Two new species from the mountains of southern Malawi and northern Mozambique

Iain Darbyshire¹ , Roger M. Polhill², Zacharia Magombo³ & Jonathan R. Timberlake⁴

Summary. Two new species are described from the proposed Mulanje-Namuli-Ribáuè Centre of Endemism. *Isoglossa perdita* I. Darbysh. (Acanthaceae) is apparently restricted to the submontane forests of southeastern Mt Mulanje in Malawi, and is assessed as Critically Endangered. *Agelanthus patelii* Polhill & Timberlake (Loranthaceae) is recorded from the montane forests of Mt Mulanje and from Mt Namuli in Mozambique, and the earlier assessment of this species as Endangered is confirmed. The habitat preferences and taxonomic affinities of these species are discussed. This work contributes to the ongoing assessment of the biodiversity and endemism of this montane region, and to the identification of Important Plant Areas in Mozambique.

Key Words. Acanthaceae, Centre of Plant Endemism, IUCN Red List assessment, Loranthaceae, montane, new species, taxonomy.

Introduction

The series of isolated mountains that extends from southern Malawi through Zambézia and Nampula Provinces of northern Mozambique is known to support a rich and varied biodiversity with many unique species (Bayliss *et al.* 2014). This montane region has been proposed as a (Sub-) Centre of Plant Endemism within the Eastern Afrotropical phytogeographical region, provisionally referred to as the Mulanje-Namuli-Ribáuè Centre of Endemism (Darbyshire *et al.* 2019a).

Mt Mulanje in Malawi, the highest massif in southern tropical Africa, is the best-known of these mountains in botanical terms due to its diverse montane grassland and forest flora, rich in endemic and range-restricted species (Dowsett-Lemaire 1988; White *et al.* 2001; Strugnell 2002, 2006). Strugnell (2002) recorded 69 species as endemic to this massif and, whilst several of these have since been located on nearby mountains in Mozambique (Harris *et al.* 2011), it remains a key site for plant endemism with 50 strict endemics documented in an updated assessment (authors' own unpubl. data). The most famous of these is Malawi's national tree, the Mulanje Cedar (*Widdringtonia whytei* Rendle), a Critically Endangered conifer that is the subject of concerted conservation efforts (Bayliss *et al.* 2007; Chanyenga *et al.* 2019).

A recent study of the endemic and near-endemic flora of Mozambique demonstrated that a significant portion (c. 9%) is restricted to this Centre of Endemism, including 30 Mozambican strict-endemics (Darbyshire *et al.* 2019a). Many of these species are found on Mt Namuli, a critical site for plant diversity in Mozambique (Timberlake *et al.* 2009; Harris *et al.* 2011; Downes & Darbyshire 2017; Darbyshire *et al.* 2019b; Timberlake 2021), but other mountains in this centre of endemism are also of high interest for their rare and threatened species and habitats, particularly Mt Mabu and the Ribáuè Mts (Bayliss *et al.* 2014; Timberlake *et al.* 2012; Darbyshire *et al.* 2019a, 2019c). These sites will form an important component of the Important Plant Areas network that is currently being identified and documented in Mozambique as part of the Tropical Important Plant Areas programme (<https://www.kew.org/science/our-science/projects/tropical-important-plant-areas-mozambique>; Darbyshire *et al.* 2019a).

During preparation for the botanical component of a forthcoming biodiversity and endemism assessment of these mountains (J. Bayliss *et al.*, in prep.), two undescribed plant species have been discovered. The first is an *Isoglossa* Oerst. (Acanthaceae) that is restricted to Mt Mulanje and the second an *Agelanthus* Tiegh. (Loranthaceae) that is found on both Mulanje

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¹ Herbarium, Royal Botanic Gardens Kew, Richmond, Surrey, TW9 3AE, UK. e-mail: i.darbyshire@kew.org

² The Belt Lodge, Sir Williams Lane, Aylsham, Norwich, NR11 6AN, UK.

³ National Herbarium & Botanic Gardens of Malawi, P.O. Box 528, Zomba, Malawi.

⁴ 30 Warren Lane, East Sussex, BN20 0EW, UK.

and Namuli. These species are formally described below and their affinities and conservation status (extinction risk) are discussed.

Materials & Methods

Herbarium specimens of the new species were analysed at K and MAL using standard herbarium practices. Prior to dissection, a flower on the K sheet of the new species of *Isoglossa* was soaked in Aerosol OT 5% solution; all other characters were measured on dry material. All duplicates cited have been seen by at least one of the authors, except where indicated (“n.v.”).

The species conservation assessments follow the Categories and Criteria of the IUCN Red List (IUCN 2012) and the guidelines for their use (IUCN Standards and Petitions Subcommittee 2019).

Results and Taxonomic Accounts

1. A new species of *Isoglossa* from Mt Mulanje

The genus *Isoglossa* (Acanthaceae: Acanthoideae: Justicieae: Isoglossinae; Kiel *et al.* 2006) is noteworthy for containing a high number of narrowly range-restricted taxa in tropical and southern Africa (Brummitt 1985; Darbyshire 2009; Darbyshire *et al.* 2011; Balkwill *et al.* 2017; Champluvier & Fischer 2020). When preparing the account of *Isoglossa* for *Flora Zambesiaca* (Darbyshire *et al.* 2015), the first author was surprised by the absence on Mt Mulanje of any species of *Isoglossa* in the group with an open, paniculate thyrsoid inflorescence and stamens with markedly offset anther thecae — the *I. dichotoma* (Hassk.) B.Hansen complex *sensu* Darbyshire (2009). This group is widespread in the montane regions of eastern tropical Africa and several of the larger mountain ranges have one or more endemic taxa in that group (Darbyshire 2009; Darbyshire *et al.* 2010, 2015). In the *Flora Zambesiaca* region, this includes *I. membranacea* C.B. Clarke subsp. *membranacea*, which is restricted to the Misuku Hills of Malawi, and *I. sp. A* (= *de Koning* 7459), known only from an immature flowering specimen from the tea estates of Mt Namuli in Mozambique (Darbyshire *et al.* 2015). Three species of *Isoglossa* have been noted previously from Mt Mulanje: *I. grandiflora* C.B. Clarke, *I. floribunda* C.B. Clarke and *I. milanjiensis* S. Moore. The former two are species of lower elevation, usually riverine woodland and dry forest, and belong to a species group with spiciform inflorescences and anthers with thecae held at an equal height and parallel. *Isoglossa milanjiensis*, which is also recorded from the Manica Highlands of Mozambique and Zimbabwe, belongs to a group with spiciform inflorescences that are most diverse in South Africa (see Balkwill *et al.* 2017), and includes the type species of the genus, *I. organoides*

(Nees) Lindau (Brummitt 1974). All of these species are quite distinct from the *I. dichotoma* complex at least in morphological terms; the phylogenetic relationships between and within these groups have not yet been explored.

In processing the accumulated research materials of Dr Richard (Dick) Brummitt at Kew following his sad passing in 2013, several mounted Kew specimens of *Isoglossa* from Malawi were found that had not been seen at the time of writing the *Flora Zambesiaca* account. These included a gathering by Francoise Dowsett-Lemaire (her number 949) of an *Isoglossa* from the *I. dichotoma* complex, collected from the Chisongeli Forest of Mt Mulanje, which Dr. Brummitt had identified as a possible new species allied to *I. membranacea*. The Kew specimen is rather scanty, with only incomplete foliage and small inflorescences. However, it has good flowering and fruiting material that allowed it to be compared with the known species in the *I. dichotoma* complex and confirmed as a distinctive new species. A duplicate of this specimen was subsequently discovered at the MAL herbarium. It is described below as *I. perdita*.

Isoglossa perdita is the fourth taxon of *Isoglossa* that is endemic to Malawi, the others being *I. eliasbandae* Brummitt from the Zomba Plateau, *I. membranacea* subsp. *membranacea* (see above) and *I. pawekiae* Brummitt & Feika from riverine thickets and woodland in the Misuku area (Darbyshire *et al.* 2015). In Mozambique, Mt Namuli also supports an endemic species in the *I. organoides* group, namely *I. namuliensis* I. Darbysh. (Harris *et al.* 2011).

***Isoglossa perdita* I. Darbysh. sp. nov.** Type: Malawi, Southern Region, Chisongeli, south-east slopes of Mt Mulanje, 29 Aug. 1983, F. Dowsett-Lemaire 949 (holotype K; isotype MAL).

<http://www.ipni.org/urn:lsid:ipni.org:names:77214825-1>

Isoglossa sp. (n° 949) *sensu* Dowsett-Lemaire (1988: 97).

Shrub 1 – 2 m tall; young branches quadrangular, with inconspicuous short pale retrorse hairs mainly in two opposite grooves and around the nodes. *Cauline leaves* only seen in incomplete state, ± elliptic, base attenuate, margin entire, apex acuminate; leaves subtending inflorescences with blade ovate to ovate-elliptic, 25 – 78 × 14 – 35 mm, base shallowly cordate, apex attenuate, adaxial surface with scattered conspicuous multicellular hairs appearing deflated in dry state, most numerous along margin, abaxial surface with somewhat shorter hairs along main veins, cystoliths linear, conspicuous in dry state; petiole to 32 mm long, pilose along adaxial groove, these hairs continuing along the blade midrib adaxially, leaves

subtending the inflorescence sessile. *Inflorescence* (perhaps not fully developed) a slender paniculate thyrses to 41 mm long including primary peduncle 11 – 22 mm long, few-branched, the branches monochasial or partially dichasial, with flowers clustering towards branch apices; inflorescence axes eglandular-puberulous and with numerous long crisped glandular hairs up to 2 mm long, these multicellular, appearing deflated in dry state and with a small gland-tip; bracts and bracteoles minute, lanceolate or triangular, 0.7 – 1.2 mm long; pedicels absent or less than 1 mm long. *Calyx* lobes linear-lanceolate, 3 – 3.6 mm long, barely lengthening in fruit, apices slightly recurved, indumentum as that of inflorescence axes externally, shortly appressed-pubescent internally. *Corolla* pinkish-white, 12.3 – 14 mm long, pubescent externally, hairs longest ventrally; tube 7.5 – 8.2 mm long, with basal cylindrical portion $\pm 5.5 \times 1.6$ mm and short abruptly ventrally-deepened throat; upper lip broadly triangular and hooded, 4 – 5 mm long, apex 2-lobed for ± 1.5 mm, somewhat reflexed; lower lip 5 – 5.8 mm long, with 3 lobes 1.5 – 1.9 mm long, palate somewhat raised with “herring-bone” patterning and central furrow, glabrous. *Stamens* inserted at apex of cylindrical portion of tube; filaments free for 4 – 4.5 mm, glabrous; anthers exserted, with thecae superposed and oblique, narrow, each 1.1 – 1.2 mm long, muticous. *Pistil* glabrous; style 7.5 – 8.3 mm long; stigma shortly bilobed. *Capsule* 18 – 19 mm long, stipitate, glabrous; seeds not seen. Fig. 1.

RECOGNITION. Resembling *Isoglossa membranacea* but differing in the corolla tube being longer, 7.5 – 8.2 mm long, and clearly divided into a basal cylindrical portion and a short deepened throat (vs 4.5 – 7 mm long and subcampanulate, without a conspicuous basal cylindrical portion); having a larger capsule 18 – 19 mm long and glabrous (vs capsule 8.5 – 11.5 mm long and puberulous and/or pilose); the inflorescences having long crisped glandular hairs to 2 mm long with an inconspicuous gland-tip (vs glandular hairs not crisped, up to 1 mm long, with a more conspicuous gland-tip); and stamens with filaments free for 4 – 4.5 mm (vs 2 – 2.5 mm).

DISTRIBUTION. This species is known only from the type specimen from Mt Mulanje in the Southern Region of Malawi.

SPECIMEN EXAMINED. MALAWI. Southern Region, Mulanje Distr., Mt Mulanje, Chisongeli, south-east slopes of Mt Mulanje, fl. & fr., 29 Aug. 1983, F. Dowsett-Lemaire 949 (K holotype, MAL isotype).

HABITAT & ECOLOGY. The single known specimen was recorded from shade near a stream in moist submontane rainforest at 1300 m elevation, on the rain-facing southeastern slopes of Mulanje. The forest at Chisongeli was dominated by *Newtonia buchananii* (Baker f.) G.C.C. Gilbert & Boutique, with *Gambeya*

gorungosana (Engl.) Liben and *Trilepisium madagascariense* DC. also common. The understorey contained abundant *Vepris nobilis* (Delile) Mziray, with *Myrianthus holstii* Engl. and *Tabernaemontana stapfiana* Britten, and with Acanthaceae taxa frequent in the ground layer including this *Isoglossa* species (Dowsett-Lemaire 1988 & pers. comm.).

CONSERVATION STATUS. To date, this species is only known from the type locality in the Chisongeli Forest in southeast Mt Mulanje. This is despite the fact that Mt Mulanje has been the focus of considerable botanical study, and suggests that this species is naturally rare. On the other hand, it is quite possible that this is a plietesial species in line with other species of *Isoglossa* (Thomas 1996; Darbyshire 2009; Darbyshire *et al.* 2011; Champluvier & Fischer 2020) with periodic mass-flowering on a cycle spanning several years. If this is the case, this species may have been overlooked during non-flowering years. Chisongeli was previously the largest single block of forest in Malawi, extending from 900 – 1800 m elevation. Between the early 1970s and 1984, it is estimated that the Chisongeli Forest shrank by 34% from 38 km² to 25 km² (Dowsett-Lemaire 1988). The forest below 1650 m, including the *Newtonia*-dominated forest in which this species occurred, was extensively destroyed in the 1980s due to expansion of subsistence agriculture (BirdLife International 2020; F. Dowsett-Lemaire, pers. comm.), hence the population at the type locality may no longer be extant. Many other areas of low or mid-elevation forest on the southern slopes of Mt Mulanje have been cleared or degraded (BirdLife International 2020). Some good quality *Newtonia*-dominated forest remains in the Ruvo Gorge area but this site has also suffered from severe encroachment at lower elevations (Dowsett-Lemaire 1988). There is some hope that this species may be rediscovered in these remaining mid-elevation forest patches on the mountain. Based on current evidence, with one location known, a maximum area of occupancy (AOO) of less than 10 km² and with a continuing decline in extent and quality of habitat, this species must be considered **Critically Endangered — CR (PE) B2ab(iii)**. The Possibly Extinct (“PE”) tag is included in view of the fact that this species has not been recorded in 37 years and suitable habitat at its only confirmed location has been largely destroyed.

ETYMOLOGY. The species epithet “*perdita*” means “lost” and refers both to the fact that the holotype collection was “lost” for many years, and to the fact that this species may now be lost due to destruction of its forest habitat.

2. A new species of *Agelanthus* from Mts Mulanje and Namuli

The genus *Agelanthus* (Loranthaceae) currently comprises 60 accepted species in tropical and southern Africa, and hence is the largest genus of African Loranthaceae (Polhill & Wiens 1998; POWO 2020). In

Fig. 1. Photograph of holotype of *Isoglossa perdita* (F. Dowsett-Lemaire 949, K) from Mt Mulanje, Malawi.

the account of Loranthaceae for *Flora Zambesiaca* (Polhill & Wiens 2006), the second author of the current work included an incompletely known species, *Agelanthus* sp. near *A. brunneus* (Engl.) Balle & N. Hallé, based on a specimen collected by Jim and Betty Chapman in 1986 from the northern slopes of Mt Mulanje. At that time there was insufficient material to fully describe it; in particular the flowers were immature and it was not certain what colour they were. In 2008, a flowering specimen of mistletoe was collected from the forest/grassland plateau on Mt Namuli, which, on subsequent identification at Kew, was seen to be very similar to the Mulanje specimen. These specimens are here described as a new species of *Agelanthus* section *Agelanthus* (Polhill & Wiens 1998), named as *A. patelii* Polhill & Timberlake.

***Agelanthus patelii* Polhill & Timberlake sp. nov.** Type: Mozambique, Mt Namuli, 23 Nov. 2008, I. H. Patel 2 (holotype K; isotype LMA [n.v.]).

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Agelanthus sp. 1 sensu Polhill in White *et al.* (2001: 349).

Agelanthus sp. aff. *A. brunneus* (Engl.) Balle & N. Hallé sensu Polhill & Wiens (2006: 162).

Small shrub, glabrous except for some small brown hairs at the base of inflorescences and on bracts; branchlets angular, soon terete. *Leaves* alternate; petiole 1–2 mm long; lamina 3.5–9 × 1–1.8 cm (no doubt considerably larger when mature), narrowly elliptic-lanceolate, tapered or slightly acuminate to an acute apex, long-cuneate and somewhat decurrent at base, with few lateral nerves, the lowest strongly ascending. *Flowers* clustered in the axils; pedicels 1–2 mm long; bract 2–3 mm long, cupular with a small triangular limb, ciliolate and with some scattered hairs. *Receptacle* c. 2 mm long; calyx 1.2–2 mm long, tubular, ciliolate. *Corolla* yellowish, c. 5 cm long; apical swelling slight, fusiform; basal swelling not evident in bud, but c. 5 mm long and ellipsoid as flower matures; lobes 20–25 mm long; upper expanded part 8–10 mm long, linear-elliptic. *Stamen* filaments with distal several mm broader, tightly coiled and corrugated without a tooth; anthers c. 4 mm long. *Style* slender, isodiametric; stigma c. 1.2 mm across, ovoid. *Mature fruit* not seen, but said to be pink (H. Patel, pers. comm.). Fig. 2.

RECOGNITION. Differing from other species in *Agelanthus* sect. *Agelanthus* with a basal swelling on the mature corolla by the corolla lobes being about half as long as the tube (vs a quarter to a third as long).

DISTRIBUTION. This species is known only from Mt Mulanje in Southern Region of Malawi and Mt Namuli

from Zambézia Province in northern Mozambique. However, although not collected during recent studies, it is possible this species may also be found in similar nearby montane forests on Mts Chipirone and Mabu in Mozambique.

SPECIMENS EXAMINED. **MALAWI.** Southern Region, Mulanje Distr., Mt Mulanje, Chipalombe (Thuchila R.), ± 15°51'30"S, 35°39'13"E, 1480 m, fl. bud, 20 Aug. 1986, J. D. & E. G. Chapman 7985 (FHO, K, MAL). **MOZAMBIQUE.** Zambézia Province, Gurué Distr., Mt Namuli, Mukotcha (Manho) Forest, 15°23'57.4"S, 37°02'33.7"E, 1712 m, fl., 23 Dec. 2008, I. H. Patel 2 (K holotype, LMA isotype n.v.).

HABITAT & ECOLOGY. This species has been collected on *Englerophytum magalismontanum* (Sond.) T.D.Penn. in montane forest on dry rocky slopes (Chapman 7985) and on *Maesa lanceolata* Forssk. on a montane forest margin (Patel 2), between 1480 and 1712 m elevation.

CONSERVATION STATUS. This species is listed as **Endangered — EN B1ab(iii)+2ab(iii)** on the IUCN Red List (Timberlake *et al.* 2018). It is particularly threatened on Mt Namuli, where there is ongoing destruction of montane forest (Timberlake *et al.* 2009; Timberlake 2017), with an estimated loss of over 20% of forest cover in the decade 2008–2018. The remaining extent of montane forest (mostly over 1400 m elevation) on these two massifs is now estimated at 1900 ha (19 km²) on Mt Mulanje and 700 ha (7 km²) on Mt Namuli.

ETYMOLOGY. The species is named after the Malawian botanist Hassam Patel, who has collected on most of the Malawi and Mozambican mountains in the region, and who collected the first fully flowering specimen.

NOTES. This is an interesting species belonging to the complex around *Agelanthus brunneus*, widespread in Guineo-Congolian forests from Senegal to Uganda and western Kenya, with several satellite species in the highlands of eastern Africa. It differs from all these species by its relatively long corolla lobes. The basal swelling of the corolla, characteristic of most of this group, only becomes marked as the corolla matures in *A. patelii*, rather similarly to what can occur in the polymorphic *A. brunneus*. The shape of the swollen part of the corolla lobes, widest near the middle, rather than towards the apex, is also like *A. brunneus*. Patel mentions the flowers were yellowish, without more detail, but other satellite species of *A. brunneus* in the mountains further north have yellow corollas with a band of white and subsidiary red/orange and/or green bands around the vents: *A. krausei* (Engl.) Polhill & Wiens from Rwanda and Western Uganda, and *A. pennatulus* (Sprague) Polhill & Wiens from the highlands of Kenya and Tanzania. The flowers of *A. brunneus* are variable in colour with the tube variously white to pink, or green to yellow or orange,

Fig. 2. Photograph of holotype of *Agelanthus patelii* (I. H. Patel 2, K) from Mt Namuli, Mozambique.

with contrasting bands of colour at the base of the lobes and generally white over the vents, but descriptions on field labels are often imprecise.

The description could be amplified by additional flowering material, the Chapman specimens being only in bud and the Patel specimen at Kew with the flowers in a packet being seemingly fallen dead ones collected from the ground, with only a young fruit still on the plant. It is hoped that this initial description will draw attention to the plant so that it can be rediscovered and suitably illustrated in the future.

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