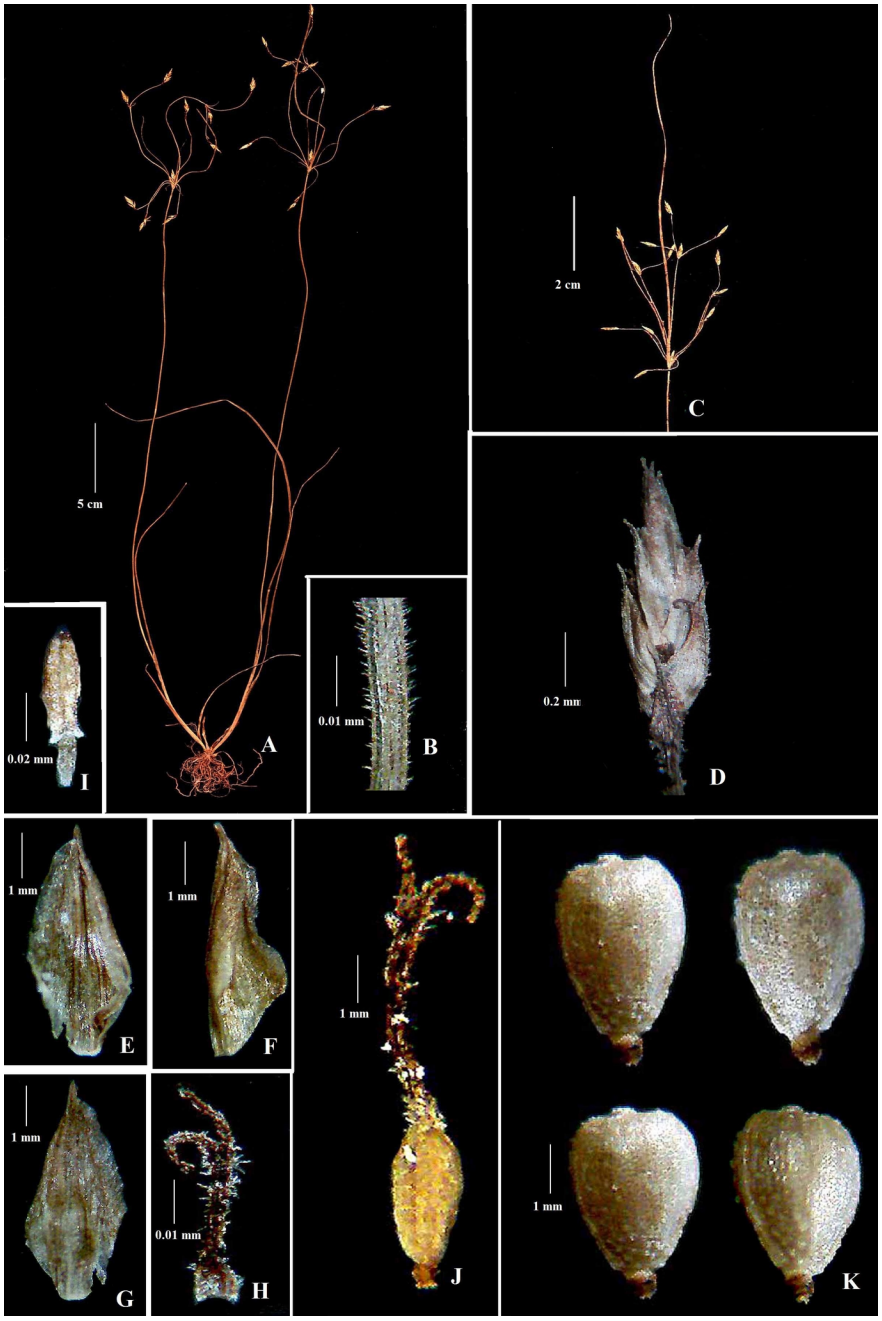

Figure 1. *Fimbristylis pachmarhiensis* Mujaffar, A.P.Tiwari & R.L.S. Sikarwar sp. nov. **A.** Habit; B. Culm;**C.** Inflorescence; **D.** Spikelet; **E.** Glume – ventral view; **F.** Glume – lateral view; **G.** Glume – dorsal view; H. Style; **I.** Stamen; **J.** Gynoecium;**K.** Achenes.

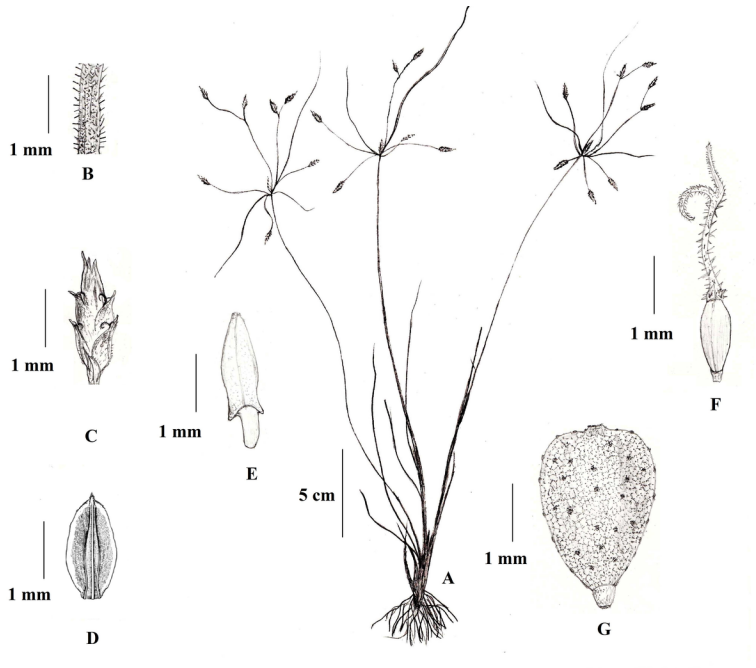

Figure 2. *Fimbristylis pachmarhiensis* Mujaffar, A.P.Tiwari & R.L.S. Sikarwar sp. nov. **A.** Habit; B. Culm showing hairs; **C.** Spikelets; **D.** Glume – ventral view;**E.** Stamen; **F.** Gynoecium; **G.** Achenes.