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# TAXONOMY OF THE GENERA *BASEONEMA*, *BATESANTHUS*, *MANGENOTIA*, *MONDIA*, *SACLEUXIA*, *SARCORRHIZA* and *ZACATEZA* (PERIPLOCOIDEAE, APOCYNACEAE)

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THESIS SUBMITTED IN ACCORDANCE WITH THE REQUIREMENTS FOR THE DEGREE

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# *Mondia whitei*

'Umondi'

Photo: Prof. H.J.T. Venter

## DEDICATION TO

My father, Leteketoa

'I said I will beat you before we reach the end, but you made it, thank you for being there.'

Spina

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# CHAPTER 1

## INTRODUCTION:

That the Apocynaceae de Jussieu (1789), Asclepiadaceae Brown (1810) and Periplocaceae Schltr. (1924) are closely related has been a subject of debate for many years. The Periplocoideae (Kunze 1990, 1996, Judd *et al.* 1994, Struwe *et al.* 1994, Sennblad & Bremer 1996, Endress *et al.* 1996, Endress 1997, Liede 1997, Sennbald 1997, Venter & Verhoeven 1997, Verhoeven & Venter 1998a, b, Endress & Bruyns 2000) as presented in this study, is an "Old World" (i.e. **Africa**, Asia, Madagascar, northern Australia and southern Europe) subfamily as a result of amalgamation of the Apocynaceae *s.s.* and Asclepiadaceae (incl. Periplocoideae). Historically the Periplocoideae was classified in the Asclepiadaceae (Schumam 1895a), but was raised to family level by Schlechter (1924). The family status has been maintained and used by Verhoeven & Venter (1988, 1994b); Venter *et al.* (1990a, b, c), Dave & Kuriachen (1991), Kunze (1993), Liede & Kunze (1993), Nilsson *et al.* (1993), Omlor (1996), Swarupanandan *et al.* (1996), until the recent change of status. The asclepiads have been included in the family: Apocynaceae *s.l.* in order to make the resultant taxon monophyletic, thus reflecting phylogeny of the group. Morphological and molecular data using the plastid gene matK has shown that the Apocynaceae\Asclepiadaceae form a monophyletic group (Civeyrel *et al.* 1998). The resulting family thus consists of 424 genera, making it the seventh largest angiosperm family.

Taxonomy entails discovery, identification, description, nomenclature as well as the synthesis of information on diversity in the form of predictive, stable and concise classification systems. The predictivity of classifications is already important for locating chemicals, particularly those of medicinal or economic importance. Most importantly, data accumulation must be done while enough of the species are still extant.

But then a question of interest is that how do we maintain species diversity when most parts of Africa are war-torn zones? Somehow our species are preserved in the herbaria although it is difficult to interpret floral structures from dried or rehydrated specimens. Of importance is the trend "conservation through cultivation", the conservation of rare and endangered plants by growing them in protected habitats (e.g. nature reserves) has now become a generally accepted practice as is the case with *Mondia whitei* (Hook. f.) Skeels. And in this study specifically based on African states, scarcity of herbarium material, not to mention new collections, makes it even more difficult to circumscribe the genera.

The Periplocoideae, "*Peri*" meaning around and "*Plecein*" to twine, has about 44 accepted generic names and c. 190 species and 18 of which are monotypic and 9 have two species. This study looks into 12 species from the following seven (7) selected genera of **African** Periplocoids:

1. *Baseonema* Schltr. & Rendle - 1 sp.
2. *Batesanthus* N.E. Br. - 4 sp.
3. *Mangenotia* Pichon - 1 sp.
4. *Mondia* (Hook. *f.*) Skeels - 2 sp.
5. *Sacleuxia* Baill. - 2 sp.
6. *Sarcorrhiza* Bullock - 1 sp.
7. *Zacateza* Bullock. - 1 sp.

In order to have natural classification systems, taxonomic evidence gathered from a variety of sources is needed and that means character states should not be used in isolation but rather to complement other characters. As a result of which, the "traditional" methods of taxonomy: vegetative and floral morphology has been used (in part II chapters 6–12). These are supported with additional morphological characters (in part I – chapters 3–5) using light microscopy (LM), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) studies so as to evaluate the generic and/or infrageneric classification, variability, uniformity and/or stability of the characters within the Periplocoideae.

Vegetative features may contribute to generic delimitation. For instance, the epiphytic growth form as a character (e.g. *Sarcorrhiza* and *Ischnolepis* Jum. & H. Perrier) is an important feature. The rest of the genera in this study co-exist as climbing lianas (e.g. *Mondia)* and/or climbing shrubs. All the species investigated inhabit tropical rain, swamp and very rarely temperate forests of Africa, sometimes some of the shrubs are found in semi-arid savanna (e.g. *Sacleuxia).*

The flowers of the Periplocoideae are borne in a cymose inflorescence; most flowers tend to be rotate. The composition and size of the inflorescence are of little taxonomic significance (Venter & Verhoeven 1997). The flower is uniquely structured and possesses a translator with a sticky viscidium to promote animal pollination. Kunze (1993), puts forward that clarifying the evolution of the translator can solve the question of common ancestry. The depth of the corolla tube, position of the stamens and gynostegium in relation to the tube can provide important taxonomic features. However, floral morphology in the periplocoids is made difficult by the fact that most of the flowers are small and fleshy.

The corona is one of the most frequently used features for taxon identification at generic level. It is usually double. Genera within the Periplocoideae have a coralline corona, usually divided into an outer and inner corona of interstaminal discs forming a ring around the basal staminal column. These interstaminal discs are nectariferous in nature (Kunze 1990). According to Liede and Kunze (1993), the coralline corona is situated in the petal sinuses that may be homologous to the sinal coralline corona in the Apocynaceae *s.s.* (Kunze 1990) and thus regarded as the oldest form of corona representing the plesiomorphic type of corona formation. An annulus (secondary coralline corona) forms a conspicuous tube inside the corolla tube; thus an annulus is included as a second element within the coralline corona type (Kunze 1993).

The objectives of this study are to add to the existing literature and research on the Periplocoideae (comprehensive palynological investigation and taxonomic revision of the Periplocoideae being undertaken at the University of the Free State – Botany Department). That is to:

⇔ draw up a dichotomous identification key to each of the seven genera and their species.

⇔ determine geographical distribution in the form of maps, ecological and economic importance of each taxon.

⇔ determine taxonomic relationships – through classification system (see chapter 13).

And at the end to determine the significance and \ or importance of each character state used in this study.

# CHAPTER 2

## MATERIAL AND METHODS

Plant specimens for morphology and taxonomy of Periplocoids studied were obtained from herbarium sheets (Appendix B). They were randomly selected from different localities within the distribution range of the family in Africa.

## PART I

No fresh material or FAA preserved material was available. Dried flowers, leaves and seeds were rehydrated in 3% phosphate-buffered glutaraldehyde (GA) for a period of 36–48 hours prior to analysis.

### 2.1 Leaf Surface Micro-morphology:

Due to limited availability of plant specimens, from two to six specimens were studied per genus, with the genus *Sarcorrhiza* limited to only two specimens.

Light Microscopy (LM); the epidermis was peeled off, stained in 1% methylene blue and mounted on slides with glycerine. Photographs (micrographs) were taken with a Nikon Microphot FXA microscope. Trichomes were measured using a Zeiss light microscope.

Scanning Electron Microscope (SEM); the rehydrated leaves were cut into smaller pieces, postfixed in 1% osmium tetroxide ($OsO_4$), dehydrated in an alcohol series (i.e. 30, 50, 70, 95 & 2 x 100%) and then critical point dried using a Polaron critical point dryer E3000. Material was glued onto stubs; gold coated with a BIO RAD SEM coating system and examined with a Jeol Winsem 6400 scanning electron microscope at 10 kV.

***Herbarium specimens studied for leaf surfaces:***

***Baseonema gregorii*** Schltr. & Rendle: *Goyder, Masinde, Meve & Whitehouse 4006* (PRE); *Faden, R.B. & A.J.* $^{74}/_{436}$ (MO); *Bally, P.R.O. 8745* (K); Field & *Powys 174* (K); *Bally, P.R.O. 8125* (K).

***Batesanthus intrusus*** S. Moore: *Tisserant, R.P. 1480* (P); *Adam, J.G. 39433* (MO); *Louis, J. 12992* (K).

***Batesanthus parviflorus*** Norman: *Polhill, R.M. & Kirkup, D.W. 5190* (K); *Deighton, F.C. 3265* (K).

***Batesanthus purpureus*** N.E. Br.: *Bates, G.L. 383* (G); *Le Testu, M. 5493* (P).

***Batesanthus talbotii*** S. Moore: *Talbot, T.A. 63* (K); *Talbot, T.A. 2021* (K).

***Mangenotia eburnea*** Pichon: *Leeuwenberg, A.J.M. 4235* (WAG); *Leeuwenberg, A.J.M. 8083* (WAG); *Adam, J.G. 30434* (MO); *Thomas, N.W. 1373* (K).

***Mondia ecornuta*** (N.E. Br.) Bullock: *Bouquet, A. 631* (P); *Klaine, R.P. 577* (P); *Musyoki, B.M. & Hansen, O.J. 956* (K); *Allen, C.E.F. 139* (K); *Grote 5795* (K); *Faulkner, H.G. 558* (K).

***Mondia whitei*** (Hook. f.) Skeels: *Leeuwenberg, A.J.M. 10026* (K); *Oldeman, R.A.A. 392* (M); *Medley Wood, J. 6180* (PRE); *Strey, R.G. 10347* (PRE); *Venter, H.J.T. 9282* (BLFU); *Biegel, H.M., Pope, G. & Simon, B. 4297* (SRGH); *Goldsmith, B.* $^{5}/_{64}$ (SRGH); *Ward, C.J. 3626* (NH).

***Sacleuxia newii*** (Benth.) Bullock: *Drummond & Hemsley 3364* (K); *Faulkner, H.G. 1434* (K); *Verdcourt 246* (K).

***Sacleuxia tuberosa*** (E.A. Bruce) Bullock: *Kerfoot, O. 3596* (K); *Ford, J. 847* (K); *Tanner, R.E.S. 360* (K).

***Sarcorrhiza epiphytica*** Bullock: *Schlieben 2939* (BR); *Bequaert 4494* (BR).

***Zacateza pedicellata*** (K. Schum.) Bullock: *Schweinfurth 3488* (K); *Gossweiler, J. 13684* (K); *Evrard 3467* (K); *Leornard 698* (K); *Louis, J. 106* (K).

## 2.2 Pollen and Translator Morphology:

Flowers were fixed in 3% GA and then dissected in alcohol. No fresh material was available except for *Mondia whitei* (*Venter 9329,* BLFU). For the genus *Mangenotia,* pollen was very sparse. There were no flowers for *Sarcorrhiza epiphytica* and *Sacleuxia tuberosa.* However, prepared stubs from the laboratory of Prof. R.L. Verhoeven were used where available and indicated by (*). Pollen samples were collected and acetolysed according to the revised method of Erdtman (1960), for use in both light and scanning electron microscopy.

Light Microscopy (LM); acetolysed pollen was mounted in glycerine jelly and sealed with paraffin wax. Samples were examined and measured with a Zeiss light microscope. Measurements of tetrad sizes were based on a minimum of 15 and maximum of 30 per slide specimen. Photos (micrographs) were taken with a Nikon Microphot FXA microscope.

Translators were mounted in glycerine jelly, examined and measured with a Zeiss light microscope. Measurements were based on a minimum of three translators per specimen because some were broken during the preparation process.

Scanning Electron Microscopy (SEM); acetolysed pollen was air dried on stubs, coated with gold and examined with a Jeol Winsem 6400 microscope at 5 kV. Translators were also mounted on stubs with double-sided tape, coated with gold and examined with a Jeol Winsem 6400 microscope at 5 and 10 kV.

Transmission Electron Microscopy (TEM); pollen was fixed in 3% GA, postfixed in 1% $OsO_4$, stained in 0.5% uranyl acetate, dehydrated in an ethyl alcohol series and embedded in Spurr's low viscocity resin. Sections were stained with uranyl acetate followed by lead citrate. Sections were cut with a glass knife. For some species like *Sarcorrhiza epiphytica* (*), acetolysed pollen was used for sectioning. Observations and micrographs were made with a Philips CM 100 electron microscope at 60 kV.

***Herbarium specimens studied for pollen and translator morphology:***

***Baseonema gregorii:*** *Field, D.V. & Powys, J.G. 174* (K); *Faden, R.B. & A.J. 74/436,* (PRE); *Verdcourt & Polhill 2695* (K).

***Batesanthus intrusus*****:** *Louis, J. 12992* (K); *Adam, J.G. 30433* (K); *Tisserant, R.P. 1480* (K).

***Batesanthus parviflorus:*** *Deighton, F.C. 3265* (K); *Polhill, R.M. & Kirkup. D.W. 5190* (K); *Gossweiler, J. 8468* (BM).

***Batesanthus purpureus:*** *Bates, G.L. 383* (G, iso); *Le Testu, M. 5493* (P).

***Batesanthus talbotii:*** *Talbot, T.A. 63* (K); *Talbot, T.A. 2021* (K).

***Mangenotia eburnea:*** *Thomas, N.W. 4546* (K); *Thomas, N.W. 4628* (K); *Adam, J.G. 30434* (MO); *Leeuwenberg, A.J.M. 4235* (P); *Leeuwenberg, A.J.M. 8083* (BR); *Thomas, N.W. 1373* (K); *Thomas, N.W. 4628* (K).

***Mondia ecornuta:*** *Allen, C.E.F. 139* (K); *Faulkner, H.G. 558* (B, K).

***Mondia whitei:*** *Strey, R.G. 10347* (PRE); *Pienaar, B.J. 170* (NH); *Leeuwenberg, A.J.M. 10026* (K); *Medley Wood, J. 6180* (PRE); *Ward, C.J. 3626* (NH); *Venter, H.J.T. 9329* (BLFU); *Scheepers, J.C. 1058* (PRE); *Venter, H.J.T. 9282* (BLFU).

***Sacleuxia newii:*** *Greenway & Kanuri 12852* (K); *Drummond, R.B. & Hemsley, J.H. 3364* (LISC); *Verdcourt 246* (K).

***Sacleuxia tuberosa:*** *Tanner, R.E.S. 360* (K)*.

***Sarcorrhiza epiphytica:*** *Semsei 2957* (K)*.

***Zacateza pedicellata:*** *Muusa, J. 3488* (K); *Louis, J. 106* (K).

### 2.3 Seed Surface Morphology:

Due to unavailability of plant material, only the seeds of *Baseonema gregorii* – *van Someren 184* (K), *Batesanthus intrusus* – *Klaine, R.P. 513* (P), *Mangenotia eburnea* – *Thomas, N.W. 4544* (K), *Mondia whitei* – *Oldeman, R.A.A. 392* (MO), *Sacleuxia newii* – *Verdcourt 246* (K), *Sacleuxia tuberosa* –

*Kerfoot, O. 3596* (K) and *Zacateza pedicellata – Evrard 3467* (K) were examined and studied.

Scanning Electron Microscopy (SEM); rehydrated seeds were rinsed in pH 7.0 phosphate buffer and dehydrated in a series of 30, 50, 70, 95 and 2 x 100% ethyl alcohol at intervals of 20 minutes. Seeds were critical point dried using a Polaron critical point dryer and coated with SEM coating system. Subsequent examinations were conducted with a Jeol Winsem 6400 microscope at 10 kV.

Stereo Microscopy; photos were taken with an Olympus SZ40 stereo microscope. External form and appearance of the seeds as well as measurements were done under a Nikon SMZ645 stereo microscope.

# PART II

## 2.4 Taxonomy:

External morphology of available plant specimens was studied with a Nikon SMZ645 stereo microscope. Plant parts were described in accordance with the Systematics Association (1962) and Porter (1967). Micrographs of corona lobes (Plate 1 – following pp. 88) were taken with SEM. Plant distribution, that is, mapping for localities with locality grid were documented with references from Bamps (1982), Polhill (1988), The Times Atlas of the World (1985) and Pope & Pope (1998). On the other hand, ecological importance was done with the aid of collection cards/ herbarium sheets. In appendix A, all plants indicated by "**(!)**" were seen personally, otherwise all other specimens were seen by my study supervisors.

List of herbaria (Holmgren *et al.* 1990) from where plant material was obtained:

ALF : Maisons–Alfort: Herbier, Départment de Botanique, Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, 10 rue Pierre–Currie, F–94704 Maisons–Alfort Cedex, France.

BLFU : Bloemfontein: Geo Potts Herbarium, Botany Department, University of the Free State, P.O. Box 339, Bloemfontein 9300, Free State Province, South Africa.

BM : London: Herbarium, Botany Department, The Natural History Museum, Cromwell Road, London $SW_7$ $_5$BD, England.

BOL : Cape Town: Bolus Herbarium, Botany Department, University of Cape Town, Private Bag, Rondebosch 7700, Western Cape Province, South Africa.

BR : Meise: Herbarium, Nationale Plantentuin van België, Jardin Botanique National de Belgique, Domein van Bouchout, B–1860 Meise, Belgium.

BRLU : Bruxelles: Herbarium, Laboratorie de Botanique Systématique et de Phytosociologie, C.P. 169, Université Libre de Bruxelles, 28 Avenue Paul Héger, B–1050 Bruxelles, Belgium.

CO : Concarneau: Herbier Crouan, Laboratorie de Biologie Marine, Collège de France, B.P. 11, F–29110 Concarneau, France.

COI : Coimbra: Botanical Institute of the University of Coimbra, Coimbra, Portugal.

G : Genève: Herbarium, Conservatoire et Jardin botaniques de la Ville de Genève, Case postale 60, CH–1292 Chambèsy/Genève, Switzerland.

GRA : Grahamstown: Herbarium, Department of Agriculture and Water Supply, Botanical Research Institute, P.O. Box 101, Grahamstown 6140, Eastern Cape Province, South Africa.

K : Kew: Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey $TW_9$ $_3$AB, England.

LISC : Lisboa: Herbário, Centro de Botânica, Instituto de Investigaçâo Cientifica Tropical, Jardin–Museu Agricola Tropical, Calçada do Galvâo–Belém, P–1400 Lisboa, Portugal.

M : München: Herbarium, Botanische Staatssammlung, Menzinger Strasse 67, D–8000 München 19, Federal Republic of Germany.

MO : Saint Louis: Herbarium, Missouri Botanical Garden, P.O. Box 299, Saint Louis, Missouri 63166 – 0299, USA.

NBY : Newbury: Herbarium, Newbury District Council, Newbury District Museum Whart Street, Newburry, Berkshire, England.

| | | |
|---|---|---|
| NH | : | Durban: Natal Herbarium, Botanical Research Unit, Botanic Gardens Road, Durban 4001, Kwazulu–Natal Province, SA. |
| NU | : | Pietermaritzburg: Herbarium, Botany Department, University of Natal, P.O. Box 375, Pietermaritzburg 3200, KwaZulu–Natal Province, South Africa. |
| P | : | Paris: Herbier, Laboratorie de Phanérogamie, Muséum National d'Histoire Naturelle 16 rue Buffon, F–75005 Paris, France. |
| PRE | : | Pretoria: National Herbarium, National Botanical Institute, 2 Cussonia Avenue, Private Bag X 101 Pretoria 0001, Gauteng Province, South Africa. |
| PRU | : | Pretoria: H.G.W.J. Schweickerdt Herbarium, Botany Department University of Pretoria, Pretoria 0002, Gauteng Province, South Africa. |
| SAM | : | Cape Town: South African Museum Herbarium, Private Bag X 7 Claremont 7735, Western Cape Province, South Africa – now deposited at NBY but maintained a separate entity. |
| SRGH | : | Harare: National Herbarium and Botanic Garden, P.O. Box 8100, Causeway, Harare, Zimbabwe. |
| W | : | Wien: Herbarium, Department of Botany, Naturhistorisches Museum Wien, Burgring 7, a–1014 Wien, Austria. |
| WAG | : | Wageningen: Herbarium Vadense, Department of Plant Taxonomy, Agricultural University Postbus 8010, 6700 ED Wageningen, Netherlands. |
| Z | : | Zürich: Herbarium, Institut für Systematische Botanik, Universität Zürich, Zollikerstrasse 107, CH–8008 Zürich, Switzerland. |

# CHAPTER 3

## LEAF SURFACE MICRO-MORPHOLOGY

### 3.1 INTRODUCTION:

The present investigation into leaf surface morphology of selected African Periplocoideae genera was undertaken in order to complement other sources of taxonomic evidence. Results of this chapter are presented in the form of descriptive analysis following Metcalfe (1987). This chapter looks into the leaf surface features namely; outline of epidermal cells, cuticular ornamentation, the stomatal complex i.e. stoma, guard cells and subsidiary cells, as well as foliar trichome types.

Since little or no information is available on leaf micro-morphology of the Periplocoideae, the aim of this study was to add to the existing information and to find the significance of all character states used to ultimately determine their taxonomic value at generic or species level or within the subfamily as a whole.

## 3.2 RESULTS:

### 3.2.1 *BASEONEMA* Schltr. & Rendle

*Baseonema gregorii* Schltr. & Rendle

***Petiole:*** (Fig. 3.1 A, B) 4-(7-10)-26 mm long, purple with hirsute surface. The petiole is more or less circular in cross-section, sometimes adaxially flattened with a groove in the center.

***Lamina:*** *Epidermis* (Fig. 3.1 C, D); cells are polygonal and cell walls straight to slightly undulate. *Cuticle* (Fig. 3.1 E) is similar on abaxial and adaxial epidermis, densely striate, with parallel wavy striae extending over periclinal walls. *Stomata* (Fig. 3.1 C, F) only on abaxial epidermis. The stomata in surface view are broadly elliptic to narrowly elliptic with broad apertures. The region between an outer broad rim (indicated by '**r**') and peristomatal rim (indicated by ▲) (i.e., a cuticular ledge) is smooth. Some stomata are surrounded by very long radiating striae (Fig. 3.1 F) whereas others have striae radiating perpendicular to the guard cells. Stomata are paracytic. ***Trichomes:*** (Fig. 3.1 G, H) are present on abaxial and adaxial epidermis. The abaxial surface has a denser indumentum than the adaxial surface. However, trichome type on both surfaces is the same. Trichomes are uniseriate, unicellular, non-glandular and are relatively long and narrow (Table 3.1). The surface of the trichomes is covered with linear, warty outgrowths (Fig. 3.1 G). Trichomes are straight to curved with an acute apex and the base is covered with a smooth cuticle (Fig. 3.1 H).

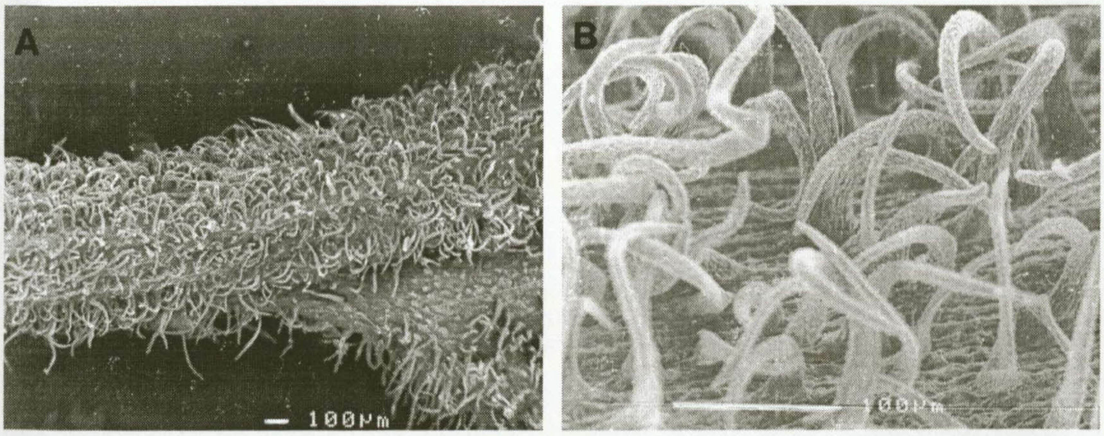
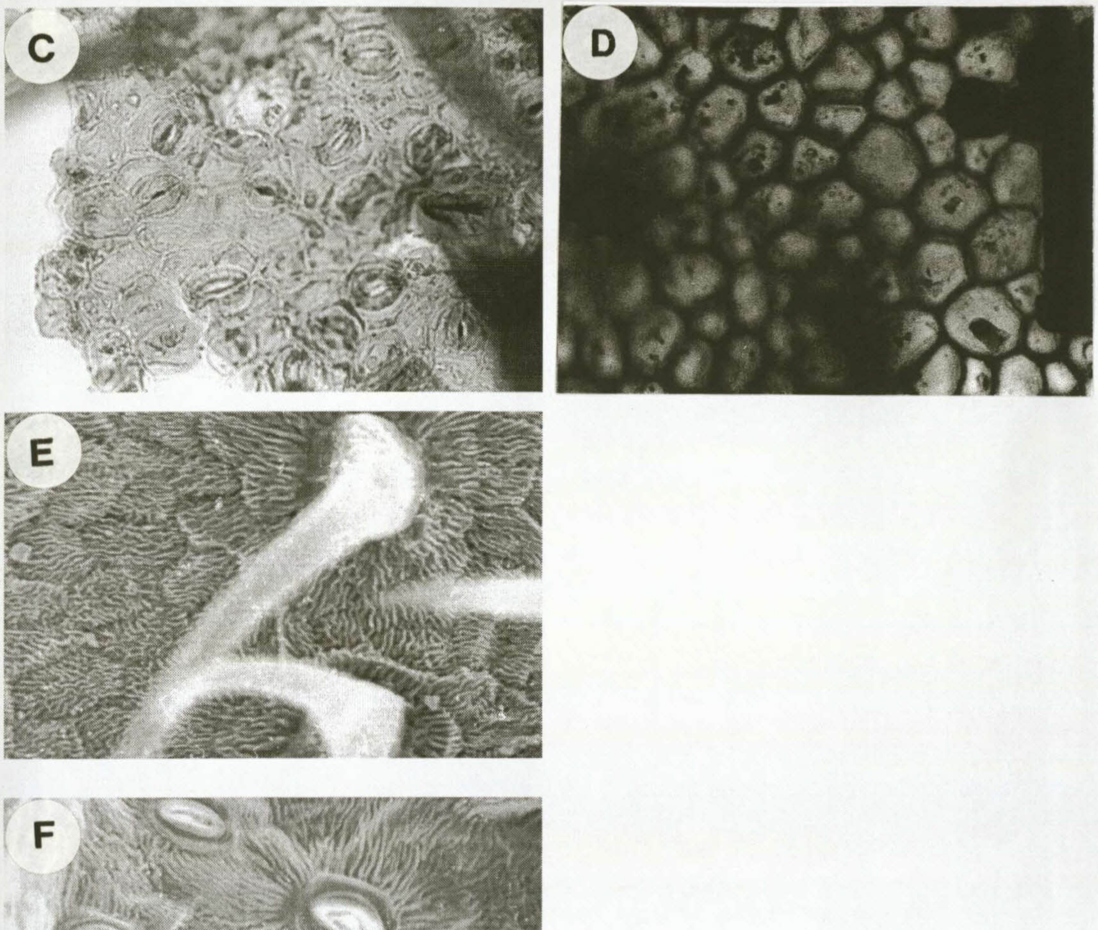
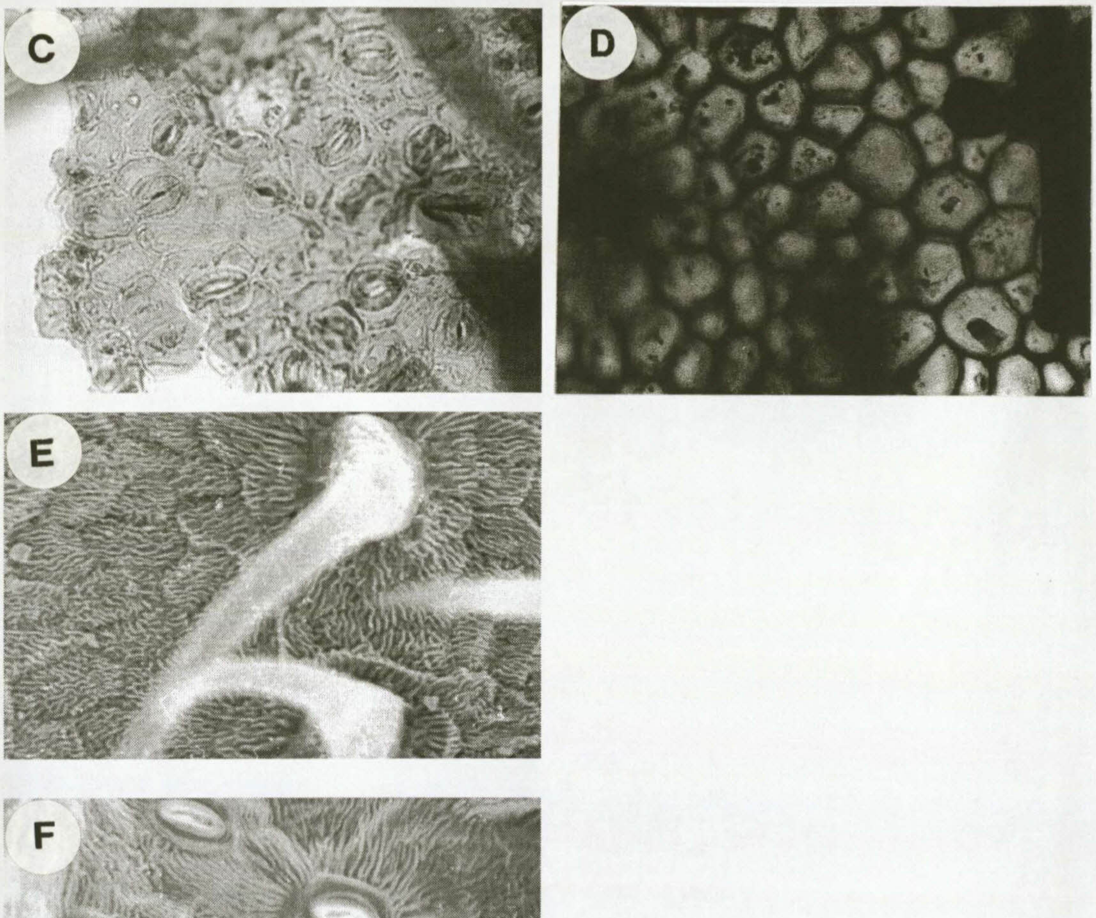



**Figure 3.1 Leaf surface of *Baseonema gregorii*: (A–B)** Petiole with trichomes. *Faden, R.B. & A.J. 74/436.* Scale bar: A – B = 100 µm




**...Figure 3.1** *B. gregorii:* (**C**) Surface view of abaxial epidermal cells. *Bally, P.R.O 8125.* **(D)** Surface view of adaxial epidermal cells. *Faden, R.B. & A.J.* $^{74}/_{436}$. **(E)** Adaxial epidermis showing densely striate cuticle. *Faden, R.B. & A.J.* $^{74}/_{436}$. **(F)** Abaxial epidermis showing stomata with long radiating striae. *Faden, R.B. & A.J.* $^{74}/_{436}$. **(G)** Abaxial epidermis with trichomes. *Field & Powys 174.* **(H)** Adaxial epidermis with trichomes. *Bally 8745.*
**r** = rim of stomata. Scale bar: C, D = 50 µm; E, F, G = 10 µm; H = 100 µm




**...Figure 3.1** *B. gregorii:* (**C**) Surface view of abaxial epidermal cells. *Bally, P.R.O 8125.* **(D)** Surface view of adaxial epidermal cells. *Faden, R.B. & A.J.* $^{74}/_{436}$. **(E)** Adaxial epidermis showing densely striate cuticle. *Faden, R.B. & A.J.* $^{74}/_{436}$. **(F)** Abaxial epidermis showing stomata with long radiating striae. *Faden, R.B. & A.J.* $^{74}/_{436}$. **(G)** Abaxial epidermis with trichomes. *Field & Powys 174.* **(H)** Adaxial epidermis with trichomes. *Bally 8745.*
**r** = rim of stomata. Scale bar: C, D = 50 µm; E, F, G = 10 µm; H = 100 µm

### 3.2.2 *BATESANTHUS* N.E. Brown

Trichomes are present in *Batesanthus intrusus* and *B. talbotii,* but absent in *B. parviflorus* and *B. purpureus*.

*Batesanthus intrusus* S. Moore

***Lamina***: *Epidermis* (Fig. 3.2 A, B, C); consists of polygonal cells. Cells of the abaxial epidermis (Fig. 3.2 A) have undulate and non-pitted anticlinal and smooth periclinal walls. Anticlinal walls of adaxial epidermis are straight to slightly undulate and periclinal walls are smooth (Fig.3.2 B, C). *Cuticle* (Fig. 3.2 D) on both abaxial and adaxial epidermis is smooth. Ornamentation on the adaxial epidermis is generally a reticulum of rounded or curved ridges. *Stomata* (Fig. 3.2 E, F) were observed only on the abaxial epidermis. The stoma in surface view are broadly elliptic (Fig. 3.2 F) to almost rounded (Fig. 3.2 E) with slightly narrow to broad apertures. The rim ('**r**') is very prominent and slightly raised above the subsidiary cells. Subsidiary cells are outlined by a slightly undulate, raised cuticular ridge (Fig. 3.2 F). ***Trichomes:*** (Fig. 3.2 G) are present on abaxial epidermis and sparsely distributed. Trichomes are uniseriate, unicellular and non-glandular. Trichomes are short and stout, smooth and straight with an acute apex. The base is nearly rounded.

*Batesanthus parviflorus* Norman

***Lamina***: *Epidermis* (Fig. 3.3 A, B); epidermal cells of the abaxial epidermis are polygonal with straight to undulate walls. *Cuticle* (Fig. 3.3 C) varies within the species from smooth to a slightly wavy. Short-radiating striae extending over the subsidiary cells occur on the lower surface (Fig. 3.3 E). *Stomata* (Fig. 3.3 E) only on abaxial epidermis. The stomata are broadly elliptic with a slightly raised broad rim and narrow apertures. The region between the guard cells and the peristomatal rim is smooth. ***Trichomes***: The leaf surface is glabrous.

*Batesanthus purpureus* N.E. Br.

***Lamina***: *Epidermis* (Fig. 3.4 A, B); abaxial and adaxial surfaces have polygonal cells. Cell walls are straight to slightly undulate, non-pitted anticlinal and smooth periclinal walls. *Cuticle* (Fig. 3.4 C) on adaxial epidermal surface is smooth with slightly undulate walls and raised cuticular ridges over anticlinal walls. *Stomata* (Fig. 3.4 D) only on the abaxial epidermis. The stoma in surface view are broadly elliptic with narrow to wide apertures and a very distinct rim ('**r**') which is slightly raised. ***Trichomes*****:** The leaf surface is glabrous.

*Batesanthus talbotii* S. Moore

***Lamina:*** *Epidermis* (Fig. 3.5 A); consists of polygonal cells. Cell walls of the abaxial epidermis have undulate, non-pitted anticlinal walls and finely striate periclinal walls. *Cuticle* (Fig. 3.5 B, C) on abaxial epidermal surface consists of short parallel striations around the stomatal region, however striations are not always in the same direction (Fig. 3.5 C). Adaxial epidermis is densely striae with wavy parallel striations continuos over irregularly raised periclinal walls and cuticular grooves over anticlinal walls (Fig. 3.5 B). *Stomata* (Fig. 3.5 C) observed only on abaxial epidermal surface. The stomata in surface view are broadly elliptic with wide and occasionally narrow apertures (Fig. 3.5 C). The rim is broad and distinct. The region between an outer broad rim and the peristomatal rim is smooth. The stomata are regularly surrounded by short radiating striae. Stomata are paracytic. ***Trichomes*****:** (Fig. 3.5 D) were only found on the abaxial epidermal surface and sparsely distributed. They are uniseriate, unicellular and non-glandular. Trichomes are short and stout. They are smooth and straight with an acute apex. The round base is broadly flattened and embedded in a rosette of epidermal cells.

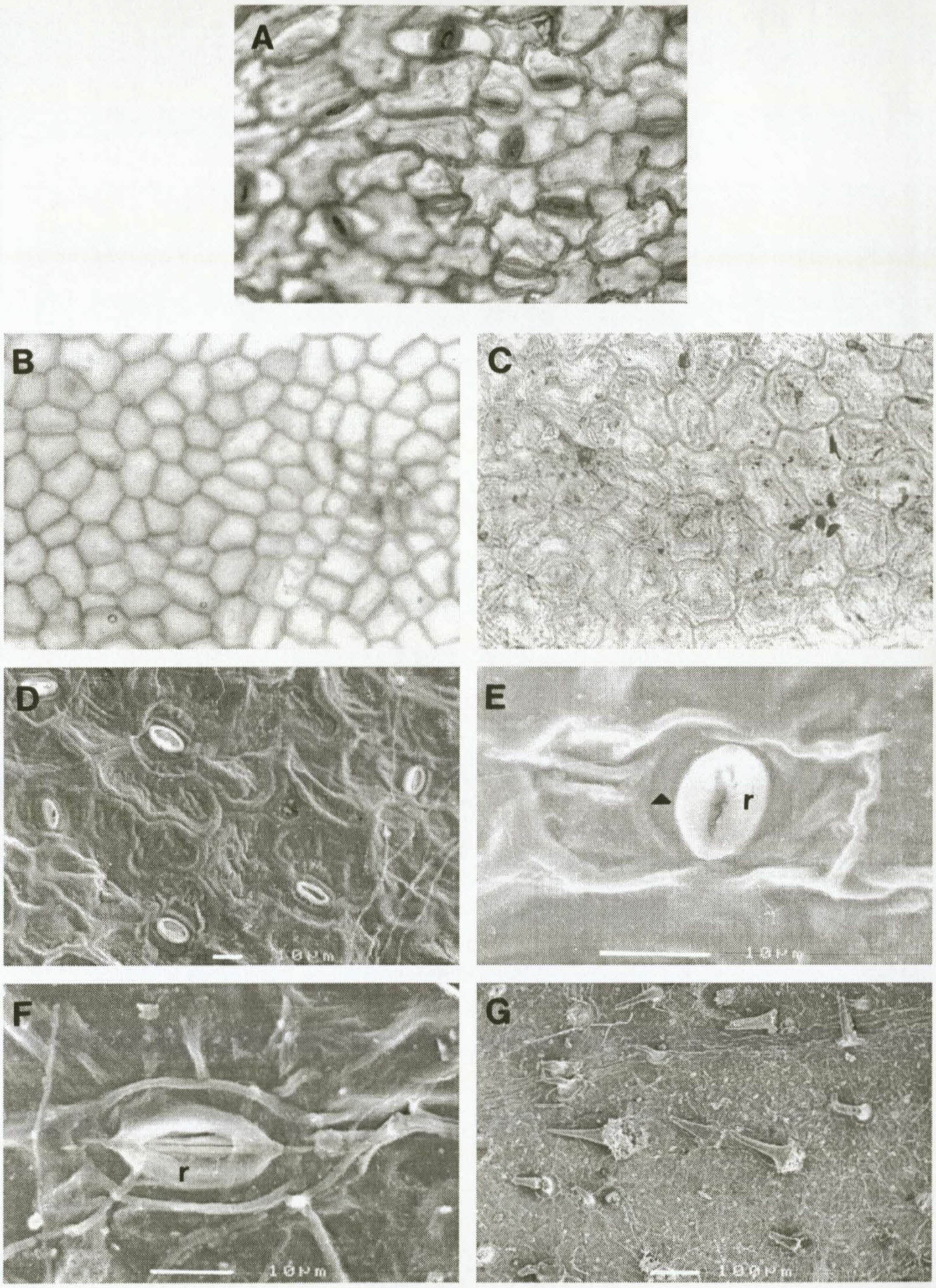



**Figure 3.2 Leaf surface of *Batesanthus intrusus:*** (**A**) Surface view of abaxial epidermis showing cells with undulate walls. *Louis, J. 12992.* (**B**) Surface view of adaxial epidermis showing cells with straight walls. *Adam 30433.* (**C**) Surface view of adaxial epidermis showing slightly undulate walls. *Le Testu 8501.* (**D**) Abaxial epidermis cuticle. *Tisserant 1480.* (**E**) Stoma in abaxial epidermis. *Adam 30433.* (**F**) Stoma in abaxial epidermis. *Tisserant 1480.* (**G**) Trichomes on abaxial epidermis. *Le Testu 8501.*

Scale bar: A–C = 50 µm; D–F = 10 µm; G = 100 µm

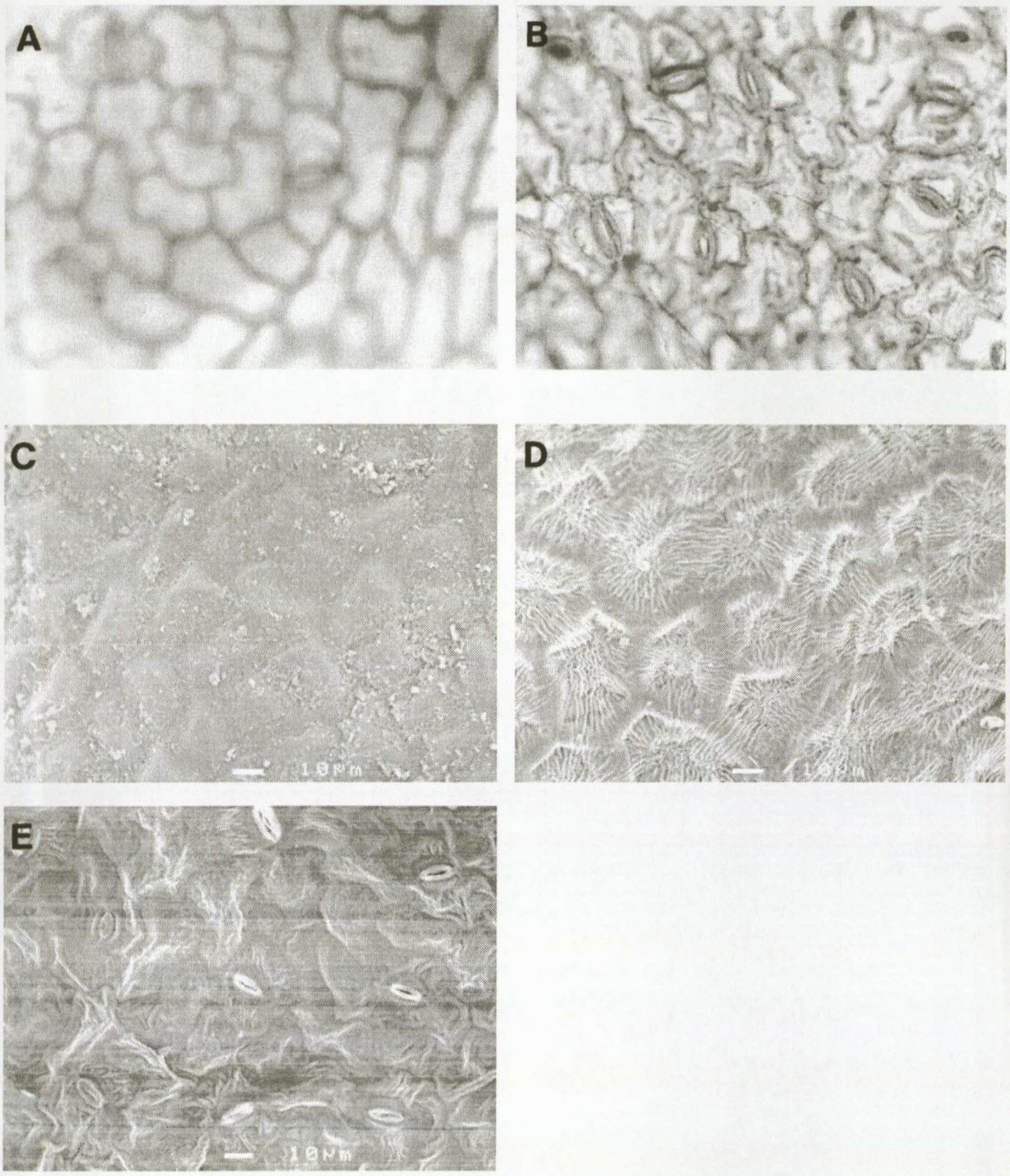



**Figure 3.3 Leaf surface of *Batesanthus parviflorus:*** (**A**) Surface view of abaxial epidermis. *Deighton, F.C. 3265.* (**B**) Surface view of abaxial epidermis. *Polhill & Kirkup 5190*. (**C**) Adaxial epidermis showing smooth cuticle. *Polhill & Kirkup 5190*. (**D**) Adaxial epidermis showing cuticle with radiating striae. *Deighton, F.C. 3265.* (**E**) Abaxial epidermis with stomata showing parallel striae. *Polhill & Kirkup 5190*.

Scale bar: A, B = 50 µm; C–E = 10 µm

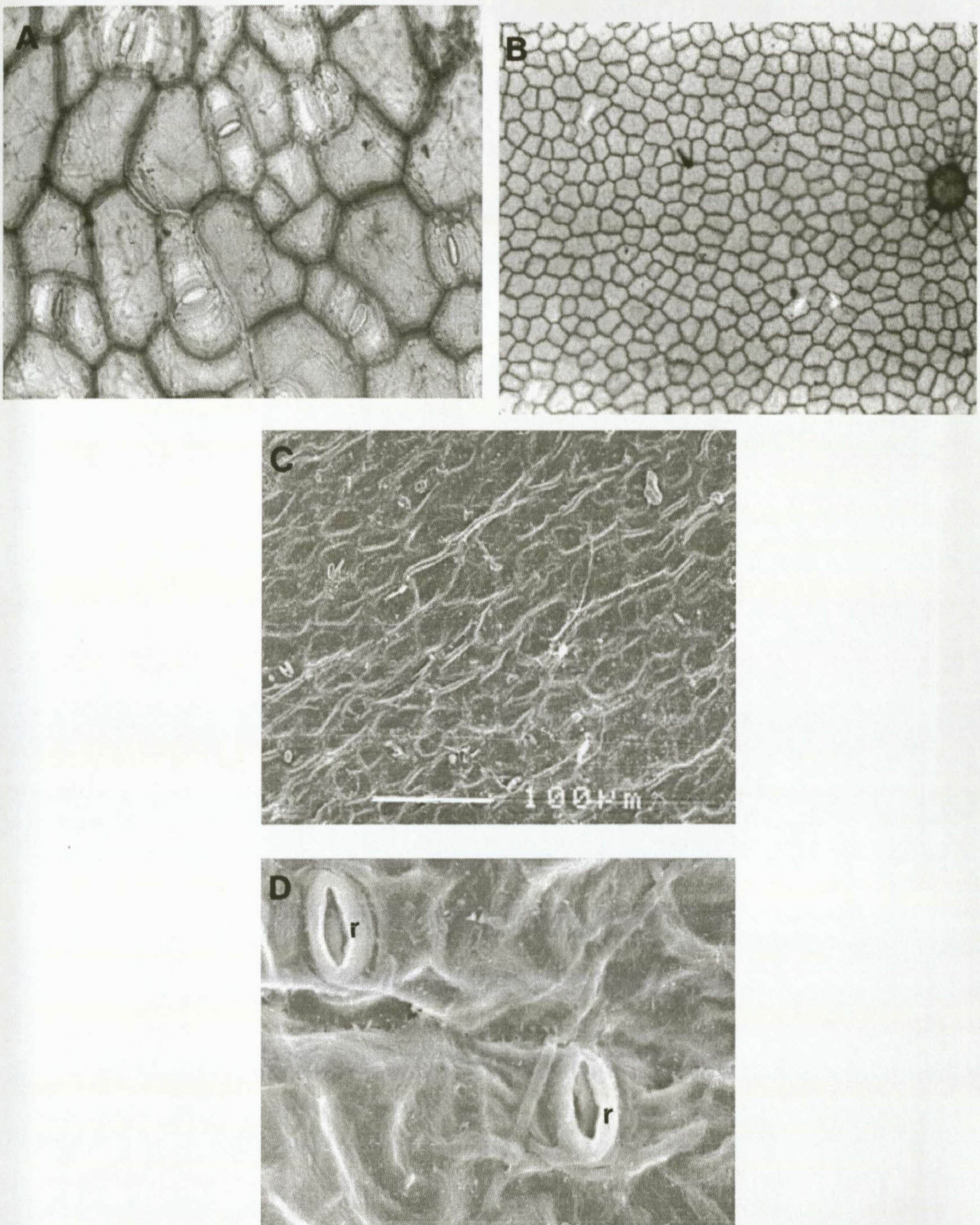



**Figure 3.4 Leaf surface of *Batesanthus purpureus:*** (**A**) Surface view of abaxial epidermal cells. *Bates, G.L. 383.* (**B**) Surface view of adaxial epidermis. *Bates, G.L. 383.* (**C**) Adaxial epidermis cuticle. *Le Testu 5493.* (**D**) Stomata on abaxial epidermis. *Le Testu 5493.*

Scale bar: A–B = 50 µm; C = 100 µm; D = 10 µm

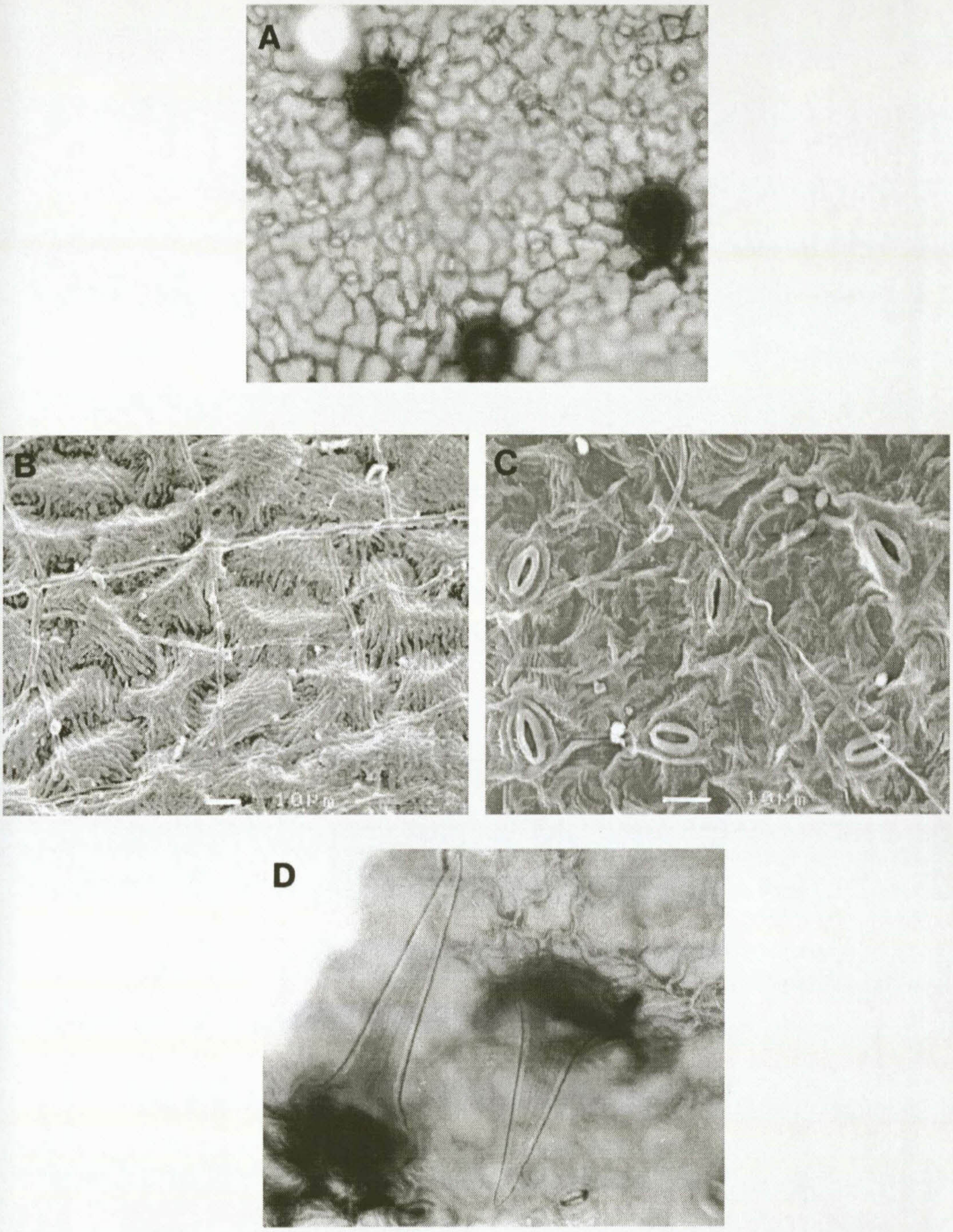


**Figure 3.5 Leaf surface of *Batesanthus talbotii:*** (**A**) Surface view of abaxial epidermal cells. *Talbot, T.A. 63.* (**B**) Cuticle on adaxial epidermis. *Talbot, T.A. 63.* (**C**) Stomata on abaxial epidermis. *Talbot, T.A. 63.* (**D**) Trichomes on abaxial epidermis. *Talbot, T.A. 63.*

Scale bar: A, D = 50 µm; B–C = 10 µm

### 3.2.3 *MANGENOTIA* Pichon

*Mangenotia eburnea* Pichon

***Lamina***: *Epidermis*; epidermal cells in surface view have straight to slightly undulate, non-pitted, anticlinal walls. *Cuticle* (Fig. 3.6 A, B): Adaxial epidermis is characterised by irregular bumps with parallel striations that extend over individual cells (Fig. 3.6 A). The cuticle is sometimes wavy with variously orientated striae (Fig. 3.6 B). Globules of papilla cover the abaxial epidermal surface. *Stomata* (Fig. 3.6 C, D) were observed only on abaxial epidermis. The stomata in surface view are narrowly elliptic to broadly elliptic; apertures are mostly narrow with a distinct raised rim (Fig. 3.6 D). The region between an outer rim and the peristomatal rim is smooth with the stomata depressed in between the papilla. ***Papillae***: Abaxial epidermis is beset with papilla. Papillae are globular and connected together by thread-like radiating ridges (Fig. 3.6 D). There are 4–6 papillose structures surrounding each stoma. ***Trichomes*** (Fig. 3.6 E): appear to be short and stout and sparsely distributed on adaxial epidermis. They are straight, smooth with an acute apex. At the base, there occur long radiating striae (Fig. 3.6 E).

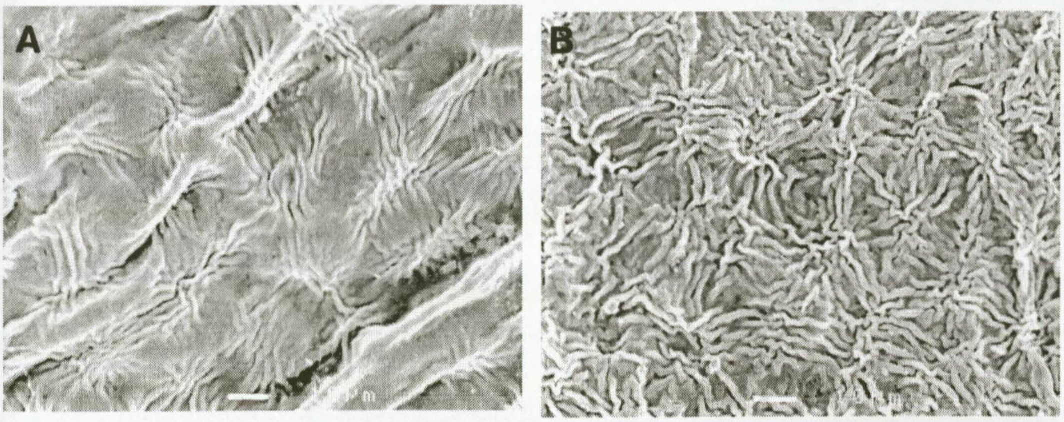



**Figure 3.6 Leaf surface of *Mangenotia eburnea*** (**A**) Cuticle on adaxial epidermis showing irregular bumps and parallel striations. *Thomas, N.W. 4628.* (**B**) Adaxial epidermis showing wavy striae. *Thomas, N.W. 1373.*

Scale bar: A–B = 10 µm

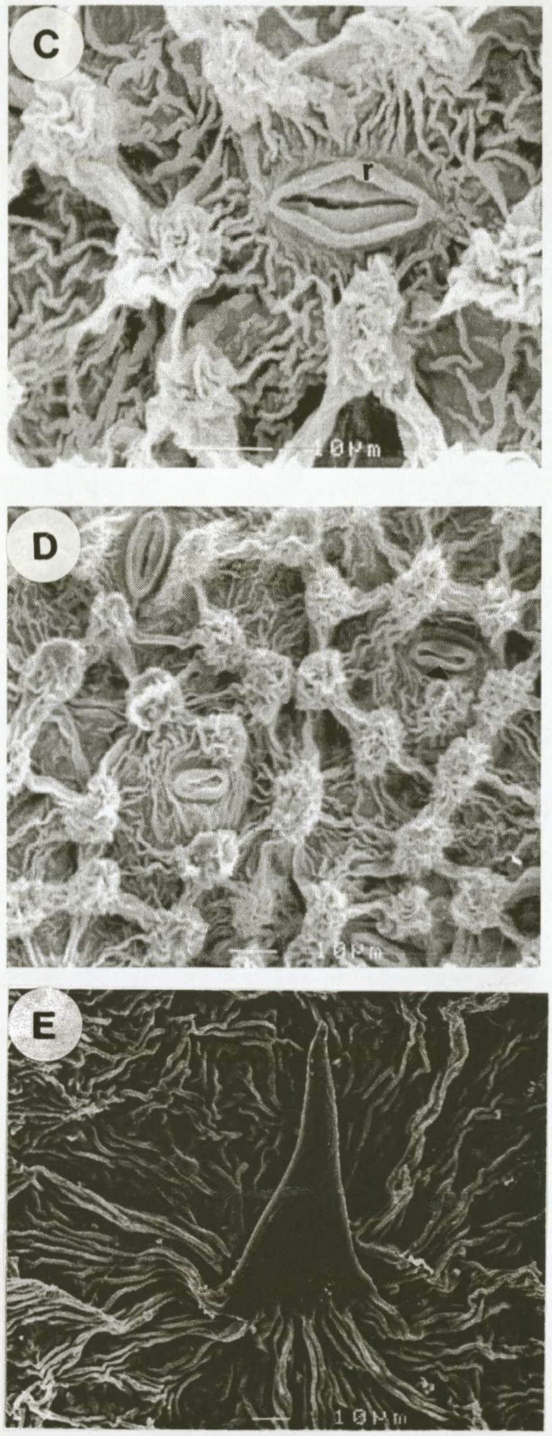



**Figure 3.6 Leaf surface of *Mangenotia eburnea:*** (**C**) Stomata on abaxial epidermis. *Thomas, N.W. 1373.* (**D**) Stomata on abaxial epidermis. *Thomas, N.W. 4628.* (**E**) Trichomes on adaxial epidermis. *Thomas, N.W. 1373.*

Scale bar: C–E = 10 µm

### 3.2.4 *MONDIA* Skeels

*Mondia ecornuta* (N.E.Br.) Bullock

***Lamina***: *Epidermis*; epidermal cells have slightly undulate anticlinal walls. *Cuticle* (Fig. 3.7 A, B) is wavy with parallel radiating striations. Most specimens studied have wavy and parallel striations with cuticular grooves over anticlinal walls (Fig.3.7 A). *Stomata* (Fig. 3.7 C, D) occur only on abaxial epidermis. The stomata are paracytic and in surface view are mostly elliptic. The apertures are narrow. ***Trichomes*** (Fig. 3.7 E, F) are present on both the abaxial and adaxial epidermis. However, the upper surface is glabrous or nearly so. Trichomes are long and narrow and are inserted in a rosette of epidermal cells (Fig. 3.7 F). The surface is covered with linear, warty outgrowths (Fig. 3.7 E).

*Mondia whitei* (Hook. f.) Skeels

***Lamina***: *Epidermis;* epidermal cells have straight to slightly undulate anticlinal walls. *Cuticle* (Fig. 3.8 A) is wavy with parallel to variously oriented striations over bumpy periclinal walls as well as deep lying cuticular grooves over anticlinal walls. *Stomata* (Fig. 3.8 B) occur only on abaxial epidermis. The stomata in surface view are narrowly elliptical with a distinct rim. Apertures are narrow with a peristomatal rim present. However rare, there occur short radiating striae perpendicular to the guard cells (Fig. 3.8 B). Stomata are paracytic. ***Trichomes*** (Fig. 3.8 C, D) occur on both abaxial and adaxial epidermis with adaxial epidermis glabrous or nearly so, especially in mature leaves. The lower surface is sparsely hairy with hairs mostly on the midrib (Fig. 3.8 C) and secondary veins (Fig. 3.8 D). Trichomes are uniseriate, unicellular and non-glandular. Trichomes are either beset with warty linear outgrowths (Fig. 3.8 C) in some specimens (e.g. Goldsmith 5/64[Ab-], Oldeman 392[Ad-] & Ward 3626[Ab-]) or smooth (Fig. 3.8 D) and straight with an acute apex (e.g. Biegel *et al.* 4297[Ab-], Medley Wood 6180[Ad-,] Leeuwenberg 10026 [Ab-,][Ad]).

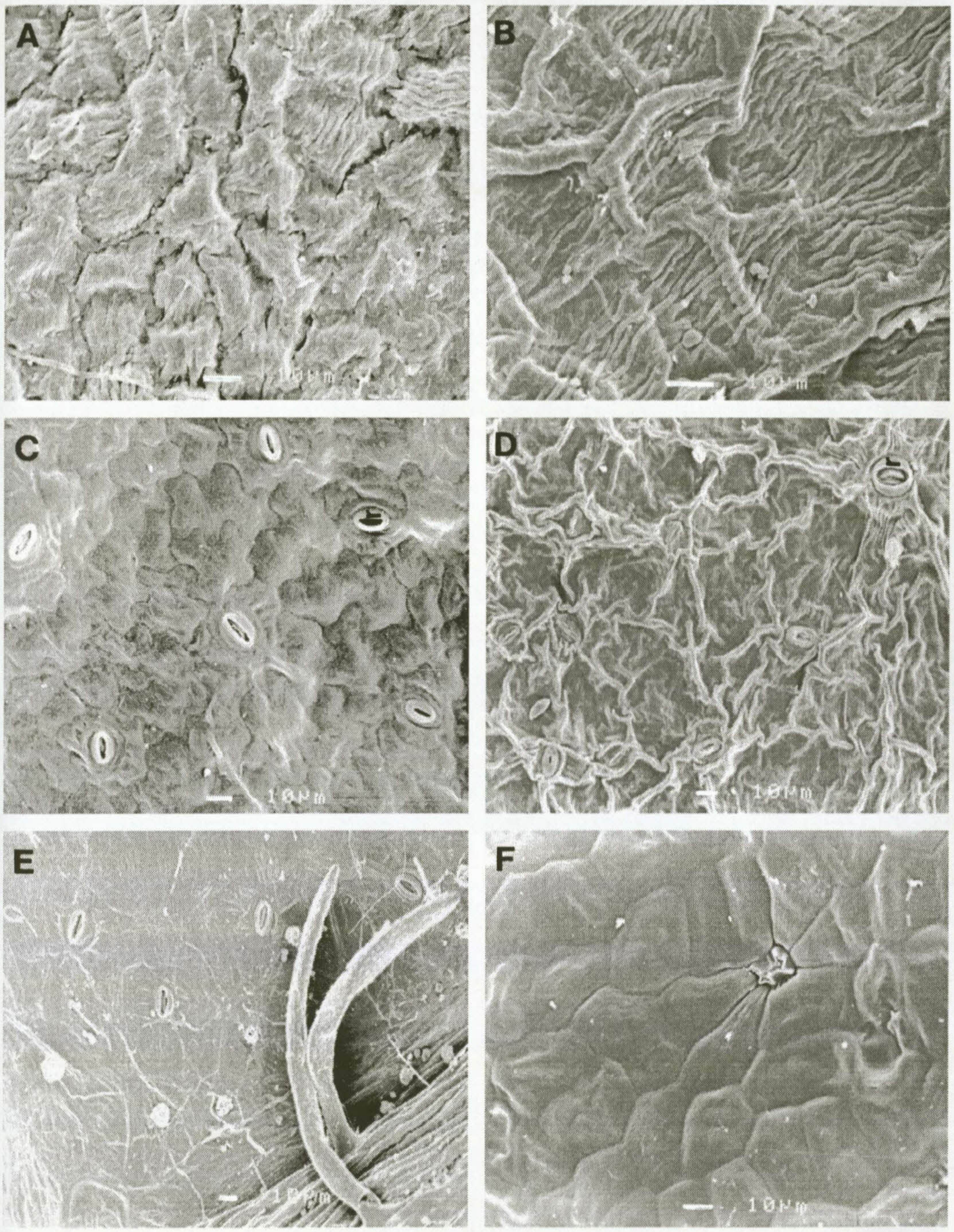



**Figure 3.7 Leaf surface of *Mondia ecornuta:*** (**A**) Cuticle on adaxial epidermis. *Faulkner, H.G. 558.* (**B**) Cuticle on adaxial epidermis. *Bouquet, A. 631.* (**C**) Stomata on abaxial epidermis. *Faulkner, H.G. 558.* (**D**) Stomata on abaxial epidermis showing perpendicular running striations. *Faulkner, H.G. 558.* (**E**) Abaxial epidermis showing trichomes on the midrib. *Musyoki & Hansen 956.* (**F**) Abaxial epidermis showing a rosette of epidermal cells at trichome insertion (trichome broken). *Allen, C.E.F. 139.*

Scale bar: A – F = 10 µm

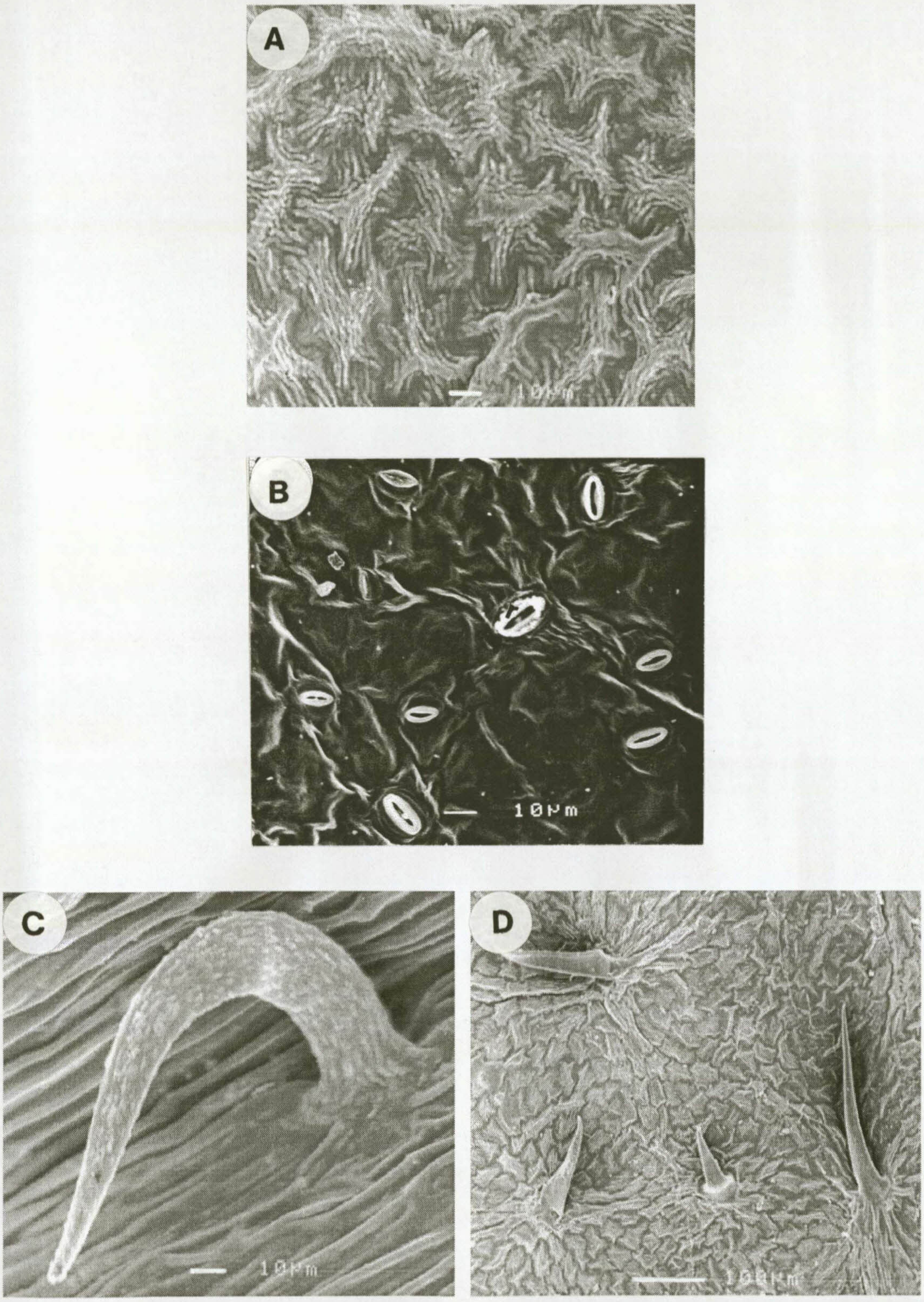



**Figure 3.8 Leaf surface of *Mondia whitei:*** (**A**) Adaxial epidermis showing cuticle with variously orientated striae. *Goldsmith, B. 5/64.* (**B**) Stomata on abaxial epidermis. *Venter, H.J.T. 9282.* (**C**) Warty trichome on abaxial epidermal midrib. *Goldsmith, B. 5/64.* (**D**) Smooth trichome on adaxial epidermis. *Leeuwenberg, A.J.M. 10026.* Scale bar: A–C 10 µm; D = 100 µm

### 3.2.5 ***SACLEUXIA*** Baill.

Leaves are simple and petiolate. Leaves are amphistomatic with paracytic stomata in *Sacleuxia tuberosa* (E.A. Bruce) Bullock and hypostomatic with paracytic stomata in *Sacleuxia newii* Baill.

*Sacleuxia newii* (Benth.) Bullock

***Lamina***: *Epidermis* (Fig. 3.9 A, B); consists of polygonal cells (Fig. 3.9 A). Cells on adaxial and abaxial surface have straight to slightly undulate anticlinal walls (Fig. 3.9 B). *Cuticle* (Fig. 3.9 C) is wavy with dense striae on both surfaces. Striae are variously orientated over slightly raised periclinal walls. Cuticular grooves occur over anticlinal walls (Fig. 3.9 C). *Stomata* (Fig. 3.9 D) only observed on abaxial epidermis. The stomata in surface view are broadly elliptic with a distinct and broad outer rim (Fig. 3.9 D). There is a narrow outline of peristomatal rim bordering the stomata. ***Trichomes*** (Fig. 3.9 E, F) occur on both abaxial and adaxial epidermis. Abaxial epidermis surface is more hairy than the adaxial and more so on the midrib and venous area. The midrib is hirsute, forming a whitish line along. Adaxial surface with sparsely distributed hairs. Trichomes are uniseriate, unicellular, non-glandular and straight to slightly curved at the tip (Fig. 3.9 E). Trichomes are long and narrow. Trichome surface is covered with linear, warty outgrowths. The base is rounded and covered with smooth cuticle and embedded in a rosette of 6–8 epidermal cells (Fig. 3.9 F).

*Sacleuxia tuberosa* (E.A. Bruce) Bullock

***Lamina***: *Epidermis* (Fig. 3.10 A, B); consists of straight to slightly undulate, non-pitted anticlinal walls on both abaxial (Fig. 3.10 A) and adaxial (Fig. 3.10 B) surfaces. *Cuticle* (Fig. 3.10 C) is wavy on both surfaces with parallel striations continuous over the walls. Prominent cuticular grooves correspond to anticlinal walls. *Stomata* (Fig. 3.10 D, E) occur on both abaxial and adaxial epidermis. Stomata on adaxial epidermis are only found near the midrib area. The stomata in surface view are broadly elliptic with a prominent rim and wide apertures. ***Trichomes*** (Fig. 3.10 F) occur on both abaxial and adaxial epidermis. Trichomes are uniseriate, unicellular and non-glandular. The trichomes are relatively short and stout – compared to those of *Sacleuxia newii.* The surface is covered with linear, warty outgrowths. The base is rounded and slightly raised above a rosette of epidrmal cells. Trichomes are mostly straight with an acute apex that is slightly curved in some instances.

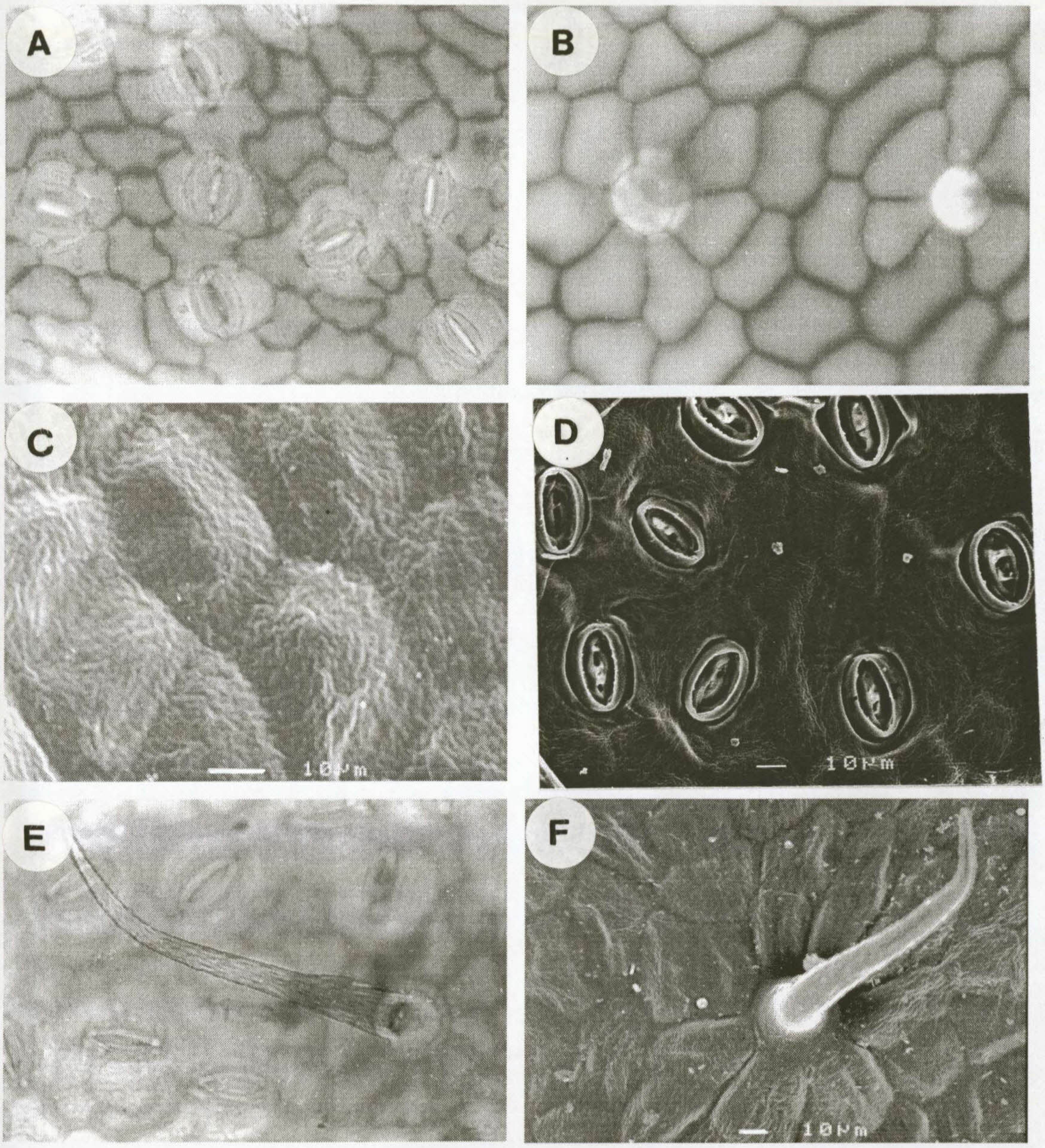



**Figure 3.9 Leaf surface of *Sacleuxia newii:*** (**A**) Surface view of abaxial epidermis. *Verdcourt 246.* (**B**) Surface view of adaxial epidermis. *Verdcourt 188.* (**C**) Aadaxial epidermis showing wavy, densely striated cuticle. *Verdcourt 246.* (**D**) Stomata on abaxial epidermis. *Verdcourt 188.* (**E**) Unicellular trichome on abaxial epidermis. *Drummond & Hemsley 3364.* (**F**) Trichome on adaxial epidermis showing rosette of epidermal cells. *Verdcourt 188.*

Scale bar: A, B, E = 50 µm; C, D, E = 10 µm

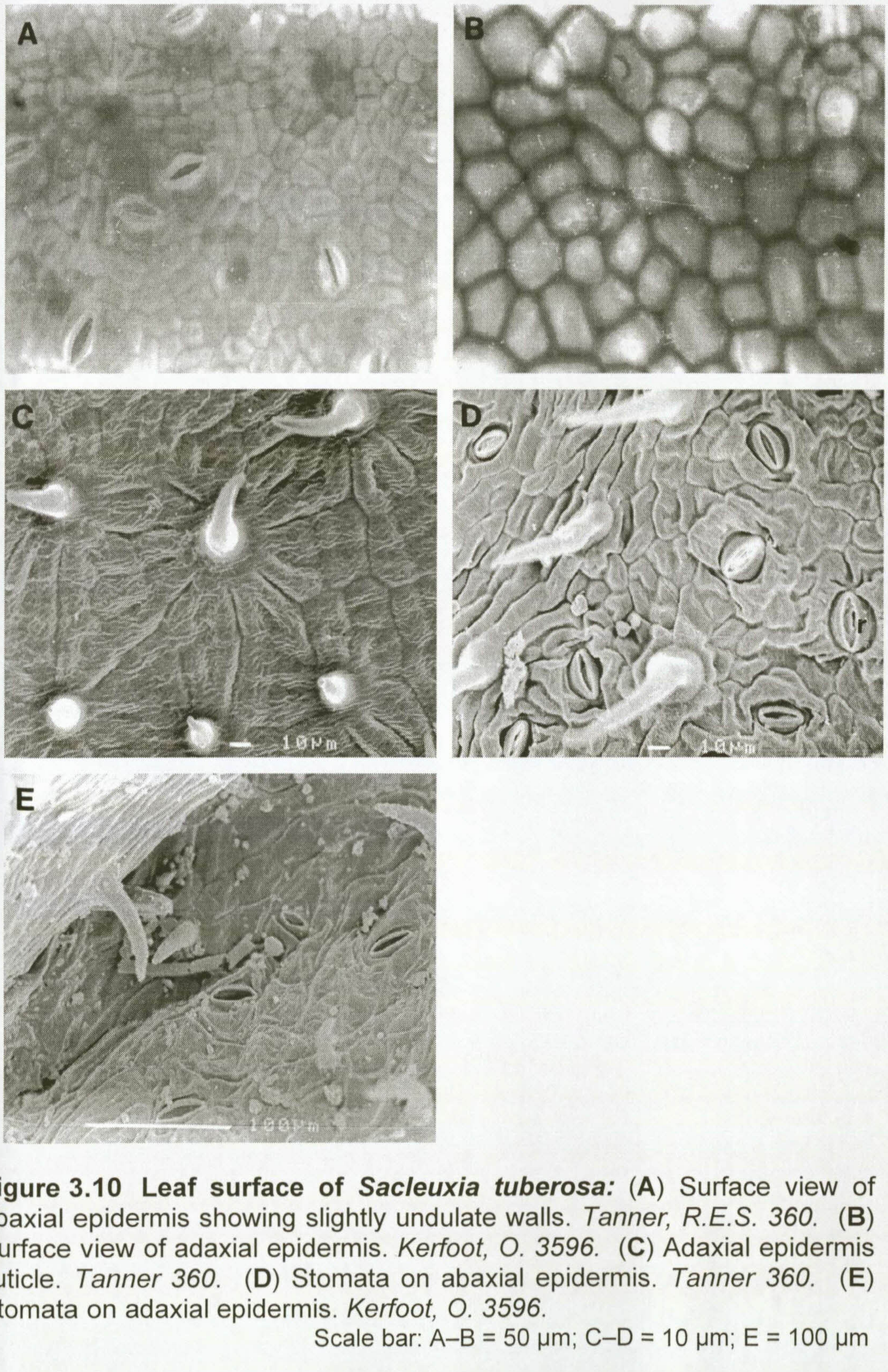



**Figure 3.10 Leaf surface of *Sacleuxia tuberosa:*** (**A**) Surface view of abaxial epidermis showing slightly undulate walls. *Tanner, R.E.S. 360.* (**B**) Surface view of adaxial epidermis. *Kerfoot, O. 3596.* (**C**) Adaxial epidermis cuticle. *Tanner 360.* (**D**) Stomata on abaxial epidermis. *Tanner 360.* (**E**) Stomata on adaxial epidermis. *Kerfoot, O. 3596.*

Scale bar: A–B = 50 µm; C–D = 10 µm; E = 100 µm

### 3.2.6 ***SARCORRHIZA*** Bullock

*Sarcorrhiza epiphytica* Bullock

The petiole is 4–(8–9)–10 mm long, pubescent and dark crimson. The petiole is more or less rounded to flattened with longitudinal fissures.

***Lamina:*** *Epidermis* (Fig. 3.11 A, B); epidermal cells are polygonal. The cells have slightly undulate, non-pitted anticlinal walls and smooth periclinal walls. *Cuticle* (Fig. 3.11 C) is smooth. *Stomata* (Fig. 3.11 D, E) occur only on the abaxial epidermis. Most of the stomata in surface view are rounded (Fig. 3.11 D), sometimes broadly elliptic (Fig. 3.11 E). The rim is very distinctive, there is no peristomatal rim. The stomata are slightly raised (Fig. 3.11 D). ***Trichomes*** (Fig. 3.11 F) were observed on the midrib of both abaxial and adaxial surfaces. Trichomes are rare and the leaves are almost glabrous in mature state. Trichomes are uniseriate, unicellular, non-glandular, short and stout. Trichomes are straight to slightly curved with a tapering point.

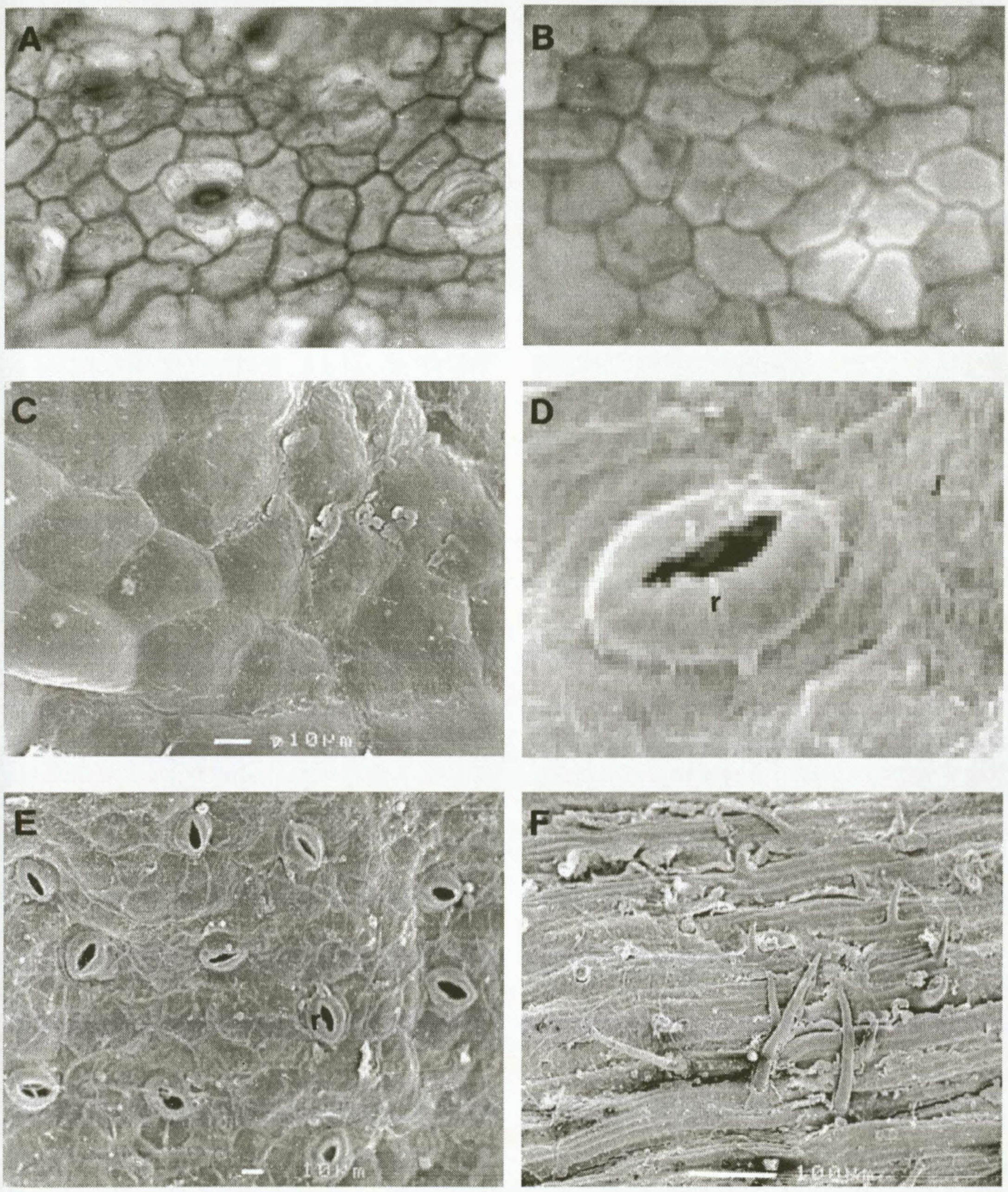



**Figure 3.11 Leaf surface of *Sarcorrhiza epiphytica:*** (**A**) Surface view of abaxial epidermis. *Bequaert 4494.* (**B**) Surface view of adaxial epidermis. *Bequaert 4494.* (**C**) Adaxial epidermis showing smooth cuticle. *Schliebenm 2939.* (**D**) Rounded stoma on abaxial epidermis. *Bequaert 4494.* (**E**) Broadly elliptic stomata on abaxial epidermis. *Schliebenm 2939.* (**F**) Trichomes on abaxial midrib. *Bequaert 4494.*

Scale bar: A–B = 50 µm; C–E = 10 µm; F = 100 µm

### 3.2.7 *ZACATEZA* Bullock

*Zacateza pedicellata* (K. Schum.) Bullock

***Lamina***: *Epidermis* (Fig. 3.12 A, B); epidermal cells are polygonal. Cells of the abaxial epidermis are undulate with pitted anticlinal and finely striate periclinal walls. Adaxial epidermal cells have straight to slightly undulate, pitted anticlinal walls, sometimes with non-pitted anticlinal walls. *Cuticle* (Fig. 3.12 C, D) is wavy and densely striate on adaxial epidermis. In some cases, the cuticle appears to be smooth with parallel striations in sunken areas (Fig. 3.12 C). Cuticle on abaxial epidermal surface is wavy (Fig. 3.12 E) with parallel striations extending over cells (Fig. 3.12 F). It can however vary to radiating striae perpendicular to guard cells (Fig. 3.12 E). *Stomata* (Fig. 3.12 E, F) were observed on the abaxial epidermis. The stomata in surface view are narrowly elliptic to broadly elliptic with narrow apertures. The region between the outer rim and the peristomatal rim is smooth. Variations occur on the lower surface, with stomata having radiating striae perpendicular to the guard cells and extended as lateral wings (Fig. 3.12 E). In other specimens, concentric rings of striae followed by variously orientated striae (Fig. 3.12 F) occur. ***Trichomes*** (Fig 3.12 G, H) are uniseriate. Trichomes are unicellular, non-glandular, relatively short and stout with acute apex. Trichomes are sparsely distributed on both surfaces.

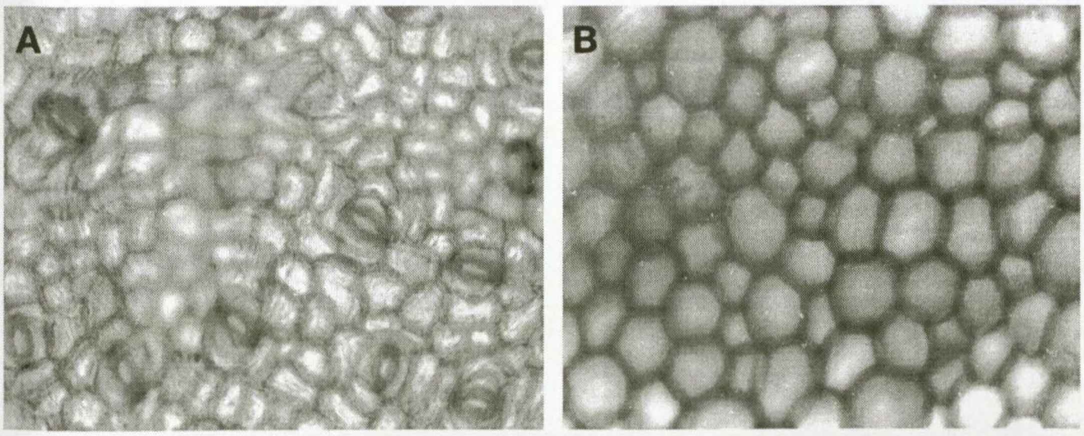
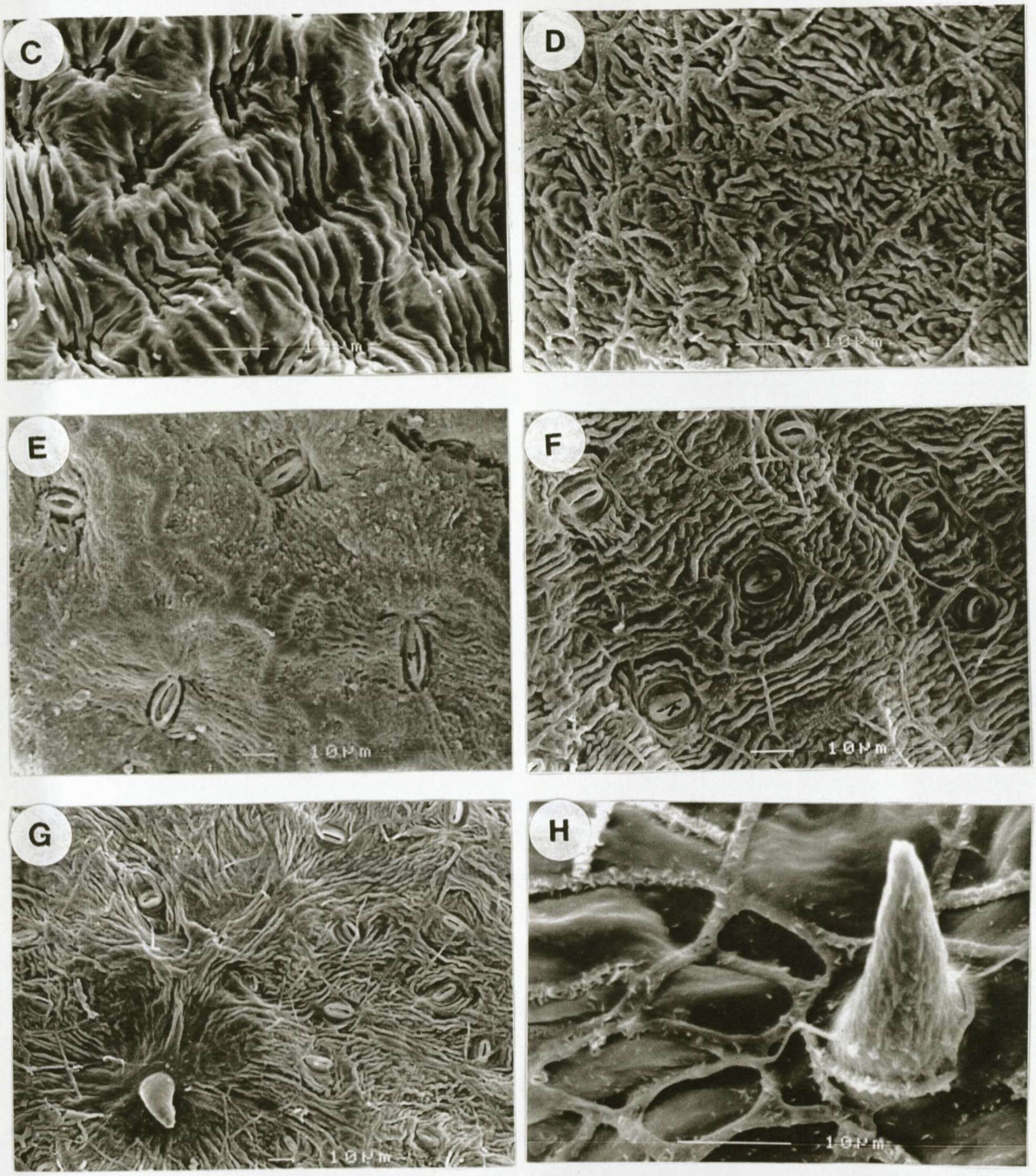



**Figure 3.12 Leaf surface of *Zacateza pedicellata:*** (**A**) Surface view of abaxial epidermis. *Gossweiler, J. 13684.* (**B**) Surface view of adaxial epidermis. *Schweinfurth 3488.*

Scale Bar: A–B = 50 µm




...**Figure 3.12 Leaf surface of *Zacateza pedicellata:*** (**C**) Adaxial epidermis showing parallel, sunken striations. *Louis, J. 106.* (**D**) Adaxial epidermis showing densely striated cuticle. *Gossweiler, J. 13684.* (**E**) Stomata on abaxial epidermis. *Evrard 3467.* (**F**) Stomata on abaxial epidermis showing concentric rings of striae. *Gossweiler, J. 13684.* (**G**) Trichome on abaxial epidermis. *Gossweiler, J. 13684.* (**H**) Trichome on adaxial epidermis. *Gossweiler, J. 13684.*

Scale bar: C – H = 10 µm

## TABLE 3.1 TYPES AND DENSITY OF FOLIAR TRICHOMES IN SELECTED PERIPLOCOID SPECIES

| SPECIES | **Ab-** | **Ad-** | Warty | Smooth | Indumentum (trichome cover/density) | Uni- |
|---|---|---|---|---|---|---|
| *Baseonema gregorii* | ✓ | ✓ | ✓ | | Hirsute<br>Very dense | ✓ |
| *Batesanthus intrusus* | ✓ | | | ✓ | Puberulent<br>Sparse to glabrous in mature leaves | ✓ |
| *Batesanthus parviflorus* | – | – | – | – | Glabrous | |
| *Batesanthus purpureus* | – | – | – | – | Glabrous | |
| *Batesanthus talbotii* | ✓ | | ✓ | | Scabrous<br>Sparsely distributed | ✓ |
| *Mangenotia eburnea* | * | ✓ | | ✓ | Puberulent<br>Sparsely distributed | ✓ |
| *Mondia ecornuta* | ✓ | ✓ | ✓ | | Puberulent<br>Sparsely distributed to glabrous on adaxial epidermis | ✓ |
| *Mondia whitei* | ✓ | ✓ | ✓ | ✓ | Puberulent to hirsute. Glabrous or nealy so in mature leaves (adaxial)<br>Sparsely distributed but dense on the midrib | ✓ |
| *Sacleuxia newii* | ✓ | ✓ | | ✓ | Hirsute<br>Sparsely distributed but dense on the midrib | ✓ |
| *Sacleuxia tuberosa* | ✓ | ✓ | | ✓ | Pubescent<br>Sparsely distributed but dense on the midrib | ✓ |
| *Sarcorrhiza epiphytica* | ✓ | | | ✓ | Puberulent<br>Rare, becoming glabrate | ✓ |
| *Zacateza pedicellata* | ✓ | ✓ | ✓ | | Puberulent<br>Rare | ✓ |

**Ab-** = Abaxial * = Papillose ✓ = Present **Uni-** = Unicellular

**Ad-** = Adaxial – = Absent

## 3.3 DISCUSSION AND CONCLUSIONS

The leaves are hypostomatic in all species except *Sacleuxia tuberosa* with amphistomatous leaves. However, the stomata in *S. tuberosa* are found towards the apex of the lamina and are situated close to the midrib.
An unsubstantiated belief is that hypostomatous leaves are better adapted to dry conditions than amphistomatous leaves (Willmer & Fricker 1996). Spacing of the stomata in the epidermis is characteristic of the species although variations do occur between species (whereby *S. tuberosa – Kerfoot 3596* is the only specimen with stomata on both surfaces) and this is likely modified by leaf morphology and / or genetic composition?
The leaves are characterized by having paracytic stomata, a character common among members of the Periplocoideae and this is considered primitive within the angiosperms (Wilkinson 1979).

The epidermal cells and cuticular ornamentation show very little variation within the taxa and they are usually uniform in structure, hence of no taxonomic value. However, *Mangenotia eburnea* is characterized by the presence of papillae on the lower surface, a character not common within the subfamily. Unpublished data of Venter & Verhoeven show presence of papillae on abaxial epidermis in some species of *Cryptolepis* R. Br. e.g. *C. stefaninii* and in *Curroria decidua* subsp. *volubilis* (Balf. f.) Bullock. The cuticle is characterised by being smooth (e.g. *Batesanthus parviflorus, Sarcorrhiza epiphytica*), wavy or with variously orientated striations (in all other taxa), sometimes parallel running striations are found.

The Periplocoids in this study are all characterised by having simple, uniseriate, unicellular and non-glandular trichomes (i.e. hairs of similar shapes are known to occur) with variations in their distribution. For instance, *Baseonema gregorii* is densely pubescent whereas all other taxa are minutely pubescent to nearly glabrous. As a result of which, trichomes are similar in structure and therefore of little taxonomic value in this regard.

However, when present on the stem, bracts and flowers they are of the same shape/type as those on the leaves. Trichomes have been found to have variation patterns on their surface, they are either smooth or with linear warts and they are straight to slightly curved. Both types were observed in specimens of *Mondia whitei.*

Nevertheless, pubescence of the leaf is one feature that varies with leaf age. For the originally pubescent leaf may remain distinctly hairy, become glabrate or glabrous or retain some trichomes in sheltered places on the abaxial surface, such as the side of the midrib (e.g. *Sarcorrhiza epiphytica*) or as Hardin (1979) states, in the axils of main secondary veins as these are the last regions to become glabrous as the leaf ages (e.g. *Mondia ecornuta* and *M. whitei*). According to Theobald *et al.* (1979), many instances of the glabrous condition represent cases where trichomes have degenerated at an early stage in their development or were lost shortly after maturation. According to Corsi & Bottega (1999), the non-glandular hairs on the vegetative and reproductive organs are abundant and longer when the organs are young. Particularly in the early phases of the ontogenetic cycle, they presumably collaborate with glandular hairs in mechanical defence, creating a thick downy layer and they are certainly also involved in protecting the plant from excessive transpiration and insolation (Corsi & Bottega 1999).

Thus, leaf surface micro-morphology has been found to be of little, if any taxonomic value within the Periplocoids investigated.

# CHAPTER 4

## POLLEN AND TRANSLATOR MORPHOLOGY

### 4.1 INTRODUCTION:

Palynologically the Periplocoideae are distinguished from Secamonoideae and Asclepiadoideae by the presence of tetrads, or free pollinia (in 11 genera; Verhoeven & Venter 1998a, b), which are shed onto translators at anthesis. The Secamonoideae are distinguished from Asclepiadoideae by having four pollinia attached to a translator as opposed to two pollinia in Asclepiadoideae. In the Secamonoideae and Asclepiadoideae, at the last stage of pollinarium development, when the anther wall dehisces, the pollinium comes into contact with, and becomes attached to the translator apparatus (Kunze 1994, Omlor 1996, Civeyrel *et al.* 1998). The pollinium is not released from the anther at this stage. The pollinium remains in the anther locule until the pollinator removes the pollinarium. In the Periplocoideae the translator is attached to the pollinator by means of an adhesive disc, while in the Secamonoideae and Asclepiadoideae it is a clasping mechanism.

The Periplocoideae are characterised by having tetrads or free pollinia which are shed onto cone-shaped or spoon-like translators, each of which consists of an adhesive disc (by which the translator sticks to the pollinator), a stalk and a spoon (onto which the tetrads or pollinium is shed at anthesis). The African Periplocoideae are characterised by having pollen in tetrads, with the exception of *Schlechterella abyssinica* (Chiov.) Venter & R.L. Verh. and *S. africana* (Schltr.) K. Schum. having tetrads cohering together to form a pollinium (Verhoeven & Venter 1998b).

The pollen morphology of genera such as *Raphionacme* Harv. (Verhoeven & Venter 1988), *Tacazzea* Decne. and *Petopentia* Bullock (Verhoeven *et al.* 1989), *Ectadium* E. Mey. (Venter *et al.* 1990b), *Curroria* Planch., *Mondia* Skeels, *Stomatostemma* N.E. Br. and *Socotranthus* Kuntze (Verhoeven & Venter 1993), *Periploca* (Verhoeven & Venter 1994a) and genera of the Periplocaceae from Madagascar (Verhoeven & Venter 1994b) have been investigated. The purpose of this investigation is to provide palynological information on the seven genera investigated and to find their taxonomic value.

In five vertical grooves situated around the periphery of the pentangular stylar head, special epithelial cells secrete the translators consisting of three morphological parts. The spoon, with its adhesive surface receives pollen tetrads from adjacent anther halves. The adhesive disc functions to stick to a visiting pollinator. The three translator parts have been described under different names, for example, the spoon as a shovel (Safwat 1962), translator (Arekal & Ramakrishna 1980) and 'Pollenschaufel' (Schick 1982). The stalk has also been called a stipe (Kunze 1993) or stipes (Schick 1982). The adhesive disc has been termed 'Klebplatte' (Schick 1982) or viscidium (Schill & Jäkel 1978; Venter *et al.* 1990 a, b). Schick (1982) introduced the term scutellum for the solid part of the adhesive disc. According to Arekal and Ramakrishna (1980), translators indicate a continued evolution from the Apocynoideae to Asclepiadoideae through the Periplocoideae. Kunze (1993), consider an adhesive disc together with the base of the stalk as the central element of the Periplocoideae translator.

The Apocynaceae *s.s.* is distinguished from the Periplocoideae and the Asclepiadoideae by its single-grained pollen and absence of translators. However, *Apocynum* L. (Apocynoideae) have band-like translators, which are homologous to those of the Periplocoideae and thus indicate a connection between Periplocoideae and Apocynaceae. *Apocynum* is the only genus in the Apocynoideae where pollen is released as tetrads (Nilsson *et al.* 1993).

## 4.2 RESULTS:

Pollen grains are united in calymmate tetrads. The size of the grain with the mean average is represented in Table 4.1 and Figure 4. The pollen grains are arranged decussately (Fig. 4.1 A – N), rhomboidally (Fig. 4.2 A – D) or tetrahedrally (Fig. 4.3 A – C), the most common arrangement being decussate. The smallest mean decussate tetrad size was observed in *Batesanthus parviflorus* (38.5 µm), *Sacleuxia newii* (38.9 µm) and *Mangenotia eburnea* (39 µm). The largest mean decussate tetrad was observed in *Baseonema gregorii* (60 µm) and *Mondia whitei* (55.7 µm).

***Pores:*** (Fig. 4.4 E, H). There are 4–6 pores per grain in all the species examined. The exception is *Baseonema gregorii* where 8–10 pores have been observed. The pores are round to oval and are situated at the junction area of adjacent grains. The pore edge is often uneven and beset with granules, while the pores themselves are sometimes covered with a thin layer of exine material (Fig. 4.1 M, N; 4.2 B, C). The pores range in size from 1.3 – 6.3 µm.

In all the genera, the ***exine*** is smooth, and consists of a distal stratum (tectum) subtended by a granular stratum. The granular stratum consists of unequal sized granules (Fig. 4.4 A, B, D, G). The intine is well developed (Fig. 4.4 A, C, F). The inner walls separating the individual grains of the tetrad have the same structure as the exterior wall, consisting of tectum, granular stratum and intine. The walls are, however, not continuous, but interrupted by wall bridges consisting of intine and a granular stratum (Fig. 4.4 C, F).

***Translators:*** There are five translators per flower positioned between the anthers, with the stalk fitting in a groove on the stigmatic head. The translator consists of a spoon, stalk and adhesive disc (Fig. 4.5 A – P). The stalk forms the connection between the spoon and adhesive disc. The spoon is the uppermost part of the translator and the pollen carrying part. It has an adhesive surface, which carries the pollen tetrads. In the investigated species there is not a clear distinction between spoon and stalk. There is a gradual transition from spoon to stalk, making demarcation between spoon and the stalk difficult (Fig. 4.5 G, O, P). The stalk measurements were taken from the base of the spoon (where it becomes narrow) to the upper end of adhesive disc. In most cases there is a median partition. The spoon varies from elliptic-linear in *Mangenotia eburnea* (Fig. 4.5 G), broadly elliptic in *Zacateza pedicellata* (Fig. 4.5 O, P) and ovate to broadly ovate in the rest of the species. The adhesive disc is positioned more or less at right angles to the base of the stalk or in an oblique position (Fig. 4.5 N). The size of the translators is presented in Table 4.2.

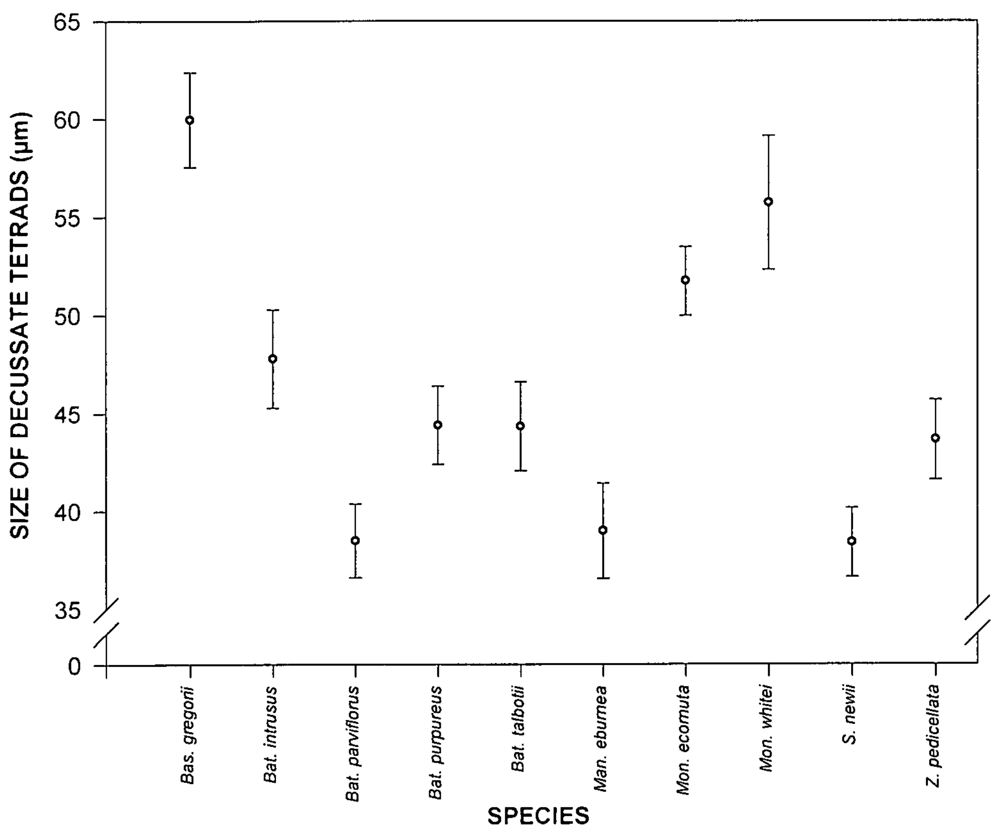



**Figure 4:** Differences in pollen range (size) of the Periplocoideae species.

**TABLE 4.1 - DIAMETER OF POLLEN TETRADS (µm)**

| TAXON | COLLECTOR(S) & NUMBER | **RANGE** - DECCUSATE TETRADS | Average ± Std.Dev. |
|---|---|---|---|
| *Baseonema gregorii* | Field & Powys 174 | **[55.92** (51.15 - 60.45) ± **2.59]** x **[56.36** (52.08 - 60.45) ± **2.15]** | |
| *Baseonema gregorii* | Faden, R.B. & A.J. 74/436 | **[69.69** (66.03 - 71.61) ± **1.55]** x **[69.63** (66.96 - 72.54) ± **1.61]** | |
| *Baseonema gregorii* | Verdcourt & Polhill 2695 | **[53.94** (47.43 - 64.17) ± **3.58]** x **[54.18** (51.15 - 63.24) ± **3.01]** | |
| | | **[59.85** (47.43 - 71.61) ± **2.57]** x **[60.06** (51.15 - 72.54) ± **2.26]** | **59.96 ± 2.42** |
| | | | |
| *Batesanthus intrusus* | Louis, J. 12992 | **[50.08** (46.50 - 56.73) ± **3.11]** x **[49.10** (43.68 - 54.87) ± **3.03]** | |
| *B.intrusus* | | **[46.07** (42.78 - 49.29) ± **1.82]** x **[45.87** (41.85 - 48.36) ± **2.03]** | |
| | | **[48.08** (42.78 - 56.73) ± **2.47]** x **[47.48** (41.85 - 54.87) ± **2.53]** | **47.78 ± 2.50** |
| | | | |
| *Batesanthus parviflorus* | Deighton, F.C. 3265 | **[35.03** (32.55 - 39.06) ± **2.01]** x **[35.59** (32.55 - 39.06) ± **1.91]** | |
| *B. parviflorus* | Polhill, R.M. & Kirkup, D.W. 5190 | **[42.72** (39.99 - 44.64) ± **1.94]** x **[41.17** (39.06 - 44.64) ± **1.88]** | |
| *B. parviflorus* | Gossweir, J. 8468 | **[38.32** (35.34 - 41.85) ± **1.66]** x **[38.01** (35.34 - 41.85) ± **1.92]** | |
| | | **[38.69** (32.55 - 44.64) ± **1.87]** x **[38.26** (32.55 - 44.64) ± **1.90]** | **38.48 ± 1.89** |
| | | | |
| *Batesanthus purpureus* | Bates, G.L. 383 | **[42.07** (38.13 - 47.43) ± **1.80]** x **[42.35** (39.06 - 45.57) ± **1.43]** | |
| *B. purpureus* | Le Testu, M. 5493 | **[46.94** (41.85 - 54.87) ± **2.51]** x **[46.16** (41.85 - 51.15) ± **2.26]** | |
| | | **[44.51** (38.13 - 54.87) ± **2.16]** x **[44.26** (39.06 - 51.15) ± **1.85]** | **44.39 ± 2.01** |
| | | | |
| *Batesanthus talbotii* | Talbot, T.A. 63 | **[41.51** (38.13 - 46.50) ± **2.06]** x **[42.56** (38.13 - 48.36) ± **2.03]** | |
| *B. talbotii* | Talbot, T.A 2021 | **[46.53** (42.78 - 53.94) ± **2.47]** x **[46.72** (42.78 - 53.01) ± **2.08]** | |
| | | **[44.02** (38.13 - 53.94) ± **2.27]** x **[44.64** (42.78 - 53.94) ± **2.28]** | **44.33 ± 2.28** |
| | | | |
| *Mangenotia eburnea* | Thomas, N.W. 4628 | **[41.85** (40.92 - 42.78) ± **1.32]** x **[40.46** (39.06 - 41.85) ± **1.97]** | |
| *M. eburnea* | Adam, J. 30434 | **[36.72** (33.82 - 41.85) ± **2.77]** x **[36.64** (32.55 - 44.64) ± **3.65]** | |
| | | **[39.29** (33.82 - 42.78) ± **2.05]** x **[38.55** (32.55 - 44.64) ± **2.81]** | **38.98 ± 2.43** |
| | | | |
| | | | |
| | | | |
| | | | |

**TABLE 4.1** - **DIAMETER OF POLLEN TETRADS (μm)**

| TAXON | COLLECTOR(S) & NUMBER | **RANGE** - DECUSSATE TETRADS | Average ± Std. Dev. |
|---|---|---|---|
| | | | |
| *Mondia ecornuta* | Allen, C.E.F. 139 | **[52.05** (48.36 - 55.80) ± **1.85]** x **[50.97** (48.36 - 54.87) ± **1.52]** | |
| *M. ecornuta* | Faulkner, H.G. 558 | **[51.93** (48.36 - 55.80) ± **1.99]** x **[51.90** (49.29 - 54.87) ± **1.59]** | |
| | | **[51.99** (48.36 - 55.80) ± **1.92]** x **[51.44** (48.36 - 54.87) ± **1.56]** | **51.72 ±1.74** |
| | | | |
| *Mondia whitei* | Pienaar, B.J. 170 | **[51.68** (48.36 - 56.73) ± **1.73]** x **[51.31** (54.87 - 64.17) ± **2.00]** | |
| *M. whitei* | Meedley Wood 6180 | **[59.71** (53.94 - 65.10) ± **3.24]** x **[59.46** (54.87 - 64.17) ± **2.93]** | |
| *M. whitei* | Ward 3626 | **[56.61** (52.08 - 69.75) ± **4.94]** x **[56.54** (51.15 - 69.75) ± **4.76]** | |
| *M. whitei* | Verhoeven & Venter 9329 | **[58.22** (52.08 - 64.17) ± **3.49]** x **[59.21** (52.08 - 65.10) ± **4.24]** | |
| *M. whitei* | Scheepers 1058 | **[51.77** (43.71 - 60.45) ± **4.87]** x **[50.99** (45.57 - 57.66) ± **3.81]** | |
| *M. whitei* | Leewenberg, A.J.M. 10026 | **[53.44** (49.29 - 58.59) ± **2.03]** x **[54.19** (51.15 - 55.80) ± **2.03]** | |
| *M. whitei* | Venter, H.J.T. 9282 | **[58.75** (53.01 - 64.17) ± **3.83]** x **[57.97** (54.87 - 65.10) ± **3.66]** | |
| | | **[55.74** (43.71 - 69.75) ± **3.48]** x **[55.67** (45.57 - 69.75) ± **3.35]** | **55.71 ± 3.42** |
| | | | |
| *Sacleuxia newii* | Verdcourt 246 | **[35.57** (35.34 - 41.85) ± **1.87]** x **[36.83** (35.34 - 38.13) ± **1.00]** | |
| *S. newii* | Drummond & Hemsley 3364 | **[37.08** (35.34 - 39.06) ± **1.10]** x **[37.45** (35.34 - 41.85) ± **1.63]** | |
| *S. newii* | Greenway & Kanuri 12852 | **[42.35** (37.20 - 47.43) ± **2.24]** x **[41.91** (39.06 - 46.50) ± **2.24]** | |
| | | **[39.00** (35.34 - 47.43) ± **1.62]** x **[38.73** (35.34 - 46.50) ± **1.62]** | **38.87 ± 1.77** |
| | | | |
| *Sacleuxia tuberosa* | **NO POLLEN** | | |
| | | | |
| *Sarcorrhiza epiphytica* | **NO POLLEN** | | |
| | | | |
| *Zacateza pedicellata* | Louis, J. 106 | **[43.56** (39.99 - 46.50) ± **1.86]** x **[42.44** (37.20 - 48.36) ± **2.11]** | |
| *Z. pedicellata* | Muusa, J. 3488 | **[44.55** (39.06 - 47.43) ± **2.12]** x **[43.93** (39.06 - 47.43) ± **2.08]** | |
| | | **[44.06** (39.06 - 47.43) ± **1.99]** x **[38.73** (37.20 - 48.36) ± **2.10]** | **43.63 ± 2.05** |
| | | | |
| | | | |

| TABLE 4.2 - SIZE (µm) OF THE TRANSLATORS & SPOON SHAPE | | | | | |
|---|---|---|---|---|---|
| SPECIES | TOTAL LENGTH | SPOON LENGTH | SPOON WIDTH | STALK LENGTH | SPOON SHAPE |
| *Baseonema gregorii* | 1678.88 | 922.63 | 550.55 | 756.25 | Broadly - ovate |
| *Baseonema gregorii* | 1881.55 | 918.09 | 592.9 | 947.83 | Broadly - ovate |
| *Baseonema gregorii* | 2109.03 | 1082.95 | 650.38 | 1026.08 | Ovate |
| *Baseonema gregorii* | **Ave.: 1889.82** | **974.56** | **597.94** | **910.05** | |
| | | | | | |
| *Batesanthus intrusus* | 812.72 | 578.78 | 252.15 | 233.93 | Ovate |
| *Batesanthus intrusus* | 1119.25 | 756.25 | 338.8 | 332.75 | Ovate to Angular ovate |
| *Batesanthus intrusus* | **Ave.: 965.99** | **667.52** | **295.46** | **283.34** | |
| *Batesanthus parviflorus* | 595.93 | 396.28 | 257.13 | 199.65 | Broadly ovate with ± round apex |
| *Batesanthus parviflorus* | 662.48 | 496.1 | 378.13 | 166.38 | Broadly ovate with acute apex |
| *Batesanthus parviflorus* | **Ave.: 629.21** | **446.19** | **317.63** | 183.02 | |
| *Batesanthus purpureus* | 1249.33 | 913.55 | 465.85 | 378.13 | Broadly ovate to Angular ovate |
| *Batesanthus purpureus* | | | | | Broadly ovate |
| *Batesanthus talbotii* | 1288.65 | 681.63 | 369.05 | 583.83 | Broadly ovate to Angular ovate |
| | | | | | |
| *Mangenotia eburnea* | | | | | Elliptic-linear |
| *Mangenotia eburnea* | | | | | Elliptic-linear |
| | | | | | |
| *Mondia ecornuta* | 2305.05 | 1839.2 | 1119.25 | 465.85 | Ovate to broadly ovate |
| *Mondia whitei* | 2994.75 | 847 | 2032.8 | 961.95 | Broadly ovate |
| *Mondia whitei* | 2964.5 | 411.4 | 1960.2 | 1004.3 | Ovate |
| *Mondia whitei* | 2432.1 | 490.05 | 1530.65 | 901.45 | Ovate |
| *Mondia whitei* | **Ave.: 2797.12** | **582.82** | **1841.22** | **955.9** | |
| | | | | | |
| *Sacleuxia newii* | 543.48 | 314.6 | 292.42 | 96.8 | Broadly ovate to Angular ovate |
| *Sacleuxia newii* | 496.6 | 290.4 | 293.93 | 116.46 | Broadly ovate to Cordate |
| *Sacleuxia newii* | **Ave.: 520.04** | **302.5** | **293.18** | **106.63** | |
| *Sacleuxia tuberosa* | | | | | Ovate |
| | | | | | |
| *Sarcorhiza epiphytica* | | | | | Ovate |
| | | | | | |
| *Zacateza pedicellata* | 1220.08 | | 445.68 | | Broadly elliptic |
| *Zacateza pedicellata* | 1382.43 | | 438.63 | | Elliptic |
| Zacateza pedicellata | **Ave.: 1301.26** | | **442.16** | | |

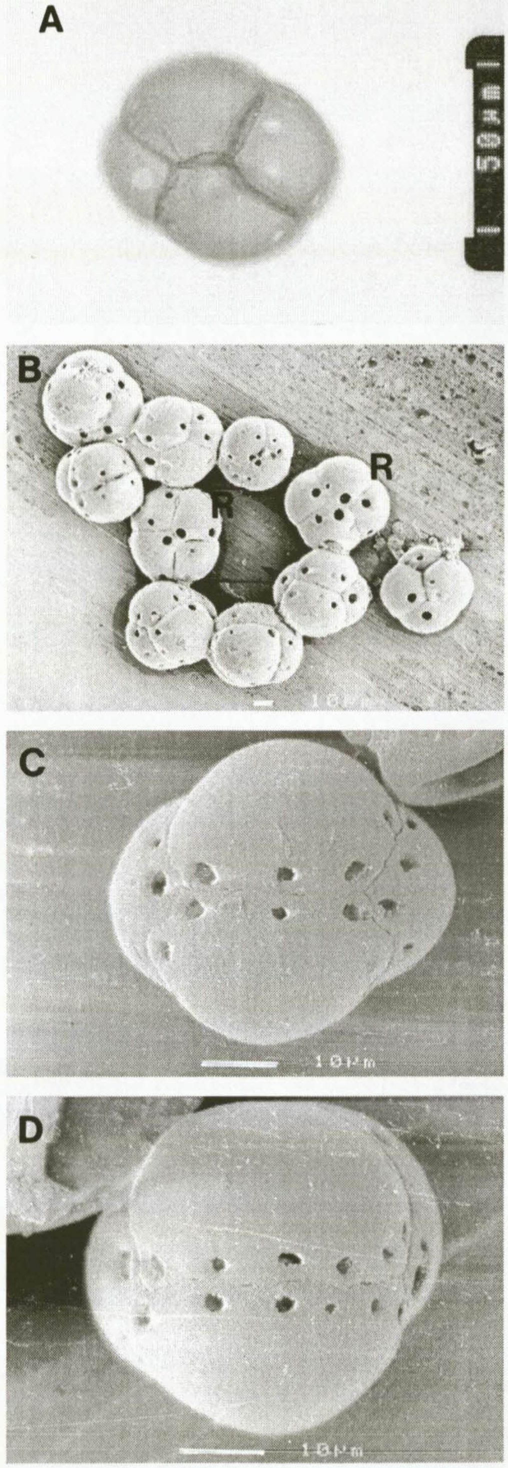
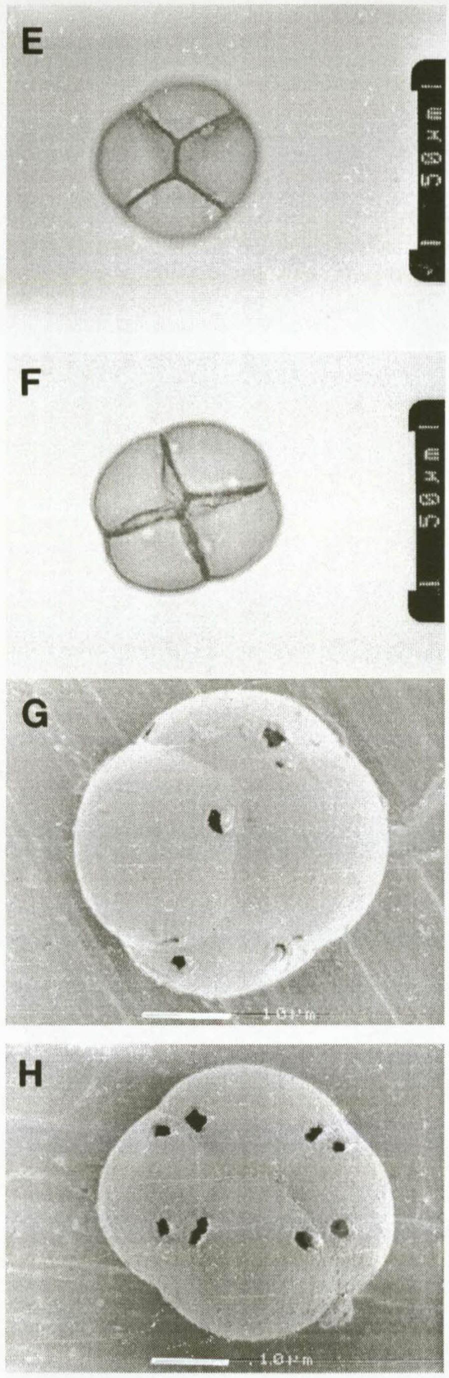
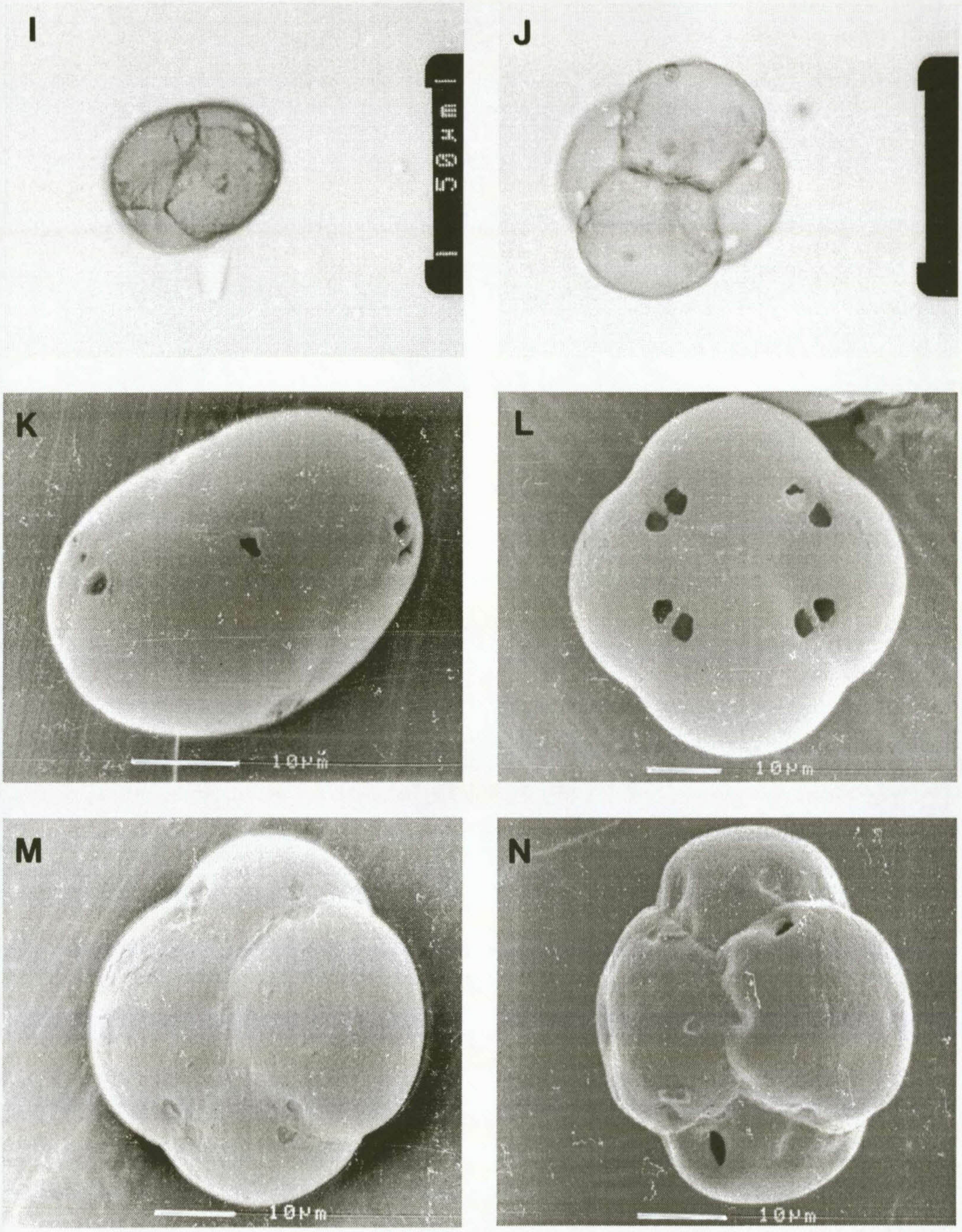



**Figure 4.1 Decussate pollen tetrads of *Baseonema gregorii:*** (**A**) LM micrograph. *Field & Powys 174.* (**B**) A group of tetrads showing different arrangements (**R = rhomboidal**). *Faden, R.B. & A.J.* $^{74}/_{436}$. (**C**) A grain showing adjacent pores. *Field & Powys 174.* (**D**) A grain showing multi pores. *Faden, R.B. & A. J.* $^{74}/_{436}$. Scale bar: A = 50 µm; B–D = 10 µm




**…Figure 4.1 Decussate pollen tetrads of *Batesanthus* sp.:** (**E**) *B. intrusus. Adam, J.G. 30433.* (**F**) *B. purpureus. Le Testu, M.G. 5493.* (**G**) *B. parviflorus. Polhill & Kirkup 5190.* (**H**) Grain showing irregular and rounded pores. *B. talbotii. Talbot, T.A. 2021.*

Scale bar: E–F = 50 µm; G–H = 10 µm




**...Figure 4.1 Decussate pollen tetrads:** (**I**) *Mangenotia eburnea. Thomas, N.W. 4628.* (**J**) *Mondia whitei. Strey, R. G. 10347.* (**K**) Grain with partially covered pores. *Mangenotia eburnea. Adam, J.G. 3043.* (**L**) *Mondia ecornuta. Faulkner H.G. 558.* (**M**) Grain showing partially covered pores. *Mondia ecornuta. Faulkner, H.G. 558.* (**N**) Grain showing partially covered pores. *Zacateza pedicellata. Schweinfurth, G. 3488.*

Scale bar: I–J = 50 μm; K–N = 10 μm

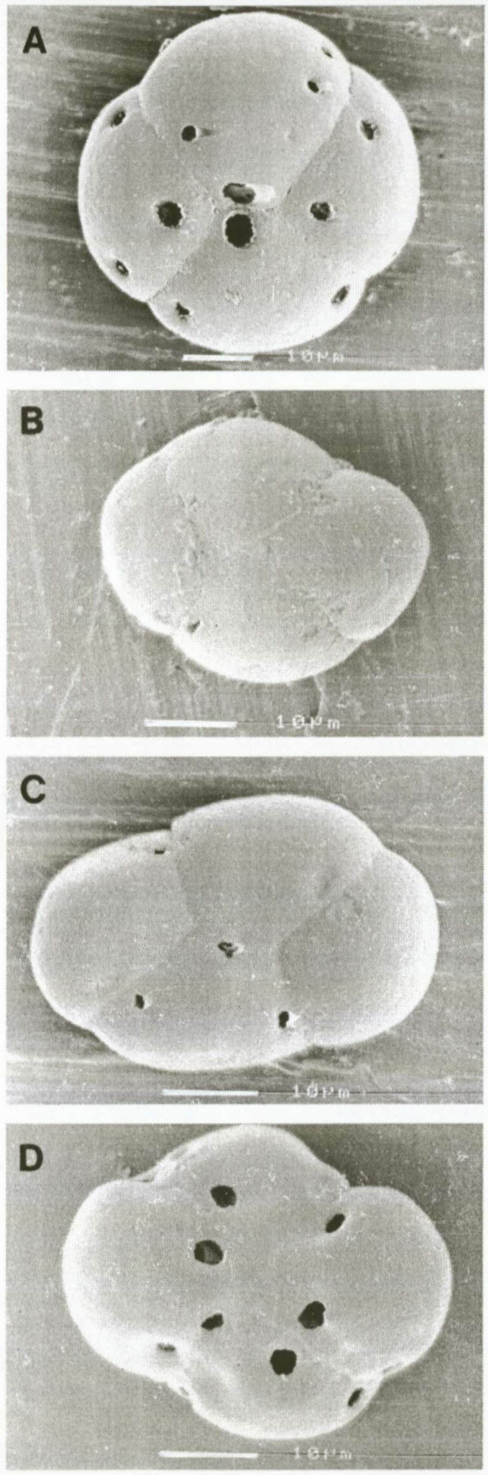



**Figure 4.2 Rhomboidal pollen tetrads:** (**A**) Grain of *Baseonema gregorii. Field & Powys 174.* (**B**) Grain with covered pores. *Batesanthus intrusus. Louis, J. 12992.* (**C**) Grain with partially covered pores. *Batesanthus purpureus. Faulkner, H.G. 558.* (**D**) Grain of *Zacateza pedicellata. Schweinfurth, G. 3488.*
Scale bar: A–D = 10 µm

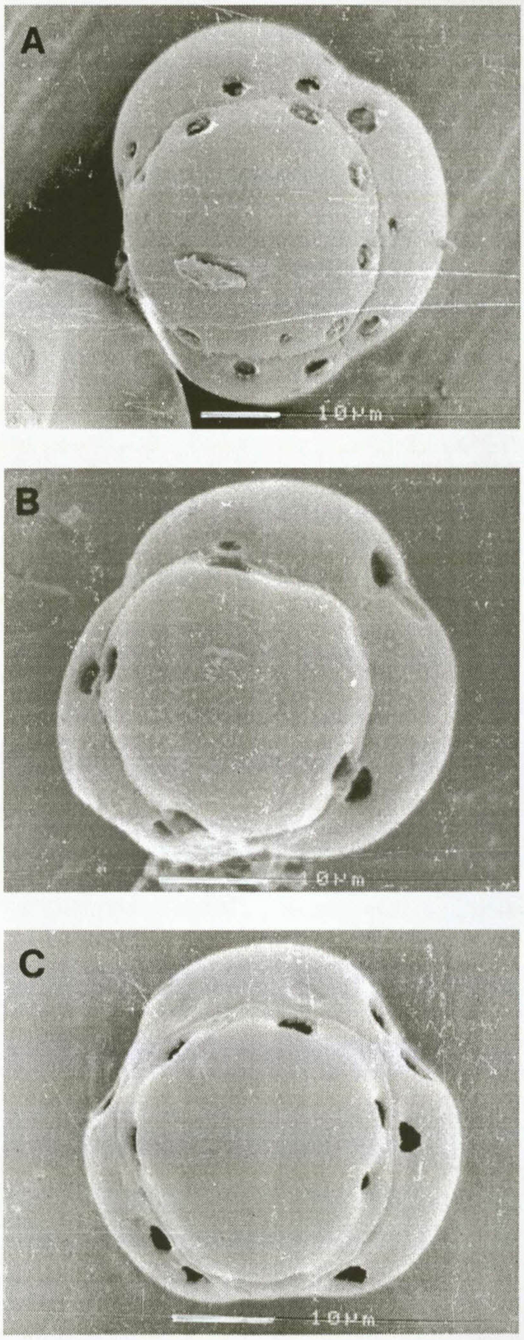



**Figure 4.3 Tetrahedral pollen tetrads:** (**A**) Grain of *Baseonema gregorii. Verdcourt & Polhill 2695.* (**B**) Grain of *Mondia ecornuta. Faulkner, H.G. 558.* (**C**) Grain of *Zacateza pedidellata. Louis, J. 106.*

Scale bar: A–D = 10 µm

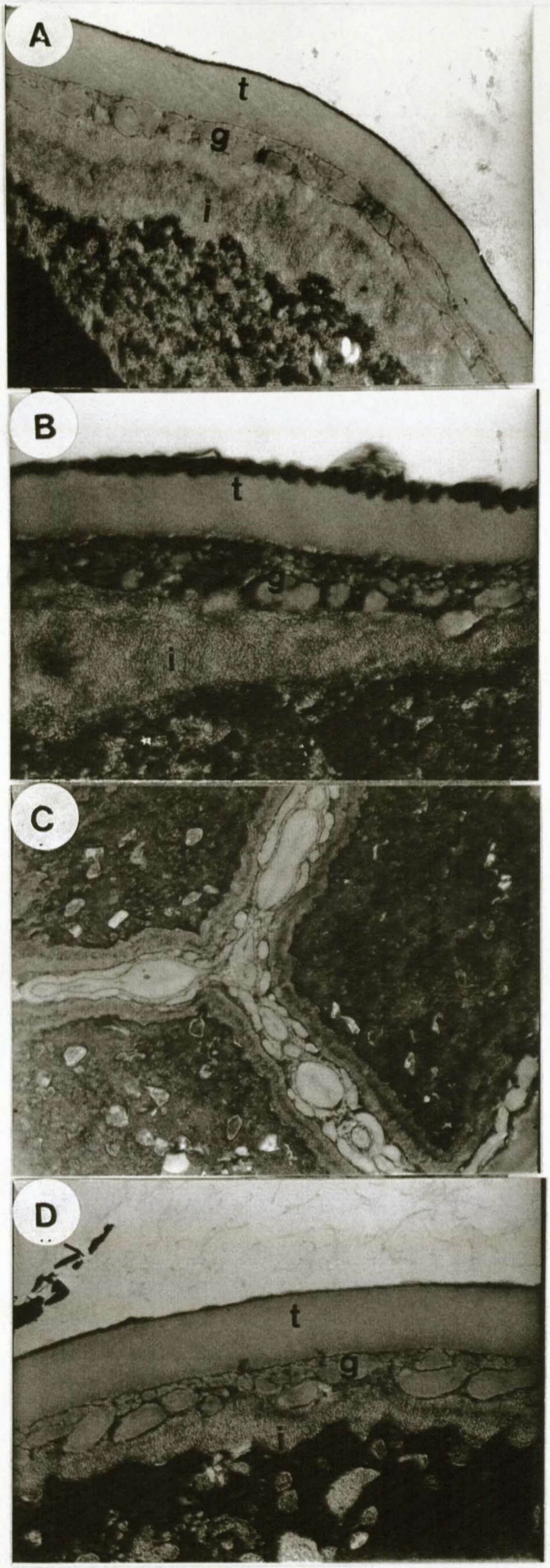
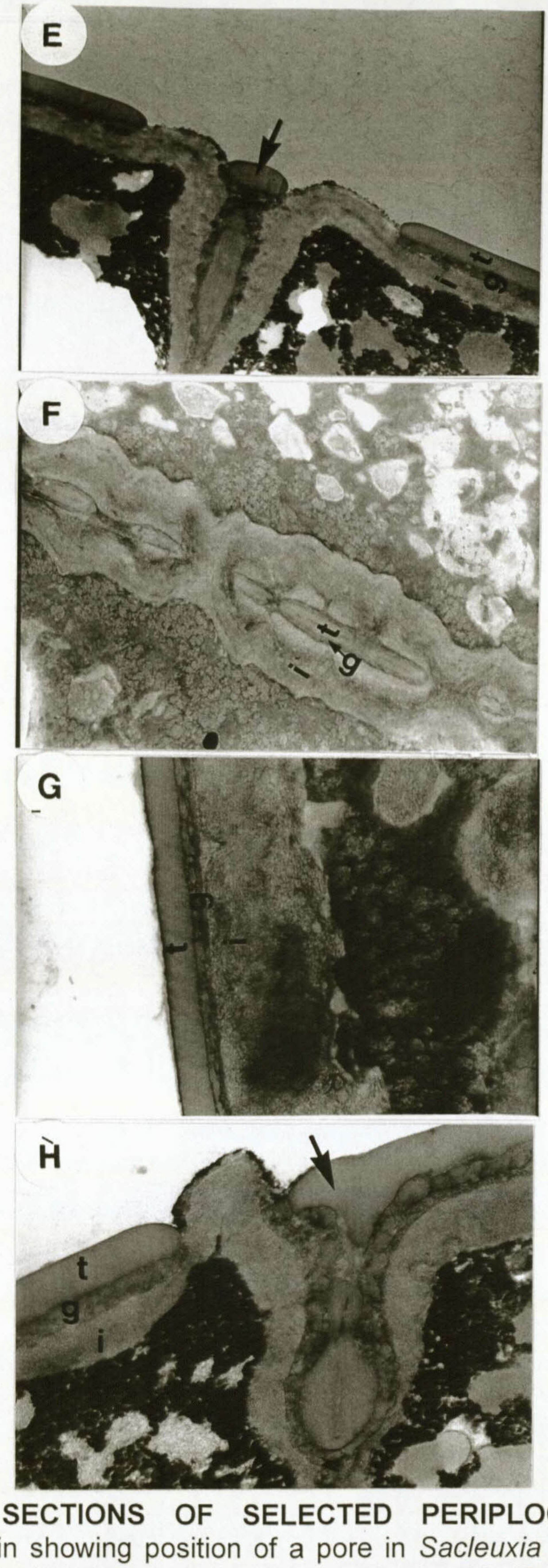



**Figure 4.4 TEM SECTIONS OF SELECTED PERIPLOCOID POLLEN GRAINS:** (**A**) Outer wall of *Batesanthus parviflorus. Polhill & Kirkup 5190.* (**B**) Outer wall of **B**. *parviflorus* showing granulose substances of the surface. *Deighton, F.C. 3265.* (**C**) Inner walls of *Mondia ecornuta. Faulkner, H.G. 558.* (**D** Outer wall of *M. ecornuta. Faulkner, H.G. 558.*

**i** = intine, g = granular. **t** = tectum




**...Figure 4.4 TEM SECTIONS OF SELECTED PERIPLOCOID POLLEN GRAINS:** (**E**) A grain showing position of a pore in *Sacleuxia newii. Verdcourt 246.* (**F**) Inner walls of *Zacateza pedicellata. Louis, J. 106.* (**G**) Outer wall of *Z. pedicellata. Muusa, J. 3488.* (**H**) A grain showing position of a pore in *Z. pedicellata. Louis, J. 106.*

**i** =**int**ine, **g** = granular, **t**= tectum; ↓ = pore

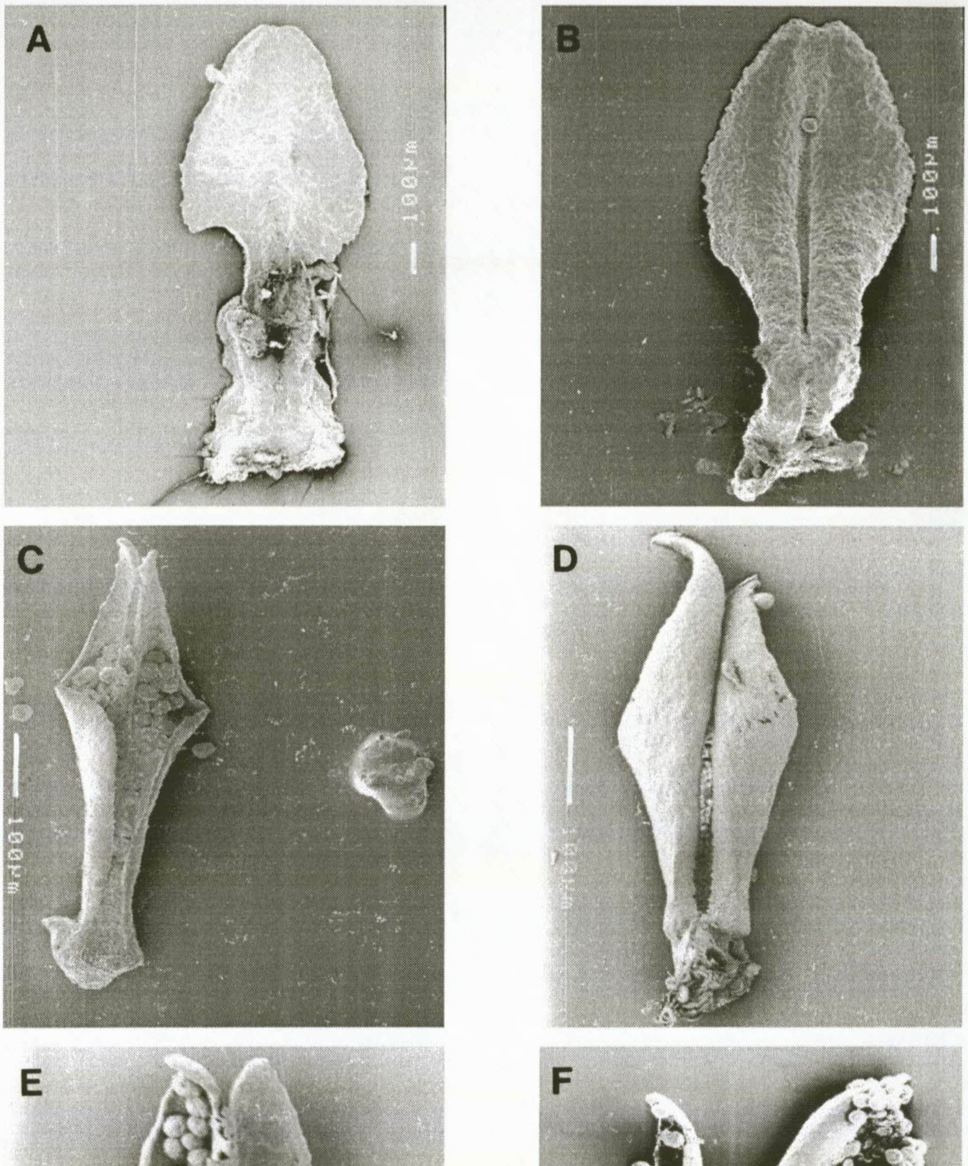
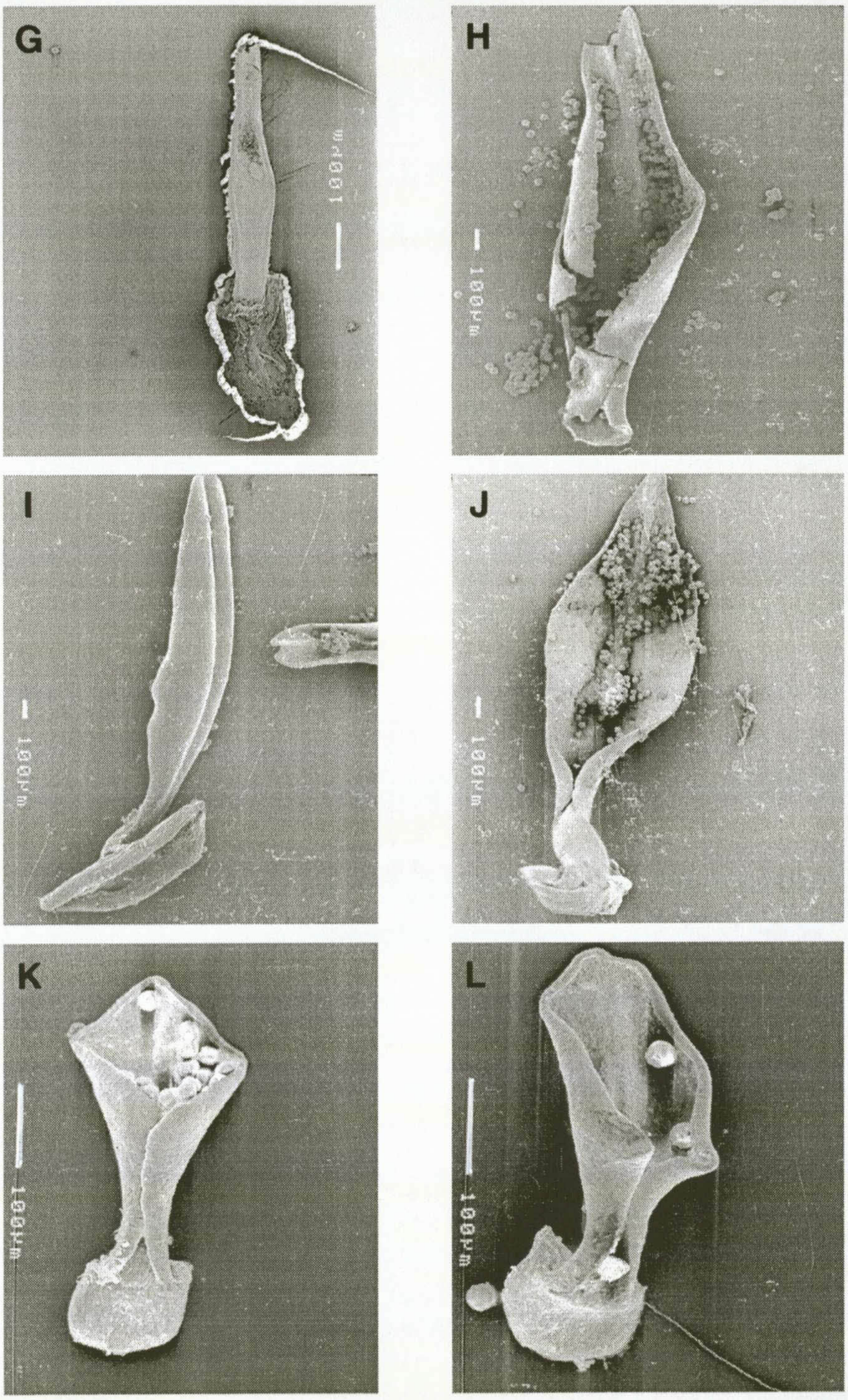


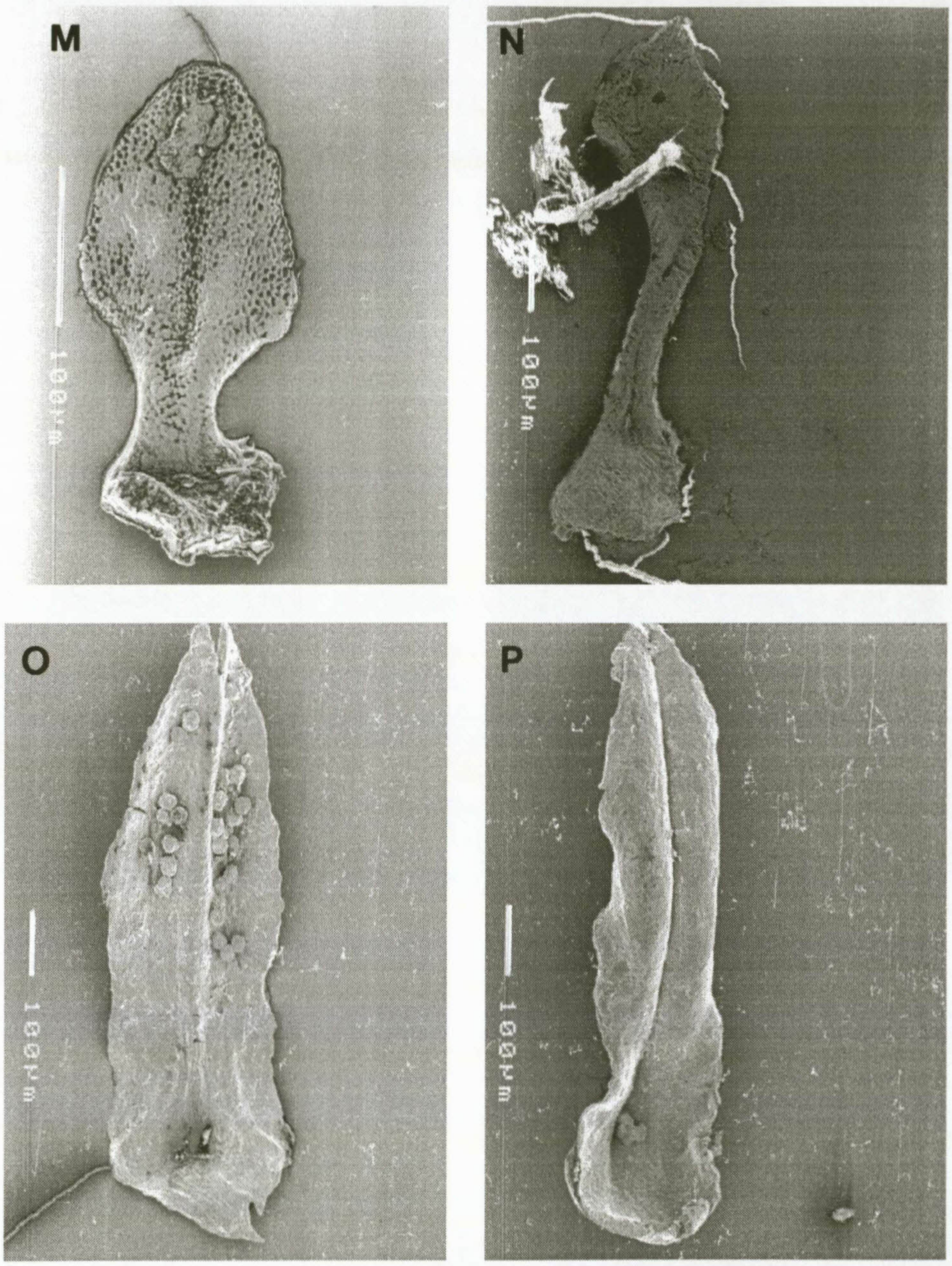

**Figure 4.5 TRANSLATORS OF SELECTED PERIPLOCOID SPECIES:** (**A**) Ovate spoon of *Baseonema gregorii. Verdcourt & Polhill 2695.* (**B**) Ovate spoon of *B. gregorii. Verdcourt & Polhill 2695.* (**C**) Broadly ovate spoon of *Batesanthus intrusus. Tisserant 1480.* (**D**) Broadly ovate spoon of *Batesathus parviflorus. Polhill & Kirkup 5190.* (**E**) Broadly ovate spoon of *B. parviflorus. Polhill & Kirkup 5190.* (**F**) Broadly ovate spoon of *Batesanthus talbotii. Talbot 2021.*

Scale bar = 100 µm




...**Figure 4.5 TRANSLATORS OF SELECTED PERIPLOCOID SPECIES:** (**G**) Elliptic-linear spoon of *Mangenotia eburnea. Leeuwenberg 8083.* (**H**) Ovate spoon of *Mondia ecornuta. Faulkner, H.G. 558.* (**I**) Broadly ovate spoon of *Mondia whitei. Strey, R.G. 10347.* (**J**) Ovate spoon of *M. whitei. Strey, R.G. 10347.* (**K**) Angular ovate spoon of *Sacleuxia newii. Verdcourt 246.* (**L**) Broadly ovate spoon of *S. newii. Greenway & Kanuri 12852.*

Scale bar = 100 µm




…**Figure 4.5 TRANSLATORS OF SELECTED PERIPLOCOID SPECIES:** (**M**) Ovate spoon of *Sacleuxia tuberosa. Tanner, R.E.S. 360.* (**N**) Ovate spoon of *Sarcorrhiza epiphytica. Semsei 2957.* (**O**) Broadly elliptic spoon of ***Zacateza*** *pedicellata. Louis, J. 106.* (**P**) Broadly elliptic spoon of *Z. pedicellata. Louis, J. 106.*

Scale bar = 100 µm

## 4.3 DISCUSSION AND CONCLUSIONS:

Palynological characters, namely pollen morphology (size, shape/arrangement and number of pores), the translator (shape) and the structure of the exine have been looked into to establish their taxonomic value.

Pollen morphology is uniform within the subfamily although some variations or exceptions do occur. *Raphionacme* Harv. is the one genus that can be distinguished by the 8–16 pores per pollen gain (Schill & Jäkel 1978, Verhoeven & Venter 1988) as against 4–6 in the other genera. So far, two genera namely *Schlechterella* K. Schum. (Verhoeven & Venter (1998b) and *Raphionacme* (Verhoeven & Venter 1988, Nilsson *et al.* 1993) are known to have multiporate pollen grains. In this study, it was observed that *Baseonema* has 8–10 pores per grain and thus can be distinguished from other genera. Having numerous pores could be regarded as more advanced than genera with 4–6 pores per grain (Nilsson *et al.* 1993). Otherwise, genera with pollinia are regarded as more advanced than other taxa within the Periplocoideae.

The decussate tetrad size of tetrads varies within the species investigated. The decussate tetrad size of *Baseonema gregorii* and *Mondia whitei* may be used to distinguish them from the other investigated species. To some extent, the size of the tetrad may be used to distinguish species that are easily confused, e.g. *Baseonema* and *Batesanthus.* Size of the tetrads has been used by Verhoeven & Venter (1994) to delimit between species of *Periploca* L.

Three common arrangements of tetrads were recognized, those are decussate, rhomboidal and tetrahedral grains. In one genus you may find all three kinds of arrangement.

In the representatives of the Periplocoideae studied so far, the exine structure consisting of a solid stratum (tectum), shows little variation (Verhoeven & Venter 1988, 1993, 1994a, b). *Camptocarpus* Decne. differs from other Periplocoideae genera in that the exine consists of a tectum, granular stratum and foot layer (Verhoeven & Venter 1994b). The exine structure of the five genera investigated in this study appears to be without variation.

Although small differences may occur, the pollen morphology of the taxa investigated is rather uniform and thus of little value in the distinction of the species and genera investigated.

The unique tri-partite translator of the Periplocoideae consists of the spoon, stalk and an adhesive disc. The adhesive spoon, which carries the pollen tetrads, varies in shape and size between genera. Arekal & Ramakrishna (1980) refer to the shovel (spoon) shaped with a median partition as the most specialized. The spoon of *Baseonema gregorii, Batesanthus intrusus. B. parviflorus, B. talbotii, Mondia whitei* and *Sacleuxia tuberosa* also have a median partition. The same structural type has been observed in *Tacazzea apiculata* Oliv., *T. rosmarinifolia* (Decne.) N.E. Br. and *T. venosa* Decne. (Venter *et al.* 1990a), *Hemidesmus indicus* (L.) R. Br. and *Decalepis hamiltonii* Wt. & Arn. (Arekal & Ramakrishna 1980), *Raphionacme dyeri* Retief & Venter (Verhoeven & Venter 1997).

Translators where the spoon gradually narrows toward the base thus making demarcation between the spoon and the stalk difficult have been observed. This feature is also referred to as an extended spoon. This kind of translator has been found in *Raphionacme caerulea* E.A. Bruce, *R. keayii* Bullock, *R. lanceolata* Schinz., *R. longituba* E.A. Bruce, *R. madiensis* S. Moore and *R. michelli* De Wilde (Verhoeven & Venter 1997). Also in *Cryptolepis oblongifolia* (Meisn.) Schltr. (Venter & Verhoeven 1997) and *C. yemenensis* Venter & R.L.Verh. (Venter & Verhoeven 1999). In the Apocynaceae *s.l.* a few genera are characterised by the presence of a primitive translator development (Verhoeven & Venter 1997).

This study shows that translators have variable spoon-shape types and therefore of taxonomic value, especially at generic level.

# CHAPTER 5

## SEED SURFACE MORPHOLOGY

### 5.1 INTRODUCTION:

The Asclepiadaceae (incl. Periplocaceae) and Apocynaceae *s.s.* are derived from schizocarpous gynoecia with ovaries united only by their styles or stigmas and the seeds do not remain attached along a marginal placenta (Spjut 1994). The gynoecium consists of two free semi-inferior ovaries with numerous ovules. The two styles are free below, but fused towards the apex, and dilate into a stigmatic head. The ovules are more or less anatropous, unitemic (i.e. uni-integumented and not provided with a tegmen) and tenuinucellate (Corner 1976). Frequently, only one fruitlet of a schizocarpous follicular gynoecium matures (Cronquist 1981), in which case the fruit is a follicle. The fruit consists of a paired or single follicle(s). The shape and texture of the follicles may be fairly constant within a genus, as in *Cryptolepis* R. Br., or vary greatly as in *Tacazzea* Decne. and *Raphionacme* Harv. (Venter & Verhoeven 1997). According to Dave & Kuriachen (1991), anatomical features of the follicles may be significant for higher level distinction.

The Periplocoideae seeds are usually narrowly elliptical in outline, numerous, flattened or compressed and characteristically dispersed by wind. Attached at the rear micropylar end is a coma of hairs. Although rare, variations do occur, for instance, there is no obvious coma at the micropylar end, instead seeds have a dense fringe of hairs around the entire margin.

The possibility that seed epidermal surface varies between genera has been taken into consideration in this study. Little has been done on the seed surface morphology of the Periplocoideae, except for "a note on *Raphionacme namibiana*" (Bruyns 1994) and "A new species of *Cryptolepis* (Periplocoideae, Apocynaceae) from Arabia" (Venter & Verhoeven 1999).

## 5.2 RESULTS:

There is no specific classification system used but terminology used in this chapter is based on comparison with the works of: Demissew & Harley (1992), Venter (2000), Venter & Verhoeven (1999) and Venter *et al.* (1990).

The fruit is a paired follicle drying brown-black and the surface beset with longitudinal fissures. The seeds are brown-black and numerous. The shape is elliptic to obovate [Table 5.1], flattened and/or compressed with a raised longitudinal fissure along the center that is referred to as a funicular or raphe-groove in all taxa investigated except for *Batesanthus intrusus*. The tufted coma of cream-white to brownish hairs is generally attached at the micropylar end in all species under investigation, except for *Batesanthus intrusus* with hairs extending around the entire margin. The coma spreads out when dry and exposed to air (Fig. 5.6 D); thus showing that the seeds are wind dispersed.

***Baseonema gregorii:*** The seed surface is somewhat rugged without an obvious reticulate pattern (Fig. 5.1 A). Epidermal cells are slightly elongated and rectangular-like (Fig. 5.1 B), they are bordered by raised ridges along the margins. Seeds (Fig. 5.1 C) are elliptic to obovate and measure 10 x 3 mm whilst the length of the coma ranges from 8–12 mm.

***Batesanthus intrusus:*** Seeds are hairy, however, when hairs are removed, the seed surface is smooth and reticulated (Fig. 5.2 A). Epidermal cells in surface view are polygonal with about six sided cells. Seeds (Fig. 5.2 B) are elliptic, ranging from 9–12 x 3–4 mm in size and the length of the coma ranges from 47–50 mm in length. The coma of hairs extends around the entire margin instead of the usual micropylar coma. Hairs (Fig. 5.2 C) are attached from the bottom rear end and form a dense mat covering the whole one surface (adaxial) of the seed. The other (abaxial) surface is devoid of hairs.

***Mangenotia eburnea:*** Seed surface has a pitted epidermis (pores) with fine parallel running striations. There are about 3–5 pores at the edges of individual cells. Epidermal cells are almost polygonal, isodiametric in various directions and irregularly arranged. Anticlinal epidermal walls are mostly sinuate (Fig. 5.3 A, B). Seeds (Fig. 5.3 C) are elliptic, ranging from 7–8 x 3 mm in size and the length of the coma ranges from 43–45 mm. The coma at the micropylar end, when compared to other species in this study is relatively long (Table 5.1).

**Table 5.1: Seed Epidermal Characteristics.**

| TAXON | SEED SHAPE | SEED SIZE (mm) | LENGTH OF COMA (mm) | EPIDERMAL CELLS (Shape) | TESTA (Surface) |
|---|---|---|---|---|---|
| *B. gregorii* | Elliptic Obovate | 10 x 3 | 8–12 | Elongated & rectangular | Rugged |
| *B. intrusus* | Elliptic | 9–12 x 3–4 | 47–50 | Polygonal, 4–6 sided | Hairy |
| *M. eburnea* | Elliptic | 7–8 x 3 | 43–45 | Polygonal | Pitted with parallel striations |
| *M. whitei* | Elliptic Obovate | 7–9 x 2–3 | 23–34 | Polygonal to elongated | Smooth |
| *S. newii* | Elliptic | 7 x 2 | 29–34 | Polygonal, 4–6 sided | Slightly rough |
| *S. tuberosa* | Elliptic | 6–7 x 2 | 9–13 | Polygonal | Smooth |
| *Z. pedicellata* | Elliptic | 9 x 2–3 | 20–23 | Irregularly Polygonal | Smooth |

***Mondia whitei:*** The seed surface is smooth. Epidermal cells are polygonal, sometimes slightly elongated, with straight to slightly undulate walls (Fig. 5.4 A, B). The seeds (Fig. 5.4 C) are elliptic to obovate, ranging from 7–9 x 2–3 mm in size. The length of the coma ranges from 23–38 mm. The coma is attached to the micropylar end of the seed.

***Sacleuxia newii:*** The seed surface is slightly rough with small granular structures (Fig. 5.5 A). The epidermal cells are 4–6 sided (Fig. 5.5 B). The seeds (Fig. 5.5 C) are narrowly elliptic and range at 7 x 2 mm in size, with the length of the coma ranging from 23–29 mm.

***Sacleuxia tuberosa:*** The seed surface is smooth. Epidermal cells are polygonal and elongated to rectangular (Fig. 5.6 A, B). The seeds (Fig. 5.6 C) are elliptic, ranging from 6–7 x 2 mm in size and the length of the coma ranges from 9–13 mm. When dry (Fig. 5.6 D), the coma of hairs are spread out.

***Zacateza pedicellata:*** The seed surface is smooth. Epidermal cells are irregularly shaped with heavy ridges along anticlinal walls (Fig. 5.7 A). The seeds (Fig. 5.7 B, C) are elliptic and they range from 9 x 2–3 mm in size. The length of the coma ranges from 20–23 mm. The funicular or raphe-groove (Fig. 5.7 C) at the center is distinct in this species.

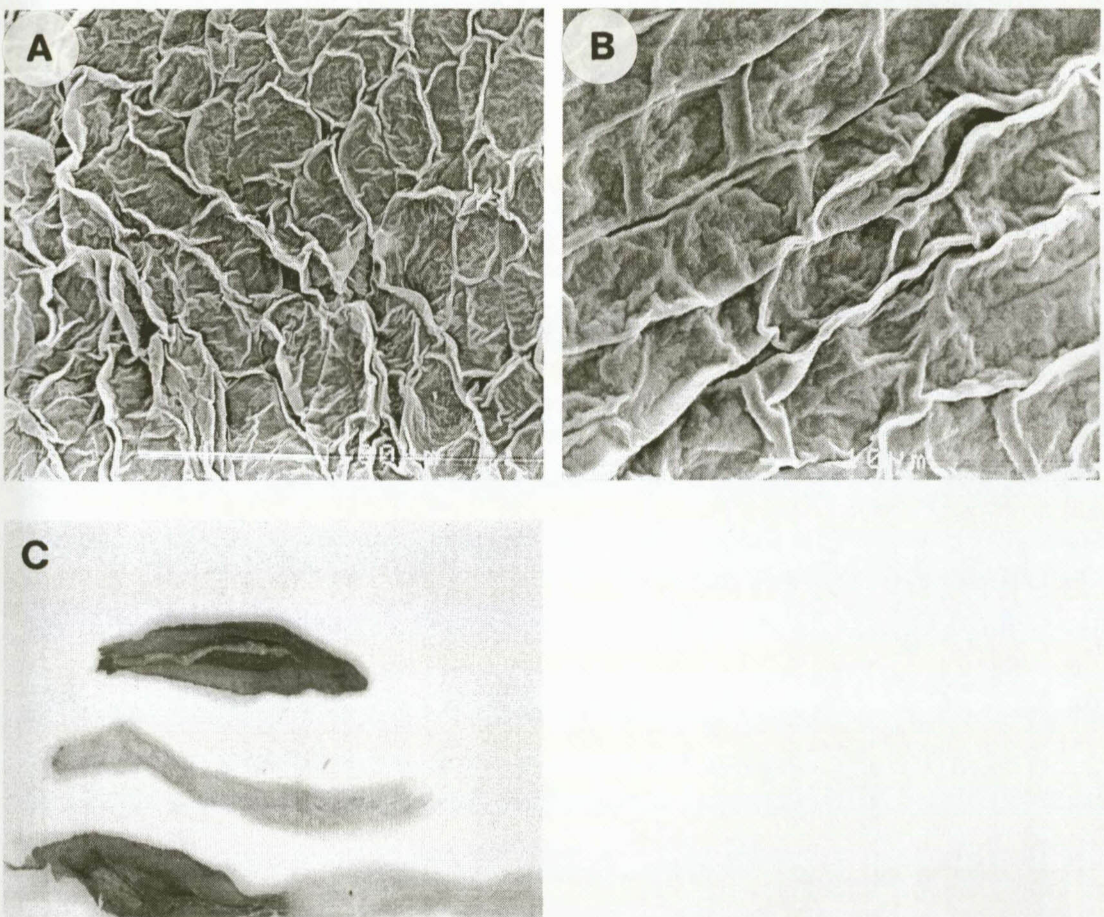



**Figure 5.1 Seed surface of *Baseonema gregorii:*** (A) rugged epidermal surface. (B) rectangular–like epidermal cells. (C) seeds with coma of hairs. All from *van Someren 184* (K). Scale bar: A, B = 10 µm

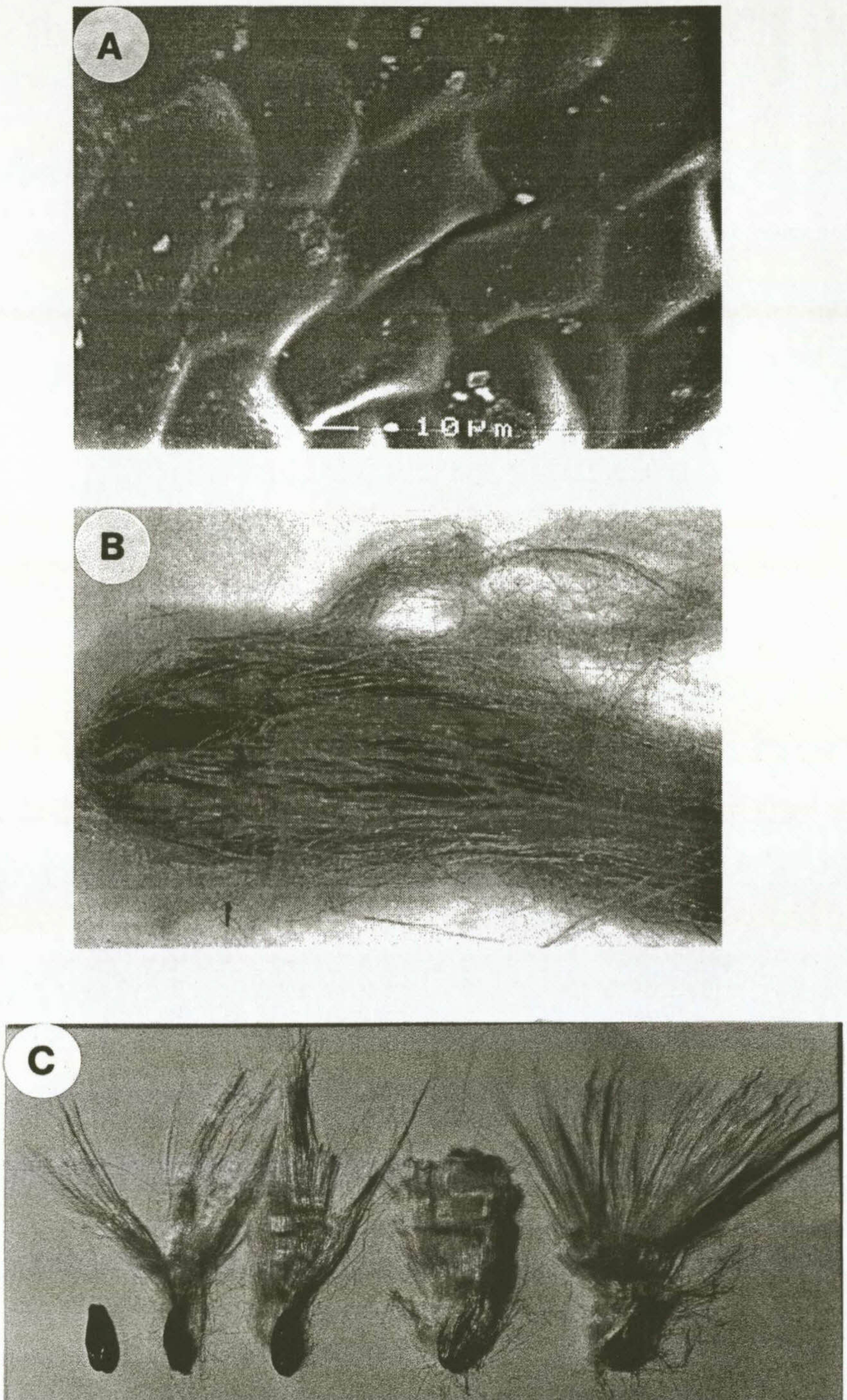



**Figure 5.2 Seed surface of *Batesanthus intrusus:*** (A) smooth surface with polygonal epidermal cells. (B – C) elliptic seed(s) with hairs extending around the entire margin covering the whole one surface. All from *Klaine, R.P. 513* (P).

Scale bar: A = 10 µm

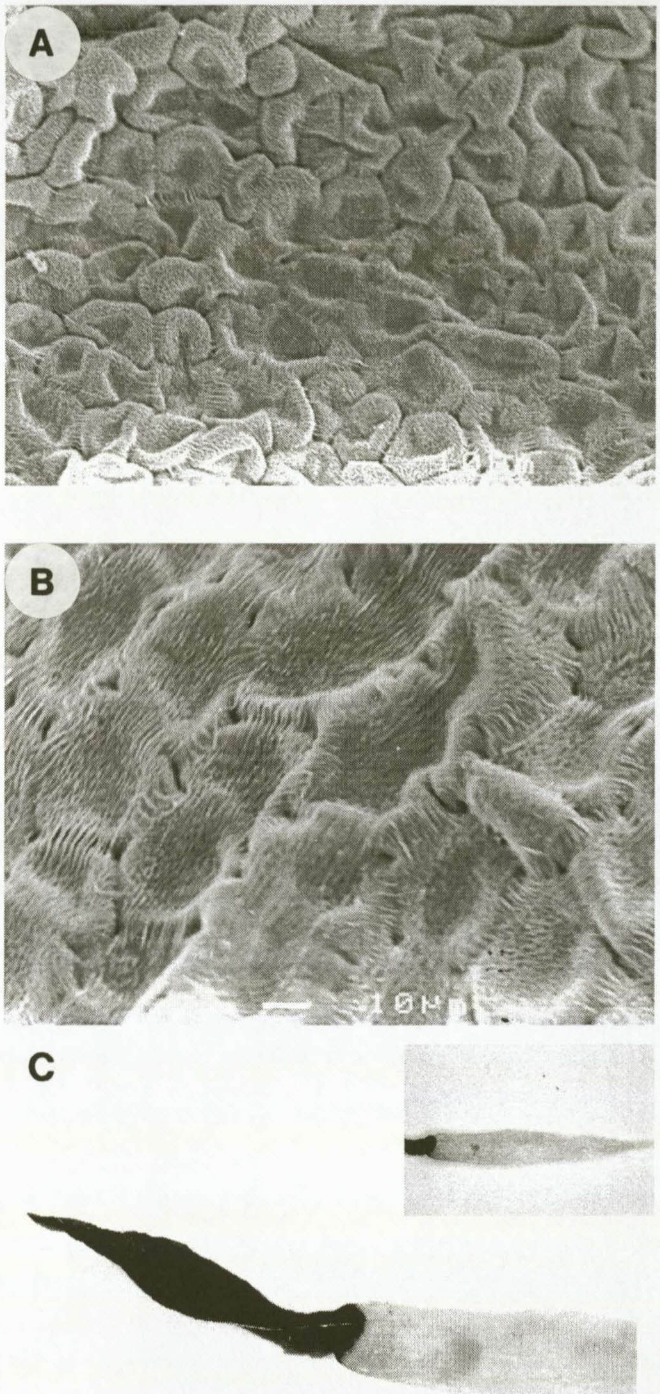



**Figure 5.3 Seed surface of *Mangenotia eburnea:*** (A–B) pitted surface, irregularly arranged epidermal cells with sinuate anticlinal walls. (C) seeds with coma of hairs. All from *Thomas, N.W. 4544* (K).

Scale bar: A, B = 10 µm

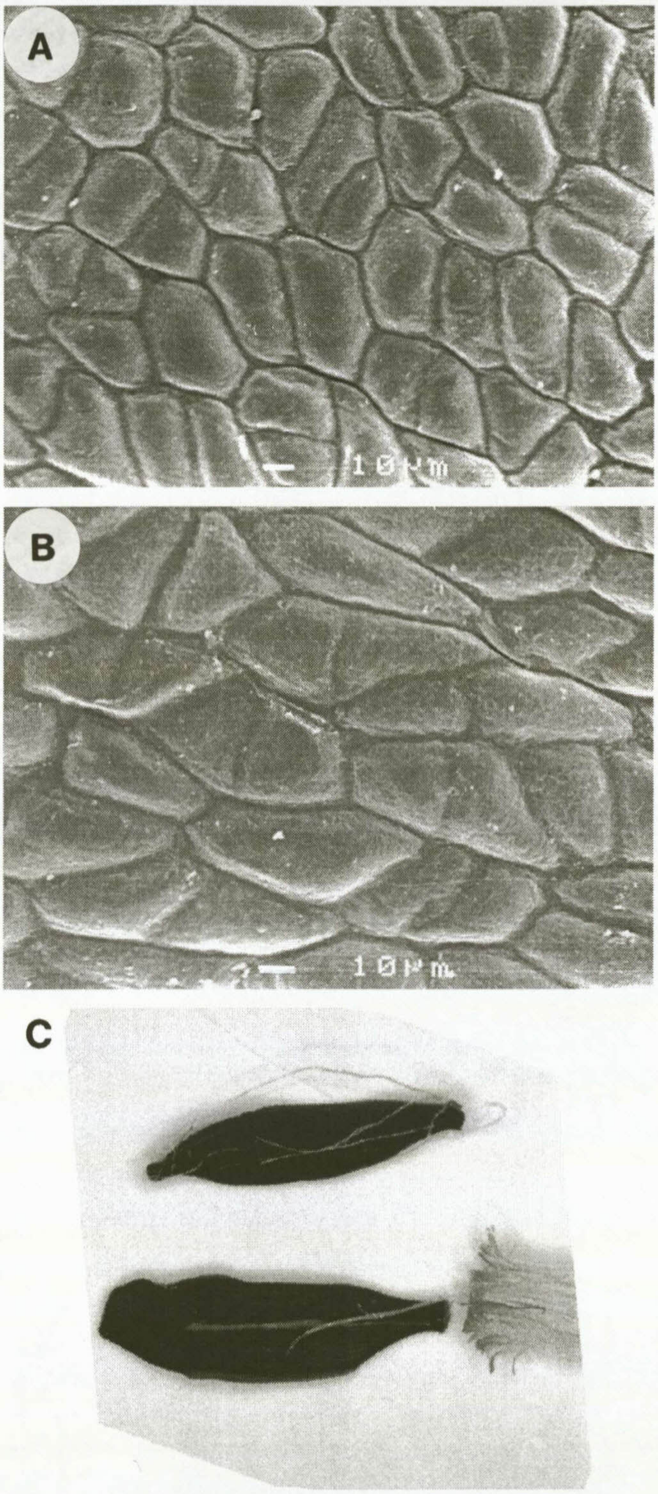


**Figure 5.4 Seed surface of *Mondia whitei*** (A–B) smooth surface with polygonal to slightly elongated epidermal cells. (C) seeds having coma of hairs broken-off. All from *Oldeman, R.A.A. 392* (MO).

Scale bar: A, B = 10 µm

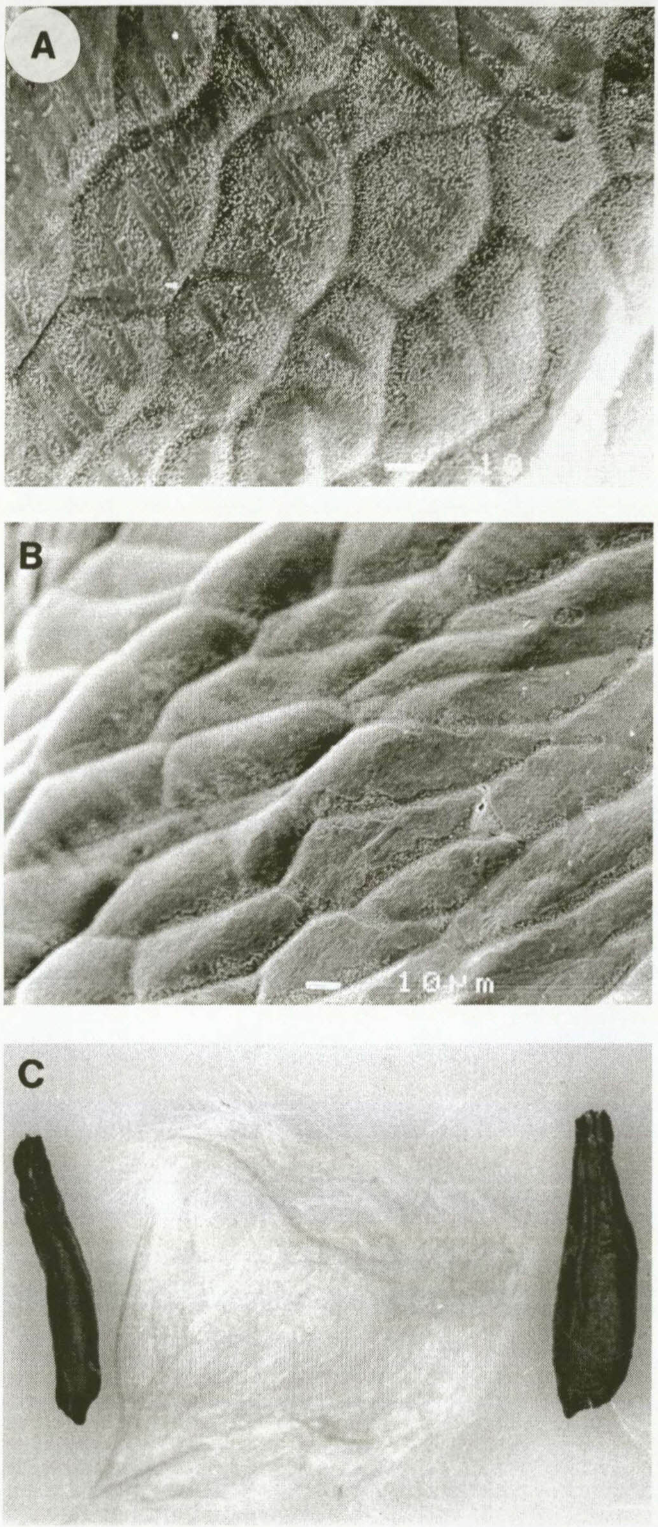



**Figure 5.5 Seed surface of *Sacleuxia newii:*** (A) rough surface beset with grain-like substances. (B) 4–6 sided epidermal cells. (C) Seeds, with hairs at the centre. All from *Verdcourt 246* (K).

Scale bar: A, B = 10 µm

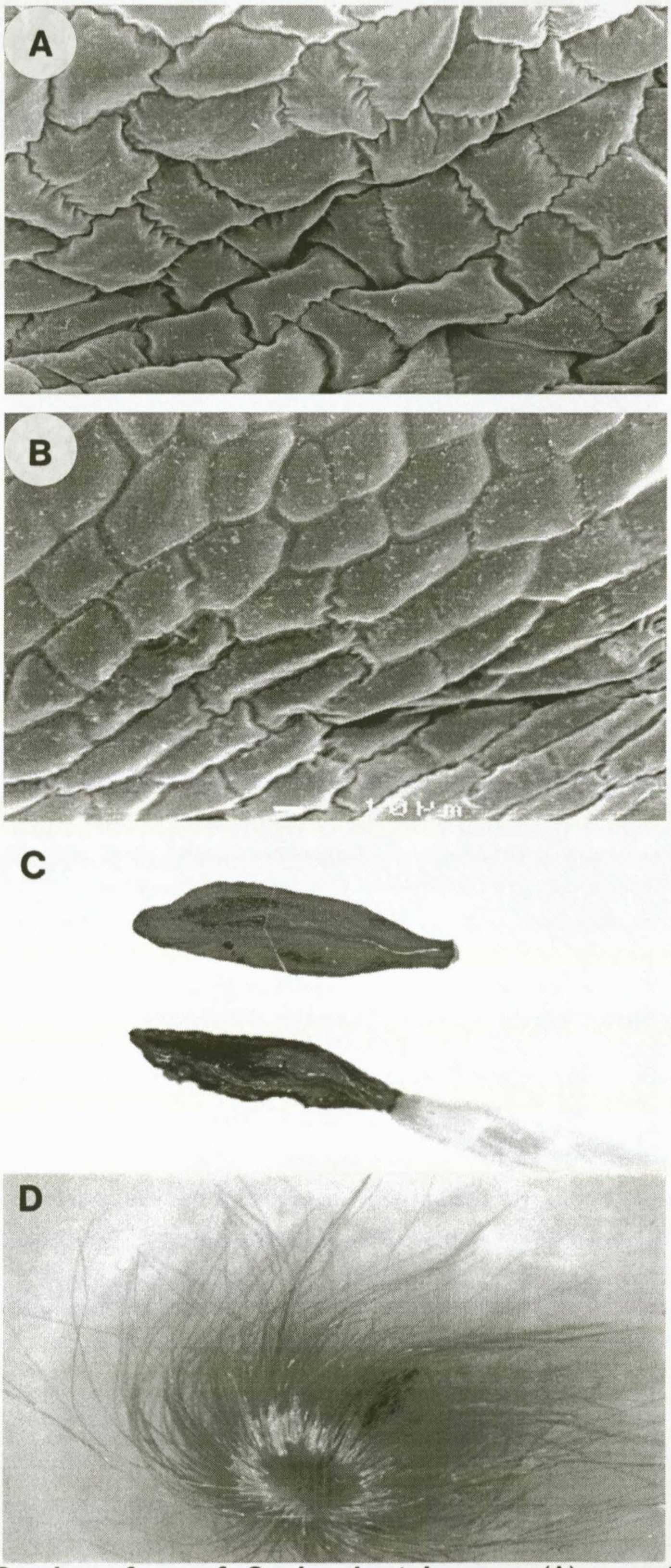



**Figure 5.6 Seed surface of *Sacleuxia tuberosa:*** (A) smooth surface with polygonal cells elongated to rectangular. (B) straight to slightly undulated anticlinal walls. (C) seeds. (D) dry seed showing spread-out hairs.
All from *Kerfoot, O. 3596* (K). Scale bar: A, B = 10 µm

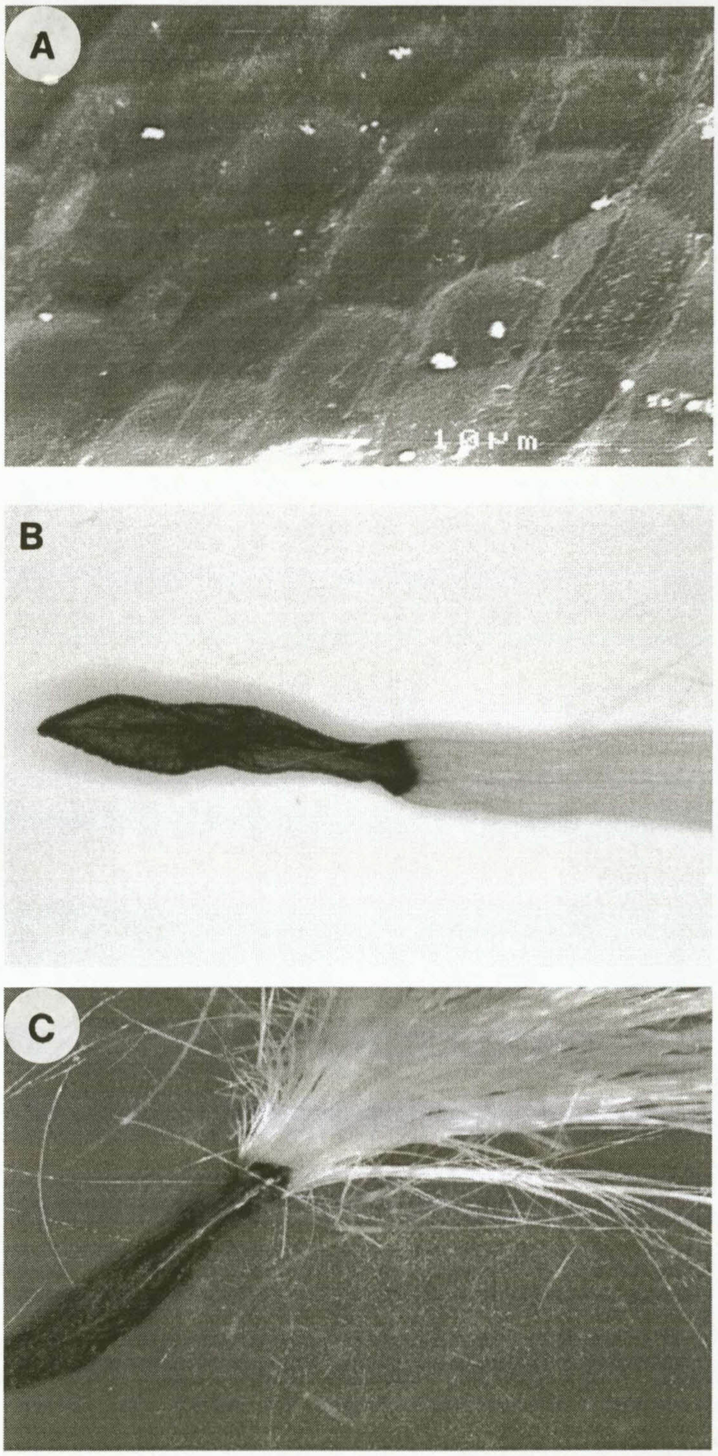



**Figure 5.7 Seed surface of *Zacateza pedicellata:*** (A) smooth surfaced epidermal cells. (B) elliptic seed. (C) seed showing funicular (*).
All from *Evrard 3467* (K).

Scale bar: A = 10 µm

## 5.3 DISCUSSION AND CONCLUSIONS:

Seed surface morphology within the Periplocoideae (Apocynaceae) is a taxonomic feature that has not been extensively studied. However, due to scarcity of seeds of selected genera, it has not been easy to find a trend to ascertain the use of this character state in classification systems.

According to Barthlott (1981), structures of particular importance in the description of the seed coat characteristics are the relief of the anticlinal cell wall as well at curvature of the outer periclinal walls. He further states that the most prominent feature is surface sculpturing, especially the outline of the cells.

Three types of seed surface sculpturing have been observed:

1) Smooth to reticulate surface and polygonal epidermal cells with deep or shallow grooves between anticlinal walls as in *Batesanthus intrusus, Mondia whitei, Sacleuxia newii, Sacleuxia tuberosa* and *Zacateza pedicellata.* A feature also observed in *Cryptolepis yemenensis* Venter & R.L. Verh., *Petopentia natalensis* (Schltr.) Bullock, *Tacazzea apiculata* D.Oliv. and *Tacazzea venosa* Decne. Venter *et al.* (1990a, c).
2) Pitted surface and polygonal cells with pores lying at the edges of individual cells as in *Mangenotia eburnea.*
3) A rugged surface without an obvious reticulate pattern and polygonal epidermal cells with raised ridges over anticlinal walls as in *Baseonema gregorii.*

The micropylar coma of hairs is characteristic and uniform, but there occurs variation in length of the coma whereby *Mangenotia eburnea* has a long coma compared to other taxa investigated. However, hairs extending around the entire margin have been observed in *Batesanthus intrusus,* a feature not common, yet not unique since it is known to occur also in seeds of *Raphionacme namibiana* Venter & R.L. Verh. (Periplocoideae), *Fockea sinuata* (E. Mey.) Druce (Asclepiadoideae – Marsdenieae) (Bruyns 1994) and *Finlaysonia* Wall. (Periplocoideae) (Endress & Bruyns 2000).

# CHAPTER 6

## TAXONOMY OF *BASEONEMA* Schltr. & Rendle

### 6.1 HISTORICAL BACKGROUND:

An East African genus: *Baseonema* Schltr. & Rendle was first established by Schlechter & Rendle in 1896 to accommodate their new species *Baseonema gregorii* Schltr. & Rendle. They based their description on a single collection from Kenya, collected between 1892–1893.

*Baseonema* is a Greek derived generic name that implies **'base thread-like'; –nema** is a Greek word that means 'thread'. The specific epithet – ***gregorii*** (Rec. 73C) is a commemorative name in honour of the first collector Dr. J.W. Gregory.

*Baseonema gregorii* is a shrub or small liana with climber stem twining. It is characterized by having interpetiolar stipules, hairy velutinous leaves, red to purple inflorescence stalks and shiny, green reflexed corolla lobes. Bullock (1954a) states that 'the type specimen has no twining shoots whereas in a specimen collected by Kässner at Kibwezi, Kenya on 27–04–1902 the shoots are evidently twining, although habit variability might be due to the immediate conditions of the environment and that the same plant may be a twiner during some years and a non-twiner during others'.

*Baseonema gregorii* is a rare species (Bullock 1954a), although it is evidently not yet extinct due to a recent collection of 11–02–1996 from Kenya – 02S 37E BB by *Goyder et al. 4006* (PRE).

### 6.1.1 GENERIC DELIMITATION:

*Baseonema* is a monotypic genus from East and Equatorial Africa. It has been separated from the then congeneric genus *Baroniella* Costantin &

Gallaud with seven species that are all endemic to the Madagascan rainforest (Klackenberg 1997).

According to Klackenberg (1997), *Baseonema* and *Baroniella* are ought to be kept separate due primarily to different flower morphology. *B. gregorii* is characterized by its almost ex-appendiculate anthers and a whorl of small coralline appendages – that is, inner corona lobes alternating with the stamens (Schlechter & Rendle 1896), although stamens arise down the corolla-tube. Corolline coronas are situated primarily in the petal sinuses (Liede & Kunze 1993). In *B. gregorii* the staminal filaments are much dilated at their bases, seemingly situated between the interstaminal discs. These interstaminal lobes are interpreted as inner corona lobes of corolline origin (Klackenberg 1997). Kunze (1990) describes these interstaminal discs which are sometimes mere spots or 'cups' as being nectariferous in nature. Although inconspicuous, the corolla tube instead of the corolla lobes is the one that reflexes back at anthesis, eventually exposing the gynostegium (Fig. 6.1 C), a character unknown in *Baroniella*. Choux (1913) had placed under *Baseonema* – *B. acuminatum, B. linearis* and *B. multiflorum* of which were later transferred by Bullock (1955) and revised by Klackenberg (1997) to the genus *Baroniella* due to different flower form, habit and ecology. Secondary veins unite in a crenate pattern in the leaf lamina whereas those of *Baroniella* species, if present are straight and parallel and united to a straight sub-marginal vein.

Pollen morphology* can also be used to distinguish between species of *Baseonema* and *Batesanthus* N.E. Br. Pollen grain size in *Baseonema* are relatively larger compared to the smaller grains of *Batesanthus* species.

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- *** Refer to Chapter 4 for review on pollen morphology**

## 6.2 TAXONOMY:

***BASEONEMA*** Schltr. & Rendle in Journal of Botany **34:** 97, t. 356 (1896).

TYPE: *Baseonema gregorii* Schltr. & Rendle

Twining shrub. Leaves hairy, orbicular, entire and ciliate. Petioles purplish, stipules interpetiolar. Inflorescence indeterminately cymose. Flowers 5-merous. Corolla hairy outside, glabrous within, green, lime-green to yellowish-green, tube reflexed. Outer corona annular; inner corona lobes lobular. Filaments with broad bases. Species 1, East Equatorial Africa

***Baseonema gregorii*** Schltr. & Rendle in Journal of Botany **34**: 97, t. 356 (1896); K. Schum.: 286 (1897); N.E. Br.: 259 (1902); Thonner: 442 (1915); Bullock: 59 (1954a); Agnew: 369 (1974).
TYPE: Kenya, K4 Machakos District, Kenani & Ongalea Mts. 1892–1893, *Gregory, J.W. 14* (BM, holotype!).

Twiner with white, milky latex. **Stems** herbaceous to woody, brownish and hollow; old stems sparsely pubescent, young stems pubescent. **Leaves** opposite, simple, with interpetiolar stipules; *petiole* (4–)7–10(–26) mm long, densely pubescent, purple; *lamina* (20–)24–60(–97) x (13–)18–63(–93) mm, broadly obovate to broadly elliptic, apex cuspidate, acuminate to acute, base rounded or cuneate, velutinous, dark green above, pale green to whitish below, hypostomatous, venation brochidodromous – evidently so abaxial, margin entire, undulate, ciliate. **Inflorescences** lax cymose panicles; primary *peduncles* (10–)22–29(–70) mm long, puberulous, purple green to shiny red; *secondary peduncles* (10–)22–27(–54) mm long, glabrous or nearly so; *pedicels* (5–)11–16(–35) mm long, puberulous, purple. **Flower** 5-merous, bisexual, actinomorphic, complete, gynostegium exposed. ***Calyx*** of 5 sepals, 1–2 x 0.5–1.5 mm, free, elliptic to ovate, apex acute, villose, green. ***Corolla*** of 5 petals; *lobes* (4–)5–6(–8) x 1–2.5 mm,free towards apex, ovate, elliptic to narrowly ovate, apex acute to acuminate, villous outside, glabrous within, reflexed at anthesis, green, lime green or green yellow; *tube: lower tube* very short $\pm$ 2 mm long, reflexed; *upper tube* absent. ***Corona:*** *outer corona* from apex of corolla tube, lobes almost triangular, apex acute; *inner corona* of interstaminal discs, arising in-between the stamens. **Androecium:** *stamens* 5, adnate to outer corona lobes and interstaminal discs, positioned from just below outer corona; *anthers* basifixed, ovate, apex sub-acute, brownish with whitish membranous flaps (microsporangium), fused to and connivent above stigma head, connective prominent; *filaments* free, basely with laterally dilated bases; *pollen tetrads* adhere to translator surface, most common arrangement decussate, otherwise rhomboidal or tetrahedral. **Gynoecium:** *ovaries* free, 2, semi-globose, semi-inferior, ovules numerous; *styles* 2, fused terminally; *stigmatic head* pentangular, deltoid/ovoid, apex almost conical; *translators* 5, from grooves in upper surface of stigmatic head, spoon spathulate with receptacle ovoid, stalk linear, viscidium sub-circular, sticky. **Fruit** of paired follicles; *follicles* 52–95 x 7–11 mm, linear–oblong, puberulous to sub-glabrous; *fruit stalk* 68–92 mm long, puberulous. **Seeds** 10–11 x 2 mm, compressed with a raised horizontal fissure towards centre; *coma* of hairs 24–27 mm long. (Figure 6.1).

## 6.3 DISTRIBUTION AND ECOLOGY:

*Baseonema gregorii* is limited in distribution to the East Africa regions of Kenya and Tanzania. It is found between the lines of longitude $01^{0}30'$ – $04^{0}16'$ S and latitude $37^{0}21'$ – $39^{0}19'$ E (Figure 6.2).

Flowering plant specimens were seen from January to April and July, fruits in March to May (Table 6.1).

**Table 6.1** Flowering and fruiting periods of *Baseonema gregorii*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWERS | | | | | | | | | | | | |
| FRUITS | | | | | | | | | | | | |

It seems to grow at a wide range of altitude, from low-lying areas of 600 m to higher ones at 1,500 m above sea level.

It is known locally by the Kamba - Kenya tribe as "Muongwa".

In Kenya, it has been found in savanna in association with species of *Acacia* Mill., *Commiphora* Jacq. and *Sansevieria* Thunb. In the dry evergreen forest dominated by species of *Euphorbia* L., *Ehretia* P. Browne, *Manilkara* Adans., *Suregada* Roxb. ex Rottler and *Strychnos* L., it occurs on very steep slopes with poor ground cover. It was also found on sandy soil near rocky outcrops together with species of *Grewia* L., *Euphorbia, Thunbergia* Retz., *Adansonia* L., *Boswellia* Roxb. ex Colebr., *Tamarindus* L. and *Bauhinia* L.

### 6.3.1 VOUCHER SPECIMENS:

KENYA: 02S 38E: 240 km from Mombasa on Nairobi road **(-CA).** *Verdcourt & Polhill 2695* (K).

— 02S 38E: Tsavo National Park, East Simba Hill **(-BC).** *Faden, R.B. & A.J. 74/436* (PRE).

— 03S 38E: Mt. Kasigau, 4 km S of Rukanga **(-DC).** *Gilbert, M.G. & C.I. 6122* (K).

TANZANIA: 03S 37E: T3 Pare District, Lembeni **(-DC).** *Bally, P.R.O. 8125* (K).

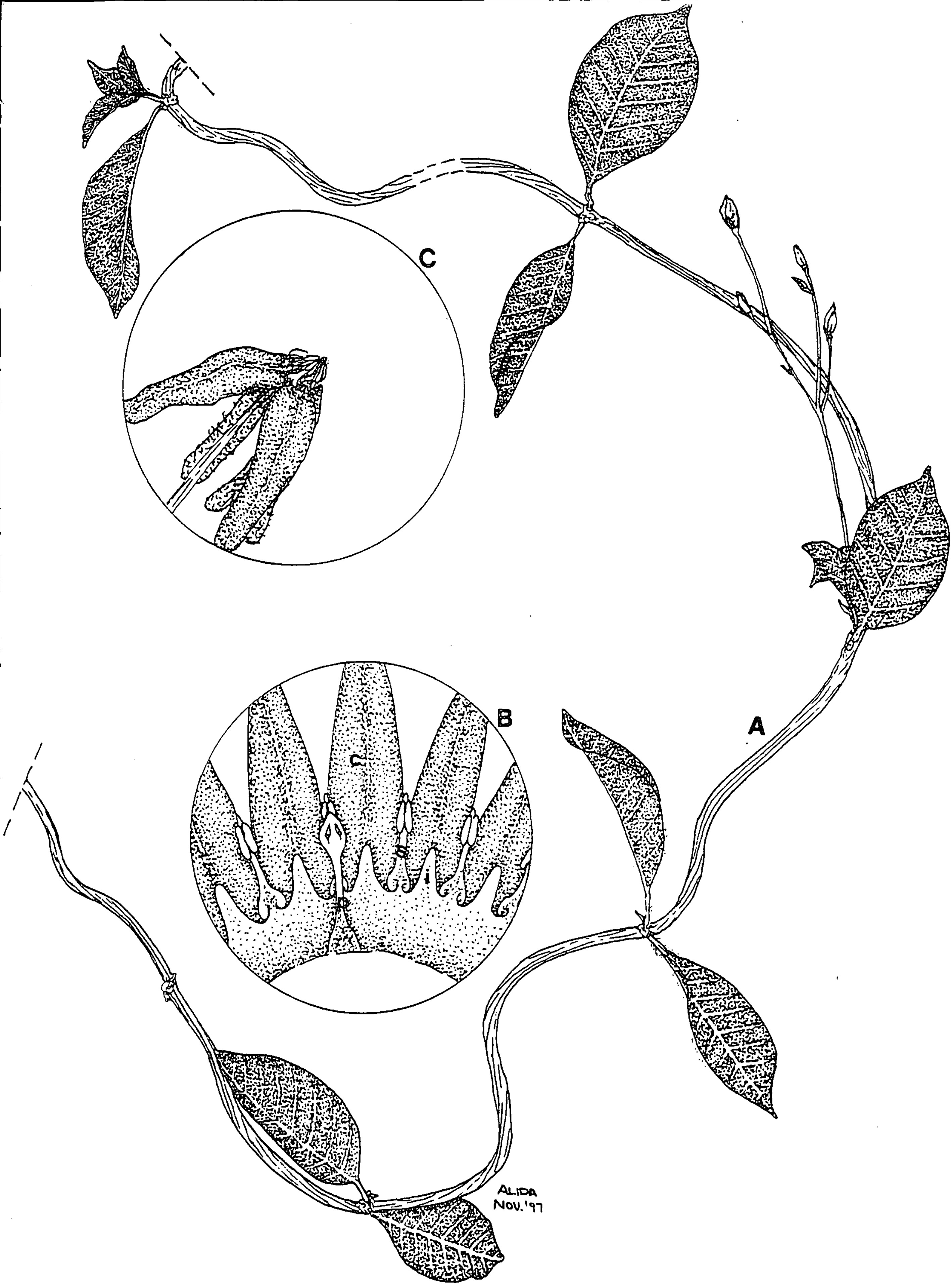



**Figure 6.1** *Baseonema gregorii:* (A) Habit showing twining stems, leaves and flowers. (B) Open flower showing corolla lobes (**c**), pistil (**p**) at the centre, stamen (**s**) and inner corona (**i**). (C) Complete flower showing reflexed corolla lobes and exposed gynostegium. Drawn from Field & Powys 174 (K).

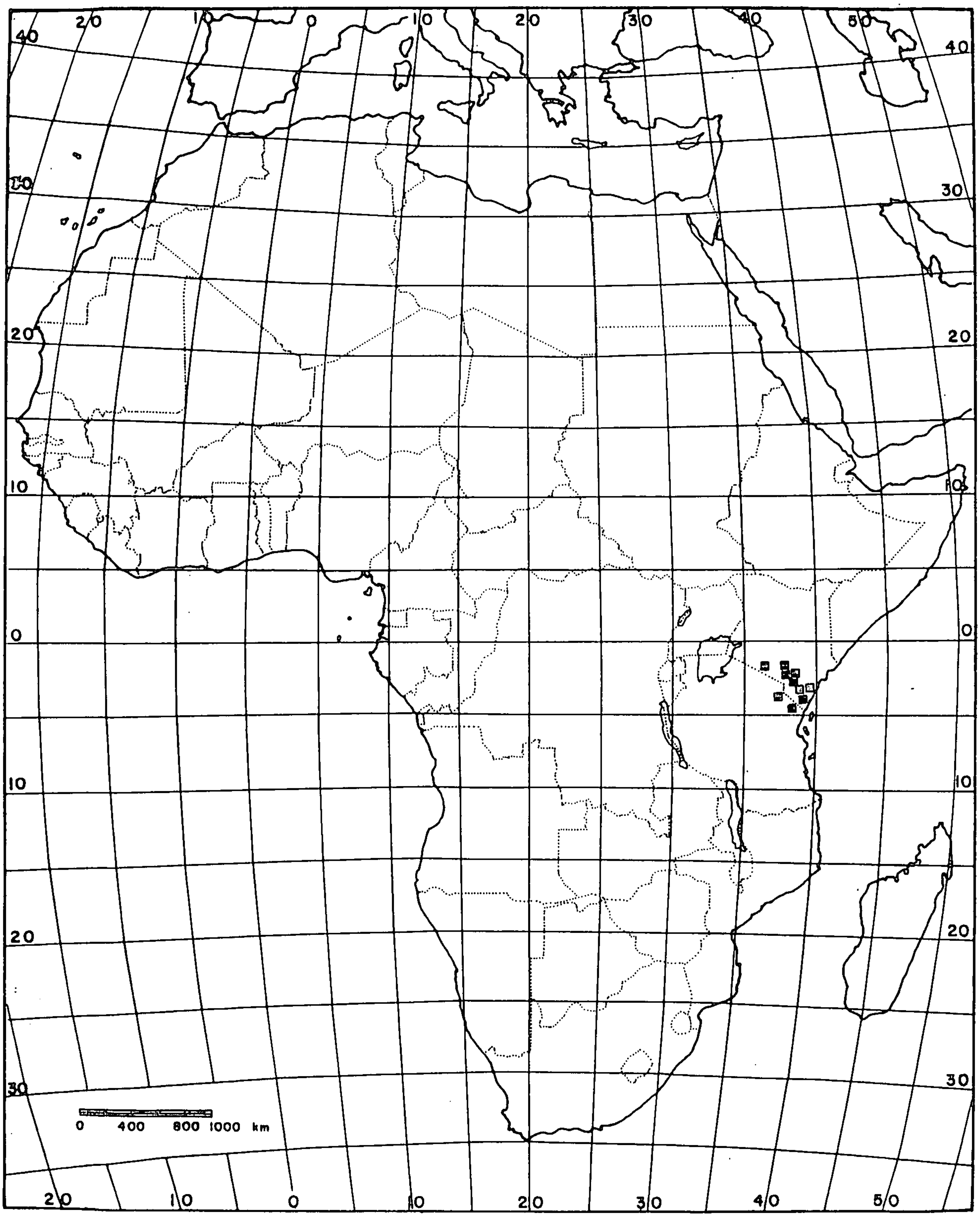



**Figure 6.2** Known geographical distribution of *Baseonema gregorii.*

# CHAPTER 7

## TAXONOMY OF *BATESANTHUS* N.E. Br.

### 7.1 HISTORICAL BACKGROUND:

*Batesanthus* N.E. Br. as currently described, comprises of four African species and has been maintained as a genus separate from *Baseonema* Schltr. & Rendle.

*Batesanthus* commemorates Mr. G.L. Bates who first collected the type specimen *Batesanthus purpureus* N.E. Br. in 1895 from Cameroon.

There are four species of *Batesanthus* N.E. Br. namely:

1. *Batesanthus intrusus* N.E. Br.
2. *Batesanthus parviflorus* Norman
3. *Batesanthus purpureus* N.E. Br.
4. *Batesanthus talbotii* S. Moore

However, of all the four species, Bullock (1961) in his notes on African Asclepiadaceae believed that there is no combination of characters that can be used to delimit between species and published the following synonyms of *B. purpureus* N.E. Br.:

> *Perithrix glabra* Pierre in Bull. Soc. Linn. Paris, nov. Sér. No. 8 (1898).
>
> *Batesanthus talbotii* S. Moore in Cat. Talb. Nig. Pl.: 63 (1913).
>
> *Batesanthus talbotii* var. *grandifolia* S. Moore, *l.c.* 64 (1913).
>
> *Batesanthus glaber* Schltr. In Mildbr. Deutschen Zentral-Afrika Expedition 1907 – 1908 2: 541 (1914).
>
> *Batesanthus intrusus* S. Moore in Journ. Bot. 58: 267 (1920).
>
> *Batesanthus mildbraedi* Schltr. In Mildbr., Wiss. Ergebn. Deutsch. Zent.-Afr. Exped. 1910 – 1911, 2: 80 (1922).
>
> *Batesanthus talbotii* var. *parviflora* S. Moore, *nomen in herb. Kew;* Hutch. & Dalziel, *l.c. in syn* (1931).

Nevertheless, the present study does not agree with Bullock's synonymy. Species of *Batesanthus* are sparsely distributed in Central and more so in the Western Tropical Africa. The genus's poor representation and thus its sparse collection may be attributed to its restricted distribution. However, slow accumulation of material enabled Brown to reduce the inadequately described *Perithrix* Pierre, hence now an illegitimate synonym.

The Greek derived name ***'intrusus'* = thrust in \ inserted** refers to the **intrusion of the corolla base, especially in bud.** Bullock (1961) dispute that the so-called intrusion is entirely due to the fact that the buds examined are at a very early stage of development. In *B. intrusus,* it should be noted that, when dried, the flowers appear to be mostly unopened buds, this is due to the short time the corolla remain expanded (Moore 1920).

*B. parviflorus* is a Greek derived name referring to the small, profusely flowering flowers, that is, ***'parvis' = small*** and ***'florus' = flower.***

*B. purpureus,* **'purpureus'** is a Greek derived name meaning **purple.**

*B. talbotii* commemorates Mr. T.A. Talbot who first collected the type specimen from Oban in Nigeria.

Brown (1896) and Venter & Verhoeven (1997) placed *Batesanthus (= Perithrix)* under the tribe Periploceae, but Endress & Bruyns (2000) have excluded *Batesanthus* from their list of genera under Periplocoideae.

### 7.2 TAXONOMY:

***BATESANTHUS*** N.E. Br. in Hooker's Icones Plantarum: 25, t. 2500 (1896); K. Schum.: 286, (2–4) (1897); N.E. Br.: 4(1), 253 (1902); Thonner: 443 (1915); Hutch. & Dalziel: 2(1), 50 (1931); Bullock: 15, 203–204 (1961); Bullock: 2, 82 (1963a).

TYPE: *Batesanthus purpureus* N.E. Br.

Shrubs. **Stems** twining, sometimes erect or climbers. Latex milky-white to absent. **Leaves** opposite, large/ample, petiolate, stipulate, stipular fringes interpetiolar, reflexed, amphistomatous; *lamina:* abaxial surface pale-green to somewhat whitish, glabrous, adaxial surface dark-green, glabrous to puberulent on midrib; apex acuminate to acute, base cordate, margin entire to slightly repand. **Inflorescences** lax, axillary cymes. **Flowers** 5-merous. ***Calyx*** free. ***Corolla*** rotate, usually glabrous, upper tube absent, lower tube inconspicuous. ***Corona*** 5 lobular, outer corona lobes absent to filiform, inner corona adnate to filament bases, annular. **Androecium:** *stamens* 5, *anthers* white to brownish, broadly ovate to oblong, erect, cohering terminally onto stigmatic head, apex connate, glabrous; *filaments* c. 1 mm long, fused to outer corona, fused sideways into an annulus outside interstaminal discs; *pollen* in granular tetrads, porate. **Gynoecium:** *ovaries* 2, ovoid, ovules numerous; *styles* 2, becoming fused into one apically; stigmatic head pentangular ovoid to deltoid, apex acuminate to conical; *translators* 5, adhering to the grooves of stigmatic head, receptacle rhombic, sometimes broadly ovate, cleft at center, stalk present, linear, viscidium rounded to half-moon, sticky. **Fruit** paired follicles. **Seeds** comose. Species 4.

**KEY TO THE SPECIES:**

**1a** Leaves glabrous or nearly so. Corona lobes annular to long filiform lobes ....... 2

**1b** Leaves scabrid to hispid on both sides or only below. Corona lobes annular, emarginate ....... 4

**2a** Bottom of corolla folded collar-like around pedicel, i.e. intruse, especially in bud; flowers purple ....... **1. *B. intrusus***

**2b** Bottom of corolla normal, without an intrusion at the base, flowers dark purple or dark reddish purple ....... 3

**3a** Corolla lobes less than 10 mm long, corona with annular lobes to filiform lobes. Climbing shrubs in savanna ....... **2. *B. parviflorus***

**3b** Corolla lobes (10–)15–20 mm long, without filiform corona lobes. Woody climber in riverine forests ....... **3. *B. purpureus***

**4a** Base of corolla not intruse ....... **4. *B. talbotii***

**4b** Base of corolla intruse ....... **1. *B. intrusus***

1. ***Batesanthus intrusus*** S. Moore in Journal of Botany lviii: 269 (1920).

TYPE: Cameroon – Yaoundé, Bitye. 1917. *Bates, G.L. 1392* (BM, holotype!).

≡ *Perithrix glabra* Pierre in Bulletin Society. Linnaeus.: 65 (1898)

TYPE: Gabon, Libreville on the Gaboon River. October 1896. *Klaine, R.P. 513* (P, holotype!, K, isotype!).

Twining liana 4–5 m high. No latex. **Stems** herbaceous, purple-reddish or brown, smooth, terete. **Leaves** sparsely hairy to glabrous; interpetiolar stipules frill-like; *petiole* (12–)21–32(–57) mm long; *lamina* (75–)120–140 (–190) x (25–)60–75(–90) mm long, ovate to lanceolate, secondary veins not raised, reddish purple. **Inflorescences** ± 2 flowered; *peduncle; primary peduncle* (20–)35–45(–120) mm long, *secondary peduncle* (25–)35–40(–70) mm long; *pedicel* (6–)10–15(–25) mm long, minutely bracteate. **Flowers:** blackish purple to violet inside, whitish to pale yellowish green outside. ***Calyx*** 2 x 1 mm, lanceolate, puberulent microscopic margins to glabrous, segmented, purple to violet range. ***Corolla:*** *lobes* 3–11 x 1–3 mm, ovate, apex acuminate to rounded, pale green outside, dark purple inside; *lower tube* intruse at the base. ***Corona***: *inner corona* awl shaped. **Androecium:** *stamens* arise from mouth of corolla tube; *anthers* ovate ± 3 x 1 mm. **Gynoecium:** ovaries 2, style short, c. 1 mm long. **Fruit:** *follicles* 112–120 x 3–4 mm elliptic to broadly elliptic, raphe at the center. **Seeds** 9–12 x 3–4 mm, elliptic; *coma* of hairs 47–50 mm long, hairs extend all around one surface of the seed. – see chapter 5. (Figure 7.1; 7.2).

2. ***Batesanthus parviflorus*** Norman in Journal of Botany lxvii Suppl. 2: 91 (1929).

TYPE: Angola, Guanza – Quilela Camabatela. 29-09-1922. *Gossweiler, J. 8468* (BM, holotype!).

Shrub. **Stems** twining, dark purple. **Leaves** glabrous; *petiole* (10–)17–20 (–30) mm long; *lamina* (62–)70–85(–115) x (30–)33–38(–60) mm, ovate to lanceolate, veins reddish purple, interpetiolar stipules inconspicuous, dentate.

**Inflorescences** many flowered cymose panicle; *peduncle* (20–)23–38(–75) mm; *pedicel* (5–)7–13(–15) mm long, moderately thick base bracteolate. **Flowers** small, dark reddish purple. ***Calyx*** 2 x 1–1.5 mm, lanceolate, margin ciliate. **Corolla:** *lobes* 4–5 x 1–2 mm, narrowly oblong, apex acuminate to rounded. ***Corona*** sometimes double; *outer corona* filamentous (Plate 1 – after page 88), lobes inserted at mouth of corolla tube, exposed at anthesis; *inner corona* triangular. **Gynoecium:** *styles* short, concealed. **Fruit** unknown. (Figure 7.3; 7.4).

3. ***Batesanthus purpureus*** N.E. Br. in Hooker's Icones Plantarum Pl. 25: t. 2500 (1896); F.T.A. 4(1): 253 (1902); Bullock: 15 (2), 203–204 (1961).

TYPE: Cameroon, Efulen – Bule country. 20-09-1895. *Bates, G.L. 383* (K, holotype!).

Woody climber, sometimes twiner, glabrous. **Stems** covered with small warty outgrowths, rusty red to purplish. **Leaves** glabrous, stipular fringes interpetiolar, reflexed, subpersistent; *lamina* (110–)145–150(–160) x (70–) 75–80(–95) mm, ovate to elliptic. **Inflorescences** lateral, lower part dichotomous, higher up undivided, simple. **Flowers:** dark purple or purple. ***Corolla:*** *lobes* broadly oblong to ovate, comparatively large at 4–6 x 8–11 mm, apex obtuse to rounded, deeply 5-lobed; *lower tube* $\pm$ 2 mm long. ***Corona*** lobes indistinct; *inner corona* of 5 minute lobules, ovate, apex acute to blunt. **Androecium:** *stamens* inserted at mouth of corolla tube. **Fruit:** *follicles c.* 120 mm long x 20 mm diameter, more or less woody, suberect, shortly beaked. **Seeds** unknown. (Figure 7.5; 7.6).

4. ***Batesanthus talbotii*** S. Moore in Catalogue of the plants collected by Mr. & Mrs. P.A. Talbot in the Oban District, South Nigeria, British Museum, Natural History: 36–64 (1913); Hutch. & Dalziel: 2(1), 52 (1931).

TYPE: Nigeria, Oban. 1912. *Talbot, T.A. 2021* (BM, holotype!, K, isotype!).

= *B. talbotii* var. *grandifolia* S. Moore

TYPE: Nigeria, Oban. *Talbot, T.A. 2021* (BM, holotype).

Climbing shrub. **Stems** brownish, warty, striated when dry. **Leaves** scabrous, interpetiolar stipules sharply toothed, reflexed; *petiole* (18–)20–25 (–35) mm long; *lamina* (120–)130–145(–155) x 70–105 mm, broadly obovate to broadly elliptic, drying scabrid brown, with minute projections \ emergences on the surface, more so on abaxial surface, lateral veins looped towards the margin (i.e. brochidodromous), inserted upon the midrib nearly at right angle. **Inflorescences** many-flowered; *peduncles* ± 30 mm long, glabrous; *pedicels* 6–12 mm long, glabrous; *bracts* ovate, small. **Flowers:** ***Calyx*** 2 x 1 mm, ovate, segmented, glabrous; ***Corolla:*** *lobes* 6–7 x 2 mm, ovate, apex rounded, pale green and glabrous outside, purple and papillose within; *lower tube* c. 1 mm long. ***Corona:*** *inner corona* a whorl of irregular bumped interstaminal discs, emarginate. **Androecium:** *stamens* ± 2 mm long, moderately thick, arise from mouth of corolla tube. ***Fruit:*** *follicles* 80–90 x 20 mm, ovoid oblong, apex narrow, dark brown. **Seeds** 5 x 2 mm, elliptic to ovate, unilaterally keeled, glabrous; *coma* 25 mm long, pale brown. (Figure 7.7).

## 7.3 DISTRIBUTION AND ECOLOGY:

*Batesanthus intrusus* has been collected between 00°50'S to 07°32'N and 09°25'E to 08°38'W; *B. parviflorus* between 08°20'S to 08°27'N and 05°02'E to 12°29'W; *B. purpureus* between 01°46'N to 03°53'N and 11°17'E to 18°01'E and *B. talbotii* between 04°09'N to 05°17'N and 07°55'E to 09°13' (Figure 7.8).

Flowering time is shown in Table 7.1. The only fruits seen were those of *Batesanthus intrusus*.

Altitude varies from species to species. For instance, *B. intrusus* has been collected at ± 550 m – 1,200 m. *B. parviflorus* at 1,225 – 1,900 m and *B. talbotii* at 980 m. There were no records of altitude for *B. purpureus.*

**Table 7.1** Flowering and fruiting periods of *Batesanthus** species.

| | *JAN* | *FEB* | *MAR* | *APR* | *MAY* | *JUN* | *JUL* | *AUG* | *SEP* | *OCT* | *NOV* | *DEC* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *B. intrusus* FLOWERS | | | | | | | | | | | | |
| *B. intrusus* FRUITS | | | | | | | | | | | | |
| *B. parviflorus* FLOWERS | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| *B. purpureus* FLOWERS | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| *B. talbotii* FLOWERS | | | | | | | | | | | | |

* No fruiting specimens of *B. parviflorus, B. purpureus* and *B. talbotii* were recorded.

*Batesanthus intrusus* and *B. talbotii* are rambling twiners in secondary forest and/or forest edge. On the other hand, *B. parviflorus* is a climber in upland evergreen bushland growing in association with *Myrica* L., *Rapanea* Aubl. and *Hypericum* L., also a climber in secondary bush. *B. purpureus* is a climber in riverine forests.

People of Yaoundé – Bitye in Cameroon refer to *B. intrusus* as "Ekôtôk", known as "Bosambala" and "Inaolo a Bosambala" in Zaire - Yangambi and Basoko respectively.

### 7.3.1 VOUCHER SPECIMENS:

**1. *Batesanthus intrusus*:**

| | |
|---|---|
| CAMEROON: | <u>06N 14E</u>: Lakka, District Barmuda **(-AD).** *Maitland 1565* (K). |
| CENTRAL AFRICAN REPUBLIC: | <u>03N 18E</u>: Boukoko and Mbaiki regions **(-CC).** *Tisserant 1480* (P). |
| GABON: | <u>00N 09E</u>: Libreville on the Gaboon |

River **(-AD).** *Klaine, R.P. 513* (P).

— 00S 12E: Region de Lastoursville **(-DC).** *Le Testu, M.G. 8501* (P).

LIBERIA: 07N 08W: Yéképa village **(-DA).** *Adam, J.G. 30433* (MO).

**2. *Batesanthus parviflorus*:**

ANGOLA: 08S 15E: Guanza, Quilela Camabatela **(-AB).** *Gossweiler,J. 8468* (BM).

CAMEROON: 05N 09E: Manengouba Lake **(-BB).** *Polhill, R.M. & Kirkup, D. W. 5190* (K).

SIERRA LEONE: 08N 12W: Near Rorules (Roruks) **(-BC).** *Deighton, F.C. 3265* (K).

**3. *Batesanthus purpureus*:**

CAMEROON: Not traced. *Bates, G.L. 383* (G, K).

GABON: 01N 11E: Haute Ngounié **(-CD).** *Le Testu, M. 5493* (P).

**4. *Batesanthus talbotii*:**

NIGERIA: 05N 08E: Oban **(-BC).** *Talbot, T.A. 63* (BM).

— 05N 08E: Oban **(-BC).** *Talbot, T.A. 2021* (BM, K).

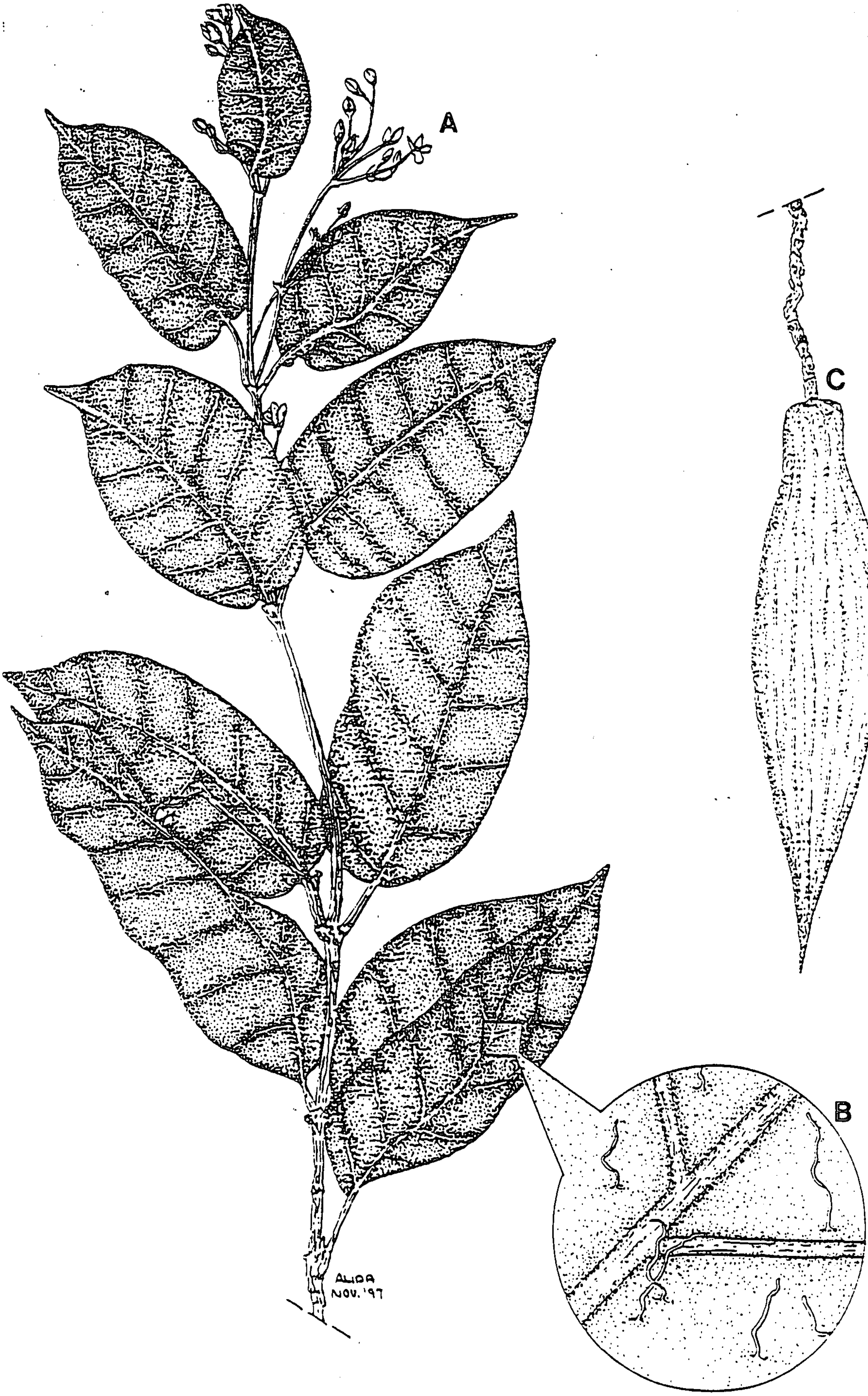



**Figure 7.1** *Batesanthus intrusus:* (A) Habit. (B) Leaf insert showing hairs. (C) Single follicle with stalk. Drawn from *Klaine 513* (K).

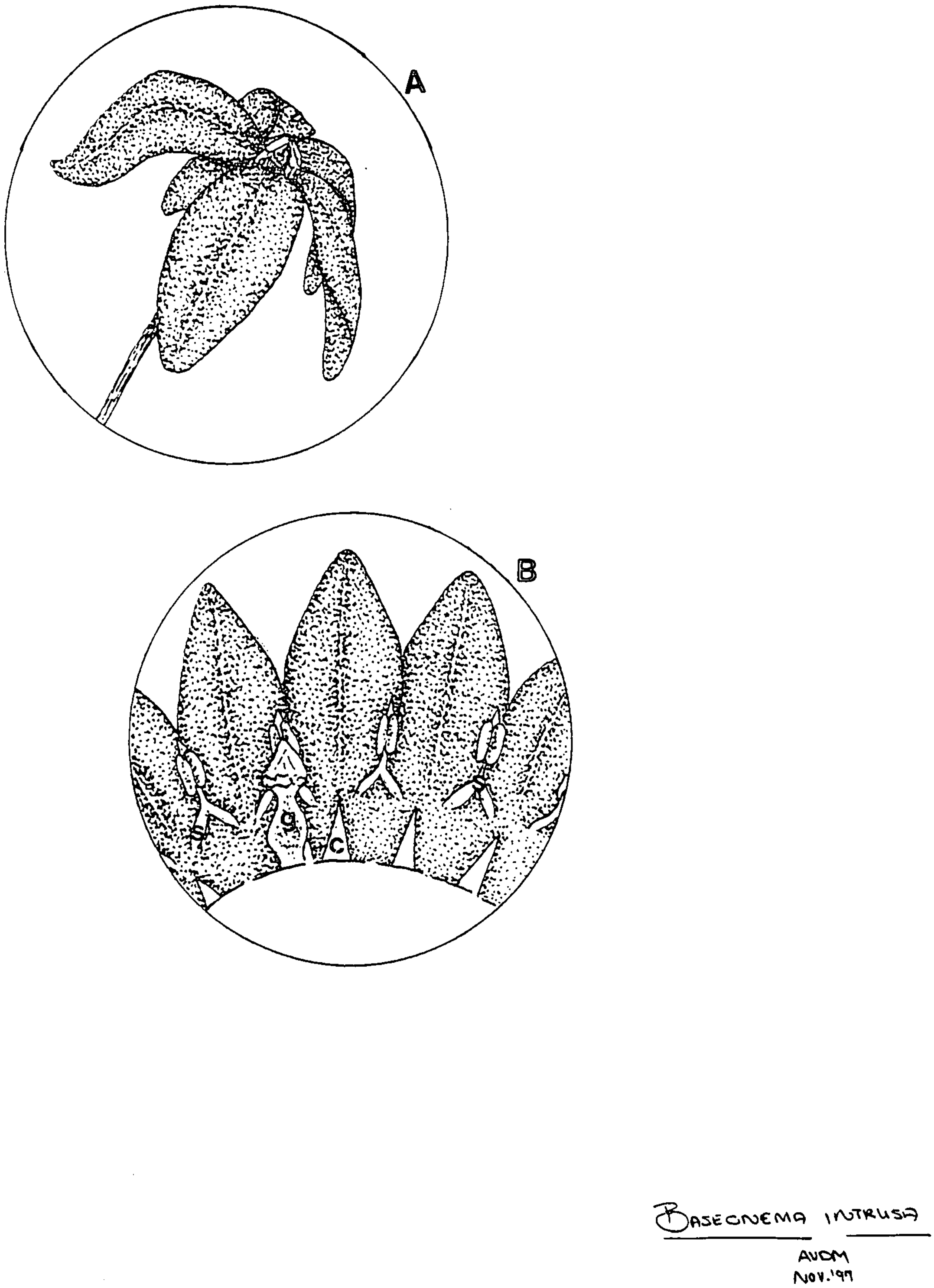



**Figure 7.2** *Batesanthus intrusus:* (A) Flower showing an intruse base. (B) Open flower showing position of gynoecium (**g**), corona (**c**) and stamens (**s**). Drawn from *Klaine 513* (K).

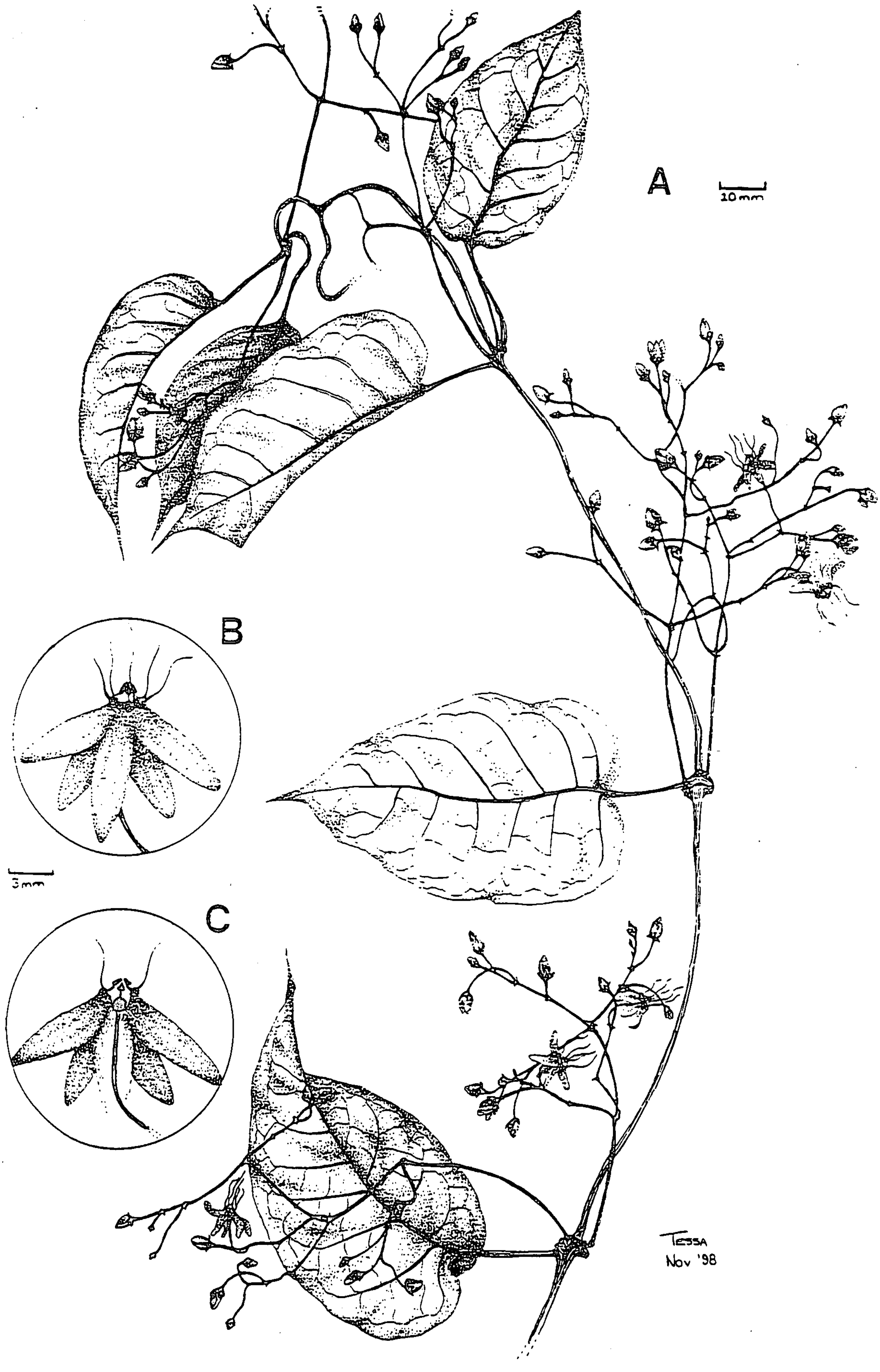



**Figure 7.3** *Batesanthus parviflorus:* (A) Specimen with flowers having **corona:** (B) Open flower showing filiform corona lobes and reflexed corolla lobes. (C) Cut flower showing position of gynoecium and insertion of corona lobes.

Drawn from *Deighton 3265* (K).

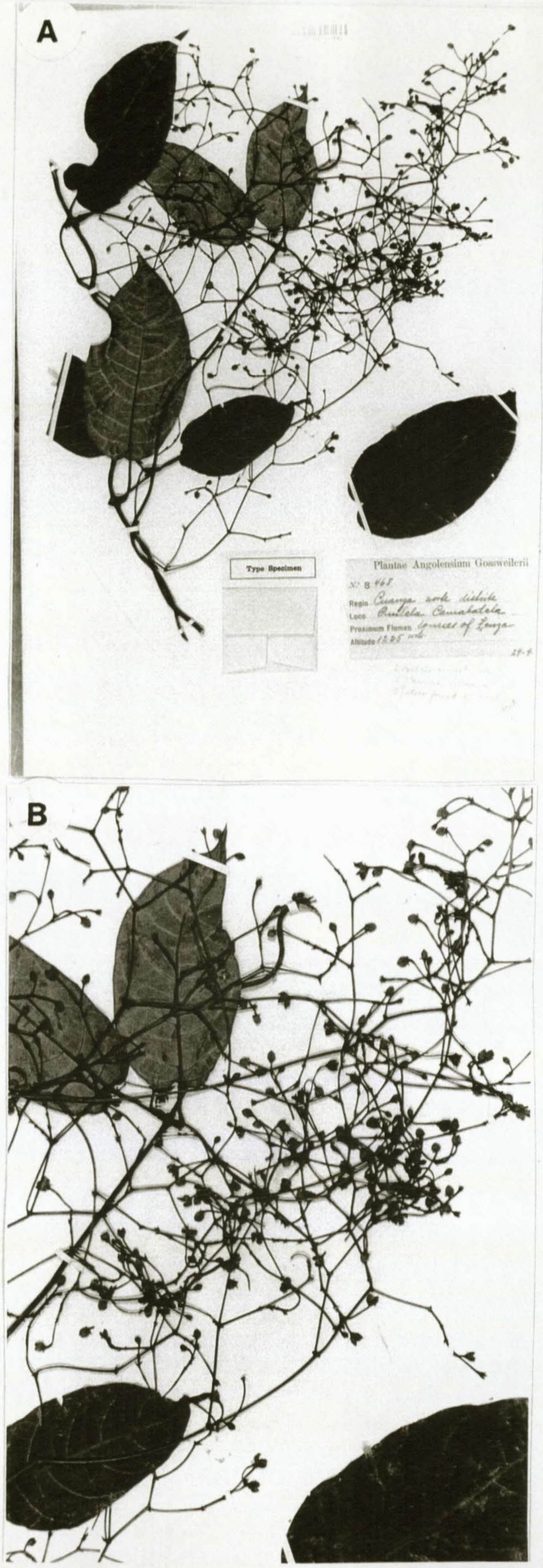



**Figure 7.4** *Batesanthus parviflorus:* Specimen, flowers **without corona:** (A–B) Habit of profusely flowering specimen.

All from *Gossweiler 8468* (BM).

Photos: Gabré Kemp

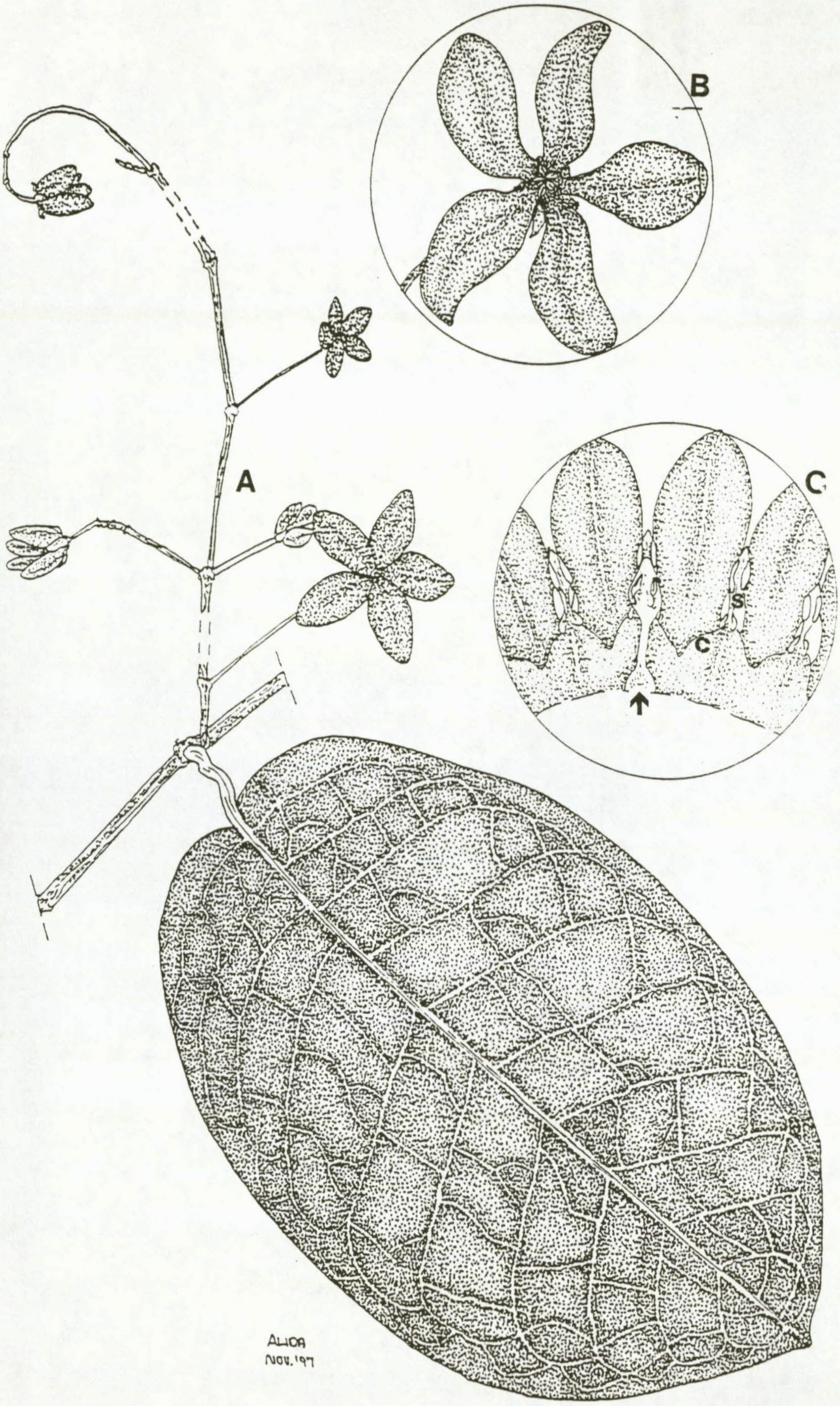



**Figure 7.5** *Batesanthus purpureus:* (A) Habit. (B) Flower with exposed gynostegium. (C) Open flower showing position of translators on the pentangular stigmatic head (**↑**), corona (**c**) and stamens (**s**).

Drawn from *Bates 383* (G iso).


**Figure 7.6** *Batesanthus purpureus:* (A) Sepal seen from within. (B) Corona and staminal column. (C) Staminal column partly dissected to show the position of the pollen carriers. (D) Pollen carriers.

Source: Brown 1896, t. 2500.

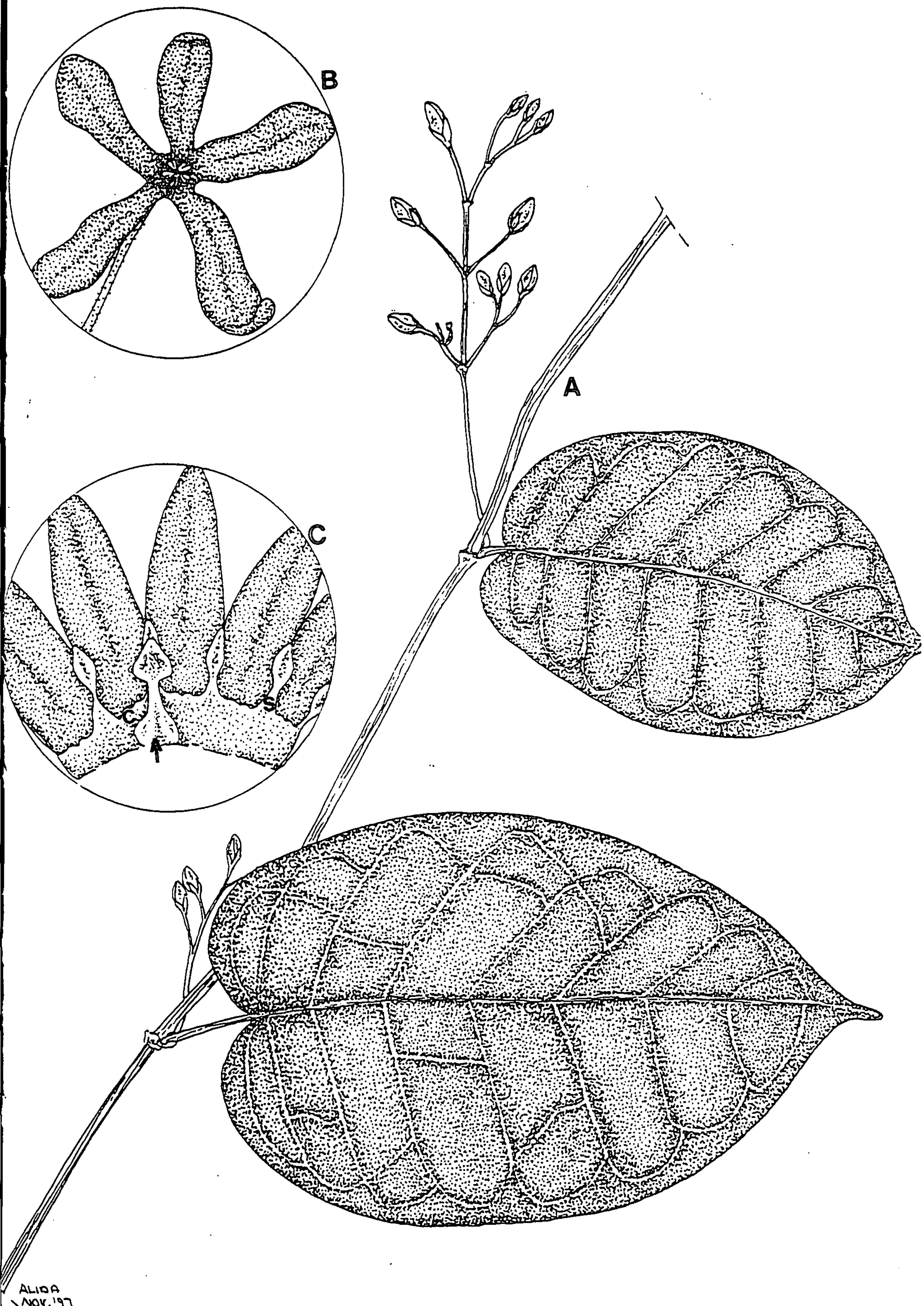



**Figure 7.7** *Batesanthus talbotii:* (A) Habit. (B) Flower exposing gynostegium. (C) Open flower showing position of corona (**c**), gynoecium (↑) and stamens (**s**).

Drawn from *Talbott 2021* (K).

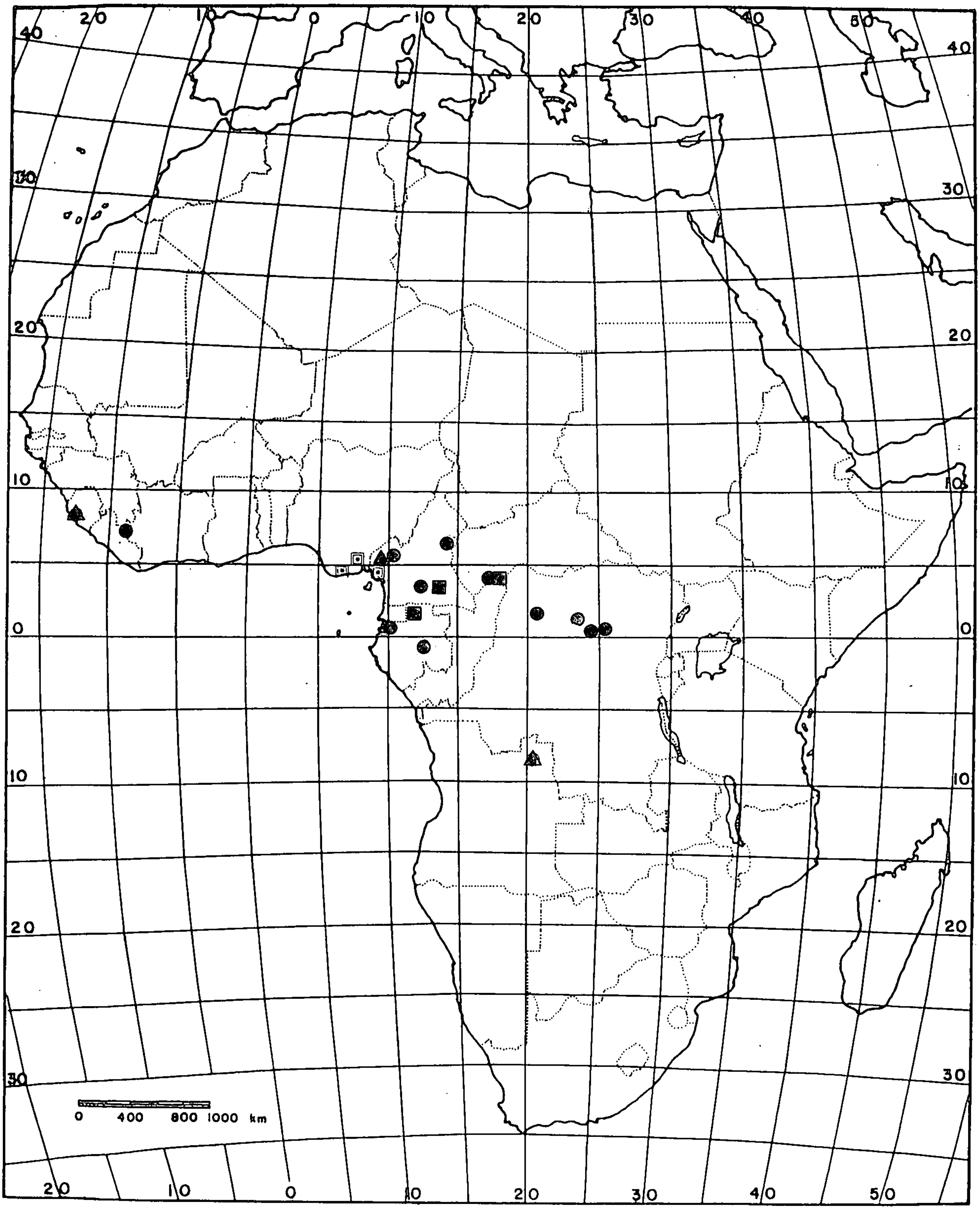
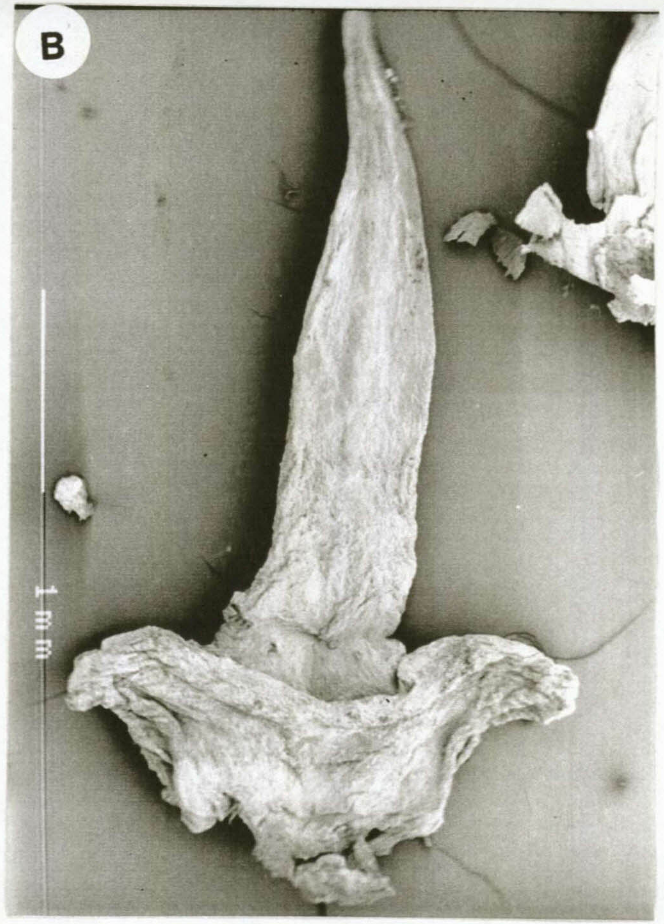



**Figure 7.8** Known geographical distribution of *Batesanthus* species.

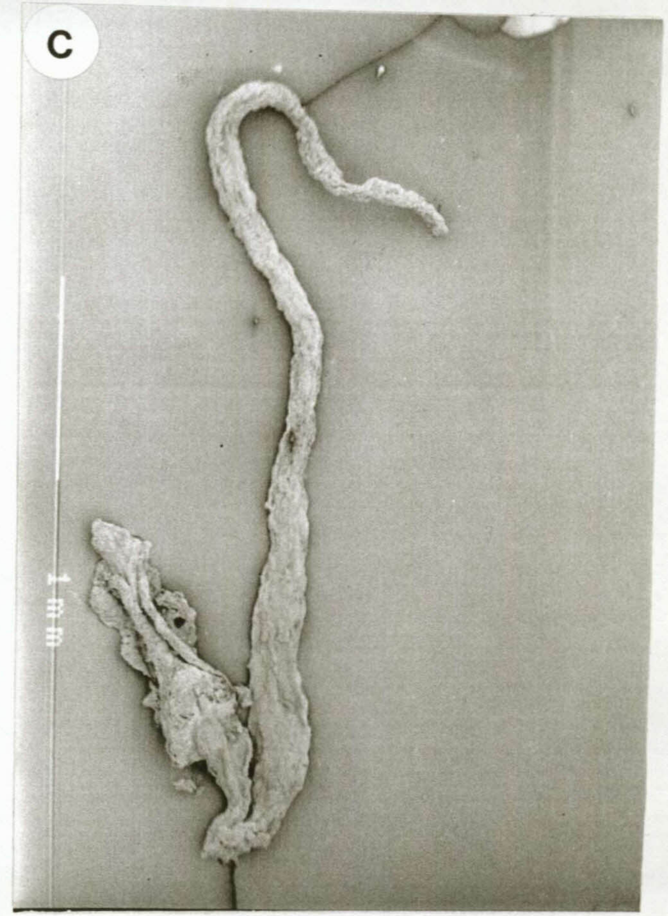
KEY: *B. intrusus* ( ● ); *B. parviflorus* (▲); *B. purpureus* (■); *B. talbotii* ( ▣ ).

# PLATE 1: CORONA LOBES.


A. Filiform lobe of *Batesanthus parviflorus*.
*Deighton, F.C. 3265* (K).
Scale bar = 100 µm




B. Obcordate lobe of *Mondia whitei*.
*Pienaar, B.J. 170* (NH).
Scale bar = 1 mm




C. Filiform lobe of *Zacateza pedicellata*.
*Gossweiler, J. 13584* (K).
Scale bar = 1 mm

# CHAPTER 8

## TAXONOMY OF *MANGENOTIA* Pichon

### 8.1 HISTORICAL BACKGROUND:

The genus *Mangenotia* was established by Marcel Pichon (1954) (Recommendation 73B.1 (b)) to commemorate its first collector Professor Mangenot. His description was based on the first collection of the specimen from Ivory Coast in 1951.

There is one species, namely *Mangenotia eburnea.* The specific epithet *eburnea* is a latin derivation of **"eburneus"**, meaning ivory white or white with a yellow tinge.

*Mangenotia* is a small liana or shrub of about 2–5 m tall, mostly in the tropical forests of Africa. It is characterised by having a narrowly urceolate to cylindrical tube as in *Cryptolepis* R. Br. (Periplocoideae). However, the flower bud is capitate, conical and remarkably twisted to the right (i.e. dextrorsum).

Pichon (1954) indicated that *Mangenotia* is nearest to *Calotropis* R. Br. (Asclepiadeae) but Bullock (1955) states that it is an obvious *lapsus calami* for *Cryptolepis* to which the genus is closely allied.

### 8.2 TAXONOMY:

***MANGENOTIA*** Pichon in Bulletin de la Société Botanique de France **101**: 246–248 (1954).

TYPE: *Mangenotia eburnea* Pichon

Twining shrub or small liana, erect at first and later climbing with thin terete stems; anthers sessile and very hairy; leaf surface puberulent adaxially and glaucous with papillae projections abaxially; flowers creamy white; West Africa (coastline)

***Mangenotia eburnea*** Pichon in Bulletin de la Société Botanique de France 101: 246–248 (1954); Bullock 10: 587 (1955); Bullock: 81, 84 (1963b).
TYPE: Cote d'Ivoire, Adiopodoumé, pres d'Abidjan. 07–06–1951. *Mangenot, s.n.* (P, holotype!).

Liane, erect at first, later climbing and twining, with terete thin branches, latex milky. **Stems** woody, drying brownish, puberulous or nearly so. **Leaves** decussate to opposite; *petiole* (3–)4–5(–7) mm long, puberulous; *lamina* (21–)30–43(–50) x (9–)13–19(–22) mm, broadly ovate, ovate to elliptic, apex acuminate to acute, base rounded, margin entire, glabrous, dark green above, pale-green to glaucous beneath with hypostomatous surface, venation brochidodromous. **Inflorescences** lax cymes, dichasial, puberulous; *peduncles* (3–)4–5(–7) mm long; *pedicels* (4–)6–9(–11) mm long, bracts small, decussate, outer side puberulous, inner side glabrous. **Flowers** pentamerous, complete, greenish, yellow, white or white creamy, flower bud capitate, conical and contorted to the right (dextrorsum), gynostegium hidden at base of corolla tube. ***Calyx*** of 5 sepals, 2 x 1 mm, pale green, free, ovate, apex acute, margin somewhat ciliate, bilobed colleters at inner base. ***Corolla*** of 5 petals, pale yellow, membranous; *lobes* free when open; *tube* 9–14 mm long, cylindrical, puberulous outside, glabrous within, *lower tube* shorter at ± 3 mm long, *upper tube* cylindrical with constricted throat, longitudinal ridges within; *lobes* linear oblong, ± 8 mm long, ivory white. ***Corona*** lobes arise at middle of corolla tube and included within; *lobes* clavate, c. 1 mm long, with ovate cushion at base. **Androecium:** *stamens* 5, inserted near base of tube; *anthers* sub-sessile, hairy, connivent around the stylar head, connective very prominent with flap/wing-like microsporangia; *pollen* granular in tetrads. **Gynoecium:** *ovaries 2,* free, broadly ovate to cushion-like (clavuncula), flattened at the base, half-inferior; *styles* 2, fused towards apex; *stigmatic head* pentangular ovoid; *translators* 5, situated around the periphery of the stigmatic head, spathulate with linear receptacle, stalk short to absent, viscidium circular, sticky. **Fruit** of paired follicles; *follicles* 100–128 x 9–12 mm long, linear–oblong and tapering into a blunt point, glabrous with longitudinal fissures on dry surface. **Seeds** 5–7 x 2 mm, numerous, flattened, elliptic; *coma* of hairs whitish brown, 37–44 mm long. (Figure 8.1).

## 8.3 DISTRIBUTION AND ECOLOGY:

*Mangenotia eburnea* Pichon is restricted to West Tropical Africa, from Nigeria to Sénégal between lines of latitude $05^{0}01'$N – $14^{0}19'$N and longitude $03^{0}23'$E –$16^{0}45'$W (Figure 8.2). Most specimens have been collected around the low-lying coastline. The species grows at an altitude range of 0–500 m.

The flowering season is around May–August. Fruits were seen around October–November (Table 8.1).

**Table 8.1** Flowering and fruiting periods of *Mangenotia eburnea*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWERS | | | | | | | | | | | | |
| FRUITS | | | | | | | | | | | | |

In Ghana, the species mostly grows in shrubland along the Cape Coast and attains a height of about 2 m. In forest habitat at higher altitudes, from 30 – 500 m, the species grows taller to about 5 m.

Ghana is situated along the coastline of the Gulf of Guinea, and consists mostly of low-lying savanna regions with a central belt of forest.

The Ivory Coast lies in coastal rain forest, and *M. eburnea* was found growing in white sandy soil at an altitude of 2 m. At sea level i.e. Island of Aladin, it has been found in sandy soil of an old secondary forest.

Liberia is characterised by tropical moist evergreen forest, which towards the interior, changes into a more deciduous type of forest. Here *M. eburnea* grows in riverine, low secondary bush and reaches a height of $\pm$ 4 m.

Sénégal is a flat country with sandy soil and an altitude that does not exceed 130 m. It is semi-arid in the north and tropical wet–dry in the south. The species was found in the forest at an altitude of 8 m.

Sierra Leone also presents varying degree of altitude, from 0–130 m. In this country, quite a number of vernacular names exist that differ from region to region or are tribal based. For instance, it is known as 'Kpokoyangoei" (Mende) in Gbangbama, a vernacular name that also refers to species of *Periploca* L., and its latex is used to treat craw-craw. In Matotaka it is "Njapagba", Yonibana people have two different names, "Kowonruia" and "Jamolal" whereas those in Port Lokoh refer to it as "Lobwe". In Mayoso it is known as "Ndifabwa" and "Moikwe" and/or "Cenje" in Mamaka.

**8.3.1 VOUCHER SPECIMENS:**

| | |
|---|---|
| IVORY COAST: | 05N 03W: Forêt de L'Abouabou, between Abidjan and Grand Bassam **(-BD)**. *Leeuwenberg, A.J.M. 4235* (WAG). |
| ____ | 05N 04W: ± 10 km. W of Jacqueville, old secondary forest **(-BA).** *Leeuwenberg, A.J.M. 8083* (BR). |
| SIERRA LEONE: | 08N 13W: Mayoso **(-CC)**. *Thomas, N.W. 1373* (K). |
| ____ | Not traced. Mamaka. *Thomas, N.W. 4544* (K). |


**Figure 8.1** *Mangenotia eburnea:* (A) Habit. (B) Closed flower, bud dextorsum; (C) Open flower showing gynostegium at base of tube. (D) Corolla tube. (E) Anther. (F) Pollen tetrads. (G) Reproductive organs / translators on apices of stylar head. Source: Pichon (1954).

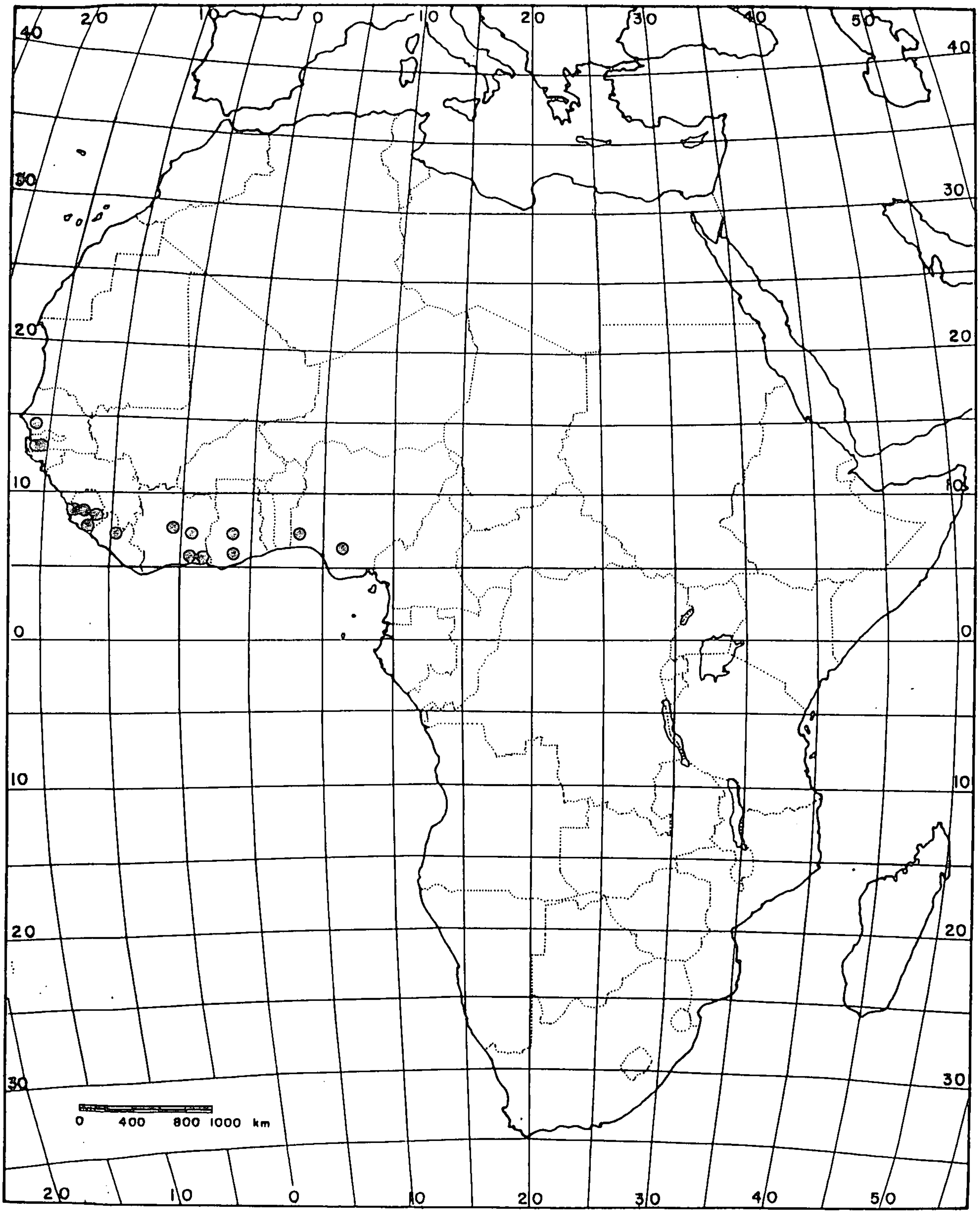



**Figure 8.2** Known geographical distribution of *Mangenotia eburnea*.

# CHAPTER 9

## TAXONOMY OF *MONDIA* Skeels

### 9.1 HISTORICAL BACKGROUND:

*Mondia* with its two species, is an African genus originally placed under the genus *Chlorocodon* Hook. f. The genus *Mondia* Skeels (1911), is a new combination resulting from Skeel's transfer of *Chlorocodon* Hook. f. (1871), thus illegitimate due to its being a later homonym of *Chlorocodon* Fourreau (1869) (Bullock 1962a).

The generic name *Mondia* has been derived from the Zulu vernacular name "uMondi", "Mundi", which refers to its aromatic tuberous roots with medicinal properties, especially *Mondia whitei* (Hook. f.) Skeels. Conservation through cultivation is an initiative that has been undertaken at Silverglen nursery in Durban. Crouch *et al.* (1998) have taken various approaches to propagate (*in vitro* culture) so as to conserve and save the endangered (if not facing extinction) species of *M. whitei.* They refer to the species as a versatile plant whose uses range from the source of stem fibers for rope-making, leaves cooked as a vegetable, to the deliciously aromatic roots employed as a tonic, anti-flatulent and aphrodisiac.

The specific epithet ***"ecornuta"*** is a Greek derived name, whereas ***"whitei"*** commemorates Mr. A.S. White from Natal who referred to the plant as 'uMondi root of Natal' and then sent a bundle of living roots to Kew. *M. whitei* is the correct name instead of the species being spelt as *whytei* or *whiteii* as it appears in some publications.

## 9.2 TAXONOMY:

***MONDIA*** Skeels in United States Department of Agriculture Bureau Plant Industrial Bulletin 223: 45 (1911).

≡ *Chlorocodon* Hook. f. in Botanical Magazine: t. 5898 (1871).

TYPE: *Mondia whitei* (Hook. f.) Skeels. (*Chlorocodon whitei* Hook. f.).

A tall liana with stems up to 20 m long. **Stem** twining and/or climbing, woody, drying brown with parallel striations, sometimes warted, terete. Latex milky white. **Leaves** opposite, large, petiolate with frill-like, toothed interpetiolar stipules, reflexed; *lamina* broadly ovate to broadly elliptic oblong, margin entire, sometimes ciliate, hypostomatous, abaxial and adaxial surfaces green. **Inflorescences** axillary paniculate cymes. **Flowers** 5-merous; ***Corolla*** campanulate to cupulatus with gynostegium exerted from corolla, glabrous or nearly so, greenish outside, maroon to reddish brown inside; *lower tube* ± 1 mm long; *upper tube* absent. ***Corona*** 5, double; *outer corona* lobes obcordate, with or without dorsal process, lobes arise at apex of lower corolla tube, basally fused with staminal filaments and nectaries; *inner corona* of interstaminal nectaries, fused basally to filament bases; nectaries sub-erect, foliose, shute-like lobes, situated basally around style. **Androecium:** *stamens* 5, inserted at mouth of corolla tube, staminal appendages white; *anthers* broadly triangular to linear with a connective, adnate to the dilated part of the style, connivent into a cone on top of capitate stigmatic head; *filaments* free basally, ± 2 mm long, adnate to corolla tube; *pollen* granular, porate tetrads. **Gynoecium:** *ovaries* 2, free, semi-inferior, ovules numerous; *styles* 2, fused into one apically, not exceeding anthers; *stigmatic head* pentangular ovoid, apex conical; translators 5, linear to narrowly ovate, in grooves of the stigmatic head, viscidium rounded, almost attached at right angle to the stalk. **Fruit:** *follicles* widely to horizontally divergent, narrowly ovoid to lanceolate, apex obtuse. Seeds comose. Species 2.

***KEY TO THE SPECIES:***

**1a** Outer corona obcordate without corniculate dorsal process...............

........................................................................1. ***Mondia ecornuta***

**1b** Outer corona obcordate with middle lobe subulate and 2 dorsal, corniculate process.............................................. 2. ***Mondia whitei***

**1.** ***Mondia ecornuta*** (N.E. Br.) Bullock in Kew Bulletin 15: 203 (1961); Agnew: 370 (1974). (*Chlorocodon ecornuta* N.E. Br. in Bulletin of Miscellaneous Information Kew 97: 111 (1895a); N.E. Br.: IV: 256 (1895b); Brenan 5(2); 64 (1949)).

TYPE: Kenya, Ribe near Mombasa. May 1870. *Rev. T. Wakefield s.n.* (K, holotype!).

Twiner about 2 m high, glabrous to somewhat pubescent. **Leaves** stipulate, interpetiolar stipules frill-like, slightly pectinate; *petiole* (10–)20–25(–35) mm long; *lamina* (25–)90–115(–145) x (10–)30–50(–100) mm, apex acuminate to cuspidate, base rounded to cuneate, sometimes auriculate[1]. **Inflorescences:** few flowered; *peduncles* (7–)10–15(–30) mm long; *pedicels* (5–)10–15(–35) mm long. **Flower:** obconic to cupulatus. ***Calyx*** 3 x 2 mm, elliptic to obtuse, free. ***Corolla***: *lobes* 7–10 x 3–6 mm (including tube). **Fruit[2]:** *follicles* paired. **Seeds[2]** globose. (Figure 9.1, 9.2).

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**1.** Three specimens, from Congo *Bouquet, A. 631* and from Gabon *Klaine, R.P. 577* and *Le Testu, M.G. 8865* have pubescent stems, leaves, petioles and peduncles. The flowers are also comparatively smaller. Leaf base is auriculate.

**2.** Fruit and seeds descriptions *cf. ic. Klaine, R.P. 577* (P), herbarium sheet.

## 9.3 DISTRIBUTION AND ECOLOGY:

*Mondia ecornuta* is restricted in distribution to the eastern coastline from Mozambique, Tanzania to Kenya between 03$^0$42'S – 07$^0$57'S and 36$^0$31'E to 39$^0$42'E and again collected from western coastline from the Democratic Republic of Congo and Gabon at 00$^0$50' S – 03$^0$57' to 00$^0$30' N and 09$^0$25' – 14$^0$38' (Figure 9.5).

The flowering season is from January to November and fruits were recorded in July and November (Table 9.1).

TABLE 9.1 Flowering and fruiting season of *Mondia ecornuta*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWERS | | | | | | | | | | | | |
| FRUITS | | | | | | | | | | | | |

This twining liana has been collected at an altitude of 50 m and 200 – 700 m. The species has been found on limestones outcrop in association with species of *Saintpaulia* H.A. Wendl., *Securinega* Comm. ex Juss., *Maytenus* Molina and *Pandanus* Parkinson. It is a creeper, in coastal scrub of Kenya in young bush and also in hill forests of Tanzania.

People of Tanzania refer to the plant as "Mwendo" or "Wendi" (Kihehe tribe) and also known as "Mwende" (Kipogoro tribe).

### 9.3.1 VOUCHER SPECIMENS:

DEM. REP. OF CONGO: <u>03S 14E</u>: Brazzaville, village de Kimpélé, km 16 route de Mayama-Mouyondzi **(-DC).** *Bouquet, A. 631* (P).

GABON: <u>00S 12E</u>: Lastoursville **(-DC).** *Le Testu, M.G. 8865* (P).

| | |
|---|---|
| KENYA: | 03S 39E: Ribe near Mombasa **(-DC).** *Wakefield, T. s.n.* (K, holo). |
| MOZAMBIÇUE: | Not traced: Misala River, Hynesa. *Allen, C.E.F. 139* (K). |
| TANZANIA: | 05S 38E: Pangani Distr., Bushiri estate **(-BA).** *Faulkner, H.G. 558* (K) (Sheet 1 & Collection (2)). |
| ___ | 07S 36E: Ulenga Distr., Ilingera near Ifakara **(-DC).** *Haerdi, F. 266\0* (K). |

**2. *Mondia whitei*** (Hook. f.) Skeels in United States Department of Agriculture Bureau Plant Industrial Bulletin 223: 45 (1911); Bullock 15(2): 203 (1961); Bullock 2(2): 82 (1963a); Ross: 282 (1973); Killick 45: t. 1792 (1978–79); Van Jaarsveld 66(3): 90–91 (1980); Retief & Herman 6: 554–555 (1997); Crouch *et. al.*: 21 (1998); McCartan & Crouch 64(5): 313–314 (1998); Victor *et al. 10: 71–98* (2000).

TYPE: South Africa, Natal, Mfundisweni. 12 Dec. 1871. *White s.n.* (K, holotype!).

≡ *Chlorocodon whitei* Hook. f. in Curtis Botanical Magazine 97: t. 5898 (1871); Bentham 2(2): 740–745 (1876a); K. Schum. 4(2): 215, 217, Fig. 64 O–Q (1895b); Masters (Ed.) 3(18): 234, 243, Fig. 48 (1895); Schltr. 34: 314 (1896); Hiern 1: 680 (1898); J.M. Wood & M.S. Evans 1(1): 27–28, t. 31 (1898); N.E Br. 4(1): 255 (1902), 4(1) 542: (1907); Marloth, R. 3(1): 72 (1932); Brenan 5(2): 64 (1949); Bullock 9: 351 (1954b).

= *Periploca latifolia* K. Schum. in Engler Pflanzenfam Ost-Afrika C: 321 (1895c), 23: 232 (1896).

TYPE: Cameroon, Yaoundé. 28 Jan. 1897. *Zeuker 589* (K, holotype!, isotype!).

= *Tacazzea amplifolia* S. Moore in Journal of Botany 50: 337 (1912).

SPECIMEN:Angola, Cazengo. *Gossweiler, J. 616* (BM, holotype, K, P).

= *Tacazzea viridis* A. Chev. (Expl. Bot. Afr. Occid. France: 429 (1920), *nomen*) ex Hutch. & Dalziel 2: 52 (1931), :339 (1937), *desc. lat.*
SPECIMEN: Ivory Coast, Mankoro district, between Dialakoro and Kénégoué. *Chevalier, A. 21975* (K, holotype!).

Twining climber. **Roots** thick, succulent with aromatic scent. **Leaves** herbaceous, interpetiolar stipules dentate, forming a band connecting the pair of petioles; *petiole* (11–)20–50(–80) mm long, deeply grooved at center, pubescent; *lamina* (40–)80–155(–245) x (15–)55–90(–120) mm, broadly ovate to suborbicular, apex acuminate to sharply acute, base cordate to cuneate, green, glabrous or nearly so adaxial, abaxial surface hirsute, more so on the midrib. **Inflorescences** many flowered, pubescent; *peduncles* (10–)15–25 (–40) mm long; *pedicel* (5–)10–15(–20) mm long, dichotomously branched; *bracts* c. 5 x 1 mm, linear oblong. **Flowers** rotate to broadly campanulate. ***Calyx*** 2 x 1 mm, ovate, acute, free, membranous, green. ***Corolla:*** *lobes* 6–8 x 3–5 mm, oblong-obtuse with round apex, greenish yellow outside, maroon to violet purple inside. ***Corona***: *outer corona* obcordate, central lobe subulate or horn shaped, 5–6 x 2 mm long, 2 obcordate or corniculate dorsal process, spreading in open flower, fused to the outside of filament bases (Plate 1 – after pp. 88). **Fruit:** *follicles* 30–120 x 15–25 mm long, ovate to lanceolate, glabrous, very rarely puberulous; *fruit stalk* 45–80 mm long, warted. **Seeds** obliquely ovate, keeled on both surfaces. (Figure 9.3, 9.4).

### 9.4 DISTRIBUTION AND ECOLOGY:

*Mondia whitei* is widely distributed (Figure 9.5) in Tropical Africa from South Africa eastern coastline of KwaZulu - Natal (Otherwise, it has been reported to occur further inland in the Northern Province (northern Transvaal prior to 1994) to Sudan and western coastline from Namibia to Senegal, that is, 05$^0$59'N 00$^0$40'W – 12$^0$48'N 16$^0$18'W to 00$^0$27'N 29$^0$29'E – 04$^0$05'N 32$^0$43'E and 01$^0$19'S 12$^0$15'E – 30$^0$43'S 30$^0$40'E. Altitude ranges from 80 – 1,900 m above sea level.

The flowers were seen from November to February in the Southern Hemisphere and June to August in the Northern Hemisphere and fruits from March to December (Table 9.2).

**Table 9.2** Flowering and fruiting period of *Mondia whitei*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWERS | | | | | | | | | | | | |
| FRUITS | | | | | | | | | | | | |

The species *Mondia whitei* is currently considered threatened \ vulnerable (Hilton-Taylor 1996), if not extinct in the wild, with its distribution in South Africa largely restricted to nature reserves and protected coastal swamp forests of KwaZulu - Natal. Hooker (1871), made a note that the nearer the plant grew to the sea, the sweeter and better was the flavour of the root. In South Africa, *Mondia whitei* has been declared threatened due to over-harvesting of the popular "liquorice' (as in *Glycyrrhiza* L.) roots that are differently used for medicinal purposes throughout Tropical Africa. In other parts of Africa, most of which are currently war-zones, there are no recent collections thus the status is not known. This species mostly grows in swampy conditions.

It is a climber on forest edge and riverine forest as in Mkuze Nature Reserve, Hlabisa and Dududuku (South Africa) as well as in dense bush of *Brachystegia* Benth. woodland. Nevertheless, it is also common in Bamboo thicket of Malawi and in decidous thicket of mixed *Acacia* Mill. woodland. Otherwise it has been found in mixed forest edge with red sandy soil. The plant is usually found in dense bush, the lower portion of the stem being naked and leafless. The leaves only appearing at the tops of supporting trees (Wood & Evans 1898) such as *Ixora* L. sp. and *Trema orientalis* (L.) Bl. In Ivory Coast, Nigeria, Cameroon and Sudan, the species has been collected mainly from the savanna to savanna woodland. Otherwise, it has been found in association with species of *Anthocleista* Afzel. ex R. Br., *Albizia* Durazz., *Berlinia* Sol. ex Hook. f. on river banks with *Barringtonia* J.R. Forst. & G. Forst.

Uses range from the source of stem fibers for rope-making (Angola) and medicinally popular among native tribes of Tropical Africa as an aphrodiasic (Zimbabwe to East-Central Africa), easing of flatulence, settling the stomach and acting as a tonic (South Africa) (McCartan & Crouch 1998).
There is an initiative at present by the Natal Herbarium together with Silverglen Medicinal Plant Nursery (Durban) to propagate *M. whitei* for both conservation and potential industrial intiatives. Wood & Evans way back in 1898 reported a proposal from the Natal colonists to make a ginger beer-like beverage from the scented roots.

There are quite a number of vernacular names. People of Angola refer to the plant as "Mudondo" or "Mundondo", although the name also refers to members of *Tylophora* R. Br., some bears a close resemblance to *M. whitei* (Hiern 1898). In South Africa, the Zulu call it "uMondi" or "Mundi". The Lissongo tribal group of Central African Republic call it "Mundondo", "Bondo" or "Molobusia". The Fula of Guinea Bissau refer to it as "Lacadje". "Sedando omutona" by the Luganda tribe of Uganda. It is "Citumbolo" in Malawi. The different tribes of Zaire refer to the plant as "Nlondo", "Kimbiolongwa", "Kumba" by the Ngwako, "Ubasangbwandiya" or "Gatimba" by the Lugware, "Mujimbaye" by the Tshiluba.

**9.4.1 VOUCHER SPECIMENS:**

CAMEROON: 09N 13E: Bosum-Buar **(-DC).** *Mildbraed 9731* (K).

IVORY COAST: 07N 04W: Brobo, 25 km ENE of Bouaké gallery forest **(-DD).** *Oldeman, R.A.A. 392* (K, MO).

MALAWI: 15S 35E: South region slopes of Zomba Plateau **(-AD).** *Brummitt, R.K. & Seyani, J.H. 14810* (SRGH).

NIGERIA: 07N 03E: Ibadan Distr., near Busogboro **(-BD).** *Onochie, 34943* (K).

SOUTH AFRICA: 23S 30E: Northern Province, Letaba, Duiwelskloof, Westfalia estate **(-CA).** *Scheepers, J.C. 1058* (PRE).

29S 31E: Kwazulu-Natal, Stanger **(-AD).** *Pienaar, B.J. 170* (NH).

29S 31E: Durban **(-CC).** *Medley Wood, J. 6180* (PRE).

30S 29E: Mfundisweni **(-DC).** *White s.n.* (K holo, iso).

ZIMBABWE: 20S 32E: Chipenge Distr., Gungungana Forest Reserve **(-BC).** *Goldsmith, B.* $^{5}/_{64}$ (SRGH).

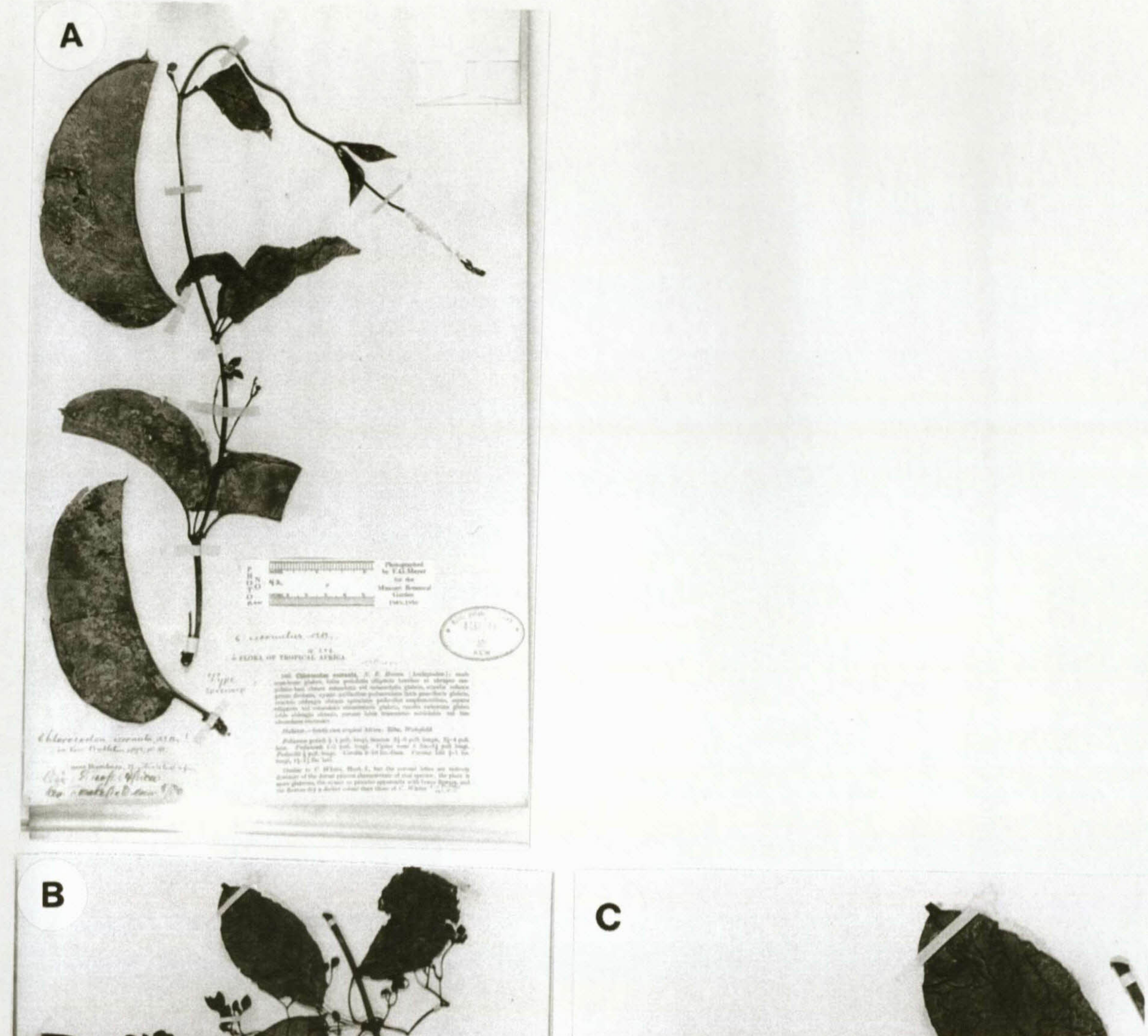


**Figure 9.1** Habit of *Mondia ecornuta:* (A) Leaves with flowers, taken from *Wakefield, T. s.n.* (K). (B–C) Leaves and flowers, taken from *Faulkner, H.G. 558* (K).

*Photos: Gabré Kemp.*

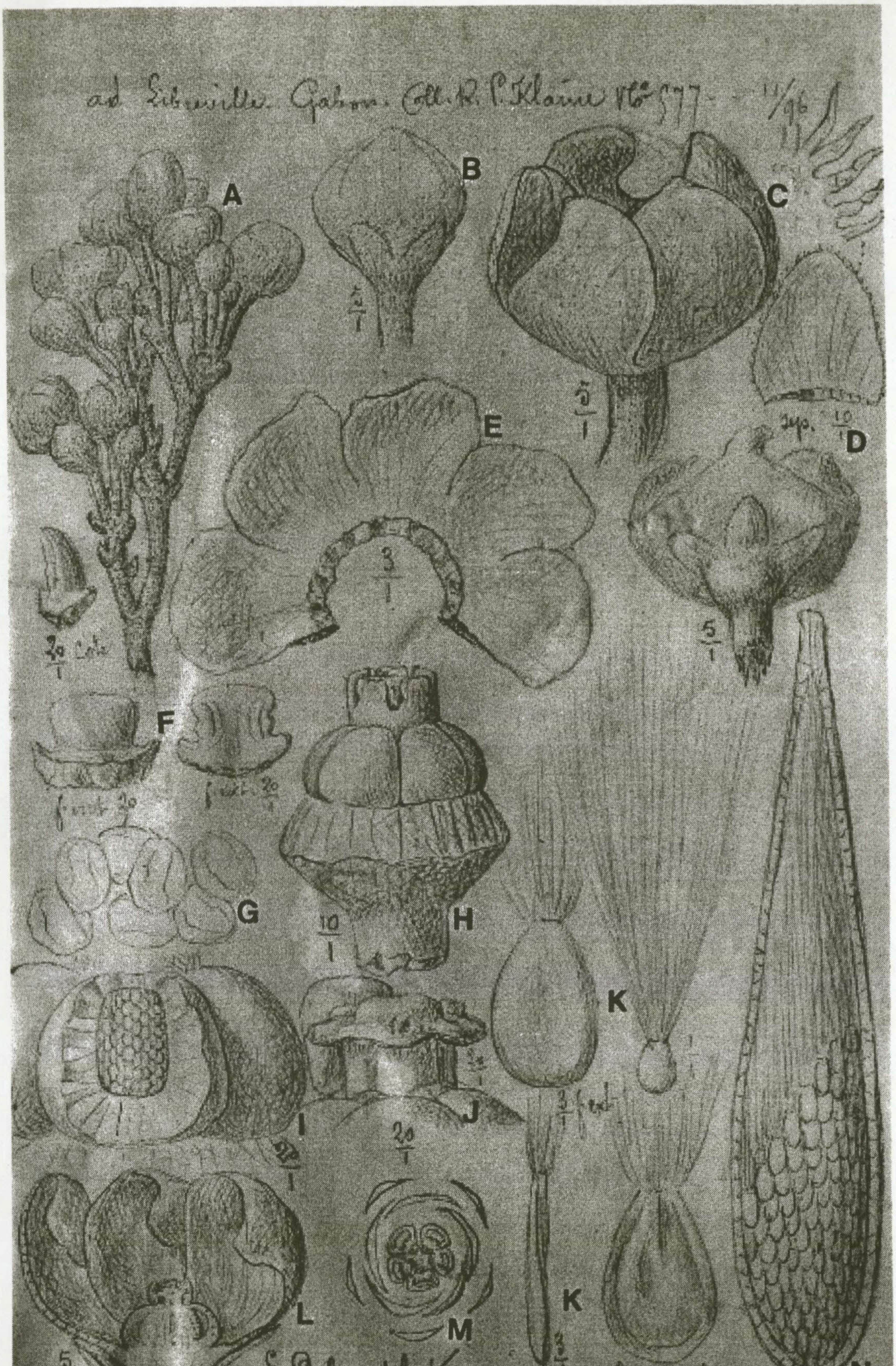



**Figure 9.2** (A – N): *Mondia ecornuta* showing floral parts (A–J, L), seeds (K), floral diagram (M) and fruit (N).

Source: Herbarium sheet - *Klaine, R.P. 577* (P).

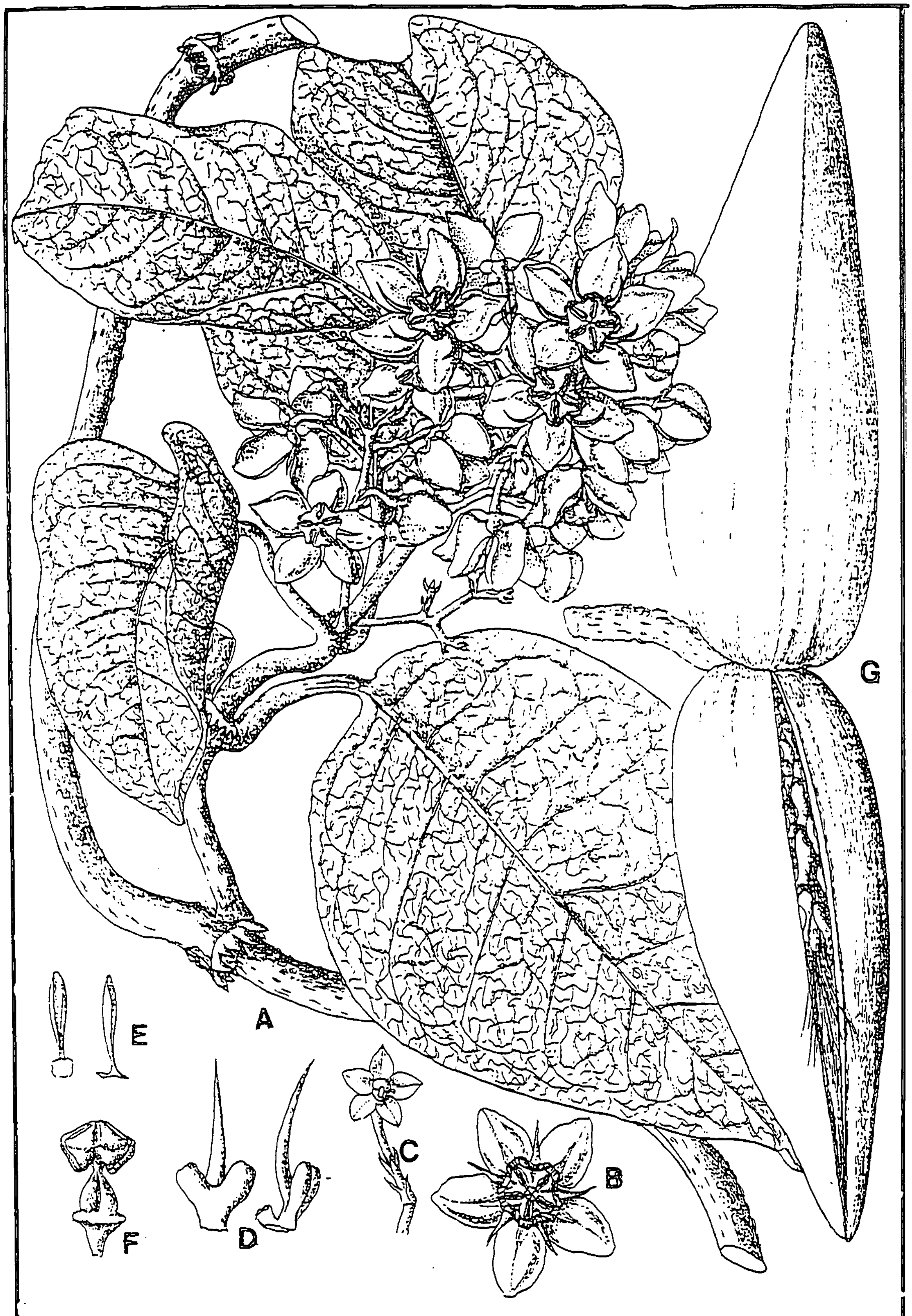



**Figure 9.3** Habit of *Mondia whitei.* (A) Branch with leaves and flowers, about natural size. (B) Flower. (C) Calyx. (D) Corona, front and side view. (E) Translator. (F) Stigma. (G) Follicles, about natural size.

Source: Wood & Evans (1898).

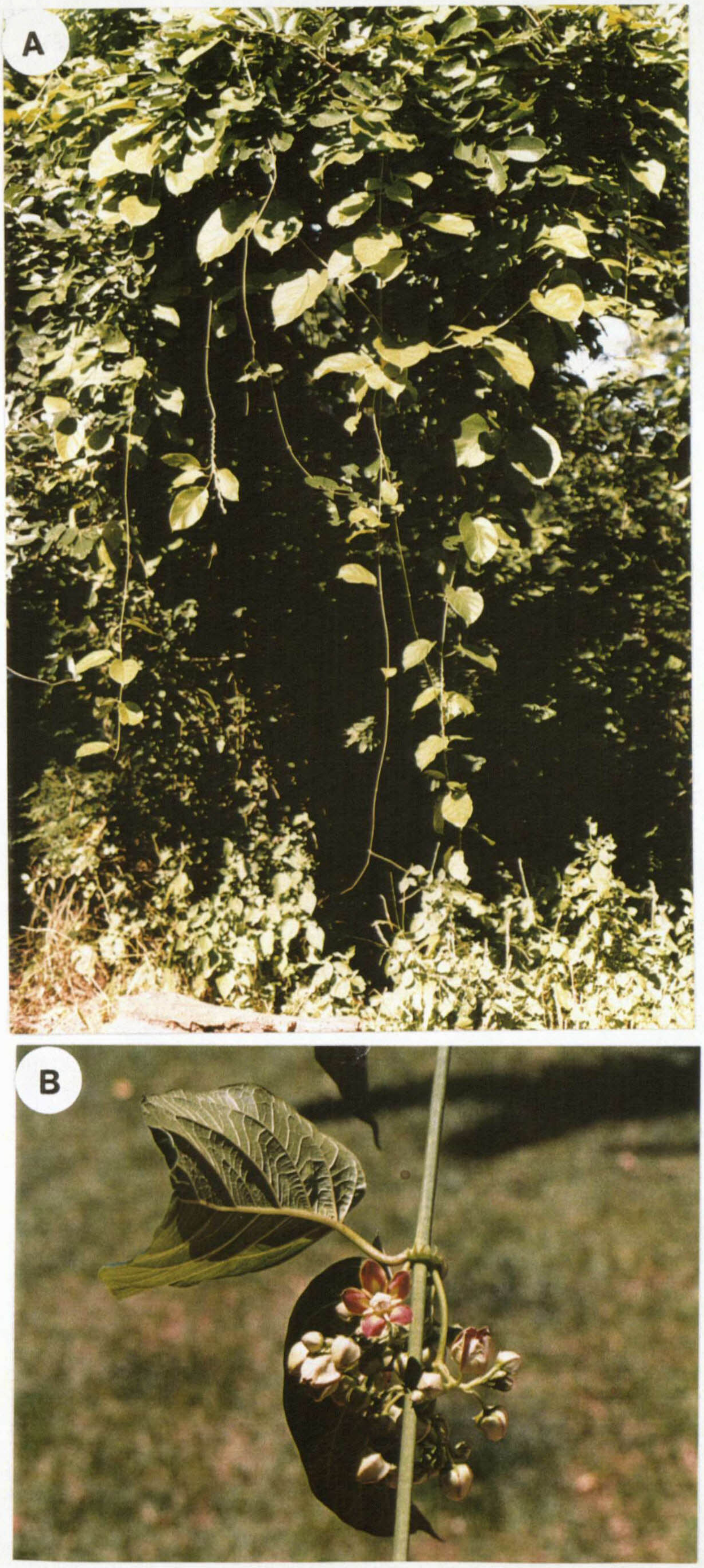



**Figure 9.4** (A) Natural habit of *Mondia whitei* in Mkuze (S.A). (B) Terete stem with leaves and flowers.

Photos: Prof. H.J.T. Venter.

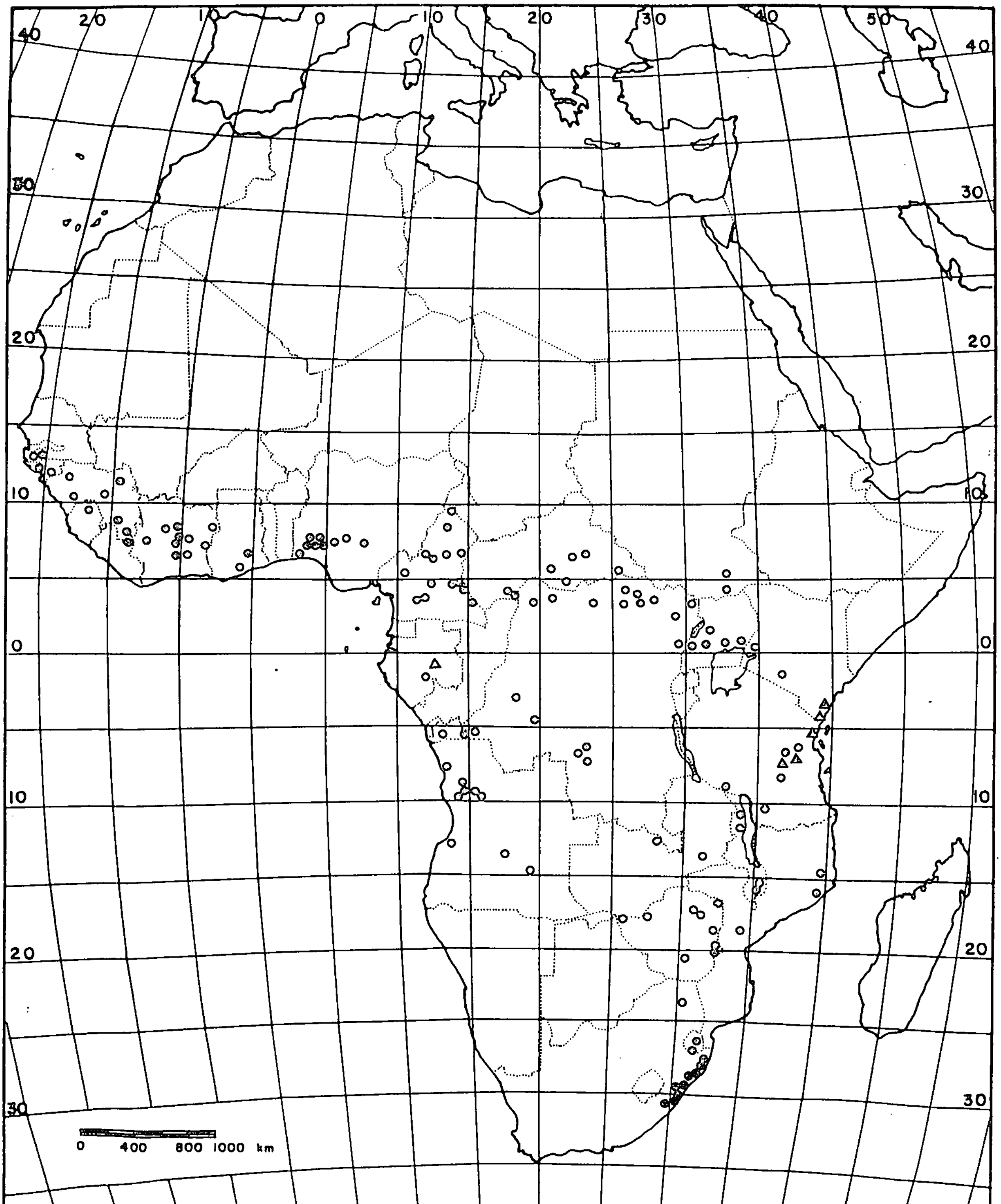



**Figure 9.5** Known geographical distribution of *Mondia ecornuta* (▲) and *M. whitei* (●).

# CHAPTER 10

## TAXONOMY OF *SACLEUXIA* Baill.

### 10.1 HISTORICAL BACKGROUND:

*Sacleuxia* is an East Africa genus with two species, namely *S. newii* (Benth.) Bullock (Fig. 10.1) and *S. tuberosa* (E.A. Bruce) Bullock (Fig. 10.2). Baillon first published the generic name in 1891 in honour of Mr. Sacleux who collected the specimen from Zanzibar with *S. salicina* Baill. as the type specimen.

*S.* ***newii*** commemorates plant collector, the late Rev. C. New who, according to herbarium records collected the specimen on his expedition up Kilimanjaro Mountain (Tanzania)). *S.* ***tuberosa*** refers to the striking potato-like tuberous roots. ***"Tuberosus'*** is a Greek derived word meaning "producing tubers or swollen into a tuber'.

*Gymnolaema* Benth. as published by Bentham (1876b) is an orthographic variant. Bullock (1962a) referred to *Gymnoleima* Decne. (type species *Lithospermum graminifolium*) a genus in the Boraginaceae, as a dead synonym. Nevertheless, Decaisne's name was validly published and it thus retains its status for purposes of priority and homonymy. Hence, *Sacleuxia* (Recommendation 73B.1 (b)) of the ICBN became the correct name for this taxon.

***Gymno-*** is a Greek derived word meaning 'naked'; the genus was named on account of the 'naked throat of the corolla'.

### 10.2 TAXONOMY:

***SACLEUXIA*** Baill. Histoire Plantarum 10: 265 (1891).

TYPE: *Sacleuxia salicina* Baill.

≡ *Gymnolaema* Benth. in Bentham & Hooker, *Gen. Pl. 2: 740* (1876a); N.E. Br. *4(1): 241* (1902); K. Schum. *4(2): 211* (1895a); Dale & Greenway: 57– 58 (1961); Sharpe & P.I. Forst. *47: 12–14* (1989), non *Gymnoleima* Decne. in A.P. Candolle (Ed.): 491–500 (1844).

Type: *Gymnolaema newii* Benth.

= *Macropelma* K. Schum. in *Engler Pflanzen. Ost. Afr. C: 321* (1895b), *23: 232* (1896).

Type: *Macropelma angustifolium* K. Schum.

Erect shrubs with tuberous roots. **Leaves** opposite, simple, margin entire, hypostomatous, venation brochidodromous, puberulous to somewhat glabrous, elliptic to oblong-linear, pale-green abaxially, dark-green adaxially. **Inflorescences** clustered, panicle or raceme of cymes, few flowered. **Flowers** pentamerous, bisexual, gynostegium exposed from corolla. ***Corolla*** with broadly campanulate tube, indistinct. ***Corona*** annular, obscure with small fleshy lobes fused to the filaments. **Androecium** of 5 stamens, epipetalous; *anthers* sub-sessile, ovate, connective apically acute, connivent on top of pentangular ovoid stigmatic head; *filaments* free fused to interstaminal discs, connate; pollen in granular tetrads. **Gynoecium:** *ovaries* 2, sub-globular, semi-inferior, pubescent' *styles* 2, becoming fused apically; *translators* 5. **Fruit** follicles, paired or clustered, divergent horizontally. **Seeds** oblong to obovate, comose. Species 2.

**KEY TO THE SPECIES:**

**1a** Leaves sessile or sub-sessile, blade base cordate; glabrous or nearly so, at least on adaxial surface. Inflorescences with peduncles slender, 30–130 mm long; flowers yellow white; ovary glabrous ................**1. *S. newii***

**1b** Leaves petiolate, blade base cuneate to obtuse; pubescent, more so abaxial. Inflorescences with peduncles up to 10 mm long; flowers purple brown; ovary hairy..........................................**2. *S. tuberosa***

1. ***Sacleuxia newii*** (Benth.) Bullock in Kew Bulletin 15: 393–394 (1962a) (*Gymnolaema newii* Benth.: *74, t. 1186* (1876b)).

TYPE: Tanzania, T2 Moshi Distr., Kilimanjaro mountain. *New s.n.* (K, holotype!).

= *Sacleuxia salicina* Baill. 10: 265 (1891).

TYPE: Zanzibar, Nguru. 01–06–1892. *Sacleux 758* (P, holotype!).

= *Macropelma angustifolium* K. Schum.: 321 (1895c).

TYPE: Tanzania, Merue. *Fischer 383* (B ψ). Synonymy after Bullock 1962b and description of species.

Virgate, branched shrub, 1,5 – 2,5 m high. Roots up to 0.15 m in diameter. **Stem** purplish, drying brown, becoming glabrescent, latex milky-white, not copious. **Leaves:** *petiole* 0–3 mm long, sessile or sub-sessile; *lamina* (33–) 64–75(–127) x (8–)12–15(–19) mm, apex acute, base cordate, adaxial surface almost glabrous but hirsute on the midrib, abaxial surface pubescent, more so on the midrib. **Inflorescences:** *peduncles* 30–130 mm long, puberulent; *pedicels* 2–5 mm long, slender, puberulent; *bracts* ovate, clustered. **Flowers: *Calyx*** ± 1,5 x 1 mm, free, triangular, sub-glabrous. ***Corolla***: *lower tube* ± 1 mm long; *lobes* 2 x 1 mm, ovate, yellow white, glabrous. ***Corona*** on apex of lower tube, cream coloured; *outer corona lobes* present as inconspicuous squarish lobules at base of staminal column. **Androecium:** *stamens* connate; *anthers* sub-sessile, arise from lower tube. **Gynoecium:** *translators'* receptacle angular ovate on sub-circular viscidium. **Fruit:** *follicles* paired, 30–37 x 5–8 mm, green, shiny, more so inside when dry, elliptic-linear; *fruit stalk* 7–9 mm long. **Seeds** 4–7 x 1–2 mm, compressed with a coma, shiny, glabrous, oblong; *coma* of hairs 29–34 mm long. (Figure 10.1).

## 10.3 DISTRIBUTION AND ECOLOGY:

*Sacleuxia newii* is very much restricted to eastern Africa between latitude $00^{0}55$'S – $06^{0}46$'S and longitude $36^{0}27$'E – $39^{0}20$'E (Fig. 10.3), that is, in Kenya and Tanzania. Altitude ranges from 600–1,700 m.

Flowers were seen more or less throughout the year as the species occur just South of the Equator (Table 10.1).

**Table 10.1** Flowering and fruiting periods of *Sacleuxia newii*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWERS | | | | | | | | | | | | |
| FRUITS | | | | | | | | | | | | |

This is a shrub with a variety of habitats, from open bushland to closed woodland. The most common habitat where the species thrives is in the bushland, rocky outcrops and slopes with shallow soil cover.

It is a frequent shrub in the more open scrub of *Markhamia* Seem. ex Baill., *Xerophyta* Juss., *Commiphora* Jacq., *and Steganotaenia* Hochst. and may also be co-dominant with *Vellozia* Vand. sp. In most of the outcrops and slopes, where the species was collected, it was growing with species of *Vellozia, Entada* Adana., *Commiphora, Terminalia* L. and *Aloe* L. In deciduous bushland, more so secondary forest, it is found with species of *Acacia* Mill., *Commiphora, Dombeya* Cav., *Stereospermum* Cham., *Markhamia, Annona* L., *Afzelia* Sm. and *Euphorbia* L.

The woodland, closely associated to thorn woodland where it was collected, was characterized by the presence of species like *Acacia, Combretum* Loefl., *Sterculia* L., as well as tall grass, although grasses are relatively a minor part of the vegetation. On the south facing, steep rocky slopes of Kanga peak (Tanzania), it grows together with *Xerophyta* Juss. and Ericaceae heath.

### 10.3.1 VOUCHER SPECIMENS:

TANZANIA: 05S 38E: T3 Handeni Distr., Kideleko Mts. **(-AC)**. *Faulkner, H.G. 1434* (K).

___ 05S 38E. T3 Lushoto Distr., Amani, Mt. Bomole, East Usambaras **(-BA)**. *Verdcourt 188* (MO).

___ 05S 38E: T3 Tanga Distr., Magunga, sisal estates, footpath between Magunga & Ngua estates, west slopes of E. Usambaras **(-BA).** *Drummond & Hemsley 3364* (LISC).

— 05S 39E T3 Lushoto/Tanga Distr., lower Sigi valley, East Usambaras **(-AA).** *Verdcourt 246* (K, MO).

**2. *Sacleuxia tuberosa*** (E.A. Bruce) Bullock in Kew Bulletin 15: 393–394 (1962a); Agnew: 369 (1974). (*Gymnolaema tuberosa* E.A. Bruce: 304 (1934)).

TYPE: Tanzania, T1 Mwanza, coast of Speke Gulf, Lake Victoria, *Burtt, B.D. 2475* (K, holotype!, isotype!).

A pubescent shrub up to 4 m high. **Stems** terete, thin, sparsely branched, lactiferous, latex colourless. **Leaves:** *petiole* 2–5 mm long, puberulent; *lamina* (31–)41–80(–131) x (6–)10–14(–19) mm, apex acute to acuminate, base cuneate to obtuse, midrib tinged with magenta. **Inflorescences:** *peduncles* up to 10 mm long, puberulent; *pedicels* 3–5 mm long, puberulent. **Flowers:** ***Calyx*** puberulent outside. ***Corolla:*** *lobes* ovate, 4 x 2 mm, puberulent, purple brown; *lower tube* c. 1 mm long. ***Corona*** fleshy, lobules triangular to linear, dull green; *outer corona* situated on the mouth of the tube, fused into an annulus to filament bases; *inner corona* of interstaminal discs fused to inner base of filaments. **Androecium:** *stamens* arise from base of corolla tube. **Gynoecium:** *ovaries* 2, hairy; *translators'* receptacle broadly ovate to cordate, viscidium almost rounded to spherical. **Fruit** paired follicles, sometimes clustered; *follicles* (30–)37–42(–50) x (5–)8–12(–15) mm, narrowly ovoid, tapering into a blunt point, glabrous or nearly so, with longitudinal fissures on surface; *fruit stalk* 5–6 mm long. **Seeds** 4–7 x 1–2 mm, flattened, drying brownish, obovate; *coma* with hairs 12–13 mm long. (Figure 10.2).

## 10.4 DISTRIBUTION AND ECOLOGY:

The species *S. tuberosa* is endemic to Eastern Africa at an altitude ranging from 800 – 1,900 m. The range of distribution is between lines of longitude

$00^{0}55'$S and $06^{0}54'$S and lines of latitude $31^{0}20'$E and $38^{0}47'$E (Fig. 10.3). The flowers were seen from October to April and the fruit from April to July (Table 10.2). However, fruits were seen as early as January (*Kerfoot, O. 3596* (K)).

**Table 10.2** Flowering and fruiting periods of *Sacleuxia tuberosa*

| | Jan | Feb | Mar | Apr | May | Jun | July | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWER | | | | | | | | | | | | |
| **FRUITS** | | | | | | | | | | | | |

In Kenya, the species was found mostly on rocky outcrops and/or slopes with reddish soil, in association with species of *Dodonaea* Mill., *Aloe, Coleus* Lour., *Gleichenia* Sm., *Lycopodium* L., *Dissotis* Benth., *Crassocephalum* Moench, sometimes with *Acacia, Ormocarpum* P. Beauv., *Teclea* Delile, *Heeria* Meisn., *Commiphora, Rhus* L., *Tarchonanthus* L., *Tinnea* Kotschy & Peyr., *Barleria* L., *Combretum* and *Ruttya* Harv.

There are a number of habitats, all have granite rocks in common. One such is the rock thicket and rocky grassland. Another example is that of rocky hill slopes with species of *Lannea* A. Rich., *Sterculia, Brachystegia* Benth. and *Loudetia* Hochst. ex Steud. Its association with *Brachystegia* has been reported to be on a shallow soil cover with brownish loam and deposits of gravel.

Taking into consideration that most of the habitats encountered so far are dry, among granite rocks near the lakeshore, it is not strange to find it among species of *Aloe.* In the dry Miombo woodland, it is exposed on sloping rockfaces and in association with species of *Xerophyta.*

Dry forest – Miombo woodland varies in density from an open park-like growth of trees to relatively dense stands. Trees which form this forest are practically the same as those which occur in *Acacia* – tall grass savanna e.g. *Strychnos* L., *Brachystegia, Acacia, Ziziphus* Mill., *Bauhinia* L., etc. (Shantz & Marbut 1923)

In Tanzania, the Wasukuma tribe uses stems of *S. tuberosa* to prepare arrow shafts. They also use the tuberous roots as medication for scabies, the roots are pounded up green and then rubbed into scabies which has been previously well washed. Its vernacular name is 'Kisukuma' (Matala).

**10.4.1 VOUCHER SPECIMENS:**

KENYA: 00S 36E: K4 Naivasha Distr., Ol Longonot Estate **(-CD).** *Kerfoot, O. 3596* (K).

TANZANIA: 02S 33E T1 Mwanza Distr., Bbarika **(-DA).** *Tanner, R.E.S. 360* (K).

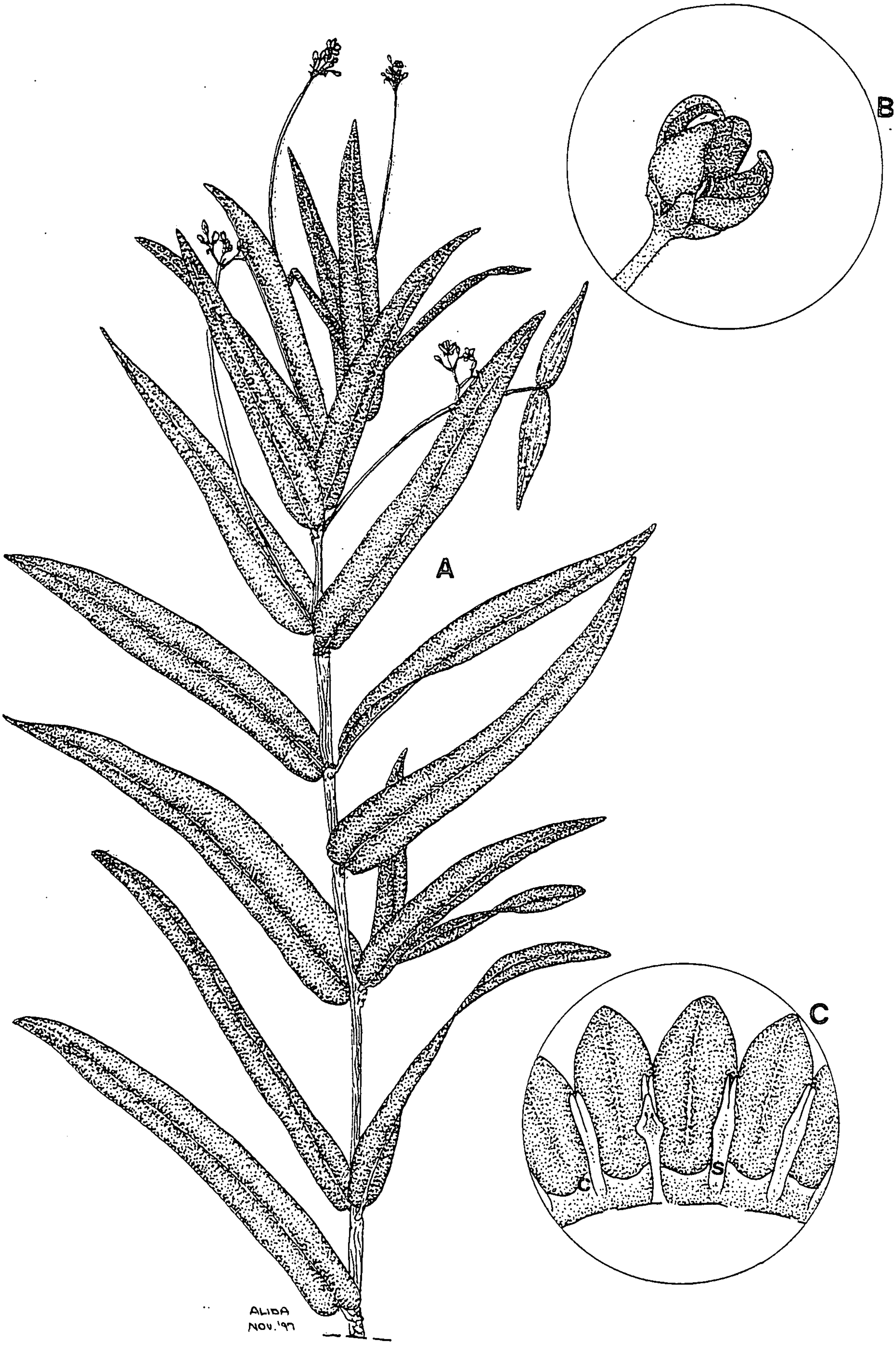



**Figure 10.1** *Sacleuxia newii:* (A) Habit. (B) Flower. (C) Open flower: ***s*** = *stamens*, **c** = outer corona.

Drawn from *Drummond & Hemsley 3364* (LISC).

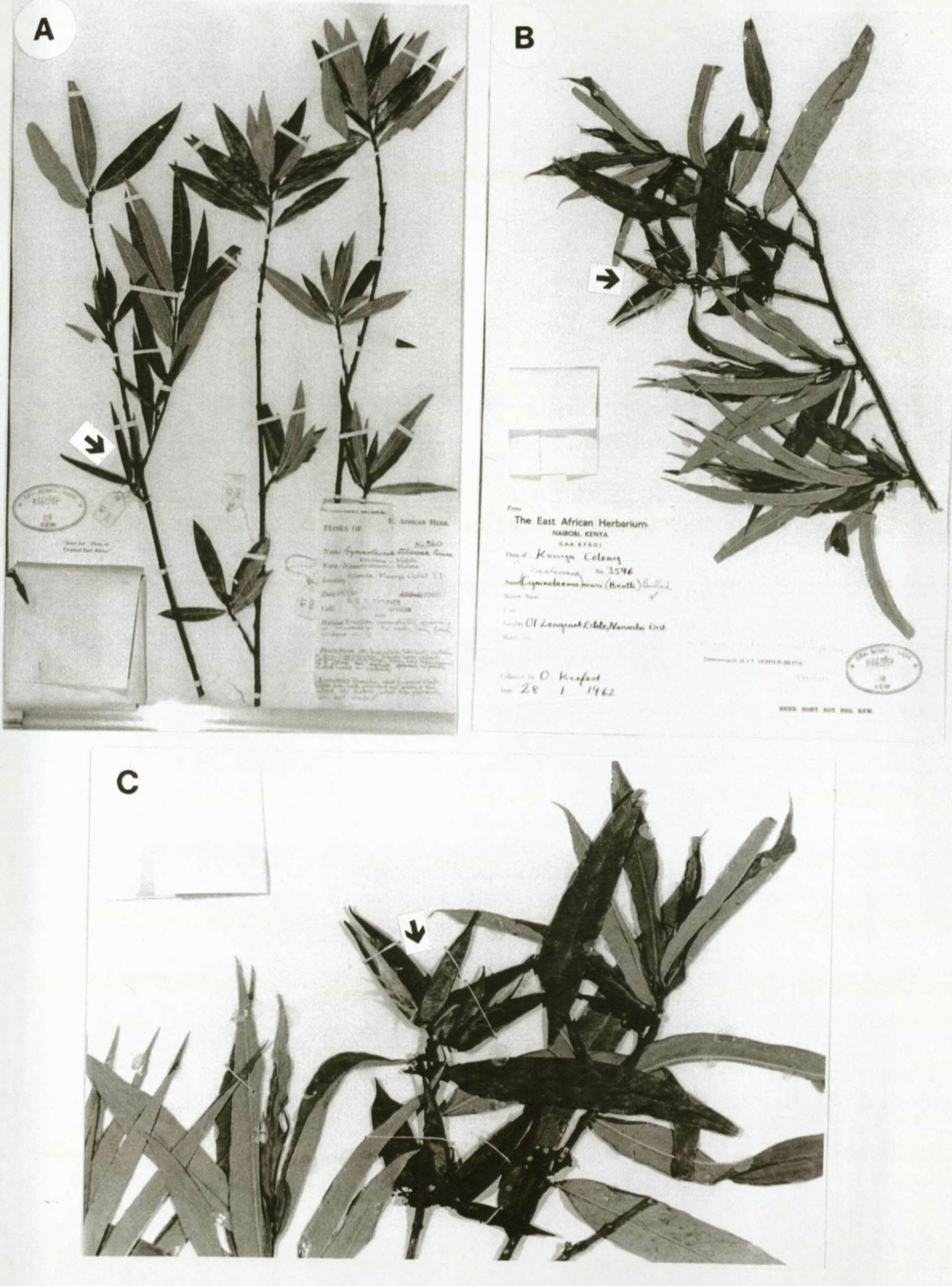



**Figure 10.2** Habit of *Sacleuxia tuberosa:* (A) Paired follicles (↑) (*Tanner 360* (K)). (B) & (C) Clustered follicles (↑) (*Kerfoot 3596* (K)).

Photos: Gabré Kemp.

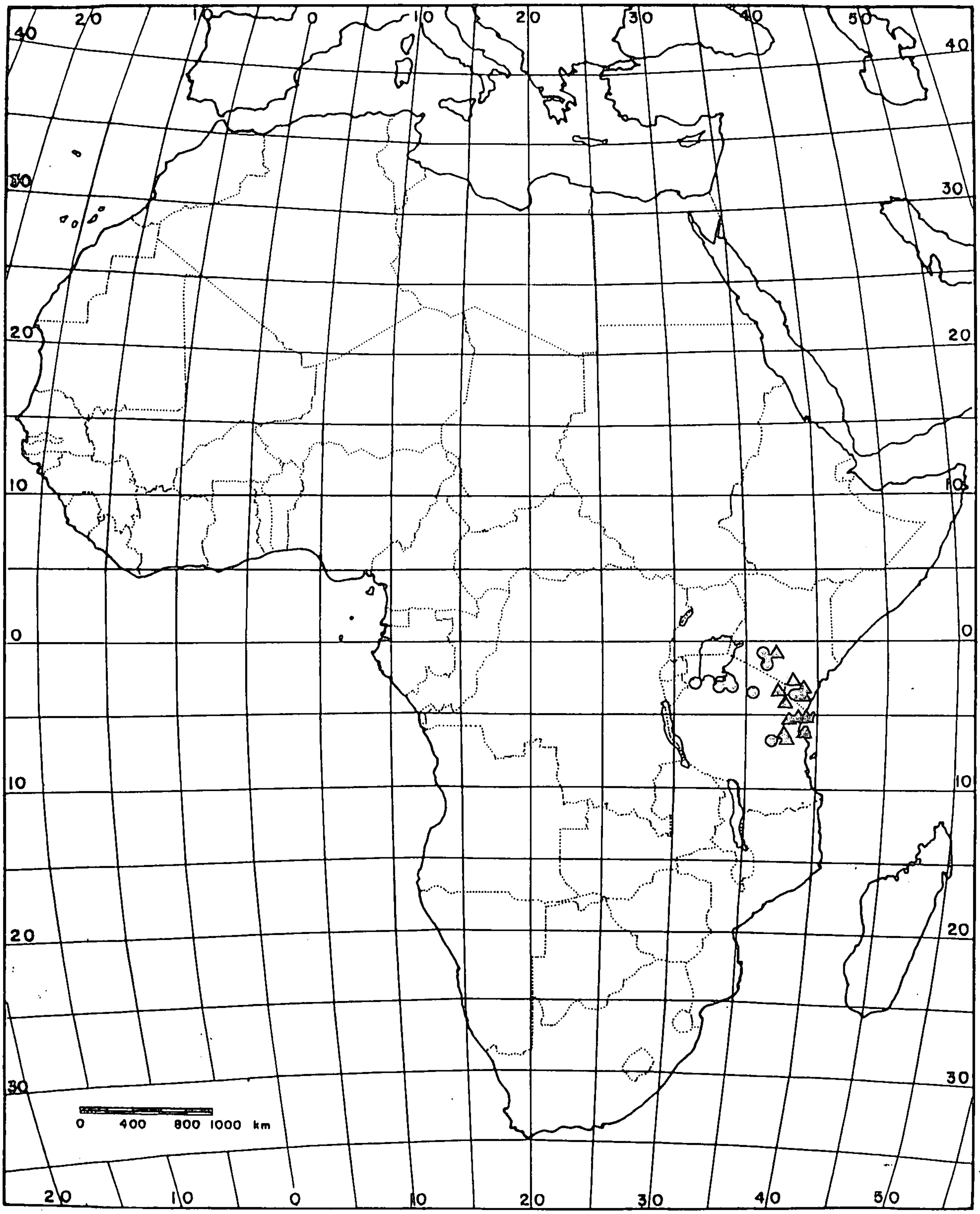



**Figure 10.3** Known geographical distribution of *Sacleuxia newii* (▲) & *S. tuberosa* (●).

# CHAPTER 11

## TAXONOMY OF *SARCORRHIZA* Bullock

### 11.1 HISTORICAL BACKGROUND:

*Sarcorrhiza* Bullock is a monotypic genus from Central and East Africa (Figure 11.3). The species *Sarcorrhiza epiphytica* Bullock was first described and established by A.A. Bullock in Hooker's, Icon. Pl. (1962b). He based his description on a collection from Tanzania, *Verdcourt, B. & L.D.* 1725 (K). *Sarcorrhiza* is a generic name that refers to the 'fleshy root-like organs'; **sarco-** is a Greek derived word meaning fleshy and **rhiz-** also a Greek derived word pertaining to the roots or root-like organs. The specific epithet – ***epiphytica*** refers to the epiphytic habit of the shrub. Hence, *Sarcorrhiza epiphytica* literally means an "epiphyte with fleshy roots."

*Sarcorrhiza epiphytica* is an epiphytic shrub, a feature rather unique within the African Periplocoideae. The only other Periplocoideae epiphytic genus is *Epistemma* D.V. Field & J.B. Hall with 3 species found in West Tropical Africa. *Sarcorrhiza* is characterized by having cylindrical, fleshy and tuberous roots. With its fleshy tuberous rootstock, it is similar to the genera within the Periplocoideae namely – *Raphionacme* Harv., *Petopentia* Bullock and *Sacleuxia* Baill. which also have large perennial rootstocks. According to Bullock (1962b), the genus is unique in its overlapping bracts and bracteoles on the peduncles. It has been in the past confused with *Petopentia* and *Tacazzea* Decne. as can be seen on some herbarium sheets.

### 11.2 TAXONOMY:

***SARCORRHIZA*** Bullock in Hooker's, Icones Plantarum: ad t. 3585 (1962b).

TYPE: *Sarcorrhiza epiphytica* Bullock

An epiphytic shrub with tuberous roots. Stems twining and convolute. Distinctly bi-coloured corolla lobes, marginal band yellow-green, central area spotted blood red and median line blood red to brownish. Corona filiform. Species 1.

***Sarcorrhiza epiphytica*** Bullock in Hooker's, Icones Plantarum: ad t. 3585 (1962b).
TYPE: Tanzania, T3 Lushoto District, path up Mt. Bomole, behind Amani. *Verdcourt, B. & L.D. 1725* (K, holotype!).

Creeping epiphyte. Tuberous roots, 50–90 mm long and around 35 mm in diameter, cylindrical, oblong to elliptic and purple brown. **Stems** contorted, twining, with adventitious rootlets (Fig. 11.2 C), branching internodes elongated as long as 150 mm but internodes on lateral branches shorter and frequently 10–30 mm long, lactiferous. **Leaves** opposite, simple, reticulate; *petiole* (4–)8–9(–10) mm long, pubescent, dark crimson to deeply blood-red; *lamina* (30–)55–75(–115) x (13–)17–20(–30) mm, narrowly elliptic, apex acuminate to acute, base cuneate to rounded, margin entire, glabrous or nearly so with hairs on the main veins, glossy on both surfaces, midrib blood-red, secondary veins looped towards the edge of the lamina with inconspicuous tertiary veins, abaxial surface pale green, hypostomatous, adaxial surface dark green. **Inflorescences** lax, cymose with monochasial branches, 2–4 flowered; *peduncles* 10–20 mm long, glabrous or nearly so; *pedicels* c. 30 mm long, glabrous or somewhat sparsely pubescent. **Flower** 5–merous, bisexual, actinomorphic, complete. ***Calyx*** of 5 sepals, 10–20 x 10 mm, free, broadly triangular to narrowly ovate, apex acute to slightly obtuse, puberulous, green. ***Corolla***: *lower tube* annular; *upper tube* absent; *lobes* broadly elliptic, ovate, apex acuminate, bi-coloured, contorted, glabrous, yellow-green outside, faintly flushed salmon inside, spotted reddish-brown with a deep blood red to brownish median line. ***Corona***: *outer corona* 5-lobed, lobes inserted towards base of lower corolla tube, opposite filaments, fused basally to staminal feet, forming a coronal annulus together with corona lobes and stamens, lobes filiform with acute apex, cream, glabrous and sinuate; *inner corona* form a ridge of interstaminal nectaries towards the base of the lower corolla tube. **Androecium:** *stamens* 5; *anthers* ovate, connective apically acute; *filaments* free, arise from inner base of corona lobes; *pollen* in granular tetrads. **Gynoecium:** *ovaries* 2, unicarpellate, semi-inferior; *styles* 2, becoming fused towards the apex, massive; *stigmatic head* pentangular, broadly deltoid/conical; *translators* arise from adaxial surface of stigmatic head (*cf. icon*), spoon shovel-like with receptacle obovate, stalk linear, viscidium rounded. **Fruit*:** *follicles* paired, pendulous, 140–450 x 45–50 mm, horizontally divergent, narrowly cylindrical, puberulous; *fruit stalk* 9–10 mm long, pubescent. **Seeds** obliquely ovate to oblong, compressed, with coma of hairs. (Figures 11.1 and 11.2).

*Described from herbarium sheet notes

## 11.3 DISTRIBUTION AND ECOLOGY:

*Sarcorhhiza epiphytica* Bullock is found in West–Central and East Equatorial Africa. It is found between the lines of longitude $05^{0}14'$N and $06^{0}55'$ S and latitude $06^{0}10$W and $38^{0}38'$E (Figure 11.3).

The flowering season for this species is around November to January (Table 11.1). Fruits were found around May.

**Table 11.1** Flowering period of *Sarcorrhiza epiphytica*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWERS | | | | | | | | | | | | |
| FRUITS | | | | | | | | | | | | |

The species was reported at altitudes from 1,000 – 1,900 m.

In Tanzania, near Amani, at an altitude c. 1,000 m, *S. epiphytica* is found in the crowns of *Piptandenia* Benth. (*P. buchananii*), and *Cupressus* L. sp. Some collectors refer to it as a climber because of its upward creeping growth on its support species. In Democratic Republic of the Congo, it was collected in Kwango south of the equator, also in the north-east region of Ruwenzori in Uganda at 1,800 m.

According to Coconet (1998), Ivory Coast, with its low lying flat to undulating terrain, is characterized by a rain season and dry season and it is a transitional zone between the moist equatorial climate and the dry tropical climate with temperatures ranging between $28^0$C and $37^0$C. Therefore, it renders the ecological status of this region more of a monsoon forest than a tropical rain forest. The collection from Ivory Coast was from a lower altitude than those found in Tanzania and Democratic Republic of the Congo. It was collected along the course of River Davo.

### 11.3.1 VOUCHER SPECIMENS:

TANZANIA: 04S 38E: T3 Lushoto Dstrict, path up Mt. Bomole **(-CD).** *Verdcourt, B. & L.D. 1725* (K, BLFU).

—— 06S 37E: T6 Morogoro District, Uluguru North, north-west side of mist forest **(-DC).** *Schlieben, N. 2939* (BR).

UGANDA: 00N 29E: U2/Zaire, Toro District, Ruwenzori, Kanvui **(-BD).** *Bequaert 4494* (BR).

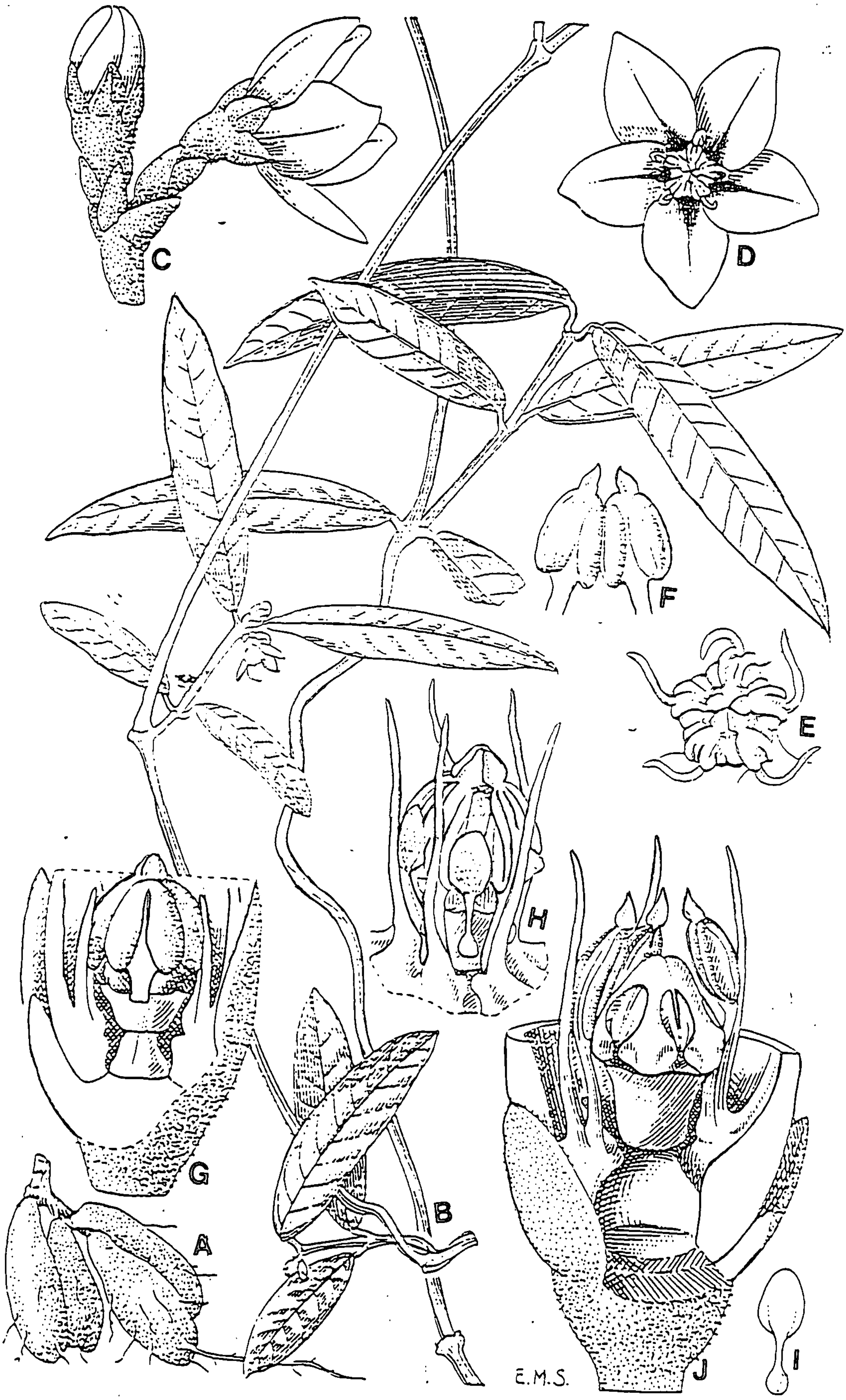



**Figure 11.1** ***Sarcorrhiza epiphytica.*** A – tuberous roots; B – habit, showing long and short shoots; C – part of inflorescence showing bracts and flowers; D – flower from above: E – flower centre from above; F – stamens from inside; G – section of flower bud; H – corona and gynostegium; I – pollen carrier; J – section of flower to show corona, stamens and style-apex (carpels removed).
All drawn from *Verdcourt 1725* K. Source: Bullock 1962b.

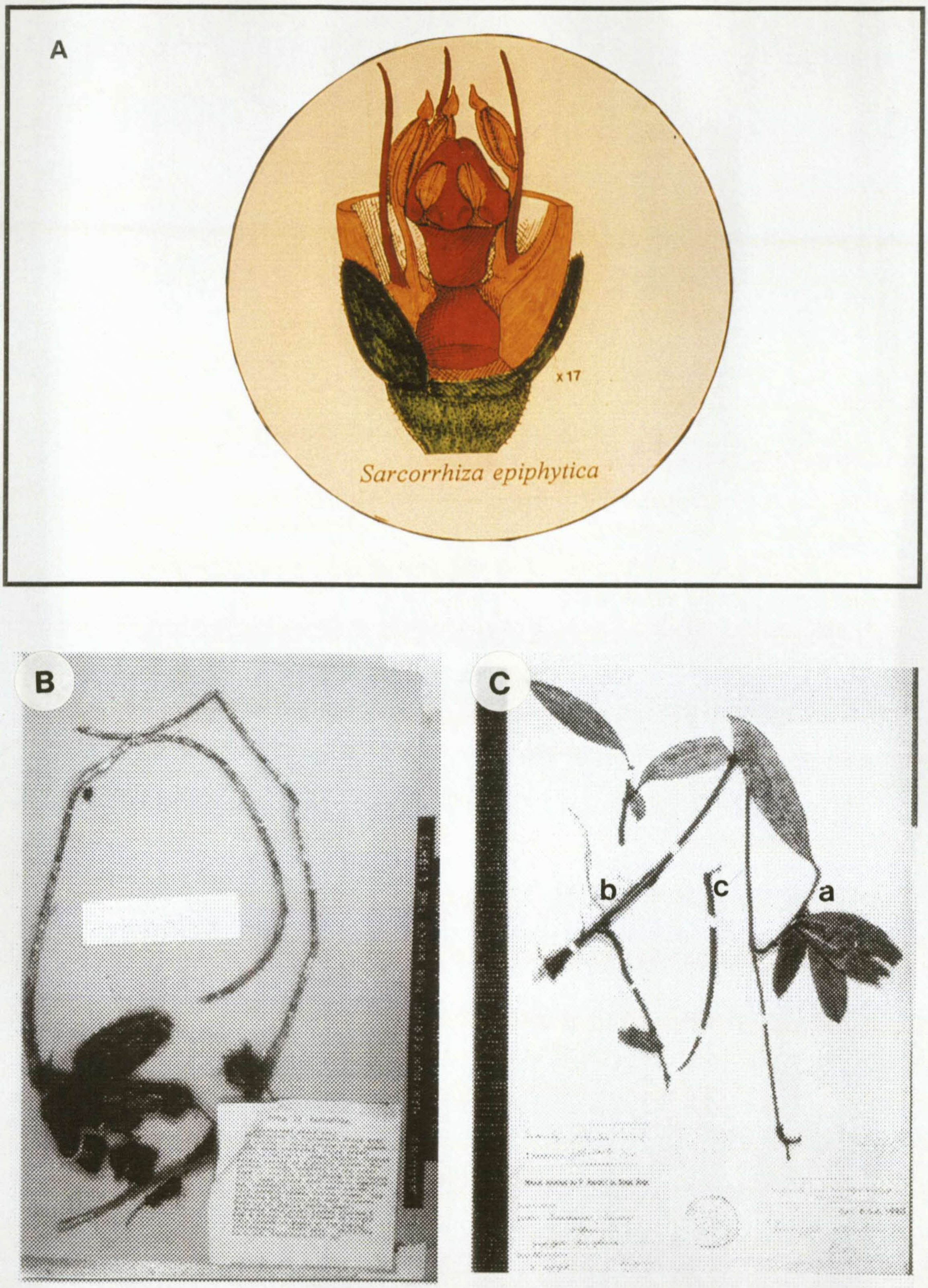



**Figure 11.2** *Sarcorrhiza epiphytica:* (A) Cross section of flower, *Bequaert 4494.* (B) Twining stem and tuberous root, *Verdcourt 1725.* (C) Habit showing leaves **(a)**, part of stem with adventitious roots **(b)** and follicle **(c)**, *Bequaert 4494.*

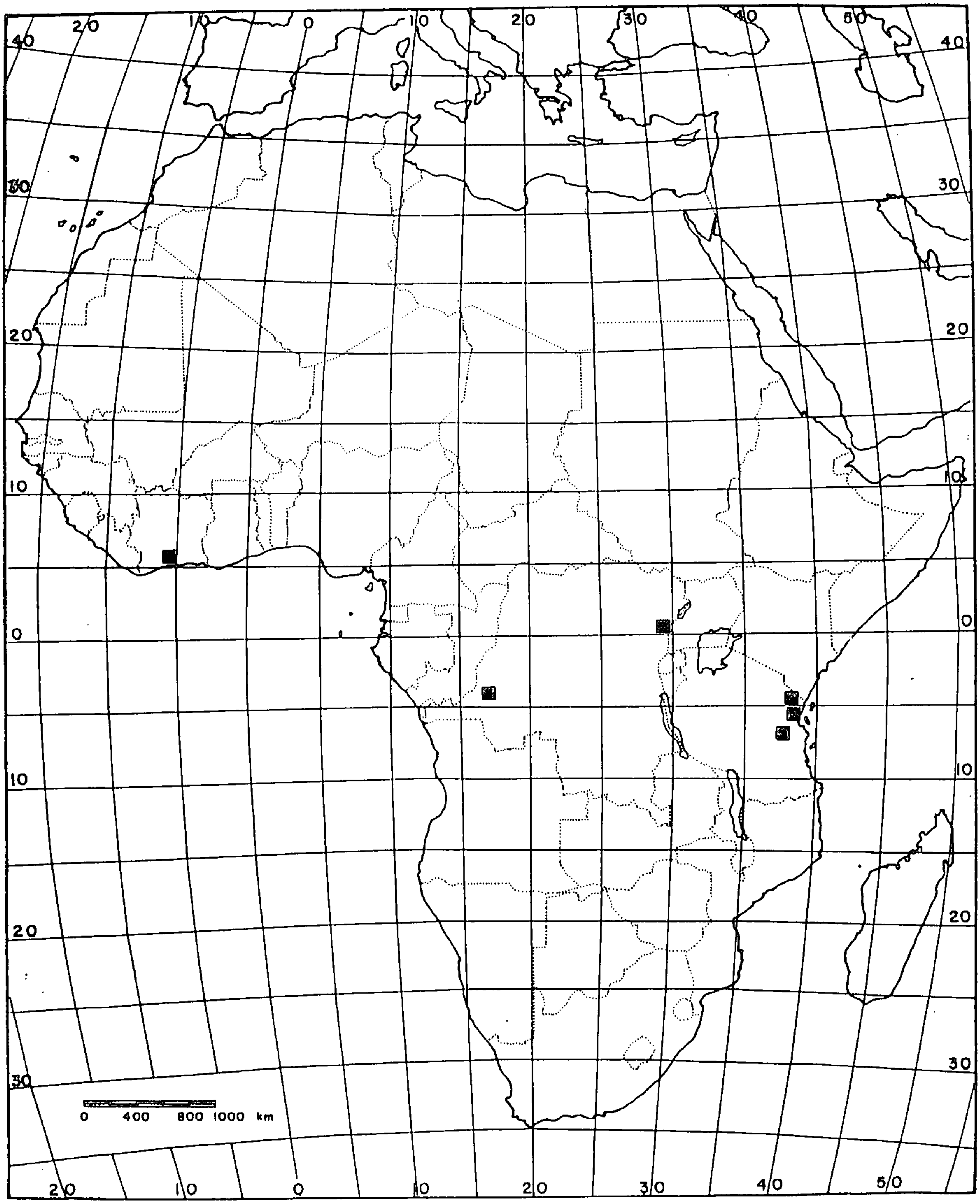



**Figure 11.3** Known geographical distribution of *Sarcorrhiza epiphytica*.

# CHAPTER 12

## TAXONOMY OF *ZACATEZA* Bullock

### 12.1 HISTORICAL BACKGROUND:

*Zacateza* is a monotypic genus established by Bullock (1954a), to accommodate his transfer of Karl Schumann's (1893) *Tacazzea pedicellata* K. Schum. (Article 55.1). The type specimen, *Schweinfurth 3483* (K), is a lectotype and *3488* (K) a syntype declared by Bullock (1954a), both specimens are on the same sheet. Schumann's types were housed in Berlin Herbarium, which was bombed in World War 2.

Schumann based his description mostly on floral characteristics of which are common features in other African Periplocoids. Floral similarity, that is, rotate flowers, filiform corona lobes as well as anthers with pollen tetrads is a common characteristic that forms a close relationship between species of *Buckollia* Venter & R.L. Verh., *Periploca* L., *Petopentia* Bullock, and *Tacazzea* Decne. Nevertheless, due to different inflorescence types between *Tacazzea* and *Zacateza,* the latter has been created as a separate taxon with exceptionally large and coriaceous leaf laminae having conspicuous patent secondary venation and it is characterized by having slender and relatively long flower pedicels with axillary clusters of monochasia. In contrast, *Tacazzea* has leaf laminae with arching secondary veins and inflorescences of many flowered cymose panicles.

### 12.2 TAXONOMY:

***ZACATEZA*** Bullock in Kew Bulletin 9: 351 (1954b).

TYPE: *Zacateza pedicellata* (K. Schum.) Bullock

Slender liana in gallery and swamp forests. Stem softly woody. Leaves coriaceous, glabrous with numerous parallel lateral patent veins and fine reticulation in between. Inflorescence cymose. Outer corona lobes filiform. Follicle falcate, reflexed. Species 1.

***Zacateza pedicellata*** (K. Schum.) Bullock in Kew Bulletin 9: 351 (1954b); Bullock: 82 (1963a) (***Tacazzea pedicellata*** K. Schum.: 115 (1893); N.E. Br. 4(1): 263 (1902)).

TYPE: Democratic Republic of the Congo – Munsa Monbuttu land. April 1870, *Schweinfurth 3488* (K, lectotype!).

= *Tacazzea pedicellata* var. *occidentalis* N.E. Br. in Flora of Tropical Africa 4(1): 263 (1902).

TYPE: Nigeria, Igbessa – Lagos Botanical Garden. January 1893. *Millen, A. 130* (K, holotype).

Slender twining and/or climbing liana about 4–15 m high with milky white, sticky latex. **Stems** thin, softly woody, sometimes much divided from the base, purplish, bark drying brown, glabrous with longitudinal fissures. **Leaves** opposite, exstipulate, simple, interpetiolar ridges with dentate colleters; *petiole* 9–14 mm long; *lamina* (55–)85–105(–200) x (15–)30–40(–60) mm long, elliptic to broadly elliptic, apex acuminate, base cordate to rounded, margin entire, lateral veins perpendicular to midrib, looped towards the margin, tertiary veins reticulate, abaxial surface pale green with red blotches, adaxial surface dark green, amphistomatous, coriaceous. **Inflorescences** cymose, cluster of monochasial branches with ± 6 flowers per node, glabrous; *peduncle* 8–10 mm long; *pedicel* (25–)35–45(–65) mm long: *bracts* c. 4 mm long. **Flower** 5-merous, greenish white or cream. ***Calyx*** of 5 sepals, 0.5–1 mm long, red, free, triangular, apex cuspidate, glabrous. ***Corolla*** of 5 petals; *lobes* 6–8 x 4 mm, narrowly ovate, apex acute to acuminate, reflexed at anthesis, rose-red; *lower tube* ± 1.5 mm long; *upper tube* absent. ***Corona*** double; *outer corona* of 5 filiform lobes (Plate 1 – after pp. 88), ± 6–11 mm long, frequently as long as the corolla lobes, free, filiform, apex tapering, greenish; *inner corona* of triangular, 2-lobed interstaminal discs, fused basally to filament bases and nectaries into a collar around style. **Androecium:** *stamens* 5, inserted at mouth of corolla tube; *anthers* whitish, abaxially fused to stigmatic head, broadly triangular to ovate with prominent connective connivent over stigmatic head; *filaments* $\pm$ 1 mm long, free basally, adnate to corona; *pollen* granular in porate tetrads. **Gynoecium:** *ovaries* 2, semi-inferior, free, unicarpellate, slightly elongated, ovules numerous; *styles* 2, becoming fused into one apically, semi-inferior; *stigmatic head* pentangular, broadly ovoid, apex acuminate; *translators* 5, arise from sides of stigmatic head, receptacle broadly obovate to oblong, stalk absent, viscidium rounded. **Fruit** paired follicles, glabrous; *follicles* 65–80 x 10–15 mm, oblong, horizontally divergent to falcate, apex tapering; *fruit stalk* 70–80 mm long. **Seeds** 5–10 x 2–3 mm, angular ovate, flattened; *coma* of hairs 20–22 mm long. (Figure 12.1).

## 12.3 DISTRIBUTION AND ECOLOGY:

*Zacateza pedicellata* has been collected between $06^{0}33'$N to $07^{0}33'$S and $03^{0}23'$E–$29^{0}49'$E (Figure 12.2).

The flowers and fruits were seen as indicated in Table 12.1.

**Table 12.1** Flowering and fruiting periods of *Zacateza pedicellata*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOWERS | | | | | | | | | | | | |
| FRUITS | | | | | | | | | | | | |

This liana species seems to thrive best at an altitude of 470–700 m above sea level. Habitat ranges from gallery forests to swampy areas (e.g. along the river). In the forests, it was found growing in association with species of *Voacanga* Thouars, *Cyperus* L. and also in the forest margin of *Raphia* Beauv. (*R. hookerii*) and *Symphonia* L. f. However, in the swampy conditions especially along the riverbanks, it is yet in association with species of *Raphia, Cyperus* (thus an overlap with forest species) as well as *Mussaenda* L. and *Nephrolepis* Schott.

People of Yalutcha – Democratic Republic of the Congo refer to the species as "Inaolo a Bosambala" (dialect of the Turumbu tribe) and called "Wilinduku" by the Ngwaka tribe of Boyasebégo.

This climbing and/or twining liana is most likely cultivated as an ornamental plant due to its attractive 'rose-like' flowers (herbarium sheets).

### 12.3.1 VOUCHER SPECIMENS:

| | |
|---|---|
| NIGERIA: | 06N 03E: Igbessa, Lagos Botanical station **(-BC).** *Millen, A. 130* (K). |
| ZAIRE: | 00N 24E: Yabalanga, Isangi territory **(-CC).** *Leonard, A. 698* (K!). |
| ___ | 03N 28E: Belgian Congo, Munsa Monbuttu land **(-CB).** *Schweinfurth, G. 3483/8* (K, lectotype). |
| ___ | 06N 19E: Congolan, Bumba territory **(-CD).** *Evrard 3467* (K). |

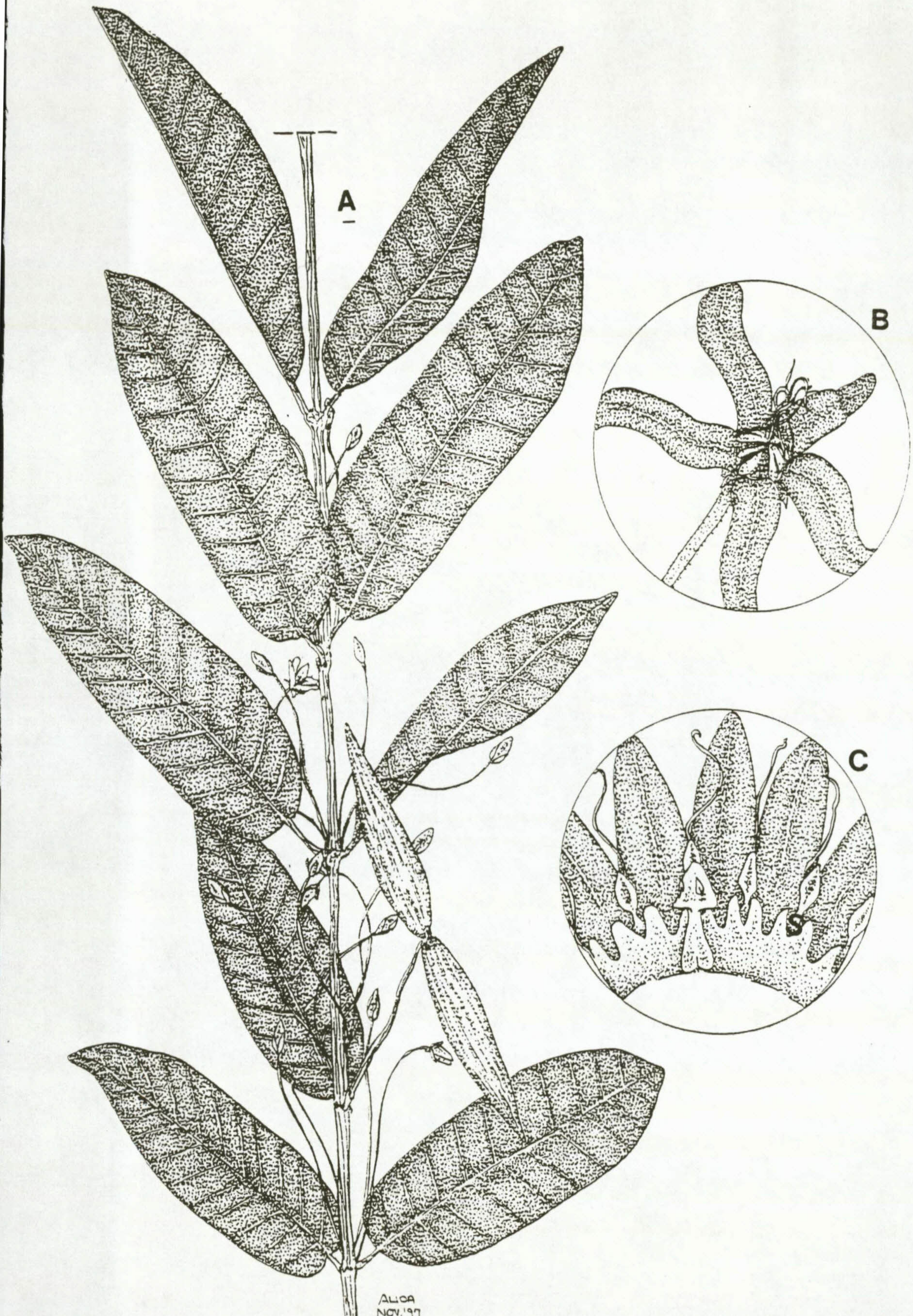



**Figure 12.1** *Zacateza pedicellata:* (A) Habit. (B) Flower with reflexed corolla lobes exposing gynostegium. (C) Open flower showing corona insertion of stamens (**s**) and stigmatic head. Drawn from *Evrard 3467* (K).

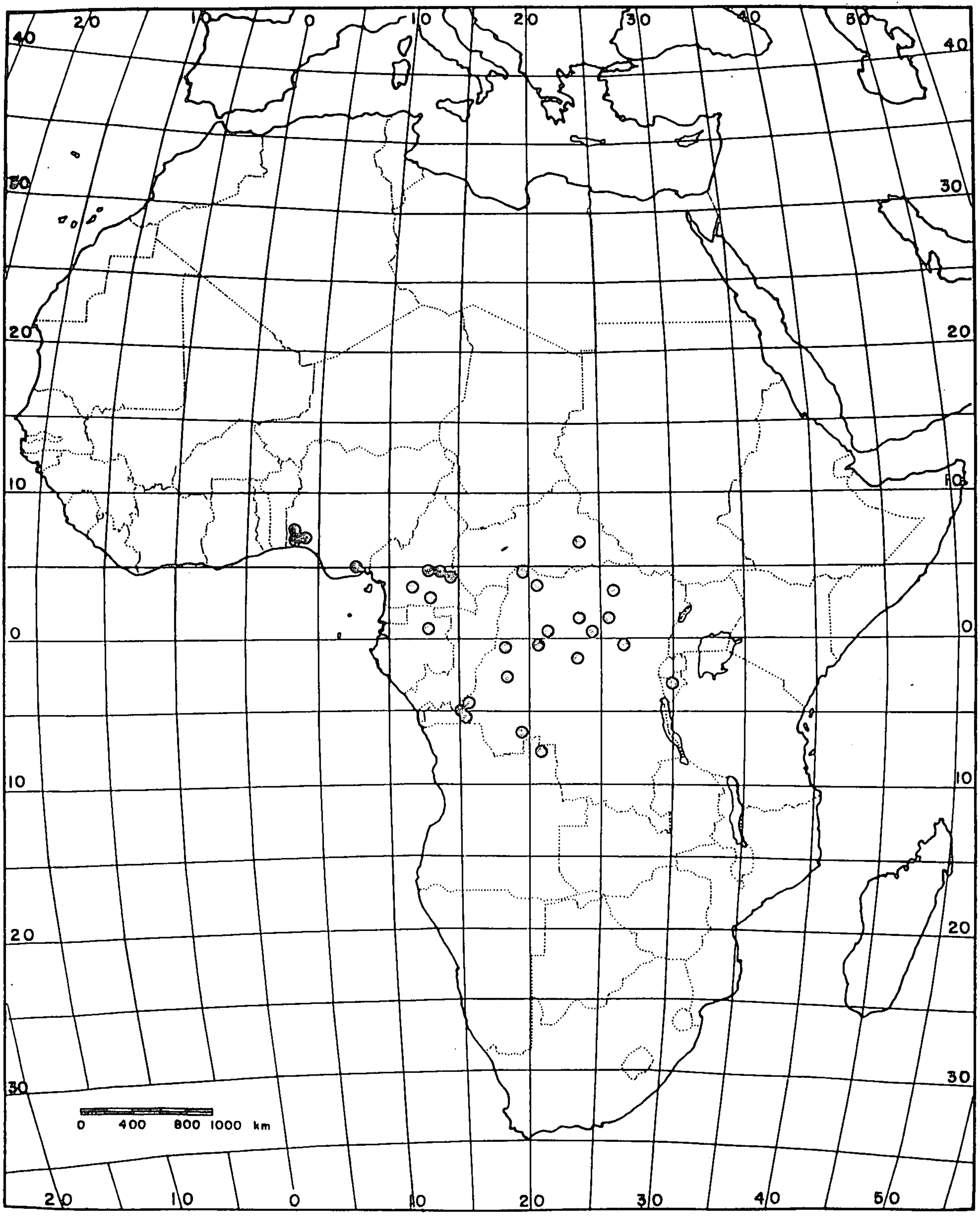



**Figure 12.2** Known geographical distribution of *Zacateza pedicellata*.

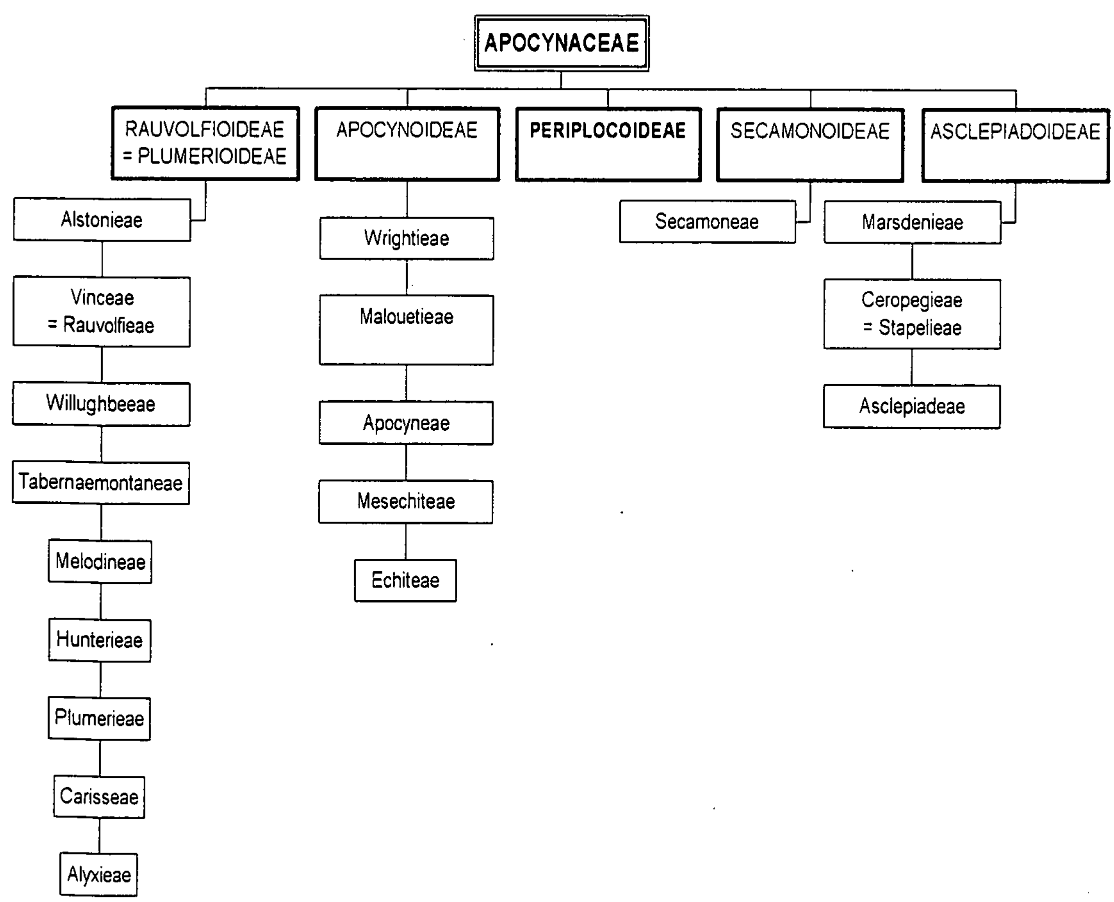
## CHAPTER 13

# CLASSIFICATION

## 13.1 CLASSIFICATION:

Endress and Bruyns (2000), provide a monophyletic classification of the family Apocynaceae *s.l.* that consists of 424 genera distributed among five subfamilies (Table 13.1).

**Table 13.1 Updated classification of the Apocynaceae *s.l.***




Source: Endress & Bruyns 2000.

However, they have not incorporated into their classification system Venter & Verhoeven (1997), three tribes of the Periplocoideae i.e. **Periploceae, Gymnanthereae** and **Cryptolepideae** stating the overlap of generic names into tribes and that their results conflict with molecular results of Civeyrel *et al.* (1998). The Gonolobeae has been included in the Asclepiadeae (Swarupanandan *et al.* 1996, Endress & Bruyns 2000). Hence the question of tribal classification within the Periplocoideae needs further data assessment and review.

### 13.2 TRIBAL POSITION

This study does not support the tribal classification put forward by Venter & Verhoeven (1997). They have placed more emphasis on the absence or presence of a well developed corolla tube, a character or an assumption which has been proven wrong with accumulation of more data. For instance, *Sacleuxia* has been placed under Periploceae (previously in the Cryptolepideae) due to the absence of a developed corolla tube. The present state is that the tribal classification has been rejected on the basis that, the corolla is much more variable within a genus, that is, the corolla tube may be distinct in some species, but indistinct in other species of the same genus.
All of which give way to a new approach to classification in the form of a phylogenetic analysis (Venter & Verhoeven 2001, in press).

## PERIPLOCOIDEAE:

Climbers, tall lianas, erect to scrambling shrubs or shrublets, geophytic herbs, or rarely epiphytes with watery or milky sap; roots often tuberous. **Leaves** with interpetiolar lines, ridges or clustered colleters adaxially at juncture of petiole and blade. **Flowers** often fragrant; *inflorescence* axilliary cymes. **Calyx** persistent. **Corolla:** *lobe* aestivation usually dextrorse. **Corona** double; *outer corona* of 5 free or fused, epipetalous lobes; *inner corona* of free or fused interstaminal discs. **Stamens:** *filaments* free or fused to outer or inner corona; *anthers* 4-locular, fused to style head, nearly horizontal to ascending, connectives apically pronounced, apiculate or variously shaped, connivent over style head; *pollen* shed in T-shaped to rhomboidal, decussate or linear tetrads, sometimes as pollinia. **Nectaries** in 5 alternisepalous troughs at base of filaments. **Ovary** half\semi inferior; *carpels* 2, free except towards base and at apex where they are fused and dilated into style head with 5 embedded, semi-erect to erect translators consisting of spoon- to cornet-shaped receptacle (onto which pollen or pollinia is shed), with small sticky viscidium at lower end; *style head* enclosed in corolla tube or exposed from it at anthesis. **Fruit** a pair of cylindrical-ovoid follicles or a solitary follicle by abortion. **Seeds** many, compressed, obliquely ovate, elliptic to oblong with tuft of hairs at the micropylar end, seldom with a ring of hairs extending around the entire margin or a membranous wing. Basic chromosome number X = 11 (diploid 2n = 2x = 22).

# CHAPTER 14

## GENERAL CONCLUSIONS:

The Periplocoideae are more derived than the Apocynoideae but less advanced than the Asclepiadoideae.

Within the Periplocoideae, the usual state is corolline corona lobes situated outside the stamens (Klackenberg 1997), except for Malagasy sp. – *Baroniella* Costantin & Gallaud having the largest lobes between the stamens and not opposite to them. The corona in *Asclepias* L. is primarily annular i.e. the staminal and interstaminal corona in Asclepiadinae is basically annular (Kunze 1997). Corolline coronas are widespread in the Periplocoideae. These are situated primarily in the petal sinuses. This kind of corona has been observed in some Apocynaceae. No staminal corona occurs in the Periplocoideae, but are found in the Asclepiadoideae. According to Liede & Kunze (1993), annular corona (and the annulus) is not homologous with corolline corona. Corolline corona almost certainly represents the plesiomorphic type of corona formation. The corona is closely associated with pollination apparatus, thus more close to the androecium than the corolla and it is optically attractive and serves as a holding device for pollinators (Endress 1994).

The stamens each have a small, more or less cylindrical filament beneath the anthers (Endress & Bruyns 2000). These filaments are inserted at different heights on the corolla tube but always arise on the apex of a thickened ridge. The number of microsporangia in the stamen has been an important feature employed in the classification of the family *s.l.* The genera in the Periplocoideae are easily distinguished by their 4-celled anther from the rest of the Asclepiadoideae except for the Secamoneae. The 4-celled anther is considered to be plesiomorphic and the 2-celled anther in Asclepiadoideae more derived (Swarupanandan *et al.* 1996).

*Baseonema* is closely allied to *Schlechterella* K. Schum. and *Raphionacme* Harv. due to their multi-porate pollen grains. Thus these three genera are more advanced than any other taxa within the African Periplocoids, most of which are characterised by presence of 4–6 pores per pollen grain. On the other hand, *Baseonema* is separated from the two geophytes with root-tubers, by having an annular corona formed from the fusion of staminal elements, quite distinct from the fusion in *Schlechterella* whereby an outer corona is basally fused into an annulus at the mouth of corolla tube. *Baseonema* is the least developed within the tribe – Cryptolepideae due to its lack of a distinct upper corolla tube. In order to justify its position (instead of being in the tribe – Periploceae) the gynostegium is included near the base of the corolla and reflexed at anthesis thus exposing the gynostegium.

*Batesanthus* with its rotate flower with or without filiform corona lobe is closely associated to *Baseonema,* these two genera have a reflexed corolla tube. *B intrusus* with a fringe of hairs around the entire seed margin is closely associated to *Finlaysonia obovata* Wall. Thus *B. intrusus* is more derived within the species and other taxa investigated, all with comose seeds (Table 14.1). The presence of outer corona lobes in one specimen of *B. parviflorus* is likely due to genetic modifications. Except for the flower with corona lobes and being geographical isolated, specimens of *B. parviflorus* are morphologically similar.

*Mangenotia* is closely associated with *Cryptolepis* by having a distinct upper corolla tube but separated from the latter by presence of hairy anthers, a character also observed in species of *Periploca* together with the presence of papillae globule on the lower leaf surface instead of striated cuticle. *Periploca* can be separated from *Mangenotia* by its trisegmented, filiform outer corona lobes.

The presence of a well developed corolla tube in *Mangenotia* makes it more derived than other taxa with an open, shallow upper tube where pollinators can easily access the nectar – thus more primitive. An advanced tube as in *Mangenotia, Cryptolepis* and *Raphionacme* can only be reached by pollinators with a long proboscis. The genera in the Periplocoideae are animal/insect pollinated. Fly-pollination with open flowers occurs in *Apocynum* (Apocynoideae) and in most of the Periplocoideae (Endress 1994).

*Mondia* with its two liana species found in moist tropical and subtropical Africa has rotate to broadly campanulate, showy flowers and a unique obcordate outer corona. Nevertheless, this kind of corona is closely linked to the trisegmented corona lobes of *Periploca* and *Raphionacme* sp. with a robust central lobule immediately behind the base of the filaments inserted on the apex of the staminal foot and two rather small lobules lateral to the central lobe. These emergences are of corolline origin (Kunze 1993). *Mondia whitei* is more advanced within infrageneric classification due to the structure of the outer corona lobe.

*Sacleuxia* and *Sarcorrhiza* with their tuberous roots recalls the genera *Tacazzea*, *Raphionacme, Petopentia* and *Schlechterella*. The rootstock found in *Mondia* is of medicinal importance.
*Sacleuxia* with an indistinct, broadly campanulate tube without an upper corolla tube has been moved from the tribe: Cryptolepideae and placed under the Periploceae. *S. tuberosa* with a hairy ovary is more advanced within the genus compared to the glabrous ovary found in *S. newii.*

The flowers of *Sarcorrhiza* and *Zacateza* are similar to those of *Buckollia*, *Periploca, Petopentia* and *Schlechterella*, in that they have a shallow lower corolla tube with the corona lobes (usually filiform) arising just above the stamens at or near the corolla mouth or the corona lobes may be fused to the filament bases. Therefore less advanced within the subfamily.

**Table 14.1: Characteristics of Selected African Periplocoideae.**

| Genera | Tribe | Distribution | Habit | Seeds | Corona | Pollen | Translators | Rootstock |
|---|---|---|---|---|---|---|---|---|
| *Baseonema* | **Cryptolepideae** | Semi-arid, Continental East Africa | Shrub -Twiner | Comose | Annular Corolline corona | Tetrads 8–10 pores per grain | Specialized | |
| *Batesanthus* | **Periploceae** | Central North Africa, very rarely West Africa | Shrubs -Twiner - Climber | Comose. Except *B. intrusus* with a fringe of hairs around entire margin | Mostly annular lobules, very rarely filiform | Tetrads 4–6 pores per grain | Specialized | |
| *Mangenotia* | **Cryptolepideae** | West Tropical Africa | Liana - Climbing or twining | Comose | Clavate | Tetrads 4–6 pores per grain | Less specialized i.e. no clear dermaction between spoon & stalk | |
| *Mondia* | **Periploceae** | Tropical and Sub-Tropical Africa | Liana - Climbing or twining | Comose | Obcordate with or without dorsal processes | Tetrads 4–6 pores per grain | Specialized | Thick, Succulent with aromatic scent; medicinally important |
| *Sacleuxia* | **Periploceae** was Cryptolepideae | East Africa | Shrub -Erect | Comose | Annular, obscure | Tetrads 4–6 pores per grain | Specialized | Tuberous |
| *Sarcorrhiza* | **Periploceae** | West-Central and East Equatorial Africa, very rarely West Africa | Epiphyte - Creeping | Comose | Annular | Tetrads 4–6 pores per grain | Specialized | Tuberous |
| *Zacateza* | **Periploceae** | Central Africa | Liana -climbing or twining | Comose | Filiform outer corona lobes | Tetrads 4–6 pores per grain | Less specialized | |

*Sarcorrhiza* and *Epistemma* D.V. Field & J.B. Hall are outstanding as epiphytes. A climbing character is considered plesiomorphic, whereas erect, epiphytic, herbaceous, geophytic, shrubby and xerophytic characters are apomorphic (Venter & Verhoeven 1997).

Within the African Periplocoideae, pollen morphology is fairly uniform, with most genera characterised by the presence of tetrads. However, with accumulation of data, Verhoeven and Venter (1998a) have published ten genera in which pollinia was found. In this study, there is no recorded occurrence of pollinia.

All the genera investigated most probably have starchless pollen grains. According to Verhoeven & Venter (1988), the starchy pollen is a feature of wind pollinated flowering plants whereas insect-pollinated plants have starchless pollen grains. The spoon with its adhesive surface receives pollen tetrads from adjacent anther halves. The adhesive disc functions to stick to a visiting pollinator.

# CHAPTER 15

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## SUMMARY

Seven genera of the African Periplocoideae namely: *Baseonema* Schltr. & Rendle, *Batesanthus* N.E. Br., *Mangenotia* Pichon, *Mondia* Skeels, *Sacleuxia* Baill., *Sarcorrhiza* Bullock and *Zacateza* Bullock are presented in this study, with special reference to taxonomy.

A complete account of taxonomic literature, keys as well as known geographical distribution of the seven genera is given. The type specimens (in red) and all other specimens studied are presented in Appendix B.

The character states and/or features used to delimit genera are circumscribed. Floral and vegetative morphology have been extensively studied with the aid of a stereo-microscope and represented in the form of diagrammatic sketches or photographic figures. Floral (i.e. corolla, corona, androecium and gynoecium) features are important to delimit between species. For instance, *Sacleuxia tuberosa* is characterised by having a hairy ovary and the anthers in *Mangenotia* are hairy. *Mondia whitei* has an obcordate corona lobe with two dorsal processes. Most of the genera co-exist as shrubs and very rarely lianas, but *Sarcorrhiza* is outstanding as an epiphyte.

To complement "traditional taxonomy", pollen and translator morphology, leaf and seed morphology have been studied, with the aid of LM, SEM and TEM. The pollen is uniform in morphology, with all the genera having pollen in tetrads and little variation between the species. However, pollen grain size can be used to a certain extent so as to distinguish between species, for example, the largest tetrads are found in species of *Baseonema gregorii* & *Mondia whitei* (Figure 4). One other important feature is the number of pores per grain. Most of the Periplocoids are characterised by having 4–6 pores per grain. This, however, does not apply to multi-porate *Baseonema* having 8–10 pores per grain, a character so far only known in species of *Raphionacme*

and *Schlechterella.* Individual grains of a tetrad are held together by wall bridges. The exine is smooth and consists of an outer homogenous stratum (tectum) subtended by a granular stratum. The intine is well developed. The layers turn out to be of little taxonomic value.

Translators are similar in structure, with three parts distinguished, the spoon, the stalk and an adhesive disc (viscidium). The whole translator varies in size (although marginal difference is small) within the species (Table 4.2).

The character state of taxonomic value in the leaf surface is the presence of papillae in *Mangenotia eburnea*. The cuticle on the leaf is variously striated or smooth.

The paracytic stomata and smooth or warty, unicellular trichomes have been found to be of little taxonomic value especially at generic level. However, at species level, the amphistomatous condition of *Sacleuxia tuberosa* might be of taxonomic value. Trichomes are present on the leaf surface of all taxa except for *Batesanthus parviflorus* and *Batesanthus purpureus* with glabrous leaf surface.

Seeds are characterised by having a coma of hairs. The exception is *Batesanthus intrusus* with a fringe of hairs around the entire margin.

# OPSOMMING

Sewe genera van die Periplocoideae uit Afrika, naamlik *Baseonema* Schltr. & Rendle, *Batesanthus* N.E. Br., *Mangenotia* Pichon, *Mondia* Skeels, *Sacleuxia* Baill., *Sarcorrhiza* Bullock and *Zacateza* Bullock is taksonomies ondersoek.

'n Volledige uiteensetting van die taksonomiese literatuur, sleutels sowel as die geografiese verspreiding van die sewe genera word gegee. Die tipe-eksemplare (in rooi) en al die bestudeerde eksemplare is in Aanhangsel B gelys.

Die kenmerke en/of strukture wat gebruik is om die genera te omgrens, is beskryf. Blommorfologie en vegetatiewe kenmerke is intensief met 'n stereomikroskoop bestudeer en die resultate is in die vorm van sketse en foto's aangebied. Blomkenmerke (bv. kroon, bykroon, androesium en ginoesium) is belangrik vir die onderskeiding van spesies. *Sacleuxia tuberosa* word deur 'n harige vrugbeginsel terwyl *Mangenotia* deur harige helmknoppe gekenmerk. Die meeste genera kom as struike voor en selde as liane. *Sarrcorhiza* kom egter as 'n epifiet voor.

Om die morfologiese ondersoek uit te brei, is stuifmeel, stuifmeeldraers, blaaroppervlak en sade ook met die LM, SEM en TEM (stuifmeel) bestudeer. Die tipiese Periplocoideae tetrades kom in al sewe genera voor met relatief min variasie tussen die spesies. Die meeste Periplocoideae word gekenmerk deur 4–6 porieë per stuifmeelkorrel. In *Baseonema* kom 8–10 porieë per stuifmeelkorrel voor, 'n kenmerk wat tot dusver net bekend was in spesies van *Raphionacme* en *Schlechterella*. Individuele stuifmeelkorrels van 'n tetrade word by mekaar gehou deur wandbrûe. Die eksien is glad en bestaan uit 'n homogene stratum (tektum) wat begrens word deur 'n granulêre stratum. Die intien is goed ontwikkel. Die wandlae van die stuifmeelkorrel is nie van taksonomiese waarde nie.

Blaaroppervlakkenmerke wat van taksonomiese waarde is, is: die teenwoordigheid van papille in *Mangenotia eburnea*. Die kutikula op die blare is gestrieerd of glad.

Die parasitiese stomata en gladde of vratagtige, eensellige trigome is van min taksonomiese waarde, veral op genusvlak. Op spesievlak kan die amfistomatiese blare van *Sacleuxia tuberosa* taksonomiese waarde besit. Trigome kom op die blaaroppervlak van al die taksa voor met die uittsondering van *Batesanthus parviflorus* en *Batesanthus purpureus* waar geen trigome voorkom nie.

Sade word gekenmerk deur 'n koma van hare. By *Batesanthus intrusus* kom die trigome egter op die rand van die saad voor.

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# APPENDIX A: GLOSSARY

**Abbreviations:**

| | | |
|---|---|---|
| ICBN | - | International Code of Botanical Nomenclature v.118 (1988) |
| LM | - | Light Microscope |
| SEM | - | Scanning Electron Microscope |
| TEM | - | Transmission Electron Microscope |
| sp. | - | Species |
| t. | - | Tabula (Latin for 'table') |
| *B. gregorii* | - | *Baseonema gregorii* Schltr. & Rendle |
| *B. intrusus* | - | *Batesanthus intrusus* S. Moore |
| *B. parviflorus* | - | *Batesanthus parviflorus* Norman |
| *B. purpureus* | - | *Batesanthus purpureus* N.E. Br. |
| *B. talbotii* | - | *Batesanthus talbotii* S. Moore |
| *M. eburnea* | - | *Mangenotia eburnea* Pichon |
| *M. ecornuta* | - | *Mondia ecournuta* (N.E. Br.) Bullock |
| *M. whitei* | - | *Mondia whitei* (Hook *f.*) Skeels |
| *S. newii* | - | *Sacleuxia newii* (Benth.) Bullock |
| *S. tuberosa* | - | *Sacleuxia tuberosa* (E.A. Bruce) Bullock |
| *S. epiphytica* | - | *Sarcorrhiza epiphytica* Bullock |
| *Z. pedicellata* | - | *Zacateza pedicellata* (K. Schum.) Bullock |
| Ic. | - | *icone* ( = illustration) |
| cf. | - | *confer* ( = compare) |
| *al.* | - | *alii* ( = other). |
| i.e. | - | *id est* ( = that is) |
| pp | | page |

**Author Citation:**

| | | |
|---|---|---|
| Baill. | - | Baillon |
| Benth. | - | Bentham |
| Decne. | - | Decaisne |
| K. Schum. | - | Karl Schumann |
| N.E. Br. | - | N.E. Brown |
| Schltr. | - | Schlechter |

**Locality:**

| | | |
|---|---|---|
| Alt. | - | Altitude |
| Distr. | - | District |
| N | - | North |
| S | - | South |
| E | - | East |
| W | - | West |
| Mts. | - | Mountain(s) |
| Dem. Rep. Congo | - | Democratic Republic of the Congo |

**Symbol:**

| | | |
|---|---|---|
| c. | - | *circa* (Latin for '$\pm$ or about') |
| km | - | kilometer |
| mm | - | millimeter |
| s.n. | - | *sine numero* (Latin for 'without collection number') |
| µm | - | micrometer |
| ! | - | *vidi* (Latin for 'I have seen it') |
| FHI | - | Forestry Herbarium in Ibadan |
| = | - | Nomenclatural synonym / Legitimate synonym |
| ≡ | - | Illegitimate synonym |

[Latin descriptions from : Jones & Luchsinger 1986 and Stearn 1983]

**Terminology:**

| | | |
|---|---|---|
| Abaxial | - | Lower surface |
| Adaxial | - | Upper surface |
| | | |
| Amphistomatic | - | Leaves with stomata present on both surfaces |
| Epistomatic | - | Leaves with stomata on the upper surface only |
| Hypostomatic | - | Leaves with stomata on the lower surface only |
| Holo | - | Holotype |
| Iso | - | Isotype |
| Lecto | - | Lectotype |

# APPENDIX B: SPECIMEN LIST

***BASEONEMA*** Schltr. & Rendle

***Baseonema gregorii*** Schltr. & Rendle

**KENYA**

-- **01S 37E, 01$^{0}$30’S 37$^{0}$47’E:** K4 Machakos/Kitui, Yatta Plateau, lower Ukamba **(-DB).** *Gardner, H.M. 3612;* 00-01-1937 (K). Alt. 4,000 m.

-- **02S 37E, 02$^{0}$02’S 37$^{0}$21’E:** K6 Masai Distr., Carabani valley **(-AB).** *van Someren 184;* 00-00-0000 (K!).

-- **02S 37E, 02$^{0}$12’S 37$^{0}$45’E:** K4 Machakos Distr., 1 km S of Hunters Lodge on track to Kenya Agricultural research station **(-BB).** *Goyder, D.J., Masinde, P.S. Meve, U. & Whitehouse, C. 4006;* 11-02-1996 (PRE!). Alt. 1,000 m.

-- **02S 37E, 02$^{0}$25’S 37$^{0}$57’E:** K4 Machakos Distr., Kibwezi **(-BD).** *Kâssner 705;* 27-04-1902 (BM).

-- **02S 38E, 02$^{0}$07’S 38$^{0}$06’E:** K4 Kitui Distr., Machakos between Yatta gap and Ikutha **(-AA).** *Bally, P.R.O. 12320;* 14-03-1961 (K!).

-- **02S 38E, 02$^{0}$32’S 38$^{0}$07’E:** 240 km from Mombasa on Nairobi road **(-CA).** *Verdcourt & Polhill 2695;* 15-04-1960 (BR, K!).

-- **02S 38E, 02$^{0}$57’S 38$^{0}$20’E:** K4/6 Machakos/Masai Distr., Kenani and Ongalea mts. **(-CD).** *Gregory, J.W. 14;* 00-00-1893 (BM holo!).

-- **03S 38E, 03$^{0}$22’S 38$^{0}$35’E:** K4 Machakos Distr., Tsavo National Park, east Simba Hill **(-BC).** *Faden, R.B. & A.J. $^{74}/_{436}$;* 17-04-1974 (BR, K, MO!, PRE!, WAG! (2x)). Alt. 600 – 630 m.

-- **03S 38E, 03$^{0}$23’S 38$^{0}$34’E:** K7 Teita/Kilifi Distr., Voi River (= Goshi) near Voi **(-BC).** *Bally, P.R.O. 8745;* 05-02-1933 (K!). Alt. 1,500 m.

-- **03S 38E, 03$^{0}$50’S 38$^{0}$38’E:** K7 Teita Distr., Mt. Kasigau, 4 km south of Rukanga at eastern base **(-DC).** *Gilbert, M.G. & C.I. 6122;* 02-05-1981 (K!).

-- **<u>03S 39E</u>, 03°10'S 39°19'E:** K7 Kilifi Distr., c. 60 km from Malindi on road from Sala gate to Malindi **(-AB).** *Field, D.V. & Powys, J.G. 174;* 07-07-1977 (K!).

<u>TANZANIA</u>

-- **<u>03S 37E</u>, 03°48'S 37°36'E:** T3 Pare Distr., Lembeni **(-DC).** *Bally, P.R.O. 8125;* 02-04-1952 (K!).

-- **<u>04S 38E</u>, 04°16'S 38°32'E:** T3 Pare/Lushoto, Mkomazi game reserve **(-BC).** *Cox & Abdallah 2028;* 00-00-0000 (K).

***BATESANTHUS*** N.E. Brown

***Batesanthus intrusus*** S. Moore

CAMEROON

-- **03N 12E, 03°01'N 12°22'E:** Bitye, Yaoundé **(-AB).** *Bates, G.L. 1392;* 00-00-1917 (BM holo).

-- **05N 10E, 05°56'N 10°10'E:** Bamenda, Bafut-Ngemba forest reserve **(-CC).** *Hepper 2173;* 25-02-1958 (K).

-- **06N 14E, 06°20'N 14°21'E:** District Barmuda, Lakka **(-AD).** *Maitland 1565;* 00-06-1931 (K). Alt. 1,300 m.

CENTRAL AFRICAN REPUBLIC

-- **03N 18E, 03°53'N 18°01'E:** Boukoko & Mbaiki regions **(-CC).** *Tisserant, R.P. 1480;* 1948–1950 (P!).

DEMOCRATIC REPUBLIC OF THE CONGO

-- **00N 24E, 00°47'N 24°24'E:** Yangambi, valley de la Luuvea, Isangi Province **(-CD).** *Louis, J. 12992;* 19-12-1938 (BR, K!, MO).

-- **00N 24E, 00°34'N 25°01'E:** Yangambi et Yakusu, secondary forest, Isangi Province **(-CA).** *Germain 4908;* 00-05-1949 (BR, SRGH).

-- **00N 25E, 00°56'N 25°09'E:** Bengamisa, Banalia Province **(-CC).** *Louis, J. 623;* 15-11-1935 (BR, K). Alt. ± 550 m.

-- **01N 23E, 01°15'N 23°36'E:** Grande Ile Esabo, Basoko **(-BC).** *Germain 4951;* 00-00-0000 (BR, SRGH).

-- **02S 20E, 02°08'S 21°34'E:** Iwama, Monkoto territory **(-DA).** *Evrard 2826;* 00-00-0000 (BR).

-- **Not traced:** Bakoko, Isle of Isabe. *Germain 4901;* 00-06-1949 (SRGH).

GABON

-- **00N 09E, 00°28'N 09°20'E:** Libreville, on the Gaboon River **(-AD).** *Klaine, R.P. 513*; 19-10-1896 (P holo!, K iso).

-- **<u>00N 09E</u>, 00$^0$28'N 09$^0$25'E:** Libreville **(-AD).** *Klaine, R.P. 2363;* 25-03-1904 (K).

-- **<u>00S 12E</u>; 00$^0$50'S 12$^0$43'E:** Region Lastoursville, Liyanga **(-DC).** *Le Testu, M.G. 7696;* 28-11-1929 (P!).

-- **<u>00S 12E</u>, 00$^0$50'S 12$^0$43'E:** Region de Lastoursville **(-DC).** *Le Testu, M.G. 8501;* 08-11-1930 (P!).

<u>LIBERIA</u>

-- **<u>07N 08W</u>, 07$^0$32'N 08$^0$38'W:** Yéképa villlage **(-DA).** *Adam, J.G. 30433;* 13-05-1965 (MO!).

***Batesanthus parviflorus*** Norman

<u>ANGOLA</u>

-- **<u>08S 15E</u>, 08$^0$20'S 15$^0$26'E:** Guanza, Quilela Camabatela **(-AD).** *Gossweiler, J. 8468;* 29-09-1922 (BM holo!). Alt. 1,225 m.

<u>CAMEROON</u>

-- **<u>05N 09E</u>, 05$^0$02'N 09$^0$50'E:** Manengouba Lake **(-BB).** *Polhill, R.M. & Kirkup, D.W. 5190;* 12-03-1984 (K!). Alt. 1,900 m.

<u>SIERRA LEONE</u>

-- **<u>08N 12W</u>, 08$^0$27'N 12$^0$29'W:** Near Roruks, northern Province **(-BC).** *Deighton, F.C. 3265;* 13-07-1936 (K!).

***Batesanthus purpureus*** N.E. Brown

<u>CAMEROON</u>

-- **<u>03N 13E</u>, 03$^0$27'N 13$^0$11'E:** Bitja, near River Dja **(-AC).** *Bates, G.L. 1855;* 00-00-1894 (BR, K).

-- **Not traced :** Efulen, Bule country. *Bates, G.L. 383;* 20-09-1895 (BM, BR, G (2x) iso!, K holo!).

<u>CENTRAL AFRICAN REPUBLIC</u>

-- **<u>03N 18E</u>, 03°53'N 18°01'E:** Oubangui, region de Mbaiki et Boukoko **(-CC).** *Tisserant, C. 1480;* 13-05-1949 (P! (2x)).

<u>GABON</u>

-- **<u>01N 11E</u>, 01°46'N 11°17'E:** Haute Ngounié **(-CD).** *Le Testu, M.G. 5493;* 03-05-1928 (P!).

***Batesanthus talbotii*** S. Moore

<u>CAMEROON</u>

-- **<u>04N 09E</u>, 04°09'N 09°13'E:** Bura/Buea **(-AA).** *Moore, T.S. 666;* 00-05-1929 (K). Alt. 1,100 m.

<u>NIGERIA</u>

-- **<u>05N 08E</u>, 05°17'N 08°33'E:** Oban **(-BC).** *Talbott, P.A. 63;* 00-00-1911 (BM holo, K! (2x)).

-- **<u>05N 08E</u>, 05°19'N 08°34'E:** Oban **(-BC).** *Talbott, T.A. 2074;* 00-00-1912 (BM).

-- **<u>04N 07E</u>, 04°39'N 07°55'E:** Eket District **(-DB).** *Talbott, T.A. & P.A. 2021;* 10-05-1912 (K!).

***MANGENOTIA*** Pichon

***Mangenotia eburnea*** Pichon

DEMOCRATIC REPUBLIC OF THE CONGO

-- **Not traced:** Moyen Congo, River Congo (= River Zaire). *Pobenguin 173;* 00-02-1920 (P).

GHANA

-- **05N 01W, 05°10'N 01°13'W:** Cape Coast **(-AA).** *Hall, J.B. 1010;* 08-08-1956 (K). Alt. 50 m.

-- **05N 01W, 05°06'N 01°15'W:** Cape Coast **(-AA).** *Hall, J.B. 409;* 26-12-1957 (K). Alt. 50 m.

-- **05N 01W, 05°10'N 01°13'W:** Cape Coast **(-AA).** *Hall, J.B. 1511;* 07-07-1959 (K). Alt. 30 m.

-- **05N 01W, c. 05°33'N 01°04'W:** Lac Baku, Baku reserve **(-CA).** *Anonymous 209012;* 19-08-1963 (G).

-- **07N 01W, 07°12'N 01°26'W:** Mampong scarp **(-AB).** *Vigne 1739;* 00-05-1929 (K). Alt. 430 m.

-- **07N 01W, 07°13'N 01°28'W:** 55 km Mampong Ash **(-AB).** *Darko, K.O. 689;* 28-07-1952 (BR, K photo!, MO, P).

IVORY COAST **(COTE d'IVOIRE)**

-- **05N 03W, 05°16'N 03°52'W:** Forest L'Abouabou, between Abidjan and Grand Bassam, coastal rain forest **(-BD).** *Leeuwenberg, A.J.M. 2654;* 04-11-1959 (WAG!). Alt. 2 m.

-- **05N 03W, 05°16'N 03°52'W:** Forest L'Abouabou, between Abidjan and Grand Bassam, coastal rain-forest **(-BD).** *Leeuwenberg, A.J.M. 4235;* 23-05-1962 (P, WAG!). Alt. 2 m.

-- **05N 04W, 05°19'N 04°01'W:** Forêt d'Adiopodoumé **(-AC).** *Aké Assi 6990;* 11-10-1960 (P photo!).

-- 05N 04W, 05°19'N 04°01'W: Abidjan (-AC). *Gremers 358, 519;* 00-10-1966 (BR).

-- 05N 04W, 05°19'N 04°01'W: Forêt d'Adiopodoumé, prés d'Abidjan (-AC). *Mangenot s.n.;* 07-06-1951 (P).

-- 05N 04W, 05°11'N 04°32'W: ± 10 km W of Jacqueville, Island Aladdin, old secondary forest (-BA). *Leeuwenberg, A.J.M. 8083;* 03-08-1970 (BR, WAG!).

-- 07N 04W, 07°27'N 04°20'W: Baouké north, Nzi Mbahiakro (-AD). *Chevalier, A. 22282;* 04-08-1909 (P).

-- Not traced: Bonake, Orumbo-Boka. *Garner 72;* 10-07-1963 (K).

LIBERIA

-- 07N 09W, 07°47'N 09°26'W: Zorzor, Gbarnga road, west of St. Paul River (-CD). *Bos 2152;* 27-07-1966 (K, WAG).

NIGERIA

-- 06N 03E, 06°28'N 03°23'E: Lagos, Skoyi plains (-AD). *Dalziel, J.M. 1405;* 18-08-1919 (K, MO!).

SÉNÉGAL

-- 12N 16W, 12°33'N 16°01'W: Region Zinguinchor, Bissine (-CA). *Berhaut, R.P. 6449;* 13-11-1963 (BR, P).

-- 12N 16W, 12°35'N 16°16'W: Region Zinguinchor, (-CB). *Berhaut, R.P. 6323;* 08-08-1963 (P).

-- 12N 16W, 12°45'N 16°13'W: Region Bignona, Tanguéme (-CC). *Berhaut, R.P. 6436;* 11-11-1963 (P).

-- 12N 16W, 12°48'N 16°18'W: Region de Bignona, Basse Casamance, forêt des Kalounayes (-CD). *Berhaut, R.P. 5958;* 09-05-1963 (P!).

-- 12N 16W, 12°29'N 16°36'W: Region d'Oussouye - Dianthéme (-DA). *Berhaut, R.P. 6550;* 20-11-1963 (P).

-- <u>12N 16W</u>, **12°40'N 16°45'W:** Loc Basse, Casamance, Djibonker **(-DB).** *van den Berghen 5378;* 00-05-1982 (BR).

-- <u>14N 16W</u>, **14°19'N 16°27'W:** Village Fatick **(-AD).** *Adam, J.G. 30434;* 05-10-1962 (MO photo!).

<u>SIERRA LEONE</u>

-- <u>07N 12W</u>, **07°42'N 12°19'W:** Between Mattru and Gbangbama **(CB).** *Deighton, F.C. 2349;* 17-11-1931 (K).

-- <u>07N 12W</u>, **07°47'N 12°18'W:** Gbangbama **(-CD).** *Thomas, N.W. 4077;* 30-10-1914 (K!).

-- <u>08N 11W</u>, **08°39'N 11°51'W:** Matotaka **(-DB).** *Thomas, N.W. 1238;* 29-07-1914 (K). Alt. 120 m.

-- <u>08N 12W</u>, **08°30'N 12°14'W:** Yonibana **(-CB).** *Thomas, N.W. 4119;* 30-10-1914 (K).

-- <u>08N 12W</u>, **08°30'N 12°14'W:** Yonibana **(-CB).** *Thomas, N.W. 4202;* 30-10-1914 (K!).

-- <u>08N 12W</u>, **03°46'N 12°47'W:** Port Lokoh **(-DD).** *Thomas, N.W. 6585;* 15-12-1914 (K). Alt. 15 m.

-- <u>08N 12W</u>, **03°46'N 12°47'W:** Port Lokoh **(-DD).** *Thomas, N.W. 6602;* 15-12-1914 (K).

-- <u>08N 13W</u>, **08°31'N 13°20'W:** Sukudu, Konno **(-CB).** *Dawe 543;* 00-08-1923 (K).

-- <u>08N 13W</u>, **08°56'N 13°13'W:** Mayoso/Mayoro **(-CC).** *Thomas, N.W. 1373;* 06-08-1914 (K!).

-- **Not traced:** Mamaka. *Thomas, N.W. 4377;* 00-00-1914 (K).

-- **Not traced:** Mamaka. *Thomas, N.W. 4427;* 02-11-1914 (K!).

-- **Not traced:** Mamaka. *Thomas, N.W. 4544, 4546;* 02-11-1914 (K!).

-- **Not traced:** Mamaka. *Thomas, N.W. 4628;* 02-11-1914 (K!).

***MONDIA*** Skeels

***Mondia ecornuta*** (N.E. Br.) Bullock

DEMOCRATIC REPUBLIC OF THE CONGO

-- **03S 14E, 03°57'S 14°38'E:** Galerie forestiére de la Loualou, village de Kimpélé, km 16 route de Mayama – Mouyondzi **(-DC).** *Bouquet, A. 631;* 05-11-1964 (P!).

GABON

-- **00S 12E, 00°50'S 12°43'E:** Lastoursville **(-DC).** *Le Testu, M.G. 8865;* 18-04-1932 (P!).

-- **00N 09E, 00°30'N 09° 25'E:** Libreville **(-CB).** *Klaine, R.P. 577;* 14-11-1896 (P!).

KENYA

-- **03S 39E, 03°44'S 39°42'E:** K7 Kilifi District, Chasimba (Chonyi) **(-DC).** *Musyoki, B.M. & Hansen, O.J. 956;* 05-06-1973 (BR!). Alt. 200 m.

-- **03S 39E, 03°53'S 39°38'E:** K7 Kilifi Distr., Ribe near Mombasa **(-DC).** *Wakefield, T. s.n.;* 00-05-1880 (K holo!).

-- **04S 39E, 04°37'S 39°22'E:** K7 Kwale Distr., 4 km west of Shimani **(-CB).** *Luke & Robertson 2352;* 30-05-1990 (MO). Alt. 500 m.

MOZAMBIQUE

-- **Not traced:** Portuguese East Africa, Misala River, Hynesa. *Allen, C.E.F. 139;* 00-01-1912 (K!).

TANZANIA

-- **05S 38E, c. 05°06'S 38°39'E:** T3 Lushoto/Tanga, Sigi valley **(-BA).** *Grote 5795;* 00-07-1913 (K!). Alt. 500 m.

-- **05S 38E, 05°08'S 38°39'E:** T3 Lushoto, Amani **(-BA).** *Burtt, B.D. 278;* 04-04-1926 (K).

-- **<u>05S 38E</u>, 05°08'S 38°39'E:** T3 Lushoto, Amani **(-BA).** *Saleman, R. 6222;* 13-03-1922 (K).

-- **<u>05S 38E</u>, 05°20'S 38°57'E:** T3 Pangani Distr., Bushiri estate **(-BA).** *Faulkner, H.G. 558;* 06-05-1950 (K! (x2), BR!). Alt. 50 m.

-- **<u>05S 38E</u>, 05°20'S 38°57'E:** T3 Pangani Distr., Bushiri estate **(-BA).** *Faulkner, H.G. 558 (2);* 22-11-1950 (K!). Alt. 50 m. [NB: 2nd collection with follicles, from the same plant as the flowers].

-- **<u>05S 38E</u>, 05°24'S 38°57'E:** T3 Pangani, Kumbamtoni **(-BD).** *Tanner, R.E.S. 1990;* 23-07-1955 (K!). Alt. sea level

-- **<u>07S 36E</u>, 07°57'S 36°31'E:** T6 Ulanga Distr., Ilingera near Ifakara **(-DC).** *Haerdi 266/0;* 00-06-1959 (K!, WAG!). Alt. 700 m.

-- **<u>07S 37E</u>, c. 07°00'S 37°48'E:** T6 Morogoro Distr., Kimbaza **(-BB).** *Parda 319;* 30-03-1954 (K).

***Mondia whitei*** (Hook. f.) Skeels

<u>ANGOLA</u>

-- **<u>07S 13E</u>, 07°50'S 13°09'E:** Luanda, Abriz, Camilemba **(-CC).** *Monteiro, R., Santos, R. & Murta 397;* 07-12-1958 (CO).

-- **<u>08S 14E</u>, 08°50'S 14°30'E:** District Cuanza Norte, location Colungo **(-DC).** *Da Silva, M. 2313;* 19-01-1968 (CO). Alt. 550 m.

-- **<u>09S 14E</u>, 09°10'S 14°45'E:** Colungo Alto **(-BB).** *Gossweiler, J. 4211;* 00-00-0000 (P).

-- **<u>09S 14E</u>, 09°10'S 14°45'E:** Colungo Alto **(-BB).** *Welwitsch, F. 4217;* 00-00-0000 (BM).

-- **<u>09S 14E</u>, 09°41'S 14°25'E:** Dondo, River Luachima **(-CB).** *Gossweiler, J. 13856;* 20-11-1946 (B, CO, K, P).

-- **<u>09S 15E</u>, 09°15'S 15°00'E:** Cazengo (Casenga) **(-AC).** *Gossweiler, J. 616;* 00-00-0000 (BM, K, P).

-- **<u>09S 15E</u>, 09°44'S 15°35'E:** Pungo Andongo **(-DC).** *Welwitsch, F. 4218, 4219;* 00-11-1878 (BM, K).

-- 12S 13E, 12°34'S 13°24'E: Benguella District, Bumbo **(-CB).** *Welwitsch, F. 4221;* 00-10-1859 (BM).

-- **13S 17E, 13°24'S 17°21'E:** Bie Distr., Maxito do Chilesso Canata **(-AD).** *Teixeira 9962;* 10-12-1965 (LISC). Alt. 1,640 m.

-- **14S 19E, 14°54'S 19°07'E:** Cababa, Kakonda, Benguela **(-CC).** *Gossweiler, J. 4288;* 01-03-1907 (CO).

-- **Not traced:** Venaut. *De Ficalho s.n.* 00-00-1882 (P).

-- **Not traced:** Queta mts., near Sange. *Welwitsch, F. 4211;* 00-11-1878 (BM, G, K).

BURUNDI

-- **Not traced:** No locality. *Lewalle, J. 921;* 00-10-1980 (K).

CAMEROON

-- **03N 11E, 03°53'N 11°27'E:** N'kolbison, ± 8 km west of Yaoundé **(-CD).** *de Wilde & de Wilde Duyfies 2621;* 24-05-1964 (BR, K, MO, P, SRGH, Z). Alt. 650 m.

-- **03N 11E, 03°53'N 11°27'E:** N'kolbison, ± 8 km west of Yaoundé **(-CD).** *de Wilde & de Wilde Duyfies 2621 b;* 24-05-1964 (MO, WAG). Alt. 650 m.

-- **03N 11E, 03°51'N 11°31'E:** Yaoundé **(-DC).** *Zenker 589;* ± 1896 (K!).

-- **03N 11E, 03°51'N 11°31'E:** Yaoundé **(-DC).** *Zenker 1397;* 00-00-1897 (BM, G, K, P, WAG, Z holo?).

-- **03N 15E, 03°56'N 15°07'E:** 41 km off road Carigombo (Garegoumo) to Soso, east of Mgbatouri (=Batouri) River, near Bayanga Kadei **(-CC).** *Leeuwenberg, A.J.M. 6244;* 26-07-1965 (K, P, WAG). Alt. 540 m.

-- **03N 18E, 03°53'N 18°01'E:** Region de Mbaiki, Boukoko **(-CC).** *Equipe 1547;* 25-07-1949 (BM).

-- **03N 18E, 03°53'N 18°01'E:** Region Mbaiki, locality Centrale de Boukoko **(-CC).** *Le Testu, M.G. 1541;* 25-07-1949 (BM).

-- **03N 18E, 03°53'N 18°01'E:** Region Mbaiki, locality Centrale de Boukoko **(-CC).** *Le Testu, M.G. 2102;* 25-07-1949 (BR).

-- <u>04N 12E</u>, **04°41'N 12°22'E:** Menyang, Nanga Eboko **(-CB).** *Letouzey, R. 2077;* 21-05-1959 (P).

-- <u>04N 13E</u>, **04°54'N 13°50'E:** 29 km off road Bertoua – Betare Oya **(-DD).** *Leeuwenberg, A.J.M. 5802;* 09-06-1965 (P, WAG). Alt. 750 m.

-- <u>04N 14E</u>, **04°07'N 14°52'E:** Banga, 65 km SE of Batouri **(-BB).** *Letouzey, R. 4894;* 00-00-0000 (BR, K, P).

-- <u>04N 14E</u>, **c 04°58'N 14°03'E:** Yangamo, 65 km NNW of Batouri **(-CC).** *Letouzey, R. 2494;* 03-05-1962 (BR, K, P).

-- <u>05N 10E</u>, **05°28'N 10°00'E:** Village Djang, 40 km west of Bertona **(-AC).** *Breteler 2947;* 15-05-1962 (BR, K, M, P, WAG). Alt. 650 m.

-- <u>06N 11E</u>, **06°42'N 11°56'E:** 10 km SSE of Banya **(-DB).** *Biholong, M. 186;* 08-06-1967 (P).

-- <u>06N 12E</u>, **06°22'N 12°20'E:** Amani **(-AD).** *de Berlin 346;* 00-00-1903 (P).

-- <u>06N 12E</u>, **06°26'N 12°42'E:** 10 km Tibati-Mabouka road, grove in woodland near Djaoro Ndo **(-BC).** *Leeuwenberg, A.J.M. 10026;* 29-06-1972 (K!).

-- <u>06N 13E</u>, **06°47'N 13°10'E:** Tekel, 40 km NNE from Bagodo **(-CC).** *Letouzey, R. 4417;* 17-07-1966 (P).

-- <u>06N 14E</u>, **06°31'N 14°18'E:** Meiganga et Betuie **(-CB).** *Jacques-Felix, H. 4521;* 00-07-1939 (P).

-- <u>08N 13E</u>, **08°20'N 13°20'E:** Gere **(-AD).** *Letouzey, J. 2294;* 29-06-1959 (K, P).

-- <u>09N 13E</u>, **09°57'N 13°42'E:** Bosum-Buar **(-DC).** *Mildbraed 9731;* 00-06-1914 (K photo!). Alt. c. 900 m.

<u>CENTRAL AFRICAN REPUBLIC</u>

-- <u>03N 15E</u>, **03°55'N 15°24'E:** 1 km road Garigombo (on Mopas Garegoumo) – Soso, east of Mgbatouri (=Batouri) River near Bayanga Kadei **(-CD).** *Leeuwenberg, A.J.M. 6244;* 26-07-1965 (BR, MO). Alt. 540 m.

-- <u>03N 17E</u>, **03°54'N 17°56'E:** Boukoko **(-DD).** *Tisserant, Cl. Tis. 1541;* 00-00-0000 (G).

-- <u>03N 17E</u>, **03°54'N 17°56'E:** Boukoko **(-DD).** *Tisserant, Cl. Tis. 1752;* 00-00-0000 (P).

-- <u>03N 17E</u>, **03°54N 17°56'E:** Boukoko **(-DD).** *Tisserant, Cl. Tis. 2102;* 00-00-0000 (P).

-- <u>03N 18E</u>, **03°53'N 18°01'E:** Mbaiki, station centrale de Boukoko **(-CC).** *Le Testu, M.G. 1488;* 20-05-1949 (BR).

-- <u>04N 21E</u>, **04°31'N 21°31'E:** La Mahake **(-DA).** *Badre, F. 51;* 24-05-1968 (P).

-- <u>05N 20E</u>, **05°40'N 20°37'E:** Region de Bambari **(-DA).** *Tisserant, T.P. 2204;* 29-06-1927 (P).

-- <u>05N 20E</u>, **05°40'N 20°37'E:** Region de Bambari **(-DA).** *Tisserant, T.P. 2205;* 29-06-1927 (P).

-- <u>05N 25E</u>, **05°05'N 25°01'E:** Ombella, Porte Boma (Drouma) **(-AA).** *Chevalier, A. 5943;* 28-10-1902 (P).

-- <u>06N 22E</u>, **06°25'N 22°02'E:** Tchekeni, Tchéné, River Mluyo **(-AC).** *Le Testu M.G. 2204;* 00-00-0000 (BR).

-- <u>06N 22E</u>, **06°25'N 22°02'E:** Tchekeni, Tchéné, River Mluyo **(-AC).** *Le Testu M.G. 2205;* 00-00-0000 (BR).

-- <u>06N 23E</u>, **06°33'N 23°14'E:** Yalinga **(-CB).** *Le Testu, M.G. 3957;* 11-06-1923 (BR).

-- <u>06N 23E</u>, **06°33'N 23°14'E:** Yalinga **(-CB).** *Le Testu M.G. 4770;* 11-06-1923 (BR).

**<u>DEMOCRATIC REPUBLIC OF THE CONGO</u>**

-- <u>00N 29E</u>, **00°27'N 29°29'E:** Beni **(-BC).** *Bequaert 5114;* 29-07-1914 (BR).

-- <u>00N 29E</u>, **00°47'N 29°36'E:** Cocalan – Jason village **(-DC).** *Leconte, H. s.n.* 31-01-1864 (P).

-- <u>02N 29E</u>, **02°45'N 29°03'E:** Wamba et Gambari **(-CC).** *Lebrun, J. 3307;* 00-07-1931 (BR, K).

-- <u>02N 19E</u>, **03°24'N 19°47'E:** Libenge & Gemena **(-BD).** *Lebrun, J. 1855;* 00-12-1930 (BR, K).

-- <u>03N 20E</u>, **03°45'N 20°29'E:** Bodangabo **(-DC).** *Evrard, C. 308;* 20-02-1955 (BR).

-- <u>03N 23E</u>, **03°28'N 23°46'E:** Brousse, La Kulu, Aketi Province **(-BD).** *Braudi, F. 570;* 04-08-1931 (BR).

-- <u>03N 23E</u>, **03°28'N 23°46'E:** Brousse, La Kulu **(-BD).** *Braudi, F. 602;* 04-08-1931 (BR).

-- <u>03N 30E</u>, **03°51'N 30°18'E:** Kurukwata (Aba), Faradje Province **(-CD).** *Gérard 3170;* 02-05-1957 (BR).

-- <u>04N 25E</u>, **04°26'N 25°51'E:** Tukpwo, Ango Province **(-BD).** *Gérard 4041;* 03-07-1959 (BR).

-- <u>03N 25E</u>, **03°28'N 25°43'E:** Bambesa **(-BC).** *Gérard 5139;* 05-06-1962 (BR).

-- <u>03N 26E</u>, **03°09'N 26°53'E:** Omadi et Poko **(-BB).** *Lebrun, J. 3081;* 00-06-1931 (BR, K).

-- <u>03N 26E</u>, **03°38'N 26°56'E:** Wangaba **(-DB).** *Seret, F. 876;* 00-05-1885 (BR).

-- <u>03N 27E</u>, **03°53'N 27°45'E:** Village Aragi, Niangara Province **(-DD).** *de Graer, P. 842;* 15-06-1937 (BR).

-- <u>03N 30E</u>, **03°10'N 30°40'E:** Kiliko, route Aru Aba – Concession **(-BA).** *Bamps 218;* 11-06-1958 (BR). Alt. 1,160 m.

-- <u>02S 18E</u>, **02°50'S 18°23'E:** Bokoro **(-CD).** *Jans, E. s.n.;* 26-11-1947 (BR).

-- <u>04S 19E</u>, **04°07'S 19°37'E:** Ipamu, Idiofa Province **(-BA).** *Vanderyst, H. 12825;* 00-12-1922 (BR).

-- <u>05S 13E</u>, **05°50'S 13°03'E:** Luki (Boma), station forestier du Mayumbe, Lukula Province **(-CC).** *Wagemans, J. 781;* 15-03-1954 (BR).

-- <u>05S 13E</u>, **05°52'S 13°03'E:** Leopoldville, Luki (Boma) **(-CC).** *Wagemans, J. 979;* 00-00-0000 (MO).

-- <u>05S 14E</u>, **05°15'S 14°52'E:** Bas Zaire, Mbanza-Ngungu **(-BD).** *Lisowski, S. 56025;* 08-01-1980 (BR).

-- <u>05S 14E</u>, **05°27'S 14°54'E:** Leopoldville Province, territory Thysville, M'vuazi, forest de Nkolo **(-BD).** *Devred, R. 415;* 08-12-1948 (BR, K).

-- <u>05S 14E</u>, **05°51'S 14°28'E:** Locality Kivala, territory Thysville **(-DD).** *Compere, D. 773;* 06-02-1959 (BR).

-- <u>05S 15E</u>, **05°08'S 15°09'E:** Kisantu (Inkisi-Kisantu) **(-AA).** *Gillet, J. 230;* 00-00-1899 (BR).

-- <u>06S 22E</u>, **06°49'S 22°54'E:** Route Bena-Kalangala, Luti **(-DD).** *Liben, L. 2425;* 07-02-1957 (SRGH).

-- <u>06S 23E</u>, **06°12'S 23°23'E:** Locality route Miabi, territory Bakwanga, Mbuji Mayi Province **(-AB).** *Liben, L. 1942;* 20-11-1956 (BR).

-- <u>07S 23E</u>, **07°01'S 23°27'E:** Locality Mwene Ditu **(-AB).** *Liben, L. 3936;* 04-11-1957 (BR, SRGH).

-- **Not traced :** Moungali. *Bouquet, A. 1266;* 05-03-1965 (P).

## <u>GABON</u>

-- <u>01S 12E</u>, **01°19'S 12°15'E:** Movila et Nolende **(-AD).** *Le Testu, M.G. 5152;* 22-12-1924 (P).

## <u>GHANA</u>

-- <u>05N 00W</u>, **05°59'N 00°40'W:** Atewa Range forest reserve **(-DC).** *Hall & Lock 46767;* 28-06-1977 (K, MO). Alt. 400 m.

-- <u>06N 00W</u>, **06°39'N 00°29'W:** Kabakaba east forest reserve **(-CB).** *Hall & Alobin, G.C. 43496;* 17-06-1972 (K).

## <u>GUINEA</u>

-- <u>07N 08W</u>, **07°39'N 08°30'W:** Yèkèpa, Nimba **(-DA).** *Adam, J.G. 24248;* 00-00-0000 (MO).

-- 07N 08W, 07°52'N 08°29'W: Nzèrèkorè – Lola (-DC). *Adam, J.G. 25921;* 13-06-1970 (MO, SRGH).

-- 07N 08W, 07°45'N 08°49'W: Nzèrèkorè, Sibamon (-DD). *Adam, J.G. 5420;* 00-00-0000 (MO).

-- 08N 09W, 08°31'N 09°32'W: Macenta, Sèrèdou (-DA). *Adam, J.G. 12001;* 00-00-0000 (MO).

-- 08N 09W, 08°31'N 09°32'W: Macenta, Tènèbadou (-DA). *Adam, J.G. 4982;* 00-00-0000 (MO).

-- 10N 11W, 10°36'N 11°51'W: Timbo (-DB). *Pobeguin, M. 1658;* 24-03-1908 (P).

-- 10N 12W, 10°04'N 12°51'W: Kindia (Benna) (-BB). *Jacques-Felix, H. 1632;* 00-06-1937 (K, P).

-- 10N 12W, 10°04'N 12°51'W: Kindia (Benna) (-BB). *Jacques-Felix, H. 1750;* 00-06-1937 (K, P).

-- 11N 09W, 11°26'N 09°24'W: Near Bafing River on Mau-Touba road (-BD). *Colenette 55;* 04-07-1926 (K). Alt. 500 m.

GUINEA BISSAU

-- 11N 14W, 11°47'N 14°11'W: Bafata, Madina fe Mamadii Alfa (-CC). *Santo 2977;* 15-11-1952 (K).

-- 11N 14W, 11°36'N 14°55'W: Fulacunda, entrè Bolala & Buba (-DB). *Santo 2155;* 01-08-1945 (K, P).

-- 11N 15W, 11°43'N 15°03'W: Fulacunda (-CA). *Santo 2161;* 09-08-1945 (K, P).

-- 11N 15W, 11°56'N 15°48'W: Bissau, Bijimita (-DD). *Santo 1760;* 03-02-1945 (K).

-- 12N 15W, 12°04'N 15°23'W: Contubô (-AB). *Perreira, J. 3114;* 10-08-1962 (BR).

## IVORY COAST (COTE d'IVOIRE)

-- **06N 04W, 06°30'N 04°37'W:** Tièmèlèkro **(-DA).** *Garner, P.G. & U.B. 22;* 23-06-1963 (K).

-- **06N 04W, 06°30'N 04°37'W:** 1 km south of Tièmèlèkro **(-DA).** *Garner, P.G. & U.B. 142;* 08-09-1963 (K).

-- **06N 05W, 06°34'N 05°01'W:** Lamto reserve, 50 km south of Toumodi **(-CA).** *Bokdam, J. 2767;* 12-06-1968 (BR, MO, WAG).

-- **07N 03W, 07°07'N 03°21'W:** Abo-N'guessan kro **(-AB).** *Garner 41;* 07-07-1963 (K).

-- **07N 04W, 07°48'N 04°50'W:** Brobo, 25 km ENE of Bouakè gallery forest **(-DD).** *Oldeman, R.A.A. 392;* 24-09-1963 (BR, K photo!, MO!, P).

-- **07N 05W, c. 07°14'N 05°18'W:** 12 km route to Sakasso (Sakassou) **(-AD).** *Garner, P.G. & U.B. 8;* 09-08-1963 (K).

-- **07N 05W, c. 07°14'N 05°18'W:** 12 km route to Sakasso (Sakassou) **(-AD).** *Garner, P.G. & U.B. 96;* 09-08-1963 (K).

-- **07N 05W, 07°42'N 05°00'W:** Bouakè **(-CA).** *Cèsar 1667;* 25-05-1982 (ALF).

-- **07N 07W, 07°34'N 07°10'W:** Man-Seguela, 55 km **(-CA).** *Bamps 1917;* 2-01-1969 (BR).

-- **08N 02W, 08°03'N 02°45'W:** North of Boudoukou **(-BB).** *Gerling, C. & Bokdam, J. 253;* 14-07-1967 (BR, WAG).

-- **08N 05W, 08°06'N 05°26'W:** Entrè Marabadiassa et Gottoro **(-AB).** *Chevalier, A. 22025;* 04-07-1909 (P).

-- **08N 06W, 08°01'N 06°09'W:** Mankono, between Dialakoro and Kènègorè **(-AA).** *Chevalier, A. 21975;* 01-07-1909 (K, P holo).

## KENYA

-- **00N 32E, 00°22'N 32°38'E:** Kiwatule, Kyadondo **(-BC).** *Liebenberg, L.C.C. 840;* 00-05-1929 (K).

-- **00N 34E, c. 00°15'N 34°52'E:** K5 North Kavirondo, Kakamega **(-BD).** *Dale, I.R. 3431;* 00-05-1935 (BR, K).

-- 01S 36E, 01°17'S 36°49'E: K4 Nairobi (-BD). *Bell 1;* 26-03-1952 (K).

LIBERIA

-- **07N 08W, 07°35'N 08°32'W:** Yèkèpa village **(-DA).** *Adam, J.G. 21462;* 11-06-1965 (K, MO). Alt. 450 m.

-- **07N 08W, 07°35'N 08°32'W:** Yèkèpa village **(-DA).** *Adam, J.G. 25739;* 11-06-1965 (MO, SRGH). Alt. 450 m.

-- **07N 08W, 07°35'N 08°32'W:** Yèkèpa village, Granfield **(-DA).** *Adam, J. G. 26800;* 00-00-0000 (MO).

-- **07N 08W, 07°39'N 08°30'W:** Nimba **(-DA).** *Vallah 107;* 15-05-1965 (K).

MALAWI

-- **10S 33E, 10°59'S 33°50'E:** Rumpi (Rumphi) District, 3,2 km up Lura escarpment **(-DD).** *Pawek, J. 13910;* 26-02-1978 (K). Alt. 840 m.

-- **10S 34E, c. 10°40'S 34°04'E:** Lura-Chiwe road, 23 km SE of Chilumba **(-CA).** *Pawek, J. 13590;* 08-01-1978 (K, SRGH).

-- **11S 34E, c. 11°36'S 34°18'E:** Nkhata Bay secondary school **(-CB).** *Pawek, J. 5849;* 01-10-1972 (K).

-- **11S 34E, c. 11°36'S 34°18'E:** Nkhata region **(-CB).** *Pawek, J. 6417;* 04-02-1973 (K, MO, SRGH).

-- **15S 35E, 15°15'S 35°18'E:** Malosa mountain, opposite Domasi valley **(-AD).** *Salubeni, Banda & Masiye 2692;* 00-00-0000 (M).

-- **15S 35E, 15°21'S 35°18'E:** South region lower slopes of Zomba plateau, near Mlunguzi stream **(-AD).** *Brummitt, R.K. & Seyani, J.H. 14810;* 06-03-1977 (K, SRGH!). Alt. 1,085 m.

-- **15S 35E, 15°23'S 35°19'E:** Zomba (= Somba) **(-AD).** *Brummitt & Patel 15501;* 19-04-1980 (K). Alt. 975 m.

-- **15S 35E, 15°23'S 35°19'E:** Zomba, Malemia road near Chichewa office **(-AD).** *Chirambo, P.C. 102;* 04-11-1978 (SRGH).

-- **15S 35E, 15°23'S 35°17'E:** Zomba Botanical Garden **(-AD).** *Salubeni, A.J. 2399;* 05-01-1979 (MO, SRGH, WAG).

-- **15S 35E, $15^{0}23'S$ $35^{0}19'E$:** Zomba Botanical Garden **(-AD).** *Salubeni, A.J. 2698;* 05-01-1979 (MO, WAG).

-- **15S 35E, c. $15^{0}23'S$ $35^{0}19'E$:** Zomba District **(-AD).** *Wiehe, N. 404;* 00-11-1949 (K, SRGH).

-- **15S 35E, c. $15^{0}40'S$ $35^{0}05'E$:** Shire Highlands **(-CA).** *Buchanan, J. 168;* 00-12-1881 (K). Alt. $\pm$ 915 m.

-- **15S 35E, $15^{0}29'S$ $35^{0}14'E$:** Ntondwe (= Thondwe) **(-CB).** *Cameron, K.J. 110;* 21-10-1905 (K).

MOZAMBIQUE

-- **14S 39E, $14^{0}59'S$ $39^{0}50'E$:** Niassa District, Meconta – 21 km from Meconta para Corrane **(-DD).** *Torre & Paiva 10056;* 18-01-1964 (LISC).

-- **16S 39E, $16^{0}11'S$ $39^{0}55'E$:** Antonio Enes, Boila $\pm$ 60 km from Nametil **(-BB).** *Torre & Correira 17836;* 25-01-1968 (LISC). Alt. 80 m.

-- **19S 34E, $19^{0}56'S$ $34^{0}03'E$:** District Manica è Sofala, Tsetserra area, road to Mavita **(-CC).** *Müller, T. 511;* 30-11-1968 (K, SRGH).

-- **08S 31E, $08^{0}47'S$ $31^{0}23'E$:** District Huamba, location Chianga (= Chinhanda) **(-CD).** *Teixeira & Andrade 6330;* 30-10-1962 (COI).

NAMIBIA

-- **17S 23E, $17^{0}46'S$ $23^{0}10'E$:** Oos Caprivi, 32 km van Singalamwe op pad na Katima Mulilo **(-CC).** *Killick, D.J.B. & Leistner, O.A. 3271;* 03-01-1959 (PRE).

NIGERIA

-- **06N 03E, $06^{0}27'N$ $03^{0}28'E$:** South Nigeria, Lagos **(-AD).** *Batton-Poole s.n.;* 00-00-1946 (K).

-- **07N 3E, $07^{0}13'N$ $03^{0}56'E$:** Ibadan District, Oke Ado on Ibadan to Ijebu. Ode motor road **(-BB).** *Tamajong* FHI *16796;* 17-07-1946 (K).

-- **07N 03E, c. $07^{0}13'N$ $03^{0}36'E$:** West of Ibadan, road to Akufo **(-BC).** *Gentry, A. & Pilz, G. 32963;* 00-00-0000 (MO).

-- 07N 03E, $07^{0}26'N$ $03^{0}37'E$: Olokomeji forest reserve **(-BC).** *Gentry, A. & Pilz, G. 32664;* 00-00-0000 (MO).

-- **07N 03E, 07⁰23'N 03⁰56'E:** Ibadan District **(-BD).** *Binuyoi & Emwiogbon,* FHI *54548;* 00-00-0000 (P).

-- **07N 03E, 07⁰23'N 03⁰56'E:** Ibadan District, Eleyele plantation by Agbaje's farm **(-BD).** *Keay, R.W.J.* FHI *25675;* 00-00-0000 (K).

-- **07N 03E, 07⁰23'N 03⁰56'E:** Ibadan **(-BD).** *Keay, R.W.J.* FHI *46310;* 01-07-1962 (K).

-- **07N 03E, 07⁰23'N 03⁰56'E:** Ibadan, garden of # 2, Jericho road **(-BD).** *Keay, R.W.J.* FHI *46320;* 01-07-1962 (K photo!).

-- **07N 03E, 07⁰23'N 03⁰56'E:** Ibadan Distr., near Busogboro **(-BD).** *Onochie 34943;* 04-11-1955 (K).

-- **07N 03E, 07⁰23'N 03⁰56'E:** South Ibadan, Oke Eleyele **(-BD).** *Sutton s.n.;* 15-07-1951 (K).

-- **07N 03E, c. 07⁰45'N 03⁰55'E:** Ibadan Distr., I.I.I.A. compound **(-DD).** *Wit, P. 2227;* 03-07-1972 (K).

-- **07N 04E, 07⁰13'N 04⁰10'E:** West Province, Gambari ± 32 km south east of Ibadan **(-AA).** *van Eijnatten, C.L.M. 1689;* 19-07-1966 (WAG x 2).

-- **07N 04E, 07⁰05'N 04⁰55'E:** Ondo state, Oka District **(-BB).** *Daramola, B.O.* FHI *91209;* 00-00-0000 (MO).

-- **07N 05E, 07⁰24'N 05⁰03'E:** Igbara Oke **(-AC).** *Keay & Meikile 508;* 11-11-1949 (K).

-- **07N 05E, 07⁰24'N 05⁰03'E:** Igbara Oke, side of the road to Igbaru Odo **(-AC).** *Meikile 508;* 11-11-1949 (P).

-- **07N 06E, 07⁰50'N 06⁰07'E:** Province Kabba, Igala Distr., Ogbogbo **(-CC).** *Latilo* FHI *47698;* 21-06-1963 (K).

-- **07N 07E, 07⁰22'N 07⁰38'E:** Province Kabba, Ankpa Distr., along road from Ankpa to Acharane **(-BC).** *Daramola, B.O.* FHI *38043;* 22-06-1958 (K).

-- **Not traced:** Bamenda Province, Wum Distr., Aba-ajia on right bank of river Ife. *Ujor, E.* FHI *30462;* 14-07-1951 (K).

## SÉNÉGAL

-- **12N 15W, 12°50'N 15°00'W:** Casamance, forest reserve at Koucouck **(-CC).** *Miege, J. & Doumbia, F. 1492;* 10-09-1962 (ALF).

-- **12N 15W, 12°44'N 15°33'W:** Region de Sèdhiou, Forte de Boudiè **(-DC).** *Berhaut, R.P. 6068;* 31-10-1983 (P).

-- **12N 15W, 12°44'N 15°33'W:** Region de Sèdhiou, Forte de Boudiè **(-DC).** *Berhaut, R.P. 6351;* 31-10-1983 (BR, M, P).

-- **12N 15W, 12°44'N 15°33'W:** Region de Sèdhiou, Forte de Boudiè **(-DC).** *Berhaut, R.P. 6357;* 31-10-1983 (BR, P).

-- **12N 16W, 12°48'N 16°18'W:** Region de Bignona, forest Kalounayes **(-CD).** *Berhaut, R.P. 7365;* 28-08-1968 (BR, M, P).

## SIERRA LEONE

-- **09N 11W, 09°40'N 11°36'W:** Kabala, north Province **(-DA).** *Glanville, D.R. 267;* 18-07-1930 (K). Alt. 400 m.

-- **09N 11W, 09°49'N 11°39'W:** Musaia **(-DC).** *Deighton, F.C. 4405;* 20-08-1946 (K).

-- **09N 11W, 09°49'N 11°39'W:** Musaia **(-DC).** *Deighton, F.C. 4805;* 20-08-1946 (K).

-- **09N 11W, 09°49'N 11°39'W:** Musaia **(-DC).** *Jordan, H.D. 494;* 22-08-1951 (K).

## SOUTH AFRICA (REPUBLIC OF SOUTH AFRICA)

-- **23S 30E, 23°42'S 30°06'E:** Transvaal, Letaba - Duiwelskloof, Westfalia estate, small kloof below road to Zulu's bull kraal & 0.8 km from new dam Westfalia **(-CA).** *Scheepers, J.C. 1058;* 24-11-1960 (BM, K, M, PRE!, PRU, SRGH, WAG, Z). Alt. 1,200 m.

-- **23S 30E, 23°46'S 30°10'E:** Northern Transvaal, Magoebaskloof forest **(-CC).** *Gerstner, J. 5805;* 22-01-1946 (PRE).

-- **23S 30E, 23°46'S 30°10'E:** Transvaal, Sendelingshoek - Noordewenke **(-CC).** *Keet, J.D.N. s.n.* 00-12-1967 (BR, K).

-- 27S 32E, **27°35'S 32°05'E:** Zululand, Ubombo **(-CA).** *Collins, E. 15;* 00-00-0000 (PRE).

-- 27S 32E, **27°35'S 32°05'E:** Ubombo (Umbombo) **(-AC).** *Stewart, L. s.n.* 00-00-0000 (P).

-- 27S 32E, **27°37'S 32°03'E:** Ubombo Distr., Mkuze Nature Reserve, wild garden **(-CA).** *Venter, H.J.T. 9329;* 16-11-1999 (BLFU!).

-- 27S 32E, **27°37'S 32°03'E:** Ubombo Distr., Mkuze Nature Reserve, confluence of Mkuze and Msunduze Rivers **(-CA).** *Ward, J. 3626;* 06-11-1960 (K, M, NU, NH, PRE, SRGH). Alt. 25 m.

-- 28S 31E, **28°38'S 31°06'E:** Zululand, Nkandla, near white Umfolozi River **(-CA).** *Gerstner, J. 617;* 20-01-1935 (PRE).

-- 28S 31E, **28°58'S 31°46'E:** Zululand, Mtunzini, Garden Ian Garland **(-DD).** *Venter, H.J.T. 8781;* 06-01-1983 (BLFU!).

-- 28S 31E, **28°45'S 31°54'E:** Zululand, Empangeni, Ann Hutchings garden **(-DD).** *Venter, H.J.T. 9282;* 30-11-1993 (BLFU!).

-- 28S 32E, **28°20'S 32°14'E:** Natal, Hlabisa - Dukuduku forest reserve **(-AD).** *Strey, R.G. 5745;* 25-01-1965 (NH, PRE).

-- 28S 32E, **28°20'S 32°14'E:** Natal, Dududuku swamp forest **(-AD).** *Strey, R.G. 10347;* 25-01-1965 (K, PRE!).

-- 29S 30E, **29°36'S 30°24'E:** Natal, Pietermaritzburg **(-CB).** *Stainbank 11900;* 17-01-1908 (NH).

-- 29S 31E, **29°20'S 31°18'E:** Natal, Stanger **(-AD).** *Pienaar, B.J. 170;* 22-02-1980 (NH!).

-- 29S 31E, **29°53'S 31°00'E:** Natal, Durban Botanical Garden **(-CC).** *Medley Wood, J. 10;* 00-00-0000 (MO, PRE, SRGH).

-- 29S 31E, **29°53'S 31°00'E:** Natal, Durban Botanical Garden **(-CC).** *Medley Wood, J. 197;* 00-00-0000 (MO, PRE, SRGH).

-- 29S 31E, **29°53'S 31°00'E:** Natal, Durban - Wentworth **(-CC).** *Medley Wood, J. 951;* 11-01-1892 (BM, BOL, GRA, SAM).

-- 29S 31E, **29°53'S 31°00'E:** Natal, Berea **(-CC).** *Medley Wood, J. 5499;* 21-12-1894 (MO, PRE!, SRGH). Alt. 50 m.

-- **29S 31E, 29$^0$53'S 31$^0$00'E:** Durban **(-CC).** *Medley Wood, J. 6180;* 20-12-1896 (BM, PRE!, SAM). Alt. 30 m.

-- **29S 31E, 29$^0$53'S 31$^0$00':** Natal, Berea **(-CC).** *Medley Wood, J. 6499;* 21-12-1894 (PRE).

-- **29S 31E, 29$^0$53'S 31$^0$00'E:** Durban **(-CC).** *Medley Wood, J. 8653;* 00-00-0000 (MO).

-- **29S 31E, 29$^0$53'S 31$^0$00'E:** Natal, Berea **(-CC).** *Medley Wood, J. 10754;* 17-12-1907 (MO).

-- **29S 31E, 29$^0$53'S 31$^0$00'E:** Durban, Wentworth **(-CC).** *Medley Wood, J. s.n.;* 00-00-0000 (K, Z).

-- **29S 31E, 29$^0$53'S 31$^0$00'E:** Natal - on verandah of hotel Avoca **(-CC).** *Olivier, J.C. 138;* 00-02-1925 (NH).

-- **29S 31E, 29$^0$53'S 31$^0$00'E:** Natal, Durban Botanical Garden **(-CC).** *Venter, H.J.T. 8976;* 14-11-1983 (BLFU!).

-- **29S 31E, 29$^0$53'S 31$^0$00':** Natal, Durban Botanical Garden **(-CC).** *Venter, H.J.T. 9068;* 20-11-1984 (BLFU!).

-- **30S 29E, 30$^0$46'S 29$^0$40'E:** Mfundisweni **(-DC).** *White s.n.;* 00-00-1869 (K holo, iso).

-- **30S 30E, 30$^0$19'S 30$^0$40'E:** Natal, Umzinto, Port Shepstone **(-BC).** *Medley Wood, J. 3271;* 00-00-1884 (NH).

-- **30S 30E, 30$^0$19'S 30$^0$40'E:** Natal, Umzinto, Port Shepstone **(-BC).** *Medley Wood 4110;* 00-00-0000 (NH).

-- **30S 30E, 30$^0$43'S 30$^0$28'E:** Natal, Port Shepstone **(-CB).** *Eyles, A. s.n.;* 00-00-1932 (K).

-- **Not traced:** Natal. *Kew, H.* $^{11}/_{74}$; 12-12-1871 (K holo! Iso!).

-- **Not traced :** Natal. *Palm, H. s.n.;* 03-08-1911 (K).

## SUDAN

-- **04N 32E, 04$^0$05'N 32$^0$43'E:** Katire, Torit District **(-BA).** *Jackson 3011;* 20-06-1953 (K).

-- <u>05N 32E</u>, **05°00'N 32°30'E:** Equatoria Province, Loti rest house, Torit District **(-BA).** *Andrews, J.W. 1739;* 09-06-1969 (BR, K).

SWAZILAND

-- <u>26S 31E</u>, **26°10'S 31°50'E:** Stezi **(-BB).** *Young, J.G.;* 00-00-0000 (PRE).

TANZANIA

-- <u>05S 38E</u>, **05°09'S 38°35'E:** T3 Lushoto/Tanga District, Ngua estate forest reserve **(-BA).** *Semsei 3213;* 27-05-1961 (BR, K).

-- <u>05S 38E</u>, **05°08'S 38°39'E:** T3 Lushoto, Amani **(-BA).** *Warneike 346;* 00-03-1903 (W, Z).

-- <u>05S 38E</u>, **05°08'S 38°39'E:** T3 Lushoto, Amani **(-BA).** *Zimmermann 1125;* 18-03-1909 (BM).

-- <u>05S 38E</u>, **05°05'S 38°45'E:** T3 Tanga, 4 km NE of Tongwe, lower slopes of Mlinga Hill, east Usambaras **(-BB).** *Drummond, R.B. & Hemsley, J.H. 1432;* 07-03-1953 (BR, K). Alt. 600 m.

-- <u>06S 36E</u>, **06°50'S 36°59'E:** T6 Kilosa **(-DD).** *Lwynnerton, C. 944;* 00-00-0000 (BM).

-- <u>06S 37E</u>, **c. 06°55'S 37°50'E:** T6 Morogoro Distr., Njurn-ya-ndogo **(-DD).** *Schlieben, H.J. 334;* 30-01-1938 (B, BM, BR, G, K, MO, P, W, Z). Alt 1,300 m.

-- <u>08S 36E</u>, **08°49'S 36°43'E:** T6 Ulanga, Mahenge Distr., Mzelezi forest reserve, c. 15 km off Mahenge **(-DC).** *Cribb, Grey-Wilson & Mwasambi 11064;* 19-01-1979 (K). Alt. 725 m.

-- <u>09S 33E</u>, **09°17'S 33°39'E:** T3 Lushoto, Nyassa Hochland, station Kyimbila **(-BC).** *Stolz, A. 1837;* 00-01-1913 (B, G, K, M, W, WAG, Z). Alt. 700 m.

-- <u>09S 39E</u>, **09°59'S 39°24'E:** T8 Lindi, Lutamba, Mirola (= Milola) River valley **(-CD).** *Schlieben, H.J. 5904;* 23-01-1935 (K, MO, SRGH).

-- **10S 35E, 10°16'S 35°39'E:** -T8 Songea, River Mutandazi, west of Gumbiro riverine forest on old termite hill **(-BC).** *Milne-Redhead & Taylor 10138;* 09-05-1956 (K). Alt. 780 m.

-- **10S 39E, 10°00'S 39°41'E:** T8 Lindi, Lindi-Bazirk, Inhamba pass **(-BA).** *Schlieben, H.J. 5909;* 23-01-1935 (BR, LISC).

UGANDA

-- **00N 30E, 00°40'N 30°10'E:** U2 Toro, 16 km from Fort Portal road **(-CA).** *Luid 2374;* 28-02-1959 (K). Alt. 1,270 m.

-- **00N 31E, 00°54'N 31°16'E:** U4 Mubende, Buganda Province, locality Kasambya **(-CD).** *Griffiths 30;* 16-05-1957 (K).

-- **00N 32E, 00°07'N 32°59'E:** U4 Mengo, Buganda Province, Kyagwe, locality Nansagazi **(-BB).** *Dawkins 706;* 24-01-1951 (BR, K). Alt. 1,300 m.

-- **00N 32E, 00°15'N 32°46'E:** U4 Mengo, Kipayo **(-BD).** *Dummer 871;* 00-00-0000 (BM).

-- **00N 32E, 00°15'N 32°46'E:** U4 Mengo Distr., Kipayo **(-BD).** *Dummer 2467;* 00-05-1915 (BOL, BM, K, MO).

-- **00N 33E, c. 00°45'N 33°30'E:** U3 Busoga **(-DC).** *Brown, E. 264;* 06-09-1905 (K). Alt. 1,300 m.

-- **01N 31E, 01°30'N 31°29'E:** U2 Bonyoro District, Bulindi **(-DA).** *Thomas, N.W. 3890;* 13-05-1941 (K). Alt. 1,270 m.

-- **01N 31E, c. 01°40'N 31°30'E:** U2 Bunyoro **(-DA).** *Brown, E. 394;* 25-11-1907 (K).

-- **01N 31E, c. 01°47'N 31°35'E:** U2 Bunyoro Distr., Budongo forest reserve **(-DC).** *Eggeling 2021;* 00-05-1935 (K).

-- **01N 31E, c. 01°40'N 31°30'E:** U2 Bunyoro **(-DA).** *Eggeling 4376;* 00-05-1941 (K).

-- **01N 31E, c. 01°47'N 31°35'E:** U2 Bunyoro, Bujenje country, locality Budongo forest **(-DC).** *Synnott, T.J. 670;* 16-09-1971 (K photo!). Alt. 1,050 m.

-- <u>01N 31E</u>, **c. 01°47'N 31°35'E:** U2 Bunyoro, Bujenje country, locality Budongo forest **(-DC).** *Synnott, T.J. 881;* 16-09-1971 (MO). Alt. 1,050 m.

<u>ZAMBIA</u>

-- <u>12S 28E</u>, **12°48'S 28°14'E:** Kitwe (Kitwe-Nkana) **(-CC).** *Fanshawe, D.B. 2699;* 08-01-1956 (K).

-- <u>13S 31E</u>, **13°55'S 31°23'E:** Sasare **(-CD).** *Robson, N.K.B. 868;* 08-12-1958 (BM, BR, K, SRGH). Alt. 750 m.

-- **Not traced:** Fort Jackson. *King, A.E.B. 457;* 17-01-1959 (K, SRGH).

<u>ZIMBABWE</u> **(RHODESIA)**

-- <u>17S 30E</u>, **17°30'S 30°59'E:** Mazoe (= Mazowe) **(-DB).** *Eyles, F. 204;* 00-12-1905 (BM, BOL, K, SAM, SRGH).

-- <u>17S 30E</u>, **17°30'S 30°59'E:** Mazoe **(-DB).** *Eyles, F. 3235;* 18-12-1921 (K, SAM). Alt. 1,400 m.

-- <u>17S 25E</u>, **17°57'S 25°50'E:** Victoria falls **(-DD).** *Allen, C.E.F. 259;* 00-01-1956 (K).

-- <u>17S 25E</u>, **17°57'S 25°50'E:** Victoria falls **(-DD).** *Lewy, B. 1311;* 00-12-1934 (K).

-- <u>17S 25E</u>, **17°57'S 25°50'E:** Victoria falls **(-DD).** *Hutchinson & Gillett 3468;* 08-07-1930 (K).

-- <u>17S 30E</u>, **17°00'S 30°30'E:** Lomagundi **(-AD).** *Cannell, J.C. 574;* 01-11-1973 (SRGH).

-- <u>17S 31E</u>, **17°43'S 31°03'E:** Salisbury (= Harare) **(-CA).** *Eyles, F. 3385;* 28-11-1923 (K).

-- <u>17S 31E</u>, **17°43'S 31°03'E:** Salisbury **(-CA).** *Eyles, F. 5522;* 28-11-1923 (SRGH).

-- <u>17S 31E</u>, **17°43'S 31°03'E:** Salisbury Botanic Gardens **(-CA).** *Eyles, F. 5666;* 02-11-1927 (SRGH).

-- <u>17S 31E</u>, **17°43'S 31°03'E:** Salisbury – springs farm **(-CA).** *Greatrex, F.C. 18213;* 11-12-1947 (K, SRGH).

-- **<u>17S 31E</u>, c. 17°50'S 31°05'E:** Salisbury Highlands **(-CC).** *Leach, L.C. 13567;* 08-11-1966 (K, SRGH).

-- **<u>17S 31E</u>, 17°55'S 31°03'E:** Harare (= Mbare) **(-CC).** *Eyles, F. 1379;* 21-11-1927 (B, K). Alt. 1,600 m.

-- **<u>17S 27E</u>, 17°52'S 31°22'E:** District Goromonzi, Binga swamp forest **(-CD).** *Brodrick 110;* 07-12-1971 (BR, K, M).

-- **<u>18S 30E</u>, 18°20'S 30°06'E:** Mazoe, Iron Duke mine **(-AC).** *Rutherford 426;* 00-00-0000 (MO).

-- **<u>18S 32E</u>, 18°58'S 32°40'E:** Umtali (= Mutare), Kukwanisa training farm **(-DC).** *Biegel, H.M. 1688;* 09-01-1966 (SRGH).

-- **<u>18S 32E</u>, 18°58'S 32°40'E:** Mutare, Black mountain inn **(-DC).** *Chase, N.C. 460;* 28-12-1947 (BM).

-- **<u>18S 32E</u>, 18°58'S 32°40'E:** Umtali District, Park River, north commonage **(-DC).** *Chase, N.C. 5424;* 27-12-1954 (BM, BR, CO, K, SRGH).

-- **<u>19S 32E</u>, c. 19°48'S 32°53'E:** Melsetter (= Chimanimani), Welgelegen **(-DD).** *Ball, J.S. 26;* 00-00-0000 (MO, SRGH).

-- **<u>19S 32E</u>, c. 19°48'S 32°53'E:** Melsetter, Umvumvumvu River **(-DD).** *Chase, N.C. 459;* 24-12-1947 (K, SRGH).

-- **<u>20S 30E</u>, 20°38'S 30°18'E:** District Belingwe, mount Buhwa **(-CB).** *Biegel, H.M., Pope, G.V. & Simon, B.K. 4297;* 04-05-1973 (K photo! SRGH!). Alt. 1,400 m.

-- **<u>20S 32E</u>, 20°24'S 32°43'E:** District Chipinga (Chipinge), Gungungana forest reserve **(-BC).** *Goldsmith, B. $^{5}/_{64}$;* 00-02-1964 (BR, K photo!, MO, SRGH!). Alt. ± 1,200 m.

-- **Not traced:** NW Rhodesia. *Rogers, F.Q. 13476;* 00-06-1920 (SRGH).

***SACLEUXIA*** Baill.

***Sacleuxia newii*** (Benth.) Bullock

KENYA

-- **00S 36E, 00°55'S 36°27'E:** K3 Naivasha District, Ol Longonot estate **(-CD).** *Kerfoot, O. 3395;* 29-12-1961 (K!).

-- **02S 38E, 02°37'S 38°02'E:** K4 Machakos Distr., Kikumbuliyu – Ruwenzori **(-CA).** *Scott Elliot 6149:* 1893 – 1894 (K). Alt. 800 – 1,500 m.

-- **03S 38E, 03°11'S 38°31'E:** K7 Teita Distr., south of Manga mountain, Ndi **(-BA).** *Verdcourt & Polhill 2712* 16–04–1960 (K).

-- **03S 38E, c.03°14'S 38°29'E:** Teita Distr., Ndi Hill **(-BA).** *Gillett, J.B. 16877:* 29-08-1965 (K). Alt. 650 – 700 m.

-- **03S 38E, 03°04'S 38°45'E:** Tsavo National Park **(-BB).** *Bally, P.R.O. 13369:* 12-08-1969 (G). Alt. 800 m.

-- **03S 38E, 03°20'S 38°33'E:** K7 Teita Distr., Worssera lookout, east Tsavo Nat. Park **(-BC).** *Greenway & Kanuri 12852:* 23-12-1966 (K!). Alt. 670 m.

-- **03S 38E, 03°20'S 38°35'E:** K7 Teita Distr., Tsavo Nat. Park, east Mzinga Hill **(-BC).** *Gillett, J.B. 17237:* 09-04-1966 (K). Alt. 750 m.

-- **03S 38E, 03°22'S 38°35'E:** K7 Teita Distr., Tsavo Nat. Park, east Simba Hill **(-BC).** *Faden, R.B. & A.J. $^{74}/_{450}$:* 18-04-1974 (K). Alt. 600 – 640 m.

-- **03S 38E, 03°23'S 38°34'E:** K7 Teita Distr., Voi, Mazinga Hill **(-BC).** *Bally, P.R.O. 8623:* 31-01-1953 (K!). Alt. 620 m (Kikumbuliyu at 830–1,000 m).

-- **03S 38E, 03°47'S 38°52'E:** K7 Teita Distr., Kivuko Hill, between Mackinnon road & Kasigau **(-DD).** *Bally, P.R.O. 12728;* 26-04-1963 (K).

TANZANIA

-- **03S 37E, 03°04'S 37°22'E:** T2 Moshi Distr., Kilimanjaro mountain **(-AB).** *New, s.n.;* 00-08–1871 (K holo, photo!).

-- **04S 37E, 04°08'S 37°57'E:** T3 Pare Distr., Kisiwani, east Usambaras **(-BB).** *Greenway, P.J. 4723;* 04-11-1936 (K).

-- **04S 37E, 04°22'S 37°53'E:** T3 Pare Distr., Pare Hills, Suji Mission **(-BD).** *Bally, P.R.O. 4237;* 14-01-1945 (K). Alt. 1,800 m.

-- **05S 38E, 05°09'S 38°28'E:** T3 Lushoto Distr., Korogwe, Lwenga estates **(-AB).** *Faulkner, H.G. 1115;* 09-01-1953 (K).

-- **05S 38E, 05°29'S 38°01'E:** T3 Handeni Distr., Kideleko mountains **(-AC).** *Archbold, N.E. 501;* 07-07-1965 (K). Alt. 1,000 m.

-- **05S 38E, 05°29'S 38°01'E:** T3 Handeni Distr., Kideleko mts. **(-AC).** *Faulkner, H.G. 1434;* 04-07-1954 (K!). Alt. 670 m.

-- **05S 38E, 05°21'S 38°14'E:** T3 Handeni Distr., Zindeni Hills **(-AD).** *Burtt, B.D. 4854;* 12-09-1933 (K). Alt. 670 m.

-- **05S 38E, 05°27'S 38°16'E:** T3 Handeni Distr., Kwa Mkono **(-AD).** *Archbold, N.E. 889;* 24-06-1969 (K).

-- **05S 38E, 05°27'S 38°16'E:** T3 Handeni Distr., Kwamkono (Kwa Mkono) **(-AD).** *Archbold, N.E. 2842;* 05-05-1981 (K). Alt. 600 m.

-- **05S 38E, 05°06'S 38°37'E:** T3 Lushoto Distr., Bomole **(-BA).** *Zimmermann, s.n.* 00-00-0000 (K).

-- **05S 38E, 05°06'S 38°37'E:** T3 Lushoto Distr., Amani, Mt. Bomole, east Usambaras **(-BA).** *Verdcourt 188;* 10-05-1950 (K, MO!). Alt. 1,200 m.

-- **05S 38E, 05°06'S 38°37'E:** T3 Lushoto Distr., Amani, Bomole Hill **(-BA).** *Burtt, B.D. 450;* 00-03-1926 (K).

-- **05S 38E, 05°06'S 38°35'E:** T3 Lushoto/Tanga Distr., Ngua, Amani **(-BA).** *Semsei 2296;* 00-09-1955 (K).

-- **05S 38E, 05°06'S 38°41'E:** T3 Lushoto Distr., Korogwe, Sigi River valley/gorge, Longuza Hill – east Usambaras **(-BA).** *Brenan 8342;* 19-11-1947 (K).

-- **05S 38E, 05°08'S 38°34'E:** T3 Tanga Distr., Magunga, sisal estates, footpath between Magunga and Ngua estates, west slopes of east Usambaras **(-BA).** *Drummond, R.B. & Hemsley, J.H. 3364;* 19-07-1953 (LISC!). Alt. c. 800 m.

-- **05S 38E, 05°09'S 38°35'E:** T3 Lushoto/Tanga, Ngua forest reserve, east Usambaras **(-BA).** *Semsei 3265;* 06-08-1961 (K).

-- **05S 39E, 05°03'S 39°04'E:** T3 Lushoto/Tanga Distr., lower Sigi valley, east Usambaras **(-AA).** *Verdcourt 246;* 30-05-1950 (K!, MO!). Alt. 400 m.

-- **06S 37E, 06°00'S 37°43'E:** T6 Morogoro Distr., Nguru mts., south face of main Kanga forest reserve **(-BA).** *Pois, T. & Temu, R.P.C., 87228;* 02-12-1987 (K!). Alt. 1,250 – 1,500 m.

-- **06S 37E, 06°46'S 37°05'E:** T6 Kilosa Distr., foothills of Uluguru mts., 10 km From Mandege – Mvumi track **(-CC).** *Thulin & Mhoro 2978;* 06-06-1978 (K). Alt. 900 m.

-- **06S 39E, 06°10'S 39°20'E:** Nguru of ngourou **(-AB).** *Sacleux 758;* 01–06–1892 (P). Alt. 1,200 m.

-- **Not traced:** Hidira Kjaro. *Dr. Kirk $^2/_{72}$;* [In Hook Icon. Pl. 12: 74, plate 1186; Flora of Tropical Africa 4(1): 241].

***Sacleuxia tuberosa*** (E.A. Bruce) Bullock

KENYA

-- **00S 36E, 00°55'S 36°19'E:** K3 Naivasha, SW of Lake Naivasha, Hell's gate, stream jets, Njorowa gorge **(-CD).** *Verdcourt 3289;* 21-10-1962 (K). Alt. 1,900 m.

-- **00S 36E, 00°58'S 36°27'E:** K3 Naivasha, Ol Longonot estate **(-CD).** *Kerfoot, O. 3596;* 28-01-1962 (K!).

-- **01S 36E, 01°10S 36°10'E:** K3 Naivasha, 32 km from Kikuyu on direct road to Narok town rift Wanyaga **(-AA).** *Verdcourt 3551;* 20-01-1963 (K). Alt. 1,800 – 2,000 m.

-- **01S 36E, c. 01°09'S 36°21'E:** K3/6 Naivasha/Masai Distr., west ruins of central motex of Mt. Suswa **(-AB).** *Glover, P.E. & Samuel 3309;* 07-10-1962 (K). Alt. 1,700 m.

-- **01S 38E, 03°46'S 38°47'E:** K7 Teita Distr., Kivuko Hill, between Mackinnon road and Kasigau **(-DD).** *Bally, P.R.O. 12728;* 26-04-1963 (G).

TANZANIA

-- **02S 31E, 02°30'S 31°20'E:** T1 Biharamulo Distr., Lake Province **(-CB).** *Ford, J. 847;* 13-11-1948 (K!).

-- **<u>02S 31E</u>, 02°35'S 31°25'E:** T1 Biharamulo, Lake Province **(-CB).** *Greenway, P.J. 7376;* 29-04-1945 (K). Alt. 1,100 m.

-- **<u>02S 32E</u>, 02°31'S 32°54'E:** T1 Biharamulo, Lake Province, Mwanza **(-DB).** *Tanner, R.E.S. 608;* 30-02-1952 (K). Alt. 1,200 m.

-- **<u>02S 32E</u>, 02°36'S 32°45'E:** T1 Mwanza, Geita Distr., Lake Province near Mwanza, Juma island **(-DB).** *Procter 136;* 00-01-1953 (K).

-- **<u>02S 33E</u>, c. 02°29'S 33°20'E:** T1 Mwanza/Kwimba/Musoma, coast of Speke Gulf, Lake Victoria **(-AD).** *Burtt, B.D. 2475;* 01-06-1931 (K holo!, iso!). Alt. 1,100 m.

-- **<u>02S33E</u>, 02°30'S 33°30'E:** T1 Mwanza Distr., Bbarika **(-DA).** *Tanner, R.E.S. 360;* 19-07-1951 (K!). Alt. 1,100 m.

-- **<u>03S 35E</u>, 03°20'S 35°05'E:** T2 Masai Distr., 80 km west of Endulen **(-AC).** *Bally, P.R.O. 11605;* 07-07-1957 (G, K). Alt. 1,800 m.

-- **<u>06S 37E</u>, c. 06°57'S 37°06'E:** T6 Kilosa Distr., Magubike village **(-CC).** *Pocs Sua 88012;* 05-02-1988 (K). Alt. 800 – 900 m.

-- **<u>06S 37E</u>, 06°42'S 37°36'E:** T6 Morogoro Distr., north of Liwale River, north Nguru mountain side above Manyangu forest **(-DA).** *Drummond, R.B. & Hemsley, J.H. 1978;* 02-04-1953 (K, M). Alt. 900 m.

-- **<u>06S 37E</u>, 06°54'S 37°38'E:** T6 Morogoro Distr., Uruguru/Uguruga, Mzinga area **(-DC).** *Burtt, B.D. 6480;* 26-06-1937 (K). Alt. 1,300 m.

***SARCORRHIZA*** Bullock

***Sarcorrhiza epiphytica*** Bullock

DEMOCRATIC REPUBLIC OF THE CONGO

-- **00N 29E, 00°20'N 29°50'E:** U2/Zaire, Toro Distr., Ruwenzori, Kanvui **(-BD).** *Bequaert 4494;* 26-05-1914 (BR!). Alt. ± 1,800 m.

-- **04S 17E, 04°00'S 17°00'E:** Kwango, Gimbi-Bas-Congo, Jochere **(-AA).** *Devred, A. 1580;* 16-02-1955 (K, BLFU photo!)

IVORY COAST

-- **05N 06W, 05°14'N 06°10'W:** ± 60 km north of Sassandra, River Davo, East of Beyo **(-AA).** *Leeuwenberg, A.J.M., 2586;* 27-01-1959 (WAG).

TANZANIA

-- **04S 38E, 04°45'S 38°38'E:** T3 Lushoto Distr., path up Mt. Bomole behind Amani **(-CD).** *Vedcourt, B. & L.D. 1725;* 24-12-1956 (K holo!; BLFU photo!). Alt. 1,000 m

-- **05S 38E, 05°06'S 38°38'E:** Usambaras, Amani **(-BA).** *Greenway 3679;* 02-01-1934 (K). Alt. 1,000 m.

-- **05S 38E, 05°10'S 38°38'E:** T3 Tanga Distr., Kwamkoro near sawmill **(-BA).** *Semsei 2957;* 15-12-1959 (K).

-- **06S 37E, 06°55'S 37°40'E:** T6 Morogoro Distr., Uluguru North, north-west side of mist forest **(-DC).** *Schlieben, H.J. 2939;* 08-11-1932 (BM, BR!, K, G). Alt. 1,900 m.

***ZACATEZA*** Bullock

***Zacateza pedicellata*** (K. Schum.) Bullock

ANGOLA

-- 07S 20E, **c. 07°33'S 20°50'E:** North van Luanda, Dundo near River Luachimo **(-DB).** *Gossweiler, J. 13684;* 14-10-1946 (CO, K!, P). Alt. 700 m.

BURUNDI

-- 02S 29E, **02°54'S 29°49'E:** Ngozi, Mukara (Rwegura) **(-DD).** *Reckmans, M. 6092;* 27-04-1977 (WAG).

CAMEROON

-- 02N 12E, **02°26'N 12°30'E:** Oveng, 30 km WNW of Sangmelina **(-BC).** *Letouzey, J. 11437;* 06-07-1972 (P).

-- 03N 11E, **03°12'N 11°50'E:** Between Kondebilong and Meyila **(-BB).** *Asonganyi 87;* 17-05-1980 (P).

-- 03N 11E, **c. 03°12'N 11°50'E:** Kondebilong and Meyila, 53 km S of Mbalmayo **(-BC).** *Asonganyi 87;* 09-07-1980 (P).

-- 04N 32E, **c. 04°46'N 12°32'E:** Forest along River Sonaga near Goysum, 20 km west of Dug Demf. **(-DC).** *Breteler, F.J. 941;* 27-01-1961 (WAG).

-- 04N 13E, **04°34'N 13°45'E:** Bertoua, 6 km along road to Batouri and Betare Oya gallery forest **(-DB).** *Breteler, F.J. 1196;* 14-03-1961 (BR, K, LISC, P, WAG). Alt. c. 650 m.

-- 04N 14E, **04°09'N 14°40'E:** 50 km SW of Batouri, E of village Mloundou, old secondary forest along small river **(-BA).** *Breteler, F.J. 2845;* 17-04-1962 (BR, K, P, WAG).

-- 04N 14E, **04°14'N 14°13'E:** Nol, 25 km WSW of Batouri **(-AC).** *Letouzey, J. 4648;* 03-04-1962 (P).

-- **Not traced:** East Cameroon, Die Bitjoknam, eyen a 12 km e de Ngeleulem. *Letouzey, J. 11618;* 00-00-0000 (BR, K, WAG).

-- **Not traced:** River de la Riviere ABO entre Koki et Moussoko, 20 km north Donala. *Letouzey, J. 14763*; 29-04-1976 (BR, K, P, WAG).

CENTRAL AFRICAN REPUBLIC

-- **06N 23E, 06°33'N 23°14'E:** Yalinga - Oubangui River **(-CB).** *Le Testu, M.G. 4744;* 21-03-1923 (BR, P).

-- **06N 23E, c. 06°33'N 23°14'E:** Oubangui, Boukoko **(-CB)**. *Tisserant, R.P. 2531;* 18-05-1953 (P).

-- **06N 23E, c. 06°33'N 23°14'E:** Boukoko **(-CB).** *Equipe 2531;* 00-00-0000 (P).

-- **06N 23E, c. 06°33'N 23°14'E:** Boukoko **(-CB).** *Equipe 2532;* 00-00-0000 (P).

DEMOCRATIC REPUBLIC OF THE CONGO

-- **00N 20E, 00°28'N 20°57'E:** Befale, Ekekeli **(-CD).** *Evrard 2883;* 22-09-1957 (BR, WAG).

-- **00N 24E, 00°48'N 24°10'E:** Yabalanga, Isangi territory **(-CC).** *Léonard, A. 698;* 19-05-1958 (BR, K!).

-- **00N 24E, 00°50'N 24°16'E:** Yangole, 20 km west of Yangambi, Isangi **(-CD).** *Louis, J. 11913;* 00-00-0000 (BR).

-- **00N 24E, 00°50'N 24°16'E:** Yangole, Isangi **(-CD).** *Louis, J. 13517;* 03-02-1939 (K, P).

-- **00N 24E, 00°47'N 24°27'E:** Yangambi **(-CD).** *Bolema 1148;* 26-08-1963 (K).

-- **00N 24E, 00°47'N 24°27'E:** Yangambi **(-CD).** *Louis, J. 10524;* 27-07-1938 (K).

-- **00N 24E, 00°43'N 24°32'E:** Yalutcha, Isangi **(-DA).** *Germain 242;* 09-03-1940 (BR). Alt. 470 m.

-- **01N 23E, 01°14'N 23°31'E:** Barumbu **(-BC).** *Laurent 1379;* 00-00-0000 (BR).

-- **01N 25E, 01°23'N 25°20'E:** Kisangani - Banalia 30 km N of Bengamisa

**(-AD).** *Lisowski 18973;* 24-06-1973 (BR).

-- **03N 20E, 03°30'N 20°07'E:** Boyasebego **(-CA).** *Evrard 836;* 00-00-0000 (BR).

-- **03N 25E, 03°25'N 25°43'E:** Bambesa **(-BC).** *Gerard 2857;* 28-07-1961 (BR, P).

-- **03N 25E, 03°28'N 25°43'E:** Bambesa **(-BC).** *Gerard 4935;* 28-07-1961 (P).

-- **03N 28E, 03°30N 28°15E:** Munsa, Monbuttu Land, Niangara Province **(-CB).** *Schweinfurth, G. 3483;* 03-04-1870 (K lecto!).

-- **03N 28E, 03°30N 28°15E:** Munsa, Monbuttu Land, Niangara Province **(-CB).** *Schweinfurth, G. 3488;* 03-04-1870 (K iso!).

-- **04N 19E, 04°58'N 19°57'E:** Borun (Boruna) - Kusu **(-DD).** *Dubais 428;* 00-07-1934 (BR).

-- **00S 18E, 00°06'S 18°41'E:** Bokuma - Equator **(-BA).** *Louis, J. 106;* 11-09-1935 (BR, K!).

-- **00S 18E, 00°45'S 18°09'E:** Equator province, territory Bikoro, locality Mabali **(-CC).** *Densa 28;* 15-04-1955 (BR).

-- **00S 18E, 00°43S 18°32'E:** Bikatola et Bikoro **(-CA).** *Lebrun 1444;* 00-00-0000 (BR).

-- **00S 18E, 00°50'S 18°00'E:** Mabali location, Tumba, Equator region **(-CC).** *Densa 239;* 16-04-1956 (BR).

-- **00S 20E, 00°02'S 20°58'E:** Bongoy (=Bongoie), territory Boende **(-BB).** *Evrard 3202;* 14-01-1958 (BR).

-- **01S 23E, 01°06'S 23°06'E:** Territory Yalikungu, Ikela **(-AA).** *Evrard 5420;* 02-01-1958 (K).

-- **01S 23E, 01°11'S 23°16'E:** Territory Ikela **(-AB).** *Evrard 5430;* 02-01-1958 (BR).

-- **02S 18E, 02°42'S 18°10'E:** Kutu (Lac Leopold), galerie forestiere **(-CA).** *Lebrun 6600;* 00-11-1932 (BR, K, P).

-- **04S 15E, 04°05'S 15°25'E:** Gamakala **(-AB).** *Farron 4141;* 14-05-1968 (P).

-- **04S 15E, 04°19'S 15°19'E:** Leopoldville (=Kinshasa) **(-AD).** *Bequaert 7529;* 05-05-1915 (BR).

-- **04S 15E, 04°06'S 15°51'E:** Sao-Ndunu, territory Maluku, Kinshasa Province **(-BB).** *Breyne 2191;* 05-05-1971 (BR).

-- **05S 14E, 05°12'S 14°56'E:** Wengu River, Boko **(-BB).** *Nsimundele 420;* 02-05-1978 (BR).

-- **05S 14E, 05°12'S 14°56'E:** Wengu River, Boko **(-BB).** *Nsimundele 424;* 02-05-1978 (BR).

-- **06S 19E, 06°50'S 19°19'E:** Congolan, Bumba territory, forest Mariçagense **(-CD).** *Evrard 3467;* 12-02-1958 (BR, K!).

GABON

-- **00N 12E, 00°38'N 12°47'E:** d'Ipassa, 10 km south of Makokou **(-DB).** *Florence 2044;* 19-05-1979 (P). Alt. 500 m.

NIGERIA

-- **04N 07E, 04°30'N 07°56'E:** South Nigeria, Eket District **(-DB).** *Talbott, T.A. 3265;* 00-04-1914 (K).

-- **06N 23E, 06°27'N 03°23'E:** Lagos **(-AD).** *Dalziel, J.M. 1348;* 14-01-1919 (K).

-- **06N 03E, 06°25'N 03°32'E:** Igbessa, Lagos Botanical station **(-BC).** *Millen, A. 130;* 00-01-1893 (K holo!).

-- **06N 03E, 06°36'N 03°28'E:** West Nigeria, swamp c. 1 km east Ikorodu road, Ikeja 11 km **(-CB).** *Killick 248;* 04-07-1965 (K).