

Andrographis producta (Acanthaceae), an endemic species from the Western Ghats: its taxonomy, lectotypification and distribution

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Abstract

The name *Andrographis producta* (C.B. Clarke) Gamble (basionym: *A. neesiana* Wight var. *producta* C.B. Clarke) is lectotypified here. As well as a complete description, including the pollen and seed morphology, the relationships, IUCN conservation status and distribution of this endemic species from the Western Ghats in India are discussed in detail for the first time.

Introduction

The genus *Andrographis* Wall. ex Nees (Andrographinae: Acanthaceae) is represented by 20 species in the world (Mabberley 2008) and distributed mainly in southern India and Sri Lanka (Gnanasekaran & Murthy 2014). However Karthikeyan et al. (2009) have enumerated a total of 28 taxa from India, of which 23 are endemics (Gnanasekaran & Murthy 2012). Clarke (1884) described five new species and seven new varieties of *Andrographis* in the *Flora of British India* including *A. neesiana* Wight var. *producta* C.B. Clarke from the Western Ghats. Later Gamble (1924) raised its status to the rank of species. During the present study on the systematics of *Andrographis* in India, we found the need for designating the lectotype for this name. It is lectotypified here in accordance with Article 9.2 of ICN (McNeill et al. 2012) and an image of the selected specimen is provided. In addition a complete description, along with pollen and seed morphology, illustrations, colour photographs and a distribution map have been provided for the first time.

Andrographis producta (C.B. Clarke) Gamble, *Flora of the Presidency of Madras*: 1049 (1924).

A. neesiana Wight var. *producta* C.B. Clarke in Hook.f., *The Flora of British India* 4: 504 (1884).

Type citation: *A. ceylanica* Wight in *Herb. Andrographis* sp. n. 13, *Herb. Ind. Or. H.f. & T.* - Shevagherry Hills; Wight (Herb. Propr. N. 2702). Tinnevely; *Beddome*. Malabar; *Gibson* (in Herb. Dalzell), &c.

Lectotype (designated here): India: Tamil Nadu: Tirunelveli district: Shevagherry hills, anno 1837, *R. Wight* 2702 (K000545943, image!) – **Fig. 4**.

Residual syntypes: Malabar Concan & c., *Stocks, Law, & c. s.n.*, without date (BM000948843!, CAL!, G30004878, G00304884, MH!, P03590464, P03590467, P03590484, S11-300095, images!); Malabar, *Gibson s.n.* (in herb. Dalzell), without date (K000592612, image!); Sivagiri [Shevagherry] hills, *R. Wight* 2702, without date (E00435358, image!); Tinnevely [Tirunelveli], Sivagiri ghat, *R.H. Beddome s.n.*, without date (BM001050055!); Tinnevely [Tirunelveli] ghats, *R.H. Beddome s.n.*, without date (BM001050056!); South Tinnevely, Calaad [Calacad] hills, *R.H. Beddome s.n.*, without date (BM001050061, image!).

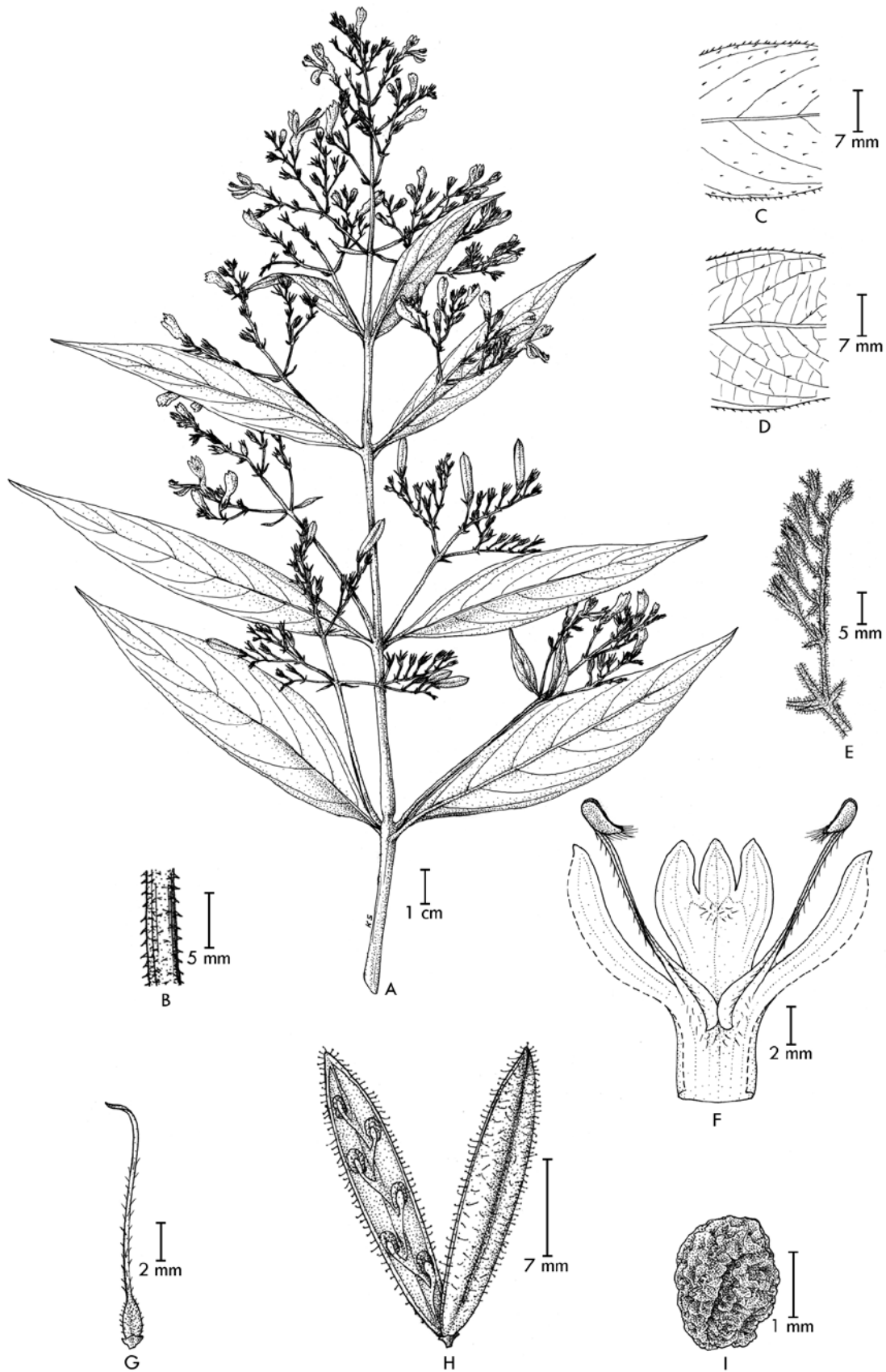


Fig. 1. *Andrographis producta* (C.B. Clarke) Gamble: A. Habit. B. Details of stem indumentum. C. Leaf – Adaxial surface. D. Abaxial surface. E. Detail of inflorescence rachis indumentum. F. Corolla – Split-open. G. Carpel. H. Fruit. I. Seed. (R. Chandrasekaran 88515 (A–G), MH; K. Ravikummar 116394 (H & I), FRLH). Drawn by K. Sivanandan.

A. explicata auct. non (C.B. Clarke) Gamble, 1924: B.D. Sharma et al., *Flora of Karnataka*: 200 (1984); M.R. Almeida, *Flora of Maharashtra* 4(A): 5, fig. 4. (2003).

Undershrub, up to 2 m high. Stems distinctly 4-angled, retrorsely scabrid on angles (Fig. 1B), puberulous, glandular-hairy when young; nodes swollen, densely pubescent. Leaves narrowly elliptic to linear-lanceolate, 8–16 cm long, 0.5–3.5 cm wide, attenuate, rarely obtuse at base, entire at margins, long-acuminate at apex, strigose above (Fig. 1C), glabrescent to glandular-pubescent beneath (Fig. 1D), black above when dry, hypostomatous (Fig. 2D, E); midrib conspicuous beneath, lateral veins 8–10 pairs; petioles 3–10 mm long, pubescent. Inflorescence racemose, branched, axillary and terminal, 4–18 cm long forming a terminal pyramidal panicle; rachis 4-angled, glandular-pubescent; flowers closely arranged (interstices less than 5 mm long), twisted at right angles to each other, one-sided; peduncles 3–8 cm long, puberulous to glandular-pubescent; pedicels slender, 2–5 mm long, glandular-pubescent. Bracts 2, linear-lanceolate, 1.8–2 mm long, 0.3–0.5 mm wide, hairy at margins, acuminate at apex, glandular-pubescent above, antrorsely strigulose beneath, green. Bracteoles 2, linear, 1.2–1.5 mm long, 0.2–0.3 mm wide, hairy at margins, acuminate at apex, glandular-pubescent above, antrorsely strigulose beneath, green. Calyx 5-lobed; lobes lanceolate, 3–4 mm long, 0.5–0.7 mm wide, hairy at margins, acute-acuminate at apex, antrorsely strigulose inside, glandular-hirsute outside. Corolla 2-lipped, 1.2–1.5 cm across, pinkish; tube prominently ventricose, 5.5–7.5 mm long, 2–3.3 mm wide, glandular-hirsute above, glabrous below; upper lip spatulate-oblong, entire at margins, minutely 2-lobed (0.8–1 mm long) at apex, 9–10 mm long, 2.5–3 mm wide, glabrous inside, glandular-hirsute outside, 6-veined; lower lip 3-lobed, entire at margins, obtuse at apex, 5.5–7 mm long, 5.2–5.6 mm wide, glabrous inside except at centre of middle lobe, glandular-hirsute outside, purple-striped inside; middle lobe ovate, 3–4 mm long, 3–3.2 mm wide, hirsute at centre, 3-veined; lateral lobes oblong, 1.6–1.8 mm across, 3-veined. Stamens 2, exserted, adnate to base of ventricose portion of corolla tube; filaments 10–12 mm long, distinctly dilated at base, retrorsely pilose above, scabrid below; anthers oblong-obovoid, 1.8–2.7 mm long, 0.6–0.8 mm wide, jointed and pilose at base, deep purple. Pollen grains (Fig 2F) 3-colporate, subprolate, 38–40 µm long, 32–36 µm wide, tectum ornamentation distinctly bireticulate (Fig 2G). Ovary oblong, 1.6–1.8 mm long, 0.8–1 mm wide, glandular-hairy; ovules 6 in each cell; style 13–15 mm long, antrorsely bristly hairy; stigma linear, green. Capsules linear, 15–30 mm long 4–6 mm wide, acute, compressed at right angles to septum with a median longitudinal groove, densely glandular-hairy except in groove, brown, 10–12-seeded. Seeds (Fig 3A–D) oblongoid, subquadrate, obovoid, 1.8–2.5 mm long, 1.4–1.8 mm wide, narrowly oblique-truncate at base, obtuse at apex, very hard, rugosely pitted, verrucose, glabrous, yellowish-brown. Figs 1, 2, 3.

Phenology: Flowering and fruiting August – March

Distribution: Endemic to INDIA: **Karnataka** (Chikkamagaluru, Coorg, Hassan and Shimoga districts), **Kerala** (Idukki, Kottayam, Palakkad, Pathanamthitta, Thiruvananthapuram and Wayanad districts), **Maharashtra** ? (Konkan – Almeida 2003) and **Tamil Nadu** (Coimbatore, Dindigul, Kanyakumari, Nilgiris, Theni and Tirunelveli districts). **Fig. 3E**

Habitat: Moist deciduous and evergreen forests, between 550 and 1800 m.

IUCN Conservation status: *Andrographis producta* is categorized here as ‘Least Concern [LC]’ according to the IUCN Red List Categories and Criteria Version 3.1 (IUCN, 2012), since it is common and widespread in their range of distribution.

Inter-relationship: *Andrographis producta* can easily be confused with morphologically closely related species namely *A. neesiana* and *A. explicata*. Therefore these three species are here keyed out to facilitate an accurate identification.

- 1a. Leaves broadly elliptic-ovate; inflorescence short, 2–4 cm long, crowded towards apex of plant, appears like subcapitate head **A. neesiana**
- 1b. Leaves narrowly elliptic-lanceolate; inflorescence large, up to 18 cm long, lax and effuse and never crowded towards apex of plant **2**
- 2a. Leaves lineolate, strigose only towards margins becomes glabrous at maturity; inflorescence raceme, very rarely one-branched, up to 10 cm long; peduncle 2–4 cm long; flowers distantly arranged (interstices up to 10 mm long); corolla white with slight pink shade; capsule smaller, less than 20 mm long **A. explicata**
- 2b. Leaves not lineolate, prominently strigose above; inflorescence panicle, profusely tri-dichotomously branched, up to 18 cm long; peduncle 3.5–8 cm long; flowers closely arranged (interstices less than 5 mm long); corolla white with dark purplish; capsule larger, up to 30 mm long **A. producta**

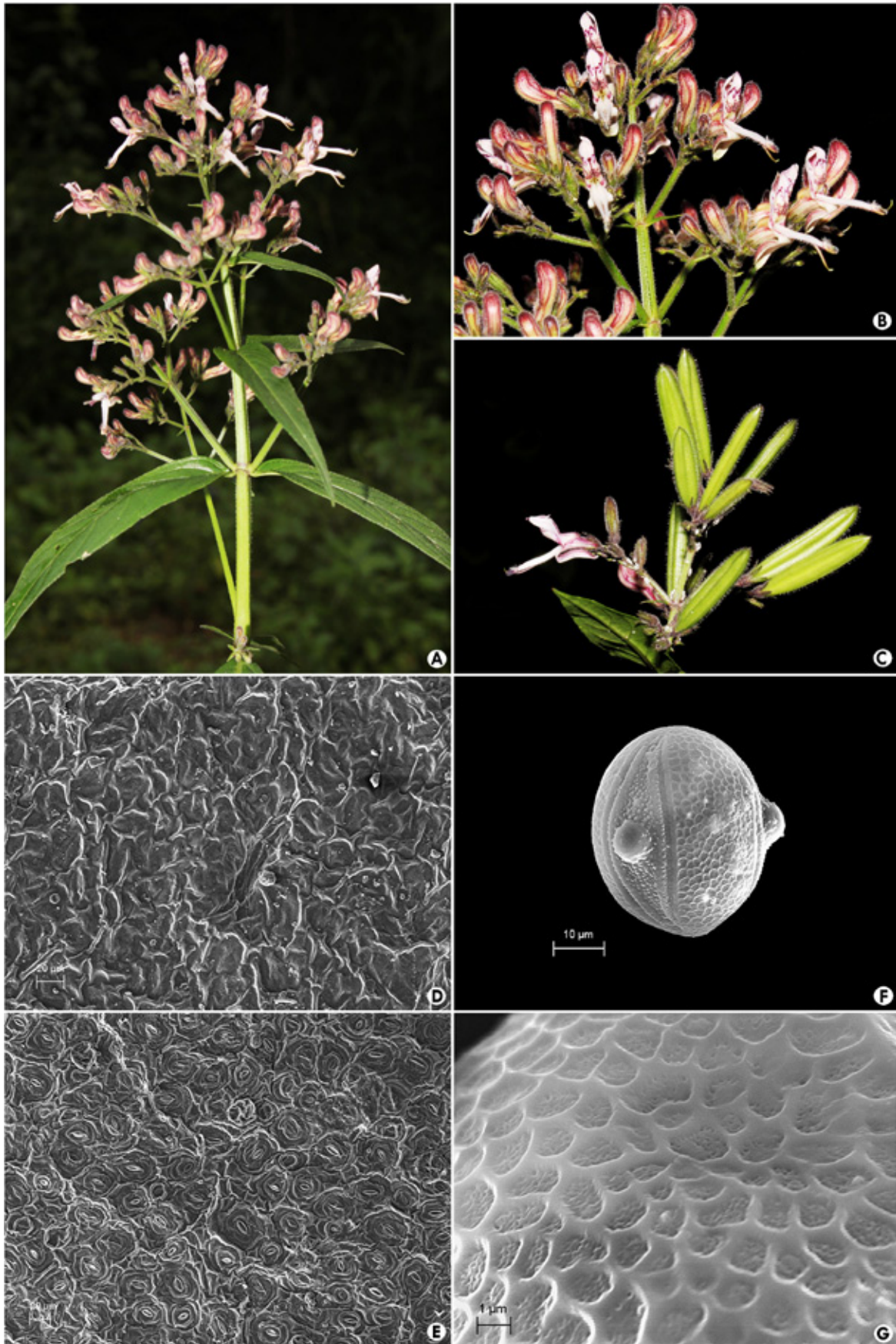


Fig. 2. *Andrographis producta* (C.B. Clarke) Gamble: **A.** Habit. **B.** Flowering twig. **C.** Fruiting twig. **D.** Leaf – Adaxial surface. **E.** Abaxial surface showing stomata. **F.** SEM image of pollen grain **G.** surface ornamentation. Images: K. Ravikumar (A–C) and G. Gnanasekaran (D–G).

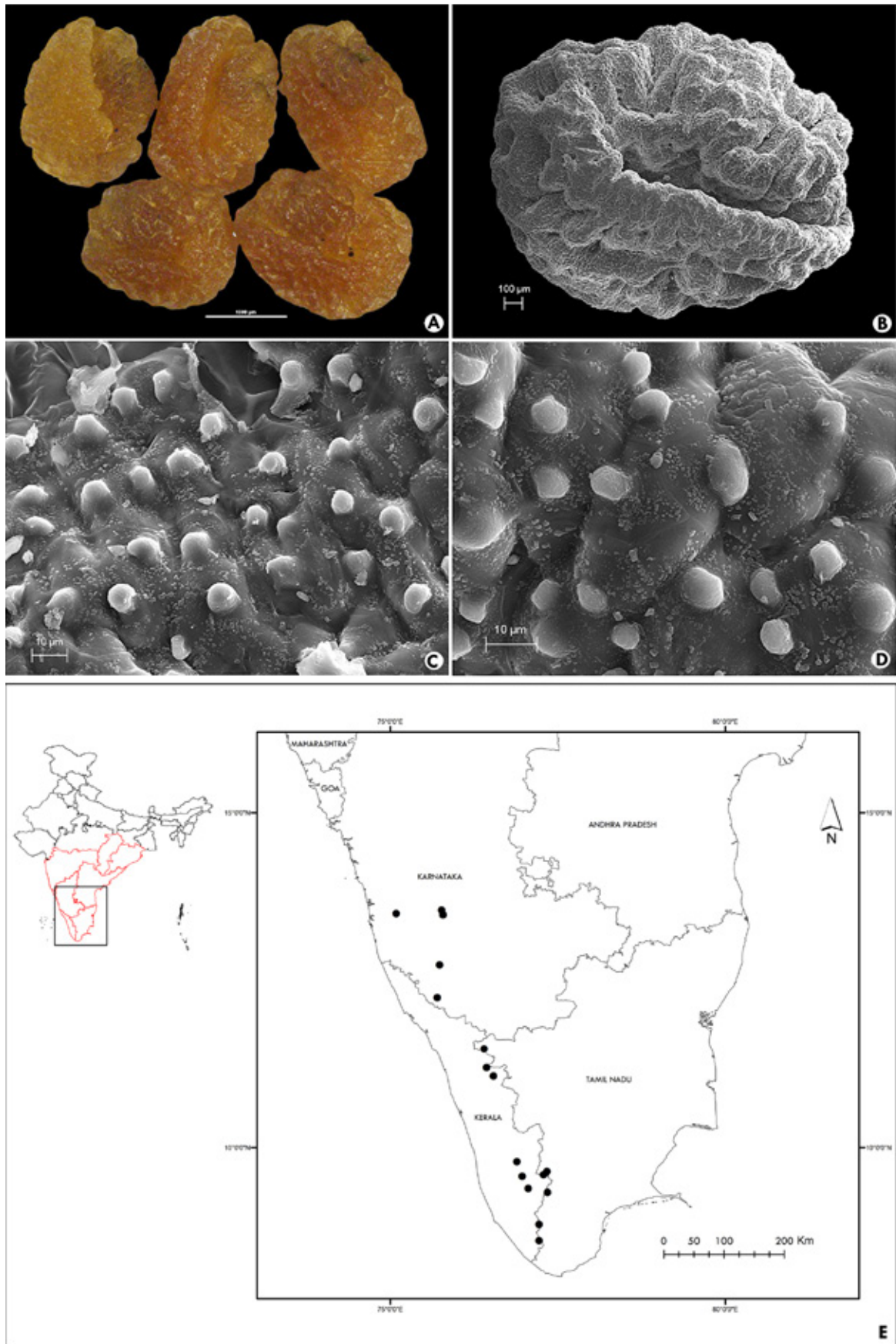


Fig. 3. *Andrographis producta* (C.B. Clarke) Gamble: A–D. Light and SEM images of seeds and surface ornamentation. E. Map showing distribution in Western Ghats in India, prepared by C.R. Magesh. Images: G. Gnanasekaran.

Other specimens examined: INDIA. KARNATAKA: **Chikkamagaluru district**, Babuboodun hills, *Law s.n.*, without date (CAL341333); Kemmangundi, *R.S. Raghavan 103644*, 20 Oct 1964 (BSI); Kemmangundi, *R.S. Raghavan 103683*, 20 Oct 1964 (BSI); Bababudan range, *R.S. Raghavan 103794*, 22 Oct 1964 (BSI); Chikkamagaluru, Bababudangiri, *R.K. Aura 5183*, 22 Oct 1965 (CAL); Bababudangiri hills, Lingadahalli, 1590 m, *K.V. Dear 8731*, 29 Sep 1996 (FRLH); **Coorg district**, Mercara, *M.P. Rama Rao s.n.*, Oct 1930 (Acc. No. 20948, FRC); Karavalabadaga behind college, *A.S. Rao 74535*, 22 Sep 1961 (BSI); On the way to Abbi, *A.S. Rao 74626*, 24 Sep 1961 (BSI); Kundalli, *A.S. Rao 94737*, 16 Oct 1963 (BSI); On the rivers of Thodiandamol, *B.C. Banerjee 11644*, 10 Feb 1976 (CAL); Near Mercara, *B.C. Banerjee 11248*, 04 Nov 1976 (CAL); Talacauvery, 990 m, *K. Ravikumar & al.*, 6408, 10 Aug 1998 (FRLH); **Hassan district**, Vanagur, 900 m, *D.H. Nicolson, S.S. Hooper, C.J. Saldanha & K.N. Gandhi 2300*, 24 Oct 1971 (CAL!, K000545934, image!); **Shimoga district**, Shirur forest, Agumbe, *R.S. Raghavan 90361*, 01 Sep 1963 (BSI, CAL); KERALA: **Idukki district**, Kuttikanam–Peermade, 1100 m, *K. Vivekananthan 20311*, 21 Sep 1964 (L0833670, MH); Kuttikanam–Peermade, 1025 m, *K. Vivekananthan 29301*, 23 Nov 1967 (MH); Vallakkadavu Reserve forest, 850 m, *B.D. Sharma 40818*, 22 Sep 1972; Kulamavu, 750 m, *K. Vivekananthan 50428*, 20 Aug 1977 (CAL, MH); Kulamavu, *C.N. Mohanan & B. Ramanujam 71906*, 24 Sep 1981 (CAL, MH); Kulamavu, 850 m, *C.N. Mohanan & B. Ramanujam 71959*, 24 Sep 1981 (CAL, MH); Pambanar, 890 m, *T.A. Panicker 15083*, 25 Jan 1996 (FRLH); **Kottayam district**, Kuthikanam–Peermade, 1000 m, *K. Vivekananthan 23003*, 25 Jan 1965 (MH); Kurisumala, 1000 m, *K.M. Matthew 18545*, 31 Aug 1985 (RHT); Nagaram para Reserve Forest, *N. Venkatasubramanian & K.R. Sasidharan 13452*, 24 Nov 1987 (FRC); **Palakkad district**, Tadikundi, Attapadi valley, 2200 ft (c. 650 m), *C.E.C. Fischer 2800*, 16 Oct 1910 (CAL, FRC); Silent Valley Dam site, 950 m, *N.C. Nair 64206*, 04 Oct 1979 (CAL, MH); Silent Valley, 1150 m, *N. Sasidharan 871A, 871B*, 29 Sep 1991 (FRLH); Attapady, 1010 m, *S. Aroumougame & Radhakrishnanan 21064*, 16 Nov 1996 (FRLH); **Pathanamthitta district**, Pamba dam, 1000 m, *K. Vivekananthan 45269*, 15 Dec 1974 (MH); Kakki damsite, *K.N. Subramanian 9811, 9822*, 21 Oct 1983 (FRC); Kakki Pamba, *C.K. Jayachandran, N. Venkatasubramanian & K.R. Sasidharan 10299*, 25 Jan 1984 (FRC); Pamba–Moozhiair, 1000 m, *N. Anil Kumar 68*, 11 Sep 1987 (MH); On the way to Kaki forest, c. 1000 m, *R. Chandrasekaran 88515*, 09 Aug 1988 (MH); Pamba Coodrical R.F., 1100 m, *N. Anil Kumar 1368*, 25 Dec 1988 (MH); **Thiruvananthapuram district**, Way to Agasthyarkudam, c. 1800 m, *M. Mohanan 66029*, 05 Mar 1980 (CAL, MH); **Wayanad district**, Meppadi, *M.A. Lawson? s.n.*, 24 Nov 1888 (Acc. No. 38085, MH); South East Wayanad, 3000 ft (c. 900 m), *J.S. Gamble 15559*, Nov 1884 (MH); TAMIL NADU: **Coimbatore district**, Anamallays, *R.H. Beddome s.n.*, without date (BM001050067, image!); **Dindigul district**, Pulney hills, anno 1864, *R.H. Beddome s.n.* (Acc. No. 38048, MH); Pulney hills, anno 1873, *R.H. Beddome s.n.* (Acc. No. 38047, MH); **Kanyakumari district**, Muthukuzhivayal, 1400 m, *A.N. Henry 48307*, 09 Sep 1976 (CAL); Way to Muthukuzhivayal, 1400 m, *A.N. Henry 68844*, 28 Sep 1980 (CAL); **Nilgiris district**, Sispara ghat, *R.H. Beddome s.n.*, without date (BM001050066, image!); Sispara ghats, *M.A. Lawson? s.n.*, Nov 1883 (Acc. No. 38074, MH); Sispara ghats, 6000 ft, *J.S. Gamble 13456*, Nov 1883 (CAL!, K000545941, image!); **Theni district**, High Wavy Mountains, 4500 ft (c. 1350 m), *K.C. Jacob 17603*, 08 Sep 1925 (K000545950 image!, MH); Vannathiparai, 540 m, *K. Subramanyam 9410*, 17 Oct 1959 (MH); High Wavy, 1650 m, *F. Blasco s.n.*, 22 Sep 1970 (HIFP, image!); Aruna estate, Vellimalai area, 1640 m, *V. Lakshmanan 93673*, 21 Aug 1990 (MH); Suruli river area, 1550 m, *V. Lakshmanan 94313*, 24 Aug 1990 (MH); **Tirunelveli district**, Shevagherry hills, *R. Wight s.n.*, Aug 1836 (Acc. No. 341337, CAL); Sangamuthirai (Panitharai), 1550 m, *R. Gopalan 91663*, 23 Feb 1990 (MH). **Without locality**, anno 1880, *R.H. Beddome s.n.* (Acc. No. 39567, MH).

Lectotypification

Clarke (1884) described *A. neesiana* var. *producta* based on the following specimens: *Andrographis* sp. n. 13, *Herb. Ind. Or. H.f. & T.* [Malabar Concan & c., *Stocks, Law, & c. s.n.*, without date (BM000948843!, CAL!, G00304878, G00304884, MH!, P03590464, P03590467, P03590484, S11-300095, images!)], Shevagherry hills, *R. Wight 2702* (K000545943, E00435358), Tinnevelly, Sivagiri ghat, *R.H. Beddome s.n.* (BM001050055), Tinnevelly ghat, *R.H. Beddome s.n.* (BM001050056), South Tinnevelly, Calaad [Calacad] hills, *R.H. Beddome s.n.* (BM001050061) and Malabar, *Gibson s.n.* (K000592612). After a critical examination of all these 15 syntype specimens, we found that the annotation of name made by the original author only on five specimens (BM001050055, BM001050056, BM001050061, K000545943, and K000592612). Therefore, these five specimens only have been considered here to choose the lectotype specimen for this name. Of these, a material collected from Shevagherry (Sivagiri) hills by *R. Wight 2702* (K000545943) is selected here as the lectotype (**Fig. 4**), since it matches well with the notes [*Andrographis ceylanica* Wight in Her.] and description provided in the protologue and also this specimen is housed at the herbarium where original author known to be worked. The other specimen of *R. Wight 2702*, housed at E is with the pencil drawing of flower showing the prominent ventricose on tube and filament by J.S. Gamble in 1923. However there is no any sign or annotation to confirm that original author had examined this specimen thus it is not considered here as the original material used while describing this species to designate it as the isolectotype.



Fig. 4. Lectotype of *Andrographis producta* (C.B. Clarke) Gamble (R. Wight 2702, K000545943)

Distribution

Andrographis producta is endemic to the Western Ghats in India (Fig. 3E) and it is well represented at BSI and CAL with many specimens from the state Karnataka. However, most of these collections were mistakenly identified as *A. explicata*, a species considered to be endemic to Tamil Nadu in the present study. Similarly, Almeida (2003) has included *A. explicata* in his flora of Maharashtra based on a specimen collected by Stocks from Concan [Konkan] with an illustration. But, an examination of the illustration and specimen during the present study revealed that they belong to the species, *A. producta*. Moreover, there was neither a representative specimen nor a report from the state of Maharashtra found other than the above mentioned specimen during the present study. Therefore the occurrence of this species in Maharashtra is uncertain and need further intensive exploration to confirm.

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