



A revision of loasoid *Caiophora* (*Caiophora pterosperma*-group, Loasoideae, Loasaceae) from Peru

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Abstract

Caiophora is a taxonomically difficult, nearly exclusively Andean genus of the largely South American family Loasaceae subfam. Loasoideae. Elevational distribution and flower morphology argue for a relatively basal position of loasoid *Caiophora* in the genus. *Caiophora* has not been revised since 1900, and details of their morphology, distribution and species delimitation are incompletely understood. The *Caiophora pterosperma*-group clearly belongs to *Caiophora* based on habit, fruit morphology, karyology and molecular data, but is florally similar to members of the closely allied genera *Loasa* and *Scyphanthus*. The Peruvian members of the *Caiophora pterosperma*-group are here revised. Three species are recognized: *C. pterosperma*, endemic to the departments of Junín and Pasco (including *C. smithii*, *C. serropetala* and *C. pavonii*), *C. stenocarpa* from the departments Cuzco and Huancavelica, and the new species *Caiophora dedereichorum*, endemic to the department of Ancash. All three species occur at low elevations for the genus (down to 2200 m a.s.l.) and in seasonally dry habitats, unlike most representatives of the genus (usually found in mesic habitats at higher elevations). A key to the Peruvian members of the group, diagnoses, drawings and photographs are provided for all species recognized.

Introduction

The family Loasaceae is widely distributed in the Americas with most of the >300 species of the subfamily Loasoideae found in Andean South America, several of them endemic to Peru (Rodríguez & Weigend 2006). During the last years dozens of new species have been described or newly circumscribed, especially in the genera *Nasa* Weigend (2006: 465) and *Mentzelia* Linnaeus (1753: 516) (Florence 1997, Dostert & Weigend 1999, Weigend 1999, 2001, 2002, 2004, Weigend & Rodríguez 2002, 2003, Weigend *et al.* 2003, Rodríguez 2008, Henning & Weigend 2009a, 2009b, 2011, Henning *et al.* 2009, 2011). Especially within the genus *Nasa*, species limits have thus largely been clarified (Weigend 2000b, Weigend & Rodríguez 2002, 2003, Weigend *et al.* 2003, Henning & Weigend 2009a, Henning *et al.* 2011). In contrast, *Caiophora* Presl (1831: 41) has not recently been studied, and its taxonomy is still largely based on older publications, mainly the one and only overall revision by Urban & Gilg (1900), and the subsequent descriptions of individual taxa (Urban & Gilg 1911, Killip 1928, 1934, Macbride 1941, Standley & Barkley 1947, Sleumer 1955) or regional revisions (Argentina: Sleumer 1955). Only the few representatives from Chile and Ecuador have recently been revised (Weigend 2000a, Ackermann & Weigend 2007).

The genus *Caiophora* ranges from Ecuador to Central Argentina and Chile, with most species found at high elevations of the Andes (3500–5000 m a.s.l.), and a centre of diversity in Peru and Bolivia. In preparation for the “Catalogue of the Vascular Plants of the Southern Cone” (Weigend *et al.* 2008) and for the “The Catalogue of the Vascular Plants of Bolivia” (Weigend & Ackermann in press) hundreds of herbarium specimen were revised, and some new, undescribed species were discovered, the majority from Peru. *Caiophora* taxonomy is complicated by widespread interspecific hybridization (Ackermann *et al.* 2008). The

present revision deals with a small group of *Caiophora* in Peru, the *Caiophora pterosperma* (Ruiz & Pav. ex Don 1834: 62) Urban & Gilg (1900: 324) group of Weigend & Ackermann (2003). Gilg (1894) divided *Caiophora* into six sections. According to the previously described sections, Urban & Gilg (1900) classified the two species into two different sections: *Caiophora pterosperma* in sect. *Dolichocarpae* Urban & Gilg (in Gilg 1894: 119) and *C. stenocarpa* Urban & Gilg (1900: 330) in sect. *Bicallosae* Urban & Gilg (in Gilg 1894: 120), respectively. Based on better specimens and the study of living material the species can be clearly recognized as closely allied to each other.

Members of the *Caiophora pterosperma*-group are atypical for *Caiophora* in their floral morphology: The narrow sepals, widely spreading, relatively narrow, whitish or greenish and often serrate petals, the complex floral scales with elaborate ornamentation and dorsal filaments, and the straight or barely twisted capsules are more similar to the neighbouring members of *Loasa* Adanson (1763: 501) and the sister genus of *Caiophora*, *Scyphanthus* Don (1828: 238), than to the bulk of the species of *Caiophora*. Also, members of the *C. pterosperma*-group are only sparsely covered with short, stinging setae (2–3 mm long), whereas other members of the genus are generally long and densely setose. In the sparse cover with setae they closely resemble *Scyphanthus* and the relevant groups of *Loasa* [especially ser. *Pinnatae* Urban & Gilg (in Gilg 1894: 117)]. *Caiophora* in general is a high-Andean genus in Bolivia and Peru, with most species restricted to elevations above 3500 m and reaching elevations up to 5000 m. Members of the *C. pterosperma*-group form an exception and are largely restricted to lower elevations, often as low as 2200 m, where no other species of *Caiophora* are found.

The *C. pterosperma*-group clearly belongs to the genus *Caiophora*, in spite of their floral similarity to *Loasa* and *Scyphanthus*—it possesses the relatively long, inferior capsules which are slightly twisted, as is characteristic for *Caiophora*. Also, the chromosome number of *C. pterosperma* ($2n = 14$ or 16 ; Weigend & Dostert 97/29) is congruent with those published for other *Caiophora* taxa (Hamel 1938, Sugiura 1940, Diers 1961, Huynh 1965, Poston & Thompson 1977, Brücher 1986, 1989, Sanso & Seo 2005, Ackermann & Weigend 2007) and differing from those of *Loasa* ($2n = 12, 24, 26, 36, 38$; Tschischow 1956, Grau 1988, Sanso & Seo 2005). Additionally, molecular data for one of the species (*C. stenocarpa*: Hufford *et al.* 2005) retrieve *C. pterosperma* as member of *Caiophora*. However, morphology clearly indicates that the group likely represents a primitive and probably early branch in this genus. Based on morphology the group should probably include several similar species in Brazil [*C. arechavaletae* (Urban 1889: 217) Urban (in Gilg 1894: 120); Weigend *et al.* 2008] and Argentina [*C. cernua* Grisebach (1874: 152) Urban & Gilg ex Kurtz (1893: 291); Sleumer 1955], but a detailed phylogenetic study is not currently available.

Based on the revision of herbarium material and field studies, one species of the group is here described as new to science: *Caiophora dedereichorium* Mark.Ackermann & Weigend *sp. nov.* from dry scrub habitats in department of Ancash.

Material and methods

The present study is based on field studies of the authors in Peru, and from cultivation of *Caiophora stenocarpa* at Berlin (voucher at BSB). Specimens of the following herbaria were revised: B, BSB, CUZ, F, HUH, HUSA, HUT, K, M, MA, MO, MSB, NY, OXF, US, USM plus the online type collections of the Royal Botanical Gardens Kew (K, <http://apps.kew.org/herbcat/navigator.do>), the Field Museum of Natural History (F, <http://fm1.fieldmuseum.org/vrrc/index.php>) the Smithsonian Museum of Natural History (US, <http://collections.mnh.si.edu/search/botany/>) and JSTOR Plant Science (<http://plants.jstor.org>). Morphological characters of growth habit, leaf-size, flower-size, petal-size, nectar scale and staminode size and shape, seed size and shape were examined.

The seeds for microscopy were checked for maturity and fungal contamination. For SEM the material was sputter-coated with gold and viewed and photographed in a LEO VP 438 SEM at a voltage of 15 kV (Fig. 3A–B; compare Weigend *et al.* 2005), or respectively with a LEO 1450 SEM (Fig. 3C–F) at a voltage of 10 or 15 kV.

Formal taxonomy

Caiophora pterosperma-group

Perennial herbs. Aerial stem thin and winding, several meters long, up to 4 mm in diameter, terete, sparsely covered with white setae (2–3 mm long), glochidiate trichomes (0.1–0.2 mm long) and scabrid trichomes (0.2–0.8 mm long). Primary root and sometimes secondary roots thickened, sometimes stoloniferous. Leaves opposite, sparsely covered with short, white setae, glochidiate and scabrid trichomes. Lamina narrowly triangular to triangular-ovate, base cordate, apex acuminate, adaxially sparsely setose (2–3 mm long) and covered with scabrid trichomes (0.2–0.8 mm long), abaxially surface sparsely setose, densely set with glochidiate (0.1–0.2 mm long) and scabrid trichomes, primary venation pinnate. Flowers pentamerous, pendent or deflexed, borne in asymmetrical dichasia, pedicels long. Inferior part of ovary conical, densely setose, covered with scabrid and glochidiate trichomes; 5–8 mm long, 2–5 mm wide at apex. Calyx lobes spreading to reflexed, linear, with entire or dentate margins, sparsely setose, with glochidiate and scabrid trichomes abaxially. Corolla rotate. Petals spreading, deeply cymbiform, membranaceous, adaxially set with glochidiate and scabrid trichomes, abaxially sparsely setose and set with glochidiate and scabrid trichomes, apex hood-shaped. Nectar scales with incurved base and apex, back rounded, with double arch. Scale neck thickened, recurved; colour contrasting to back of nectar scale, back sometimes papillose, and sparsely covered with glochidiate and scabrid trichomes, nectar scale marginally always papillose (0.3–0.8 mm long). Dorsal filaments present, situated near middle of the nectar scale, 1–6 mm long. Staminodia two per scale, L-shaped; base dilate, with papillose appendage, apex abruptly filiform and straight. Stamens numerous, in epipetalous fascicles of 15–20 each; filaments ca. 7–9 mm long, white. Anthers ca. 1 mm long and 0.8 mm wide, yellowish. Ovary inferior, unilocular, with 3 parietal placentae. Capsule opening with 3 longitudinal sutures.

Key to the species:

1. Leaves pinnate-pinnatifid, with 4–5 lobes on each side, only first pair of leaflets free, petals greenish to yellowish, 11–17 mm long, nectar scales greenish or yellowish, dorsal filaments on scales 2.5–5 mm long, seeds laterally flattened and winged (Dept. Junín and Pasco) 1. *C. pterosperma*
 - Leaves (pinnatifid to) bipinnatifid, with 5–8 lobes on each side, never with free leaflets, petals white, cream or greenish, 12–20 mm long, nectar scales white or green, dorsal filaments 1–2 or 5–6 mm long, seeds neither flattened nor winged (Dept. Ancash, Cuzco and Huancavelica) 2
2. Petals white or cream, 14–20 mm long, petal margins serrate, nectar scales white, dorsal filaments 5–6 mm long, whitish, anticlinal walls of testa epidermis with irregular fenestration (Dept. Ancash) 2. *C. dederichiorum*
 - Petals greenish, 12–16 mm long, petal margins entire, nectar scales greenish, dorsal filaments 1–2 mm long, greenish with white tip, anticlinal walls of testa epidermis with regular fenestration (Dept. Cuzco and Huancavelica) 3. *C. stenocarpa*

1. *Caiophora pterosperma* (Ruiz & Pav. ex G. Don) Urban & Gilg (1900: 324) (Figs. 1, 2A–E, 3A–B)

Basionym: *Blumenbachia pterosperma* Ruiz & Pav. ex Don (1834: 62).—*Loasa pterosperma* Ruiz & Pavón (1958: 419, plate 448). Lectotype (designated by Weigend 1997: 227):—PERU. Locality unknown, Plate 448 of Ruiz & Pavón (1958) (“*Loasa pterosperma*”). Epitype (designated by Weigend 1997: 227):—PERU. Junín: Huasahuasi, anno 1794, Ruiz & Pavón s.n. (MA, photo M!).

= *Caiophora pavonii* Urban & Gilg in Gilg (1894: 119). Type:—PERU. without locality, no specimen cited.

= *Caiophora serropetala* Macbride (1941: 179). Type:—PERU. Junín: Huasahuasi, 29 April 1940, Woytkowski 39 (holotype US!).

= *Caiophora smithii* Killip (1934: 51). Type:—PERU. Junín: Carpapata above Huacapistana, 3000 m, Killip & Smith 24419 (holotype US!; isotypes F!, NY!).

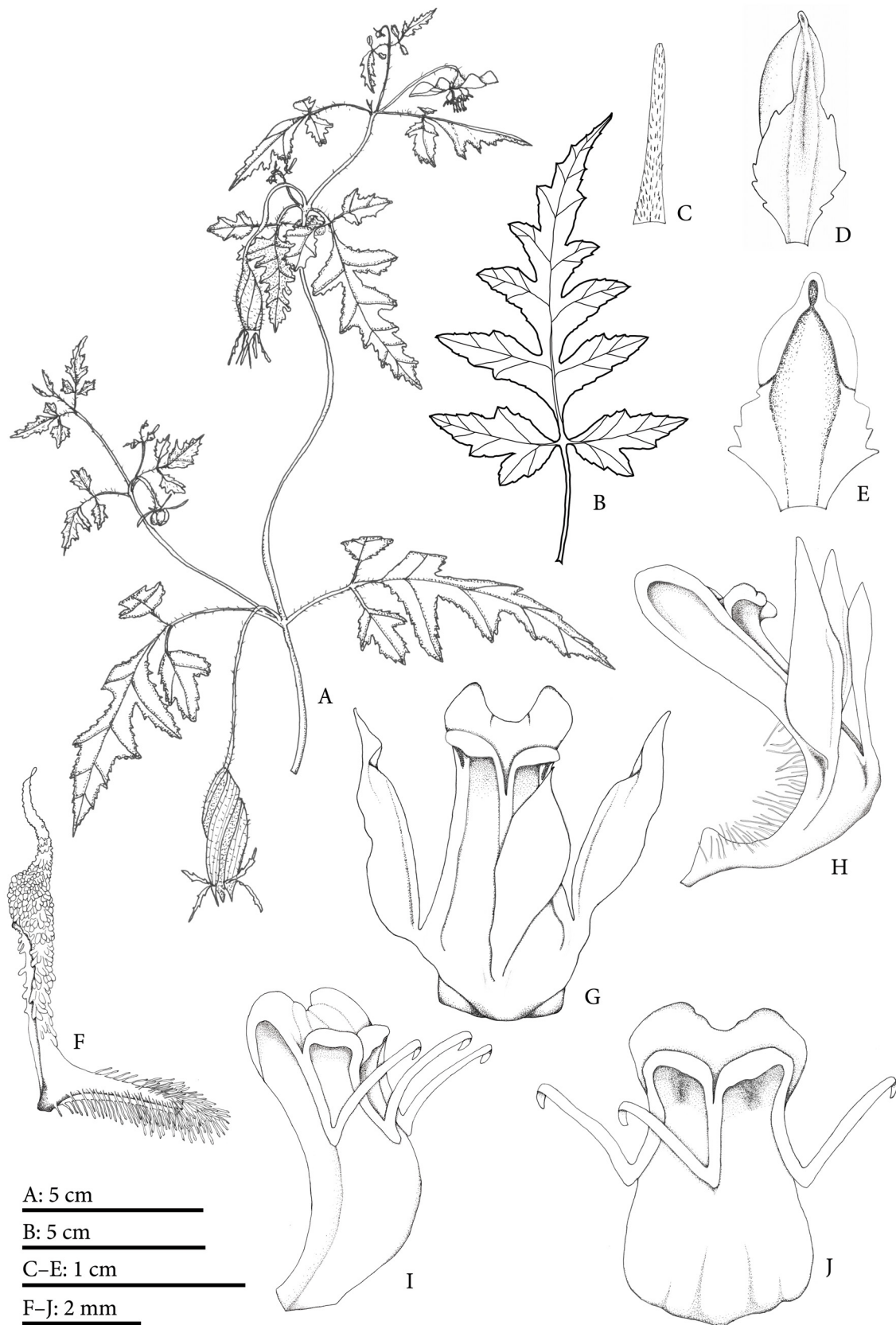


FIGURE 1: *Caiophora pterosperma*. A. Shoot with flowers and fruits. B. Leaf. C. Sepalum, D. Petal, frontal view. E. Petal, lateral view. F. Staminode, lateral view. H–J. Nectar scales. G, J. Dorsal view. H, I. Lateral view. (Drawn from: A: Sandeman 4533; B–D, F–H: Weigend et al. 5484; E, I–J: Weigend & Dostert 97/29. Drawings prepared by: A: M. Weigend; B, G–H: M. Ackermann; C–F, I–J: I. Hoyer)



FIGURE 2: A–E: *Caiophora pterosperma*. A, D. Flower, frontal view. B. Flower, dorsal view. C. Leaf. E. Staminodial complex. F–L: *Caiophora dederingiorum*. F. Flower, frontal view. G–H. Flower, lateral view. I. Flower, dorsal view. J. Staminodial complex. K. Bud. L. Leaf. (A–C: Weigend & Dostert 97/29; D–E: Weigend et al. 5484; F–H, J–K: Henning & Schulz 19; I: Weigend et al. 7738; L: Weigend & Dostert 97/177. Photos F–H, J–K: T. Henning)

Plant with thickened tap-root. Leaves opposite, petioles 8–45 mm long. Lamina triangular-ovate in outline, 35–110(–145) mm long, 15–70(–90) mm wide near base, pinnate-pinnatifid with 4–5 lobes on each side, first pair of leaflets free, lobes triangular; lobe margin serrate, larger lobes 10–45 mm long and 5–18 mm wide, lamina base cordate (sinus 5–10 mm deep). Flowers with pedicels 10–25 mm long. Calyx lobes with entire margins, 7–10 mm long and 1–2 mm wide near base. Petals 11–17 mm long, 6–10 mm wide, margin entire or serrate; greenish to yellowish. Nectar scales 5–7 mm high, 2–3.5 mm wide, scale itself greenish or yellowish, apex orange or reddish brown; dorsal filaments laterally compressed and linear, green and apically white, or flag-shaped, yellowish and apically white, 2.5–5 mm long, and up to 1.5 mm wide. Staminodia 5–8 mm long. Capsule ovoidal or cylindrical, 20–30 mm long and 5–8 mm wide at apex; apex coherent, protracted into conical beak ca. 5–7 mm long; 0–1 x twisted. Pedicel 10–25 mm long. Seeds numerous, ca. 1400 µm long and 900 µm wide, laterally flattened, anticlinal walls in one plane extremely high (seed winged), with transverse secondary sculpture and spongy walls.

Habitat:—Andean scrub, also along road margins in former montane rain forest. Its elevational range is 2200–3400 m a.s.l.

Distribution:—*Caiophora pterosperma* is now reported from the department of Junín (provinces Chanchamayo and Tarma) and the department of Pasco (province Oxapampa).

Etymology:—The Latin word *pterosperma* is derived from the Greek *pteron* (= wing) and from the Greek word *sperma* (= seed).

Observations and affinities:—All specimens seen are characterized by pinnate-pinnatifid leaves in contrast to the plate of Ruiz & Pavón (1958) where leaves are illustrated as regularly pinnatifid. Collections are somewhat heterogenous with regard to details of the floral morphology: filaments on the back of the nectar scales are either filiform, greenish and apically white or flag-shaped, yellowish and apically white. The later one, described by Killip (1934) as *C. smithii* and placed in synonymy by Weigend & Ackermann (2003), was found in both departments, sharing all other characters with the remaining specimens and is therefore not recognized as a separate species. *Caiophora pterosperma* can be distinguished from *C. stenocarpa* and *C. dedrichiorum* by leaves with the first pair of leaflets free to the rachis, in combination with its intermediate sized filament length (2.5–5 mm versus 1–2 mm in *C. stenocarpa*, 5–6 mm in *C. dedrichiorum*) and its winged seeds.

Specimens seen:—PERU. Depto. Junín: Prov. Chanchamayo, Huacapistana, 2200 m, October 1943, Sandeman 4533 (OXF!); Prov. Tarma, Huasahuasi, path to the ruins of Chupas above Huasahuasi, 3000–3400 m, 5 February–2 April 1997, Weigend & Dostert 97/29 (F!, HUT!, MSB!, NY!, USM!); Depto. Pasco: Prov. Oxapampa, road from Paucartambo to Oxapampa, towards Tingo Chontabamba, km 82, S10°38', W075°25', 2280 m, 4 April 2001, Weigend et al. 5484 (BSB!, HUT!, MO!, MSB!, USM!); Distr. Chontabamba, Carretera la Suiza Nueva, S10°40'44", W075°26'34", 2360 m, 8 August 2008, Rodríguez et al. 89 (BSB!, MO).

2. *Caiophora dedrichiorum* Mark.Ackermann & Weigend, *sp. nov.* (Figs. 2F–L, 3F–H, 4)

Differs from C. stenocarpa and C. pterosperma by its white or cream-coloured petals and nectar scales (versus greenish or yellowish), from C. stenocarpa by its serrate petal margin (versus entire), dorsal filaments on nectar scales of 5–6 mm (versus 1–2 mm), staminodes of 7–10 mm (versus 4–5 mm) and by anticlinal walls of seed testa with irregular fenestrations of 1–15 windows per wall (versus regular fenestrations of 5–25 per wall), from C. pterosperma by its leaves with 5–8 lobes on each side (versus 4–5 and first pair of leaflets free) and by its never laterally flattened nor winged seeds (versus laterally flattened and winged).

Type:—PERU. Depto. Ancash: Prov. Bolognesi, ca. 2 km from Chiquián, on road to Conococha, UTM 18L 0262638, UTM 8878212, 3590 m, 18 May 2003, Weigend, Henning & Mohr 7738 (holotype USM!; isotypes BSB!, F!, M!, MO!).

Plant with thickened tap-root and rhizomes. Leaves opposite, petioles 12–15 mm long. Lamina triangular-ovate in outline, 30–60(–90) mm long, 20–40(–70) mm wide near base, (pinnatifid to) bipinnatifid with 5–8 lobes on each side, lobes ovate to triangular; lobe margin serrate, larger lobes often very narrow and linear, 18–34 mm long and 8–26 mm wide, base cordate (sinus 6–8 mm deep). Flowers with pedicels 15–20(–70) mm long. Calyx lobes entire, 9–15 mm long and 2 mm wide near base. Petals 14–20 mm long, 7–10 mm wide, margin serrate;

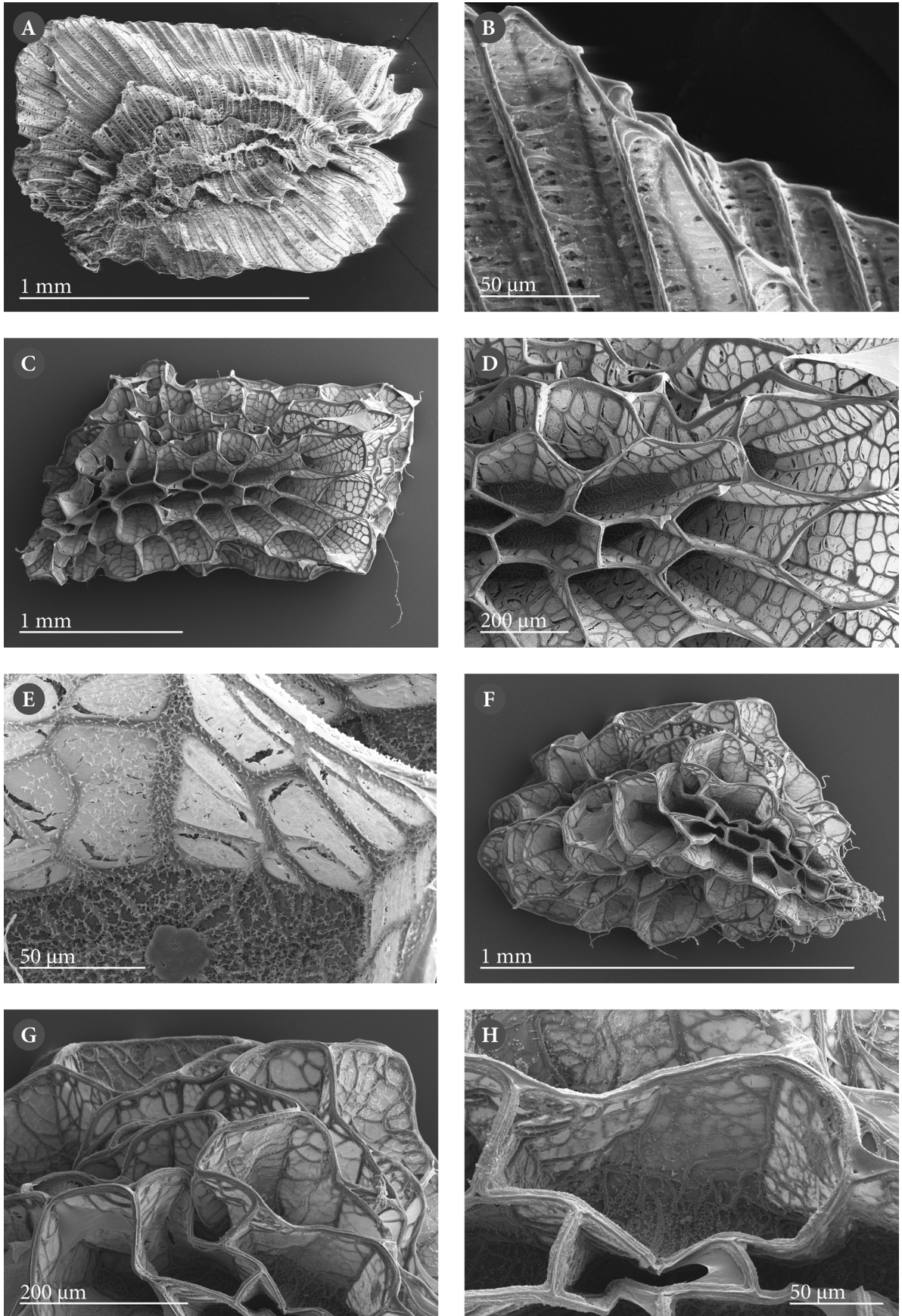
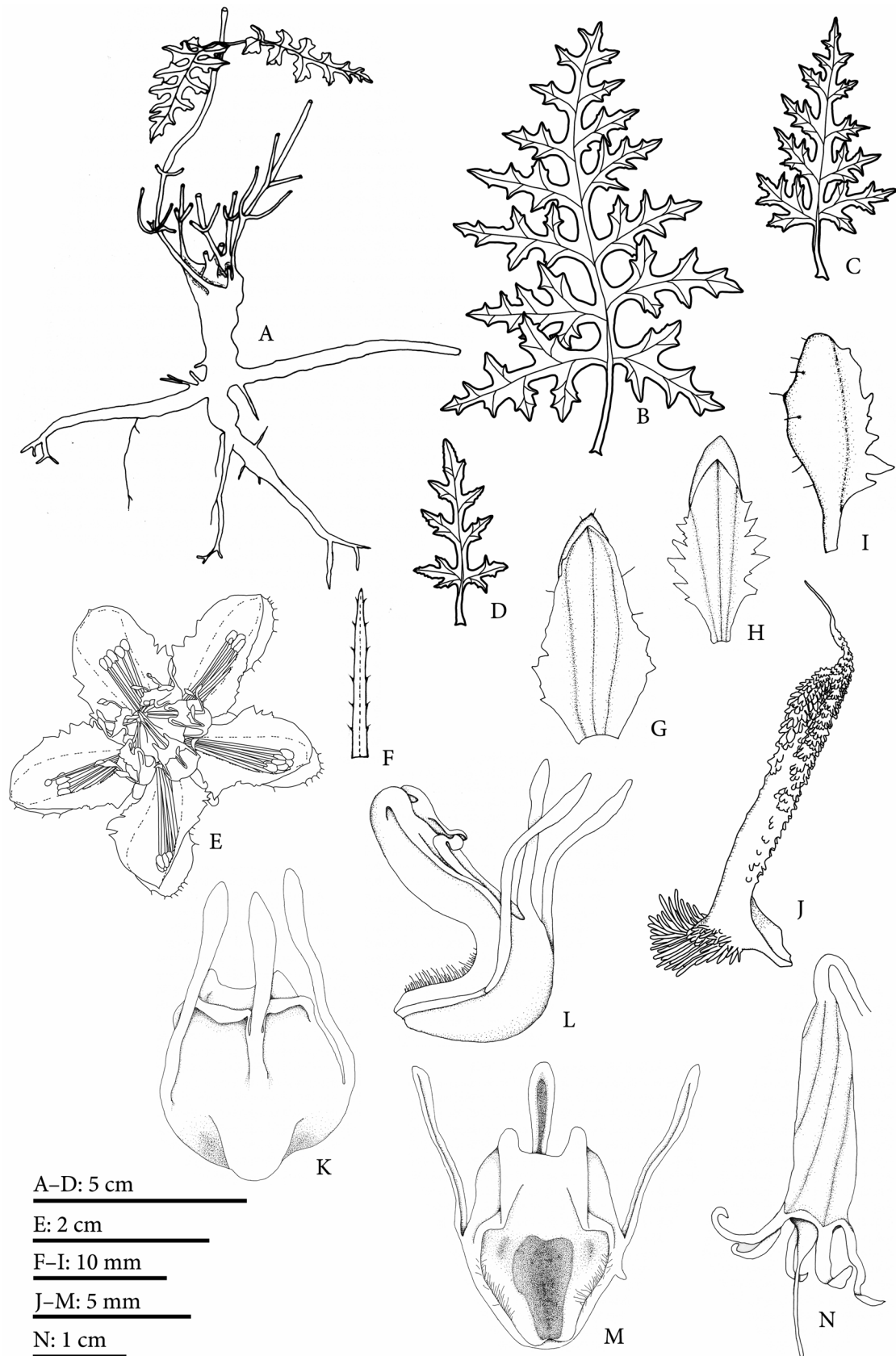


FIGURE 3: Seeds. A–B: *Caiophora pterosperma*. C–E: *Caiophora stenocarpa*. F–H: *Caiophora dedereichiorum* (A–B: Weigend & Dostert 97/29, C–E: Ackermann 758, F–H: Henning & Schulz 19. Photos C–H: H. J. Ensikat)



A–D: 5 cm

E: 2 cm

F–I: 10 mm

J–M: 5 mm

N: 1 cm

FIGURE 4: *Caiophora dedereichiorum*. A. Root system. B–D. Leaves, B–C Upper leaves. D. Bract. E. Upper view of flower. F. Sepalum. G. Petal, frontal view. H. Petal, lateral view. I. Staminode, lateral view. J–L. Nectar scales. J. Dorsal view. K. Lateral view. L. Ventral view M. Fruit. (Drawn from A–D, G: Weigend et al. 7737; E–F, H–N: Weigend et al. 7738. Drawings prepared by: A–E, J–M: M. Ackermann; F–I, N: I. Hoyer)

white or cream-coloured. Nectar scales 6–8 mm high, 4–5 mm wide; scale itself whitish, neck orange. Dorsal filaments dorsiventrally compressed and apically widened, oblong, white, 5–6 mm long. Staminodia 7–10 mm long. Capsule cylindrical, 20–30 mm long and 4–7 mm wide at apex, apex coherent, protracted into conical beak ca. 5 mm long; 0–0.3 x twisted. Pedicel 15–70 mm long. Seeds numerous, 1100–2400 µm long and 700–1500 µm wide, anticlinal wall with irregular, scabrid secondary sculpture, leading to very large, irregular fenestrations of only 1–15 per wall.

Habitat:—*Caiophora dedereichiorum* grows in dry scrub vegetation dominated by *Agave* Linnaeus (1753: 323), *Colletia* Jussieu (1789: 380) and *Austrocyllindropuntia* Backeberg (1938: 21). Its elevational range is ca. 3000–3600 m a.s.l.

Distribution:—The newly described species is narrowly endemic to the province Bolognesi in department of Ancash, central Peru, and currently only known from the surroundings of Chiquián.

Etymology:—*Caiophora dedereichiorum* is named in honour of Rolf and Gisela Dederich, Bonn, Germany, benefactors of the Bonn University Botanical Gardens.

Observations and affinities:—This species is characterized by its white or cream-coloured petals and whitish nectar scales, whereas both other species do have greenish or yellowish nectar scales, additionally larger leaf segments are often very narrow and linear whereas *C. stenocarpa* and *C. pterosperma* are characterized through always triangular leaf segments.

Paratypes:—PERU. Depto. Ancash: Prov. Bolognesi, above Chiquián, 3500 m, 15 April 1949, *Ferreyra 5790* (MO, US, USM!); same locality, 3350 m, 5 May 1950, *Ferreyra 7448* (MO, US, USM!); road from Chiquián to Conococha, 2 km out of town, S10°08'444", W077°10'095", 3599 m, 2 June 2008, *Henning & Schulz 19* (BSB!, HUT, M, USM!); below Chiquián, 3150–3400 m, February 1997, *Weigend & Dostert 97/177* (F!, HUT!, K!, MSB!, NY!, USM!); Chiquián, footpath from Chiquián towards to the river Pativilca, 3000–3400 m, 17 March 2001, *Weigend et al. 5188* (2001/188) (BSB!, HUT!, M!, USM!); immediately below Chiquián, 3300 m, 17 May 2003, *Weigend et al. 7737* (BSB!, USM!).

3. *Caiophora stenocarpa* Urban & Gilg (1900: 330) (Figs. 3C–E, 5–6)

Type:—PERU. [Huancavelica], *MacLean s.n.* (holotype K!).

Plant with thickened secondary roots (tubers). Leaves opposite, petioles 10–40 mm long. Lamina triangular-ovate in outline, 50–90(–130) mm long, 30–65(–80 mm) wide near base, (pinnatifid to) bipinnatifid with 6–8 lobes on each side, lobes ovate to triangular; lobe margin serrate, larger lobes 14–35 mm long and 12–25 mm wide, base of lamina cordate (sinus 5–11 mm deep). Flowers with pedicel 20–40 mm long. Calyx lobes with serrate or entire margins 6–8 mm long and 2 mm wide near base. Petals 12–16 mm long, 6–9 mm wide, margin entire; greenish. Nectar scales 4–6 mm high, 3–4 mm wide, scale itself greenish, apex contrasting to scale, reddish-brown. Dorsal filaments dorsiventrally compressed and apically widened, oblong, green and apically white, 1–2 mm long. Staminodia 4–5 mm long. Capsule cylindrical, 15–25 mm long and 6–8 mm wide at apex; apex coherent, protracted into conical beak ca. 3–5 mm long; 0–0.3 x twisted. Pedicel 20–40 mm long. Seeds numerous, 1400–2000 µm long and 600–1350 µm wide, anticlinal wall with regular, scabrid secondary sculpture, leading to very large, regular fenestrations of 5–25 per wall.

Habitat:—*Caiophora stenocarpa* grows in dry scrub vegetation on sunny, rocky hillsides. Its elevational range is 2800–3750 m a.s.l.

Distribution:—*Caiophora stenocarpa* is known from the departments of Cuzco and Huancavelica and also expected in the intervening parts of department Ayacucho.

Etymology:—The Latin word *stenocarpa* derived from the Greek word *stenos* (= narrow) and from the Greek word *karpos* (= fruit).

Observations and affinities:—The type collection of *C. stenocarpa* is without locality, but circumstantial evidence indicates that it was likely collected in the department of Huancavelica. *Caiophora stenocarpa* is the only species out of the group with entire petals and very short dorsal filaments on the back of the nectar scales (1–2 mm, *C. pterosperma* 2.5–5 mm, *C. dedereichiorum* 5–6 mm). The testa epidermis has

regular fenestrations on the anticlinal walls unlike the widely irregular fenestrations on the seeds of *C. dedrichiorum*. Up to now it is the only known *Caiophora* species with tuberous secondary roots.

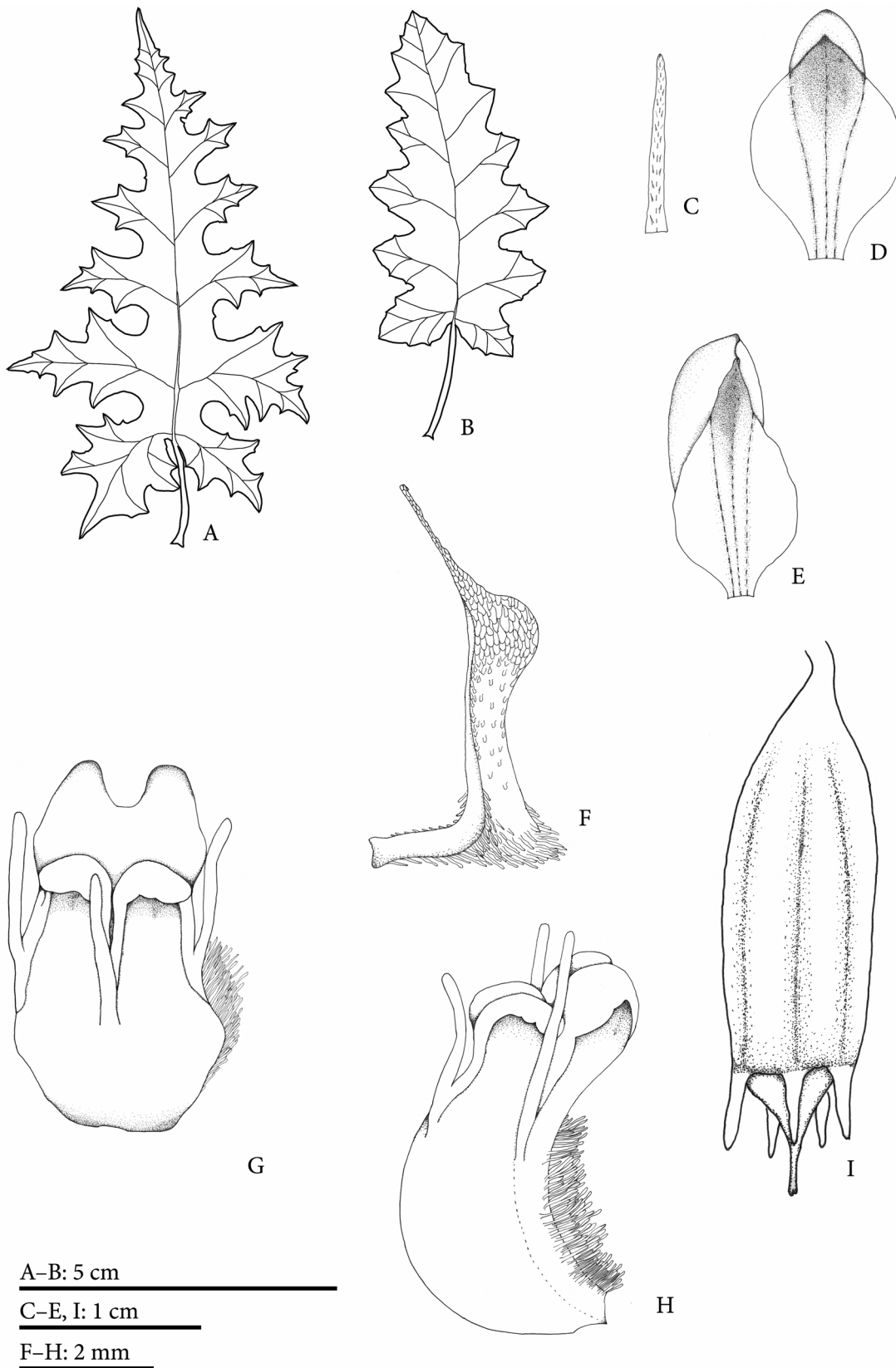


FIGURE 5: *Caiophora stenocarpa*. A–B Leaves. A. Upper leaf, B. Basal leaf. C. Sepalum. D. Petal, frontal view. E. Petal, lateral view. F. Staminode, lateral view. H–I. Nectar scales. H. Dorsal view. I. Lateral view. J. Fruit. (Drawn from A, C–J: Weigend & Weigend 2000/211; B: Ackermann *et. al* 325. Drawings prepared by: A–B, F–I: M. Ackermann. C–E, J: I. Hoyer)

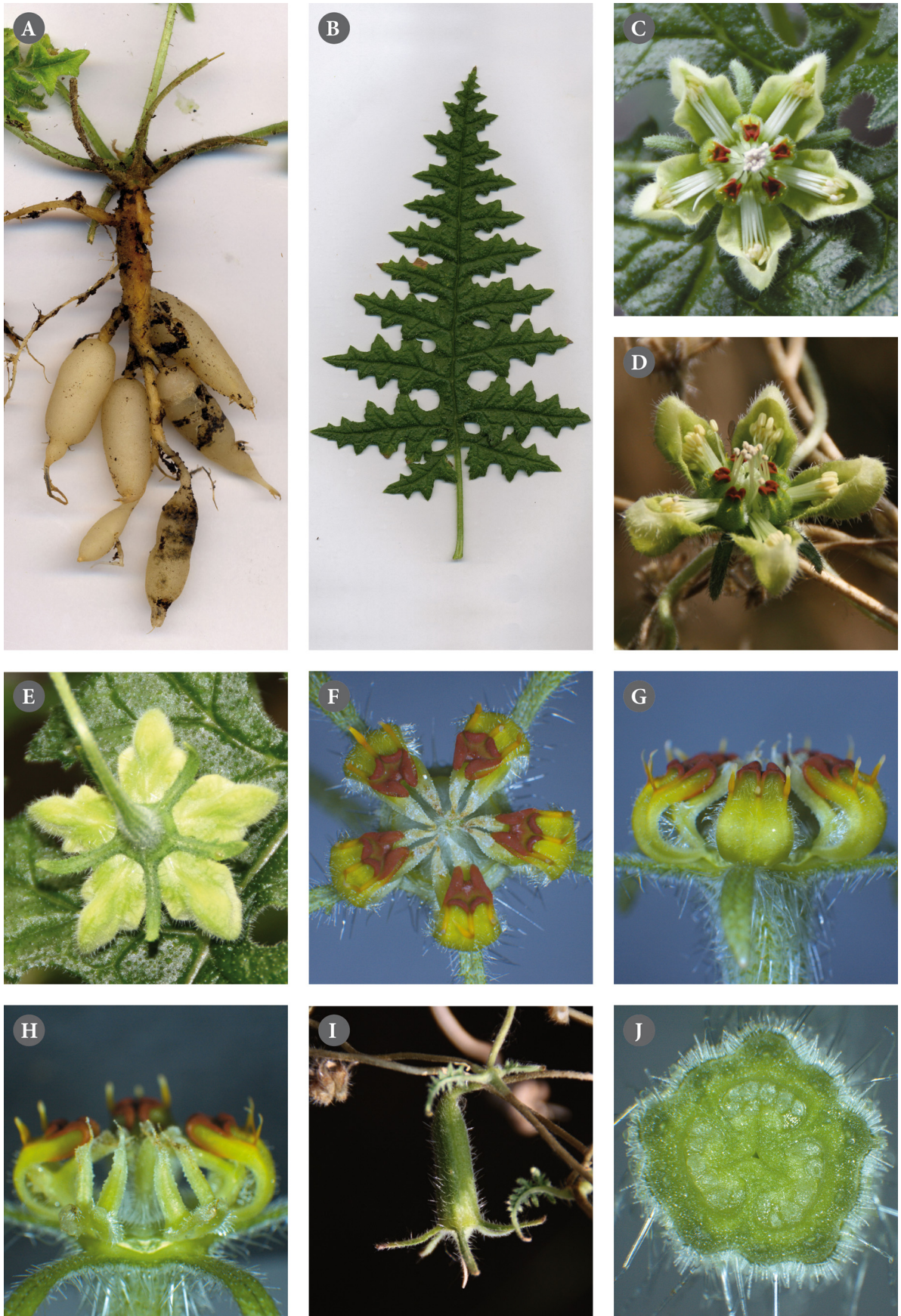


FIGURE 6: *Caiophora stenocarpa*. A. Root system with secondary tubers. B. Leaf. C. Flower, frontal view D. Flower, lateral view. E. Flower, dorsal view. F–H: Staminal complex; petals and stamens removed. F. Frontal view. G. Lateral view. H. Lateral view, two nectar scales removed. I. Fruit. J. T-shaped placentation (A–J: *Ackermann 758*).

Specimens seen:—PERU. Depto. Cuzco: Trail over K'Enti Cuesta to Pojpoj, 3370 m, 21 January 1982, *Davis et al. 1736* (F!, HUH, USM!); same locality, 3400 m, 25 January 1982, *Davis et al. 1779* (F!, HUH); Prov. Anta, Cerro Huanacori, El Chaccan, 3710 m, 18 April 1973, *Brunel 894* (MO!); Prov. Calca, Had. Paucartica, 2900 m, 20 February 1942, *Vargas 2442* (CUZ!); Prov. Cuzco, Dist. Chinchero, Chinkana, 3750 m, 27 December 1985, *Franquemont & Franquemont 265* (F, NY!); Prov. Paucartambo, Caicay, S13°34'54", W071°42'45", 3089 m, 27 February 2006, *Valenzuela et al. 6452* (BSB!, MO); Prov. Urubamba, Pomatales, 52 km from Cuzco, Huayocondo Cañon, 2800–2950 m, 6 March 1987, *Nuñez 7287* (MO, USM!); Dist. Ollantaytambo, Village Ollantaytambo, other side of the river, hillsides, S13°15'55,7", W072°15'59,9", 2858 m, 2 April 2009, *Ackermann 758* (BSB!, HUSA!, USM!); Urubamba valley, above village Ollantaytambo, S13°15', W072°15', 2880 m, 15 September 2002, *Ackermann & Salinas 325* (BSB!); Cachijata, S13°15'00", W072°18'00", 2800 m, 8 January 2003, *Galiano et al. 4612* (BSB!, CUZ, MO, USM!); Above ruins of Ollantaytambo, S13°15', W072°16', 3000 m, 8 February 2000, *Weigend & Weigend 2000/211* (F!, HUSA!, M!, MO!, NY!, USM!); Depto. Huancavelica: Ayán below Conaica, 3300–3350 m, 13 March 1951, *Tovar 147* (US!).

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