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Research

Curculigo sabui sp. nov. (Hypoxidaceae), a new species from Balaghat Ranges of Maharashtra, India

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A new species, *Curculigo sabui* S.P.Gaikwad & Gore is described from margins of temporary fresh water streams in Yedshi-Ramling Wild Life Sanctuary of Balaghat Ranges of Maharashtra, India. Morphologically it resembles *Curculigo janarthanamii* Gore & S.P.Gaikwad and *C. multiflora* Zimudzi but differs in having elliptic-lanceolate to obovate (20–52 × 3.0–4.5 cm) leaf lamina, flowers three to five in umbel-like racemes or sometimes solitary, seed coat with irregular striations and somatic chromosome number 2n = 36. A detailed morphological description with line drawings, photographs and comparative account of the species is provided here.

Keywords: *Curculigo*, dehiscent capsules, India, spongy elaisome, taxonomy

Introduction

The genus *Curculigo* Gaertn., with about 19 species and four varieties (Govaerts 2016, Gore and Gaikwad 2018), is widespread in tropical Africa, Asia and America (Wiland 1997, Nordal 1998). The genus is characterized by pseudopetiolate leaves, subterranean beaked ovaries, indehiscent fruits and strophiolate seeds (Zimudzi 1994). In India, the first detailed taxonomic treatment of *Curculigo* is that of Baker's publication 'A synopsis of Hypoxidaceae' (1878), in which he recorded seven species and three varieties from British India. Roxburgh (1832) in his 'Flora Indica' included three species namely *Curculigo orchioides* Gaertn., *C. recurvata* W.T. Aiton and *C. sumatrana* Roxb. Hooker (1892) recorded six species and two varieties from British India and divided them into two sections *Molineria* with *Curculigo recurvata* W.T. Aiton, *C. gracilis* (Kurz.) Wall. ex Hook.f., *C. crassifolia* Hook.f., *C. finlaysoniana* Wall. and *C. finlaysoniana* var. *linearifolia* Thwaites and *Curculigo* proper with *C. orchioides* Gaertn., *C. latifolia* Dryand. and *C. latifolia* var. *villosa* Baker. Karthikeyan et al. (1989) enumerated five species of *Curculigo* from India. Thomas (2000) has recorded nine species of *Curculigo* for India, of which *Curculigo capitulata* (Lour.) Kuntze, *C. crassifolia* Hook.f., *C. gracilis* (Kurz.) Wall. ex Hook.f., *C. latifolia* Dryand, *C. oligantha*, (C.E.C. Fisch.) Bennet & Raizada, *C. prainiana* (Deb) Bennet & Raizada and *C. trichocarpa* (Wight) Bennet & Raizada are transferred

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to the genus *Molineria* Colla (Odyuo et al. 2016). In last two decades, *Curculigo maharashtrensis* M.R. Almeida and S. Yadav, *C. savantwadiensis* M.R. Almeida and S. Yadav and *C. janarthanamii* Gore & S.P.Gaikwad. have been added to the list. Hence, India now has five species of *Curculigo*.

Some specimens of the genus *Curculigo* were collected from Ramling Wild Life Sanctuary of Osmanabad district in 2012, which have been tentatively assigned to *Curculigo orchioides* Gaertn. Observed differences from typical *Curculigo orchioides* were thought to be due to ecological variations. However, Gore and Gaikwad (2018) while working on geophytes of Balaghat Ranges of Maharashtra came across these specimens, which were morphologically similar to *C. janarthanamii* Gore & S.P.Gaikwad and *C. multiflora* Zimudzi, but differs in several characters (Table 1). Hence, specimens were collected from above mentioned locality and detailed morphological, cytological and SEM studies were carried out, which revealed that the plants in query represent a new species. It has been confirmed by perusal of relevant literature (Roxburgh 1832, Baker 1878, Karthikeyan et al. 1989, Zimudzi 1994, Thomas 2000, Almeida and Yadav 2009, Kocyan et al. 2011, Liu et al. 2012, Kocyan and Wiland-Szymanska 2016) and expert opinion on the identity of the species.

Key to the Indian species of *Curculigo*

1. Fruit a berry ……..… 2
   – Fruit a capsule ……..…. 4
2. Flowers arise in bunch of five to six together before leaves …… *C. savantwadiensis*
   – Flowers arise with leaves or after leaves ……3
3. Flower one or two from the center of leaves ……..…. …… *C. maharashtrensis*
   – Flowers in raceme, lowest bisexual and upper male arise from leaf axils …….. *C. orchioides*
4. Capsule dehisces by three-loculicidal valves or irregularly; seeds 8 to 20,seed coat smooth without striations ……. *C. janarthanamii*
   – Capsule dehisces by longitudinal slit; seeds 3 to 12, seed coat with irregular striations ……..…. *C. sabui*

Taxonomy

Curculigo sabui S.P.Gaikwad & Gore sp. nov. (Fig. 1–3)

The new species resembles *Curculigo janarthanamii* and *Curculigo multiflora* but differs in having elliptic-lanceolate to obovate (20–52 × 3.0–4.5 cm) leaf lamina, flowers three to five in umbel-like racemes or solitary, fruit capsular dehisces by forming longitudinal slit, seed coat with irregular striations and somatic chromosome number 2n = 36.

Type: India, Maharashtra, Osmanabad district, Yedshi-Ramling Wild Life Sanctuary, 18°17′26.7″N, 75°57′19.4″E, 655 m alt., 27 Aug. 2017, *R.D. Gore*-13097 (holotype: CAL; isotypes: BSI, BAMU, Walchand College Herbarium Solapur).

Etymology

The specific epithet honors Prof. Mamiyil Sabu, Department of Botany, University of Calicut, Kerala (India), in recognition of his valuable contribution to the taxonomy of Zingiberaceae of India.

Description

Perennial, acaulescent, geophytic herbs, highly variable in size (37–82 cm high); rootstocks thick, vertical, 10–30 × 1.0–2.0 cm, rarely branched, crowned with persistent black-fibrous remnant of former leaves and bearing scattered three to six fibrous roots at upper part and white, thick, fleshy contractile roots at basal region. Leaves three to

Table 1. Comparison of morphological characters of *Curculigo sabui* S.P.Gaikwad & Gore, *Curculigo janarthanamii* Gore & S.P.Gaikwad and *Curculigo multiflora* Zimudzi.

	C. sabui	*C. janarthanamii*	*C. multiflora*
Rhizome	10–30 cm long, bearing three to six fleshy contractile roots at basal region.	10–45 cm long, bearing many contractile fleshy roots throughout the rhizome.	1–5 cm long, bearing contractile roots at basal region.
Leaves	lamina elliptic-lanceolate to obovate, 20–52 × 3.0–4.5 cm.	lamina linear-lanceolate, 15–45 × 1.0–2.5 cm.	lamina linear to lanceolate, ca 12 × 0.4 cm.
Flowers	three to five in umbel-like racemes or solitary.	six to eight in elongated racemes.	two to four in umbellate inflorescence.
Fruits	capsular, dehisces by longitudinal slit.	capsular, dehisces into three valves or irregularly.	berry.
Seeds	3 to 12 per capsule.	8 to 20 per capsule.	three to six per capsule.
Seed coat	shiny with irregular vertical striations or wavy lines.	smooth, shiny, without wavy lines.	shiny with irregular vertical striations or wavy lines.
Somatic chromosome number	2n = 36	2n = 18	Not known
Distribution	so far only known from Ramling Wildlife Sanctuary, in Osmanabad district of Maharashtra State.	endemic to Maharashtra State, India.	endemic to Mwinilunga district of Zambia.

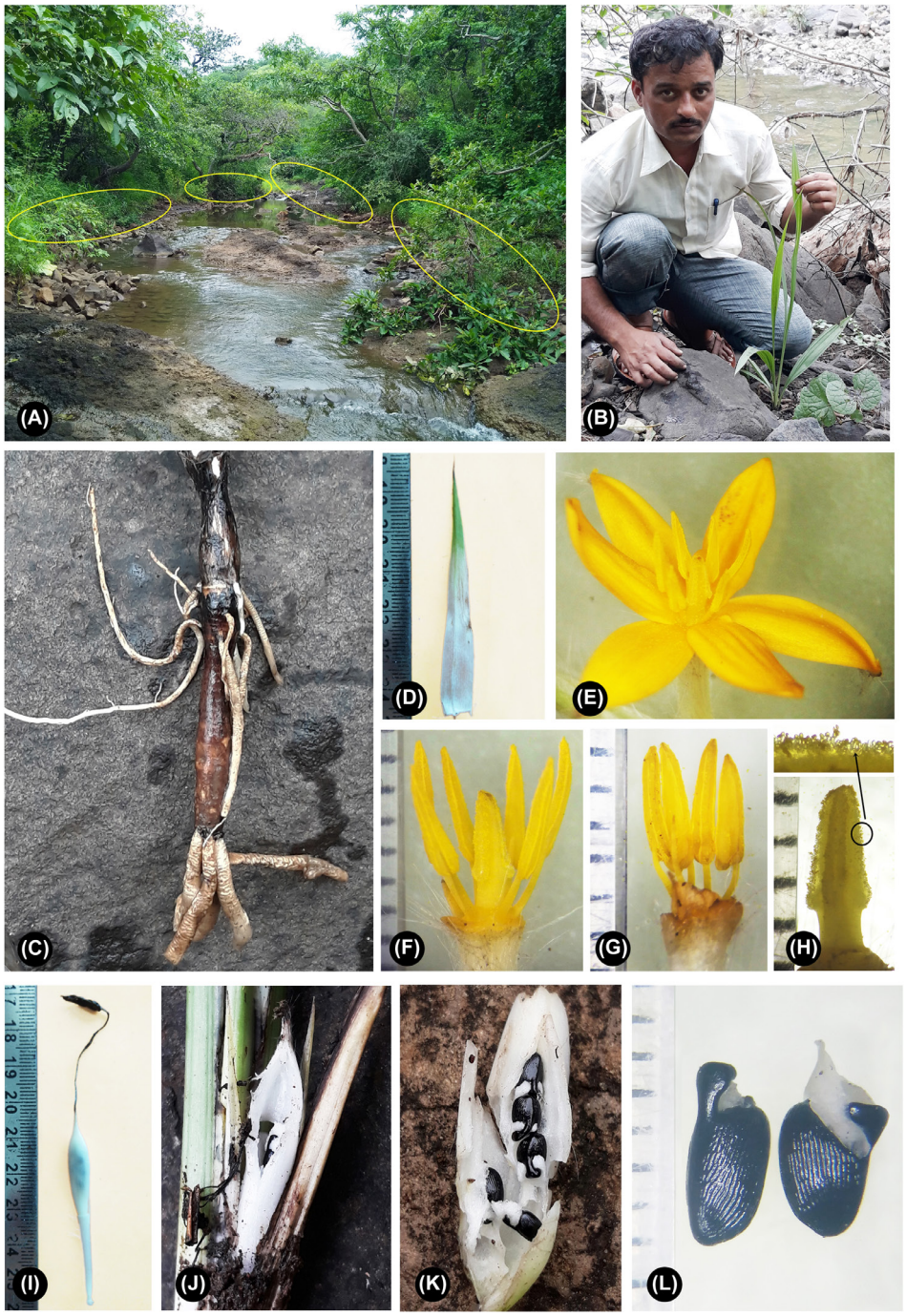

Figure 1. *Curculigo sabui* sp. nov. S.P.Gaikwad & Gore: (A) habitat, (B) habit, (C) rhizome, (D) floral bract, (E) bisexual (hermaphrodite) flower, (F) dissected bisexual flower, (G) dissected male flower, (H) pistil, (I) capsule with perianth tube, (J–K) capsule showing dehiscing pattern, (L) seeds with spongy eliosome.

six, basal, three-ranked rosulate, plicate, elliptic-lanceolate to obovate, 20–52 × 3.0–4.5 cm, base ending into pseudopetiole, upper surface glabrescent, prominently nerved beneath with 2.0–3.0 mm long, sparsely simple and unequal stellate hairy on nerves, apex acute to acuminate sometimes obtuse ending with fine tip; pseudopetiole distinct, canaliculate, 17–30 × 0.4–0.7 cm, base membranous and pale green to white, sheathing. Flowers three to five, yellow, polygamous (lower hermaphrodite and upper male), distichous, subsessile and arising from leaf axils on elongated (4–9 cm long) umbel-like racemes or sometimes solitary; peduncles 1.0–2.5 cm long, whitish, fleshy. Bracts persistent, scarious, linear-lanceolate, 3.0–11 × 0.5–2.7 cm (more broader and persistent in fruiting), keeled, base whitish, unequal

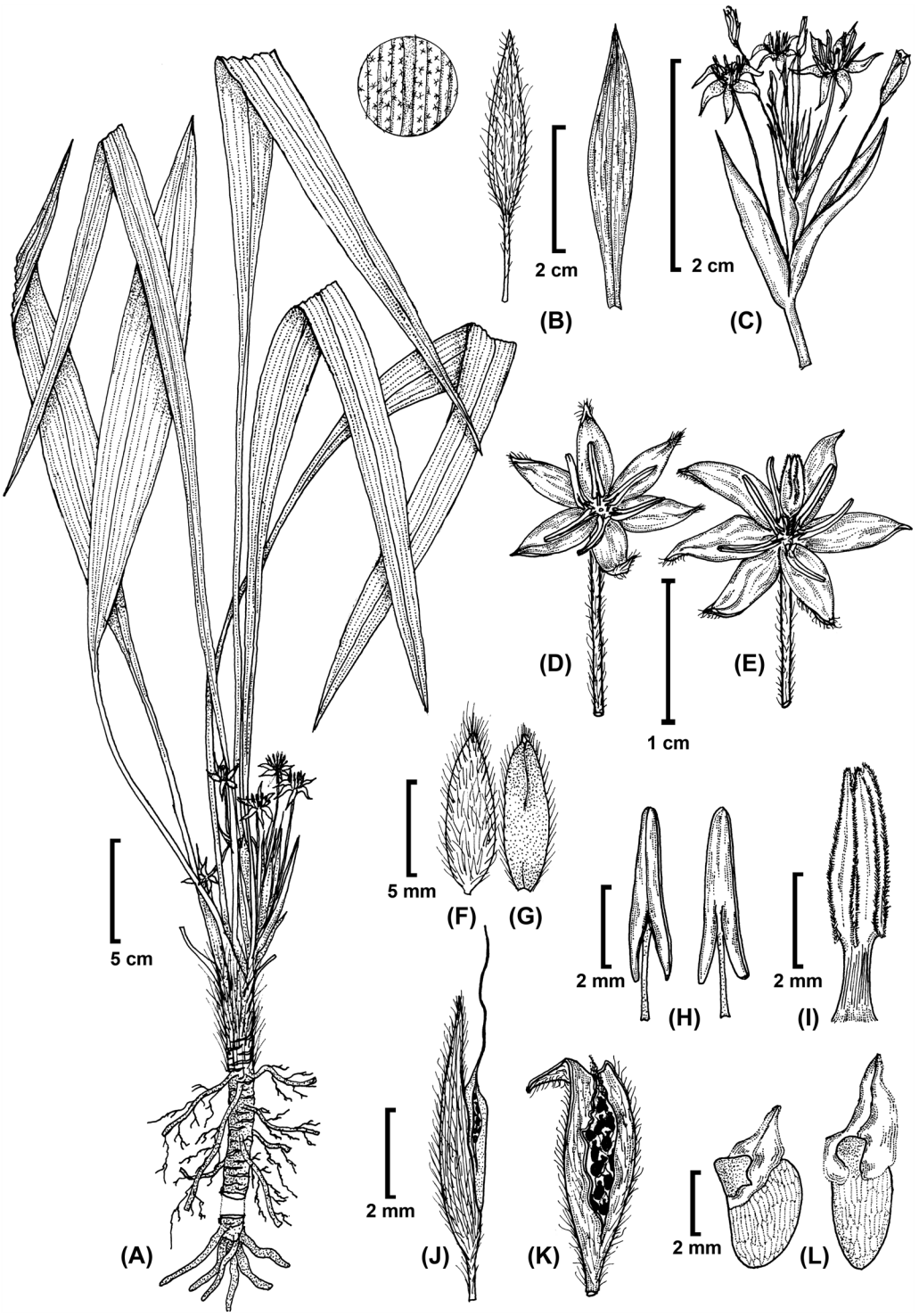

Figure 2. *Curculigo sabui* sp. nov. S.P.Gaikwad & Gore: (A) habit, (B) floral bract, (C) inflorescence, (D) male flower, (E) bisexual (hermaphrodite) flower, (F–G) outer and inner tepal, (H) stamens, (I) pistil, (J–K) capsule showing dehiscing pattern, (L) seeds.

sided, membranous covered with 1.0–4.0 mm long unicellular unbranched silky hairs, apex acute to acuminate, pale green. Perianth fused into elongated tube and base included into ovary region; perianth tube white, slender, 2.6–10.5 cm long, terete or minutely angled, as long as or slightly longer than bracts, covered with 1.0–4.0 mm long, white silky hairs. Tepals 3 + 3, bright yellow, unequal, persistent, ovate to lanceolate, 0.6–0.9 × 0.8–2.5 mm, entire, tapering towards base, glabrous above, whitishyellow beneath covered with 1.0–1.5 mm long simple and stellate hairs, apex somewhat

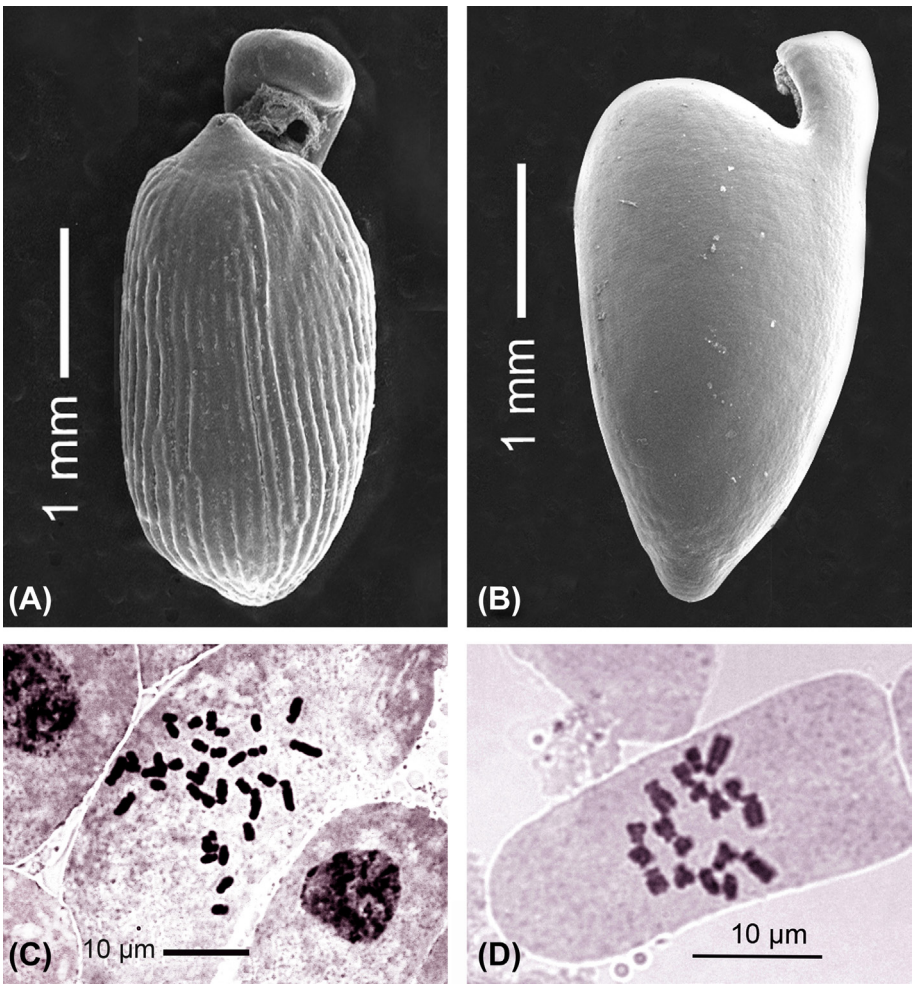

Figure 3. Seed SEM microphotographs (A) *C. sabui*, (B) *C. janarthanamii*. Somatic metaphase (C) *C. sabui* (2n = 36), (D) *C. janarthanamii* (2n = 18).

hooded and possesses ca 1 mm long appendage, acute with long intermixed hairs. Male flowers bearing perianth segments and anthers (ovary, style and stigma absent); perianth tube 2.5–6.0 cm long; stamens 3 + 3, yellow, uniseriate, opposite to perianth lobes; filaments glabrous, 2.0–2.7 mm long, arising from the base of perianth lobes or mouth of perianth tube; anthers yellow, 3.5–4.5 × 0.3–0.6 mm, sagittate, basifixed, lobes unequal, 1.0–1.5 mm long, dehisces through vertical slits along margins. Bisexual (hermaphrodite) flowers perianth tube 2.6–10.5 cm long, sub-terete or minutely angled; stamens 3 + 3, uniseriate, perigynous; filaments 2.0–2.5 mm long, glabrous, adnate to the base of perianth lobes; anthers yellow, 3.5–4.5 × 0.6–1.0 mm, basifixed, sagittate, dehisces through vertical slits along margins, lobes unequal 0.8–1.5 mm long; ovary inferior, trilocular, villous, prolonged into 3.0–5.5 mm long epigynous beak; ovules three to six in each locule; style yellowish, terete, 1.2–1.8 mm long (above perianth tube), glabrous, fleshy, compressed at middle, marked with vertical lines; stigmas 3.0–3.5 mm long, usually compressed with basally broadened furrows and grooved along the style, apex obtusely three-cleft, ridges papillate. Fruit a dehiscent capsule which dehisces by opening into longitudinal slit, succulent, fleshy, oblong-clavate, 4.0–6.0 × 0.6–0.8 cm, quite hidden in the radical tuft of leaf bases, covered with white-silky 1.0–2.5 mm long hairs, apex prolonged into 3.0–5.5 mm long beak with persistent perianth tube. Seeds 3 to 12, black, globose, ellipsoid to ovoid, 3.5–5.5 × 1.5–2.0 mm; seed coat black, shiny with irregular striations, strophiolate; beak glabrous, knob-like, 1.0–1.5 mm long, curved inside; eliosome white, spongy. Flowering and fruiting in July to October.

Distribution, habit and ecology

The new species is known so far from Yedshi-Ramling Wild Life Sanctuary of Osmanabad district, Maharashtra State, India. It grows along the margins of seasonally running fresh water stream in humus rich soil in association with *Caesulia axillaris* Roxb., *Canscora diffusa* (Vahl) R. Br. ex Roem. and Schult, *Desmodium triflorum* (L.) DC., *Indigofera glandulosa* var. *sykesii* Baker, *Ludwigia hyssopifolia* G. Don) Exell and *Eriocaulon duthiei* Hook.f. under the shade of riverine trees such as *Pongamia pinnata* (L.) Pierre, *Terminalia*

arjuna (Roxb. ex DC.) Wight and Arn., *Terminalia bellirica* (Gaertn.) Roxb., *Syzygium cumini* (L.) Skeels and *Strychnos potatorum* L.f. at about 655 m a.s.l. In natural habitat, underground perennial rhizome of *C. sabui* sprouts and new leaves are produced in response to the monsoon rain in the month of June, and vegetative growth continues till October. Inflorescences are developed during the vegetative growing season. Seed setting takes place rapidly and aerial parts dry off with the end of October. The underground perennial rhizome remains dormant during dry season (six to seven months). The white spongy elaisome has a sweet taste.

Similar species and remarks

The dehiscent capsular fruit of *Curculigo sabui* is unusual in the genus *Curculigo*. However, characters like pseudopetiolate leaves, seeds with expanded hilum (beak) and white elaisome and perianth separated from the ovary by a long perianth tube encourage assigning it into the genus *Curculigo*. This kind of fruit is also reported in recently described species *Curculigo janarthanamii*, hence, these two species seems to be closely allied (Table 1).

Conservation status

The new species is so far known only from its type locality; hence it is difficult to determine the conservation status of the species according to IUCN (2018) categories and criteria.

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