

## FSA contributions 9: Onagraceae

P. GOLDBLATT\* and P.H. RAVEN\*\*

Annual, biennial, or perennial herbs, sometimes aquatic. *Leaves* opposite or alternate, simple, entire or variously lobed; stipules usually present or 0. *Flowers* bisexual, usually regular, mostly solitary and axillary, subtending leaves sometimes greatly reduced or 0. *Sepals* (2-)4-5(-7), lobes valvate, free floral tube present or 0. *Petals* as many as sepals, or 0, caducous. *Stamens* as many or twice as many as sepals; anthers oblong or linear, introrse, versatile. *Ovary* inferior, locules as many as sepals, with 1 to many ovules in each loculus; style single, terete, often thick; stigma entire or deeply lobed. *Fruit* a capsule or nut, often elongated. *Seeds* terete or prismatic-angled, smooth or papillose, with a terminal tuft of hairs in *Epilobium*. *Ancestral basic chromosome number*:  $x = 11$ .

Characters not applicable in southern Africa: some shrubs or trees; fruit a berry in *Fuchsia*, widely cultivated as an ornamental in southern Africa; flowers unisexual in some species of *Fuchsia*.

Genera 17, species  $\pm 674$ , cosmopolitan in tropical and temperate areas, but mostly America. Two genera native in southern Africa, and two more introduced and naturalized. Unless stated otherwise, all cited type specimens were seen by one or both authors.

- 1a Floral tube 0; sepals persistent in fruit after petals have fallen; petals lacking, or if present, yellow ..... *Ludwigia*
- 1b Floral tube present; sepals not persistent in fruit, falling with floral tube; petals yellow, rose-purple, or white:
  - 2a Flower zygomorphic, petals white; fruit nutlike, indehiscent, with 2-8 ovules ..... *Gaura*
  - 2b Flower actinomorphic, petals yellow, rose-purple, or white; fruit a dehiscent capsule, with many ovules:
    - 3a Seeds with an evident coma (tuft of hairs); petals rose-purple or white; capsule slender, more than 10  $\times$  as long as broad; basal leaves opposite ..... *Epilobium*
    - 3b Seeds lacking a coma; petals yellow, rose-purple or white; capsule clavate or elongate, thicker, less than 10  $\times$  as long as broad; all leaves alternate ..... *Oenothera*

### 5793000 LUDWIGIA

**Ludwigia** L., Species plantarum 118 (1753); Harv.: 504 (1862); P.H.Raven: 327 (1963); Schreiber: 2 (1967); R.Fern. & A.Fern.: 190 (1970); Ross: 262 (1972); R.A.Dyer: 409 (1975); P.H.Raven: 333 (1978). Type species *L. perennis* L.

*Jussiaea* L.: 388 (1753); Harv.: 504 (1862).

Annual or perennial herbs, or undershrubs, sometimes prostrate, often associated with water. *Leaves* alternate or

opposite, simple, usually entire. *Stipules* present, often much reduced. *Flowers* actinomorphic, borne in axils of reduced upper leaves, their opening not highly synchronized. *Sepals* 3-7, persistent after petals have fallen. *Floral tube* 0. *Petals* as many as sepals or 0, yellow, usually entire. *Stamens* as many as or twice as many as sepals; anthers ovoid or oblong. *Pollen* shed in tetrads or singly. *Stigma* entire. *Ovary* with many pluriseriate or uniseriate ovules in each loculus. *Capsule* terete or with 4 or 5 ribs, angles or wings, irregularly loculicidal. *Seeds* ellipsoid, lacking hairs, free or embedded in endocarp at maturity, light brown. *Basic chromosome number*:  $x = 8$ .

Species  $\pm 85$  and sections 23, worldwide, mainly South America, relatively few in Africa; seven in southern Africa, widespread in subtropical parts, extending to southern Western Cape.

Note: *Ludwigia perennis* L. is treated as occurring in southern Africa in Raven (1963: 367) based on the single collection, *Schlechter 12189*, from Lions Creek. This locality has been found to be in southern Mozambique (Raven 1978: 339). *L. polycarpaea* Short & Peter ex Torr. & Gray has possibly been introduced to southern Africa: *Zambatis 1165* from Klaserie and *Barrett 488a* from Swaziland are housed at PRE. *L. stenorrhaphe* (Brenan) Hara subsp. *macrocephala* (Brenan) P.H.Raven has been collected in Botswana: *Smith 1975* (SRGH, PRE).

- 1a Leaves opposite; petals absent ..... 7. *L. palustris*
- 1b Leaves alternate; petals present:
  - 2a Stamens twice as many as sepals; plants evidently pubescent or glabrous:
    - 3a Sepals 4; seeds free, not embedded in endocarp, pluriseriate; stems without white pneumatophores:
      - 4a Plants densely pubescent to subglabrous; capsules subterete, 17-45 mm long; seeds 0.60-0.75 mm long, raphe equal in diameter to body of seed . . . 2. *L. octovalvis*
      - 4b Plants subglabrous; capsules sharply 4-angled, 10-19 mm long; seeds 0.3-0.4(-0.5) mm long, the raphe narrow ..... 1. *L. erecta*
    - 3b Sepals 5-7, very rarely 4; seeds embedded in endocarp, uniseriate; stems with white spindle-shaped pneumatophores:
      - 5a Seeds firmly embedded in woody, coherent endocarp, pendulous, appearing as bulges in capsule wall  $\pm 1.5$  mm apart; leaves with 6-12 lateral veins on each side of midrib; pollen grains shed singly . . . . . 6. *L. adscendens* subsp. *diffusa*
      - 5b Seeds loosely embedded in horseshoe-shaped pieces of endocarp, horizontal, appearing as bulges in capsule wall  $\pm 0.5$  mm apart; leaves with 11-20 lateral veins on each side of midrib; pollen grains shed as tetrads ..... 4. *L. leptocarpa*
  - 2b Stamens as many as sepals; plants glabrous or minutely puberulent:
    - 6a Sepals 3 (very rarely 4 or 5); stems creeping and rooting at nodes; capsules normally tapering to apex; seeds free ..... 3. *L. senegalensis*
    - 6b Sepals 4; stems erect; capsule truncate at apex; seeds loosely embedded in chunks of endocarp at maturity ..... 5. *L. abyssinica*

\* B. A. Krukoff Curator of African Botany, Missouri Botanical Garden, P. O. Box 299, St. Louis, Missouri 63166, USA.

\*\* Director, Missouri Botanical Garden, P. O. Box 299, St. Louis, Missouri 63166. Supported by grants from the U.S. National Science Foundation.

MS received: 1986.



1. *Ludwigia erecta* (L.) Hara in Journal of Japanese Botany 28: 292 (1953); P.H.Raven: 348 (1963); P.H.Raven: 333 (1978). *Jussiaea erecta* L.: 388 (1753); Brenan: 12 (1953b). Type: from America, probably Colombia, from seeds cultivated in Europe.

*Jussiaea altissima* Perr. ex DC.: 55 (1828). Type: Senegal, in 1825, Perrotet s.n. (G.-DC, lecto.; P, isolecto.).

*Isnardia discolor* Klotzsch, in Peters: 70 (1861). Type: Mozambique, Zambezi R. between Sena and Lupata Mts. Peters s.n. (B, holo.†).

Subglabrous erect herb, sometimes woody at base, 30 mm to more than 3 m tall, freely branched, stems sharply angled from decurrent leaf bases. Leaves 20–130 × 2–45 mm, lanceolate to elliptic, rarely ovate, main veins 16–27 on each side of midrib; petiole 2–15 mm long. Bracteoles ± 0.5 mm long. Sepals 4, 2–6 × 1.0–1.5 mm. Petals 3.5–5.0 × 2.0–2.5 mm. Stamens 8. Pollen shed in tetrads. Capsule 10–19 × 2.0–2.5 mm, sharply 4-angled with 4 nearly flat walls, subsessile or on a pedicel up to 2 mm long. Seeds 0.3–0.4(–0.5) × 0.2–0.3 mm, pluriseriate, free, pale brown, raphe narrow. Autogamous. Chromosome number:  $n = 8$ .

Native in the New World from Mexico and Florida to Brazil and Paraguay; introduced throughout tropical Africa, and in southern Africa in Botswana (Figure 1).

Voucher: *Smithers s.n.* (SRGH).

2. *Ludwigia octovalvis* (Jacq.) P.H.Raven in Kew Bulletin 15: 476 (1962); P.H.Raven: 356 (1963); Schreiber: 4 (1967); Ross: 262 (1972); P.H.Raven: 336 (1978). *Oenothera octovalvis* Jacq.: 19 (1760). Type: from West Indies. Figure 2A–C.

*Jussiaea suffruticosa* L.: 388 (1753); H.Perrier: 20 (1950); Brenan: 14 (1953b). Type: from India. Not *Ludwigia suffruticosa* Walter.

*J. angustifolia* Lam.: 331 (1789); Harv.: 504 (1862). Type: from the Moluccas.

*J. linearis* Willd.: 575 (1799); Peters: 70 (1861). Type: Guinea. *Isert s.n.* (B-Willdenow, photograph K). *J. suffruticosa* var. *linearis* (Willd.) Oliv. ex Kuntze: 251 (1891); Brenan: 15 (1953b).

*J. linearis* Hochst.: 425 (1844), illegitimate homonym non Willd. 1799. Type: South Africa, KwaZulu-Natal, Umhloti and Umgeni Rivers, Krauss 73 (K, iso.).

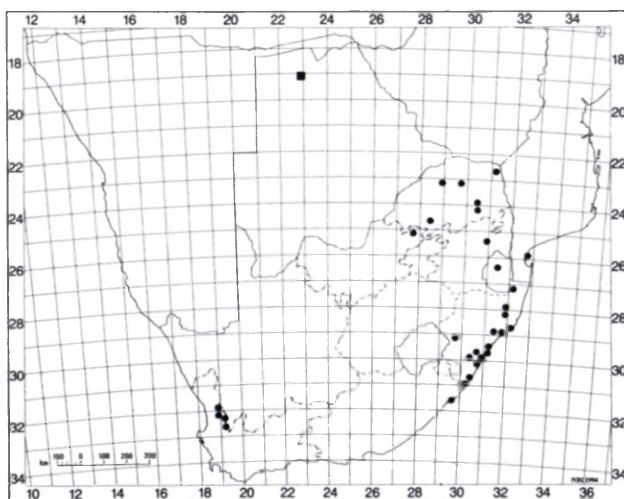


FIGURE 1.—Distribution of *Ludwigia octovalvis*, ●; and *L. erecta*, ■.

*L. octovalvis* subsp. *sessiliflora* (Micheli) P.H.Raven: 476 (1962); P.H.Raven: 362 (1963); Ross 262 (1972); P.H.Raven: 336 (1978). *J. octonervia* forma *sessiliflora* Micheli: 171 (1875). Type: from Brazil.

*J. didymosperma* H.Perrier: 148 (1947); H.Perrier: 23 (1950). Type: Madagascar, Firingilava, Perrier 755 (P, lecto.).

*L. octovalvis* subsp. *brevisejala* (Brenan) P.H.Raven: 476 (1962); P.H.Raven: 365 (1963); Schreiber: 4 (1967); P.H.Raven: 338 (1978). *J. suffruticosa* L. var. *brevisejala* Brenan: 168 (1953a). Type: Cameroun, Cameroun River, in 1863, Mann 2227 (K, holo.).

Robust well-branched herb, up to 4 m tall, freely branched, subglabrous, puberulent, or densely villous. Leaves linear to subovate, 7–145 × 1–40 mm, 11–20 main veins on each side of midrib; petiole 0 to 10 mm long. Bracteoles 0–1 mm long. Sepals 4, 3–15 × 1.0–7.5 mm. Petals 3–17 × 2–17 mm. Stamens 8. Pollen shed in tetrads. Capsule 17–45 × 2–8 mm, terete, pale brown with 8 darker ribs, readily and irregularly loculicidal; pedicel up to 10 mm long. Seeds 0.60–0.75 × 0.5–0.7 mm including inflated raphe which is equal in size to body of ridged, free, brown seed. Autogamous. Chromosome numbers  $n = 16$  (only number known for Africa), 24.

Throughout the tropics and subtropics of the world. In southern Africa in N Namibia, Northern Province, North West, Gauteng and Mpumalanga, KwaZulu-Natal and also in southern Western Cape (Figure 1); wet places, 0–1 500 m. A careful study of this species throughout its range has led to the conclusion that it is best not to attempt to recognize infraspecific taxa in a formal taxonomic sense. The most distinct of the entities recognized earlier was subsp. *brevisejala* (Brenan) P.H.Raven, with sepals only 3–6 mm long, which is confined to but widespread in Africa.

Vouchers: *Acocks 19643*; *Rodin 3037*; *Schlechter 2803*; *J.M. Wood 5341*.

3. *Ludwigia senegalensis* (DC.) Troch. in Mémoires de l'Institut Français d'Afrique Noire 2: 378 (1940); P.H.Raven: 371 (1963); Schreiber: 4 (1967); P.H.Raven: 339 (1978). *Prieurea senegalensis* DC.: 58 (1828). *Jussiaea senegalensis* (DC.) Brenan: 164 (1953a). Type: Senegal, in 1825, *Le Prieur s.n.* (G-DC, holo.; P, iso.).

*J. pulvinaris* (Gilg) Brenan: 163 (1953a); P.H.Raven: 372 (1963). *L. pulvinaris* Gilg: 324 (1903). Type: Angola, Huila, left bank of the Cunene and Humbe, Baum 97 (COI, lecto.; BM, G, P, S, isolecto.).

*L. pulvinaris* subsp. *lobayensis* P.H.Raven: 373 (1963). Type: Zaïre, Yatolema-Yahila (route Stanleyville–Ikela) Léonard 1865 (BR, holo.).

Low herb, creeping and rooting at nodes, sometimes completely submerged, stems mostly 50–350 mm long, finely puberulent or glabrous. Leaves narrowly lanceolate to rounded, 5–30 × 3–10 mm, veins obscure; petioles 1–2 mm long. Bracteoles 0. Sepals 3 (rarely 4 or 5), 1–3 mm long. Petals 3 (rarely 4 or 5), 2.0–2.5 × 0.5–1.0 mm. Stamens 3 (rarely 4 or 5). Pollen shed in tetrads. Capsules plump, thin-walled, 3.5–9.0 × 1.3–2.0 mm, pale brown, readily and irregularly loculicidal, subsessile. Seeds showing clearly through capsule wall, in ± two rows in each locule, free, ovoid, ± 0.7 mm long, rounded at ends, light brown; raphe narrow and inconspicuous. Autogamous or cleistogamous. Chromosome number:  $n = 8$ .

Coastal Senegal to southern Sudan, Zaïre, and south to northern Namibia and probably northern Botswana



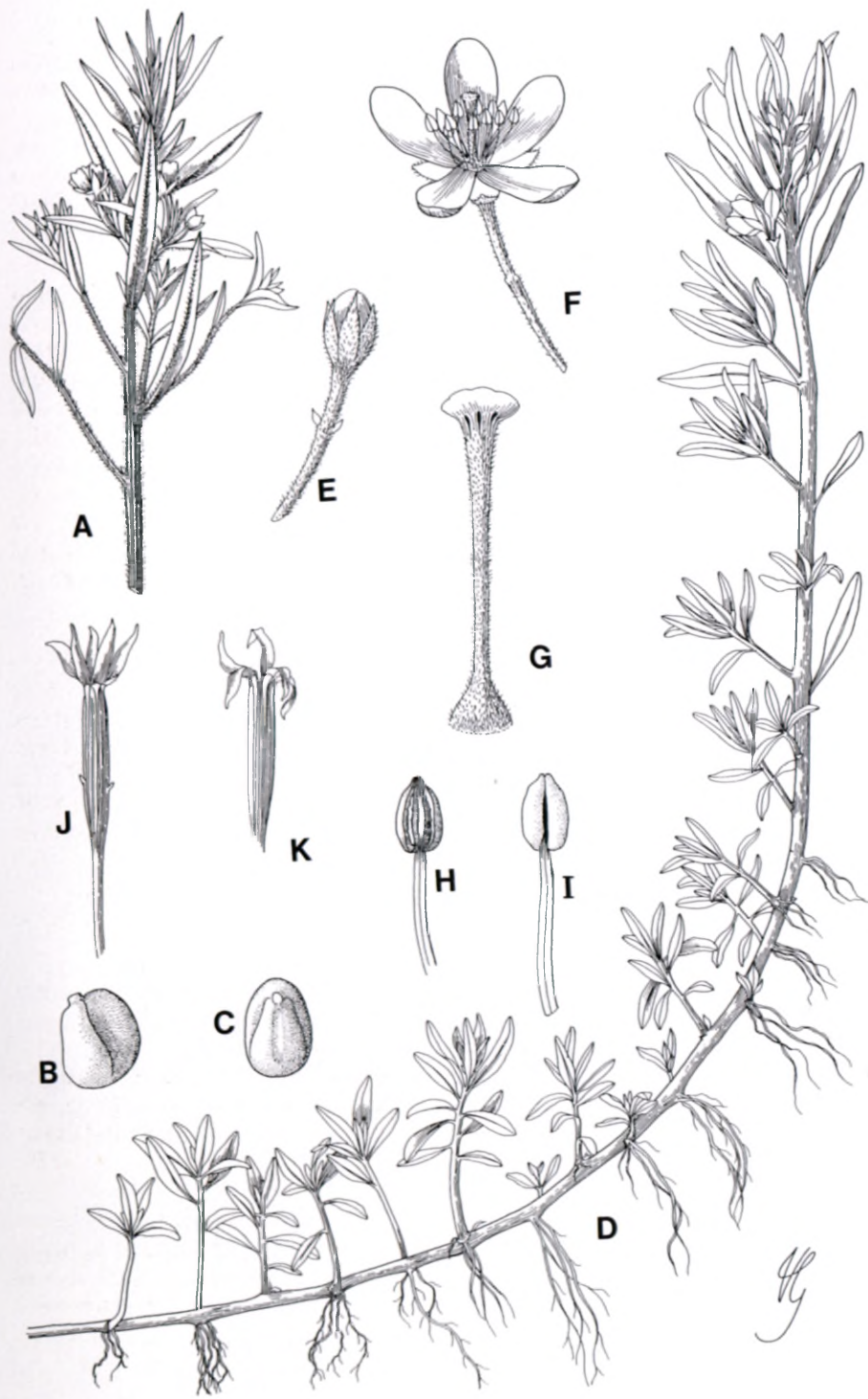


FIGURE 2.—A–C, *Ludwigia octovalvis*. A, flowering branch,  $\times 0.5$ . B, C, seed,  $\times 17$ : B, side view; C, ventral view. D–K, *L. adscendens* subsp. *diffusa*. D, habit,  $\times 0.5$ ; E, flower bud,  $\times 1.5$ ; F, flower,  $\times 1.5$ ; G, style and stigma,  $\times 6$ . H, I, stamen,  $\times 6$ : H, ventral view; I, dorsal view. J, fruit,  $\times 0.5$ ; K, fruit splitting,  $\times 0.5$ . A, Van Rensburg 858; B, C, Eyles 120; D, E, J, K, Robson & Fanshawe 679; F–I, Pope 154. Reproduced by kind permission of Flora Zambesiaca Managing Committee.

(Figure 3); wet places, sometimes completely submerged.

Vouchers: Merxmüller & Giess 1902; Vlok 1906.

4. *Ludwigia leptocarpa* (Nutt.) Hara in Journal of Japanese Botany 28: 292 (1953); P.H.Raven: 376 (1963); Schreiber: 3 (1967); P.H.Raven: 340 (1978). *Jussiaea leptocarpa* Nutt.: 279 (1818); Brenan: 16 (1953b). Type: from North America.

*J. pilosa* Kunth: 101 (1823); Mogg in MacNae & Kalk: 150 (1958). Type: from Colombia.

*J. seminuda* H.Perrier: 146 (1947). Type: Madagascar, south of Maravoay, Boina, Perrier 17641 (P, lecto.).

Robust hairy plants to 3 m tall, reclining at base but erect and well branched, with erect floating pneumatophores, often forming large masses. Leaves broadly lanceolate, long-hairy, 35–180  $\times$  10–40 mm, 11–20 main veins on each side of midrib; petiole 2–35 mm long. Bracteoles 0 or reduced. Sepals 5 (rarely 4, 6, or 7) 5.5–11  $\times$  1.5–3.0 mm. Petals 5–11  $\times$  4–8 mm. Stamens twice as many as sepals. Pollen shed in tetrads. Capsule relatively thin-walled, long-hairy, 15–50  $\times$  2.5–4 mm, terete, dull light brown, with prominent ribs over locules and less prominent ones over septa, marked on outside with bulges  $\pm 0.5$  mm apart corresponding to position of seeds, slowly and irregularly loculicidal; pedicels 2–20 mm long. Seeds uniseriate in each locule of capsule, hor-

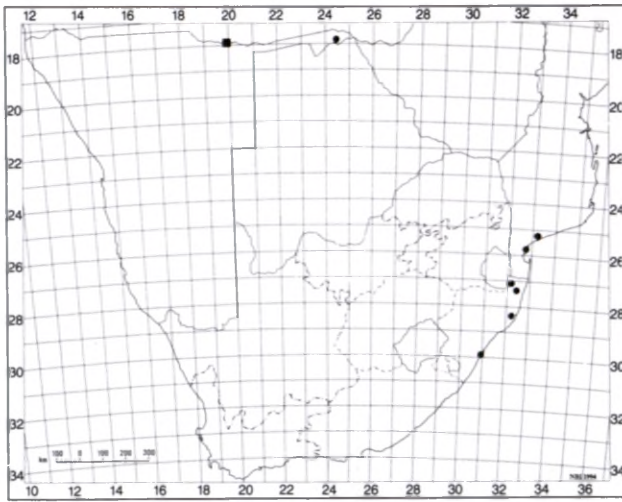


FIGURE 3.—Distribution of *Ludwigia leptocarpa*, ●, and *L. senegalensis*, ■.

izontal, obovoid, 1–1.2 mm long, shiny pale brown; raphe much narrower than body of seed; each seed loosely embedded in an easily detached horseshoe-shaped segment of firm pale brown endocarp  $\pm$  1.0–1.5 mm thick and  $\pm$  1 mm high. Somewhat outcrossing but self-compatible. *Chromosome numbers*:  $n = 24$  (in Africa), 16 (in New World).

In the Americas from the southeastern USA to Argentina and in Africa. Rare in southern Africa, in KwaZulu-Natal, northern Namibia and Botswana (Figure 3).

Vouchers: Carson 754; Killick & Leistner 3077; Tinley 225; Ward 5564.

**5. *Ludwigia abyssinica* A.Rich.**, Tentamen florae abyssinicae 1: 274 (1848); P.H.Raven: 380 (1963); Schreiber: 2 (1967); Ross: 262 (1972); P.H.Raven: 340 (1978). Type: Ethiopia, Shire, *Quartin-Dillon & Petit s.n.* (P. holo.).

*Jussiaea abyssinica* (A.Rich.) Dandy & Brenan in F.W.Andrews: 145 (1950); Brenan: 18 (1953b).

*L. jussiaeoides* sensu Harv.: 505 (1862), non Desr. (1792).

Stout, subsucculent herb, sometimes woody at base, up to 3 m tall, well branched, glabrous except for minute hairs on midribs and margins of young leaves. *Leaves* lanceolate or broadly elliptic, 20–130  $\times$  0.5–3.5 mm, 13–22 main veins on each side of midrib; petiole 2–20 mm long. *Sepals* 4, 1.7–3.0  $\times$  0.4–1.0 mm. *Petals* 1.5–3.5  $\times$  1.2–2.6 mm. *Stamens* 4. *Pollen* shed in tetrads. *Capsule* relatively thin-walled, glabrous, 10–20  $\times$  1–2 mm, terete, light brown; pedicels 0.5–3.0 mm long. *Seeds* uniseriate in each locule, diagonal, obovoid, 0.60–0.75  $\times$  0.4–0.5 mm brown; raphe inconspicuous, each seed loosely but completely embedded in an easily detached piece of soft powdery endocarp 0.6–1.0  $\times$  0.5–0.7 mm. Autogamous. *Chromosome number*:  $n = 24$ .

Endemic in Africa from Senegal and Sudan to Madagascar and southern Africa where it occurs only in northern Namibia and in KwaZulu-Natal (Figure 4); in swampy situations.

Vouchers: Loeb 495; Strey 5726; Wood 3877.

**6. *Ludwigia adscendens* (L.) Hara subsp. *diffusa*** (Forssk.) P.H.Raven in Kew Bulletin 15: 476 (1962); P.H.Raven & Tai: 876 (1979). *Jussiaea diffusa* Forssk.: 210 (1775). *L. diffusa* (Forssk.) Greene: 227 (1891) nom. illeg., non Buch.-Ham. (1824). *J. repens* var. *diffusa* (Forssk.) Brenan: 171 (1953a); *L. adscendens* var. *diffusa* (Forssk.) Hara: 291 (1953). Type: Egypt, Rosetta, banks of Nile, *Forsskål s.n.* (C). Figure 2D–K.

*J. stolonifera* Guill. & Perr.: 292 (1833). *L. stolonifera* (Guill. & Perr.) P.H.Raven: 390 (1963); Schreiber: 3 (1967); Ross: 262 (1972); P.H.Raven: 341 (1978). Type: Senegal, in 1825, *Perrottet s.n.* (P. holo.).

*J. fluitans* Hochst.: 425 (1844) nom. illeg., non G.Don 1832; Harv.: 504 (1862). Type: South Africa, KwaZulu-Natal, Umlaas R., *Krauss s.n.* (not seen).

*J. alternifolia* E.Mey. ex Peters: 69 (1861). Type: South Africa, between Omsamkulu and Omkomas, below 500 ft. *Drège s.n.* (HAL, PR, SAM).

*J. diffusa* subsp. *albiflora* H.Perrier: 144 (1947). Type: Madagascar, Ankarafonsika, Boina, *Decary 12872* (P!).

Herb with prostrate or ascending stems, rooting at nodes, with conspicuous, white, erect, spindle-shaped, mucronate pneumatophores arising in clusters at nodes of floating stems and from roots; plants more or less densely villous to glabrous. *Leaves* narrowly lanceolate to narrowly elliptic, 20–90  $\times$  5–17(–23) mm on flowering stems, broader on floating non-flowering branches, 6–12 main veins on each side of midrib; petioles 2–20 mm long. *Bracteoles*  $\pm$  1 mm long. *Sepals* 5, 5–14  $\times$  1.5–2.8 mm. *Petals* 7–18  $\times$  4–10 mm. *Stamens* 10. *Pollen* grains shed singly. *Capsule* 10–30 mm long, light brown, with 10 conspicuous darker brown ribs, terete, with bulges  $\pm$  1.5 mm apart, thick-walled, very tardily and irregularly dehiscent; pedicel 5–20 mm long. *Seeds* uniseriate, 1.1–1.3 mm long, pale brown, more or less vertical, firmly embedded in coherent cubes of woody endocarp 1.2–1.5  $\times$  1.0–1.2 mm, endocarp firmly fused to capsule wall. Somewhat outcrossing but self-compatible. *Chromosome number*:  $n = 16$ .

Northern Namibia, Botswana and throughout eastern southern Africa (Figure 5), widely distributed in Africa and Middle East; wet places especially along rivers and lakes and often floating, sometimes forming large masses.

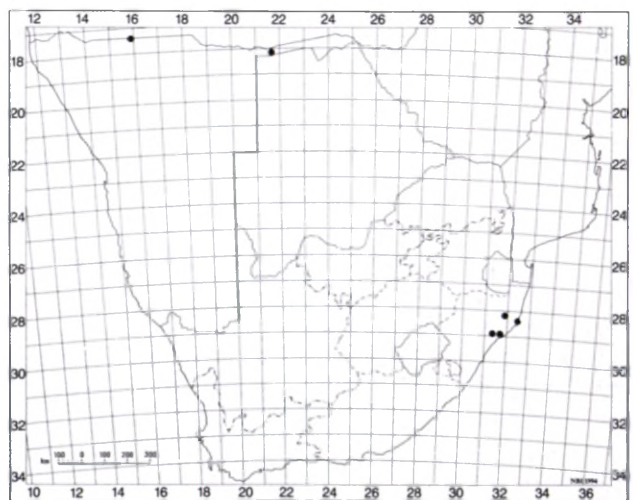


FIGURE 4.—Distribution of *Ludwigia abyssinica*.



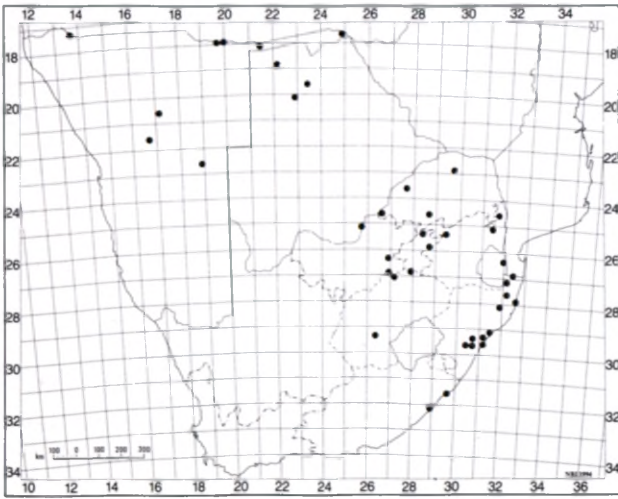


FIGURE 5.—Distribution of *Ludwigia adscendens* subsp. *diffusa*.

Vouchers: Codd 4376; De Winter & Marais 4471; Dinter 2730; Drummond 7148; Ward 2284.

7. *Ludwigia palustris* (L.) Elliott, A sketch of the botany of South Carolina and Georgia 1: 211 (1817); Harv.: 505 (1862); P.H.Raven: 399 (1963); Schreiber: 4 (1967); Ross: 262 (1972); P.H.Raven: 342 (1978). *Isnardia palustris* L.: 120 (1753). Type: from Europe.

Glabrous herb, creeping and rooting at nodes, with opposite leaves, stems at most ascending-decumbent, up to 0.5 m long or perhaps longer, well-branched and forming mats. *Leaves* broadly elliptic or subovate, 7–45 mm × 4–23 mm, 4–8 main veins on each side of midrib. *Bracteoles* 0 or up to 1 mm long. *Sepals* 4, 1.4–2.0 × 0.8–1.8 mm. *Petals* 0. *Stamens* 4. *Pollen* shed singly. *Capsule* elongate-globose, (2.0–)2.5–5.0 × 2–3 mm, obscurely 4-angled, dull light brown, smooth and somewhat corky-walled, but fairly readily and irregularly loculicidal, with a broad green band 0.4–0.5 mm wide on each angle of capsule. *Seeds* pluriseriate in each locule, free, elongate-ovoid, 0.6–0.9 × ± 0.3 mm thick, light brown; raphe very narrow. Autogamous. *Chromosome number*: n = 8.

Throughout southern Africa (Figure 6); widespread from temperate North America to Colombia, in Eurasia to Iran and in Africa N of the Sahara and in southern Angola; margins of streams, lakes, wet places.

Vouchers: Dieterlen 1002; Galpin 10128; Parker 4852; Schlechter 6413; Thode A1212.

5795000 EPILOBIUM

*Epilobium* L., Species plantarum 347 (1753); Harv.: 506 (1862); Adamson: 605 (1950); Schreiber: 1 (1967); P.H.Raven: 309 (1967); R.Fern. & A.Fern.: 199 (1970); Ross: 262 (1972); R.A.Dyer: 410 (1975); P.H.Raven: 343 (1978). Type species: *E. hirsutum* L.

Perennial herbs, often flowering in first year. *Leaves* alternate above, opposite below, entire or toothed. *Stipules* 0. *Flowers* actinomorphic, borne in axils of reduced upper leaves, their opening not highly synchronized. *Sepals* 4,

caducous. *Floral tube* present. *Petals* 4, rose-purple to white, notched. *Stamens* 8; anthers linear to oblong. *Pollen* shed in tetrads. *Ovary* with many uniseriate ovules in each locule. *Stigma* entire or 4-lobed. *Fruit* a slender loculicidal capsule. *Seeds* ellipsoid, with a terminal tuft of hairs (coma), free, brown. *Basic chromosome numbers*: x = 12, 13, 15, 16, or 18 (the only number in Africa).

A large cosmopolitan genus of ± 185 species, with a centre of diversity in North America, 10 species in Africa, four native in southern Africa and fairly widespread.

- 1a Stigma deeply 4-cleft:
  - 2a Stem clothed with long, spreading pubescence; leaves subsessile, distinctly clasping at base; fleshy scales absent at base of plant ..... 1. *E. hirsutum*
  - 2b Stems clothed with strigillose pubescence; leaves distinctly petiolate, rounded to obtuse or more rarely subcordate at base with petioles 1.0–2.5 mm long; underground stems invested with white, fleshy, rounded scales ..... 3. *E. capense*
- 1b Stigma entire, clavate:
  - 3a Leaves narrow, subsessile and strongly decurrent; flowers erect at anthesis; petals pale lilac to pink, 2.5–3.5 mm long ..... 2. *E. tetragonum*
  - 3b Leaves broader, distinctly petiolate, narrowly cuneate to attenuate at base; flowers nodding in bud and when opening first, later erect; petals at first white or cream, rose following pollination, 5–15 mm long .... 4. *E. salignum*

1. *Epilobium hirsutum* L., Species plantarum 347 (1753); Harv.: 506 (1862); Hausskn.: 53 (1884); Burt Davy: 201 (1926); Adamson: 605 (1950); Schreiber: 2 (1967); P.H.Raven: 312 (1967); R.Fern. & A.Fern.: 200 (1970); P.H.Raven: 343 (1978). Type: from Europe.

*E. tomentosum* Vent.: t. 90 (1802); Brenan: 2 (1953b). Type: from Persia, cultivated in France.

*E. mirei* Quézel: 90 (1957). Type: Chad, Tigui, in 1956, Quézel s.n. (herb. Quézel, holo.).

Robust herb 0.2–2.5 m tall; rhizome stout; plants more or less white-pubescent all over. *Leaves* mostly opposite, oblong-lanceolate, sessile, clasping at base, coarsely toothed, 20–120 × 4–30 mm. *Inflorescence* with an admixture of glandular trichomes, erect in bud; flowers erect in bud. *Floral tube* 2.5–3.0 mm across, ± 1.0–1.5 mm deep. *Sepals* 6–10 × 2.0–2.5 mm. *Petals* 6–16 × 6–15 mm, bright purplish rose. *Style* 6–10 mm long; stigma deeply 4-lobed, held above anthers at an-

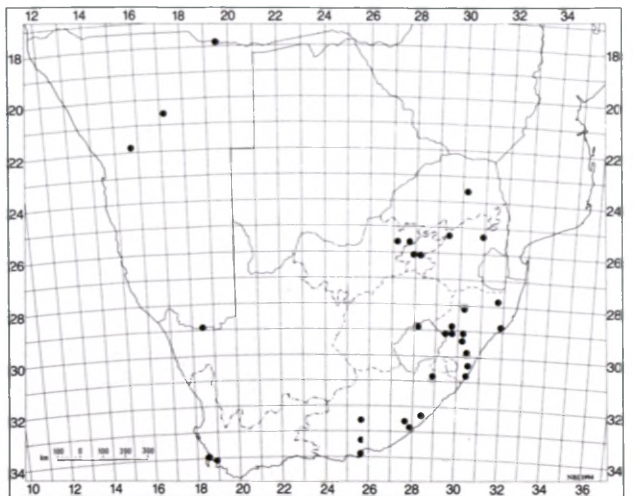


FIGURE 6.—Distribution of *Ludwigia palustris*.



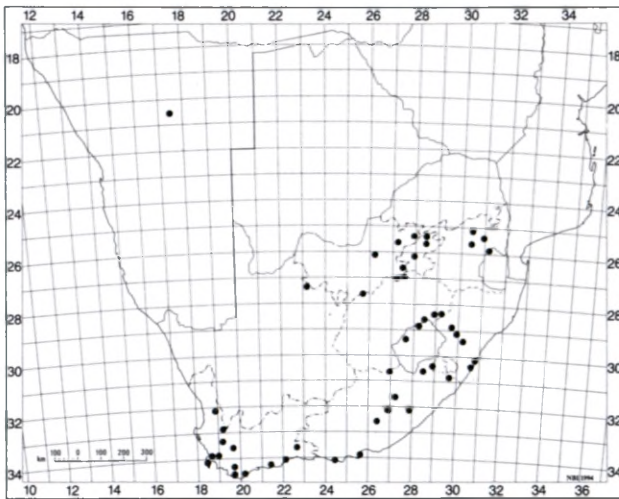


FIGURE 7.—Distribution of *Epilobium hirsutum*.

thesis, lobes 1.5–2.5 mm long. *Capsules* 30–80 mm long; pedicel 2–12 mm long. *Seeds* oblong-obovoid, acute at base, coarsely papillose, 0.90–1.15 mm long, dark brown or even coppery, coma 5–7 mm long, dull white. Outcrossing but self-compatible. *Gametic chromosome number*:  $n = 18$ . Protandrous.

Widespread in Africa, Europe and temperate Asia, in wet places. In southern Africa it occurs on the Waterberg in Namibia and throughout South Africa (Figure 7), predominantly in montane regions.

Vouchers: *Rehmann* 4752; *Rodin* 2586; *Rudatis* 1649; *Schlechter* 10446.

2. *Epilobium tetragonum* L., *Species plantarum*: 348 (1753); *Harv.*: 597 (1862); *Adamson*: 606 (1950). Type: from France.

subsp. *tetragonum* P.H. Raven, *Flora zambesiaca* 4: 318 (1967).

*E. adnatum* Griseb.: 851 (1852). *E. tetragonum* subsp. *adnatum* (Griseb.) Maire in *Jehandiez & Maire*: 515 (1932). Type: from Europe.

Perennial herb 0.1–1.0 m tall, producing leafy rosettes from short stolons near base in autumn; plants strigillose, especially above, and with raised lines running down from bases of petioles, these pubescent above. *Leaves* mostly opposite, subsessile and usually decurrent on stem, narrowly lanceolate to nearly elliptical, 15–75 × 3–15(–21) mm, bluish green, evenly and strongly denticulate. *Inflorescence* erect in bud; flowers erect in bud. *Flower tube* ± 1 mm across and deep. *Sepals* 2.8–4.2 × 0.8–1.8 mm. *Petals* 2.5–5.0(–7.0) × 2.0–3.5(–4.5) mm, pale lilac to pink. *Stigma* entire, clavate. *Capsules* (35–)50–110 mm long, on a pedicel 1.2–3.0 mm long. *Seeds* oblong-obovoid, acute at base, coarsely papillose, 1.0–1.3 mm long, brown, coma ± 8–10 mm long, dull white. Autogamous or cleistogamous. *Gametic chromosome number*:  $n = 18$ .

In South Africa and Lesotho, coastal to high altitudes (Figure 8), probably introduced early from Europe; in Europe east to the Caucasus and Iran, in North Africa from Tangier to Tunisia in the north including Madeira and Canary Islands; in moist places.

Vouchers: *Bolus* 215; *Dieterlen* 936; *Parker* 3638; *Schlechter* 6129; *Thode* A320.

3. *Epilobium capense* Buch. ex *Hochst.* in *Flora* 27: 425 (1844); *Hauskn.*: 229 (1884); *P.H.Raven*: 324 (1967); *P.H.Raven*: 343 (1978). Type: South Africa, Western Cape, George Dist., Knysna River, *Krauss s.n.* (LZ, holo., destroyed; G, iso.). Figure 9.

*E. flavescens* E.Mey. ex *Harv.*: 506 (1862); *Hauskn.*: 230 (1884). Type: South Africa, KwaZulu-Natal, Umlaas, *Krauss* 154 [K, lecto.; BM, G, isolecto. fide *Raven*: 324 (1967)].

*E. bojeri* *Hauskn.*: 90 (1879). Type: Madagascar, near Be'zongzong, Feb.–Mar., *Bojer s.n.* (JE, lecto.).

*E. biforme* *Hauskn.*: 230 (1884). Type: South Africa, Eastern Cape, Somerset East, Boschberg, 1 050 m, *MacOwan* 729 (BM, BOL, G, GRA, K, NH, P, SAM).

*E. jonathum* *Hauskn.*: 231 (1884). Type: South Africa, Free State, without precise locality, *Cooper s.n.* (K, holo.; BOL, iso.).

*E. karsteniae* *Compton*: 297 (1967). Type: Swaziland, Mbabane Dist., swamps near Forbes Reef, 4500–5000ft, *Compton* 30487 (NBG, PRE).

Perennial herb 0.1–1.2 m tall; underground stems vertical or nearly so, densely invested with thick white, fleshy, rounded scales ± 4 × 2–10 mm after first year; plants strigillose with some glandular trichomes in the more densely lanceolate, serrate with prominent forward-directed teeth, 20–50 × 0.4–2.5 mm; petioles 1.0–2.5 mm long. *Inflorescence* erect in bud; flowers erect or somewhat drooping in bud. *Floral tube* 2.0–2.5 mm across, 1.1–1.5 mm deep. *Sepals* 4.2–10.0 × 1.2–2.5 mm. *Petals* 6–16 × 3.0–10.5 mm, bright rose-purple, paler purplish, creamy, or white. *Stigma* white, 4-lobed, lobes 0.7–2.0 mm long. *Capsules* 30–90 mm long; pedicel 10–60 mm long. *Seeds* oblong-obovoid, papillose, 1.3–1.6 mm long, brown, coma 5–7 mm long, dingy white. Outcrossing or self-pollinating. *Gametic chromosome number*:  $n = 18$ .

Moist places and mountain meadows in Madagascar and in Africa from southern Tanzania to the southern Western Cape (Figure 10).

Vouchers: *MacOwan* 729; *Schlechter* 10095; *Tyson* 1813; *Wood* 686.

4. *Epilobium salignum* *Hauskn.* in *Oesterreichische Botanische Zeitung* 29: 90 (1879); *Hauskn.*: 236 (1884); *Brenan*: 5 (1953b); *P.H.Raven*: 331 (1967);

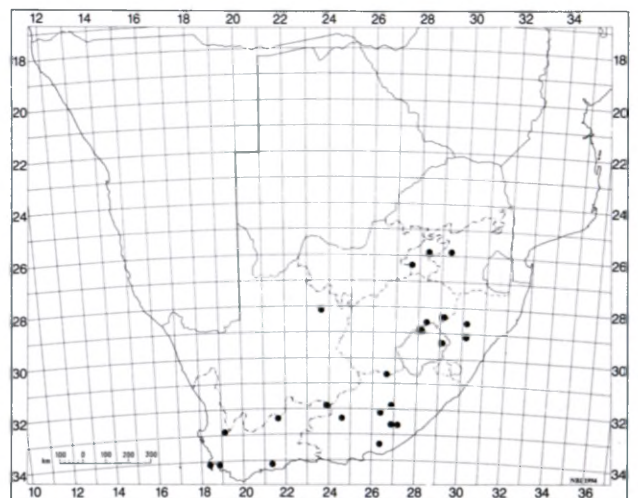


FIGURE 8.—Distribution of *Epilobium tetragonum* subsp. *tetragonum*.



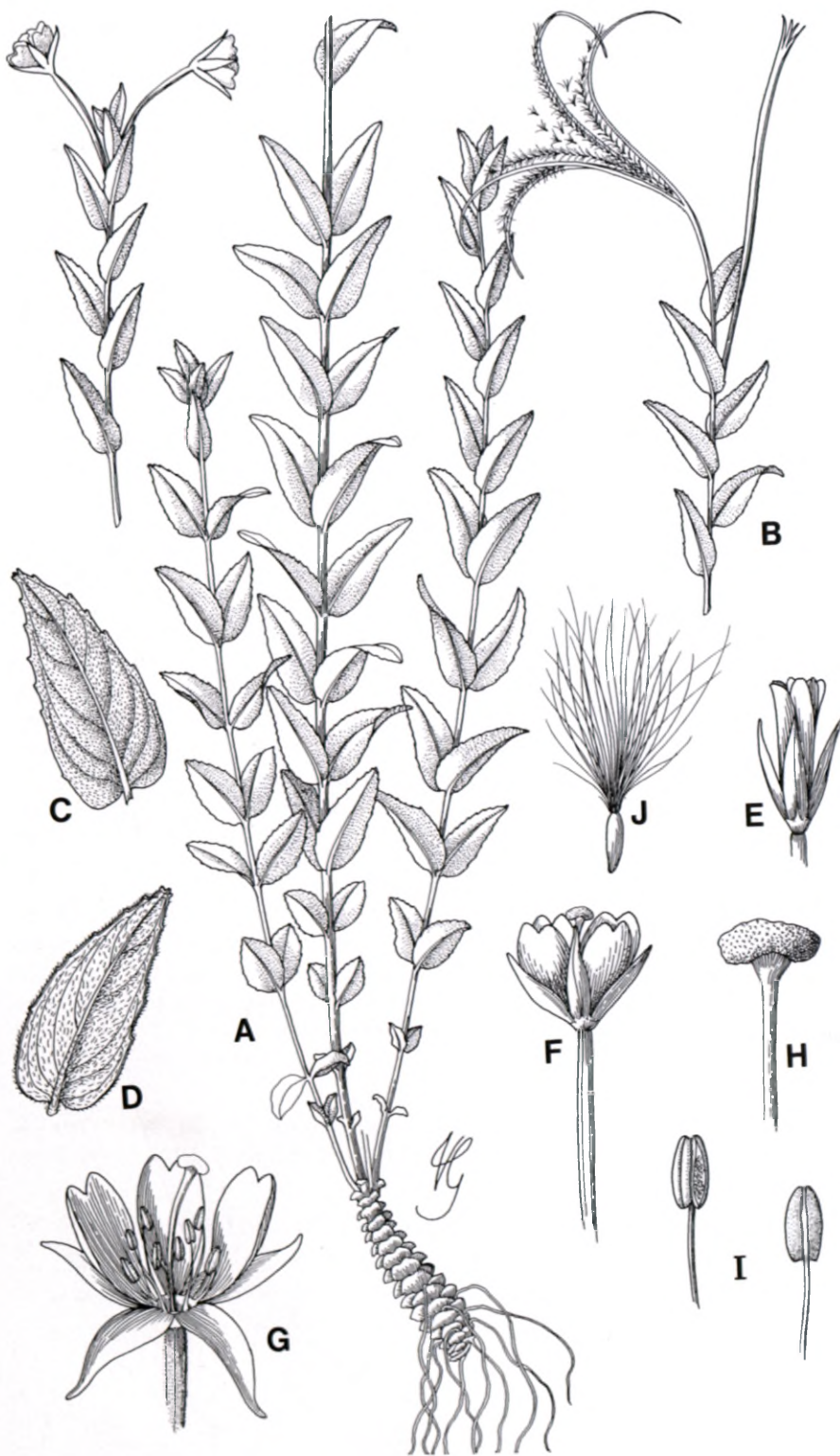


FIGURE 9.—*Epilobium capense*. A, habit,  $\times 0.5$ ; B, branch with mature fruit,  $\times 0.5$ . C, D, leaf,  $\times 1$ : C, upper surface; D, underside. E, bud,  $\times 2$ . F, G, flower: F,  $\times 1.5$ ; G, with petal removed to show style and stamens,  $\times 2$ . H, part of style with stigma,  $\times 6$ ; I, stamen,  $\times 4$ ; J, seed,  $\times 4$ . A, C, D, *Robson 245*; B, J, *Stohr N44*; E–I, *Chase 5883*. Reproduced by kind permission of Flora Zambesiaca Managing Committee.

P.H.Raven: 345 (1978). Type: Madagascar, Antananarivo and Be'zongzong, *Bojer s.n.* (P, lecto.!).

*E. neriophyllum* Hausskn.: 19 (1880). Type: South Africa, Eastern Cape, Somerset East, Boschberg 900 m, *MacOwan 1487* (K, lecto.; GRA, NH iso. lecto.).

*E. mundtii* Hausskn.: 235 (1884). Type: South Africa, Western Cape, Cape Peninsula, in 1820, *Mundt & Maire s.n.* (JE, lecto.).

*E. natalense* Hausskn.: 235 (1884). Type: South Africa, KwaZulu-Natal, 'Natal Bay', *Gueinzus s.n.* (LZ, holo., destroyed; JE, iso. lecto.).

*E. oliganthum* Baker: 345 (1886) nom. illeg., non Michx. (1803).

*E. benguellense* Welw. ex Hiern: 378 (1898). Type: Angola, Huila, Monino River, *Welwitsch 4458* (LISU, lecto.; BM, COI, G, K, isolecto.). *E. tetragonum* subsp. *benguellense* (Welw. ex Hiern) Engl.: 773 (1921).

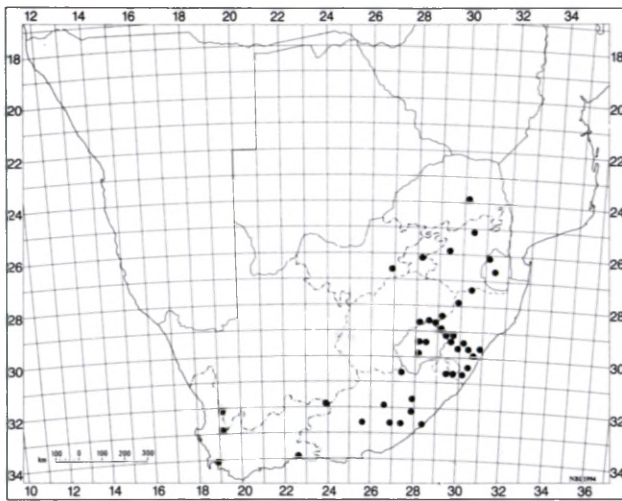
*E. tetragonum* subsp. *benguellense* var. *welwitschii* Engl.: 773 (1921). Type: Angola, Huila, Quilengues, rio Caculovar, *Welwitsch 4459* (LISU, lecto.; B, COI, G, P, isolecto.).

*E. madagascariense* H.Lév.: 225 (1907). Type: Madagascar, Ranobé, near Sirabe, in 1895, *Forsyth-Major s.n.* (G, holo.).

*E. perrieri* H.Lév.: 3 (1917). Type: Madagascar, Ankaratra, 900 m, *Perrier 6630* (P, lecto.).

*E. schinzii* H.Lév.: 225 (1907). Type: South Africa, KwaZulu-Natal, Noodsberg, 600–900 m, *J.M. Wood 5282* (Z, holo., not seen; BM, NH, SAM, iso.).



FIGURE 10.—Distribution of *Epilobium capense*.

Perennial herbs 0.2–1.6 m tall; strongly rhizomatous; rhizomes lacking scales, long-spreading and giving rise to new leafy shoots; plants evenly strigillose, sometimes sparsely so, with faintly marked lines running down from margins of pedicels. *Leaves* mostly opposite, very narrowly to narrowly elliptic, rarely almost lanceolate, weakly serrulate or rarely serrate, 20–80 × 3–20 mm; petiole 1–8 mm long. *Inflorescence* erect in bud, to 300 mm long; bracts usually not much reduced; flowers nodding in bud and when opening first, later erect. *Floral tube* 0.8–2.0 mm across, 1.5–2.3 mm deep. *Sepals* 3.5–8.5 × 1.2–2.2 mm. *Petals* 5–15 × 2–7 mm, at first white or cream, then rose following pollination. *Stigma* usually clavate, rarely subcapitate, entire. *Capsules* 30–70 mm long, on a pedicel 8–45 mm long. *Seeds* oblong-obovoid, obtuse at base, minutely reticulate, 1.00–1.35 × 0.35–0.60 mm; light brown or tan, coma ± 5–9 mm long, copious, white. Mainly autogamous. *Gametic chromosome number*:  $n = 18$ .

Extending in southern Africa along the eastern mountains to the Transkei, including Lesotho and Swaziland (Figure 11), from the highlands of tropical and temperate Africa and Madagascar; moist places, 500–3 000 m.

Vouchers: Flanagan 665; Rudatis 1346; Scheepers 625.

## 5819000 GAURA

**Gaura** L., Species plantarum 1: 347 (1753); L.: 163 (1754); R.A.Dyer: 410 (1975). Type species: *G. biennis* L.

*Gauridium* Spach: 379 (1835a).

*Schizocarya* Spach: 325, 381 (1835b); Spach: 170, 283 (1835c).

Annual, biennial, or perennial herbs. *Leaves* alternate, entire to deeply lobed. *Stipules* 0. *Inflorescence* a spicate raceme, sharply delimited, not leafy, more or less conspicuously pedunculate. *Flowers* usually strongly zygomorphic, borne in axils of much reduced upper leaves (bracts), opening either near sunset or near sunrise and fading within a day. *Floral tube* present, long and narrow. *Sepals* 4, caducous. *Petals* 4, white, usually sharply clawed, entire. *Stamens* 8; anthers linear, sporogenous tissue divided by sterile tissue into discrete packets. *Pollen* shed singly. *Stigma* deeply 4-lobed. *Ovary* with 1 or 2 ovules in each locule. *Capsule* indehiscent, nutlike,

with hard, woody walls, septa incomplete and fragile, not evident at maturity. *Seeds* ovoid, yellowish to pale brown. *Basic chromosome number*:  $x = 7$ .

A genus of 21 species of North America, centring in the Great Plains and Texas. Two species are naturalized in South Africa.

- 1a Inflorescences strigillose; plants rhizomatous; flowers opening near sunset; fruits evidently stipitate, with stipe 2–8 mm long ..... 1. *G. sinuata*  
 1b Inflorescence villous; plants clumped; flowers opening near sunrise; fruits sessile, broad-based ..... 2. *G. lindheimeri*

1. **Gaura sinuata** Nutt. ex Ser. in DC., Prodrumus 3: 44 (1828). Type: from USA.

Aggressively rhizomatous perennial herb, forming extensive mats with well-branched stems 200–600 mm tall; plants subglabrous or sparsely pubescent, stems strigillose and with long, spreading hairs; leaves densely strigillose in relatively hairy plants. *Leaves* linear to narrowly oblanceolate, 10–110 × 1–20 mm, sparsely sinuate-dentate, rarely subentire, often undulate. *Inflorescence* 100–300 mm long, simple or branched; bracts lanceolate to narrowly ovate, 1–5 × 0.5–2.0 mm. *Flowers* opening near sunset. *Floral tube* 2.5–5.0 mm long. *Sepals* 7–14 × 1.25–2.50 mm, strigillose. *Petals* 7.0–14.5 × 3–7 mm, white, fading pink. *Ovary* outside of floral tube, strigillose. Body of *capsule* 8–15 × 1.5–3.5 mm; stipe 2–8 mm long. *Seeds* (1–)2–4 × 2–3 mm, light to reddish brown. Self-incompatible. *Gametic chromosome number*:  $n = 14$ .

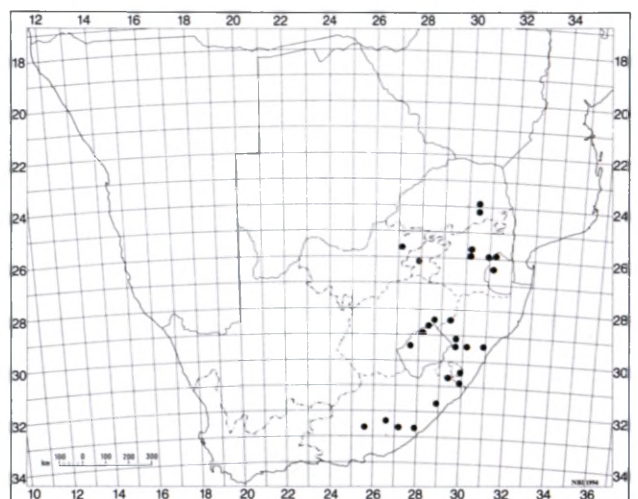
Native to USA, Texas and Oklahoma; widely introduced elsewhere in USA, in Italy and locally in South Africa on Van Staden's Pass (Figure 12); a noxious weed limited by self-incompatibility.

Vouchers: Theron 1837; Wells 3192.

2. **Gaura lindheimeri** Engelm. & A.Gray in Boston Journal of Natural History 5: 217 (1845). Type: from USA. Figure 13.

*G. filiformis* Small var. *munzii* Cory: 420 (1937). Type: from USA.

Robust clumped perennial herb, usually branching copiously from a heavy underground crown; stems erect or

FIGURE 11.—Distribution of *Epilobium salignum*.



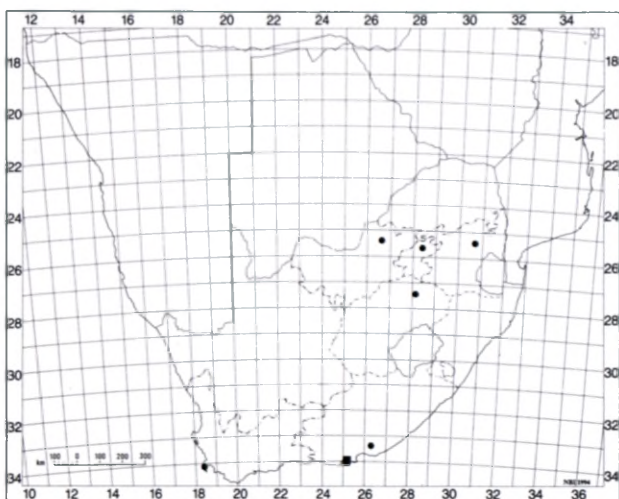


FIGURE 12.—Distribution of *Gaura sinuata*, ■, and *G. lindheimeri*, ●.

more often arching outward from crown to form a full, clumped plant 0.5–1.5 m tall; entire plant villous, inflorescence with a more or less dense admixture of glandular trichomes. *Leaves* very narrowly elliptic (to occasionally narrowly oblanceolate), 5–90 × 0.1–1.3 mm, coarsely and remotely serrate, occasionally subsinuately so. *Inflorescence* 100–800 mm long, well branched or simple; bracts narrowly to broadly elliptic, 4–11 × 1.5–6.0 mm. *Flowers* opening near sunrise. *Floral tube* 4–9 mm long. *Sepals* 8.5–17.0 × 1–2 mm. *Petals* white, fading to light or deep pink, 10.5–15.0 × 5–10 mm. *Capsule* 6–9 × 2.0–3.5 mm. *Seeds* 1–4, 2.3 × 1.0–1.5

mm, yellowish to light brown. Self-incompatible. *Gametic chromosome number*: n = 7.

Native to USA, Louisiana and Texas; widely cultivated and occasionally spontaneous; occurring in South Africa in Gauteng, Free State and the Western Cape (Figure 13).

Vouchers: Galpin 14525; Goldblatt 1436; Leach & Bayliss 12582.

5804000 OENOTHERA\*

*Oenothera* L., Species plantarum 346 (1753); L.: 163 (1754); Harv.: 505 (1862); Munz: 79 (1965); Schreiber: 5 (1967); P.H.Raven: 330 (1978); R.A.Dyer: 410 (1975). Type species: *O. biennis* L.

Annual, biennial, or perennial herbs. *Leaves* alternate, entire to pinnatifid. *Stipules* 0. *Flowers* actinomorphic, borne in axils of reduced leaves, often clustered near ends of stems, opening either near sunset or near sunrise and usually fading within a day. *Floral tube* present. *Sepals* 4, caducous. *Petals* 4, yellow, white or rose-purple, usually entire. *Stamens* 8; anthers linear. *Pollen* shed singly. *Stigma* deeply 4-lobed. *Ovary* with many pluriserial or uniserial ovules in each locule. *Capsule* stout, loculicidal. *Seeds* lacking hairs, free, usually brown. *Basic chromosome number*: x = 7.

Approximately 125 species, all native to North and South America, but widely naturalized in the Old World; 14 species recorded in southern Africa.

- 1a Petals white or rose-purple; flowers opening near sunrise or sunset; capsules evidently clavate:
  - 2a Petals rose-purple, 5–10 mm long; flowers opening near sunrise, diurnal ..... 13. *O. rosea*
  - 2b Petals white, fading purplish, 20–35 mm long; flowers opening near sunset, nocturnal ..... 14. *O. tetraptera*
- 1b Petals yellow; flowers opening near sunset; capsules not evidently clavate, sometimes slightly enlarged in upper third:
  - 3a Floral tube longer than 60 mm:
    - 4a Buds densely grey-strigillose; open flowers ± reaching apex of stem and mostly concentrated there; capsules sessile, broad at base; seeds sharply angular ..... 1. *O. jamesii*
    - 4b Buds villous; open flowers not reaching apex of stem, well spaced; capsules cylindrical; seeds rounded, not sharply angular:
      - 5a Plants not forming a basal rosette, softly villous; bracts longer than capsules they subtend; capsules ± enlarged in upper third ..... 8. *O. affinis*
      - 5b Plants forming a basal rosette, coarsely and densely villous; bracts shorter than capsules they subtend; capsules not enlarged above ..... 7. *O. longiflora*
  - 3b Floral tube shorter than 60 mm:
    - 6a Capsules broad at base; seeds sharply angular; open flowers ± reaching apex of stem:
      - 7a Petals 35–50 mm long ..... 3. *O. glazioviana*
      - 7b Petals 7–25 mm long:
        - 8a Floral tube 10–18 mm long; plant exclusively appressed pubescent (strigillose) throughout ..... 5. *O. villosa*
        - 8b Floral tube 20–50 mm long; plant glandular pubescent and with eglandular spreading hairs (villous):
          - 9a Tips of sepals subterminal, divergent; petals 7–20 mm long; tip of inflorescence often arched ..... 4. *O. parviflora*
          - 9b Tips of sepals terminal, erect; petals 10–25 mm long; tip of inflorescence erect ..... 2. *O. biennis*
      - 6b Capsules cylindrical or tapering at base; seeds rounded, not sharply angular; open flowers well-spaced down stem, not especially clustered above:
        - 10a Leaves usually deeply and coarsely toothed; buds curved upward ..... 11. *O. laciniata*
        - 10b Leaves with ± blunt, shallow teeth or entire to remotely sinuate-dentate; buds various:
          - 11a Petals 15–45 mm long:
            - 12a Stems prostrate or decumbent; plant canescent; mature buds curved upward; leaves entire to remotely sinuate-dentate ..... 12. *O. drummondii*
            - 12b Stems erect; plant ± strigillose, never canescent; mature buds erect; leaves serrate ..... 9. *O. stricta*
          - 11b Petals 3–12 mm long:
            - 13a Plants appearing glabrous to naked eye, but actually with very short erect hairs; bracts cuneate at base, as long as or longer than capsules they subtend; capsules 1.5–2.0 mm thick ..... 6. *O. indecora*
            - 13b Plants evidently erect-pubescent; bracts rounded at base, clearly shorter than capsules they subtend; sepals often flecked with dark reddish brown; capsules 2–3 mm thick ..... 10. *O. parodiana* subsp. *parodiana*

\*In collaboration with Werner Dietrich, University of Düsseldorf, and Warren Wagner, Smithsonian Institution, Washington DC.





FIGURE 13.—*Gaura lindheimeri* Engelm. & A.Gray. A, flowering branch,  $\times 0.4$ ; B, capsule, scale bar: 2 mm. Artist: Yevonn Wilson-Ramsey.

1. *Oenothera jamesii* Torr. & A.Gray, Flora of North America 1: 493 (1840); Munz: 131 (1965). Type: from Oklahoma or Texas.

Stout, erect winter annuals or biennials, simple or sparsely branched,  $\pm 1.0$ – $1.5$  m tall, forming a rosette; stems strigillose, with scattered longer subappressed hairs, red papillae few or 0. *Leaves*: rosette leaves 60–200 mm long; cauline leaves broadly lanceolate, conspicuously sinuate-serrulate, acuminate at apex, strigillose, 50–120  $\times$  20–35 mm; petioles 0–12 mm long. *Bracts* 10–50 mm long. *Floral tube* 80–130 mm long, strigillose and glandular-pubescent. *Sepals* 35–60 mm long, strigillose, with free tips 3–6 mm long. *Petals* 40–50 mm long, yellow. *Anthers* 12–22 mm long. *Capsule* 20–50  $\times$  6–10 mm, strigillose but with short fine and longer coarser hairs. *Seeds* sharply angled, 1.5–2.0 mm long. Outcrossing but self-compatible. *Chromosome number*:  $n = 7$  (7 bivalents or small rings at meiotic metaphase I).

Native to North America from Oklahoma and southern Kansas to northeastern Mexico. In southern Africa widespread in Northern Province, North-West, Gauteng and Mpumalanga and local in northern Cape, coastal KwaZulu-Natal and the Western and Eastern Cape (Figure 14). First recorded in 1926 at Welverdiend Station.

Vouchers: Codd 2756; Galpin 2585; Stadler s.n.

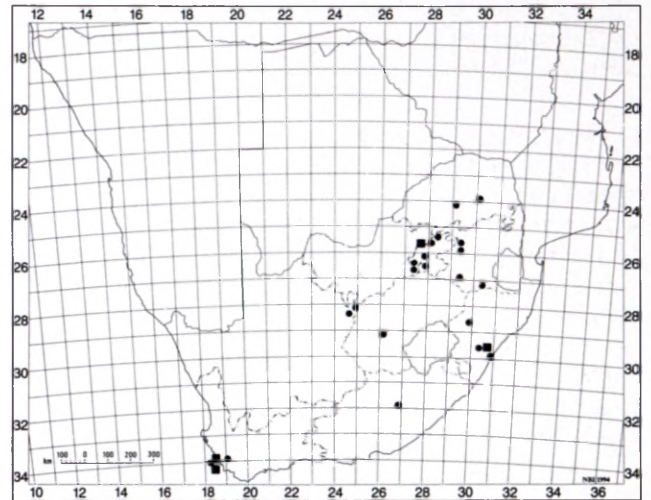


FIGURE 14.—Distribution of *Oenothera jamesii*, ●; and *O. biennis*, ■.

2. *Oenothera villosa* Thunb., Prodrum plantae capensium: 75 (1794); W.Dietr. & P.H.Raven: 382 (1976). Type: South Africa, Western Cape, without precise locality, Thunberg s.n. (UPS, hol.).

*O. biennis* L. sensu Harv.: 505 (1862) pro parte.

*O. strigosa* subsp. *canovirens* (Steele) Munz: 136 (1965). Type: from USA.

The African plants belong to subsp. *villosa*.

Biennial 50–200 mm tall, simple or branched plants, forming a rosette, exclusively greyish strigillose throughout, some of hairs arising from red papillae. *Cauline leaves* narrowly lanceolate, acute to subacuminate at apex, 70–150  $\times$  14–30 mm. *Bracts* 10–50 mm long. *Floral tube* 20–37 mm long, strigillose. *Sepals* 10–18 mm long, strigillose, free tips 1–3 mm long. *Petals* 8–15(–17) mm long, yellow, often ageing orange. *Anthers* 4–7 mm long. *Capsules* 18–43  $\times$  4–6 mm, strigillose. *Seeds* sharply angled, 1–2 mm long. Autogamous. *Chromosome number*:  $n = 7$  (ring of 14 at meiotic metaphase I).

Native of North America, first recorded from the Cape Peninsula by Thunberg in 1772–1775, and occasionally since (Figure 15).

Vouchers: Ecklon & Zeyher 1762; Esterhuysen s.n.; Salter 8895.

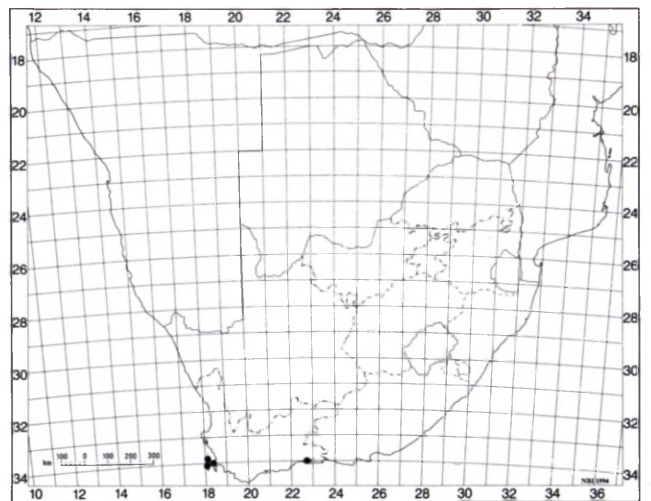


FIGURE 15.—Distribution of *Oenothera villosa*.



3. *Oenothera biennis* L., Species plantarum 346 (1753); non sensu Harv.: 505 (1862) vide *O. villosa*; Munz: 132 (1965). Type: from Europe.

Weedy biennial 0.3–2.0 m tall, simple or branched, forming a rosette; stems pubescent throughout with short appressed hairs (strigillose) and usually longer curved or spreading hairs, some arising from red papillae. *Cauline leaves* lanceolate, sinuate-denticulate, sharply acute to acuminate at apex, strigillose and with some longer hairs, 80–170 × 20–50 mm; petioles short or 0. *Bracts* 10–40 mm long. *Floral tube* 25–40 mm long, with some gland-tipped as well as non-glandular hairs. *Sepals* 8–28 mm long, pubescent as in floral tube, free tips terminal, erect, 1.5–3.0 mm long. *Petals* 10–25 mm long, yellow, generally aging old gold. *Anthers* 4–7 mm long. *Capsule* 14–40 × 3–6 mm, strigillose and villous to subglabrous. *Seeds* sharply angled, 1.2–1.8 mm long. Autogamous. *Chromosome number*:  $n = 7$  (ring of 14 or ring of 8 and ring of 6 at meiotic metaphase I).

Native of eastern USA and Canada. Local in southern Africa in Northern Province, North-West, Gauteng, Mpumalanga, Lesotho and northern Karoo (Figure 14). First recorded in 1910 at the Crocodile River (Ermelo District).

Vouchers: *Burt Davy 9311; Collins 9884; Werger 1330.*

4. *Oenothera glazioviana* Micheli, in *Flora brasiliensis* 13,2: 178 (1875). Type: from Rio de Janeiro, Brazil.

*O. erythrosepala* (Borbás) Borbás: 203 (1902); Borbás: 245 (1903); Munz: 130 (1965). *Onagra erythrosepala* Borbás: 203 (1902).

*O. lamarckiana* sensu auct., non Sér.

Erect, bushy biennial to short-lived perennial, 0.8–1.2 m tall, forming a rosette; stems ± densely crisp-puberulent and with numerous longer spreading hairs, many arising from red papillae. *Cauline leaves* broadly lanceolate to ovate-oblong, crinkled, obtuse to acute at apex, substriate, mostly 50–100 × 25–40 mm; petioles 0–20 mm long. *Bracts* 10–30(–50) mm long. *Floral tube* 35–50 mm long, glandular-pubescent and villous. *Sepals* 30–40 mm long, glandular-puberulent and villous, free tips 5–8 mm long. *Petals* 35–50 mm long, yellow. *Anthers* 10–12 mm long. *Capsule* 20–25(–30) × 5–6 mm, villous and glandular-puberulent. *Seeds* sharply angled, 1.3–1.7 mm long. Outcrossing but self-compatible. *Chromosome number*:  $n = 7$  (ring of 12 and 1 bivalent at meiotic metaphase I).

A species of garden origin, widely distributed in cultivation and as a naturalized plant in the Old World and North America; in southern Africa local throughout eastern southern Africa, although not in Swaziland, and as far south as Knysna (Figure 16). First recorded in 1891 in Eastern Cape.

Vouchers: *Dieterlen 633; Flanagan 723; Fourcade 2048; Strey 7285.*

5. *Oenothera parviflora* L., *Systema naturae* edn 10: 988 (1759); Munz: 121 (1965). Type: from North America or Europe.

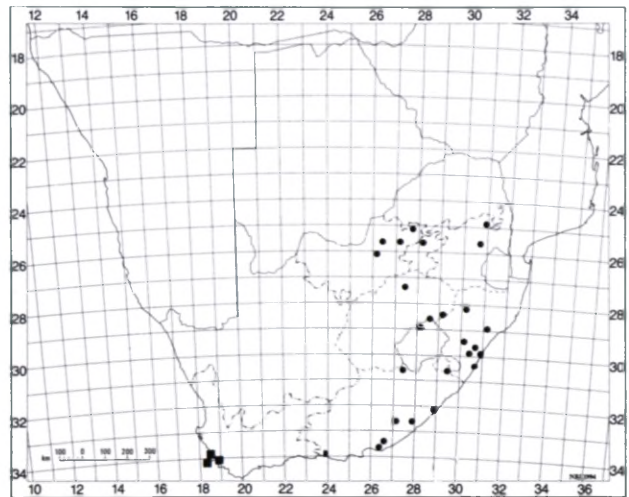


FIGURE 16.—Distribution of *Oenothera glazioviana*, ●; and *O. parviflora*, ■.

Weedy biennial 1.0–1.5 m tall, simple or branched, forming a rosette; stems subglabrous to strigillose-puberulent and with looser longer spreading hairs that may arise from red papillae. *Cauline leaves* narrowly lanceolate, shallowly denticulate, acute to subacuminate at apex, strigillose to subglabrous, 50–120 × 12–30 mm; petioles short. *Bracts* 10–30 mm or longer. *Floral tube* 20–40 mm long, subglabrous or strigillose or more or less glandular-pubescent and strigillose, often also with somewhat stiffer erect hairs. *Sepals* mostly 8–20 mm long, usually pubescent as in floral tube, sometimes almost shaggy-villous, free tips subterminal, divergent, 1–5 mm long. *Petals* 7–20 mm long, yellow, ageing somewhat orange. *Anthers* 4–7 mm long. *Capsule* 15–40 × 3–6 mm, ± scattered to densely villous and ± strigillose, only strigillose or almost glabrous. *Seeds* sharply angled, 1.2–1.8 mm long. Autogamous. *Chromosome number*:  $n = 7$  (ring of 14 at meiotic metaphase I).

Native of eastern USA and eastern Canada. Recorded in southern Africa locally in Western Cape between the Peninsula and Stellenbosch (Figure 16). First recorded in 1884.

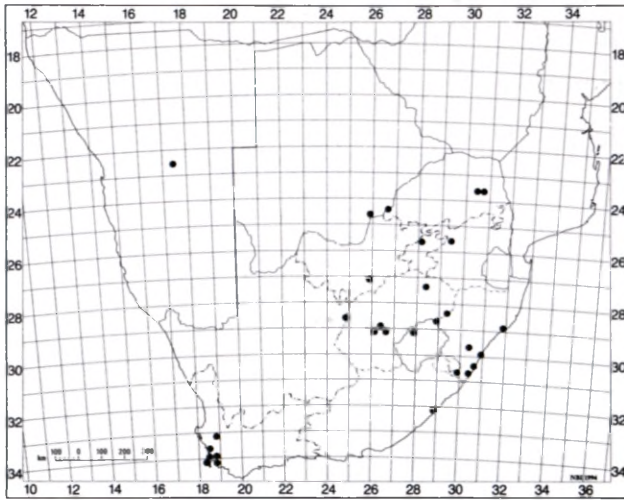
Vouchers: *Goldblatt 1435; Marloth 86; Purcell 442.*

6. *Oenothera indecora* Cambess. in *Saint-Hilaire, Flora brasiliensis meridionalis* 2: 268 (1830); Munz: 658 (1935); P.H.Raven: 332 (1978); W.Dietr.: 515 (1978). Type: from Brazil.

*O. indecora* subsp. *bonariensis* W.Dietr. 519 (1978). Type: from Argentina.

Erect annual with several branches, up to 600 mm tall from base, everywhere covered with fine, erect pubescence. *Leaves* 10–60 mm long, sinuate-dentate, lanceolate or narrowly ovate, sessile. *Inflorescence* erect, buds also erect; flowers borne in axils of much reduced leaves, opening near sunset. *Floral tube* 8–15 mm long. *Sepals* 5–6 mm long with slender free tips ± 1 mm long. *Petals* 3–6 mm long, bright yellow, fading reddish. *Anthers* ± 2 mm long; filaments 4–6 mm long. *Style* surrounded by anthers at anthesis; stigma with linear lobes 2–3 mm long. *Capsule* 15–22 × 1.5–2.0 mm, cylindrical, not winged, subsessile. *Seeds* 0.7–1.3 mm long, broadly el-



FIGURE 17.—Distribution of *Oenothera indecora*.

lipsoïd, indistinctly and shallowly pitted, light brown. Autogamous. *Chromosome number*:  $n = 7$  (7 bivalents or ring of 14 at meiotic metaphase I).

Native of South America. Scattered in weedy places and cultivated fields in eastern southern Africa, and also in Western Cape and central Namibia (Figure 17); not recorded in Swaziland or Lesotho. First recorded in 1918 on the Cape Peninsula, and only after 1948 elsewhere.

Vouchers: Parker 4849; Scheepers 270; Seydel 1965; Strey 7094.

7. *Oenothera longiflora* L., Mantissa plantarum 227 (1771); W.Dietr. 509 (1978). Type: cultivated in Sweden from seeds from Buenos Aires, Argentina.

The African plants belong to subsp. *longiflora*.

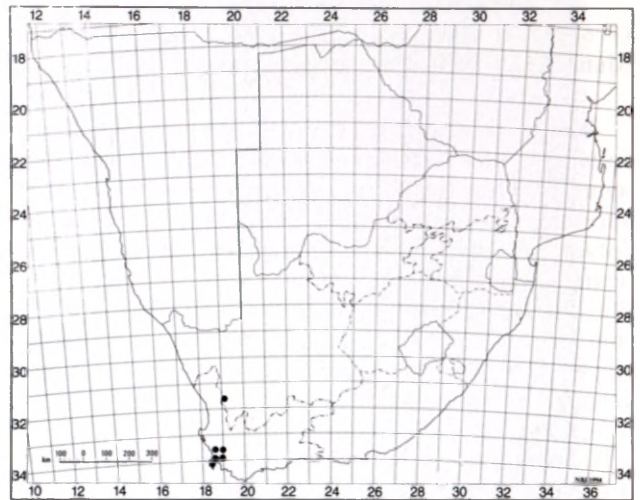
Annual or biennial, 400–800 mm tall, forming a rosette, simple or branched, densely long-villous and sparsely glandular-pubescent. *Cauline leaves* oblong to elliptic or narrowly ovate to ovate, short-acute, truncate to subcordate at base, sessile, 15–60 × 10–25 mm. *Bracts* 10–30 mm long, usually red along margins. *Floral tube* (65–)80–100 mm long, often streaked and flecked with dark red. *Sepals* 20–25 mm long, free tips 1–2 mm; apices erect or divergent. *Petals* 20–30 mm long, yellow, often with a red spot at base. *Anthers* 7–13 mm long. *Capsule* mostly curved and with 4 clearly distinct crenate valves at apex, 30–45 × 3–4 mm. *Seeds* ellipsoid to broadly ellipsoid, 1.5–2.0 mm long, brown. Autogamous. *Chromosome number*:  $n = 7$  (ring of 14 at meiotic metaphase I).

Native in southern Brazil, Uruguay and Argentina. Recorded in southern Africa only locally in Western Cape, from the Peninsula to Citrusdal (Figure 18). First recorded in 1835.

Vouchers: De Jongh sub Galpin 4932; Hanekom 1233.

8. *Oenothera affinis* Cambess. in Saint-Hilaire, Flora brasiliæ meridionalis 2: 269 (1830); W.Dietr.: 524 (1978). Type: from southern Brazil.

Erect annual, 0.4–1.5 m high, without a rosette, unbranched or ± well branched throughout, densely to

FIGURE 18.—Distribution of *Oenothera longiflora*.

sparsely long-villous, and densely glandular-pubescent. *Cauline leaves* cultrate to narrowly lanceolate, apex acute, acute to rounded at base, sessile, 50–150 × 5–15 mm. *Bracts* (30–)40–90 mm long. *Floral tube* 80–110(–130) mm long. *Sepals* 20–35 mm long, free tips 1.5–4.0 mm long, erect or divergent. *Petals* very broadly obovate, (15–)20–40 mm long, yellow. *Anthers* 10–14 mm long. *Capsule* 20–40(–50) × 3–4 mm, thicker in upper third, with 4 valves clearly separated at apex. *Seeds* elliptic in outline, 1.5–2.0 × 0.5–0.6 mm. Outcrossing but self-compatible. *Chromosome number*:  $n = 7$  (7 bivalents, ring of 14 or intermediate configurations at meiotic metaphase I).

Native in South America, and widely naturalized elsewhere. Reported in southern Africa, from coastal KwaZulu-Natal, Lesotho, Northern Province, North-West, Gauteng and Western Cape (Figure 19). First recorded in 1902 in the central Northern Province.

Vouchers: Adamson 3076; Burt Davy 1248; De Jongh sub Galpin 6529; Dieterlen 1352.

9. *Oenothera stricta* Ledeb. ex Link ('striata'), Enumeratio plantarum horti regii berolinensis altera 1: 377 (1821); Munz: 661 (1935), tab. 82, figs B1–B9; P.H.Raven: 330 (1978); W.Dietr. 536 (1978). Type: from Chile. Figure 20C–K.

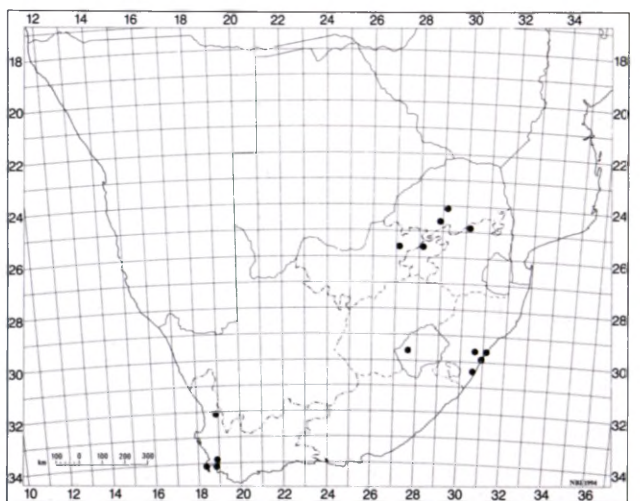
FIGURE 19.—Distribution of *Oenothera affinis*.





FIGURE 20.—A, B, *Oenothera rosea*: A, flowering branch,  $\times 0.5$ ; B, flower,  $\times 1.5$ . C–K, *O. stricta*: C, habit,  $\times 0.5$ ; D, flower bud,  $\times 1$ ; E, flower partly dissected,  $\times 1$ ; F, style and stigma,  $\times 2$ ; G, anther, two aspects,  $\times 2$ . H, I, fruit,  $\times 1$ : H, before dehiscence; I, after dehiscence. J, K, seed: J, ventral view,  $\times 12$ ; K, lateral view,  $\times 8$ . A, Drummond 4887; B, Brooke 233; C, Phipps 2844; D, H, I, Chase 2960; E–G, Munz 169; J, K, Goldsmith 126/68. Reproduced by kind permission of Flora Zambesiaca Managing Committee.

*O. nocturna* sensu Harv.: 506 (1862), non Jacq.; Burt Davy: 202 (1926). Type: from South Africa.

The African plants are subsp. *stricta*.

Annual or short-lived perennial, forming a rosette, often flowering in first year, with several stout stems 0.3–1.0 m tall from a taproot, subglabrous below, villous and glandular pubescent above. *Cauline leaves* 20–80 mm long, narrowly oblanceolate, sparsely serrulate, sessile. *Flowers* in axils of much reduced upper leaves. *Floral tube* 20–45 mm long, slender. *Sepals* 15–22 mm long, with free tips  $\pm 2$  mm long. *Petals* 15–32 mm long, bright yellow, fading reddish. *Anthers* 7.0–8.5 mm long. *Capsule* cylindric, 20–40  $\times$  3–4 mm,

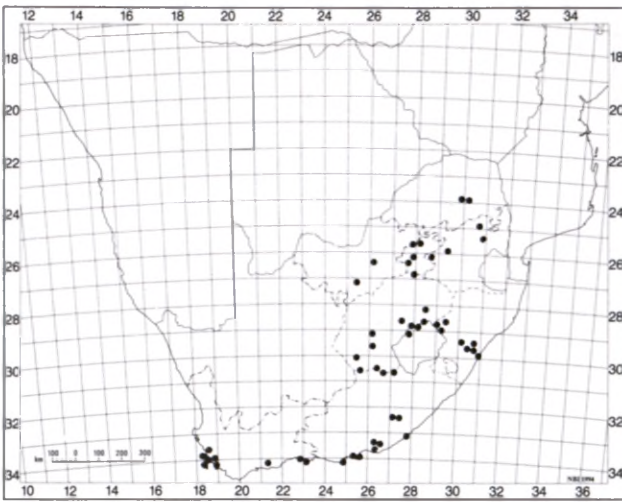
enlarged upward, not winged, sessile. *Seeds*  $\pm 1$ –5 mm long, brown, obovoid, in 1 row in each locule. *Autogamous*. *Chromosome number*:  $n = 7$  (ring of 14 at meiotic metaphase I).

Native to southern Chile and Argentina, widely naturalized elsewhere. Widespread in South Africa and Lesotho (Figure 21). First recorded in 1888, in Eastern Cape.

Vouchers: Dieterlen 169; Galpin 365; Leendertz 412; Parker 4391.

10. *Oenothera parodiana* Munz, Physis 11: 283 (1933); W.Dietr.: 564 (1978). Type: from Argentina, Prov. Buenos Aires.



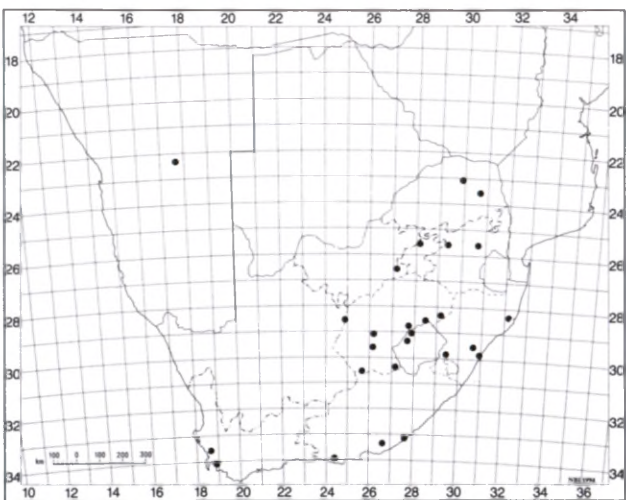
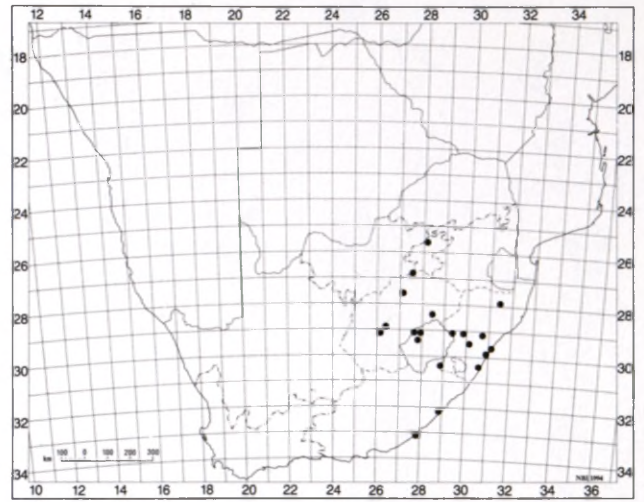
FIGURE 21.—Distribution of *Oenothera stricta*.

The African plants are subsp. *parodiana*.

Erect or somewhat decumbent annual or biennial, 300–700 mm high, forming a rosette, main stem simple or branched, obliquely ascending or arching side branches arising from rosette, densely to sparsely long- and short-villous and glandular-pubescent, or densely to sparsely villous and glandular-pubescent. *Cauline leaves* narrowly oblong to lanceolate or oblanceolate, acute, rounded to truncate at base, sessile, 25–150 × 5–10 mm. *Bracts* 10–20 mm long. *Floral tube* 10–20 mm long, sometimes flecked and streaked with red. *Sepals* 5–9 mm long, often flecked with red, free tips 1.0–1.5 mm long, erect or divergent. *Petals* 7–12 mm long, yellow. *Anthers* 3–8 mm long. *Capsule* 20–30 × 2.5–5.0 mm thick, valves often clearly separated at end. *Seeds* ellipsoid, 1.1–1.5 × 0.5–0.8 mm. Autogamous. *Chromosome number*:  $n = 7$  (ring of 14 at meiotic metaphase I).

Native in South America, from southern Brazil to Argentina. In southern Africa, common in KwaZulu-Natal, Free State, Northern Province, North-West, Gauteng and Mpumalanga, and apparently local in Eastern Cape, southern Western Cape, Lesotho, and central Namibia (Figure 22). First recorded in 1909 in Mpumalanga, but becoming common only after 1940.

Vouchers: *Leendertz* 9202; *Ruch* 2328; *Seydel* 2686; *Ward* 6192.

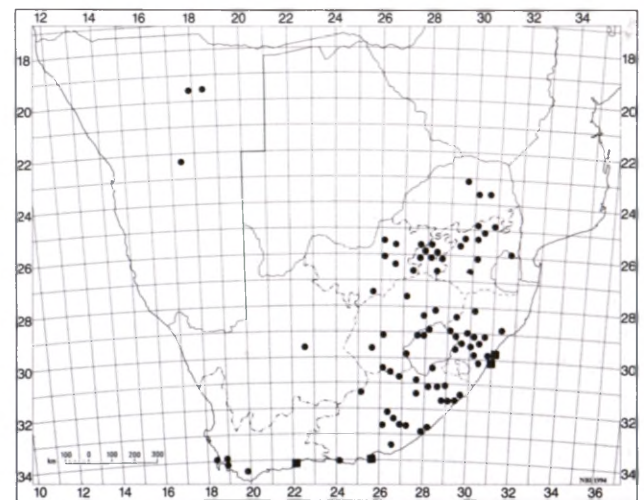
FIGURE 22.—Distribution of *Oenothera parodiana*.FIGURE 23.—Distribution of *Oenothera laciniata*.

11. *Oenothera laciniata* Hill, The complete vegetable system, edn. 1: 12, Appendix: 64, t. 10–70 (1767); Hill: 172, t. 6 (1768). Munz: 654 (1935); P.H.Raven: 330 (1978). Type from seeds obtained near Charleston, S Carolina.

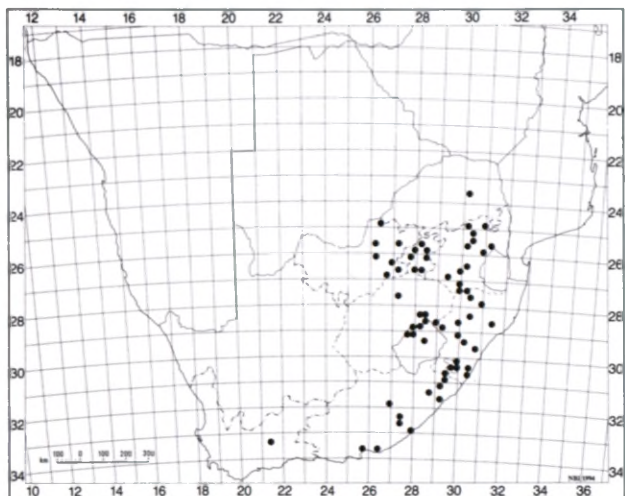
Erect, often rank, annual, not forming a rosette, usually with many branches from base, these often decumbent and up to 0.4 m long, strigillose and densely villous above, especially in the inflorescence, also glandular-pubescent. *Cauline leaves* 10–80 mm long, sinuate-dentate or sinuate-pinnatifid, more rarely subentire, lanceolate, lower ones petiolate, upper ones sessile. *Flowers* borne in axils of much reduced leaves. *Floral tube* 12–35 mm long. *Sepals* 5–15 mm long, with slender free tips 0.5–3.0 mm long. *Petals* 5–22 mm long, bright yellow, fading reddish. *Anthers* 2–5 mm long. *Capsule* 15–50 × 2–4 mm, cylindrical, not winged, subsessile. *Seeds* ± 1 mm long, obovoid, coarsely and conspicuously pitted, light brown. Autogamous. *Chromosome number*:  $n = 7$  (ring of 14 at meiotic metaphase I).

Native in eastern N America. Widespread in eastern southern Africa, although not recorded from Swaziland, and the lowveld of Northern Province and Mpumalanga (Figure 23). First recorded in 1905 in KwaZulu-Natal.

Vouchers: *Gordon Gray* 863; *Jacot Guillarmod* 4717; *Pont* 669; *Ward* 3763.

FIGURE 24.—Distribution of *Oenothera rosea*, ●; and *O. drummondii*, ■.



FIGURE 25.—Distribution of *Oenothera tetraptera*.

12. *Oenothera drummondii* Hook. in Curtis' Botanical Magazine 61: t. 3361 (1834); Munz: 107 (1965). Type: from Texas.

The African plants are subsp. *drummondii*.

Suffrutescent perennial not forming a rosette, with prostrate or decumbent, mostly simple stems 200–500 mm long, densely canescent-pubescent throughout. *Cauline leaves* oblanceolate or more often oblong-ovate to obovate, sessile or nearly so, densely appressed-pubescent, 10–40 mm long, often with one pair or more of rounded teeth or lobes near base, not much reduced up the stem. *Flowers* borne in axils of leaves. *Floral tube* 25–50 mm long, densely villous. *Sepals* 20–30 mm long, commonly reflexed in pairs at anthesis, free tips divergent, 1–3 mm long. *Petals* yellow, turning reddish, 25–45 mm long. *Anthers* 7–12 mm long. *Capsule* sessile, cylindrical, 25–55 mm long, about 3 mm thick, often curved, villous. *Seeds* ellipsoid to broadly ellipsoid, pitted, 1.0–1.2 mm long, brown. Outcrossing, but self-compatible. *Chromosome number*:  $n = 7$  (usually 7 bivalents at meiotic metaphase I).

Native in coastal North America from S Carolina to eastern Mexico, with a second subspecies in lower California. Naturalized locally in southern Africa north of Durban and in the Port Elizabeth area (Figure 23). First reported in 1912.

Vouchers: *Paterson 2343; Urton 316; Watmough 492.*

13. *Oenothera rosea* L'Hér. ex Aiton, Hortus kewensis edn 1, 2: 3 (1789); Burt Davy: 202 (1926); Schreiber: 5 (1967); P.H.Raven: 332 (1978). Type grown from seeds collected in Peru. Figure 20A, B.

Weedy perennial, not forming a rosette, often blooming in first year, 200–500 mm high, with numerous stems from a somewhat woody caudex, strigillose throughout, more densely so in inflorescence. *Cauline leaves* 20–50 mm long, oblanceolate to narrowly obovate, entire to somewhat pinnatifid at base of blade, acute, base narrowly cuneate; petioles 4–30 mm long, distinct. *Flowers* borne in axils of much reduced leaves. *Floral tube* 4–8 mm long, slender. *Sepals* 5–8 mm long, commonly co-

herent and deflexed to one side in anthesis. *Petals* 4.5–10.0 mm long, bright purplish rose. *Anthers* 2.5–4.0 mm long. *Capsule* clavate, 8–10 × 3–4 mm, strigillose, narrowly winged, base passing gradually into hollow, ribbed stipe 5–20 mm long. *Seeds* oblong-ovoid, ± 0.6 mm long. Autogamous. *Chromosome number*:  $n = 7$  (ring of 14 at meiotic metaphase I).

Weed of American origin, now widespread in all warm parts of the world. Recorded throughout South Africa, Swaziland and Lesotho, and in extreme southern and northern Namibia (Figure 24). Introduced in the 1890's.

Vouchers: *Burt Davy 1039; Dieterlen 1317; Flanagan 589; Salter 8902.*

14. *Oenothera tetraptera* Cav., Icones et descriptiones plantarum 3: 40, t. 279 (1796); Burt Davy: 202 (1926); P.H.Raven: 332 (1978). Type: from Mexico.

Weedy perennial, not forming a rosette, often flowering in first year, 150–400 mm high, with numerous stems from a somewhat woody caudex, covered with long spreading hairs throughout, and also with shorter appressed hairs. *Cauline leaves* 30–100 mm long, oblanceolate or elliptic, irregularly sinuate-pinnatifid in outline to entire, much reduced above; petioles mostly shorter than 10 mm. *Flowers* borne in axils of much reduced leaves. *Floral tube* 8–10 mm long. *Sepals* 20–30 mm long, usually coherent and deflexed to one side in anthesis. *Petals* 25–35 mm long to 14 mm long late in season, white, fading purplish. *Anthers* 5–6 mm long. *Capsule* clavate, 10–15 × 6–8 mm, with prominent wings 2–3 mm wide, base gradually narrowed into a hollow, ribbed stipe 5–25 mm long. *Seeds* obovoid, ± 1.3 mm long. Self-compatible. *Chromosome number*:  $n = 7$  (7 bivalents at meiotic metaphase I).

Native in the New World from Texas to northern South America. In southern Africa common in the Northern Province, North-West, Gaunteng, Mpumalanga, KwaZulu-Natal, Free State, and Lesotho, and extending into Eastern Province (Figure 25). First recorded in 1883 at Queenstown.

Vouchers: *Dieterlen 327; Galpin 13215; Schlechter 6416; Tyson 1994.*

## REFERENCES

- AITON, W. 1789. *Hortus kewensis* edn 1, 2. George Nicol, London.
- ADAMSON, R.S. 1950. Oenotheraceae. In R.S. Adamson & T.M. Salter, *Flora of the Cape Peninsula*: 605–607. Juta, Cape Town.
- ANDREWS, F.W. 1950. *The flowering plants of the Anglo-Egyptian Sudan* 1: 145. Arbroath, Scotland.
- BAKER, J.G. 1886. Further contributions to the flora of central Madagascar. *Journal of the Linnean Society, Botany* 21: 345.
- BORBÁS, V. VON. 1902. *Kerteszet Lapok* 1902: 203.
- BORBÁS, V. VON. 1903. *Magyar Botanikai Lapok* 2: 245.
- BRENAN, J.P.M. 1953a. Notes on African Onagraceae and Trapaceae. *Kew Bulletin* 1953: 163–172.
- BRENAN, J.P.M. 1953b. Onagraceae. In W.B. Turrill & E. Milne-Redhead, *Flora of tropical East Africa*: 12. Crown Agents for the Colonies, London.
- BUCHANAN-HAMILTON, F. 1824. A commentary on the second part of the Hortus Malabaricus. *Transactions of the Linnean Society* 14.
- BURT DAVY, J. 1926. *A manual of the flowering plants and ferns of the Transvaal with Swaziland*. Longmans, Green, London.



- CAVANILLES, A.J. 1796. *Icones et descriptiones plantarum* 3: 40, t. 279.
- COMPTON, R.H. 1967. Plantae novae africanae, series 23. *Journal of South African Botany* 33: 297.
- CORY, V.L. 1937. Some new plants from Texas. *Rhodora* 39: 417–423.
- DE CANDOLLE, A.P. 1828. *Prodromus* 3: 1–683.
- DESROUSSEAUX, L.A.J. 1792. In J.A. Lamarck, *Encyclopédie Méthodique* 3. Panckoucke, Paris.
- DIETRICH, W. 1978 (1977). The South American species of *Oenothera* sect. *Oenothera* (*Raimannia*, *Renneria*; Onagraceae). *Annals of the Missouri Botanical Garden* 64: 425–626.
- DIETRICH, W. & RAVEN, P.H. 1976. An earlier name for *Oenothera strigosa* (Onagraceae). *Annals of the Missouri Botanical Garden* 63: 382, 383.
- DIETRICH, W., WAGNER, W.H. & RAVEN, P.H. 1997. Systematics of *Oenothera* section *Oenothera* (Onagraceae). *Systematic Botany Monographs* 50: 1–234.
- DON, G. 1832. *A general history of dichlamydeous plants* 2. Rivington, London.
- DYER, R. A. 1975. *Genera of southern African flowering plants* Vol. 1. Botanical Research Institute, Pretoria.
- ELLIOTT, S. 1817. *A sketch of the botany of South Carolina and Georgia* 1: 211. Schenk, Charleston.
- ENGELMANN, G. & GRAY, A. 1845. Plantae Lindheimerianae. *Boston Journal of Natural History* 5: 217.
- ENGLER, A. 1921. Vegetation der Erde 9. *Die Pflanzenwelt Afrikas* 3,2: 773. Wilhelm Engelmann, Leipzig.
- FERNANDES, R. & FERNANDES, A. 1970. Onagraceae. *Conspectus florum angolensis* 4: 190. Junta de Investigações do Ultramar.
- FORSKÅL, P. 1775. *Flora aegyptiaco-arabica*. i-cxxvi, 1–219. Möller, Copenhagen.
- GREENE, E.L. 1891. *Flora franciscana* 1: 227. Curbey, San Francisco.
- GRISEBACH, A.H.R. 1852. *Botanische Zeitung* 10.
- GUILLEMIN, A. & PERROTTET, G.S. 1833. *Flora senegambiae tentamen*: 292. Treuttel & Wurtz, Paris.
- GILG, E.F. 1903. Onothenaceae. In O. Warburg, *Kunene-Sambesi Expedition*. Warburg, Berlin.
- HARA, K. 1953. *Ludwigia* versus *Jussiaea*. *Journal of Japanese Botany* 28: 289–294.
- HARVEY, W. H. 1862. Onagrariaceae. In W.H. Harvey & O.W. Sonder, *Flora capensis* 2: 503–507. Hodges, Smith, Dublin.
- HAUSSKNECHT, H.C. 1879. *Epilobia nova*. *Oesterreichische Botanische Zeitung* 29: 90.
- HAUSSKNECHT, H.C. 1880. *Abhandlungen der Naturwissenschaftlichen Vereine zu Bremen* 7: 19.
- HAUSSKNECHT, H.C. 1884. *Monographie der Gattung Epilobium*. Gustav Fischer, Jena.
- HIERN, W. P. 1898. *Catalogue of the African plants collected by Dr. Friedrich Welwitsch, Dicotyledons* 1: 378. Trustees of the British Museum, London.
- HILL, J. 1767. *The complete vegetable system*, edn. 1: 12, Appendix: 64, t.10–70. Hill, London.
- HILL, J. 1768. *Hortus kewensis*: 172, t. 6. Baldwin & Ridley, London.
- HOCHSTETTER, W. 1844. *Flora* 27: 425.
- HOOKER, W.J. 1834. *Oenothera drummondii*. *Curtis' Botanical Magazine* 61: t. 3361.
- JACQUIN, N.J. VON. 1760. *Enumeratio systematica plantarum*: 1–41. Theodor Haak, Leiden.
- JEHANDIEZ, E. & MAIRE, R. 1932. *Catalogue des plantes du Maroc* 2: 515. Alger.
- KUNTH, C.S. 1823. *Jussiaea pilosa*. In A. von Humboldt, A.J. Bonpland, & C.S. Kunth, *Nova genera et species plantarum* 6: 101. Sumptibus Librariae, Paris.
- KUNTZE, O. 1891. *Revisio generum plantarum*: 251. Arthur Felix, Leipzig.
- LAMARCK, J.B.A.P.M. DE. 1789. *Jussiaea angustifolia*. *Encyclopédie méthodique* 3: 331. Paris.
- LÉVEILLÉ, A.A.H. 1907. *Epilobium schinzii*. *Feddes Repertorium* 4: 225.
- LÉVEILLÉ, A.A.H. 1917. Nouveautés de Madagascar. *Bulletin de l'Académie Internationale de Géographie, Botanique* 27: 3.
- LINK, J.H.F. 1821. *Enumeratio plantarum horti regii berolinensis altera*: 377. Reimer, Berlin.
- LINNAEUS, C. 1753. *Species plantarum*. Salvius, Stockholm.
- LINNAEUS, C. 1754. *Genera plantarum* edn 5. Salvius, Stockholm.
- LINNAEUS, C. 1759. *Systema naturae*, edn 10.
- LINNAEUS, C. 1771. *Mantissa plantarum altera*: 227.
- MICHAUX, F.A. 1803. *Flora boreali-americana* 1. Crapelet, Paris.
- MICHELI, M. 1875. Onagraceae. In C.F.P. von Martius, *Flora brasiliensis* 13: 144–182.
- MOGG, A.O.D. 1958. *Jussiaea pilosa*. In W. Macnae & R. Kalk. *A natural history of Inhaca Island*: 150. University of the Witwatersrand Press, Johannesburg.
- MUNZ, P.A. 1933. Las Onagráceas de la Argentina. *Physis* 11: 283.
- MUNZ, P.A. 1935. Studies in Onagraceae. IX. The subgenus *Raimannia*. *American Journal of Botany* 22: 658.
- MUNZ, P.A. 1965. Onagraceae. *North American Flora*, ser. 2, 5: 1–231. New York Botanical Garden, New York.
- NUTTALL, T. 1818. *The genera of North American plants*. Nuttall, Philadelphia.
- PERRIER DE LA BÂTHIE, J.M.H.A. 1947. *Jussiaea didymosperma*. *Notululae systematicae* 13: 148.
- PERRIER DE LA BÂTHIE, J.M.H.A. 1950. Onothenacées. *Flore de Madagascar et des Comores*: 20. Muséum National d'Histoire Naturelle, Paris.
- PETERS, W.C.H. 1861. *Naturwissenschaftliche Reise nach Mossambique, Botanik* 6,2: 70. Georg Reimer, Berlin.
- QUÉZEL, P. 1957. Plantes nouvelles du Tibesti. *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord* 48.
- RAVEN, P.H. 1962. New combinations in *Ludwigia*. *Kew Bulletin* 15: 476.
- RAVEN, P.H. 1963. The Old World species of *Ludwigia* (including *Jussiaea*) with a synopsis of the genus (Onagraceae). *Reinwardtia* 6: 327–427.
- RAVEN, P.H. 1967. A revision of the African species of *Epilobium* (Onagraceae). *Bothalia* 9: 309–333.
- RAVEN, P.H. 1978. Onagraceae. In E. Launert, *Flora zambesiaca* 4: 329–346. Flora Zambesiaca Managing Committee.
- RAVEN, P.H. & TAI, W. 1979. Observations of chromosomes in *Ludwigia* (Onagraceae). *Annals of the Missouri Botanical Garden* 66: 862–879.
- RICHARD, A. 1848. *Tentamen florum abyssinicae* 1: 274. Bertrand, Paris.
- ROSS, J. 1972. The flora of Natal. *Memoirs of the Botanical Survey of South Africa* No. 39.
- SAINT-HILAIRE, A.F.C.P. 1830. *Flora brasiliae meridionalis* 2: 268. Belin, Paris.
- SCHREIBER, A. 1967. Onagraceae. In H. Merxmüller, *Prodromus einer Flora von Südwestafrika*. Cramer, Lehre.
- SPACH, E. 1835a. *Histoire naturelle des végétaux* 4. Librairie encyclopédique de Roret, Paris.
- SPACH, E. 1835b. Synopsis monographiae Onagrearum. *Nouvelles Annales du Muséum d'Histoire Naturelle*, 4 sér. 2: 325, 381.
- SPACH, E. 1835c. Onagrearum novarum vel minus notarum descriptiones. *Nouvelles Annales du Muséum d'Histoire Naturelles*, 4 sér. 2: 170, 283.
- TORREY, J. & GRAY, A. 1840. *Flora of North America* 1: 493.
- TROCHAIN, J.-L. 1940. Contribution à l'étude de la végétation du Sénégal. *Mémoires de l'Institut Français d'Afrique Noir* 2: 386.
- THUNBERG, C.P. 1794. *Prodromus plantae capensium*: 75. Edman, Uppsala.
- VENTENAT, P. 1802. *Description des plantes nouvelles et peu connues*: t. 90. Paris.
- WILLDENOW, C.L. 1799. *Caroli a Linné Species plantarum* 2: 575. Edn 4. Nauk, Berlin.



## INDEX TO TAXA

- Epilobium* L., 153  
*adnatum* Griseb., 154  
*benguellense* Welw. ex Hiern, 155  
*biforme* Hausskn., 154  
*bojeri* Hausskn., 154  
*capense* Buch. ex Hochst., 154  
*flavescens* E.Mey. ex Harv., 154  
*hirsutum* L., 153  
*jonathum* Hausskn., 154  
*karsteniae* Compton, 154  
*madagascariense* H.Lév., 155  
*mirei* Quézel, 153  
*mundtii* Hausskn., 155  
*natalense* Hausskn., 155  
*neriophyllum* Hausskn., 155  
*oliganthum* Baker, 155  
*perrieri* H.Lév., 155  
*salignum* Hausskn., 154  
*schinzii* H.Lév., 155  
*tetragonum* L., 154  
    subsp. *adnatum* (Griseb.) Maire, 154  
    subsp. *benguellense* (Welw. ex Hiern) Engl., 155  
    subsp. *benguellense* var. *welwitschii* Engl., 155  
    subsp. *tetragonum* P.H.Raven, 154  
*tomentosum* Vent., 153  
*Gaura* L., 156  
*filiformis* Small var. *munzii* Cory, 156  
*lindheimeri* Engelm. & A.Gray, 156  
*sinuata* Nutt. ex Ser. in DC., 156  
*Gauridium* Spach, 156  
*Isnardia*  
*discolor* Klotzsch, 150  
*palustris* L., 153  
*Jussiaea* L., 149  
*abyssinica* (A.Rich.) Dandy & Brenan, 152  
*alternifolia* E.Mey. ex Peters, 152  
*altissima* Perr. ex DC., 150  
*angustifolia* Lam., 150  
*didymosperma* H.Perrier, 150  
*diffusa* Forssk., 152  
    subsp. *albiflora* H.Perrier, 152  
*erecta* L., 150  
*fluitans* Hochst., 152  
*leptocarpa* Nutt., 151  
*linearis* Hochst., 150  
*linearis* Willd., 150  
*octonervia* forma *sessiliflora* Micheli, 150  
*pilosa* Kunth, 151  
*pulvinaris* (Gilg) Brenan, 150  
*repens* var. *diffusa* (Forssk.) Brenan, 152  
*seminuda* H.Perrier, 151  
*senegalensis* (DC.) Brenan, 150  
*stolonifera* Guill. & Perr., 152  
*suffruticosa* L., 150  
    var. *brevisepala* Brenan, 150  
*Jussiaea* (cont.)  
    var. *linearis* (Willd.) Oliv. ex Kuntze, 150  
key:  
*Epilobium* spp., 153  
*Gaura* spp., 156  
*Ludwigia* spp., 149  
*Oenothera* spp., 157  
*Onagraceae* genera, 149  
*Ludwigia* L., 149  
*abyssinica* A.Rich., 152  
*adscendens* (L.) Hara  
    subsp. *diffusa* (Forssk.) P.H.Raven, 152  
    var. *diffusa* (Forssk.) Hara, 152  
*diffusa* (Forssk.) Greene, 152  
*erecta* (L.) Hara, 150  
*jussiaeoides* sensu Harv., 152  
*leptocarpa* (Nutt.) Hara, 151  
*octovalvis* (Jacq.) P.H.Raven, 150  
    subsp. *brevisepala* (Brenan) P.H.Raven, 150  
    subsp. *sessiliflora* (Micheli) P.H.Raven, 150  
*palustris* (L.) Elliott, 153  
*perennis* L., 149  
*polycarpa* Short & Peter ex Torr. & Gray, 149  
*pulvinaris* Gilg, 150  
    subsp. *lobayensis* P.H.Raven, 150  
*senegalensis* (DC.) Troch., 150  
*stenorrhapha* (Brenan) Hara subsp. *macrocephala* (Brenan) P.H.Raven, 149  
*stolonifera* (Guill. & Perr.) P.H.Raven, 152  
*suffruticosa* Walter, 150  
*Oenothera* L., 157  
*affinis* Cambess., 160  
*biennis* L., 159  
*biennis* L. sensu Harv., 158  
*drummondii* Hook., 163  
*erythrosepala* (Borbás) Borbás, 159  
*glazioviana* Micheli, 159  
*indecora* Cambess., 159  
    subsp. *bonariensis* W.Dietr., 159  
*jamesii* Torr. & A.Gray, 158  
*laciniata* Hill, 162  
*lamarckiana* sensu auct., non Sér., 159  
*longiflora* L., 160  
*nocturna* sensu Harv., 161  
*octovalvis* Jacq., 150  
*parodiana* Munz, 161  
*parviflora* L., 159  
*rosea* L'Hér. ex Aiton, 163  
*stricta* Ledeb. ex Link, 160  
*strigosa* subsp. *canovirens* (Steele) Munz, 158  
*tetraptera* Cav., 163  
*villosa* Thunb., 158  
*Onagra erythrosepala* Borbás, 159  
*Prieurea senegalensis* DC., 150  
*Schizocarya* Spach, 156