

## A synopsis of the genus *Linnaeopsis* (Gesneriaceae), an “Uluguru *Streptocarpus*”

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### Summary

A synopsis of the poorly known genus *Linnaeopsis*, endemic to the Uluguru Mts. in Tanzania, is provided. Three species are recognized: *L. subscandens* B. L. BURTT, *L. heckmanniana* ENGL. and *L. alba* (E. A. BRUCE) B. L. BURTT. *L. heckmanniana* is subdivided into two subspecies, ssp. *heckmanniana* and ssp. *gracilis* (E. A. BRUCE) WEIGEND, stat. nov., and also in *L. alba* two subspecies are distinguished, ssp. *alba* and ssp. *edwardsii* WEIGEND, subsp. nov. The latter is marked by rugose leaves with 5-to 6-celled trichomes on the adaxial side (vs. 3- to 4-celled hairs in ssp. *alba*) and by different hair cover of the ovary and stem. The affinities of *Linnaeopsis* are discussed and an origin within or near *Streptocarpus* subg. *Streptocarpus* suggested. A close relationship with *Saintpaulia* appears rather unlikely.

Key words: *Linnaeopsis*, *Streptocarpus*, Tanzania.

### Introduction

*Linnaeopsis* is a very small genus of Gesneriaceae which is endemic to the Uluguru Mountains in Tanzania. This region is rich in species of Gesneriaceae. In addition to the three species of *Linnaeopsis* there are eight species of *Streptocarpus*, two of them from subgenus *Streptocarpus* and six from subgenus *Streptocarpella*, and three species of the genus *Saintpaulia*. In both genera some species found in the Ulugurus are systematically remarkably isolated.

Unlike *Saintpaulia* and *Streptocarpus*, the genus *Linnaeopsis* has received scanty attention in the past and its affinities have remained largely obscure. Due to the lack of adequate collections all three species here recognized are still poorly known and only one (*L. heckmanniana*) has been successfully cultivated. Their ecology and morphology are still incompletely understood. The synopsis here presented is highly provisional in nature.

### Characters of *Linnaeopsis*

*Linnaeopsis* can not be readily defined by “hard” morphological characters. The most important character used to define the genus is the alternate phyllotaxy. As

has been recently shown, all three species of *Linnaeopsis* share very small, punctate pollen grains otherwise unknown in African Gesneriaceae (WEIGEND & EDWARDS 1996). These two characters, overall similarity in floral and vegetative traits and the distribution pattern argue that *Linnaeopsis* is a natural group.

The flowers of *Linnaeopsis* are disposed in axillary inflorescences. These axillary inflorescences are either borne singly (*L. heckmanniana*, *L. subscandens*) or they arise serially on the petiole (*L. alba*). The latter pattern is strongly reminiscent of *Streptocarpus*, especially subgenus *Streptocarpus* (e. g. *S. cyaneus* and others), while it is neither found in *Saintpaulia* nor in caulescent *Streptocarpus* (subgen. *Streptocarpella*).

*Linnaeopsis* has white, obliquely campanulate corollas, almost identical to those found in many taxa of *Streptocarpus* (e. g. *S. kirkii*, *S. schliebenii*, *S. bullatus*) and also found in *Hovanella* (WEBER & BURTT 1998), *Schizoboaea* and some species of *Saintpaulia* (e. g. *S. pusilla*). *Linnaeopsis* has been considered as possessing straight fruits, but this is not entirely correct. The only fruiting specimen of *L. subscandens* (Schlieben 2936 – G) has a twisted capsule identical to those found in *Streptocarpus*, while the other taxa of *Linnaeopsis* have relatively thin-walled, straight capsules. Fruit morphology is probably of very limited use in defining genera in Cyrtandroideae: The large genus *Streptocar-*

*pus*, which is traditionally defined carpologically, does not always have twisted fruits (cf. HILLIARD & BURTT 1971, HUMBERT 1971).

The seed surface of *Linnaeopsis* is verrucose as in *Nodonema*, *Saintpaulia*, *Trachystigma*, *Schizoboea*, *Colpogyne*, *Hovanella*, *Acanthonema* and most *Streptocarpus*, only some members of *Streptocarpus* subgen. *Streptocarpus* have reticulate seed surfaces (pers. obs., cf. HILLIARD & BURTT 1971 for *Streptocarpus*). Verrucose seed surface seems to be the plesiomorphic character state in African Cyrtandroideae and reveals little about affinities within this group.

### Species limits in *Linnaeopsis*

*L. subscandens* with its chartaceous leaves, serrate leaf margins, lignescent stems and subscandent habit is relatively isolated in the genus. The other two species in *Linnaeopsis* are more closely related to each other.

*L. gracilis* up until now has been recognized at species level, but it is very closely related to *L. heckmanniana*. It differs primarily in leaf outline and the number of flowers per inflorescence. On closer inspection there are also differences in the trichome cover of these two taxa: all *Linnaeopsis* (and indeed most Gesneriads) have simple, uniseriate, apically tapering trichomes on their leaves and other surfaces. In *L. heckmanniana* these are densely spaced and 2- to 3-celled, whereas they are more scattered and 4- to 5-celled in *L. gracilis*. The ovary in *L. gracilis* is eglandular, while the ovary in *L. heckmanniana* is covered with gland-tipped trichomes. *L. heckmanniana* also has much more narrowly spaced trichomes on the leaf lamina whereas they are more scattered and dense only along the leaf margins in

*L. gracilis*. In view of these slight differences it is here proposed to reduce *L. gracilis* to subspecies rank under *L. heckmanniana*.

Interestingly enough we find an entirely parallel morphological situation in *L. alba*: there is typical *L. alba* with flat leaves and 3- to 4-celled trichomes which are distributed evenly over the entire leaf surface, and then there is a second type which has slightly rugose leaves and 5-to 6-celled trichomes which are found only between the secondary veins on the adaxial leaf surface. Moreover, while typical *L. alba* has an eglandular ovary, the ovary is covered with spreading, gland-tipped trichomes in the latter form. It is therefore proposed to recognize it as a new subspecies and it is formally described below as *L. alba* subsp. *edwardsii*.

### Affinities and generic rank of *Linnaeopsis*

Traditionally *Saintpaulia* has been considered as the closest ally of *Linnaeopsis* (BURTT 1958: 114). However, clearly derived characters which are shared by these two taxa (i.e. synapomorphies supporting an exclusive common ancestry) have not been proposed. The derived (!) pollen type of *Linnaeopsis* is also not paralleled in *Saintpaulia* and the hard, tardily dehiscent fruits of *Saintpaulia* are not found in *Linnaeopsis*, which has twisted fruits in one species. The strong trend towards thickly carnosely leaves in *Saintpaulia* is not at all paralleled in *Linnaeopsis*.

The two genera thus share no derived and potentially synapomorphic characters: they are hence unlikely to share an exclusive common ancestry. The same holds true for the relationship between *Linnaeopsis* and other small genera of African/Malagasy Cyrtandroideae (esp.

**Table 1.** Diagnostic features of the species and subspecies of *Linnaeopsis*

| taxon                       | <i>L. subscandens</i> |                            | <i>L. heckmanniana</i> |                    | <i>L. alba</i>          |  |
|-----------------------------|-----------------------|----------------------------|------------------------|--------------------|-------------------------|--|
|                             |                       | subsp. <i>heckmanniana</i> | subsp. <i>gracilis</i> | subsp. <i>alba</i> | subsp. <i>edwardsii</i> |  |
| stem diameter               | 2–2.5 mm              | <1 mm                      | 1 mm                   | 2–4 mm             | 2–3 mm                  |  |
| stem structure              | lignescent            | herbaceous                 | herbaceous             | herbaceous         | herbaceous              |  |
| average internode length    | 15–30 mm              | 15–20 mm                   | 25–50 mm               | 5 mm               | 3–5 mm                  |  |
| leaf shape                  | ovate                 | subcircular                | widely ovate           | oblong             | oblong                  |  |
| leaf apex                   | acuminate             | rounded                    | rounded                | rounded            | rounded                 |  |
| leaf margin                 | finely dentate        | crenate                    | crenate                | crenate            | crenate                 |  |
| leaf surface                | flat                  | flat                       | flat                   | flat               | rugose                  |  |
| number of cells/trichome    | 2                     | 2–4                        | 4–5                    | 3–4                | 5–6                     |  |
| ovary                       | pubescent             | glandular                  | eglandular             | eglandular         | glandular               |  |
| no of inflorescence/leaf    | 1                     | 1                          | 1                      | 2–3                | 1–2                     |  |
| no of flowers/inflorescence | 5–10                  | 2                          | 5–10                   | 10–20              | 5–10                    |  |

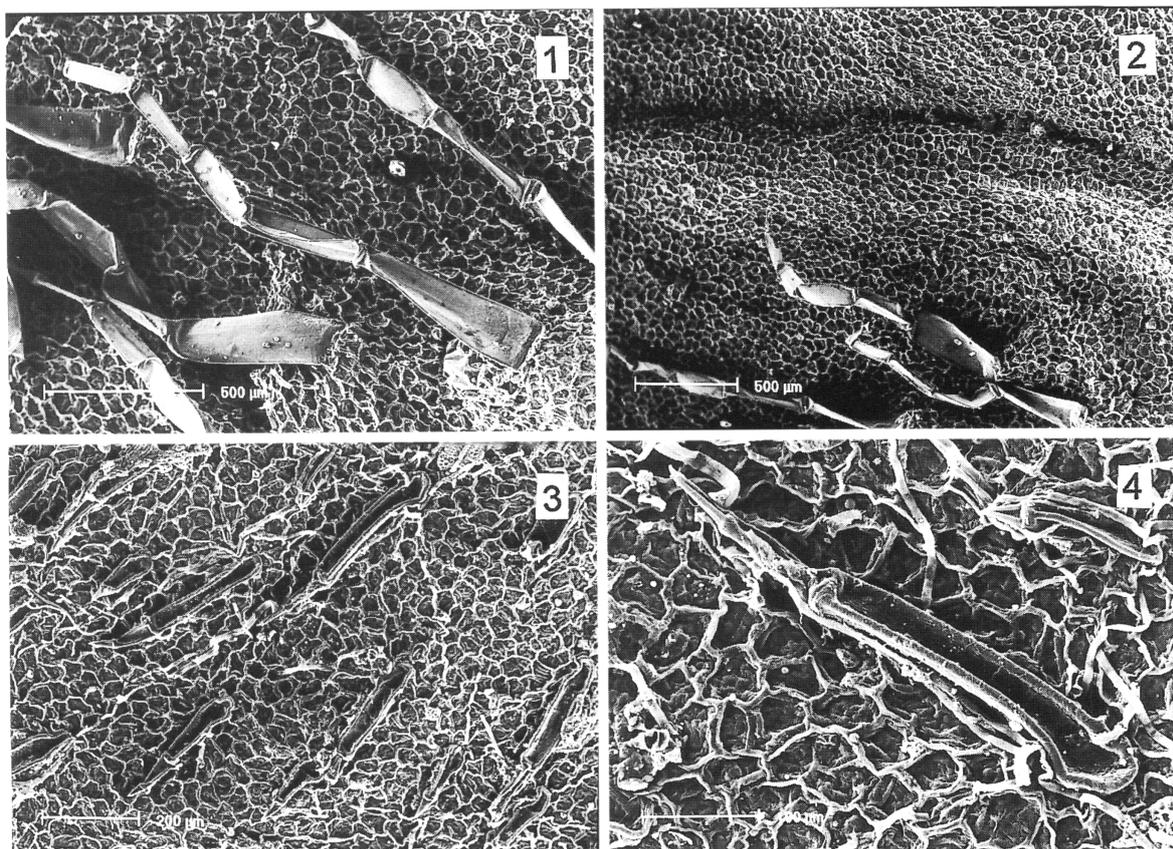


Fig. 1. Upper row: 5- to 6-celled trichomes on the adaxial side of a leaf of *L. alba* subsp. *edwardsii* – Mabblerley 1254. [The horizontal depression in 2 marks a leaf vein, note the lack of trichomes on the vein]. Lower row: 3-celled trichomes on the adaxial side of a leaf of *L. alba* subsp. *alba*-Schlieben 2935.

*Schizoboea* and *Hovanella*), all of which are characterized by one or two derived characters and none of which shares any exclusive derived characters with *Linnaeopsis*.

The technical definition of the genera in African Cyrtandroideae and of *Streptocarpus* in particular is based on carpology. Carpology can not be used to separate *Linnaeopsis* from *Streptocarpus* (see above). Alternate phyllotaxy similar to that of caulescent *Linnaeopsis* is not known in caulescent *Streptocarpus*, but subrosulate *Streptocarpus* may have an elongated, creeping rhizome with alternate leaves almost indistinguishable from (subrosulate) *L. alba*. Serial inflorescences on the petioles as found in *L. alba* are also characteristic of these members of *Streptocarpus*. The only character which separates *Linnaeopsis* from *Streptocarpus* seems to be its unique pollen surface, but there are numerous taxa in *Streptocarpus* which have a much more isolated pollen morphology than *Linnaeopsis* (e.g., *S. daviesii*, *S. nimbicola* and others, WEIGEND & EDWARDS 1996): *Streptocarpus* is eurypalynous. Autapomorphic pollen types can therefore not be used to segregate groups from this genus.

Morphologically *Linnaeopsis* is poorly supported as a genus distinct from *Streptocarpus*: Generic limits as currently defined disregard character polarity. Summarizing the morphological data, *Linnaeopsis* appears to be a small, monophyletic group ultimately derived from *Streptocarpus*. It subsequently underwent limited independent evolution in the Uluguru Mountains. Generic rank is here maintained with a query, but once molecular data become available, the genus will almost certainly have to be reduced to *Streptocarpus*.

### Key to the species

- 1 Erect to subscandent herb with stiff, slightly lignescent stems; trichomes on stems and leaf veins very dense and appressed; leaf apex acuminate, leaf margin serrate, fruit twisted *L. subscandens*  
 1\* Decumbent to creeping herbs with rooting stems; trichomes on stems and leaf veins erect; leaf apex rounded, leaf margin crenate, fruit straight 2

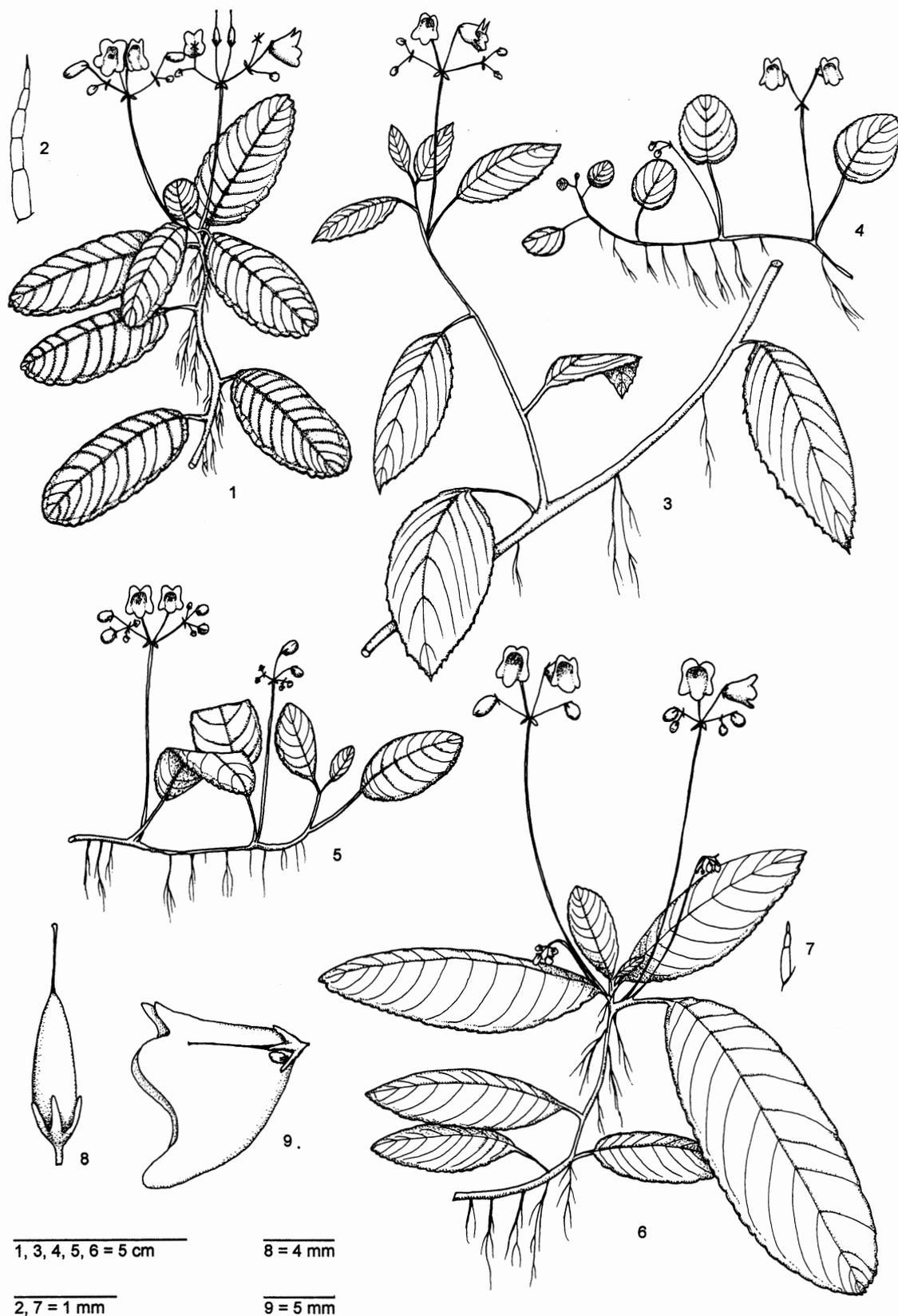


Fig. 2. 1: *L. alba* subsp. *edwardsii*, habit; 2: *L. alba* subsp. *edwardsii*, typical trichome from the adaxial leaf surface; 3: *L. subscandens*, habit; 4: *L. heckmanniana* subsp. *heckmanniana*, habit; 5: *L. heckmanniana* subsp. *gracilis*, habit; 6: *L. alba* subsp. *alba*, habit; 7: Typical trichome from the adaxial leaf surface; 8: Fruit; 9: Flower.

2 Decumbent stem thin (ca. 1 mm); leaves well spaced; petioles more than half as long as the lamina; lamina 25–45 (–50) mm long

3 – *L. heckmanniana*

3 Ovary densely glandular; leaf lamina subcircular to widely ovate, c. 25 mm in diameter; trichomes on the adaxial leaf surface 2- to 4-celled

*L. heckmanniana* subsp. *heckmanniana*

3\* Ovary eglandular; leaf lamina widely ovate, over 30 mm in diameter; trichomes on the adaxial leaf surface 4- to 5-celled

*L. heckmanniana* subsp. *gracilis*

2\* Decumbent stem thick (ca. 2–4 mm), leaves crowded near the end (subrosulate habit); petioles less than half as long as the lamina; lamina (5-) 6–13 cm long

4 – *L. alba*

4 Ovary eglandular; leaf lamina up to 130 mm long, more or less flat above, trichomes on the adaxial surface 3- to 4-celled

*L. alba* subsp. *alba*

4\* Ovary with gland-tipped trichomes; leaf lamina up to 60 (–80) mm long, rugose, trichome on the adaxial surface 5- to 6-celled

*L. alba* subsp. *edwardsii*

## Formal Taxonomy

*Linnaeopsis* ENGL., Bot. Jahrb. Syst. 28: 483. 1900. – Type species: *L. heckmanniana* ENGL.

Perennial herbs with subrosulate, subscandent or creeping habit. Leaves alternate, petiolate, widely ovate to subcircular or oblong, apex acuminate or rounded, base shallowly cordate, truncate or shortly tapering, leaf margin serrate or crenate, lamina membranaceous or subchartaceous, flat or rugose. Leaf surface covered with uniseriate, apically tapering trichomes of 2–6 cells, dense or scattered, sometimes concentrated along the leaf margins and always abundant on the veins on the lower leaf surface. Stomata elevated above lamina.

Inflorescences axillary 1–10 flowered cymes, flowers in pairs. Pedicels hairy, frequently with few or many gland-tipped trichomes. Sepals free nearly to base, linear-lanceolate. Corolla 7–10 mm long, 5–8 mm wide at mouth, obliquely campanulate, tube short and wide, limb +/- spreading with short, circular lobes, white, loosely covered with gland-tipped trichomes on the outside.

Stamens 2, inserted near the base of the corolla, filaments short, curved, anthers coherent. Pollen grains spheroidal, 9.5 x 11 µm, exine unevenly minutely perforate, perforations ca. 0.1 µm wide. Disc cup-shaped. Ovary conical, nearly glabrous or covered with apically tapering or gland-tipped trichomes. Style exceeding the ovary in length, stigma capitate to slightly lobed.

Fruit a conical to cylindrical, straight or narrowly

twisted capsule. Seeds prolate, reddish brown, finely and evenly verrucose.

1. *L. subscandens* B. L. BURTT, Notes Roy. Bot. Gard. Edinburgh 22: 581 (1975). – Holotype: Tanzania. Uluguru Mountains, Lupanga Peak, 1950 m, Eggeling 6273 (EA; K!, iso).

Additional material: Tanzania. Uluguru Mountains, Cloud forest on Northwestern side of Uluguru Mountains, Schlieben 2936 (BM, BR, G, M).

Very readily distinguished from the other species by its semi-erect to subscandent growth habit and its acuminate leaves with serrate margin. The fruit is narrowly twisted in this species.

2. *L. heckmanniana* ENGL., Bot. Jahrb. Syst. 28: 484 (1900). – Type: Tanzania: Uluguru Mountains, Lukwangule Plateau, cloud forest at 1300–2000 m, Goetze 251 (B†).

*L. heckmanniana* ENGL. subsp. *heckmanniana*

Additional material: Tanzania: Uluguru Mountains, Lukwangule Plateau, cloud forest at 2300 m, south facing slope, Schlieben 4937 (BM, G, M).

*L. heckmanniana* ENGL. subsp. *gracilis* (E. A. BRUCE) WEIGEND, status novus. – Basionym: *L. gracilis* E. A. BRUCE, Kew. Bull. 9: 486 (1936). – Lectotype (here designated): Tanzania Uluguru Mountains, Matombo road, Tanana, in forest, 2000 m, E. M. Bruce 802 (holo K! ; iso BM!).

Only known from type collection.

3. *L. alba* (E. A. BRUCE) B. L. BURTT, Gard. Chron. (Ser. 3) 72: 23. – Basionym: *Saintpaulia alba* E. A. BRUCE, Kew Bull. 1933: 475. – Holotype: Tanzania. Uluguru Mountains. Lupanga Mountain, Tanana, 6500–7000 m, B. D. BURTT 3470 (K!).

*L. alba* (E. A. BRUCE) B. L. BURTT subsp. *alba*

Additional Material: Tanzania. Uluguru Mountains, cloud forest, 1900 m, Schlieben 2935 (M).

*L. alba* (E. A. BRUCE) B. L. BURTT subsp. *edwardsii* WEIGEND, subsp. nova. – Holotype: Tanzania. Uluguru Mountains, high mountain forest, summit of Palata, 2000 m, A., B. & T. Pócs, E. Fráter & G. Kósa 87182 (K!).

*L. alba* subsp. *edwardsii* differt a subsp. *alba* ovario glanduloso et foliis rugosis in latere adaxiali pilis 5-vel -6-cellulatis uniseriatis praeditis nervis autem glabris; *L. alba* subsp. *alba* ovario eglanduloso foliis planis pilis 3-vel 4-cellulatis uniseriatis super laminam aequaliter dispersis distincta est.

Additional specimens examined: Tanzania, Uluguru Mountains, Palata, 2000 m, Mabberley 1254 (BM). Uluguru Mountains, high mountain forest, summit of Palata, 2000 m, A., B. & T. Pócs, E. Fráter & G. Kósa 87182 (K).

Named in honour of Dr. T. J. EDWARDS of Natal University (Pietermaritzburg, South Africa), who introduced me to the study of African Gesneriads.

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