

ing variable efficacy *in vitro*, inhibiting growth of *Penicillium italicum* (blue mould rot, 89.81%), *Penicillium digitatum* (green mould rot, 83.15%), *Botryodiplodia theobromae* (stem-end rot, 80.93%), *Geotrichum candidum* (sour rot, 87.22%) and *Alternaria alternata* (core rot, 53.33%) respectively. The same when evaluated for rot reduction, both by pre- and post-inoculation treatments exhibited efficacy *in vivo* as well. In general, the pre-inoculation treatment proved more effective, perhaps by out-competing post-inoculated (post-harvest) pathogen(s) for space and nutrients.

S. pararoseus is known to be mainly associated with the phylloplane of the terrestrial plants³. Nevertheless it has been reported from Antarctic sea water, oil-field soil and also from air atmosphere in dairy⁴. This yeast species is also known to produce killer toxins, which are proteinaceous in nature and are lethal to susceptible yeast strains. These toxins have no activity against microorganisms other than yeasts, and the killer strains are insensitive to their own toxins. Killer yeasts and their toxins have many potential applications in environmental, medical and industrial biotechnology⁵⁻⁷. Its antagonistic potential against post-harvest

fungal pathogens as well as rots incited by them, thus seems to be a new record from Rajasthan. The biocontrol of various rots of kinnow fruit by this yeast strain may have commercial importance too, possibly after a large-scale testing with convenient formulations. Two bio-control products, Aspire (Ecogen, Langhorne, PA), which contains the yeast⁸ *Candida oleophila* strain I-182 and Bio-Save 110 (EcoScience, Worcester, MA; formerly Bio-Save 11), which contains a saprophytic strain of the bacterium *Pseudomonas syringae*⁹ are currently registered for post-harvest application to fruit.

The novel yeast strain, based on morphological and physiological characters and confirmed by molecular characterization has been designated as KFY-1 strain of *S. pararoseus* with MTCC number 8337. The culture is preserved in the microbial type culture collection and gene bank of Institute of Microbial Technology, Chandigarh, India. Further studies are in progress.

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Conservation status and distribution range of *Ixora johnsoni* Hook. f. (Rubiaceae)

Ixora johnsoni Hook. f. (Figure 1) was described by Joseph Dalton Hooker¹ in 1880 based on a single collection of Johnson in 1865 from Wennamala, Cochin. In 1915 Calder collected this species from Konni. In 1997 Dan *et al.*² cleared the taxonomic ambiguity regarding the identity of this species and were able to locate a few populations of this species from Mookanpetty, Kottayam District, Kerala. We conducted an exploration and were able to locate this species from a rubber plantation in Vazhoor, Kottayam District. This species is a perennial undershrub growing as an undergrowth in a small population in the rubber plantation. About 20–25 individuals were found growing together and some of them were in bloom. The detailed taxonomic description with relevant notes is provided here.

Ixora johnsoni Hook. f., *Fl. Brit. India*, 3: 139. 1880; Gamble, *Fl. Pres. Madras*, 630, (444). 1921; Mohanan, *Fl. Quilon Dist.*, 212. 1984; Hussain & Paul, *J. Econ. Tax. Bot. Addl. Ser.*, 6: 131. 1989; Mathew Dan *et al.*, *Rheedeia*, 7: 73. 1997; Sasidh., *Fl. Periyar Tiger Reserve*, 177. 1998.

Perennial undershrub, 25–55 cm tall, stem erect, unbranched. Leaves opposite, decussate, simple, entire, petiolate; petiole 2.5–10 mm long, green to reddish-brown; lamina 8–25 × 4–13 cm, elliptic–obovate, cuneate at the base, mucronate at apex, lateral veins 9–12 pairs, prominent on the adaxial side, greyish-white patches radiate from the midrib; stipules interpetiolar, 5–6.5 mm long, laterally joined at the base forming a tube, broadly triangular with a central cusp ca. 2–3.5 mm long with dense golden, brownish

hairs on the inner side. Inflorescence subsessile, peduncle 4–10 mm long, puberulous, bright red, with branchlets and pedicels articulated at ramifications; each unit a corymb of 10–17 flowers. Flowers sessile to shortly pediceled; pedicel 1–5 mm long, puberulous, reddish-brown; bracts to 5 mm long, reddish-brown; bracteoles to 4 mm long, reddish-brown; calyx lobes four, linear–triangular, acute at the tip, longer than ovary 5–6 mm long, puberulous, reddish-brown; corolla, white, tubular, slender, glabrous, 15–30 mm long; lobes four, 4.5–9 mm long, oblong, naked at the throat, buds with a reddish hue on the margins; stamens four attached at the mouth, alternating with the corolla lobes; filaments short 2.5–3 mm long; anthers linear, 4–5.5 mm long, beaked at the tip, bifid, mucronate at base, creamy-white; ovary two-celled,



Figure 1. *Ixora johnsoni* Hook. f. **a**, Habitat and **b**, Close-up view of inflorescence.

ovules one in each locule, axillary; style slender 17–32 mm long, bright red; stigma bifid, 3.5–4.5 mm long, bright red. Fruits a didymous berry, bright red when ripe, 5.6–6.5 mm in diameter, calyx accrescent; seeds two.

Locality: India, Kerala, Kottayam District, Kodungoor \pm 155 m; Vazhoor East, \pm 100 m, strictly endemic to southern Western Ghats.

Habitat and ecology: Growing as perennial undershrub in rubber and teak plantations.

All the reported localities of this species lie along the midlands of southern Kerala, more specifically in the Ernakulam, Kottayam, Kollam, Idukki and Pathanamthitta districts. These localities are under high anthropogenic pressure due to the large-scale developmental activities in the industrial and agricultural sector. Changes in the land-use pattern, habitat alterations and modernization of agricultural practices have created an increased pressure on the environment and existing natural vege-

tation, especially for the surviving population of this critically endangered species. Recently, due to the non availability of labourers and for monetary benefit rubber growers are extensively using chemical weedicides like Gramaxone, 2.4 D to check the growth of weeds in their plantations. This practice is a serious threat to this flowering species. The cover crops such as *Mucuna*, *Pueraria*, etc. in rubber plantations pose a threat for this species. Use of heavy machinery like earth movers for digging and contouring land during the replanting period also causes damage to the surviving population. This type of massive removal leads to the sudden disappearance of this species from an entire area. IUCN and SSC have already listed this species as 'Critically Endangered' and its conservation status is (CR B1 + 2c (Ver 2.3 1994))³. During our fieldwork we observed that this species is under higher risk than that stated by IUCN, as majority of the population is within private agricultural land. The 'narrow distributional range'

and 'unprotected area of occurrence' have pushed this species to the brink of extinction. Hence urgent steps need to be taken to conserve this critically endangered species.

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