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Piper rukshagandhum (Piperaceae): a new species from southern Western Ghats, India

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Abstract

Piper rukshagandhum J.Mathew is described as a new species from the Achankovil forest, Kerala section of the southern Western Ghats, India. The diagnostic morphological characters, distribution, conservation status and colour images of the new species are presented. The significance of this newly discovered species in breeding programs of black pepper is also briefly discussed. A key to *Piper* from the southern Western Ghats is provided.

Introduction

Piper L. (Piperaceae) consists of approximately 1,300 species in the Neotropics with another 700 species distributed in the Old World tropics (Quijano-Abril et al. 2006). In India, *Piper* is represented by more than 100 species, most of which (65 species) are confined to the northeastern region. Evergreen forests of the southern Western Ghats also form a significant centre of diversity for *Piper*, with 18 taxa (17 species and two subspecies; see key for full list) reported from the Kerala region of the Western Ghats (Sasidharan 2013). Among these taxa, 10 are local endemics with one species categorized as critically endangered (IUCN 2012).

Floristic studies of the Achankovil forests in the Agasthyamala Biosphere Reserve, southern Western Ghats, conducted between 2009–2014, have uncovered several interesting specimens from the genus *Piper*. Study of literature and herbarium specimens revealed that some of these *Piper* specimens do not belong to any described species. This has resulted in the recognition of a novel species here described as *Piper rukshagandhum* J.Mathew.

Taxonomic treatment

Piper rukshagandhum J.Mathew, ***sp. nov.***

Diagnosis: *Piper rukshagandhum* differes from all *Piper* species except *P. velaudhanii* E.S.S.Kumar & S.P.Mathew by the colour of the spike and overall appearance. It differs from *P. velaudhanii* in having glabrous recurved receptacles (versus pubescent and straight), petioles to 3 cm long (versus to 1.5 cm long), unequal leaf base and long acuminated leaf tip (versus rounded leaf base and short acuminated leaf tip), smaller leaf size of 8-16 x 6-9 cm (versus 15-22 x 10-15 cm), pinkish young nodes (versus yellow to greenish coloured young

nodes), blush red/pink coloured spike (versus greenish purple coloured), green fruit with pink apex (versus green fruit including apex) and its strong pungency (versus very weak pungency).

Type: India: Kerala: Kollam District, Kottavasal Valley, 77° 08' 11"E, 09° 13' 06"N, alt. 700 m, *J. Mathew 2811* (flowering: female), 28 Feb 2011 (holo: MH; iso: CMS).

A branched, evergreen dioecious, woody climber. Stem terete, glabrous, rooting at nodes; nodes swollen, young nodes pinkish in colour; internodes 1–7 cm long, slender, glabrous, green and slightly angular when young, brown and woody with lenticels at maturity. Leaves alternate; petioles 2–3 cm long; lamina 8–16 cm long, 6–9 cm wide, very broadly ovate, coriaceous and glabrous on both surfaces, apex long acuminate, base not equal, coriaceous, margin entire, venation pinnate with 2(3) prominent veins, all arising from the base or near it. Inflorescence a spike, leaf-opposed, solitary, pendulous. Male inflorescence 15 cm long, 100–120 flowered, blush red/pink in colour; peduncle 1.5–2.5 cm long, glabrous; receptacle sessile, globose, glabrous, parallel to the axis, recurved; bracts adnate to the axis, recurved, transformed into a fleshy cup with narrow slit-like mouth, glabrous. Male flower: stamens 2, short, 0.3–0.5 mm long; filaments thick, glabrous; anthers 2-celled, dehiscing through apical longitudinal slit. Female inflorescence 3–7 cm long, 16–22 flowered, blush red/pink in colour; peduncle 1.5–2.5 cm long, glabrous; receptacle sessile, globose, glabrous, parallel to the axis, recurved; bracts adnate to the axis, recurved, transformed into a fleshy cup with narrow slit like mouth, glabrous. Female flower: carpel 1; ovary globose, sessile; stigmas 4, white, sessile. Fruit a drupe, 6–8 mm long and wide, globose, sessile, green and apically purple -when young, red when ripe. Single seed. Figs 1-3.

Phenology: Flowering in November–December; fruit develop in December and mature in May.

Etymology: The specific epithet is derived from the Sanskrit *rukshagandha* which means pungency in reference to the very pungent fruit.

Conservation status: Field surveys have located about 20 individuals within the Kottavasal valley of the Achankovil forests covering an area of 2 km^2. This data was evaluated according to the IUCN categorization (IUCN 2012) and indicates that at least 'Critically Endangered' status would be appropriate for the species. Apart from habitat destruction caused by wild fires, no other specific threats where determined during the field studies.

Habitat: *Piper rukshagandhum* is a climber that grows on the edges of riverine valleys of the Agasthyamala Biosphere Reserve. Trees that provide support for *P. rukshagandhum* are *Elaeocarpus variabilis* Zmarzty and *Chionanthus mala-elengi* (Dennst.) P.S.Green subsp. *mala-elengi* which are both endemic to peninsular India. Common associates are *Oxyceros rugulosus* (Thwaites) Tirveng., *Eugenia mooniana* Wight and *Calamus gamblei* Becc., of which, *C. gamblei* is endemic to Western Ghats while the former two associates are Indo-Sri Lankan elements.

Additional specimen examined: INDIA: Kerala: Kollam District, Vellakkaltheri, 77° 14' 06"E, 09° 11' 24"N, alt. c. 1200 m, *J. Mathew 2793* (male) *& 2794* (female), 28 Nov 2011 (School of Environmental Sciences Herbarium, Kottayam, M.G. University, Kerala).

Relationships: Based on morphological characters *Piper rukshagandhum* is considered a member of section *Muldera* as proposed by Hooker (1886). Members of this section are dioecious and possess fleshy bracts. In the Flora of British India, Hooker placed five species within this section namely *P. galeatum* Cas., *P. maingayi* Hook.f., *P. pachyphyllum* Hook.f., *P. schizonephros* C.DC., and *P. trichostachyon* (Miq.) C.DC. Recently, Lekhak et al. (2012, 2014) included two additional species *P. relictum* Lekhak, Kambale & S.R.Yadav and *P. dravidii* Lekhak, Kambale & S.R.Yadav within the section, both restricted to high altitude lateritic plateaus of northern Western Ghats, India. *Piper trichostachyon* (Miq.) C.DC. was reported from peninsular India while *P. galeatum* Cas. is endemic to southern Western Ghats. However, the remaining species *P. maingayi, P. pachyphyllum* and *P. schizonephros* have not been recollected in India (Lekhak 2014).

Piper rukshagandhum is distinguished from other members of section *Muldera* by characteristic blush red/pink coloured spikes, fruit and internodes (Figs 1-3). Apart from these characters, this new species has a comparatively long petiole (c. 3 cm long) and an elongated male inflorescence (c. 15 cm long) (Fig. 3a, c). Ravindran (1990) noted that *P. nigrum* may have a hybrid origin suggesting *P. galeatum* and *P. trichostachyon* are putative parents. The fruits of these species have moderate pungency and flavor, while, *P. rukshagandhum* has large, strongly pungent fruit, and coupled with its ability to withstand dry wind and drought conditions will offer scope for improving the gene pool and may serve as suitable candidate for the future breeding program of *Piper* species.

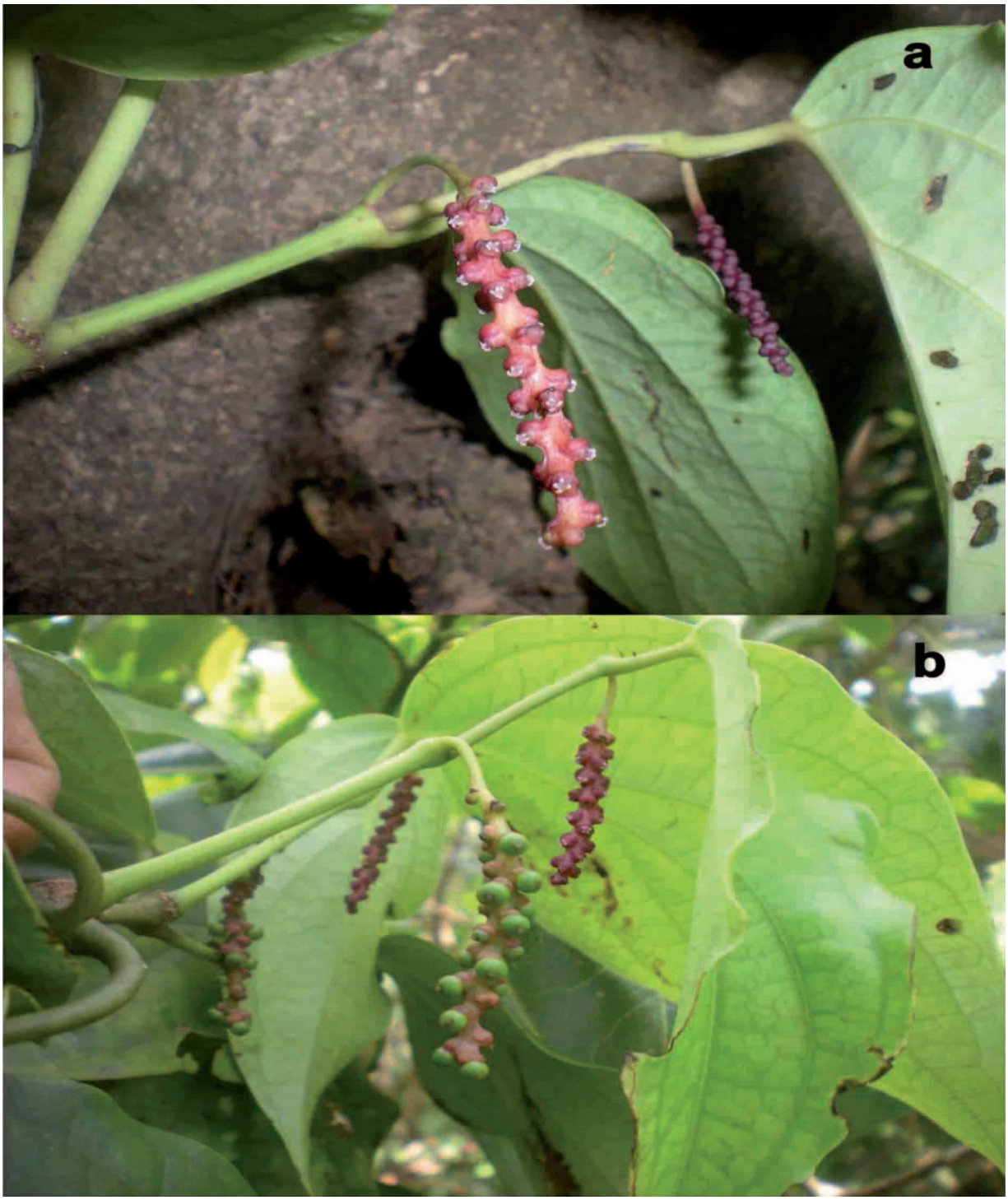

Fig. 1. *Piper rukshagandhum*: **a,** flowering female spike**, b** flowering and fruiting female spike. Photos: J. Mathew (*Mathew 2793*).

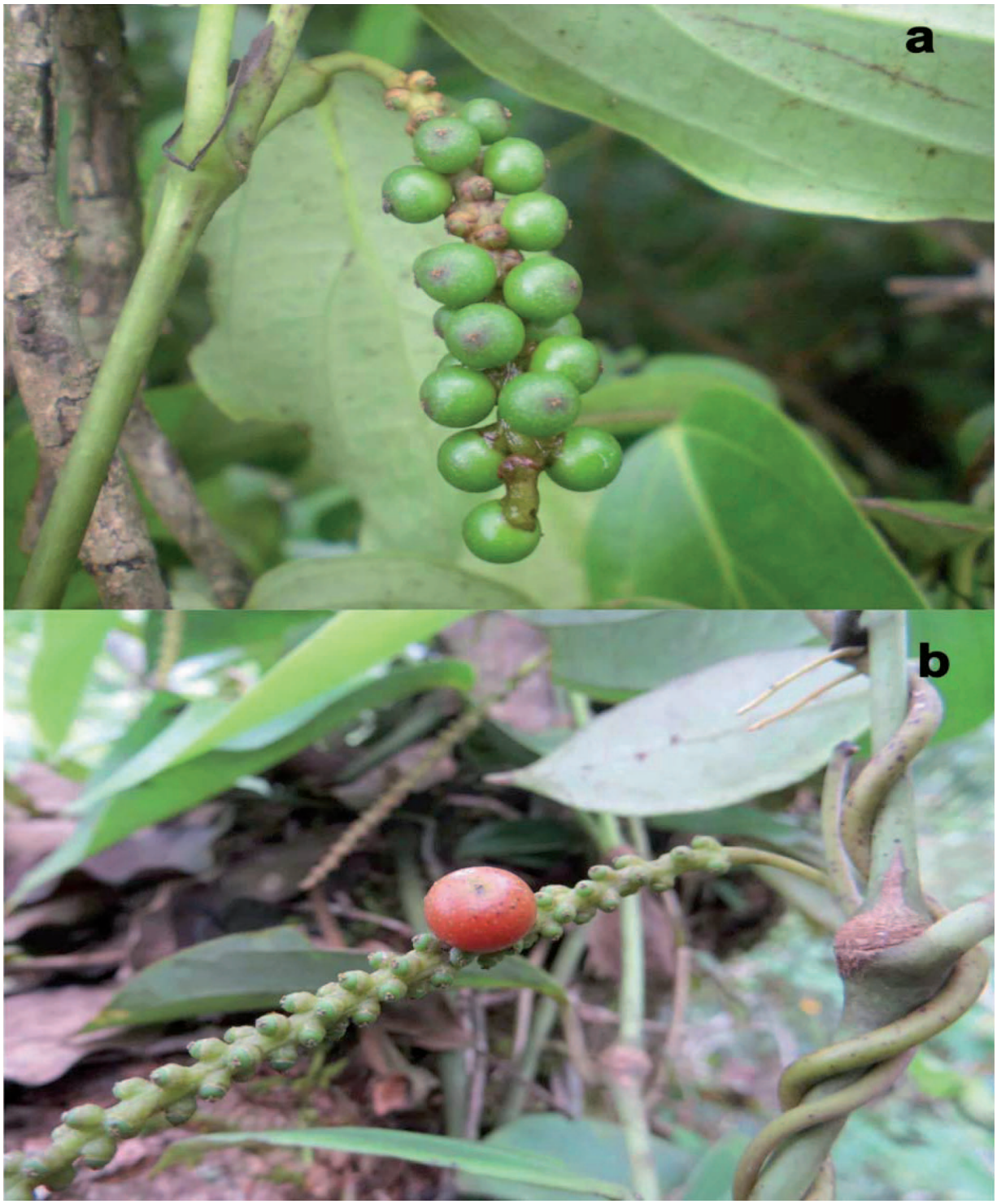

Fig. 2. *Piper rukshagandhum* **a,** infructescence; **b,** mature fruit. Photos: J. Mathew (*Mathew 2811*).

Fig. 3. *Piper rukshagandhum* **a,** male spikes; **b,** leaf adaxial surface; **c,** leaf abaxial surface (note length of petiole); **d,** young leaf and pink nodes; **e,** woody stem. Photos: J. Mathew (*Mathew 2794*).

Key to *Piper* species from the Kerala region of southern Western Ghats

1 Spike upright cylindrical 2

1: Spike drooping, slender or erect 4

2 Leaves usually cordate or strongly oblique at base; spike non-conical towards tip ..... *P. longum*

2: Leaves obtuse, oblique at base; spike conical towards tip 3

3 Vines up to 3 m long; spike to 6–9 cm in length; reddish tinge present the petiole and peduncle ..... *P. colubrinum*

3: Vines up to 0.50 m long; spike to 4 cm in length; pale reddish tinge rarely present in petiole and peduncle ..... *P. chaba*

4 Peduncle 6-8 cm long; leaves with 6 lateral nerves ..... *P. barberi*

4: Peduncle to 4 cm long; leaves with 3, 5 or 7 lateral nerves 5

5 Bracts hooked at one side; fruits beaked ..... *P. wightii*

5: Bracts not hooked; fruits not beaked 6

6 Spike purple or blush red in colour 7

6: Spike green or yellowish white in colour 8

7 Receptacle recurved; fruit mostly green but apex pink ..... *P. rukshagandhum*

7: Receptacle straight; fruit green ..... *P. velaudhanii*

8 Infructescence to 0.7 cm long ..... *P. mullesua*

8: Infructescence 2.5–15 cm long 9

9 Plant bisexual ..... *P. silentvalleyense*

9: Plants unisexual 10

10 Spikes with hairs 11

10: Spikes glabrous 12

11 Receptacles sessile, pubescent, parallel to the axis, compact shaped; plants not hairy ..... *P. trichostachyon*

11: Receptacles stipitate, kidney-shaped, glabrous, right angle to the axis, distant and recurved; plants hairy ..... *P. hymenophyllum*

12 Spikes more than 15 cm long ..... *P. argyrophyllum*

12: Spikes less than 12 cm long 13

13 Leaves deeply cordate at base 14

13: Leaves round or acute at base 15

14 Lamina 6–12 x 3–6 cm, ovate, cordate at base, puberulous along the nerves beneath ..... *P. hapnium*

14: Lamina 12–20 x 6–11 cm, ovate, rounded or shallowly cordate and slightly asymmetrical at the base, no pubescence along the nerves ..... *P. betle*

15 Receptacle recurved, flowers distant ..... *P. galeatum*

15: Receptacle straight, flowers compactly arranged 16

16 Lateral nerves of leaves 5 ..... *P. schmidtii*

16: Lateral nerves of leaves 7 17

17 Flowering spike filiform, up to 20 cm long; fruits not pungent ..... *P. trioicum*

17: Flowering spike compact, up to 12 cm long; fruits pungent 18

18 Mature fruit about 0.8 cm in diameter ..... *P. nigrum* var. *hirtellosum*

18: Mature fruit about 0.4 cm in diameter ..... *P. nigrum* var. *nigrum*

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