

Christisonia flavirubens (Orobanchaceae), a new species from south Western Ghats, India

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Abstract. *Christisonia flavirubens* J.Mathew & P.M.Salim (Orobanchaceae), a new holoparasitic plant species from the southern Western Ghats, Kerala, India, is described based on morphological data. The diagnostic morphological characters, distribution and images of the new species are presented. Images and comparative characters of the reddish yellow coloured *Christisonia* species of the south Western Ghats are also provided for its easy identification.

Keywords: holoparasitic plant, India, Kerala, new species, *Strobilanthes*, taxonomy

1. Introduction

Family Orobanchaceae has a cosmopolitan distribution, including about 100 genera and 2000 species (Kanivalan & Rajendran 2022; POWO 2022). The genus *Christisonia* Gardner is a root parasite plant, consisting of about 22 species distributed in India, China, Laos, Sri Lanka, Vietnam, the Malay Peninsula, Myanmar and Thailand (POWO 2022; Mathew & George 2015a), as well as the Philippines and Borneo (van der Ent & Wong 2016). Mathew and George (2015a, 2015b) recently added *Christisonia mira* J.Mathew and *C. tomentosa* J.Mathew & Kad.V.George as new species from the Kerala part of Southern Western Ghats. They enlisted eight *Christisonia* species from the Kerala part of south Western Ghats viz., *C. bicolor* Gardner, *C. calcarata* Wight, *C. indica* Anil Kumar, *C. keralensis* Erady, *C. mira* J.Mathew, *C. neilgherrica* Gardner, *C. tomentosa* J.Mathew & Kad. V. George and *C. tubulosa* (Wight) Hook.f.

In a recent botanical exploration to the Kannur District of southern Western Ghats (2019-2021), some interesting specimens of *Christisonia* with reddish yellow coloured flowers were collected. Critical analysis of the literature as well as herbarium specimens revealed that the collected specimens do not match with

described species. This has resulted in the recognition of a novel species, which is described here as *Christisonia flavirubens*.

2. Materials and Methods

Critical analysis of the literature (Hooker 1884; Benniamin *et al.* 2012; Sasidharan 2013; Nayar *et al.* 2014; Mathew & George 2015a, 2015b; Kanivalan & Rajendran 2022; POWO 2022), as well as from the scrutiny of vouchers deposited in K, NY, PE, MH, CAL, TBGT and CUBH were carried out. The data presented was obtained through the study of live specimens in the wild, available herbarium materials, and an in-depth literature survey. Photographs are provided for a better understanding of the morphological diversity. Its voucher material is stored in the MH (Madras Herbarium, India) and KUBH (Kerala University Botany Herbarium, Thiruvananthapuram).

3. Taxonomic Treatment

Christisonia flavirubens J.Mathew & P.M.Salim, sp. nov. (Fig. 1).

Diagnosis: *Christisonia flavirubens* is morphologically similar to *C. mira* (Fig. 2) especially in the reddish



Fig. 1. *Christisonia flavirubens* J.Mathew & P.M.Salim

Explanations: A – opened flower, B-C – inflorescence, D-E – uprooted plant with inflorescence, F – dissected flower, G-J – stamen and spur, K – gynoecium, L – ovary cross section (photograph by J. Mathew)

yellow flower colour and host specificity. However this new taxon differs in: anthers of equal length to filaments, 0.6-0.7 mm long, yellow in colour, hairs present at the base of the filaments (vs. anther filaments are 3-4 times longer than anther lobes, 2.5-3 cm long, light purplish in colour, glandular hairs present throughout the filaments in *C. mira*); both anther locules having fertile pollens (vs. one anther locule has fertile pollen and the other one is sterile in *C. mira*) and spur originating from the connective and having same length of anthers (vs. spur originating from the sterile locule and having double size of the anthers in *C. mira*). Distinguishing

characters from other reddish yellow coloured species of *Christisonia* found in the south Western Ghats are listed in Table 1. Pollen viability of both locules of anther the anther is an interesting character among *Christisonia*. Apart from this, *Christisonia subacaulis* is the only known Indian species having this peculiarity. However, *C. subacaulis* can be easily distinguished by the violet colour corolla and didynamous conditions of the stamen.

Type: India: southern Western Ghats, Kerala, Kannur district, Paithalmala Hills, 1310 m, 15 June 2019, Jose Mathew 4613 (holo, KUBH; iso, MH).



Fig. 2. *Christisonia mira* J.Mathew

Explanations: A – opened flowers, B – stamens and gynoecium, C – inflorescence pattern (photograph by J. Mathew)

Table 1. Comparative characters of morphologically similar species of *Christisonia flavirubens*

	<i>Christisonia mira</i>	<i>Christisonia tomentosa</i>	<i>Christisonia bicolour</i>	<i>Christisonia flavirubens</i>
Flower				
number	8-9	10-12	9-11	7-14
corolla colour	red, throat yellow	red, throat yellow to orange	yellow	red, throat yellow to orange
Stamens				
arrangement	didynamous	didynamous	didynamous	not didynamous
filament	light purplish, 2.5-3 cm long, glandular hairy throughout, having bend at connection	red, 0.5-0.7 cm long, glandular hairy throughout, straight	yellow, 2.5-2.7 cm long, glandular hairy throughout, having bend at connection	yellow, 0.6-0.7 mm long, hairs only at the base, straight
anther locule	one fertile, other sterile	one fertile, other sterile	one fertile, other sterile	both fertile
Spur				
origin	from the sterile cell	from the sterile cell	from the sterile cell	behind the connective
length	double size of the anther cell	same of the anther cell	double size of the anther cell	same size of the anther cell

Description: Herb, erect to 6-9 cm high, achlorophyllous, parasitic on the roots of *Strobilanthes lawsoni* Gamble, hairy. Roots numerous, profusely branched, up to 1.5 mm thick, with haustoria at the place of contact with the host roots and developing many adventitious buds. Stem branched, with whorled, ovate bracts. Inflorescence racemose, 7- or 14- flowered. Bracts 5 mm long, 3.5-4 mm wide, light brownish, hairy. Pedicels 1-1.5 cm long, 3-5 mm thick, erect, orange to brown in colour. Bracteoles 2, elliptic to oblanceolate, 5 mm long, 3 mm wide. Flower buds glandular hairy, covered with copious translucent tasteless slime when young. Calyx 5, 1.1-1.4 cm long, 0.5-0.8 cm wide, lobes red, white hairy, tubular- campanulate with slight median zygomorphy, tube split at the top to one third the length into 5 subequal triangular valvate lobes with acute apex. Corolla tube 3.1-3.4 cm long, red – coloured, trichomes on outer sides, lower half closely appressed to the ovary, upper half inflated; throat yellowish with a tinge of orange; tube expanding into a sub-bilabiate 5 – lobed limb; lobes red, 0.7-1.1 cm long, orbicular reniform, imbricate, anterior three lobes somewhat equal and slightly smaller than the posterior lobes. Stamens 4, inserted at the constricted part of the corolla tube, included, non – didynamous; filaments yellow, 0.6-0.7 mm long, glandular hairy at base, above glabrous; anthers yellow, two-celled, both cells fertile, ovate, 0.6-0.7 mm long, connective with a prominent swelling on one side. Spur formed from connective, a knob above the connective is present. Pollen grains with smooth wall. Ovary of 2 equal carpels, superior, unilocular with a tendency to become bilocular at the base; placentae 2, parietal, bipartite, tips expanding into fleshy portions; ovules 150-1800 µm long, 120-145 µm broad, numerous, anatropous and arising from the entire surface of the placenta; style glabrous, 2-2.2 cm long, included but

reaching above the level of the anthers; stigma peltate and with a narrow depression in the centre. Fruit a capsule, pyriform, ca 1.5 × 1.8 cm, unilocular, enclosed by persistent calyx. Seeds minute, numerous.

Phenology: The flowerings observed in June.

Etymology: The epithet (*'flavirubens'*) is used to indicate the reddish yellow colour of the corolla in this taxon.

Additional materials examined: India, Kerala, Kannur district, Paithalmala, 11 June 2022, *Jose Mathew* 4617, 4618 (KUBH).

Habit and distribution: *Christisonia flavirubens* is endemic to the Southern Western Ghats, currently known only from two localities from Paithalmala Hills of Kannur district. The species grows on the wet roots of *Strobilanthes lawsoni* Gamble at altitudes of c. 1300 m. The distribution of this new species is limited to a few plants at the two known locations (each with c. 10-25 plants). Further survey for this species is suggested, which would need to be conducted in June-July when the northeast Monsoon starts.

Remarks: Thorogood *et al.* (2007) pointed that host specificity is a driving force in the evolution and speciation of parasitic plants. Most of the *Christisonia* species found in south Western Ghats show host specificity with *Strobilanthes* species. An interesting fact is that these parasitic plants are only visible when the host plants begin to dry out after mass flowering. Based on field observations, authors proposing the scope of studies on ecological aspects of these host parasitic interactions. An enhanced understanding of the evolution, cell biology, and physiology of host specificity in this, and related taxa is interesting.

Key to the *Christisonia* in Kerala part of southern Western Ghats (modified from Mathew & George 2015a)

- 1a. Anthers not spurred 8
 1b. Anthers spurred 2
 2a. Inflorescence 15-26 cm long, flowers loosely arranged in racemes *C. tubulosa*
 2b. Inflorescence up to 10 cm long, flowers compactly arranged in racemes 3
 3a. Racemes of 3 or 4 flowers; calyx 1.7-2 cm wide, conceals most of corolla-tube *C. indica*
 3b. Racemes of ≥ 5 flowers; calyx campanulate, up to 1.5 cm wide, conceals 1/3 of corolla tube 4
 4a. Corolla lobes white or cream 5
 4b. Corolla lobes red or yellow 6
 5a. Pedicels as long as the calyx or shorter
 *C. calcarata*
 5b. Pedicels longer than the calyx (3 cm long)
 *C. keralensis*
 6a. Stamens non – didynamous; both anther locules having viable pollen *C. flavirubens* (Fig. 1)
 6b. Stamens didynamous; one anther locule is fertile and other is sterile 7
 7a. Anthers elliptic to oblanceolate; corolla throat orange-tinged *C. mira* (Fig. 2)
 7b. Anthers lanceolate or acute, corolla throat concolourous with corolla tube *C. bicolor* (Fig. 3)
 8a. Corolla lobes red, stamens didynamous
 *C. tomentosa* (Fig. 4)
 8b. Corolla lobes yellow, stamens equal in length
 *C. neilgherrica*



Fig. 3. *Christisonia bicolor* Gardner

Explanations: A – opened flowers, B – stamens and gynoecium, C – inflorescence pattern (photograph by J. Mathew)



Fig. 4. *Christisonia tomentosa* J.Mathew & Kad.V.Geroge

Explanations: A – opened flowers, B – stamens in didynamous condition, C –inflorescence pattern (photograph by J. Mathew)

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements. The authors are thankful to the Kerala Forest Department for permission to conduct research. The corresponding author is grateful to the Principal and Management of the Sanatana Dharma College, Alappuzha, Kerala for support; to Dr. K.N. Gandhi, Harvard University, USA for nomenclatural corrections; and to the Mohamed bin Zayed

Species Conservation Fund (project 190521457); SERB (DST – INDIA) Project No. NPDF-PDF/2017/000135; DOEACC, Kerala (head no. 3435-04-104-98(P)-1) and NMPB (Project No. HG/KE-01/2019-2020) for financial assistance.

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References

- BENNIAMIN A., CHATURVEDI S. K., DEY S. & MOAAKUM 2012. Supplements to the root parasitic plant in India. A new recorded species *Christisonia siamensis* Craib. (Orobanchaceae). *Taiwania* 57(2): 217-221.
- HOOKE J. D. 1884. Orobanchaceae. In: J. D. HOOKE (ed.). *Flora of British India* 4: 319-328.
- KANIVALAN I & RAJENDRAN A. 2022. A new species *Christisonia rarissima* (Orobanchaceae) from the southern Western Ghats of India. *Nordic Journal of Botany* 10: e03686. <https://doi.org/10.1111/njb.03686>
- MATHEW J. & GEROGE K. V. 2015a. *Christisonia mira* (Orobanchaceae): a new plant species from Southern Western Ghats, India. *Telopea* 18: 425-431.
- MATHEW J. & GEORGE K. V. 2015b. *Christisonia tomentosa* (Orobanchaceae): a new plant species from southern Western Ghats, India. *Webbia* 70(2): 1-4 <http://dx.doi.org/10.1080/00837792.2015.1074791>
- NAYAR T. S., RASIYA B. A. & SIBI M. 2014. Flowering plants of the Western Ghats, India. 2 Volumes, 1700 pp. Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram, Kerala, India.
- NICKRENT D. L. 2012. The parasitic plant connection: parasitic plant genera. Department of plant Biology, Southern Illinois University, Carbondale, Illinois, USA.
- PARNELL J. 2001. A Revision of Orobanchaceae in Thailand. *Thai For. Bull. (BOT)* 29: 72-80.
- POWO. 2022. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Available online: <http://www.plantsoftheworldonline.org/> (accessed on 20 December 2022).
- SASIDHARAN N. 2013. Flowering plants of Kerala: CD-ROM ver. 2.0. Kerala Forest Research Institute, Peechi, Kerala.
- THOROGOOD C. J., RUMSEY F. J. & HISCOCK S. J. 2007. Speciation and host specificity in Orobanche. In: *Proceedings of the IPPS 9th World Congress on Parasitic Plants*. June 3. Charlottesville, Virginia, United States.
- VAN DER ENT A. & WONG K. M. 2016. Range extension of *Christisonia scortechinii* from mainland Southeast Asia into Borneo, and notes on the distinction between *Aeginetia* and *Christisonia* (Orobanchaceae). *Botanical Studies* 56: 28. DOI 10.1186/s40529-015-0109-3