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THREE NEW RECORDS OF LYTHRACEAE IN THE FLORA OF BANGLADESH

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Abstract

In the course of studying the family Lythraceae of Bangladesh in 2023–2024, some specimens of the family were found to be different than those of any other species of this family reported so far from this country. After a critical examination, these specimens have been identified as *Ammannia auriculata*, *Rotala ramosior*, and *Rotala malampuzhensis* of the Lythraceae. These species are new to the flora of Bangladesh. A detailed taxonomic description, including data on ecology, distribution, and use, a list of representative specimens examined, and illustrations have been provided for each species.

Introduction

Almost every year, Bangladesh's plant taxonomists sporadically describe newly recorded species. In the last several decades, they have published a significant number of new records as a part of their persistent efforts to discover new plant species from this country. Since the publication of Ahmed *et al.* (2008–2009, 2009) and Siddiqui *et al.* (2007), about 288 new records pertaining to the angiosperms of this country have been made available (e.g., Rahman and Hassan, 2017; Islam and Rahman, 2017; Sourav *et al.*, 2017; Ara and Hassan, 2018; Rahman and Uddin, 2018; Uddin, 2018; Alfasane *et al.*, 2019; Hossain *et al.*, 2020; Sultana and Rahman, 2021; Hossain *et al.*, 2022; Rahman *et al.*, 2022; Sultana *et al.*, 2022; Uddin and Uddin, 2022; Hossain *et al.*, 2023; Rahman *et al.*, 2023). The majority of these new records contain information on the precise locality of the species.

With the addition of these new records to the 3611 Angiosperm species described in the Encyclopedia of Flora and Fauna of Bangladesh EFFB), edited by Ahmed *et al.* (2008–2009, 2009) and Siddiqui *et al.* (2007), the total number of species of this plant group reported from Bangladeshi territory has now risen to 3899 (Hossain *et al.* 2023; Rahman *et al.* 2023). It means the status of at least 1101 (20.16%) species of Angiosperms in this country is unknown and needs to be explored for adding new data and obtaining a better idea of this country's flora, if Khan's (1977) estimation of 5000 species' occurrence in Bangladesh and all new records for this country reported so far after the publication of EFFB are considered. Besides, the introduction of exotic species is a global event driven by both economic and non-economic factors. Some new species might have been introduced recently into this country, either deliberately or inadvertently, and need to be verified and reported. Therefore, the small pool of plant taxonomists in this country is devoting a great deal of effort to find and publish the details of these unreported and newly introduced species.

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The family Lythraceae comprises small to large trees, shrubs, perennials, and annual herbs adapted to a wide variety of vegetation types, including mangrove swamps, coastal dunes, freshwater marshes, and shallow waters of ponds and rivers in Bangladesh. Hooker (1886) described 19 species under four genera, and Prain (1903) described 14 species under three genera; Khanam (2009) and Rahman (2009) compiled 24 species from six genera from the political boundary of Bangladesh. Heinig (1925) reported 14 species under four genera from the Chittagong region. Recently, in 2023–2024, Rani (2023) conducted a taxonomic study on the Lythraceae of Bangladesh based on the voucher specimens housed in the herbaria of this country and described a total of 27 species under six genera.

Recently, in 2023–2024, a taxonomic study on the Lythraceae of Bangladesh was conducted based on the voucher specimens housed in the Bangladesh Forest Research Institute Herbarium (BFRIH), the Bangladesh National Herbarium (DACB), the Dhaka University Salar Khan Herbarium (DUSH), the Herbarium of Chittagong University (HCU), and the Jahangirnagar University Herbarium (JUH). Some of these specimens collected from Dinajpur, Moulvibazar, Rajshahi, and Sylhet districts, housed at DACB, were identified as members of Lythraceae, which did not match the specimens or the taxonomic description or key characters of any species of this family that had been previously recognised or documented in Bangladesh. After a rigorous examination, a few of these specimens were identified as the representatives of a species of *Ammannia* L. and a few as the members of two species of *Rotala* L. of the Lythraceae that were never reported previously from this country (e.g., Hooker, 1886; Prain, 1903; Heinig, 1925; Uddin *et al.*, 2003; Khanam, 2009; Rahman, 2009; Tutul *et al*., 2010; Uddin *et al*., 2013; Rahman *et al*., 2015; Rahman, 2017; Uddin and Hassan, 2018; Roy and Khan, 2020; Khanam *et al*., 2020; Khan *et al*., 2021a,b; Hossain *et al*., 2022; Shetu *et al*., 2022). As a result, these species are circumscribed here as new to Bangladesh's flora. The specimens are currently deposited at DACB.

Materials and Methods

This study was based on the voucher specimens housed at DACB. The taxonomic identification of the specimens was verified by comparing their characteristics with the clear images of Lythraceae voucher specimens available on the websites of a few international herbaria (e.g., K, P) and pertinent taxonomic literature (e.g., Hooker, 1886; Prain, 1903; Cook, 1996; De Wild *et al*., 2014). With close observation and critical examination of the morphological characteristics of the typical specimens, the taxonomy description of each species was created. The nomenclatural information was confirmed through consulting the nomenclatural databases (GBIF Secretariat, 2023a,b,c,d; POWO, 2024; Tropicos, 2024; WFO, 2024).

Results and Discussion

The taxonomic identification of the unnamed specimens of Lythraceae collected from different areas of Bangladesh has been confirmed as *Ammannia auriculata* Willdenow, *Rotala malampuzhensis* R. Vasudevan Nair *ex* C.D.K. Cook, and *Rotala ramosior* (L.) Koehne. The following taxonomic descriptions of these species, including a key for the identification of two *Rotala* species, have been produced based on the specimens.

Ammannia auriculata Willd. (Hort. Berol. [Willd.]), 1: 7, pl. 7 (1803). —TYPE: Egypt: Aegypt prope Rosette, *Anonymous* s.n., LT, designated by Graham, J. Arnold Arbor. 66: 403 (1985). C.D.K. Cook, Aqua. and Wetl. Pl. of Ind., 248 (1996); W.J.J.O. De Wild *et al*., 2014, Fl. of Thailand 11: 549–550 (2014). **(Fig.1)**

English name: Eared redstem (GBIF Secretraiat 2023a).

An erect annual herb. Stem erect, decumbent, 4-angled, glabrous, unbranched to branched. Leaves opposite, lanceolate, 15–30 mm × 0.8–12 mm, mostly longer than the internode, marginally entire, adaxially and abaxially glabrous, eglandular, apically acute, basally cordate or auriculate, mid-vein one, reaches upto apex, adaxially raised, abaxially plane, lateral veins not clear, leaves two per node. Inflorescence cymes, laxly flowered, 14–16 inflorescence from the middle of the branches, 8–10 flower per inflorescence, peduncles 1.8–4.5 mm long, Flowers 1.2–2 × 1.2–1.8 mm, pedicels of the central flowers 1–2 mm long, bracts 2, opposite, appressed, linear to oblong, 1–1.2 mm, apically acute, basally cuneate, marginally entire, bracteoles 2, opposite, appressed, linear, c. 0.5 mm long, apically acute, basally cuneate, marginally entire.Calyx campanulate, 1.2–1.5 mm long, 8–ribbed, sepals 4–lobed, glabrous, petals 4, 1.8–2 × 0.6–0.8 mm, apex round, base cuneate, margin entire. Stamens 4. Styles 1–1.5 mm long, as long as ovary, ovary 1–1.5 × 0.6–0.7 mm broad. Fruit a capsule with persistent erect calyx, 1.5–1.8 mm long. Seeds discoid, ca. 17 per fruit, 0.2–0.3 mm long, ca, 0.2 mm broad, deep brown colour. Flowering and fruiting period: August-December.

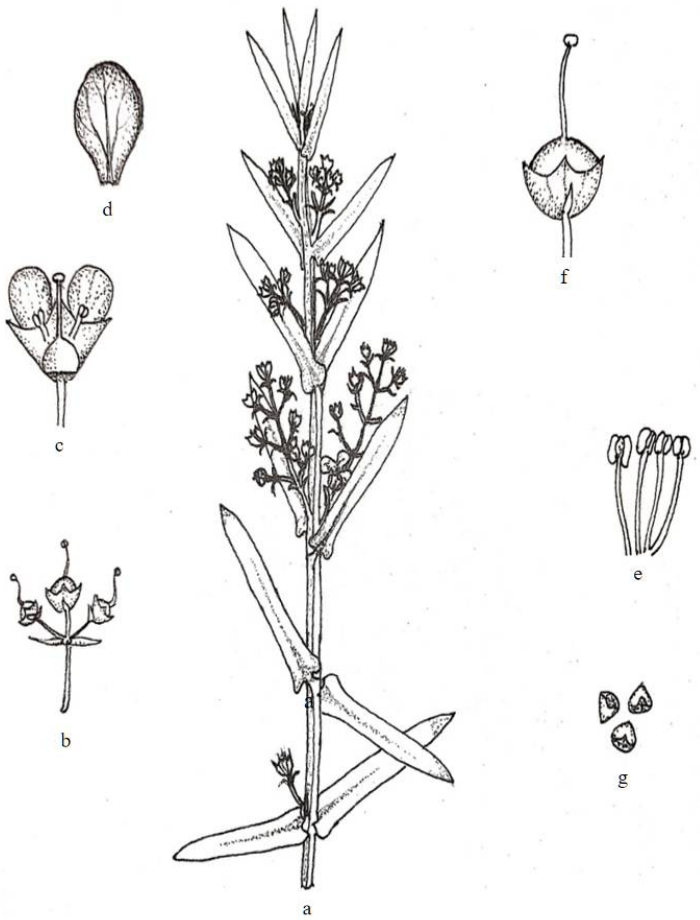

Fig. 1. *Ammannia auriculata* Willd. a. A branch (× 5 cm), b. Three immature fruits (× 6 cm), c. L.S. of a flower (× 1.3 cm), d. A petal (× 1.1 cm), e. Four stamens (× 1.4 cm), f. An imature fruit with calyx and style (× 0.5 cm), g. Three seeds (× 1.6 cm).

Ecology: In wet places, marshes, river banks and rice fields (Cook, 1996).

Specimens examined: **Dinajpur:** Dinajpur, 11 viii 1977, *Shahera Begum*, 14934 (DACB); **Rajshahi:** South side of Amalihala, 12 x 1977, *Md. Nazrul Islam* 73 (DACB 14933).

Distribution: The species is native to East, West, West-Central, and South Tropical Africa, temperate and tropical Asia, Northern America, and Southern America. It is introduced to Japan, Nansei-Shoto, Kirgizistan, the Northern Territory, Queensland, Western Australia, Southeastern Europe, Sardegna, and Hawaii (POWO, 2024; WFO, 2024).

Use: Use as a counter irritant for rheumatic pains (Cook, 1996).

Notes: *Ammannia senegalensis* var. *auriculata* (Willd.) Hiern is a homotypic synonym. *A. auriculata* var. *auriculata* and *A. auriculata* var. *bojeriana* Koehne-are the two accepted varieties of this species (POWO, 2024). Morphologically, *A. auriculata* seems similar to *A. multiflora* Roxb. However, it can be distinguished by its laxly flowered 14–16 inflorescences from the middle of the branches, 8–10 flowers per inflorescence, erect calyx in fruit, ca.1.8–2 mm long petals, styles almost as long as ovary or longer, and capsules of 1.5–1.8 (–2) mm in diameter, in contrast to *A. multiflora*'s densely flowered, many inflorescences along the length of the branches, more than 10 flowers per inflorescence, reflexed fruiting calyx, up to 1 mm long petals, styles ca. 1/2 as long as ovary, and capsules, ca. 1.5 mm in diameter.

Rotala malampuzhensis R.V. Nair *ex* C.D.K. Cook, Boissiera 29: 98 (1979). —TYPE: H868/68, HT (K), PT (Department of Botany, University of Calcata). C.D.K. Cook, Aqua. and Wetl. Pl. of Ind., 248 (1996). **(Figs 2 & 3)**

An aquatic, cespitose, annual herb, 5.3–7 cm long. Stem 4-angled, erect, branched, glabrous. Leaves opposite, decussate, 2- leaves per node, elliptic-oblong, 8–12 × 1–2 mm, apex acute, base attenuate, entire, adaxially and abaxially glabrous, eglandular, mid-vein one, reached upto apex, lateral vein not clearly seen, vein adaxially raised. Bracts leaf-like, apically acute, basically cuneate, adaxially and abaxially glabrous, bracteoles 2, erect, adppressed, apex acute, base attenuate, glabrous, shorter than the calyx. Flowers sessile, monomorphic, 2–2.5 × 1–1.5 mm, 2-flowers per node. Calyx campanulate, ca. 2.5 mm long, 4-merous. Sepals 4, crimson red, triangular, ca. 0.2 mm long, glabrous, apex acute, base cuneate, sepal appendages longer than the sepal lobes. Petals 4, triangular, c. 0.5 mm long. Stamens 4 to 5, filaments ca. 2 mm long, originated from the base of the calyx, anther 0.2 mm long. Ovary 1 × 1 mm. Style 0.1 mm long. Stigma capitate. Fruit a capsule, crimson red, ca. 1 mm long, opening by 3-valves, surface semi-transparent and raised. Seeds 0.3–0.6 mm long, straw-coloured or crimson red. Flowering and fruiting period: October-January.

Ecology: Moist or wet soil, usually in rice field, temporary pools, beside streams and in wet pockets in rocks (Cook, 1996).

Specimens examined: **Moulvibazar:** Kulaura, Tilagaon, Lalpur, Lalpur chabagan, 22 i 2023, *Najmul, Delwar, Liton, Riajul, Tanvir and Shakil*, MOUL. 00746 (DACB).

Distribution: Native to Assam, India (POWO, 2024; WFO, 2024).

Notes: *R. malampuzhensis* was published in J. Bombay Nat. Hist. Soc. 72(1): 57 (1975) without Type, in J. Bombay Nat. Hist. Soc. 73(1): 248 (1976) without the date of Latin description, and in Ex C.D.K. Cook, Boissiera 29: 98 (1979), with Type. In GBIF Secretariat (2023b), *R. malampuzhensis* R.V.Nair is cited as an accepted species, and instead *R. malampuzhensis* R.V.Nair *ex* C.D.K. Cook is cited as a doubtful species (GBIF Secretariat (2023c), which is not supported by other nomenclatural databases (POWO, 2024; Tropicos, 2024; WFO, 2024). Morphologically, *R. malampuzhensis* seems alike to *R. rosea* (Poir.) C.D.K. Cook, but it differs by its cespitose habit, semi-transparent and capsule's raised wall corresponding to the

firmly attached seeds, crimson red sepals, capsules, and seeds, in contrast to *R. rosea*'s, non-transparent, even capsule surface, pinkish red sepals, capsules, and seeds. In *R. malampuzhensis*, the filament originated from the base of the calyx, whereas in *R. rosea*, the filament originated from the middle of the calyx.

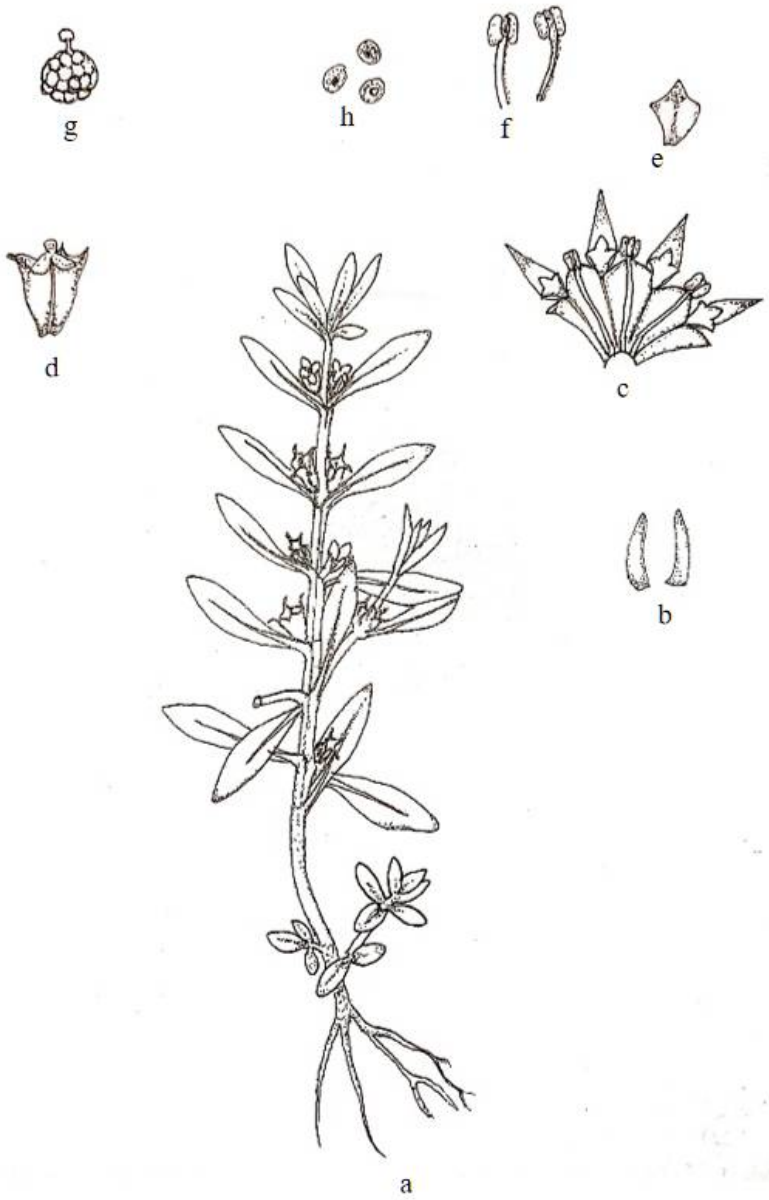

Fig. 2. *Rotala malampuzhensis* R.V.Nair *ex* C.D.K. Cook. a. Habit (× 2.1 cm), b. Two bracteoles (× 1.5 cm), c. An opened flower excluding carpel (× 1.3 cm), d. A flower (× 1.5 cm), e. A petal (× 1.6 cm), f. Two stamens (× 9 cm), g. An ovary (× 1.3 cm), h. Three seeds (× 1.6 cm).

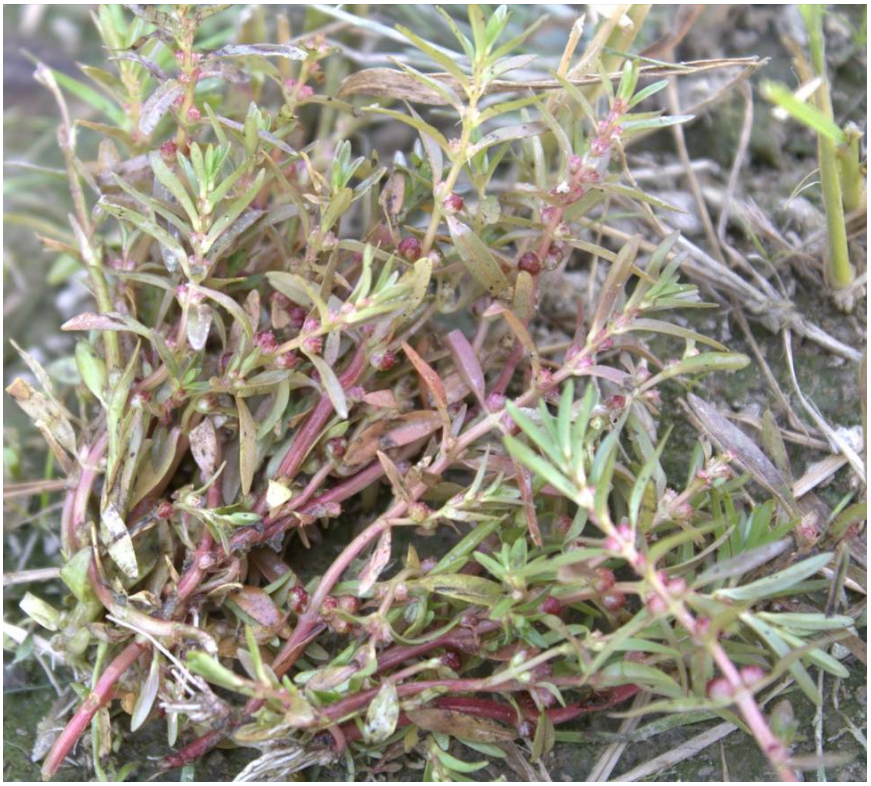

Fig. 3. Habit of *Rotala malampuzhensis* R.V. Nair *ex* C.D.K. Cook.

Rotala ramosior (L.) Koehne, C.F.P. von Martius and auct. suc. (eds.), Fl. Bras. 13(2): 194 (1877). *Ammannia catholica* Hook. and Arn. *ex* Seem. (1856), *A. humilis* Michx. (1803), *A. monoflora* Blanco (1837), *A. occidentalis* (Spreng.) DC. (1828), *A. ramosa* Hill (1767), *Rotala dentifera* (A.Gray) Koehne (1880), *Boykinia humilis* Raf. *ex* S.Watson (1878). **(Fig. 4)**

English name: Lowland rotala (GBIF Secretraiat 2023d).

An annual, amphibious or terrestrial herb. Stem 4-angled, not distinctly winged, much branched, 1–1.5 cm long, glabrous. Leaves opposite, decussate, oblong to narrowly oblanceolate, 5–6 × 0.5–0.8 mm, apically acute, basally attenuate, marginally entire, adaxially and abaxially glabrous, eglandular, mid-vein one, reached upto apex, lateral veins 5–8 pairs. Inflorescence axile, one per leaf axis. Bracts two, less than half of the length of floral tube, apically obtuse, basally attenuate, entire, opposite, erect, adppressed, adaxially and abaxially glabrous. Flowers small, 4-merous, globose, reddish, sessile or shortly pedicellate, 1.3–1.8 mm long, symmetrical, 2-flowers per node. Epicalyx 4, deltate, c. 1 × c. 0.5 mm, calyx campanulate, 0.3–0.5mm long, adaxially and abaxially glabrous, sepals 4, shorter than epicalyx, apically obtuse, basally cuneate. Petals absent or 4, obovate, 3.3 mm long, entire, apically obtuse, basally cuneate. Stamens 4. Fruit a capsule, pinkish red, surface non-transparent and even, 1.8–2 mm in diameter, opening by 3-valves. Seeds ovoid, c. 0.2 × c. 0.1 mm, brown color. Flowering and fruiting in July–October.

Ecology: On plain land, agricultural field, moist soil.

Specimens examined: Sylhet: Chattak, 5 i 1978, *Huq and Rahman H. 3653* (DACB).

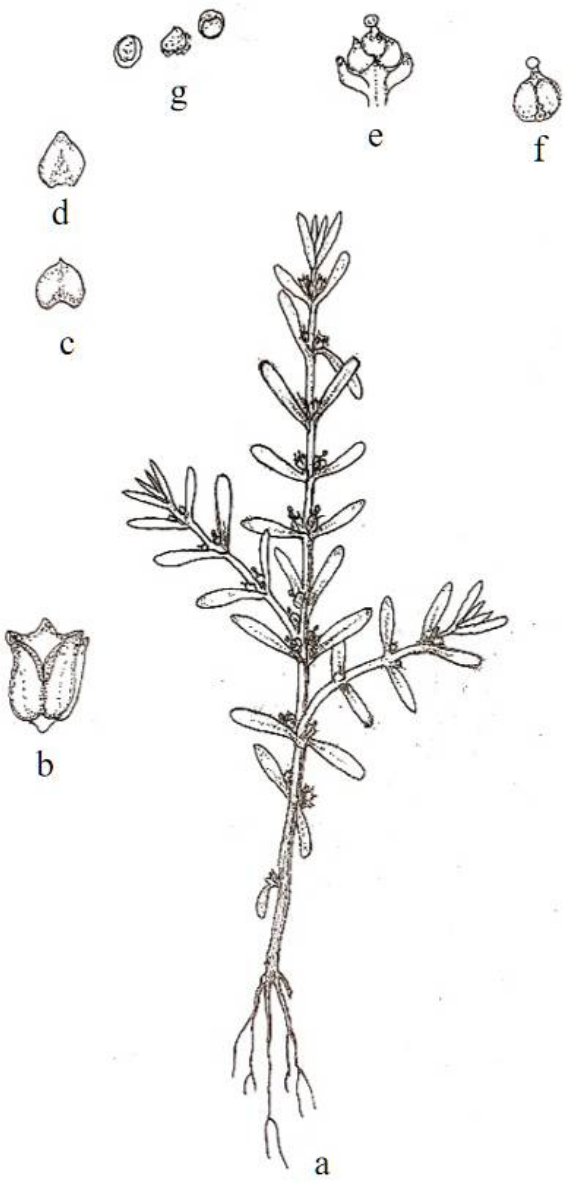

Fig. 4. *Rotala ramosior* (L.) Koehne, a. Habit (× 10 cm), b. A flower (× 1.1 cm), c. A sepal (× 18 cm), d. A petal (× 0.3 cm), e. A mature fruit (× 1 cm), f. An ovary (× 1.6 cm), g. Three seeds (× 2.5 cm).

Distribution: This species is native to Argentina, Bolivia, Colombia, Costa Rica, Cuba, Guatemala, Haiti, Honduras, Jamaica, Mexico, the Netherlands, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Trinidad-Tobago, the USA, and Venezuela. It is introduced to Greece, Italy, the Philippines, Taiwan (POWO, 2024; WFO, 2024).

Use: Use as aquarium plant.

Notes: *Ammannia ramosior* L. and *Rotala ramosior* var. *typica* Fernald and Griscom ~~(1935)~~ are homotypic synonyms (POWO, 2024). *R. ramosior* seems similar to *R. simpliciuscula* (Kurz) Koehne, but it differs from *R. simpliciuscula* by its oblanceolate leaves, sessile flower, and 4 sepals, petals, and stamens, each in contrast to *R. simpliciuscula*'s oblong leaves, 3 sepals, pedicellate, apetalous flower, and 1–2 stamens.

Key to the two newly recorded *Rotala* species:

1 Leaves 8–12 mm long, capsule surface semi-transparent and raised, seed straw colour ..... *R. malampuzhensis*

- Leaves 3–5 mm long, capsule surface non-transparent and even, seed brown colour ..... *R. ramosior*

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