

The Genus *Ludwigia* (Onagraceae) in India

I.C. Barua

Department of Agronomy, Assam Agricultural University, Jorhat – 785 013, Assam, India.

E-mail: iswar_barua@yahoo.co.in

Abstract

The genus *Ludwigia* L. consists of seven species and one infraspecific taxon in India, of which *L. decurrens* forms the first report for India. This revision provides a key to species, descriptions and illustrations along with data on phenology, distribution and notes on ecology.

Keywords: India, *Ludwigia*, Taxonomy

Introduction

Ludwigia L. and *Jussiaea* L. have been treated as distinct genera in several Indian Floras (Clarke, 1879; Cooke, 1901; Gamble, 1919; Fischer, 1935). Baillon (1877) has merged three Linnaean genera namely, *Ludwigia*, *Jussiaea* and *Isnardia*, that were published simultaneously and chose the name *Ludwigia* for the combined genus. Hara (1953) has clearly pointed out that the choice of Bailon should be upheld instead of *Jussiaea*, the name chosen by Brennan (1953) for the combined *Ludwigia* and *Jussiaea*.

Ludwigia is a cosmopolitan genus, represented by c. 82 species (Mabberley, 2005), mostly concentrated in Tropical American region. There are seven species and one infraspecific taxon in India. A key to species, descriptions and illustrations along with data on phenology, distribution and ecology are provided for all Indian species in this paper.

Ludwigia L., Sp. Pl. 1: 118. 1753 & Gen. Pl.: 55. 1754 (=“*Ludvigia*”, “*Ludwighia*”); Clarke in Hooker, Fl. Brit. India 2: 588. 1879; Raven in Reinwardtia 6: 330. 1963. - Lectotype: *L. alternifolia* L.

Isnardia L., Sp. Pl. 1: 120. 1753 & Gen. Pl.: 56. 1754. - Type: *I. palustris* L.

Jussiaea L., Sp. Pl. 1: 388. 1753 & Gen. Pl.: 183. 1754; Clarke in Hooker, Fl. Brit. India 2: 587. 1879. - Lectotype: *J. repens* L.

Cubospermum Lour., Fl. Cochinch. 1: 275. 1790. - Type: *C. palustre* Lour.

Prieurea DC., Prodr. 3: 58. 1828. - Type: *P. senegalensis* DC.

Corynostigma C. Presl, Spim. Bot.: 218. 1850. - Type: *C. sussiaeoides* C. Presl.

Nematopyxis Miq., Fl. Ind. Bat. 1(1): 600. 1855. - Type: *N. prostrata* (Roxb.) Miq.

Ludwigiantha (Torr. & A. Gray) Small in Bull. Torrey Bot. Club 24: 178. 1897. - Type: *L. arcuata* Walt.

Herbs or shrubs. Leaves simple, alternate or opposite; stipule absent or reduced. Flowers axillary, solitary or in inflorescence, bisexual, actinomorphic, 4- or 5-merous. Calyx adnate to ovary; lobes valvate, persistent. Petals 4 or 5, distinct, contorted, caducous. Stamens equal to or twice as many as sepals; anthers 2-loculed. Ovary inferior; ovules on axile placenta; style slender. Capsules irregularly dehiscent; seeds exalbuminous, with more or less prominent raphe, sometimes embedded in powdery or woody endocarp.

Key to the species

1. Plants prostrate; adventitious roots present; leaves rounded or subacute at apex; flowers 5-merous; petals white **L. adscendens**
1. Plants erect or semi-erect; adventitious roots absent; leaves acute or acuminate at apex; flowers 4-(rarely 5)-merous; petals yellow.....2
2. Stems and leaves pubescent to villous3
2. Stems and leaves glabrous or puberulous 4
3. Capsules terete; raphe nearly equal to seed
.....**L. octovalvis**
3. Capsules 4-angled; raphe much smaller than seed **L. peruviana**

4. Stems woody below; stamens 8; ovary glabrous 5
 4. Stems herbaceous throughout; stamens 4; ovary puberulous or pubescent..... 6
 5. Flowers 1.5 – 2 cm across; capsules 4-angular **L. decurrens**
 5. Flowers under 1 cm across; capsules terete **L. linifolia**
 6. Stems winged, well-branched; capsules 4-angular; seeds uniseriate **L. prostrata**
 6. Stems not winged, scarcely branched; capsules terete; seeds pluriseriate..... **L. perennis**

Ludwigia adscendens (L.) H. Hara in J. Jap. Bot. 28: 290. 1953 & Fl. E. Himal. 1: 224. 1966; Raven in Reinwardtia 6: 387. 1963; Paul in Bull. Bot. Surv. India 40: 17. 1998. *Jussiaea adscendens* L., Mant. Pl. 1: 69. 1767. *J. repens* L., Sp. Pl.: 388. 1753; Clarke in Hooker, Fl. Brit. India 2: 588. 1879. **Fig. 1**

Aquatic or semi-aquatic, floating or semi-erect, well-branched herbs with adventitious roots, c. 15 cm high; stems terete, glabrous or villous. Leaves oblong-elliptic, 2.2–4.8 × 1–2.3 cm, narrowly cuneate at base, entire at margin, rounded or broadly acute at apex, subcoriaceous, glabrous, glossy above, often slightly glaucous below; lateral nerves 6–13 pairs. Flowers in upper leaf axils, c. 3 cm across, showy, 5-merous; pedicels terete, c. 2.15 cm long; bracteoles 2, minute. Sepals 5, deltoid-acuminate to oblong-lanceolate, c. 6.5 × 2.2 mm, glabrate above, pilose with long-silky hairs beneath, 3-nerved. Petals 5, oblong-obovate to broadly elliptic, c. 12 × 9 mm, shortly clawed, emarginate or rounded at apex, white with yellow base. Stamens 10, 2-whorled, white; filaments of outer stamen opposite petals (petaliferous), c. 2.25 mm long; filaments of inner stamens c. 2.88 mm long; anthers 0.7–1 mm long, yellowish or cream-coloured. Disc slightly elevated, villous; nectary V-shaped, depressed, with adpressed white hairs, surrounding the base of each petaliferous stamen. Ovary terete, c. 1.13 × 0.13 cm, as narrow as pedicel, villous or glabrous, 5-loculed; ovules 2 per locule; style c. 4.3 mm long with lax hairs, white; stigma subglobose, c. 1.5 mm across, obscurely 5-partite, green or yellow. Capsules terete, c. 1.68 × 0.18 cm, thick-walled, glabrous or villous, with 10 darker brown ribs, very late and irregularly dehiscent; seeds uniseriate in each locule of the capsule, ellipsoid to oblong-ellipsoid, c. 0.44 × 0.15 × 0.18 mm, cream to pale brown, with a distinct papillae and narrow linear raphe that often widen at one end; raphe c. 0.38 × 0.03 mm.

Flowering & Fruiting: Almost throughout the year.

Distribution: India (almost throughout), Sri Lanka to SE Asia, China and Australia.

Specimens examined: INDIA, Assam, Bongaigaon district, N. Salmara, 15.12.1991, Barua 1892 (ASSAM); Cachar district, Silchar, 7.8.1903, A.T. Gage s.n.; Dhemaji district, Siman Bank, 17.7.1992, Barua 2170; Nagaon district, Kholahat, 1.9.1964, Balakrishnan 39584 (CAL); Nagaon, 30.12.2000, Barua 3311; NC Hills district, Haflong, 21.1.2004, Barua 4051; N. Lakhimpur district, Subansiri Bank, 12.1.2005, Barua 4108 (AAU Weed Herbarium).

Notes: A common herb in ditches, ponds, rice fields and other marshy places; floats on water by means of white-cellular floats formed in whorls at the nodes of prostrate stem. The plant is villous with white hairs while grown on dry ground.

Ludwigia decurrens Walt., Fl. Caroin: 89. 1788; Raven in Reinwardtia 6: 347. 1963. *Jussiaea decurrens* (Walt.) DC., Prodr. 3: 56. 1828; Munz in Darwiniana 4: 198. 1942; Brenan in Hutchinson & Dalziel, Fl. W. Trop. Africa ed. 2, 1: 169. 1954. **Fig. 2**

Annual, erect herbs, 150–200 cm high, glabrescent; stems 4-winged. Leaves subsessile, lanceolate to narrowly elliptic, 3.8–11.5 × 1–2 cm, narrowly cuneate at base, entire at margin, acute or sub-acuminate at apex, membranous; lateral nerves 11–17 pairs; petioles c. 2.6 mm long. Flowers c. 1.75 cm across, showy, 4-merous; bracteoles 2, minute; pedicels quadrangular, 0.6–1.1 mm long. Sepals 4, ovate-lanceolate or ovate-acuminate, 6–9 × 0.25–0.32 cm, minutely crenulate and purple at margin, glabrous or glabrate, 5-nerved. Petals obovate-elliptic, 0.90–1.22 × 0.4–0.7 cm, abruptly acute at apex, yellow, 1-nerved. Stamens 8 (4 + 4), petaliferous ones slightly shorter; filaments c. 2.42 mm long, white; anthers c. 1 mm long, pale yellow to cream-coloured. Disc not elevated; nectary sunken, C-shaped, white-hairy, surrounding the base of each epipetalous stamen. Ovary c. 7 mm long, 4-angled (angles winged), 4-loculed; ovules 3 per locule; style thick, c. 2 mm long; stigma globose, c. 1.5 mm. Capsules 1–1.7 × 0.3–0.4 cm, sharply 4-angled or narrowly winged (wings crenulate), puberulent when young but turning glabrous after maturity, greenish to purplish brown, irregularly loculicidal; seeds pluriseriate in each locule, free, globose to ellipsoid, c. 0.52 × 0.23 × 0.15 mm, brown, with a blackish emergent papillae and a narrow linear raphe; raphe c. 0.45 × 0.06 mm.

Flowering & Fruiting: July–November.

Distribution: India (Assam and West Bengal), Africa, Japan, Argentina to Northeastern United States. Native of New World (Raven, 1963).

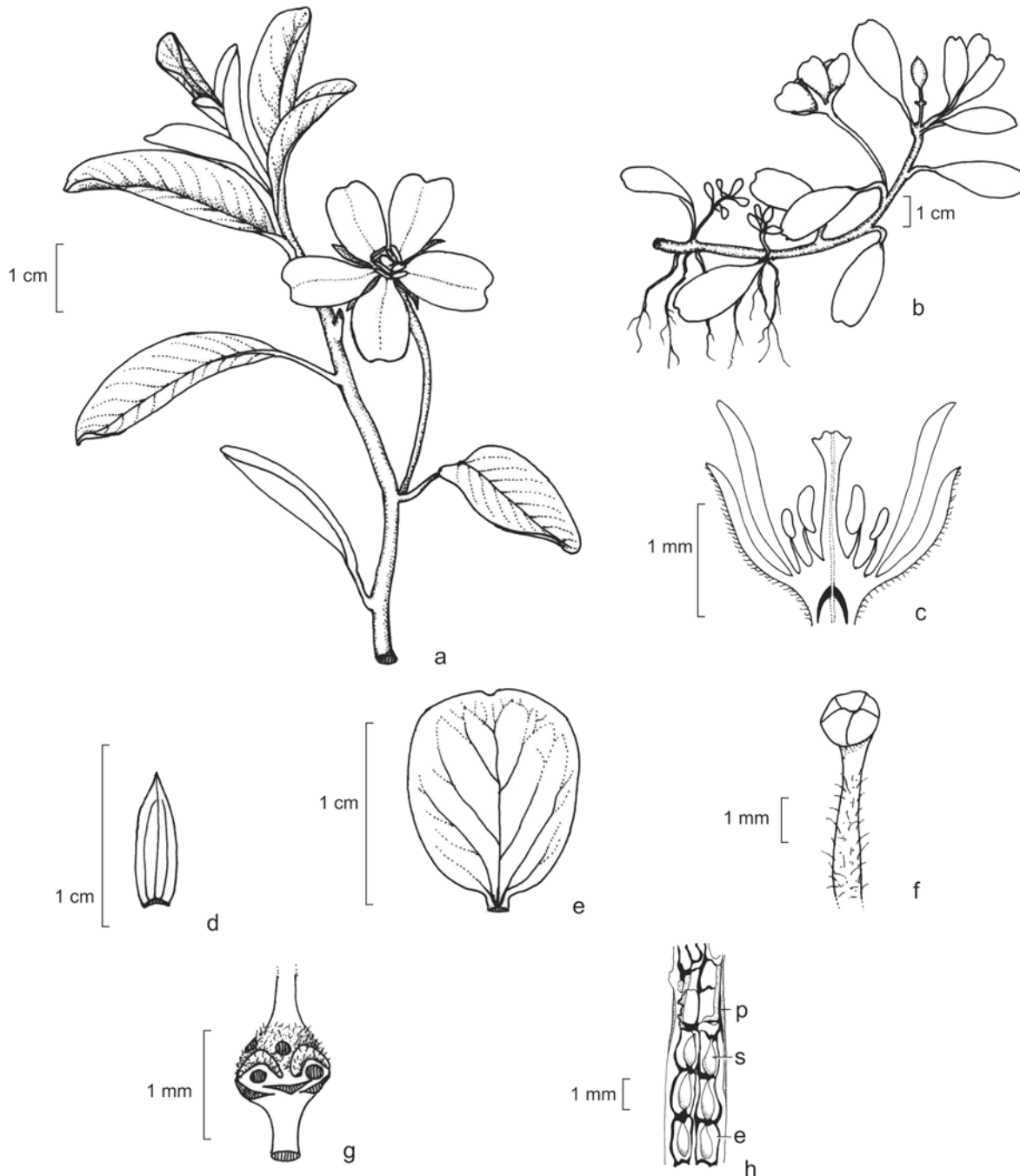


Fig. 1. *Ludwigia adscendens* (L.) H. Hara: a, b. Habit; c. L.S. of flower; d. Sepal; e. Petal; f. Style with stigma; g. Disc; h. L.S. of a portion of capsule showing the embedded seeds [p - pericarp; e - endocarp; s - seed].

Specimens examined: INDIA, Assam, Jorhat district, AAU Campus, 19.10.1994, Barua 2330 (CAL); Darrangichuk, 23.9.2005, Barua 2337 (ASSAM). West Bengal, Nalhati to Bahrapur, 12.11.2001, Barua 3319 (ASSAM).

Note: This is a new record for India. It grows in typical paddy growing wet situations.

Ludwigia linifolia (Vahl) R.S. Rao, Fl. Goa, Diu, Daman & Nagarhaveli 1: 179. 1985; Paul in Bull. Bot. Surv. India 40: 17. 1998. *Jussiaea linifolia* Vahl, Eclog. Amer. 2: 32. 1798, non Poir. 1813. *J. hyssopifolia* G. Don, Gen. Syst. 2: 693. 1832. *J. fissendocarpa* Haines in J. Asiat. Soc. Bengal 15: 314. 1919. *Ludwigia hyssopifolia* (G. Don) Exell in Garcia de orta 5: 471. 1957; Raven in Reinwardtia 6: 385. 1963; Hara,

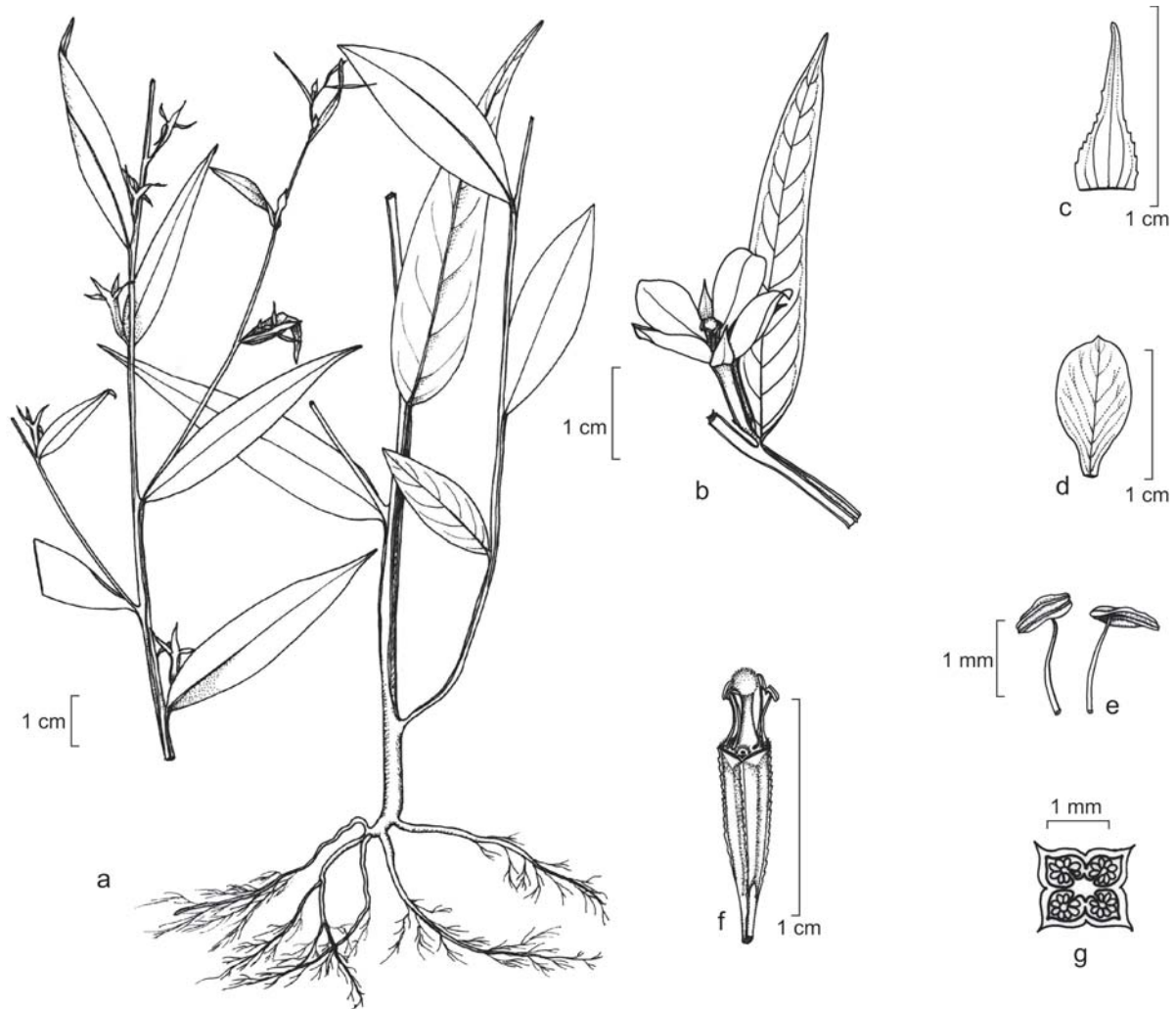


Fig. 2. *Ludwigia decurrens* Walt.: a. Habit; b. Flower with leaf; c. Sepal; d. Petal; e. Stamens; f. Gynoecium with stamens; g. T.S. of ovary.

Fl. E. Himal. 1: 224. 1966. *Fissendocarpa linifolia* (Vahl) Bennet in J. Bombay Nat. Hist. Soc. 67: 126. 1970.

Fig. 3

Annual undershrubs, up to 2.5 m high, well-branched; stem semiwoody, quadrangular, narrowly winged, cylindrical and woody below. Leaves narrowly oblong, lanceolate or sometimes ovate-elliptic, $1.6-8.4 \times 1-2.8$ cm, cuneate at base, acute or subacuminate at apex, glabrate with short-adpressed hairs; lateral nerves 11-17 pairs; petiole c. 2 cm long. Flowers in almost all leaf-axils, c. 5 mm across, 4-merous; pedicels c. 2 mm long; bracteoles 2, short, usually at base of the upper enlarged portion of the ovary. Sepals 4, lanceolate, c. 4×1 mm, glabrous or finely pubescent, 3-nerved. Petals 4, elliptic-ovate, c. 4×2 mm, 1-nerved, yellow to orange yellow, with often light-coloured nerves. Stamens 8, 2-whorled; outer 4 opposite petals,

slightly shorter; filaments 0.4-1.5 mm long, white; anthers c. 0.5 mm long, pale yellow. Disc not or slightly elevated, glabrous; nectary reniform, with long-white hairs, between the petaliferous stamens and style, encircles the stamen at base. Ovary quadrangular, 7-1 mm long, glabrous, 4-loculed; ovules 2 per locule in upper region and solitary in lower region of the ovary; style c. 1.5 mm long, glabrous, pale greenish yellow; stigma depressed-globose, c. 1 mm across, obscurely 4-lobed. Capsules straight, subterete, c. 2×0.2 cm, thin-walled, finely pubescent, brownish, irregularly loculicidal; upper portion enlarged with biseriate naked seeds; lower portion with uniseriate seeds finely coated with endocarpous tissues; seeds ellipsoid, c. $0.66 \times 0.39 \times 0.28$ mm, light brown, with a slightly distinct papillae, smooth integument and a deep brown raphe of narrow ridge shape and c. 0.5×0.05 mm size; seeds coated with

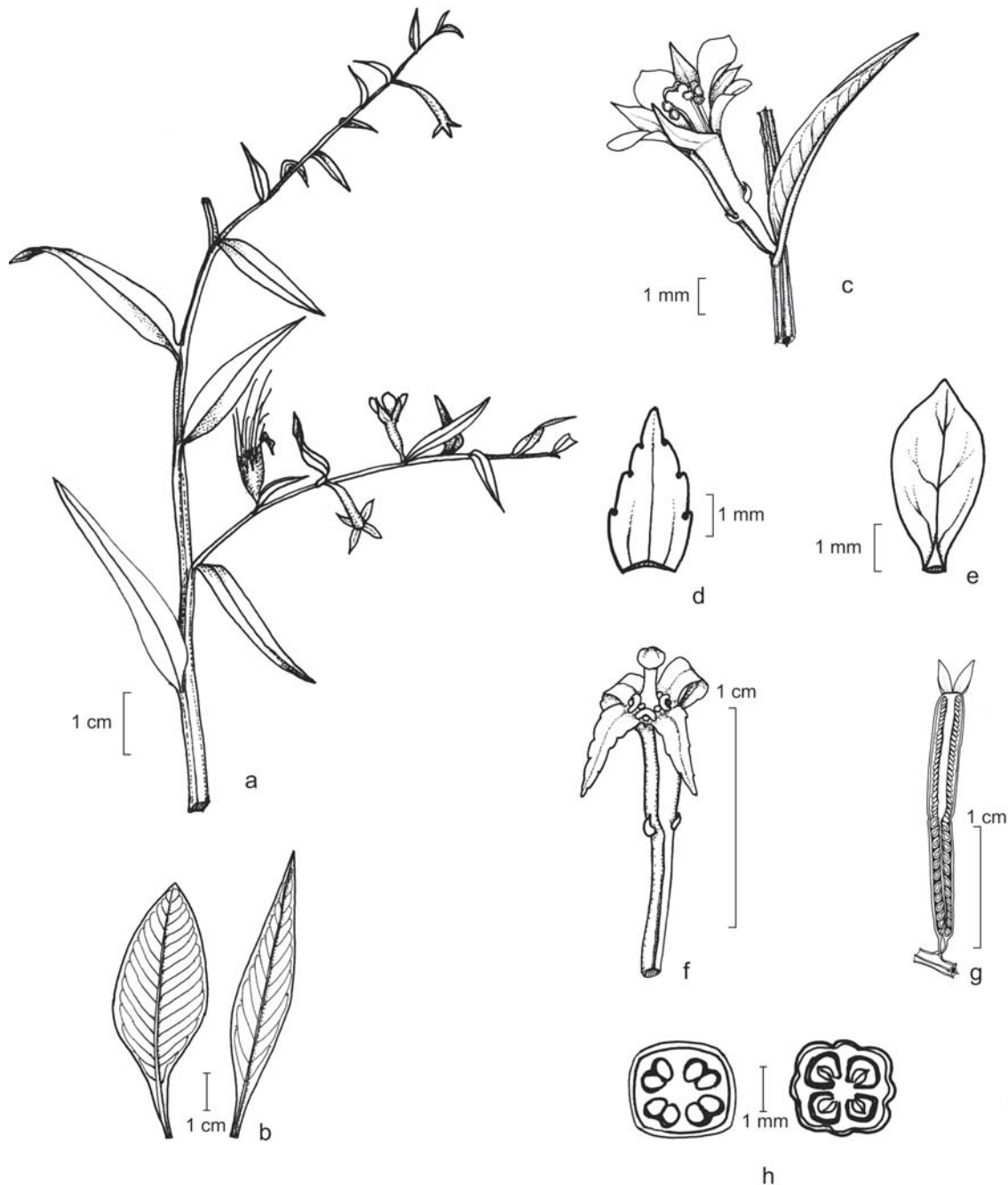


Fig. 3. *Ludwigia linifolia* (Vahl) R.S. Rao: a. A twig with flowers and fruits; b. Leaves; c. A flower from axil of a leaf; d. Sepal; e. Petal; f. Gynoecium with sepals and bracteoles; g. L.S. of ovary; h. T.S. of ovary.

endocarpous tissues, angular-trapezoid, 0.84 ± 0.09 mm, 0.58 ± 0.06 mm and 0.30 ± 0.08 mm in length, breadth and width respectively, rough, brown.

Flowering & Fruiting: June – November.

Distribution: India (wet places and rice growing areas of the country up to foothill areas of

Arunachal Pradesh), Sri Lanka to throughout SE Asia, N. Australia, Pacific Islands, Tropical America and W. Africa.

Specimens examined: INDIA, **Assam**, Jorhat district, AAU Campus, 15.10.1993, Barua 2310; Kamrup district, Garbhanga, 16.11.1985, Barua 496 (ASSAM). **Rajasthan**, without precise locality, September 1960, Nair 962 (BSD). **Uttar Pradesh**, Banda, 19.11.1957,

Rao 3837 (BSD). West Bengal, Cochbehar, 27.12.1991, Barua 1898; Purulia, 4.3.1997, Paul 558 (CAL).

Ludwigia octovalvis (Jacq.) Raven in Kew Bull. 15: 476. 1962 & Reinwardtia 6: 356. 1963; Hara, Fl. E. Himal. 1: 224. 1966; Paul in Bull. Bot. Surv. India 40: 18. 1998. *Oenothera octovalvis* Jacq., Enum. Syst. Pl.: 19. 1760. *Jussiaea suffruticosa* L., Sp. Pl.: 388. 1753; Clarke in Hooker, Fl. Brit. India 2: 587. 1879. *J. octovalvis* (Jacq.) Sw., Obs. Bot.: 142. 1791.

Undershrubs, erect, up to 2.5 m high, well-branched. Leaves lanceolate to subovate, 5–6 × 1.0–1.5 cm, more or less cuneate at base, acute at apex, subcoriaceous; lateral nerves 13–17 pairs; petioles 3–5 mm long. Flowers large and showy, 4-merous,

yellow; bracteole absent, or reduced to solitary gland. Sepals ovate-lanceolate, crenate, green with pinkish margins, 3-nerved. Petals broadly ovate or cuneate, emarginate. Stamens 8, almost equal; filaments white; anthers pale yellow. Disc slightly elevated, with C-shaped nectary between the petaliferous stamens and style; nectary sunken, reddish inside, with long white hairs, encircles the stamen at base. Ovary 1.5–1.8 cm long, 4-loculed; ovules 3 per locule; style thick, c. 1.5 mm long; stigma globose, c. 1.5 mm, obscurely 4-lobed. Capsules straight or gently bent, thin-walled, with 8 darker ribs, brownish, irregularly loculicidal; seeds pluri-seriate in each locule of the capsule, free, globose to ellipsoid, deep brown, with a blackish emergent

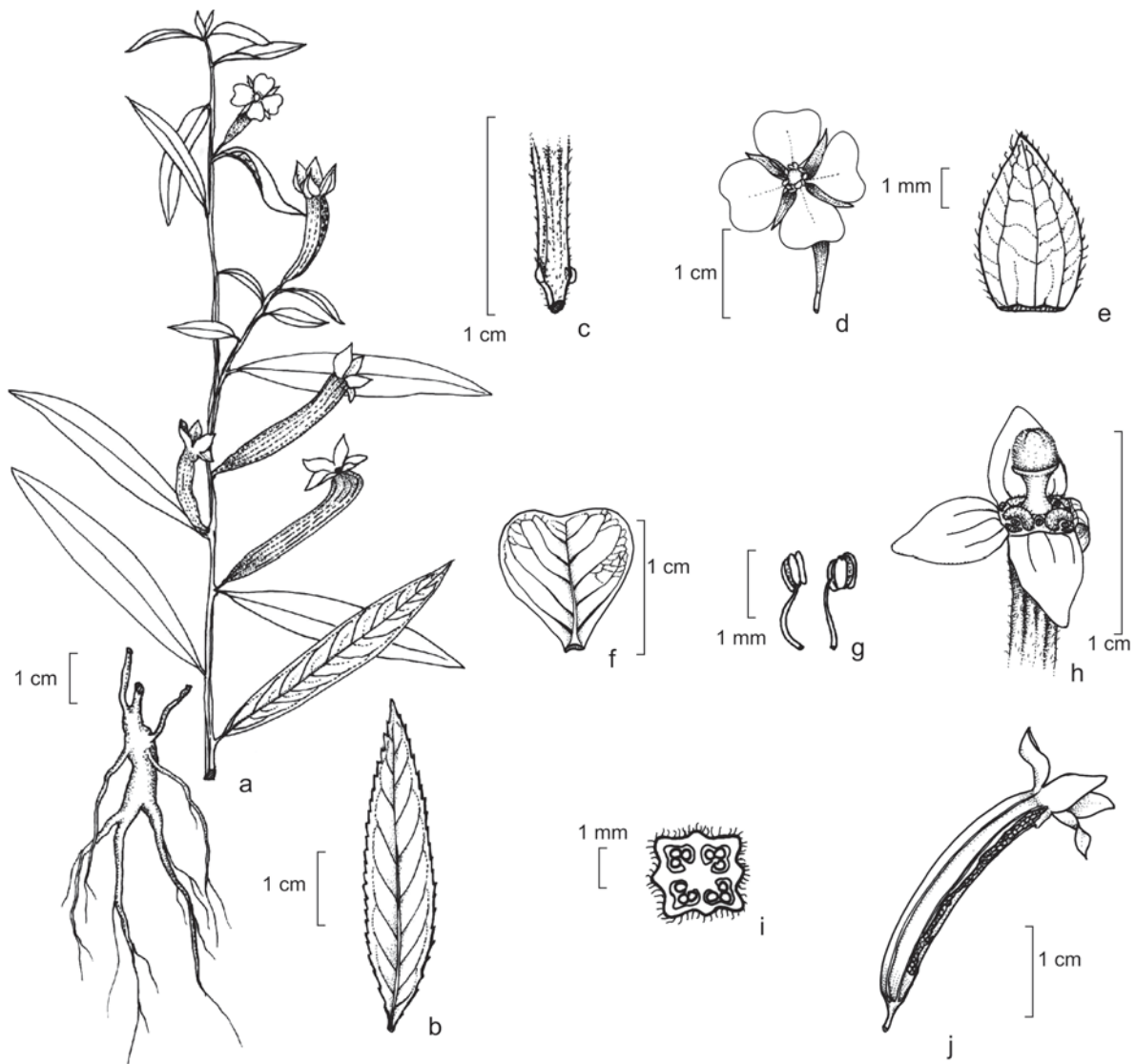


Fig. 4. *Ludwigia octovalvis* (Jacq.) Raven subsp. *octovalvis*: a. A twig with flowers and fruits, and root; b. Leaf; c. Bracteole; d. Flower; e. Sepal; f. Petal; g. Stamens; h. Gynoecium with sepals; i. T.S. of ovary; j. Capsule.

papillae and a thick inflated and transversely ridged large raphe.

Key to the subspecies

1. Stems and leaves with adpressed trichomes; leaves usually subovate.....subsp. **octovalvis**

1. Stems and leaves with long erect trichomes; leaves narrowly ovate to linear.....subsp. **sessiliflora**

Ludwigia octovalvis (Jacq.) Raven in Reinwardtia 6: 357. 1963, subsp. **octovalvis**: Raven in Reinwardtia 6: 357. 1963; Paul in Bull. Bot. Surv. India 40: 18. 1998. *Jussiaea pubescens* L., Sp. Pl. 2, 1: 555. 1762. **Fig. 4**

Flowers 1.5 – 2.1 cm across; pedicels *c.* 4 mm long. Sepals *c.* 7 × 3.2 mm. Petals *c.* 9.5 × 7.3 mm. Filaments 2 – 2.5 mm long; anthers *c.* 1 mm long. Capsules *c.* 2.8 × 0.4 cm; seeds *c.* 0.63 × 0.54 × 0.28 mm; raphe *c.* 0.51 × 0.24 mm.

Flowering & Fruiting: August – February.

Distribution: India (marsh places in plains and low hills), Australia, Bangladesh, China, Japan, Malaysia, Pacific Islands, SE Africa, Taiwan and Tropical America.

Specimens examined: INDIA, **Assam**, Bongaigaon district, Borpara, 15.12.1986, *Barua* 1889 (AAU Weed Herbarium); Dhubri district, Dhubri, 27.12.1991, *Barua* 1899 (AAU Weed Herbarium); Jorhat district, Jorhat, 18.10.1994, *Barua* 2327; Kamrup district, Manas Wildlife Sanctuary, Bansbari, 23.11.1986, *Barua* 1149 (ASSAM). **Chhattishgarh**, Bilaspur district, Khondra, 23.10.1970, *Panigrahi* 12755 (CAL). **Karnataka**, Kannarehalla, 23.4.1962, *Rao* 80259 (CAL). **Kerala**, Travancore, 27.2.1894, *Bourdillon* 99 (CAL).

Ludwigia octovalvis (Jacq.) Raven subsp. **sessiliflora** (Mich.) Raven in Kew Bull. 15: 476. 1962 & Reinwardtia 6: 362. 1963; Paul in Bull. Bot. Surv. India. 40: 18. 1998. *Jussiaea octonervia* forma *sessiliflora* Mich. in Mar., Fl. Bras. 13(2): 171. 1875.

Flowers 2 – 2.3 cm across; pedicels 4 – 5 mm long. Sepals *c.* 7.8 × 4.3 mm. Petals *c.* 10.8 × 9.3 mm. Filaments 2.3 – 2.8 mm long; anthers *c.* 1 mm long. Capsules 3 – 3.5 × *c.* 0.4 cm; seeds *c.* 0.52 × 0.33 × 0.29 mm; raphe *c.* 0.56 × 0.26 mm.

Flowering & Fruiting: June – February.

Distribution: India, Africa, Australia, Bangladesh, China, Japan, Malaysia, Pacific Islands, Sri Lanka, Tropical America and Madagascar.

Specimens examined: INDIA, **Assam**, Dhemaji district, Dhemaji, 8.9.1998, *Barua* 2296 (ASSAM); Jorhat district, Jorhat, 30.12.2004, *Barua* 4066 (AAU Weed

Herbarium); Kamrup district, Hahim, 24.6.1964, *Rao* 39073 (CAL); Chandubi, 19.4.1986, *Barua* 712; Manas Wildlife Sanctuary, Pohubil, 26.11.1986, *Barua* 1338 (ASSAM); Karbi Anglong district, Koliyoni, 11.2.2002, *Barua* 3330; Fangsu village, 11.2.2002, *Barua* 3333 (AAU Weed Herbarium); NC Hills district, Haflong, 22.12.1953, *Godfrey* 607 (CAL).

Note: Both the subspecies thrive in damp and marshy places in plains and low hills.

Ludwigia perennis L., Sp. Pl. 1: 119. 1753, excl. verba falsa “foliis opposites”; Raven in Reinwardtia 6: 367. 1963; Hara, Fl. E. Himal. 1: 225. 1966; Paul in Bull. Bot. Surv. India 40: 19. 1998. *L. parviflora* Roxb., [Hort. Bengal.: 11. 1814] Fl. Ind. ed. Carey 1: 440. 1820; Clarke in Hooker, Fl. Brit. India 2: 588. 1879. *Jussiaea perennis* (L.) Brenan in Kew Bull. 8: 163. 1953. **Fig. 5**

Annual, erect herbs, 50 – 75 cm high, puberulent with lax short-hairs turning glabrous when matured; stems cylindrical, often hollow. Leaves very narrowly elliptic to lanceolate, 3.2 – 4.8 × 0.5 – 0.9 cm, narrowly cuneate at base, minutely crenate at margin, (broadly) acute at apex, membranous, glabrous above, laxly puberulent with short-adpressed hairs beneath; lateral nerves 6 – 12 pairs; petioles *c.* 7 mm long. Flowers *c.* 6 mm across, 4-merous; pedicels *c.* 2 mm long; bracteole absent. Sepals 4 (rarely 5), deltoid to ovate-lanceolate, *c.* 4 × 1.5 mm, entire at margin, glabrous, 3-nerved. Petals elliptic, *c.* 3 × 2 mm, rounded at apex, yellow, 1-nerved. Stamens 4 (as many as sepals), opposite sepals, pale yellow to cream-coloured; filaments *c.* 1 mm long; anthers *c.* 0.5 mm long. Disc slightly elevated, glabrous (rarely puberulent); nectary elliptic, opposite petals, alternating stamens. Ovary 4.5 – 6.6 mm long, 4-ridged, puberulent with white-adpressed hairs, 4-loculed; ovules 3 per locule; style thick, *c.* 1 mm long; stigma globose, *c.* 1.5 mm. Capsules terete, 5 – 11 × 2 – 3 mm, thin-walled, with 4 longitudinal ribs, puberulent when young but turning glabrous after maturity, greenish to purplish brown, irregularly loculicidal; seeds pluriseriate in each locule, free, globose to ellipsoid, *c.* 0.33 × 0.21 × 0.18 mm, with a blackish emergent nipple, brown; raphe linear, *c.* 0.20 × 0.03 mm.

Flowering & Fruiting: June – March.

Distribution: India (throughout), Afghanistan, Africa, Japan, New Caledonia, Sri Lanka, Tropical Asia to subtropical China and Tropical Australia.

Specimens examined: INDIA, **Assam**, Jorhat district, Kakoi R.F., 23.11.1957, *Panigrahi* 11554; Jorhat,

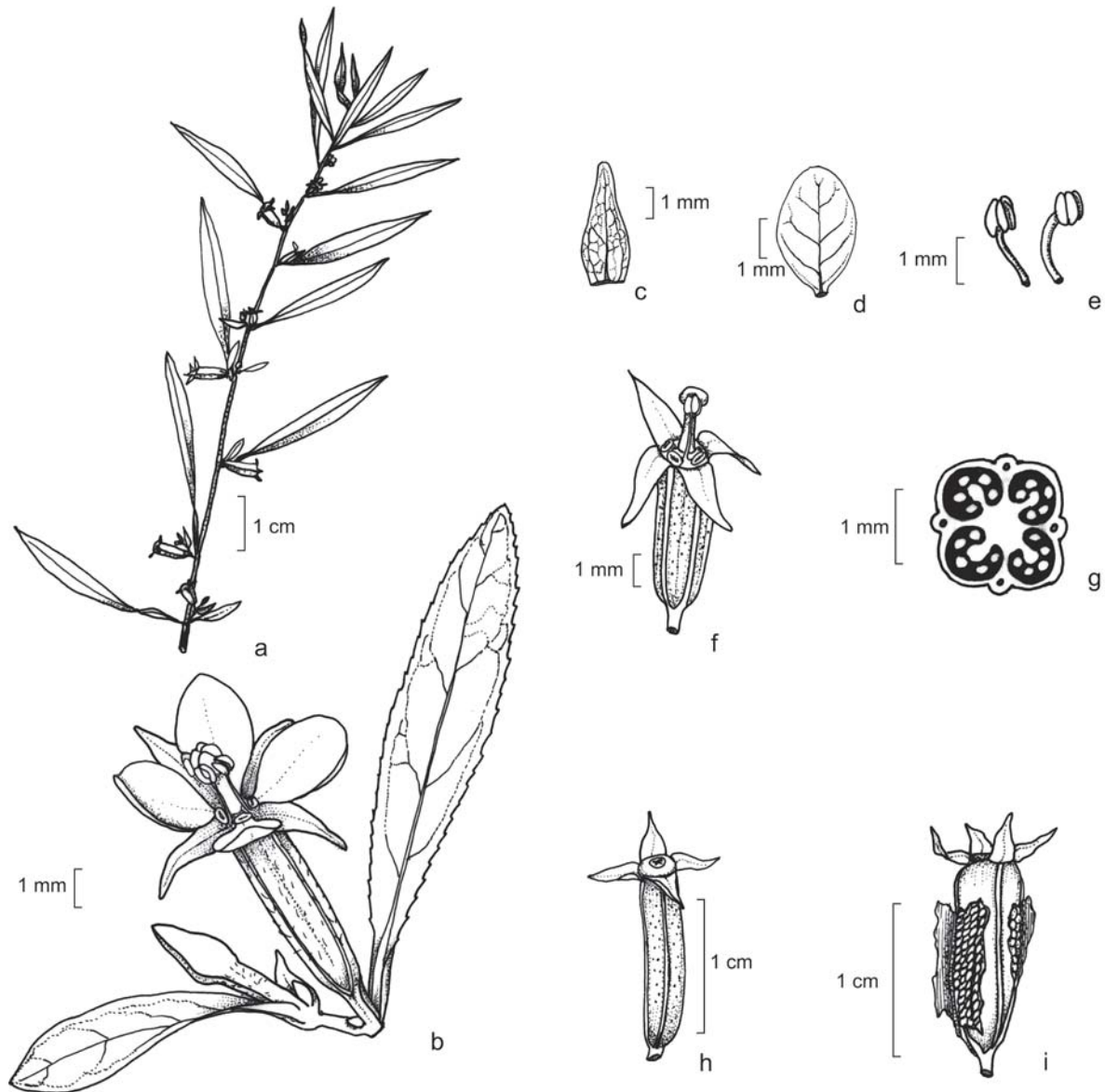


Fig. 5. *Ludwigia perennis* L.: a. A twig with flowers and fruits; b. Leaf and flower; c. Sepal; d. Petal; e. Stamens; f. Gynoecium with sepals; g. T.S. of ovary; h, i. Capsule.

19.10.1994, Barua 2331 (CAL); Titabar, 5.8.1995, Barua 2335; Charigaon, 18.11.2004, Barua 4103 (ASSAM); Karimganj district, Potlagaon, 26.6.1992, Barua 2078 (AAU Weed Herbarium). **Haryana**, Karnal, s. die, Nair 24629 (BSD). **Punjab**, Mukerian, 16.9.1979, Daniel 67491 (BSD). **Tamil Nadu**, Periaranganar Kuppam, 4.2.1931, Narayanswami 5069; Pichvaram R.F., 5.3.1970, Subramanian 3964 (DD). **Uttar Pradesh**, Kumaon, 18.9.1957, Rao 4095 (BSD).

Note: It prefers to grow in partially shaded and marshy places and as a weed in rice fields.

Ludwigia peruviana (L.) H. Hara in J. Jap. Bot. 28: 293. 1953; Raven in Reinwardtia 6: 345. 1963;

Paul in Bull. Bot. Surv. India 40: 19. 1998. *Jussiaea peruviana* L., Sp. Pl. 1: 388. 1753. *J. speciosa* Ridley in J. Bot. (Lond.) 59: 259. 1921; Fischer in Gamble, Fl. Madras 3: 1298. 1957 (repr. ed.). **Fig. 6**

Shrubs, 2 – 3 m high, villous throughout; stem cylindrical, hollow. Leaves lanceolate or ovate-lanceolate, 5 – 10 × 1.6 – 3.1 cm, cuneate at base, entire at margin, acute or subacuminate at apex, coriaceous; lateral nerves 12 – 22 on either side of midrib; petioles 7 – 10 mm long. Flowers on upper leaf axils, c. 5 cm across, showy; pedicels quadrangular, c. 1.4 cm long, villous; bracteoles 2, subulate, as long as or slightly longer than the ovary. Sepals 4(or 5), lanceolate to ovate-lanceolate, or

deltoid-acuminate, $1.5 - 2.2 \times 0.5 - 1$ cm, irregularly serrulate at margin, fleshy, villous outside, glabrous inside, 9-nerved. Petals suborbicular, $1.5 - 2.4 \times 1.6 - 2.6$ cm, shortly clawed, slightly emarginate, yellow with brownish nerves. Stamens 8 or 10, subequal, yellow; filaments $1.5 - 3$ mm long; anthers $1.8 - 3.2$ mm long, apparently basifixed by reduction, somewhat extrorse. Disc much elevated; nectary depressed, U- or C-shaped, densely white-hairy, surrounding the base of each petaliferous

stamen. Ovary quadrangular, $9 - 11$ mm long, pubescent, 4-loculed; ovules 3 per locule; style $c. 1$ mm long, thick; stigma elongated-hemispherical to ellipsoid, longer than style, $c. 3$ mm across. Capsules sharply quadrangular, $1.2 - 3 \times 0.6 - 1$ cm, thin-walled, with 4 prominent deep brown ribs, villous, irregularly loculicidal; seeds pluri-seriate, free, ellipsoid, $c. 0.79 \times 0.40 \times 0.39$ mm, with a prominent nipple and transversely striped integument, brown; raphe $c. 0.74 \times 0.16$ mm.

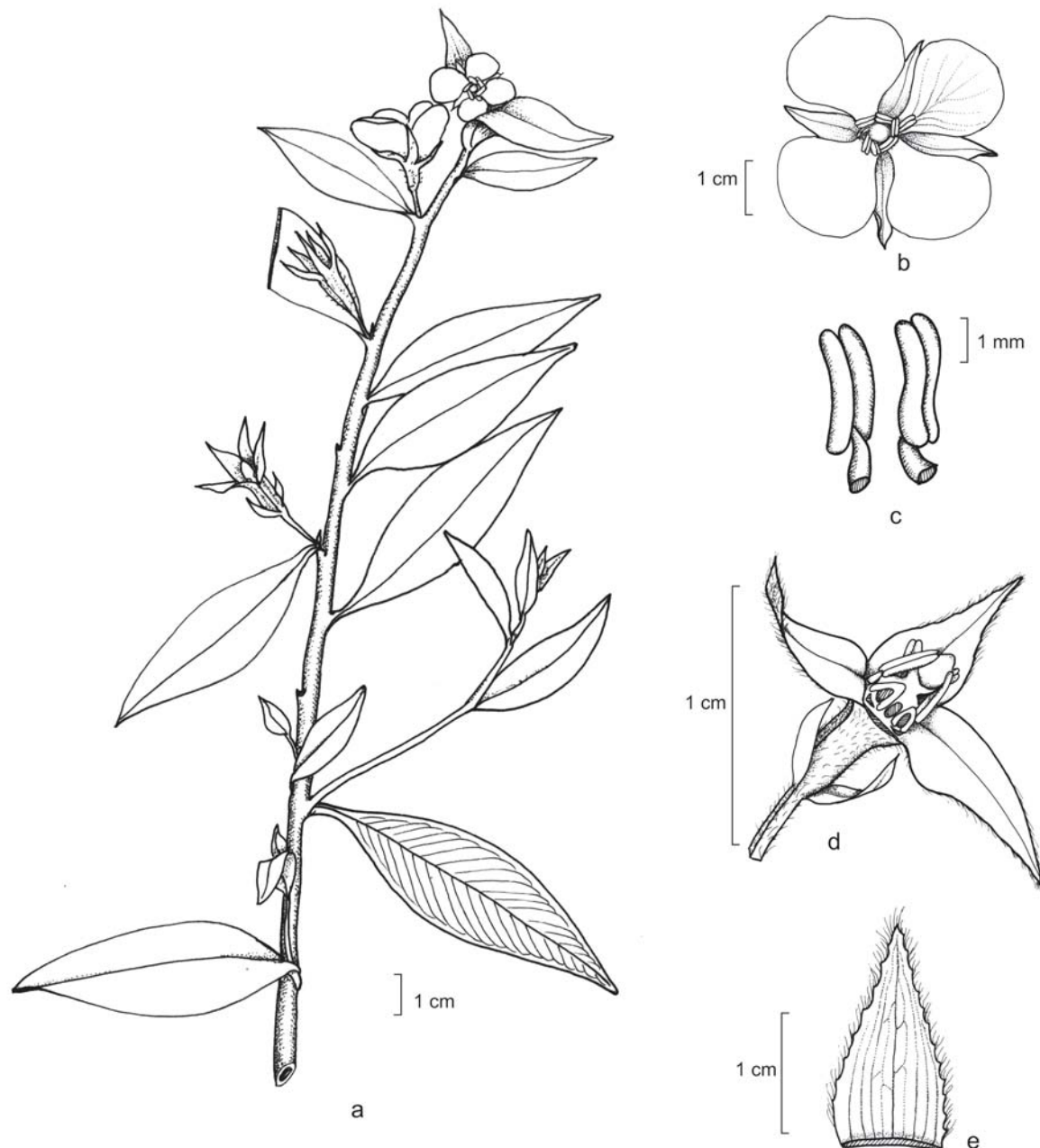


Fig. 6. *Ludwigia peruviana* (L.) H. Hara: a. A flowering twig; b. Flower; c. Stamens; d. Gynoecium with disc, sepals and bracteoles; e. Sepal.

Flowering & Fruiting: Almost throughout the year.

Distribution: India (S. India, S. Andaman and Assam), Indonesia (Java and Sumatra), Malaysia, Singapore, Sri Lanka, throughout America excluding southern USA (Arceo, 1979). Native of New World.

Specimens examined: INDIA, **Assam**, Karbi Anglong district, Lungcholi, 24.10.1993, *Barua* 2313 (CAL); Diphu, 14.9.2006, *Barua* 4199 (ASSAM). **Kerala**, Panthenthode, 10.4.1978, *Nair* 56741 (CAL). **Tamil Nadu**, Coimbatore district, Siruvani, 3.1.1978, *Nair* 41480; Nilgiri district, Madgami, 27.9.1920, *Fischer* 4492; Mudumalai R.F., 1100 m, 17.11.1958, *Sebastine* 7334 (CAL).

Note: This is a new record for Northeast India. A bushy plant, grows along the margins of water sources.

Ludwigia prostrata Roxb. [Hort. Bengal.: 11. 1814], Fl. Ind. ed. Carey 1: 441. 1820; Clarke in Hooker, Fl. Brit. India 2: 588. 1879; Raven in Reinwardtia 6: 374. 1963; Hara, Fl. E. Himal. 1: 225. 1966; Paul in Bull. Bot. Surv. India 40: 19. 1998. *Jussiaea prostrata* (Roxb.) H. Lev. in Feddes Rep. Sp. Nov. 8: 138. 1910.

Fig. 7

Annual, (semi-)erect herbs, 20 – 50 cm high; branches winged, glabrous. Leaves narrowly ovate, elliptic or ovate, 1.4 – 6 × 0.8 – 2.5 cm, cuneate to subdecurent at base, acute to subobtusate at apex, membranous, glabrous or slightly adpressed-hairy beneath; lateral nerves 10 – 14 pairs; petiole 0.5 – 4 cm long. Flowers sessile, c. 6.4 mm across, 4-merous; bracteolet absent. Sepals 4, deltoid, c. 2 × 1 mm, fleshy, glabrous, but margins laxly and minutely ciliolate while in bud, 3-nerved. Petals 4, narrowly spatulate, 2.5 – 3 × 0.6 – 1 mm, yellow, 1-nerved. Stamens 4, opposite sepals, pale yellow to cream-coloured; filaments 1 – 1.5 mm long; anthers c. 0.4 mm long. Disc elevated, glabrous; nectary reniform, opposite petals, alternating stamens, often with 3 or 4 hairs at style-base. Ovary 4-angled, 6 – 9 mm long, pubescent while in bud turning glabrous after blooming, 4-loculed; ovule one per locule; style stout, c. 1 mm; stigma globose, c. 0.5 mm. Capsules narrowly elongated, 0.6 – 2 cm long, 1 – 2 mm in diam., thin-walled, 4-angled and with 4 longitudinal ribs, glabrate, pubescent when young, greenish to purplish brown, irregularly loculicidal; seeds uniseriate in each locule, free, globose to ellipsoid, c. 0.36 × 0.21 × 0.15 mm, with a blackish emergent nipple, brown; raphe narrow linear, c. 0.30 × 0.06 mm.

Flowering & Fruiting: August – February.

Distribution: South and SE Asia.

Specimens examined: INDIA, **Assam**, Cachar district, near Badarpur, 11.8.1903, *A.T. Gage s.n.* (CAL); Jorhat district, Near Kohora, 22.9.1957, *Rolla Rao* 9797 (CAL); Jorhat, 16.8.1993, *Barua* 2306, 2307 (ASSAM); Jorhat, 19.10.1994, *Barua* 2329; Karbi Anglong district, Deithor-Rangsali Route, 11.2.2002, *Barua* 3332 (AAU Weed Herbarium); **Kerala**, *sine loco*, 11.12.1957, *Raizada* 25769 (DD). **Uttaranchal**, Dehra Dun, 8.10.1922, *Parker* 73; Dehra Dun, 13.9.1968, *Naithani* 6005 (DD). **Uttar Pradesh**, Saharanpur, August 1984, *Murthy & Goel* 786; Goraparo, 19.10.1989, *Singh* 957 (DD).

Note: It prefers to grow in shaded and marshy places.

Notes: The *Ludwigia* taxa recorded in India are semi-aquatic herbaceous to subshrubby plants; submerged parts of the stem often with spongy tissue (*L. decurrens*, *L. linifolia* and *L. octovalvis*) or bearing inflated pneumatophores arising from buried submerged roots (*L. linifolia*) or from floating nodes and roots (*L. adscendens*). Plants erect, subshrubby (*L. decurrens*, *L. linifolia* and *L. octovalvis*), (semi-)erect herbs (*L. perennis* and *L. prostrata*) or spreading on ground and water with anchored floating branches (*L. adscendens*). Branches terete (*L. adscendens*, *L. octovalvis*, *L. perennis* and *L. peruviana*) or angular and winged (*L. decurrens*, *L. linifolia* and *L. prostrata*) and sometimes hollow as in *L. perennis* and *L. peruviana*.

Leaves simple, alternate, variously elliptic to lanceolate or linear, acute or acuminate at apex, acute or obtuse in *L. adscendens*, base narrowly (or broadly) cuneate; venation brochidodromous (Hickey, 1973), submarginal veins usually weakly developed, but prominent in *L. octovalvis* subsp. *octovalvis* and *L. decurrens*; petioles well-developed except in *L. decurrens* where leaves are sessile or subsessile.

Flowers usually 4-merous (5-merous in *L. adscendens* and *L. peruviana*), solitary, axillary, showy and large (1.4 – 5.3 cm across), but less than 1 cm across in *L. linifolia*, *L. perennis* and *L. prostrata*. Sepals usually persistent. Petals yellow or white (*L. adscendens*), caducous. Stamens in two whorls (4 + 4, 0 + 4 or 5 + 5); outer opposite petals, distinctly shorter than others in *L. adscendens*, *L. decurrens* and *L. linifolia* and absent in *L. perennis* and *L. prostrata*; filaments filiform, distinctly shorter than anthers and thick in *L. peruviana*; anthers versatile, but apparently basifixed by reduction in *L. peruviana*, extrorse, usually shed directly on the stigma at anthesis; pollen united in tetrahedral tetrads, very less frequent in single grains as in *L. adscendens* and *L. peruviana*; triangular, 3-porate, sexine most

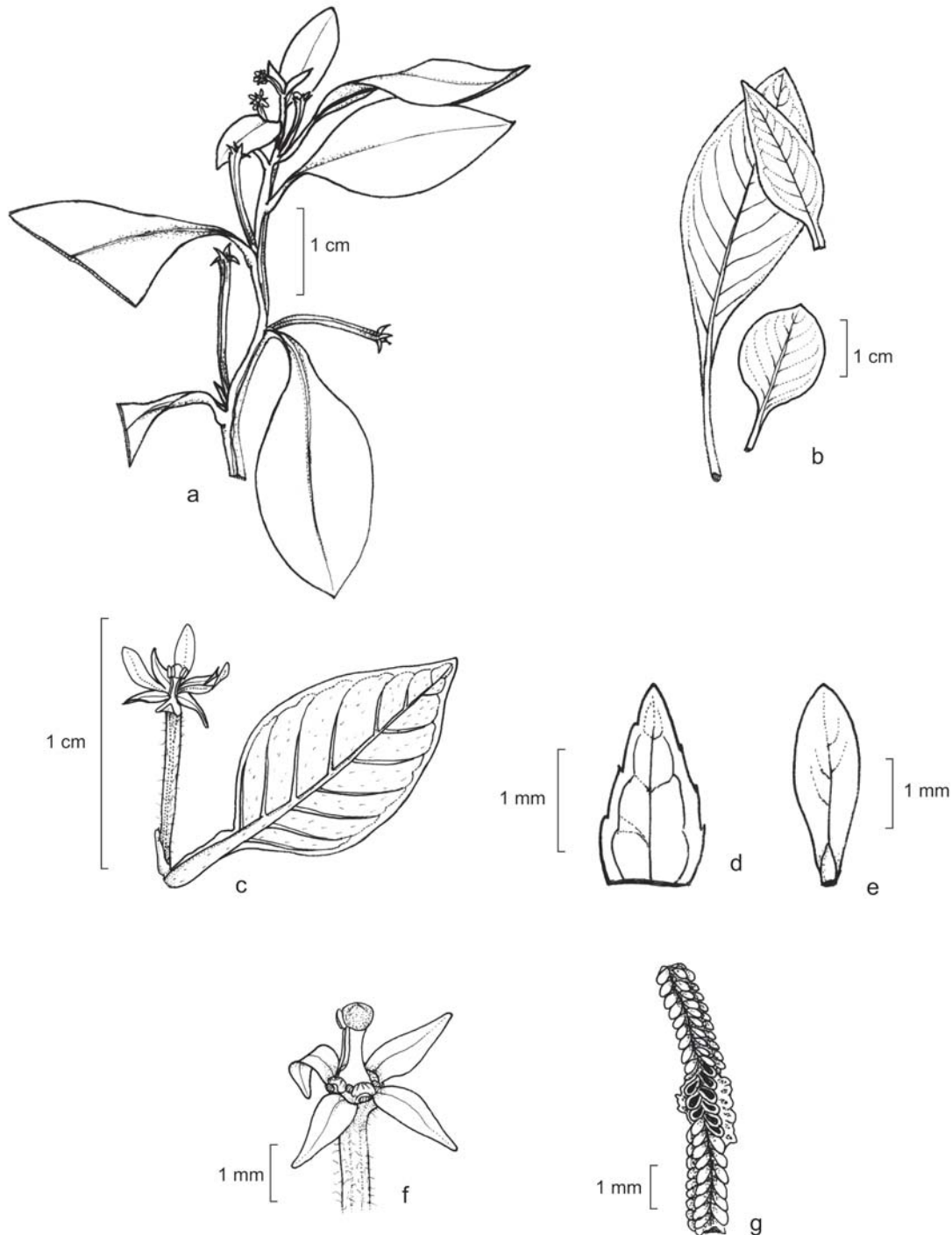


Fig. 7. *Ludwigia prostrata* Roxb.: a. A twig with flowers and fruits; b. Leaves; c. Flower with leaf; d. Sepal; e. Petal; f. Gynoecium with sepals; g. Seeds in capsule.

often thicker than nexine, tetrads are sometimes arranged in rhomboidal manner in *L. decurrens* and nexine sometimes as thick as or thicker than sexine in *L. prostrata*. Ovary 4-loculed; ovules usually 3 per locule, 2 in *L. adscendens*, and solitary in *L. prostrata*; ovules 2 per locule in upper region and solitary in lower region of the ovary

in *L. linifolia*. Disc usually glabrous, hairy in *L. adscendens* and *L. perennis*, patently elevated in *L. adscendens*, *L. peruviana* and *L. prostrata*, but slightly elevated in *L. octovalvis* and *L. perennis* and obscurely elevated in *L. decurrens* and *L. linifolia*. Nectaries are densely white-hairy, but ciliate in *L. linifolia*, *L. perennis* and *L. prostrata*.

Capsules longer than 1 cm, except *L. perennis*, very thin in *L. prostrata*; seeds more or less ellipsoid; raphe usually narrow and smaller than seeds, but thick and as big as or more than the seed in *L. octovalvis*.

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