

## ***VISCUM SAHYADRICUM* (VISCACEAE), A NEW SPECIES FROM THE WESTERN GHATS OF INDIA**

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*Viscum sahyadricum* (Santalaceae) from the Western Ghats of India is here described as a new species with description, illustrations and notes.

*Keywords.* Epiparasite, mistletoe, Santalales, taxonomy.

### INTRODUCTION

The Visceae is one of seven tribes within the Santalaceae in the most recent Angiosperm Phylogeny Group classification (Angiosperm Phylogeny Group, 2016), having been previously recognised as the family Viscaceae. Nonetheless, in treatments based on both molecular phylogenetic and evolutionary studies in which members of the Santalales are placed in 18 different families (Nickrent *et al.*, 1998, 2010), it has been proposed that the Viscaceae should be retained. In these treatments, the family is characterised by the absence of an embryo suspensor (Ross & Sumner, 2005a, 2005b; Ross Friedman & Sumner, 2009), the presence of which is characteristic of the Santalaceae. Whether recognised at the tribe or family level, molecular analyses strongly indicate that the group is monophyletic (Der & Nickrent, 2008; Su *et al.*, 2015; Maul *et al.*, 2019). Subsequent authors (Sanjai & Balakrishnan, 2006; Mathiasen & Daugherty, 2009; Mehrvarz *et al.*, 2012; Sanjai & Balakrishnan, 2012; Kołodziejek *et al.*, 2013; Mathiasen & Daugherty, 2013; Kuijt & Hansen, 2015; Mathiasen & Kenaley, 2015a, 2015b; Petersen *et al.*, 2015; Su *et al.*, 2015; Kuijt, 2016; Mathiasen & Kenaley, 2016; Sadowski *et al.*, 2017) have followed the treatment of Nickrent *et al.* (1998, 2010), and we do so here.

The genus *Viscum* L. is variously estimated to comprise about 120 species (Nickrent, 1997–), 150 species (Mabberley, 2017) or 113 species (POWO, 2019), distributed in tropical to temperate regions of the Old World. Hooker (1886) reported 11 species and two varieties of *Viscum* for the Indian subcontinent. Danser (1941) reported 24 species of *Viscum* for erstwhile British India, 14 of which also occur in Southeast Asia, including Malaysia, and Australia. Later, Rao (1957), Sanjai & Balakrishnan (2006, 2012) and Thriveni *et al.* (2013) reported the occurrence of 16 species in India.

In the leafless species that occur in India, owing to the polymorphism of *Viscum articulatum* Burm.f., many species and infraspecific taxa have been described and

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nomenclatural combinations made by various authors. Danser (1941) considered *Viscum articulatum*, *V. liquidambaricola* Hayata and *V. nepalense* Spreng. as separate taxa based on their internodal length and breadth. He also provided additional information on the distribution and host specificity of these taxa, particularly *Viscum articulatum* and *V. nepalense*. Moreover, he described the variety *Viscum nepalense* var. *thelocarpum* Danser based on the presence of warty young fruits. However, in the same publication he clearly pointed out difficulties in differentiation, citing instability in the size of the internodes and the size and shape of the fruit when used as taxonomic characters. Although he noted that *Viscum articulatum* is usually parasitic on members of Loranthaceae, many authors (Fischer, 1926; Rao, 1957; Sanjai & Balakrishnan, 2006, 2012) have pointed out various other host associations.

Rao (1957) showed that there are no significant taxonomic differences between *Viscum nepalense* and *V. articulatum* except the degree of variation in the size of internodes and fruits after maturity. Therefore, he merged *Viscum nepalense* into *V. articulatum* but retained the varietal status of variety *thelocarpum* and considered *V. liquidambaricola* as a variety of *V. articulatum*. In contrast, Sanjai & Balakrishnan (2006) stated that internodal length and breadth and shape of fruits vary continuously, and that distinctions based on these characters cannot be supported, recognising all these taxa under *Viscum articulatum*.

During field expeditions, specimens from certain populations of a squamate *Viscum* were collected from two localities in the Western Ghats of India. On critical analysis, they were found to be similar to the squamate *Viscum mysorensis* Gamble group (Kirkup *et al.*, 2000), although the presence of a central male flower in the triad is identical to the morphology found in the *V. capitellatum* Sm. group. For these reasons, these plants cannot be attributed to any known species of *Viscum*. Therefore, a new species is described here and notes on its phenology and ecology are provided, together with a comparison with allied species.

#### TAXONOMIC TREATMENT

##### ***Viscum sahyadricum* Sardesai, S.P.Gaikwad & S.R.Yadav, sp. nov.**

In overall morphology very similar to *Viscum articulatum* Burm.f. but differing in having a central male flower without its own bracteal cup, the presence of a peduncle, and male and female flowers with three petals (or corolla lobes). It is also similar to *Viscum capitellatum* Sm. and *V. trilobatum* Talbot in inflorescence architecture with characteristic central male flowers; however, it differs from both in having flattened upper internodes, very inconspicuous, scale-like leaves, and male and female flowers with three corolla lobes. – Type: India, Maharashtra, Kolhapur District, near Suleran Village, on the way to Amboli, 16°3'29.27''N 74°4'43.69''E; c.690 m, 20 vi 2006, Sardesai 3540 (holo CAL; iso BAMU, BSI, MH, SUK). **Figs. 1, 2.**

Monoecious evergreen, herbaceous partial stem-epiparasite. *Branches* dark green; stems branched, stiff, basal branches percurrent, upper ones dichotomously or trichotomously

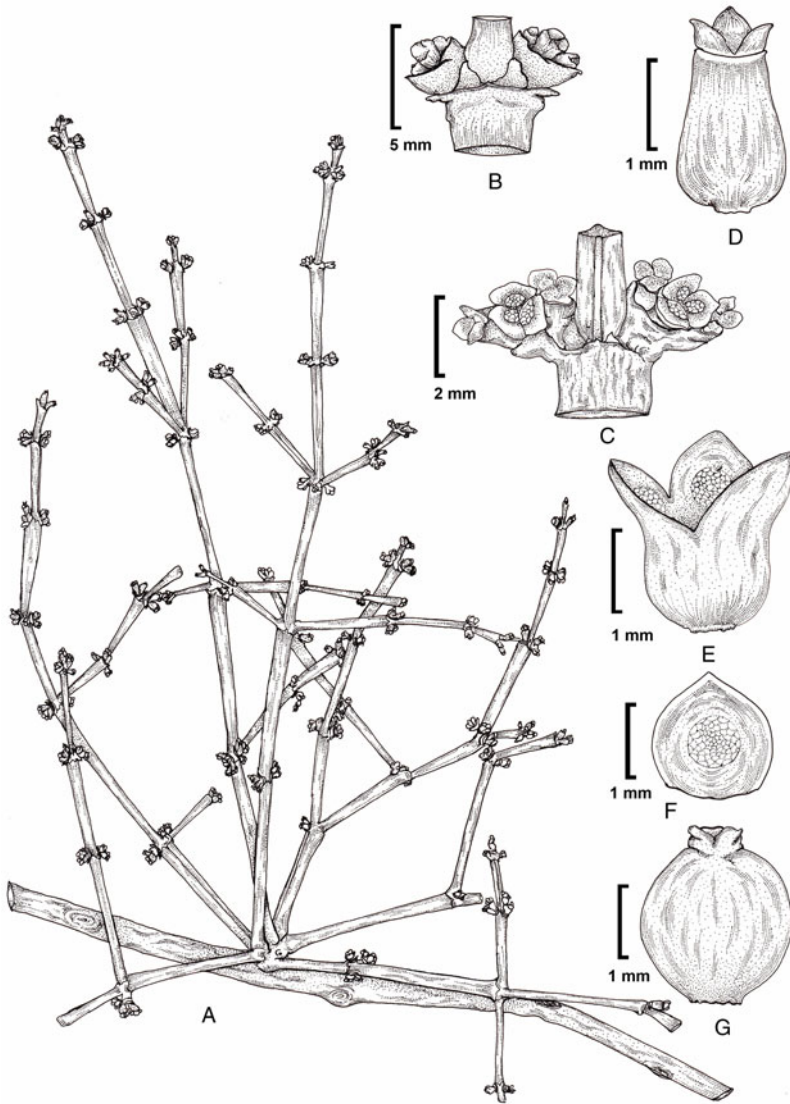


FIG. 1. *Viscum sahyadricum* Sardesai, S.P.Gaikwad & S.R.Yadav. A, Habit; B and C, part of branch, showing a pair of scale leaves and young inflorescences; D, female flower; E, male flower; F, corolla lobe with anther; G, fruit. Drawn by Ramchandra Gore.

branched; nodes swollen; lower internodes stout, terete,  $3-5 \times 0.2-0.4$  cm; upper internodes  $5-7 \times 0.1-0.2$  cm, slender and longitudinally grooved, gradually flattened towards apex. *Leaves* all inconspicuous, scale-like, at the base of the branches very small, triangular, often absent and those at the apices acute, conduplicate, triangular or claw shaped, connected at their bases forming a boat-like sheath at the apex of every internode, 0.8–2.5 mm long. *Inflorescences* cymose, arising from the nodes, sessile or subsessile,

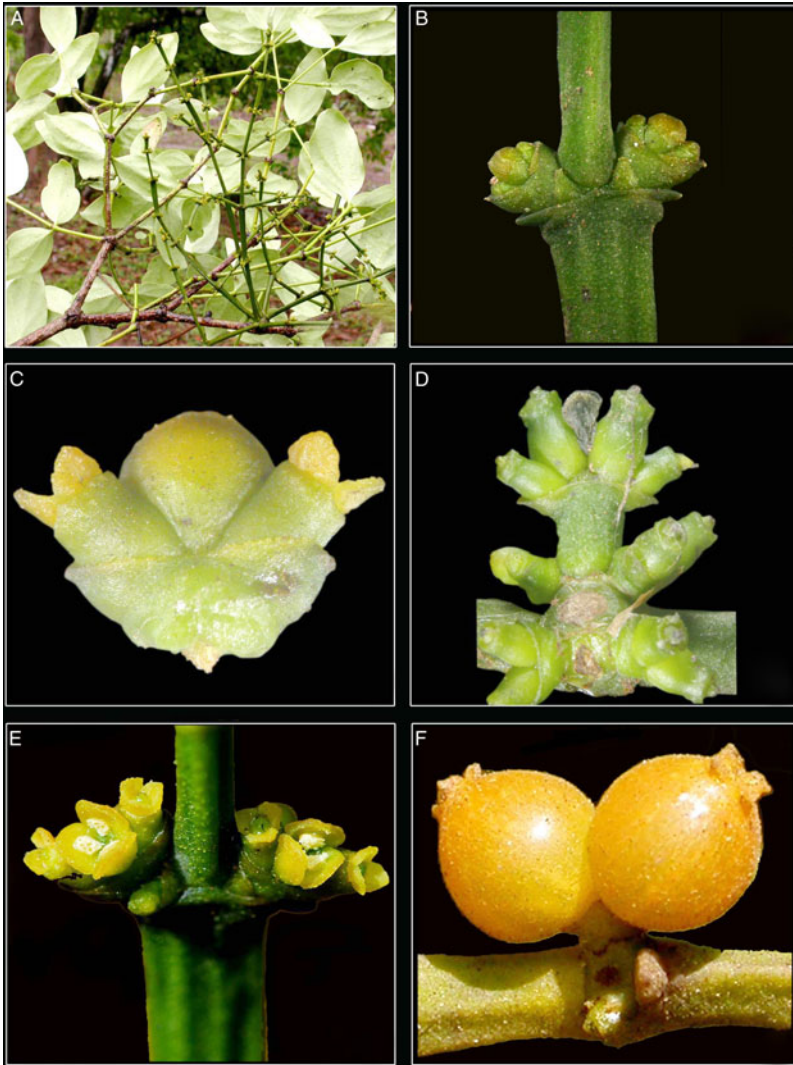


FIG. 2. *Viscum sahyadricum* Sardesai, S.P.Gaikwad & S.R.Yadav. A, Habit with host; B, branch showing a pair of scale leaves and young inflorescences; C and D, 3- and 5-flowered cymules, respectively, showing central male and lateral female flowers; E, cymules showing central male and lateral female flowers; F, fruits. Figure prepared by Ramchandra Gore. (Photographs: A, E and F, M. M. Sardesai; B–D, S. R. Yadav.)

peduncle up to 13 mm long. *Flowers* unisexual, sessile, regular, 3-merous, usually in triads, rarely 5, with female lateral flowers and a central male flower or all flowers female; enclosed in a cupule of 2 connate acute bracts, bracts c.1 × 1 mm, broadly ovate with acute apex, with some hairs and deposits. *Male flowers* sessile, globose, c.1.5 × 1 mm; corolla lobes 3, free, valvate, concave, ovate, c.1 × 0.75 mm, acute at apex, each bearing an anther

on the inner surface; stamens 3, c.0.5 × 0.5 mm, anthers sessile, opposite and attached to the inner surface of the corolla lobes, opening by many pores; pistillodes absent. *Female flowers* sessile, oblong, c.2 × 1 mm; perianth lobes 3, free, valvate, triangular, c.1 × 0.5 mm, acute at apex; ovary inferior; styles short, thick; stigma dome-shaped. *Fruits* globose, smooth, c.5 mm in diameter, apiculate with persistent corolla lobes, orange at maturity. *Seeds* compressed, subcordate, c.2.5 mm across.

*Flowering and fruiting.* April to November.

*Distribution.* Western Ghats mountains, Gavase and Suleran in Kolhapur District of Maharashtra State and Kudremukha in Chikkamagaluru District of Karnataka State.

*Ecological note.* The populations observed near Gavase and Suleran villages in Kolhapur District of Maharashtra State occur as epiparasites only on *Helicanthes elastica* (Desr.) Danser, whereas individuals in the population at Kudremukha, on the way to Kalasa, Chikkamagaluru District, Karnataka State, grow as an epiparasite only on *Macrosolen capitellatus* (Wight & Arn.) Danser. The species is so far known to occur in only these two localities, which lie approximately 300 km apart in the Western Ghats. It is quite possible that the species may occur elsewhere in the region, and therefore attempts were made to locate it in accessible parts of the Western Ghats in Maharashtra State, but without success. It may, however, occur in parts of the Western Ghats in Goa and Karnataka States, where the forests are more dense, humid and inaccessible.

*Etymology.* The specific epithet '*sahyadricum*' is derived from the Sahyadri mountains (northern Western Ghats), which include the type locality.

*Additional specimens examined.* INDIA. **Maharashtra:** Kolhapur District, Near Gavase Village, 16°6'19.98''N, 74°8'3.39''E, 705 m, 04 iv 2004, *Sardesai* 3127 (BAMU!). **Karnataka:** Chikkamagaluru District, Kudremukha, on the way to Kalasa, 13°12'38.79''N, 75°15'29.28''E, 802 m, 9 vii 2007, *SR Yadav* 102 (SUK!).

As mentioned above, the new species is very similar to *Viscum articulatum* and in inflorescence architecture to *V. capitellatum* and *V. trilobatum*, but it differs from all in having percurrent branching and an absence of adventitious flowers. Leaves are conspicuous in both *Viscum capitellatum* and *V. trilobatum*; however, in the former they are sometimes reduced to scales, although both morphologies are present on the same plant. Interestingly, in these two species different numbers of corolla lobes have been reported in male and female flowers by different authors. In *Viscum capitellatum*, male flowers are reported as having two (Sanjai & Balakrishnan, 2006, 2012), three (Cooke, 1908) or four (Rao, 1957) corolla lobes and female flowers three (Sanjai & Balakrishnan, 2006, 2012) or four (Rao, 1957) corolla lobes. In *Viscum trilobatum*, male flowers are reported as having three (Sanjai & Balakrishnan, 2006, 2012) or four (Danser, 1941; Rao, 1957) corolla lobes, and female flowers four corolla lobes (Danser, 1941; Rao, 1957; Sanjai & Balakrishnan, 2006, 2012). However, during our studies we observed that male as well as female flowers have three corolla lobes each in both these species. Comparative morphological characters are shown in the [Table](#).

TABLE. Comparative account of the species

| Character                                | <i>Viscum sahyadricum</i> Sardesai,<br>S.P.Gaikwad & S.R.Yadav   | <i>Viscum articulatum</i> Burm.f.  | <i>Viscum capitellatum</i> Sm.   | <i>Viscum trilobatum</i> Talbot  |
|--|--|--|--|--|
| Stem                                     | Percurrently branched below,<br>di- and/or trichotomously<br>branched above  | Decussately branched below,<br>dichotomously branched above  | Decussately and divaricately<br>branched below, umbellately<br>branched above  | Decussately branched below,<br>dichotomously branched above  |
| Upper internodes                         | Slender and gradually flattened<br>towards apex  | Slender and gradually flattened<br>towards apex  | Stout and terete   | Stout and terete   |
| Leaves                                   | Inconspicuous, scale-like,<br>0.8–2.5 mm long  | Inconspicuous, scale-like,<br>0.5–0.75 mm or absent at<br>branch bases                                     | Conspicuous, obovate, roundish-<br>ovate to spatulate,<br>conduplicately folded or even<br>rolled, sometimes reduced to<br>scale and both are present on<br>same plant   | Conspicuous, obovate or<br>suborbicular, 3-nerved  |
| Central flowers of<br>cymes              | Male   | Female   | Male or female   | Male   |
| Adventitious flowers                     | Absent   | Very rarely present  | Present  | Present  |
| Peduncle                                 | 0.5–13 mm long   | Sessile  | 3–15 mm long   | Up to 2 mm long  |
| No. of corolla lobes in<br>male flower   | 3  | 4  | 2 (Sanjai & Balakrishnan, 2006,<br>2012), 3 (Cooke, 1908) or<br>4 (Rao, 1957)  | 3 (Sanjai & Balakrishnan, 2006,<br>2012) or 4 (Danser, 1941;<br>Rao, 1957)   |
| No. of corolla lobes in<br>female flower | 3  | 4  | 3 (Sanjai & Balakrishnan, 2006,<br>2012) or 4 (Rao, 1957)  | 4 (Danser, 1941; Sanjai &<br>Balakrishnan, 2006, 2012)   |
| Bracteal cup of central<br>flower        | Absent   | Present  | Absent   | Absent   |
| Host                                     | Known only on species of<br>Loranthaceae such as<br><i>Helicanthes elasticus</i> (Desr.)<br>Danser and <i>Macrosolen</i><br><i>capitellatus</i> (Wight & Arn.)<br>Danser | Usually other than Loranthaceae<br>and very rarely on <i>Scurulla</i> sp.<br>(Sanjai & Balakrishnan, 2006) | Usually on species of<br>Loranthaceae, such as<br><i>Dendrophthoe falcata</i> (L.f.)<br>Ettingsh., <i>Loranthus bracteatus</i><br>Rich., <i>L. tomentosus</i> B.Heyne<br>ex Roth, and rarely on<br><i>Erythroxylum monogynum</i><br>Roxb. (Sanjai & Balakrishnan,<br>2006) | Usually on species of<br>Loranthaceae, such as<br><i>D. falcata</i> , <i>L. bracteatus</i> , and<br><i>L. tomentosus</i> , and rarely on<br><i>Excoecaria agallocha</i><br>L. (Sanjai & Balakrishnan,<br>2006) |

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