

# A revision of the genus *Bolusia* (Fabaceae, Crotonaceae)

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## Abstract

A taxonomic revision of *Bolusia* Benth. is presented. Diagnostic characters at generic level are the dentate stipules, the helically coiled keel of the flowers, the glabrous style and the chromosome number of  $2n=18$ . The five species recognised in this revision are all endemic to tropical Africa south of the equator. They are *B. amboensis* (Schinz) Harms, *B. resupinata* Milne-Redhead, *B. ervoides* (Welw. ex Baker) Torre, *B. acuminata* (DC.) Polhill and *B. grandis* B.-E. Van Wyk. One species from Tanzania is insufficiently known and no material is available for study. *Bolusia* is morphologically rather uniform, so that morphological characters do not allow for a meaningful analysis of phylogenetic relationships within the genus. ITS, *rbcl* and morphological data confirmed the sister relationship between *Crotalaria* and *Bolusia*. The revision includes a brief discussion of morphological characters, phylogenetic relationships, a key to the species, a distribution map, descriptions and synonymies, together with the correct nomenclature and typification of the genus and the species.

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**Keywords:** *Bolusia*; Crotonaceae; Fabaceae; Taxonomy

## 1. Introduction

*Bolusia* is one of 12 genera of the tribe Crotonaceae and is morphologically similar to *Crotalaria* L. (Van Wyk, 2005; Boatwright et al., 2009). The species of the genus are very distinct in their strange keels that are helically coiled through several complete turns. Polhill (1968, 1976, 1982) mentioned the similarity between *Crotalaria* and *Bolusia* and suggested that *C. cornu-ammonis* R. Viguier (section *Stipulosae*) from southern Madagascar could be a morphological “prototype” for the unusual characters in *Bolusia*.

In this revision, an attempt is made to clarify uncertainty about the identity, circumscription, nomenclature and typification of taxa. Polhill (1976) studied the morphology of *Bolusia* species and gave a generic description, but no comprehensive taxonomic treatment of *Bolusia* has ever been published. Four of the species occur in the Flora Zambesiaca area and a short floristic treatment was published by Van Wyk (2003).

## 2. Materials and methods

### 2.1. Morphology

Herbarium specimens from the following herbaria were studied: BOL, K, MO, NBG, PRE, SRGH and WIND. Specimens were initially sorted into 15 operational taxonomic units based on overall morphology and geographical origin. Detailed morphometric analyses, based on a minimum of five measurements per herbarium specimen, are given in Venter (unpublished).

## 3. Results and discussion

### 3.1. Characters and character states

#### 3.1.1. Habit

Judged from the available herbarium collections, *Bolusia* species are all perennial herbs or small shrublets with several branched flowering stems spreading from a woody rootstock. The only exception is *B. amboensis*, which appears to be an annual or short-lived perennial in some parts of northern

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Namibia. Several herbarium specimens show erect, non-woody plants with notes suggesting that the plant is an annual, but field studies are needed to verify if this was not mere seedling recruitment after good rains. The herbarium record shows

clearly that all species (including *B. amboensis*) resprout from a woody base after fire. Own observations in northern Namibia showed that the plant is likely to be a short-lived perennial (Fig. 1a), with a few branches spreading from a somewhat

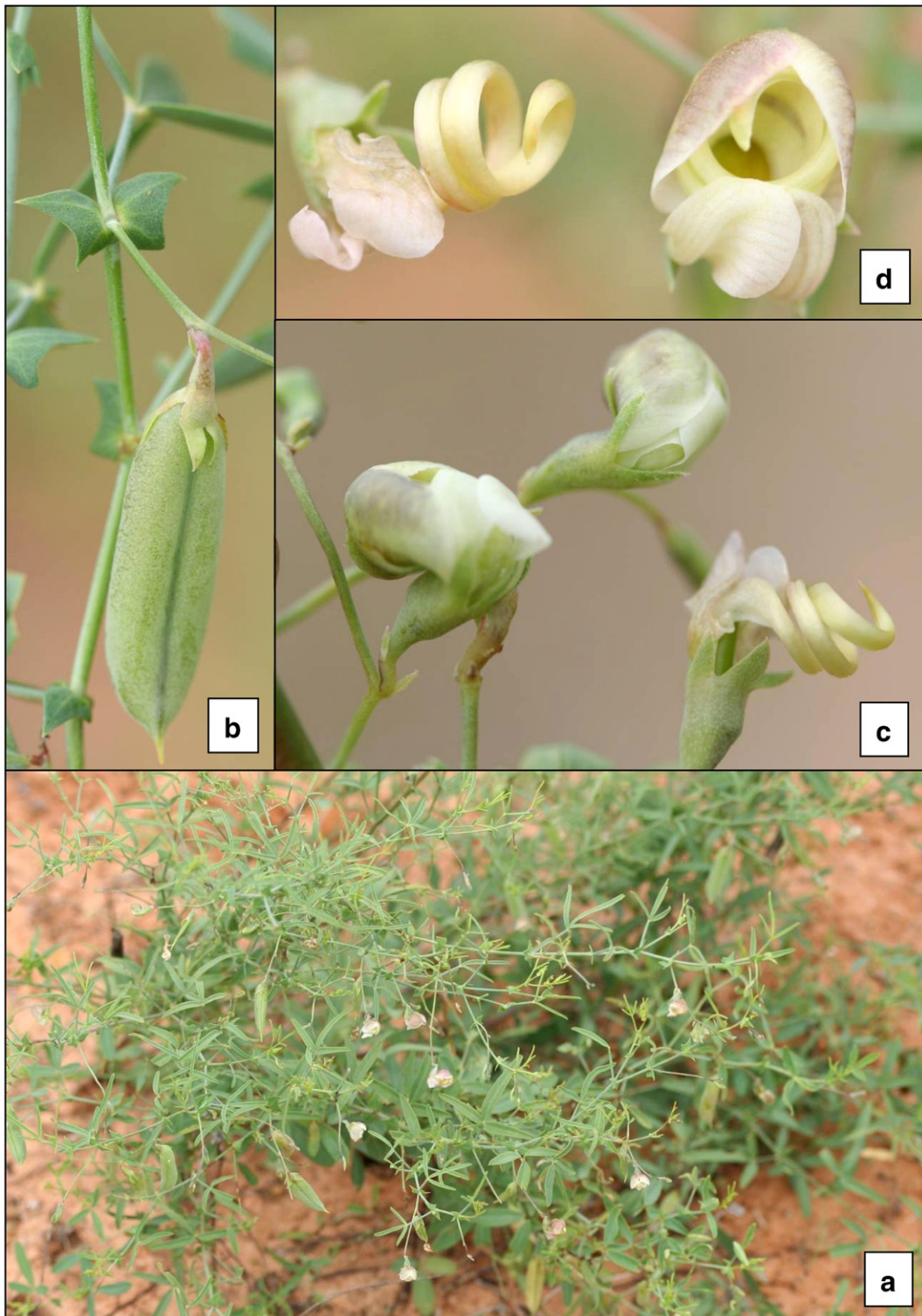


Fig. 1. *Bolusia amboensis*. (a) Flowering and fruiting plant, showing the habit; (b) Fruit (note the dentate stipules); (c) Flowers in lateral view (note the flower colour and cucullate standard petals); (d) Flower in front view (right) and older flower in side view (left), showing the orientation of the cucullate standard petal, the helically coiled keel and wing petals. Voucher specimen (*Boatwright et al.* 248 (NBG, WIND). Photographs taken by B.-E. Van Wyk (Namibia, ca. 130 km north of Grootfontein on the road to Rundu).

woody rootstock. All the species are erect to procumbent, except for *B. grandis*, which is said to have trailing branches.

### 3.1.2. Leaves

*Bolusia* species are relatively uniform in the morphology of the leaves, but there are some taxonomically useful discontinuities (Fig. 2). The leaves are invariably trifoliolate in all the species except *B. acuminata*, where they are unifoliolate (Fig. 2s) although some of the basal (juvenile) leaves may also be trifoliolate. As can be expected, the widely distributed *B. amboensis* shows considerable regional variation in the shape and size of the leaflets (Fig. 2a–i). The leaf morphology and indumentum of *B. amboensis* differ from all other species

in the totally glabrous leaflets — hairs, when present, are confined to the petiolules or lower midribs. *Bolusia resupinata* (Fig. 2q) usually has hairs on the adaxial surface as well as the abaxial surfaces of the leaflets — these hairs tend to be somewhat curly. Hairs are confined to the abaxial (lower) surfaces of the leaflets in *B. acuminata*, *B. ervoides* and *B. grandis*. In *B. ervoides*, (Fig. 2o) the leaflets are relatively small, usually linear and acute, while they are exceptionally large in *B. grandis* (Fig. 2k). The stipules are usually asymmetrically ovate and more or less truncate at the base in all the species. They are distinctly or obscurely dentate, often with one or two lateral teeth along the lobed side of the stipule (Fig. 1b, 2j1–8, l, n, p, r, t). The extreme of the variation is seen

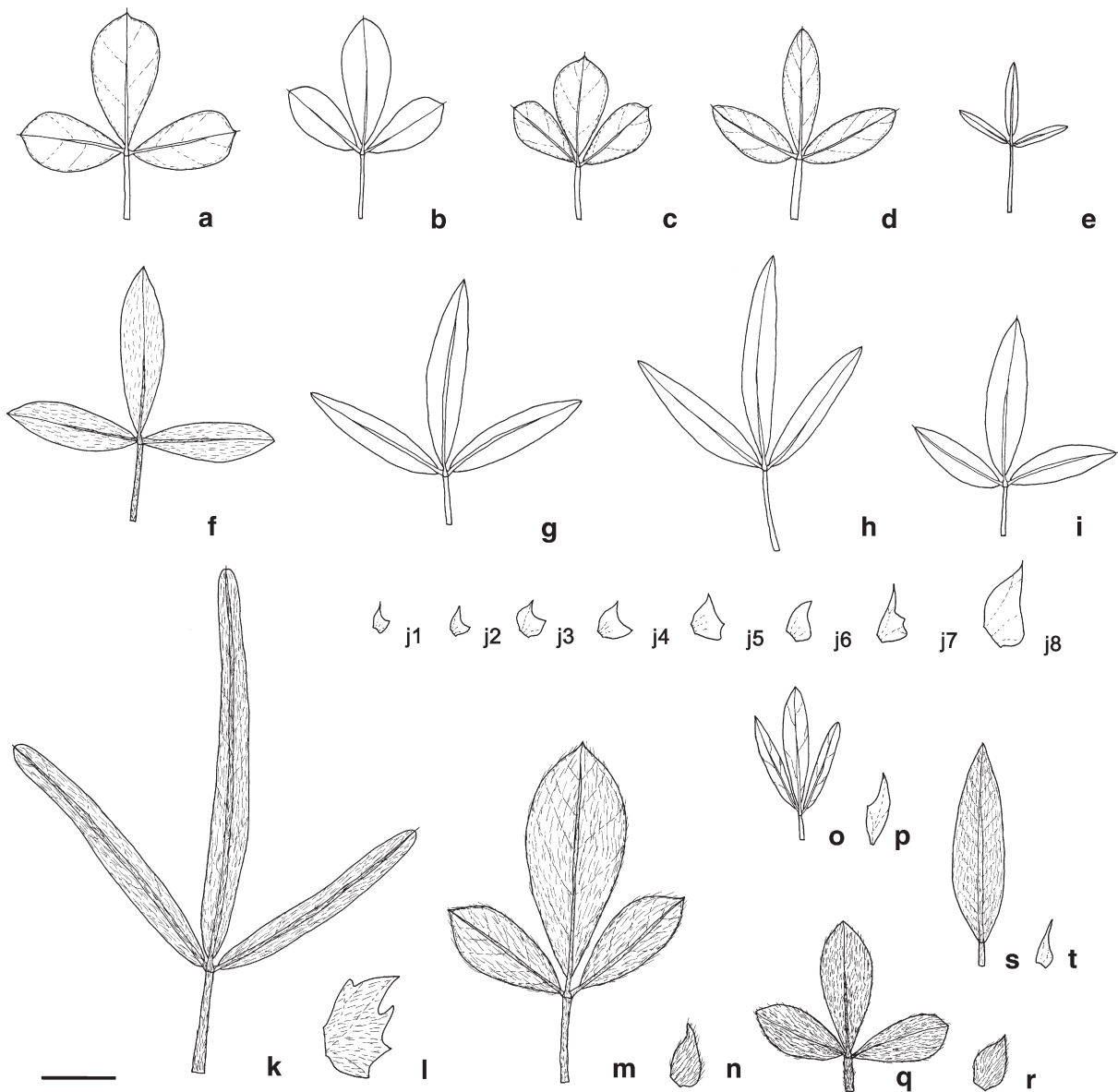


Fig. 2. Leaves and stipules of *Bolusia* species. (a–j) *B. amboensis*; (k–l) *B. grandis*; (m–n) *Bolusia* sp.; (o–p) *B. ervoides*; (q–r) *B. resupinata*; (s–t) *B. acuminata*. Voucher specimens: (a, j3) *Giess 10091* (PRE); (b, j4) *Biegel et al. 4993* (SRGH); (c) *Anon. Dept Agric. 4* (K); (d) *Brummitt et al. 14211* (MO); (e, j2) *Pocock 153* (BOL); (f, j7) *Robinson 1558* (K); (g, j8) *Corby 1710* (SRGH); (h) *Strang 2215* (SRGH); (i, j5) *Fanshawe 7008* (K); (j1) *Van Rensburg 3008* (K); (j6) *Hislop 26* (K); (k, l) *Richards 5308* (K); (m, n); (o, p) *Texeira 2944* (SRGH); (q, r) *St. Claire Thompson 1283* (K); (s, t) *Acocks 12481* (PRE). Scale bar: 10 mm.

in *B. grandis*, where the stipules are markedly dentate, often with four to five distinct teeth (Fig. 21). It is possible to identify all of the species by their leaflets alone, taking into account the number, size, shape and distribution of hairs (see key to the species below).

### 3.1.3. Inflorescences and flowers

Flowers (Fig. 1c, d) are borne on short, leaf-opposed inflorescences in all five species. There are usually two or three flowers, but up to five may be present in vigorous specimens. The flowers are relatively uniform in size — 8 to 10 mm long in all except in *B. grandis*, where they are 12 to 16 mm long. In shape they are quite uniform, with a subequally lobed calyx (the upper two lobes usually slightly broader than the lower three), a broad and strongly hooded standard petal (Fig. 1c, d), broad wing petals and the peculiar keel with its narrowly linear petals produced into the spirally coiled beak (Fig. 2c, d). The keel petals are about three to four times as long as the standard and wing petals. Coiled keels appear to have evolved several times in different parts of the subfamily, e.g. in species of *Phaseolus* L. (tribe Phaseoleae), *Vaughania* S. Moore (tribe Indigofereae) and to a limited extent in some species of *Lebeckia* Thunb. (tribe Crotalariaeae).

### 3.1.4. Fruits and seeds

Apart from size differences, fruits have no obvious taxonomic value in *Bolusia*. They are all shortly stipitate, strongly inflated, oblong-fusiform to oblong-clavate, dehiscent and many-seeded. The yellowish brown to dark brown seeds are similar to those of some species of *Crotalaria*, but the radicular lobe is exceptionally long and the hilar sinus very deep, resulting in an almost horseshoe shape when viewed from the side. The surface varies from almost smooth to markedly verrucose, especially in *B. acuminata*. *B. grandis* may be distinguished by the larger fruits and seeds.

### 3.2. Phylogenetic relationships

The generic status of *Bolusia* has until now been open for speculation. The coiled keel is not present in *Crotalaria*, but Polhill (1968) suggested that there could be a phylogenetic link between *C. cornu-ammonis*, with its narrow, incurved beak, and *Bolusia*. Analysis of the internal transcribed spacer of nuclear ribosomal DNA (ITS), *rbcL* and morphological data by Boatwright et al. (2008) indicated a sister group relationship between *Crotalaria* and *Bolusia* and confirms that the generic status of *Bolusia* is justified, as *Bolusia* is not embedded within *Crotalaria* (Fig. 3). *Bolusia* and *Crotalaria* were sisters to *Lotononis* section *Euchlora* [*L. hirsuta* (Thunb.) D.Dietr.] and this clade formed the earliest diverging lineage within the tribe Crotalariaeae (Boatwright et al., 2008). *Bolusia* differs from *Crotalaria* in its dentate stipules, coiled keels, glabrous styles and chromosome base number of  $x=9$ . In *Crotalaria* the stipules are not dentate, the keel never coiled, the style almost always with one or two lines of hairs along the upper half and the chromosome base number is  $x=7$  or 8. If the base number of the tribe is  $x=9$ , as suggested by Goldblatt (1981), then *Bolusia*

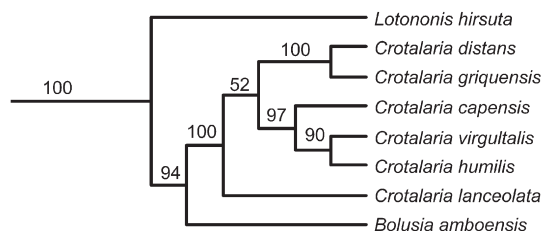


Fig. 3. Strict consensus of 370 equally parsimonious trees produced by an analysis of genetic (ITS, *rbcL*) and morphological data (from Boatwright et al., 2008). Numbers above the branches are bootstrap percentages above 50% (tree length=1166; consistency index=0.53; retention index=0.84).

could be an early segregate of *Crotalaria*, basal to the rest of the genus. If it is  $x=7$ , then the increase to  $x=9$  must have occurred many times in the tribe, since most genera have  $2n=18$ .

### 3.3. Taxonomy

***Bolusia*** Benth. in Hook., Ic. Pl. 12, t. 1163 (1873); Bak. in Oliv., Fl. Trop. Afr. 2: 168 (1871); Hutch. Gen. 1: 360 (1964); Schreiber in FSWA 60: 15 (1970); Polhill in F.T.E.A., Leguminosae, Pap.: 995 (1971); Dyer, Gen. S. Afr. Fl. Pl. 1: 259 (1975); Polhill in Bot. Syst. 1: 323 (1976); B.-E. Van Wyk in Fl. Zam. 3,7: 228–233 (2003); B.-E. Van Wyk in Legumes of the World: 278 (2005).

Erect to spreading perennial herbs or small suffrutices (*B. amboensis* occasionally annual?). Leaves digitately 3-foliolate, 1-foliolate in *B. acuminata*; stipules lanceolate to asymmetrically ovate, more or less truncate at the base, obscurely or markedly dentate, with 1–5 teeth along the outer edge. Leaflets variable in size and shape, the upper ones often markedly narrower than the lower ones. Inflorescences leaf-opposed or terminal, short, racemose, with 1–5 flowers, bracts and bracteoles linear to lanceolate, persistent. Flowers yellow to whitish-cream or flushed with pink or purple. Calyx 5-lobed, slightly zygomorphic, the upper pair of lobes slightly broader than the lower three lobes, the lobes usually longer than the tube. Standard rounded to transversely oblong, cucullate, claw short but distinct, 1–3 mm, lamina 7–14 × 10–21 mm, slightly to markedly emarginated, with two callosities at point of attachment of the claw, glabrous or with a few hairs along the middle; wing petals broadly obovate-falcate, claw 2–4 mm, lamina 7–15 × 5–11 mm, with prominent auricles at the base; keel petals narrowly linear, helically coiled through several (3–4) turns, 3–4 times as long as the standard and wings, claws 3–4 mm long, lamina 25–50 × 1–2 mm with small auricles at the base. Androecium as long as the keel; stamens fused into a slender, helically coiled sheath; vexillary stamen part of the sheath or sometimes free; anthers strongly dimorphic, the 5 longer basifixed anthers ±2.5 times as long as the 5 shorter subbasifixed anthers. Ovary oblong, subsessile, several-ovuled; style long, filiform, glabrous, helically coiled, stigma small and terminal. Pods shortly stipitate, oblong-ellipsoid, often somewhat clavate, markedly inflated, glabrous, smooth, dehiscent. Seeds obliquely cordiform to nearly horseshoe-shaped, with a deep hilar sinus; surface smooth to verrucose; rim-aril inconspicuous.

*Bolusia* is a group of five species endemic to tropical Africa south of the equator. All except *B. amboensis* are relatively rare and poorly represented in herbarium collections. *Bolusia* species are easily distinguished from *Crotalaria* by the peculiar keel that forms a spirally coiled beak, the glabrous style and the dentate stipules.

#### Key to the species

1. Leaves predominantly 1-foliolate, basal ones sometimes 3-foliolate (S. Botswana and South Africa) ..... ***B. acuminata***
1. Leaves all 3-foliolate; (southern Tropical Africa – Namibia, N. Botswana, Angola, Zimbabwe, Zambia) ..... **2**
2. Leaflets glabrous below (a few hairs may be present along the midrib only); stems glabrous or almost so ..... **3**
2. Leaflets sparsely to densely hairy below; stems sparsely to densely silky ..... **4**
3. Stipules ovate, soft in texture, different from leaflets in shape, as long or usually much shorter than the petiole (if somewhat long, then broadly ovate, not linear); leaflets (at least the lower ones) elliptic to obovate, usually >4 mm wide, soft in texture (southern Tropical Africa, but not S.W. Angola) ..... ***B. amboensis***
3. Stipules linear to lanceolate, firm in texture, similar to the leaflets in shape, markedly longer than the petiole; leaflets linear, 2–4 mm wide, firm in texture (known only from S.W. Angola) ..... ***B. ervoides***
4. Leaflets linear, 2–4 mm wide; stipules lanceolate, longer than the petiole (S.W. Angola) ..... ***B. ervoides***
4. Leaflets oblanceolate to elliptic, 3–20 mm wide; stipules ovate, usually shorter than the petiole (if longer, then foliaceous and markedly dentate) (Zambia) ..... **5**
5. Stipules more or less entire, 3–7 (10) × 3–6 (8) mm; flowers 8–10 mm long; pods 17–27 (35) mm long ..... ***B. resupinata***
5. Stipules (at least the larger ones) markedly dentate, with up to 5 distinct teeth, (6) 10–15 (18) × (3) 6–9 (11) mm; flowers 12–16 mm long; pods ±.48 mm long ..... ***B. grandis***

1. ***Bolusia acuminata*** (DC.) Polhill, *Crotalaria* in Africa and Madagascar: 375 (1982); B.-E. Van Wyk in Fl. Zamb. 3,7: 231 (2003). Type: South Africa, Northern Cape Province, N. of Mashowa R. [2723BB], Burchell 2327 (G-DC, holotype; K!, isotype).

≡ *Crotalaria acuminata* DC., Prodr. 22: 128 (1825).

= *Bolusia capensis* Benth. in Hook., Ic. Pl. 12, t. 1163 (1873). Type: South Africa, Northern Cape, Cruickshank 2517 (K!, holotype; BOL!, isotype).

Erect to procumbent perennial herb, 0.2–0.3 m high. Leaves predominantly 1-foliolate, basal ones sometimes digitately 3-foliolate. Leaflets variable in shape, usually linear to narrowly elliptic, (15–) 17–45 (–55) × 3–11 (–13) mm, apex usually acute to acuminate, sometimes the basal ones broadly obovate to broadly oblong with rounded apices, glabrous above, densely silky below; petiole 5–10 (–12) mm long, densely silky; stipules lanceolate to narrowly ovate, (2–) 4–7 × 2–4 mm, acuminate, not dentate or rarely with 1–2 small teeth. Inflorescences leaf-opposed or terminal, short, racemose, with 1–3 (–5) flowers; rachis (15–) 20–35 mm long; peduncle 10–20 mm long; bracts small, linear, 2–4 mm long, silky; bracteoles small, linear, 0.5–1.0 mm long, silky. Flowers 8–10 mm long, yellow. Calyx 5–8 mm long, tube

markedly shorter than the lobes. Standard claw ± 1 mm; lamina ± 7.5 × 10.5 mm, with hairs along the dorsal midrib. Wing claw ± 2 mm; lamina ± 8.5 × 5 mm. Keel ± 28 × 1 mm. Androecium as long as the keel. Ovary ± 5 mm long. Pods 18–24 mm × 5–8 mm, smooth, dehiscent. Seeds brown, ± 3.0 × 2.5 mm, distinctly verrucose.

This is a relatively rare species, known only from a few localities (Fig. 4). In addition to being geographically separated from the rest of the genus, *B. acuminata* is easily recognised by the predominantly unifoliolate leaves. It occurs in grassland and open woodland on sandy soil.

#### Botswana:

- **2425** (Gaborone): Kweneng Distr., 8 km to Ngware from turn-off from Molepolole-Letlhakeng road (–AB), Hansen 3191 (K, PRE, SRGH).

#### South Africa:

- **2723** (Kuruman): Kuruman, near village (–AD), Esterhuysen 842 (BOL, KMG, NBG); Kuruman (–AD), Lewis s.n. sub SAM 54032 (SAM); North of Mashowa River (–BB), Burchell 2327 (K).
- **2725** (Bloemhof): Bloemhof Dam Nature Reserve, Vlakfontein (–DA), Pettifer 244 (PRE); 5 miles [8 km] N.E. of Hoopstad (–DD), Acocks 12481 (PRE).
- **2726** (Odendaalsrus): Voetpaddrif (–AC), Morris 1193 (PRE); Losdoorns Railway Siding (–CB), Acocks 12493 (K); Hoopstad District, 6 km from Wesselsbron on Bothaville road, Story 878 (K, PRE).
- **Without precise locality:** Between Kuruman and the Vaal River, Cruickshank 2517 (BOL, K).

2. ***Bolusia amboensis*** (Schinz) Harms in Bull. Herb. Boiss. 2, ser I, p. 876 (1901); Harms in Warb., Kunene-Sambesi Exped.: 260 (1903); Bak. in Oliv., Fl. Trop. Afr. 2: 169 (1871); Schreiber in FSWA 60: 15 (1970); B.-E. Van Wyk in Fl. Zamb. 3,7: 229–231 (2003). Type: Namibia, “Amboland”, Olukondo-Oshiheke, Schinz 2076 (Z?), Schinz s.n. (K!, probably an isotype). [Note: Schinz (1901) published the new combination *B. amboensis* (Schinz) Harms, with mention of the basionym. It is assumed that this is in accordance with the rules, and that the new combination was made by Schinz (1901) for Harms, and not by Harms (1903) himself in Warburg].

≡ *Phaseolus amboensis* Schinz in Bull. Herb. Boiss 7: 36 (1899).

= *Bolusia rhodesiana* Corbishley in Kew Bull. 1920: 329 (1920); Bak. in Oliv., Fl. Trop. Afr. 2: 169 (1871). Type: Zimbabwe, Rusape, Hislop 26 (K!, sheet 1, holotype; K!, sheet 2, isotype).

Erect to procumbent perennial herb (rarely annual?), 0.2–0.5 m high. Leaves digitately 3-foliolate. Leaflets variable in shape and texture, linear, narrowly elliptic to broadly obovate, (5–) 13–22 (–36) × 3–9 (–14) mm, the upper ones often markedly narrower than the lower ones, glabrous above, glabrous below or with hairs along the midribs only; petiole (4–) 6–12 (–17) mm

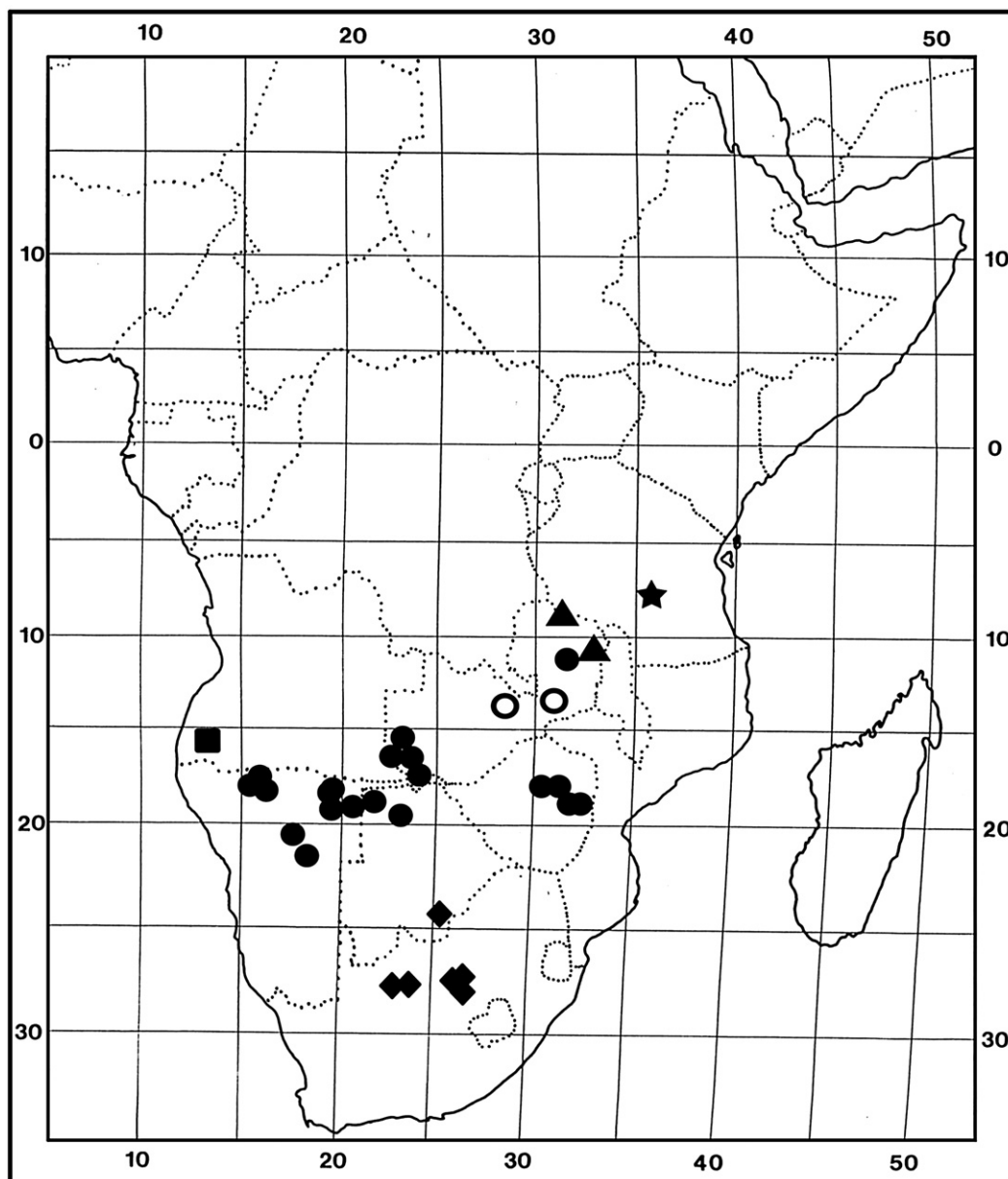


Fig. 4. The known geographical distribution of *Bolusia acuminata* (diamonds), *B. amboensis* (circles), *B. ervoides* (square), *B. grandis* (triangles), *B. resupinata* (open circles) and *Bolusia* sp. (star).

long; stipules asymmetrically ovate, more or less truncate at the base, 3–7 (–10) × 3–5 (–7) mm, obscurely to markedly dentate, with one or two teeth along the outer edge. *Inflorescences* leaf-opposed or terminal, short, racemose, with 1–4 flowers; rachis (5–) 15–40 (–50) mm long; peduncle 5–20 mm long; bracts small, linear, 2–4 mm long; bracteoles small, linear, ±0.5 mm long. *Flowers* 9–10 mm long, white, whitish-cream to yellow and flushed with pink or purple. *Calyx* 5–8 mm long, tube slightly shorter than the lobes. *Standard* claw ±2 mm; lamina 8.5–11 × 11–12.5 mm, glabrous. *Wing* claw 3–3.5 mm; lamina ± 9.5 × 5.5–7.5 mm. *Keel* ±35 × 1.0 mm. *Androecium* as long as the keel. *Ovary* ±5 mm long. *Pods* ±25–35 mm × 8–10 mm, smooth, dehiscent. *Seeds* brown, ±3 × 2 mm long, smooth.

This is the only common and relatively well-known member of the genus (Fig. 1). As can be expected from a widely

distributed species, it shows considerable regional variation, especially in the size and shape of the leaflets. The lower leaflets are often much broader than the upper ones. Forms with narrow (almost linear) leaflets from the border of Angola and Zambia (e.g. *Pocock* 542) and from central Zimbabwe (e.g. *Pope* 915) merge gradually with forms with broad leaflets from central Zimbabwe (e.g. *Hislop* 26, the type of “*B. rhodesiana*”). The latter are very similar to the “typical form” from northern Namibia (e.g. *Schinz* s.n. and *Maguire* 2088). According to label information, the flowers are usually white flushed with purple, but they may also be cream (“dirty white”) or yellow tinged with purple. Our own observations agree with these descriptions (Fig. 1c, d). Plants collected at some localities are labelled as annuals (e.g. *Kers* 454 and *Giess, Volk & Bleissner* 6557) but it is possible that these are seedlings emerging in

favourable conditions (perhaps after good rains following a prolonged drought?). Field observations would be useful to determine the longevity of the species, particularly in northern Namibia, where most of the “annuals” were collected.

The geographical range of the species extends from northern Namibia and south-eastern Angola through northern Botswana to Zambia and central Zimbabwe (Fig. 4). The habitat varies from open sandy plains, dry lake margins and river banks in the west, to open grassland and open woodland in the east. This includes miombo woodland dominated by *Brachystegia* species, as well as other types, with *Colophospermum mopane*, *Combretum collinum* and *Baikiaea plurijuga*. Plants are often found in partially disturbed habitats, such as river banks and abandoned fields. The substrate is invariably very sandy.

#### Zambia:

- **1131** (Chinsali): Shiwa Ngandu (–BA/BB), *Robinson 1558* (K, SRGH); 12 miles [19.2 km] from Shiwa Ngandu to Kasama (–BA/BB), *Richards 10774* (K).
- **1523** (Mongu): Namushakende (–AC), *Anon. s.n. sub Dept. Agric. 4* (K); Mongu (–AC), *Van Rensburg 3008* (K, SRGH); Mongu, near Mushitu (–AC?), *Verboom 1004* (SRGH).
- **1623** (Senanga): Sioma, 80 km S. of Senanga, W. bank of the Zambezi River (–DA), *Brummitt, Chisumpa & Polhill 14211* (K, MO, PRE, SRGH); Sandy peninsula below Gonyé [Ngonye Falls, 16° 40' S, 23° 35' E], Zambesi River (–DA), *Pocock 153* (BOL).
- **1724** (Katima Mulilo): Ilongo (–AA), *Fanshawe 7008* (K).

#### Angola:

- **1622** (Bié): Kunzumbia (–DD), *Pocock 542* (BOL).

#### Zimbabwe:

- **1730** (Sindia): Hartley District, ±18 km S.E. of Norton (–DC), *Pope 915* (MO, PRE, SRGH).
- **1731** (Harare): Cleveland Dam (–CC), *Biegel 385* (SRGH); Harare (–CC), *Eyles 1886, 8361* (K); Harare, Hatfield (–CC), *Bayliss & Bayliss 8926* (MO, 2 sheets); Harare, Makabusi River area (–CC), *Lindley 331* (SRGH); Makabusi Woodlands (–CC), *Best 1671* (SRGH); Cawdor farm (–CC), *Strang 2215* (SRGH).
- **1831** (Marondera): Marondera (previously Marandella) (–BA), *Corby 72* (K), *1640* (K, PRE), *1710* (K, SRGH).
- **1832** (Mutare): Makoni District (–AD), *Drummond 5071* (K); Rusape (–CA), *Hislop 26* (K).

#### Namibia:

- **1715** (Ondangwa): Oshikango District, Ondangua (–BD), *Loebb 117* (PRE); Oshikango (–BD), *Boss 35991* (PRE); Ogongo Agricultural College (–CB), *Van Jaarsveld 2871, 2889* (NBG).
- **1716** (Eenhana): “Amboland”, Olukondo[a]-Ushiheke (–CC), *Schinz s.n.* (K).

- **1719** (Rundu): Okavango, 10 miles [16 km] south of Runtu, eastern shore of Omuramba fountain (–DD), *Giess 10091* (K, NBG, PRE, WIND).
- **1819** (Karakuwisa): Namibia, ca. 130 km north of Grootfontein on the road to Rundu (–CA), *Boatwright et al. 248* (NBG, WIND); Tsammagaigai, east of Karakuwisa (–DC), *Maguire 2088* (NBG).
- **1820** (Tarikora): Omurambo Kaudum, 8 miles [12.8 km] east of Tamsu (–DA), *De Winter & Marais 4674* (PRE).
- **1821** (Andara): Popa Falls, in the Okavango River (–BA), *De Winter 4348* (K, WIND).
- **2017** (Waterberg): Along the Rietfontein–Waterberg track, 4 miles [6.4 km] from farm Leo 979 (–BB), *Kers 454* (WIND); Grootfontein District, farm Biesiespan (–BC), *Giess, Volk & Bleissner 6557* (MO, PRE).

#### Botswana:

- **1821** (Andara): Khardoum Valley [Xaudum Valley] (–AC), *Wild & Drummond 7053* (K).
- **1923** (Maun): Mboma (–AB), *Smith 1242* (MO, PRE, SRGH).
- **2118** (Steinhausen): Shakawe (–CD), *Biegel, Muller & Gibbs Russell 4993* (K, MO, PRE, SRGH).

3. *Bolusia ervoides* (Welw. ex Bak.) Torre in Mem. Junta Invest. Ultram. 19: 49 (1960). Type: Angola, Huila District, Benguela, “in marshy meadows, dried up at the time of gathering, between Ferrão da Sola and Jáu, in the territory of Lopollo, with few flowers and with fruit, April 1860”, *Welwitsch 1984* (BM).

≡ *Crotalaria ervoides* Welw. ex Bak. in Oliv., Fl. Trop. Afr. 2: 59 (1871); Hiern, Cat. Afr. Pl. Welw. 1: 198 (1896); Bak.f. in J. Linn. Soc. Bot. 42: 412 (1914); Bak.f., Legum. Trop. Afr. 2: 59 (1926).

Erect to procumbent perennial herb, 0.2–0.3 m high. Leaves digitately 3-foliolate. *Leaflets* linear to narrowly elliptic, somewhat conduplicate when dried, (8–) 10–19 (–22) × 1–3 (–4) mm, firm in texture, apex usually acute to acuminate, the basal ones similar to the upper ones, glabrous above, very sparsely silky below, sometimes appearing glabrous; petiole (3–) 4–6 mm long, sparsely silky; stipules linear to narrowly elliptic, similar to the leaflets, firm in texture, 4–5 (–9) × 2–4 mm, often with 1–2 teeth along the outer edge. *Inflorescences* leaf-opposed or terminal, short, racemose, with 1–3 (–5) flowers; rachis 15–25 mm long; peduncle (5–) 7–12 (–15) mm long; bracts small, linear, 1–2 mm long, silky; bracteoles small, linear, 0.5–1 mm long, silky. *Flowers* 8–10 mm long, yellow, flushed with purple. *Calyx* 7–8 mm long, tube not markedly shorter than the lobes. *Standard* claw ± 2.5 mm; lamina ± 9 × 13 mm, glabrous. *Wing* claw ± 4 mm; lamina ± 10 × 7 mm. *Keel* ± 38 × 1.2 mm. *Androecium* as long as the keel. *Ovary* ± 5 mm long. *Pods* 24–30 mm long. *Seeds* not seen.

This species is superficially similar to *B. amboensis* and *B. resupinata* but can easily be distinguished by the small, linear leaflets, the short petioles and the narrow stipules that resemble the leaflets. Both leaflets and stipules are firm in texture and have prominently raised primary and secondary veins. The stems and leaflets vary from nearly glabrous to sparsely silky,

but the upper surfaces of the leaflets are never silky as in *B. resupinata*. *B. ervoides* appears to be a rare species and is known from only a few collections made in the south-western parts of Angola (Fig. 4). It appears to grow in sandy places along rivers and the margins of lakes.

Angola:

- **1513** (Huila): Huila District, Humpata, Lagoa do Ontiti, alt. 1900 m (–AB), *Teixeira 1957* (PRE); Huila District, Estação Zootécnica da Humpata, 1900 m (–AC), *Teixeira 2944* (SRGH).

**4. *Bolusia grandis* B.-E. Van Wyk in Flora Zambesiaca 3,7: 232–233 (2003).** Type: Zambia, Abercorn [Mbala]–Mpulungu road, not far from Mukoma turning, *Richards 5308* (K!, sheet 1, holotype; K!, sheet 2, isotype).

Procumbent, trailing, perennial herb, up to 0.5 m wide. *Leaves* digitately 3-foliolate. *Leaflets* variable in shape, upper ones usually linear, lower ones narrowly elliptic, 25–65 (–75) × 4–11 (–13) mm, all with rounded apices, glabrous above, densely silky below; petiole 10–17 mm long, silky; stipules ovate to broadly ovate-auriculate, foliaceous, very large, (6–) 10–15 (–18) × (3–) 6–9 (–11) mm, acuminate, usually distinctly dentate with 3–5 prominent teeth. *Inflorescences* leaf-opposed or terminal, short, racemose, with 1–3 flowers; rachis (15–) 20–35 mm long; peduncle 5–15 mm long; bracts linear, 2–4 (–6) mm long, silky; bracteoles linear, 1–2 (–3) mm long, silky. *Flowers* large, 14–16 mm long, cream. *Calyx* 8–12 mm long, tube markedly shorter than the lobes. *Standard* claw ±3 mm; lamina ±14 × 21 mm, glabrous. *Wing* claw ±4 mm; lamina ±15 × 11 mm. *Keel* ±50 × 2 mm. *Androecium* as long as the keel. *Ovary* ±6 mm long. *Pods* very large, ±48 mm × 10–14 mm, smooth, dehiscent. *Seeds* brown, ±4 × 3 mm, smooth.

This seemingly rare species is easily recognised by the large size of the leaves, stipules, flowers and fruit, which are at least 1.5 to 2 times larger than in other species. Especially interesting are the stipules, which are large, foliaceous and markedly dentate along the outer edge, with three to five prominent teeth. The trailing habit appears to be unique, as other species are erect to procumbent. According to label information on the only two collections known, the plants grow in red sandy soil in woodland. It has also been collected in the Democratic Republic of Congo (Katanga).

Zambia:

- **0831** (Mbala): Abercorn [Mbala] to Mpulungu road, not far from Mukoma turning (–CC/CD), *Richards 5308* (K, 2 sheets).
- **1032** (Isoka): Isoka airstrip (–BA), *Lawton 1521* (K).

**5. *Bolusia resupinata* Milne-Redhead in Hook. Ic. Pl. 33, t.3246 (1934); B.-E. Van Wyk in Fl. Zamb. 3,7: 231 (2003).** Type: Zambia, Mpika district, Musha hills near Kanona on the Mpika–Broken Hill road, *St. Clair Thompson 1283* (K!, sheet 1, holotype; K!, sheet 2, isotype).

Erect to procumbent perennial herb 0.2–0.4 m high. *Leaves* digitately 3-foliolate. *Leaflets* narrowly elliptic to obovate, (8–) 10–15 (–20) × 3–6 (–10) mm, the upper ones often markedly narrower than the lower ones, sparsely silky above and below, ± glabrescent above; petiole 6–9 (–15) mm long, sparsely silky; stipules asymmetrically ovate, 3–7 (–10) × 3–6 (–8) mm, not dentate or obscurely dentate. *Inflorescences* leaf-opposed or terminal, short, racemose, with 1–4 flowers; rachis 10–20 mm long; peduncle 5–15 mm long; bracts small, linear, 2–4 mm long, silky; bracteoles small, linear, ±0.5 mm long. *Flowers* 8–10 mm long, pale yellow flushed purple. *Calyx* 5–7 mm long, tube slightly shorter than the lobes. *Standard* claw ±1 mm; lamina ±7 × 10 mm, with hairs along the dorsal midrib. *Wing* claw ±2 mm; lamina ±7 × 5 mm. *Keel* ±25 × 1 mm. *Keel* ±50 × 2 mm. *Androecium* as long as the keel. *Ovary* ±5 mm long. *Pods* 17–27 (–35) mm × 6–11 mm, smooth, dehiscent. *Seeds* brown, ±3 × 2 mm long, smooth to slightly verrucose.

This is another poorly recorded and poorly known species that scarcely differs from *B. amboensis* except for the silky vestiture. It is easily recognised since it is the only species where the upper surfaces of mature leaflets are usually silky. The resupinate flower is given as a diagnostic character in the original description, but this character has not been studied in the other species. Judged from pressed specimens, resupinate flowers are quite common, but field studies are needed for a proper evaluation. The habitat is recorded as sandy soil in open grassland. Only two collections from Zambia (Fig. 4) were available for study, and it is possible that the geographical range will be extended in future.

Zambia:

- **1328** (Kapiri): Kapiri Mposhi (–DC), *Fanshawe 3428* (K).
- **1330** (Serenje): Near Kanona on the Mpika–Broken Hill Rd, Musha Hills (–BA), *St. Clair Thompson 1283* (K, 2 sheets).

**6. *Bolusia* sp. Polhill in F.T.E.A., Leguminosae, Pap.: 995, fig. 136 (1971).** An imperfectly known species, apparently closely related to *B. resupinata* but the flowers are not resupinate. It has only been collected once in Tanzania (about 22 km south of Iringa, 0735 DC — see Fig. 4, on 13 July 1956). The specimen (*Milne-Redhead & Taylor 11068*) was unfortunately lost after it had been used for preparing the illustration in *Polhill (1971)*. The plant could not be found again despite a thorough search of the only known locality in 1962 (*Polhill, pers. comm.*).

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