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Studies in the genus *Lotononis* (Crotalarieae, Fabaceae). 9. Four new species of the *L. pentaphylla* group, section *Lipozygis*

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ABSTRACT

L. pentaphylla (E. Mey.) Benth. and related species were previously shown to be very different from the rest of the section *Lipozygis* (E. Mey.) Benth. of *Lotononis* (DC.) Eckl. & Zeyh. These species are all annuals and can easily be distinguished by their capitate inflorescences, sessile flowers and indehiscent, wind-dispersed pods. Four new species of this group are described, namely *L.* **oligocephala** B-E. van Wyk, *L.* **globulosa** B-E. van Wyk, *L.* **laticeps** B-E. van Wyk and *L.* **longicephala** B-E. van Wyk.

UITTREKSEL

Daar is voorheen aangetoon dat *L. pentaphylla* (E. Mey.) Benth. en verwante spesies baie verskillend is van die res van die seksie *Lipozygis* (E. Mey.) Benth. van *Lotononis* (DC.) Eckl. & Zeyh. Hierdie spesies is almal jaarplante en kan maklik onderskei word aan hul hofievormige bloeiwyses, sittende blomme en nie-oopspringende, windverspreide peule. Vier nuwe spesies van hierdie groep word beskryf, naamlik *L.* **oligocephala** B-E. van Wyk, *L.* **globulosa** B-E. van Wyk, *L.* **laticeps** B-E. van Wyk en *L.* **longicephala** B-E. van Wyk.

INTRODUCTION

Lotononis pentaphylla (E. Mey.) Benth., *L. polycephala* (E. Mey.) Benth., *L. anthylloides* Harv., *L. bolusii* Dümmer and *L. rosea* Dümmer differ from all other annual species of *Lotononis* (DC.) Eckl. & Zeyh. in their densely capitate inflorescences, sessile flowers and indehiscent, wind-dispersed pods (Van Wyk 1989). These five species were previously included by Bentham (1843), Harvey (1862) and Dümmer (1913) in the section *Lipozygis* (E. Mey.) Benth., but their annual habit and unusual morphology have apparently been overlooked. Four new species that clearly belong to this group are described below.

Wind-dispersal is not uncommon in the tribe Crotalarieae but it is usually accomplished by winged pods, as in the genus *Wiborgia* Thunb. Personal observations have shown that wind-dispersal also occurs in *Lotononis benthamiana* Dümmer and in *Lebeckia melilotoides* Dahlgren. In these two species, the highly persistent corolla acts as a wing to facilitate dispersal. *L. pentaphylla* and its allies however, show an unusual and interesting mode of seed dispersal. The tiny pods are few-seeded, totally indehiscent and are completely enclosed by a densely hirsute, much-inflated calyx. When the seeds have matured, the calyx with its enclosed pod is shed from the peduncle. At this stage, the petals are crumpled up and withered, but the total absence of a pedicel and the hairy, inflated calyx result in a very effective dispersal by wind. Only a slight wind is necessary to move the pod (diaspore) over long distances by a rolling rather than floating action. Morphological features associated with this dispersal mechanism are unique within the genus *Lotononis* and therefore valuable as diagnostic characters. The total absence of a pedicel is the most obvious one, and perhaps also the most useful.

1. **Lotononis oligocephala** *B-E. van Wyk*, sp. nov., *L. polycephalae* (E. Mey.) Benth. valde affinis, sed foliis minoribus 5-foliolatis (in *L. polycephala* 3-foliolatis), inflorescentiis floribus bracteisque minoribus, lobis calycis brevioribus latioribusque, atque corolla omnino glabra (in *L. polycephala* dense pubescente) differt.

TYPE.—Cape Province, 2918 (Gamoep): Areb, ± 27 miles [43,2 km] NE of Springbok, 25.07.1972, *Van der Westhuizen 276* (PRE, holo.; K, MO, iso.).

Prostrate annual up to 0,8 m wide. *Branches* sparsely leafy, densely silky. *Leaves* invariably 5-foliolate, (6–)10–18(–24) mm long; petiole ± as long as the terminal leaflet or longer; leaflets relatively small, broadly obovate, (3–)5–8(–10) mm long, (2–)3–5(–7) mm wide, base cuneate, apex truncate to emarginate, densely silky on both surfaces. *Stipules* single at each node, lanceolate to broadly ovate, 3–4 mm long, 2–3 mm wide, densely silky on both surfaces. *Inflorescences* in terminal heads, the heads somewhat flattened, 4–8-flowered; peduncle variable in length, 5–50 mm long; bracts large, broadly obovate, ± 4 × ± 4 mm; bracteoles absent. *Flowers* relatively small, 12–14 mm long, yellow; pedicel absent. *Calyx* subequally lobed but with the lower lobe slightly narrower than the upper four lobes, the sinuses of equal depth; lobes broadly triangular, acute. *Standard* oblong, as long as the keel; claw 4–5 mm long; lamina ± 8 mm long, 5–6 mm wide, without lobes or callosities, glabrous but with a few hairs dorsally along the middle. *Wing petals* oblong, ± as long as the keel, glabrous; auricle small, ± 1 mm long; apex obtuse; sculpturing in 4–5 rows of intercostal lunae, fading into transcostal lamellae towards the auricle. *Keel petals* obovate-oblong, only slightly auriculate; claw 5 mm long; lamina 9 mm long, 5 mm wide, glabrous; apex rounded. *Androecium*

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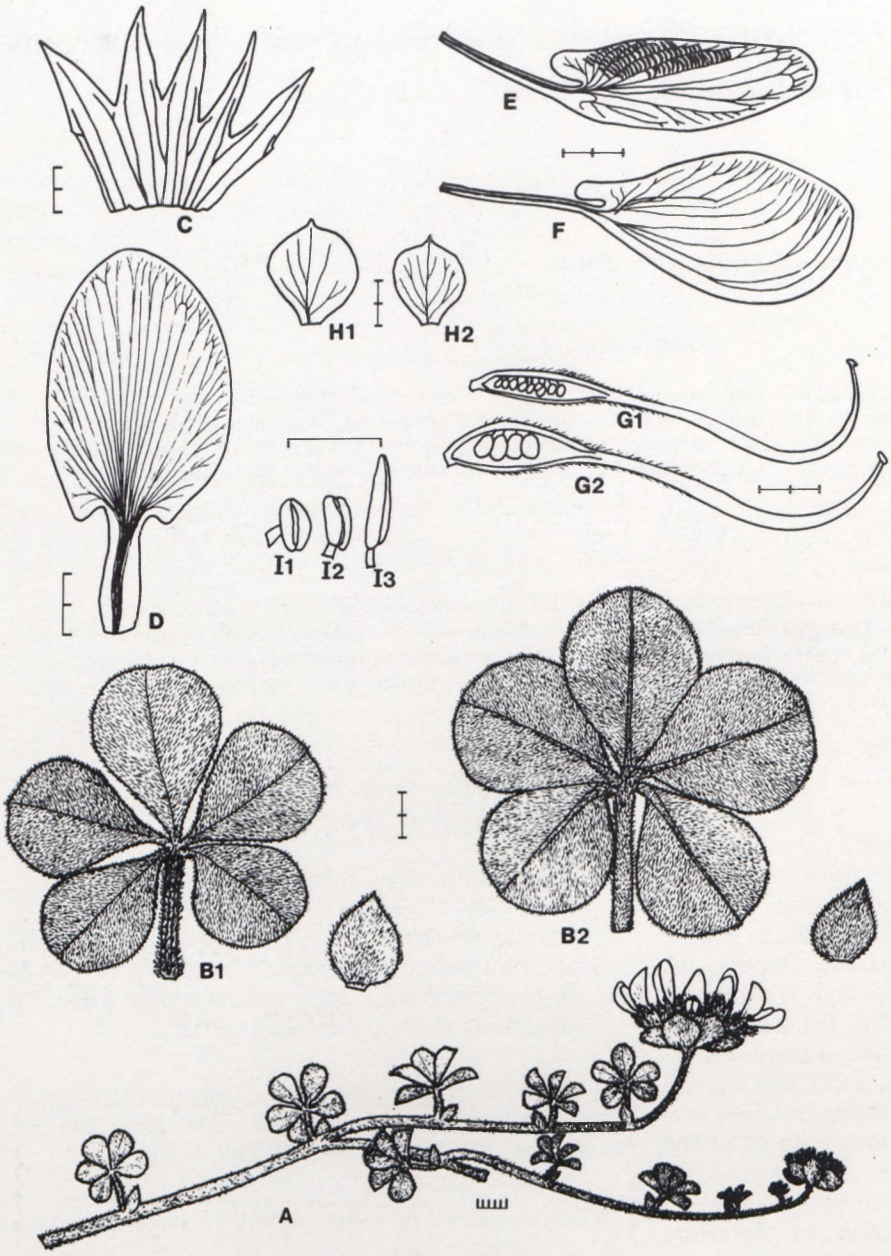

FIGURE 1.—*Lotononis oligocephala*. A, flowering twig; B1 & B2, leaves and stipules: B1, adaxial view, B2, abaxial view; C, calyx opened out with the upper lobes to the left (vestiture not shown); D, standard petal; E, wing petal; F, keel petal; G1 & G2, pistils: G1, from young flower, G2 from older flower; H1 & H2, bracts; I1, I2 & I3, anthers: I1, dorsifixed anther, I2, carinal anther, I3, long basifixed anther. All from *Van der Westhuizen 276*. Scales in mm.

long and narrow; anthers dimorphic; basifixed anthers oblong, slightly longer than the small ovoid dorsifixed anthers; carinal anther similar to dorsifixed anthers. *Gynoecium* sessile; pistil very small, ovoid-oblong, pubescent, with 5–12 ovules; style long and slender. *Pods* and *seeds* unknown (Figure 1).

L. oligocephala is closely related to *L. polycephala* (E. Mey.) Benth. but can easily be distinguished by the much smaller and 5-foliolate leaves (3-foliolate in *L. polycephala*), the smaller inflorescences and flowers, the smaller bracts, the shorter and wider calyx lobes, and the corolla, which is totally glabrous (densely pubescent in *L. polycephala*). This species is known only from the type collection, which is from northern Namaqualand (Figure 2).

CAPE.—2918 (Gamoep): Areb, ± 27 miles [43,2 km] NE of Springbok (–AC), *Van der Westhuizen 276* (PRE, holo.; K, MO, iso.).

2. **L. globulosa** *B-E. van Wyk*, sp. nov., *L. pentaphyllae* (E. Mey.) Benth. et *L. bolusii* Dümmer similis, sed bracteis maximis late ovatis, floribus paulo maioribus, vexillo suborbiculari (non oblongo) et foliis semper 3-foliolatis (folia quidem nonnulla 5-foliolata in *L. pentaphylla* et *L. bolusii*). Praesertim similis *L. laticipi* B-E. van Wyk, sed ab illo specie inflorescentiis globosis (non discoideis), bracteis maioribus, vestitura densius hirsuta, vexillo longiore, lobis calycis latioribus, atque lobis calycis duobus superioribus latioribus quam inferioribus (superioribus inferioribus aequantibus in *L. laticipe* differt).

TYPE.—Cape Province, 3320 (Montagu): 29,5 km from Touws River to Laingsburg, near Tweedside, 13.10.1986, *B-E. van Wyk 2210* (PRE, holo.).

Prostrate annual up to 0,4 m wide. *Branches* sparsely leafy, densely to sparsely hirsute. *Leaves* invariably 3-foliolate, (5–)8–16(–32) mm long; petiole as long or usually longer than the terminal leaflet; leaflets comparatively small, oblanceolate to obovate, (3–)5–10(–14) × (1–)3–4(–6) mm, base cuneate, apex rounded or rarely emarginate, abaxial surface sparsely hirsute, adaxial

surface glabrous. *Stipules* single at each node, lanceolate to oblong, 3–6 × ± 1 mm. *Inflorescences* in terminal heads, the heads globose, 8–20-flowered; peduncle variable in length, usually short, 5–25 mm long; bracts large, very broadly ovate, (4–)7–10 × (4–)7–10 mm; bracteoles absent. *Flowers* relatively small, 9–10 mm long, yellow; pedicel absent. *Calyx* subequally lobed but with the two upper lobes slightly wider than the lower lobes, the sinuses of ± equal depth; lobes narrowly triangular, acute. *Standard* suborbicular, as long as the keel or slightly shorter; claw ± 4 mm long; lamina 5–6 × 5–8 mm, without lobes or callosities, pubescent over most of the abaxial surface. *Wing petals* oblong, ± as long as the keel, pubescent along the apex; auricle small, ± 0,5 mm long; apex obtuse; sculpturing in 4–5 rows of intercostal lunae, fading into transcostal lamellae towards the auricle. *Keel petals* obovate, only slightly auriculate; claw ± 4 mm long; lamina 4–6 × 3–4 mm, pubescent over most of the surface; apex rounded. *Androecium* long and narrow; anthers dimorphic; basifixed anthers oblong, slightly longer than the small ovoid dorsifixed anthers; carinal anther similar to dorsifixed anthers. *Gynoecium* sessile; pistil very small, ovoid-oblong, pubescent, with 5–9 ovules; style long and slender. *Pods* very small, ovoid, ± 4 × 2,5 mm, much inflated laterally, totally indehiscent, enclosed by the persistent and much-inflated calyx; upper suture minutely verrucose, 2–3-seeded. *Seeds* suborbicular, ± 1,5 mm in diameter, testa minutely but densely tuberculate (Figure 3).

L. globulosa is similar to *L. pentaphylla* (E. Mey.) Benth. and *L. bolusii* Dümmer but differs in the very large, broadly ovate bracts, the slightly larger flowers, the suborbicular (not oblong) standard petal and in the consistently 3-foliolate leaves (always at least some leaves 5-foliolate in *L. pentaphylla* and *L. bolusii*). It is particularly similar to *L. laticeps* B-E. van Wyk, but differs from this species in the globose (not discoid) inflorescences, the larger bracts, the more hirsute vestiture, the longer standard petal, the wider calyx lobes and the two upper calyx lobes, which are wider than the lower lobes (upper lobes as wide as the lower lobes in *L. laticeps*). These differences are clearly shown in Figures 3 & 4. This species is known from a limited area in the south-western Cape (Figure 2), where it is perhaps more common than the very poor herbarium record would suggest.

CAPE.—3319 (Worcester): Ceres Division, Gydouw (–AB), *Leipoldt 3123* (BOL, K); Ceres District, Laken Vlei (–BC), *Compton 12074* (NBG), *Levyns 1053* (BOL, SAM). 3320 (Montagu): 29,5 km from Touws River to Laingsburg, near Tweedside (–AD), *B-E. van Wyk 2210* (PRE, holo.), *2211* (JRAU).

3. **L. laticeps** *B-E. van Wyk*, sp. nov., *L. globulosae* B-E. van Wyk valde affinis, sed capitulis discoideis (non globosis), bracteis minoribus, vestitura sparsiori breviori, vexillo breve carina valde breviori (vexillum carinam in *L. globulosa* speciebusque affinibus aequans) differt. A *L. globulosa* calyce minori sub-pariter lobato (superioribus inferioribus haud latioribus), lobis angustioribus etiam differt. A *L. pentaphylla, L. bolusii, L. roseaque* etiam folios semper 3-foliolatis, bracteis valde maioribus late ovatis (non linearibus nec lanceolatis) atque vexillo suborbiculari (non oblongo) etiam differt.

TYPE.—Cape Province, 3219 (Wuppertal): Ceres District, Stompiesvlei, Swartruggens (sandy stony plateau, 3500 ft.), 19.11.1961, *Esterhuysen 29334* (BOL, holo.; C, K, M, MO, S, iso.).

Prostrate annual up to 0,3 m wide. *Branches* sparsely leafy, minutely hirsute. *Leaves* invariably 3-foliolate, (6–)12–15(–17) mm long; petiole ± as long as the terminal leaflet or slightly longer; leaflets relatively small, oblanceolate to obovate, (3–)5–8(–10) × (1,5–)3–4(–5) mm, base cuneate, apex rounded to truncate, sparsely hirsute on both surfaces. *Stipules* single at each node, lanceolate to oblong, 3–5 mm × ± 1 mm. *Inflorescences* in terminal heads, the heads discoid (wider than long), 8–20-flowered; peduncle variable in length, 3–28 mm long; bracts large, broadly ovate, 4–5 × 4–5 mm; bracteoles absent. *Flowers* relatively small, 9–10 mm long, yellow; sessile. *Calyx* subequally lobed, the sinuses of ± equal depth; lobes narrowly linear, acute. *Standard* suborbicular, much shorter than the keel; claw 1–2 mm long; lamina ± 3 × ± 4 mm, without lobes or callosities, pubescent over most of the abaxial surface. *Wing petals* oblong, shorter than the keel, pubescent along the apex; auricle small, ± 0,5 mm long; apex obtuse; sculpturing in 4–5 rows of intercostal lunae, fading into transcostal lamellae towards the auricle. *Keel petals* oblong, only slightly auriculate; claw ± 2,5 mm long; lamina ± 6 × ± 3 mm, pubescent over most of the surface; apex rounded. *Androecium* long and narrow; anthers dimorphic; basifixed anthers oblong, slightly longer than the small ovoid dorsifixed anthers; carinal anther similar to dorsifixed anthers. *Gynoecium* sessile; pistil very small, ovoid-oblong, pubescent, with 2–4 ovules; style long and slender. *Pods* and *seeds* unknown (Figure 4).

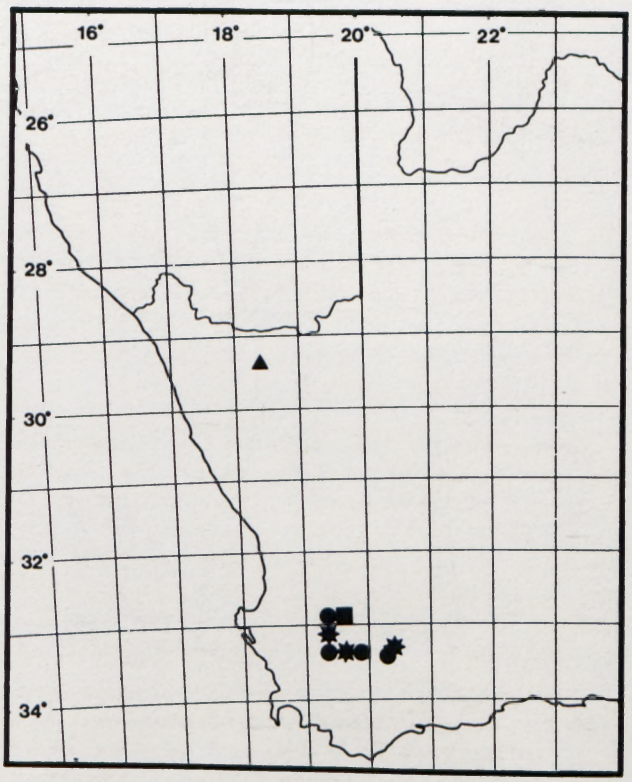

FIGURE 2.—The known geographical distribution of *Lotononis oligocephala*, ▲; *L. globulosa*, ✶; *L. laticeps*, ■; and *L. longicephala*, ●.

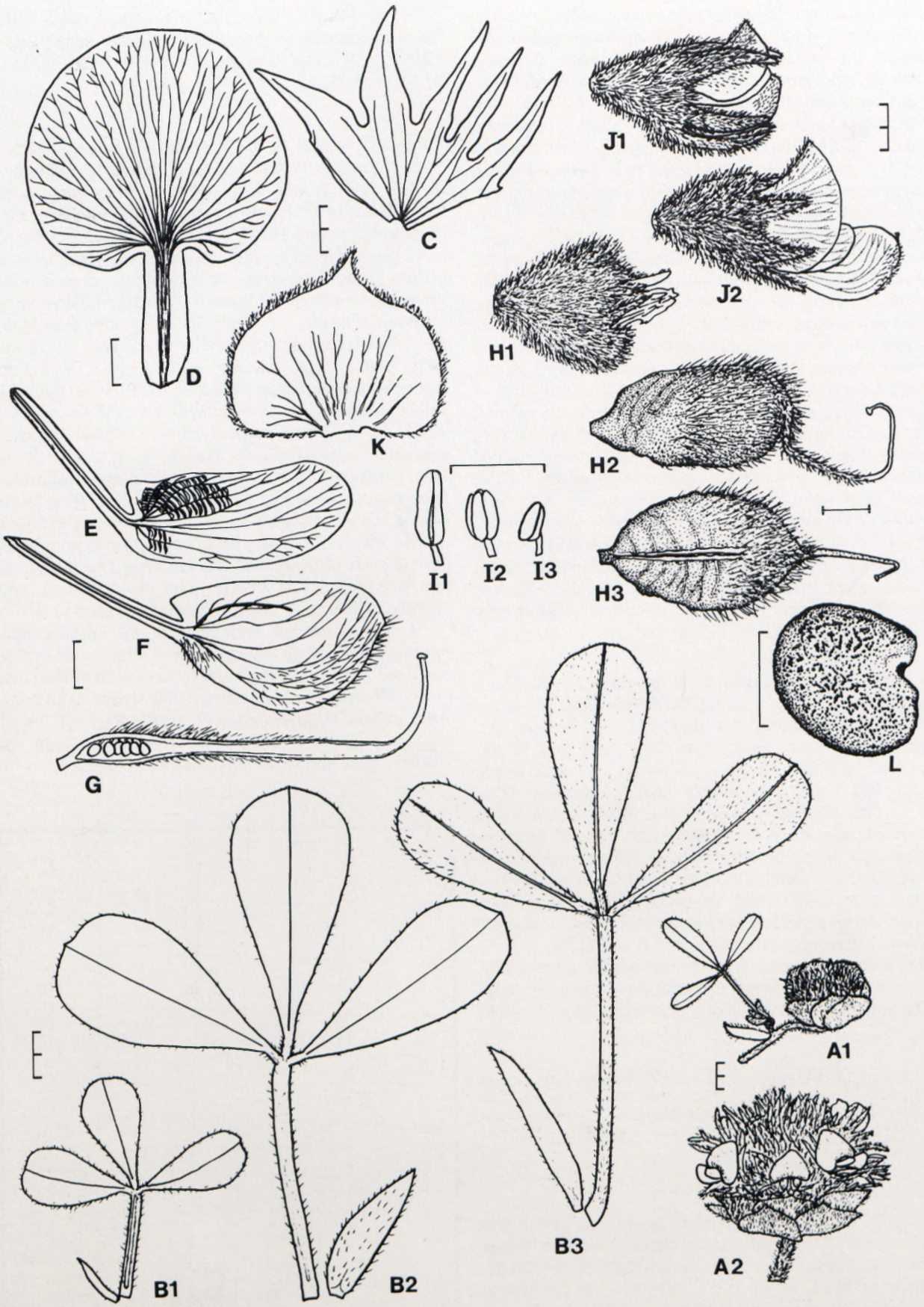

FIGURE 3.—*Lotononis globulosa*. A1 & A2, inflorescences: A1, young inflorescence, A2, mature inflorescence showing the globose shape and large bracts; B1, B2 & B3, leaves and stipules: B1 & B2, adaxial view, B3, abaxial view; C, calyx opened out with the upper lobes to the left (vestiture not shown); D, standard petal; E, wing petal; F, keel petal; G, pistil; H1, mature fruit (dispersal unit or diaspore), showing the persistent inflated calyx which totally encloses the pod; H2 & H3, pods with the calyx removed: H2, lateral view, H3, top view; I1, I2 & I3, anthers: I1, long basifixed anther, I2, carinal anther, I3, dorsifixed anther; J1 & J2, flowers in lateral view; K, bract; L, seed in lateral view. All from *Van Wyk 2210* except J1 from *Van Wyk 2211*, J2 from *Leipoldt 3123*. Scales in mm.

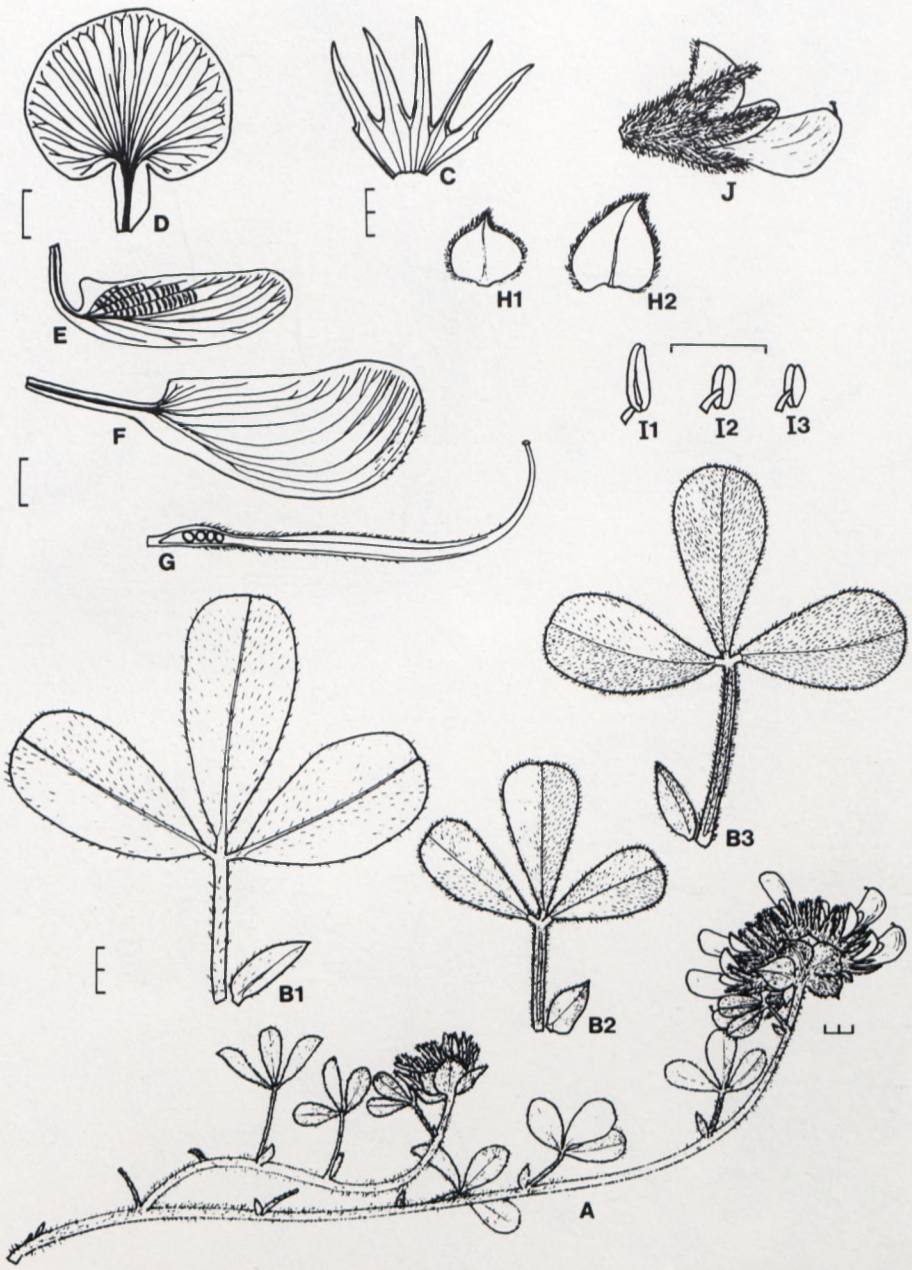

FIGURE 4.—*Lotononis laticeps*. A, flowering twig; B1, B2 & B3, leaves and stipules: B1, abaxial view, B2 & B3, adaxial view; C, calyx opened out with the upper lobes to the left (vestiture not shown); D, standard petal; E, wing petal; F, keel petal; G, pistil; H1 & H2, bracts; I1, I2 & I3, anthers: I1, basifixed anther, I2, carinal anther, I3, dorsifixed anther; J, flower in lateral view showing the short standard petal. All from *Esterhuysen 29334*. Scales in mm.

This poorly known species has so far been recorded only from a single locality in the Ceres District (Figure 2). It is very closely related to *L. globulosa*, but can easily be distinguished by the short standard petal. Other diagnostic characters (see Figures 3 & 4) are given under *L. globulosa*.

CAPE.—3219 (Wuppertal): Ceres District, Stompiesvlei, Swartruggens (−DC), *Esterhuysen 29334* (BOL, holo.; C, K, M, MO, S, iso.).

4. **L. longicephala** *B-E. van Wyk*, sp. nov., distincta sine affinitatibus manifestis. Similis est *L. pentaphyllae* (E. Mey.) Benth. et *L. bolusii* Dümmer, sed ab illis speciebusque omnibus affinibus foliis semper 3-foliolatis, capitulis valde minoribus oblongis (non globosis nec discoideis), floribus leguminibusque valde minoribus differt. A *L. globulosa* B-E. van Wyk et *L. laticipe* B-E. van Wyk etiam bracteis linearibus inconspicuis (non magnis ovatis) differt.

TYPE.—Cape Province, 3319 (Worcester): flats east of Prince Alfred's Hamlet, 10.10.1974, *Oliver 5063* (PRE, holo.; K, MO, STE, iso.).

Prostrate annual, 0,5−0,8 m wide. *Branches* sparsely leafy, sparsely pubescent. *Leaves* invariably 3-foliolate, (5−)10−14(−22) mm long; petiole ± as long as the terminal leaflet; leaflets relatively small, oblanceolate to obovate, (3−)5−9(−12) × (1,5−)3−4(−6) mm, base cuneate, apex truncate to emarginate, abaxial surface sparsely pubescent, adaxial surface glabrous. *Stipules* single at each node, lanceolate, 2−6 × ± 1 mm. *Inflorescences* in terminal or subterminal heads, the heads globose when young, oblong when fully developed, (4−)12−52-flowered; peduncle variable in length, 5−24 mm long; bracts small, linear or narrowly lanceolate, 2−3 mm long, up to 0,5 mm wide; bracteoles absent. *Flowers* very small, ± 6 mm long, yellow; pedicel absent. *Calyx* subequally lobed, the sinuses of ± equal depth; lobes

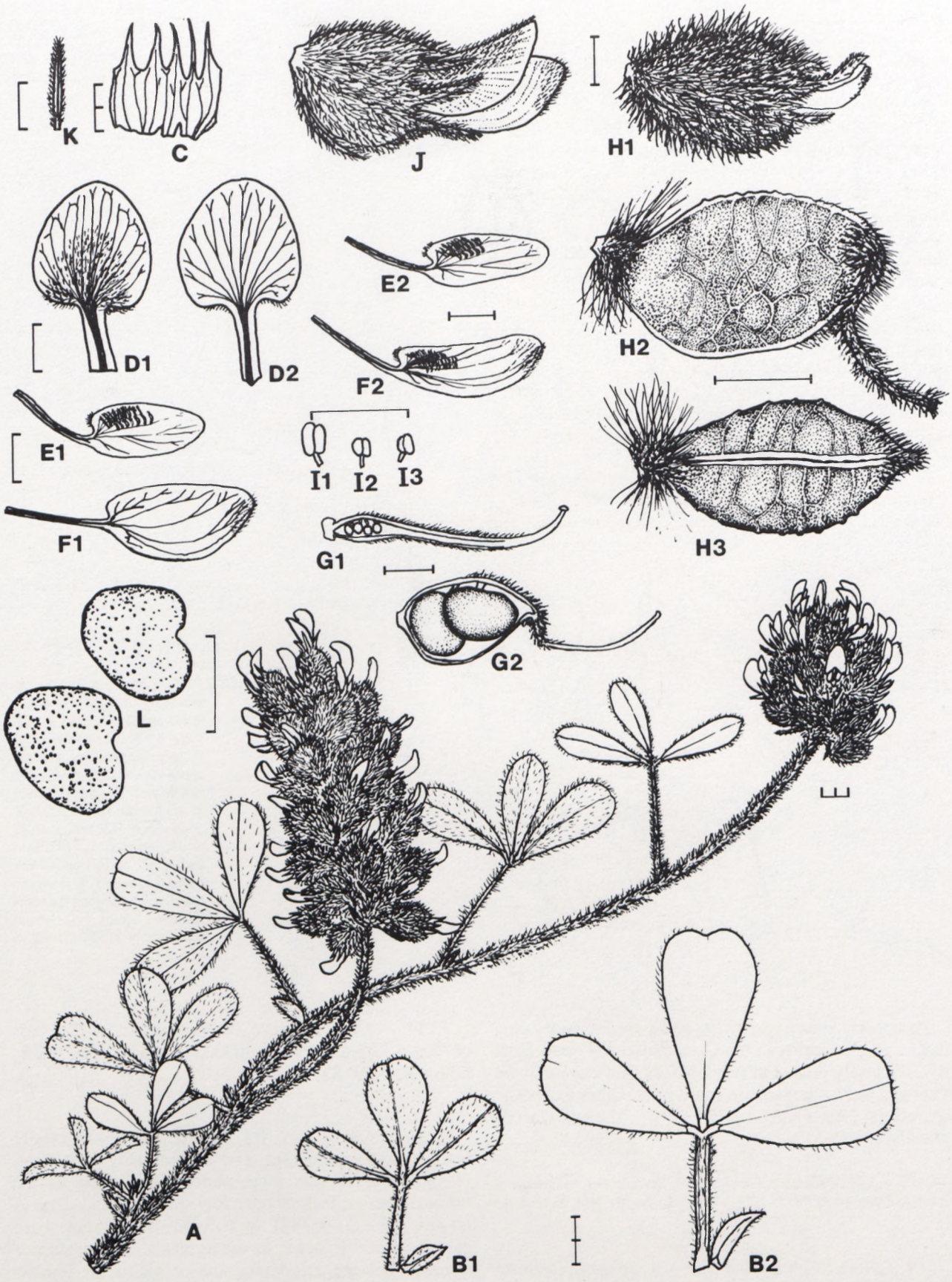

FIGURE 5.—*Lotononis longicephala*. A, flowering twig, showing the elongated (spicate) inflorescences; B1 & B2, leaves and stipules: B1, abaxial view, B2, adaxial view; C, calyx opened out with the upper lobes to the left (vestiture not shown); D1 & D2, standard petals: D1, abaxial view, D2, adaxial view; E1 & E2, wing petals; F1 & F2, keel petals (note sculpturing on F2); G1, pistil; G2, young pod; H1, mature fruit (dispersal unit or diaspore), showing the persistent inflated calyx which totally encloses the pod; H2 & H3, pods with the calyx removed: H2, lateral view, H3, top view; I1, I2 & I3, anthers: I1, long basifixed anther, I2, carinal anther, I3, dorsifixed anther; J, flower in lateral view; K, bract; L, seeds in lateral view, showing the sparsely tuberculate surface. All from *Van Wyk 2200* except C, D1, E2, F2, G2 & K from *Esterhuysen 29299*. Scales in mm.

narrowly triangular, acute. *Standard* suborbicular, as long as the keel; claw ± 1,5 mm long; lamina ± 2,5 × ± 4 mm, without lobes or callosities, abaxially pubescent over most of the basal part. *Wing petals* oblong, almost as long as the keel, glabrous except for a few hairs on the auricle and near the attachment of the claw; auricle small; apex obtuse; sculpturing in 4–5 rows of intercostal lunae, fading into transcostal lamellae towards the auricle. *Keel petals* oblong, only slightly auriculate; claw ± 2 mm long; lamina ± 3 × ± 1,5 mm, pubescent at least towards the apex; apex rounded. *Androecium* long and narrow; anthers dimorphic; basifixed anthers broadly oblong, much larger than the small ovoid dorsifixed anthers; carinal anther similar to dorsifixed anthers. *Gynoecium* sessile; pistil very small, ovoid-oblong, pubescent, with 3–4 ovules; style long and slender. *Pods* very small, ovoid, ± 2,5 × ± 1,5 mm, much inflated laterally, totally indehiscent, enclosed by the persistent and much-inflated calyx; upper suture minutely verrucose, 2–3-seeded. *Seeds* suborbicular, ± 1,2 mm in diameter, testa sparsely tuberculate (Figure 5).

L. longicephala is a distinct species with no obvious affinities. It is similar to *L. pentaphylla* and *L. bolusii*, but differs from these and all related species in the consistently 3-foliolate leaves, the much smaller and oblong (not globose or discoid) heads, the much smaller flowers and the much smaller pods. It differs from *L. globulosa* and *L. laticeps* also in the inconspicuous, linear bracts (Figure 5). *L. longicephala* is known only from the vicinity of Touws River in the south-western Cape (Figure 2).

CAPE. —3219 (Wuppertal): Ceres District, E foot of Schurweberg (next to Bokkeveld Tafelberg) (–CD), *Esterhuysen 20631* (BOL); near the base of Schurweberg Peak (–CD), *Esterhuysen 29299* (BOL, C, K, S). 3319 (Worcester): flats east of Prince Alfred's Hamlet (–AD), *Oliver 5063* (PRE, holo.; K, MO, STE, iso.); Verkeerdevlei, 64,5 km from Ceres to Touws River (–BD), *B-E. van Wyk 2241* (BOL, C, GRA, JRAU, K, MO, NBG, PRE, SAAS, STE). 3320 (Montagu): 29,5 km from Touws River to Laingsburg, near Tweedside (–AD), *B-E. van Wyk 2200* (JRAU), *2202* (BOL), *2203* (GRA), *2204* (K), *2205* (MO), *2206* (NBG), *2207* (PRE), *2208* (S), *2209* (NH, SAAS, STE).

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