



Flora of Panama. Part IV. Family 84. Oxalidaceae

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FLORA OF PANAMA¹

BY ROBERT E. WOODSON, JR. AND ROBERT W. SCHERY
AND COLLABORATORS

Part IV

FAMILY 84. OXALIDACEAE

ALICIA LOURTEIG²

Trees, shrubs or herbs. Leaves alternate, subopposite or apparently basal, 1–multipinnate; stipules absent or connate to the petiole. *Inflorescences* axillary or cauliflorous, bifid or umbelliform cymes, rarely solitary flowers, or panicles of cymes. *Flowers* actinomorphic, hermaphrodite, sometimes cleistogamous; calyx 5-partite, imbricate; petals 5, hypogynous, free or connate near the middle, contorted, the upper part enlarged, white, yellowish to orange, or pink to violaceous, the base clawed; stamens 10 (5 + 5), hypogynous, connate or almost free, sometimes only 5 bearing anthers, the anthers ovoid, 2-locular, opening lengthwise; ovary superior, 5-carpellate, generally 5-lobed, 5-locular, the carpels with 2–15 ovules, the ovules axile, pendulous, the styles 5, free, persistent, the stigma shortly bifid or 2-capitate. *Fruit* a 5-lobed capsule or berry, 5-locular, the calyx and styles persistent, the dehiscence loculicidal; seeds often projected by an elastic tegument, the endosperm fleshy, the embryo straight.

The Oxalidaceae is a family of 6 genera and about 950 species distributed worldwide from tropical to cold regions. *Dapania* and *Sarcotheca* occur in the Old World, *Oxalis* is cosmopolitan, *Averrhoa* is mostly cultivated in tropical regions, *Biophytum* occurs in tropical regions and *Hypseocharis* is endemic to the tropical Andes. Only three genera are represented in the flora of Panama, one of which is cultivated.

- a. Trees; leaves imparipinnate; fruit an indehiscent fleshy berry 1. *Averrhoa*
- aa. Small shrubs or herbs; fruit a dehiscent capsule.
 - b. Leaves multifoliolate, the last foliole reduced to a mucro or bristle; capsules loculicidal in a radiate form, the carpels after dehiscence attached to the axis only at the base 2. *Biophytum*
 - bb. Leaves 3-foliolate; capsules loculicidal by longitudinal slits, the carpels after dehiscence attached along their full length to the central axis 3. *Oxalis*

Literature:

- Lourteig, A. 1975. Oxalidaceae extra-austroamericanae. I. *Oxalis* L. Sectio *Thamnoxys* Planchon. *Phytologia* 29: 449–471.
- . 1979. Oxalidaceae extra-austroamericanae. II. *Oxalis* L. Sectio *Corniculatae* DC. *Phytologia* 42: 57–198.

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1. AVERRHUA

Averrhoa L., Sp. Pl. 428. 1753; Gen. Pl. ed. 5. 196. 1754. TYPE: *A. bilimbi* L.

Carambola Adans., Fam. Pl. 2: 508. 1763.

Oxynis Noronha, Verh. Batav. Gen. 5: Art. 4. 13. 1790.

Small to large branched *trees*. *Leaves* imparipinnate. *Inflorescences* of cymes united in racemes, then in fascicles or pseudopanicles, axillary or cauliflorous; bracts and bracteoles subulate, caducous. *Flowers* heterostylous; sepals shortly connate at the base, imbricate; petals hypogynous, contorted, free or connate near the middle; stamens 10 (5 + 5) or 5 fertile and 5 staminodes; ovary 5-lobed, the carpels 2–7 ovuled. *Berries* indehiscent; seeds 2–several in each carpel, the endosperm fleshy, the outer tegument present or absent.

- a. Leaves 7–20 jugate, pseudoverticillate at the apex of the branches; petals 10–20 cm long, purplish, glabrous inside; fertile stamens 10; berry oblong-cylindric, slightly lobed to smooth; seed without outer tegument 1. *A. bilimbi*
- aa. Leaves 3–8 jugate, distributed along the branches; petals to 9 mm long, violaceous, the borders white, minutely glandular inside; fertile stamens 5; berry ovoid, asymmetric, deeply 5-lobed; seeds with outer tegument 2. *A. carambola*

1. **Averrhoa bilimbi** L., Sp. Pl. 428. 1753. TYPE: Ceylon, *Hermann* ex herb. Banks no. 177, 1672–1677 (BM).

Tree to 15 m tall, 30 cm diam.; branches ascending, new branches and rachis densely yellow or rusty tomentose. *Leaves* pseudoverticillate at the top of the branches, 7–20 jugate, ovate to 65 cm long; leaflets alike, discolorous, oblong or elliptical, asymmetrical, 2.5–15 cm long, 1–5 cm wide, the lower leaflets smaller, 1–2 cm long 1–1.5 cm wide, acute or acuminate with a mucro 2 mm long, the base rounded or subcuneate, softly pubescent on both sides, more so beneath and above on the midrib; petiolules fleshy, tomentose; petiole pubescent, to 17 cm long, enlarged at the base. *Inflorescences* axillary or often cauliflorous on aborted branches, sometimes even on the lower part of the trunk, of cymes forming racemes or panicles, 15–20-flowered, or of solitary flowers, pubescent and glandular; bracts ca. 4 mm long, bracteoles 1.5–2 mm long, both subulate, densely tomentose; pedicels 4–20 mm long, articulate near the middle. *Flowers* with the sepals 5–2.5 mm long, 1.5–3 mm wide, ovate to elliptical, asymmetrical, acute, mucronate, one internal sepal oblong and obtuse, pubescence appressed and glandular inside and out, green yellow to purplish; petals purplish, free or sometimes connate near the middle, linear spatulate, 10–20 mm long, 2.5–4 mm wide, clawed, caducous, apically with a short caducous cilium and minute glandular hairs; stamens 10, nearly free, glabrous, the longer 10 mm and the shorter 4 mm long, the anthers suborbicular, the connective conspicuous; pistils mostly mesostylous, 7.5–12 mm long, the ovary cylindrical, 5-lobate, 4–7.5 mm long, acute, lengthened into the styles, the styles cylindrical, ca. 2 mm long, 2-lobed or truncate, densely appressed pilose, the hairs yellow, straight, ascending, the stigma inconspicuous, liguliform or subulate, the carpels with (1–3–)4–7 ovules. *Berry* oblong, to 7.5 cm long, 3.5 cm in diam., 5-lobate or smooth, in transverse section subcircular or pentagonal, the base roundish, the apex lobulate; seeds 4–7 per carpel.



FIGURE 1. *Averrhoa carambola* L. Habit ($\times\frac{1}{2}$). [After *Chi-en Chang* 8567, Taiwan.]

Averrhoa bilimbi is a widespread tree in tropical regions. Frequent in the Orient, in America it is known only in botanical gardens and experiment stations.

CANAL ZONE: Summit Garden, *Steyermark* 6, 7, 17.I.1935 (MO).

2. *Averrhoa carambola* L., Sp. Pl. 428. 1753. TYPE: Ceylon, *Hermann* ex herb. Banks no. 178, 1672–1677 (BM).—FIG. 1.

Tree to 25 m tall, 25 cm diam., abundantly branched; branches sometimes drooping; pubescence of short curved whitish to reddish ascending deciduous hairs. *Leaves* disposed along the branches, 3–8 jugate, the leaflets alternate or subopposite, discolorous, variable in shape, asymmetric, the upper leaflets elliptical or ovate, oblong, cuspidate, basally rounded or truncate, the lower leaflets smaller, 1.5–3 cm long, 1–2 cm wide, acuminate or cuspidate, the secondary nerves 4–10 pairs, the pubescence short and even beneath, the nerves pubescent above, the margin appressed ciliate; rachis to 20 cm long, rigid, pubescent; petioles thick, 1.5–3 mm long; petioles to 3.5 cm long, pubescent, thickened towards the base. *Inflorescences* axillary or cauliflorous, of pubescent and glandular cymes united into racemes and these into fascicles or pseudo-panicles; peduncle to 1 cm long; pedicels 3–4 mm long. *Flowers* with the sepals oblong or obovate oblong, 2.5–3.5 mm long, 1–2 mm wide, obtuse and somewhat emarginate, rarely subacute, a few hairs appressed on the central zone, the margin irregular, hyaline, finely ciliate; petals violaceous, white bordered, linear spatulate, 6.5–9 mm long, 1.5–3 mm wide, clawed, connate at the middle, seldom free, densely glandular inside; stamens enlarged toward the base, connate up to $\frac{1}{5}$, the anthers orbicular, the connective conspicuous, the longer stamens 2–2.5 mm long, fertile, the shorter stamens without anthers, seldom with rudimentary anthers (*D'Arcy & D'Arcy 6799* and others), or rarely with 2 rudimentary thecas separated by a short connective, in macrostylous flowers the longer stamens with small glands on the upper half, in mesostylous flowers (most frequent) the short stamens very short, microstylous flowers not seen; pistils 3–4 mm long, sometimes glandular, the ovary ellipsoid, the pubescence scant, appressed, sometimes only on the back of the carpels, the carpels 3–5-ovuled, the styles short, thick, pilose, the stigma enlarged, 2-lobed. *Berry* greenish or yellow, ovoid or ellipsoid, asymmetric, 8–12.5 cm long, 5–6 cm wide, the carpels uneven, angular, the base and apex 5-lobed, in transverse section 5-rayed; seeds without outer integument.

This species is frequently cultivated in all tropical regions. It probably originated in the Orient and was introduced into America. Fruits are consumed fresh or in conserves, also as refreshments.

CANAL ZONE: Barro Colorado Island, *Foster 2190* (US). PANAMÁ: Tobago Island, *D'Arcy & D'Arcy 6799* (MO).

2. BIOPHYTUM

Biophytum DC., Prodr. 1: 140. 1824. LECTOTYPE: *B. sensitivum* (L.) DC.

Oxalis L. sect. *Biophytum* Endl., Gen. 1172. 1840.
Toddavaddia Kuntze, Rev. Gen. Pl. 1: 96. 1891.

Herbs or *subshrubs*, erect or decumbent, the base sometimes ligneous; stems generally bearing a ring of rigid, retrorse pubescence at the apex. *Leaves* fasciculate at the stem apex, imparipinnate, the terminal leaflet reduced to a bristle-like mucro; leaflets sessile, the pairs gradually modified in shape and size upwards, the lower pairs usually subtriangular or ovate, smaller, petiole minute, broader than long, fleshy; petiole short, thick, articulating at the rachis, the bases persistent on the stem. *Inflorescences* of cymes, globose or cylindric; peduncu-

late; bracts subulate, situated at the insertion of the peduncles; bracteoles spirally overlapping; pedicels shorter or longer than the bracteoles, articulate near the base, the flowers opening successively, often only 1 or 2 to several seen opened to different degrees. *Flowers* white to red; sepals almost free, imbricate; petals connate near the middle; stamens short-connate at the base, all fertile or sometimes the shorter stamens reduced and sterile; ovary 5-lobed, the carpels 2–6-ovulate, the ovules in two rows alternating in length, the stigmas terminal, enlarged, bifid, subcapitate, papillose. *Fruit* a capsule covered by the calyx, the carpels 1–6-seeded, loculicidally dehiscent, the valves opening flat over the sepals in a star shape, remaining attached at the base; seeds 2-tegmic, the outer tegument opening and ejaculating the seed at maturity.

Biophytum is a pantropical genus of about 75 species. Five species occur in Panama, 3 of which are endemic.

- a. Cymes glomeruliform or fusiform, 1–2 mm diameter; few-bracteolate.
 - b. Pubescence hirsute, the hairs with thickened bases; bracteoles long setose 1. *B. dendroides*
 - bb. Pubescence very short, more or less appressed; bracteoles appressed ciliate 5. *B. soukupii*
- aa. Cymes globose or cylindroid, ca. 5 mm diameter; bracteoles subtriangular, keeled.
 - c. Peduncles ca. 10 cm long; calyx and capsule glabrous 3. *B. mucronatum*
 - cc. Peduncles to 2 cm long; calyx pubescent and glandular, the capsule pubescent at the apex.
 - d. Leaflets oblong, the distal border obtuse, mucronate; petals white, the throat yellow 4. *B. panamense*
 - dd. Leaflets falcate, acute, mucronate; petals yellow, red-veined 2. *B. falcifolium*

1. *Biophytum dendroides* (H.B.K.) DC., Prodr. 1: 690. 1824.—FIG. 2.

Oxalis dendroides H.B.K., Nov. Gen. Sp. Pl. 5: 194. 1821. TYPE: Colombia, near Quebrada de la Carbonera, *Bonpland 1744* (P, holotype; B, P, isotypes).

O. viva Willd. ex Steud., Nom. ed. 2: 242. 1844. TYPE: Colombia, *Bonpland 1744* (B, holotype; P, isotypes), nom. illeg. incl. typ. sp. prior.

Toddavaddia dendroides (H.B.K.) Kuntze, Rev. Gen. Pl. 1: 96. 1891.

Biophytum mexicanum Kl. ex Knuth, Pflanzenr. 130: 401. 1930, nom. nud. in syn.

B. longiscapum Kl. ex Knuth, Pflanzenr. 130: 401. 1930, nom. nud. in syn.

Oxalis dendroides fo. *longiscapa* Zucc. ex Knuth, Pflanzenr. 130: 140. 1930, nom. nud. in syn.

Biophytum mimosoides sensu auct., non (St. Hil.) Guillaumin.

B. dormiens sensu auct., non Mart. & Zucc.

Rhizomatous *herb*, stems obsolete or to 35 cm tall and woody, to 5 cm diam.; rooting up to 20 cm from the base, sometimes 2- or 4-branched; bark rough, appressed retrorse pubescent, glabrescent; root fibrous, to 10 cm long, twisted, branched. *Leaves* pseudoverticillate at the end of the stems, 15–30, 9–26 jugate, linear in outline, subcuneate; lower leaflets ovate to subtriangular, asymmetric, 1–2.5 mm long, 1–2.5 mm wide, the middle leaflets subrectangular to subfalcate, 2.5–10 mm long, 1.5–7 mm wide, the terminal leaflets semiobovate, asymmetric, basally truncate to subhastate, 6–11 mm long, 2.5–5 mm wide, the leaflets sometimes overlapping, glabrous or sparsely hirsute on one or both sides, hirsute ciliate, obtuse or subacute, the mucro sometimes violaceous, the midrib medial or emerging from nearer the posterior angle, secondary nerves ascending, curved, branched, connected to a marginal nerve; rachis 2–10 cm long, hirsute, more so at the insertion of the leaflets; petiolules ¼ mm long, thick, fleshy; petiole 1 mm

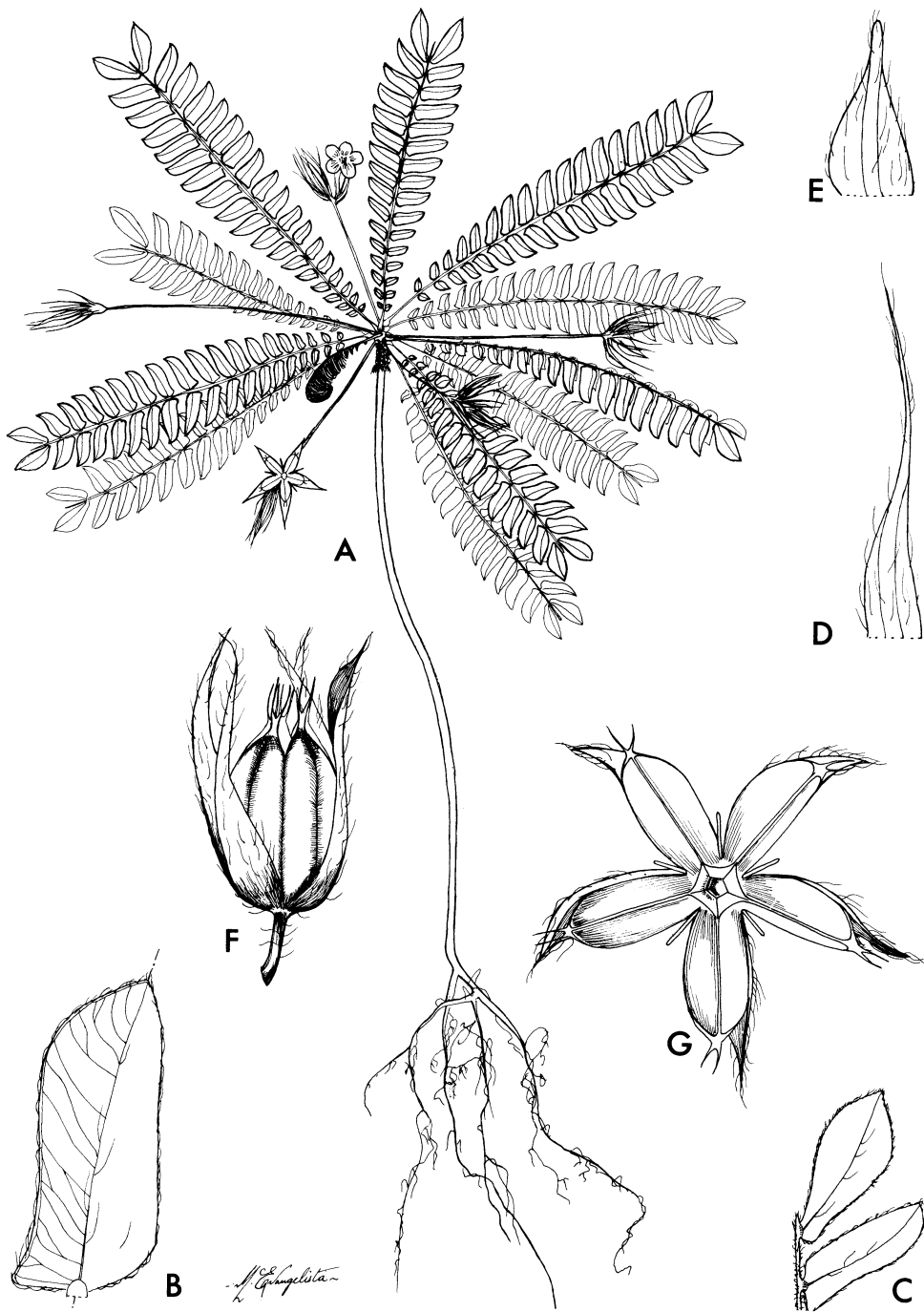


FIGURE 2. *Biophytum dendroides* (H.B.K.) DC.—A. Habit ($\times 1$).—B. Middle leaflet, upper and lower surfaces ($\times 5$).—C. Terminal leaflets ($\times 3$).—D. Inner bracteole ($\times 6$).—E. Outer bracteole ($\times 6$).—F. Fruit ($\times 6$).—G. Fruit in dehiscence ($\times 6$). [After a plant cultivated in Paris and studied by Lourteig.]

long, fleshy. *Inflorescences* subsessile or pedunculate, shortened, glomeruliform or fusiform, only 1 flower appearing at a time; peduncle erect, 1–8 cm long, subappressed pubescent or hirsute, the apex thickened, densely pilose; bracts subulate, to 6 mm long, purplish, pubescent; bracteoles 2–7 mm long, 0.5–1.5 mm wide, triangular linear to linear, the inner bracteoles prominently keeled, the keels somewhat lengthened, ascending ciliate; exceeding or about equalling the pedicels; pedicels 1–5 mm long, articulate in the lower half, glabrous or finely pubescent. *Flowers* with the sepals linear, 5–7 mm long, 1–1.5 mm wide, acuminate, 7–10-nerved, glabrous or ascending pubescent, the base densely hirsute, the apex ciliate; petals whitish to pink or lilac, the base obovate or spatulate, 1.5–1.3 times the calyx length, slightly retuse, the base clawed, white; stamens with the filaments basally enlarged, glabrous, the longer stamens 4.5–5.5 mm long, the shorter stamens 3–4 mm long; pistils micro- and macrostylous, the ovary apically pilose, the carpels 1–6-ovuled, the styles sometimes unequal, pilose below, the stigma small, bifid. *Capsule* subglobose or oblong, 2.5–4 mm long, yellowish to violaceous, scarious, apically pubescent, or rarely pubescent overall, exceeded 1.75–2 times by the calyx, the carpels 1–6-seeded, short pubescent within; seeds semiovoid-triquetrous, one face more or less plane with an acute margin and the opposite face convex, 1.5 mm long, acute, longitudinally tuberculate.

This species ranges along the American cordillera from Mexico to Ecuador. It has been introduced with greenhouse plants to botanic gardens on other continents, in some cases becoming subsponaneous, for example in Malasia and Brazil. However, records from Knuth (1930) for Brazil are not this species.

COCLÉ: Mountain beyond La Pintada, 400–600 m, *Hunter & Allen 615* (F, GH, MO, NY, P, U, US).

2. ***Biophytum falcifolium*** Lourt.³ TYPE: Panama, *Folsom & Collins 5609* (MO, holotype; P, isotype).—FIG. 3A.

Erect or decumbent *herbs* to 20 cm long; stems single or basally branched, with curved, short pubescence, glabrescent; root fibrous, branched. *Leaves* 9–20 pseudovercillate at the end of the stem, linear subcuneate, to 15 cm long, 1.6 cm wide, 13–34 jugate; lower leaflets ovate or subtriangular, ca. 3 mm long, 1.5 mm wide, the middle leaflets falcate, 5.6–11 mm long, 2.5–4 mm wide, basally the posterior side curved, the anterior side slightly curved or truncate at the midrib, central or emerging from nearer the posterior angle, the terminal leaflets elliptical, asymmetric, about equalling or shorter than the middle leaflets, the leaflets opposite or subopposite, subacute, the mucro 0.1–0.2 mm long, fine pubescent on both sides or glabrous or glabrescent above, ciliate, the minor venation reticulate; petiole ca. 1 cm long, fleshy; rachis narrowly winged, minutely pubescent above, hirsute beneath; petiolules wider than long, 0.1–0.2 mm long, fleshy. *Inflorescences* 1–3, globose or cylindrical, 1–3(–5) flowers seen at different degrees of opening; peduncles 0–7 mm long, violaceous, glabrous or minutely

³ *Biophytum falcifolium* Lourt. spec. nov. *Biophytum panamense* Lourt. simile, differt forma foliolorum, colore petalorum (fide collectores), etiam bracteolis pubescentiaque.

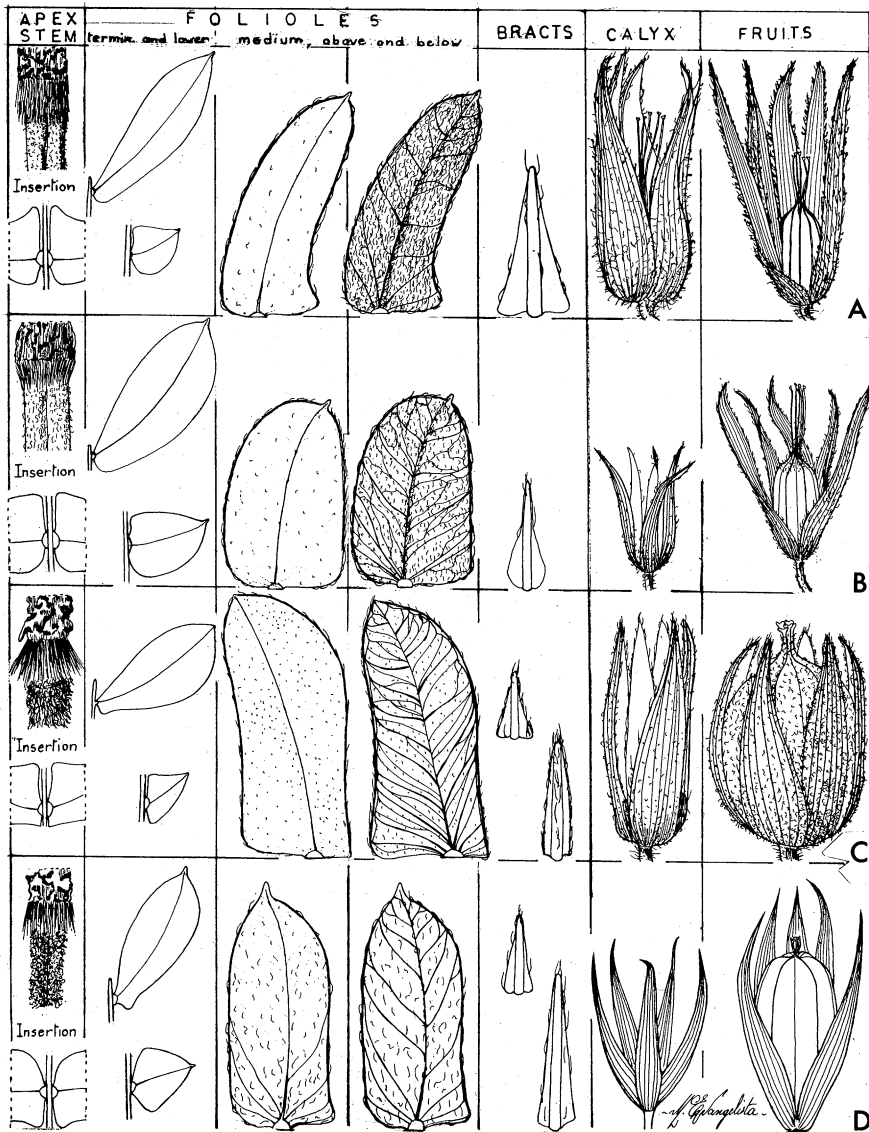


FIGURE 3. *Biophytum*, diagnostic plate.—A. *Biophytum falcifolium* Lourt. [After Collins 6500.]—B. *Biophytum panamense* Lourt. [After Hammel 2528.]—C. *Biophytum soukupii* Lourt. [After Williams 765; Bristan 1322.]—D. *Biophytum mucronatum* Lourt. [After Allen 3775.] Stems and leaflets (foliioles) ($\times 4$), bracts and fruits ($\times 10$), calyces ($\times 10$) except B. *Biophytum panamense* ($\times 6$).

pubescent; bracts subulate, ca. 2.5 mm long, purplish, situated at the insertion of the peduncle, sparsely short pilose; bracteoles spirally overlapping, green, basally violaceous, narrowly triangular, 1.5–3 mm long, 1-nerved, strongly keeled, short pubescent and glandular, the hairs 1–several celled; pedicels 7–15 mm long, violaceous, fine pubescent. *Flowers* with sepals linear-elliptic, sharp, 4.5–7 mm long, 0.7–1.2 mm wide, 5–7-nerved, densely glandular, the hairs 1–

several celled; petals cream, pinkish veined, oblong spatulate, the base clawed, 1.5 times the calyx length; longer stamens unequal, 3–3.5 mm long, white, flat with a few glandular hairs; the anthers ovoid with cordate base, the shorter stamens 1–1.5 mm with sterile anthers, or the entire stamen becoming a glandular relic; pistil equalling or shorter than the long stamens, 2.5–3.5 mm long, the style glandular pubescent, the stigma bifid, the ovary 5-lobulate, apically pilose, the carpels 3–4-ovuled. *Capsule* globose, ca. 3.5 mm long, shorter than the calyx, apically glandular pubescent, the carpels 3-seeded; seeds too immature to describe.

This species is closely allied to *Biophytum panamense* but is distinguished by the shape of the leaflets and the white petals. Also the bracteoles and the pubescence are different.

The epithet refers to the shape of the leaflets, curved like a sickle.

COCLÉ: Rivera sawmill, Alto Calvario, 7 km N of El Copé, 700–850 m, *Folsom & Collins 6509* (MO, P). Trail from Río San Juan to Río Tife Falls, 1200–2500 ft, *Hammel 3352A* (MO).

3. ***Biophytum mucronatum* Lourt.**⁴ TYPE: Panama, *Allen 3775* (US, holotype; F, G, MO, isotypes).—FIG. 3D.

Decumbent *herb* or *shrub*; stems woody, 50 cm long, 3–4 cm diam., finely short pubescent, glabrescent, decumbent, rooting at the base. *Leaves* 20–22, pseudovercillate at the end of the stem, linear subcuneate, to 14 cm long, 2.7 cm wide, 7–27 jugate; lower leaflets suborbicular or ovate, 2–3.5 mm long, the middle leaflets oblong rectangular, oblique, 7–11 mm long, 3–5 mm wide, basally truncate or the posterior side curved, secondary nerves 5–7 pairs, prominent beneath, the terminal leaflets elliptic, 8.5–10 mm long, 2.5–5 mm wide, basally truncate, curved on the posterior side, obliquely truncate on the anterior side,

⁴ *Biophytum mucronatum* Lourt., spec. nov. Radix fibroso ramosa. Caulis lignosus (usque 30 cm altus, 3–4 mm diam.), decumbens, basi radicans, pubescentia brevi tenuique, glabrescens. Apex caulis incrassatus, cum annulo dense pilifero, pilis rigidis, retrorsis, infra foliorum insertionem posito. Caulis supra anulum pilorum foliorum delapsorum cicatricibus instructus. Folia 20–22, pseudovercillata, in apice caulis disposita, ambitu lineari-subcuneato (usque 14 × 2.7 cm) 7–27-juga imparipinnata cum mucrone terminali. Petiolus 1–3 cm longus, carnosus. Rachis canaliculatus hirsuto-pilosus. Petiolulus ¼ mm longus, carnosus. Foliola opposita, inaequilatera, antice crescendo majora, discolora, supra pubescentia laxa, tenui, adpressa (pilis ca. ½ mm longis) subtus breviter pilosa, glabrescentia; apice insigniter mucronato (mucro ½ mm longus); infima minima, suborbiculata vel ovata (2–3.5 mm longa); media oblique oblongo-rectangularia (7–11 × 3–5 mm), 5–7 jugis secundariorum nervorum subtus prominentium (paria inferiora parallela, superiora subparallela), basi truncata vel dimidio posteriore plus vel minus curvo et dimidio anteriore obliquo; summa elliptica (8.5–10.5 × 2.5–5 mm), basi lobulato-curvata in dimidio posteriore, obliquo-truncata in dimidio anteriore. Cymae 2–5, abbreviatae, globoso-congestae (ca. 5 mm diam.) 1–7 floribus adspectabilibus, vicissim apertis. Pedunculi erecti, longi (7–10 cm), hirsuto-pilosi. Bractaeae subulatae, adpresso-ciliatae (3–4 mm) ad pedunculorum insertionibus. Pedicelli bracteolis occulti, glabri, ca. basim articulati. Bracteolae spiraliter superpositae, lineare-triangulares (2.5–4 mm), 1-nervatae, valde carinatae, longae et tenuiter ciliatae. Sepala linearia, acutissima (5 × ca. 1 mm), manifeste (7–)9–11-nervata, glabra. Petala rosea (fide coll.), oblongo-spathulata, basi dentiformi. Petalorum longitudo et latitudo ignotae (flos non apertus est). Stamina filamentis flavis: longiora (ca. 2 mm) pauci glanduloso-pilosa, antheris ovoideis; breviora filamentis lato in dimidio inferiora, sursum filiformi, anthera reducta (sterilis?). Pistillum plus minusve aequale longioribus staminibus; stigmata minuta, vix bi-capitata, papillosa; ovarium ellipsoideum, 5-lobulatum, carpello 2–3-ovulato. Capsula ellipsoidea (3–5.5 mm) rite calyce minor, glabra (inmatura); carpella 1–2(?)—seminata. Semina inmatura.

the leaflets discolorous with loose appressed hairs ca. $\frac{1}{2}$ mm long above, short pilose and glabrescent beneath, the apical mucro ca. $\frac{1}{2}$ mm long; petioles 1–3 cm long, fleshy; rachis hirsute; petiolule $\frac{1}{2}$ mm long, fleshy. *Inflorescences* 2–5, globose, ca. 5 mm diam., 1–7 flowers seen opened to different degrees, peduncles erect, 7–10 cm long, hirsute; bracts subulate, 3–4 mm long, appressed ciliate, subtending the pedicels; bracteoles spirally overlapping, linear triangular, 2.5–4 mm long, 1-nerved, keeled, fine and long ciliate. *Flowers* with sepals linear, 5 mm long, ca. 1 mm wide, acute, (7–)9–11-nerved, glabrous; petals pink oblong spatulate, basally clawed; stamens with filaments yellow, the longer ones ca. 2 mm long, sparingly glandular pubescent, the anthers ovoid, the shorter filaments with reduced (?) sterile anthers, enlarged in the lower half, filiform above; pistil about equalling the stamens, the ovary ellipsoidal, 5-lobed, the carpels 2–3-ovuled. *Capsule* (immature) ellipsoidal, 3–3.5 mm long, shorter than the calyx, glabrous; seeds 1–2(?) in each carpel.

The size of the petals is unknown to me because the flowers on the collection are not open.

The epithet used for this species refers to the conspicuous mucro of the leaflets.

PANAMÁ: Cerro Trinidad, 800–1000 m, *Allen 3775* (F, G, MO, US).

4. ***Biophytum panamense*** Lourt.⁵ TYPE: Panama, *Hammel 2528* (MO, holotype; MO, P, isotypes).—FIG. 3B.

Erect or decumbent *herbs* to 20 cm long, the stem branched at the base or not, pubescent with curved, short hairs, glabrescent; roots fibrous, branched.

⁵ *Biophytum panamense* Lourt., spec. nov. Radix fibroso ramosa. Caulis unus, vel plures, erectus vel decumbens (usque 35 cm altus), pubescentia brevi retrorsa. Apex caulis claviformis, cum annulo dense pilifero, pilis rigidis retrorsis, infra foliorum insertionem posito. Caulis supra annulum pilorum foliorum delapsorum cicatricibus instructus. Folia 9–20, pseudoverticillata, in apice caulis disposita, ambitu lineari-subcuneato (usque 18×2.2 cm), 20–32-juga, imparipinnata cum mucrone terminali. Petiolus (ca. 2 mm longus) carnosus. Rachis canaliculatus, angustissime alatus, hirsuto-pilosus. Petiolulus latior quam longus ($\frac{1}{3}$ mm longus) carnosus. Foliola atroviridia, opposita, aliquam superposita, inaequilatera, mucronata (mucro ca. $\frac{1}{4}$ mm), antice crescendo majora, pubescentia tenuissima et brevissima, glabrescentia, margine ciliata; nerviatione secundaria et tertiaria reticulata; *infima* minima, ovato-triangularia vel suborbiculata ($3\text{--}4.5 \times 3\text{--}4$ mm); media oblongo-asymmetrica, paulo curvata ($5\text{--}12 \times 6.5\text{--}7$ mm), latere distali obtuso, nervo medio in medio basis vel paulo viciniore angulo posteriore oriundo; basi dimidio anteriore truncato et dimidio posteriore curvato; *summa* angustoe elliptica usque semiobovata ($8\text{--}11 \times 4\text{--}5.5$ mm), basi dimidio posteriore lobulato-curvato, dimidio anteriore obliquo-truncata. Cymae 1–3, abbreviatae, globoso- vel cylindrico-congestae (ca. 5 mm diam.), 1–2(–5) floribus adspectabilibus, vicissim apertis. Pedunculi erecti, brevi (ca. 5 mm) violacei, pubescentia brevi. Bracteae violaceae, subulatae (2–2.5 mm) ad pedunculorum insertionibus. Pedicelli longi (10–13 mm) violacei, brevissime pubescentes et glandulosi, ca. basim articulati. Bracteolae sprialiter superpositae, ovatae ad lineares (usque 4×1 mm), virides ad basim violaceae, valde carinatae, glabrae vel paulo pubescentes, apice ciliatae. Sepala linearia, acutissima (usque 7×1 mm), 5–7-nervata, pubescentia et glandulosa, basim plus minusve violacea, margine subhyalina. Petala alba, fauce flava (fide coll.), oblongo-linearia, obtusa, calycis duplo longiora. Stamina longiora (ca. 4.5 mm), filamentis pilis glandulosis conspersis, antheris ovoideis basim cordatis; breviora (ca. 1 mm) filamentis lato versus basim, anthera sterilia vel abortiva. Pistillum plus vel minus aequale longioribus staminibus; ovarium 5-lobulatum, apice vix pubescens, carpello 2–3-ovulato; stylis pubescentibus et glandulosis; stigmata conspicua bifida, papillosa. Capsula sphaeroidea (ca. 3.5 mm diam.), apice vix piloso, rite calyce minor, stylis longis, carpellis 1-seminatis. Semina (ca. 1.5 mm, immatura), semiellipsoidea, fulva, obtusa, verosimiliter longitudinaliter striata vel tuberculata.

Leaves 9–20, pseudovercillate at the end of the stem, linear subcuneate, 18 cm long, 2.2 cm wide, 20–32 jugate; lower leaflets ovate triangular, 3–4.5 mm long, 3–4 mm wide, middle leaflets oblong, asymmetric, slightly curved, 5–12 mm long, 6.5–7 mm wide, basally the posterior side curved, the anterior side truncate, the midrib emerging from the center or near the posterior angle, the terminal leaflets narrowly elliptic to semiobovate, 8–11.5 mm long, 4–5.5 mm wide, oblique basally the posterior side lobulate, the anterior side truncate, the leaflets somewhat overlapping, minutely fine pubescent, glabrescent, ciliate, the mucro ca. $\frac{1}{2}$ mm long, minor venation reticulate. *Inflorescences* 1–3, contracted, globose to cylindrical, ca. 5 cm diam., 1–2(–5) flowers seen at a time, opening successively; peduncle erect, ca. 5 mm long, violaceous, short pubescent; bracts subulate, 2–2.5 mm long, violaceous, situated at the insertion of the peduncles; bracteoles ovate to linear, to 4 mm long, 1 mm wide, green, violaceous at the base, strongly keeled, glabrate; pedicels 10–13 mm long, violaceous, minutely pubescent and glandular. *Flowers* with the sepals linear, to 7 mm long 1 mm wide, sharp, 5–7-nerved, pubescent and glandular, the base violaceous, the margin subhyaline; petals white, linear oblong, obtuse, twice as long as the calyx; longer stamens ca. 4.5 mm long, sparsely glandular, and the anthers ovoid, basally cordate, the shorter stamens ca. 1 mm long, larger basally, the anthers sterile or obsolete; pistil about equalling the longer stamens, the ovary 5-lobed, apically slightly pubescent, the carpels 2–3-ovuled, the styles pubescent and glandular, the stigma bifid, papillose. *Capsule* globose, ca. 3.5 mm diam., slightly pilose apically, shorter than the calyx, the style persistent, elongate, the carpels 1 seeded; seeds (immature) tawny, semiellipsoidal, ca. 1.5 mm long, obtuse, perhaps longitudinally striate or tuberculate.

The epithet refers to the country where the species was found.

COCLÉ: Coclesito road, continental divide ridge, *Hammel 2528* (MO, P).

5. ***Biophytum soukupii*** Lourt.⁶ TYPE: Peru, Prov. Mariscal Cáceres, Tocache Nuevo, Quebrada de Cachiyacu de Lopuna, carretera a Progreso, 500–850 m, *Schunke 7640* (P, holotype; MO, isotype).—FIG. 3C.

Herb or *subshrub* apparently stemless or the stem to 50 cm tall, 4 mm in diam., erect or decumbent, tomentose; root branched, fibrous, elongate. *Leaves*

⁶ *Biophytum soukupii* Lourt., spec. nov. Radix copiose ramosa, longa. Subcaulis vel caule sub-lignoso erecto vel decumbens, basi radicante, tomentoso-pubescente (usque 50 cm lato \times 4 mm diam.). Apex caulis claviformis cum annulo dense pilifero, pilis rigidis, retrorsis, infra foliorum insertionum posito. Caulis supra annulum pilorum foliorum delapsorum cicatricibus instructus. Folia 7–30, viride-purpurea, pseudovercillata in apice caulis disposita, ambitu lineari-subcuneato (usque 13 \times 2.5 cm), 10–25-juga, imparipinnata cum mucrone terminali. Petioles (ca. 2 mm longus), carnosus. Rachis canaliculatus, angustissime alato (alis inconspicuis), pubescentia brevi, subhirsuta, inaequali. Petiolulus (ca. $\frac{1}{4}$ mm) carnosus, latior quam longus. Foliola discolora viridia et purpurea, opposita, oblique, inaequilatera, nervo mediano in tercio basis viciniore angulo posteriore oriundo; secundariis nervis in 20–35 jugis dispositis, tenuibus et crassis alternatis, in nervo marginalo collectis, in pagina inferiore prominentibus; pubescentia minutissima recta, subappressa, sparsa in utraque pagina vel interdum glabra in una vel duabus paginis; *infima* minima, subtriangularia asymmetrica (ca. 3 \times 2.5 mm); *media* oblongo-rectangularia (6–14.5 \times 2.5–4.5 mm) obtusa, basi truncata, angulo posteriore recto vel parte anteriore oblique truncata angulo anteriore curvato vel raro elongato; *summa* obovato-elliptica, leviter asymmetrica in medio vix latiora (5.5–6.5 mm), basi dimidio posteriore in angulo

7–30 pseudoverticillate at the end of the stem, linear subcuneate, to 13 cm long, 2.5 cm wide, 10–25-jugate; lower leaflets subtriangular, 3 mm long, 2.5 mm wide, the middle leaflets larger, 6–14 mm long, 2.5–4.5 mm wide, oblong rectangular, obtuse, basally truncate or oblique on the anterior side, the anterior angle roundish, the posterior angle square, the terminal pair obovate elliptic, 5.5–6.5 mm, basally truncate, on the posterior side, the angle square, the anterior side oblique, the leaflets green above, violaceous beneath, oblique, the midrib emerging at the base $\frac{1}{3}$ way to the posterior angle, secondary nerves 20–35 pairs, alternating thick and fine, terminating in a marginal nerve, short appressed pubescent on both sides; petiole ca. 0.25 mm long, broader than long. *Inflorescences* 1–4(–7), glomeruliform or fusiform, 5 mm long, 2–2.5 mm wide, one flower opening at a time; peduncle 1–2 cm long, shorter than the leaves, pubescent; bracts situated at the insertion of the peduncles, subulate, 2.5–5 mm long, short appressed pubescent, purplish; outer bracteoles triangular, 1.0 mm long, 0.5 mm wide, inner bracteoles elongate, subulate, keeled, to 3.5 mm long appressed ciliate, sparingly short pilose; pedicels about equalling the bracteoles, somewhat longer, to 3.5 mm, in fruit, articulate near the base. *Flowers* with the sepals sublinear, 5.5–7 mm long, 1–1.5 mm wide, acute, 5–7-nerved, hirsute with long and glandular short hairs; petals white (?pink), oblong spatulate, 1.5 times the calyx length, basally clawed, minutely glandular outside; stamens with filaments enlarged toward the base, the thecas subsagittate, the longer stamens ca. 6.5 mm long, pubescent and glandular, the shorter stamens ca. 3 mm long, glabrous; pistils macro-, meso-, and microstylous and as long as the shorter stamens, the style pubescent and glandular, the stigma enlarged, 2-lobed, subcapitate, papillose, the ovary apically pubescent and glandular, the carpels 4–6-ovuled. *Capsule* oblong, 4.5–5 mm long, about equalling the calyx, apically pubescent and glandular or glabrate, the carpels 4–6-seeded; seeds tawny, semi-ovoid, ca. 1.5 mm long, apiculate, margined, longitudinally tuberculate.

This novelty is named after Father Jaroslav Soukup of the Colegio Salesiano of Lima, Peru, editor of the review *Biota*, enthusiastic botanist who has collected for many years all over Peru, and who has collected this species twice.

DARIÉN: Cabecera del Río Pirre, *Bristan* 1322 (MO). Caná, 200–6500 ft, *Gentry et al.* 28545 (MO, P), *Williams* 765 (NY).

recto truncato, dimidio anteriore oblique truncato. Cymae 1–4(–7), congestae (5 × 2–2.5 mm), glomeruliformes vel fusiformes plerumque flore uno simul. Pedunculi rite foliis minores (1–2 cm); pubescentiae pedunculi et rachis similis. Bracteae purpureae, subulatae (2.5–5 mm), brevissime adpresso-pilosa ad pedunculorum insertionibus. Pedicelli plus minusve bracteolis aequales, in fructificatione paulo acrescentes (raro usque 3.5 mm), ca. basim articulati. Bracteolae spiraliter disposita exteriores triangulares (1 × 0.5 mm) interiores longae plus minusve setiformes, longe carinatae (usque 3.5 mm). Sepala sublinearia (5.5–7 × 1–1.5 mm), 5–7-nervata, acutissima, pubescentia hirsuta longa et glandulosa brevissima in variabili proportione. Petala alba (rosea?), oblongo spathulata, basi dentiformi 1–3-plo calycis longiora in exteriori parte glandulis minutis inconspicuis. Stamina filamentis versus basim latioribus, antheris thecis subsagittatis; longiora (ca. 6.5 mm) pubescentia et glandulosa; breviora (ca. 3 mm) glabra. Pistillum (macro-, meso- et microstyleum, et staminibus brevibus aequale) ca. 10 mm; styli pubescentia et glandulosa; stigmata aucta 2-lobulata, subcapitata, papillosa; ovarium apice pubescens et glandulosum, carpello 4–6-ovulato. Capsula globosa (4.5–5 mm), calyce aequalis, apice pubescens et glandulosa, carpello 4–6-seminato. Semina fulva, semiovoideo-convexa (ca. 1.5 mm) apiculata, marginata, tuberculis longitudinaliter dispositis ornata.

3. OXALIS

Oxalis L., Sp. Pl. 433. 1753. TYPE: *O. acetosella* L.

Acetosella Moehr, Hort. Priv. 4. 1736.

Oxys [Tourn.] Adanson, Fam. Pl. 2: 388. 1763.

Sassia Molina, Saggio Chile 145. 1782.

Oxallis Noronha, Verh. Batav. Gen. 5. Art. IV, 21. 1790.

Pseudoxalis Rose, Contr. U.S. Natl. Herb. 10: 116. 1906.

Ionoxalis Small, Fl. S.E. U.S. 665. 1903. N. Amer. Fl. 25(1): 26. 1907.

Monoxalis Small, Fl. S.E. U.S. 665. 1903. N. Amer. Fl. 25(1): 45. 1907.

Lotoxalis, Small, Fl. S.E. U.S. 666. 1903. N. Amer. Fl. 25(1): 46. 1907.

Xanthoxalis Small, N. Amer. Fl. 25(1): 49. 1907.

Hesperoxalis Small, N. Amer. Fl. 25(1): 26. 1907.

Otoxalis Small, N. Amer. Fl. 25(1): 27. 1907.

Bolboxalis Small, Fl. S.E. U.S. 665. 1903. N. Amer. Fl. 25(1): 27. 1907.

Herbs or *subshrubs*, rarely lianas; roots branched fibrous or subligneous thickened; stems underground and reduced to an invisible disc covered with bracts and the base of petioles connate to the stipules, or modified in a more or less ligneous, thickened rhizome covered with the base of the decayed leaves, or aerial and climbing, decumbent, trailing or erect, subligneous at the base, or all herbaceous. *Leaves* alternate, apparently basal or cauline, subopposite or pseudoverticillate, 3(–4)-foliolate, digitate or pinnate, with or without stipules connate to the petioles. *Inflorescences* axillary, of 2-branched or umbelliform cymes or solitary flowers; bracteoles 2; bracts small. *Flowers* varying in size, rarely cleistogamous; calyx 5-partite; petals 5, connate near the middle; stamens 10, connate at the base, the series of 5 external alternisepalous stamens opposite the petals, shorter, the internal series alternipetalous, longer, usually all fertile; pistils heterostylous, bi-, trimorphic, the carpels 1–15-ovuled, the styles 5, free, the stigmas capitate. *Capsule* globose, oblong to cylindrical, glabrous or pubescent, the carpels (1–)2–15-seeded, loculicidally dehiscent, the carpels connate to the central axis, persistent; seeds generally ovoid, apiculate or oblong, more or less flattened, the testa crustaceous, longitudinally zig-zag ribbed, transversally striate or sculptured densely verrucate, 2-tegmic, the external integument fleshy, arilliform, breaking elastically and projecting the ripe seeds; albumen fleshy; embryo straight.

Oxalis includes more than 800 species distributed around the world in tropical and cold regions, from sea level to the snow-line in the highest mountains. Twelve species have been found in Panama, none endemic.

- a. Leaves 3-foliolate, pinnate.
 - b. Petals white or yellow at the base, the limb pinkish 2. *O. barrelieri*
 - bb. Petals yellow.
 - c. Cymes with foliaceous bracts; leaflets glaucous with white cystoliths 5. *O. dombeii*
 - cc. Cymes with linear, small bracts; leaves green or more or less violaceous.
 - d. Cymes long branched, 10–40-flowered; capsule globose 9. *O. microcarpa*
 - dd. Cymes umbelliform, 3–7(–11–15)-flowered; capsule ovoid or oblong 7. *O. frutescens* ssp. *angustifolia*
- aa. Leaves 3–4-foliolate, digitate.
 - e. Roots fibrous or thickened; stems aerial or rhizomatous; sepals without calli at the apex.
 - f. Stem aerial, erect or rooting; flowers yellow, sometimes violaceous veined.
 - g. Liana; leaves exstipulate, the leaflets ovate 10. *O. rhombifolia*

- gg. Herbs; leaves with stipules connate to the petiole, the leaflets commonly obovate with the apex incised.
- h. Stipules truncate or narrowed towards the apex; capsules oblong or cylindrical covered with hairs (rarely glabrate).
- i. Stems decumbent or erect.
- j. Petals light yellow, translucent; leaflets green, the lobules ascendent; calyx to $\frac{1}{5}$ – $\frac{1}{4}$ of the capsule length 3c. *O. corniculata* ssp. *corniculata*
- jj. Petals bright yellow, orange or pinkish outside; leaflets glaucous, the lobules more or less divergent; calyx to $\frac{1}{4}$ – $\frac{1}{3}$ of the capsule length 3a. *O. corniculata* ssp. *albicans*
- ii. Stems filiform, creeping.
- k. Stem greenish to violaceous, dark green when dry; capsule cylindrical, calyx to $\frac{1}{5}$ – $\frac{1}{4}$ its length, slightly retrorse-pubescent to glabrous ... 3b. *O. corniculata* var. *atropurpurea*
- kk. Stem reddish, decorticate, leaves green; flowers yellow; capsule oblong, calyx to $\frac{1}{2}$ – $\frac{2}{3}$ its length, short pubescent 6. *O. filiformis*
- hh. Stipules with free, acute apex; capsules conic, glabrous or with sparse pluricellular hairs 11. *O. spiralis* ssp. *vulcanicola*
- ff. Plants apparently stemless, rhizomatous to 2 cm diam., ligneous, bearing the bases of decayed leaves; flowers pink 1. *O. articulata*
- ee. Bulbs formed by the reduced stem covered with bracts and the stipules connate to the petioles; sepals usually with calli at the apex; flowers pink.
- i. Leaflets 3, entire to bilobate.
- m. Leaflets subtriangular 8. *O. latifolia*
- mm. Leaflets obovate, incised, the lobes rounded 4. *O. debilis* var. *corymbosa*
- ll. Leaflets 4, entire or rarely slightly retuse 12. *O. tetraphylla*

1. *Oxalis articulata* Savigny in Lamarck, Encycl. 4. 686–687. 1797. TYPE: Uruguay, Montevideo, in pascuis, Commerson May 1767 (P-Juss., holotype; P, isotype).

Apparently stemless herb to 40 cm; stem ligneous, rhizomatous, brown, dark, more than 15 cm long, to 2 cm diam., tortuose, bearing the scars of the bases of stipules adnate to petioles of decayed leaves; roots tuberous, subligneous, cylindrical, knobby or articulate, dark, thick, more than 10 cm long, 25 mm diam., branched, fibrous, to 15 cm long, sometimes with a long branch bearing a tuber at its apex. Leaves 3–30-fasciculate; leaflets widely obovate subcuneate or cuneate, 5–30 mm long, 7–45 mm wide, slightly retuse or acute, incised to $\frac{1}{5}$ of its length, a purplish basal callus frequently present, the pubescence straight, appressed, uniform, dense on both faces or only below, or shorter and loose; orange calli abundant near the margins, unequal, rarely scattered on the rest of the surface; stipules connate to the petiole, ovate or triangular, 4–16 mm long, 2–6.5 mm wide, narrowed towards the apex, the hairs appressed ascendent, ciliate; petioles ascendent, 13–30 cm long, densely appressed pubescent to glabrate with short appressed hairs; petiolule ca. $\frac{1}{2}$ mm long, thick, densely pilose. Inflorescences of umbelliform simple cymes, 2–5-flowered, bifid, asymmetric, multiflowered with up to 20 flowers or of bifid cymes composed of umbelliform cymes; peduncles taller than the foliage (2.5–40 cm) the pubescence similar to that of the petioles; bracts 2–3 mm long; bracteole 0.5–1(–2) mm long, situated at the base of the inflorescence, oblong or linear, appressed-pilose with 1–2 orange calli at the apex; pedicels long filiform, 1–5.5 cm long, articulate near the base. Flowers with the sepals linear-elliptic to linear 2.5–6.5 mm long, 1–2 mm wide, acute, the internal sepal obtuse, often with 3–4 unequal calli, densely appressed-pubescent,

the hairs straight; petals violaceous, obovate-oblong, clawed, connate near the middle, 2–3 times the length of the sepals, the areas exposed in bud covered with white sericeous appressed hairs; stamens with linear filaments, basally broad and abruptly narrowed about the middle, the longer stamens 3.5 mm long, pubescent, the shorter stamens 2 mm long, glabrous, connate to about $\frac{2}{3}$, the anthers ovoid; pistils macro-, meso- and microstylous, ca. 5.5 mm long, the ovary pilose at least at the apex and back of the carpels, carpels 4–8-ovuled, the styles densely pilose, the stigma small, capitate. *Capsule* cylindrical or oblong, acute, 8–11 mm long, the calyx to $\frac{1}{2}$ of its length, densely ascending appressed pubescent overall or only at the apex of the carpels, the carpels 4–8-seeded; seeds light brownish, ovoid or ellipsoid, acute at both ends, 1–1.25 mm long, 8–9-ribbed in zig-zag, transversally striate with 4–8 deep pits.

Originally from Uruguay, extreme southern Brazil, and some localities of Buenos Aires (Argentina), this species is introduced and cultivated in other American countries and in the Old World. It may escape and become naturalized.

CHIRIQUÍ: Bambito, escaped from cultivation, roadside, *Croat 15882* (MO).

2. *Oxalis barrelieri* L., Sp. Pl. ed. 2. 1763. TYPE: Barrelier, Plant. Rar. Tab. 1139.

Acetosella barrelieri (L.) Kuntze, Rev. Gen. Pl. 1: 90, 92. 1891.

Lotoxalis barrelieri (L.) Small, N. Amer. Fl. 25(1): 49. 1907.

Erect *herb* or *shrub* to 1 m tall, pubescent; stems green or violaceous, pubescence white or yellowish hirsute, in part retrorse, the apex finely pubescent; internodes to 8 cm long, sometimes almost obsolete resulting in subopposite leaves, hairs at the insertion of the petioles straight; roots fibrous, branched; petioles ascendent, to 4 cm long, canaliculate, enlarged to the base, the margin of the groove ciliate; rachis to 15 cm long pubescent; petiolule fleshy, ca. 1 mm long, pilose. *Leaves* with leaflets varying in shape on the same plant, suborbicular, oblong, ovate to elliptic, 10–55 mm long, 8–25 mm wide, obtuse, seldom acute, the base acute, roundish or subpeltate, asymmetric, discolorous, glaucous above, hairs irregularly scattered, below caducous, the margin or only the base ciliate. *Inflorescences* of cymes taller than the foliage loosely 1–11(–30)-flowered; peduncles to 6.5 cm long, pubescent, bifid with branches to 3 cm long; bracts reddish, lanceolate or triangular, acuminate, ca. 2 mm long, pilose; pedicels to 2.5 mm long, articulate near the base; bracteoles smaller, appressed to the pedicel. *Flowers* with the sepals light green, sometimes red-veined, 3–3.5 mm long, 1–1.5 mm wide, linear to ovate or oblong, acute, mucronate, pubescent, the margin hyaline; petals white or yellowish at the throat and base, the limb pink, obovate-subspatulate, clawed, 7–9 mm long, 3.5 mm wide, slightly notched; longer stamens ca. 3 mm long, pubescent or glabrous, ligulate about the middle, the shorter stamens 1.5–2 mm long, glabrous; pistil 3.5–4 mm long, the ovary ovoid, glabrous, the carpels 3–4-ovuled, the styles pubescent, the stigma widened, bifid, subcapitate, papillose. *Capsule* ovoid 7–9 mm long; acute, rarely oblong, glabrous, membranous, calyx to $\frac{1}{2}$ its length, the carpels (2–)3(–4)-seeded, inside setose pubescent; seeds brownish, ovoid-compressed, apiculate, 1.5–2 mm long, 8-ribbed in zig-zag, deeply transversally striate, finely tuberculate at the intersections.

This species occurs in tropical and subtropical America. It is introduced into some tropical places of the Old World.

BOCAS DEL TORO: Road to "Bomba" Almirante, *Blum 1316* (MO). Ojo de Agua, ca. 7 km W of Almirante, 190–220 m, *Croat 38149* (MO). Near Milla 7.5, *Croat & Porter 16284*; Milla 10, *16344*; Milla 7.5 *16455*; Milla 5, *16498* (all MO). Cerro Jefe, in cafetal, *D'Arcy 3968* (MO, P). Changuinola, 0–100 m, *D'Arcy 11168* (MO). Santa Rita Ridge, *Lewis et al. 5245* (MO, P). Runway at Bocas, *Lazor 2439* (MO). Zigla Road, junction of Changuinola and Tuibe Rivers, *Lazor et al. 2512* (MO). CHIRIQUÍ: Between Cerro Punta and Bajo Grande, *Croat & Porter 16095* (MO). Volcán Chiriquí, Aguacatal 2000 m, *Killip 3578* (F). COLÓN: Santa Rita Ridge, 7 mi from Transisthmian highway, 650 ft, *Wilbur 15034* (MO). Without locality: *Seemann* (BM, K).

3. *Oxalis corniculata* L., Sp. Pl. 435. 1753. NEOTYPE: Cult. hort. Uppsal. herb. Thunb. 11084 (UPS).

3a. *Oxalis corniculata* L. ssp. *albicans* (H.B.K.) Lourt., Phytologia 42: 137. 1979.

O. albicans H.B.K., Nov. Gen. Sp. Pl. 5: 244. 1821. TYPE: Mexico, *Bonpland & Humboldt 4071* (P, holotype; B, isotypes).

Herb to 40 cm; stems branched at the base, prostrate or decumbent, rarely erect, pubescence whitish or yellowish to rusty, ascending or appressed to subhirsute, curved, sometimes dense; root often ligneous, turnip-shaped, thick, more than 30 cm long, branched. *Leaves* pseudovercillate, subopposite or alternate; leaflets greenish, glaucous, largely obovate-cuneate, generally wider than long, incised up $1/5$ – $1/3$ ($-1/2$) of the length, the lobes divergent, the lateral leaflets asymmetric, the margin often violaceous (conspicuous in dried specimens), the pubescence varied, appressed to hirsute-ciliate, commonly glabrous above; petioles ascendent, pilose; petiolules fleshy, violaceous. *Inflorescences* ascendent, 1–2 (–3)-flowered cymes; generally shorter than the foliage, appressed-pubescent; peduncle pilose, to 5 cm long; pedicels appressed-pubescent, longer in fruit, generally the same length or shorter than the fruit. *Flowers* with sepals elliptic, oblong, commonly greenish-violaceous, uneven, the outer sepals pubescent, the others glabrate; petals yellow striate with red outside, pinkish or salmon inside (*fide coll.*) the border villous (observed in buds); pistils mostly mesostylous, some pistils about as long as the longer stamens, a few microstylous. *Capsules* cylindrical, acute, the calyx to $1/4$ – $1/3$ its length, the styles short.

The remaining characters are the same as the ssp. *corniculata*.

This subspecies occurs in Western United States, Mexico, Guatemala, Honduras and Panama.

CHIRIQUÍ: Río Chiriquí Viejo across from town of Cerro Punta, 6000 ft, *D'Arcy 6575* (MO, P). La Popa, above Boquete, 1500–2500 m, *D'Arcy 10929* (MO). Paseo Respingo, 8400 ft, *D'Arcy & Hammel 12888* (MO). Cerro Punta, 6000 ft, *Tyson 5792* (MO).

3b. *Oxalis corniculata* var. *atropurpurea* Planchon in van Houtte, Fl. Serres 12: 47–48, *t.* 205. 1857. TYPE: Planchon's plate.

O. corniculata L. var. *viscidula* Wiegand, Rhodora 27: 117, 121. 1925. TYPE: Massachusetts, *Terry* (GH).

Small *herbs*; roots deep, fibrous, profusely branched; stems, stipules and leaves violaceous. *Flowers* with the sepals green or somewhat violaceous; pistil

micro- or macrostylous, mostly near the same length as the longer stamens. *Capsule* slightly pubescent to glabrous.

This variety, of horticultural origin from Europe, is easily recognized in the living state. It is found in gardens, greenhouses and often escapes. It is not weedy.

CANAL ZONE: Salamanca Hydrological Station, Río Pequeñí, 80 m, *Woodson et al.* 1622 (GH).

3c. *Oxalis corniculata* L. ssp. *corniculata*.

Prostrate *herb*, many branched, hirsute; stems to 50 cm long, branched, the tips ascending; internodes variable in length, roots fibrous. *Leaves* sometimes in long petiolate fascicles; leaflets obovate, cuneate, 4–20 mm long, 7.5–20 mm wide, widely incised up to $\frac{1}{6} \times \frac{1}{3}$ of the length, the lobes roundish, obtuse, above glabrous, pubescent below (often only one half), appressed-ciliate; petioles to 7 times the length of the blade; stipules 0.8–3 mm long, 1–3 mm wide, truncate, hirsute-ciliate. *Inflorescences* of umbelliform 2–7-flowered cymes; peduncles to 21 cm long, ascending, loosely pilose; the bracts linear-triangular 0.5–3 mm long, longer in fruit; bracteoles smaller, linear, ciliate; pedicels 4–15 mm long in fruit and deflexed; sepals linear or narrowly ovate, acute 2.5–5.5 mm long, 4–15 mm wide, greenish or violaceous, sparingly pubescent; petals yellow, oblong-subspatulate, about twice as long as the sepals, 5–11 mm long, 1–2.5 mm wide; stamens glabrous, the longer stamens ca. 6 mm long, the shorter stamens ca. 4 mm long, connate up to about $\frac{1}{3}$; pistils micro-, meso-, and macrostylous to 8 mm long; the ovary oblong, acute, retrorse-pubescent, the styles appressed retrorse pubescent, the stigma 2-lobed, papillose, the carpels 4–15-ovuled. *Capsule* cylindrical, acute, 5–20 mm long, 1–3 mm diam., retrorse pubescent with pluricellular glandular hairs, exceptionally glabrous, the carpels commonly 8–10(–14)-seeded, pubescent, pubescent inside, the calyx to $\frac{1}{4}$ – $\frac{1}{5}$ the capsule length, the styles long connate, straight; seed reddish-brown, ca. 1 mm long, ovoid, apiculate, flattened, 6-ribbed, transversally striate and finely tuberculate at the intersections.

This species is distributed worldwide, originating in the European Mediterranean region. It is well adapted to all climates, requiring only some humidity, and reaching its largest forms in cultivated lands. It can become weedy and hybridize with autochthonous species of the same section.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 393 (F, US). CANAL ZONE: Chagres, between Gamboa and Alahueta, 30–60 m, *Allen* 975 (MO). Balboa, *Standley* 28561 (US). Río Pequeñí, Salamanca Hydrographic Station, 80 m, *Woodson et al.* 1622 (MO, NA, NY). CHIRIQUÍ: Río Chiriquí Viejo "New Switzerland," 1800–2000 m, *Allen* 1403 (GH, MO). Boquete, Finca Collins, *Blum & Dwyer* 2581 (MO). Volcán, Escuela San Benito, *Croat* 10416 (MO). N of Cerro Punta, *Croat* 10484 (MO, P). Cerro Punta, IDAAN water tank, 700 m, *Croat* 26551 (MO, P). 4 mi above Boquete on road to Volcán Barú, 1475 m, *Croat* 34855 (MO). Between Boquete and Monte Rey, *Croat & Porter* 15627, 15732 (both MO). Between Cerro Punta and Bajo Grande, *Croat & Porter* 15994 (MO, P, US). Bambito, 5500 ft, *D'Arcy* 5341 (MO). Río Chiquero, *D'Arcy* 11006 (MO). La Popa, Boquete, *D'Arcy & D'Arcy* 6370 (MO, P). Boquete, 4200 ft, *D'Arcy & D'Arcy* 6458 (MO, P). Cerro Respingo, Cerro Punta, 8400 ft, *D'Arcy & D'Arcy* 6551 (MO, P). Cerro Horqueta, 1500 m, *Duke et al.* 13657 (MO). Boquete, Finca Collins, *Ebinger* 715 (F, MO, NY). Las Cumbres near Cerro Punta, 7200 ft, *Hammel* 6952 (MO). Boquete, 3300–4200 ft, *Lewis et al.* 347 (GH, MO, UC, US); *Maurice* 685 (US). Finca Collins, "El Velo," 6150 ft, *Stern et al.* 1967 (MO). Boquete, 4200 ft, *Sucre* 194 (RB). Nueva California, 4000 ft, *Tyson* 5709 (MO). Cerro Punta, 6000 ft, *Tyson* 5793 (MO). Volcán de Chiriquí, Casita Alta, 1500–2000 m, *Woodson et al.* 990 (MO, NA, NY). Finca Lérida, *Woodson & Schery* 310 (MO). COCLÉ: Club Campestre, El Valle de Antón, 700 m, *Duke* 13237 (MO).

4. *Oxalis debilis* H.B.K., Nov. Gen. Sp. Pl. 5: 236. *t.* 466. 1821.4a. *Oxalis debilis* H.B.K. var. *corymbosa* (DC.) Lourt., comb. nov.

O. corymbosa DC., Prodr. 1. 696. 1824. LECTOTYPE: Insula Borbona (G-DC).

O. martiana Zuccarini, Denksch. Akad. Wiss. Muench. 9: 144. 1825.

O. urbana St. Hil., Fl. Bras. Mer. 1: 100. 1825.

O. bipunctata Graham ex Hook., Bot. Mag. 54: *t.* 2781. 1827. TYPE: cult. Roy. Bot. Gard. Edinburgh, seed from Brazil, Rio de Janeiro, sent by Harris to Graham April 1827 (E).

O. violacea auct. non L.

Acetosella martiana (Zucc.) Kuntze, Rev. Gen. Pl. 1: 90. 1891.

Ionoxalis martiana (Zucc.) Small, Fl. S.E. U.S. 665. 1903.

Apparently stemless *herb*; root vertical, thick with fibrous branches; bulb globose, ovoid or oblong, 1–2 cm long, 3 cm diam., formed of nutritious scales and numerous bulbils covered by protective scales and the stipules connate to the petioles; scales brown, ovate, scarious 7–11 mm long, 3–5 mm wide often covered with rigid, acuminate, orange calli, the margin hyaline, ciliate with long smooth hairs, to 4 mm long, rusty, the 3 longitudinal nerves connate below the apex. *Leaves* with leaflets suborbicular or broadly obovate, 1.25–5.5 cm long, 1.5–4.7 cm wide, incised up to $1/9$ – $1/5$ of the length, cuneate, the hairs short, sparse on both faces or only beneath, with punctiform minute, translucent orange or violaceous oxalate “crystals” scattered on the blade, more visible below, frequently a larger and more prominent row along the border; petioles to 30 cm long with sparse hairs, rarely densely pubescent; petiolules 0.5–1 mm long, fleshy, pilose; stipules completely connate, 13 mm long, 2 mm wide, scarious, brown, linear, 3-nerved, the nerves salient, convergent just below the apex, sometimes with 2 additional thinner lateral nerves running with the central nerve into the petiole, the borders ciliate as the scales; bulbils covered by similar smaller scales. *Inflorescences* bifid cymes, the branches unequal, sometimes twice bifid, generally asymmetric or umbelliform, loosely 3–15-flowered; peduncles little shorter to longer than the foliage, to 45 cm long, similar to the petioles; bracts opposite, hyaline, largely ovate or rhombic, 2–5 mm long, 2–2.5 mm wide; bracteoles inserted near the base of the pedicel on the pilose articulation, 1–3 mm wide, 0.25–1 mm long, bracts and bracteoles with calli; pedicels 4–20 mm long, similar to the peduncle, articulate 1–3 mm from the insertion. *Flowers* with the sepals greenish, the margin hyaline, linear to elliptic, 4–7 mm long, 0.75–1.5 mm wide, subequal, obtuse or acute, the apex ciliate, the calli orange, linear or enlarged towards the apex, parallel or oblique, rarely convergent or divided giving 3 or 4 calli; petals pinkish, salmon or red-violet, sometimes with inconspicuous short appressed hairs outside, obovate, clawed, 2–3 times the length of the sepals; stamen filaments enlarged towards the base, the longer stamens 4.5 mm long, pilose towards the apex and with some short glandular hairs mixed; the shorter stamens ca. 3 mm long, glabrous, connate to $1/3$; pistil macro- and mesostylous, rarely microstylous; 7.5 mm long, with scattered ascendent hairs and short glandular hairs, the stigma bifid, subcapitate, the ovary glabrous, the carpels 2–12-ovuled. *Capsules* (immature) cylindrical, thin, glabrous to 17 mm long, the calyx to $1/4$ – $1/3$ as long as the capsule, styles ca. 2 mm long, the carpels short pilose inside, 3–10-seeded; seeds (immature) brownish, ovoid, flattened, 12-ribbed in zig-zag and 12 transversal striae.

This is a South American species widespread in the whole world, occasionally fruiting but reproducing through abundant bulbils developing simultaneously.

BOCAS DEL TORO: Bocas, border mangrove swamp, *Lazor et al.* 2428 (MO). CHIRIQUÍ: Boquete, 4500 ft, *D'Arcy* 5446 (MO); *D'Arcy & D'Arcy* 6460 (MO), 3 mi N of Boquete, 3300–4200 ft, *Lewis et al.* 340 (MO). Alto Lino, *Maurice* 873 (US).

5. *Oxalis dombeyi* St. Hil., Fl. Bras. Mer. 1: 111. 1825. TYPE: Perú, *Dombey* (P).

O. darienensis Woodson, Ann. Missouri Bot. Gard. 27: 312–313. 1940. TYPE: Panama, *Allen* 881 (MO, holotype; GH, NY, P, US, isotypes).
O. barrelieri sensu auct. non L.

Erect herb to 60 cm, glabrous or puberulent on younger parts; white cystoliths often present on the leaves, bracts, bracteoles, occasionally on the sepals; pubescence long transparent, sometimes viscous; stem sometimes subligneous at the base, to 6 mm diam. often with glandular hairs, these inconspicuous when lacking secretion; internodes 1.5–4 mm; roots fibrous, branched; rhizome cylindrical, slender. *Leaves* alternate, subopposite or pseudovercillate; leaflets oblong obovate to suborbicular, the lateral leaflets asymmetric, 9–25 mm long, 5–22 mm wide, glabrous or with hairs on the nerves below and fine ciliate, obtuse or retuse, basally subpeltate or barely auriculate; petiole to 4 cm long, canaliculate, often narrowly winged; rachis to 6 mm long. *Inflorescences* of cymes taller than the foliage, loosely 10–25-flowered; peduncle to 6 cm long, bifid with long branches, one branch aborted or shortened; bract and bracteoles overlapping, bracts ca. 3 mm long, bracteoles ca. 1.5–2.5 mm, foliaceous, lanceolate, acuminate, greenish or red-striate, appressed to the rachis, subamplexicaul, pedicels ca. 3 mm long, glabrous, rarely pubescent, articulate near the base. *Flowers* with the sepals greenish, the margins hyaline, ovate and acuminate or oblong 4.5–7 mm long, 1–2 mm wide, glabrous, acute; petals yellow-orange, obovate-subspatulate, 7–13 mm long; stamens longer, ca. 2.5 mm long, pubescent with a thin ligule, acute in the lower half, the shorter stamens ca. 1.25 mm long, glabrous; pistils ca. 3 mm wide, the ovary oblong, the carpels to 10-ovuled, the styles thin, pubescent, the stigma capitate. *Capsule* oblong to ellipsoid, ca. 10 mm long, the calyx to $\frac{2}{3}$ of its length, glabrous, the carpels 7–10-seeded, inside densely and finely pubescent; seeds rusty, ca. 1 mm across, subpyriform, 5–6-ribbed in zig-zag, transversally striate and tuberculate at the intersections.

This species occurs on dunes and arid regions, rarely in cultivated fields, of the Pacific coast and Andean slopes of Perú, Ecuador, and Panamá. It also occurs in the Galápagos Archipelago.

DARIÉN: Boca de Cupe, *Allen* 881 (MO, NY, P, US). Río Chico, near Yaviza junction with Río Chucunaque, *Burch et al.* 1086 (MO). Junction Río Peresenico and Río Pirré, *D'Arcy* 5531 (MO, P). 4 mi S of Cañitas, *D'Arcy & D'Arcy* 6057 (MO, P). 2–3 mi SE of El Real, *Duke* 4858 (MO, P). 10 mi S of El Real on Río Pirré, *Duke* 5371 (MO, P). Pigi Vasal, Choco village, *Folsom* 4557 (MO). Río Chucunaque, *Larsen* 215 (G). Camino de El Real a Río Pino, *Lazor* 1550 (MO). Between Caná and Boca de Cupé, near El Real along Río Pirré, *Stern et al.* 609 (GH, MO, US). PANAMÁ: Between Río Bayano Dam and Cañitas, *D'Arcy* 9395 (MO, P). Near Bayano bridge, *Folsom* 3556 (MO).

6. *Oxalis filiformis* H.B.K., Nov. Gen. Sp. Pl. 5: 190, t. 460. 1821. TYPE: Colombia, Guaduas, Santa Ana, *Bonpland* (P, holotype; B, P, isotypes).

Xanthoxalis filiformis (H.B.K.) Holub., Folia Geobot. Phytol. Praha 8: 175. 1973.

Creeping *herb* to 10 cm tall, pubescent with fine and whitish or reddish simple and pluricellular hairs, 1.5–2 mm long, mixed; roots fibrous, branched; rhizomes and stems filiform, to more than 50 cm long, reddish, decorticating, hirsute, rooting; internodes 1–5 cm long, the nodes 1-leaved or with fascicles of leaves. *Leaves* with leaflets cordiform or transversely oblong, cuneate, 2–15 mm long, 3–20 mm wide, incised to $\frac{1}{4}$ of its length, both faces pubescent or above glabrous, glabrescent, ciliate; stipules connate, reddish, enlarged at the apex, 2–3 mm long, 0.75–1.75 mm wide, setose-ciliate, concave. *Inflorescences* of the cymes longer than the foliage, 1-flowered; peduncles 1–7 cm, filiform; bracteoles linear, pilose, 1.5–3 mm long; pedicel 0.5–2.5 cm long. Flowers with the sepals greenish, the margins often violaceous, oblong, 3–5 mm long, 1–2 mm wide, obtuse, the apex densely ciliate, pubescent; petals 2–3.5 times the length of the sepals, rarely with minute glandular hairs scattered on the border and outside; stamens minutely pubescent, the longer stamens to 5.5 mm long, the shorter stamens to 4 mm long, connate to $\frac{1}{4}$ of its length; pistils all longistylous, 6.5–7.5 mm long, the ovary reddish, carpels with a few short hairs inside, 3–6-ovuled, styles densely pubescent, ca. 5 mm long, slightly connate at the base, the stigma bifid, laciniate, papillose. *Capsule* oblong, 5–12 mm, thick, the calyx to $\frac{1}{2}$ – $\frac{2}{3}$ the capsule length, acute, minutely pubescent, the styles long, free, the carpels 3–6-seeded; seeds reddish-brown ca. 1 mm long, ellipsoid, flattened, acute, 6-ribbed, transversally striate.

This species ranges from Costa Rica along the cordillera to Ecuador, occurring among herbs in prairies and savannas above 1,000 m elevation.

CHIRIQUÍ: 5.4 km del Hato del Volcán en el camino a Las Lagunas, *Correa & Lazor 1479* (MO).

7. *Oxalis frutescens* L., Sp. Pl. 435. 1753.

7a. *Oxalis frutescens* ssp. *angustifolia* (H.B.K.) Lourt., Phytologia 29: 463–471, f. 3. 1975.

O. angustifolia H.B.K., Nov. Gen. Sp. Pl. 5: 193. 1821. TYPE: Mexico prope La Venta del Peregrino, *Humboldt & Bonpland 3906* (P, holotype; B, isotype).

O. coccinea Woodson & Schery, Ann. Missouri Bot. Gard. 28: 431. 1941. TYPE: Panamá, *Woodson & Schery 1029* (MO, holotype; NY, US, isotypes).

Hirsute *subshrub* to 40 cm tall or small *shrubs* branched from a ligneous base, the branches ascending, twisted or decumbent; stems with hirsute, fine long, uneven pubescence; roots twisted, often swollen, to 7 mm diam. *Leaves* pseudoverticillate, crowded or the internodes to 5.5 cm long, leaflets green, glaucous or violaceous, the middle one at least twice as long as the laterals, elliptic, subacute or obovate, generally notched, 10–45 mm long, 4–20 mm wide, the lateral leaflets oblong, rarely elliptic, asymmetric, notched, 4–20 mm long, 1.5–10 mm wide; pubescence dense on both faces or above glabrous or glabrescent, some specimens only pubescent on the midrib, ciliate; rachis 0.2–10 mm; petiole 10–40 mm, ascendent, pubescence as on the stems. *Inflorescences* of cymes umbelliform, 2.5 cm, somewhat taller than the foliage, 3–7(–11–15)-flowered; branches shortened ca. 1 cm, 1 often aborted; bracts 1.5 mm and bracteoles ca. 1 mm, linear,

acute; peduncles to 3.5 cm; pedicels 5 mm, pilose, articulate 1 mm from the base. *Flowers* with the sepals elliptic or linear, 3–5.5 mm long, 0.25–1.5 mm wide, acute, mucronate, pilose to glabrous, the interior sepal glabrate, the apex ciliate; petals yellow, $2\frac{1}{2}$ –3 times the length of the sepals, obovate, clawed, slightly notched; longer stamens ca. 3 mm long, pilose, the ligule acute near the middle, the shorter stamens ca. 1.5 mm long, connate up to $\frac{1}{3}$; pistil 4.5 mm long, pilose, the ovary ovoid, the style pilose, the stigma bifid, capitate. *Capsule* ovoid or oblong, 5–6 mm long, except those with 1-seeded carpels, rarely to 8 mm when carpels 8-seeded, the calyx usually $\frac{1}{2}$ ($-\frac{4}{5}$) its length; the carpels ciliate on the back, inside pubescent, rarely glabrous, 1–5-seeded; seeds brownish 1.5–2 mm long, ovoid, apiculate, 8-ribbed in zig-zag with 10–12 transversal deep striae and fine tubercles on the intersections.

This species is frequent in poor sandy, stony soils and savannas and campos from the Texas-Mexican frontier to the northwest of Argentina.

BOCAS DEL TORO: Nievécita, *Woodson & Schery 1029* (MO, NY, US). COCLÉ: Santa Clara beach, *Croat 9587* (MO). 4–6 mi E of Natá, 10–25 m, *Duke 12402* (MO). Penonomé, *Dwyer 2040* (MO); *Ebinger 996* (F, MO). Natá, *Seemann 1227* (K). Río Grande 10 mi E of Natá, *Tyson 5277* (MO). HERRERA: 10 mi S of Ocu, *Tyson et al. 2874* (MO). PANAMÁ: Cerro Jefe, 700 m, *Davidse & D'Arcy 10115* (MO, P). Near Playa Río Mar, 10–100 ft, *Duke 11783* (MO, US), *12408* (MO, NY); *Ebinger 497* (F).

8. *Oxalis latifolia* H.B.K., Nov. Gen. Sp. Pl. 237. t. 467. 1821. TYPE: Mexico, Campeche, *Humboldt et Bonpland* (P-HB, holotype; B, isotype).

O. intermedia Richard, Essai Fl. Cuba 315. 1841. TYPE: Cuba, *de la Sagra* (P, holotype; P, isotypes).

O. mauritiana Loddiges, Bot. Cab. 178. tab. 1780. 1832. TYPE: Loddiges' plate.

O. lilacina Klotzsch in Otto & Dietrich, Allgem. Gartenzeit. 8: 285. 1840. TYPE: Not found.

O. chiriquensis Woodson, Ann. Missouri Bot. Gard. 24: 190. 1937. TYPE: Panama, *Seibert 222* (MO, holotype; NY, isotype).

O. stylosa Klotzsch ex Knuth in Engler, Pflanzenr. 95(130): 273. 1930. nomen in syn.

O. elegans H.B.K. var. *karwinski* Progel ex Knuth in Engler, Pflanzenr. 95(130): 273. 1930. nomen in syn.

Aetosella violacea (L.) Kuntze ssp. *latifolia* (H.B.K.) Kuntze, Rev. Gen. Pl. 1: 90. 1891.

Ionoxalis latifolia (H.B.K.) Rose, Contr. U.S. Natl. Herb. 10: 113. 1906.

I. intermedia (Richard) Small, N. Amer. Fl. 25(1): 43. 1907.

Apparently stemless *herb*; roots deep, vertical, the branches fibrous; bulbs ovoid or globose to 25 mm long, 20 mm diam., outer scales papyraceous, large, sometimes absent; scales (nutritious) brown, elliptic, acute, narrow, 7–15 mm long, 4–6 mm wide, strongly 3-nerved, 1–2 lateral pairs of nerves thinner, exceptionally yet another shorter lateral pair present; bulbils ovoid, acute, ca. 1 cm, young, protected by several hyaline bracts similar to those described above, smaller. *Leaves* with the leaflets green, violaceous below, triangular, cuneate 10–45 mm long, 20–75 mm wide, the distal margin straight, rarely incised to $\frac{1}{5}$ – $\frac{1}{4}$ the length, short mucronate or broken in a broad, obtuse angle and the lobes divergent, small calli of various shapes often nearby, the distal angles obtuse, glabrous or sparse hairy below on the nerves or rarely overall; the margin with some cilia; petioles ascendent 5–15 cm long, glabrous or somewhat pilose; petioles fleshy, ca. 1 mm long, pilose; stipules connate to the petioles, hyaline-papyraceous, rusty-brown, ovate or rectangular, the apex auriculate, ciliate with long, viscid rusty hairs, the margins glandular, 3 prominent nerves arising from

the base and with orange calli converging just below the apex, lateral pairs generally 2, thinner and shorter, not reaching the apex: the inner pair sometimes bifurcate. *Inflorescences* umbelliform cymes commonly twice as long as the foliage, to 30 cm long, loosely 5–20-flowered; peduncles 10–25 cm long, similar to the petioles; bracts ca. 2 mm long, 2 mm wide, and bracteoles ca. 1 mm, all at the base of the inflorescence, hyaline, broadly ovate to rhombic or elliptic, acute, clasping the peduncle or the pedicel, ciliate, 1-nerved, softly crenate; pedicels thin, 14–20 mm long. *Flowers* with the sepals green, the margin hyaline, glabrous, uneven, linear-elliptic to oblong, narrowed to the apex, obtuse or subacute, 3–5 mm long, 0.5–1.5 mm wide, with orange or violaceous calli at the apex, 0.3–0.8 mm long, 2-lobate, convergent at the top end, sometimes entire, ovate, the base irregular; petals white at the base, pink to purplish at the limb, 2.5–3.5 times the length of the calyx, obovate, spathulate, clawed; stamens with filaments enlarged towards the base, pilose on the upper half, the longer stamens ca. 4 mm long with an obtuse sometimes inconspicuous ligule near the middle; the shorter stamens ca. 3 mm long, connate $\frac{1}{4}$ way up; pistils micro- or rarely macrostylous, 4.5–5.5 mm long, the ovary ovoid, glabrous, the carpels 4–8-ovuled, the styles fine, glabrous, the stigma bifid, papillose. *Capsule* oblong, acute, glabrous 4–8.5 mm long, the calyx to $\frac{1}{4}$ – $\frac{1}{2}$ its length, the styles 1.5–2 mm long, the carpels 4–8-seeded, the hairs inside sometimes inconspicuous; seeds brownish, ellipsoid, slightly flattened, ca. 1–1.1 mm long, 8–9-ribbed in zig-zag with 12–13 transversal striae.

This species occurs in Mexico, Costa Rica, the Antilles, and the Andes of South America up to 1,800 m elevation and south to Bolivia. It is introduced to the southeast of Brazil, Europe, Africa, Australia, and New Zealand.

CHIRIQUÍ: Volcán, Escuela San Benito, *Croat 10415* (MO). Boquete, 3800 ft, *Davidson 703* (F, GH, MO). Volcán Barú, 8000 ft, *Hammel 2918* (MO). Valley of upper Río Chiriquí Viejo, Monte Lirio, 1300–1900 m, *Seibert 222* (MO, NY). Chiriquí Viejo valley, *White 102* (MO). Boquete, 1200–1500 m, *Woodson & Schery 777* (MO).

9. *Oxalis microcarpa* Benth., Pl. Hartweg. 115. 1839. TYPE: Ecuador, prope Zamboronton, *Hartweg III* . . . (K).

O. Guayaquil Turcz., Bull. Soc. Imp. Moscou 31: 427. 1858. TYPE: Ecuador, banks of Guayaquil River, *Jameson 557* (K, Holotype; BM, G, W, isotypes).

Herb or *subshrub* to 1.20 m; stem erect, green or brown, the pubescence fine, curved, generally retrorse, long, hirsute, whitish or yellowish; internodes 2.5–5.5 mm, roots fibrous, branched; rhizome thin, to 4 mm diam. *Leaves* alternate to subopposite; leaflets ovate, elliptic or subrhombic unequal, 10–38 mm long, 16–20 mm wide, obtuse or subacute basally cuneate or slightly cordate, the pubescence subappressed, even, scattered, above denser, glabrescent beneath, unevenly ciliate; petiole filiform, ascendent to 4 cm long, pubescent, canaliculate, enlarged to the base, with hairs at its insertion. The *inflorescences* of bifid cymes, 10–12(–40)-flowered, peduncles filiform, pubescent as on the petioles up to 6 cm long, branches longer in the fruit, to 6 cm; bracts linear, acuminate, hirsute, 1–1.5 mm; pedicels articulate near the base 2–3 mm long. *Flowers* with the sepals green, ovate or elliptic, acuminate, 3 mm long, 0.75–1 mm wide, acute or rarely

subacute, the margin hyaline, often apically ciliate, glabrous; petals yellow, obovate-subspathulate 6–7 mm long; longer stamens ca. 2.5 cm long, ligulate under the middle, glabrous or pubescent; the shorter stamens 1.5–2 mm long, glabrous; pistil about equalling the longer stamens; styles pilose, the stigma enlarged, 2-lobulate, capitate, the carpels 1–2-ovuled, glabrous. *Capsule* subglobose ca. 3 mm long, glabrous, about equalling calyx; the carpels membranous, thin, glabrous inside, 1-seeded; seeds brownish ca. 1.5 mm long, 8-ribbed in zigzag, deeply transversally striate with small tubercles on the intersections.

This species occurs along the Pacific coast and western slopes of the cordillera from Ecuador to Mexico.

CANAL ZONE: Quebrada La Palma and Cañon of Río Chagres, 70–80 m, *Dodge & Allen 17337* (G). Río Indio, 70–100 m, *Dodge & Allen 17381* (BR, G, K, MO, P). Chagres, 1 mi above Madden Lake, *Duke 4475* (MO, P). Madden Dam, *Ebinger 876* (US). Chagres, *Fendler 25* (K, US), *26* (GH, MO). Fort Sherman between Chagres Batteries and Fort San Lorenzo, *Maxon & Valentine 6991* (GH, NY, US). Punta de Garachiné, *Seemann 1063* (K). Las Cascadas Plantation near Summit, *Standley 29618* (US). Río Boquerón, *Steyermark & Allen 17230* (BR, G, MO, P, S, US). Quebrada La Palma and Cañon Hill, *Woodson et al. 720* (F, GH, MO). DARIÉN: Río Chico, near Yaviza at junction with Río Chucunaque, *Burch et al. 1192* (MO). Mannené, *Kirkbride & Bristan 1572, 1612* (both MO). Río Tuquesa, Camp Charco Peje of Tuquesa Mining Co., 250 m, *Mori 7042* (MO). PANAMÁ: Río Cañita, near Jenine, *Duke 3838* (MO). Junction Río Pacora and Río Corso, 450 m, *Duke 11955* (P). Tortí Arriba, *Folsom 5163* (MO). La Chorrera, *Lewis et al. 5198* (MO). Río Tapia, *Standley 28075* (US). VERAGUAS: Piria, 120 m, *Duke 14359* (MO).

10. *Oxalis rhombifolia* Jacq., *Oxalis Monogr. 22. tab. 2. 1794*. TYPE: Venezuela, Caracas, Bredemeyer ex herb. Jacquin (W).

O. maxonii Standley, *J. Wash. Acad. 17: 311–2. 1927*. TYPE: Panamá, *Maxon 4996* (US, holotype; F, G, GH, US, isotypes).

O. rhombifolia Jacq. var. *pubescens* Pittier, *Trab. Mus. Com. Venezuela 7: 310. 1930*. TYPE: not seen.

Acetosella rhombifolia (Jacq.) Kuntze, *Rev. Gen. Pl. 1: 93. 1891*.

Climbing subligneous *shrub* to 6 m; pubescence yellow to rusty, long hirsute; stems profusely branched, brownish, new branches hirsute, glabrescent; internodes 5–40 cm long, shortened at the apex and on the small lateral aborted branches which bear a fascicle of leaves. *Leaflets* elliptic to rhombiform or rhombic ovate, 14–45 mm long, 10–26 mm wide, obtuse or subacute, the middle leaflet longer, the lateral leaflets somewhat asymmetric, both faces pubescent, glabrescent above, ciliate; petiolules ca. 1 mm thick, pubescent; petioles filiform, 1½–2 times the length of the blades, pubescent, swollen at the base. *Inflorescences* with cymes bifid, loosely 3–5-flowered, pubescent; peduncles to 5 cm long; bracts 3–7 mm long; bracteoles 1.5–2 mm long, linear, narrow, pubescent; pedicels 3–5 mm long, articulate near the base. *Flowers* with the sepals oblong or linear oblong, 4–5.5 mm long, 1.5–2 mm wide, obtuse, densely ciliate at the tip; petals yellow, obovate, subspathulate, 10–17 mm long, the longer stamens 5–8 mm long, hirsute, the shorter stamens ca. 3 mm long, enlarged towards the base, connate to ⅓; pistils 7–10 mm long, macro-, meso-, and microstylous, the styles hirsute, the stigma bifid, enlarged, papillose, the ovary densely pubescent, the carpels 3-ovuled. *Capsule* oblong or ovoid 7–9 mm long, densely tomentose, the calyx ½ as long as the capsule, the carpels setose inside, 2–3-seeded; seed dark colored ca. 2.25 mm long, semiovoid, flattened, 13–14-ribbed, the ribs tuberculate.



FIGURE 4. *Oxalis spiralis* ssp. *vulvanicola* (D. Sm.) Lourt. Habit ($\times\frac{1}{2}$). [After Nee 10001.]

This species occurs from Mexico to Venezuela and Colombia in humid and shadowed situations of the forest.

CHIRIQUÍ: Bajo Mono, 4500 ft, *D'Arcy 11062* (MO, P); *Davidson 495* (F, MO). Without locality, *Duke et al. 13631* (MO). Horqueta, Griffen's trail, 1700 m, *Killip 3527* (US). Bajo Lino, *Maurice 888* (COL, US). Boquete, 1000–1300 m, *Maxon 4996* (F, G, GH, US); *Pittier 2970* (F, US). Quiel Road 12.2 km above Boquete, *Proctor 31847* (IJ). Quebrada Horqueta, 1600 m, *Webster 10705* (F). Between Bajo Quiel and Bajo Mono, ca. 6 mi N of Boquete, 1450 m, *Wilbur et al. 12014* (MO). Bajo Mono, mouth of Quebrada Chiquero along Río Caldera, 1500–2000 m, *Woodson et al. 1011* (GH, NA, MO); *Woodson & Schery 526* (MO).

11. *Oxalis spiralis* R. & P. ex Don, Gen. Syst. 1: 755. 1831.

11a. *Oxalis spiralis* ssp. *vulcanicola* (D. Sm.) Lourt., comb. nov.

O. vulcanicola D. Sm., Bot. Gaz. 23: 241. 1897. TYPE: Costa Rica, Montée au flanc SE du Poás, 1900 m, *Pittier 869* (US).

Xanthoxalis vulcanicola (D. Sm.) Small, N. Amer. Fl. 25(1): 55. 1907.

X. "siliquosa" J. Roy. Hort. Soc. 85: 371. 1960, nom. inval. sine diag. lat.

Decumbent or trailing *herb* (small young plants erect), finely pubescent with yellow or reddish hairs, sometimes glabrate, succulent, to 1.5 m, branched; internodes 2–10 cm long. *Leaves* with leaflets oblong to suborbicular, cuneate, widely notched, mucronate, 10–35 mm long, 8–23 mm wide, dark green above, violaceous below, the midrib pubescent below, lateral leaflets asymmetric; petioles violaceous 2–4 cm long; stipules reddish, hyaline, connate except at the

narrow and acute apex, 2.5–5.5 mm long, slightly pubescent. *Inflorescences* of lateral, axillary and terminal cymes taller than the foliage, (1–)2–17-flowered; peduncles to 12 cm; bracts 1.5–4 mm long and bracteoles ca. 1 mm long, linear, pubescent; pedicels to 16 mm long, articulate near the base. *Flowers* with the sepals linear, 5–7 mm long, 0.75–1.5 mm wide, narrowed towards the apex, acute, glabrous or somewhat pubescent; petals yellow, obovate, cuneate 12–18 mm long, violaceous-veined; stamens with filaments short, glabrous, the longer stamens ca. 6 mm long with an obtuse ligule near the middle; the shorter stamens ca. 2 mm long, connate halfway up; pistils micro-, meso-, and macrostylous, 6 mm long; the ovary glabrous, the styles very thin, the stigma bifid, capitate papillose. *Capsule* ellipsoid, acute ca. 6 mm long, glabrous, the calyx the same length, the carpels 3–4-seeded; seeds oblong ca. 1 mm long, dark violaceous.

Oxalis spiralis ssp. *vulcanicola* is a common plant of the forest in the sub-params and cloudy forest of Central America south to Panama, occurring in volcanic regions up to 3,500 m elevation. It is cultivated as an ornamental in greenhouses, usually in hanging pots, for the beauty of its profusely branched red stems and its abundant bright yellow flowers. Grown in this way the branches are pendulous.

CHIRIQUÍ: Cerro Punta to headwaters of Río Caldera, 2250–2500 m, *Allen 1425* (F, GH, MO, US). NW of Boquete, Río Caldera, 6400 ft, *Averett 1105* (MO, P). Cerro Punta a Las Nubes, 6000 ft, *Correa 1341* (MO). Cerro Punta, *Croat 10451* (MO, P, US). 2.7 mi NW of Río Chiriquí Viejo, 2200 m, *Croat 22362* (MO, P). W of Cerro Punta, 2200 m, *Croat 22363* (MO). Road to Volcán Barú, 12 mi above Boquete, *Croat 34867* (MO). Alto Respingo, 2800 m, *D'Arcy 9959* (MO, P). Potrero Muleto to summit of Volcán Barú, *D'Arcy 10155* (MO, P). Alto Respingo, above Cerro Punta, 3000 m, *D'Arcy 10731* (MO). La Popa above Boquete, 1500–2500 m, *D'Arcy 10854* (MO, P). La Nevera, below summit of El Barú, 10,400–10,500 ft, *D'Arcy & Hammel 12447* (MO, P). El Volcán SE of La Nevera, 10,000 ft, *D'Arcy & Hammel 12512* (MO). Between Guadalupe and Paso Respingo, 8100 ft, *D'Arcy & Hammel 12836* (MO, P). Ridge above Alta Boquete, 7400–8000 ft, *D'Arcy et al. 13147* (MO). Volcán Barú, above Boquete, 3100 m, *Davidse & D'Arcy 10270* (MO, P). Boquete, Bajo Choro, 6000 ft, *Davidson 418* (F, GH, MO, US). Las Nubes region 7 km NW of Cerro Punta, 7200 ft, *Hammel 1383* (MO). Volcán Barú, E slope, 9000–10,000 ft, *Hammel 2812* (MO). Volcán Barú, E slope W of Finca Yen, 8000 ft, *Hammel et al. 6470* (MO). Cerro Punta, roadside W of Paso Respingo, 8200 ft, *Hammel et al. 6648* (MO). Alto Pineda, *Hammel et al. 6990* (MO). Chiriquí Volcano, 2300 m, *Killip 3578* (F, US). Above El Potrero camp, Chiriquí Volcano, 2890–3025 m, *Maxon 5318* (F, US). Cerro Punta, *Mori & Kallunki 5653* (MO, P). Bajo Grande, 1–3 km from town of Cerro Punta, 2000–2200 m, *Nee 10001* (MO, P, US). Boquete, 10,000 ft, *Terry 1342* (F, GH, MO, US). Quebrada Grande from Bajo Grande to Paso de Respingo, 2100–2400 m, *Wilbur et al. 15118* (MO). Potrero Muleto to summit, Volcán de Chiriquí, 3500–4000 m, *Woodson & Schery 467a* (MO).

12. *Oxalis tetraphylla* Cav., *Icones* 3: 19–20. *t.* 237. 1794. TYPE: Cavanilles' plate.

O. deppei Loddiges, Bot. Cab. 15. *t.* 1500. 1828. TYPE: Loddiges' plate.

O. esculenta Dietrich in Otto & Dietrich, Allgem. Gartenz. 3: 388. 1835. TYPE: not found.

O. zonata Lejeune, Bull. Acad. Sci. Bruxelles 2: 334. 1836. TYPE: Lejeune's plate.

O. pseudotetraphylla Knuth, Notizbl. Bot. Gart. Berlin-Dahlem 7: 316. 1919.

O. mucronata (Rose) Knuth, Notizbl. Bot. Gart. Berlin-Dahlem 7: 315. 1919.

O. hayi Knuth, Notizbl. Bot. Gart. Berlin-Dahlem 7: 316. 1919.

O. scopulorum (Rose) Knuth, Notizbl. Bot. Gart. Berlin-Dahlem 7: 391. 1919.

O. cuernavacana (Rose) Knuth, Notizbl. Bot. Gart. Berlin-Dahlem 7: 291. 1919.

O. quadrifolia Knuth in Engler, Pflanzenz. 95(4). 130: 288. 1930, nom. inval. in synonym.

Acetosella tetraphylla (Cav.) Kuntze, Rev. Gen. Pl. 1: 92. 1891.

A. deppei (Lodd.) Kuntze, Rev. Gen. Pl. 1: 92. 1891.

Ionoxalis tetraphylla (Cav.) Rose, Contr. U.S. Natl. Herb. 10: 115. 1906.

I. deppei (Lodd.) Small, N. Amer. Fl. 25(1): 32. 1907.

I. scopulorum Rose in Small, Fl. S.E. U.S. 666. 1903.

I. divaricata Small, Fl. S.E. U.S. 666. 1903.

I. mucronata Rose in Small, N. Amer. Fl. 25(1): 40. 1907.

Apparently stemless *herb*; roots vertical, fasciculate, turnip-like or cylindrical, sometimes with profuse and very long fibrous branches; bulb globose or ovoid to 4 cm long, 3 cm diam., formed by the reduced conic or discoid stem, the scales and the stipules connate to the petioles; bulbils distant on thin stolons, rarely observed in present material; outer scales scarious, brownish or with hyaline margin, the outermost row linear, 3–5-nerved, 4–18 mm long, 1–12 mm wide, sharp, sometimes absent or lost in collecting, the other ovate or largely ovate-triangular, (5–)7–14-nerved, 15–17 mm long, 5–8 mm wide, abruptly acute; inner nutritious scales yellow, thick rigid, flat-convex or subconcave, 3–5(–7)-nerved, the nerves broad, prominent, 3–7 mm long, 2–7 mm wide; stipules hyaline or scarious, whitish or reddish-brown, connate, broad at the base, 12–30 mm long, 4–13 mm wide, auriculate at the apex, 1–2 mm long, rarely acute, (5–)10–12-nerved, 5–7 nerves more salient, alternate with the other 5–7 and 2 lateral thinner nerves that do not reach the apex and are sometimes absent; in both bracts and stipules the nerves joining at different levels, only a few reaching the apex or running into the petiole, all having rigid rusty hairs 5–6 mm long inside and long cilia at the margins. *Leaves* with 4 leaflets, exceptionally in young plants 3, subequal, obovate or subtriangular, rarely suborbicular or with divergent lobules, 20–70 mm long, 25–75 mm wide, truncate, roundish, incised $\frac{1}{10}$ of its length, the midrib sometimes lengthened with a short mucro, discolorous, with a transverse fringe, purplish to blackish in the middle, the hairs simple or rarely short pluricellular, reddish on the nerves below, rarely above and on the margin, generally with small unequal translucent or dark oxalate spots located near the incision on the margin or scattered on the upper part of the blade; petioles 5–30 cm, glabrous or sparsely hairy. *Inflorescences* of bifid cymes, umbelliform 3–2-flowered, peduncles as tall as the foliage or much taller, to 50 cm, similar to the petioles; bracts 2–4 mm long, 2–2.5 mm wide, and bracteoles smaller, hyaline, ovate to rhombic, generally keeled, the midrib lengthened in a mucro, sometimes covered with oxalate calli, irregularly long ciliate; pedicels to 17 mm articulate at the base. *Flowers* with the sepals green, oblong to elliptic, 4–7.5 mm long, 1–2 mm wide, the margin hyaline, obtuse, truncate to subacute, glabrous or with a few hairs and glandular hairs, the apex ciliate with 2–4 unequal, linear, apically parallel calli, obtuse, truncate or subacute; petals pink to violet, the lower part greenish-white, 2–5 times the length of the calyx, seldom with glandular and short hairs outside; stamens longer, 2.5–4 mm long, with short hirsute, uneven hairs and glandular hairs above, the ligule large, linear, obtuse, near the middle the shorter stamens 1.5–2.5 mm long, enlarged to the base, glabrous, connate to $\frac{1}{4}$ – $\frac{1}{2}$; pistils mostly macrostylous, only 1 mesostylous and 1 microstylous, 5–7 mm long, the ovary glabrous or with hairs at the top of the carpel backs, the styles pilose with curved hairs and a few glandular hairs, the stigma bifid, papillose, the carpels 3–6-ovuled. *Capsule* cylindrical, acute, 13 mm long, glabrous, the calyx up to $\frac{1}{4}$ of its length, the styles ca. 1.5 mm long, the carpels 4–5-seeded, the interior pilose; seeds tawny, ovoid, flattened, apiculate, 1.25 mm long, 9–14-ribbed in zig-zag, the 12–16 transversal striae prominent.

This species seems to originate from Mexico. It has been introduced to all the continents, often cultivated as a good luck token. Difficult to eradicate, it does not seem, however, to be weedy.

CHIRIQUÍ: Finca Lériá, S slope of the Quebrada Velo, 5000 ft, *Allen 4733* (G, MO, NY). Boquete near Finca Collins, *Blum & Dwyer 2556* (MO). Above Boquete, 4500 ft, *D'Arcy 5447* (MO, P). 1.5 mi from Boquete, *Dwyer & Hayden 7636* (GH, MO). Boquete near Finca Collins, *Ebinger 727* (F, MO, US). 3 mi N of Boquete, 3200–4200 ft, *Lewis et al. 428* (GH, MO). Bajo Mona and Quebrada Chiquero, 1500 m, *Woodson & Schery 568* (MO).

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