

SHORT COMMUNICATION

Additions to the Flora of Telangana state of India, with notes on the phytogeographical importance

Ravi Gollamandala¹  | Arunraj Parappurakkal Thazhe²  | Paramesh Lingala³  | Anjaneyulu Paradesi⁴  | Veeranjanyulu Dasari⁵ 

¹Bharatiya Engineering Science and Technology Innovation University, Anantapur, Andhra Pradesh 515731, India

²'Parappurakkal Thazhe' House, Thuvvakkode P.O., Chemanchery, Kozhikode, Kerala 673304, India

³Applied Palynology Laboratory, Department of Botany, Nizam College, Osmania University, Hyderabad, Telangana 500001, India

⁴Department of Botany, Sri Krishnadevaraya University, Ananthapuramu, Andhra Pradesh 515003, India

⁵ENVIS Division, EPTRI, Hyderabad, Telangana 500032, India

Correspondence

Gollamandala Ravi, Bharatiya Engineering Science and Technology Innovation University, Anantapur, Andhra Pradesh, 515731, India.
Email: gollamandala.ravi2@gmail.com

Abstract

The recent floristic explorations in Bhadradi Kothagudem district yielded three flowering plants as additions to the flora of Telangana state. These additions include new record of one family Rhizophoraceae Pers., represented by *Carallia brachiata* (Lour.) Merr. and two species records from the family Linderniaceae Borsch, Kai Müll. & Eb.Fisch. viz. *Torenia godefroyi* Bonati and *Lindernia rotundifolia* (L.) Alston. Detailed morphological description, distribution, habitat and ecology, and photographs of each species are provided. A brief account on the phytogeographical importance of the present additions is given.

KEYWORDS

Carallia, *Lindernia rotundifolia*, new additions, Rhizophoraceae, *Torenia godefroyi*

1 | INTRODUCTION

The Telangana state, came into existence on 2nd June 2014 as the 29th state of India, lies on the Deccan plateau to the west of the Eastern Ghats. The terrain is mostly of plains, gentle slopes and undulating hills, isolated peaks and rocky clusters, which are found all over the state. The elevation of the state starts from 30 m to approx. 900 m in Nallamalais of Mahabubnagar (Pullaiah 2015; Reddy and Reddy 2016). The recent study on the total floristic wealth of the state (Reddy and Reddy 2016) enumerated 2078 taxa (1537 dicotyledons and 541 monocotyledons) belong to 916 genera and 162 families.

The family Rhizophoraceae Pers. is hitherto unreported for the state, where as family Linderniaceae Borsch, Kai Müll. & Eb.Fisch. is represented by 9 species (Pullaiah 2015; Reddy and Reddy 2016; Annamma et al. 2017). The present collection of *Carallia brachiata* (Lour.) Merr., *Torenia godefroyi* Bonati and *Lindernia rotundifolia* (L.) Alston from Bhadradi Kothagudem

district is reported here as the first record of family Rhizophoraceae (represented by *C.brachiata*) and species records of the latter ones for the state.

2 | MATERIALS AND METHODS

The extensive floristic surveys were conducted for the last 2 years in Bhadradi Kothagudem District of Telangana state. Specimens of the newly recorded species were collected from Manuguru mandal of the district (Figure 1). Voucher herbarium sheets were prepared by standard herbarium methods (Jain and Rao 1977), and deposited in BSID. The specimens were identified using relevant Floras and literature (Bonati 1908; Gamble and Fischer 1915-1935; Mukherjee 1945; Sivarajan and Mathew 1983; Prasad et al. 2017). The photographs of fresh specimens were taken using Nikon camera and microscopic observations were carried out for critical studies using Olympus stereo microscope.

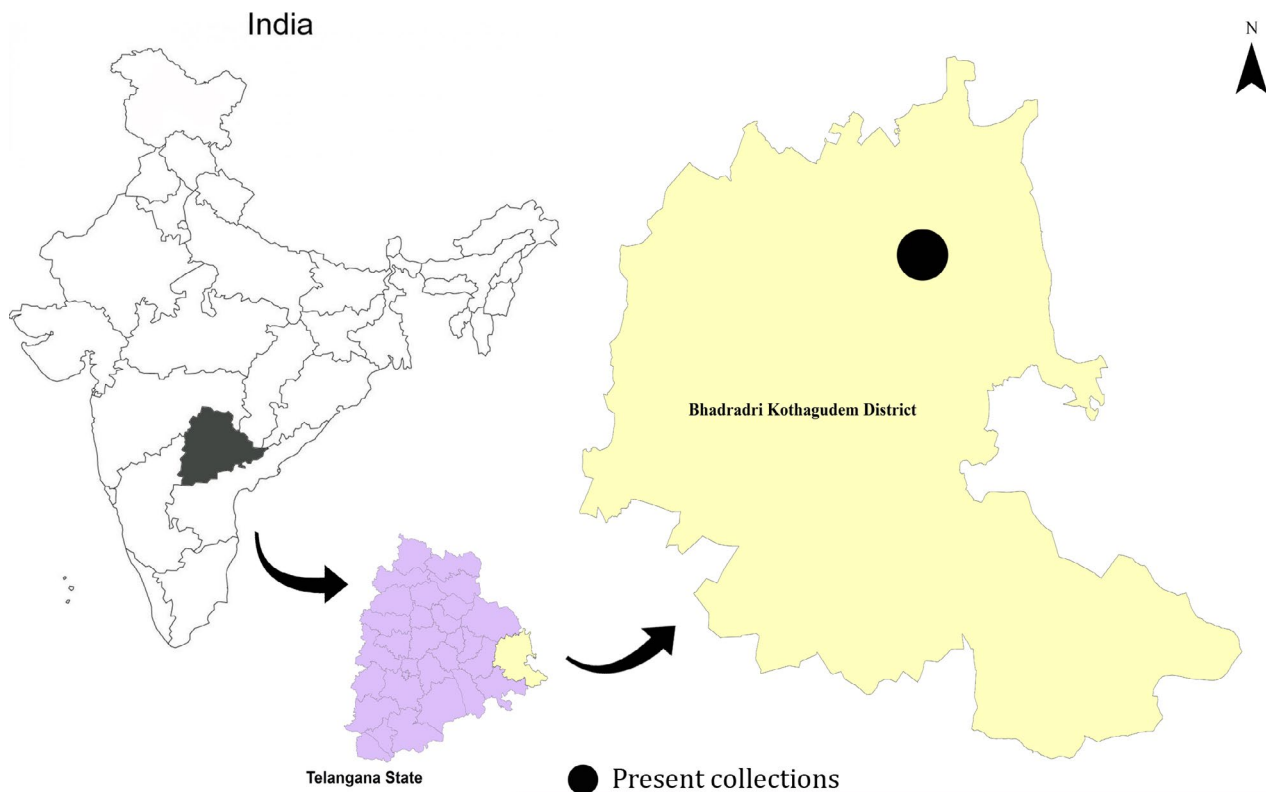


FIGURE 1 Map showing location of the present collections (Manuguru mandal)

3 | RESULT

New family record

Rhizophoraceae Pers. Syn. Pl. [Persoon] 2: 2. 1806. Type genus: *Rhizophora* L.

The family consists of 15 accepted genera globally, out of 7 are present in India (POWO 2021). The genus *Carallia* Roxb. is represented by two species in India viz. *C. brachiata* and *C. borneensis* Oliv. (the latter is from Andaman – Nicobar Islands, hitherto unreported from mainland India) (POWO 2021; Balachandran et al. 2019).

Carallia brachiata (Lour.) Merr. Philipp. J. Sci. 15: 249. 1919; *Diatoma brachiata* Lour. Fl. Cochinch. 296. 1790. Type: INDIA. **Karnataka.** Canara, Mangalore, Pl. Indiae or. (Terr. Canara.) Prope urbem Mangalor., December 1847, R.F. Hohenacker 307 (Undesignated type: U 0005799!)

Evergreen tree, up to 20 to 30 m tall. Bark dark grey, corky, prominently pustular-lenticellate. Leaves simple, petiolate, elliptic-lanceolate, serrulate in juvenile stage, turns to obovate, entire-revolute in mature individuals; lamina 7 – 10 x 3 – 6 cm, base sub-acute, acute, attenuate or cuneate, apex broadly obtuse to round, coriaceous, glabrous and shiny; lateral nerves 6 – 10 pairs, slender, pinnate, obscure, secondary nerves present; petiole 7 – 10 mm. Stipules caducous. Inflorescence short trichotomous axillary cymes; buds exuding a sticky resinous substance. Flowers small, white, usually

octamerous, bisexual, sessile. Calyx 4 – 6 mm long, campanulate, glabrous, lobes 6 – 8, triangular. Petals white 5 – 8, clawed, obovate, sub-orbicular, margin deeply lacerate, reddish, inserted on a crenulate disc. Stamens 10 – 16, inserted on the disc. Ovary bulbous; stigma 3 – 5 lobed. Fruit spherical or pisiform, ca. 8 mm in diameter, bright red when ripe. Seed one, bright orange. (Figure 2).

Distribution:– India, Sri Lanka, Myanmar, Malaysia, China, Australia, Bangladesh, Thailand, Vietnam, Laos, Cambodia, Indonesia, Australia, Madagascar. In India, it is distributed in West Bengal, Assam, Sikkim, southern Peninsula (Pullaiah et al. 2009) including the present record from Telangana.

Habitat and ecology:– Two well established populations of the species with 8 individuals were located near Budugula tribal village, Kondapur reserve forest of Bhadradi Kothagudem district, growing in sandy soil and near small water streams up to 270 m elevation in association with *Diospyros malabarica* (Desr.) Kostel., *Glochidion zeylanicum* (Gaertn.) A.Juss., *Syzygium cumini* (L.) Skeels, *Ardisia solanacea* Roxb., *Anodendron parviflorum* (Roxb.) I.M.Turner, *Erycibe paniculata* Roxb. and *Putranjiva roxburghii* Wall.

Specimens examined:– INDIA. **Telangana state.** Bhadradi Kothagudem district, Kondapur reserve forest, Manuguru mandal, Budugula village, 15 March 2021, G. Ravi 3457 (BSID)

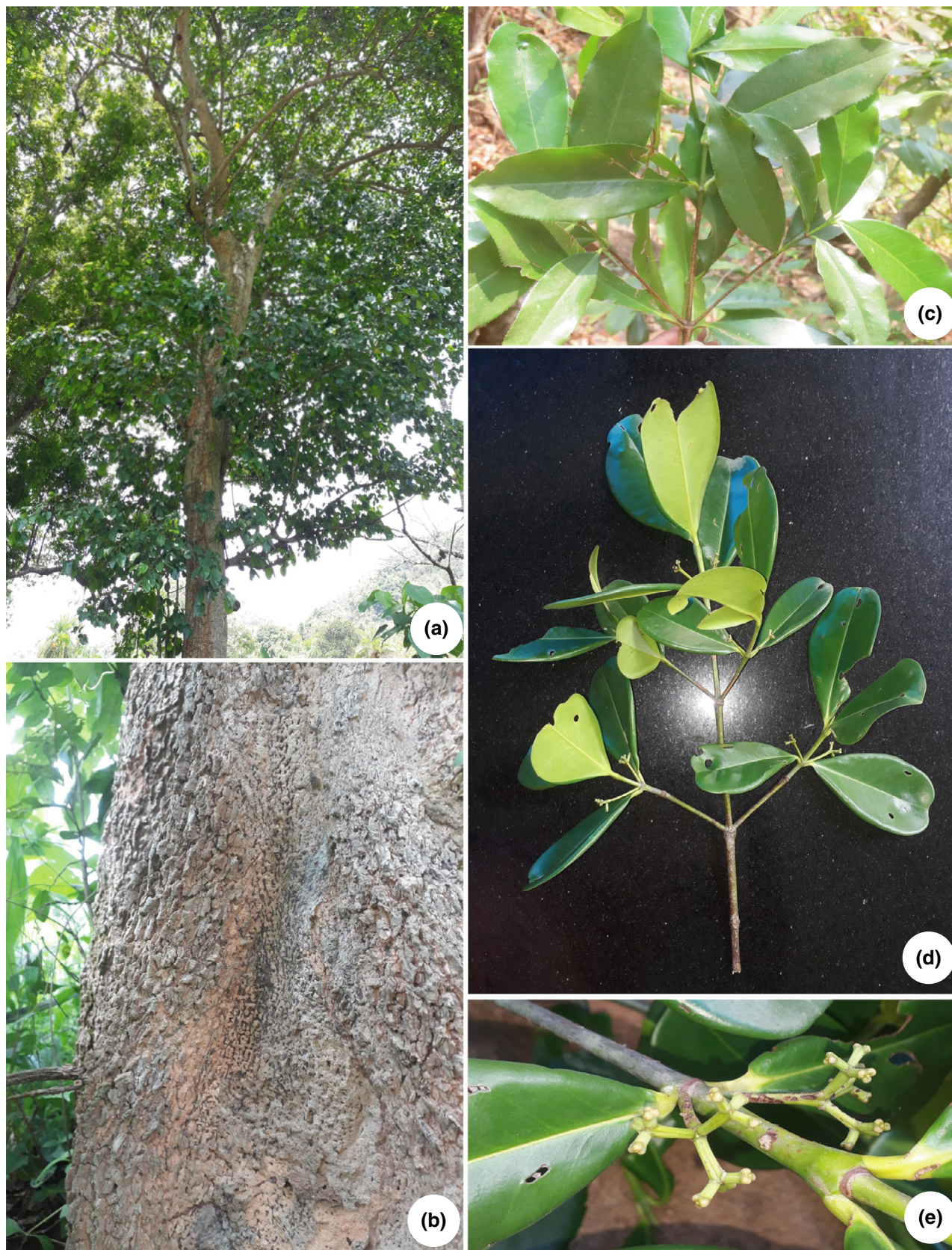


FIGURE 2 *Carallia brachiata* (Lour.) Merr. (a) Habit; (b) Bark; (c) Leaves in juvenile plant; (d) Flowering twig; (e) Inflorescence axis after shedding flowers



FIGURE 3 *Torenia godefroyi* Bonati (a) Habit; (b) Flowering twig; (c–e) Flower; (f) Fruiting calyx; (g) Capsule; (h) Seeds

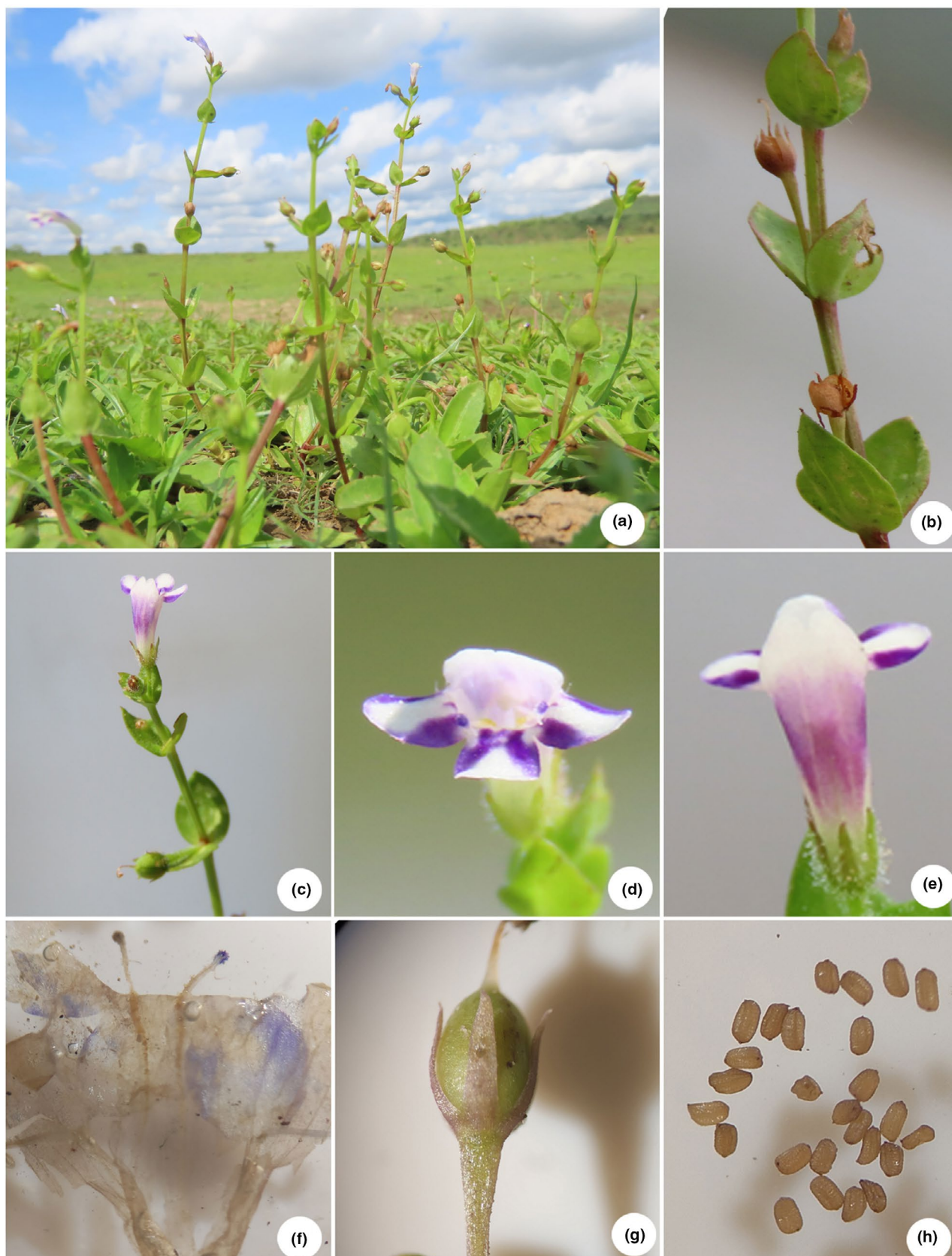


FIGURE 4 *Lindernia rotundifolia* (L.) Alston (a) Habit; (b) Enlarged view of a branch; (c) A flowering twig; (d, e) Flower; (f) Flower cut opened; (g) Capsule; (h) Seeds

New species records

Torenia godefroyi Bonati, Bull. Soc. Bot. France 55: 514 (1908); *Lindernia crustacea* (L.) F. Muell. var. *godefroyi* (Bonati) T. Yamaz., J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13: 37 (1981). –Type: CAMBODIA. **Compon Chuang**. 1875, Godefroy 186 (Lectotype P00586632!, designated by Sutthisaksopon 2013, according to the herbarium database)

Torenia godefroyi var. *filiformis* Bonati, –Type: CAMBODIA. 1875, Godefroy (Probably holotype P00586631!).

Torenia lindernioides C.J. Saldanha, Bull. Bot. Surv. India 8: 130 (1967) –Type: INDIA. **Karnataka**. Dandelli, N. Kanara, May 1919, Sedgwick 2511 (Holotype BLAT).

Annual, ascending to prostrate herb, 7 – 20 cm, branched, rooting from lower nodes. Stem quadrangular, mature parts glabrous, sparse hairs on young parts, greenish to reddish; internodes up to 1.5 cm long. Leaves simple, opposite, pinnately veined, petiolate; petiole 1.5 – 3.5 cm, grooved above, sparsely hairy or glabrous, green to reddish; lamina ovate, 1 – 1.2 × 0.8 – 1 cm, cordate to subcordate or cuneate at base, acute at apex, margin crenate – serrate, subglabrous to sparsely hairy on both sides, mid vein purplish to reddish. Inflorescence axillary solitary or 1 – 3 – flowered terminal cluster. Flowers pedicellate; pedicel short, 1.5 – 3 mm long, angular, glabrous, elongate up to 8 mm in fruit. Calyx 4 – 5 × 1.5 – 2.0 mm, elliptic to oblong – elliptic, bi-labiate, distinctly winged with wings decurrent on pedicel; tube 4 mm long; posterior lip 1.6 – 2.0 × 0.8 – 1.2 mm, slightly 2-partite at apex; anterior lip 1.8 – 2.0 × 1.0 – 1.2 mm, shallowly 3-lobed at apex. Corolla 7 – 8 × 2 – 3.5 mm, bi-labiate with lips not fully opened, with or without yellow patch on inner side of the lower lip; tube 5 mm long, cylindrical, glabrous, white with a violet tinge on upper surface; posterior lip 1.8 – 2.0 × 2.0 – 2.3 mm, ovate, slightly emarginate at apex, white, glabrous; anterior lip 2.9 – 3.4 × 4.0 – 4.2 mm, distinctly 3-lobed with the middle lobe slightly larger than lateral ones; middle lobe 2 × 2 mm; lateral lobes 1 × 1 mm. Stamens 4, all fertile, paired; posterior pair fused below the upper lip; filaments of posterior c. 1 mm long, glabrous, the anterior 3 mm, long, with a 1 mm long cylindrical appendage; anthers 0.6 – 0.8 × 0.2 – 0.3 mm, bi-thecate, united in pairs, their lobes ovate, acute at apex. Gynoecium superior; ovary 1.6 – 2.0 × 0.8 – 1.1 mm, sub-globose to elongated globose, glabrous, placed on a membranous pale orange hypogynous disc; style 3.0 – 3.4 mm long, slender, glabrous; stigma bi lamellate. Capsule 5 – 6.3 × 2.5 – 3.0 mm, elliptic – oblong, completely included in the fruiting calyx. Seeds numerous, minute, bothrospermous, yellowish brown, striate, pitted. (Figure 3).

Distribution: – It is distributed in South to South – East Asia. In India, it is recorded from Karnataka (Hassan and North Kanara districts), Kerala (Kozhikode, Malappuram, Wayanad, Thrissur, Palakkad and Alappuzha districts) (Prasad et al. 2017) and present report to Telangana (Bhadradi Kothagudem district)

Habitat and ecology: – Two well established populations of the species with up to 15 individuals were located in Regulagondi village, Manuguru mandal of Bhadradi Kothagudem district. Both populations are growing on sandy soil in the banks of small stream, in association with *Dentella repens* (L.) J.R. Forst. & G. Forst., *Coldenia procumbens* L., *Mecardonia procumbens* (Mill.) Small. etc.

Notes: – *Torenia godefroyi* can be distinguished from *T. crustacea* (L.) Cham. & Schltdl. (= *Lindernia crustacea* (L.) F. Muell.) in having 5-winged calyx (vs distinctly 5-nerved), cylindrical or tubular corolla tube (vs campanulate), unequal lobes of lower lip of corolla (vs equal lobes), fruiting calyx completely covering the fruit (vs barely reaching the fruit apex) and elliptic – oblong capsule (vs obovate) (Prasad et al. 2017).

Specimens examined: – INDIA. **Telangana state**. Bhadradi Kothagudem district, Manuguru mandal, Regulagondi village, 22 April 2021, G. Ravi 3460 (BSID)

Lindernia rotundifolia (L.) Alston, Handb. Fl. Ceylon 6 (Suppl.): 214. 1931; *Gratiola rotundifolia* L., Mant. Pl. 2: 174. 1771. –Type: “Habitat in Malabaricae arenosis” (Lectotype: LINN 30.4! designated by L. H. Cramer 1981).

Annual, trailing or erect herb. Stems green, four-angled, rooting at nodes, branching from base of stem. Leaves simple, opposite, sessile; lamina elliptic, ovate, obovate, or orbicular, 2 – 16 × 1 – 12 mm, base cuneate to rounded, apex acute or obtuse, margin 2 – 3(4) pairs serrate or remotely toothed, occasionally entire, palmately 3–5-nerved, minutely glandular-punctate on both surfaces. Flowers solitary in axils, pedicellate; pedicels 2 – 18 mm long, erect, often reflexing in fruits. Calyx deeply 5-lobed, slightly unequal, 1.4 – 2.5 mm long, ovate to lanceolate, acute – acuminate, glandular hairy. Corolla white or light blue with purple blotches on throat and lower lobes; tube 8 – 11 mm long, campanulate; bilipped, upper lip 2 – lobed, lower lip 3 – lobed, trichomes present at the base of lobes of lower lip. Androecium of 2 fertile stamens and 2 staminodes; staminodes slightly exerted from corolla tube, free part of staminodial filament 2 – 3 mm long, hairy; fertile anthers coherent, filaments 1.4 – 1.7 mm long, glabrous. Ovary ellipsoid. Capsule 1.5 – 3 mm long, more or less equal or slightly exceeding the length of persistent calyx, ovate to ellipsoid, apex acute, glabrous; fruiting pedicel 5 – 7 mm. Seeds yellow, oblong, rugate. (Figure 4).

Distribution: – It is a widespread species, distributed in South America, Africa, India, Sri Lanka, China, Madagascar, Mauritius and Vietnam (Mukerjee 1945; POWO 2021). In India, it is recorded from almost all peninsular states, including present report from Telangana state (Bhadradi Kothagudem district)

Habitat and ecology: – It is growing near the bank of the water body, in association with *Dentella repens* (L.) J.R. Forst. & G. Forst., *Lindernia parviflora* (Roxb.) Haines, *Torenia crustacea* (L.) Cham. & Schltdl. and *Coldenia procumbens* L.

Specimens examined:– INDIA. **Telangana State.** Badradri Kothagudem district, Kondapur Reserve Forest, Manuguru mandal, 15 May 2021, G. Ravi 605 (BSID).

4 | PHYTOGEOGRAPHICAL IMPORTANCE OF THE PRESENT ADDITIONS

The present location of *Carallia brachiata* in Telangana cannot be considered as an isolated or discontinuous patch, but a clear case of continuous distribution. The Badradri Kothagudem district lies in touch with Andhra Pradesh, at the foot hills of Eastern Ghats. In Andhra Pradesh, the species has been recorded from Eastern Ghats regions of Cuddapah and Chittoor (Reddy et al. 2009; Pullaiah et al. 2018). The present collection is an extended distribution of this species towards the western side, at the foot hills of central Eastern Ghats.

Torenia godefroyi is hitherto known only from Western Ghats mountain range in India, and the present report is the first one on its distribution to outside of the mountain range. Prasad et al. (2017) pointed out the presence of a distinct yellow patch in the throat of corolla of *T. crustacea*, and absence of it in *T. godefroyi*. The flowers in the present collections possess yellow patch in the throat, sometimes it turns obscure. The collections by Prasad et al. (2017) from Western Ghats lack the yellow patch, where as the collections from Telangana possess it. This implies that the character is a gradually varying one in this species, with least taxonomic importance.


The third addition, *Lindernia rotundifolia* is a widely distributed species in India, with preference of wet or marshy areas for the growth. Telangana state is rich with such habitats in its lower plains. So the new record of this species from the state is the expected one, might be misidentified or neglected by previous floristic studies in this geographical area. The shape of calyx lobes in this species is highly variable, from ovate to lanceolate. The accessions of this species from southern Western Ghats show this variation prominently (Pers. obs.), but the accessions from Deccan plateau including the present collections are more or less stable towards the lanceolate shape.

The authors are very thankful to YVB Charan and P. Bharat Simha Yadav (both from PJTSAU, Hyderabad), B. Venkata Raju (Field Botanist, Andhra Pradesh) and Telangana State Forest Department of Bhadradi Kothagudem District for their endless support.

We hereby declare that there is no conflict of interest.

ORCID

Ravi Gollamandala  <https://orcid.org/0000-0002-7463-0967>

Arunraj Parappurakkal Thazhe  <https://orcid.org/0000-0003-0644-6380>

Paramesh Lingala  <https://orcid.org/0000-0001-8570-6843>

Anjaneyulu Paradesi  <https://orcid.org/0000-0001-7570-8036>

Veeranjaneyulu Dasari  <https://orcid.org/0000-0002-2281-1125>

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