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RESEARCH ARTICLE

A TAXONOMIC REVISION OF *EXACUM* L. (GENTIANACEAE - EXACEAE) IN SOUTH INDIA.

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Corresponding Author*Shahina P.M.****Abstract**

The paleotropic genus *Exacum* (Gentianaceae: Exaceae) is revised for South India, recognizing twelve species and one variety. *E. wightianum* var. *uniflorum* is synonymized under *E. klackenbergii* while *E. grande* is reduced to the variety of *E. tetragonum*. Nine out of thirteen taxa (75%) are endemic to the southern Western Ghats while one is critically endangered (*E. travancoricum*), one endangered (*E. tetragonum*), one vulnerable (*E. courtallense*) and six are rare (*E. anamallayanum*, *E. atropurpureum*, *E. klackenbergii*, *E. lawii*, *E. tetragonum* var. *grande* and *E. wightianum*). The problems in the typification of *E. courtallense* var. *laxiflorum* are discussed. Detailed taxonomic descriptions, photoplates and a key to the identification of species in South India are provided.

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Introduction

The name *Exacum* was first used by Linnaeus (1747 a, b). But even before Linnaeus, Plukenet (1700) in his *Phytographia* illustrated the species now known as *E. pedunculatum*. Linnaeus in 1753, described two species of *Exacum*, namely, *E. sessile* and *E. pedunculatum* as well as *Chironia trinervia* (= *Exacum trinervium*). Though different authors subsequently described several species of *Exacum* from South America, Africa, Europe, North America and Asia, none of these are now referred to as *Exacum*. Roxburgh (1814, 1820) described five new species and Wallich (1831) one species of *Exacum* from India. Among them, except *E. teres* and *E. tetragonum*, all others became synonyms.

Grisebach (1838) recognized 13 species of *Exacum* in his *Genera et species Gentianearum*. More Asian species were added in the mid to late 1800s by various authors such as Don (1837), Arnott (1839), Grisebach (1845), Thwaites (1860), Beddome (1874) and Clarke (1883).

Klackenberg (1985) monographed *Exacum* and recognised 65 species in two sections. The sect. *Exacum* includes all Asiatic species (21 sp. and 1 var.), majority of them occur in India and Sri Lanka. He (l.c.) created a new section *Africana* to accommodate all the 44 African species distributed mainly in Madagascar, Socotra and African mainland. Thulin (2001) reported three species from southern Arabian peninsula and the Island of Socotra. Based on morphological and molecular data, Klackenberg (2006) transferred all species of *Cotylanthera*, which is represented by four saprophytic species, to *Exacum*.

At present, *Exacum* is represented by seventy species and one variety including four new combinations from *Cotylanthera* and two recently described species *E. klackenbergii* (Gopalan, 2002) and *E. darae* (Hul, 2010). In the present treatment, *E. grande* is reduced to a variety of *E. tetragonum*. Madagascar is presently considered to be the center of species diversity with 38 species and Western Ghats is the second most species-rich area with 12 species and one variety.

Materials and Methods

Specimens for the present study were collected through field trips across South India. Voucher specimens were deposited at CALI. Morphological descriptions were recorded after consulting live and herbarium specimens. Herbarium materials from BLAT, BSD, BSI, CAL, CALI, DD, DEV, FRC, JCB, KFRI, MH, RHT, RRLB, SNC, SKU and TBGT were examined (abbreviations follow Holmgren et al. (1990)). Identification of each species was done in consultation with type and protologue. Type images of species were procured from the virtual data bases of foreign herbaria like BM, E, G-DC, HAL, K, K-W, L, LINN, S, U and W. The details on chromosome number, distribution and uses were procured from literature and colour photographs were prepared using Leica EZ4HD Stereo Microscope.

Results & Discussion

Systematic Treatment

Exacum L., Sp. Pl. 1: 122. 1753; Klack., Opera Bot. 84:1. 1985. **Type:** *Exacum sessile* L.

Chondropsis Rafin., Fl. Tellur 3: 29. 1836. Type: *C. trinervis* (L.) Raf. (= *Exacum trinervium* (L.) Druce).

Paracelsea Zoll. & Moritzzi, Natuur. Geneesk. Arch. Ned. Indie 2: 18. 1845. Type: *P. amoena* Zoll. & Moritzzi

Annual, erect or trailing, glabrous herbs or subshrubs. Stems terete, 4-angular, 4-winged or 4-lineolate. Radical leaves rosette, spatulate; cauline leaves sessile-subsessile or petiolate, ovate-lanceolate, elliptic, 3–5-nerved at base; acute or acuminate at apex, amplexicaul, cuneate or truncate at base. Cymes axillary or terminal, lax or dense, dichasial, 1–5 flowered. Flowers 4–5 merous, blue-violet or white, tubular; bracts foliaceous. Calyx green, persistent, tubular, winged or wingless; lobes 4–5, ovate-lanceolate, 3-nerved. Corolla tubular, salver shaped or subrotate, contorted in bud; lobes 4–5, ovate-elliptic, oblong or lanceolate, 3-nerved, acute at apex. Stamens 4–5, isomorphic; filaments linear, anthers oblong, tetragonal, declinate, basifixed, emarginate at base, recurved or erect, dehiscing by apical pores or later by lateral slits. Ovary bicarpellary, syncarpous, bilocular, globose; style filiform, declinate; stigma subcapitate, 2-lobed. Capsules globose, dehisces longitudinally. Seeds yellowish-reddish brown, numerous, minute; testa scorbiculate.

Distribution: A paleotropical genus found in tropical regions of Africa, Asia and Madagascar (Klackenberg, 2006).

Habitat: In grasslands, road side cuttings, rock crevices and forests, from sea level to c. 2800 m elevation. Most species occur in lowland and montane rainforests, although they usually grow in full sun.

Etymology: The name ‘Exacum’ is derived from its property of expelling pollens through apical pores of anthers.

Key to the species of Exacum

- | | |
|---|--------------------------------------|
| 1a. Flowers tetramerous..... | 2 |
| 1b. Flowers pentamerous..... | 7 |
| 2a. Leaves with a distinct petiole; calyx wings enlarging in fruit, with prominent veins..... | 7. E. petiolare |
| 2b. Leaves sessile-subsessile; calyx wings not enlarging in fruit, without prominent veins..... | 3 |
| 3a. Leaf base not amplexicaul; petals bicoloured..... | 10. E. tetragonum |
| 3b. Leaf base amplexicaul; petals single coloured..... | 11. E. tetragonum var. grande |
| 4a. Calyx winged..... | 5 |
| 4b. Calyx without wings..... | 6 |
| 5a. Cymes never clustered, often solitary or 1–3 flowered..... | 8. E. pumilum |
| 5b. Cymes often clustered, 1–5 flowered..... | 6. E. pedunculatum |
| 6a. Flowers sessile-shortly pedicellate, pedicels 0.5–1.5 cm long; central flower drooping..... | 9. E. sessile |
| 6b. Flowers always long pedicellate, pedicels 2–4.5 cm long; flowers not drooping..... | 5. E. lawii |
| 7a. Stems 4-angular, winged; anthers papillate; fruits drooping..... | 13. E. wightianum |
| 7b. Stems terete, woody; anthers not papillate; fruits not drooping..... | 8 |
| 8a. Leaves petiolate..... | 4. E. klackenbergii |
| 8b. Leaves sessile-subsessile..... | 9 |
| 9a. Leaf base amplexicaul; lamina coriaceous..... | 1. E. anamallayanum |
| 9b. Leaf base not amplexicaul; lamina non coriaceous..... | 10 |

- 10a. Anthers rectangular **2. E. atropurpureum**
 10b. Anthers bottle shaped 11
 11a. Habit cushion type; leaves succulent **12. E. travancoricum**
 11b. Habit non cushion type; leaves not succulent **3. E. courtallense**

1. Exacum anamallayanum Bedd., Icon. Pl. Ind. Or. 1: 33. t. 154. 1874; Klack., Opera Bot. 84: 69. 1985; Sasidh., Biodivers. Doc. Kerala 6: 297. 2004. *Exacum atropurpureum* var. *anamallayanum* (Bedd.) C.B. Clarke in Hook.f., Fl. Brit. India 4: 97. 1883. **Type:** Anamallays, *s. die*, *Beddome 5332* (lecto, BM!).

Exacum beddomei C.B. Clarke, J. Linn. Soc., Bot. 14: 427. 1875. **Type:** Pulney hills, *s. die*, *Beddome 49* (lecto, CAL!).

Exacum saulierei Dunn, Bull. Misc. Inform. Kew 30. 1914. **Type:** South India, Madura district, *Sauliere 69* (lecto, K!). **Figure 1**

Herbs, 35–90 cm tall. Stems terete but 4-angular when young, woody, moderately-much branched basally and apically. Leaves sessile; lamina broadly ovate-lanceolate, 3–8 × 1.5–4 cm, 3–5-nerved at base, coriaceous, acute or mucronate at apex, amplexicaul at base. Cymes terminal or axillary, 1–5 flowered; bracts ovate, 0.3–2 × 0.2–1 cm; pedicels 1–4 cm long. Calyx green, persistent but not accrescent in fruit, dorsally winged; wings thick, without prominent veins, 1–1.5 mm wide, narrow at apex, truncate at base; lobes-5, ovate-lanceolate, 7–15 × 2–3.5 mm, acute-acuminate at apex. Corolla tube white, 0.5–0.8 cm long; lobes-5, violet, yellow at throat, obovate-elliptic, 2–4 × 0.5–1.8 cm, cuspidate. Stamens-5; filaments short, pale green-yellow, 1.5–3 mm long; anthers orange yellow, linear, erect, sagittate, 5–12 mm long, papilla indistinct, seen on the dorsal side near the apex; dehiscence through apical pores, later widen to slits. Ovary green, ovate, 0.25–0.8 × 0.2–0.3 cm; style greenish white, longer than the stamens, 0.5–2.5 cm long, deflexed; stigma simple, rounded, faintly 2-lobed; lobes 0.1 cm long. Capsules brown, oblong-ovate, 1–2 × 0.2–0.35 cm, unilocular, dehisces longitudinally. Seeds many, irregular or tetrahedral with shallowly sunken sides, 0.25–0.4 × 0.1–0.2 mm; testa brown.

- ❖ **Chromosome number:** Not reported.
- ❖ **Flowering & fruiting:** March–July.
- ❖ **Habitat:** It is a higher elevation plant (1700–2700 m alt.) found in grasslands.
- ❖ **Distribution:** This is rare and endemic to southern Western Ghats, occurring in Anamalais, Munnar and Palnis.

Specimens examined: Kerala, Idukki district, Anamudi hills, 31.03.1912, *C.E.C. Fischer 3314* (CAL), *Ibid.*, 19.03.1986, *B. Gurudev Singh 12209* (FRC); Devikolam, 17.04.1966, *B.V. Shetty 2525* (MH); Munnar, Silent Valley, 13.04.2013, *A.J. Robi & K.M. Manudev 4982*, *Ibid.*, 02.05.2013, *P.M. Shahina & Santhosh Nampy 4985* (CAL). **Tamil Nadu**, Dindigul district, Kodaikanal, 29.07.1913, *Sauliere 817* (CAL); Palni hills, *s. die*, *Beddome s.n.*, *Ibid.*, 02.1898, *A.G. Bourne 321* (CAL), *Ibid.*, 05.06.1899, *J.S. Gamble s.n.* (MH). Theni district, High wavy mountains, 05.1917, *Blatter & Hallberg 5* (CAL).

Notes: Beddome (1874) described *E. anamallayanum* as the loveliest species of this genus. It is close to *E. atropurpureum* but differs by its broadly ovate, coriaceous, distinctly amplexicaul leaves and cuspidate petals.

2. Exacum atropurpureum Bedd., Icon. Pl. Ind. Or. 1: 24. pl. 119. 1874; Klack., Opera Bot. 84: 71. 1985. **Lectotype:** Icon. Pl. Ind. Or. 1: 24. pl. 119. 1874. **Figure 2**

Herbs, 20–65 cm tall. Stems 4-lineolate at young but terete and woody when mature, moderately branched basally and apically; internodes usually shorter than the leaves. Leaves sessile, stem clasping but not amplexicaul; lamina broadly ovate-suborbicular or elliptic, 3–10 × 1.5–3 cm, 3–5 nerved at base, coriaceous, acuminate at apex, rounded at base. Cymes terminal or axillary, 1–5 flowered; bracts ovate, 1–1.5 × 0.3–0.6 cm; pedicels 1–3 cm long. Calyx green, edges hyaline, persistent, prominently winged; wings without prominent veins, not accrescent in fruit, semicordate, 2–4 mm wide; lobes-5, ovate, 10–15 × 2–3.5 mm, acuminate at apex. Corolla tube pale blue-white, 0.4–0.7 cm long; lobes-5, blue-violet, ovate-oblong, 1.5–3.5 × 0.5–1.3 cm, acute-acuminate at apex. Stamens-5; filaments short, pale green-yellow, 1.5–2.5 mm long; anthers orange yellow, linear-ovate, erect, sagittate, 6–10 mm long, dehiscence through apical pores later widen to slits, small papilla present near the apex on the dorsal side.



Figure 1: *Exacum anamallayanum* Bedd.: **A.** Flowering twig; **B.** Flower; **C.** Calyx; **D.** Corolla opened; **E.** Apical pore of stamens; **F.** Gynoecium; **G.** Fruit; **H.** Seeds (from Robi A.J. & Manudev K.M. 4982).

Ovary green, ovate, 0.25–0.5 × 0.2–0.3 cm; style greenish white, often longer than the stamens, 0.4–1.2 cm long, deflexed; stigma simple, rounded, faintly 2-lobed; lobes c. 0.1 cm long. Capsules brown, elliptic-oblong, 1–2.5 × 0.2–1 cm. Seeds many, irregular or tetrahedral with shallowly sunken sides, 0.2–0.4 × 0.1–0.25 mm; testa brown.

- ❖ **Chromosome number:** 2n = 34 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** January–December.
- ❖ **Habitat:** In higher elevation grasslands.
- ❖ **Distribution:** It is a rare species endemic to southern Western Ghats. Klackenberg (1985) recorded it as a local endemic, restricted to Tirunelveli hills, but it also occurs in Dindigul, Idukki and Wayand districts.

Specimens examined: Kerala, Idukki district, Kurisumala, 20.12.1993, *E.S. Santhosh Kumar 19157* (TBGT). Thiruvananthapuram district, Chimunji, 14.03.2007, *A. Nazarudheen 34199* (TBGT), *Ibid.*, 11.04.1898, *Beddome 935* (CAL). Wayanad district, Periya, Gurukula Botanical Sanctuary 14.01.2013, *P.M. Shahina & Santhosh Nampy 4993* (CALI). Tamil Nadu, Dindigul district, Kodaikanal, Silver Cascade, 14.02.1974, *Beddome 2692* (CALI), *Ibid.*, 1940, *s.coll. 2733* (RHT); *s.loc.*, 14.02.1974, *B.K. Nayar & K. Unnikrishnan s.n.* (CALI). Kanyakumari district, Kuttigar, 25.05.1988, *R. Gopalan 88642*; Upper Kodayar, 30.09.1980, *A.N. Henry 68873* (CAL). Tirunelveli district, Tirunelveli, 22.05.1908, *C.A. Barber 289* (CAL).

Notes: *E. atropurpureum* is closely allied to *E. anamallayanum* but differs in the texture and clasping nature of leaves, prominently winged calyx and ovate-oblong petals. Klackenberg (1985) remarked that *E. atropurpureum* exhibits wide variation in leaf shape and size and considered them as normal infraspecific variations. We have seen 4-lineolate condition in younger plants but never petiolate leaves.

3. Exacum courtallense Arn., Ann. Sci. Nat., Bot. sér. 2, 11: 175. 1839; Klack., Opera Bot. 84: 66. 1985.

Type: Courtallum, 1835, *Wight 553* (lecto, E!).

Exacum courtallense var. *laxiflorum* Gamble, Fl. Madras 2: 873. 1923; A.N. Henry & Swamin., J. Bombay Nat. Hist. Soc. 80: 458. 1983. Type: Travancore, 1873, *Beddome s.n.* (lecto, MH!).

Exacum courtallense var. *boneccordense* (as *bonneccordensis*) M. Mohanan in M. Mohanan & A.N. Henry, Fl. Thiruvananthapuram 305. 1994. Type: Thiruvananthapuram district, Bonacaud, *s. die*, *M. Mohanan 63225* (holo, CAL).

Figure 3

Herbs, 25–70 cm tall. Stems pale green, terete, woody, 4-lineolate when young, dichotomously much branched basally and apically; internodes usually shorter than the leaves. Leaves sessile-subsessile, waxy coated; lamina oblong-lanceolate, 2–7 × 1–4 cm, 3-nerved at base, acuminate at apex, cuneate at base. Cymes terminal or axillary, 1–5 flowered; bracts lanceolate, 1–3 × 0.5–1 cm; pedicels 1–3.5 cm long. Calyx green, persistent, winged; wings 1–1.6 mm wide; lobes-5, ovate-narrowly lanceolate, 10–15 × 2–3.5 mm, distinctly nerved, fused 1/4th of its length, slightly accrescent in fruits, acute-acuminate at apex. Corolla tube 0.4–0.7 cm long; lobes-5, blue, white at throat, elliptic-obovate, 1–1.2 × 0.3–0.9 cm, obtuse-rounded at apex. Stamens-5; filaments short, yellow, fused to the corolla, 1.5–3 mm long; anthers yellow, bottle shaped, straight, 3–6 mm long, opening by apical pores, later widen to slits, papilla absent. Ovary green, ovate, 0.4–0.6 × 0.2–0.35 cm; style greenish white, 0.6–1 cm long, often longer than the stamens, curved; stigma simple, rounded, faintly 2-lobed; lobes c. 0.1 cm long. Capsules brown, ovate-elliptic, 1–1.5 × 0.6–0.95 cm. Seeds many, irregular or tetrahedral with shallowly sunken sides, 0.3–0.5 × 0.2–0.4 mm; testa reddish brown.

- ❖ **Chromosome number:** 2n = 34 (Mallikarjuna *et al.*, 1987).
- ❖ **Flowering & fruiting:** September–April.
- ❖ **Habitat:** In grasslands, at an elevation of 500–1200 m.
- ❖ **Distribution:** It is vulnerable and endemic to South India. Klackenberg (1985) reported *E. courtallense* as a local endemic, restricted to Tirunelveli hills. But it is much more common than the previous species and also recorded from many districts in Kerala.

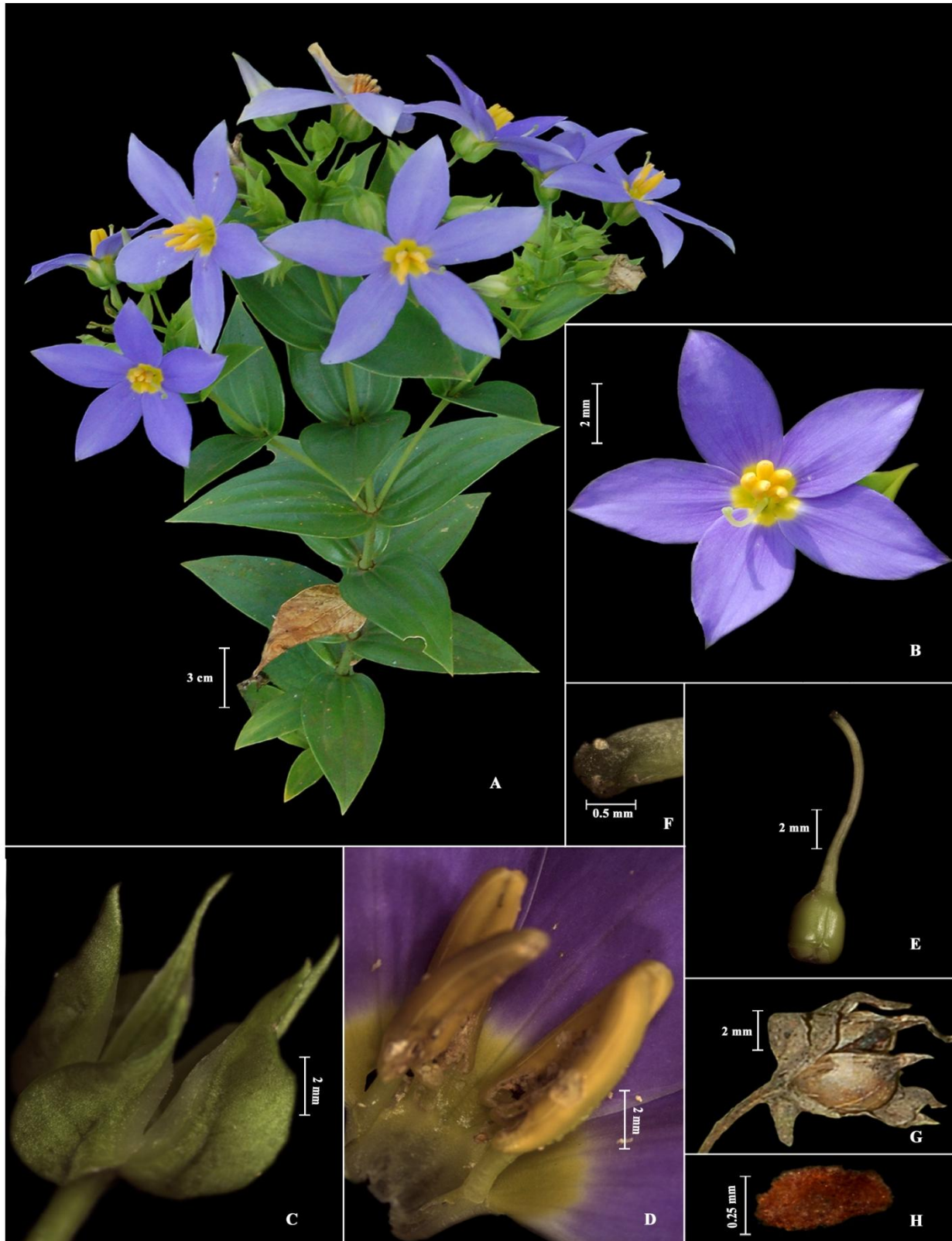


Figure 2: *Exacum atropurpureum* Bedd.: A. Flowering twig; B. Flower; C. Calyx; D. Corolla opened; E. Gynoecium; F. Stigma; G. Fruit; H. Seed (from *Shahina P.M. & Santhosh Nampy 4993*).

Specimens examined: Kerala, Idukki district, Kulamav, 07.06.1984, *N. Mohanan 82012* (MH); Vagamon, 17.08.2011, *K.M. Manudev & P.M. Shahina 4992, Ibid.*, 17.08.2013, *A.J. Robi & K.M. Manudev 135339* (CALI). Pathanamthitta, district, Chuttippara hills, 15.05.1979, *C.N. Mohanan 68363* (CAL, MH). Thiruvananthapuram district, Agasthyamala, 24.04.1990, *N. Mohanan & T. Shaju 02055* (TBGT), *Ibid.*, 17.02.2011, *K.M. Manudev, P.M. Shahina & Santhosh Nampy 4913* (CALI); Athirumala, 12.10.1988, *N. Mohanan 4215*; Bonacaud, 18.05.1991, *N. Mohanan 10818, Ibid.*, 30.10.1992, *E.S. Santhosh Kumar & M. Abdul Jabbar 14727* (TBGT), *Ibid.*, s. die, *N. Mohanan 58823, Ibid.*, 01.10.1973, *J. Joseph 44484* (MH), *Ibid.*, 22.03.1978, *M. Mohanan 54736* (CAL); Chemungi, 05.02.1991, *N. Mohanan 10325*; Karamanayar, 30.07.1991, *N. Mohanan 10704*; Meenmutti, 06.11.1990, *N. Mohanan 10147*; Thovazhu hill, s. die, *K. Narayana Iyer 01445* (TBGT); Travancore, s. die, *Bourdillion s.n.* (MH), *Ibid.*, 08.1913, *C.C. Calder & M.S. Ramaswami 858* (CAL). Wayanad district, Periya, Gurukula Botanical Sanctuary, 14.01.2013, *P.M. Shahina & Santhosh Nampy 4976* (CALI). Tamil Nadu, Kanyakumari district, Way to Muthukuzhivayal, 31.08.1976, *A.N. Henry 48174* (CAL, MH). Theni district, High wavy mountain, 05.1917, *Blatter & Hallberg 496* (CAL).

Notes: *E. courtallense* is easily recognized by its delicate bottle shaped anthers, which is also found in *E. travancoricum*, but the latter is separated by its short cushion like habit and succulent leaves.

Gamble (1923) described the variety laxiflorum based on Beddome's specimens from Travancore hills. There are two sheets in MH and one sheet in Kew. Henry and Swaminathan (1983) selected one of the sheets in MH as the lectotype (Acc. No. 33198). Unknowingly, Klackenberg (1985) selected the Kew specimen as the lectotype. Hence, the lectotype designated by Henry and Swaminathan in 1984 will serve as the type of this variety.

4. Exacum klackenbergii Gopalan, J. Bombay Nat. Hist. Soc. 99(2): 271. 2002. **Type:** Tamil Nadu, Tirunelveli district, Sangumuthirai, way to Pothigaimalai, Agasthyamalai, 05.02.1989, *R. Gopalan 88726* (holo, CAL!; iso, MH!).

Exacum wightianum var. *uniflorum* A.N. Henry & Swamin., J. Bombay Nat. Hist. Soc. 80: 459. 1983, *syn. nov.* **Type:** Tamil Nadu, Tirunelveli district, Agasthyamalai, 27.05.1963, *A.N. Henry 16335* (holo, CAL!). **Figure 4**

Herbs, 40–120 cm tall. Stems terete-4-lineolate, woody, much branched basally and apically. Petiole 0.4–1.2 cm long; lamina elliptic-lanceolate, 3–8 × 1–15 mm, 3-nerved at base, acuminate at apex; attenuate at base. Cymes often terminal, 1–3 flowered, or rarely solitary and axillary; bracts elliptic, 1–3 × 0.5–2.8 cm; pedicels 4-lineolate, 1–4 cm long. Calyx green, persistent, dorsally winged; wings semi cordate at base, 1–1.5 mm wide, veins not prominent, not accrescent in fruit; lobes-5, ovate-lanceolate, 8–15 × 3–5 mm, acuminate at apex. Corolla tube 6–9 mm long; lobes-5, blue, yellow at throat, broadly elliptic, 1.5–3.5 × 0.7–2 cm, margins wavy, cuspidate. Stamens-5; filaments pale green-yellow, 2–3 mm long; anthers yellow, linear, erect, oblong, 6–9 × 1–2 mm long, dehiscence through apical pores that later widen to slits, papilla not distinct. Ovary green, oblong, 4–8 × 2–4 mm; style greenish white, 5–12 mm long, curved; stigma simple, rounded, faintly 2-lobed; lobes 1–1.3 mm long. Capsules brown, oblong-globose, 8–15 × 3–8 mm, unilocular. Seeds many, irregular, 0.3–0.5 × 0.1–0.3 mm; testa brown.

- ❖ **Chromosome number:** Not reported.
- ❖ **Flowering & fruiting:** February–August.
- ❖ **Habitat:** Exposed wet grassy slopes in hill tops, about 1500 m. altitude.
- ❖ **Distribution:** It is a local endemic, restricted to Tirunelveli hills, rare.

Specimens examined: Tamil Nadu, Tirunelveli district, Agasthyamalai hills, 01.07.1964, *Henry & Chandrabose 19181*; Kalivayalpil, 01.06.1901, *Barber 3023* (CAL, MH).

Notes: *Exacum klackenbergii* shows resemblance to *E. wightianum* but easily distinguished by its petiolate, elliptic-lanceolate leaves, 4-lineolate-woody stem and larger flowers.

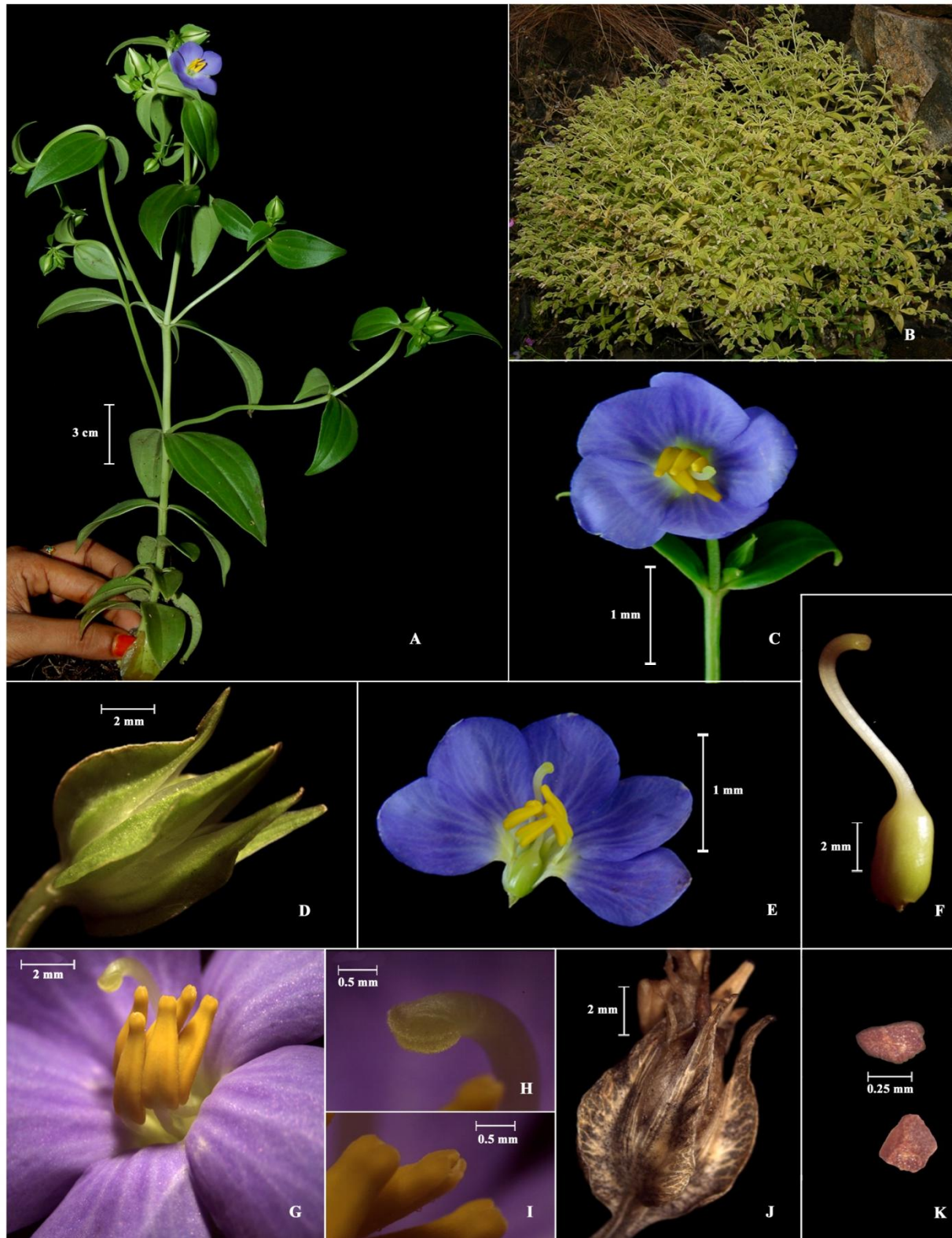


Figure 3. *Exacum courtallense* Arn.: **A.** Habit; **B.** Plant in natural habitat; **C.** Flower; **D.** Calyx; **E.** Corolla opened; **F.** Gynoecium; **G.** Anthers; **H.** Stigma; **I.** Apical pore of stamens; **J.** Fruit; **K.** Seeds (A from Manudev K.M. & Shahina P.M. 4992; B-K from Shahina P.M. & Santhosh Nampy 4976).

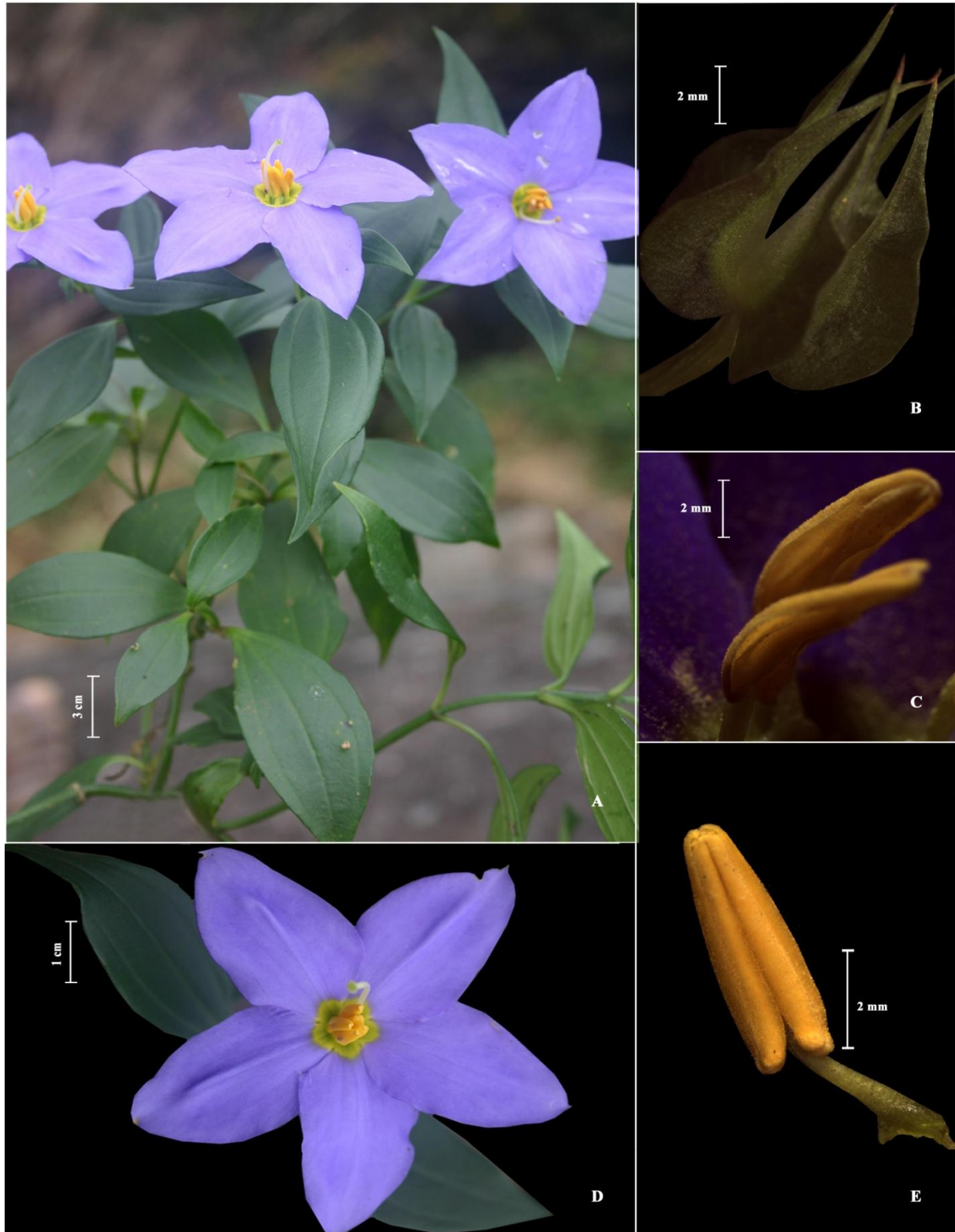


Figure 4. *Exacum klackenbergii* Gopalan: **A.** Flowering twig; **B.** Calyx; **C.** Dehiscent anther; **D.** Flower; **E.** Stamen (from N. Sasidharan s.n.).

Henry and Swaminathan (1983) described *E. wightianum* var. *uniflorum* from Tirunelveli hills, differentiated from the typical variety *wightianum* in having few, mostly solitary flowers. On critical study in consultation with the type and protologue, it is found that it is conspecific to *E. klackenbergii* and is here reduced to the synonymy of the latter.

5. *Exacum lawii* C.B. Clarke in Hook.f., Fl. Brit. India 4: 98. 1883; Gamble, Fl. Madras 2: 874. 1923; Klack., Opera Bot. 84: 53. 1985; Manilal, Fl. Silent Valley 182. 1988. **Type:** Baba Budan hills, *s. die*, *Law s.n.* (lecto, K; iso, K!). **Figure 5**

Herbs, 3–30 cm tall. Stems pale green, 4-angular, minutely winged-4-lineolate, unbranched to sparsely branched; branches confined to the upper part of the stem; internodes much longer than the leaves. Leaves sessile; lamina ovate-orbicular, 0.3–1 × 0.7–1.3 cm, 3-nerved at base, acute-obtuse at apex, cuneate at base. Flowers solitary or few in terminal or axillary lax cymes; bracts ovate, 0.3–0.5 × 0.2–0.4 cm; pedicels 0.5–5.5 cm long, slender, terminal one often longer and slightly curved than the axillaries. Calyx green, persistent, wingless; lobes-4, elliptic-broadly ovate, fused towards the very base, 1.8–3.5 × 2–3.5 mm, prominently nerved, accrescent in fruit; acute-acuminate at apex. Corolla tube white, 0.4–1 mm long; lobes-4, blue-violet, broadly obovate, 0.3–1.2 × 0.3–0.7 cm, acute-obtuse at apex. Stamens-5; filaments short, white, fused to the corolla, 1–2 mm long; anthers yellow, erect, rectangular, opening by apical pores that later do not widen to slits, papilla absent, 0.5–1.5 mm long. Ovary green, ovate, 0.3–0.6 × 0.2–0.35 cm; style bluish white, 2–3 mm long, straight as long as the stamens or a little beyond; stigma simple, capitate, faintly 2-lobed; lobes c. 0.1 cm long. Capsule brown, globose, 0.4–0.8 × 0.4–0.6 cm. Seeds many, irregular or tetrahedral with shallowly sunken sides, 0.2–0.5 × 0.2–0.3 mm; testa reddish brown.

- ❖ **Chromosome number:** 2n = 56 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** October–December.
- ❖ **Habitat:** In higher elevation grasslands.
- ❖ **Distribution:** India, fairly common in Maharashtra but rare in South India.
- ❖ **Uses:** It is used as a laxative. Powdered plants are used against kidney disorders and plants boiled with oil used for eye diseases (Struwe *et al.* 2002).

Specimens examined: Kerala, Idukki district, Anamalai, 10.10.1901, C.A. Barber 3729 (MH); Vagamon, 17.08.2013, A.J. Robi & K.M. Manudev 135338 (CALI); Vengoli peak, 30.09.1912, C.E.C. Fischer 3488 (CAL). Kozhikode district, Vellarimala, 17.10.1997, A.K. Pradeep 56140, *Ibid.*, 14.11.1997, A.K. Pradeep 56163 (CALI). Palakkad district, Silent valley, Dam site, 04.12.1981, C. Satheesh Kumar 10207 (CALI). Wayanad district, Chembra peak, 24.11.2012, P.M. Shahina & Santhosh Nampy 4958 (CALI). Tamil Nadu, Tirunelveli district, Mahendrahill, *s. die*, *s.coll. s.n.* (MH).

Notes: *E. lawii* and *E. sessile* are difficult to distinguish easily. These are the only south Indian species having no wings on calyx. But *E. lawii* can be separated by its long pedicellate flowers and prominently nerved calyx.

6. *Exacum pedunculatum* L., Sp. Pl. 112. 1753; Klack., Opera Bot. 84: 48. 1985. **Type:** The drawing in Plukenet, Phytographia, Almagesti botanici mantissa. t. 343. f. 43. pl. 3. 1700 (holo!)
Exacum punctatum L.f., Suppl. Pl. 124. 1782. **Type:** India, 1777, *Koenig s.n.* (LINN!)
Exacum carinatum Roxb., Fl. Ind. 1: 415. 1820. *Sabaea carinata* (Roxb.) Spreng., Syst. Veg. 1: 426. 1825. **Type:** Roxb. Icon No. 1210 (lecto!)
Exacum sulcatum Roxb., Fl. Ind. 1: 415. 1820. *Sabaea sulcata* (Roxb.) Spreng., Syst. Veg. 1: 426. 1825. **Type:** India, *s. die*, *Roxburgh s.n.* (lecto, BM!)
Exacum pedunculare Arn., Ann. Sci. Nat. Bot. 11: 176. 1839; Wight, Icon. Pl. Ind. Orient. 2: 336. 1843. **Type:** Wallich Cat. No. 4359 (holo!) **Figure 6**

Herbs, 4–45 cm tall. Stems pale green, 4-angular, 4-lineolate, usually much branched. Leaves sessile-subsessile; lamina oblong-elliptic, lanceolate, 3–7 × 0.7–2 cm, 3-nerved at base, acute at apex, attenuate at base. Cymes terminal or axillary, often clustered, 1–5 flowered; bracts ovate-lanceolate, 0.5–2 × 0.3–0.6 cm; pedicels 0.5–3.5 cm long. Calyx green, persistent, dorsally winged; wings semi cordate, 0.6–1.8 mm wide; lobes-4, hyaline towards the edge, broadly ovate, 4–6.5 × 2–3.5 mm, fused 1/3rd of its length, not accrescent in fruits, acute or acuminate at apex.

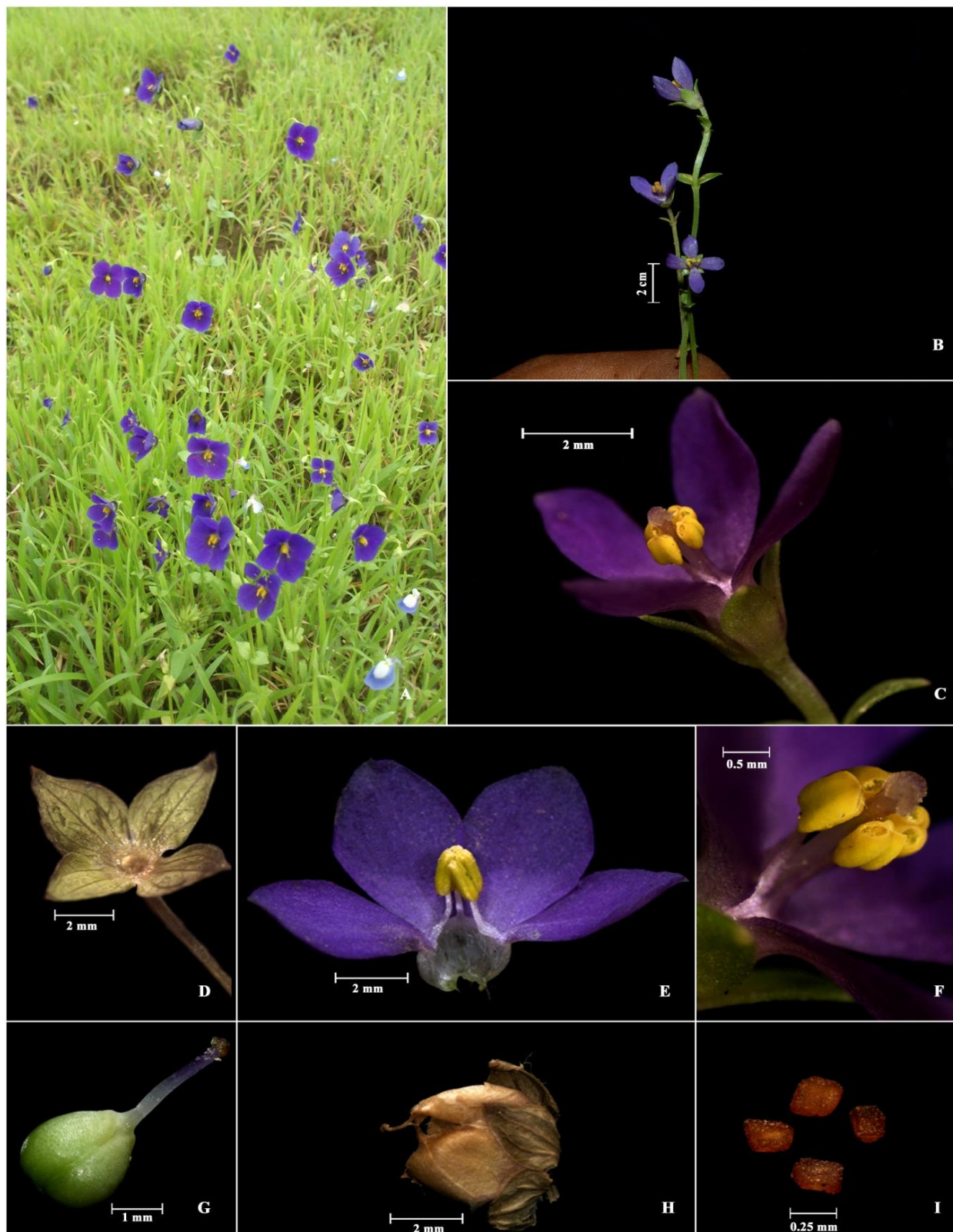


Figure 5. *Exacum lawii* C.B. Clarke: **A.** Plants in natural habitat; **B.** Flowering twigs; **C.** Flower; **D.** Calyx; **E.** Corolla opened; **F.** Stamens; **G.** Gynoecium; **H.** Fruit; **I.** Seeds (A, D from *Manudev K.M. 134732*; B-C, E-I *Shahina P.M. & Santhosh Nampy 4958*).



Figure 6: *Exacum pedunculatum* L.: **A.** Flowering twig; **B.** Flower; **C.** Calyx; **D.** Corolla opened; **E.** Apical pore of stamens; **F.** Gynoecium; **G.** Stigma; **H.** Fruit; **I.** Seeds (from *Shahina P.M. & Santhosh Nampy 134733*).

Corolla tube white, 0.4–1 mm long; lobes-4, blue, pale green-yellow at throat, elliptic-broadly ovate, 4–10 × 3–7 mm, cuspidate. Stamens-4; anthers yellow, erect, more or less bottle shaped, 2–3.5 mm long, opening by apical pores that later do not widen to slits, papilla absent; filaments white, fused to the corolla, 0.5–1.2 mm long. Ovary green, ovate-orbicular, 0.3–0.5 × 0.2–0.4 cm; style white, 5–7 mm long, deflexed; stigma simple, capitate, faintly 2-lobed; lobes 0.1–0.3 mm long. Capsules brown, globose, 0.4–0.8 × 3–6 mm. Seeds many, round or tetrahedral with shallowly sunken pits, 0.15–0.35 × 0.1–0.25 mm; testa reddish brown.

- ❖ **Chromosome number:** 2n = 62 (Mallikarjuna *et al.*, 1987).
- ❖ **Flowering & fruiting:** January–December.
- ❖ **Habitat:** This is one of the common species of *Exacum* in South India and occurs both in the eastern and western Ghats. It is recorded from forests margins, open grasslands and banks in marshy fields.
- ❖ **Distribution:** India, Sri Lanka and Bangladesh.

Specimens examined: **Andhra Pradesh**, Anantapur district, Anantapur, *s. die*, Tiruvenkatachari *s.n.* (FRC). Chittoor district, Chittoor, 22.02.1918, *s.coll.* 426 (FRC); Kuppam, 30.04.1914, *s.coll.* 10310 (MH). Cuddapah district, Bale Palle, 21.07.1962, *J.L. Ellis 14318* (CAL). Krishna district, Bellamkonda, 1887, *Gamble 18638* (CAL). Kurnool district, Kurnool, 02.1953, *C. Rajasekar Mudaliar 94406, 32619*; Kristnachullypally, 06.1883, *Gamble 10960* (DD); Nandyal, 1953, *Rajasekar Mudaliar 94406* (MH). Nellore district, Nellore, 03.02.1929, *K.C. Jacob 18527, Ibid.*, 03.1901, *Ruiz 33249*; Nepilogunta, 11.02.1916, *s.coll.* 12762; Tada, 13.03.1901, *Sharmishta Gupta 33231* (MH), *Ibid.*, 11.03.1962, *D.C.S. Raju 201, Ibid.*, 26.02.1971, *A.R.K. Sastry 770* (CAL). (MH). Visakapatanam district, Visakapatanam, 03.12.2011, *P.M. Shahina & Santhosh Nampy 134733* (CALI). **Karnataka**, Bellary district, Siruguppa, 1952, *Krishna Swamy 94241* (MH). Bengaluru district, Bengaluru, 02.1988, *s.coll.* 33246 (MH). Chamarajanagar district, Sivasamudram, 12.05.1914, *s.coll.* 10402 (MH). Chickmagalur district, Chickmagalur, 1979, *Kesava Murthy & Ramesh 6284* (CAL). Chitradurga district, Hosadurga-Holalkera road, 1979, *Ramesh & Sreenath s.n.* (CAL). Dharwar district, Dharwar, 1978, *Saldanha & Prakash 3426*; Hugli, 02.1919, *Sedgwick & Bell 5345* (CAL). Nallamalais, 26.11.1969, *J.L. Ellis 32619* (MH), *Ibid.*, 28.11.2013, *S. Syam Radh, P.G. Arun Kumar & P.M. Shahina 134739* (CALI). Mysore district, Bandipur, 1965, *B.D. Naithani 23191*; Mysore, 27.01.1965, *B.D. Naithani 23191, Ibid.*, 11.1987, *s.coll.* 33230 (MH). **Tamil Nadu**, Chennai district, Chennai, *s.coll.* 33242; M.C.C. Campus, 07.11.1985, *D. Narasimhan 936* (MH). Chengalpatt district, Kambakkam hills, 02.1914, *s.coll.* 10243 (MH). Coimbatore district, Coimbatore, 24.02.1924, *K.C. Jacob 17376, Ibid.*, 28.01.1932, *M. Rathnavel 201*; Siruvani, 25.08.1960, *A.N. Henry 646*; Sivasamudram, 24.02.1924, *K.C. Jacob 17376* (CAL, MH). Kancheepuram district, Vandalur, 06.02.1915, *s.coll.* 11450 (MH). Nagapattinam district, Caleroon river, 11.11.1976, *K.M. Matthew 6139, Ibid.*, 19.02.1977, *K.M. Matthew 6719, Ibid.*, 21.02.1978, *Rajendran & Diravium 12150, Ibid.*, 24.02.1978, *Rajendran & Diraviam 12234*; Kollidam, 15.11.1969, *K.M. Matthew 10575, Ibid.*, 29.12.1969, *K.M. Matthew 10734, Ibid.*, *K.M. Matthew 14723, Ibid.*, 30.07.1970, *K.M. Matthew 11990* (RHT). Namakkal district, Namakkal, 10.12.1978, *K.M. Matthew 19963* (MH). Salem district, Attur, 20.02.1979, *T.S. Jayaseelan 26520*; Salem, 05.01.1978, *V. Alphonse 10793, Ibid.*, 27.06.1978, *N. Venugopal 14409* (RHT), *Ibid.*, 10.2000, *K.C. Jacob 18042* (MH). South Arcot district, South Arcot, 07.04.1978, *K.M. Matthew 12872, Ibid.*, 30.01.1980, *K.M. Matthew 26196* (RHT); Perugudinedu, 02.1898, *s.coll.* 33254 (MH); Takarai R.F. 04.02.1931, *V. Narayanaswamy 5064, Ibid.*, 19.01.1978. *K. Ramamurthy 52844* (RHT, CAL). Thanjavur district, Thamarankottai, 07.03.1989, *S. Regupathy 1028*; Thanjavur, *s. die, s.coll.* 33247 (MH). Tiruchirappalli district, Erattamalai, 23.03.1984, *K.M. Matthew 29901*; Kondayampetta, 06.02.1969, *K.M. Matthew 9972*; Lalgudi, 17.02.1978, *Perianayagam 11966*; Oosipalayam, 28.12.1976, *K.M. Matthew 5672, Ibid.*, 23.01.1998, *K.M. Matthew 9779*; Peramangalam, 15.01.1982, *K.M. Matthew, John Britto & N. Rani 28995*; Srirangam island, 19.01.1979, *S. Perianayagam 21133, Ibid.*, 02.04.1979, *C. Manoharan 22633, Ibid.*, 23.01.1980, *K.M. Matthew 25992, Ibid.*, 26.01.1980, *S. Perianayagam & R. Natarajan 26153, Ibid.*, 07.03.1992, *C.D.K. Cook 30758*; Tiruchirappalli, 17.03.1969, *K.M. Matthew 10089, Ibid.*, 26.02.1976, *C. Rajamani 1278; Ibid.*, 30.07.1990, *K.M. Matthew 11990*; Thuraiyur, 20.03.1978, *K.M. Matthew 12549* (CAL, RHT), *Ibid.*, 20.03.1978, *K.M. Matthew 12552, Ibid.*, 24.07.1978, *K.M. Matthew & N. Venugopal 15529, Ibid.*, 27.11.1978, *K.M. Matthew & V.S. Manickam 19340, Ibid.*, 06.01.1979, *A. Diraviam & Xavier 20712* (RHT). Tirunelveli district, *s.loc.*, 04.09.1963, *A.N. Henry 17449* (MH). Villupuram district, Kalpadai, 21.12.1926, *S.R. Raju & Nagathan 17843* (MH). **Telangana**, Karim Nagar district, Recha palli, 22.12.1964, *G.V. Subba Rao 21897, Ibid.*, 28.02.1959, *K. Subramanyam 7811* (MH). Medak district, Medak, 1959, *Sebastian 8004* (CAL, MH).

Notes: *Exacum pedunculatum* is a beautiful plant, usually with terminal/axillary, profuse cymes. It is often confused with *E. petiolare* but differs by its subsessile-sessile, oblong-elliptic or lanceolate leaves, basally fused stamen

filaments and fruits without enlarging calyx. This is one among the four species of *Exacum* in South India having strict poricidal dehiscence, in which the pores do not widen into slits.

Linnaeus (1753) cited Plukenet's (1700) drawing in Mantissa for *E. pedunculatum* and hence it is the holotype of the species.

7. *Exacum petiolare* Griseb. in A. DC., Prodr. 9: 46. 1845; Klack., Opera Bot. 84: 54. 1985. *Exacum pedunculatum* var. *petiolare* (Griseb.) Trimen, Handb. Fl. Ceylon 3: 182. 1895. **Type:** Asia, *s. die*, Hugel *s.n.* (lecto, W!). **Figure 7**

Herbs, 10–50 cm tall. Stems 4-angular, winged, sparsely-much branched. Petiole 2.5–5 cm long; lamina broadly ovate, 2.5–7 × 0.7–3.5 cm, 3–5 nerved at base, acute at apex, attenuate at base. Cymes terminal or axillary, 1–5 flowered; bracts ovate, 1–3 × 0.8–1.5 cm; pedicels 0.5–2.5 cm long. Calyx green, hyaline towards the edge, persistent, prominently winged; wings cordate, prominently nerved, 1.8–3 mm wide; lobes-4, ovate, 3–5.5 × 2–3.5 mm, fused 1/3rd of its length, accrescent in fruits with prominent veins, acuminate at apex. Corolla tube pale green, 0.8–1.5 mm long; lobes-4, pale blue or white, pale green at throat, elliptic-broadly ovate, 6–10 × 2.3–7 mm, acute at apex. Stamens-4; filaments pale green, fused to the corolla, 0.6–1.2 mm long; anthers yellow, erect, linear-ovate, 1.8–2.5 mm long, opening by apical pores, later widen into slits, papilla absent. Ovary green, ovate-orbicular, 1.5–2.5 × 1–3 mm; style white, 4.5–7 mm long, deflexed; stigma simple, capitate, faintly 2-lobed; lobes 0.25–0.4 mm long. Capsules brown, globose, 6–10 × 3–6 mm. Seeds many, tetrahedral with shallowly sunken pits, 0.15–0.35 × 0.1–0.25 mm; testa reddish brown.

- ❖ **Chromosome number:** 2n = 62 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** July–December.
- ❖ **Habitat:** Road side cuttings and moist places in grass or on damp rocks, usually in shade.
- ❖ **Distribution:** India and Sri Lanka. It is fairly common in South India, distributed both in the eastern and western Ghats.

Specimens examined: **Andhra Pradesh**, Visakapatanam district, near Sileru approach, 24.10.1972, *G.V. Subba Rao 42713* (MH). Kurnool district, way to Diguvatta, 24.10.1964, *J.L. Ellis 22193*; *s.loc.*, 12.1880, *J.S. Gamble 8847* (MH). **Karnataka**, Bengaluru district, on the way to Ramanagaram, 23.02.1978, *S.R. Ramesh 263* (JCB). Chickmagalur district, Charmadi ghat, 13.11.1978, *C.J. Saldanha & P. Prakash s.n.* (CAL, JCB). Mysore district, Chianthapura, 10.1908, *A. Meebold 9809* (CAL). Dakshina Kannada district, Dakshina Kannada, 10.11.1962, *R.K. Arora 1128* (CAL). Shimoga district, Hosur-Sagar road, 26.09.1978, *K.P. Sreenath & K.R. Keshava Murthy 2909*; Hulical ghat, 10.10.1962, *R.S. Raghavan 83129* (CAL, JCB); Mattiga, near Yedur, 06.10.1962, *R.S. Raghavan 83010*, *Ibid.*, 16.10.1964, *R.S. Raghavan 90465* (CAL); Kudajadri, 08.11.2013, *P.M. Shahina, A.P. Janeesha & H.S. Ashwini 134717* (CALI). Uttara Kannada district, Dandeli, 29.09.1978, *K.P. Sreenath & K.P. Keshava Murthy 3066*; Uttara Kannada, 09.1887, *W.A. Talbot 155* (CAL). **Kerala**, Idukki district, Anamalais, 1838, *Beddome 38*; Thekkady, 29.08.1912, *C.E.C. Fischer 3479* (CAL). Palakkad district, Mukkali, 15.10.1979, *N.C. Nair 64665* (CAL, MH); Parambikulam, 11.1909, *A. Meebold 12380* (CAL), *Ibid.*, 24.09.2013, *A.P. Janeesha & P.M. Shahina 4999* (CALI); Walayar Dam, 25.10.1963, *J. Joseph 17869* (MH). Kannur district, Paithalmala, 27.09.2012, *P.M. Shahina, A. Anna Ancy Antony & Santhosh Nampy 4929, 4934* (CALI). **Tamil Nadu**, Coimbatore district, Mount Stouert, 27.10.1961, *J. Joseph 13342* (CAL). Nilgiris district, Nilgiris, 11.1884, *J.S. Gamble 15438* (CAL).

Notes: *E. petiolare* and *E. klackenbergi* are the only two south Indian species having distinct petioles on leaves. The former is distinct from the latter in having tetramerous flowers and prominently winged calyx which is prominently nerved and accrescent in fruits. *E. petiolare* is also easily differentiated from *E. sessile*, *E. lawii* and *E. pumilum* by its prominently winged, accrescent calyx and petiolate leaves.

8. *Exacum pumilum* Griseb. in A. DC., Prodr. 9: 46. 1845; Klack., Opera Bot. 84: 50. 1985. **Type:** Bombay, Salsetta, *s. die*, *Graham s.n.* (lecto, W!). **Figure 8**

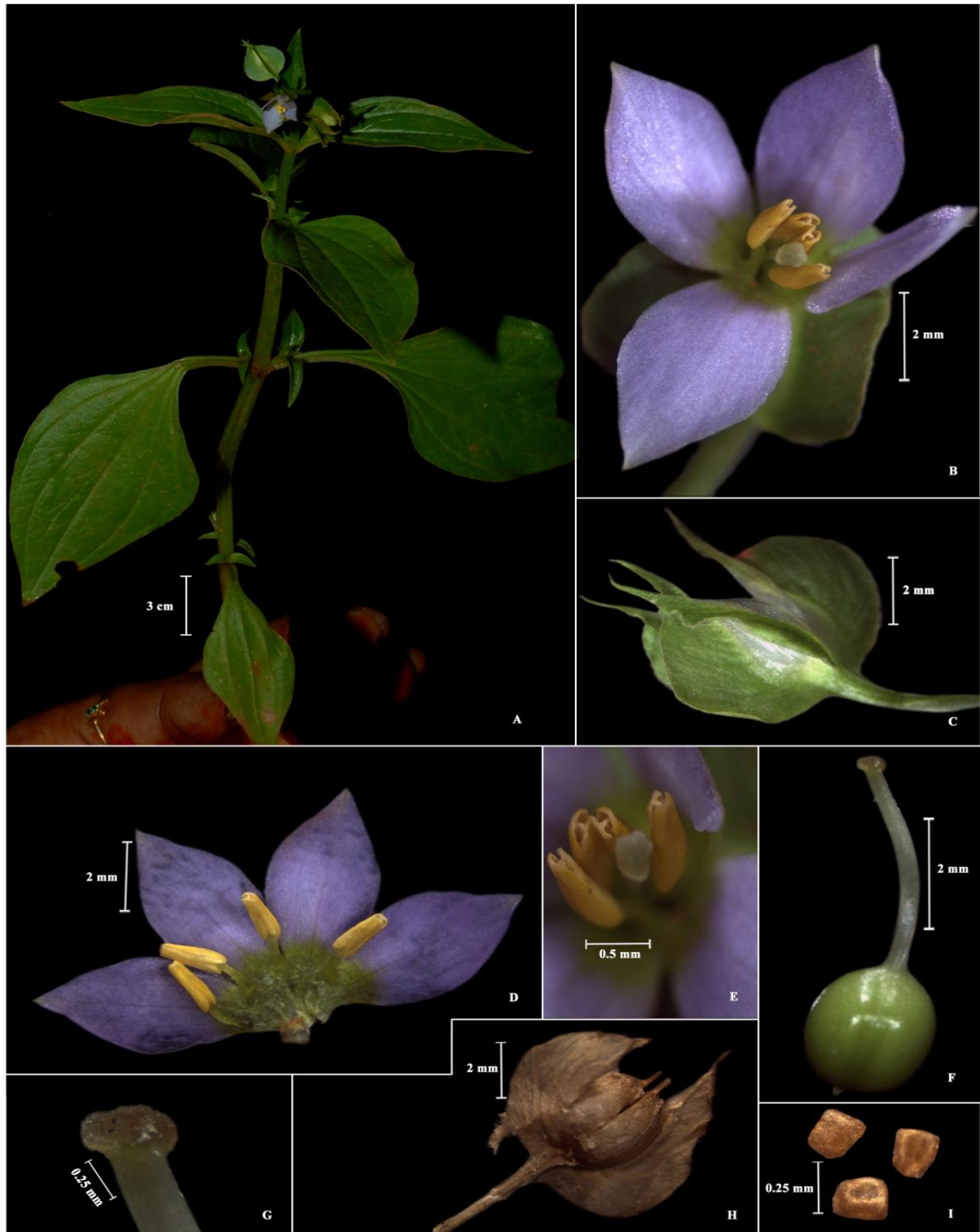


Figure 7. *Exacum petiolare* Griseb.: **A.** Flowering twig; **B.** Flower; **C.** Calyx; **D.** Corolla opened; **E.** Apical pores of stamen; **F.** Gynoecium; **G.** Stigma; **H.** Fruit; **I.** Seeds (from *Shahina P.M., Anna Ancy Antony A. & Santhosh Nampy 4929*).

Slender herbs, 5–40 cm tall. Stems green, 4-angular, 4-lineolate, branched. Leaves sessile; lamina broadly oblong-linear lanceolate, 0.3–7 × 0.2–3 cm, 1 or 3-nerved at base, obtuse at apex; cuneate at base. Cymes lax, terminal or axillary, 1–5 flowered; bracts linear lanceolate, 0.5–1.5 × 0.2–0.5 cm; pedicels 1–3.5 cm long. Calyx green, hyaline towards the edge, persistent, winged; wings cordate, 1.8–3 mm wide; lobes-4, ovate, subulate, 4–6.5 × 1–2.5 mm, fused 1/3rd of its length, without prominent veins, not accrescent in fruits, acute-acuminate at apex. Corolla tube white, 0.4–1 mm long; lobes-4, blue-violet, broadly ovate, cuspidate, 6–9.5 × 3–6 mm. Stamens-4; filaments bluish white, fused to the corolla, 0.8–1.6 mm long; anthers yellow, erect, rectangular, 1–2.5 mm long, opening by apical pores that later do not widen to slits, papilla absent. Ovary green, oblong, 4–5.5 × 3–4 mm; style white, as long as the stamens or longer, 3.5–6 mm long, deflexed; stigma simple, capitate, faintly 2-lobed; lobes 0.25–0.4 mm long. Capsules brown, globose, 3–7 × 2–4 mm. Seeds many, tetrahedral with shallowly sunken pits, 0.15–0.25 × 0.1–0.25 mm; testa reddish brown.

- ❖ **Chromosome number:** n = 31 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** September–December.
- ❖ **Habitat:** On grassy slopes, banks of streams and also on wet rocks.
- ❖ **Distribution:** India, in the eastern and western Ghats.

Specimens examined: Karnataka, Chitradurga district, Lokadolalu Hosadurg, 21.09.1979, B.R. Ramesh & K.P. Sreenath 7249 (CAL). Hassan district, Devalkarai, 13.09.1970, S. Suresh 35 (JCB). Shimoga district, Eduvanji sagar-jogroad, 27.09.1978, K.R. Kesava Murthy & K.P. Sreenath 2958 (CAL). Kerala, Palakkad district, Anamooly, 25.09.1997, R. Ansari 51484 (CAL); Below Ayyapancoil area, 26.10.1976, E. Vajravelu 48704; Mampara, 05.10.2013, K.M. Prabhu Kumar 4986; Nelliampathy, 03.11.2011, P.M. Shahina & Santhosh Nampy 134731 (CALI); *s.loc.*, *s. die*, *Stocks law s.n.* (CAL, MH).

Notes: *Exacum pumilum* is related to *E. pedunculatum*, *E. sessile* and *E. lawii* in having the stamen filaments basally fused and the anthers opening by apical pores that later do not widen to slits to the base. From *E. pedunculatum*, differs by its more slender habit and smaller, rectangular anthers and from *E. sessile* and *E. lawii*, by its oblong-linear lanceolate leaves and winged or keeled calyx.

9. *Exacum sessile* L., Sp. Pl. 1: 112. 1753; Klack., Opera Bot. 84: 50. 1985; Manilal, Fl. Silent Valley 182. 1988. **Type:** *Centaurium zeylanicum* minus, flore luteo, Herb. Hermann Vol. 3. p. 42. (lecto, BM!).
Exacum dichotomum Wall., Num. List 152. 1831. nom. nud. Type: Wallich Cat. No. 4359 F (!).
Exacum macrantherum Miq., Anal. Bot. Ind. 3: 10. 1852. Type: Metz 582 (lecto, U!).

Figure 9

Herbs, 5–45 cm tall. Stems 4-angular, winged (wings 1–3 mm broad). Leaves sessile; lamina ovate-orbicular, 0.5–1.5 × 0.7–1.3 cm, 3-nerved at base, acute-obtuse at apex, cordate at base. Flowers often terminal solitary or axillary, lax cymes, sessile-pedicellate; bracts ovate, 0.3–0.8 × 0.3–0.5 cm; pedicels short, 0.5–1.5 cm long, drooping. Calyx green, persistent, wingless; lobes-4, elliptic-broadly ovate, fused to the very base, 3–4.5 × 2–3.5 mm, prominently nerved, not accrescent in fruit, acute at apex. Corolla tube white, 0.6–1.5 mm long; lobes-4, blue-violet, broadly obovate, 0.3–1 × 0.2–0.7 cm, acute-obtuse at apex. Stamens-4; filaments short, white, fused to the corolla, 0.3–0.6 m long; anthers yellow, erect, rectangular, 0.5–1.2 mm long, opening by apical pores that later do not widen to slits, papilla absent. Ovary green, ovate-obovate, 0.5–2.5 × 3–4.5 mm; style bluish white, as long as or slightly longer than the stamens, 2–4 mm long, straight; stigma simple, capitate, faintly 2-lobed; lobes c. 0.1 cm long. Capsules brown, globose, 4–8 × 4–6 mm. Seeds many, irregular or tetrahedral with shallowly sunken sides, 0.1–0.25 × 0.2–0.3 mm; testa reddish brown.

- ❖ **Chromosome number:** n = 31 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** October–December.
- ❖ **Habitat:** On wet rocks, in wet open grasslands and moist places.
- ❖ **Distribution:** India and Sri Lanka, fairly common in South India.

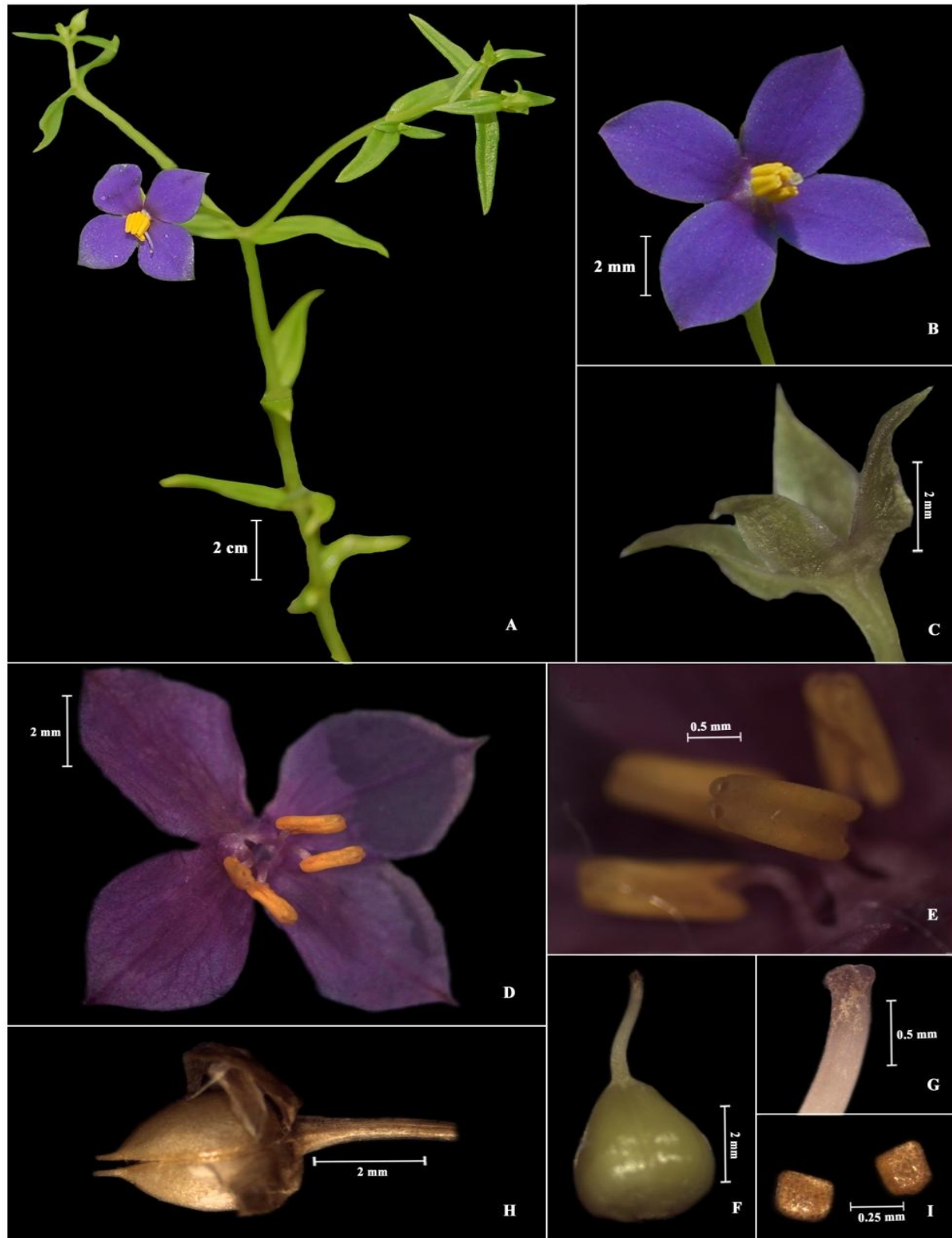


Figure 8. *Exacum pumilum* Griseb.: **A.** Flowering twig; **B.** Flower; **C.** Calyx; **D.** Corolla opened; **E.** Apical pore of stamen; **F.** Gynoecium; **G.** Stigma; **H.** Fruit; **I.** Seeds (A-B from *Shahina P.M. & Santhosh Nampy 134731*; C-I from *Prabhu Kumar K.M. 4986*).



Figure 9. *Exacum sessile* L.: A. Flowering twigs; B. & C. Flower; D. Calyx; E. Gynoecium; F. Corolla opened; G. Stamens; H. Stigma; I. Fruit; J. Seeds (from *Shahina P.M. & Santhosh Nampy 3302*).

Specimens examined: **Karnataka**, Chickmagalur district, Baba Budan hills, 07.11.2013, *P.M. Shahina, A.P. Janeesha & H.S. Ashwini 134716* (CALI). Hassan district, Bannuhalla, 10.10.1969, *C.J. Saldanha 15289*; Bisle ghat, 18.08.1969, *C.J. Saldanha 15098*; Devarunde, 16.09.1969, *C.J. Saldanha 177935*; Devanangaundi, 13.09.1970, *N. Sathyananda 12*; Shiradi ghat, Panorama point, 03.09.1969, *C.J. Saldanha 15159* (JCB). **Kerala**, Ernakulam district, Malayattoor, 18.08.1913, *M. Rama Rao 476*; Kavalay, 11.1909, *A. Meebold 12334*; Killan hills, 01.09.1913, *M. Rama Rao 1553* (CAL). Idukki district, Dhanas valley, 17.10.1989, *P. Bhargavan 90996*; Kulamav, 20.08.1977, *K. Vivekananthan 50433, Ibid.*, 08.10.1982, *C.N. Mohanan 74521* (MH), *Ibid.*, 12.10.1982, *C.N. Mohanan 74589, Ibid.*, 03.10.1983, *C.N. Mohanan 79965, Ibid.*, 26.09.1981, *C.N. Mohanan & B. Ramanujan 72001* (CALI); Kurisumala, 23.08.1975, *J. Joseph 46506*; Painavu-kulamvu, 21.08.1986, *K. Vivekananthan & V.S. Raju 71740* (MH); Thenkanchi, 23.09.1972, *B.D. Sharma 40855*; Vagamon, 17.08.2013, *A.J. Robi. & K.M. Manudev 135338* (CALI). Kannur district, Paithal mala, 27.09.2012, *P.M. Shahina & Santhosh Nampy 4933* (CALI). Kollam district, Chittar, 31.07.1978, *C.N. Mohanan 58351* (CAL, MH); Chuttipara hills, 15.05.1980, *C.N. Mohanan 68370* (MH). Kottayam district, Kuttikanum-Perumade, 25.09.1964, *K. Vivekanathan 21372* (MH). Kozhikode district, Kaatulla mala, 29.07.2010, *P.M. Shahina & Santhosh Nampy 3302*; Kakkayam, 19.09.2013, *A.P. Janeesha & S. Syam Radh 134702*; Thampuram kolli, 30.10.2013, *P.M. Shahina & Santhosh Nampy 4989* (CALI). Palakkad district, Aruvanpara forest, 08.10.1979, *N.C. Nair 64415* (MH, CAL), *Ibid.*, 05.12.1982, *T. Sabu 11047* (CALI). Thrissur district, Athirapally, 13.09.1976, *K. Ramamurthy 48497* (CAL, MH); Mudiyanakunnu, 13.12.2013, *A.P. Janeesha & S. Syam Radh 5000* (CALI); Thrissur, 08.1884, *J.S. Gamble 14718* (CAL). Thiruvananthapuram district, Bonacaud, 24.11.1984, *s.coll. s.n.* (CALI), *Ibid.*, 09.10.1973, *J. Joseph 44648*; Meenmutty, 02.10.1983, *C.N. Mohanan 79919*; Ponnudi, 13.09.1977, *N.C. Nair 51402* (MH), *Ibid.*, 16.10.1959, *K.M. Matthew 1334, Ibid.*, 20.09.1968, *K.M. Matthew 9259, Ibid.*, 11.09.1970, *K.M. Matthew 12345, Ibid.*, 12.09.1970, *K.M. Matthew 12383, Ibid.*, 15.09.1985, *K.M. Matthew 18581* (RHT), *Ibid.*, 16.08.1980, *M. Mohanan 69215* (MH), *Ibid.*, 16.08.1980, *M. Mohanan 69215* (CALI), *Ibid.*, 28.11.2012, *P.M. Shahina & Santhosh Nampy 4965* (CALI). Vallakadavu, 04.10.1976, *K. Vivekananthan 48594* (CAL, MH); *s.loc.*, 1873, *Beddome s.n.* (MH). Wayanad district, Churam, 07.10.2012, *K.M. Manudev & P.M. Shahina 4935* (CALI); Manikkunnu, 18.11.2012, *P.M. Shahina & Sheba M. Joseph 4953* (CALI). **Tamil Nadu**, Coimbatore district, Pandavarimalai, Cinamalai hills, 04.11.1914, *C.E.C. Fischer 11434* (MH). Dindigul district, Palamalai, 12.01.1987, *K.M. Matthew 48321*; Dindigul, 30.12.1987, *K.M. Matthew 52368* (RHT). Kanyakumari district, 11.09.1969, *B.V. Shetty 32347*; Kodayar, 07.08.1977, *A.N. Henry 49649* (CAL, MH); Kuliratti, 26.01.1984, *N. Parthasarathy 668*; Mahendragiri, 11.09.1969, *B.V. Shetty 32347*; Muthukuzhivayal, 09.09.1976, *A.N. Henry 48310*; Paralai, Anamalai, 07.11.1901, *C.A. Barber 3981* (MH). Nilgiris district, Nilgiris, 18.11.1886, *s.coll. 18417* (MH). Salem district, Namakkal, 12.01.1986, *K.M. Matthew & John Britto 28916* (RHT). **Telangana**, Medak district, Medak, 28.01.1992, *B.R.P. Rao & C. Prabhakar 11419* (SKU). Nisamabad district, Gundaram R.F., 11.02.1990, *B.R.P. Rao & K. Hanumanthappa 9680*; Manchippa, 05.04.1989, *K. Hanumanthappa 554, Ibid.*, 05.04.1989, *Ravi Prasad Rao & K. Hanumanthappa 9039*; Naparam, 10.03.1990, *B.R.P. Rao 9709* (SKU).

Notes: *Exacum sessile* closely resembles to *E. lawii*. Both are small herbs with ovate-cordate leaves and without calyx wings. From *E. lawii*, it is easily separated by its sessile-shortly pedicellate, drooping flowers at the junction of branching stem where as in *E. lawii*, the flowers are always long pedicellate (2–4.5 cm long).

10. Exacum tetragonum Roxb., Fl. Ind. 1: 413. 1820; Klack., Opera Bot. 84: 37. 1985. **Type:** Herb. Roxburgh, *Wallich 4356 A* (lecto, K-W!).

Exacum bicolor Roxb., Fl. Ind. 1: 413. 1820. *Exacum tetragonum* var. *bicolor* (Roxb.) Hook.f., Bot. Mag. 73: t. 4340. 1847. **Type:** Cuttack, *Roxburgh (n.v.)*.

Exacum grandiflorum Wall. ex G. Don, Gen. Hist. 4: 212. 1838. *nom. illeg.* **Type:** Courtallum, *Wallich 4358* (lecto, K-W!).

Exacum stylosum Wall. ex G. Don, Gen. Hist. 4: 212. 1838. *E. tetragonum* Roxb. var. *stylosa* (Wall. ex G. Don) C.B. Clarke in Hook.f., Fl. Brit. India 4: 95. 1883. **Type:** Prome, 1826, *Wallich 4355* (lecto, K-W!).

Exacum perrottetii Griseb. in A. DC., Prodr. 9: 45. 1845. 1923. **Type:** 1840, *Perrottet s.n.* (holo, G-DC!).

Exacum bellum Lindl. ex Hance, London J. Bot. 7: 472. 1848. **Type:** Victoria peak, Hongkong, *Hance 505* (lecto, BM!).

Exacum horsfieldianum Miq., Fl. Ned. Ind. 2: 556. 1857. **Type:** Java, Priangan, *Horsfield s.n.* (lecto, BM!).

Exacum metzianum Hohen. ex C.B. Clarke in Hook.f., Fl. Brit. India 4: 96. 1883. **Type:** India, Mangalore, *Hohenacker 857* (holo, HAL!).

Exacum sulcatum Wight ex C.B. Clarke in Hook.f., Fl. Brit. India 4: 96. 1883. **Type:** *Wight 96* (K!).

Exacum cambodianum Dop, Bull. Soc. Bot. France 59: 145. 1912. Type: Cambodge, Mont de Pursat, Godefroy 445 (lecto, P).

Figure 10

Herbs, 15–120 cm tall. Stems 4-anglular, winged (wings 0.2–0.4 cm broad), branched basally and apically. Leaves sessile-subsessile; lamina broadly elliptic-ovate, spatulate or linear lanceolate-broadly oblong, 4–16 × 1.5–2.5 cm, 3–5 nerved at base, acute at apex, cuneate at base. Cymes dichasial, terminal or axillary, lax-dense, 1–5 flowered; pedicels 0.5–3 cm long. Calyx green, persistent, dorsally winged; wings 3–5 mm wide; lobes-4, ovate-lanceolate, 1–1.5 × 0.3–0.5 cm, acute-acuminate at apex. Corolla tube yellowish white, 0.5–1 cm long; lobes-4, violet at the apex and white the rest, yellow at throat, obovate-elliptic, 3–5 × 1–2 cm, cuspidate. Stamens-4; filaments pale green-yellow, short, 0.3–1.5 cm long; anthers orange yellow, linear, curved, sagittate, 1–1.8 cm long, dehiscence through apical pores, later widen to slits. Ovary green, ovate, 0.5–1.5 × 0.3–0.8 cm; style greenish white, 1–2 cm long, deflexed; stigma simple, rounded, faintly 2-lobed; lobes c. 0.15 cm long. Capsule brown, oblong-ovate, 1–2 × 0.8–1 cm, unilocular. Seeds many, tetrahedral, 0.2–0.35 × 0.1–0.2 mm; testa reddish brown.

- ❖ **Chromosome number:** 2n = 62 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** January–December.
- ❖ **Habitat:** It occurs in exposed grasslands and occasionally at road cuttings.
- ❖ **Distribution:** *E. tetragonum* is distributed in India, Philippines, New Guinea and northern Australia (Klackenberg, 1985). It is the most widespread species of this genus in India, distributed from sea level to about 2000 m altitude.
- ❖ **Local name:** Kannanthali (Malayalam).
- ❖ **Uses:** Uses as a substitute for other gentians and an antidiabetic, stomachache and antifungal agent (Kirtikar & Basu, 1935; Sreelatha *et al.* 2007).

Specimens examined: **Andhra Pradesh**, East Godavari district, Sukumarai hill, *J.S. Gamble 16871* (CAL). **Karnataka**, Chickmagalur district, Baba Budan hills, 10.1908, *A. Meebold 19599*, *Ibid.*, 22.10.1965, *R.K. Arora 5210* (CAL). Dakshina Kannada district, Uppinangadi, 12.11.1960, *R.K. Arora 3448*; Kaskal, 07.11.1960, *R.K. Arora 3356* (CAL). Shimoga district, Kudajadri, 08.11.2013, *P.M. Shahina, A.P. Janeesha. & H.S. Ashwini 134718* (CALI). Uttara Kannada district, Uttara Kannada, 1880, *W.A. Talbot s.n.* (DD). **Kerala**, Idukki district, Anamalai hills, 30.12.1911, *C.E.C. Fischer 3235* (CAL); Chinnar, Marayur, *Ibid.*, 24.02.1903, *Roshni Balakrishnan 89915*, *K. Reesha 89430*, *Smitha 89130*, *Ibid.*, 25.02.1903, *N. Shylaja 88329*, *Ibid.*, 25.02.1903, *K. Nishitha 90430*, *Ibid.*, 24.02.1903, *M.B. Reena 89014*, *N. Divya 90515*, *Ibid.*, 24.02.2003, *K.V. Radhika 88615*, *A.M. Dhanya 89615* (CALI); Idukki-kattapana, 08.11.1981, *B. Ramanujan 72417*; Kulamavu, 11.10.1982, *C.N. Mohanan 74549*, *Ibid.*, 07.06.1984, *C.N. Mohanan 82013*; Kurisumala, 08.11.1984, *Fr. Kadavil 928*; Meenmutty, 04.10.1983, *C.N. Mohanan 79974* (CAL, MH); Munnar, 13.12.1970, *M.K. Sreedharan Nambiar 222* (CALI); Painavu, 08.11.1981, *C.N. Mohanan 71212*, *V.S. Raju 71213*; Rajamalai, 26.12.1983, *A.G. Pandurangan 66500*; Vallakadavu, 3.09.1972, *B.D. Sharma 40841* (CAL, MH). Kannur district, Chandanathode, 08.11.1978, *V.S. Ramachandran 58615* (CAL, MH); Kannur, 31.10.1965, *J.L. Ellis 25783* (MH); *s.loc., s. die, N.L. Bor s.n.* (DD). Kasaragod district, Bela, 01.10.1982, *R. Ansari 74421* (MH). Kollam district, Pamba dam-Anathode, 15.12.1974, *K. Vivekananthan 45283* (CALI), *Ibid.*, 09.11.1975, *K. Vivekananthan 46579* (CAL, CALI). Kozhikode district, Chelannur, 23.09.2010, *P.M. Shahina, Johnny & Santhosh Nampy 3431*; Kurichiar mala, 28.10.2013, *A.P. Janeesha & P.M. Shahina 4988* (CALI). Malappuram district, Calicut University Campus, 05.07.1976, *Majeed 20693*, *Ibid.*, 04.02.1977, *E. Saradamma s.n.*, *Ibid.*, 10.12.1981, *A. Rajani 156*, *Ibid.*, 28.03.1982, *Egy T. Paul 200*, *Ibid.*, 30.11.1982, *Shanthi K. Nair 2010*; *Ibid.*, 11.09.1984, *Raja Lakshmi K. 2285*, *Ibid.*, 10.10.1984, *Mary Princy 1886*, *Ibid.*, 30.10.1985, *P.A. Naseem 5443*, *M.P. Anitha 5141*, *Ibid.*, 05.10.1986, *Jaison Lal 4398*, *Ibid.*, 12.08.1987, *Kutty Sankaran 103*, *Ibid.*, 08.03.1990, *Betsy K. Mathai 1782*, Kadalundi, 26.08.1998, *Ravindra Kurup 24630* (CALI). Palakkad district, Poochipara, 10.12.1980, *N.C. Nair & P. Bhargavan 69501* (CAL); Silent valley, 24.09.1977, *R. Ansari 51462*, *Ibid.*, 04.10.1979, *N.C. Nair 64441*, *Ibid.*, 09.10.1979, *N.C. Nair 64250* (CAL), *Ibid.*, 04.12.1981, *T. Sabu 10005*; Kunthipuzha-Poochipara, 10.12.1980, *M.C. Nair 69501*; Way to Valiyaparathode, 20.01.1980, *P. Bhargavan 65607* (CALI). Pathanamthitta district, Kakki, Coodrical Foreset, 25.12.1988, *N. Anilkumar 1330* (CAL, CALI). Kottayam district, Pamba, 24.06.1968, *D.B. Deb 30305* (MH). Thrissur district, Peruvan mala, 06.11.2010, *P.M. Shahina, Alfred Joe &*

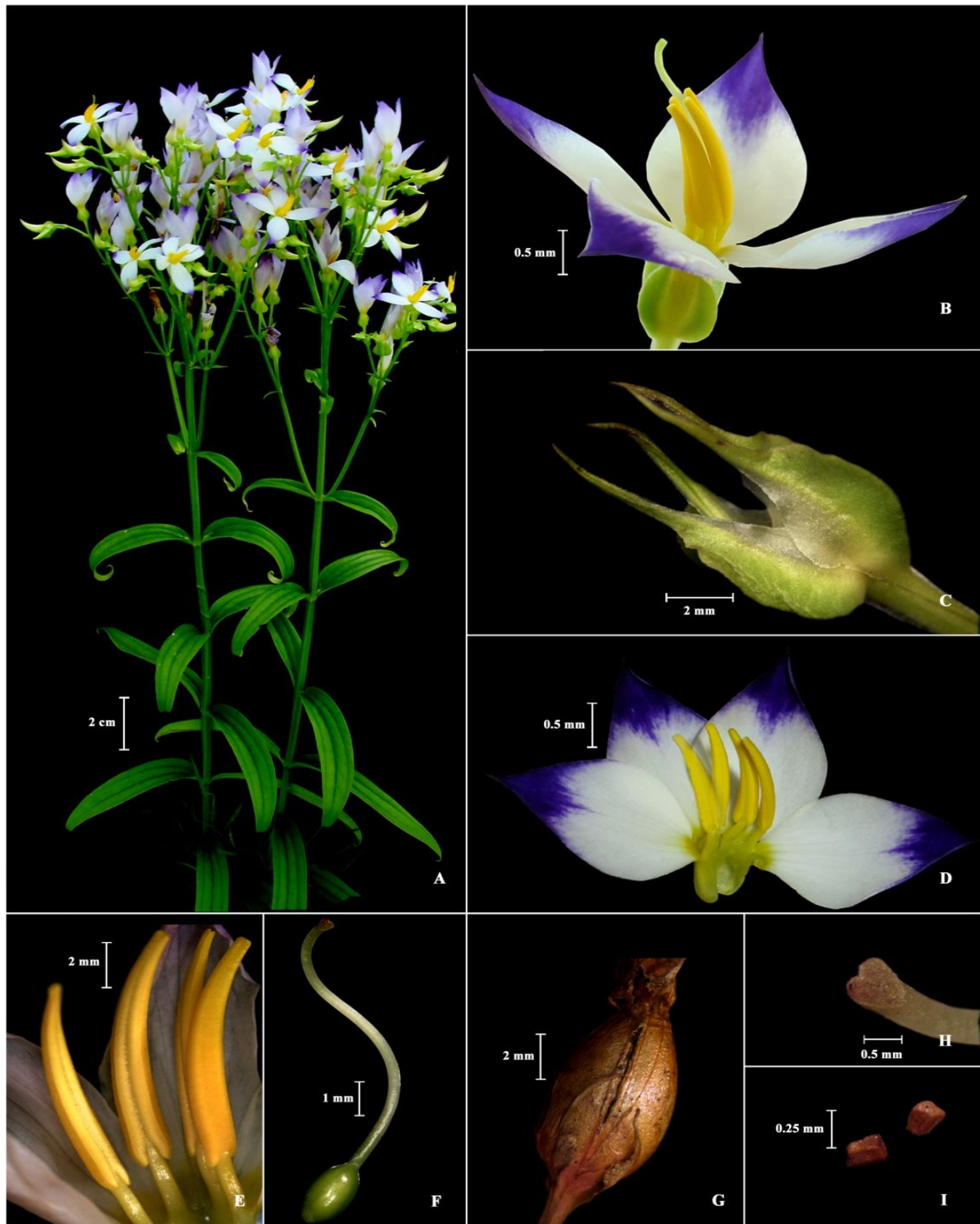


Figure 10. *Exacum tetragonum* Roxb.: A. Flowering twig; B. Flower; C. Calyx; D. Corolla opened; E. Stamens; F. Gynoecium; G. Fruit; H. Stigma; I. Seeds (from Alfred Joe & Shahina P.M. 3961).

Sandhya 3961; *Ibid.*, 03.10.2011, P.M. Shahina & Santhosh Nampy 4901; Vilangan kunnu, 02.10.2010, P.M. Shahina & Santhosh Nampy 3061 (CALI). Wayanad district, Chembra, 24.11.2012, P.M. Shahina, A.P. Janeesha & Satheesh 4959; Manikkunnu, 18.11.2012, P.M. Shahina & Sheba M. Joseph 4954; Wayanad, 22.11.1909, C.A. Barber 8507 (CALI). **Tamil Nadu**, Coimbatore district, Siruvani, 18.12.1956, K. Subramanyam 10478 (CAL). Nilgiris district, Benne forest, 19.07.1960, K. Subramanyam 1796; Brahmagiris, 06.12.1907, C.E.C. Fischer 225; Gudalur, 09.01.1903, s.coll. 5561, *Ibid.*, 18.11.1958, K.M. Sebastine 7397; Naduvattam, 10.1886, J.S. Gamble 18315; Nilgiris, 1880, W.A. Talbot s.n. (DD), *Ibid.*, 1887, M.A. Lawson s.n., *Ibid.*, 10.1884, J.S. Gamble 14873 (CAL).

Notes: The south Indian populations are usually known under the name *E. bicolor*. Klackenberg (1985) in his monograph on *Exacum*, considered *E. bicolor* and *E. tetragonum* as conspecific (both published at the same time) and chose the latter epithet for this species, being the best known and widely used name.

Exacum tetragonum is the only species with bi-coloured petals (blue to violet or white at the base with violet tips), but single coloured populations also met with. The petals also change their color with age. In South India, the plants are tall and flowers are large with long, curved anthers and broader calyx lobes which tapering abruptly to a long point at the apex.

Klackenberg (1985) considered *E. tetragonum* as the most widely distributed and variable species in this genus. *E. tetragonum* closely resembles to *E. tetragonum* var. *grande* but differs by its non-amplexicaul leaves, usually curved anthers and 2-coloured petals. Roxburgh (1832) stated that “this is one of the most elegant plant, the flowers not only numerous, large and beautiful but retaining their beauty and expansion for many days, which is a rare circumstance in an Indian plant”.

11. *Exacum tetragonum* var. *grande* (Klack.) Shahina & Nampy, *stat. nov.* *E. grande* Klack., Oper. Bot. 84: 43. 1985. **Type:** India, Karnataka, Chickmagalur district, Baba budan hills, along road from Chickmagalur - Dattatreypapeeta, 09.10.1982, Klackenberg & Lundin 321 (holo, S!).

Exacum perrottetii sensu auct. Wight, Icon. Pl. Ind. Orient. 4: 7. t. 1322. 1850, C.B. Clarke in Hook.f., Fl. Brit. India 4: 95. 1883, Gamble, Fl. Madras 872. 1935, non Griseb. 1845.

Figure 11

Herbs, 15–50 cm tall. Stems 4-angular, winged (wings c. 0.2 cm broad), branched apically. Leaves sessile; lamina elliptic-ovate, 5–12 × 1.5–6 cm, 3–5 nerved at base, acute at apex, amplexicaul at base. Flowers terminal or axillary, few-many, lax-dense dichasial cymes; bracts ovate, 3–6 × 1–2 cm; pedicels 1–5 cm long. Calyx green, persistent, dorsally winged; wings 1–1.5 mm wide, not distinctly nerved, fused 1/5th of its length, not accrescent in fruit; lobes-4, ovate-lanceolate, 7–15 × 2–3.5 mm, acute-acuminate at apex. Corolla tube white, 0.5–0.8 cm long; lobes-4, violet, yellow at throat, obovate-elliptic, 2–4 × 0.5–1 cm, cuspidate. Stamens-4; filaments short, pale green-yellow, 1.5–3 mm long; anthers orange yellow, linear, straight-bent, sagittate, 5–8 mm long, dehiscence through apical pores that later widen to slits, papilla absent. Ovary green, ovate, 0.25–0.5 × 0.2–0.3 cm; style greenish white, longer than the stamens, 0.4–0.8 cm long, deflexed; stigma simple, rounded, faintly 2-lobed; lobes c. 0.1 cm long. Capsules brown, elliptic-ovate, 1–2 × 0.4–0.8 cm, unilocular. Seeds many, irregular or tetrahedral with shallowly sunken sides, 0.25–0.4 × 0.1–0.2 mm; testa brown.

Chromosome number: Not reported.

❖ **Flowering & fruiting:** August–November.

❖ **Habitat:** In open grasslands and in road side earth cuttings.

❖ **Distribution:** It is a rare species endemic to peninsular India, Klackenberg (1985) cited a specimen from Mahendragiri, Ganjam district in Orissa. Mahendragiri might be ‘Mahyandra hills’ in Kanyakumari district and hence the occurrence of this species in Orissa is doubtful.

Specimens examined: Andhra Pradesh, East Godavari district, Sukumari Hill, s. die, Gamble 16071 (CAL).



Figure 11. *Exacum tetragonum* var. *grande* (Klack.) Shahina & Nampy: **A.** Habit & Habitat; **B.** Flower; **C.** Inflorescence (from Prabhu Kumar K.M. 7577).

Karnataka, Chickmagalur district, Baba Budan hills, *C.J. Saldanha s.n.* (JCB). **Kerala**, Palakkad district, Dhoni hills, 26.09.2013, *K.M. Prabhu Kumar 7577* (CMPR). Wayanad district, Mananthavady, 08.1885, *s.coll. s.n.* (MH); Periya, 26.11.2013, *P.M. Shahina & Santhosh Nampy 4901* (CALI). **Tamil Nadu**, Coimbatore district, Dimbam, 1905, *Fischer 630* (CAL). Nilgiris district, Coonoor, 1883, *Gamble 12261* (CAL, DD). Salem district, Shevaroy hills, *s. die, Beddome s.n.* (MH).

Notes: Klackenberg (1985) described *E. grande* to replace *E. perrottetti* sensu Wight (Icon. Pl. Ind. Orient. 4: 7. t. 1322. 1850) in South India. He (l.c.) separated his *E. grande* from *E. tetragonum* by its stem-clasping leaves, always violet flowers and straight anthers against non-amplexicaul leaves, double coloured (white-violet) flowers and declined anthers in the latter. However, in his description, the anthers are described as straight to some what curved for *E. grande*. Similarly, the present study shows that the leaf character is also much variable in *E. grande*. Hence, *E. grande* is reduced here to the variety of *E. tetragonum*.

12. Exacum travancoricum Bedd., Icon. Pl. Ind. Or. 1: 24. 1869; Klack., Opera Bot. 84: 68. 1985. *Exacum courtallense* var. *travancorica* (Bedd.) C.B. Clarke in Hook.f., Fl. Brit. India 4: 97. 1883. Type: Travancore hills, *s. die, Beddome 47* (lecto, K!). **Figure 12**

Small cushion herbs, 8–25 cm tall. Stems green, terete, highly branched. Leaves sessile-subsessile, succulent; lamina spathulate, incurved, 2–4 × 0.5–1.2 cm, 3-nerved at base, acute at apex, truncate at base. Cymes often terminal or axillary, solitary, pedicellate; pedicels 1–4.5 cm long. Calyx green, persistent, winged; wings semicordate, 1–3 mm wide, tapering towards apex, prominently veined; lobes-4, elliptic-lanceolate, 1–2 × 0.5–1 cm, 3-nerved, acute-acuminate at apex. Corolla tube white, 3–5 mm long; lobes-5, blue, broadly elliptic-obovate, 1–2 × 0.6–1.5 cm, obtuse at apex. Stamens-5; filaments short, pale green-white, 2–4 mm long; anthers yellow bottle shaped, erect, opening by apical pores later widen to slits to the base, 1.5–2.5 mm long. Ovary green, obovate, 4–6.5 × 2.5–4.5 mm; style bluish white, 1–1.2 cm long, curved; stigma simple, capitate, faintly 2-lobed; lobes c. 0.1 cm. Capsule brown, obovate, 4–10 × 4–6 mm. Seeds many, irregular or tetrahedral with shallowly sunken sides, 0.25–0.6 × 0.2–0.4 mm; testa reddish brown.

- ❖ **Chromosome number:** 2n = 68 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** October–December.
- ❖ **Habitat:** On wet rocks and open grasslands.
- ❖ **Distribution:** Endemic to South India, critically endangered.

Specimens examined: **Kerala**, Thiruvananthapuram district, Agasthyamala, 06.02.1988, *s.coll. 9476* (CALI), *Ibid.*, 01.07.1964, *A.N. Henry 19189*, *Ibid.*, 06.10.1973, *J. Joseph 44586* (MH); *Ibid.*, 06.02.1988, *N. Mohanan 9476*, *Ibid.*, 19.10.1993, *S. William Decruse 18402*; Pongalapara, 25.08.1990, *N. Mohanan 10043*, *Ibid.*, 14.11.1991, *N. Mohanan 10937* (TBGT); Travancore hills, *s. die, R.K. Arora 3356* (CAL). Shimoga district, Kudajadri, 08.11.2013, *P.M. Shahina, A.P. Janeesha. & H.S. Ashwini 134718* (CALI). Uttara Kannada district, Uttara *s.coll. 33203, 33197* (MH). Wayanad district, Gurukula Botanical Sanctuary, 14.01.2013, *P.M. Shahina & Santhosh Nampy 4975* (CALI). **Tamil Nadu**, Kanyakumari district, Muthukuzhivayal, 09.09.1976, *A.N. Henry 48294* (MH). Tinnevely district, Tinnevely, 22.05.1907, *C.A. Barber 2888* (CAL).

Notes:- *E. travancoricum* is easily distinguished by its dense, cushion-like habit, succulent leaves and solitary terminal flowers on long pedicels.

13. Exacum wightianum Arn., Ann. Sci. Nat., Bot. II, 11: 176. 1839; Klack., Opera Bot. 84: 74. 1985. **Type:** Peninsula Indiae Orientalis, *Wight s.n.* (lecto, E!). *Exacum foliosum* Griseb. in A. DC., Prodr. 9: 45. 1845. Type: Asia, Hugel (lecto, W!). *Exacum atropurpureum* var. *palghatense* Gamble, Fl. Madras 2: 874. 1923. Type: Palghat hills, *s. die, Beddome 33* (lecto, MH!). **Figure 13**



Figure 12. *Exacum travancoricum* Bedd.: **A.** Flowering twig; **B.** Flower; **C.** Calyx; **D.** Corolla opened; **E.** Stigma; **F.** Fruit; **G.** Gynoecium; **H.** Stamens; **I.** Seeds (from *Shahina P.M. & Santhosh Nampy 4975*).

Herbs, 20–120 cm tall. Stems 4-angular, winged (wings 2–6 mm broad), woody, branched basally and apically. Leaves sessile; lamina broadly ovate, 2.5–8 × 1–3 cm, 3-nerved at base, acute-acuminate at apex; base attenuate. Cymes usually terminal/axillary, 1–3-flowered; bracts ovate, 0.5–1.5 × 0.5–0.8 cm; pedicels 4-lineolate, 1–4 cm long. Calyx green, persistent, dorsally winged; wings semi cordate at base, 1–1.5 mm wide; lobes-5, ovate-lanceolate, 8–15 × 3–5 mm, acuminate at apex. Corolla tube white, 6–9 mm long, yellow at throat; lobes-5, blue, broadly elliptic, 1.5–3.5 × 0.7–2 cm, margins wavy, cuspidate. Stamens-5; filaments pale green-yellow, 2–3 mm long; anthers yellow, erect, linear, oblong, papillate, 6–9 × 1–2 mm long, dehiscence through apical pores. Ovary green, oblong, 4–8 × 2–4 mm; style greenish white, 5–12 mm long, curved; stigma simple, rounded, faintly 2-lobed; lobes c. 1 mm long. Capsule brown, drooping, oblong-globose, 8–15 × 3–8 mm, unilocular. Seeds many, irregular, 0.3–0.5 × 0.1–0.3 mm; testa brown.

- ❖ **Chromosome number:** 2n = 68 (Mallikarjuna *et al.* 1987).
- ❖ **Flowering & fruiting:** June–March.
- ❖ **Habitat:** Along road sides, on road cuttings and in open grasslands, at altitudes above 1700 m.
- ❖ **Distribution:** Endemic to southern Western Ghats, rare.
- ❖ **Uses:** It is as an efficient antimicrobial therapeutic agent in acute anti inflammatory conditions (Arumugasamy, 2012).

Specimens examined: **Karnataka**, Mysore district, Nagavalli, 30.10.1969, *S. Vijaya 16* (JCB). **Kerala**, Idukki district, Devikolam, 27.12.1938, *P. Kumara Pillai s.n.* (TBGT); Idukki, 06.12.1987, *P. Bharghavan 87353*, *Ibid.*, 14.10.1989, *P. Raghavan 90940* (MH); Kanthallur, 30.03.1978, *Nambiar 00259* (KFRI); Maatupetti, 19.11.2012, *K.M. Manudev & P.M. Shahina 4957*; Munnar, 05.11.1961, *C.J. Saldanha 8042* (BLAT), *Ibid.*, 15.06.1985, *K.M. Matthew 18469* (RHT), *Ibid.*, 19.11.2010, *Sheba M. Joseph 3973*, *Ibid.*, 15.11.2012, *A.K. Pradeep 4950*, *Ibid.*, 08.12.2010, *P.M. Shahina & Santhosh Nampy 4119*, *Ibid.*, 21.01.2011, *P.M. Shahina, Sandhya Vincent & Alfred Joe 4167*, *Ibid.*, 18.11.2012, *K.M. Manudev 4956*; Silent Valley, 16.12.2012, *K.M. Manudev & A.J. Robi 4968* (CALI). Kottayam district, Kottayam, 10.10.1963, *K.M. Sebastine 17495*, *Ibid.*, 16.11.1965, *B.V. Shetty s.n.* (MH). Thiruvananthapuram district, Ponmudi, 20.09.1968, *K.M. Matthew 9258* (RHT). **Tamil Nadu**, Dindigul district, Kodaikanal, 10.08.1959, *C.J. Saldanha 4383* (BLAT), *Ibid.*, 22.09.1956, *K.M. Matthew 2668* (RHT), *Ibid.*, 15.02.1974, *K.C. Sankaran 8867* (CALI), *Ibid.*, 16.08.1975, *K.M. Matthew 14812*, *Ibid.*, 26.09.1984, *K.M. Matthew 40903*, *Ibid.*, 30.07.1985, *S.J. Britto 41556*, *Ibid.*, 13.08.1985, *K.M. Matthew 42004*, *Ibid.*, 06.09.1985, *S.J. Britto 42162*, *Ibid.*, 28.11.1985, *K.M. Matthew & N. Rajendran 43419*, *Ibid.*, 04.02.1986, *K.M. Matthew & N. Rajendran 43961*, *Ibid.*, 13.06.1986, *K.M. Matthew 45449*, *Ibid.*, 30.07.1986, *K.M. Matthew 53701* (RHT); Pongalpara, 07.02.1988, *s.coll. 9508* (CALI). Nilgiris district, Conoor, *D.B. Deb 31728*; Ebanad koil, Belta slopes, 15.09.1970, *G.V. Subba Rao 36621*; Kodanad, 12.11.1970, *E. Vajravelu 36853*; Nilgiris, 09.12.1957, *K.M. Sebastine 4848*, *Ibid.*, 29.08.1970, *B.D. Sharma 359114*; Naduvatam, 29.08.1970, *B.D. Sharma 35914* (MH). Kanyakumari district, Anamalais, Akamalai, 15.12.1986, *K.M. Matthew 18773*; Kodayar, 18.01.1986, *K.M. Matthew 18739*; Muthukuzhivayal, 20.10.1985, *S. Sebastine 18639*; Periyakulam, 09.02.1985, *K.M. Matthew 40964* Subagun, 13.09.1959, *s.coll. 1198*; Tiger shola, 11.06.1986, *K.M. Matthew 45430* (RHT). Tirunelveli district, 22.09.1916, *s.coll. 33188* (MH); Kaliyalpil, 01.06.1901, *s.coll. 3023* (MH).

Notes:- *Exacum wightianum* is a showy plant with bright violet flowers. It is easily distinguished by its broadly winged stem, sessile, leathery leaves, drooping fruits and anthers with a prominent papilla near the apex.

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Figure 13. *Exacum wightianum* Arn.: A. Flowering twig; B. Flower; C. Calyx; D. Stamens; E. Corolla opened; F. Gynoecium; G. Stigma; H. Fruit; I. Seed (A from Manudev K.M. & Robi A.J. 4968; B-I from Shahina P.M. & Santhosh Nampy 4119)

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