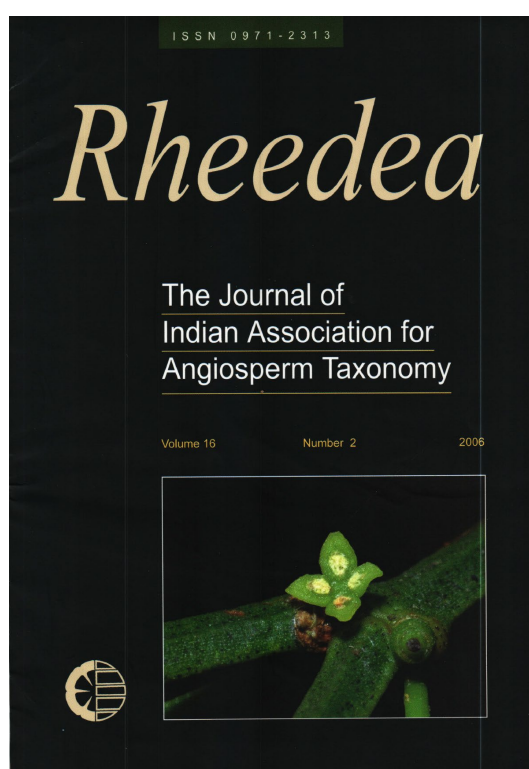




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A Revision of Indian Viscaceae

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Abstract

The family Viscaceae in India with 19 species under *Arceuthobium* M. Bieb., *Ginalloa* Korth., *Korthalsella* Van Tiegh. and *Viscum* L. is taxonomically revised based on herbarium studies, explorations and collections from different parts of India. *Viscum* is represented by 15 species. Among them, 4 species, including the recently described *V. malurianum* Sanjai & N.P. Balakr. and *V. subracemosum* Sanjai & N.P. Balakr., are endemic to India. *Viscum articulatum* var. *thelocarpum* and var. *liquidambaricolum* are merged with *V. articulatum*. *Viscum album* var. *meridianum* is sunk under *V. album* proper. *V. orbiculatum* and *V. verruculosum* are treated as synonyms of *V. heyneanum*. *Viscum acaciae* Danser is a new record for India. *Viscum mysorensis* is considered as a link between the leafy and leafless species. *Korthalsella* is represented by a single species, *K. japonica* (Thunb.) Engler, as *Korthalsella japonica* var. *coralloides* is merged with *K. japonica* proper. *Ginalloa andamanica* Kurz is endemic to South Andamans. Systematic position, factors affecting distribution, morphology, hyperparasitism and cryptic mimicry of/in Viscaceae are discussed.

Keywords: Viscaceae, India, Four genera, 19 species

Introduction

Viscaceae, previously treated as part of the mistletoe family Loranthaceae, consists of hemiparasites, mostly distributed in tropical and warm temperate regions. The family is represented by seven genera and about 400 species (Barlow, 1997).

J. D. Hooker (1886) in *Flora of British India* described 12 species among 3 genera under the present Viscaceae from within the present political boundary of India. Later, one genus and several species have been described from the country (Danser, 1941; R.S. Rao, 1957). After Hooker, Gamble (1925), T. Cooke (1901-08), Duthie (1903-22), Prain (1903) and Haines (1921-25) studied the family. Danser (1941) revised the British Indian species of *Viscum* and R. S. Rao (1957) revised its Indo-Malayan species. Apart from these, there is no other major taxonomic work on Indian Viscaceae.

The members of Viscaceae cause extensive damage to fruit trees and forest trees (Therkommedahl & Williams, 1983). Recently, the family has triggered some curiosity as some members like *Viscum album* L. were found useful as cure for cancer and tumour (Adler, 1997; Basaran *et al.*, 1997; Gholap, 1998).

Some biochemical studies dealing with secondary metabolites have also come up (Rikovski & Basiric, 1949; Plouvier, 1953; Richter & Popp, 1987). We do not have sufficient basic knowledge on delimitation and identity of various members of such an important family. An in-depth revision of Indian Viscaceae was done in this context.

The family is named after the type genus *Viscum* L. The name *Viscum* comes from the viscous nature of their fruits. The European mistletoe, *Viscum album* L., is the type of this genus. Members of the family are easily distinguished in field by their semiparasitic habit, small unisexual flowers arranged in units of small cymes (triads) often grouped in homogeneous or heterogeneous racemes or spikes and viscous small globose or ovoid berries or drupaceous fruits. Out of the 4 genera in India, *Viscum* has the largest representation with 15 species. The plants of this genus have a tendency towards hyperparasitism. *Arceuthobium*, commonly called the dwarf mistletoe, was previously included in *Viscum*. Members of this genus have restricted host range, mostly the coniferous trees. They cause extensive damage to coniferous forests

(Hawksworth, 1977; Hawksworth & Geils, 1990; Parker & Riches, 1993). *Korthalsella*, named after the Dutch botanist Pieter Willem Korthals, another genus of the family, was also previously included in *Viscum*. These are high altitude plants found mostly on Rhododendrons. *Ginalloa* is the fourth genus represented in India by *G. andamanica*, an endemic species of doubtful distinction. J.D. Hooker who could not see a specimen based his descriptions solely on the protologue given by Kurz.

Systematic position

Miers (1851) was the first to treat Viscaceae as a family distinct from Loranthaceae. He was of the opinion that while there were several characters distinguishing the two families, the only characters of resemblance between them are the position of stamens, mode of development of seeds, their glutinous properties and the semiparasitic habit.

Linnaeus (1753) in his *Species Plantarum* placed *Viscum* under the group Dioecia Tetrandria. Humboldt *et al.* (1818) did not distinguish Viscaceae, and *Viscum* and its allies were not given any special status under Loranthaceae. Roxburgh (1832), following Linnaeus, placed *Viscum* under the group Dioecia Tetrandria. Wight and Arnott (1834) included Viscaceae in Loranthaceae. Likewise, Griffith (1854) also considered it as part of Loranthaceae, though he observed that *Loranthus* and its allies possessed corolla while *Viscum* and its allies did not.

Bentham and Hooker (1883) elevated it to a tribe Visceae of Loranthaceae under the order Achlamydosporae in Monochlamydeae. Van Tieghem (1896 a), while treating Viscaceae as a family, separated it from Loranthaceae and elevated its status to the order Viscales under the subclass Lorantheines. The order comprised the solitary family Viscaceae with subfamilies Arceuthobidees, Ginalloidees and Viscidees. Engler and Prantl (1897) placed *Viscum* in a subfamily Viscoideae under Loranthaceae. They divided Viscoideae into four tribes: Eremolepideae, Phoradendreae, Arceuthobieae and Visceae. Bessey (1915) included it in Loranthaceae under the order Celastrales. Hutchinson (1926) did not see any reason to separate it from Loranthaceae and placed it in the order Santalales, Division Lignosae, subphylum Dicotyledonae. Danser (1933), following Engler and Prantl, treated it as a subfamily, Viscoideae of Loranthaceae though in an earlier publication, he (1929) stated that he did not see any necessity to treat

the subfamily Viscoideae as a separate family. According to Gunderson (1950), it comes under Loranthaceae of the order Santalales. Rendle (1956) considered it as a subfamily of Loranthaceae in the order Santalales under Monochlamydeae. Maheshwari (1954, 1958) based on their embryological characters, treated Viscaceae as a family distinct from Loranthaceae. Johri and Bhatnagar (1960), Barlow (1964) and Kujit (1969) held the same view.

Thorne (1968) distinguished it as a family under the order Santalales in the super order Santaliflorae of subclass Dicotyledonae. Lawrence (1951) considered it as a subfamily under Loranthaceae. Takhtajan (1969) did not separate it from Loranthaceae which he placed in the order Santalales, super order Celastrinae, subclass Rosidae of the class Magnoliophyta. Though Cronquist (1970) did not distinguish Viscaceae as a separate family, Samuel and Singer (1979) mentioned that Cronquist had the intention to treat Viscaceae as a distinct family under the Santalales, subclass Rosidae of the Class Magnoliopsida of Division Magnoliophyta. Wiens (1987) treated Viscaceae as a separate family. Blancho and Parvathi (1996) studied chemotaxonomy of some members of the Loranthaceae and Viscaceae and their results substantiated the separation of Viscaceae from Loranthaceae.

Thus, there are wide differences of opinion regarding the status of the family Viscaceae. Since there are several valid reasons for separating it as a family distinct from Loranthaceae by morphological as well as embryological characters, we treat here Viscaceae as a family distinct from Loranthaceae.

Factors affecting distribution

Several factors affect the growth of Viscacean members.

I. Physical factors: There can be slight variations in requirement of light intensity among various members of Viscaceae. Their affinity towards high tree tops, open stands or edges of dense forests show their preference to light. However, the genus *Arceuthobium* is found growing well even on lower branches of host plants where sunlight is poor.

Altitude appears to restrict distribution of Viscaceae members in certain areas. *A. minutissimum* is found only in upper dry cold ranges of the Himalayas where its host *Pinus excelsa* is found. The frequency and abundance of *Arceuthobium* species in relation to

steepness of slopes have been provided in the studies of Korstian and Long (1922), Roth (1954) and Hawksworth (1959). According to them, the abundance of this species increases with steepness and altitude.

The dry humid atmosphere existing in rain shadow localities of Deccan plateau might have played a key role in restricting the distribution of *Viscum heyneanum* to the west coast and the Western Ghats up to 2000 m. It was observed that the leafless *V. articulatum* was distributed in the plains throughout the country but the leafy species were found mostly on hills at altitudes between 250 and 1800 m.

Biotic factors: *Viscum* is found on a number of hosts, whereas *Korthalsella* has a restricted host range. *Arceuthobium* occurs only on conifers. A species of *Arceuthobium* may have a specific host, though it may occur less commonly on a few other selected hosts (Kujit, 1955). There are also situations where a species of *Arceuthobium* can parasitise even laticiferous angiosperms (Hawksworth & Peterson, 1959; Kujit, 1956; Horwood, 1983). A large part of this plant occurs inside the host tissue as branching runners. In case of *A. minutissimum*, the stem is of a single internode of about 5 mm length and this portion alone is visible outside.

Mistletoe birds (Dicaeidae) play a key role in pollination and dissemination of seeds in Viscaceae. Sun birds (*Nectariniidae*) are important pollinators in the tropics (Salim Ali, 1932). In Europe, the mistletoe thrushes (*Turdus viscivorus*) are the principal vector of *Viscum album*. These birds migrate from Africa to Europe in late winter (January to March) and during this period feed almost exclusively on mistletoe berries. They utilize only a portion of the pulp and eliminate seeds in viable condition. It is believed that their migration paths positively influenced the abundance of mistletoe in Europe.

The shoots of *Arceuthobium* which often girdle the infected conifer stems are eaten by porcupines. This destroys the parasites to some extent (Taylor, 1935). Some insects facilitate propagation of mistletoes acting as pollinators; others are limiting agents as they destroy the aerial shoots (Tubeuf, 1923). Tubeuf (1923) discussed some fungi like *Shaenopsis visci* growing on *Viscum album*. A leaf spot caused by it is found damaging this species. Fungi which cause extensive damage to mistletoes (*Herpotrichia juniperi*, *Sphaeria arceuthobii* and *Caliciopsis arceuthobii*) have been reported from countries like Canada, United States and Mexico (Hawksworth & Weins, 1996).

Morphology

a. **Habit:** Viscaceae members are hemiparasites but *Arceuthobium minutissimum* Hook. f. is a parasite growing endophytically within the host and is devoid of chlorophyll. While some members could be minute and microscopic, others could grow to a height of about one meter. The smallest member of the family is *A. minutissimum*.

b. **Stems:** Stem of Viscaceae provides significant characters for identification. In *Viscum*, it is highly variable: terete in *V. orientale* and *V. ramosissimum*, terete and longitudinally grooved in *V. heyneanum*, variously quadrangular in *V. angulatum* and longitudinally flattened in *V. articulatum*. It is longitudinally flattened in *Korthalsella* but the flattening is only in one plane. The stem is not visible in *Arceuthobium minutissimum* as it is a much ramified endophytic structure inside the host. It is short and terete in *A. oxycedri*; *Ginalloa* has also terete stem. Nodal region in all members is found a little swollen. The branching pattern varies from dichotomy and trichotomy to umbellate condition.

c. **Leaves:** Viscaceae members may have leaves or may not. This plays an important role in identification. Lushington (1902) has provided a key for identification of Loranthaceae (*sensu lato*) using leaf characteristics. *Korthalsella* and *Arceuthobium* are leafless. Leaves are present in *Ginalloa*. *Viscum articulatum*, *V. angulatum*, *V. ramosissimum* and *V. malurianum* are leafless. Leaves are rarely present in *V. ramosissimum*. *V. mysorensis* possesses only a few leaves.

d. **Inflorescences:** Inflorescences are highly modified in Viscaceae. *Viscum* possesses only cymose inflorescences arising from nodes. Number of cymes at each node may vary from species to species. Cymes may be bisexual or unisexual. Sometimes up to five flowers are found on a single cyme. In bisexual inflorescences, the central flower may be female as in *V. orientale* and *V. acaciae* or male as in *V. capitellatum* and *V. trilobatum* Talbot. In *V. monoicum*, the central flower of the triad is usually male; sometimes, it is absent. In *V. subracemosum*, cymes get enlarged by the development of an adventitious cyme in the long axis and are subracemose. *V. album* is dioecious. Further, the central flower of the cyme has an individual bract. Individual bracts are also noticed in *V. articulatum*. In *V. malurianum*, flowers are borne in triads with 2 bracts for each. *Arceuthobium* is also dioecious. Only the flowers are seen projected above the host tissue in *A. minutissimum*. Inflorescence bears male and female flowers in

Korthalsella. It starts with a single axillary flower but later it develops into a group of flowers with the sprouting of adventitious and collateral serial buds. Inflorescences are axillary or terminal, sessile and spicately arranged, dichasial cymes in *Ginalloa*. The central flower of the dichasium is female and the lateral ones are male.

e. **Bracts:** Bracts enclose inflorescences or individual flowers. Sometimes we could observe presence of both the situations in a single inflorescence. Bracts could arise from the base of peduncle or the top. Bracts possess calcareous thickening along the margins. In most cases bracts are found united, at least basally, if not wholly to form a navicular structure enclosing the inflorescence or flower. Often they are persistent and could be seen along with fruits forming a saucer shaped protective structure at the base.

f. **Fruits:** Fruits are usually drupes, each with a solitary seed enclosed within the sweet viscous pulp. Sahni (1933) termed the fruits as false fruits because the fruit cover is the enlarged thalamus which encloses the ovary.

Dispersal

Members of *Viscum* make use of birds for the dispersal. Attracted by the sweet pulp of the fruits, birds either feed on it and disperse the seed unaffected through the excretion at a distant place or accidentally the sticky seeds get attached to the body of the birds and get dispersed. They get attached to the surfaces of host plants and under favourable environmental conditions, germinate giving rise to new plants (K. N. Rao, 1967). According to Sahni (1933) seeds have to undergo a pretreatment in the alimentary canal of birds for germination. *Korthalsella* and *Arceuthobium* forcefully discharge their seeds. In *Ginalloa andamanica*, the mechanism of dispersal is unknown.

Hyperparasitism

Hyperparasitism – parasitisation of an established parasite on another plant of the same or different species – is observed in many members of Indian Viscaceae. Burkill (1906) reported *Viscum articulatum* parasitic on *Loranthus vestitus* which in turn was parasitic on *Quercus incana*. *Loranthus exocarpi* was found growing on *Loranthus pendulus* and *Loranthus quandang*. Sanjai and Balakrishnan (2001a) reported *Viscum capitellatum* and *Viscum trilobatum* showing strong preference to grow on *Loranthus longiflorus* var.

falcatus (= *Dendrophthoe falcata*). *Viscum loranthei*, likewise, is found to parasitise on *Taxillus* species. This is found only in the western Himalaya. Though rare, *Viscum orientale* is found as a parasite on *Macrosolen* species. Hyperparasitism exhibited by these species may be considered as a step towards complete parasitisation. Lack of good conducting system may be the reason behind the phenomenon of hyperparasitism.

Cryptic mimicry

The term cryptic mimicry according to Wickler (1968) is restricted to situations where a potential prey species deceives a predator by providing false signals of unpalatability. He observed that cryptic or camouflaged species avoid predation by giving no signals.

It seems that host specificity plays a key role in cryptic mimicry. Sanjai and Balakrishnan (2001b) observed that when a parasite was found on host other than its normal or more specific host, the incidence of cryptic mimicry was not observed. In Indian Viscaceae, it is found that the parasite tries to mimic vegetative characters of host, mainly stems and occasionally colour and shape of leaves. *V. angulatum*, when found on its common host *Olea dioica*, is leafless and generally possesses green colour. At times it develops brownish colour and resembles a leafless twig of the host. The leafless branches are commonly noticed on the host also.

The new species *V. malurianum* was collected from the host tree *Ficus benghalensis*. From a distance the parasite looks just like the hanging aerial roots of the host. *V. subracemosum* usually found on *Pongamia glabra* depicts the leaf colour of the host. It is very difficult to distinguish the parasite from the dense foliage of the host. *V. trilobatum*, usually found as a hyperparasite on Loranthaceous members, also shows cryptic mimicry. Some of its older branches are leafless and appear as a branch of young shoots of the host (specifically on *Dendrophthoe falcata*). Similarly, the hyperparasite *V. capitellatum* when found on the same host appears as a young inflorescence of the host.

Arceuthobium minutissimum found on *Pinus wallichiana* appears as brown pustules. This resembles the scale leaves of the host or projections of the bark. *A. oxycedri* growing on *Juniperus* species appears as a small branch of the host, though distinguishable by its distinct colour. *V. acaciae* collected from sandalwood tree mimics the host in having linear-lanceolate leaves. The colour of branches and leaves

and branching patterns were also similar to those of the host. *V. loranthi* found on *Taxillus* species appears as a leafless branch of the host.

As there are little predators for the family Viscaceae, the reason behind the phenomenon of cryptic mimicry may probably be to derive advantages from the pollinating and seed dispersing agents of the host.

Conclusion

Viscaceae members are exclusively semi-stem-parasites and this character distinguishes the family from Loranthaceae which accommodates root parasites like *Nuytsia*. A gradual reduction in morphological characters that mark advanced feature is noticed in Viscaceae. Members do not have external runners to spread on host, which is a salient feature in Loranthaceae. They use internal, endophytically growing structures as runners that give rise to vegetative buds at intervals.

Among the Indian members, a reduction in leaf structure is evident. Leaves are fully developed in *Ginalloa andamanica* but are absent in *Arceuthobium* and *Korthalsella*. *Viscum* has both leafy and leafless species. Similarly, we see a gradual reduction in size from shrubby habit of *Ginalloa andamanica* to the microscopic nature of *Arceuthobium minutissimum*.

Much variation has been noticed in size of inflorescences. Long spike of triads are found in *Ginalloa andamanica* but in *Arceuthobium* it is reduced to a cluster of unisexual flowers borne on an individual of either sex. In *Viscum subracemosum*, cymes and sometimes dichasia are found. *Ginalloa*, *Korthalsella* and *Viscum* (except *V. album*) are monoecious, whereas *Arceuthobium* is dioecious. Sometimes adventitious cymes develop laterally from the initial triad as in *V. angulatum*, which often encircle the whole node as in *V. loranthi* and *V. malurianum*. In a monoecious plant, the central flower of the floral triad may be male or female. Sometimes, all male and female inflorescences are also seen as in *V. heyneanum*.

Viscaceae

Viscaceae Miers in Ann. & Mag. Nat. Hist. Ser. 2, 8: 179. 1851; Miq., Fl. Ind. Bat. 1, 1(5): 803. 1856; Van Tiegh. in Bull. Soc. Bot. France 43: 247. 1896. *Loranthaceae* subfamily *Viscoideae* Engler in Engler & Krause Pflanzenfam. 16b: 182-203. 1935. Barlow in Proc. Linn. Soc. N.W. Wales 89: 269. 1964; Kujit in Brittonia 20: 138. 1969.

Type genus: Viscum L.

Shrubs or herbs, perennial, evergreen, parasitic on aerial parts of the host plants, attachment by a single primary haustorium, pubescent or glabrous, monoecious or dioecious; stems usually forked, brittle, much branched with usually swollen and articulated nodes; internodes terete, often angular or flattened, especially in species without developed leaves, usually green. *Leaves* present or absent, opposite, single, entire, evergreen or sometimes reduced to scales; stipules absent. *Inflorescences* axillary or terminal, unit of the inflorescence a cyme, solitary or sometimes aggregated to form racemose or spicate compound inflorescences or condensed to dense clusters. *Flowers* minute, unisexual, actinomorphic, monochlamydous; perianth lobes 2 - 4, valvate, persistent in fruits; stamens as many as or less than the number of perianth lobes, opposite and adnate to the inner surface of perianth lobes or free; anthers basifixed or sometimes united into a synandrium, 1- to many loculed, opening by pores or slits; pollen spherical; ovary inferior, unilocular, with a short placental column; ovules not distinct, sporogenous cells located at the base of the placental column; style short, sometimes conical; stigma simple, subsessile, capitate or nipple-shaped. *Fruits* berry-like, one-seeded, covered by a sticky layer; seeds solitary in each fruit, with endosperm.

Distribution: The family comprises of seven genera and about 400 species, predominantly of tropical distribution with a few species in temperate regions. In India, four genera and 19 species are found. Some species are widely distributed but many are localized in distribution, especially in the southern peninsula of India.

Key to genera

- 1a. Internodes flattened in one plane, leafless, up to 20 cm long; inflorescence pubescent; anthers united into a single unit.....**Korthalsella**
- 1b. Internodes flattened in different planes, terete or angular, leafy or leafless; inflorescence glabrous; anthers not united into a single unit**2**
- 2a. Mature plants always less than 8 cm long, leafless, dioecious **Arceuthobium**
- 2b. Mature plants always more than 8 cm long, leafy or leafless, monoecious or dioecious**3**
- 3a. Internodes with sheathing cataphylls above

each node, not twisted above each node; inflorescence a spike of 3-flowered cymes; anthers with filaments free from perianth lobes, opening by slits **Ginallia**

- 3b. Internodes without cataphylls above each node, twisted 90° just above the node; inflorescences cymose or subracemose, 3- to 5-flowered; anthers sessile, attached to the perianth lobes, opening by pores **Viscum**

Arceuthobium M. Bieb.

Arceuthobium M. Bieb., Fl. Taur. Cauc. 3(4) Suppl: 629. 1819, *nom. cons.*; Engler & Krause in Engler, Pflanzenfam. 16b: 182-203. 1935.

Type species: *A. oxycedri* (DC.) M. Bieb.

Small herbs or shrubs, dioecious, semi-parasitic on stems (sometimes endophytic), 0.5 cm to 7 cm long, glabrous, variously coloured from greenish yellow to orange, reddish or black, tufted, branches jointed, terete or slightly angular, compressed. *Leaves* absent or reduced to minute opposite and connate scales. *Flowers* coloured, generally decussate or rarely whorled in young shoots, 2-4 mm across, monochlamydous. *Male flowers* sessile with a central nectary; perianth with 3 or 4 segments (rarely up to 7), free; stamens equal to perianth lobes; filaments absent; anthers opposite to and adnate to each perianth segment, spreading, circular, uniloculate, dehiscing by a slit; female flowers pedicellate; perianth with 2 segments adnate to the ovary, persistent; ovary inferior, ovate, compressed; style single, short; stigma round or capitate; ovules not distinct. *Fruits* ovoid, berry, 1-seeded, mucilaginous, bi-coloured (distal and basal portions of different shades), explosive at maturity; seeds without true integuments, usually 3-5 mm long, ovoid to lanceolate, containing one (rarely 2) distal, cylindrical embryo with copious endosperm.

Distribution: Forty two species are distributed mostly in the United States and Mexico. In Old World, 8 species occur and two species are found in India. *Arceuthobium* holds the unique distinction of having representations in both Old and New Worlds.

Host range: Species of *Arceuthobium* are specific parasites on conifers and not reported from any other plant species. The genus exhibits a very narrow host range. Some species are restricted to a single host species. Usually there are one to several major hosts within a single host genus. Parker and Riches (1993) have noticed secondary hosts when they are growing

in association with a heavily infested primary host. It is observed that poor soil conditions and stem growth rate of the host favour *Arceuthobium*.

Note: This genus is a dominant parasite of the coniferous forests. A substantial area of forests in North America is infested with this genus leading to serious loss in timber volume and quality (Parker & Riches, 1993). A 6-point rating system for defining the *Arceuthobium* infestation of individual trees has been developed by Hawksworth (1977) and Hawksworth and Geils (1990). With a rating of six for this genus, almost 100% of ponderosa pines of less than 23 cm in diameter are expected to die within a few years.

Key to species

- 1a. Plants always visible for less than 3 mm outside the host body, endophytically growing, appearing only as brown pustules on the surface of host **A. minutissimum**
- 1b. Plants always visible for more than 5 mm outside the host body and well branched **A. oxycedri**

Arceuthobium minutissimum Hook. f., Fl. Brit. India 5: 227. 1886. **Figs 1a,b**

Type: Kumaon Himalaya, 3250 m, 1884, *Duthie s. n.* (K-n. v.).

Dioecious, minute, stem-parasites without any visible stem, appearing as green or brown pustules on the bark of the host, the inconspicuous stem ramifying inside bark tissue rarely projecting above the surface for only up to 3 mm long; staminate plants yellow green; pistillate plants greenish, usually about twice as long as the staminate plants, primary branches many, arising from basal cups but without secondary branching, joints up to 2 mm long; sheaths minute, 2-toothed. Basal portions of the dominant shoots c. 1 mm in diameter; third internode 0.5-1.4 mm long, 0.3 -1 mm wide; flower branches piercing the epidermis of host and appearing as minute 2-lipped cups. *Male flowers* sessile in cup, 2-2.5 mm across; perianth mostly (3-) 4 (-5)-merous, free, lobes c. 0.8 x 0.8 mm; anthers 0.4-0.5 mm across. *Female flowers* pedicellate, perianth slightly bifid. *Fruit* borne on minute branches composed of 2 joints, a berry, 2-2.5 x 1-1.5 mm, with persistent perianth on its tip.

Flowering & Fruiting: June-October.

Distribution: The Himalayas. According to Bagchee (1952) it is usually found in dry regions of the

Himalayas (Upper and Lower Bashahr and Kulu in Himachal Pradesh, Kashmir).

Hosts: Pinus wallichiana A.B. Jacks, *Abies pindrow* (Royle ex D. Don) Royle and *Cedrus deodara* (Roxb.) G. Don

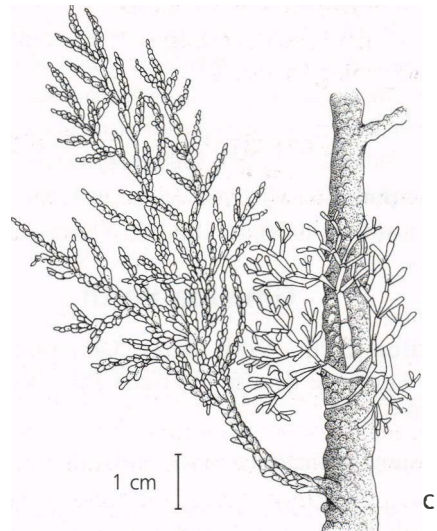
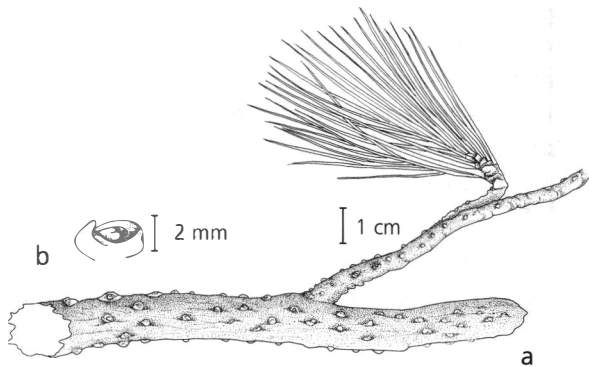


Fig. 1c

1805.

Type: Unknown but Komarov (1936) states it is at *P. Dioecious, semi-parasites*, small, tufted, evergreen, glabrous up to 10 cm high, usually verticillately branched; branches jointed; basal shoots 1-4 mm

Figure 1. *Arceuthobium minutissimum* Hook. f. – a. Habit, b. Flower, enlarged view; *Arceuthobium oxycedri* (DC.) M. Bieb. – c. Habit.

Notes: J. D. Hooker, while describing this plant, mentioned that it was the minutest plant that he could recollect. *Pinus wallichiana* is the principal host of this plant. This plant causes considerable damage by killing the top of the blue pine saplings of about 1.8 meter in height. It is also observed that the plant is parasitic on younger parts, may be due to its difficulty in penetrating thick bark of older parts.

Specimens Examined: Himachal Pradesh, Baspa Valley, 3425 m, 26.5.1972, *Janardhanan* 47486 (BSD); Mastrang, 19.8.1973, *Janardhanan* 52791 (BSD); Purbami hillslope, 2533 m, *Janardhanan* 46538 (BSD); Chikkul, 16.8.1973, *Janardhanan* 52734 (BSD); Chamoli, Nitic Village, 3800 m, 9.9.1975, *Naithani* 56138 (BSD). Jammu & Kashmir, Kashmir, Bhadrovah, 2000 m, 29.5.1959, *T.A. Rao* 9065 (CAL); Pahalgaoon, 8000 ft., June 1905, *Meebold* 4070 (CAL); Sind Valley, 8000-9000 ft., 26.6.1892, *Duthie* 11481 (CAL); Sumbliali, 10,000-11,000 ft., 22.5.1892, *Duthie* 11204 (CAL); Kaimulhiddar Valley, 10000-11000 ft., 21.7.1893, *Duthie* 14181 (CAL). Uttaranchal, Nabikali river side, 12.9.1900, collector's name illegible, 24933 (CAL); Pauri, 2400 m, 4.10.1971, *Janardhanan* 46463 (BSD).

Arceuthobium oxycedri (DC.) M. Bieb., *Fl. Taur. Cauc. Suppl.* 3(4): 629. 1819; Parker, *Fl. Pl. Punjab* 440. 1918; *Naithani* in *Fl. Pl. India, Nepal & Bhutan* 370. 1990. *Viscum oxycedri* DC., *Fl. Franc.* (ed. 3) 4: 274.

across; internodes terete, c. 5-9x1 mm, often markedly wider at top than at base. *Leaves* reduced to triangular connate scales forming a small cup-like sheath at nodes. *Male flowers* sessile, 1.5-2.5 mm across; perianth mostly 3-merous, occasionally 4-merous and rarely 2-merous; anthers unilocular, opening by an aperture. *Female flowers* pedicellate, 1 or 2 together, usually 3-partite; ovary inferior; style short; stigma minute. *Fruit* a berry, ovoid, mature fruit c. 3x1.5-2 mm.

Chromosome number: n=13-17 (Pisek, 1924).

Flowering & Fruiting: June to September.

Distribution: Old as well as New World; widely distributed in the Himalays (Uttaranchal, Himachal Pradesh and Jammu Kashmir).

Hosts: *Juniperus oxycedrina* St.-Leg., *J. excelsa* M. Bieb., *J. macropoda* Boiss., *Cupressus macrocarpa* Hartw. ex Gordon.

Note: It is a medicinally important plant having properties more or less similar to that of *Viscum album*. *Arceuthobium oxycedri* is closely related to *A. azoricum* and *A. juniperi-procerae* (Hawksworth & Wiens, 1975) but differs in its deep green colour, higher frequency of whorled branching, elongated internodes and more glaucous fruits.

This species is reported to be damaging Juniper forests in many areas. Jamal and Beg (1974) reported 50% tree mortality on *Juniperus macrocarpa*.

Specimens Examined: **Himachal Pradesh**, Pooli hill slope, 2837 m, 7.6.1972, *Janardhanan* 47787 (BSD); Pooli hill slope, above PWD guest house, 2837 m, 7.6.1972, *Janardhanan* 47786 (BSD). **Jammu & Kashmir**, Pahalgaoon, 7200 ft., 19.8.1969, *Vaid* 7148 (DD); 19.8.1969, *Keshavanand* 7148 (DD); Koram forest, 7000-8000 ft., 20.8.1906, *Keshavanand* 457 (DD); Jhelam Valley, 7000-9000 ft., 11.8.1908, *Keshavanand* 1065 (DD); Kashmir, 8000 ft., 8.9.1893, *Keshavanand* 14182 (DD); Narva forest, 7500-8000 ft., 29.6.1908, *Keshavanand* 1023 (DD). **Uttaranchal**, Kumaon, Kali Valley, 14.9.1884, *Duthie* 3359 (DD); Garhwal, 10,500 ft., 18.7.1916, *Osmaston* 743 (DD).

Ginalloa Korth.

Ginalloa Korth., Verh. Batav. Genootsch. 17: 260. 1839; Engler & Krause in Engler Pflanzenfam. 16 b: 182-203. 1935.

Type species: *Ginalloa arnottiana* Korth.

Aerial, semi-parasitic, slender shrubs, usually less than 1 m high, monoecious, glabrous; stems dichotomously or trichotomously branched, striate or longitudinally grooved with terete slender internodes, bearing a sheath-like thickening (cataphylls) above each node. *Leaves* normally developed, entire, opposite, unifacial, curvined, often with 1-5 elongated veins, usually visible on both surfaces; rudimentary leaves forming a boat shaped collar encircling the stem. *Inflorescences* terminal and axillary, sessile spikes of decussate pairs of cymes (triads) subtended by subcupular involucre. *Flowers* unisexual, 3-merous, sessile, the central flower of the triad usually female and the laterals male; bracts small, in pairs, bracts of each pair of opposite cymes united to form a cupular rim; bracteoles of the lateral flowers subtending each cymule, small, free, entire to densely fimbriate. *Male flowers* globose or slightly flattened, 0.5-1 mm long; perianth lobes 3, free, triangular, valvate; stamens basally fixed; filaments short; anthers disc shaped, opening by longitudinal slits. *Female flowers* cylindrical or narrowly ellipsoid; c. 2 mm long; perianth united into a short tube at base, lobes 3, persistent, triangular to suborbicular; ovary inferior; style short and stigma mamilliform. *Fruits* narrow, ovoid to ellipsoid, smooth or tuberculate, crowned by persistent perianth lobes, bright red in colour with viscous pericarp.

Distribution: Nine species are distributed from India (Andaman Islands) southwards to Sri Lanka, eastwards and southeastwards through Malesia to

New Guinea and Solomon Islands. In India, only one species is reported from Andaman Islands.

Habitat: Mostly occurring in closed humid forests, often extending to open woodlands and disturbed habitats; common in low lands but sometimes up to an altitude of 2100 m. Host specification very low (Barlow, 1997).

Note: Stem in most of the *Ginalloa* species remains green for long. It is similar to *Notothixos* in having both normal leaves and rudimentary cataphyll like leaves on each branch system, but differs in having more variable pattern and some species bearing a very few normal leaves.

The basic inflorescence unit is a small dichasium (a cymule which is a triad), usually with both male and female flowers. During prolific flowering exclusive female cymules are also produced. The spicately arranged cymules are a consistent feature of *Ginalloa* although in some species they are reduced to solitary flowers (Barlow, 1997).

Van Tieghem (1894) proposed to treat this genus under a separate family Ginalloaceae.

Ginalloa andamanica Kurz in J. Asiat. Soc. Bengal 41(ii): 309. 1872 & For. Fl. Brit. Burma 2: 326. 1877; Hook.f., Fl. Brit. India 5: 228. 1886.

Type: Photo (K); BSI 8136 (Negative, CAL).

Large semi-parasitic shrubs; stems terete, dichotomously branched. *Leaves* opposite, thickly coriaceous, shortly petioled, stout, flat, obovate-oblong, tip rounded, obscurely 3-5-nerved, 3-5 cm long. *Spikes* 4, robust, terminal and at the forks of stem branches. *Flowers* minute, clustered, dioecious, sunk in fleshy rachis of spikes and by a thin dilation of rachis; perianth segments 3, triangular; immature fruit elongate, ovate.

Distribution: Endemic to South Andaman Islands.

Note: The above description is based solely on the protologue and *Flora of British India*, as no specimen is available in any Indian herbaria. Even J. D. Hooker could not see any specimen and based his descriptions purely on the protologue. This species has not been reported or collected since the original collection. J. D. Hooker (1886) and Barlow (1997) have expressed their doubts regarding the existence of this species. However, there is a photograph of a specimen in Kew with Danser's determinavit slip indicating the specimen as *G. andamanica*. This specimen is in a damaged state and hence difficult to determine the authenticity.

Korthalsella van Tiegh.

Korthalsella Van Tiegh. in Bull. Soc. Bot. France 43: pp. 83, 163. 1896; Gamble in J. Asiat. Soc. Bengal 75(2): 384. 1914; Engler & Krause in Engler, Pflanzenfam. 16b: 182 - 203. 1935.

Type species: Korthalsella remyana van Tiegh.

Monoecious, aerial semi-stem-parasites, undershrubs or herbs, perennial, often less than 10 cm high, rarely up to 20 cm high, found mostly on dicotyledonous woody plants, rarely on conifers, glabrous except for the floral clusters; stems green or yellowish, strongly articulated at nodes; internodes often flattened or terete, if flattened, the flattening being always in the same plane, forming a cladode. *Leaves* rudimentary, opposite, united in pairs to form collars at the top of internodes subtending floral clusters. *Flowers* 3 merous, developing successively in lateral clusters, surrounded and separated by multicellular, sparsely branched, thick walled hairs (derived from floral bracts) which often forming a raised mound (floral cushion); floral clusters sometimes coalescing and completely encircling the stem at each node; first formed flower male and arising in an axillary position; subsequent flowers developing laterally to the first and often also in further transverse rows below the first, mostly female. *Male flowers* globose in the bud state, attenuate at the base and shortly stipitate; perianth lobes persistent, triangular, valvate; stamens 3, without filaments, 6 locular, introrse, connate into a globose synandrium with the 6 loculi opening towards the centre with the slits and pouring out the pollen from a single apical pore; pollen grains globose, smooth. *Female flowers* globose, clavate or pear-shaped in bud state, usually less than 0.5 mm long, 3-merous; perianth shortly tubular at base, lobes triangular, persistent, valvate; ovary inferior; stigma nipple-shaped; embryo sacs first growing downward from the central parenchyma-mass, then growing upward into ovary wall and finally becoming 'U'-shaped. *Fruits* clavate or pear-shaped or ellipsoid, up to 3 mm long crowned by persistent perianth lobes, containing one flattened seed in the upper portion, dehiscing explosively.

Distribution: About 25 species are distributed in Asia, Australia and Africa, from Japan to Australia and New Zealand, extending eastwards to several Pacific Archipelagos and westwards to Indian Ocean Islands and Ethiopia. In India, only one species is found above 1800 m altitude in the Himalayas and the Nilgiri Hills. The distribution is disjunct, probably due to the lack of required altitudinal range and hosts in between.

Habitat: In India, it is mostly found, though not so frequent, in humid forests above 1800 m but extends to savannah. It is never recorded in lowlands of India. It is rare. Specificity of hosts might have played a key role in its distribution.

Note: *Korthalsella* is homogenous in inflorescence and floral characters, but species vary strikingly in general appearance owing to differences in vegetative characters and in degree of differentiation of flower bearing stems. The leaf pairs are distichous or decussate in species with terete or weakly compressed internodes. In strongly flattened internodes the flattening is in one plane. All nodes may bear flowers in some species or may be restricted in others. The hairs which form the floral cushion are probably modifications of very densely fimbriate floral bracts and hence, are probably homologous to the hairs of some *Ginalloa* species.

The most significant work on the genus is that of van Tieghem (Bull. Soc. Bot. France 43: 83 - 87, 162 - 167. 1896). He was the first to recognize *Korthalsella* as a genus distinct from *Viscum*. He further recognised 2 more genera, *Bifaria* and *Heterixia*, which are now regarded as congeneric to *Korthalsella*. Most of the van Tieghem's species have been reduced to synonyms (Barlow, 1997). Danser (1937) published a world revision of *Korthalsella*.

Korthalsella japonica (Thunb.) Engler in Engler & Prantl, Pflanzenfam. Nachtr. 1: 138. 1897; Gamble, Fl. Pres. Madras 7: 1256. 1925; Grierson & Long, Fl. Bhutan 1(1): 151. 1983; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 414. 1987; Barlow in Fl. Malesiana 13: 421. 1997. *Viscum japonicum* Thunb. in Trans. Linn. Soc. London 2: 329. 1794; Hook.f., Fl. Brit. India 5: 226. 1886. *Bifaria japonica* (Thunb.) van Tiegh. in Bull. Soc. Bot. Fr. 43: 175. 1896. **Fig. 2**

Korthalsella opuntia (Thunb.) Merr. in Bot. Mag. Tokyo 30: 68. 1916, *comb. illegit.*; Danser in Bull. Jard. Bot. Btzg. III, 11: 453. 1931; *ibid.* 14: 134. 1937 & *ibid.* 16: 333. 1940. *V. opuntia* Thunb., Fl. Japon. 64. 1784, *nom. superfl.*

Type: Herb. Thunberg (*n. v.*).

V. moniliforme Wight & Arn. var. *coralloides* Wight, Icon. Pl. Ind. Or. t. 1019. 1845. *V. japonicum* Thunb. var. *coralloides* (Wight) Hook.f., Fl. Brit. India 5: 227. 1886. *K. japonica* (Thunb.) Engler var. *coralloides* (Wight) Gamble, l. c. 1925. *Bifaria coralloides* (Wight) van Tiegh. in Bull. Soc. Bot. Fr. 43: 175. 1896.

Monoecious, yellowish, aerial semi-parasites, up to 10 cm long (rarely up to 20 cm), relatively slender, much branched; branching di- or trichotomous, the

main stem with about 8-25 internodes, the unbranched extremities with about 5 internodes, often densely flabellately branched by the occurrence of collateral branches arising from the nodes, plants basally cylindrical and flattened at the apex, the following internodes strongly flattened, narrow spatulate to oblong-spathulate, gradually narrowed towards apex, 10-25 mm long, 4-8 mm

lowermost, gradually emerging from the axils, first a few-flowered and later many, up to 8 per cluster, the opposite clusters meeting and encircling the stem. *Male flowers* solitary, globose, c. 0.75 x 0.75 mm; anthers united to form a synandrium in the centre. *Female flowers* large, c. 1.5x0.75 mm, ovules not distinct. *Fruits* subpyriform, usually 1-2 mm long.

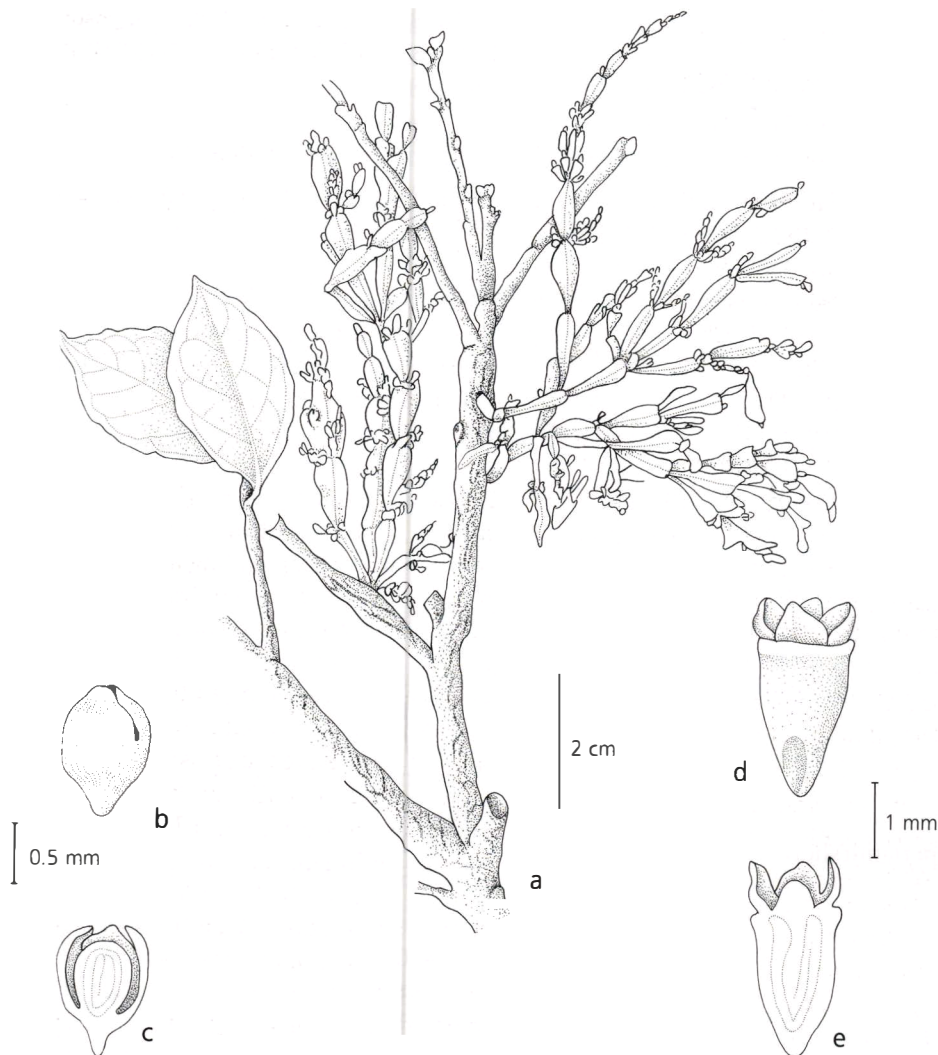


Figure 2. *Korthalsella japonica* (Thunb.) Engler – a. Habit; b. Male flower; c. Male flower, l. s.; d. Female flower; e. Female flower, l. s.

broad, with one prominent midrib and usually 3-5 lateral veins. *Leaves* rudimentary, encircling the node, 0.2 - 0.5 mm long, usually thin, truncate. Hairs of the floral cushion a few or absent, if present probably modifications of very small bracts, scarcely protruding, reddish. *Flowers* less than 1 mm across, in a cluster from the axils with the exception of the

Flowering & Fruiting: March-August.

Distribution: India (the Himalayan ranges, hill ranges of NE India and the high hills of the Western Ghats, mostly between 1000-2500 m), Bhutan, Japan, Malaysia, Australia, Indian Ocean Islands and Pacific Islands.

Habitat: Moist deciduous forests of the hill tops, occasionally in savannahs. So far this species has not been reported from the plains.

Hosts: Mostly *Rhododendron* species, occasionally on *Eurya japonica* Thunb. Conifers are generally avoided. Joseph and Deka (1960) record several additional hosts from Cherrapunji in Meghalaya: *Cinnamomum zeylanicum* Blume, *Camellia caudata* Wall., *Styrax hookeri* C.B. Clarke, *Phyllanthus glaucus* Wall. ex Mull. Arg. and *Photinia arguta* Lindl. In Bhutan, it has been reported on *Quercus semicarpifolia* Sm.

Note: *K. japonica* var. *coralloides* (Wight) Gamble is a smaller form with narrower joints, a very variable character and not considered worthy of separate entity.

Specimens Examined: **Arunachal Pradesh**, Marumboan roadside, 4000 ft., 20.9.1859, *Duthie 19054* (CAL); Mount Khazi, 4500 ft., *Hooker s. n.* (Accn No. 396096, CAL); without exact locality, 3750 ft., 9.5.1886, *Clarke s. n.* (Accn No. 43729, CAL); Kameng, 3250 ft., 14.11.1885, *Clarke 41982* (CAL); Mount Khazi, 4000-5000 ft., *Hooker & Thomson 70831* (MH). **Himachal Pradesh**, Koditali, 5200 ft., 17.6.1974, *Wadhwa 53002* (BSD); Agrakhal, 1400 ft., 8.4.1981, *Anil 73039* (BSD); Urui, 2800 m, 29.8.1963, *N.C. Nair 30099* (BSD); Lahul, 1950 ft., 23.7.1963, *V.J. Nair & Malhotra 28301* (BSD); Karcham, 26.8.1973, *Janardhanan 52837* (BSD); Kilbam-Karcham Road, 10.10.1971, *Janardhanan 46600* (BSD); Thal, 2200 m, 4.5.1962, *Bhattacharya 21390* (BSD); Nayan-Najar Bridle Path, 1800 m, 1.8.1969, *Arora 38409* (BSD); Simla, 6000 ft., June 1881, *Brandis 1532* (DD); Simla, 7000-8000 ft., 20.5.1888, *Browne 7352* (DD); Simla, 7500 ft., 18.6.1937, *Parkinson 7393* (DD); Baswer, 8000 ft., 11.9.1896, *Gammie 18576* (DD); Kilba, 6000 ft., 21.5.1928, *Parker 2871* (DD); Kilba, 15.7.1953, *Sethi & Raizada 20320* (DD); Karcham, 20.6.1973, *Janardhanan 52837* (CAL); Vatiana, 8000 ft., 30.4.1907, *Burkill 28686* (CAL); Chamba, 6000 ft., 30.5.1898, *Lace 1702* (CAL). **Jammu & Kashmir**, Baswar, 31.5.1986, *Uniyal 80341* (BSD); Karinah Bagh, 4000-7000 ft., 19.7.1906, *Keshavanand 240* (DD); Muzafarbad, 3000-6000 ft., August 1907, *Harkishen Singh 1844* (DD); Dharmasala, August 1906, *Parker 10004* (DD); Kilba, 7.6.1935, *Lawrie 5398* (DD). **Kerala**, Idukki, Kanthallur, 2120 m, 30.3.1978, *Nambiar 272* (KFRI); Kottayam, Umayamalai, 2125 m, 18.11.1965, *Shetty 26493* (MH); Munnar, 2300 m, 27.5.1994, *Stephen 7565* (KFRI). **Meghalaya**, Cherrapunji, 1200 m, *Joseph & Deka s. n.* (ASSAM). **Sikkim**, *King 1287* (CAL); *Wight 49, 50* (CAL). **Tamil Nadu**, Coimbatore, way to Thenkamalai from Konalar, 1975 m, 17.2.1980, *Chandrabose 65828* (MH); Kodaikanal, 26.4.1905, *Barber 7316* (MH); Kodaikanal, Pillar rock, 2333 m, 9.3.1958, *Subramanyam 5539* (MH); *ibid.* 26.4.1905, *Barber 7318* (MH); Nilgiri, Glenmorgan, 2000 m, 24.4.1971, *Rathakrishnan 38055* (MH); Longwood R. F., 1875 m, 17.5.1971, *Vajravelu 38426* (MH); Avalanche, 1925 m,

29.3.1972, *Vivekananthan 40638* (MH); Naduvattam, 2000 m, 18.1.1961, *Shetty 11923* (MH); Ootacamund, 15.5.1904, *Barber 6430* (MH); 18.5.1904, *Barber 6440, 6442, 6443* (MH); Lakkadi, 2250 m, 2.6.1970, *Shetty 34061* (MH); Nanjanad, 2150 m, 7.7.1970, *Ellis 34504* (MH); Pykara, 2075 m, 17.7.1970, *Ellis 34635* (MH). **Uttaranchal**, Garhwal, 1864, *Falconer 504* (CAL); Laria kunta, 7700 ft., 20.6.1914, *Dutt 8036* (DD); Mussoorie, 6500 ft., 12.6.1894, *Forster 82* (CAL). Tehri, 1400 m, 31.5.1979, *Goel 67753* (BSD); Kumaon, Didihat, 1500 m, 22.7.1965, *Pant 35113* (BSD); Didihut, 1500 m, 8.3.1965, *M.A. Rau 35312* (BSD); Kumaon, Champavati, 1700 m, 9.5.1961, *Bhattacharya 15040* (BSD); Kumaon, *Duthie 4371* (DD).

Viscum L.

Viscum L., Sp. Pl. 2: 1023. 1753 et Gen. Pl. ed. 5: 448. 1754.

Type species: *V. album* L.

Aspidixia (Korth.) Van Tiegh. in Bull. Soc. Bot. France 43: 191. 1896. *Viscum* sect. *Aspidixia* Korth., Verh. Bat. Genovtsch. 17: 235. 1839.

Type species: *V. articulatum* Burm.f.

Aerial semi-stem-parasites, glabrous, monoecious or dioecious, herbs or shrubs, usually less than 1 m tall, mostly glabrous, spreading along branches of hosts, densely dichotomously or trichotomously branched, erect or sometimes pendulous; nodes swollen; internodes terete or compressed or flattened decussately, often longitudinally ridged or striate. *Leaves* present, rudimentary or absent, normally developed leaves opposite, entire, unifacial, curvinerved, usually with 3 or 5 visible veins; rudimentary leaves bract-like, up to 1 mm long. *Flowers* uniform, usually 4-merous, arranged in inflorescences which are terminal or axillary and sometimes solitary or fascicled, usually in triads, middle flowers of the triad being female, the lateral ones male or vice versa, sometimes all female or all male; bracts small, triangular, in pairs forming boat-shaped cupule subtending each cymule. *Male flowers* flattened, 0.5 - 1.5 mm long, 4-merous; perianth lobes triangular, valvate; anthers disc-shaped, multi-loculate, opening by pores, sessile and fused to the perianth lobes; pistillode absent. *Female flowers* cylindrical, oblong, up to 3 mm long, 4-merous; perianth lobes triangular, sometimes persistent; ovary inferior, ovules not distinct; style short, subconical; stigma small, nipple-shaped, rounded, flat or capitate. *Fruit* a berry, usually dehiscent, narrowly ellipsoid, perianth lobes rarely persistent as a crown on the fruit.

Distribution: About 100 species distributed in southern Europe, throughout tropical Africa and eastwards to tropical and subtropical Asia, Malesia and Australia. In India 15 species are present, of which 4 are endemic.

Habitat: The species of *Viscum* occur in a range of habitats from dense wet evergreen forests, moist deciduous forests to open lands and disturbed areas. They are adapted to live from sea level to 2500 m altitude.

Morphology: In most of the species of *Viscum*, the stems remain green for a long time. Plants are leafy or leafless. The basic inflorescence unit is a simple cyme (triad), which is usually 3-flowered. The inflorescences are subracemose, sessile or pedunculate, terminal or axillary.

Key to species

- | | | | |
|-----|--|------|--|
| 1a. | Plants dioecious, leafy; leaves lanceolate to elliptic-lanceolate or obovate-lanceolate; central flower subtended by a cupule V. album | 6a. | Internodes flattened in a plane at right angles to the preceding one, contracted at nodes; inflorescences lateral V. articulatum |
| 1b. | Plants monoecious, leafy or leafless; leaf-shape varying; central flower subtended or not by a cupule 2 | 6b. | Internodes terete, not distinctly contracted at nodes; inflorescences lateral or around the node 7 |
| 2a. | Internodes flattened; leaves a few, lanceolate; inflorescence a 3-flowered cyme with the central flower female V. mysorensis | 7a. | Plants erect; fruits verruculose, subglobose V. loranthi |
| 2b. | Internodes terete, angular or flattened; leaves a few or many, shape varying; inflorescence cymose or subracemose with the central flower either male or female 3 | 7b. | Plants drooping; fruits smooth, globose to ovoid 8 |
| 3a. | All plants leafless (rarely leafy in <i>V. ramosissimum</i>); internodes flat, angular or terete; inflorescences sessile 4 | 8a. | Branches strong; inflorescence encircling the node; fruits with persistent bracteal cup V. malurianum |
| 3b. | All plants leafy; internodes terete; inflorescences sessile or pedunculate 5 | 8b. | Branches slender; inflorescence lateral; fruits without bracteal cup V. ramosissimum |
| 4a. | Internodes of young branches distinctly 4-angled; flowers arranged laterally V. angulatum | 9a. | Internodes terete; leaves falcate; young fruits smooth, flask-shaped; inflorescence sessile V. monoicum |
| 4b. | Internodes of young branches terete or flattened; flowers arranged laterally or encircling the node 6 | 9b. | Internodes terete or slightly angular; leaves variously shaped; young fruits smooth or warty, globose or oblong; inflorescence sessile or pedunculate 11 |
| 5a. | Central flower male; leaves cuneate, subtruncate, ovate, obovate or lanceolate 9 | 10a. | Leaves large, c. 5 x 2 - 3.5 cm; inflorescence sessile; fruits warty V. ovalifolium |
| 5b. | Central flower female; leaves lanceolate, oblong, ovate-acute 10 | 10b. | Leaves small, c. 2 - 5 x 0.5 - 2 cm; inflorescence pedunculate; fruits smooth 13 |
| | | 11a. | Internodes longitudinally grooved; leaves ovate, obovate or oblong; young fruits warty V. heyneanum |
| | | 11b. | Internodes not longitudinally grooved; leaves lanceolate, cuneate or subtruncate; young fruits smooth 12 |
| | | 12a. | Inflorescences distinctly pedunculate, at times subracemose; internodes terete throughout; leaves lanceolate, thick; perianth lobes 2 (rarely 3) for male and 3 for female V. capitellatum |
| | | 12b. | Inflorescences sessile, never subracemose, always cymose; leaves cuneate, subtruncate or suborbicular; upper internodes slightly angled; perianth lobes 3 in both male and female V. trilobatum |
| | | 13a. | Internodes longitudinally grooved; leaves lanceolate to ovate-lanceolate; inflorescences subracemose, sometimes only with female flowers, fruits globose V. subracemosum |
| | | 13b. | Internodes terete or longitudinally grooved; leaf shape varying; inflorescences cymose or |

subracemose, heterosexual; fruits globose or oblong14

- 14a. Branches slender; leaves lanceolate, inflorescences always 3-flowered **V. acaciae**
- 14b. Branches strong, terete; leaves ovate, obovate, acute at apex, inflorescences up to 5-flowered **V. orientale**

Viscum acaciae Danser in Blumea 4: 298. t. 1. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 150. 1957; Sanjai & N.P. Balakr., J. Econ. Taxon. Bot. 25(1): 18. fig. 1. 2001. **Fig. 3**

Type: Burma (Myanmar), Magwe dist., Ywamun-Shwetandaw, 800 ft., 7.9.1925, *Robertson 1823 (DD!)*.

Semi-parasitic herbs, monoecious, leafy evergreen, drooping, up to 75 cm long or even more; stems slender, dichotomously branched at all nodes towards the basal portion and less branched upwards; branches at each node 3 or 2, lower internodes terete, slender, longitudinally grooved, not flattened, 2 - 7 x 0.1 - 0.3 cm; nodes slightly swollen; internodes towards the apices gradually more delicate, short. *Leaves* petiolate, lanceolate or subspathulate to spathulate, tapering at base, rounded at apex, entire or slightly wavy along the margins, with 3 distinct longitudinal veins, 1.5 - 7 x 0.5 - 2 cm; petioles 2 - 5 mm long. *Inflorescence* single, usually lateral at the axils of leaves, but occasionally terminal, up to 6 at each node, cymose, usually 3-flowered but sometimes with up to 5 flowers; peduncles 3 - 7 mm long, bearing a navicular cup of bracts formed of 2 segments at its apex, each bract triangular, c. 3 x 2 mm, bearing a 3-flowered triad in it, the central flower large and female, the laterals male, sometimes the central flower absent and instead developing another set of flowers in a peduncled cyme of the same size and structure. *Male flowers* slightly wedge-shaped, sessile, c. 1.5 x 1 mm; perianth lobes 4, 2 larger and 2 smaller, the larger lobes c. 1 x 0.75 mm, broadly ovate with broad base and rather rounded apex, bearing an anther on its inner surface; the smaller perianth lobes c. 1 x 0.5 mm, oblanceolate, with slightly broad base and acute to acuminate apex, without anthers attached to them; stamens 2, sessile, opposite to and attached on the inner surface of the larger perianth lobes; anthers c. 0.75 x 0.75 mm, opening by pores; pistillode absent. *Female flowers* sessile, oblong, clavate, c. 3 x 1 mm; perianth lobes 4, free, valvate, c. 1 x 0.75 mm, caudate; staminodes absent; ovary inferior, ovules not distinct; style short; stigma globular. *Fruits* drupaceous, oblong, 5 - 8 x 3 - 5

mm, abruptly tapering at base into the stalk, smooth.

Flowering & Fruiting: February-August.

Distribution: India (Karnataka), Myanmar.

Note: Earlier, this species was known only from its type locality and adjacent areas in Myanmar (Burma). The first author collected this species from Bangalore in Karnataka state and reported it as a new record for India. R.S. Rao (1957) did not mention the occasional subracemose nature of inflorescence and occurrence of more than one fruit in an inflorescence in this species.

Hosts: *Acacia leucophloea* (Roxb.) Willd. and *Santalum album* L. are the common hosts. In Bangalore this species was collected from *Santalum album* where *Viscum acaciae* was seen mimicking the leaf and stem of its host (Sanjai & Balakrishnan, 2001 a,b,c).

Specimen Examined: Karnataka, Bangalore, 1.5.1997, Sanjai 104935 (MH).

Viscum album L., Sp. Pl. (ed. 1), 2: 1023. 1753; Brandis, For. Fl. N.W. & C. India 392. 1874; Kurz, For. Fl. Brit. Burma 2: 323. 1877; Boiss., Fl. Orient. 4: 1065. 1879; Aitchinson in J. Linn. Soc. Bot. 18: 92. 1880, p. p.; Benth. & Hook.f., Gen. Pl. 3: 213. 1880; Hook.f., Fl. Brit. India 5: 223. 1886; Gamble, Indian Timbers 583. 1902; Collett, Fl. Simlensis 440. 1902; Brandis, Indian Trees 552. 1906; Parker, Fl. Pl. Punjab 441. 1924; C.E.C. Fischer in Rec. Bot. Surv. India 11: 160. 1926; Osmaston, Forest Fl. Kumaon 465. 1927; Danser in Blumea 2: 55. 1936; Danser in Bull. Jard. Bot. Btzg. (ser. 3), 16: 58. 1938; Danser in Blumea 4: 268. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 118. 1957; Grierson & Long, Fl. Bhutan 1(1): 150. 1983. **Fig. 4**

Type: *Linnaeus 1166-1 (LINN - Microfiche!)*.

Viscum costatum Gamble in Bull. Misc. Inf. Kew 1913: 46. 1913.

Type: India: Darjeeling, the shrubbery, 7000 ft., *Gamble 711 (K)*.

Viscum album var. *meridianum* Danser in Blumea 4: 274. 1941.

Type: India: Assam, Naga Hills, R.N. De 17461 (ASSAM).

Semi-parasitic shrubs, evergreen, dioecious up to 75 cm high; stems dichotomously or trichotomously or even umbellately branched; number of branches up to 10 or sometimes more; nodes swollen; internodes terete, smooth and green when young but wrinkled and yellowish when dried. *Leaves* normal, opposite, sessile or subsessile, exstipulate, lanceolate-elliptic to

obovate-lanceolate or sometimes obovate-cuneate, usually oblique with one side straight and the other slightly curved, obtuse or rotund at apex, entire, abruptly narrowed towards the base, c. 2.5 - 10 x 0.5 - 3.7 cm, thin, coriaceous with 3-9 longitudinal nerves connected together by indistinct reticulate veins, prominent when dry. *Inflorescences* cymose, terminal or axillary at bifurcations of stems towards the basal portion, peduncled. *Male flowers* cymose with 3-

flowers, central the older, laterals the younger, all protected in a connate cup of two acute, short and round or larger and triangular bracts, the central flower with an individual bracteal cup of its own similar to that of the inflorescence; flowers globose, basally slightly conical c. 2.5 x 2.5 mm; perianth lobes 4, valvate with a short perianth tube, triangular, broadly ovate, acute at apex, c. 1.75 x 1 mm; stamens 4, sessile; filaments absent; anthers sessile, attached

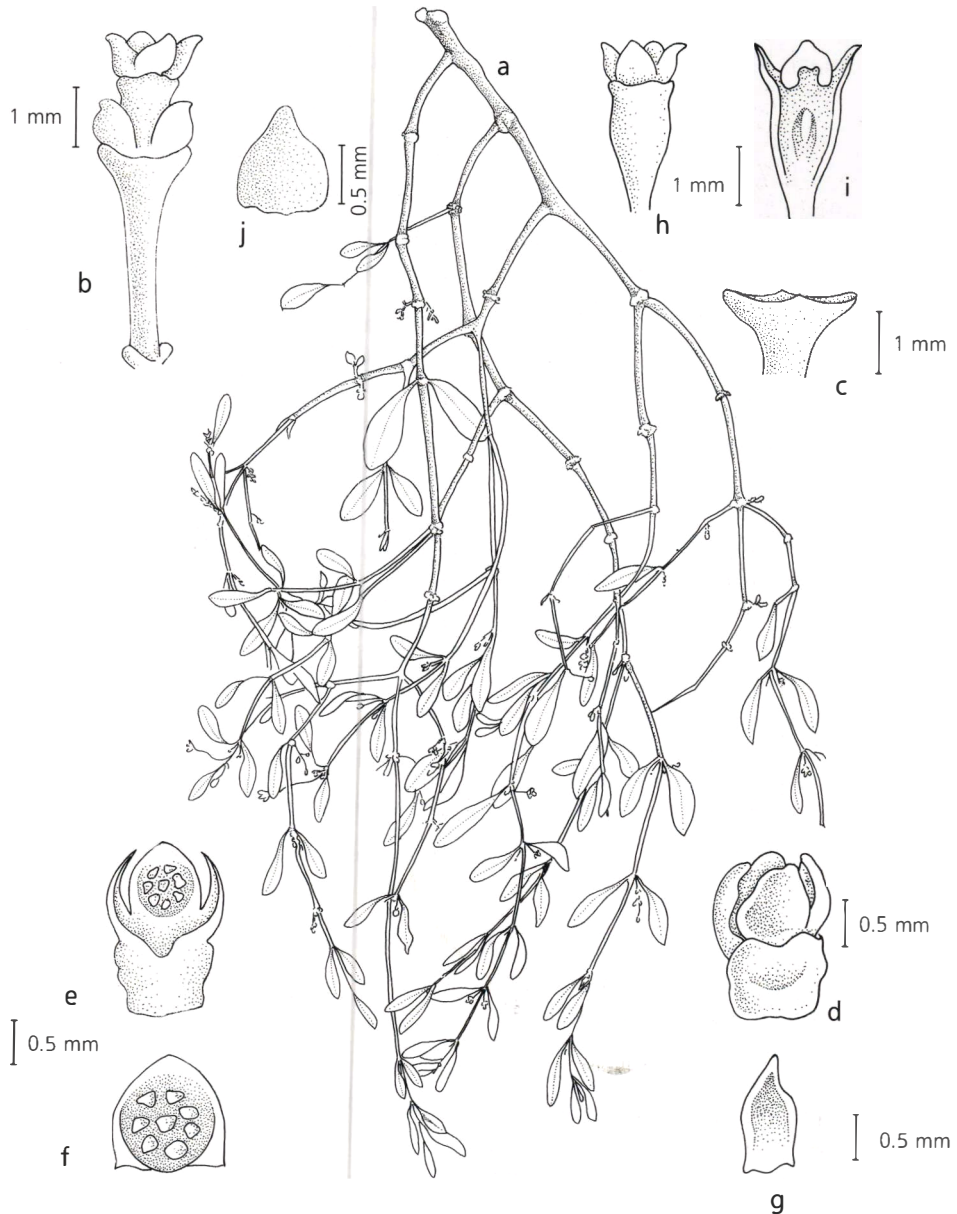


Figure 3. *Viscum acaciae* Danser – a. Habit; b. Inflorescence; c. Bracteal cup; d. Male flower; e. Male flower, l. s.; f. Large perianth lobe with anther; g. small perianth lobe; h. Female flower; i. Female flower, l. s.; j. Female perianth lobe.

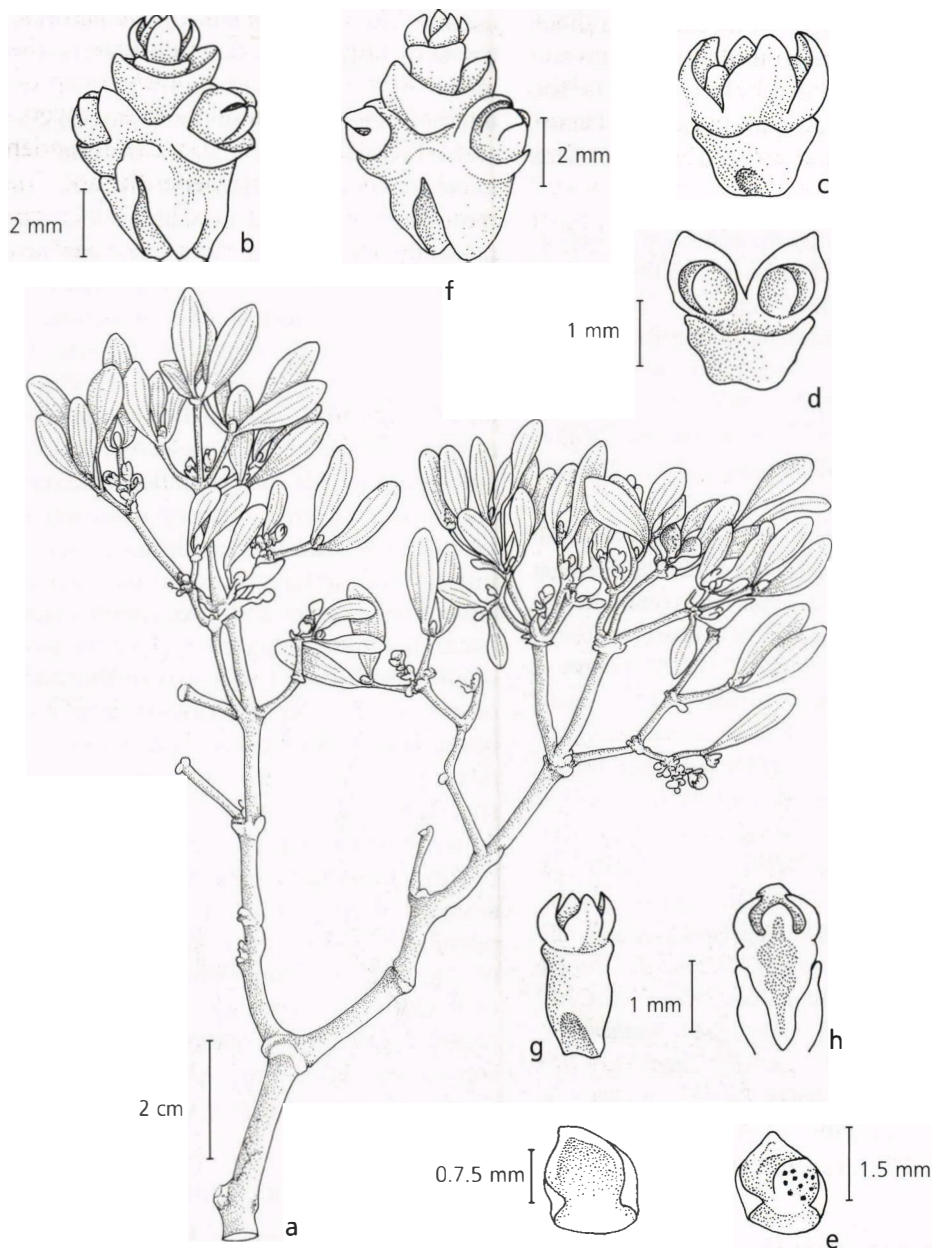


Figure 4. *Viscum album* L. – a. Habit, female plant; b. Male inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female inflorescence; g. Female flower; h. Female flower, l. s.; i. Female perianth lobe.

to the inner surface of perianth lobes; pistillode absent. *Female flowers* cymose with 3-5 flowers, protected by a pair of connate, acute bracts forming a cupule; bracts as in male inflorescence; flowers smaller than the male, oblong, c. 2 × 1 mm; perianth lobes 4, valvate, perianth tube fused with the inferior ovary; ovules not distinct; style short; stigma small and flat. *Fruits* globose or ellipsoid, 4-8 mm long, white.

Flowering & Fruiting: February-October.

Vernacular names: Harchur (Nepali).

Distribution: India (Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Assam and Arunachal Pradesh), Temperate Europe and Asia.

Chromosome number: $n = 10$ (Pisek, 1924; Steindl, 1935).

Hosts: Species of *Abies*, *Acer* and *Ulmus*.

Note: With regard to *V. album* var. *meridianum* Danser, the present authors accept the view of R.S. Rao (1957) that *V. album* is a highly polymorphous species and the slight variation in leaf characters is too insignificant to keep it as a separate variety. Hence, *V. album* var. *meridianum* is merged with *V. album* proper here.

Specimens Examined: **Himachal Pradesh**, Simla, 5000 ft., 1898, *Gamble* 62269 (DD); Simla, 7000 ft., 18.5.1890, *Lace* 167 (CAL); Jeon, 1600 m, 25.5.1962, *N.C. Nair* 21823 (BSD); Manali, 1900 m, 16.7.1972, *Bhattacharya* 48559 (BSD); Nichar, 2300 m, 28.5.1962, *N.C. Nair* 22008 (BSD); Tsella chamba, 1800 m, 27.7.1964, *N.C. Nair* 32860 (BSD); Kalpa, 2750 m, 3.6.1972, *Janardhanan* 47665 (BSD); Kushrang, 2850 m, 2.10.1971, *Janardhanan* 46380 (BSD); Baspa, 2825 m, 21.9.1971, *Janardhanan* 46148 (BSD); Shangtong, 1970 m, 6.10.1971, *Janardhanan* 46476 (BSD); Zirnar, 30.8.1963, *N.C. Nair* 30139 (BSD); Bharmisain, 26.6.1979, *Naithani* 68125 (BSD); Sangla, hill slopes, 2650 m, 15.5.1972, *Naithani* 63758 (BSD); Rohim, 1800 m, 18.7.1965, *N.C. Nair* 35790 (BSD); Bharmar, 1650 m, 23.7.1963, *V.J. Nair & Malhotra* 28332 (BSD). **Jammu & Kashmir**, Pal, 29.5.1986, *Uniyal* 80316 (BSD); Ferozpurinalal, 2.7.1956, *Rao* 401 (BSD); Kulal, 25.8.1896, *Gammie* 18220 (DD); Sangla, 10.4.1913, *Kartar Singh* 52 (DD); Jarahala, 6.10.1950, *Raizada* 19839 (DD); Jhari, 5300 ft., 16.8.1934, *Parkinson* 3906 (DD); Kagol, 14.6.1950, *Jain & Bharadwaj* 13517 (DD); Kotikanagar, 6000 ft., 1.6.1936, *Parkinson* 7037 (DD); Laran, 7000 ft., 12.9.1895, *Galan* 17526 (DD); Harsil, 2100 m, 24.11.1968, *K.M. Nair* 5307 (DD). **Nagaland**, Japonaga hills, May 1895, without collector's name 11477 (CAL). **Punjab**, Pangee, *Stoliczka s .n.* (Accn No. 395692 in CAL). **Uttaranchal**, Garhwal, 5500 ft., 26.3.1844, *Bentham* 8523 (DD); 7000 ft., 1898, *Gamble* 26736 (CAL); Almora, 2000-2200 ft., 2.10.1957, *M.A. Rau* 4743 (BSD); Tolusy, 13.8.1988, *Hajra* 87126 (BSD); Kumaon, Pithorgarh, 1750 m, 11.5.1961, *Bhattacharya* 15135 (BSD); Pangu, 1800 m, 10.3.1965, *M.A. Rau* 35346 (BSD).

Viscum angulatum Heyne ex DC., Prodr. 4: 283. 1830; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 380. 1834; Dalzell & Gibson, Bombay Fl. 110. 1861; Hook.f., Fl. Brit. India 5: 225. 1886; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2: 533. 1906; Talbot, For. Fl. Bombay 2: 422, 481. 1911; Gamble, Fl. Pres. Madras 7: 1259. 1925; C.E.C. Fischer in Rec. Bot. Surv. Ind. 11: 181. 1926; Danser in Blumea 4: 222. 1941; Santapau in Rec. Bot. Surv. India 16: 267. 1953; R.S. Rao in J. Indian Bot. Soc. 36(2): 140. 1957 & in Fl. Goa, Diu, Daman & Nager-Haveli 2: 374. 1986. **Fig. 5**

Type: Herbarium Heyne (*n. v.*).

V. ramosissimum auct. non Roxb. ex DC.: Wight, Icon. Pl. Ind. Or. 3: t. 1017 *tantum*, 1845; Hook. f., l. c. 225.

Semi-parasitic herbs, monoecious, green or yellowish, usually hanging, sometimes erect on branches and trunks of the host; stems slender, branches numerous, more than 2, rarely decussate at nodes; lower internodes terete with opposite ridges, 2-5 cm long and 1-4 mm thick, attenuate towards the extremities; internodes of the middle region distinctly tetragonal, more or less flattened, sometimes less distinct ribs present in between the prominent ones towards the apical portion. *Leaves* scaly, mostly not visible, up to 0.5 mm long or much smaller, sometimes prophylls observed at the base of branches. *Inflorescences* usually sessile, rarely subsessile, lateral, sometimes present at the extremities of branches, peduncled, usually arising from the nodes, 1-flowered, or 3-flowered, if 1-flowered, female and subtended by 2 connate bracts at base; if 3-flowered, the central one female and the laterals male with individual bracts, sometimes the inflorescence enlarged due to the development of adventitious cymes and if so, 2 more cymes present lateral to the central cyme, making the total number of inflorescences at a node to 6, further additions not observed; the bracts in all cases triangular with broad base and acute apex, measuring c. 0.75 x 0.5 mm. *Male flowers* globose, laterally compressed and wedge-shaped towards the base, c. 1 x 1 mm; perianth lobes 4, free, broadly ovate, acute at apex, c. 0.5 x 0.5 mm; bearing an anther on its inner surface; stamens 4, sessile; anthers attached to the perianth lobes, opening by pores; pistillode absent. *Female flowers* oblong, c. 1.25 x 0.5 mm; perianth lobes 4, free, broadly ovate with acute apex, c. 0.5 x 0.5 mm; staminodes absent; ovary inferior; ovules not distinct; style short, conical and stigma nipple-shaped. *Fruits* subglobose to globose, up to 4 mm in diameter with persistent bracts at base.

Flowering & Fruiting: February-August.

Venacular name: Bandaguli (Marathi).

Distribution: India (the Western Ghats of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu and southern areas of Andhra Pradesh), endemic.

Hosts: *Opilia amentacea* Roxb., *Zizyphus xylopyrus* Willd., *Olea dioica* Roxb. and *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.

Specimens Examined: **Goa**, Verlium hills, 1.10.1972, *Sahni* 3727 (DD). **Karnataka**, Mysore, Yelandir to Biliguri road, 26.4.1962, *Rao* 80359 (CAL); Chathura Kallubetta, 26.3.1876, *Clarke* 11254 (CAL); Gopaldaswamy hill, Bandipur, 1500 m, 30.1.1965, *Naithani* 23254 (MH); way to Bedaguli B.R. hills, 25.10.1978, *Ramesh & Manohar* 3846 (IISc); Pilligiri Rayan hills, 10.2.1972, *Raghavendra Rao* 1796 (IISc); Hassan, Balupet, Sakespur road, 13.3.1969, *Saldanha* 12988 (IISc); Hills beyond

Bangleshpur, 6.8.1969, *Saldanha* 14379 (IISc); Chickmagalur, Kaldenapura, 2.5.1978, *Ahmed, Ramesh & Ravindra* 876 (IISc); Shimoga, Kodajadri, 9.4.1979, *Keshavamurthy & Ramesh* 6265 (IISc); Kodagu, Mercara, 23.7.1979, *Manohar & Ramesh* 8478 (IISc). **Kerala**, Wyanad, Sultan's Battery, 900 m, 22.8.1997, *Sanjai* 104943 (MH); *ibid.* 14.2.1964, *Ellis* 18699 (MH); *ibid.* 3000 ft., Nov. 1884, *Gamble* 15436 (MH); Thamarassery, 30.7.1905, *Barber* 7400 (MH); Sugandhagiri, 9.1.1986, *Antony* 1715 (SBC); Kannur, Chandanathode, 1150 m, 30.6.1965, *Ellis* 25245 (MH); Thirunelli R.F., 700 m, 4.3.1979, *Ramachandran* 62103 (MH); Palghat, Ayankoil area, Nelliampathy R.F., 925 m, 13.2.1979, *Bhargavan* 60403 (MH); Calicut, Ottengadi, 870 m, 27.4.1978, *Nambiar* 337 (KFRI). **Tamil Nadu**, Nilgiri, Sirurghat, 4000 ft., June 1884, *Gamble* 14508 (CAL); Doddaikambai, 1800 m, 4.1.1971, *Shetty* 37701 (MH); Nadugani, 860 m, 31.1.1971, *Ellis* 37804 (MH); Gudalur, 950 m, 23.2.1973, *Vajravelu* 43709 (MH); Kotagiri, 1166 m, 6.1.1957, *K. Subramanyam* 1961 (MH); Ramanathapuram, Mudaliarathu, 1100 m, 11.12.1971, *Vajravelu* 39330 (MH); Eluttuparai, Ayyankoil, 450 m, 21.9.1971, *Vajravelu* 38647 (MH); Madurai, Sirumalai, 967 m, 25.4.1958, *K. Subramanyam* 5784 (MH); Lower Pulneys, 28.12.1898, *Barber* 2423 (MH);

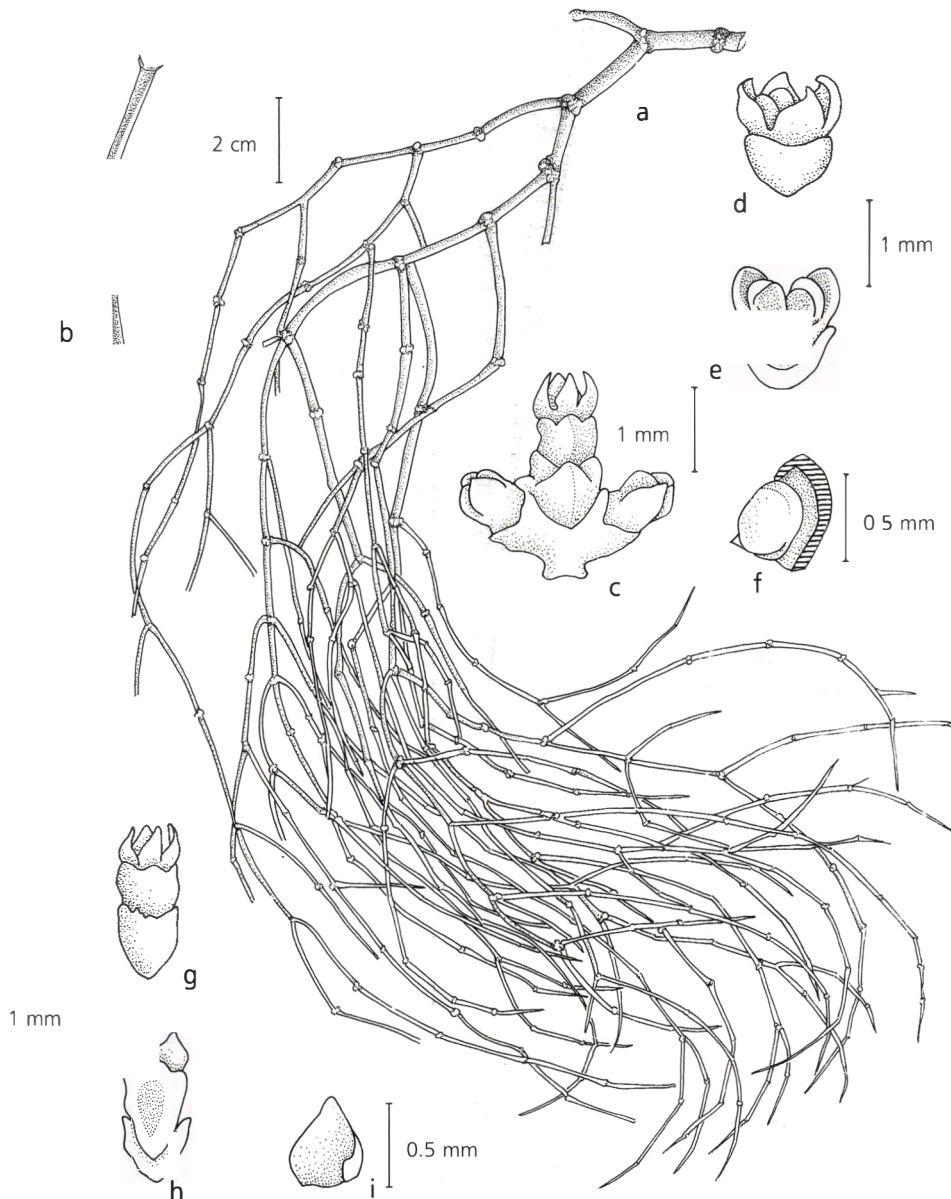


Figure 5. *Viscum angulatum* Heyne ex DC. – a. Habit; b. Portion of stem; c. Inflorescence; d. Male flower; e. Male flower, l. s.; f. Male perianth lobe; g. Female flower; h. Female flower, l. s.; i. Female perianth lobe.

Middle Pulneys, 4000 ft., *Rodriguez* 2065 (CAL); North Coimbatore, 2.3.1968, *K.N. Subramanian* 3317 (DD); Martahalli, 3200 ft., 13.2.1930, *Narayanaswamy* 19931 (MH); Poonchi, Anamalais, 24.10.1961, *Joseph* 13251 (MH).

Viscum articulatum Burm. f., Fl. Ind. 211 (311). 1768; Kurz in J. As. Soc. Bengal 40: 64. 1871; Kurz, For. Fl. Brit. Burma 2: 325. 1877 (incl. var. *dichotoma* Kurz); Hook.f., Fl. Brit. India 5: 226. 1886 incl. var. *dichotoma* Kurz); Trimen, Handb. Fl. Ceylon 3: 472. 1895; Brandis, Indian Trees 552 & 716. 1906; Gamble in J. As. Soc. Bengal 75 (Pt. 2): 389. 1914; Gamble, Indian Timbers 584. 1902; T. Cooke, Fl. Pres. Bombay 2: 553, t. 482. 1906; Duthie, Fl. Upper Gangetic Pl. 3: 65. 1915; Haines, Bot. Bihar & Orissa 5: 804. 1924; Parker, For. Fl. Punjab 441. 1924; Gamble, Fl. Pres. Madras 7: 1258, 1259. 1925 (incl. var. *dichotoma* Kurz); C.E.C. Fischer in Rec. Bot. Surv. India 11: 161, 181. 1926 (incl. var. *dichotoma* Kurz); Osmaston, For. Fl. Kumaon 465. 1927; Kanjilal, For. Fl. Philibit etc. 319. 1933; Kanjilal *et al.*, Fl. Assam 4: 119. 1940; Danser in Blumea 4: 280. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 126. 1957 & in Fl. Goa, Diu, Daman & Nager-Haveli 2: 375. 1986; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 416. 1987.

Fig. 6

Type: Java, *Pryon s. n. (n. v.)*.

Viscum nepalense Spreng., Syst. Veg. 4(2): 47. 1827; Danser in Blumea 4: 283. 1941; Santapau in Rec. Bot. Surv. India 16: 283. 1941; Santapau in Rec. Bot. Surv. India 16: 268. 1953 (incl. var. *thelocarpum* Danser); Grierson & Long, Fl. Nepal 1(1): 150. 1983.

Type: Nepal, *Wallich s. n. (K)*

Viscum dichotomum Bertero ex Spreng., Syst. Veg. 1:488. 1824 (non Gilibert 1792); Gamble in J. Asiat. Soc. Bengal 75 (Pt. 2): 389. 1914.

Type: *Viscum amuseo* Lambertiano Don misit 1822 (ex Herb. Kunth C.G. Bertero) (BD)

Viscum attenuatum DC., Prodr. 4: 284. 1830; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 380. 1834; Brandis, For. Fl. NW. & C. India 394. 1874; Trimen, Syst. Catal. Ceyl. Pl. 77. 1885.

Type: Indiae Orientalis, Herb. *Heyne*.

Viscum opuntioides Roxb., Fl. Ind. 3: 764. 1832 (non L. 1753).

Type: Roxburgh *s. n. (K)*.

Viscum liquidambaricolum Hayata, Ic. Pl. Formos. 5: 194, t. 71, 72. 1915; Danser in Blumea 4: 289. 1941; Grierson & Long, Fl. Bhutan 1(1): 150. 1983.

Type: Java, *Pryon s. n. (n. v.)*.

Semi-parasitic shrubs, monoecious, slightly yellowish, evergreen, drooping, up to 1 m or more; stems slender, much-branched; branches decussate, sometimes more than 2 at each node; lower internodes terete at basal portion, 2 - 5 cm long, up to 8 mm thick, thicker at nodes, younger upper ones slightly flattened at base, more towards the apex, flattening in a plane at right-angle to the preceding one, gradually broadening from base to tip, twisted near the base, longitudinally prominently grooved with 3-5 prominent veins, slightly thickened towards the node and truncate or rounded at apex, c. 2-6 x 0.3-1 cm. *Leaves* rudimentary, not visible, scale-like, at first erect, later spreading, obtuse, 0.5-0.75 mm long, obtuse; scales at bases of branches indistinct or absent. *Inflorescences* sessile, borne at nodes, cymose, in triads, up to 2.5 mm long and c. 2 mm broad, usually 3-flowered, rarely 5-flowered, usually with one central female flower subtended by a pair of small scaly bracts united into a cup, then a pair of lateral male flowers, one on either side below the upper bracteal cup and in the axils of another pair of lower decussately developed bracts, c. 0.75 mm long; bracts incrustated with calcareous deposits along the margins, at times another pair of similar triads developing laterally on either side of the first triad, thus up to 6 cymes at a node. *Male flowers* sessile, globose, laterally compressed towards the base, c. 1 x 1 mm; bracteoles absent; perianth lobes 4, free, ovate, acute, with another attached internally, c. 0.5 x 0.4 mm; stamens 4, filaments absent, anthers sessile, attached to the perianth lobes, c. 0.3 x 0.35 mm, dehiscing by pores; pistillode absent. *Female flowers* sessile, oblong, c. 1.5 x 1 mm; bracts 2, panduriform, coherent, c. 1 x 1 mm; perianth lobes as in male flowers; staminodes absent; ovary inferior; ovules not distinct; style short, cylindrical; stigma nipple-shaped. *Fruit* somewhat globose, globose to ovoid or oblongoid, green when young, yellow when mature, usually 4-5 mm in diameter; fruit wall nearly smooth when fresh and much wrinkled after drying, rarely warty when young, pulp highly viscous, whitish with a bright green seed.

Flowering & Fruiting: May-December.

Vernacular names: *Banda* (Marathi), *Vando* (Gujarati), *Harchur* (Nepali).

Distribution: India (Nagaland, Manipur, Meghalaya, Sikkim, Uttaranchal, W. Bengal, Bihar, Madhya Pradesh, Nager-Haveli, Daman, Maharashtra, Goa, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) Tropical Asia, Australia.

Chromosome number n = 11, 12 (Barlow, 1963).

Hosts: *Kydia calycina* Roxb., *Grewia tiliifolia* Vahl, *G. rotundifolia* Juss., *Ochna squarrosa* Bennett, *Zizyphus jujuba* Lam., *Rhus mysorensis* Roth, *Buchanania lanzan* Sprengel, *Dalbergia latifolia* Roxb., *Cassia montana* Roth, *Acacia tomentosa* Willd., *Diospyros melanoxyton* Roxb., *Santalum album* L., *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Quercus* sp. etc. and sometimes on species of Loranthaceae, particularly *Scurrula*.

Note: This species as treated here is an amalgamation of *V. articulatum*, *V. articulatum* var. *thelocarpum*, *V. liquidambaricolum* and *V. nepalense*. Danser (1941) separated the species based on their internodal length and breadth. He distinguished var. *thelocarpum* by its warty young fruits. R.S. Rao (1957) while agreeing with Danser's variety *thelocarpum* merged the rest with *V. articulatum* and provided varietal status to *V.*

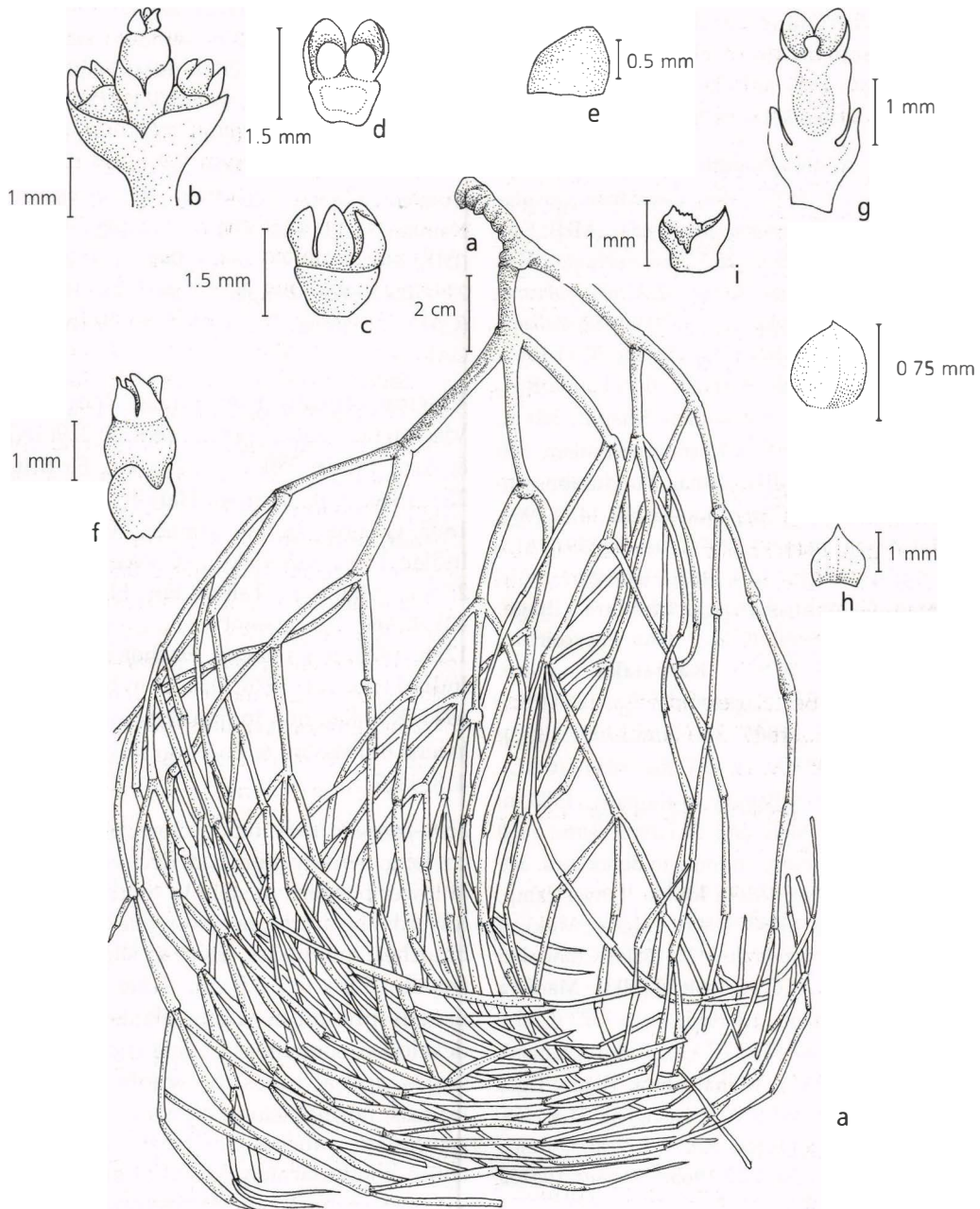


Figure 6. *Viscum articulatum* Burm.f. – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe; i. Female bracteal cup; j. Female single bract.

liquidambaricolum as *V. articulatum* var. *liquidambaricolum* saying that the fruits are oblong. While merging *V. nepalense* with *V. articulatum*, he followed Danser in keeping the var. *thelocarpum* as distinct.

The present authors after examining fresh and preserved materials found that the internodal length and breadth continuously vary and the distinctions based on them do not stand. They also found that the shape of fruits varies from globose to ovoid or oblongoid and fruits were always found smooth and not warty even in young conditions. Since the distinctions based on these characters are not dependable, the present authors treat all these taxa as one species, *V. articulatum* proper.

Specimens Examined: **Andhra Pradesh**, Chittoor, Fuel camp, 650 m, 6.1.1976, *Subbarao* 46971 (MH); Cuddapah, Guvalacheruvu, 500 m, 8.10.1958, *Subramanyam* 6847 (MH); East Godavari, Cheedipalem, 325 m, 28.5.1966, *Subbarao* 27436 (MH); Karimnagar, Kodimial, 400 m, 17.7.1964, *Subbarao* 20073 (MH); Anantapur, Kekathi R.F., 30.9.1982, *Pullaiah* 751 (MH); Warangal, Pakhal R.F., 290 m, 30.11.1960, *Sebastine* 11699 (MH); Visakhapatnam, Borukonda R.F., 9.9.1923, *Jacob* 17158 (MH); Srikakulam, Khapur, 300 m, 22.5.1979, *Subbarao* 62488 (MH); Kurnool, Srisailam, 550 m, 15.7.1963, *Ellis* 16882 (MH). **Bihar**, Pundusabuscen, 31.12.1960, *Subbarao* 22986 (CAL); Murrum hill, 14.11.1964, *Kanodia* 1201 (CAL); Koderna, 3.3.1976, *Banerji* 3319 (CAL); Someshwar hills, 7000 ft., 13.4.1963, *Thothathri* 10058 (CAL). **Daman**, Gambhirghat near Dhodara village, 12.5.1963, *M.Y. Ansari* 89246 (CAL). **Goa**, Porvoricum, 4.9.1963, *Kanodia* 89753 (CAL). **Karnataka**, Mysore, Chamundi hills, 22.9.1969, *Raghavendra Rao* 128 (IISc); Hassan, Nagapuri, 16.7.1969, *Saldanha* 14091 (IISc); Chathura Kallubetta, 18.4.1962, *R.S. Rao* 80059 (CAL). **Kerala**, Wyanad, Sultan's Battery to Pulpally, 1300 m, 22.8.1997, *Sanjai* 104944 (MH); *ibid.* 30.7.1905, *Barber* 7400 (CAL); Thiruvananthapuram, on route to Bonoccord, 340 m, 13.8.1995, *Sanjai* 104902 (MH); Idukki, Lower camp, Periyar, 27.9.1995, *Sanjai* 104908 (MH); Palghat, Mukkali forest, 475 m, 14.10.1965, *Vajravelu* 26255 (MH); Chindakki forest, 750 m, 16.10.1979, *N.C. Nair* 64680 (MH). **Madhya Pradesh**, Bilaspur, Kumkuri, 1.1.1965, *Arora* 7372 (CAL); Pali, 16.4.1965, *Panigrahi* 8593 (CAL); Indore, Chisal, 27.1.1967, *Arora* 5561 (CAL). **Maharashtra**, Thana, Tiger hill, 22.7.1968, *Billore* 116333 (CAL); Devighat, 31.5.1968, *Billore* 116091 (CAL); Wajii forest, 8.9.1964, *Venkata Reddy* 99115 (CAL); Jugar jungle, 12.3.1965, *Pataskar* 105139 (CAL). **Manipur**, Simhipara, 6000 ft., April 1882 *George Watt* 6484 (CAL). **Meghalaya**, Cherrapunji, 26.3.1960, *Das* 21336 (CAL); Barapani, 17.1.1957, *Panigrahi* 4773 (CAL); Khasia, 5600 ft., 14.7.1886, no coll. name 44243 (CAL).

Nagar Haveli, Altiale forest, 7.5.1963, *R.S. Rao* 89082 (CAL). **Nagaland**, Kenoma, Naga hills, May 1895, *no coll. name* 11750 (CAL). **Sikkim**, 2500 ft., *Hooker* s. n. (Accn No. 395753, CAL); Luchung Valley, 7000 ft., 14.9.1892, *Gammie* 1203 (CAL). **Tamil Nadu**, Tirunelveli, Courtallam, 420 m, 3.7.1996, *Sanjai* 104932 (MH); Kanniyakumari, Keeriparai to Balamore, 400 m, 20.3.1979, *Henry* 60778 (MH); Kamaraj, Bothaimettur, 650 m, 23.2.1992, *Srinivasan* 98348 (MH); Dharmapuri, Anchetty forest, Kunthu Kottai, 750 m, 26.7.1978, *Vajravelu & Rajan* 57986 (MH); Madurai-Kodaikanal road, 667 m, 10.3.1958, *Subramanyam* 5560 (MH); Coimbatore, Maruthamalai, 653 m, 5.11.1956, *Sebastine* 1200 (MH); Salem, Gundur road, Yercaud, 1340 m, 3.5.1965, *Karthikeyan* 26820 (MH); Nilgiri, Bokkapuram R.F., 1000 m, 13.18.1970, *Sharma* 35437 (MH). **Uttaranchal**, Garhwal, Chamoli, 1800 m, 27.5.1961, *Subbarao* 14850 (BSD); Almora, Siuri, 1800 m, 17.6.1923, *Parker* 2002 (DD); Kumaon, Kapkot, 1200-1300 m, *T.A. Rao* 6523 (BSD); Nainital, Haldwani, 1000 ft., 18.8.1926, *Osmaston* 42775 (DD); Mussoorie, Jharipani, 1500 m, 27.4.1957, *T.A. Rao* 2394 (BSD). **West Bengal**, Chakulia, Jan. 1881, *Gamble* 9210 (CAL); Hot spring, 17.11.1891, *Prain* s. n. (Accn No. 395744, CAL).

Viscum capitellatum Sm. in Rees, Cyclop. 37: *Viscum* no. 18. 1817; DC., Prodr. 4: 279. 1830; Wight & Arn., Prodr. 380. 1834; Hook.f., Fl. Brit. India 5: 225. 1886, *p. p.*; Trimen, Handb. Fl. Ceylon 3: 471. 1895; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2: 552. 1906, *p. p.*; Talbot, For. Fl. Pres. Bombay 2: 421, t. 480. 1911; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925, *p. p.*; C.E.C. Fischer in Rec. Bot. Surv. India 11(1): 171. 1926; Danser in Blumea 4: 309, t. 2. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 166. 1957; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 418. 1987.

Fig. 7

Semi-parasitic herbs, monoecious, evergreen, up to 15 cm long, densely branched, decussate and divaricate at lower portions of stem to more or less umbellate towards the apices; nodes swollen bearing whorl of branches; internodes terete or slightly compressed, smooth, 5-6 x 0.2-0.5 cm. *Leaves* sessile, opposite, usually present in young plants, partly normally developed, sometimes lacking entirely or reduced to scales, and at times the whole plant apparently leafless; normal leaves obovate, roundish-ovate to spatulate, subcuneate at base, rounded at apex, entire, conduplicate folded or even rolled, *c.* 1-2.5 x 0.5-0.9 cm, thick, sometimes coriaceous, dull green. *Inflorescence* cymose, lateral at the axils of leaves, hardly terminal at apices of the branches, up to 6 at each node; peduncles prominent, up to 3 mm long,

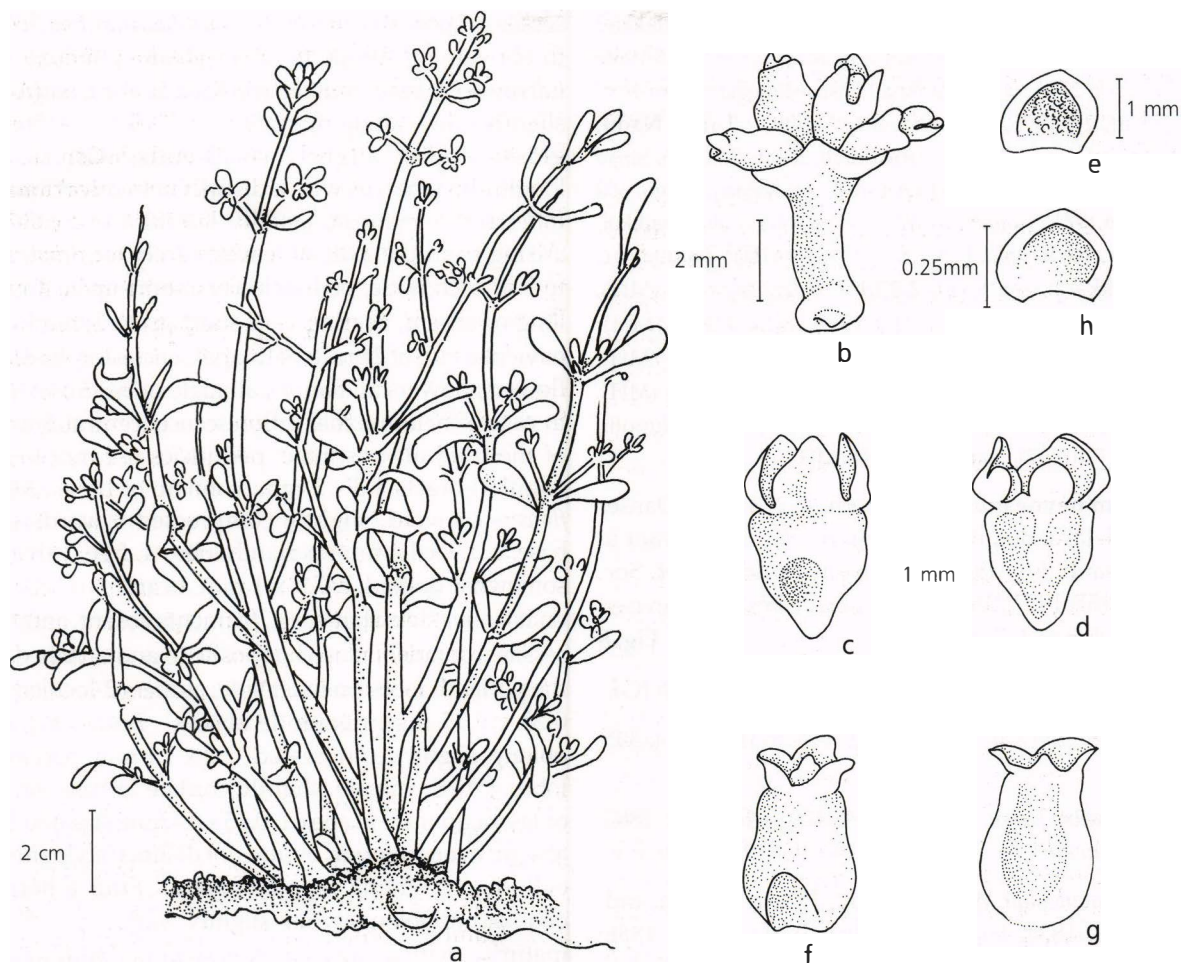


Figure 7. *Viscum capitellatum* J.E. Smith – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe.

bearing a navicular bracteate cup at its apex with 3 flowers, sometimes with up to 5 flowers, the central flower being male, the laterals female, at times the male flower absent and then the whole inflorescence having only female flowers and in such cases the central female flower possessing its own bracteal cup; occasionally another inflorescence of similar nature developing at the place of the central flower with normal flower arrangements. *Male flowers* sessile, obovate, slightly compressed towards the base, c. 2×1 mm; perianth lobes 2, free, valvate, with serrate margins bearing an anther on its inner surface, c. 1.2×1.2 mm; stamens 2, sessile; anthers 2-locular, attached to the inner surface of perianth lobes, c. 0.8×0.8 mm; pistillode absent. *Female flowers* bracteolate, oblong, elongate, c. 2.5×1 mm; perianth lobes 3, free, valvate, more or less conical, c. 0.5×0.75 mm; staminodes absent; ovary inferior; ovules not distinct; style very short; stigma conical. *Fruit* a drupe, ellipsoid or ovoid, smooth, shiny green when fresh,

distinctly constricted just below the perianth bearing a rim.

Flowering & Fruiting: February - July.

Distribution: India (Karnataka, Kerala, Tamil Nadu), Sri Lanka.

Hosts: *Dendrophthoe falcata* (L. f.) Ett., *Loranthus bracteatus* Wall., *L. tomentosus* Roth and *Erythroxylon monogynum* Roxb.

Note: This is found mainly as hyperparasites on *Dendrophthoe falcata*.

Specimens Examined: **Karnataka**, Nagalari, Dharwar, Dec. 1949, Johri 111459 (DD); Bangalore, Bennarghatta road, 2.12.1978, Saldanha & Sreenath 4853 (IISc); Bennarghatta, 4.6.1975, Saldanha 18443 (IISc); North Kanara, Thumbebedu, 4.6.1981, Ramesh & Shivaprakash 12985 (IIS); Kodagu, Arekad Kushalnagar, 4.6.1979, S.R. Ramesh & B.R. Ramesh 7956 (IISc). **Kerala**, Wayanad Dist., en route to Pulapally, 1450 m, 22.8.1997, Sanjai 104941 (MH); Kozhikode Dist., Calicut,

Idimuzhikkal, 25.5.1971, *Sivarajan 1115* (CALI); Palakkad Dist., Bhavani bank, Attappady R.F. 525 m, 31.5.1966, *Vajravelu 27742* (MH); Palakkad Dist., Mangalam dam area, 175 m, 2.3.1975, *Vajravelu 46144* (MH). **Tamil Nadu**, Kanniyakumari, Thadikaramkonam, 200 m, 2.7.1996, *Sanjai 104931* (MH); Nilgiri, Mulli forest, Attappady range, 600 m, 27.6.1974, *Vajravelu 44988* (MH); Salem, Hoganaikkal, 260 m, 15.3.1965, *Vajravelu 23564* (MH); Thanjavur, Kodaikkarai, sea level, 2.2.1987, *Ragupathy 154* (MH); Kodaikadu, sea level, 21.1.1961, *Ellis 11819* (MH); Coimbatore, Iruttupallam, 18.6.1910, *Barber 8552* (MH); Iruttupallam to Vellapathy, 31.5.1911, *Barber 8640* (MH); 3500 ft., 2.6.1905, *Fischer 24* (CAL); Tirunelveli, Chellupulli, 250 m, 7.10.1971, *Vajravelu 38904* (MH).

Viscum heyneanum DC., Prodr. 4: 278. 1830; Danser in Bull. Jard. Bot. Btzg. (ser. 3), 16: 51. 1938; Danser in Blumea 4: 301. 1941; R.S.Rao in J. Indian Bot. Soc. 36(2): 157. 1957; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 417. 1987. **Fig. 8**

Type: Indiae Orientalis, *De Candolle Herbarium* (G).

V. heyneanum var. *liocarpum* Danser in Blumea 4: 305. 1941.

Type: India, Nilgiris, Koorgooch (Kaguchi), Nov. 1883, *M.A. Lawson s. n.* (MH: Accn No. 45849!, K - n. v.)

V. verruculosum Wight & Arn., Prodr. Fl. Pen. Ind. Or. 379. 1834; Hook.f., Fl. Brit. India 5: 224. 1886; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; Talbot in For. Fl. Bombay 2: 419. 1911; Gamble, Fl. Pres. Madras 7: 1257. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11: 180. 1926; Alston in Trimen, Handb. Fl. Ceylon 6: 250. 1931.

Type: Dindigul Hills, *Wight s. n.* (K - n. v.).

V. orbiculatum Wight, Ic. Pl. Ind. Or. 3: 13, t. 1016. 1845; Hook.f., Fl. Brit. India 5: 224. 1886; Gamble, Indian Timbers 594. 1902; Brandis, Indian Trees 552. 1906; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11: 16b. 201. 1935.

Type: Nilghiri hills, *Wight s. n.* (K - n. v.).

V. orientale auct. non Willd. 1806: Thw., Enum. Pl. Zey. 136. 1859 (non DC. 1830); Brandis, For. Fl. NW. & C. India 393. 1874, p. p.; Hook.f., Fl. Brit. India 5: 224. 1886, p. p.;

Semi-parasitic herbs, evergreen monoecious, up to 40 cm long or even more, much branched; branches dense and sometimes apically whorled, often decussate towards apices; internodes terete at basal regions of the plant, slightly flattened and prominently longitudinally grooved towards the upper portion, c. 4 x 0.5 cm with swollen nodes. *Leaves*

sessile or subsessile, normal, opposite, roundish ovate to obovate or elliptic to oblanceolate, attenuate to narrowed at base, acute to rounded at apex, entire or slightly wavy along margins, c. 1.5 - 3 x .6-1.5 cm, glossy above, slightly coriaceous, with 3 - 5 longitudinal nerves with a distinct network of veins. *Inflorescence* cymose, usually lateral and axillary, arising from the axils of leaves, rarely terminal, up to 5 at each node; peduncle very short up to 4 mm long or absent, bearing very short up to 2 mm long navicular cup of 2 bracts at its apex, enclosing 3 sessile flowers; flowers all female, all male or heterosexual, in case of heterosexual inflorescence, central flower of the triad always male; peduncles 0-4 mm long, angular; bracts 1.5 - 2 mm, connate at base. *Male flowers* obovoid, slightly compressed towards the base, c. 1.9 x 1.4 mm; perianth lobes 4, free, valvate, somewhat deltoid, c. 7.5 x 1 mm, bearing an anther on its inner side; stamens 4, filaments absent, anthers sessile, roundish, placed opposite to and attached to the perianth lobes on inner side; anthers 2-loculed, c. 0.25 x 0.25 mm; pistillode absent. *Female flowers* oblong, slightly compressed, c. 2 x 1.1 mm; perianth lobes 4, free, valvate, slightly cordate at base, more or less acuminate at apex, c. 0.75 x 0.4 mm; staminodes absent; ovary inferior; ovules not distinct; style short, cylindrical; stigma nipple-shaped. *Fruit* a berry, ellipsoid to oblong-ovoid, slightly warty, smooth at maturity, with a crown of persistent perianth lobes, c. 5 x 2 mm, withering off at a later stage.

Flowering & Fruiting: February-July.

Distribution: India (Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Andaman & Nicobar Islands), Sri Lanka.

Hosts: *Punica granatum* L., *Helecteris isora* L., *Rhizophora* sp., *Memecylon umbellatum* Burm., *Mallotus philippinensis* (Lam.) Muell., *Grewia flavescens* Juss., *Syzygium jambolanum* (Lam.) DC., etc.

Note: Danser (1941) treated this species under *V. orbiculatum* and R.S. Rao (1957) under *V. verruculosum*. Both these species are here considered synonymous to *V. heyneanum*, since the distinctive features that supposedly separated them were found variable and overlapping among *V. heyneanum*, *V. verruculosum* and *V. orbiculatum*. The present authors studied live materials but could not make any distinction among the three species.

V. heyneanum var. *liocarpum* proposed by Danser based on warty or smooth fruits does not stand, as fruits in this species can be warty or smooth, depending on maturity as pointed out by R. S. Rao (1957).

The present authors discovered 3 types of inflorescences in this species and found them on one and the same plant. They are all female, all male or heterosexual. In the heterosexual inflorescence, contrary to the views of Danser (1941) and R.S. Rao (1957), the central flower was found male instead of female. This character was mentioned as a distinctive feature of *V. orbiculatum* by Gamble. Further, peduncled triads were attributed to *V. verruculosum*, but since a continuous gradation exists in the length

of peduncle, (from 0 to 4 mm) this attribute does not stand as a distinguishing character.

Specimens Examined: **Andaman & Nicobar Islands**, South Andamans, Poona Nallah, 6.9.1982, *D.K. Hore* 9121 (PBL). **Andhra Pradesh**, Chittoor, 3500 ft., 28.4.1918, *Fischer* 4319 (CAL). **Karnataka**, North Canara, 10.3.1896, *Talbot* 3573 (CAL); Mysore, 1850, without collector's name *s. n.* (Accn No. 45795, MH). **Kerala**, Kottayam, Kumarakam, up to 5m, 4.5.1996, *Sanjai* 104927 (MH); Thiruvananthapuram, Kulathoopuzha, 750 m, 26.4.1996, *Sanjai* 104923 (MH);

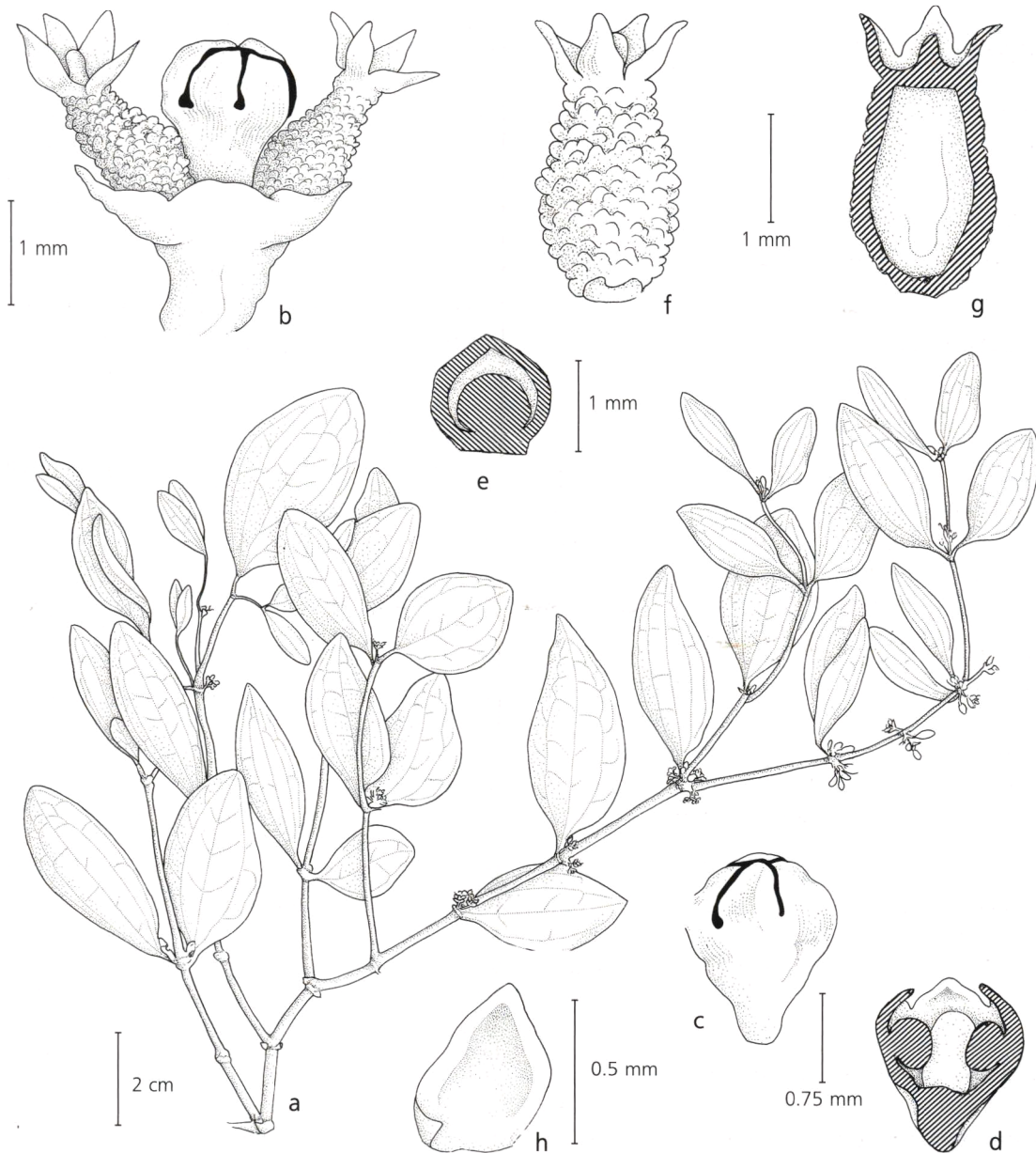


Figure 8. *Viscum heyneanum* DC. – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe.

Idukki, Anjuruli, Thekkad, 900 m, 4.10.1972, *Sharma 42403* (MH); Calicut, Odapallam - Chedalet, 900 m, 14.8.1964, *Ellis 19979* (MH); Trichur, Athirapally R.F., 100 m, 19.3.1966, *Ramamurthy 27011* (MH). **Tamil Nadu**, Coimbatore, 2700 ft., 20.12.1905, *Fischer 805* (CAL); Hassanur, 3000 ft., 9.3.1931, *Jacob 179* (MH); Sadvayal, 400 m, 6.8.1960, *Henry 99* (MH); South Arcot, Melpat, 28.9.1899, *Barber 1082* (MH); Nilgiri Dist., Avalanche, 2000 m, 14.6.1970, *Shetty 34228* (MH); Bikkatti, 5000 ft., May 1899, *Gamble 20669* (MH); Bokkapuram R.F., 1025 m, 12.8.1970, *Sharma 35381* (MH); Tirunelveli, lower Kannikatti, 15.7.1964, *Henry 19883* (MH); Tiger falls, Mancholai, 466 m, 11.10.1957, *Sebastine 4371* (MH); Kanniyakumari, on way to Sengammal estate, 500 m, 27.7.1961, *Shetty 27999* (MH); Madurai, way to Sirumalai, 967 m, 25.4.1968, *Subramanyam 5774* (MH); Vannathiparai, 1400 ft., 18.9.1923, *Jacob 17741* (MH); Madurai Dist., Pombari Valley, Pulney hills, 15 May 1899, *Bourne 1767* (MH acc. No. 45794); Pulney, July 1897, *Bourne s. n.* (Accn. o. 395916, CAL); Coimbatore Dist., Anamalais, Punachihill, June 1883, *Gamble 12114* (CAL).

Viscum loranthe Elmer, Leaflets Philipp. Bot. 8: 3089. 1919; Merrill, Enum. Philip. Fl. Pl. 2: 113. 1923; Danser in Bull. Jard. Bot. Btzg. (Ser. 3), 11: 464. t. 27 b, c. 1931; Danser in Blumea 4: 295. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 144. 1957.

Fig. 9

Type: India, Kumaon, East Almora Div., Nalia Reserve, 6000 ft., 8.1.1933, *Osmaston 1536* (DD!).

Semi-parasitic herbs, monoecious, dark green found exclusively on lorantheous members, moderately robust, up to 25 cm high; stems rigid, much branched at base, branches decussate; internodes terete, lower internodes slightly longitudinally ridged, c. 2-2.5 x 0.3x0.4 cm, becoming shorter towards the apices, the uppermost about 4-6 mm long. *Leaves* rudimentary or even absent. *Inflorescences* sessile, forming a cluster of cymes at the apex of each internode just below the node, cyme 3-flowered, sessile, subtended by a cupule, c. 0.5 mm, the central flower female, the laterals male, at times all flowers female; later subsequent cymes developing on either side of the first cyme to form a cluster around the node. *Male flowers* ovoid, c. 0.75 mm long; perianth lobes 4, free, broad at base and acute at apex. *Female flowers* oblongoid, c. 1 mm long; perianth lobes 4, triangular and acute at apex; ovary inferior, verruculose; ovules not distinct; style very short with nipple-shaped stigma. *Fruits* drupaceous, urceolate, sessile, subglobose to globose, coarsely wrinkled, crowned by persistent perianth lobes, c. 4x3 mm.

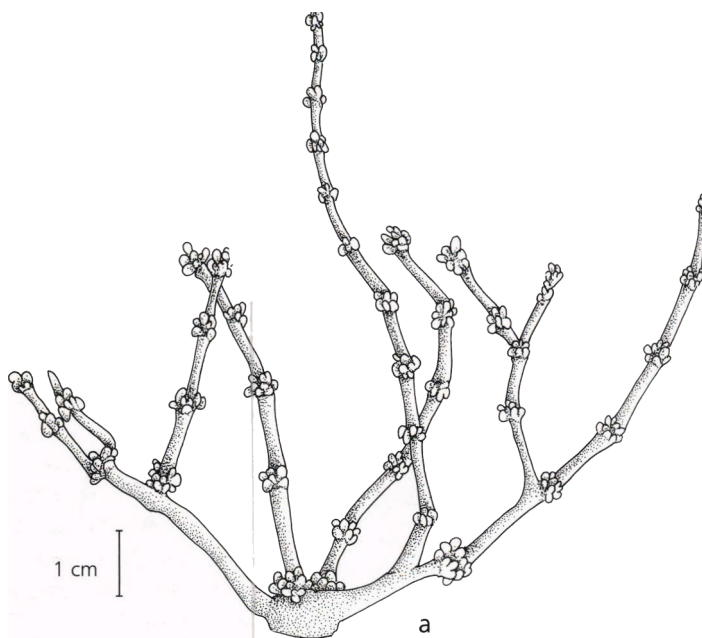


Figure 9. *Viscum loranthe* Elmer – a. Habit.

Type: Luzon, Mt. Maquiling, *Elmer 17777* (n. v.).

Viscum osmastonii Raizada in Indian For. 60: 537. t. 55. 1934. *Viscum* sp. Osmaston, Fl. Kumaon 465. 1927.

Flowering & Fruiting: May - September.

Distribution: India (Western Himalayas, Assam, Manipur), Myanmar, Malaysia.

Hosts: Taxillus vestitus (Wall.) Danser, *Scurrula cordifolia* (Wall.) Don, *S. pulverulenta* and *Dendrophthoe falcata* (L. f.) Ett.

Specimens Examined: Manipur, Kongpokpi, 3400 ft., 10.2.1954, Deb 1714 (CAL). *Uttaranchal*, Almora, 6000 ft., 8.1.1933, Osmaston 1536 (DD); Kumaon, Kherapattil, 1000 m, 10.3.1965, M.A. Rau 35350 (BSD); Dehradun, 7.7.1899, Mackinnon s. n. (Accn No. 395836, CAL).

Viscum malurianum Sanjai & N.P. Balakr., *Nordic J. Bot.* 21 (3): 267. f. 1. 2001.

Type: India, Karnataka, Malur, 850 m, near the Railway Station on Ficus benghalensis, 20.10.1995, Sanjai 104911 (Holotype CAL; Isotype MH).

Semi-parasitic shrubs, monoecious, leafless, light to dark green, drooping from branches and trunks of host trees; stems densely branched, basal branches dichotomous, upper ones sometimes trichotomous or even irregular, woody, brittle at nodes, slightly fibrous along the internodes, terete and wrinkled towards base, very rarely flattened and smooth towards the upper portion; internodes 1.5-3.5 cm long, 2-8 mm wide; nodes slightly swollen, sometimes with minute scale-like structures and calcareous margins. *Leaves* absent. *Inflorescence* cymose, usually arising from node, but also terminal on short branches from nodes and at the extremities of branches, up to 8 at each node, encircling it, clustered, sessile, usually with a central female flower and two lateral male flowers, enclosed in a depression at the node. *Male flowers* sessile, c. 3 x 2 mm, enclosed in a 4-lobed involucre cup, c. 1.5 x 1.5 mm, each lobe triangular, pointed at tip, serrate along margins, c. 1 x 1 mm, enclosed in another 2-lobed bracteal cupule of c. 1.75 x 2 mm; each bract slightly triangular, c. 2 x 2 mm, with some hairs and calcareous deposits; perianth lobes 4, valvate, suborbicular, obtuse at apex, c. 1.5 x 1 mm; stamens 4, sessile, anther lobes united, without interstitium, c. 1x0.5 mm, attached along the back side to the inner side of perianth lobes, opening by pores, placed opposite to perianth lobes; pistillode absent. *Female flowers* sessile, c. 4 x 2 mm, protected by two consecutive coverings, the outer formed of a 4-lobed involucre cup, c. 1.5 x 1.5 mm, almost flower-like with a central seat, each lobe triangular, c. 1 x 1 mm; the upper cup formed by fusion of 2 bracts, c. 2 x 2.5 mm; bracts almost triangular, with grooved margins, c. 2 x 2 mm and with some calcareous deposits; perianth lobes 4, free, valvate, triangular, ovate, acuminate at apex, c. 0.75 x 0.5 mm; staminodes absent; ovary inferior, c. 2 x 1 mm; ovules not distinct; style short; stigma round. *Fruit* a berry,

globose to ovoid, c. 3-5 mm in diameter with persistent bracteal cup.

Flowering & Fruiting: March-July.

Distribution: India (Karnataka), endemic.

Note: This species is so far reported only from the type locality. It is allied to V. ramosissimum but differs from it as shown below:

V. ramosissimum	V. malurianum
Branches slender and weak	Branches thick and strong
Inflorescences lateral at two sides of the node	Inflorescences placed around the nodes
Female flowers c. 1.75 x 0.75 - 1 mm	Female flowers c. 4 x 2 mm
Male flowers 1 - 1.25 x 1 - 1.25 mm	Male flowers c. 3 x 2 mm
Fruits without persistent bracteal cup	Fruits with persistent bracteal cup

Specimens Examined: Karnataka, Malur, 850 m, near the Railway Station on Ficus benghalensis, 20.10.1995, Sanjai 104911 (CAL, MH).

Viscum monoicum Roxb. [Hort. Beng. 105. 1814, *nom. nud.*] ex DC., Prodr. 4: 278. 1830; Roxb., Fl. Ind. (ed. 2) 3: 763. 1832; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 379. 1834; Brandis, For. Fl. NW. & C. India 393. 1874; Hook. f., Fl. Brit. India 5: 224. 1886; Clarke in J. Linn. Soc. Bot. 25: 64. 1889; Trimen, Handb. Fl. Ceylon 3: 471. 1895; Gamble, Indian Timbers 584. 1902; Burkill in Rec. Bot. Surv. India 4(4): 77, 129. 1904; T. Cooke, Fl. Pres. Bombay 2: 552. 1906, p. p.; Brandis, Indian Trees 552, 716. 1906; Gamble in J. Asiat. Soc. Bengal 75(2): 386. 1904; Duthie, Fl. Upper Ganget. Plain 3(1): 68. 1915; Haines, Bot. Bihar & Orissa 5: 803. 1924; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11(1): 161. 1926; Cowan in Rec. Bot. Surv. India 11(2): 221. 1928; Kanjilal, For. Fl. Philibit etc. 319. 1933; Kanjilal et al., Fl. Assam 4: 118. 1940; Danser in Blumea 4: 305. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 160. 1957; Grierson & Long, Fl. Bhutan 1(1): 150. 1983; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 420. 1987.

Type: Roxburgh 1181 (K - n. v.).

V. falcatum Wall. [Cat. no. 492. 1829, *nom. nud.*] ex DC., Prodr. 4: 278. 1830.

Type: India, Mont. Pundua, Wallich s. n. (G-microfishe!)

V. confertum Roxb. [Hort. Beng. 105. 1814, *nom. nud.*] Fl. Ind. (ed. 2), 3: 764. 1832; (ed. 3), 715. 1874.

V. benghalense Roxb. ex Wight & Arn., Prodr. 379. 1834.

V. orientale auct. non Willd.: Talbot, For. Fl. Bombay 2: 421. 1911.

Semi-parasitic shrubs, monoecious, evergreen, 30-75 cm long, drooping from the branches and trunks of the host, pale green and slightly yellowish when dry, much branched, a pair of prophylls, usually indistinct, present at the base of every branch, decussate towards base and dichotomous towards apices; internodes terete, 3-7 cm long, 2-5 mm wide, usually smooth, sometimes longitudinally ribbed; nodes swollen. *Leaves* normal, subsessile, opposite, asymmetric, elliptic to lanceolate, slightly falcate, acute to attenuate at base, acute or subacuminate at apex, 5-10 x 1-3 cm, thinly coriaceous, entire, or wavy along margins, dull or slightly shiny; nerves curvilinear, palmately 5-nerved from the base. *Inflorescences* cymose at axils of leaves, aggregated at nodes, up to 6 at each node, sessile or subsessile; peduncle up to 2 mm long, bearing a boat-shaped pair of connate acute bracts of 1 mm long at its apex, enclosing a cluster of 3 flowers, the central one male, the laterals female or all female. *Male flowers* sessile, oblong, compressed below, c. 2 x 1 mm; perianth lobes 4, free, valvate, slightly cordate at base and apiculate at apex, c. 1.25 x 1 mm, bearing an anther on its inner surface; stamens 4, sessile; anthers 2-loculed, placed opposite to and attached to the inner side of perianth lobes; pistillode absent. *Female flowers* clavate or obovate, attenuate to nearly rounded at base, c. 2.5 x 1 mm; perianth with 4 erect, free, valvate, short triangular lobes, c. 1 x 0.75 mm; staminodes absent; ovary inferior; ovules not distinct; style short; stigma capitate. *Fruits* usually ellipsoid, oblong, attenuate to round at base, truncate at apex, c. 4-6 x 2-3 mm, green, glossy, distinctly smooth.

Flowering & Fruiting: Almost throughout the year, mainly during May - September.

Veracular name: Pullurivi (Tamil).

Distribution: India (northeast-central-west-southwards to southern India), Bhutan, Sri Lanka.

Uses: The leaves of plants parasitising *Strychnos nux-vomica* trees possess poisonous properties (Wealth of India - Raw Materials, 1976). They are dried and used as a substitute for the medicinal chemicals, strychnine and brucine, obtained from *Strychnos* trees.

Note: R.S. Rao (1957), probably due to lack of fresh collections, classified this species in a group along

with that of *V. orientale* Willd. on the basis that in both the central flower of the triad was female. Instead, J.D. Hooker (1886) correctly pointed out that the plant had a central male flower in the triad or sometimes absent. This feature was evident in the collections made by the first author.

Hosts: *Macaranga indica* L., *Meyna spinosa* Roxb. ex Link., *Murraya koenigii* (L.) Spreng., *Atalantia monophylla* (L.) DC., *Zizyphus oenoplia* Miller, *Pongamia glabra* Vent., *Acacia caesia* (L.) Willd., *Albizia odoratissima* (L. f.) Benth., *Albizia amara* (Roxb.) Boiv., *Punica granatum* L., *Adina cordifolia* (Roxb.) Brandis, *Schrebera sweitenioides* Roxb., *Wrightia tinctoria* (Roxb.) R. Br., *W. tomentosa* (Roxb.) Roem. & Schult., *Strychnos nux-vomica* L. and *Santalum album* L.

Specimens Examined: **Andaman & Nicobar Islands**, South Andamans, Nilambur, 10 m, 22.7.1975, *Bhargava* 2473 (CAL, PBL); near Shoal Bay, sea level, 16.3.1976, *Balakrishnan & Bhargava* 3626 (PBL). **Andhra Pradesh**, Chittoor, 3500 ft., 28.4.1918, *Fischer* 4319 (CAL). **Assam**, Chaga hill, March 1899, *Prain* 742 (CAL); Katakhal R.F., 1.9.1957, *R.S. Rao* 9078 (CAL). **Bihar**, Duli forest, 20.11.1964, *Kanodia* 1303 (CAL); Sonapi, 3.1.1961, *Subbarao* 23134 (CAL); Hyarbagh, 24.11.1891, *Prain* s. n. (CAL herb. Accn no. 70830). **Karnataka**: Hassan, Chikkanahalli-Archalli road, 900 m, 7.8.1970, *Saldanha & Ramamoorthy* 470 (IISc); Dharwar, April 1918, *Bell* 3889 (DD); North Kanara, Sampkhand, 1600 ft., October 1904, *Talbot* 780 (CAL). **Kerala**, Idukki, Thankakanam estate, Vagamun, 1100 m, 20.2.1996, *Sanjai* 104919 (MH); Udumbancholai, 5000 ft., Dec. 1910, *Meebold* 13039 (CAL); Wyanad, Kalpetta, 1200 m, 21.8.1997, *Sanjai* 104939 (MH); Palghat, Siruvani western slopes, 625 m, 29.5.1979, *Vajravelu* 62865 (MH). **Madhya Pradesh**, Bilaspur, Ghagra, 23.4.1965, *Arora* 8930 (CAL). **Manipur**, Rongtang, 14.3.1838, *Biswas* 4810 (CAL). **Meghalaya**, Khasi, 3000 ft., *Thomson* s. n. (Accn No. 395954, CAL). **Orissa**, Keonjargarh, 7.7.1957, *Panigrahi* 8703 (CAL); Chakala, 21.2.1958, *Panigrahi* 12689 (CAL); Rebnalpalaspal, 30.6.1957, *Panigrahi* 8451 (CAL); Bharaj Bossa, 2600 ft., 13.2.1958, *Panigrahi* 12265 (CAL); Daringbad, 2.2.1900, *Barber* 1361 (MH). **Mizoram**, Aijal, protected forests, 3500 ft., 11.1.1963, *Deb* 30511 (CAL). **Sikkim**, without exact locality, 2400 ft., *Hooker* s. n. (CAL herb. Accn no. 395957). **Tamil Nadu**, Coimbatore, 2000 ft., 1.8.1903, *Fischer* 103 (CAL); Kowattiyasi, 2350 ft., 25.9.1916, *Fischer* 4000 (CAL); Nilgiri hills, Gudalur, 3000 ft., 9.11.1890, *Barber* s. n. (MH herb. Accn no. 45973); Madras, Rangi hill, 2000 ft. Feb. 1883, *Gamble* 16012 (DD); Tirunelveli, Mancholai, 1066 m, 17.10.1957, *Sebastine* 4530 (MH). **Tripura**, Agartala, 500-800 ft., 30.12.1914, *Debbarmann* 511 (CAL); Pungchen, 7.7.1961, *Deb* 26569 (CAL). **West Bengal**, Lohadigga, 2000 ft., Nov. 1880, *Gamble* 8711 (CAL); Chota Nagpur, 1000 ft., 9.4.1884, *Clarke* 34631 (CAL).

Viscum mysorens Gamble in Kew Bull. 329. 1925 & in Fl. Pres. Madras 7: 1257, 1259. 1925; Danser in Blumea 4: 279. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 125. 1957.

Fig. 10

Type: South India, Mysore, Arisikere, 600 m, Feb. 1908, *Meebold 8207* (K-Photograph!).

Semi-parasitic herbs possessing a golden yellow colour on all parts; stems slender, over 50 cm long, dichotomously or trichotomously branched at nearly all the nodes, basal portion terete, 5-6 cm long, up to 3 mm thick, longitudinally wrinkled, hardly striped, slightly thickened at the nodes, the young internodes

usually 2.5-4 cm long, distinctly longitudinally striped with shallow grooves, nearly terete, or slightly flattened near the base, 1-1.5 mm broad, strongly alternately flattened and double-edged towards the apex, 2-3 mm broad. *Leaves* of two types, the larger leaves normally developed only at some node, the largest leaf obtusely lanceolate to spatulate, up to 4x1 cm in size, often smaller, rounded at apex, decurrent into a short petiole, rather thickly coriaceous, with 3 longitudinal nerves, more distinct above than beneath and connected by indistinct veins; petioles abaxially rounded and adaxially flat or canaliculate; the scale-like leaves appearing at most

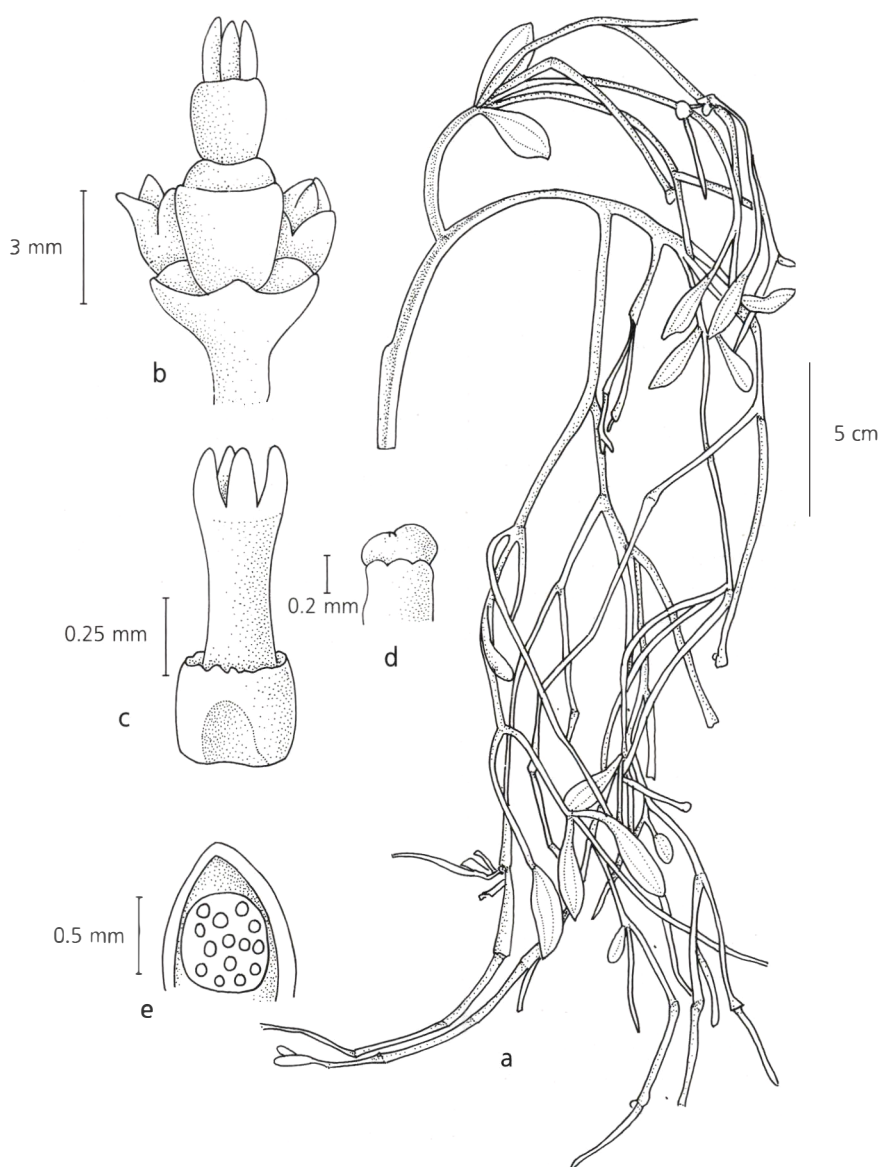


Figure 10. *Viscum mysorens* Gamble – a. Habit; b. Inflorescence; c. Female flower; d. Style and stigma; e. Male perianth lobe with anther.

of the nodes, nearly 0.5 mm long, acute; prophylls 2 in number, noticed at the bases of all ramifications. *Inflorescences* rarely terminal, usually axillary or at both sides of the axillary ones, sessile or shortly pedunculate, 1-3-flowered cymes; peduncle flattened, up to 1 mm long and broad, bearing at its apex 2 opposite acute bracts forming together a navicular cup up to 2 mm long, each bearing one sessile flower in its axil, devoid of a bracteal cup and usually male, rarely female, nearly 1 mm long and compressed between the bracts and the middle flower; the middle flower female, rarely sessile and without bracteal cup, usually very shortly pedicellate and surrounded by a cup composed of two small bracts alternating with those of the lower pair. *Fruits* unknown.

Distribution: Known only from the type locality in India.

Note: Danser (1941) who examined the type material at Kew held the opinion that this was a very distinct species. He further observed that the flattening of the articulations was intermediate between the leafy and the leafless forms, just like *Viscum wrayi* Gamble of Malaya, but was entirely different from this species and its allies by the structure of its inflorescence. R.S. Rao (1957), while revising the Indo-Malayan species of *Viscum*, could not see any material of *V. mysorensis* Gamble, and he followed the description given by Danser (1941).

The original specimen could not be seen and the description given here is a combination of the protologue and Danser's description. The first author made intensive search for this species at 10 km radius of Arisikere in Karnataka but could not locate any Viscaceae in the area. No one seems to have collected this species after the original collection of Meebold.

Most of the areas explored by Meebold have been converted to coconut plantations and fields of *Sorghum* and other crops.

Viscum orientale Willd., Sp. Pl. 4(2): 737. 1805; Persoon, Synopsis Plant. 2: 613. 1807; Poirlet in Lamarck, Encycl. Meth. Suppl. 2: 860. 1811; DC., Prodr., 4: 278. 1830, *p. p.*; Wight & Arn., Prodr. 379. 1834; Oliver in J. Linn. Soc., Bot. 7: 103. 1864; Brandis, For. Fl. NW. & C. India 393. 1874, *p. p.*; Hook.f., Fl. Brit. India 5: 224. 1886, *p. p.*; Gamble, Indian Timbers 584. 1902, *p. p.*; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2(3): 552. 1906; Haines, Bot. Bihar & Orissa 5: 803. 1924; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11(1): 161, t. 1, 2, 4. 1926; Danser in Bull. Jard. Bot. Btzg. ser. 3, 16(1): 53. 1938, *p. p.*; Danser in Blumea 4: 299. 1941; Wiens in Dassan. & Fosberg, Revised Fl.

Ceylon 6: 419. 1987.

Fig. 11

Type: Indiae Orientalis, Willdenow 18293 (BD - Microfiche!).

Viscum verticillatum Roxb. [Hort. Beng. 105. 1814, nom. nud.] Fl. Ind. ed. 2: 764. 1832 & ed. 3: 715. 1814.

Type: Wallich 491C (K).

Viscum verruculosum auct. non Wight & Arn. 1834: Talbot, For. Fl. Bombay 2: 419. 1911, *p. p.*

Semi-parasitic herbs, monoecious dark green, up to 50 cm long and rarely more, bushy in appearance, with strongly branched stem, the lower internodes terete and sometimes slightly striped, up to 6 cm long, c. 6 mm thick, internodes generally terete, somewhat angular and reduced in diameter and length towards the apices, 2-3 cm long, 2-3 mm wide; nodes swollen, branches decussate towards the basal region, but often more with additional branches on the nodes, more dichotomously or even umbellately arranged towards the extremities of the stem. *Leaves* opposite, subsessile, ovate or oblong, cuneate and distinctly tapering into a short or very short petiole at base, obtuse, rounded or even acuminate at apex, entire, 2-6 x 0.6-3 cm, thinly coriaceous, usually with 3 distinct longitudinal and curved nerves which are more distinct above; prophylls present at the bases of all the branchings. *Inflorescences* cymose, lateral on the nodes, with up to 8 cymes at each node, also terminal on the weak extremities of twigs; peduncles 1-5 mm long, distinct, slightly grooved, bearing at its apex a navicular cup formed of 2 bracts which are connate at base, enclosing usually 3, but rarely up to 5 flowers, the central flower being female and larger, the laterals small and male. *Male flowers* short and strongly compressed, obovate with a rounded or even flat base, c. 2-5 x 1 mm; perianth lobes 4, free, valvate, slightly cordate at base with acute apex, c. 0.9 x 0.75 mm, with an anther attached on the inner side; stamens 4, sessile, round, attached to perianth lobes internally, opening by pores, pistillode absent. *Female flowers* oblong, c. 3 x 1 mm, perianth lobes as in male flowers; staminodes absent; ovary inferior; ovules not distinct; style short, deciduous; stigma capitate. *Fruits* roundish to oblong, ovoid, contracted at apex, c. 6 x 5 mm, surface dull with minute granules, smooth, never warty.

Flowering & Fruiting: January-July. In many areas it was found to bear flowers or fruits throughout the year.

Vernacular names: *Banda* (Hindi), *Chandra badamika*, *Sundara badanika* (Telugu), *Banda* (Santhal), *Pilluli* (Tamil).

Distribution: India (North-east to the Peninsula, central India, southwards Andaman & Nicobar Islands), Sri Lanka.

Chromosome number 10-13 (Schaeppi & Steindl, 1945 Barlow & Wiens, 1971).

Hosts: *Albizia amara* (Roxb.) Boiv., *Excoecaria agallocha* L., *Pongamia pinnata* (L.) Pierre, *Securinega virosa* (Willd.) Baill., *Strychnos nux-vomica* L., *Wrightia tinctoria* (Roxb.) R. Br., *Grewia tiliaefolia* Vahl, *Helecteris*

isora L., *Capparis sepiaria* L., *Shorea tumbagaia* Roxb., *Citrus decumana* (L.) L., *Zizyphus oenopia* Miller, *Scutia myrtina* (Burm.) Kurz, *Aphania bifoliata* (Thw.) Radlk., *Lepisanthes tetraphylla* (Vahl) Radlk., *Mangifera indica* L., *Acacia caesia* (L.) Willd., *Albizia odoratissima* (L. f.) Benth., *Memecylon umbellatum* Burm., *Punica granatum* L., *Gardenia gummifera* L. f., *Diospyros ebenum* Koenig, *Cryptolepis grandiflora* Wight, *Decalepis hamiltoniana* Wight & Arn., *Elaeagnus latifolia* Bedd., *Santalum album* L., *Cleistanthus collinus* (Roxb.) Benth. ex Hook. f.,

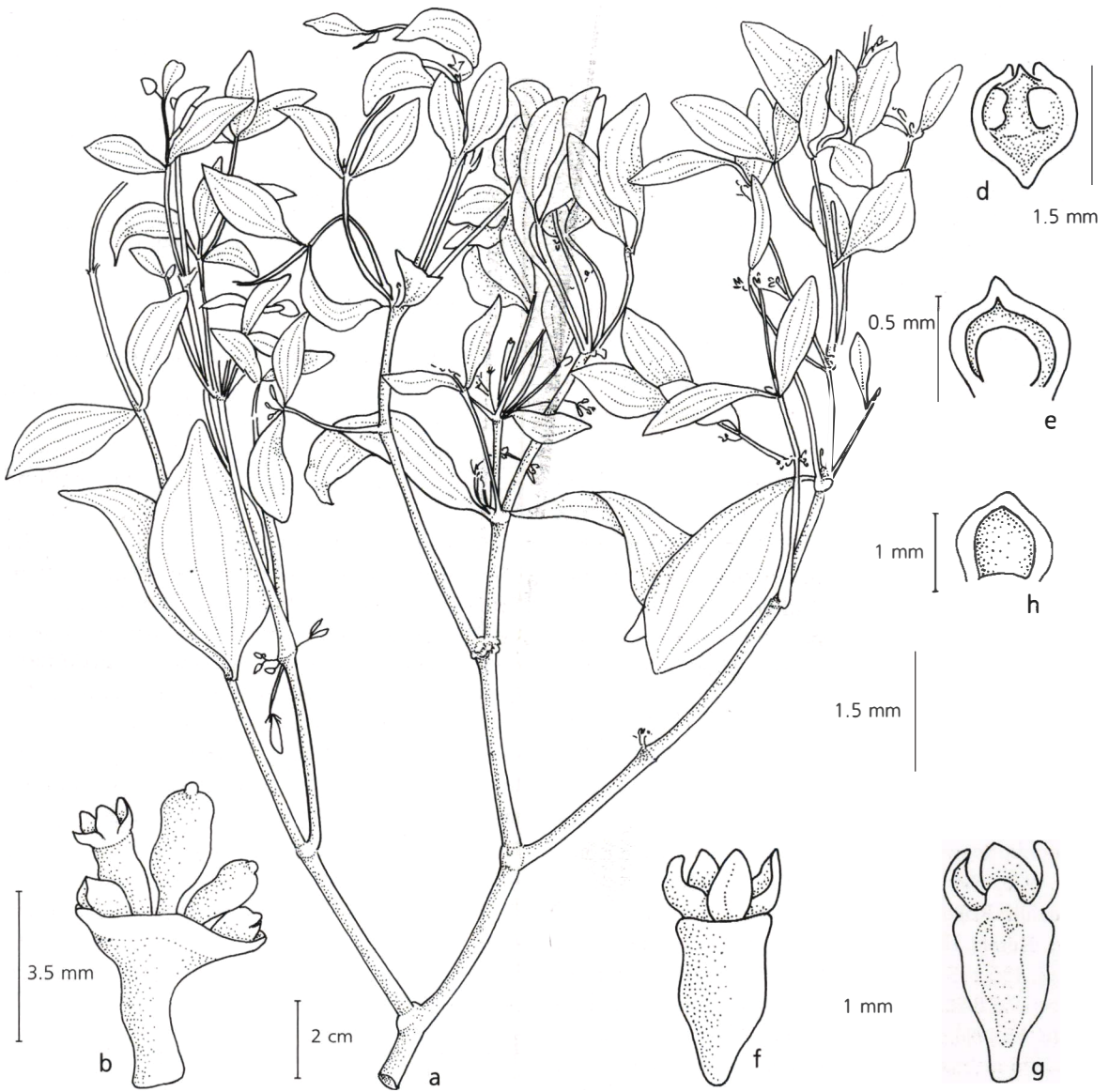


Figure 11. *Viscum orientale* Willd. – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe.

Flueggea leucopyrus Willd., *Flueggea microcarpa* Blume, *Putranjiva roxburghii* Wall., *Mallotus philippensis* (Lam.) Muell.

Occasionally it parasitizes on other Loranthaceous species.

Note: Plants parasitising on *Strychnos nux-vomica* are used in India as a substitute for nux-vomica. A poultice of leaves is used for neuralgia. Plants are burnt and ashes rubbed on the body for treatment of itches. They are used in earache. An unnamed alkaloid has been reported from the plant (Wealth of India - Raw Materials, 1976).

Remarks: Both Danser (1941) and R.S. Rao (1957) had difficulties in distinguishing *Viscum orientale* Willd. from its allied *V. heyneanum* DC., *V. ovalifolium* DC., *V. verruculosum* Wight & Arn. and *V. monoicum* DC. They grouped all these species under *V. orientale* Willd. The protologue of *V. orientale* is based on three specimens of Willdenow bearing the Cat. no. 18293. These specimens carry the same note, or rather a short description, pasted to it. The protologue is a combination of the characters of all these three specimens. In fact, only two of these specimens belong to *V. orientale* and the other to *V. monoicum*.

Specimens Examined: **Andaman & Nicobar Islands**, North Andamans, Saddle Peak, 400 m, 31.3.1977, *Balakrishnan* 5390 (PBL). **Andhra Pradesh**, Godavari, Venkataparat, 5000 ft., Jan. 1887, *Gamble* 18565 (MH); Cuddapah, Balapalle, 250 m, 10.11.1962, *Ellis* 14983 (MH); Nellore, Racupattam, Aug. 1883, *Gamble* 12380 (MH); Visakhapatnam, 8.5.1900, *Barber* 1570 (MH); Medak, Narasapur, 710 m, 24.4.1959, *Sebastine* 7979 (MH); East Godavari, Kutraveda, 600 m, 20.5.1966, *Subbarao* 27275 (MH); Kurnool, Rollapenta to Pecheravee, 700 m, 16.8.1972, *Ellis* 42273 (MH). **Bihar**, Murram hill, Rangarh, 14.11.1964, *Kanodia* 1200 (CAL). **Chhattisgarh**, Bailadilla, near Raipur, 10.2.1963, *Panigrahi* 6755 (CAL); Bastar, Keskal, 567 m, 17.11.1958, *Subramanyam* 7123 (MH). **Karnataka**, Mysore, Kukkunahally, 18.10.1969, *Raghavendra Rao* 219 (IISc); Bangalore, museum road, 16.6.1980, *Ramesh & Gurudev Singh* 11596 (IISc); Thumkur, Devarayana Durga, 14.7.1978, *Ravindra & Ramesh* 1514 (IISc); Mandeya, Malavalli - Kollegal road, 31.7.1979, *Ramesh & Manohar* 8610 (IISc). **Kerala**, Thiruvananthapuram, en route to Bonaccord, 380 m, 13.8.195, *Sanjai* 104903 (MH); Idukki, Vellikulam, 900 m, 19.2.1996, *Sanjai* 104918 (MH); Kottayam, Keezhoor, 300 m, 4.5.1996, *Sanjai* 104928 (MH); Trichur, Chimini dam area, 175 m, 21.3.1980, *Ramamurthy* 66238 (MH); Palghat, 500 ft., 27.1.1910, *Fischer* 1707 (CAL); Attappady, 1400 ft., 11.2.1910, *Fischer* 1743 (CAL). **Maharashtra**, Without locality, 5.3.1896, *Talbot* 3573 (DD). **Orissa**, Sukinola, 23.6.1957, *Panigrahi* 8287 (CAL); Ghatgaon, 23.6.1957, *Panigrahi* 8413 (CAL); Ganjam, Kaliyaguda, 500 ft., Feb. 184,

Gamble 13837 (CAL); Chamudya, 19.8.1931, *Narayanaswami* 5861 (MH); Tikkapalli to Linepada, 23.1.1900, *Barber* 1205 (MH). **Tamil Nadu**, Nilgiri, Kunjapanai slopes, 600 m, 10.8.1970, *Vajravelu* 35281 (MH); Coimbatore, Mettupalayam, 17.8.1910, *Meebold* 8549 (CAL); Kurudimalai, northern slopes, 800 m, 6.8.1956, *Subramanyam* 485 (MH); Dharmapuri, Kudigere, Kodagarai, 19.12.1990, *Ravishankar* 84181 (MH); Madura, Sirumalai, 266 m, 18.2.1958, *Subramanyam* 5351 (MH); Anna, Sattiar, 600 m, 19.6.1986, *Ramamurthy* 83846 (MH); Tirunelveli, Mundanthurai, 14.5.1901, *Barber* 2786 (MH); Ramanathapuram, Thiruppathur, 250 m, 29.11.1977, *N.C. Nair* 52923 (MH); Salem, Hoganaikkal, Chinnar bank, 275 m, 14.7.1964, *Vajravelu* 20619 (MH); Tiruchirapalli, Narathamalai, Pudukkotai, 125 m, 22.6.1965, *Ramamurthy* 23690 (MH); Thanjavur, Kodaikanal, 25 m, 24.5.1978, *V.J. Nair* 57074 (MH).

***Viscum ovalifolium* Wall.** [Cat. no. 489. 1829, *nom. nud.*] ex DC., Prodr. 4: 278. 1830; Hook.f. in Fl. Brit. India 5: 225. 1886, *p. p.*; Gamble, Indian Timbers 584. 1902, *p. p.*; Brandis, Indian Trees 552. 1906, *p. p.*; Danser in Blumea 4: 296. 1941; R.S. Rao in J. Indian Bot. Soc. 32(2): 146. 1957; Grierson & Long, Fl. Bhutan 1(1): 150. 1983.

Fig. 12

Type: Penang, *Wallich* 489 (K, CAL-Microfiche!).

V. orientale auct non Willd.: Benth. in Hooker's Lond. Journ. Bot. 2: 222. 1843; Brandis, For. Fl. NW. & C. India 393. 1874, *p. p.*; Gamble in J. Asiat. Soc. Bengal 75(2): 386. 1914 (cum. var. *ovalifolio*).

Semi-parasitic shrubs, monoecious, evergreen; stems slender to robust, up to 1.5 m long, sparingly branched, glabrous; internodes terete, sometimes slightly longitudinally grooved, flattened towards the apical portions, 2-5 cm long and to a maximum of about 1 cm thick; nodes swollen, those bearing leaves 3-6 mm in diam. *Leaves* normal, opposite, lanceolate, ovate, oblong or slightly obovate, attenuate at base tapering into a very short petiole, apex obtuse or slightly acute, entire, coriaceous, dull on both surfaces, inequilateral, 5-9 x 2-3.5 cm, with 3-5 longitudinal nerves, which are more distinct above. *Inflorescences* usually lateral, at first single, sessile or shortly peduncled, 3-flowered cyme with the middle flower female and laterals male, later similar such cymes develop adventitiously at the node encircling it, most of which lacking male flowers and in appearance look like a cluster of female flowers with male flowers distributed here and there; flowers enclosed in a navicular cup of bracts about 2 mm long. *Male flowers* sessile, compressed longitudinally, about 1 mm long; perianth lobes 4, free, triangular with anthers attached on inner surface; stamens 4, sessile;

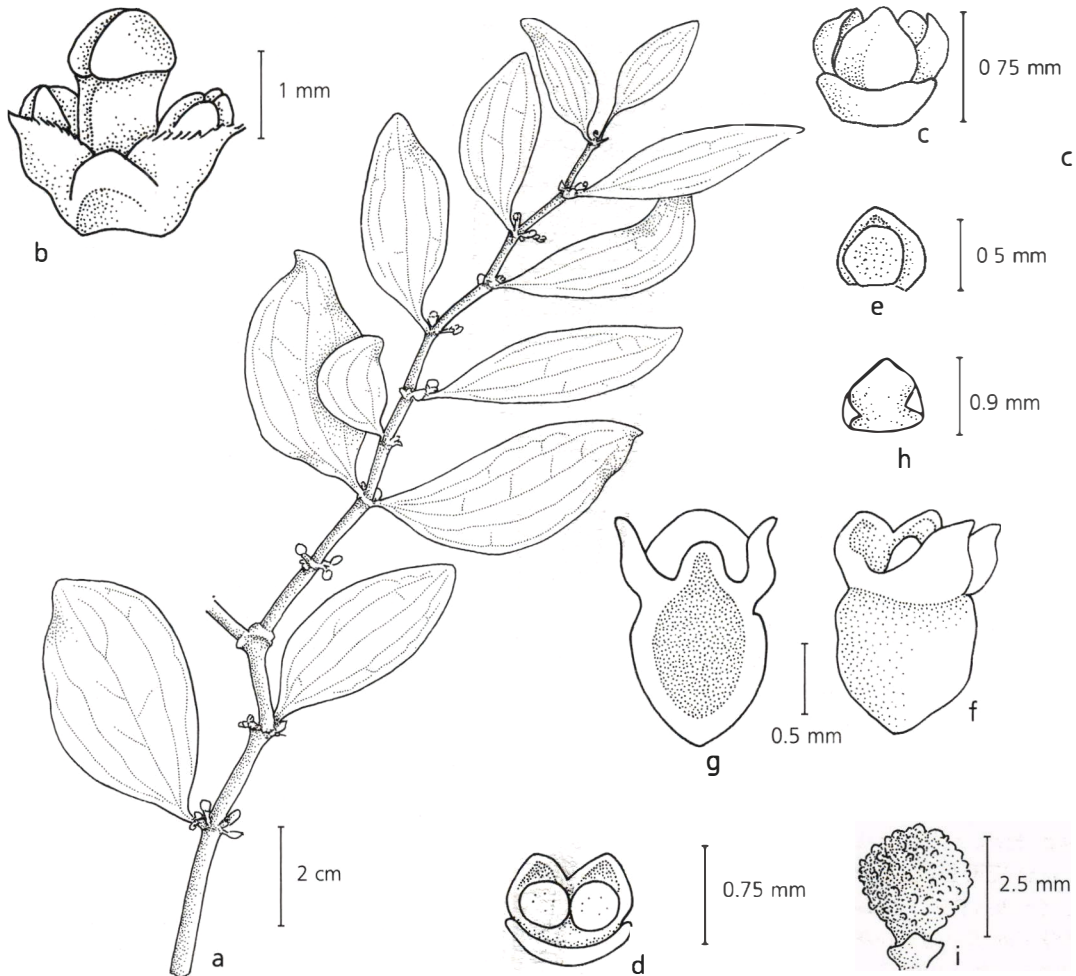


Figure 12. *Viscum ovalifolium* Wall. ex DC. – a. habit; b. inflorescence; c. male flower; d. male flower, l. s.; e. male perianth with anther; f. female flower; g. female flower, l. s.; h. female perianth lobe; i. fruit.

anthers attached to tepals, opening by pores; pistillode absent. *Female flowers* oblong, 1.5-2 mm long, sessile; perianth lobes 4, free, triangular; ovary inferior, warty; ovules not distinct; style short, conical; stigma capitate. *Fruits* roundish to ellipsoidal, somewhat contracted at base, distinctly warty till ripening, c. 5-6 × 4 mm, covered by slightly enlarged conical style.

Flowering & Fruiting: January-April.

Distribution: India [Andaman & Nicobar Islands (a new record), Assam and Manipur states], Bhutan, Myanmar, Hongkong, Malesia, up to Australia (Queensland).

Chromosome number $n = 11$ (Barlow, 1964)

Host: *Quercus incana* Roxb.

Note: This species was under doubtful status as it was treated as a larger form of *V. orientale*. Hooker, while treating this as a separate species has expressed his doubt as to whether this was a larger form of *V. orientale* or not. However, this species can be distinguished from *V. orientale* by its sessile to subsessile inflorescences and warty globular young fruits. Previously, this species was not known within the political boundary of India. R.S. Rao (1957) reported it for the first time from Assam and Manipur.

Specimens Examined: **Andaman & Nicobar Islands**, South Andaman, Shoal Bay, sea level, 16.3.1976, Balakrishnan & Bhargava 3617 (PBL). **Manipur**, Kongpokpi, 10.2.1954, Deb 1712 (CAL); Longapole, 21.1.1953, Prasanthi 664 (CAL); Kaupro hill, 6000 ft., 19.12.1953, Deb 1499 (CAL).

13. *Viscum ramosissimum* Roxb. [Hort. Beng. 105. 1814, *nom. nud.*] ex DC., Prodr. 4: 278. 1830; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 380. 1834; Wight, Icon. Pl. Ind. Or. 3: 13. 1845 (excl. t. 1017); Hook.f., Fl. Brit. India 5: 225. 1886; Trimen, Fl. Ceylon 3: 472. 1895; Gamble, Indian Timbers 584. 1902; Brandis, Indian Trees 552. 1906; T. Cooke, Fl. Pres. Bombay 2: 554. 1906; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925; C.E.C. Fischer in Rec. Bot. Surv. India 11: 161. 1926; Danser in Blumea 4: 294. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 142. 1957; Wiens in Dassan. & Fosberg, Revised Fl. Ceylon 6: 416. 1987.

Fig. 13

Type: Wallich Cat. 6876 (K, CAL-Microfiche!).

Aspidixia ramosissima (Wall. ex DC.) van Tiegh. in Bull. Soc. Bot. Fr. 43: 193. 1896.

Semi-parasites herbs, monoecious, pendulous, yellowish green, very rarely erect on the branches as well as on main trunks of the host; stems slender, branches numerous, decussate or more than two at each node; nodes swollen; internodes terete throughout except the extremities, generally flattened, smooth or wrinkled, the basal internodes may be up to 5 cm long, up to 5 mm thick, the upper internodes shorter

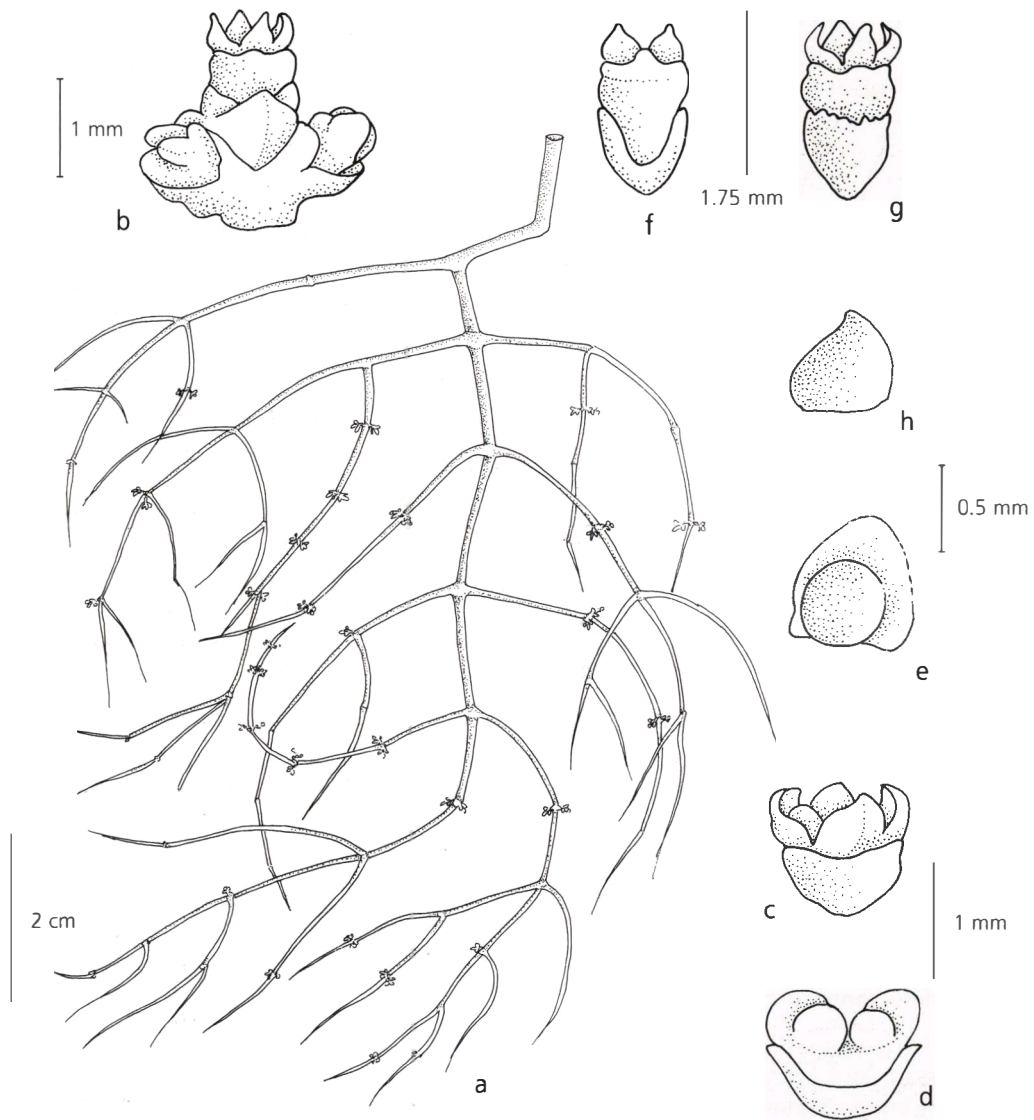


Figure 13. *Viscum ramosissimum* Roxb. ex DC. – a. Habit; b. Inflorescence; c. Male flower; d. Male flower, l. s.; e. Male perianth lobe with anther; f. Female flower; g. Female flower, l. s.; h. Female perianth lobe.

and more slender. *Leaves* generally absent; [the only leaf seen in Wallich's specimen (6876) is lanceolate-obovate, attenuate towards the base but not petiolate, rotund at apex, c. 2.2 x 0.5 cm, with distinct longitudinal nerves]. *Inflorescences* usually sessile and lateral but sometimes terminal, if so peduncled, 1-flowered or 3-flowered, if 1-flowered, female subtended by 2 bracts connate at base; if 3-flowered, the central one being female and the laterals male with individual bracts, sometimes adventitious cymes developing laterally to the first with a similar structure, making the total number of cymes at the node to 6, further additions not observed, the bracts in all cymes triangular, with broad base and acute apex, c. 0.75 x 0.75 mm. *Male flowers* more or less globose, compressed laterally with wedge-shaped base, c. 1x1 mm; perianth lobes 4, free, broadly ovate, acute at apex, bearing an anther on its inner surface, c. 0.75 x 0.5 mm; stamens 4, filaments absent, anthers sessile, round, attached to the perianth lobes on inner surface, c. 0.5 x 0.5 mm, opening by pores; pistillode absent. *Female flowers* oblong, c. 1.75 x 0.75 mm; perianth lobes 4, free, conical with short base, acute at apex, c. 0.5 x 0.25 mm; staminodes absent; ovary inferior, ovules not distinct; style short, slightly conical; stigma nipple-shaped. *Fruits* small, drupaceous, subglobose to globose, 3-4 mm in diameter, pale green.

Flowering & Fruiting: February-August.

Distribution: India (The Western Ghats of Maharashtra, Karnataka, Kerala and Tamil Nadu and Southern parts of Andhra Pradesh), Sri Lanka.

Hosts: *Erythroxylon monogynum* Roxb., *Zizyphus jujuba* Lam., *Z. nummularia*, *Rhus mysorensis* (Burm. f.) Wight & Arn., *Cassia montana* Roth, *Acacia sundra* (Roxb. ex Rottl.) Willd., *Santalum album* L., *Flueggea microcarpa* Blume and *F. leucopyrus* Willd.

Note: This species is very distinct from its allies *V. angulatum* and *V. articulatum* in having terete internodes. Besides Wallich's specimen, there is another specimen (*Alphonse Amalraj* 11025 in RHT) with leaves. Thus, this cannot be taken as a leafless species.

Specimens Examined: **Karnataka**, Mysore, 3000 ft., 5.7.1893, Talbot 3000 (CAL); Coorg, Mercara, *Gamble* 74627 (CAL). **Kerala**, Wyanad, Chundal, 1450 m, 22.8.1997, *Sanjai* 104942 (MH); Thiruvananthapuram, Bonoccord, 1200 m, 20.4.1994, *Abdul Jaleel & Shanavaz Khan* 16004 (TBGT). **Tamil Nadu**, Coimbatore, 1400 ft., 9.2.1910, *Fischer* 1734 (CAL); Anamalai hills, 4500 ft., 11.5.1912, *Fischer* 3418 (CAL); Tholanpalayam, 1400 ft., 10.1.1953, *Vaid* 23245 (DD); Mettupalayam,

17.5.1910, *Barber* 8547 (MH); Kollegal, 11.2.1924, *Jacob* 17327 (MH); Vellingiri, 666 m, 6.3.1957, *Sebastine* 2487 (MH); Salem, Thumbal, 1000 m, 19.7.1977, *Ansari* 49914 (MH); Attur, Chinnakal ranges, Thumbal extension R.F., 500 m, 9.1.1978, *Alphonse Amalraj* 11025 (RHT); Woddapatti R.F., 300 m, 18.7.1964, *Vajravelu* 20704 (MH); river bank, Hoganaikkal, 275 m, 11.3.1965, *Vajravelu* 23527 (MH); Tiruchirapalli, foot of Pachamalai hills, 333 m, 18.3.1959, *Sebastine* 7886 (MH); Ramanathapuram, Cumummedu, 1025 m, 14.3.1970, *Vajravelu* 33746 (MH); Tirunelveli, Tiger falls, Manimuthar, 333 m, 11.10.1957, *Sebastine* 4370 (MH); Mundanthurai, 14.5.1901, *Barber* 2785 (MH); Kalakkad R.F., 275 m, 7.3.1963, *Joseph* 15810 (MH); Kanniyakumari, way to Sengammal estate, 500 m, 27.7.1966, *Shetty* 27998 (MH).

Viscum subracemosum Sanjai & N.P. Balakr. in *Rheedea* 10(2): 113, f. 1. 2000.

Type: India, Karnataka, Krishnarajapuram, 900 m, 20.10.1995, *Sanjai* 104912 (Holotype, CAL; Isotypes, MH).

Semi-parasitic herbs, monoecious, evergreen, up to 75 cm long, dichotomously or trichotomously branched; branches slender, dark green in colour, lower internodes terete, c. 3-5 x 0.2-0.4 cm; upper internodes slender and longitudinally grooved, c. 5-7 x 0.1-0.2 cm; nodes swollen. *Leaves* opposite, broadly lanceolate, nerved, c. 3-6 x 1.5-2.5 cm, tapering towards base, rounded at apex, with 3 veins, more distinct above than below. *Inflorescences* distinctly subracemose, rarely cymose, pedunculate, laterals arising from the axils of the leaves at nodes, up to 6 at each node; flowers enclosed in a cupule formed out of 2 connate acute bracts; bracts c. 1 x 1 mm, broadly ovate, caudate at base and acute at apex; flowers usually 5 in a group, very rarely 3, the central flower female and laterals male; at times all-female-inflorescences also noticed. *Male flowers* sessile, subglobose, c. 1.5 x 1 mm; perianth lobes 4, free, of two types, the larger ones two, c. 1 x 0.75 mm, ovate, acute at apex, oppositely placed, bearing an anther each on the inner surface, ovate, acute at apex, c. 1 x 0.75 mm, the smaller ones two, opposite, acuminate at apex, c. 1 x 0.5 mm; stamens 2, filaments absent; anthers 2, sessile, attached to the inner surface of the larger perianth lobes, dehiscence by means of pores; pistillode absent. *Female flowers* oblong, c. 2 x 1 mm; perianth lobes 4, free, valvate, broadly ovate, acute at apex, c. 1 x 0.5 mm; staminodes absent; ovary inferior, ovules not distinct; style short; stigma nipple-shaped. *Fruit* a berry, globose, smooth, up to 5 mm in diameter.

Flowering & Fruiting: January-September.

Distribution: India (Tamil Nadu, Karnataka), endemic.

Host: Pongamia glabra Vent. Heavy parasitisation of the host is noticed at various places.

This species is allied to *V. acaciae* but differs in the following characters:

<i>Viscum acaciae</i>	<i>V. subracemosum</i>
Inflorescence generally cymose, only rarely subracemose	Inflorescence distinctly subracemose, only rarely cymose
All-female-flowered inflorescences absent	All-female-flowered inflorescences present
Usually 3 flowers in a group, rarely more	Usually 5 flowers in a group, rarely less
Female flowers large, c. 3 x 1 mm	Female flowers small, c. 2 x 1 mm
Male flowers oblong, c. 1.5 x 0.5 mm	Male flowers subglobose, 1.5 x 1 mm
Fruits oblong	Fruits globose

Specimens Examined: **Karnataka**, Krishnarajapuram, 900 m, near the ITI gate on *Pongamia glabra*, 20.10.1995, *Sanjai* 104912 (CAL, MH). **Tamil Nadu**, Coimbatore, TNAU campus, 260m, in front of the canteen on *Pongamia glabra*, 3.6.1997, *Sanjai* 104936 (MH).

Viscum trilobatum Talbot, For. Fl. Bombay 2: 419, t. 479. 1911; Danser in Blumea 4: 308, t. 3 A & B. 1941; R.S. Rao in J. Indian Bot. Soc. 36(2): 163. 1957.

Type: North Canara, *Talbot s. n.* (DD!)

Viscum capitellatum auct. non Sm.: Hook.f., Fl. Brit. India 5: 225. 1886, *p. p.*; T. Cooke, Fl. Pres. Bombay 2: 552. 1906, *p. p.*; Gamble, Fl. Pres. Madras 7: 1257, 1258. 1925, *p. p.*;

Semi-parasitic herbs, evergreen, monoecious, erect, up to 25 cm long, decussately branched below and dichotomously branched towards the upper portions; internodes terete at base, slightly stripped or angular upwards, up to 8 cm long and up to 4 mm in diameter; nodes swollen. *Leaves* normal, opposite, sessile or subsessile, obovate or suborbicular, slightly wavy along margins, c. 0.75-2 x 0.5 x 1.5 cm, coriaceous; main nerves 3, distinct above; petioles up to 2 mm long. *Inflorescence* cymose, shortly peduncled, mainly axillary at nodes, but rarely terminal, up to 6 at each node; peduncles short, up to 5 mm long, bearing a boat-shaped cup of 2 connate bracts enclosing 3 sessile flowers, the central one being large and male, the laterals female, rarely all the flowers female, at times very rarely instead of the central flower, another peduncle with a similar set of flowers arise. *Male*

flowers sessile, pandurate, c. 2.5 x 1.5 mm; perianth lobes 3, free, valvate, triangular in shape, c. 1.5 x 1.5 mm; stamens 3, sessile; anthers 2-loculed, attached to and placed opposite to the perianth lobes on the inner side; pistillode absent. *Female flowers* sessile, oblong, compressed towards the base, c. 2 x 1 mm; perianth lobes 4, free, valvate, erect, c. 0.75 x 1 mm; staminodes absent; ovary inferior, ovules not distinct; style short and stigma capitate. *Fruit* a drupe, nearly rounded or ovoid, smooth but with some ridges, c. 5 x 4 mm.

Flowering & Fruiting: February to June.

Distribution: India (Karnataka, Kerala, Tamil Nadu), endemic.

Hosts: *Dendrophthoe falcata* (L. f.) Ett., *Loranthus bracteatus* Wall., *L. tomentosus* Roth and *Excoecaria agallocha* L.

Note: We found this species exclusively hyper-parasitic.

Specimens Examined: **Karnataka**, Without locality, 1888, *Talbot* 1619 (CAL). **Kerala**, Thiruvananthapuram, before Bonoccord tea estate on roadside, 900 m, 28.4.1996, *Sanjai* 104924 (MH); Wyanad, Kallur, 1500 m, 22.8.1997, *Sanjai* 104940 (MH); Malabar, 24.12.1907, *Fischer* 329/1178 (DD). **Maharashtra**, Siddapur, 10.1.1896, *Talbot* 3739 (CAL). **Tamil Nadu**, Nilgiri, Devarshola, 1200 m, 19.1.1961, *Shetty* 11934 (MH); Bokkapuram R.F., 1100 m, 12.8.1970, *Sharma* 35430 (MH); *ibid.* 1050 m, 19.2.1972, *Sharma* 39861 (MH); *ibid.* 3000 ft., Nov. 1884, *Gamble* 15693 (CAL); Coimbatore, Jirgan halli, 3000 ft., 24.9.1906, *Fischer* 1020 (DD).

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Literature Cited

- Adler, M. 1997. Open clinical study with a homoeopathic combination containing *Crataegus*, *Arnica* and *Viscum*. *Phytotherapy* V. 3 (Suppl. 1): 86.
- Bagchee, K. 1952. A review of work on Indian tree diseases and decay of timbers and methods of control. *Indian For.* 78: 540-546.
- Barlow, B. A. 1963. Studies in Australian Loranthaceae IV. Chromosome number and their relationships. *Proc. Linn. Soc. N.S. Wales* 88:151-160.
- Barlow, B. A. 1964. Classification of the Loranthaceae and Viscaceae. *Proc. Linn. Soc. N. S. Wales* 89: 268-272.
- Barlow, B. A. 1997. Viscaceae. In: C. Kalkman *et al.* (Eds) *Fl. Malesiana*, Ser. 1, Vol. 13: 403-442.
- Barlow, B. A. & D. Wiens 1971. The cytogeography of the loranthaceous mistletoes. *Taxon* 20(2/3): 291-312.
- Basaran, A. A., U. Ceritoglu & N. Basaran 1997. Immunomodulatory activities of some Turkish medicinal plants. *Phytotherapy Research* 2(8): 609-611.
- Bentham, G. & J. D. Hooker 1883. *Genera Plantarum*, Vol. 3. L. Reeve & Co., London.
- Bessey, C. E. 1915. The Phylogenetic taxonomy of flowering plants. *Ann. Missouri Bot. Gard.* 2: 109-164.
- Blanco, M. A. S. & A. Parvathi 1996. Chemotaxonomy of Loranthaceae and Viscaceae In: K. S. Manilal & A. K. Pandey (eds.). *Taxonomy and Plant Conservation*. CBS Publishers and Distributors, New Delhi.
- Burkill, I. H. 1906. A parasite upon a parasite. *J. Proc. Asiat. Soc. Bengal* (n. s.) 2: 299-301.
- Cooke, T. 1901-08. *The Flora of Presidency of Bombay*. London.
- Cronquist, A. 1970. *The evolution and classification of flowering plants*. Thomson Nelson & Sons Ltd., London.
- Danser, B. H. 1929. On the taxonomy and nomenclature of the Loranthaceae of Asia and Australia. *Bull. Jard. Bot. Buitenz.* 10: 291-373.
- Danser, B. H. 1933. A new system for the genera of Loranthaceae, Loranthoideae with a nomenclature for the old world species of this subfamily. *Verh. K. Akad. Wetensch. Amsterdam afd. Natuurk.*, Sect. 2. 29(6): 1 - 128.
- Danser, B. H. 1937. A revision of the genus *Korthalsella*. *Bull. Jard. Bot. Buitenz.*, Ser. 3, 14: 115-159.
- Danser, B. H. 1941. The British-Indian species of *Viscum* revised and compared with those of South-eastern Asia, Malaysia and Australia. *Blumea* 4: 260-321.
- Duthie, J. F. 1903-22. *Flora of the Upper Gangetic Plains and of the adjacent Siwalik and Sub-Himalayan Tracts*, 3 vols. Calcutta.
- Englér, A. & K. Prantl 1897. Loranthaceae. In: *Die Natürlichen Pflanzenfamilien*. Duncker & Humblot, Berlin.
- Gamble, J. S. 1925. *The Flora of Presidency of Madras*. West Newman & Co., Adlard & Sons, London.
- Gholap, H. T. 1998. In: *Cancer and Homeopathy*. Pp. 42-48.
- Griffith, W. 1854. *Icones plantarum asiaticarum*. A. B. Loshan, Calcutta.
- Gunderson, A. 1950. *Families of Dicotyledons*. Chronica Botanica Co., U.S.A.
- Haines, H. H. 1921-25. *The Botany of Bihar and Orissa*. Adlard & Sons, London.
- Hawksworth, F. G. 1959. Distribution of dwarf mistletoes in relation to topography on the Mescalero Apache Reservation, New Mexico. *Jour. Forestry* 57: 919-922.
- Hawksworth, F.G. 1977. The 6 class dwarf mistletoe rating system. *General Technical Report RM 48*. Fort Collins, Co. US Dept. of Agr. Forest Service. Rocky Mountain Forest and Range Experimental Station.
- Hawksworth, F.G. & B.W. Geils 1990. How long do mistletoe infected ponderosa pines live? *Western Journal of Applied Forestry* 5:47-48.
- Hawksworth, F.G. & R.S. Peterson 1959. Notes on the hosts of three pine dwarf mistletoes in northern Colorado. *U.S. Agr. Res. Serv. Plant Dis. Rptr.* 43:109-110.
- Hawksworth, F. G. & D. Wiens 1971. *The classification and biology of dwarf mistletoes*. Agric. Handb. U.S. Dept. of Agriculture. Washington DC.
- Hawksworth, F. G. & D. Wiens 1975. *Arceuthobium oxycedri* and its segregates *A. juniperi-procera* and *A. azoaricum* (Viscaceae). *Kew Bull.* 31(1): 71-80.
- Hawksworth, F. G. & D. Wiens 1996. Dwarf mistletoes: biology, pathology and systematics. *U.S. Dept. Agric. Forest Serv., Agric. Handb.* No. 709: xiv, Pp. 410.
- Hooker, J. D. 1886. *Flora of British India* 5: 203. L. Reeve & Co., London.
- Horwood, F. K. 1983. Two parasites of *Euphorbia*: *Viscum minimum* and *Hydnora africana*. *The Euphorbia J.* 1: 45

- 48, colour photos.
- Hutchinson, J. 1926.** *The families of flowering plants.* Macmillan, London.
- Hutchinson, J. 1948.** *British Flowering Plants. Evolution & Classification.* P. R. Gawthorn Ltd., Russell Square, London.
- Jamal, S. M. & A. R. Beg 1975.** Natural infection of mistletoes in Pakistan. *Proc. Pakistan Forestry Congress, November, 4 – 8, 1974.* pp. 187-189.
- Johri, B. M. & S. P. Bhatnagar 1961.** Embryology and taxonomy of the Santalales - 1. *Proc. Natn. Inst. Sci. India.* 26B: 199-220.
- Joseph, J. & G. K. Deka 1960.** Additional hosts for *Korthalsella opuntia* (Thunb.) Merr. *Curr. Sci.* 29: 292.
- Komarov, V.L. 1936.** Flora of the USSR 4:108-111. Moscow
- Korstian, C.F. & Long, W.H. 1922.** The Western yellow pine mistletoe: effect on growth and suggestions for control. *U.S.D.A. Bull.* 1112:36.
- Kujit, J. 1955.** Dwarf mistletoes. *Bot. Rev.* 21: 569 - 626.
- Kujit, J. 1956.** A new record of dwarf mistletoe on lodgepole and western whitepine. *Madrono* 13(3): 170-172.
- Kujit, J. 1969.** *The biology of parasitic flowering plants.* University of California Press, Berkeley & Los Angeles.
- Lawrence, H. M. 1951.** *Taxonomy of vascular plants.* Oxford and IBH Publishing Co. Ltd., New York.
- Linnaeus, C. 1753.** *Species Plantarum* 2: 1023. The Ray Society, London.
- Lushington, A. W. 1902.** Identification of Loranthaceae by their leaves. *Indian Forester* 28: 58-68.
- Maheshwari, P. 1954.** Embryology and systematic botany. *Proc. 8th Int. Bot. Congress, Paris, Sects. 7 & 8:* 254 - 255.
- Maheshwari, P. 1958.** Embryology and taxonomy. *Mem. Indian Bot. Soc.* 1: 1-9.
- Maheshwari, P., B. M. Johri & S. N. Dixit 1957.** The floral morphology and embryology of the Loranthoideae (Loranthaceae). *J. Madras Univ.* 27B: 121-136.
- Miers, J. 1851.** Observations on the affinities of Olacaceae. *Ann. Mag. Nat. Hist.* 8: 161-184.
- Naithani, H. B. & Pratap Singh 1989.** Notes on the occurrence of genera *Arceuthobium* M. Bieb. in Eastern Himalaya. *Indian Forester* 115(3): 196.
- Parker, C. & C. R. Riches 1993.** *Parasitic weeds of the world. Biology and Control.* Cab International.
- Pisek, A. 1924.** Antherentwicklung und Meiotische Teilung bei der Wacholdermistel [*Arceuthobium oxycedri* (DC.) M.B.] : Antherenbau und Chromosomenzahlen von *Loranthus europaeus* Jacq. *Akad. Wiss. Wien Math.-Nat. Kl. Sitzber. Abt.,* 133: 1-15.
- Plouvier, V. 1953.** Chimie vegeta. sur la recherche des itols et des heterosides dugui, *Viscum album* L. (Loranthaceae). *Paris Acad. des. Sci. Compt. Rend.* 237: 1761-1763.
- Prain, D. 1903.** *Bengal Plants*, 2 vols. Calcutta.
- Rao, K. N. 1967.** *The Outlines of Botany.* S. Viswanathan & Co., Madras.
- Rao, R. S. 1957.** A revision of the Indo-Malayan species of *Viscum* Linn. *J. Indian Bot. Soc.* 36(2): 113-168.
- Rendle, A. B. 1956.** *The classification of flowering plants.* Vol. 2. Cambridge University Press.
- Rikovski, I. I. & R. Basaric 1949.** Vitamin C content of some indigenous fruits. *Belgrade Soc. Chin. Bull.* 14: 129-132.
- Roth, L.F. 1954.** Distribution, spread and intensity of dwarf mistletoe on ponderosa pine. *Phytopathology* 44:504.
- Roxburgh, W. 1832.** *Flora Indica.* Repr. ed., Today and Tomorrow Printers and Publishers, New Delhi.
- Sahni, B. 1933.** Explosive fruits in *Viscum japonicum* Thunb. *J. Indian Bot. Soc.* 12: 96 -101.
- Salim Ali, A. 1932.** Flower-birds and bird-flowers in India. *J. Bombay Nat. Hist. Soc.* 35: 598-601.
- Samuel, B. Jones Jr. & A. E. Luch Singer 1979.** *Plant Systematics.* McGraw Hill Book Company, New York.
- Sanjai, V. N. & N. P. Balakrishnan 2000.** A new species of *Viscum* L. (Viscaceae) from India. *Rheedea* 10: 113-116, fig. 1.
- Sanjai, V. N. & N. P. Balakrishnan 2001a.** A note on the cryptic mimicry exhibited by Indian Viscaceae. *Indian J. For.* 24: 233-234.
- Sanjai, V. N. & N. P. Balakrishnan 2001b.** A note on hyperparasitism in Indian Viscaceae. *Indian J. For.* 24: 235-236.
- Sanjai, V. N. & N. P. Balakrishnan 2001c.** *Viscum acaciae* Danser (Viscaceae), a new record for India. *J. Econ. Taxon. Bot.* 25(1): 18 – 20, fig. 1.
- Sanjai, V. N. & N. P. Balakrishnan 2001d.** *Viscum malurianum* (Viscaceae), a new species from India. *Nordic J. Bot.* 21(3): 267 - 269, f.1.
- Schaepfi, H. & F. Steindl 1945.** Blütenmorphologische und Embryologische Untersuchungen an enigen Viscoideen. *Zurich Naturf. Gesell. Vierteljahrschr.* 90(1): 1-46.
- Steindl, F. 1935.** Pollen und Embrosackentwicklung bei *Viscum album* L. und *Viscum articulatum* Burm. *Schweiz. Bot. Gesell. Berlin* 4: 343-388.
- Takhtajan, A. 1969.** *Flowering plants - origin and dispersal.* Oliver & Broyd. Edinburgh.
- Taylor, W. P. 1935.** Ecology and life history of the percupine (*Erothixon epixanthum*) as related to the forests of Arizona and the Southwestern United States. *Ariz. Univ. Biol. Sci. Bull.* 3: 177.
- Therkommendahl & P. W. Williams 1983.** *Challenging problems in plant health.* American Phytopathological Society.
- Thorne, R. 1968.** Synopsis of a putatively phylogenetic classification of the flowering plants. *Aliso* 6: 57 - 66.

- Tubeuf, C. 1923.** *Monographie der mistel*. Munich & Berlin. 832 pp.
- Van Tieghem, P. E. L. 1894.** Sur La Classification Des Loranthees. *Bull. Soc. Bot. Fr.* 41: 138-144.
- Van Tieghem, P. E. L. 1896a.** *Korthalsella* genre, nouveau - pour la famille des Loranthees. *Bull. Soc. Bot. France* 43: 83-87.
- Van Tieghem, P. E. L. 1896b.** Quelques conclusions D'um Travail Sur les Loranthees. *Bull. Soc. Bot. France* 43: 241-256.
- Wealth of India - Raw Materials.** Vol. 10. 1976. CSIR, New Delhi.
- Wickler, W. 1968.** *Mimicry in plants and animals*. Translated from German by R.D. Martin. McGraw Hill, New York.
- Wiens, D. 1987.** Viscaceae. In: M. D. Dassanayake & F. R. Fosberg (eds.) *A revised Handbook of Flora of Ceylon*, Vol. 6: 412 - 420. New Delhi.
- Wight, R. & G. A. W. Arnott 1834.** *Prodromus Florae Peninsulae Indiae Orientalis*. Vol. I. Allen & Co., London.

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