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Short communication

A revision of the African genus *Robynsiophyton* (Crotalarieae, Fabaceae)

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Abstract

The monotypic genus *Robynsiophyton* is revised. *Robynsiophyton vanderystii* occurs in central and southern tropical Africa and is unique in the reduction of the androecium to nine stamens and five fertile anthers. It is morphologically similar to *Pearsonia* and *Rothia* and sister to the latter based on morphological and DNA sequence data. A revision of the genus is presented, including illustrations of vegetative and reproductive features and distributional information.

Keywords: Crotalarieae; Fabaceae; *Robynsiophyton vanderystii*; Taxonomic revision

1. Introduction

Robynsiophyton Wilczek is a poorly known, monotypic genus that occurs in south-central tropical Africa. It is morphologically similar to *Pearsonia* Dümmer and *Rothia* Pers., suggesting a close relationship with these genera (Polhill, 1976, 1981; Van Wyk, 1991). *Pearsonia* occurs in central and southern tropical Africa, while *Rothia* is widely distributed throughout tropical Africa, Asia and Australia (Polhill, 1974; Boatwright et al., in press). These three genera differ from the rest of the tribe in their monomorphic anthers and straight styles (Polhill, 1976; Van Wyk, 1991; Van Wyk and Schutte, 1995; Boatwright et al., in press). Chemically they are also unique within Crotalarieae in accumulating angelate esters of hydroxylupanine-type alkaloids (Van Wyk and Verdoorn, 1991). Recently, Boatwright et al. (2008), through the study of molecular (ITS and *rbcL*) and morphological data, demonstrated that *Pearsonia*, *Robynsiophyton* and *Rothia* form a strongly supported clade and that the latter two are strongly supported as sister genera (Fig. 1). Doubt regarding the generic status of *Robynsiophyton* has been expressed by previous authors (Polhill, 1976; Van Wyk, 1991), who suggested that it could merely be a local derivative of *Pearsonia*. However, according to Boatwright et al. (2008) the genus is not embedded within *Pearsonia*, but sister to *Rothia* with both of these subsequently sister to *Pearsonia*. These data in combination with the annual life history and the unusual androecium (nine stamens with only five fertile anthers) support the generic concept of *Robynsiophyton*.

The aim of this paper is to present a revision of *Robynsiophyton* with illustrations, a discussion on diagnostic characters and a distribution map.

2. Materials and methods

2.1. Morphology

Morphological data were obtained through the study of herbarium material from BM, K and PRE (abbreviations according to Holmgren et al., 1990). Digital images of critical specimens were obtained from BR and LISC. Illustrations were prepared using a stereoscope (WILD M3Z) with a camera *lucida* attachment.

3. Results and discussion

A summary of the diagnostic characters for *Robynsiophyton*, *Rothia* and *Pearsonia* is presented in Table 1. *Robynsiophyton vanderystii* Wilczek is a small annual (or rarely a short-lived perennial) with hairy, reddish-brown branches. It shares with *Rothia* the annual life history, a trait which is not found in

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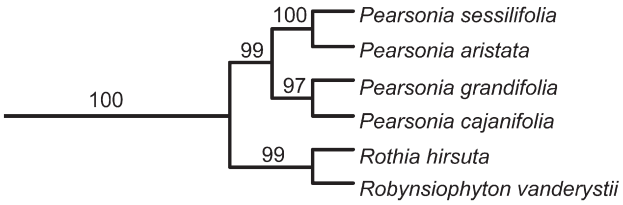

Fig. 1. Phylogenetic position of *Robynsiophyton vanderystii* based on gene sequences (ITS and *rbcL*) and morphological data (strict consensus of 370 trees from Boatwright et al., 2008; tree length = 1166; consistency index = 0.53; retention index = 0.84). Numbers above the branches are bootstrap percentages above 50%.

Pearsonia, a genus comprising perennial herbs or small shrubs. The leaves are digitately trifoliolate and sparsely pubescent adaxially but densely pubescent on the abaxial surface. The narrow stipules are paired at the base of the petiole. *Rothia hirsuta* (Guill. & Perr.) Bak. has single stipules at each leaf; *Rothia indica* (L.) Druce has paired stipules; and *Pearsonia* has the stipules paired or less often absent (Polhill, 1974; Boatwright et al., in press).

The flowers of *Pearsonia*, *Robynsiophyton* and *Rothia* are all relatively unspecialised, with straight or even down-curved styles and monomorphic anthers (Polhill, 1976). In *Rothia* the anthers are all small and rounded as opposed to the large, elongate anthers of *Pearsonia*, six of which are attached slightly higher up to the filament (Polhill, 1974, 1976). *Robynsiophyton* has a reduced number of stamens (from 10 to nine) and only five fertile stamens (the other four stamens lack anthers and are sterile). This is the most notable feature of the genus. In the Crotalarieae, Genisteae and Podalyrieae there is great variation in staminal arrangement from completely free stamens (Podalyrieae) to those joined in either an open sheath (Crotalarieae) or closed tube (most Genisteae). The anthers may be either dimorphic with alternating basifixed and dorsifixed anthers, or monomorphic as found in *Pearsonia*, *Robynsiophyton* and *Rothia* (a feature that is unique to this clade within the Crotalarieae). Anther characters are very reliable in legumes and usually consistent with other characters, thus providing important insight especially at generic and tribal levels (Bentham, 1843; Polhill, 1976; Boatwright et al., 2008, in press).

The calyx of *Robynsiophyton* is equally lobed, while in *Pearsonia* and *Rothia* the upper lobes are larger than the three lower lobes. In *Pearsonia*, the upper and lateral lobes on either side are often fused higher up (the so-called "lotononoid" calyx type). Bracts are present in all three genera, but bracteoles are generally lacking in *Pearsonia* (if present very small) and completely absent in *Robynsiophyton* and *Rothia* (Polhill, 1974, 1976).

The pods of *Robynsiophyton* are relatively short and few-seeded when compared to those of *Rothia*. The mature seeds are brown, smooth and similar in size to those of *R. indica*. *Robynsiophyton vanderystii* has larger seeds than *Rothia hirsuta* that are even coloured with a smooth surface, whereas those of *R. hirsuta* are mottled with a somewhat rugose surface (Boatwright et al., in press).

4. Taxonomy

4.1. Robynsiophyton

Wilczek in Bull. Jard. Bot. État. 23: 128 (1953); in F. C. B. 4: 286 (1953); Hutchinson, Genera of Flowering Plants: 362 (1964); Polhill in Bot. Syst. 1: 326 (1976); Van Wyk and Schutte, Advances in Legume Systematics 7: 306 (1995); Polhill, Fl. Zam. 3 (7): 66 (2003); Leistner, Seed Plants of southern Tropical Africa: Families and Genera: 202 (2005); Van Wyk in Legumes of the World, Lewis et al. (Eds): 281 (2005).

Type species: *R. vanderystii* Wilczek.

The genus is monotypic and distinguished by the reduced number of stamens (nine instead of 10) and presence of four staminodes (Table 1). It occurs in central tropical Africa extending from Angola to Zambia in the east.

4.2. R. vanderystii

Wilczek in Bull. Jard. Bot. État. 23: 128 (1953); in F. C. B. 4: 286, t. 17 (1953); White, F. F. N. R.: 164 (1962); Torre in C. F. A. 3: 6 (1962); Lock, Leg. Afr. Check-list: 232 (1989); Polhill, Fl. Zam. 3 (7): 66 (2003).

Type: Democratic Republic of Congo, Lazaret du Sacré-Coeur [1025 BA], *Vanderyst s.n.* (BR, holo., photo!).

Small, prostrate or ascending annual or short-lived perennial up to ±0.3 m in height. *Branches* reddish-brown, pubescent. *Stipules* 5–8 mm long, linear to lanceolate, invariably paired, pubescent. *Leaves* digitately trifoliolate; petiole shorter than leaflets, 4–7 mm long; leaflets elliptic to oblanceolate, subsessile, sparsely pubescent adaxially and densely so abaxially, terminal leaflet 14–22 × 4–9 mm, lateral leaflets 7–16 × 2.5–6.0 mm, obtuse, base cuneate. *Inflorescence* axillary or rarely terminal congested racemes, with (2–) 5 to 9 (–10) flowers; pedicel less than 1 mm long; bract linear, 1.5–3.0 mm long, pubescent, caducous; bracteoles absent. *Flowers* pale yellow, 3–6 mm long. *Calyx* equally lobed, pubescent, 4–5 mm long; tube 1.5–2.0 mm long; lobes subulate, 1.5–3.0 mm long, tips minutely pubescent on inner surface. *Standard* 3–5 mm long; claw 1.0–1.5 mm long; lamina elliptic to ovate, 2–4 × 1.0–1.5 mm, obtuse to very slightly emarginate, pilose along dorsal midrib. *Wings* 2.5–4.5 mm long; claw 1.5–1.8 mm long;

Table 1
Summary of diagnostic characters for *Robynsiophyton*, *Rothia* and *Pearsonia*.

Character	*Robynsiophyton*	*Rothia*	*Pearsonia*
Life history	Annual or short-lived perennial	Annual	Perennial
Stipules	Paired	Paired or single	Paired or absent
Bracteoles	Absent	Absent	Small or absent
Calyx	Equally lobed	Sub-equally lobed	Zygomorphic
Androecium	9 Stamens, 5 rounded anthers, 4 staminodes	10 Stamens, 10 rounded anthers, 0 staminodes	10 Stamens, 10 elongated anthers, 0 staminodes
Fruit	Oblong to ovate	Linear to ovate or falcate	Ellipsoid to linear-oblong
Seeds	Brown, smooth	Brown or mottled, smooth or rugose	Light or dark brown, sometimes mottled, smooth

lamina oblong to obovate, as long as or slightly longer than keel, 1.0–2.5 × 0.5–1.0 mm, obtuse, glabrous, with 1–2 rows of sculpturing. *Keel* 3–4 mm long; claw 1–2 mm long; lamina boat-shaped, 1.5–3.0 × 0.5–0.8 mm, obtuse, glabrous, sometimes with a very slight pocket. *Stamens* 9, anthers monomorphic with 5, sub-basifixed anthers alternating with 4 staminodes. *Pistil* subsessile, pubescent, ovary elliptic, 1.5–2.0 × 0.5–0.8 mm with ±5 to 8 ovules; style straight, 1.5–1.8 mm long, glabrous. *Pods* oblong to ovate, laterally compressed, subsessile, 7–10 × 3–4 mm, ±2 to 8 seeded, dehiscent. *Seeds* oblique-cordiform, 1.0–1.5 × 1.0–1.2 mm, brown, smooth (Fig. 2). Flowering time: April. Plants appear to be inconspicuous and are poorly collected so that the flowering time needs confirmation.

5. Distribution and habitat

R. vanderystii occurs in moist, sandy soils and is especially common along roadsides. Very few specimens are available for study and these include collections from Angola, the Democratic Republic of Congo and Zambia, but it is likely that the distribution range is more extensive (Fig. 3).

5.1. Additional specimens examined

Angola:

– *0614:* Kimbambu, Madimba (–AA), Pauwels 6470 (PRE).

– *0720*: Lunda, Chicapa (–BC), Exell and Mendonça 657 (BM, K, LISC 3 sheets).

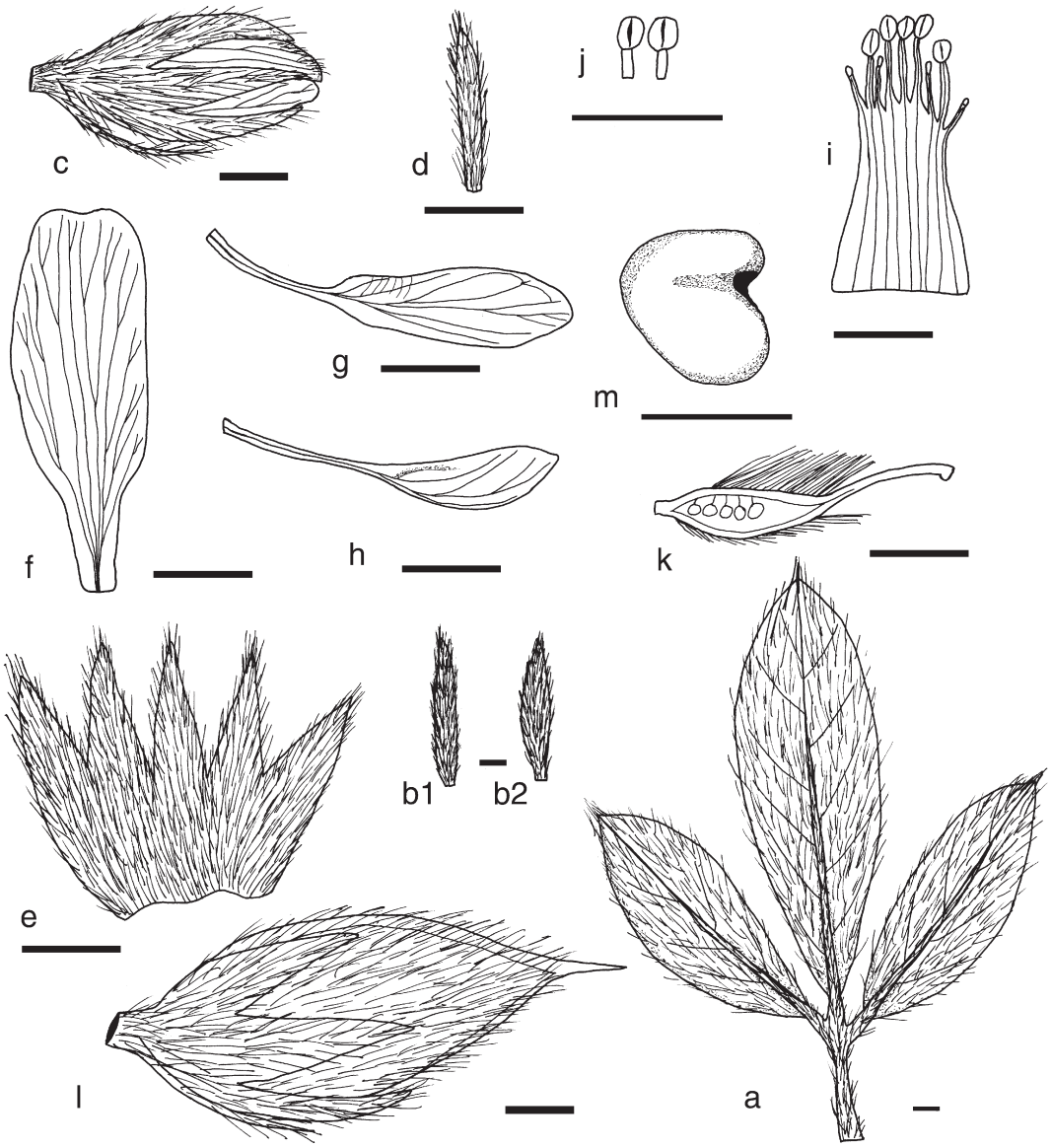

Fig. 2. Morphology of *Robynsiophyton vanderystii* (drawings by JSB): (a) leaf in abaxial view; (b1–b2) stipules; (c) flower in lateral view; (d) bract; (e) outer surface of the calyx (upper lobes to the left); (f) standard petal; (g) wing petal; (h) keel petal; (i) androecium showing the five uniform anthers and four staminodes; (j) anthers (carinal anther on the left); (k) pistil; (l) pod in lateral view; (m) seed in lateral view. Voucher specimens: (c, d, f, g, h, i, j, k) *McCallum Weston 717* (K); (e) *Lisowski 20326* (K); (l) *Richards 9321* (K); (a, b1–b2) *Richards 18144* (K); (m) *Exell and Mendonça 657* (K). Scale bars: (a–m) 1 mm.

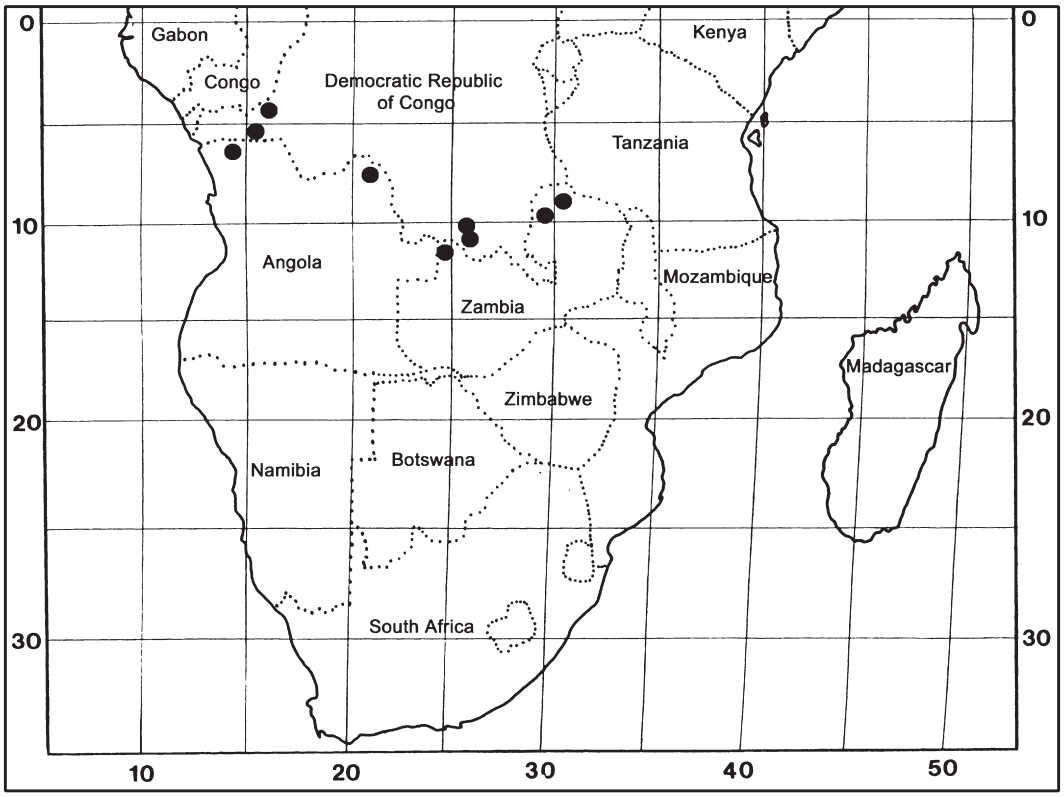

Fig. 3. Known geographical distribution of *Robynsiophyton vanderystii*.

Democratic Republic of Congo:

– *0416*: Bakama (–AB), Flamigni s.n. (K).

– *0515*: Bas-Congo, Kisantu (–AA), Vanderyst s.n. (BM, K); Bas-Congo, Kimpako (–AB), Vanderyst 42290 (K).

– *1025*: Haut-Shaba, Kolwezi (–DA), Lisowski 20326, 20333 (K).

Zambia:

– *0831*: Chilongowelo, Abercorn (–CA), McCallum Weston 717 (K); Mpulungu Abercorn road, close to Chilongowelo turning (–CA), Richards 5309, 5317, 18144 (K), Richards 11097 (K, PRE).

– *0929*: Kawambwa, Timnatushi Falls (–CC), Richards 9319a, 9321 (K).

– *1124*: Mwinilunga (–CD), Mutimushi 3416 (K).

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