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Revision of the genus *Psilanthus* Hook. f. (Rubiaceae tribe Coffeeae) in India

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Abstract. *Psilanthus* Hook. f., of Rubiaceae tribe Coffeeae in India is revised. There are seven species in all (including the three new species described here). Six of these are native to India, while *P. fragrans*, originally described from Sylhet in Bangladesh, is known only from cultivation. An artificial key, correct nomenclature, species descriptions and illustrations are provided for the seven species.

Key words: *Coffea*; *Psilanthus*; Rubiaceae; Taxonomy.

Introduction

The genus *Coffea*, in the traditional sense of the name, has been known for its economically important species, but in the recent times, its circumscription and classification have been matters of intense debate. Hooker (1873a,b) retained *Lachnostoma* Korthals as a distinct genus from *Coffea* and established the genus *Psilanthus* to accommodate the African *P. mannii*. Later, he relegated both of them into sectional status (sect. *Lachnostoma* and sect. *Eucoffea*) under a broad concept of *Coffea* (Hooker, 1880). This broad concept of the genus was followed by specialists like Chevalier (1947) and most authors of Indian Floras (Gamble, 1921; Kanjilal *et al.*, 1939; Narasimhaswamy and Vishweshwara, 1963). Current taxonomic opinion, however, is overwhelmingly in favor of recognition of *Coffea* L., *Nostolachma* Durand (syn. *Lachnostoma* Korth.) and *Psilanthus* Hook. f. as distinct genera (see Leroy, 1980, 1981; Bridson, 1982, 1987; Robbrecht, 1988). *Nostolachma* (also the African segregates *Argocoffeopsis* Lebrun and *Calycosiphonia* Lebrun - in Mem. Inst. Roy. Col. Belgie, sect. Sci. Nat. & Med. 8 Vol. xi. Fasc. 3: 55, 67. 1941.) has now been transferred to the tribe Gardenieae subtribe Diplosporinae, leaving only *Psilanthus* and *Coffea* in the Coffeeae (Robbrecht and Puff, 1986; Robbrecht, 1988). Consequently, the three native Indian species which were placed in Hooker's *Coffea* sect. *Lachnostoma*, viz. *C. khasiana* (Korth.) Hook. f., *C. Jenkinsii* Hook. f., and *C. crassifolia* Gamble, have been transferred to *Nostolachma* (see Deb and Lahiri, 1978), while the other Indian species of the sect. *Eucoffea* have been moved to *Psilanthus*.

The macromorphological characterisation of the two genera of Coffeeae (*Psilanthus* and *Coffea*) has been mainly based on flower position, relative length of corolla tube and lobes, and the nature of stamens and styles. The two can be distinguished as follows:

1. Flowers in axillary inflorescence, less often terminal on reduced shoots; corolla tube almost as long as lobes; anthers distinctly filamented and exserted; style long, stigmatic lobes exserted . . . . . *Coffea*
1. Flowers terminal on reduced shoots, or sometimes axillary; corolla tube longer than lobes; anthers sessile or subsessile, fully or partly included (the tips sometimes projecting out of the corolla tube); style short, stigmatic lobes included . . . . . *Psilanthus*

Psilanthus, with about twenty species (see Bridson, 1987) is comprised of two subgenera. Subgenus *Psilanthus*, characterised by accrescent calyx lobes and ribbed fruits is restricted to western and central Africa.

Subgenus *Afrocoffea* (Moens.) Bridson [= *Paracoffea* (Miq.) Leroy, invalid; *Psilanthus* subgen. *Paracoffea* (Miq.) Leroy, invalid, for complete synonymy see Bridson, 1987] with its non-accrescent calyx and unribbed fruits extends from Africa to Asia, Malesia, the Philippines and northern Australia.

Hooker (1880) has reported four species of *Psilanthus* (under *Coffea* sect. *Eucoffea*) from British India, *P. bengalensis* (Heyne ex J. A. Schult.) Leroy [= *Coffea bengalensis* Heyne ex J. A. Schult.], *P. wightianus* (Wall. ex Wt. & Arn.) Leroy [= *Coffea wightiana* Wall. ex Wt. & Arn.], *P. travancorensis* (Wt. & Arn.) Leroy [= *Coffea travancorensis* Wt. & Arn.], and *P. fragrans* (Wall. ex Hook. f.) Leroy [= *Coffea fragrans* Wall. ex Hook. f.]. Recently, Bridson (1987) listed two more names from India, *Coffea semi-exserta* Colebr. ex Wall. (erroneously cited as *Psilanthus semi-exserta* Colebr. ex Wall.; the combination was never made. Bridson, pers. comm.) and *P. merguensis* (Ridley) Leroy [= *Coffea merguensis* Ridley] . While describing *C. semi-exserta*, Wallich (1824) himself has observed: "I know nothing of this species except from an elegant drawing made under the direction of my most esteemed friend and patron, H. T. Colebrooke Esq···". Chevalier (1947: 128) observed: "Plante mal connue, peut-entre identique a *C. bengalensis* Heyne ex Roem. et Schult."; and following literature cited its distribution as Assam. In any case, we have not been able to locate Colebrook's drawing, nor have we discovered any material of this species in any of the Indian Herbaria. So we have excluded this species from the present study.

Bridson (1987) indicated the distribution of *P. merguensis* [= *Coffea merguensis* Ridley; *Paracoffea merguensis* (Ridley) Leroy] as "India, Burma & Indo -China". This species is interesting with respect to the polymorphism it displays in inflorescence characters (see Leroy, 1971). We had the opportunity to study some of the syntypes of this species (Mergui, *Griffith 578*; Tenasserim. *Helfer 3016*, K) used by Ridley to describe the species, but no collection of this species from India has been found and so, this will not be dealt with here.

Hooker (1880) described *Coffea fragrans* on the basis of Gomez's collection from Sylhet (in Wall. Cat. *8480*, K) but also cited two other collections ("Tenasserim, *Helfer*; Mergui, *Griffith*"). In studying these three collections we found that Gomez's material is different from the other two (*Helfer 8450* & *Griffith 578*, K). Ridley (1920) has rightly commented that "this plant was confused by Hooker with *C. fragrans* Wallich, a very distinct plant from Sylhet with much larger leaves and flowers". Thus, he segregated these as *C. merguensis* (see also Chevalier, 1947). So, Hooker's *C. fragrans* is now based solely on Gomez's collection from Sylhet (see also Kanjilal *et al.*, 1939). During our studies we were only able to locate one specimen (*Kurz s.n.*, CAL) of this species from the geographical boundaries of India (s.s.). This was collected from a plant in cultivation at the Calcutta Botanic Garden. It seems it does not occur in the wild in India. But nevertheless, we have included this species in the present treatment.

Coffea bengalensis was first recorded by Roxburgh (Hort. Beng. 15. 1814 nom. nud.). The name was subsequently validated by Heyne (in Roem. & Schult., Syst. Veg. 5: 200. 1819, 'benghalensis') who described it as "... foliis ovatis acuminatis subtus ad costam pilosis, floribus axillaribus, aggregatis subsessilibus per paria involucro tetraphyllo, aristato, calyciforme cinctis, corollis quinquifidis ...", based on a material then under cultivation in the Calcutta Garden (Now at NA, photograph seen). Subsequently, in the Carey and wallich edition of Roxburgh's Flora Indica (1824) Carey observed that "it is indigenous to every part of Bengal" and Wallich noted that "My people brought it to me from Neakote in Nipal, blossoming in May." There are three sheets of this species in Wallich's Herbarium at Kew (*Wallich 6244 A-C*, microfische seen) which correspond well with our current understanding of this taxon.

Later on, William Hooker (1856) published an illustration and description of *Coffea bengalensis* based on specimens "sent to us from the Exotic Nurseries of Messrs Veitch and son, Exter and Chelsea, who received it from Assam through their collector Thomas Lobb." It seems that Chevalier's (1947) citation of W. Hooker's illustration under *C. bengalensis* was not done with adequate caution. William Hooker himself had commented on the specimen that "Indeed, though we have reason to believe ours to be the true plant of Roxburgh ... yet the leaves and flowers are twice as large as Roxburgh's drawings ... and the calyx in that drawing is represented as quite truncate and entire and even Wight and Arnott do not notice the peculiar calyx limb, each lobe being deeply lobed into two, three or more clavate or glandular segments as described by Roxburgh and Wight and Arnott in the calyx of *C.*

wightiana, which latter, however, has quite diminutive leaves and flowers as compared with our plant; but it is not otherwise different."

We have not been able to study Roxburgh's drawing of this species, but it seems that William Hooker has not taken note of Roxburgh's description of the species as having "margins of the calyx crowned with an undetermined number of minute points" which apparently accounts for the latter's description.

Nevertheless, Wight and Arnott (1834) have confused *C. bengalensis* and *C. wightiana*, describing the calyces as "calyx almost entire" in *C. bengalensis* and "limb of calyx with about ten minute gland like teeth" in *C. wightiana*. Under *C. bengalensis*, they have observed that "we have great doubts if this and the next two (i.e. *C. travancorensis* and *C. wightiana*) be not varieties of one species .... *C. travancorensis* is intermediate, the three agree in all the remarkable or essential points, the long tube of the corolla and included stamens attached by the middle of their back". Incidentally, one should give credit for their critical observations, by which they foresaw correctly that "perhaps none of them belong to the present genus", i.e. *Coffea*.

Consequently, in an attempt to elucidate the delimitation and circumscription of *C. bengalensis*, we studied all available material. We found two specimens from India (Bengal. *Wallich 185* & Orissa *Draper 1*) at CAL, which matched William Hooker's description and figures. One specimen (*Bourne 5318*, K) from Nilgiris also approximately matches the other two, but it is too poor to draw any definite conclusion about its identity. In addition we found a live plant in the Calcutta Garden (probably not the one seen and described by Roxburgh and Heyne) that has been identified as *C. bengalensis*. This same taxon introduced from Bengal is being cultivated in the research farms of the Central Coffee Research Institute, Chickmagalore and in their Regional Centre at Chundale, Wynad. On closer examination, all these specimens differed from *C. bengalensis* in several respects and turned out to be a new species. This taxon described here is named after Baba Budan, the Muslim Monk who is believed to have introduced coffee into India from Yemen sometime around 1600 A. D. (Anonymous, 1985).

Despite Wight and Arnott's (1834) scepticism that *C. bengalensis*, *C. travancorensis* and *C. wightiana* might be different varieties of a single species, we believe that they are distinct species (see also Chevalier, 1947). The original description of *C. wightiana* was based on two specimens, *Wight 1358* and *Wallich Cat. 6246* (K, seen), of which the former from Coimbatore has been selected as the lectotype (Chevalier, 1947).

Recently, we collected an interesting specimen from the Kappi-pacha forest near Peechi in Trissur which bears some resemblance to *C. wightiana*, but it is obviously different. Further studies on herbarium specimens revealed four additional collections of this taxon. Of these, *Lawson s.n.*, *Gamble 14899* and *Cameroon s.n.* (all labelled as *C. travancorensis*), were examined by Leroy (and possibly others) and bear annotations expressing doubts about their identification, while *Burkill 36848* (three sheets) collected from Assam during the Abor Expedition was identified as *C. bengalensis*. This taxon is described here as a new species, *Psilanthus bridsoniae*, after Diane Bridson (Kew), in acknowledgement of her unstinted support and assistance during the course of this work.

Coffea travancorensis, originally described by Wight and Arnott (1834) as having "... flowers 3-4, nearly sessile on very short, axillary, somewhat abortive leafless branchlets ..." was based on two specimens from Travancore (*Wallich 6245* and *Wight 1357*, K, both studied). However, they were doubtful about the specific status as it was "perhaps only to be distinguished from the last (*C. bengalensis*) by its stipules." After careful studies of all available material, we are inclined to treat it as a distinct species, as has been done by Chevalier (1947) and most other subsequent authors.

However, the fact that Wight and Arnott's description of this species is incomplete is obvious from Wallich's note on his collection, *Wallich 6245*, (K), ("floris ternis terminalis axillaris que subpedunculati ..."). We have now seen this species growing wild in the sacred groves of Iringolkavu near Alwaye, and in several gardens. Our observation reveals that this taxon is characterised by (mostly) terminal and (less commonly) axillary inflorescences. It was also found that the number of flowers varied from one to five and that some are bracteolate and others ebracteolate. The occasional single terminal flowers and the lateral ones in 3-5 flowered inflorescences are bracteate and bracteolate, the bracteoles occassionally developing into adult leaves. The central flower in such inflorescences is most commonly ebracteate and ebracteolate.

This species has also been reported from Ceylon,

but some have doubted that the Travancore and Ceylonese specimens may well belong to different species (Krug, 1959). We have not been able to study adequate materials from Ceylon. But we have seen Trimen's drawing (Ill. Handb. Fl. Ceylon, t. 53, 1895) and two other specimens, of which *Thwaites 2458* (K) has broadly 'orbicular-elliptic' leaves and *Thwaites 16* (K) has narrowly elliptic or lanceolate, acuminate leaves. We have studied this taxon in Kerala (both in the wild and cultivated) and have observed that leaves are quite variable in size and shape. The Indian and Ceylonese materials, in our view, belong to the same species.

However, some of the specimens at Kew (*Wight 1431 & s.n.*, from Malabar, both studied) labelled as *C. travancorensis* by J. D. Hooker and C. B. Clarke respectively have also been annotated as " ? aff. *travancorensis*" by Leroy. Unlike *C. travancorensis*, they have broadly elliptic, acute or subacute, apparently bifarious leaves and sessile or subsessile, solitary flowers virtually in every axil and sometimes at the tips of branches. From *P. fragrans* they differ in their submembranous leaves drying black, calyx shorter than the disc and stigmatic lobes rounded at apex. Critical studies have revealed many other differences, and hence we have described Wight's specimens as a new species, *Psilanthus malabaricus*, after the type locality.

Hooker (1880) described *Coffea fragrans* as "very similar indeed to *C. travancorensis*, and perhaps a variety of it, but the leaves are more shining, with the nerves more raised and the calyx limb which is deeply cupped, is many toothed", based on Gomez's collection from Sylhet (in Wall. Cat. 8450, K, seen). However, he also cited Helfer's collections from Tenasserim and Griffith's collection from Mergui. But these were subsequently found the belong to *C. merguensis* (see Ridley, 1920; Chevalier, 1947).

We have recognized 7 species of this genus in India, including the three new taxa described here.

Systematic Treatment

Key to the Species of ***Psilanthus*** *in India*

1. Flowers with one pair of bracts and one pair of bracteoles.
   2. Leaves with domatia in the vein axils beneath. Inflorescence-stalk elongated between bracts and bracteoles . . . . . *P. bababudanii*
   2. Leaves without domatia; bracts and bracteoles closely set without an elongation of the inflorescence stalk.
      3. Leaves to 4 × 2 cm, subacute or obtuse at apex; calyx limb many-toothed with the disc included; stamens fully included in the corolla tube; flowers sessile . . . . . *P. wightianus*
      3. Leaves to 12 × 6 cms, acute or acuminate at apex; calyx limb subentire with the disc far exceeding it; tips of stamens exserted; flowers stalked . . . . . *P. travancorensis*
1. Flowers with two pairs of bracts and one pair of bracteoles.
   4. Leaves without domatia.
      5. Leaves chartaceous, drying green; flowers terminal or in the upper axils only; calyx deeply cupped and much exceeding the disc, the limb irregularly many lobed. *P. fragrans*
      5. Leaves submembranous, drying black; flowers in almost all axils; calyx slightly shorter than the disc, the limb minutely 5 -lobed. . . . . *P. malabaricus*
   4. Leaves with domatia in the vein axils beneath.
      6. Inflorescence usually 1-flowered; lower pair of bracts elliptic acute or shortly acuminate, to 4 mm long; ovary with a ring of colleters at base; fruits ellipsoid . . . . . *P. bridsoniae*
      6. Inflorescence 1-5 flowered; lower pair of bracts lanceolate-acuminate, 10-14 mm long; ovary without colleters at base; fruits subglobose . . . . . *P. bengalensis*

Psilanthus bababudanii Sivarajan, Biju & Philip Mathew, sp. nov. (Fig. 1, A-J)—Type: INDIA, Kerala, Wynad. Chundale. *Biju 44701* (holotype: K; isotype: CALI). Introduced from Bengal and cultivated in the farm of the Regional Coffee Research Centre.

Coffea bengalensis sensu W. Hook., Curt. Bot. Mag. 12. t. 4917. 1856, non Heyne ex J. A. Schult., 1819.

Psilantho bengalensi arcte affinis, sed facile distinguenda in habitu glabro, foliis domatiis foveiformibus glabris, floribus tantum uno pari bractearum et uno pare bracteolarum foliiformium maturescentium in foliis adultis, internodio inter se elongato, ovario basiannulo colleteriorum, corolla glabra.

Closely similar to *Psilanthus bengalensis*, but can

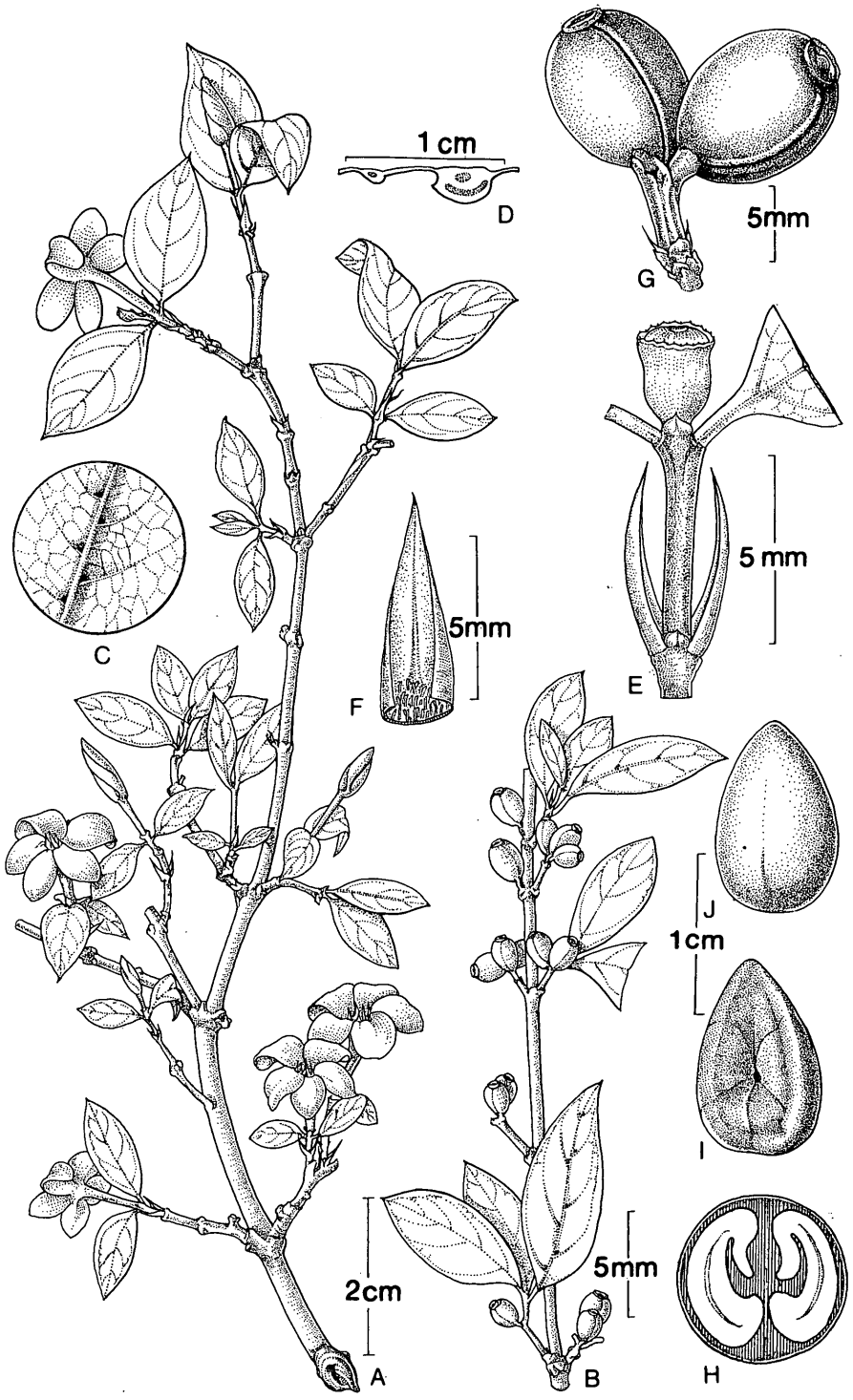

Fig. 1. *Psilanthus bababudanii* (A, C-F, *Biju 44701*, type: B, G-J, *Sivarajan & Biju 50476*). A, Flowering twig; B, Fruiting twig; C, Abaxial surface of leaf showing glabrous domatia; D, T. S. of leaf through domatia; E, Inflorescence; F, Bract, inside view showing colleters at base; G, Fruits enlarged; H, Fruit Cross section showing ventrally grooved seeds; I-J, Seed, dorsal and ventral view.

easily be distinguished by its glabrous habit, leaves with glabrous pit domatia in the vein axils beneath, flowers having one pair of bracts and one pair of leaf -like bracteoles (which often mature into adults leaves) with the inflorescence stalk elongated in between, glabrous corolla, and ovary with a ring of colleters at base.

Shrubs, 1-1.25 m tall, glabrous; Leaves decussate, subcoriaceous, drying brown, 3.2-6 × 1-3.5 cm, ovate or broadly elliptic, acute or shortly acuminate at apex, cuneate or attenuate at base, lateral veins 5-6 on each side, mostly with glabrous pit-domatia in the axils beneath. Petiole 2-5 mm, glabrous. Stipules ovate, long -aristate, 5-6 mm long. Flowers usually borne with leaves, white, fragrant, 1-3 mostly on terminal, less commonly axillary brachyblasts. Bracts 1 pair, lanceolate-acuminate, 6.5-7.5 mm long with colleters at base within and a pair of button-like structures (probably stipular) alternating with them. Bracteoles young -leaf like, often developing into adult leaves in fruiting stage with ovate-acuminate, stipule-like structures alternating with them at base, and at times producing shoots from either one or both the axils (when only one of the bracteoles produce an axillary shoot, it pushes the inflorescence into an apparently axillary position). Inflorescence stalk elongated between bracts and bracteoles, to 2.5-3.5 mm. Calyx campanulate, 2-3 mm long , almost equalling the disc or a little shorter, limb minutely 16-20 toothed with as many as or more colleters at the rim. Corolla tube 12-20 × 2 mm, cylindric, glabrous, lobes 5, elliptic, obtuse or rounded at tip, 8 -10 × 4-5 mm. Stamens 5, inserted below the throat of the corolla tube; anthers sessile, 1-1.2 mm long, tips exserted. Ovary with a ring of colleters at base; style to 3.2 mm long, glabrous; stigma 2-fid, almost as long as style. Fruits obovoid or ellipsoid, longer than broad, to 10 × 5 mm, smooth with a persistent crown of calyx, black when ripe. Seed ovoid, or ellipsoid, with a faint, irregular ventral groove.

Distribution: India (Bengal and Orissa).

Specimens examined: INDIA. Orissa: *Draper 1* (K), Nilgiris: ? *Bourne 5318* (K), Bengal: *Wallich 185* (from cult. in Calcutta Garden, (K), Karnataka: *Sivarajan 54076* (from cultivation at Chikmagalore, CALI), Kerala: *Sivarajan & Biju 20121, Biju 44701* (from cultivation at Chundale, Wynad, CALI).

Psilanthus bengalensis (Heyne ex J. A. Schult.) Leroy, Bull. Mus. Natn. Hist. nat., Pairs IV, 3. sect. B. 3: 252. 1981; Bridson, Kew Bull. 42: 455. 1987.(Fig. 2, A -E)

Coffea bengalensis (Roxb., Hort. Beng. 15. 1814, nom. nud.) Heyne ex J. A. Schult. in Roem. & Schult., Syst. Veg. 5: 200. 1819, 'benghalensis'—Type: *Roxburgh s. n.*, (NA, photograph seen); Roxb., Fl. Ind. 2: 194. 1824; DC., Prodr. 4: 499. 1830; Wt. & Arn., Prodr. 1: 435. 1834; Brand., For. Fl. 277. 1874; Hook. f., Fl. Brit. Ind. 3: 153. 1880; Gamb., Fl. Pres. Madras: 636. 1921; Kanjilal *et al.*, Fl. Assam, 3: 75. 1939; Chevalier, Encycl. Biol. 28: 120. 1947; Narasim. & Vishwesh., Turrialba, Costa Rica 5: 66. 1963.

Shrubs, 2-3 m tall, usually deciduous; young stem greyish brown pubescent. Leaves 3-6 (-13) × 5-7 cm, broadly ovate or elliptic, acuminate at apex, acute, rounded or slightly cuneate at base, subcoriaceous, pale green when young, yellow-brown on drying, glabrous above, pubescent on nerves beneath, lateral veins 3-5 on each side with hair-lined pit-domatia in the axils beneath. Petiole 3 (-10) mm long, pubescent. Stipules 5 -6 mm long, triangular-aristate, pubescent outside and with colleters within. Flowers borne with leaves or precocious, white, fragrant, 1-5, mostly on terminal or less commonly on axillary brachyblasts with 2 pairs of closely set bracts, the outer pair lanceolate-acuminate, 10-14 × 3-4 mm, pubescent outside and without colleters inside, the second pair similar but with colleters within. Bracteoles one pair, often of two young leaves, sometimes developing into mature leaves with a pair of ovate or triangular, acuminate stipules, closely set with bracts. Calyx 3-4 mm long, funnel-shaped, hardly projecting above the disc, limb minutely 5-7 lobed, with scattered colleters on the rim. Corolla pubescent, tube cylindric, 17-20 × 3 mm, lobes 5, ovate or elliptic, acute or obtuse, 10-13 × 5-6 mm. Stamens inserted below the throat of the corolla tube. Anthers sessile, 1-1.2 mm long, tips slightly exserted. Ovary without colleters at base; style 3.5 mm, glabrous; stigma 2-fid, 1.5 mm long. Fruits subsessile, obovoid or ellipsoid, crowned by the persistent calyx, longer than broad, 10-13 × 5-8 mm, entire or didymous, blue-black when ripe. Seeds oblong or ellipsoid with a longitudinal ventral groove.

Distribution: Bangladesh (Stylhet to Chittagong),

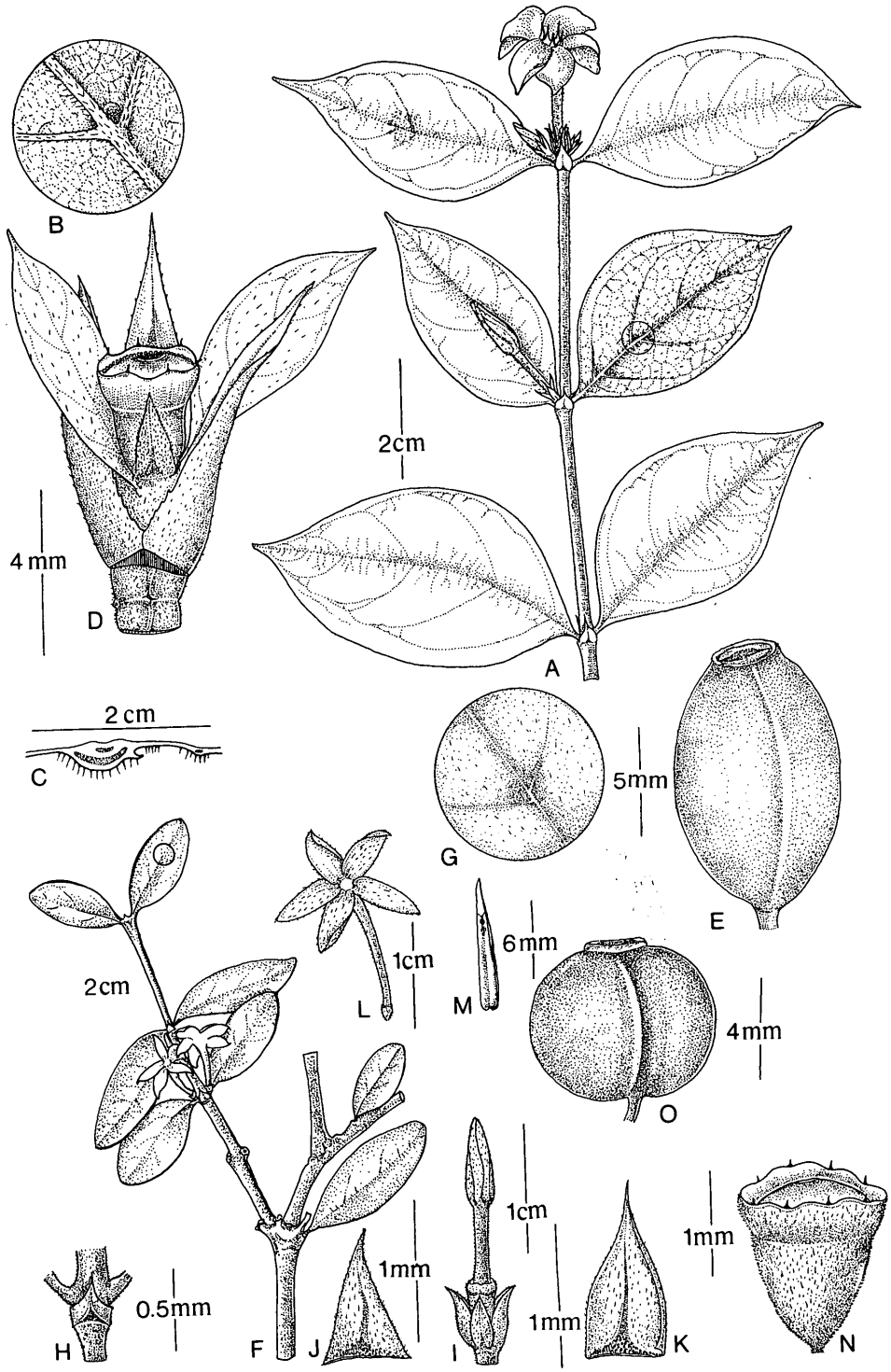

Fig. 2. A-E, *Psilanthus bengalensis* (A-C, *Hooker & Thomson 267*; D, *Barber 1405*; E, *Deka 16970*). A, Flowering twig; B, Abaxial surface of leaf showing hairy, pitted domatia; C, C. S. of leaf through domatia; D, Inflorescence, E, Fruit; F-O, *Psilanthus wightianus* (F-N, *Wight 1358*, type; O, *Wight 1429*); F, Flowering twig; G, Abaxial surface of leaf to show absence of domatia; H, Stipule; I, Inflorescence; J, Bract with colleters at base within; K, Bracteole with colleters at base within; L, Single flower; M, Anther showing apical attachment; N, Ovary with calyx; O, Fruit.

Bhutan, India (Arunachal Pradesh, Assam, Bengal, Meghalaya, Orissa, Rajasthan and Sikkim), Nepal.

Psilanthus bengalensis is probably the most widely distributed species of the genus. It has been attributed a much wider distribution (including Burma and Indonesia also) by Hooker (1880), Cheney (1925) and Chevalier (1947). But, Diane Bridson has expressed doubts about the identity of the Burmese specimen and has also suggested that its distribution from "Himalayas to Java seems an unlikely distribution to me" (pers. comm.). We have seen specimens identified as belonging to this species from Burma (Tamasun: *Maung Po Khant 15536*, K) and Indonesia (Java: *Kurzius s.n.*, CAL), but unfortunately these are poor and not suitable for critical study.

Specimens examined: INDIA: Arunachal Pradesh: *Kobo s.n., Conit 10931, Machinnon s.n.* (CAL), *Parasuranikind 10931*, Assam: *Deb 35246, Kanjilal 480, 2179; Rao 9722, Kanjilal & Mukherjee 137, Balakrishnan s.n., Fischer s.n., Deb s.n., Kanjilal & Ramdas 4276, Panigrahi 5825; Dora 16970* (ASSAM); *Party 1308* (K). Bengal: *Gulaty s.n.* (MH), *Griffith 3018* (K). Meghalaya: *Fischer s.n.* (CAL). Orissa. *Barber 1390, 1326, 1403* (MH). Rajasthan: *Burkill s.n.* (CAL). Sikkim: *Hooker s.n., King s.n.* (MH), *Hooker & Thomson s.n., Clarke 26334* (K). BHUTAN: *Thothathri 10356, Deb 120, Subba Rao 6, Senguptha 1188* (CAL), *Gamble s.n.* (MH). NEPAL: *Hata & Co. 1401, Stainton s.n.* (CAL). BANGLADESH: Chittagong: *Hooker & Thomson 167* (K), Sylhet: *Hooker & Thomson s.n.* (K), *Griffith 3018* (CAL).

Psilanthus bridsoniae Sivarajan, Biju & Philip Mathew, sp. nov. (Fig. 3, A-P)—Type: India, Kerala. Kappi-pacha Forest near Peechi near Trissur, as forest undergrowth, especially near streams. *Sivarajan & Biju 43240* (holotype: K; isotype: CALI).

Psilantho wightiana arcte, affinis, sed distinguenda in absentia surculis florentibus spiniformibus, foliis membranaceis acuminatis domatiis marginibus ciliatis, floribus duobus paribus bracteorum et uno pare bracteolarum foliar formium maturescentium in foliis adultis, ovario glabro basi annulo colleteriorum, corolla maiore, apicibus antherarum elongatis.

Psilanthus bridsoniae is closely allied to *P. wightianus* but can be easily distinguished by the absence of spiniform flowering shoots, membranous, acuminate leaves with hair-lined domatia, flowers with two pairs of bracts and a pair of leaf-like bracteoles which mature into adult leaves, glabrous ovary with a ring of colleters at base, and large corolla with exserted anther tips.

Shrubs, 1.5-2.5 m tall; younger parts minutely pubescent. Leaves apparently bifarious, elliptic, entire, long acuminate at apex, attenuate at base, 4-17 × 3-6 cm, membranous, glabrous, drying olive-green, lateral veins 3-6 on each side with hair-lined pocket domatia beneath. Petiole 2-5 mm long. Stipules ovate -acuminate, 7 × 6 mm, pubescent outside and with colleters within. Flowers borne with leaves or precocious, usually solitary, terminal or axillary, subsessile, white, fragrant. Bracts 2 pairs, closely set, elliptic, acute or shortly acuminate, 4 × 1.5 mm, pubescent outside and with colleters at base within, second pair similar, but slightly smaller. Bracteoles 1 pair, closely set with bracts with no elongation of stalk in between, like young-leaves, often developing into mature leaves in fruits with a pair of small, pubescent stipules with colleters on the margin and inside. Calyx cup-like, 2 mm long, glabrous, limb 5-toothed with interspersed colleters, hardly exceeding disc. Corolla pubescent outside, tube cylindric, to 2 cm long, lobes 5, elliptic, obtuse or subacute, 6-8 × 4-5 mm. Stamens inserted below the throat; anthers sessile, 2.5-4.5 mm long, tips slightly exserted. Ovary with a ring of colleters at base, style to 3.5 mm long, glabrous, stigma 2-lobed, lobes linear, almost as long as style. Fruits obovoid or depressed globose, to 1 cm across, didymous. Seeds oblong with a ventral groove.

This plant is native to some parts of Western Ghats and is deciduous. Flower initiation starts when the plants are leafless. Open flowers usually appear during February-April, along with new flushes and fruits during May-June.

Distribution: India: Eastern Himalayas (Abor Hills) and Western Ghats.

Additional specimens examined: INDIA: Assam: Abor Hills. *Burkill 36848* (CAL). Tamilnadu: Gudalur. *Lawson s.n.* (K), Nilgiris. *Gamble 14899* (K), Karnataka: Coorg. *Cameroon 9* (K). Kerala: Peechi. *Biju & Sasidharan 44800* (CALI). No locality, *Wight s.n.* (K).

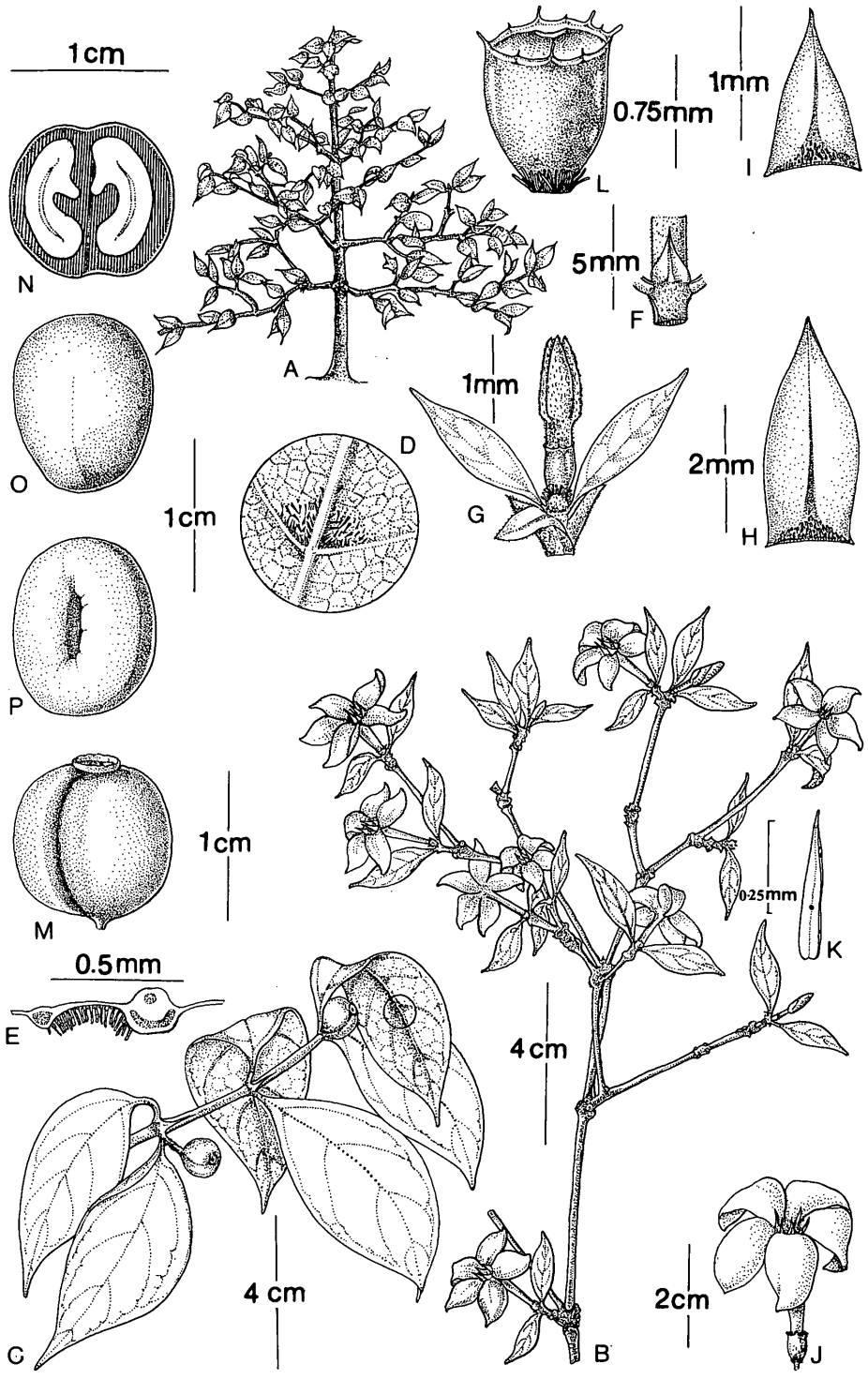

Fig. 3. A-P, *Psilanthus bridsoniae* (A-B, D-L, *Sivarajan & Biju 43240*, type; C, *Biju & Sasidharan 44800*; M-P, *Lawson s.n.*). A, Habit showing branching pattern; B. Flowering twig; C, Fruiting twig; D, Abaxial surface of leaf showing hairy domatia; E, C. S. of leaf through domatia; F, Stipule; G, Inflorescence; H, Bract showing colleters at base within; I, Bracteole with colleters at base within; J, Single flower; K, Anther showing attachment at middle; L, Ovary with calyx with a characteristic ring of colleters at base; M, Fruit; N, C. S. of fruit showing seeds within; O-P, Seed, dorsal and ventral view.

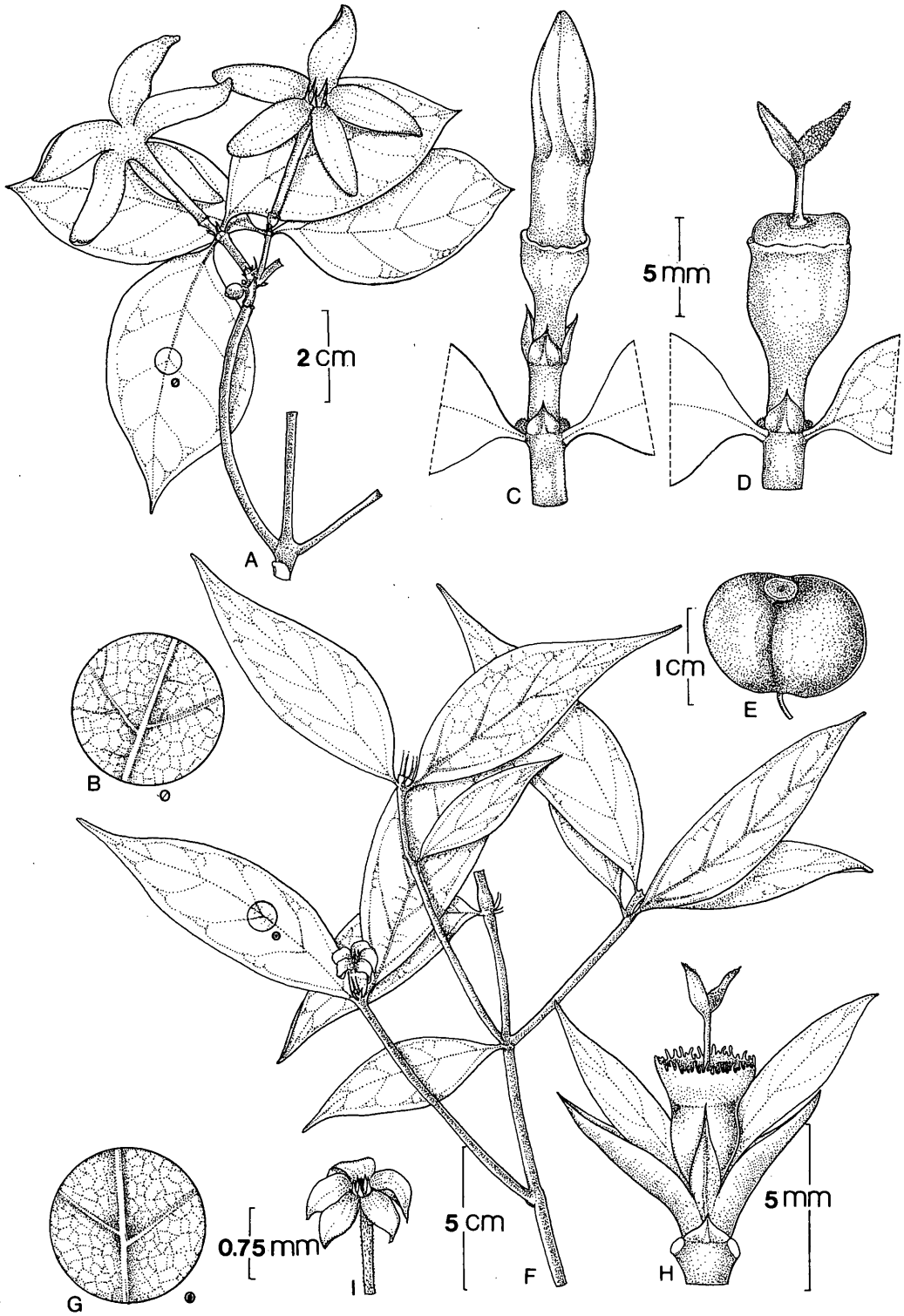

Fig. 4. A-E, *Psilanthus travancorensis* (A-B, *Wight 1357*, type; C-D, *Sasidharan 10267*; E, *Sivarajan & Biju 23021*). A, Flowering twig; B, Abaxial surface of leaf to show absence of domatia; C, Inflorescence (bracteolate); D, Inflorescence (ebracteolate); E, Fruit; F-I, *Psilanthus fragrans (Wallich 8450*, type); F. Flowering twig; G. Abaxial surface of leaf to show absence of domatia; H, Inflorescence; I, Corolla.

Psilanthus fragrans (Wall. ex Hook. f.) Leroy, Adansonia 3: 256. 1981; Bridson, Kew Bull. 42: 455. 1987. (Fig. 4, F-I)

Coffea fragrans Wall. (Cat. 8450. 183, nom. nud.) ex Hook. f., Fl. Brit. India. 3: 154. 1880, in part — Type: Sylhet. *Wallich* 8450 (K, seen). Brand., Ind. Tr. (3 ed.): 390. 1911; Cheney, Coffee: 17-18. 1925; Kanjilal *et al*., Fl. Assam 3: 76. 1939; Chevalier, Encycl. Biol. 28: 123. 1947.

Woody shrubs. Leaves to 15 × 5 cm, elliptic to lanceolate, acute or acuminate at apex, cuneate at base, chartaceous, glabrous, prominently veined, lateral veins 5-8 on each side, more raised below, without domatia, drying green. Petiole 4-5 mm long, glabrous. Stipules triangular, shortly aristate, with colleters at base within. Flowers mostly solitary, terminal or axillary, subsessile, white, generally appearing with leaves. Bracts 2 pairs, closely set, outer pair 3.5-4 × 1-1.5 mm, elliptic-lanceolate, aristate, pubescent outside and with colleters at base within, second pair similar but smaller. Bracteoles one pair, closely set with bracts and like young leaves, elliptic-acuminate, entire, 4.5-5.2 × 1-1.5 mm, sparcely pubescent with faint lateral veins. Calyx funnel-shaped to 2.5 mm long and 3 mm across, expanded above and projecting well above the disc, limb apparently lacerate with an indefinite number of unequal, finger-like colleters at the rim. Corolla white, tube cylindric, 1-1.6 cm long, minutely pubescent outside, lobes 5, ovate or elliptic, acute, 6-7 × 2-3 mm. Stamens attached below the throat of the corolla tube; anthers sessile, 4 mm long, tips exserted. Style to 7 mm long, glabrous, stigma 2-lobed, 1-1.2 mm. Fruit not seen.

Distribution: India (known only from cultivation), Bangladesh, and Burma.

Specimen examined: INDIA: Cult. in Calcutta Garden: *Kurz s.n.* (CAL).

Psilanthus malabaricus Sivarajan, Biju & Philip Mathew sp. nov. (Fig. 5, A-H) — Type: Malabar. *Wight 1431* (holotype: K).

A Psilantho travancorensi (Wt. & Arn.) Leroy et Ps. fragranti (Wall. ex Hook. f.) Leroy speciebus affinibus haec distinguenda potest in foliis membranaceis bifariis ut videtur nigrescentibus in sicco, inflorescentia 1-(vel 2-vel 3-) floribus in apicibus ramulorum et quoque in omnibus axillis, disco paullo vel vix calycem excedenti et lobis stigmaticis apice rotundatis.

From the allied *P. travancorensis* (Wt. & Arn.) Leroy and *P. fragrans* (Wall. ex Hook. f.) Leroy, *P. malabaricus* can be distinguished by its membranous, apparently bifarious leaves which turn black on drying, 1-(2-3) flowered inflorescence at the tips of branches and also in every axil, disc a little or hardly exceeding the calyx, and stigmatic lobes rounded at apex.

Shrubs; younger parts pubescent. Leaves apparently bifarious, membranous, glabrous, drying black, narrowly elliptic to oblanceolate, acute or subacute at apex, cuneate or attenuate at base, 5-9 × 2-3 cm, lateral veins 4-5 on each side without domatia. Petiole 5-8 mm, glabrous. Stipules truncate, shortly aristate at apex, 1 mm long, glabrous with colleters at base within. Flowers white, usually borne with leaves, solitary or occasionally 2-3 in every axil and also at the tips of branches, subsessile. Bracts two pairs, almost similar, closely set, glabrous, oblong or lanceolate, acute, 3.5-4.2 × 1-1.5 mm, with colleters within at base. Bracteoles closely set with bracts, linear-lanceolate, acuminate, slightly exceeding the bracts and never developing into leaves. Calyx 1.5-2 mm long, cupshaped, slightly shorter than the disc, glabrous, limb minutely and obtusely 5-lobed with scattered colleters at the rim. Corolla slightly pubescent outside, tube cylindric, to 2-5 cm long, lobes 5-ovate or oblong, acute, 10-13 × 3-4 mm. Stamens 5, inserted below the throat; anthers sessile, 4-5 mm long, tips exserted. Style 1.2 mm, glabrous; stigma bifid, lobes rounded at apex, 2 mm long. Fruit not seen.

Distribution: India (Malabar).

Additional specimen examined: Malabar. *Wight s. n.* (K).

Psilanthus travancorensis (Wt. & Arn.) Leroy, Compt. Rend. Hebd. Seances Acad. Sci. 29, D: 595. 1980; Bridson, Kew Bull. 42: 455. 1987. (Fig. 4, A-E)

Coffea travancorensis Wt. & Arn., Prodr. 433. 1834; Thw., Enum. Pl. Zeyl. 154. 1864 — Type: Travancore. *Wight 1357* (K, seen); Hook. f., Fl. Brit. India 3: 154. 1880; Trimen, Ill. Handb. Fl. Ceylon t. 53. 1893 & Handb. Fl. Ceylon 2: 353. 1894; Brand., Ind. Tr. (rep. ed.): 390. 1911; Gamble, Fl. Pres. Madras: 637. 1921; Cheney, Coffee: 19-22. 1925; Chevalier, En-

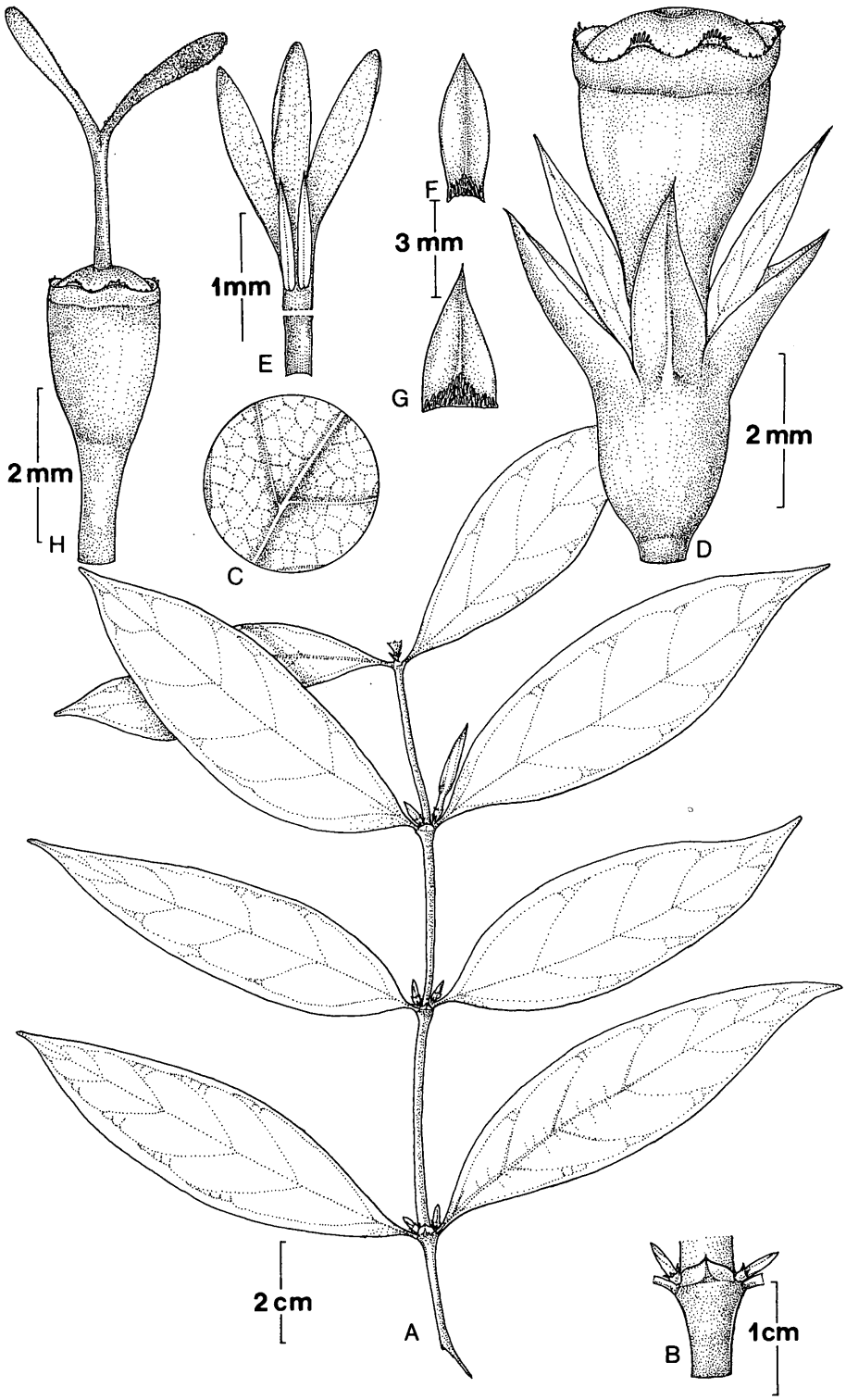

Fig. 5. *Psilanthus malabaricus* (*Wight 1431*, type). A, Flowering twig; B, Node showing sessile inflorescence and stipules; C, Abaxial surface of leaf to show absence of domatia; D, Inflorescence; E, Corolla, dissected; F-G, Bracts, one each from the I & II pair showing colleters within at base; H, Bracteole; I, Calyx and ovary with style and stigma.

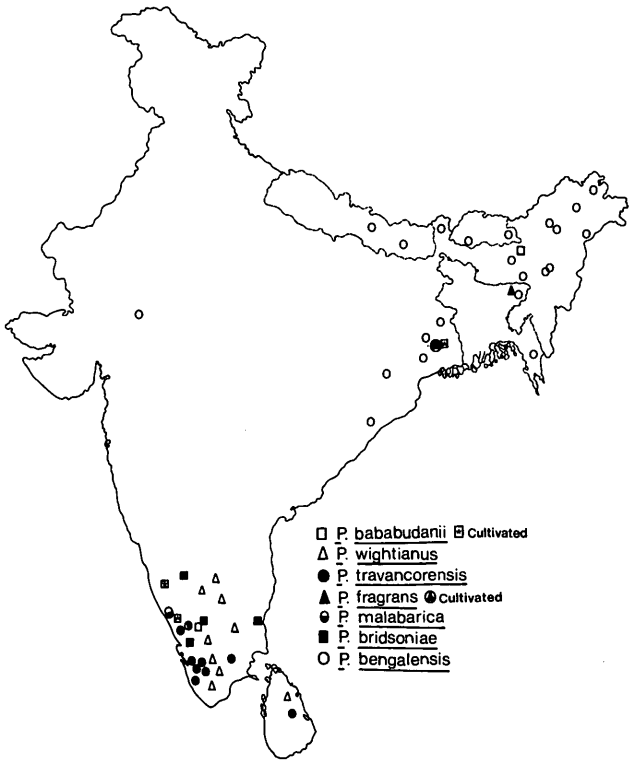

Fig. 6. Distribution map of *Psilanthus* species in India and adjoining areas.

cycl. Biol. 28: 123-125. 1947; Narasimh. & Vishwesw., Turrialba, Costa Rica 5 (19): 67. 1963.

Shrubs, to 1.5-2.5 m tall. Leaves variable in size and shape, broadly ovate, elliptic or oblanceolate, entire, acute or shortly acuminate at apex, acute or cuneate at base, to 12 × 6 cm, coriaceous, glabrous, shining green above, paler beneath, lateral veins 5-8 on each side, faint above, raised below, without domatia. Petiole 1-3 mm, glabrous. Stipules ovate, shortly acuminate at tip, 1.5-2 mm long, glabrous outside and with colleters at base within. Inflorescence 1-5 flowered, mostly on terminal, less commonly on axillary brachyblasts. Flowers white, fragrant, the central flower in 3-5 flowered inflorescence usually ebracteate and ebracteolate, others with one pair of bracts and a pair of closely set bracteoles. Bracts ovate-cuspidate, to 1-1.6 mm long, glabrous outside and with colleters at base within. Bracteoles lanceolate, to 2 mm long, sometimes developing into leaves. Calyx cup-shaped, to 1.2 mm long, glabrous, much shorter than the disc, limb subentire. Corolla glabrous, tube cylindric, 10-18 mm long, lobes 5, elliptic-obtuse, 8-12 × 3-7 mm. Stamens 5, inserted below the throat; anthers sessile, 5-7 mm long, tips exserted. Ovary stipitate, style 1.2 mm, glabrous; stigma 2-lobed, lobes acute, 1-1.4 mm. Fruits blue-black when ripe, depressed globose, didymous, 14 × 20 mm. Seeds dark, ellipsoid, 5-7 × 4-5 mm, with a prominent ventral groove.

Distribution: Southern India (Tamil Nadu & Kerala) and Sri Lanka. This species, indigenous to Travancore Hills in Kerala, is also frequently grown as an ornamental in the State. Under cultivation, depending on exposure and other environmental conditions, the leaves may show considerable variation as compared to the ones in natural habitat (Narasimhaswamy and Vishweshwara, 1963).

There is no material to support Chevalier's (1947) indication of its occurence in Java. In Kerala, due to widespread forest destruction, this species is now extremely rare. However, recently we found it growing wild in a sacred grove near Alwaye.

Additional specimens examined: INDIA: Travancore: *Ellis 24056, Narayana Swamy s.n., Mohan 36167, 30190, Vaidyasarathy s.n.* (MH), *Biju 23021* (CALI), *Sasidharan 10267* (KFRI), Tamil Nadu: *Ellis 35301* (MH), SRI LANKA: *Thwaites 16, 2458* (K).

Psilanthus wightianus (Wt. & Arn.) Leroy, Bull. Mus. Hist. Nat. (Paris) ser. (4) 3. Sect. B. Adansonia 3: 252. 1981; Matthew, Fl. Tamilnadu Carnatic 3: 734. 1983; Bridson, Kew Bull. 42: 455. 1987. (Fig. 2, F-O)

Coffea wightiana Wt. & Arn., Prodr. 436. 1834; Wt., Icon. t. 1598. 1850—Type: India, Coimbatore. *Wight 1358* (K, seen); Thw., Enum. Pl. Zeyl. 154. 1864; Hook. f., Fl. Brit. India 3: 154. 1880; Trimen, Handb. Fl. Ceylon 2: 252. 1894; Gamble, Fl. Pres. Madras 2: 636. 1921; Narasimh, & Vishwesh., Turrialba, Costa Rica 5 (19): 67. 1963; Matthew, Ill. Fl. Tamilnadu Carnatic t. 329. 1982.

Deciduous shrubs, often with spiniform branches, to 2.4 m tall, greyish in colour. Leaves to 4 × 2 cm, decussate, ovate or elliptic, entire, subacute or obtuse at apex, cuneate or attenuate at base, subcoriaceous, green above, grey beneath, lateral veins 3-4 on each

side without domatia. Petiole 1-2 mm. Stipules triangular, acuminate, 6 × 4 mm, pubescent outside and with colleters within at base. Flowers usually borne on leafy, spiniform branches, rarely on bare ones, solitary, rarely in pairs, white, sweet-scented. Bracts one pair, minute, ovate or elliptic, acute, to 2 × 1 mm, pubescent with colleters at base within. Bracteoles closely set with bracts, much larger, to 2.5 × 2 mm, ovate -acuminate, pubescent outside. Calyx campanulate, 1 -1.5 mm long, pubescent outside, slightly exceeding the disc, limb minutely and obtusely 8-10 lobed with colleters on the margin. Corolla tube cylindric, to 1-1.5 cm long, pubescent outside, lobes 5, oblong or elliptic, to 10 × 6 mm. Stamens inserted below the throat, anthers sessile, 1.5-2.5 mm long, fully included. Style glabrous, to 1.5 mm long; stigma 2-lobed, the lobes almost as long as style. Fruit broader than long, 4 × 8 mm, distinctly 2-lobed, blue-black when ripe. Seeds oblong, 3 × 2 mm, with a ventral groove.

Distribution: Peninsular India (mainly in arid parts of Deccan and Carnatic) and Sri Lanka. In India, it occurs in the dry or semi-dry areas along the eastern slopes of Western Ghats and on the Eastern Ghats up to an elevation of 1800 ft. This species sems to be restricted to areas of N. E. Monsoon and forms a dominant undergrowth in scrub jungles and in open places, frequently appearing stunted due to cattle browsing (Narasimhaswamy and Vishweshwara, 1963).

Specimens examined: INDIA: Tamil Nadu: *Ramamurthy 14059, Vajravelu 38585, Barber 3206, Narayanaswamy 19993* (MH), *Fischer 3967, 1851 & 4250, Hooker s.n.* (CAL), *Wight 1429* (K). Karnataka: *Matthew & Venugopal 23003* (CAL); SRI LANKA: *Thwaites 1654* (K), s.c., *s.n.* (CAL).

Discussion

Phytogeographically, *Psilanthus* is an Old World genus distributed in Indo-Malaysia, Australia and Africa. Of the seven species described here from India, six are native, and *P. fragrans*, is known only from cultivation. *P. bengalensis* has the widest distribution extending from the western to the eastern Himalayas. *Psilanthus malabaricus* has the smallest range, being known only from Malabar. The Indian taxa fall under two distinct phytogeographical groups: *P. bababudanii, P. bengalensis* and *P. fragrans* restricted mostly in the eastern Himalayas and *P. malabaricus, P. travancorensis* and *P. wightianus* occurring only along the Western Ghats in Peninsular India (The latter two species also occur in Sri Lanka). *Psilanthus bridsoniae* has an apparent disjunct distribution, occuring in the eastern Himalayas in the north and also on the Western Ghats in the south, with no record from the intervening areas.

Of all the taxonomic characters used in this study, the most important are the inflorescence characters. The nature and position of the inflorescence, nature of the inflorescence stalk, and disposition and nature of bracts and bracteoles have been found to be highly useful in species delimitation. The flowering behaviour of these species also have been studied in some detail. Bridson (1982) found that in the genus *Coffea* most species bear flowers with leaves, but some flower precociously. She had also remarked that "some precocious species may also have a phase when both leaves and a second flush of flowers may be borne together." Our observations reveal that this is true of the Indian species of *Psilanthus* also. It is also apparent that this is mostly controlled by the drought-monsoon cycle. Generally, they flower soon after the first rains succeeding a dry spell. In such cases, the flowering is precocious. However, if the dry spell is interrupted by off-season showers, or if the plants are irrigated during the dry period, they bear flowers with leaves.

Furthermore, we have found that the occurrence and nature of domatia is useful in the delimitation of species within the Indian *Psilanthus*. Chinnappa and Warner (1982) studied the domatial types in the *Coffea* complex (incl. *Psilanthus*) which included three of the species described here. They found that *P. bengalensis* and *P. wightianus* have no domatia on their leaves and that *P. travancorensis* has hairy domatia. They regarded domatial characters as having no systematic usefulness because "no clear pattern emerged when domatial types were compared with either the taxonomic or pollen type groupings". Unfortunately voucher specimens were unavailable for their investigation, and our revision calls into question their identifications.

We have found that *P. fragrans, P. malabaricus, P. travancorensis*, and *P. wightianus* lacked domatia on their leaves, and *P. bengalensis* and *P. bridsoniae* are characterised by hair-lined pit domatia. It is not a constant character in *P. bababudanii*, but when present they are glabrous.

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印度產茜草科咖啡族 *Psilanthus* 屬植物之分類訂正

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本文訂正茜草科咖啡族 *Psilanthus* Hook f. 屬之印度種類計七種（含本文所發表的三新種）。其中的六種是印度原產；至於 *P. fragrans*，最早被報導在孟加拉 Sylhet，僅知爲栽培種類。以上各種的檢索表，正確命名、描述和繪圖在文中均有詳記。