

## *Schaueriopsis*: a new genus of Acanthaceae (Acanthoideae: Barlerieae) from the Democratic Republic of Congo

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**Background** – A new genus of Acanthaceae, *Schaueriopsis* Champl. & I.Darbysh., is described from the eastern Democratic Republic of Congo in preparation for the account of the family in the Flore d’Afrique Centrale.

**Methods** – Standard practices of herbarium taxonomy were applied.

**Key results** – *Schaueriopsis variabilis* Champl. & I.Darbysh., representing a new genus of Acanthaceae, is described from the forests of the eastern Congo basin. Morphological evidence, notably the quincuncial corolla aestivation, the reticulate prolate tricolporate pollen and the narrowly oblong 4-seeded capsule with seeds bearing minute trichomes, together with results from preliminary molecular analyses, place it within tribe Barlerieae of subfamily Acanthoideae. A key to the four African genera in this tribe is presented, *Schaueriopsis* being separated from *Lepidagathis* by the subregular linear calyx lobes, the androecium of two stamens and two staminodes and the seeds with only minute trichomes towards the rim. *Schaueriopsis variabilis* is provisionally assessed as Endangered based upon the herbarium and field data available.

**Key words** – Africa, Barlerieae, *Chroesthes*, Congo, conservation, *Lepidagathis*, new genus, pollen, *Schaueria*, *Schaueriopsis*, staminodes.

### INTRODUCTION

During the preparation of the treatment of Acanthaceae for the ‘Flore d’Afrique Centrale’, three specimens were uncovered at BR of a species from the eastern Democratic Republic of Congo which did not fit within any of the currently recognised African genera. However, the material lacked fruits and seeds, which are of diagnostic importance in Acanthaceae and assist in the placement of taxa within the wider classification of the family. Recent botanical survey work in eastern Congo by Quentin Luke and Benny Bytebier produced a fourth collection, this time including fruits with immature seeds. Following detailed morphological analyses of the available material, we conclude that this taxon is best considered to represent a new genus of Acanthaceae, which we describe below as *Schaueriopsis* Champl. & I.Darbysh., with a single species *S. variabilis* Champl. & I.Darbysh.

Its placement within the current classification of the family, based on morphological evidence and preliminary molecular data, is discussed below and a key to distinguish it from (putatively) related genera in Africa is presented.

### MATERIAL AND METHODS

Herbarium material was studied at BR and K, together with photographs of living material supplied by Quentin Luke. Flowers were dissected and measured under a Leica MZ6 binocular microscope following soaking in Aerosol OT 5% solution; measurements of other organs were made on dry material. All specimens cited have been seen except where noted (n.v.).

For study of the pollen, an anther was extracted from a flower bud on *Luke* 12527 and dissected to extract the pollen, which was then mounted on a SEM stub coated with double-sided sticky tape, sputter coated with platinum and examined using a Hitachi S4700 cold field emission SEM at 2 kV. Pollen from *Bequaert* 6855 was acetolyzed and studied under a Jeol 5800 Lv SEM.

The Categories and Criteria of IUCN (2001) were used to assess the conservation status of the species. Area of Occupancy (further AOO) was calculated based upon an average population size of 4 km<sup>2</sup> per locality, this being the recommended cell size by the IUCN Standards and Petitions Working Group (IUCN 2010: 34). This is considered the most ap-

propriate cell size to use in view of our very limited field knowledge of the size of individual populations, which precludes the use of a tailored grid cell size.

#### THE NEW GENUS *SCHAUERIOPSIS* AND ITS PLACEMENT WITHIN THE CLASSIFICATION OF ACANTHACEAE

The new genus *Schaueriopsis* is recognised by having the combination of a dense terminal thyrse; pedicellate flowers; a calyx comprising five subequal long-linear lobes; a bilabiate corolla with cylindrical tube; an androecium comprising two stamens and two minute staminodes, the anther thecae being somewhat divergent and mucicous or minutely apiculate at the base; and 4-seeded capsules, not contracted at the base and bearing seeds with few minute trichomes only towards the rim (figs 1 & 2). Whilst none of these characters are diagnostic in isolation, this combination of characters is unique in Acanthaceae and so justifies the recognition of a new genus.

On cursory inspection, the combination of five subequal linear calyx lobes, a bilabiate corolla and two stamens may suggest that *Schaueriopsis* should be placed within Acanthaceae tribe Justiceae (*sensu* McDade et al. 2000, 2008). Indeed, it superficially looks very similar to some species of the Neotropical genus *Schaueria* Nees such as *Schaueria calycotricha* (Link & Otto) Nees. However, preliminary molecular evidence from limited sequence data places the new genus within tribe Barlerieae (L. McDade, Rancho Santa Ana Botanic Garden, unpubl. res.). A careful morphological study reveals several characters that support this placement, each of which is discussed below.

#### Corolla aestivation

Corolla aestivation patterns are highly conserved across genera of Acanthaceae and so have been accorded considerable significance in the classification of the family (e.g. Scotland et al. 1994, Scotland & Vollesen 2000). The quincuncial aestivation, in which two corolla lobes of a pentamerous flower wholly overlap the other lobes in bud (Scotland et al. 1994), has been proposed as synapomorphic for the tribe Barlerieae (McDade et al. 2008). This feature is most readily observable in genera with large corolla lobes such as *Barleria* L. and *Crabbea* Harv.

The aestivation pattern is difficult to observe in *Schaueriopsis* whose corolla lobes are short and slender, the two lips soon unfolding even prior to maturity, and the dense trichomes in bud obscuring the margins of the lobes. However, in mature corolla buds on both *Bequaert* 6855 and *Lejoly* 4810, the lateral lobes of the lower lip appear to be held outermost, with the median lobe always and the upper lip usually folded within them (on one flower bud observed, one margin of the upper lip was found to overlap on the outside of one of the lateral lobes, though it is unclear whether this was due to distortion on pressing). Although confirmation from living material is desirable, it nevertheless appears that *Schaueriopsis* displays a quincuncial pattern. Within Barlerieae, this pattern most closely resembles that seen in the pantropical genus *Lepidagathis* Nees, which shares a bilabiate corolla with *Schaueriopsis*.

Genera in tribe Justiceae have ascending cochlear aestivation in which only one corolla lobe (the abaxial one which would be the median lobe of the lower lip on a typical bilabiate corolla) wholly overlaps both of its neighbouring lobes (Scotland & Vollesen 2000).

#### Pollen

The prolate, trizonocolporate pollen grains of *Schaueriopsis*, with their reticulate interapertural tectum and densely baculate lumina (fig. 3), are a close match for those of several genera either confirmed to belong to or putatively placed within Barlerieae, including *Lepidagathis*, and the two tropical Asian genera *Chroesthes* Benoist and *Hulemacanthus* S. Moore (see Scotland & Vollesen 2000: figs. 22 & 23). The latter two genera also share with *Schaueriopsis* the dense conical processes on the colpi, which give them a granular appearance. This pollen type is somewhat different to the one of *Barleria* (see Scotland & Vollesen 2000: figs. 19 & 20) in which the grains are more globose in equatorial view with shorter, more deeply incised colpi. This difference led Bremekamp (1965) to separate his Barleriinae (which he placed within his tribe Ruellieae on the basis of pollen features) from his Lepidagathideae. However, molecular evidence indicates that these two groups should be combined together in a single tribe Barlerieae (McDade et al. 2008).

#### Capsule and seeds

The capsule of *Schaueriopsis* is 4-seeded, narrowly oblong in face view and with the base not contracted into a sterile stipe (fig. 2J & K). This matches the 'box-shaped' capsules described by Hansen (1983) in *Chroesthes* and is close to those of the subgroup '*Neuracanthopsis*' of *Lepidagathis* (*sensu* Darbyshire 2010). Most genera of Justiceae, on the other hand, have capsules with a contracted, slender sterile stipe at the base.

The seeds of *Schaueriopsis* have minute and inconspicuous non-hygroscopic trichomes only towards the rim, the remainder of the surface being glabrous. Whilst other members of Barlerieae in Africa have seeds clothed in long hygroscopic trichomes, the Asian *Chroesthes* has seeds very similar to those of *Schaueriopsis*.

#### Androecium

Dissection of the corolla of *Schaueriopsis* reveals two minute lateral staminodes in addition to the functional ventral pair of stamens (fig. 2G). In African Barlerieae, the genera either have four functional stamens (*Lepidagathis*, *Crabbea*) or two that are functional and two or three staminodes (*Barleria*). Staminodes are uncommon in Acanthaceae, though certainly not restricted to Barlerieae. For example, within Justiceae they are frequently recorded in the group of genera in the *Pseuderanthemum* lineage (McDade et al. 2000) and in Whitfieldieae s. lat. they are sometimes recorded in *Lankesteria* Lindl. (*vide* Vollesen 2008).

### Calyx

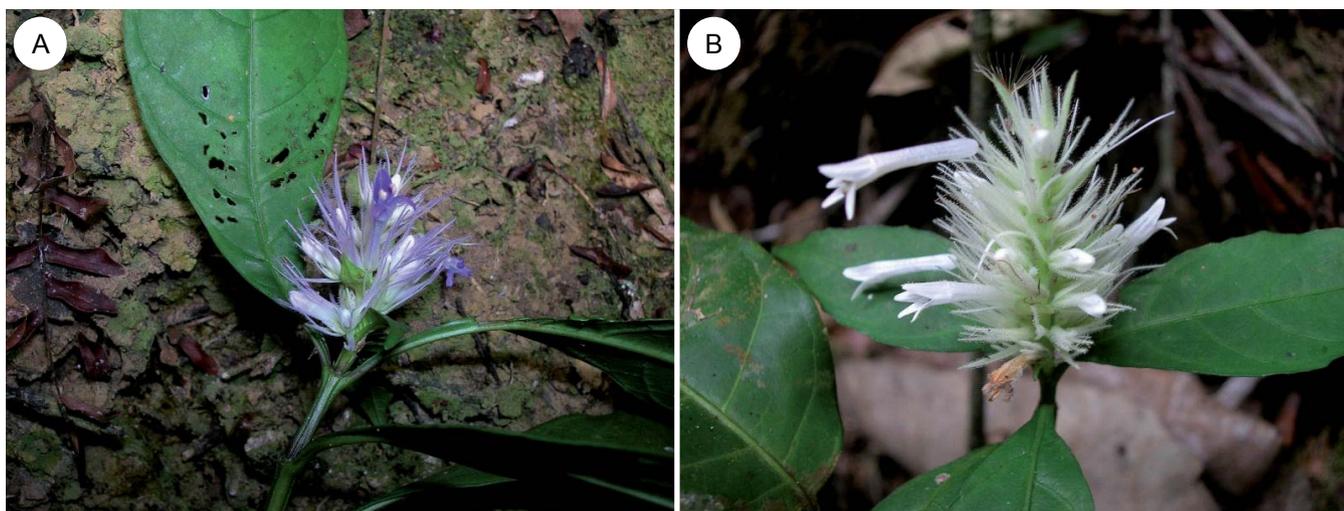
Most genera of Barlerieae have highly unequal calyx lobes, the lateral pair usually narrowest and the posticous lobe broadest. In the extreme case, seen in *Barleria*, the anticous pair are largely or wholly united, resulting in a 4-lobed calyx, usually with two large, broad lobes and two small, narrow ones. The subequal lobes of *Schaueriopsis* at first seem at odds with this pattern. However, whilst Hansen (1983) recorded *Chroesthes* as having unequal calyx lobes, in *Chroesthes bracteata* (Imlay) B.Hansen they are linear, with the posticous lobe only marginally wider than the others (see Hansen 1983: fig. 1M). This is very similar to the pattern observed in *Schaueriopsis* (fig. 2E here). It should be noted, however, that this calyx pattern is widespread in Acanthaceae and common within tribe Justiceae.

It can be seen from the discussion presented above that *Schaueriopsis* shares several characters with the Asian genus *Chroesthes*, which ranges from Burma and South-West China to Malaysia and Vietnam (Hansen 1983). Indeed, the inflorescences of *C. bracteata* and *Schaueriopsis* look strikingly similar. However, the two genera are easily separated from one another by the corolla and androecium: *Chroesthes* has a widely funnel-shaped throat to the corolla tube and has four stamens with the anther thecae parallel and conspicuously spurred, whilst *Schaueriopsis* has a cylindrical corolla tube barely widened in the throat and has two stamens and two staminodes, the thecae of the stamens being somewhat divergent and basally muticous or at most minutely apiculate. Within Africa, *Schaueriopsis* is most likely to be confused with *Lepidagathis* with which it is, nevertheless, easily separated by having an androecium of two functional stamens and two staminodes, not four functional stamens, and by having largely glabrous seeds with minute trichomes towards the rim only, rather than having dense long trichomes throughout.

*Schaueriopsis* is the fourth currently recognised genus assigned to Barlerieae in Africa (we here follow Thulin (2006) in including *Acanthostelma* Bidgood & Brummitt and *Golaea* Chiov. within *Crabbea*). These genera can be separated using the following key.

### Key to the Barlerieae of Africa

1. Corolla limb variously subregular to zygomorphic but not strongly bilabiate, adaxial pair of lobes at least partially free and not forming a hooded upper lip.....2
1. Corolla limb bilabiate with a shortly bilobed or entire hooded upper lip and a 3-lobed lower lip.....3
2. Calyx 5-lobed; stamens 4, didynamous but anthers equal in length, staminodes absent; flowers borne in ± globose heads with several whorls of large bracts.....*Crabbea*
2. Calyx 4-lobed, anticous lobe with apex entire to bifid; stamens 2, staminodes 2 or 3, these sometimes bearing antherodes containing a few pollen grains but then these much smaller than in the functional anthers; inflorescences not globose or enclosed within several whorls of bracts.....*Barleria*
3. Stamens 4; staminodes absent; calyx lobes unequal, the posticous lobe clearly broadest; seeds clothed in long hygroscopic trichomes.....*Lepidagathis*
3. Stamens 2; staminodes 2, minute; calyx lobes subequal, all linear; seeds glabrous except for minute trichomes towards the rim.....*Schaueriopsis*



**Figure 1** – *Schaueriopsis variabilis* in the field at Namoya, D.R.Congo: A, blue-mauve-flowered variant; B, white-flowered variant (photographs by Q. Luke).



**Figure 2** – *Schaueriopsis variabilis*: A, habit, flowering branch; B, cymule with maturing corolla; C, bract, external (abaxial) surface; D, bracteole, external (abaxial) surface; E, dissected calyx, internal surface, posticous lobe second from left; F, dissected corolla with androecium; G, androecium, showing ventral pair of stamens and lateral pair of staminodes; H, detail of anthers, ventral (left) and dorsal views; I, pistil; J, capsule within persistent calyx, posticous calyx lobe to the left; K, capsule, internal view; L, seed on retinaculum, with fine detail of seed surface showing fingerprint-like patterning and minute trichomes along rim. A, B, H & I from *Lejoly* 4810; C, D, G, J, K & L from *Luke* 12527, E & F from *Bequaert* 6855. Scale bars: A, B, J & K = 1 cm; C–E, F & I = 5 mm; G & L = 3 mm; H = 1 mm. Drawing by Juliet Williamson.

## TAXONOMIC TREATMENT

*Schaueriopsis* Champl. & I. Darbysh., **gen. nov.**

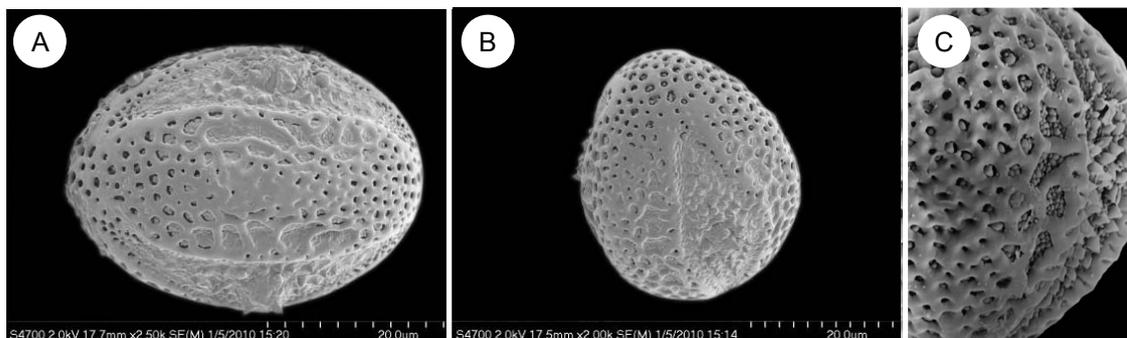
*Schaueriopsis variabilis* Champl. & I. Darbysh., **sp. nov.**

*Lepidagathi* similis sed calycis lobis subaequalibus nec in latitudine valde dissimilibus, floribus duobus nec quatuor staminibus atque duobus nec nullis staminodiis munitis, seminibus glabris praeter marginem pilis minutissimis munitam nec pilis hygroscopicis omnino obtectis bene differt; a *Chroesti* corollae tubo sursum vix nec late ampliato, floribus duobus nec quatuor staminibus atque duobus nec nullis staminodiis munitis, antheris calcaribus carentibus nec calcaribus prominentibus instructis bene differt; *Schaueriae* similis sed corolla coerulea vel lilacea vel alba, nec flava vel rubra, staminum filamentis applanatis, glabris, basi quam apice duplo latioribus, antherae thecis ellipsoidis divergentibus, pilosis, basi mucronatis bene distinguitur. – Type: D.R. Congo, Lubutu–Kirundu, 6 Feb. 1915, *Bequaert* 6855, fl. (holo-: BR).

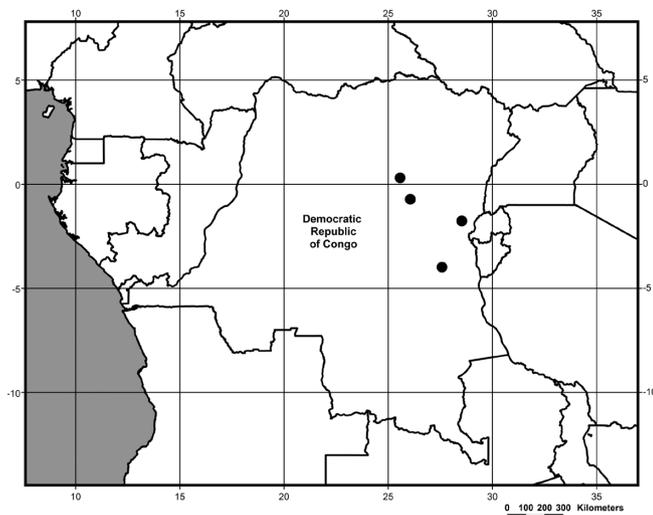
Perennial herb or subshrub, to 100–120 cm tall. Stems (yellowish-) brown, convexly quadrangular with four green ridges, slightly swollen or (in dried material) contracted above the nodes, with minute spreading or antrorse trichomes on the ridges of the uppermost internodes and along the nodal line but soon glabrescent. Leaves opposite-decussate; blade elliptic, oblong-elliptic or somewhat obovate, 8–15 × 2.5–6 cm, base long-attenuate, margin entire, apex acuminate, surfaces glabrous; lateral nerves 5 to 9 pairs; cystoliths minute, rod-shaped, scattered on the upper surface or obscure on some leaves; petiole to 15–20 mm long, narrowly winged and decurrent onto leaf base; leaves of short lateral branches smaller and pairs somewhat anisophyllous. Inflorescence a congested spiciform thyrse, 3–12.5 × 2–3 cm (excluding the flowers), each cymule monochasial or dichasial, several-flowered or the lowermost fertile node reduced to a single flower; axes densely puberulous and with interspersed longer patent glandular trichomes; main axis bracts opposite-decussate, green or turning whitish-green to pale blue distally, elliptic to lanceolate, 8–17 × 2.5–6 mm, apex acuminate, indumentum as on axes but sparser or largely restricted to the margins, particularly in the basal portion of the thyrse; secondary bracts and bracteoles of each cymule white or blue-purple, linear, 8–15 × 0.5–1.5 mm, densely puberulous and with numerous interspersed longer patent glandular trichomes; pedicels 1–3 mm long. Calyx divided

almost to the base, white or blue-purple, lobes 5, linear, anticus and lateral pairs 9–12.5 × 0.5–0.8 mm, posticus lobe somewhat broader and sometimes longer, 10.5–13.5 × 0.75–1.1 mm, indumentum as on bracteoles, midrib prominent at least on the posticus lobe, this sometimes also with two parallel lateral nerves, anticus lobes with midrib often offset from the centre. Corolla 17–21.5 mm long, pale blue, mauve or white, shortly retrorse-puberulous externally and with numerous short patent glandular trichomes on the limb, tube puberulous below the attachment of the stamens within; tube cylindrical, the throat barely widened, 13–15 mm long, 1.8–2.5 mm wide at the base, 3–3.5 mm wide at the mouth; limb bilabiate; upper lip ovate, hooded, 3–5 × 2.5–4 mm, apex obtuse or minutely notched; lower lip 3.5–6 mm long, deeply divided into 3 subequal lanceolate lobes, each 2.5–5 × 1–1.7 mm. Stamens 2, ventral, attached 1.5–2.5 mm from the mouth of the corolla; filaments flattened, 3.5–5 mm long, broadening towards the base, glabrous; anthers bithecal, thecae held at the same height but somewhat divergent, each oblong-ellipsoid, 0.8–1.2 mm long, base mucous to minutely apiculate, with scattered pale flexuose trichomes particularly at the apex; staminodes 2, lateral, inserted at ± the same height as the stamens, 0.25–1.3 mm long, with sparse minute eglandular trichomes or glabrous, antherodes absent. Ovary 1–1.7 mm long, densely antrorse-puberulous; style 12.5–15.5 mm long, with minute antrorse trichomes in the lower half or two thirds; stigma subcapitate, minutely bilobed; disk cupuliform, ± 0.5 mm high. Capsule 4-seeded or fewer by abortion, narrowly oblong in face view, 10–10.5 mm long, without a contracted basal stipe or apical rostrum, surface finely puberulous throughout. Seeds lenticellate, 1.8 mm long when immature, surface with minute trichomes towards rim, elsewhere smooth except for shallow ‘fingerprint-like’ whorls. Figs 1 & 2.

Pollen trizonocolporate, prolate, c. 40 × 30 µm (P/E 1.3–1.35), tectate-reticulate to tectate-perforate; apocolpium perforate to microreticulate (lumina less than 1 µm in diameter); mesocolpium microreticulate, with two weakly defined irregularly reticulate (lumina more than 1 µm in diameter) bands on each side of each colpus in the equatorial zone, the area of mesocolpium between these two bands sometimes almost imperforate; lumina with baculae free or connate; colpi covered with conical acute processes fading or vanishing towards the apices; pori c. 5.5 µm in diameter. Fig. 3.



**Figure 3** – Pollen of *Schaueriopsis variabilis*: A, equatorial view showing two colpi and mesocolpium; B, view showing apocolpium; C, detail of sculpturing of mesocolpium and colpus. A & B from *Luke* 12527; C from *Bequaert* 6855.



**Figure 4** – Distribution of *Schaueriopsis variabilis* (●).

**Distribution** – Restricted to eastern Democratic Republic of Congo (fig. 4).

**Additional specimens examined** – **D.R.Congo:** entre Walikale et Kalehe, alt. 800–1000 m, Mar. 1932, *Lebrun* 5260 (BR\*); km 45, route Kisangani–Wanié-Rukula, 5 km à l’Est, chutes Amunyala (0°18’N, 25°34’E), 10 Mar. 1979, *Lejoly* 4810, fl (BR); Maniema Prov., Namoya, N of Kibiswa (3°59’25”S 27°34’54”E), alt. 875 m, 14 Aug. 2008, *Luke [with Bytebier]* 12527, fl & fr (BR n.v., EA n.v., K, MO n.v.); Maniema, km 7 Lubutu–Obokoto, chute Otoko, fané [faded], Mar. 1975, *Lisowski* 40322 (BR).

\* the BR sheet of *Lebrun* 5260 is currently missing, hence the exact date of collection and phenology are unknown.

**Habitat and Ecology** – Primary rainforest, sometimes seasonally dry, *Gilbertiodendron dewevrei* forest; 800–1000 m elevation.

**Conservation** – Only four locations are currently known from herbarium data, with an estimated Area of Occupancy (AOO) of 16 km<sup>2</sup>. Of these, that at Namoya is very close to a site proposed for goldmining and, with the likelihood of significant human in-migration at the onset of mining activity and the resultant increased pressure on natural resources, it is very likely that the forests in this region will be degraded or lost unless direct conservation action is taken (Q. Luke, pers. comm.). Satellite imagery on Google Earth ([http://www.google.co.uk/intl/en\\_uk/earth/index.html](http://www.google.co.uk/intl/en_uk/earth/index.html)) shows that large areas of forest remain intact in the Kisangani-Lubutu-Kirundu region away from the main transport routes. However, the forest between Walikale and Kalehe appears rather fragmented and degraded. Continued forest clearance is believed to be widespread within this species’ range. In light of this evidence, we provisionally assess *Schaueriopsis variabilis* as Endangered (EN B2ab(iii)). The forests of eastern Congo remain under-explored botanically and it is quite likely that further sites will be uncovered which may ultimately lead to a downgrading of this threat level.

**Etymology** – The name ‘*Schaueriopsis*’ is proposed because its inflorescence bears a striking resemblance to that of *Schaueria calycotricha* (Link & Otto) Nees and allies. The species epithet ‘*variabilis*’ refers to the variation in corolla and inflorescence colour (fig. 1).

**Notes** – The wet forests of the eastern Congo basin are not renowned as an area of highly localised plant endemism, with many species being widespread throughout the basin and the more localised species typically extending at least into the forests of the Lake Victoria Basin in Uganda and western Kenya. The discovery of a new genus restricted to this area is therefore all the more remarkable.

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