**Rotala** Linn. (Lythraceae) in peninsular India

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**Abstract.** This paper deals with a revised taxonomic study of *Rotala* species in peninsular India, where it displays maximum morphological diversity than in other parts of the subcontinent. Of the 19 species reported from India, 14 are distributed here. Besides, two new species of the genus, *Rotala cookii* Joseph and Sivarajan and *Rotala vasudevanii* Joseph and Sivarajan have also been discovered and described from this part of the country, making the total number of species 16. An artificial key for the species, their nomenclature and synonymy, descriptions and other relevant notes are provided here.

**Keywords.** Lythraceae; *Rotala*; *Ammannia*.

1. **Introduction**

The genera *Ammannia* Linn. (1753) and *Rotala* Linn. (1771) are closely allied with a remarkable degree of similarity in habit often leading to confusion in their generic recognition. Earlier authors considered *Ammannia* as a larger, more inclusive taxon, including *Rotala* in it. Bentham and Hooker (1865) recognised two subgenera in *Ammannia* viz., Subg. *Rotala* and Subg. *Eu-Ammannia* and this was followed by Clarke (1879) in his account of Indian species of this group for Hooker's *Flora of British India*. However, the current consensus among botanists is in favour of treating them as distinct genera, based mainly on the dehiscence of the fruits and structure of the pericarp (see van Leeuwen 1971; Panigrahi 1976).

*Rotala* is an aquatic or amphibious, tropical and sub-tropical genus with a considerable amount of phenotypic plasticity, so much so that the 97 species recognised by various authors have now been reduced to 44 good species (Cook 1979). Indian species of this genus, with their maximum morphological diversity in south Asia have been revised by Blatter and Hallberg (1918). But, the concept of species in this genus has undergone great changes since then. Of the 19 species reported from India (Cook 1979), *Rotala mexicana*, *R. serpyllifolia*, *R. rotundifolia*, *R. densiflora* and *R. rosea* are widely distributed in India. *R. subrotunda*, *R. cordata*, *R. simpliciuscula*, *R. rubra* and *R. wallichii* are available only in north and northeastern India, and hence are excluded from the consideration of this paper.

Peninsular India has now 16 species of the genus, including the two new species discovered and described recently from Kerala, namely *R. cookii* Joseph and Sivarajan (1988) and *R. vasudevanii*, Joseph and Sivarajan (present paper). The latter was collected and described as a new record of *Hydrolythrum wallichii* Hook. f. [now *Rotala wallichii* (Hook. f.) Koehne] for south India (Vasudevan Nair 1965). But, this is an east Indian endemic. We have seen both the Wallichian material (Cat. no. 9059) and Vasudevan Nair’s collections and are convinced that they are different. The latter turns out to be a new species, *R. vasudevanii*, so named to commemorate the name of its original collector. Most of the species are distributed throughout peninsular India, but *R. cookii* and *R. vasudevanii*, are not known...
except from the type locality. *R. occultiflora*, seen also in Australia, is now extremely rare so much so that we could not find any specimen of this species in the Madras Herbarium. Except for old collections of Talbot, Blatter and Hallberg, there are only very few recent collections at Pune. *R. ritchiei* has already entered the 'red data book' (Nayar and Sastry 1987) and *R. floribunda* is a highly local endemic to Mahabaleswar.

Species of the genus *Rotala* fall under two groups, based on the nature of their habitat, viz., obligate aquatics which grow in shallow water, and semi-aquatics or terrestrials which thrive in marshy lands. Most of the aquatic species are characterised by what is called ‘Hippuris syndrome’ (Cook 1978): erect unbranched stems with simple, elongate leaves borne in symmetrical whorls “heterophylly manifesting itself as variation in number of leaves in each whorl and in individual leaf shape and size.” Among the Indian species, this syndrome is displayed by *R. verticillaris*, *R. mexicana* (only where it grows as an emergent aquatic), *R. cookii* and *R. vasudevanii*. Most other species have decussate leaves, while *R. floribunda* has alternate ones and *R. occultiflora* has leaves disposed in whorls of 3.

Leaf and flower arrangement has been taken as an important taxonomic character in this genus by many. Koehne (1903) divided the genus into two sections based on these characters: Sect. *Hippiuridum* with whorled/alternate leaves and flowers and Sect. *Enantiorotala* with decussate leaves and flowers. But, species like *R. mexicana*, and *R. myriophylloides* display both these situations depending upon whether they are growing as aquatics or terrestrials. Consequently, Cook (1978, 1979) considered these characters to be direct responses to the aquatic environment and that these ‘Hippuris mimics’ do not constitute a single phyletic group. Cook (1979) has also found that the genus, being very uniform, does not yield to a satisfactory subgeneric classification into natural subgeneric groups.

2. **Key to the species**

1a. Flowers apetalous ......................................................... 2
b. Flowers petaliferous (except sometimes in *R. illecebroides*) .................. 3

2a. Leaves usually in whorls of 3, base often sheathing, bracteoles much exceeding and often enclosing the flower .................................. *occultiflora* (10)
b. Leaves in whorls of 3–8 or decussate, base not sheathing, bracteoles scarcely exceeding and enclosing the flower .......................... *mexicana* (9)

3a. Plants emergent aquatics ............................................. 4
b. Plants terrestrial ............................................. 6

4a. Leaves monomorphic ............................................... *vasudevanii* (15)
b. Leaves dimorphic .................................................. 5

5a. Stamens inserted above the middle of calyx tube, nectar scales absent ........

.................................................. *verticillaris* (16)
b. Stamens inserted towards the base of calyx tube, nectar scales present ....

.................................. *cookii* (1)

6a. Calyx appendages present ............................................. 7
b. Calyx appendages absent ........................................... 11

7a. Flowers trimerous ............................................. *malampuzhensis* (8)
b. Flowers 4–5 merous ........................................... 8

8a. Bracteoles longer than flowers .................................. *densiflora* (2)
b. Bracteoles shorter than flowers .................................. 9
3. Systematic account


Submerged annual, stem up to 40 cm long, creeping and rooting below. Leaves in whorls of 7–10, dimorphic, submerged leaves capillary, often reflexed, to 15 mm long, microscopically bimucronate at apex, aerial leaves broader, spreading, linear, to 6 x 0·8 mm, bimucronate at apex, narrowed towards base. Bracts leaf-like. Bracteoles linear, ca. 0·5 mm long, shorter than calyx tube, persistent in fruit. Flowers 2–4 in each node, those on submerged shoot cleistogamous and those on emergent branches normal, sessile. Calyx tube campanulate, to 1 mm long, splitting and disintegrating as the fruit ripens, lobes 4, deltate, to 0·5 mm long. Petals 4, obovate-obtuse, white, alternating with calyx lobes, to 0·8 mm long. Stamens 4, inserted on the lower half of calyx tube, filaments white, anthers borne level with the base of petals. Nectar scales 4, small, greenish yellow or pink, minute, broader than long, apex obtuse or truncate. Ovary globose. Style simple, short, persistent. Stigma capitate, minutely papillose. Capsule globose, to 1·2 mm across, opening by valves. Seeds 4–5, semi-ellipsoidal, to 1 mm long.

*R. cookii* grows abundantly in flooded paddy fields during the rainy season, in association with *Hydrilla verticillata*, *Wiesneria triandra*, *Limnopoa meeboldii*, and *Nymphoides indica*.

**Distribution:** Collected from Parappanangadi, Kerala state, India (type locality), this is not known from anywhere else.

**Specimens examined:** K T Joseph 38967, 39069 (Parappanangadi).

Erect, amphibious or terrestrial annuals. Stem 4-gonous, often narrowly winged at the angles, to 50 cm tall, simple or branched. Leaves decussate below, alternate above, but often apparently whorled due to very short internodes, variable in size and shape, ovate or elliptic-oblong, acute, to 2.5 × 0.5 cm. Bracts dimorphic, those on main stem and lower branches leaf-like, and those on upper branches considerably smaller, ovate or elliptic, scarcely exceeding the flowers. Bracteoles pinkish, lanceolate-acuminate, exceeding the calyx. Flowers monomorphic, solitary, sessile in the axils of bracts. Calyx tube campanulate, 1 mm long, lobes 5, triangular acute, 0.5 mm long, appendages longer than and alternating with calyx lobes, linear. Petals 5, obovate, obtuse or retuse at apex, persistent, at least as long as calyx lobes. Stamens 5 or rarely fewer, attached below the middle of the calyx tube, anthers borne level with calyx lobes. Capsules globose, 3-valved, as long as calyx. Seeds semi-ovoid, 0.5 mm long.

A pretty herb with pink flowers growing in marshy places, paddy fields and the sides of small streams. It is a very variable species. Variation is chiefly found in the size of the plant, presence or absence of wings on the stem, size and shape of leaves and shape of petals.

**Distribution:** Western Himalaya, northeast India and widespread in peninsular India, Sri Lanka, Australia and north Italy.

**Specimens examined:** Andhra Pradesh: Subba Rao 22581 (Kilagada) Henry 15914 (Warrangel); Goa: R S Rao 84418 (Goa), Raghavan 103292 (Goa); Karnataka: Talbot 1066, Sn. 408, 1586 (north Canara) Raghavan 103912 (Mysore); Kerala: K T Joseph 38916 (Sultan’s Battery) Sivarajan 646 (Calicut), Meenabai 1211 (Calicut), Sworoopanandan 151 (Palghat).


*A. heyneana* Wall., Cat. 2104, 1828, nom. nud.

*A. hexandra* Panigrahi, Indian Forester 102 766, 1976, non Wall. ex Koehne, 1880 (figure 9).

Aquatic or amphibious annual. Stems creeping and rooting below, erect above, up
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to 40 cm tall, usually much branched. Leaves decussate, sessile, oblong to lanceolate, obtuse, to $20 \times 3$ mm, lower leaves cuneate or cordate at base, upper ones cordate or auriculate. Bracts leaf-like. Bracteoles triangular-acute, to 1 mm long. Flowers monomorphic, sessile, solitary in axils of leaf-like bracts. Calyx tube campanulate, 2 mm long, lobes 5, deltoid, 0-5 mm long, appendages absent. Petals 5, 2-5 mm long, pinnately divided into linear segments, pink. Stamens 5, filaments 3-4 mm long, attached to the base of calyx tube, anthers exserted, borne on level with the stigma. Capsule ellipsoid, 3-valved, 2-5 mm long. Seeds semi-ellipsoidal, 1-5 mm long.

In shallow water or marshes, commonly associated with species like Dopatrium junceum, Lindernia hyssopioides etc.


Distribution: Endemic to peninsular India.

Specimens examined: Andhra Pradesh: Subba Rao 25687 (Karimnagar); Karnataka: Radolph D Austead M 116 (Mysore); Maharashtra: Bhide ? (Badami); Tamil Nadu: Sebastine 5228 (south Arcot) J Joseph 13240 (Coimbatore).


Nimmonia floribunda Wight, Madras J. Lit. Sci. 5 312, t. 20, 1837.

Ameletia floribunda (Wight) Wight in Hook., Ic. Pl. Ser. 2, 5 t 826, 1840.


Amphibious or terrestrial, slender herbs. Stem creeping and rooting below, erect and branched above, branches capillary. Leaves sessile, rigid, green or tinged with red, highly variable in size and shape in the same plant, basal leaves elliptic-lanceolate, obtuse to $10 \times 4$ mm, upper ones smaller, lanceolate-acuminate, cordate or auriculate at base, often with a cluster of smaller leaves in the axils. Bracts leaf-like at base and bracteole-like above, c. 2 mm long. Bracteoles 2, linear to lanceolate, 1-8 mm long. Flowers dimorphic, heterostylos, subsessile or sometimes pedicelled in dense, terminal glomerules. Calyx tube campanulate, c. 2 mm long, 4-nerved, lobes 4, deltate, 0-4-0-5 mm long, pink, appendages absent. Petals 4, showy, bright rose, obovate, 1-1-5 mm long. Stamens 4, inserted below the middle at the calyx tube, filaments either c. 1 mm or c. 4 mm long, anthers either included in the calyx tube or borne above the petals. Nectar scales 4, prominent, slightly bilobed. Styles either longer or shorter than the stamens. Capsule ovoid to ellipsoidal, 2-valved. Seeds semi-ellipsoidal, c. 0-04 mm long.

A gregarious much branched herb on wet rocks in Mahabeleswar, where it is a local endemic. Cook (1979) describes this plant as a heterophyllumous species having linear, flaccid submerged leaves about 5 cm long. However we collected this material from wet rocks near a fast-flowing brooklet at Mahabeleswar, where they had no submerged leaves.

Distribution: India (local endemic confined to Mahabeleswar in Maharashtra).

Specimens examined: Maharashtra: Wight Sn. 21866 (Malabar concan), Valsamma 1146a (Mahabeleswar), Sivarajan 19794 (Mahabeleswar).


Rotala fynsonii Blatt. and Hallb., J. Bombay Nat. Hist. Soc. 25 709, 1918 (figure 8).

Terrestrial or amphibious annual, to 10 cm tall. Stem erect or creeping below, simple or branched above; branches slender, 4-angled to 4-winged. Leaves decussate, sessile, broadly ovate-cordate, lower leaves larger, to 4 x 3 mm, semi-amplexicaul at base, acute at apex. Bracts leaf-like, Bracteoles 2, persistent, linear, equal to calyx lobes. Flowers monomorphic, sessile, solitary in the axils of leaf-like bracts. Calyx tube campanulate, 0-8 mm long, lobes 4, triangular-acuminate, to 1 mm long, apiculate at apex, appendages 4, linear, about as long as calyx lobes. Petals 4, sometimes absent. Stamens 4, inserted on upper half of calyx tube, not exerted. Ovary globose. Style very short, Stigma capitate. Capsule globose, to 1 mm, 3–4-valved. Seeds semi-ellipsoidal, c. 0.3 mm long.

A very distinct species, usually seen in wet places and on dripping rocks in hilly areas.

Flrs. and Frts: Nov.–Dec.

Distribution: Central peninsular India.

Specimens examined: Andhra Pradesh: Rajagopal, 578 (Hyderabad); Tamil Nadu: J Joseph 13561 (Coimbatore), Rangachari 13962 (Salem).


Peplis indica Willd. Sp. pl. 2 244, 1799.


Ammannia nana Roxb., Fl. Ind. (ed. 1) I 448, 1820, non Wall.

Ameletia polystachya wall. ex Wt. and Arn., Prodr. 1 304, 1834.


Aquatic or marshy annual. Stems erect or decumbent, to 30 cm tall, 4-angled or terete, creeping and rooting at base, branched above. Leaves decussate, sessile, to
15 x 10 mm elliptic, obovate-spathulate or suborbicular, cuneate or obtuse at base, obtuse or rounded at apex, margin cartilaginous. Bracts dimorphic, leaf-like on major branches, much smaller elliptic-oblong on flowering branches which ultimately look like bracteate spikes. Bracteoles 2, linear to lanceolate, almost equalling the calyx tube. Flowers sessile, axillary, solitary. Calyx tube campanulate, pink or red at anthesis, 1.5-3 mm long, lobes 4, triangular-acute, to 1 mm long, appendages absent. Petals 4, persistent, elliptic, 0.5 mm long, sometimes absent. Stamens 4 or sometimes less, filaments inserted at about the middle of calyx tube, anthers borne above the calyx tube. Ovary ellipsoidal, 1-1.5 cm long. Style 0.8 cm long, persistent. Stigma capitate. Capsule ellipsoidal, 2 mm long, 2-valved. Seeds hemispherical, 0.3-0.4 mm long.

A very common weedy species in wet or moist rice fields, river banks and other marshy places usually associated with other species such as Rotala rotundifolia, R. rosea and a variety of grasses and sedges. Probably, the most variable of all species. This does not yield to a convenient, natural subspecific classification because of continuous variation. Blatter and Hallberg (1918) have recognised about 8 'formae' in this species, but our observations reveal that this is of doubtful merit. As Cook (1979) has opined, phenotypic plasticity in this species is so great that it hinders taxonomic recognition based on morphological characteristics.

Blatter and Hallberg (1918) accredit the combination R. indica to themselves without probably being aware that Koehne (1903) has already done it much earlier and that both are homotypic.

**Distribution:** Native to southeast Asia. Introduced and more or less naturalised in Italy, Portugal, Congo and USA.

**Specimens examined:** Andhra Pradesh: Henry 15913 (Warrangal), Sebastine 11678 (Warrangal); Goa: Ansari, 127185, Kanodia 89395, R S Rao 84566, Chelian 10612, Singh 125063; Karnataka: Jain 24560 (north Canara), Arora 46164 (Coorg), Talbot 1116 (north Canara), Barber, 2403, 2404 (south Canara); Kerala: K T Joseph 39313 (Sultan's Battery), Sivarajan 68 (Calicut), Umadevi 62 (Kadalundy), Sebastine 20875 (Palghat), Ramachandran 60089, 60083 (Kannoth), Ramamurty 47653 (Guruvayur) 63980 (Tellhipherry); Maharashtra: Billore 116725, 115304, Kulkarni 108663; Tamil Nadu: Subramanyam 7539 (Yercad), Barber 99, 135 (Madras) 13960 (Salem), Sn. 21711 (Padakoth), Ramamurty 51135 (south Arcot).


*Amelotia rotundifolia* Wt., It. t. 258. 1840, non Roxb. 1820.


Aquatic or amphibious, heterophyllous annuals or perennials. Stem terete, creeping and rooting below, branches decumbent. Leaves: when the plant grows as
an emergent aquatic the submerged leaves are lanceolate, membraneous and in
whorls of 3 to begin with and ovate-acute, and decussate later on, aerial leaves
decussate, fleshy, to 2 cm across, reddish tinged, ovate-orbicular, obtuse or rounded
at apex, cordate at base, basally nerved. In the terrestrial forms only the latter types
of leaves are seen. Flowers in terminal, simple or branched, bracteate spikes or very
rarely in the axils of foliage leaves, monomorphic. Bracts closely imbricating,
broadly ovate-acute, to 3 mm long. Bracteoles linear, half as long as the calyx
tube. Calyx tube campanulate, to 1 mm long, membraneous, lobes 4, triangular-
acute, to 1 mm long, pink, appendages absent. Petals 4, obovate-obtuse, to 2 mm
long, bright rose. Stamens 4, inserted at the base of the calyx tube, much exerted.
Ovary globose. Style to 3 mm long. Stigma simple. Capsule globose, 1-5 mm across,
4-valved. Seeds semi-ellipsoidal, about 0.05 mm long.

A very common weed in streams, temporary ponds and flooded paddy fields. In
submerged condition the plant is very flexuous, leaves are very thin and more or
less translucent, shape varies from lanceolate to orbicular and are pale green, pink
or red. It usually set flowers and fruits when the surrounding water recedes or get
dried up. It is seen usually associated with Blyxa auberti and Vallisneria spiralis
and resembles R. rotundifolia in general appearance but differs in having exerted
stamens. It is usually restricted to the wet low lands in the coastal region.


Distribution: Confined to southern India in the states of Karnataka and Kerala.
Specimens examined: Karnataka: Rangachari 16309 (south Kanara); Kerala:
Joseph 38942 (Malappuram), 38694 (Calicut), 41291 (Cannanore), Kumari 69
(Tellicherry), Mary Cherian 12501 (Trichur), Sivarajan 71 (Calicut); Tamil Nadu:
Wight Sn. 21743.

3.8 *Rotala malampuzhensis* R Vasudevan Nair (J. Bombay Nat. Hist. Soc. 72 57,
1975. nom. invalid.) ex Cook, Boissiera 29 98, 1979; Mani. and Sivar., Fl. Calicut
114, 1982; Panigrahi and Nicols., Taxon 32 120, 1983 (figure 7).

Amphibious or terrestrial, gregarious annuals. Stems much branched, creeping
and rooting below, branches erect, to 30 cm long. Leaves simple, decussate, sessile,
submerged leaves scale-like, to orbicular, upper leaves linear to lanceolate, to
15 x 4 mm. Bracts leaf-like. Bracteoles almost equalling calyx tube, capillary,
c. 1 mm long. Flowers-monomorphic, sessile, solitary. Calyx tube campanulate,
0.8 mm long, bright red, lobes 3, ovate-acute, appendages 3, minute, sometimes
absent. Petals 3, small, bright red. Stamens 3, inserted above the base of the calyx
tube, anthers level with the middle of calyx lobes. Nectar scales 3, prominent, linear
and alternating with the stamens. Ovary globose. Style very short or absent. Stigma
capitate. Capsule globose, bright red, exceeding the calyx tube, opening by 3 valves.
Seeds 10-15, semi-ovoid, smooth, bright red.

Common in flooded paddy fields and low lands, in temporary pools on rocky,
lateritic slopes and on the banks of slow-flowing streams in the coastal plains of
Kerala. Often forming dense, deep green carpets, it sets flowers and fruits within a
fortnight after the onset of monsoon. Commonly associated species are Limnophila
indica, Dopatrium junceum and Echinochloa colonum. It is easily distinguished in the
field by its tufted habit, bright red flowers and fruits and the smaller leaves.

For notes on nomenclature see Panigrahi and Nicolson (1988).
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**Distribution:** The coastal plain of Kerala.

**Specimens examined:** Kerala: K T Joseph 38516, 38467, 38407, 14388, Sivarajan 307, Shyamala 18587, Maro 6091, Sainaba 5949, Dinesh 30452.

3.9 *Rotala mexicana* Cham. and Schlecht., Linnaea 5 567, 1830; Koehne, Bot. Jahrb. 1 150, 1880 and in Engl., Pflanzenr. IV. 216 29, 1903; Blatt. and Hallb., J.


Rotula verticillaris Hiern in Oliver, Fl. Trop. Africa 2 467, 1871, non Linn., 1771.


Rotala pygmaea (S Kurz) Rajagopal and Ramayya, Kew Bull. 23 465, 1969 (figure 4).

Aquatic or amphibious, heterophyllous annual. Stem profusely branched, slender, 4-angled, creeping or ascending, rooting at nodes. Leaves in whorls of 3–8 when submerged, capillary, to 5 mm long, aerial ones decussate, to 5 mm long and less than 1 mm broad, linear-oblong. Bracts leaf-like. Bracteoles linear, usually as long as calyx tube. Flowers monomorphic, solitary, axillary, sessile, less than 1 mm long. Calyx tube 0·6 mm long, pink, lobes 4, triangular, 0·4–0·5 mm long, appendages absent. Petals absent. Stamens usually 2, inserted near the base of calyx tube, not exserted. Ovary globose, 0·5 mm across. Style short. Stigma capitate. Capsule globose, to 0·8 mm across, 2–3 valved, slightly exceeds the calyx lobes. Seeds 10–18, smooth, black, semi-obovate, 0·3 mm long.

A wide spread and variable species found usually in shallow water or wet or moist open grounds during monsoon. Sometimes looking like terrestrial algae, it is very short-lived and complete its life-cycle within a fortnight. In water of 10 cm or more deep, stem is erect and branched below and the submerged leaves are linear, thin, usually in whorls. The common form found in the prostrate, creeping one. Blatter and Hallberg (1918) and Cook (1978, 1979) have dealt with variations within the species in considerable detail.

Flrs. and Frts: July-Nov.

Distribution: Throughout the warmer parts of the world, northeast Africa, Arabia and Pacific Islands.

Specimens examined: Andhra Pradesh: Ellis 22196 (Kurnool); Karnataka: Talbot 1317 (north Kanara); Kerala: K T Joseph 38541 (Tenhipalam), 3940 (Sultan's Battery).


Amphibious annuals. Stem creeping and rooting below, branches erect, to 6 cm tall. Leaves in whorls of 3, obspathulate, plicate, base dialated enclosing the flowers, to 9 mm long. Bracteoles two, bract-like, longer than flowers. Flowers monomorphic, very shortly pedicillate, solitary in the axils of bractiform leaves. Calyx tube membranous, translucent, 1 mm long, disintegrating at ripening of fruit, lobes 4, triangular, up to 0·5 mm long, appendages absent. Petals absent. Stamens 2(–3), inserted near the base of the calyx tube, included. Ovary ellipsoidal. Style short, 0·2 mm long, persistent. Stigma capitate. Capsule ellipsoidal, 1 mm long, opening by 3 valves. Seeds 10–15, semi-ellipsoidal, 0·3 mm long.

Koehne (1903) has described a distinct variety, var. leichhardtii from Australia
characterised by “folia ... in ramis opposita anguste oblonga, basi nec dialata nec plicata...”. However, Blatter and Hallberg (1918) have reported intermediates and hold that this variety is untenable. This is supported by Cook (1978, 1979) also.

A very distinct, highly localised and short-living species in wet or moist fields, among Rotala rosea Eriocaulon cinereum, Dopatrium junceum, Lindernia spp., and Fimbristylis miliacea. An inconspicuous species, this was missed or probably over looked by Clarke (1879) and Cooke (1978, 1979), and more strange, there are no collections of this species in the Madras Herbarium.


Distribution: Western peninsular India and Australia.

Specimens examined: Goa: John Cheriyan 106604 (Goa); Karnataka: Talbot 1036, 273, 1332 (north Canara); Kerala: Sivarajan 588. K T Joseph 3909, 19792 (Calicut); Maharashtra: Billore 11920, 113293; Hemadri 102350, 107446.


An aquatic or amphibious, slender, glabrous annual, to 30 cm tall, with the flowering branch apices emerging out of water. Stem branched, creeping or floating below, simple above. Leaves decussate, ovate-elliptic to obovate, obtuse or rounded at apices, narrowed towards base, 7–10 × 3–4 mm. Bracteoles subulate, much shorter than the calyx tube. Flowers monomorphic, solitary in the axils of bractiform leaves, shortly pedicillate. Calyx tube 2 mm long, tubular-campanulate, lobes 4, triangular, appendages minute. Petals 4, 1 mm long, slightly exceeding the calyx tube. Stamens 4, inserted below the middle or the calyx tube, included. Ovary ellipsoidal. Styles very short, persistent. Stigma capitate, minutely papillose. Capsule ellipsoidal, 3 mm long, opening by 4 valves. Seeds elliptical, 0.8 mm long.

An aquatic plant growing along the shallow margins of fresh water ponds with only tips of flowering branches emerging above water surface.

A rather vulnerable species, this has already entered the 'red data book' (Nayar and Sastry, 1987). Originally described from Ritchie’s collections from Belgaum in Maharashtra, this species was not collected again until 1966, when Janardhanan (l.c.) reported it from Pune.

Flrs. and Frts.: Aug.–Nov.

Distribution: Endemic to western ghats.

Specimens examined: Maharashtra: Janardhanan 92784, 68579 (Poona).


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Amphibious or marshy annual. Stem sometimes creeping at base, simple or branched from below, 15-30 cm tall. Leaves decussate, 5-25 x 2-6 mm linear-lanceolate, base cuneate, apex obtuse. Flowers monomorphic, sessile and solitary in the axils of bractiform leaves. Bracteoles linear, shorter than calyx tube. Calyx tube campanulate, 1.5 mm long, lobes 5, triangular, 0.2 mm long, appendages 0.5 mm long, lobes 5, triangular, 0.2 mm long, appendages 0.5 mm long, subulate, alternating with calyx lobes. Petals 5, pink, obovate, dentate at apex, 0.4 mm. Stamens 5, inserted just below the middle of calyx tube, included. Ovary globose. Style short c. 0.2 mm. Stigma capitate. Capsule globose, 2 mm diam., 3-valved, exceeding the calyx. Seeds semiovoid, 0.3 mm, brownish.

Usually found in marshy or flooded fields. Not very common. It is found in associated with A. baccifera.

Blatter and Hallberg (1918) have considered this species as conspecific to R. illecebroides and R. densiflora, under the binomial R. pentandra based on Ammannia pentandra Roxb. (1820). On the other hand, Van Leeuwen (1971) has asserted that, R. rosea and R. densiflora are clearly distinct and can easily be recognised by their bracteoles and relative length of calyx appendages. From R. illecebroides it differs in its leaves, the presence of petals and capsules exceeding the calyx. The correct name for this taxon is Rotala rosea, based on Poiret's binomial Ammannia rosea (1810).


Distribution: India, southeast Asia to New Guinea, Philippines, south China, Korea and Japan.

Specimens examined: Andhra Pradesh: Yesoda 1182 (Anantapur), Subba Rao 46967 (Chittoor); Goa: Kanodia 89395, R S Rao 84566, Cherian 10612, Singh 125063; Karnataka: Anslead M 116 (Nandi Doorg); Kerala: K T Joseph 48635, 38661 (Calicut), 38909 (Parakadavu), 65367 (Parur), ? 63980 (Tellicherry), Ramamurthy 47653 (Guruvayoor). Maharashtra: Bilage 116725, 115304, Kulkarni 108663. Tamil Nadu: Subramaniam 7539 (Yercaud), Barber 99, 135 (Madras), ? 13960 (Salem) ? Sn 21711 (Padakottu), Ramamurty 51135 (south Arcot).


Ammannia rotundifolia Buch.-Ham. ex Roxb., Fl. Ind. ed. 1. 1 446, 1820; D, Don,

*Ameletia rotundifolia* (Roxb.) Dalz. and Gibs., Bombay Fl. 96, 1861, non Wt., 1840 (figure 13).

Aquatic or amphibious, heterophyllous annuals or perennials branched from base. Stem woody at base, creeping and rooting below. Branches decumbent. Leaves all decussate, submerged leaves linear, oblong or oblanceolate, obtuse, membraneous, to 10 x 3 mm, serial leaves to 15 x 10 mm, obovate- orbicular, obtuse or rounded at apex, cuneate below, sessile or shortly petioled, green or reddish. Flowers in terminal, simple or branched, bracteate spikes, monomorphic. Bracts closely imbricate, ovate-acute, to 20 x 15 mm, green or pinkish. Bracteoles linear, almost equalling the calyx tube. Calyx tube campanulate, 1.5 mm long, lobes 4, acute or shortly acuminate, short, light pink, appendages absent. Petals 4, pink, obovate or sub-orbicular, to 1.2 mm across, narrowed below. Stamens 4, inserted at the base of calyx tube, 1.5 mm long, never exserted from the calyx. Ovary globose, 1 mm. Stigma peltate or discoid. Capsule sub-globose, 1.5 mm across, 4-valved. Seeds 15–20, semi-ellipsoidal, 0.5 mm.

Common in marshes, swamps and shallow ponds and pools at higher altitudes. Many of the earlier authors have treated *R. rotundifolia* and *R. macrandra* as conspecific. Clarke (1879) observed that “in this species... the flowers are dimorphic. One kind has the stamens included and the style very long-exserted, the other kind has the stamens long exserted, and the style short. These are doubtless reciprocally fertile”. Blatter and Hallberg (1918) also considered the length of stamens as an unreliable taxonomic character for their separation. Our observations however, reveal that these two differ in their habitat preferences (*R. macrandra* is a low-land species and *R. rotundifolia* is usually seen at higher altitudes) and in several characters besides the length of stamens, i.e. in the relative length of bracteole, extent of calyx lobing and the nature of the submerged leaves. This corroborate the concept of the species held by Koehne (1903) and Cook (1978, 1979).

Flrs. and Frts. Sept.–March.

**Distribution:** South and southeast Asia from India to Japan.

**Specimens examined:** Andhra Pradesh: Subba Rao, 22578, 19698, 47315 (Visakapatnam), Rajasekhar Mudaliar Sn. 96292 (Araker Valley); Karnataka: Cleghorn Sn. 21768 (Bangalore), ? 12013 (south Kanara), Raghavan 74344, 86025, 69491, 79634; Puri 31966 (Mysore), Jain 16317, Talbot Sn. 4718 (north Canara); Kerala: K T Joseph 30246, 30245 (Wynad), Ramesh 20541 (Calicut), Ayishabi 8433 (Vythiri), Ellis 18588 (Chedaleth), 17122, 29550 (Cannanore), Ramachandran 59050 (Pazhasi), 61315 (Cannanore) 66819 (Kannoth), V J Nair 59741 (Mattannur), Barber 5623 (south Wynad), Ansari 64287 (Nilesvar), Narayana 6295 (Malabar); Maharashtra: Kulkarni 118975, 121788, 121511 (Ratnagiri); Orissa: Barber 1223 (Tickapalli); Tamil Nadu: Gammie 115 (Ooty), Gamble 16643 (Nilgiri), Barber 259 (Ooty), Wight Sn. 21743 (Nilgiri).


Ameletia tenuis Wight, Fl. Pl. Ind. Or. 1 13, t. 2578, 1840.


Aquatic or amphibious herbs, to 20 cm tall. Stem branched from base, creeping and rooting below, erect or ascending above. Leaves decussate in distant pairs, submerged leaves linear, to 40 mm long, aerial leaves sessile, broadly ovate or orbicular, acute or obtuse, to 15 × 4 mm. Flowers in simple or branched, bracteate, terminal spikes, monomorphic, sessile or sub sessile. Bracts oblong, smaller than foliage leaves, green or tinged with red, to 4 mm long. Bracteoles linear, to 1.5 mm long, never exceeding the calyx tube. Calyx tube to 3 mm long, urceolate, slightly constricted above the middle, lobes 4, triangular-acute, c. 0.05 mm long, appendages absent. Petals obovate, obtuse or retuse, longer than calyx lobes, pink. Stamens 4, inserted at about the middle of the calyx tube, included. Ovary ellipsoid. Style short. Stigma capitate. Capsule 2-valved, ellipsoid, included in the persistent calyx. Seeds semi-ellipsoid, to 0.7 mm long, brownish yellow.

Grows in seasonally inundated areas and flowers as the water recedes. The erect stems are often dense and cushion-forming.

Flrs. and Frts. Throughout the year, but abundant in Oct.–Feb.

Distribution: Central and northwest India and Pakistan.

Specimen examined: Gujarat: R S Rao 892025 (Damen), 89162, Ansari 127097, 122137, 126868 (Nagar Haveli), 61056, 61057 (Sasangir), Jain 38588 (Dangswaghai), Wadhwa 60802, 60809 (Dangs), Puri 50919 (Vadgamba); Maharashtra: Narasimhan 165370, 165340 (Nasik), Subramaniam 64788 (Pashaw), Billeore 113033 (Thana), Ansari 101993, Pataskar 110269 (Patnpur), 105167 (Dhulia), Puri 12433, R S Rao 77822, Janardhanan 76396.

3.15 Rotala vasudevanii Joseph et Sivarajan, Sp. nov.

Hydrolythrum Wallichii sensu Vasudevan Nair, J. Bombay Nat. Hist. Soc. 61 718, 1965, non Hook. f. 1867, non Rotala Wallichii (Hook. f.) Koehne, 1880 (figure 3).

Rotala wallichii simillima, receditfolis monomorphis, ad partes submersas emersasque nonis ad duodenis verticillatis; bracteolis ultra dimidium tubi calycis longis; staminibus inclusis, connectivis apiculatis; et squamis nectariferis imperfecte bilobis. A Rotala cookii recedit foliis monomorphis, bracteolis majoribus, et floribus cleistogamis carentibus.


Rotala vasudevanii is closely similar to R. wallichii (Hook. f.) Koehne but differs in its monomorphic leaves arranged in whorls of 9–12 in both submerged and emergent parts, bracteoles more than half as long as the calyx tube, included stamens with apiculate connectives, and imperfectly bilobed nectar scales. From R.
In *R. cookii* it differs in its monomorphic leaves, larger bracteoles and in the absence of cleistogamous flowers.

Aquatic annual, submerged with only the flowering branch apices emerging out of the water. Stem up to 50 cm long, sparsely branched with 8–9 shallow longitudinal furrows. Leaves in whorls of 9–12, monomorphic, to 10 × 1 mm, sessile, linear acute, base narrowed, glabrous. Bracts leaf-like, c. 0.5 mm long; bracteoles 2, transparent, more than half as long as the calyx tube. Flowers towards branch tips, c. 1.5 mm long, monomorphic, sessile in the axils of bracts. Calyx tube campanulate, lobes 4, 0.4 mm long, triangular-acute, appendages absent. Petals 4, obovate pink, alternating with calyx lobes. Stamens 4, inserted below the middle of calyx tube, filaments slender, white, anther pink. Nectar scales 4, small, fleshy, shortly bilobed. Ovary globose. Style simple, short, persistent. Stigma capitate, minutely papillose. Capsule subglobose, more than 1 mm across, opening by 2 valves. Seeds 3–4, ellipsoidal with concave ventral side, smooth.

Vasudevan Nair collected this material from a fresh water pond in Alwaye, Kerala state in south India, where it was growing associated with *Hydrilla verticillata*, *Rotala rotundifolia*, *Nymphaea* sp. and *Myriophyllum tuberculatum*, and wrongly identified it as *R. wallichii*, reported only from Bengal in India. We have examined the Wallichian material (Cat. no. 9059, microfiche) and have found that this specimen is different. However, our efforts to recollect this material from its type locality have been of no avail since most of these marsh lands have already been reclaimed.

Specimens examined: Kerala: Vasudevan Nair 3997 (Alwaye)

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*Ammannia rotala* Clarke in Hook f., Fl. Brit. India 2 567, 1879; Cooke, Fl. Pres. Bombay 1 507, 1903, non F V Muller, 1862 (figure 1).

Aquatic or amphibious herbs. Stem terete below, angular above, creeping and rooting below, erect above, to 15 cm tall. Leaves in whorls of 4–10 occasionally decussate below, to 10 × 1 mm, linear, acute or minutely bifid at apex, submerged leaves capillary, thin. Bracts leaf-like. Bracteoles 2, 0.8 mm long. Flowers monomorphic, solitary. Calyx tube 3 mm long, membranous, subulate, constricted at mouth, lobes 3, 0.5 mm long, appendages absent. Petals 3, obovate-obtuse, as long as calyx lobes, pink. Stamens 3, inserted at about the middle of the calyx tube, included, Ovary ellipsoidal, 1.5 mm. Style short. Stigma capitate. Capsule ellipsoidal, 3-valved. Seeds ovoid, 0.25 mm long, black.

First recorded by Rheede (Hort. Malab. 9. t. 81, 1678–1703), this species has been known to occur in wet or marshy low lands in south India. Cook (1979) has recorded that the most recent collection from south India that he could see was of 1915, and that ‘it has become very rare or even extinct’. However, we could find collections as recent as 1978 in the Madras Herbarium. Matthew (1983) also recently
**Rotala Linn. (Lythraceae) in peninsular India**

collected it and reported that it is locally abundant in the marshy margins of ponds in Tamil Nadu Carnatic.

**Distribution:** Southeast India, Sri Lanka.

**Specimens examined:** Andhra Pradesh: ? 10006 (Chandragiri), Tamil Nadu: Ramamurtty 25912 (Tiruchirapalli), 53744 (Pudukkottai), Subramanian 3508 (Madurai), Henry 47092 (Chengalpet), ? Sn. 21681 (Madras ? Sn. 21682 (Fairly Park) ? 11512 (Chengalpet), Balakrishnan 262 (Vandallur).

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**References**

Bentham G and Hooker J D 1867 Lythraceae; *Genera Plantarum* 1 773–785
Cook C D K 1979 A revision of the genus *Rotala* (Lythraceae); *Boissiera* 29 1–156
Janardhanan K P 1979 Rediscovery of *Rotala ritchei* (C B Cl.) Koehne (Lythraceae) after one hundred years; *Bull. Bot. Surv. India* 21 230–231
Joseph K T and Sivarajan V V 1988 *Rotala cookii*: A new species of Lythraceae from India showing Hippuris syndrome; *Plant Syst. Evol.* 159 141–144
Linnaeus C 1753 *Species plantarum* (Berlin: Impensis G C Nauk)
Matthew K M 1983 *Flora of Tamil Nadu Carnatic* (Tiruchirapalli: The Rapinat Herbarium)
Panigrahi G and Nicolson D H 1988 Indication of the nomenclatural type (Art. 37.1); *Taxon* 32 120–122
Van Leeuwen B L J 1971 A preliminary revision of the genus *Rotala* (Lythraceae) in Malesia; *Blumea* 19 53–56