

The genus *Anisotes* (Acanthaceae), a taxonomic revision

Claus Baden



Baden, C. 1981. The genus *Anisotes* (Acanthaceae), a taxonomic revision. – Nord. J. Bot. 1: 623–664. Copenhagen. ISSN 0107-055X.

The genus *Anisotes* Nees is revised. A total of 24 taxa had previously been described. In the present revision 19 species, 3 subspecies and 1 variety are recognized. A new infrageneric classification of *Anisotes* is proposed.

In the general part the morphology, with special emphasis on pollen morphology, and the diagnostic characters of the genus are outlined. Phytogeographical and ecological aspects are discussed in relation to the phytogeographical division of Africa.

C. Baden, Inst. of Systematic Botany, Univ. of Copenhagen, Gothersgade 140, DK-1123 Copenhagen K, Denmark.

Introduction

My attention was drawn to the genus *Anisotes* by my tutor Ib Friis and Dr. R. K. Brummit, Kew. It was necessary to include the genus *Macrorungia* C. B. Clarke because this genus had previously been reduced to a synonym of *Anisotes* by Heine (1966). However, the two genera are not at all closely related, and the revision of *Macrorungia* has been published separately (Baden 1981b).

As there has been a delay in the publication of the full revision, the Latin diagnoses of all the new taxa proposed in this paper have been presented elsewhere (Baden 1981a). Full descriptions (exclusive of the Latin diagnoses), specimen citation and drawings of all the new taxa are presented in this paper.

Materials and methods

The present revision is based on herbarium material borrowed from the following herbaria (abbreviations according to Holmgren and Keuken (1974): ALF, B, BM, BR, C, COI, DSM, E, EA, FI, G, HBG, K, L, LISC, M, MO, P, PRE, S, SRGH, UPS, W, WAG, Z. Measurements of the floral parts from dried specimens have been made after soaking in 27% ammonia for 2–4 hours before transferring to 70% alcohol; a few were

boiled in alcohol. All other measurements were made directly from herbarium specimens. The measurements were made on as many collections as possible; each specimen scored as the average of at least 3 values. Mean values and standard deviations were calculated and used to indicate the variation in the descriptive part; the most extreme values outside the standard deviation are given in brackets. The descriptive terminology used is in accordance with Stearn (1973), with the exception of the indumentum which follows Lawrence (1955). For study under the light microscope, pollen was acetolyzed after the standard method devised by Erdtman (1952). The pollen terminology is also in accordance with Erdtman (1952). For tracing the collecting localities, the Official Standard Names Gazetteers, United States Board on Geographic Names, and the Times Atlas of the World (ed. 4, 1972) have been used.

Historical outline

The genus *Anisotes*, with the type-species *A. trisulcus*, was first described in De Candolle's Prodrômus (1847) by Nees, based on material collected in Arabia by Forsskål, who named it *Dianthera trisulca* Forssk. (basionym for *Justicia trisulca* (Forssk.) Vahl and *Anisotes trisulcus* (Forssk.) Nees). Only one species was proposed in the new genus.

Between 1847 and 1895 three additional new species were described: *A. diversifolius* Balf. f., *A. parvifolius* Oliv. and *A. velutinus* Lindau.

Anderson (1876) described the tropical African genus *Himantochilus*, with the type-species *H. sessiliflorus*, and between 1876 and 1916 five new species were described and one combination was proposed: *H. macrophyllus* Lindau, *H. zenkeri* Lindau, *H. marginatus* Lindau, *H. pubinervius* (T. Anders.) Lindau (basionym: *Rungia pubinervia* T. Anders. 1863), *H. comorensis* Lindau and *H. sereti* De Wild. Lindau (1894) also described another African genus *Symplectochilus*, with the type-species *S. formosissimus* (Klotzsch) Lindau (basionym: *Adhatoda formosissima* Klotzsch).

Lindau (1895a) recognized all four species of *Anisotes*, the only species of *Symplectochilus*, and five species of *Himantochilus*. Lindau (1898) described *S. madagascariensis* from Madagascar, which, however, has never been mentioned in later publications; its taxonomic position remains doubtful due to inadequate type material.

Clarke (1900) described a new genus *Macrorungia*, which included *Symplectochilus* and parts of *Himantochilus*. He transferred *Himantochilus sessiliflorus* and *H. zenkeri* to *Anisotes* and *H. macrophyllus* to *Macrorungia*. The new genus *Macrorungia* was distinguished from *Anisotes* by the dehiscence of the mature capsules. The transfer of two such closely related species as *H. macrophyllus* and *H. zenkeri* to different genera makes it doubtful whether Clarke had seen the capsules of these species.

Between 1900 and 1936 nine new taxa were proposed: *A. guineensis* Lindau, *A. ukambensis* Lindau, *A. involucratus* Fiori, *A. rogersii* S. Moore, *A. ukambanensis* Lindau, *A. madagascariensis* Benoist, *A. bracteatus* Milne-Redhead, *A. umbrosus* Milne-Redhead and *A. dumosus* Milne-Redhead.

Milne-Redhead (1954b) transferred *Macrorungia formosissima* to *Anisotes*, based on new evidence from collections with mature fruits.

Heine (1966) suggested that the genus *Macrorungia* should be included in *Anisotes*, and thus listed *Symplectochilus*, *Himantochilus* and *Macrorungia* as synonyms of *Anisotes*. He also regarded *H. sereti* and *M. batesii* (Wernham 1916) as synonyms of *A. macrophyllus* and regarded *H. marginatus* as a synonym of *Anisotes pubinervis*. Mature fruits of some species in *Macrorungia* sensu Clarke show that *Macrorungia* should not be treated as a synonym (Baden 1981a).

A total of 24 taxa were recognized in *Anisotes* before the present revision.

Taxonomic position and delimitation of *Anisotes*

Bremekamp (1965) removed Nelsonioideae, Thunbergioideae, Mendoncioideae from the Acanthaceae proper, and divided the remaining genera into two subfamilies, Acanthoideae and Ruellioideae. I agree, however, with Melchior (1964) and find for the moment a classification of the family in four subfamilies i.e. Nelsonioideae, Mendoncioideae, Thunbergioideae and Acanthoideae the most satisfactory. The classification of the Acanthoideae with imbricate corollas will in this paper correspond more to the classification made by Bremekamp (1944, 1948) and Clarke (1900), apart from the subtribes Barlerieae and Tetrandae which later have been raised to the rank of tribes. The system followed is based on this classification.

The placing of *Anisotes* in subfamily Acanthoideae, tribe Justicieae is accepted by all authors (Tab. 1), due to the 2-lipped, imbricate corolla with two 2-theous stamens. The Justicieae is a natural and homogeneous group of closely related and taxonomically critical genera, and the generic delimitation within the tribe is rather difficult. The following characters are the major ones used in the generic delimitation: 1. corolla subequally 5-lobed or 2-lipped; 2. flowers with 4 or 2 stamens, sometimes with staminodes; 3. anthers 1- or 2-celled, with one anther-cell either distinctly below the other, somewhat below the other or at the same level; 4. one or both anther-cells distinctly tailed or mucronate

Tab. 1. The placing of *Anisotes* in suprageneric taxa by previous authors, and the used diagnostic characters.

	Nees 1847	T. Anderson 1863	Lindau 1895	Clarke 1900
Subfamily	Echmatacantheae	—	Acanthoideae	—
Tribe	Gendarusseae	Justicieae	Justicieae	Justicieae
Subtribe	—	Eujusticieae	—	Eujusticieae
Section	—	—	—	Typicae
Characters	2-lipped, imbricate corolla; two 2-theous stamens; capsules with 4 seeds.	2-lipped, imbricate corolla; two 2-theous stamens; capsules with 4 seeds.	2-lipped, imbricate corolla; pollen with one or more longitudinal rows of insulae in the trema area.	2-lipped, imbricate corolla; two 2-theous stamens; placenta not rising elastically in fruit; flowers not enclosed by bracts.

or rounded; 5. placenta rising or not rising elastically in fruit. It is point 3 and 4 which may cause difficulties because intermediary forms may occur.

The affinity of *Anisotes* is neither with genera with 5-lobed corollas nor with genera with a placenta rising elastically from the base at maturity. Genera with 4 stamens are also well separated from *Anisotes*. The placing and the number of the anther-cells distinguishes *Anisotes* respectively from genera which have anther-cells placed at the same level (*Ecbolium*, *Graptophyllum*, *Fittonia*, *Harporchilus*) and from genera with only one anther-cell (*Hypoestes*, *Monothesium*). The remaining genera of Clarke's subtribe Eujusticieae, with anther-cells in \pm different level, are rather homogenous and more or less closely related, and their relationship needs further investigations. However, some suggestions regarding the affinity of *Anisotes* may be made. *Justicia* and *Beloperone* are distinguished by their distinctly tailed anther-cells.

The morphology of the different components of the 2-lipped corolla provide a number of important characters, which had previously been overlooked. These characters, the corolla/tube-length ratio, shape of the tube, the size and the placing of the upper lip in proportion to the tube, are not only specific characters but can also be used to recognize groups of species at generic or infrageneric levels. In *Anisotes* the posterior lip is rigidly held as a prolongation of the short and nearly cylindrical tube. This distinguishes *Anisotes* from genera with very long cylindrical tubes in proportion to the lips (*Rhinacanthus*, *Siphonoglossa*, *Ecbolium*) and from those with a hood-like upper lip and spreading lobes of the lower lip, making the lower lip more conspicuous in proportion to the upper lip (*Justicia*, *Adhatoda*, *Duvernoia*). Genera with distinctly funnel-shaped tubes, much longer than the lips (*Isoglossa*, *Polystachys*, *Trichocalyx*) are no doubt more closely related to one another than to genera such as *Anisotes* with short cylindrical tubes.

Corollas resembling those of *Anisotes* are found in species of *Beloperone*, *Jacobinia*, *Macrorungia*, and a few species within *Justicia*. *Justicia* differs by the distinctly tailed anther-cells. However, some American species (subgenus *Dianthera*) fail to have tailed anther-cells, but differ by the hood-like upper lip and broad spreading lobes of the lower lip. *Beloperone* and *Jacobinia* differ from *Anisotes* by having long funnel-shaped tubes in proportion to the short lips; also the anther-cells in *Beloperone* are usually tailed. The corolla of *Macrorungia* is very similar to that of *Anisotes* but the presence of an elastically rising placenta places it distantly from *Anisotes* (Baden 1981b).

Morphology and characters of taxonomic importance

Habit. The habit, shape and colour of the branches are very variable both within the genus and within some

species, possibly due to seasonal variation, or the placement of the shoots or branches on the shrubs (annual growth, long shoot, old branch with brachyblast). Therefore, the habit, shape and colour of the branches are considered to be of limited taxonomic importance.

Leaves. The shape and size of the leaves are very variable within the genus. The size is obviously correlated with the habitat. The large to very large leaved species (longer than 10 cm) are found in the Guinean-Congolian or the Usambara rain-forest area and in the montane or riverine forests of East Africa. The small- to medium leaved species (2–10 cm long) occur in drier habitats, in bushland or along sandy river beds.

A useful distinction can be made between species with sessile or petiolate leaves. This may be used for specific delimitation, together with characters relating to size and shape. The indumentum is also of taxonomic value, in spite of the decreasing density with age.

Inflorescence. The inflorescences and the shape and size of the bracts and bracteoles are of high taxonomic significance for species delimitation. The infrageneric

Tab. 2. Comparison of inflorescence types in the different sections.

Section	Type	Characteristic
<i>Tetrapori</i>	1	Dichasium; numbers of flowers one, where the terminal plus two lateral buds develop or two, where only the lateral flowers develop.
<i>Thyrsiflora</i>	2	Flowers in thyrses, which are built up of equivalent decussate axillary cymes. The whole inflorescence is often very strongly condensed and reduced. A number of thyrses are often clustered together and the whole is appearing like a head.
<i>Bracteati</i>	3	Flowers arranged in axillary racemes to form spike-like synflorescences with opposite bracts. Bracts in 4 rows, but flowers only develop within two adjacent rows of bracts which support a strongly condensed and reduced 1–3 flowered cymule of monochasial structure; additional flowers develop in the axils of the bracteoles.
<i>Spiciflora</i> <i>Macrophylli</i>	4	Flowers in axillary or terminal spikes or axillary racemes. Bracts in 4 rows, all supporting flowers.
<i>Anisotes</i>	5	2(4) flowered spikes (two opposite bracts terminates the peduncle and enclose an abortive terminal bud and two lateral flowers with decussate bracteoles) or solitary (sometimes with rudiments of additional flowers in the axils of the bracts).

classification proposed below is based mainly on the morphology of the inflorescences. There are five types of flower arrangement in the inflorescences, the differences of which are summarized in Tab. 2.

In Type 5 the terminal bud sometimes continues the growth and terminates with a repetition of the 2-flowered inflorescence, in a decussate position to the lower bracts; the whole thus forming a 4-flowered inflorescence. This shows that the inflorescence is basically monopodial and not a dichasium with a suppressed central flower. It must therefore be considered to have developed from a spike, where the number of flowers has been reduced to 2 or 4; consequently the inflorescence type is a 2-flowered spike. A variant type may also occur within one species (*A. involuocratus*); here both bracts may support a very condensed 3-flowered cyme.

The different inflorescence types and the probable derivation of the types from one another are shown in Fig. 1.

Calyx, corolla and stamens. The calyx is of very uniform shape, but varies in size, degree of division and density of the indumentum, characters which can be used in specific delimitation.

The absence or presence of glands or hairs on the outer side of the corolla, the size of the lips and the degree of division of the lower lip are additional characters of taxonomic importance.

The arrangement of the stamens is the same in all species of *Anisotes* and of limited taxonomic importance. The pollen morphology is considered of high taxonomic importance at both inter- and infrageneric level. The size, the numbers of pores, the size of the

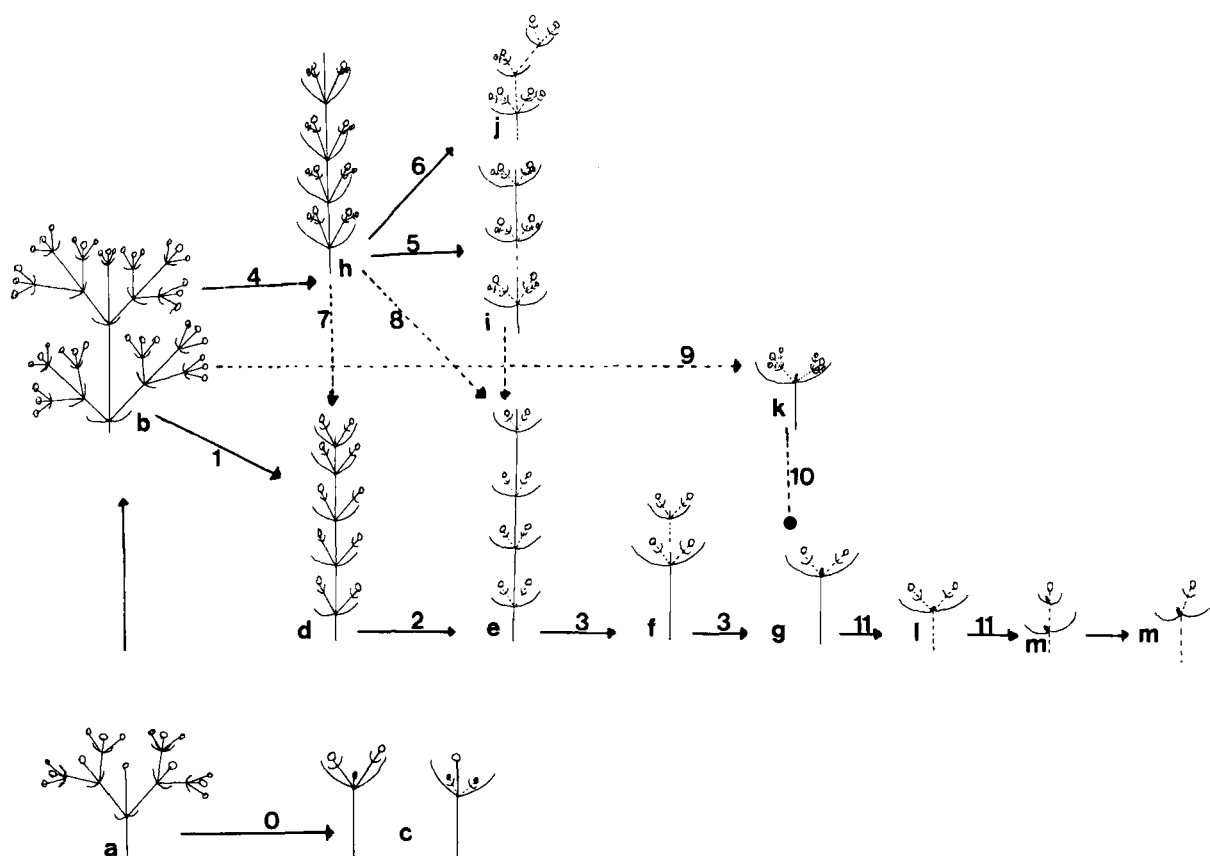


Fig. 1. Synopsis of the different inflorescence types and their probable derivation from one another. a: ancestral compound dichasium. (Lawrence 1956, Fig. 3) b: hypothetical ancestral thyrses. (Lawrence 1956) c: dichasium; either 2-flowered or 1-flowered. d: racemose inflorescence. e: spike. f: 4-flowered spike; evolved by reduction from the spike. g: 2-flowered spike. h: thyrses with 2-flowered cymes. i: spike-like synflorescence; bracts support a 2-flowered cyme. j: strongly condensed thyrses with axillary cymes. k: inflorescence in which each bract support a dichasium. l: sessile 2-flowered spike. m: flowers solitary with rudiments of additional flowers in the axils of the bracts. — 1: reduction to one flower in the cymes = raceme. 2: reduction by the pedicel length = spike. 3: reduction of number of nodes in the spike leads to an intermediary stage, a 4-flowered spike. 4: reduction to 2 flowers. 5: condensation of the cymes. 6: condensation of the thyrses and the lateral cymes. 7: reduction to one flower. 8: reduction and condensation by the lateral cymes. 9: reduction to one node. 10: reduction in the number of flowers to two. 11: one flower suppressed. — d + e: sect. *Macrophylli*. — h + j: sect. *Thyrsiflori*. — i: sect. *Bracteati*. — k + g + f + l + m: sect. *Anisotes*. — c: sect. *Tetrapori*. — e: sect. *Spiciflori*.

Tab. 3. Numerical data on the pollen in *Anisotes*. N = number of pores; \pm faint indication of colpi; P = polar axis; E = equator diameter; Tr. = trema area with reticulate band (bd), two (2) or four (4) rows of insulae; Sect. = proposed sections. All measurements in μm .

Taxon	N	P	E	Tr	Sect.	Voucher
Type 1						
<i>A. nyassae</i>	2-porate \pm colpi	37–41	21–23	4	<i>Thyrsiflori</i>	Semsei 2529
<i>A. umbrosus</i>	2-porate \pm colpi	60–65	37–44	4	<i>Bracteati</i>	Burt 5183
<i>A. bracteatus</i>	2-porate	51–60	31–37	4	<i>Bracteati</i>	Fanshawe 4543
<i>A. macrophyllus</i>	2-colporate	68–73	37–44	4	<i>Macrophylli</i>	–
<i>A. tangensis</i>	2-porate	61–65	36–41	4	<i>Macrophylli</i>	Parry 150
<i>A. diversifolius</i>	2-porate \pm colpi	55–60	35–43	4	<i>Thyrsiflori</i>	Forbes 153
<i>A. zenkeri</i>	2-porate \pm colpi	68–77	39–48	2	<i>Macrophylli</i>	de Wilde 1644
<i>A. dumosus</i>	2-porate	61	41	2	<i>Thyrsiflori</i>	Burt 5144
<i>A. ukambensis</i>	2-porate \pm colpi	61–65	39–44	2	<i>Thyrsiflori</i>	Verdcourt 1844
Type 2						
<i>A. madagascariensis</i>	3-porate	68–74	34–42	bd	<i>Spiciflori</i>	Bathi 9494
<i>A. formosissimus</i>	3-porate	51–60	34–41	bd	<i>Spiciflori</i>	Grosvenor 595
<i>A. tanensis</i>	3-porate	51–54	41–48	bd	<i>Anisotes</i>	Gillett and Newbould 19180
<i>A. trisulcus</i>						
ssp. <i>trisulcus</i>	3-porate	53–60	34–43	2	<i>Anisotes</i>	Schweinfurth 1788
ssp. <i>webi-scheбелиensis</i>	3-porate \pm colpi	60–68	36–48	2	<i>Anisotes</i>	Gilbert 2122
<i>A. involucratus</i>	3-porate	51–53	31–34	2	<i>Anisotes</i>	Bally and Melville 16390
<i>A. sessiliflorus</i>						
ssp. <i>sessiliflorus</i>	3-porate	61–71	37–43	2	<i>Anisotes</i>	Bowbrick 220
ssp. <i>iringensis</i>	(2-)3-porate	56–59	34–37	2	<i>Anisotes</i>	Mhoro 1236
<i>A. rogersii</i>	3-porate	58–63	34–43	2	<i>Anisotes</i>	Verdermann 1985
<i>A. parvifolius</i>	3-porate	54–61	34–39	2	<i>Anisotes</i>	Verdcourt 2353
Type 3						
<i>A. guineensis</i>	4-porate	70–76	39–43	bd	<i>Tetrapori</i>	Jac.-Felix s.n.

pores and the morphology of the trema area can be used in specific delimitation.

Ovary and fruits. The indumentum of the ovary is considered to be of taxonomic importance. Three types are recognized; one where the ovary is densely covered by stiff, straight hairs, a glabrate type, and an intermediary type with soft hairs at the transition to the style and on the suture. Both infra- and interspecific variation may occur.

The fruit is the common acanthaceous capsule and is very uniform in shape throughout the genus.

Palynology

Pollen in *Anisotes* is prolate or sometimes subprolate. The generic variation in the polar axis ranges from 37 to 77 μm and the equatorial diameter ranges from 21 to 48 μm . The number of apertures are 2, 3 or 4. The

grains are colpate or porate, sometimes with indications of colpi. The pores are surrounded either by two reticulate longitudinal bands (colpoid streaks) or by two (one on each side) or four (two on each side) longitudinal rows of reticulate insulae of variable size.

The pollen are of 3 different types according to the numbers of pores, and the dimension of the pollen grains are shown in Tab. 3. The pollen grains are illustrated in Fig. 2.

Lindau (1895a) used characters referring to the trema area to distinguish between *Anisotes* and related genera, but did not investigate sufficient material (only one species in *Anisotes*, *A. diversifolius*, was investigated). This paper shows (Tab. 3, Fig. 2G, L), that *Anisotes* sensu Lindau may have pollen grains with only two rows of insulae (*A. trisulcus*, *A. parvifolius*) in the trema area and not 4 or 6 as stated by Lindau. *Himantochilus* sensu Lindau has four rows of insulae instead of two (Lindau 1895a). Both genera (sensu Lindau) have pollen with two or four rows of insulae in the trema area

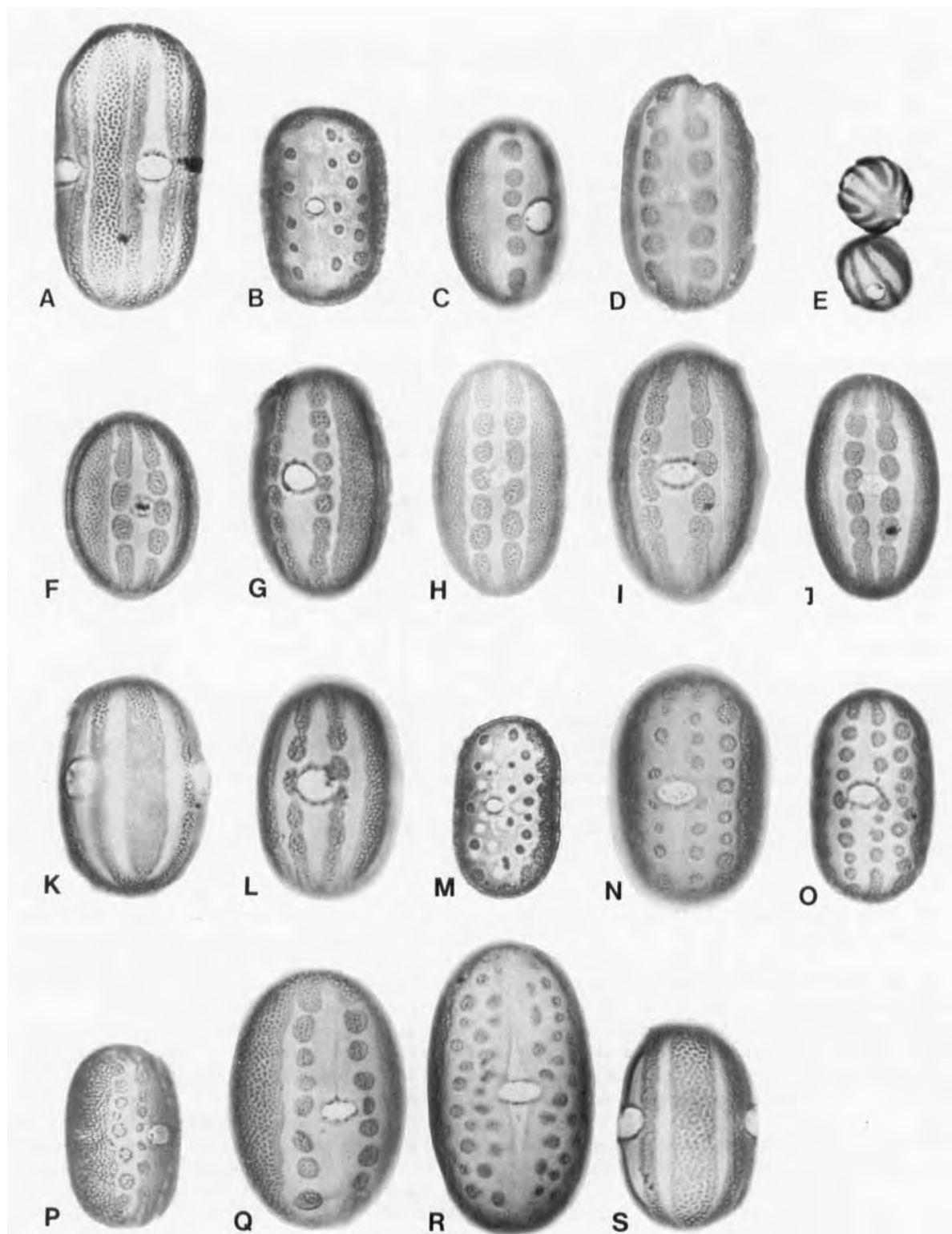


Fig. 2. Pollen grains of *Anisotes*, sexine pattern. A: *A. guineensis*, LM, $\times 460$. – B: *A. diversifolius*, LM, $\times 360$. – C: *A. dumosus*, LM, $\times 300$. – D: *A. ukambensis*, LM, $\times 400$. – E: *A. tanensis*, LM, $\times 165$. – F: *A. involucratus*, LM, $\times 380$. – G: *A. parvifolius*, LM, $\times 400$. – H: *A. sessiliflorus* ssp. *iringensis*, LM, $\times 430$. – I: *A. sessiliflorus* ssp. *sessiliflorus*, LM, $\times 370$. – J: *A. rogersii*, LM, $\times 380$. – K: *A. trisulcus* ssp. *webi-schebeliensis*, LM, $\times 330$. – L: *A. trisulcus* ssp. *trisulcus*, LM, $\times 330$. – M: *A. nyassae*, LM, $\times 480$. – N: *A. umbrosus*, LM, $\times 400$. – O: *A. bracteatus*, LM, $\times 400$. – P: *A. tangensis*, LM, $\times 330$. – Q: *A. zenkeri*, LM, $\times 370$. – R: *A. macrophyllus*, LM, $\times 450$. – S: *A. formosissimus*, LM, $\times 380$.

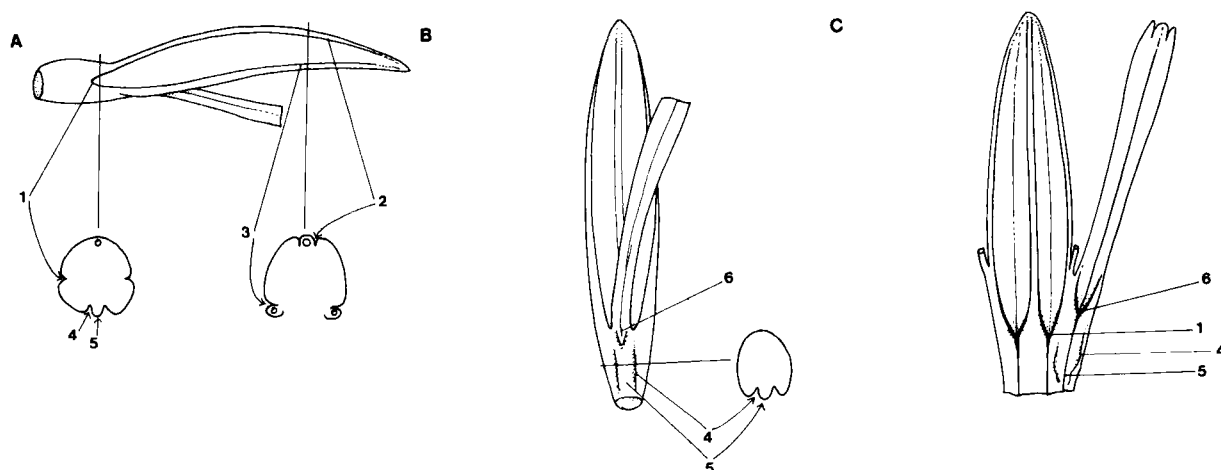


Fig. 3. Corolla morphology of *Anisotes*. A: lateral view of corolla, with transsection of the distal part of the tube (left), and of the upper lip (right). B: corolla seen from below, with transsection of the proximal part of the tube. C: inside view of corolla. 1: lateral invaginations (projections on the inside); 2: axial pleat; 3: marginal pleat; 4: ventral longitudinal invagination (groove, projection on the inside); 5: median hump; 6: ventral distal invagination at the base of the lip.

Synopsis of species according to pollen characters

1. Pollen 4-porate 1. *A. guineensis*
1. Pollen 2- or 3-porate, sometimes with faint colpi 2
2. Pollen 2-porate, sometimes with faint colpi 3
3. Trema area with 4 rows of insulae 4
4. Pollen with an indication of a colpus or colpate 5
5. Pollen 2-colporate, $68-73 \times 37-44 \mu\text{m}$ 5. *A. macrophyllus*
5. Pollen with an indication of colpi 6
6. Pollen $37-41 \times 21-23 \mu\text{m}$ 10. *A. nyassae*
6. Pollen $60-65 \times 37-44 \mu\text{m}$ 9. *A. umbrosus*
4. Pollen without colpi 7
7. Pollen $51-60 \times 31-37 \mu\text{m}$ 8. *A. bracteatus*
7. Pollen $61-65 \times 36-41 \mu\text{m}$ 7. *A. tangensis*
3. Trema area with 2 rows of insulae 8
8. Pollen porate, $61 \times 41 \mu\text{m}$ 3. *A. dumosus*
8. Pollen with faint colpi 9
9. Pollen $61-65 \times 39-44 \mu\text{m}$ 4. *A. ukambensis*
9. Pollen $68-77 \times 39-48 \mu\text{m}$ 6. *A. zenkeri*
2. Pollen 3-porate, sometimes with faint colpi 10
10. Pores surrounded by two longitudinal bands (colpoid streak) 11
11. Pollen $68-74 \times 34-42 \mu\text{m}$ 12. *A. madagascariensis*
11. Pollen smaller than $60 \mu\text{m}$ long 12
12. With faint colpi, $51-60 \times 34-41 \mu\text{m}$ 11. *A. formosissimus*
12. Without faint colpi, $51-54 \times 41-48 \mu\text{m}$ 15. *A. tanensis*
10. Pores surrounded by 1 or 2 rows of insulae, may coalesce towards the poles 13
13. Trema area with 4 rows of insulae 2. *A. diversifolius*
13. Trema area with 2 rows of insulae 14
14. Pollen with faint colpi, $60-65 \times 36-48 \mu\text{m}$ 13b. *A. trisulcus* ssp. *webi-schebeliensis*
14. Pollen without colpi 15
15. Pollen $51-53 \times 31-34 \mu\text{m}$ 16. *A. involucreatus*
15. Pollen more than $53 \mu\text{m}$ in polar axis 16
16. Pores up to $5 \times 3 \mu\text{m}$ 17
17. Pores 4×3 , pollen $54-61 \times 34-39 \mu\text{m}$ 19. *A. parvifolius*
17. Pores 5×3 , pollen $58-63 \times 34-43 \mu\text{m}$ 17. *A. rogersii*
16. Pores $7-9 \times 5-7 \mu\text{m}$ 18
18. Pollen $61-71 \times 37-43 \mu\text{m}$ 15a. *A. sessiliflorus* ssp. *sessiliflorus*
18. Pollen $53-60 \times 34-43 \mu\text{m}$ 19
19. Pollen $53-60 \times 34-43 \mu\text{m}$ 13a. *A. trisulcus* ssp. *trisulcus*
19. Pollen $56-59 \times 34-37 \mu\text{m}$ 18b. *A. sessiliflorus* ssp. *iringensis*

A. velutinus pollen is not described in the text nor included in the above key due to inadequate material.

and also 2- or 3-porate pollen (whereas Lindau (1893) stated that *Himantochilus* had 3-, and *Anisotes* 2-porate pollen), so the pollen morphology gives additional support the inclusion of *Himantochilus* in *Anisotes*.

The size of the pollen has been measured by Lindau (1894, 1908, 1913), but his pollen seems to have had a longer polar axis than that measured in this paper. This must be due either the swelling or, more likely, the compression of the pollen investigated by Lindau.

Anisotes

Anisotes Nees 1847: 424; Lindau 1895a: 351; 1895b: 374; Clarke 1900: 226; Brenan and Greenway 1949: 1; Dale and Greenway 1961: 16; White 1962: 381; Heine 1963: 424; 1966: 186; Agnew 1974: 605; Dyer 1976: 600. – *Dianthera* Linné 1742: 13; 1753: 27, p.p., quoad *D. trisulca* Forssk. – *Justicia* Linné 1753: 15, p.p., quoad *J. trisulca* (Forssk.) Vahl. – Type: *Anisotes trisulcus* (Forssk.) Nees. *Himantochilus* T. Anders. ex Bentham 1876: 1117, p.p., excl. *H. pubinervia* (T. Anders.) Lindau. – Type: *Himantochilus sessiliflorus* T. Anders. *Symplectochilus* Lindau 1894: 45. – Type: *Symplectochilus formosissimus* (Klotzsch) Lindau. *Macrorungia* C. B. Clarke 1900: 254, p.p., excluding type (*M. pubinervia* (T. Anders.) C. B. Clarke).

Suffrutescent perennials, small to medium sized shrubs, or small trees; strongly branched or multi-stemmed, with erect or straggling-spreading branches. Young branches tetragonous to indistinctly angled or terete; indumentum variable; cystoliths and few lenticels may be present; nodes often swollen; leaf scars conspicuous, sometimes decurrent, and with connecting pads. Older branches tetragonous to terete, greenish, brown, grey or whitish; more sparsely haired or glabrate; sometimes with opposite brachyblasts.

Leaves opposite, evergreen or deciduous, petiolate to sessile; petiole, if present, carinate to half terete; with variable indumentum, often with cystoliths; lamina dark to light green above, paler below; indumentum variable, with circular or elliptical cystoliths. Margins entire or crenate, sometimes slightly involute. Nervation pinnate or pinnate-reticulate, with 3–16 pairs of lateral nerves branching from the midnerve at an angle of about 30°–90°; secondary and tertiary nerves usually distinct, conspicuous below; main nerve carinate and depressed above.

Flowers arranged in pedunculate to sessile spikes, racemose spike-like synflorescences, racemes, dichasia, thyrses with axillary cymes, 2-(4)-flowered inflorescences (spikes), 6-flowered synflorescences or solitary, from the upper part of the branches or brachyblasts; axillary or terminal. Bracts opposite, ovate to elliptic or triangular, with variable indumentum and nervation. Bracteoles 2, ovate to elliptic or triangular, indumentum variable. Flowers solitary or several (1 + rudiment, 2 + rudiment, 3 + rudiment) in the axils of the bracts. Where each bract supports more than one flower, additional flowers arise from the bracteoles of the central

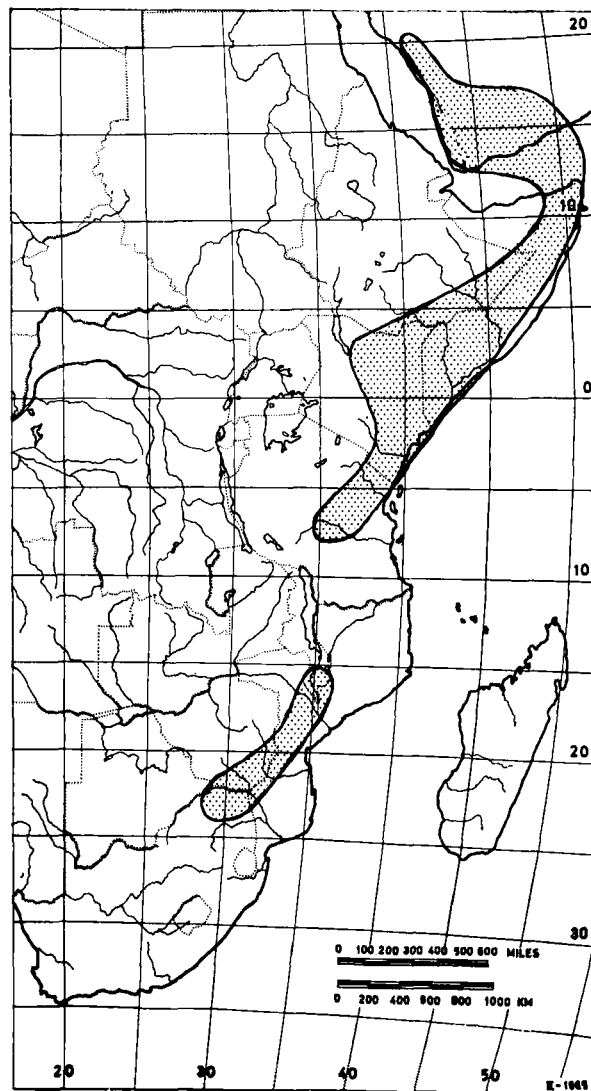


Fig. 4. Distribution of section *Anisotes*.

flower; this “elementary inflorescence” forms a mono- or dichasium. Peduncles absent, or present, with variable indumentum.

Calyx campanulate, rarely gradually tapering into the pedicel, 5-fid, variably divided; with variable indumentum of up- or downwards pointing hairs, rarely glandular or glabrate, sometimes with cystoliths.

Corolla 2-lipped, purple, red, yellow, orange, greenish yellow or yellow white; pubescent-glandular or glabrate outside. Corolla tube cylindrical at the base, distally ± funnel-shaped, slightly compressed laterally; laterally with two invaginations from the outside, which from within appears as two puberulent or hirsute projections from which the nerves divide (Fig. 3). Ventrally two longitudinal grooves from above the middle to near the base; sometimes with a protruding hump developed

Tab. 4. A comparison of the distribution of the species and sections within the phytogeographical Regions and Domains. (White 1965).

	Species no.	Section no.
Guinean-Congolian Region	1, 5, 6	I, III
Usambara-Zululand Domain	7	III
Sudano-Zambesian Region	2, 3, 4, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19	II, IV, V, VI
Oriental Domain (incl. S Arabia) . .	2, 3, 4, 13, 14, 15, 16, 19	IV
Zambesian Domain	8, 9, 10, 11, 17, 18,	II, IV, V, VI
Sudanien Domain		
Madagascar	12	V

in between; ventrally, at the transition to the lower lip, an invagination of variable size from the outside which from within appears as two parallel or oblique ridges. Upper lip boat-shaped arching; narrowly ovate to narrowly oblong, acuminate towards the apex; apex entire or 2-fid; the axial nerves in the back forming a channel, the rugula, within which the style is situated; margins involute; with longitudinal pleats at the back and at the margin. Lower lip narrowly oblong or narrowly obovate; 3-lobed; the central lobe broadest and longest.

Stamens 2, inserted at the top of the tube; located between the involuted margin and a marginal pleat, enclosed under the upper lip (Fig. 3); filaments broadly linear; anthers 2-theous, one theca placed a little below the other; oblong; base mucronate.

Ovary compressed, narrowly ovoid, 2-locular, with 2 ovules in each locule; glabrate or with variable indumentum or glandular. Style filiform, stigma minutely 2-fid or entire, hairy at the base. Discus saucer-shaped, glabrate.

Fruit an obovoid capsule; base compressed; apex sometimes beaked; the placenta does not rise elastically from the base at maturity. Seeds 4, or 2 + 2 abortive, planocompressed; surface variable.

Distribution: Tropical and Southern Africa, Madagascar and Tropical Arabia. The subgeneric classification of *Anisotes* which is proposed below shows clear geographical separation of the sections, apart from few overlapping areas where a clear ecological separation is observed (Figs 4, 5). The distribution and the frequency of species and sections in different phytogeographical Regions and Domains suggested by White (1965) are shown in Tab. 4.

Ecology: See under the species. The terminology is similar to that of Greenway (1973).

Infrageneric classification of *Anisotes*

Previously no infrageneric classification of the genus *Anisotes* has been proposed. In this paper I will suggest a classification in sections, based on morphological differences in the inflorescences (Tab. 1), correlated with differences in pollen morphology (Latin diagnoses in Baden 1981a). The distribution of the sections shows geographical segregations with some marginally overlapping areas (see above).

Key to the sections

1. Inflorescences of spikes, racemes or spike-like synflorescences, bracts imbricate, in four rows 2
2. Inflorescences spike-like synflorescences, with two adjacent rows of bracts supporting a condensed cyme, bracts camptodrome-reticulate nerved, corolla/tube-ratio small, pollen 2-porate IV. sect. *Bracteati*
2. Inflorescences of spikes or racemes, bracts not reticulate nerved, corolla/tube-ratio large 3
3. Pollen 2-porate III. sect. *Macrophylli*
3. Pollen 3-porate V. sect. *Spiciflori*
1. Inflorescence a dichasium, 2-(4)-flowered (spike), 6-flowered synflorescence, thyrses or flowers solitary. . 4
4. Inflorescence a dichasium, pollen 4-porate I. sect. *Tetrapori*
4. Inflorescence not a dichasium, pollen 2- or 3-porate 5
5. Inflorescence a thyrses, pollen 2-porate II. sect. *Thyrsiflori*
5. Inflorescence a 2-(4)-flowered spike, 6-flowered synflorescence or flowers solitary; pollen 3-porate VI. sect. *Anisotes*

Key to the species

1. Inflorescences of elongated spikes, racemes or spike-like synflorescences 2
2. Inflorescences of spikes or racemes; bracts supporting one flower; flowers 3.8–6.2 cm long 3
3. Spikes 0.4–1.2 cm long; bracts triangular to broadly triangular, 1.5–2.5 × 1.5–2.0 mm, tomentose; calyx 2.5–4.0 mm; leaves 2.0–4.5 × 1.4–2.5 cm, densely tomentose 12. *A. madagascariensis*
3. Spikes 2.0–13.0 cm long; bracts more than 4 mm long, not tomentose; calyx 5 mm long or longer; leaves more than 3.0 cm long, not tomentose 4
4. Young branches tetragonous, grooved, greenish; leaves 3.0–11.0 × 1.9–5.0 cm; bracts rhombic to elliptic, with 5 distinct ribs; bracteoles 6–12 × 1.5–2.5 mm; corolla 4.3–5.3 cm, glandular-pubescent 11. *A. formosissimus*
4. Young branches terete or subtetragonous, not grooved; leaves 19.0–44.0 × 8.0–17.0 cm; bracts narrowly elliptic, elliptic, ovate or narrowly triangular, with 3–5 ± distinct nerves; bracteoles 0.5–5 × 0.5–1.5 mm; corolla 3.8–6.2 cm, glabrate, puberulent or glandular 5
5. Flowers pedicellate, pedicels 5–8 mm long; bracts narrowly elliptic, 12–17 × 3–5 mm; corolla 3.8–4.2 cm long, puberulent; lower lip 3-partite to the base 7. *A. tangensis*
5. Flowers sessile; bracts ovate-elliptic or narrowly triangular; corolla 4.5–6.2 cm long, glandular or glabrate; lower lip only slightly 3-fid 6
6. Bracts ovate to elliptic, 10–18 × 6–12 mm; bracteoles ovate, 1–2 × 0.5–1.5 mm, puberulent to strigose; corolla glabrate; ovary glabrate 5. *A. macrophyllus*
6. Bracts narrowly triangular, 4–7 × 1–2 mm, ciliate; bracteoles narrowly triangular, 3–5 × 1–1.5 mm, glabrate, margin ciliate; corolla glandular; ovary strigose 6. *A. zenkeri*
2. Inflorescences spike-like; bracts supporting a 1–3 flowered condensed cyme, often reduced to one flower + abortive flower buds; flowers 2.2–3.8 cm long 7
7. Bracts not imbricate, narrowly elliptic to elliptic, sessile, 14–18 × 4–7 mm; flowers clearly visible, not concealed by the bracts, 3.2–3.8 cm long, purple or pinkish purple, lower lip divided to the base 10. *A. nyassae*
7. Bracts imbricate, broadly ovate to ovate, base cordate to shortly attenuate, 14–30 × 9–18 mm; flowers almost concealed by the bracts, 2.2–3.7 cm long, greenish yellow or pale yellow brown; lower lip slightly 3-fid or divided to the middle 8
8. Corolla 2.2–3.0 cm; lower lip slightly 3-lobed; lobes 2–3 mm long; calyx 5–7 mm; bracteoles of first order 14–21 × 4–6 mm 8. *A. bracteatus*
8. Corolla 3.0–3.7 cm; lower lip deeply 3-lobed, lobes 1.5–1.8 cm long; calyx 7–10 mm; bracteoles of first order 9–13 × 2–3.5 mm 9. *A. umbrosus*
1. Inflorescences in thyrses; 2-(4)-flowered spike, 6-flowered synflorescence (not elongated and spike like) or dichasia 9
9. Inflorescences 2-(4)-flowered spikes (sessile or pedunculate) or 6-flowered synflorescence, enclosed by two opposite bracts and each flower by 2 bracteoles 10
10. Inflorescences pedunculate, peduncle 1.5–9 mm long; ovary densely hirsute or strigose over the entire surface, glabrate or sparsely strigose at the apex and on the suture 11
11. Bracts ovate, base cordate to shortly attenuate, 7–15 × 5–11 mm; with 5 distinct palmate nerves; inflorescence a 2-flowered spike or 6-flowered synflorescence 16. *A. involucratus*
11. Bracts narrowly obovate to narrowly oblong, base cuneate, 2.5–6 × 1–2 mm; spikes 2-(4)-flowered 13. *A. trisulcus*
10. Inflorescences sessile or subsessile, peduncle up to 1.5 mm long; ovary hirsute at the apex and on the suture, glabrate on the the valves 12
12. Bracts narrowly obovate-obovate to narrowly oblong-oblong, 5–11 × 2–6 mm; villous to tomentose when young; corolla densely glandular 15. *A. tanensis*
12. Bracts narrowly oblong, 3–5 × 1–1.5 mm, puberulent; corolla sericeous, not glandular 14. *A. velutinus*
9. Inflorescences in thyrses, dichasia or flowers solitary 13
13. Flowers solitary, ± with abortive flower-buds, or rarely a 2-flowered spike 14
14. Flowers solitary, enclosed by 2 pairs of bracts; bracts narrowly triangular to narrowly ovate, 5–9 × 1.5–2.5 mm, strigose to glabrate; calyx 5–7 mm, with conspicuous midnerve and margins; corolla glandular with few (pilose) hairs 19. *A. parvifolius*
14. Flowers appearing solitary, but actually 1 flower + 1 abortive bud, rarely a 2-flowered spike; bracts oblong, triangular or narrowly triangular, 1.5–7 × 1–2 mm, tomentose-puberulent; calyx 3–6 mm; corolla glandular-pubescent 15

15. Leaves elliptic, 6.5–17.0 × 3.0–5.6 cm; dark green above; calyx 3–5 mm; ovary densely strigose or glabrate with strigose hairs at the transition to the style 18. *A. sessiliflorus*
15. Leaves narrowly elliptic to elliptic or obovate, 3.0–8.0 × 1.5–3.5 cm; light green above; calyx 3.5–6 mm; ovary densely strigose; inflorescence mostly on brachyblasts 17. *A. rogersii*
13. Inflorescences thyrses, often strongly condensed, or dichasia 16
16. Inflorescences in dichasia; bracteoles of first order narrowly elliptic, 12–20 × 4–7 mm; calyx 12–17 mm; corolla 4.5–5.2 cm, dark red-green to violet, puberulent 1. *A. guineensis*
16. Inflorescences in axillary thyrses, bracteoles scale-like or narrowly triangular 17
17. Thyrses with long peduncles; leaves obovate, 2.0–3.5 × 1.2–2.5 cm; bracteoles triangular, 1–2.5 × 0.5–1 mm; calyx (4–) 6–9 mm; corolla 3.7–4.3 cm; red, velutinous 2. *A. diversifolius*
17. Thyrses strongly condensed, often several clustered together 18
18. Bracts scale-like, triangular, 1.5–3 × 1–2 mm; densely tomentose or shortly hirsute; bracteoles scale-like, triangular, 1–2 × 1 mm; densely tomentose or shortly hirsute; calyx 4–5 mm, divided to the middle; glandular and shortly hirsute 3. *A. dumosus*
18. Bracts narrowly triangular, 4–8 × 1 mm, puberulent; bracteoles bract-like, narrowly triangular, 7–8.5 × 0.5–1 mm, puberulent; calyx 7–9 mm, divided below the middle, shortly hirsute to puberulent 4. *A. ukambensis*

Section I. Tetrapori C. Baden

Sect. *Tetrapori* C. Baden 1981a: 35 (Latin diagnosis). – Type species: *A. guineensis* Lindau.

Shrubs; inflorescence a dichasia with leaf-like bracts; calyx very large and deeply divided, pollen 4-porate, trema area with colpoid streaks.

Species: *A. guineensis*.

Distribution: Guinean Republic. – Fig. 11.

1. *Anisotes quineensis* Lindau

Anisotes guineensis Lindau 1908: 53; Chevalier 1920: 501; Heine 1963: 424. – Type: Guinean Republic, between Diaguissa and Timbo, April 1905, Chevalier 13444 (P holotype, K isotype, fragment).

Erect shrubs or small trees; 1.5–2.0 (–4.0) m high; branches terete, young puberulent; older more sparsely puberulent or glabrate.

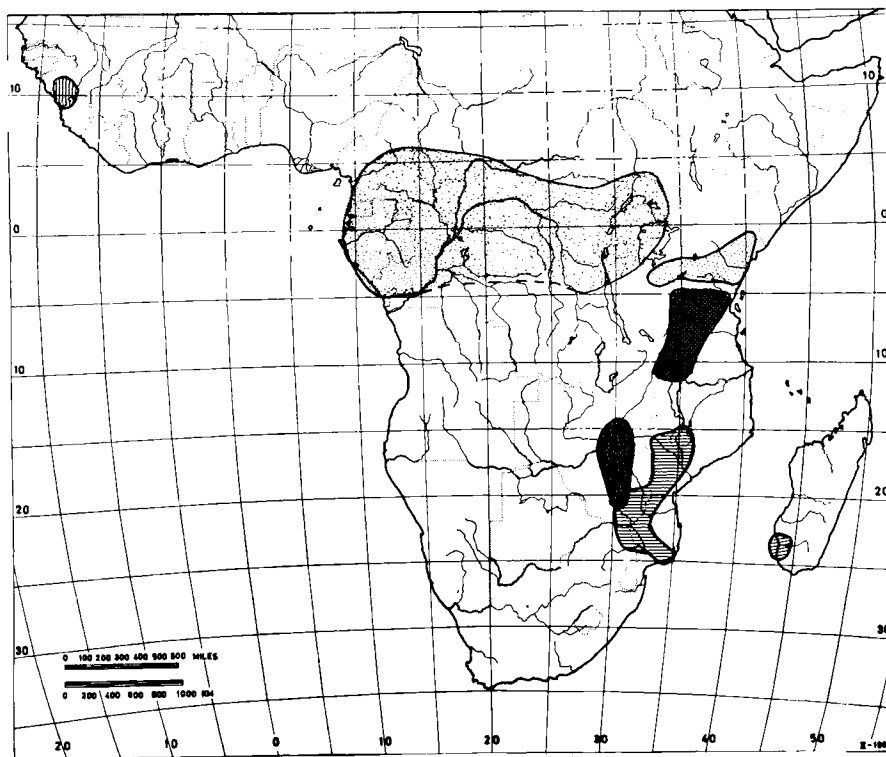


Fig. 5. Distribution of sect. *Tetrapori* (vertically hatched area), sect. *Macrophylli*, with exception of *A. tangensis* (freely dotted area), sect. *Thyrsiflori* (area with regularly arranged black dots), sect. *Bracteati* (areas with regularly arranged white dots), and sect. *Spiciflori* (horizontally hatched area).

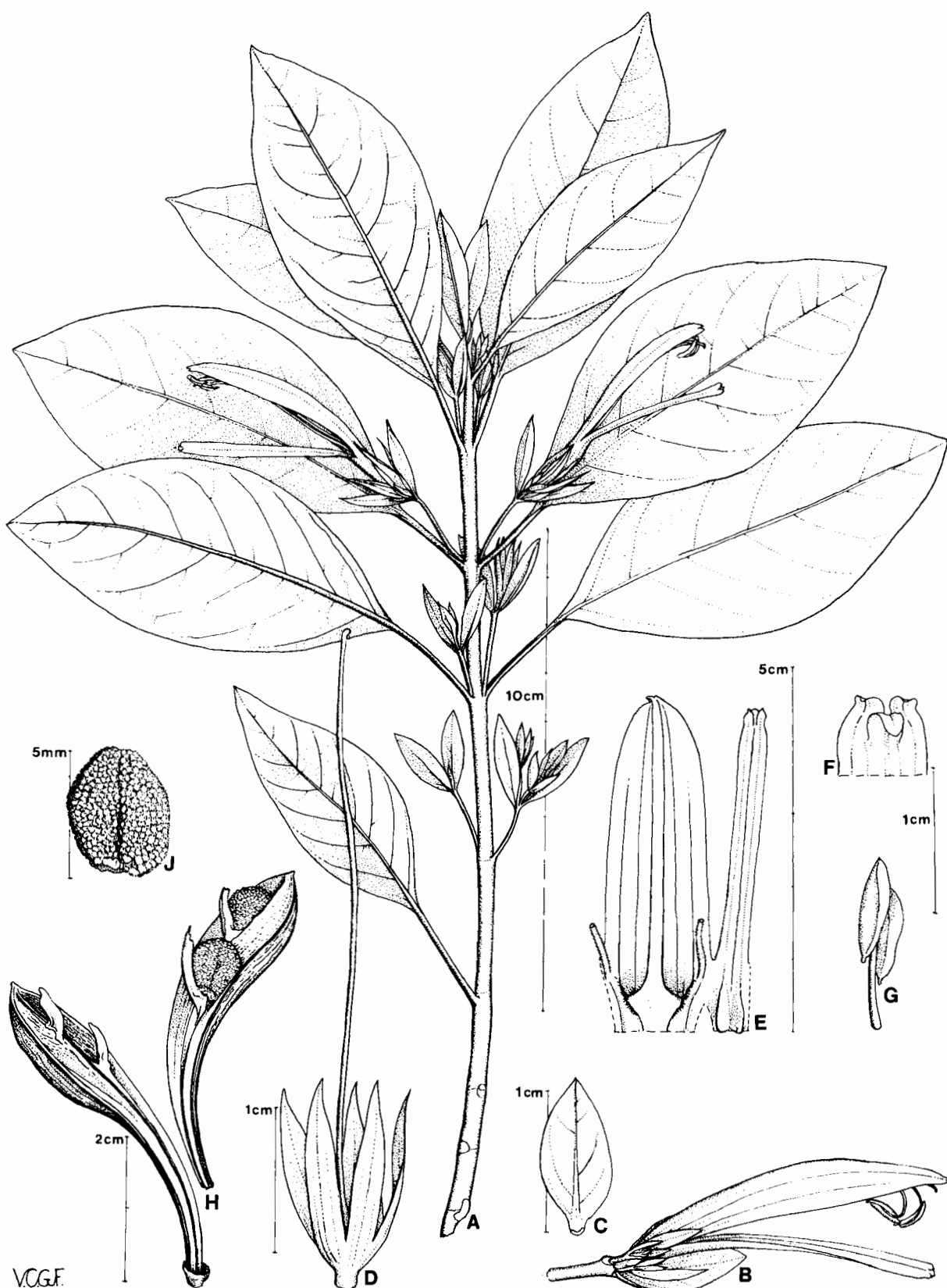


Fig. 6. *Anisotes guineensis*. A: habit. — B: inflorescence with one flower. — C: bract. — D: calyx. — E: inside view of corolla. — F: apex of the lower lip. — G: anther. — H: capsule. — J: seed. — A: Pobéguin 2136; B–G: Jacques-Félix 7099; H–J: Roberty 16454.

Leaves with petiole 1.0–2.0 (–2.4) cm long, glandular-pubescent, weakly carinate to trigonous; lamina narrowly elliptic to elliptic, 5.0–9.5 cm long and 3.0–4.5 cm broad; l/w-ratio: (1.9–) 2.1–2.5 (–2.8); apex acute to obtuse, rarely acuminate, base wedge-shaped; margin involute, entire and sparsely strigose; nervation pinnate; nerves strigose to puberulent, secondary and tertiary nerves inconspicuous below; lamina dark green, glossy, glabrate above; paler, glabrate or when young, with simple hairs below.

Inflorescences axillary, 1–3 flowered, often with only one central flower and two lateral flower buds developing or with one terminal flower bud and two lateral flowers; the pedicel length and bracteole size decrease with flowers of higher order; first order pedicels 1.0–2.3 cm long; subtetragonous, strigose; with two bracteoles just under and enclosing the flowers; first order bracteoles narrowly elliptic, (12–) 15–20 mm long and (4–) 5–7 mm broad; l/w-ratio: 2.4–3.3; coriaceous, apex acute; margin sometimes involute, nerves and margin strigose; second order pedicels 5–11 mm long, subtetragonous, puberulent; bracteoles of second order similar to first order bracteoles, 5–9 (–12) mm long and 1–3 (–4) mm broad; l/w-ratio: (2.7–) 3.0–5.0.

Calyx 12–17 mm long, base tapering gradually into a 2–3 mm long pedicel; lobes oblong to triangular, (8–) 10–13 mm long and 1–2 mm broad; margin ciliate; with 3 nerves of which the midnerve is strigose, distinct; calyx with subsessile glands within.

Corolla 4.5–5.2 cm long, dark red-green to violet, puberulent. Corolla-tube 7–10 (–12) mm long and 4 mm in diameter; lateral pockets 4 mm from the base. Upper lip 35–40 mm long and 10–12 mm broad, apex emarginate; margin later revolute. Lower lip involute and protruding; narrowly oblong, 35–38 mm long and 3–4 mm broad; lobes 1.5–2 mm long and 1 mm broad.

Stamens. Filaments 2.7–3.2 cm long; glabrate. Anthers 4–6 mm long. Pollen grains, prolate, 70–76 × 39–43 µm; pores lalongate 9 × 7 µm; NPC: 444. – Fig. 2A.

Ovary 2.5–3 mm long; glabrate. Style 4.0–4.7 cm long; with simple hairs below the middle. Discus 2 mm high. Capsule 3.4–4.7 cm long, 7–8 mm broad and 5–6 mm thick; glabrate. Seeds 5–6 mm long, 3.5–5 mm broad and 1 mm thick; densely verrucate, glandular. – Fig. 6.

Ecology: From 990–1200 m a.s.l. Recorded from lowland rainforest and riverine forest on wet ground. Flowering specimens from April to July, and specimens with mature fruits from October to January.

Section II. *Thyrsiflori* C. Baden

Sect. *Thyrsiflori* C. Baden 1981a: 35 (Latin diagnosis). – Type species: *A. ukambensis* Lindau.

Shrubs, rarely small trees; inflorescences of lax to strongly condensed thyrses; pollen 2-porate, trema area with 2 (4) rows of insulae.

Species: *A. ukambensis*, *A. dumosus*, *A. diversifolius*.

Distribution: Kenya, N Tanzania and Socotra.

2. *Anisotes diversifolius* Balf. f.

Anisotes diversifolius Balfour f. 1884: 88, 407; 1888: 223; Forbes 1903: 497. – Types: Socotra, in montibus Haghier, Balfour 506 (K lectotype, selected here) and 576 (K), Schweinfurth 477 (K, P, W) syntypes. Illustration: Balfour 1888.

Shrubs; Young branches terete, with four longitudinal grooves; puberulent to shortly velutinous, only puberulent in the grooves or glabrate; leaf scars projecting, bark pale brown to grey; older branches glabrate.

Leaves with petiole (2–) 4–8 (–10) mm long; terete, puberulent to more sparsely haired; lamina obovate, 2.0–3.5 cm long and 1.2–2.5 cm broad; l/w-ratio: (1.1–) 1.2–1.6 (–1.8); coriaceous; apex obtuse or cordate; base shortly attenuate; margin entire, sometimes with short simple hairs; with large papillae when dry; nervation pinnate, nerves sparsely puberulent to glabrate.

Thyrses axillary; 2-many flowered, peduncles 5–10 mm long, peduncles of higher order shorter, terete, densely puberulent to shortly velutinous or more sparsely haired; bracts scaly at the forks or sometimes leaf-like in the inflorescence; bracts supporting flowers triangular, 0.5–1.5 (–2) mm long and 1 mm broad; puberulent to shortly velutinous; bracteoles triangular, 1–2 (–2.5) mm long and 0.5–1 mm broad; bract-like.

Calyx 4–8 (–9) mm long, glandular-papillose or glabrate; lobes triangular or narrowly oblong, 2–6 mm long and 1–1.5 mm broad, apex acuminate.

Corolla 3.7–4.3 cm long, red; velutinous. Corolla tube 12–16 mm long; 2–2.5 mm in diameter at the base, 3.5–4 cm in diameter at the apex. Upper lip 21–28 mm long and 9–10 mm broad; apex emarginate. Lower lip narrowly oblong, 20–22 mm long and 3–4 mm broad, lobes 1–1.5 mm long, lateral lobes 1–1.5 mm broad, central lobe 1.5–2 mm broad.

Stamens. Filaments 1.8–2.5 cm long; glabrate. Anthers 3 mm long. Pollen grains prolate, trema area with 4 rows of insulae, NPC: 244. – Fig. 2B.

Ovary 2.5–3 mm long, 1–1.5 mm broad and 1 mm thick; glabrate. Style 2.8–3.2 cm long, puberulent below the middle. Discus 1 mm high, 1–1.5 mm in diameter. Capsule (16–) 19–22 mm long, 4 mm broad and 3.5 mm thick; glabrate. Seeds 2 mm long, 2 mm broad and 0.5 cm thick; tuberculate to verrucate.

Distribution: Endemic on Socotra (Dem. Rep. Yemen).

Ecology: From 450–1050 m a.s.l. Flowering specimens from January to April, and August.

Key to the varieties

- Calyx large, 6–8 mm long, lobes 4–6 mm long
..... var. *diversifolius*
Calyx small, 4 mm long, lobes 2 mm long
..... var. *brevicalyx*

2a. *Anisotes diversifolius* Balf. f. var. *diversifolius*

Calyx 6–8 (–9) mm long; lobes 4–6 mm long.

2b. *Anisotes diversifolius* Balf. f. var. *brevicalyx* Balf. f.

Anisotes diversifolius Balf. f. var. *brevicalyx* Balfour f. 1884: 407; 1888: 224; Forbes 1903: 497. – Type: Socotra, Balfour 497 (E lectotype, selected here, K isotype).
Illustration: Balfour f. 1888.

Differs from var. *diversifolius* by the shorter calyx, 0.4 cm long, and shorter calyx lobes, 0.2 cm long.

Notes: It is not without hesitation that I maintain this variety, which only differs in the shorter calyx. The material is very limited (2 collections of the type) but I have not seen any intermediate specimens.

3. *Anisotes dumosus* Milne-Redhead

Anisotes dumosus Milne-Redhead 1936: 487; Brenan and Greenway 1949: 2. – Type: Tanzania, Shinyanga District, July 1935, Burt 5144 (EA lectotype, selected here, BM, BR, K isotypes).

Densely branched shrubs; 1.0–3.6 m high; the annual growth with long internodes; young branches terete; glabrate, old branches terete with short internodes; glabrate.

Leaves deciduous; with petiole 3–10 mm long, carinate, glabrate; lamina narrowly ovate to narrowly elliptic, 7.0–13.0 cm long and 3.0–4.0 cm broad; l/w-ratio: 2.5–4.0; apex obtuse to acute; base attenuate; margin entire; lamina dark green, glabrate, nervation pinnate; nerves sparsely sericeous when young, later glabrate.

Thyrse axillary, pedunculate or subsessile, strongly condensed and reduced with decussate axillary con-

densed cymes; thyrses 2–5 flowered; several thyrses develop close together in clusters on brachyblasts; flowers develop as soon as the leaves have fallen; bracts triangular, (1.5–) 2–3 mm long and 1–2 mm broad; l/w-ratio: 1.5–2.0; densely tomentose or shortly hirsute; bracteoles triangular, 1–2 mm long and 1 mm broad; densely tomentose or shortly hirsute.

Calyx with base tapering gradually into the pedicel, 4–5 mm long, glandular and shortly hirsute or more sparsely haired; lobes ovate or triangular, 1.5–2.5 (–3) mm long and 1–1.5 mm broad; apex acute.

Corolla 4.3–4.7 (–5.0) cm long; greenish yellow, yellow white or pale purple; densely glandular outside. Corolla tube 10–17 mm long, 2–3 mm in diameter at the base, 4–5 mm in diameter at the apex; lateral invaginations 4–6 mm from the base. Upper lip 32–36 mm long and 10–16 mm broad; apex emarginate. Lower lip at anthesis twisted and involute, narrowly oblong, 30–36 mm long and 4–6 mm broad; lobes 5–10 mm long, lateral lobes 2.5–3 mm broad, central lobe 3.5–4 mm broad; apex obtuse.

Stamens. Filaments 3.0–3.4 cm long, glabrate. Anthers 4–5 mm long. Pollen grains, prolate, $61 \times 41 \mu\text{m}$; pores circular, up to $12 \mu\text{m}$ in diameter; trema area with two rows of circular insulae, $8\frac{1}{2} \mu\text{m}$ in diameter; NPC: 244. – Fig. 2C.

Ovary 2.5–3 mm long, 2 mm broad and 1 mm thick, with simple hairs on the suture or glabrate. Style 3.5–4.0 cm long; glabrate. Discus 1 mm high, 2 mm in diameter. Capsules 25–30 mm long, 7 mm broad and 5 mm thick; glabrate. Seeds 5 mm long, 4 mm broad and 0.5–1 mm thick; rugose. – Fig. 7.

3a. *Anisotes dumosus* Milne-Redhead ssp. *dumosus*

Leaves 10.0–13.0 cm long and 3.0–4.0 cm broad; l/w-ratio: 3.0–4.0. Bracts and bracteoles densely tomentose. Corolla yellow white, corolla tube distally broadly funnel-shaped, 1.0–1.2 cm long, with a large invagination at the transition to the lower lip; upper lip 13–16 mm broad, lobes of the lower lip 7–10 mm long.

Distribution: Tanzania (Shinyanga District) – Fig. 8.

Ecology: From 900–1200 m a.s.l. Recorded from grouped tree grassland, deciduous bushland or deciduous thickets. Reported to grow on poor hardpan soil, sandy soil at foot of catenas, decayed granite soil or

Key to the subspecies

1. Bracts and bracteoles densely tomentose; corolla tube distally broadly funnel-shaped, 1.0–1.2 cm long, with a large ventral invagination at the top, without a ventral hump; upper lip 13–16 mm broad ssp. *dumosus*
1. Bracts and bracteoles shortly hirsute; corolla tube distally weakly funnel-shaped, (1.1–) 1.2–1.4 (–1.7) cm long, with a small ventral invagination at the top, with a distinct ventral hump at the base; upper lip 10–13 mm broad ssp. *galanae*

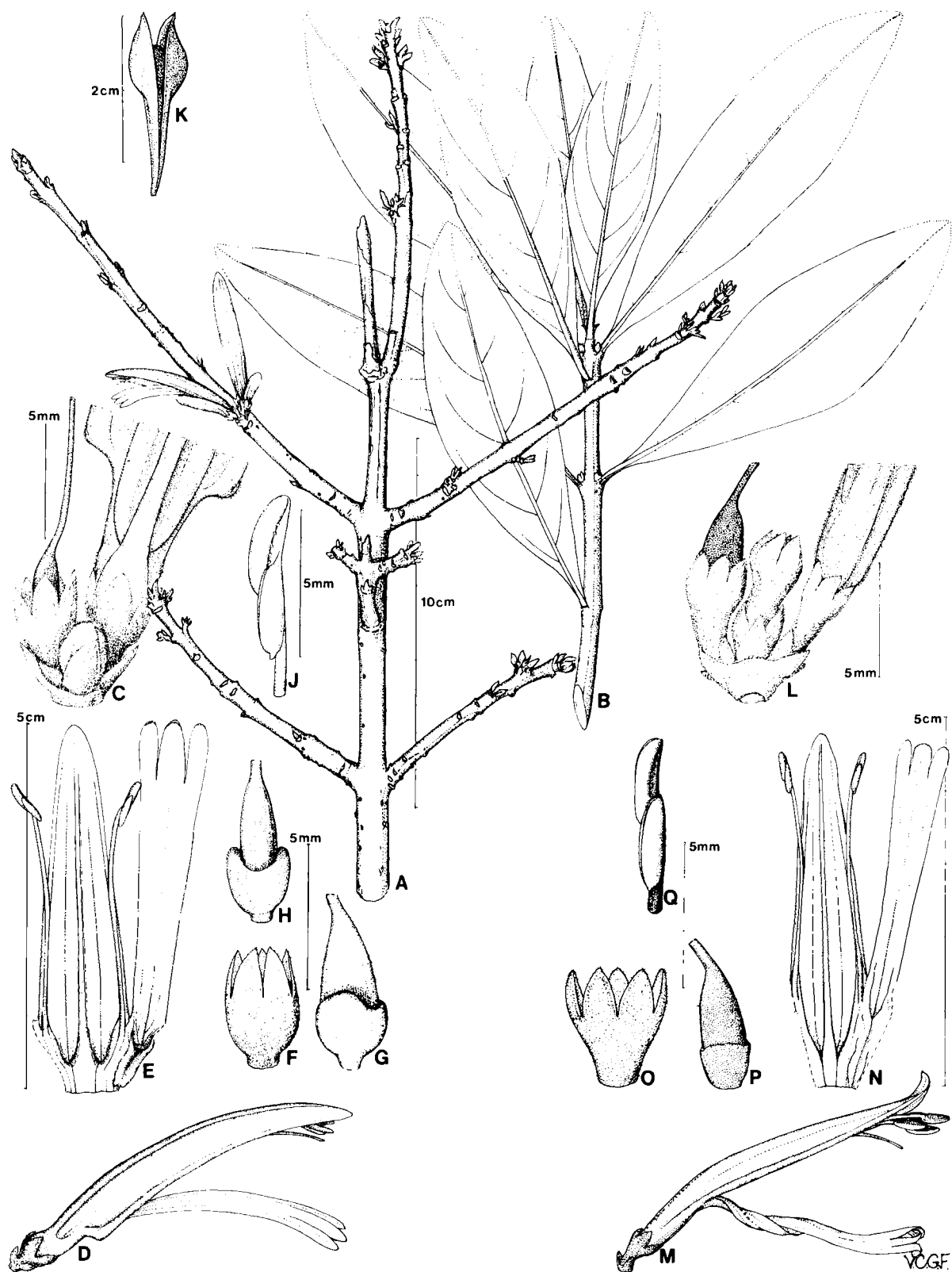


Fig. 7. *Anisotes dumosus* ssp. *dumosus* (A–K), and *A. dumosus* ssp. *galanae* (L–Q). A: habit, flowering. – B: habit with leaves. – C: inflorescence. – D: flower. – E: inside view of corolla. – F: calyx. – G, H: two views of ovary and disc. – J: anther. – K: capsule. – L: inflorescence. – M: flower. – N: inside view of corolla. – O: calyx. – P: ovary and disc. – Q: anther. – A: Burtt 5144; B, K: Eggeling 6266; C–J: Burtt 3438; L–Q: Leuthold 86.

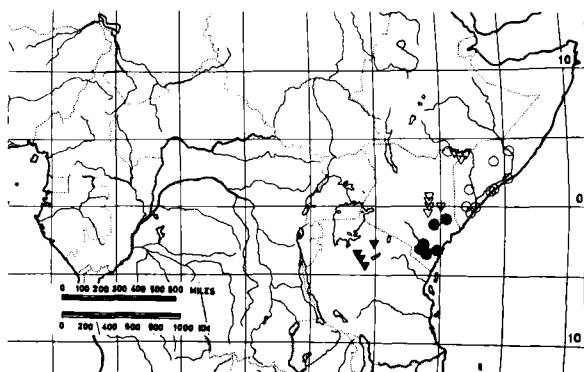


Fig. 8. Distribution of *Anisotes dumosus* ssp. *dumosus* (triangles), *A. dumosus* ssp. *galanae* (dots), *A. involucratus* (open dots); *A. tanensis* (open triangles).

alluvial mudflats. The leaves are not shed until well into the dry season, June, whereupon the flowers develop. Flowering specimens from June to October.

3b. *Anisotes dumosus* Milne-Redhead ssp. *galanae* C. Baden

Anisotes dumosus Milne-Redhead ssp. *galanae* C. Baden 1981a: 36 (Latin diagnosis). – Type: Kenya, Melka Faya, 18 Aug. 1969, Leuthold 85 (K holotype, EA isotype). The name refers to the Galana River at the type locality.

Leaves 7.0–10.0 cm long and 3.0–4.0 cm broad; l/w-ratio: 2.5–3.5. Bracts and bracteoles shortly hirsute. Corolla greenish yellow or pale purple. Corolla tube distally weakly funnel-shaped, (1.1–) 1.2–1.4 (–1.7) cm long, with a small invagination at the transition to the lower lip and a large ventral hump between the grooves. Upper lip 10–13 mm broad; lobes of the lower lip 5–8 mm long. – Fig. 7.

Distribution: Kenya. – Fig. 8.

Ecology: From 200–400 m a.s.l. Recorded from *Acacia-Commiphora* bushland, on red sandy soil, or sandy alluvium near rivers. Flowering specimens from March–April and from July to October.

4. *Anisotes ukambensis* Lindau

Anisotes ukambensis Lindau 1913: 409; Dale and Greenway 1961: 17 (wrong type cited); Agnew 1974: 607. – Type: Kenya, Kibwesi, 1910, Scheffler 455, (E lectotype, selected here, BM isotype).

Anisotes ukambanensis Lindau 1920: 23, syn. nov. – Type: Kenya, Masaiteppes, 1906, Scheffler 181 (E lectotype selected here, BM, G, HBG, L, PRE, S, W, Z isotypes).

Erect shrubs or small trees; 2.0–3.0 (–5.0) m high; branches terete; glabrate, bark pale grey, smooth.

Leaves deciduous, petiolate or subsessile; petiole if present (0.2–) 0.3–0.7 (–0.9) cm long, half-terete or

carinate; lamina narrowly elliptic, (6.0–) 7.0–11.5 (–15.0) cm long and (1.5–) 2.0–4.0 (–5.0) cm broad; l/w-ratio: (2.5–) 3.1–5.1 (–6.5); apex acuminate to acute; base attenuate; margin entire or repand; nervation pinnate, nerves puberulent to strigose or more sparsely haired.

Thyrse axillary, pedunculate, condensed 3-many flowered consisting of equivalent decussate condensed cymes; often more thyrses close together and appearing head-like; inflorescences often developed when the leaves are fallen or before they are fully developed. Bracts narrowly triangular, (4–) 5–8 mm long and 1 mm broad; l/w-ratio: (5.0–) 7.0–8.0; puberulent, often only at the margin; with sessile glands. Bracteoles bract-like, narrowly triangular 7–8.5 mm long and 0.5–1 mm broad; l/w-ratio: 8.0–10.0; puberulent; with sessile glands and with cystoliths. Peduncles 1–4 mm long, subtetragonous, grooved, strigose, glandular.

Calyx narrowing at the base to a 1 mm long pedicel, 7–9 mm long; shortly hirsute to puberulent, mostly on the nerves and at the apex; lobes narrowly triangular or narrowly oblong, 6–7 mm long and 1.5 mm broad; apex acuminate; with three distinct nerves.

Corolla 4.5–5.2 cm long, pale yellow or greenish-yellow; densely glandular-pilose without. Corolla tube 10–12 mm long, 2.5 mm in diameter at the base, 4–5 mm in diameter at the apex; lateral invaginations 6 mm from the base. Upper lip 36–41 mm long and 12–16 mm broad; apex entire. Lower lip at anthesis involute, twisted, narrowly oblong, 35–40 mm, long and 6–8 mm broad; lobes 14–18 (–20) mm long, lateral lobes 2–3 mm broad, central lobe 4–5 mm broad.

Stamens. Filaments 3.2–3.6 (–3.7) cm long; anthers 3.5–4 (–5) mm long. Pollen grains with indication of faint colpi, prolate, 61–65 × 39–44 μm; pores lalongate; trema area with two rows of insulae up to 10 μm in diameter; NPC: 244. – Fig. 2D.

Ovary 3–4 mm long, 2 mm broad and 1 mm thick; glabrate. Style 4.2–4.6 (–4.7) cm long; glabrate. Discus 1 mm high, 1.5 mm in diameter. Capsule 25–30 mm long, 7 mm broad and 4 mm thick; glabrate. Seeds 5 mm long, 4 mm broad and 0.5–1 mm thick; glabrate. – Fig. 9.

Distribution: Kenya (Machakos District, Kajiado District). – Fig. 19.

Ecology: From 750–1200 m a.s.l. Recorded from deciduous bushland and semi-evergreen bushland. Reported to grow in rocky volcanic soil. Flowering specimens from July to September.

Section III. *Macrophylli* C. Baden

Sect. *Macrophylli* C. Baden 1981a: 35 (Latin diagnosis). – Type species: *A. macrophyllus* (Lindau) Heine.

Shrubs or small trees; inflorescences axillary or terminally pedunculate spikes or racemes; bracts opposite, in

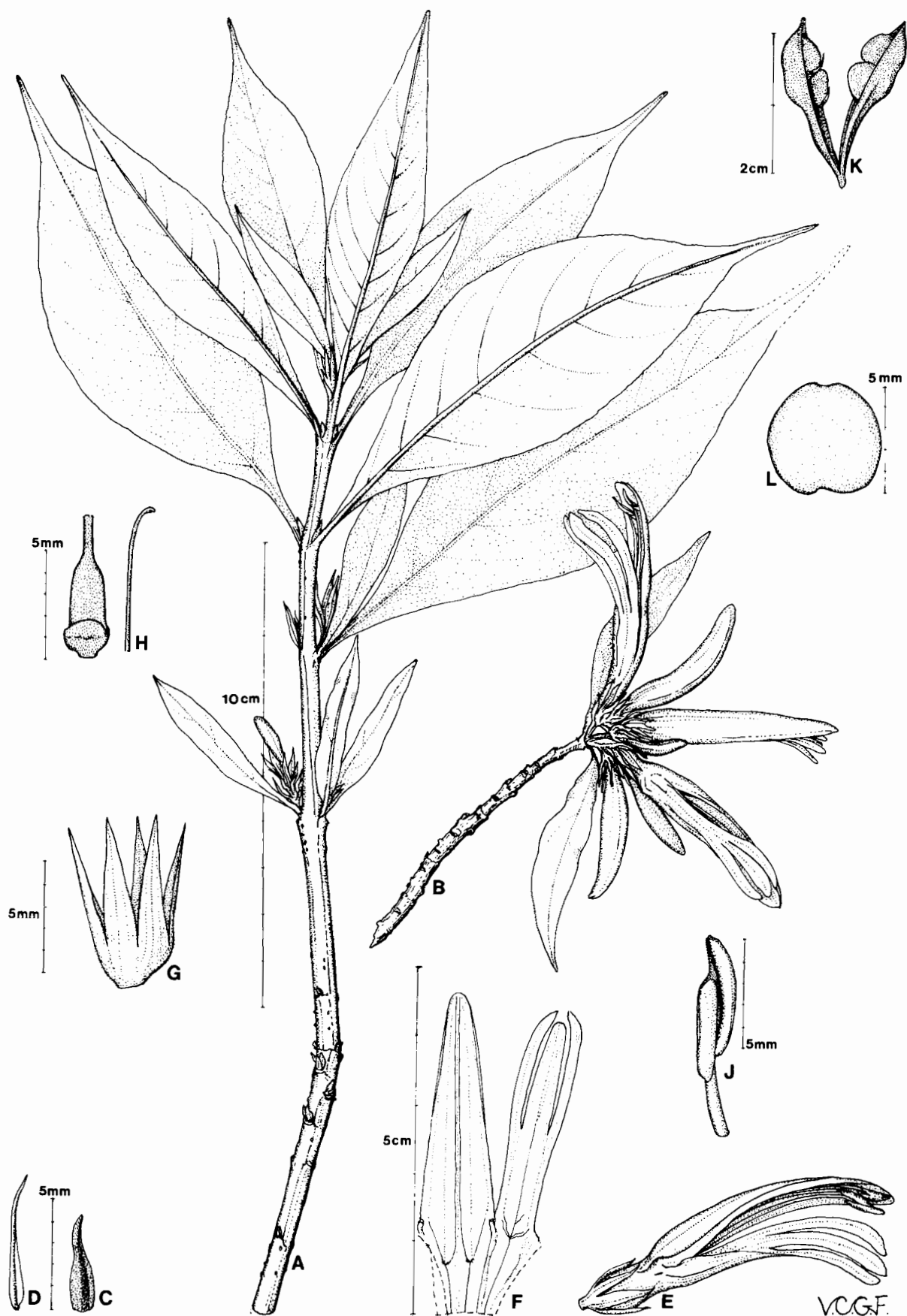


Fig. 9. *Anisotes ukambensis*. A: habit. – B: branch with inflorescence. – C: bract. – D: bracteole. – E: flower. – F: inside view of corolla. – G: calyx. – H: ovary, style and disc. – J: anther. – K: capsule. – L: seed. – A: Bally A, cult.; B–L: Verdcourt 1844.

four rows, imbricate, supporting one flower, pollen 2-porate, in *A. macrophyllus* 2-colporate, trema area with 4 (2) rows of insulae.

Species: *A. macrophyllus*, *A. zenkeri*, *A. tangensis*.

Distribution: From Cameroun and Gabon to Uganda and NE Tanzania.

5. *Anisotes macrophyllus* (Lindau) Heine

Anisotes macrophyllus (Lindau) Heine 1966: 189. – Basionym: *Himantochilus macrophyllus* Lindau 1894: 60; 1895b: 372. – *Macrorungia macrophylla* (Lindau) C. B. Clarke 1900: 255; Benoist 1928: 48. – Type: Congo, Is-sange-Semliki, Stuhlmann 2938 (B. holotype, probably destroyed).

Himantochilus sereti De Wildemann 1910: 274 t. XLVII. – *Anisotes sereti* De Wildemann 1910: 274 t. XLVII nom. inval. (published in synonymy). – Type: Riviere Nadi, 15 Jan 1906, Seret 458 (BR lectotype, selected here); Entre Duru et Rungu, 7 Jan, Seret sn. (BR); environs d'Arebi, Dec. 1906, Seret 458 bis (BR) syntypes.

Macrorungia batesii Wernham 1916: 229. – Type: Cameroun, Bite, rock of Messe, 26 Dec 1914, Bates 687 (Z lectotype, selected here, BM, MO isotypes).

Illustrations: Heine 1966, De Wildemann 1910.

Subherbaceous shrublets or shrubs, (0.7–) 1.5–3.0 (–4.0) m high; young branches subtetragonous or rarely terete, strigose to sparsely strigose or glabrate, nodes hardly compressed; bark with a violet tinge; older branches slightly to markedly angular, glabrate.

Leaves with petiole (1.4–) 3.5–7.0 (–9.7) cm long;

carinate, strigose in the channel, outside with simple hairs or glabrate; lamina narrowly elliptic to elliptic, rarely obovate; (19.0–) 24.0–36.0 (–44.0) cm long and 8.0–13.0 (–17.0) cm broad; l/w-ratio: (2.0–) 2.5–3.3 (–4.1); apex acuminate to obtuse; base attenuate; margin crenate; nervation pinnate; lamina green, glossy above, glabrate; young nerves sparsely strigose; paler green below and with simple hairs or glabrate.

Inflorescences axillary pedunculate spikes; (2.0–) 3.5–5.5 (–8.0) cm long; flowers developed in the upper part of the branches with the foliage; with axillary accessory buds which sometimes develop into spikes; inflorescence axis angled, strigose. Bracts imbricate, ovate to elliptic, (10–) 11–15 (–18) mm long and 6–10 (–12) mm broad; l/w-ratio: (1.2–) 1.4–1.9 (–2.3); apex acute or mucronate; base very shortly attenuate or cuneate; 5 distinct nerves, nervation palmate; strigose, the basal part and nerves often more hairy. Bracteoles ovate, 1–2 mm long and 0.5–1.5 mm broad, puberulent to strigose. Peduncle (0.3–) 0.5–1.6 (–3.0) cm long, tetragonous, strigose, hairs upward-pointing.

Calyx 5–7 mm long, with simple hairs at apex or glabrate; lobes narrowly elliptic to triangular, 3–4 mm long and 1–1.5 mm broad; with 3 nerves.

Corolla (4.5–) 4.9–5.8 (–6.2) cm long, orange, or yellow red, glabrate. Corolla-tube (11–) 13–17 mm long, 2–3 mm in diameter at the base, 3–3.5 mm in diameter at the apex; lateral invaginations 0.9–1.0 cm from the base. Upper lip (30–) 34–40 (–45) mm long and 10–13 mm broad; apex 2-fid. Lower lip at anthesis narrowly obovate, 32–38 (40) mm long and 5–7.5 mm

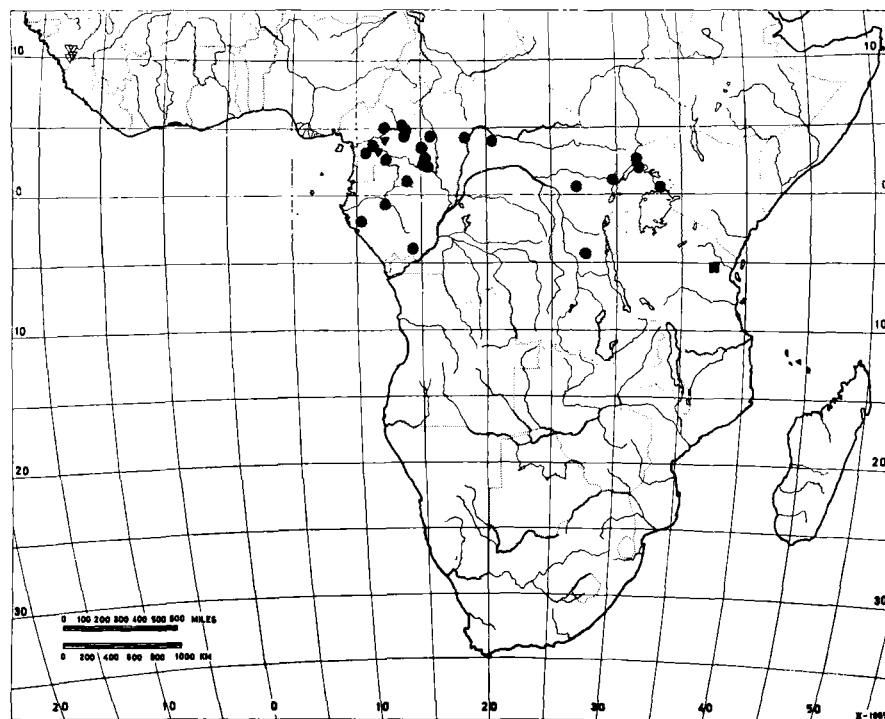


Fig. 10. Distribution of *Anisotes macrophyllus* (dots); *A. zenkeri* (triangles); *A. tangensis* (square); *A. guineensis* (open triangle).

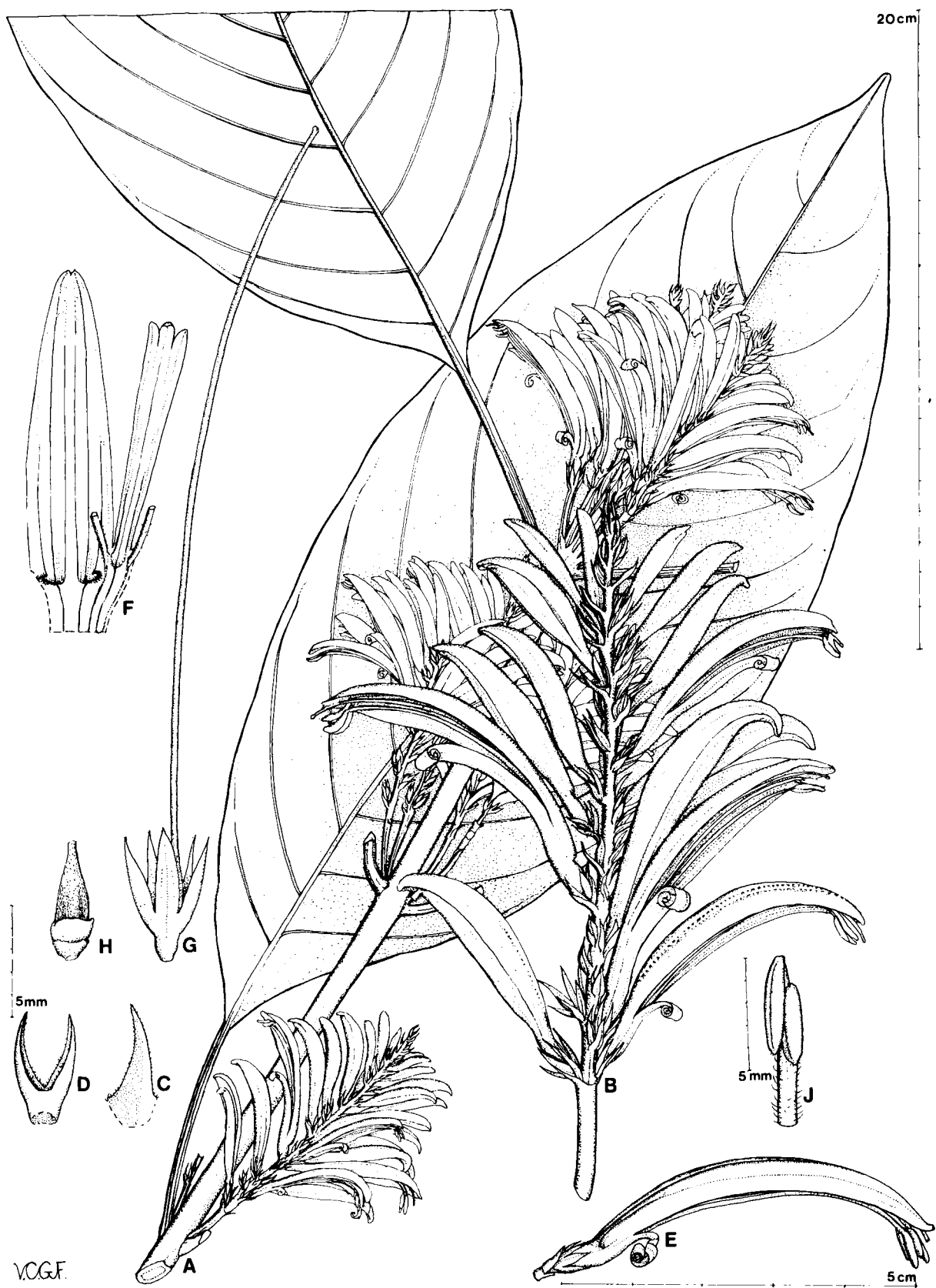


Fig. 11. *Anisotes zenkeri*. A: habit. – B: inflorescence. – C: bract. – D: bracteole. – E: flower. – F: inside view of corolla. – G: calyx. – H: ovary and disc. – J: anther. – A–J: de Wilde 1644.

broad; inrolled; lobes 2–3 mm long, lateral lobes 1–1.5 mm broad, central lobe 2–2.5 mm broad; apex obtuse.

Stamens. Filaments (3.0–) 3.2–3.6 (–3.7) cm long; glabrate. Anthers 5–6.5 mm long. Pollen grains 2-colporate, prolate, $68\text{--}73 \times 37\text{--}44 \mu\text{m}$; pores lalongate, $7\frac{1}{2} \times 4 \mu\text{m}$; trema area with 4 rows of insulae; NPC 245. – Fig. 2R.

Ovary 2.5–3.5 mm long, 1.5–2 mm broad and 1 mm thick; glabrate. Style 4.5–5.5 (–5.7) cm long, sparsely strigose below the middle or glabrate. Discus 2 mm in diameter, 2 mm high. Capsules 26–30 mm long, 6–9 mm broad and 4–6 mm thick, glabrate. Seeds 5–6 mm long, 5–6 mm broad and 1–1.5 mm thick; rugose.

Distribution: Cameroun, Gabon, Central African Republic, Congo (= Congo Brazz.), Zaire (= Congo Leop.), Uganda. – Fig. 10.

Ecology: From 600–1050 m a.s.l. Recorded from lowland rain-forest types: in secondary riverine forest, secondary or primary forest in shady places with Sterculiaceae, Ulmaceae (*Celtis* spp.) (Cameroun), *Terminalia*-forest (Zaire) or in mature forest with *Aningeria altissima* and *Lannea welwitschia* (Uganda). Flowering period from December to first half of February and from July to first half of October.

6. *Anisotes zenkeri* (Lindau) C. B. Clarke

Anisotes zenkeri (Lindau) C. B. Clarke 1900: 226. – Basionym: *Himantochilus zenkeri* Lindau 1894: 60. – Type: Cameroun, Yaunde station, Jan. 1892, Zenker 675 (S lectotype, selected here, BM, BR, COI, Z isotypes; Zenker 119 (BM, S) syntype).

Suffrutescent to shrub-like plants, 1.5–3.0 m high; young branches terete to subtetragonous; glabrate, nodes compressed; older branches terete; glabrate.

Leaves with petiole (3.0–) 4.0–7.0 cm long; weakly carinate to 3-angular; glabrate; lamina elliptic, (20.0–) 23.0–36.0 cm long and 8.5–13.5 cm broad; l/w-ratio: (2.3–) 2.5–3.1 (–3.3); apex acuminate to acute; base attenuate; margin distantly crenate or entire; nervation pinnate; lamina dark green above, glabrate; paler green below, glabrate; nerves glabrate.

Inflorescences axillary pedunculate spikes; in the distal part of the branches; 4.0–8.0 cm long; often more than one spike in each axil, developed from accessory buds; inflorescence axis subtetragonous to tetragonous; puberulent to strigose on two sides and glabrate on the other two sides. Bracts narrowly triangular, 4–7 mm long and 1–2 mm broad; l/w-ratio: (2.7–) 3.0–4.7 (–6.0); apex acute; glabrate; with 3 indistinct nerves; margin ciliate. Bracteoles narrowly triangular, 3–5 mm long and 1–1.5 mm broad; glabrate; margin ciliate; bracteoles often larger than the bracts in the young stages.

Calyx 6–7 mm long; lobes triangular, 3.5–4.5 mm long and 1–1.5 mm broad; apex strigose or glabrate; margin ciliate.

Corolla 5.0–5.7 (–6.0) cm long; reddish brown to red; glandular, mostly on the distal part of the tube and on the lips. Corolla tube 11–12 (–14) mm long; 3 mm in diameter at the base, 4 mm in diameter at the apex; lateral invaginations 5–7 mm from the base. Upper lip (39–) 40–45 mm long and 12–15 mm broad; apex emarginate, lower lip at anthesis inrolled; narrowly obovate, 35–41 mm long and 4–6 mm broad; lobes (2–) 4–5 (–7) mm long, lateral lobes 1.5–2 mm broad, central lobe 2–3 mm broad.

Stamens. Filaments (3.2–) 3.5–4.2 cm long; sparsely sericeous to sparsely velutinous, only on the edge. Anthers 3.5–4.5 mm long, base acute; sparsely pilose. Pollen grains, with an indication of a faint colpus, prolate, $68\text{--}77 \times 39\text{--}48 \mu\text{m}$; pores lalongate, $9 \times 7 \mu\text{m}$; trema area with two rows of insulae, 5 μm in diameter; NPC: 244 (5). – Fig. 2Q.

Ovary 3–3.5 mm long, 1.5 mm broad and 1 mm thick; strigose, hairs upward-pointing. Style 4.8–5.5 cm long; glabrate, strigose just above the ovary. Discus 1.5 mm high and 1 mm in diameter. Capsule more than 2.0 cm long; young fruits puberulent. Seeds not seen. – Fig. 11.

Distribution: Cameroun. – Fig. 10.

Ecology: From 600–800 (–1500) m a.s.l. Recorded from riverine or secondary lowland rain forest. Flowering specimens from December, February to March and June.

7. *Anisotes tangensis* C. Baden

Anisotes tangensis C. Baden 1981a: 36 (Latin diagnosis). – Type: Tanzania, Tanga Province, Nguru Mt., 15 Aug 1952, Parry 150 (EA., holotype, K isotype). The name refers to the Tanga Province.

Sprawling shrubs; branches subtetragonous or terete, glabrate, nodes slightly swollen.

Leaves with petiole 6.0–8.0 cm long, carinate, glabrate; lamina elliptic, 33.0–37.0 cm long and 13.0–15.0 cm broad; l/w-ratio: 2.2–2.4; apex broken in specimens seen; base shortly attenuate; margin crenate; nervation pinnate-reticulate; lamina with single hairs or glabrate.

Inflorescences axillary, pedunculate racemes, 5.0–8.0 cm long, 15-more flowered; inflorescence axis angular, puberulent to tomentose; bracts all supporting flowers; sessile, narrowly elliptic, 12–17 mm long and 3–5 mm broad; l/w-ratio: 2.5–5.6; apex acuminate; shortly puberulent; nervation acrodrome, with 3 main nerves. Bracteoles narrowly triangular, 0.5–1 mm long. Flowers pedicellate; pedicel 5–8 mm long, puberulent.

Calyx 7–9 mm long; shortly puberulent; lobes narrowly triangular, 6 mm long and 2 mm broad; with 3 nerves.

Corolla 3.8–4.2 cm long; puberulent. Corolla tube 14–15 mm long, ca. 3 mm in diameter; lateral invaginations 7 mm from the base. Upper lip 25–26 mm long

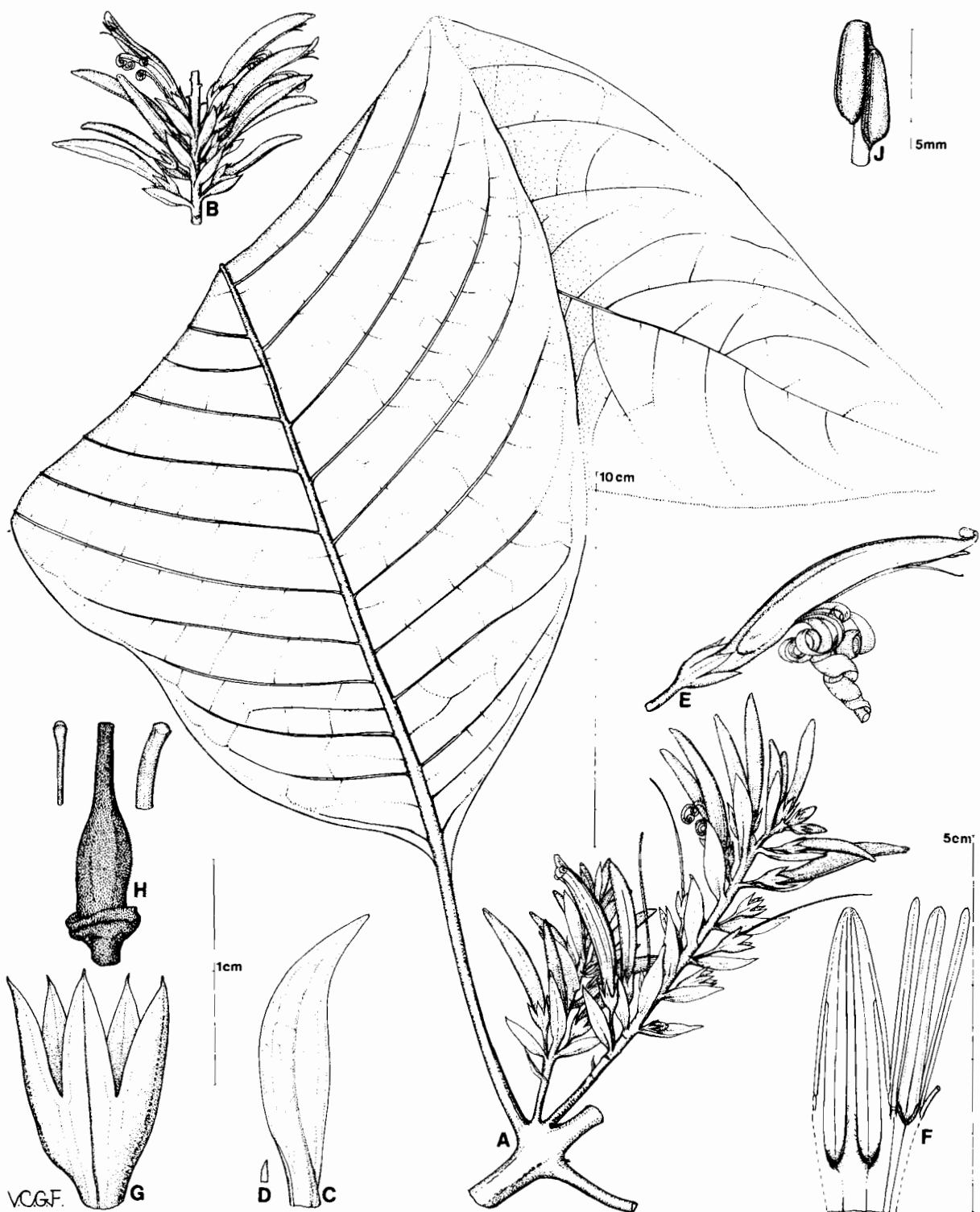


Fig. 12. *Anisotes tangensis*. A: habit. – B: inflorescence. – C: bract. – D: bracteole. – E: flower. – F: inside view of corolla. – G: calyx. – H: ovary, style and disc. – J: anther. – A–J: Parry 150.

and 11 mm broad; apex entire. Lower lip 25–26 mm long, divided to the base; lobes narrowly oblong, inrolled at anthesis; lateral lobes 25 mm long and 1.5 mm broad, central lobe 27 mm long and 2.5 mm broad.

Stamens. Filaments ca. 2.0 cm long; anthers 3 mm long. Pollen grains prolate, $61\text{--}65 \times 36\text{--}41 \mu\text{m}$; pores lalongate, $8.5 \times 5.5 \mu\text{m}$; trema area with 4 rows of insulae, $4 \mu\text{m}$ in diameter; NPC: 244. – Fig. 2P.

Ovary 3 mm long, glabrate. Style 3.5 cm long, puberulent below the middle. Discus 1.5 mm high; 1.5 mm in diameter. Capsules not seen. – Fig. 12.

Ecology: Altitude 1200 m a.s.l. In lowland rain forest. Flowering specimens from August.

Distribution: Only known from Tanzania (Handeni District). – Fig. 10.

Notes: Closely related to *A. macrophyllus* and *A. zenkeri* both in morphology and ecology. The shape of the corolla and position and shape of the anther-cells suggest an affinity with *Anisotes*. However, the capsules have not been seen, so it has been impossible to establish whether the placenta rise elastically or not, but the inflorescence and the corolla shape are so close to those of *A. macrophyllus* and *A. zenkeri*, that these plants must be congeneric. The 2-porate pollen grains also show a close relation to the above mentioned species.

Section IV. Bracteati C. Baden

Sect. *Bracteati* C. Baden 1981a: 35 (Latin diagnosis). – Type species: *A. bracteatus* Milne-Redhead.

Shrubs; inflorescences of spike-like synflorescences; bracts opposite, imbricate, in four rows, reticulate-camptodrome nerved, two adjacent rows of bracts supports a strongly condensed, reduced cyme (1 flower + 1 or 2 bud(s), rarely 2 flowers + 1 bud); corolla lip/tube-ratio small, pollen 2-porate, trema area with 2 (4) rows of insulae.

Species: *A. bracteatus*, *A. umbrosus*, *A. nyassae*.

Distribution: From Tanzania to Rhodesia.

8. *Anisotes bracteatus* Milne-Redhead

Anisotes bracteatus Milne-Redhead 1935: t. 3268; Brenan and Greenway 1949: 1; Milne-Redhead 1954a: 25; White 1962: 381; Bjørnstad 1976: 25. – Type: Tanzania, Dodoma District, Gulwe, 19 Aug. 1930, Greenway 2407 (EA lectotype, selected here, K isotype).
Illustration: Hook., IC Pl. 33: t. 3268.

Small to medium sized shrubs, 1.2–3.5 m high; young branches terete to subtetragonous with four grooves; strigose to sparsely strigose, later only in the grooves; older branches terete; glabrate.

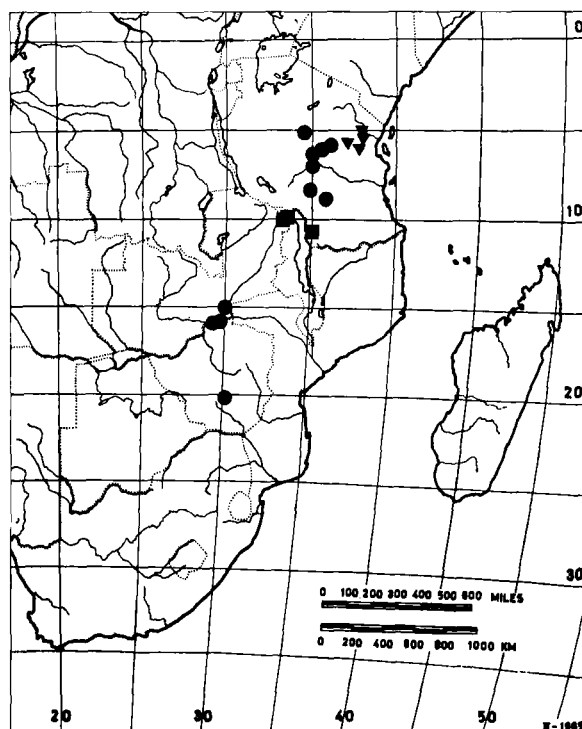


Fig. 13. Distribution of *Anisotes bracteatus* (dots); *A. umbrosus* (triangles); *A. nyassae* (squares).

Leaves deciduous, with petiole 1.5–3.0 cm long, half-terete puberulent or glabrate; lamina narrowly ovate to narrowly elliptic, 4.0–16.0 cm long and 3.0–10.0 cm broad; l/w-ratio: (1.4–) 1.6–2.2 (–2.5); apex obtuse or shortly acuminate to obtuse; base attenuate; margin entire; nervation pinnate, lamina pilose to puberulent above when young, becoming glabrate; pilose to velutinous below when young, becoming puberulent or glabrate.

Inflorescences axillary, pedunculate, strobilaceous; (3.0–) 4.0–6.0 (–7.0) cm long; developed in the upper part of the branches; leaves often fallen or falling at anthesis; inflorescence axis densely puberulent to strigose, with cystoliths; triangular or terete. Bracts pale green or pale greenish-yellow, broadly ovate 14–26 (–30) mm long and 10–18 mm broad; l/w-ratio: (1.1–) 1.4–2.2 (–2.9); apex long acuminate to acute; base cordate in the lower part of the inflorescence and subcordate to truncate or attenuate in the upper part; margin entire, ciliate, often wrinkled; with 5 distinct nerves, strigose or puberulent above, mostly on the nerves; puberulent below. Bracteoles hidden by the bracts; of the same colour as the bracts; first order bracteoles narrowly ovate, 14–21 mm long and 4–6 mm broad; l/w-ratio: 2.8–4.4 (–6.0); long acuminate to acute, margin ciliate; with 3 distinct nerves, camptodrome-reticulate; puberulent above and below; second order bracteoles

teoles similar to those of first order, 5–7 mm long and 1–2 mm broad; third order 2–4 mm long and 1 mm broad; if flower buds of higher order develop, the bracteoles of higher order will be of the same length as the buds. Peduncle 1.0–3.0 cm long, terete with four grooves; densely puberulent.

Calyx 5–7 mm long, strigose to puberulent without, sometimes only on the 5 distinct nerves; puberulent within; lobes narrowly oblong to triangular, 3.5–4.5 mm long and 1–2 mm broad.

Corolla greenish yellow or pale yellow brown; 2.2–3.0 cm long, almost concealed by the bracts, outside pilose to sericeous, more densely at the base; glandular; hairs downward-pointing. Corolla tube 10–12 mm long and 3 mm in diameter; lateral invaginations 4 mm from the base. Upper lip 13–19 mm long and 10 mm broad; apex entire to emarginate. Lower lip inrolled at anthesis, narrowly oblong, 13–19 mm long and 3–4 mm broad; lobes 2–3 mm long, lateral lobes 1–1.5 mm broad, central lobe 1.5–2 mm broad.

Stamens. Filaments 1.2–2.0 (–2.1) cm long; glabrate. Anthers 3–4 mm long. Pollen grains prolate, 51–60 × 31–37 µm; pores lalongate, 4 × 2.8 µm; trema area with 4 rows of insulae, 3.5 µm in diameter; NPC: 244. – Fig. 2O.

Ovary 2–3 mm long and 1.5 mm broad; glandular, often only at the distal part and on the suture. Style 1.9–2.7 cm long, puberulent to above the middle. Discus 1.5 mm high, 1.5 mm in diameter. Capsules 20–25 mm long, 6–7 mm broad and 4–5 mm thick, glandular. Seeds 6 mm long, 5–6 mm broad and 1 mm thick; with a longitudinal ridge; reticulate-areolate.

Distribution: Tanzania, Zambia, Rhodesia. – Fig. 13.

Ecology: From 480–1200 m a.s.l. Recorded from deciduous woodland (Zambia); riverine forest (Rhodesia, Tanzania); *Combretum* bushland or *Acacia*-, *Cordia*-*Commiphora* thickets (Tanzania). Flowering in the first part of the dry season from late April–May–June. Later a few flowers together with developed mature capsules in July to September.

9. *Anisotes umbrosus* Milne-Redhead

Anisotes umbrosus Milne-Redhead 1935: t. 3267; Brenan and Greenway 1949: 2. – Type: Tanzania, Upper Tubugwe Valley, Mpwapwa, 3 Aug. 1933, Burtt 4776 (EA lectotype, selected here, K isotype).

Illustration: Milne-Redhead 1935: t. 3267.

Thick-stemmed shrubs, 1.5–2.4 m high; young branches greenish, distinctly tetragonous; internodes short; hirsute to velutinous or pilose; indumentum on all sides near the apex; lower down sparser and restricted to two opposite edges; older branches subtetragonous; glabrate.

Leaves with petiole (1.5–) 2.5–4.2 cm long, carinate; velutinous, later hairy only in the groove; lamina narrowly elliptic to elliptic or rarely ovate, (10.0–) 15.0–25.0 (–33.0) cm long and (3.5–) 5.0–9.0 (–15.0) cm broad; l/w-ratio: (2.1–) 2.4–3.2 (–3.5); apex shortly acuminate to obtuse or acute; base attenuate; margin entire, ciliate or glabrate; nervation pinnate; lamina strigose, hirsute or with simple hairs or glabrate above; velutinous, strigose or glabrate below.

Inflorescences axillary, pedunculate; (3.0–) 5.0–8.0 (–12.0) cm long; bracts ovate (16–) 18–25 mm long and (9–) 10–13 (–16) mm broad; l/w-ratio: (1.4–) 1.6–2.0 (–2.3); apex shortly acuminate–acute; base subcordate to shortly attenuate; margin entire, ciliate; with 5 distinct nerves, puberulent to strigose or velutinous; above usually mainly on the nerves; more sparsely haired below. Bracteoles concealed by the bracts, narrowly obovate to narrowly elliptic, 9–13 mm long and 2–3.5 mm broad; l/w-ratio: (2.7–) 3.1–4.7 (–5.3); apex acuminate; margin entire, ciliate; with 3 distinct nerves, camptodrome-reticulate; densely strigose. Peduncle 1.5–3.0 cm long; tetragonous; strigose to velutinous, hairs downward pointing.

Calyx 7–10 mm long; densely glandular, puberulent on the 5 distinct nerves; lobes triangular or narrowly oblong with acuminate apex, (5–) 7–8 mm long and 1.5–2 mm broad; ciliate; with 3 nerves; sericeous-strigose within.

Corolla (3.0–) 3.3–3.7 cm long; glandular and sparsely puberulent without, glabrate within. Corolla tube (10–) 12–14 mm long and 4 mm in diameter; lateral invaginations 4–6 mm from the base. Upper lip 19–23 mm long and 10–12 mm broad; apex acuminate, entire to 2-fid. Lower lip at anthesis involute and twisted, narrowly oblong, 19–23 mm long and 3–4 mm broad; 3-fid nearly to the base; lobes 15–18 mm long, lateral lobes 1.5–2 mm broad, central lobe 2–3 mm broad.

Stamens. Filaments (1.2–) 1.7–2.0 cm long; glabrate. Anthers 2–3.5 mm long. Pollen grains with an indication of faint colpi, prolate, 60–65 × 37–44 µm; pores lalongate 7 × 4 µm; trema area with 4 rows of insulae, 3–4 µm in diameter; NPC: 244 (5). – Fig. 2N.

Ovary 2–4 mm long, 1.5–2 mm broad and 1–1.5 mm thick; glandular. Style 2.3–2.9 cm long, puberulent to strigose below the middle. Discus 1 mm high and 1.5 mm in diameter. Capsules 20–22 mm long, 8.5 mm broad and 5 mm thick; glandular-pubescent. Seeds 6 mm long, 5 mm broad and 1 mm thick; margin rugose.

Distribution: Only known from Tanzania (Morogoro District, Mpwapwa District and Handeni District) – Fig. 13.

Ecology: From 500–1100 m a.s.l. Recorded from riverine forest, on banks of dry streams in riverine forest or from margins of shady streambed ravines. Flowering specimens from July–August and October.



Fig. 14. *Anisotes nyassae*. A: habit. – B: inflorescence. – C: bract. – D: bracteole. – E: flower. – F: inside view of corolla. – G: calyx. – H: ovary, style and disc. – J: enlargement of ovary. – K: capsule. – A–J: Semsei 2529; K: Fanshawe 11546.

10. *Anisotes nyassae* C. Baden

Anisotes nyassae C. Baden 1981a: 36 (Latin diagnosis). – Malawi, Misuku Hills, Müller 1675 (K holotype, SRGH isotype).

The name refers to Lake Nyasa (Now Lake Malawi).

Lax shrubs; 2.0–2.5 (–4.5) m high; young branches subtetragonous to terete; velutinous to strigose or puberulent; older branches terete; glabrate.

Leaves with petiole 1.0–2.0 cm long; half terete to carinate; densely strigose to velutinous; lamina narrowly elliptic to elliptic, 11.0–20.0 cm long and 4.0–7.0 cm broad; l/w-ratio: 2.8–3.2; apex acuminate to obtuse or rarely acute; base attenuate; margin entire or weakly crenate; nervation pinnate-reticulate; lamina dark green above, sparsely scabrate; paler below; nerves scabrate to velutinous.

Inflorescences axillary, pedunculate; 2.0–4.5 cm long; inflorescence axis densely puberulent, subtetragonous; bracts sessile, narrowly elliptic to elliptic, 14–18 mm long and 4–7 mm broad; l/w-ratio: 2.5–3.3; apex acuminate; puberulent; nerves strigose; margin entire, ciliate; with 3 main nerves; bracteoles narrowly triangular or filiform, 3–5 (–9) mm long and 0.5–1.5 mm broad; puberulent; bracteoles of higher order filiform, 2 mm long. Peduncle 2.4–4.0 cm long; terete to angular; puberulent.

Calyx 7–9 mm long; the outside puberulent; lobes narrowly elliptic to narrowly triangular, 5–7 mm long and 1.5–2 mm broad.

Corolla 3.2–3.8 cm long; purple or pinkish purple; glandular without, glabrate within. Corolla tube 15–17 mm long, 1–2 mm in diameter at the base, 2–3 mm in diameter at the apex; lateral invaginations 4–6 mm from the base. Upper lip (16–) 17–23 mm long and 8–11 mm broad; apex acuminate to obtuse. Lower lip 16–23 mm long; divided to the base; inrolled at anthesis; lateral lobes 16–22 mm long and 1.5–2 mm broad, central lobe narrowly oblong, 16–23 mm long and 2–2.5 mm broad; apex obtuse.

Stamens. Filaments 1.9–2.2 cm long. Anthers 2–2.5 mm long. Pollen grains with indication of a faint colpus, prolate, 37–41 × 21–23 µm; pores lalongate, 7 × 5 µm; trema area with 4 rows of insulae, 3 µm in diameter; NPC: 244 (5). – Fig. 2M.

Ovary 3 mm long, 2 mm broad and 1 mm thick; distal part and suture glandular. Style 2.9–3.1 cm long, puberulent at the base. Capsules 20–24 mm long, 8 mm broad and 4 mm thick; densely hirsute to velutinous. Seeds 4.5 mm long, 3.5 mm broad and 1 mm thick; rugose with a longitudinal ridge. – Fig. 14.

Distribution: Tanzania (Songea District), Malawi (Karonga District) and Zambia (Northern Province). – Fig. 13.

Ecology: About 1800 m a.s.l. Recorded from stream-sides in montane forests (Zambia), in mixed evergreen forest (Malawi) or on edge of forest (Tanzania).

Section V. *Spiciflori* C. Baden

Sect. *Spiciflori* C. Baden 1981a: 35 (Latin diagnosis). – Type species: *A. formosissimus* (Klotzsch) Milne-Redhead.

Shrubs, inflorescences spikes, pollen 3-porate, trema area with two colpoid streaks.

Species: *A. formosissimus*, *A. madagascariensis*.

Distribution: Mozambique, Rhodesia, S Malawi and Madagascar.

11. *Anisotes formosissimus* (Klotzsch) Milne-Redhead

Anisotes formosissimus (Klotzsch) Milne-Redhead 1954b: 25. – Basionym: *Adhatoda formosissima* Klotzsch 1862: 215. – *Symplectochilus formosissimus* (Klotzsch) Lindau 1894: 45; 1895a: 339; 1895b: 372. – *Macrorungia formosissima* (Klotzsch) C. B. Clarke 1900: 255; Schijff 1969: 88. – Type: Mosambique, Lower Zambesi, Sena, Peters s.n. (K lectotype, selected here).

Erect to semi-scandent shrubs 1.0–2.5 (–4.0) m high; young branches erect; greenish; tetragonous with grooved sides; grooves with longitudinal rows of elliptical cystoliths often giving the stems a striped appearance; glabrate or with simple hairs; brachyblasts opposite, tetragonous, puberulent; older branches becoming greyish, terete to subtetragonous.

Leaves with petiole (0.5–) 0.6–2.0 (–3.5) cm long; carinate, glabrate; lamina ovate to elliptic, (3.0–) 3.4–7.0 (–11.0) cm long and 1.9–3.9 (–5.0) cm broad; l/w-ratio: (1.2–) 1.4–2.4 (–2.9); apex obtuse; base wedge-shaped or rarely truncate; margin entire; nervation pinnate; lamina light green above, glabrate; strigose to sericeous when young; lamina glaucous and glabrate below.

Spikes 2.1–6.5 (–13.0) cm long; terminal on axillary brachyblasts or main shoot; inflorescence axis tetragonous, strigose to pilose and glandular; bracts imbricate in four rows; all supporting flowers; rhomboid to elliptic, 10–14 (–17) mm long and 3–4.5 (–5) mm broad; l/w-ratio: (2.4–) 2.7–4.3 (–5.0); with 5 distinct ribs, and sometimes indistinct axillary ribs; apex acute; margin pale and involute, ciliate; strigose on the ribs above; glandular, with subsessile glands; sparsely sericeous at the distal part below. Bracteoles narrowly elliptic to triangular, (6–) 8–11 (–12) mm long and 1.5–2.5 mm broad; l/w-ratio: 4.0–5.5 (–7.0); densely glandular, with sessile glands; curved to keeled; margin pale, ciliate; 3 distinct ribs, densely pilose on the midrib.



Fig. 15. *Anisotes formosissimus*. A: habit. – B: bract. – C: bracteole. – D: flower. – E: inside view of corolla. – F: ovary, style and disc. – G: calyx. – H: anther. – A–H: Davies D2785.

Calyx (7–) 8–10 (–11) mm long; strigose to sericeous; lobes bracteole-like, narrowly elliptic to triangular, 6–8 (–9) mm long and 1.5–2 mm broad; weakly curved; with 3–5 ribs; densely glandular and with simple hairs on the ribs; margin ciliate.

Corolla (4.3–) 4.4–5.0 (–5.3) cm long; greenish pink, reddish or rarely yellow; glandular-pubescent. Corolla tube 12–18 (–21) mm long; lateral invaginations 6–10 mm from the base. Upper lip (28–) 30–33 (–35) mm long and 9–11 mm broad; apex emarginate to 2-fid. Lower lip at anthesis involute and twisted, narrowly obovate, (25–) 27–30 (–33) mm long and 3.5–4.5 mm broad; lobes 6–8 (–9) mm long; lateral lobes 1–2 mm broad, central lobe 2–3 mm broad, lobes obtuse with involute margin.

Stamens. Filaments 2.5–3.0 cm long. Anthers 3–4 mm long. Pollen grains with indications of faint colpi, prolate, $51\text{--}60 \times 31\text{--}41 \mu\text{m}$, pores along $5.5 \times 3.5 \mu\text{m}$, margin with very small processes; trema area with two reticulate bands (colpoid streaks); NPC: 244 (5). – Fig. 2S.

Ovary 1.5–2.5 mm long, 1 mm broad and 1 mm thick; glabrate. Style (3.8–) 4.0–4.5 (–4.9) cm long; puberulent below the middle. Discus 0.5–1 mm high and 1 mm in diameter. Capsules 30 mm long and 4.5 mm broad. – Fig. 15.

Distribution: Malawi, Rhodesia, Mozambique, South African Republic (Transvaal). – Fig. 16.

Ecology: From 200–600 (–1500) m a.s.l. Recorded from the following vegetation types: Riverine forest (Rhodesia, Mozambique, South African Republic); *Colophospermum mopane*- and *Acacia* woodlands (Rhodesia); *Julbernardia* woodland, evergreen forest or giant grass thicket (Malawi); or from *Copaifera* forest (Mozambique). Reported to grow on bare ground, on sandy soil or on clayey loam. Flowering specimens from April to August.

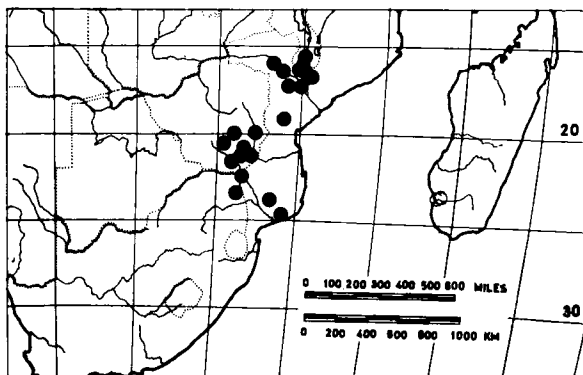


Fig. 16. Distribution of *Anisotes formosissimus* (dots); *A. madagascariensis* (open dots).

Notes: Borzi (1908) and later Cufodontis (1965) cites a *Macrorungia* (*Anisotes*) *formosissima* from Ethiopia. This must be a wrong determination although the specimens in Florence have not been seen.

12. *Anisotes madagascariensis* Benoist

Anisotes madagascariensis Benoist 1929: 1036. – Type: Madagascar, Perrier de la Bâthie 9494 (P lectotype, selected here); Poisson 234, Poisson 277 (P), Decary 2729 syntypes.

Small to medium sized shrubs; 2.0–3.0 m high; young branches terete; densely greyish-white, tomentose; older branches with cracks and irregular tomentose.

Leaves evergreen; with petiole (0.3–) 0.4–0.8 (–1.0) cm long; carinate; densely tomentose; lamina ovate to obovate, 2.0–4.5 cm long and 1.4–2.5 cm broad; l/w-ratio: 1.5–1.9; apex rounded to obtuse or emarginate; base cuneate; lamina densely tomentose; nervation pinnate, only visible on older leaves; nerves tomentose; on older leaves only haired on the sides.

Spikes axillary, pedunculate; 0.4–1.2 cm long; 5–7 flowered; inflorescence axis tomentose; bracts triangular to broadly triangular, 1.5–2.5 mm long and 1.5–2 mm broad; l/w-ratio: 1.2–1.3; tomentose; bracteoles not seen. Peduncle 5–15 mm long; subtrigonous, grooved; tomentose to sparsely tomentose.

Calyx 2.5–3.5 (–4) mm long; glabrate; lobes ovate to elliptic, 1.5–2 mm long and 0.5–1 mm broad; apex acute; margin ciliate.

Corolla (4.0–) 4.6–4.8 cm long; red; the outside glabrate. Corolla tube 13–14 mm long; 3 mm in diameter; lateral invaginations 5 mm from the base. Upper lip 30–36 mm long and 10 mm broad; apex entire or emarginate. Lower lip at anthesis involute and twisted, 30–34 mm long and 3–4 mm broad; lobes 15 mm long, lateral lobes 2–2.5 mm broad, central lobe 3–3.5 mm broad; obtuse.

Stamens. Filaments 2.5 cm long; glabrate. Anthers 4 mm long. Pollen grain prolate, $68\text{--}74 \times 34\text{--}42 \mu\text{m}$, trema area with two colpoid streaks (longitudinal bands); NPC 344.

Ovary 2–3 mm long and 1–1.5 mm broad; densely strigose to puberulent, hairs upward-pointing. Style 3.5 cm long, glabrate. Discus 1 mm high and 1.5 mm in diameter. Capsule not seen. – Fig. 17.

Distribution: Endemic on Madagascar. – Fig. 16.

Ecology: From 1–10 m a.s.l. Recorded from dunes along rivers. Flowering specimens from June to September.



Fig. 17. *Anisotes madagascariensis*. A: habit. – B: inflorescence. – C: bract (note the indumentum). – D: flower. – E: inside view of corolla. – F: enlargement of lateral invagination. – G: apex of upper lip. – H: calyx. – J, K: ovary, style and disc of two different specimens. – L: anther. – A–J, L: Perrier de la Bâtie 9494; K: Humbert 2425.

Sectio VI. *Anisotes* mut. char.

Baden 1981a: 35.

Flores solitarii, in spicas 2 (4) floras collecti vel in inflorescentiam 6 floram; granum pollinis 3 porum, area trematica insulis reticulatis seriatis ornata.

Species typifica *Anisotes trisulcus* (Forssk.) Nees.

Distributed from Yemen to Rhodesia in E Africa.

Shrubs, inflorescences axillary, in pedunculate or sessile 2-(4)-flowered spike, 6-flowered synflorescence or flowers solitary, enclosed by two pairs of bracts; pollen 3-porate, very rarely 2-porate, trema area with 2 rows of insulae.

Species: *A. trisulcus*, *A. velutinus*, *A. tanensis*, *A. involucratus*, *A. rogersii*, *A. sessiliflorus*, *A. parvifolius*.

Distribution: From Yemen and Ethiopia to Rhodesia.

Notes: Species with apparently solitary flowers must be referred to this section since intermediary forms with rudiments of additional flowers in the axils of the bracteoles also occur; sometimes both solitary and 2-flowered inflorescences occur on the same specimens. The pollen supports this placing.

13. *Anisotes trisulcus* (Forssk.) Nees

Anisotes trisulcus (Forssk.) Nees 1847: 424; Deflers 1889: 182; Rolfe 1894: 338; Schwartz 1939: 259; Cufodontis 1964: 978. – Basionym: *Dianthera trisulca* Forsskål 1775: 7. – *Justicia trisulca* (Forssk.) Vahl 1791: 10; Willdenow 1797: 97; Vahl 1804: 161; Dietrich 1831: 403. – Type: Arabia, Surdud, Forsskål s.n. (C. holotype). *Justicia biflora* Lamarck 1788: 629. – Type: not seen.

Subshrubs to medium sized shrubs or small tree-like shrubs; 0.6–3.0 m high; young branches subtetragonous or terete; tomentose or puberulent; older branches terete; glabrate; bark with cracks.

Leaves with petiole 0.2–1.3 (–1.9) cm long; carinate; densely puberulent to tomentose; lamina ovate to obovate, (1.2–) 1.8–4.7 (–8.2) cm long and (0.6–) 1.0–3.2 (–4.7) cm broad; l/w-ratio: (0.9–) 1.0–2.1 (–2.4); apex rounded to obtuse or emarginate, rarely acute; base cuneate to truncate or shortly attenuate; nervation pinnate lamina coriaceous; rugose above,

densely puberulent to tomentose when young, becoming sparsely puberulent, often only on the nerves, or glabrate.

Inflorescences axillary, reduced pedunculate 2-(4)-flowered spikes; developed on brachyblasts or branches with short internodes; two lateral flowers plus an abortive middle bud terminate the peduncles, enclosed by two opposite bracts; each flower always with two bracteoles; bracts narrowly obovate to narrowly oblong, 2.5–5 (–6) mm long and 1–2 mm broad; l/w-ratio: (1.3–) 1.6–3.9 (–5.0); apex acute to obtuse; puberulent to tomentose; bracteoles triangular, 1.5–3 mm long and 1–2 mm broad; l/w-ratio: 1.1–2.7; keeled; puberulent to tomentose; bract/bracteole ratio: 1.3–2.5. Peduncle 1.5–5 mm long; subtetragonous, grooved; puberulent to tomentose.

Calyx 4–6 mm long; shortly strigose to puberulent; lobes triangular, 2–4 mm long and 1–2 mm broad.

Corolla (3.5–) 4.0–5.0 (–5.7) cm long; orange-red or yellow, reddening with age; glandular-pubescent without, pilose within, mostly on the nerves. Corolla tube distally ± funnel-shaped, 8–12 (–13) mm long; 2–3 mm in diameter at the base, 4–6 mm in diameter at the apex; a large ventral invagination at the transition to the lower lip; lateral invaginations 5–7 mm from the base. Upper lip (29–) 31–39 (–46) mm long and 11–17 mm broad; apex 2-fid to emarginate; lobes 0.5–2 mm long and 0.5–2 mm broad. Lower lip narrowly oblong, (28–) 31–37 (–41) mm long and 3.5–5 mm broad; lobes 2–7 (–9) mm long; lateral lobes 1.5–2 mm broad, central lobe 2–3 mm broad; obtuse.

Stamens. Filaments (2.5–) 2.8–3.4 (–3.9) cm long; glabrate. Anthers 3–4 mm long.

Ovary 2–3 mm long, 1–1.5 mm broad and 0.5–1 mm thick; densely hirsute over the whole surface or strigose at the transition to the style and on the suture, or glabrate; if hairs present, upward-pointing. Style (3.3–) 3.5–4.7 (–5.5) cm long, puberulent at the base or glabrate. Discus 1–1.5 mm high and 1–2 mm in diameter. Capsule 22–40 mm long, 6–10 mm broad and 3–6 mm thick; glabrate. Seeds 4–6 mm long, 4.5–6 mm broad and 1.5–2.5 mm thick; rugose.

Distribution: Ethiopia, Somalia, Socotra, Yemen, Dem. Rep. Yemen, Saudi Arabia.

Ecology: From 250–2400 m a.s.l. In bushland and dry wadi beds or deserts. Further information under subspecies.

Key to the subspecies

1. Ovary strigose at the transition to the style and on the suture, or glabrate; corolla tube distally distinctly funnel-shaped; upper lip 14–17 mm broad, apex 2-fid; lower lip deeply 3-fid, lobes 4–7 mm long ssp. *trisulcus*
1. Ovary densely hirsute on the entire surface; corolla tube distally weakly funnel-shaped; upper lip 11–15 mm broad, apex emarginate; lower lip 3-fid, lobes 2–4 mm long ssp. *webi-schebeliensis*

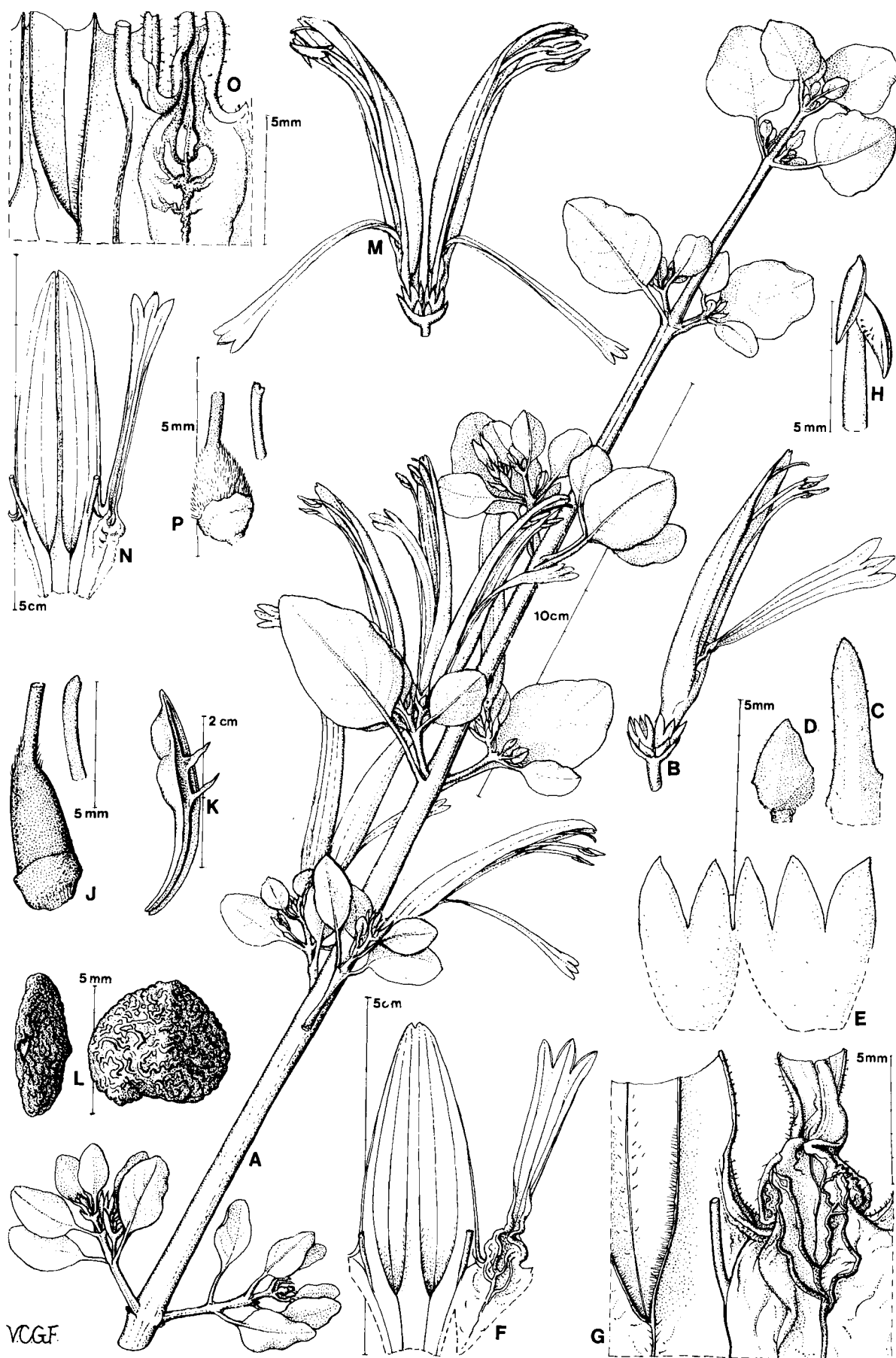


Fig. 18. *Anisotes trisulcus* ssp. *trisulcus* (A–L), and *A. trisulcus* ssp. *webi-schebeliensis* (M–P). A: habit. – B: inflorescence. – C: bract. – D: bracteole. – E: calyx (opened). – F: inside view of corolla. – G: detail of transition from tube to lower lip. – H: anther. – I: ovary, style and disc. – J: capsule. – K: seed. – L: seed. – M: inflorescence. – N: inside view of corolla. – O: detail of transition from tube to lower lip. – P: ovary, style and disc. – A–J: Rauh 13339; K–L: Grierson 164; M–P: Ellis 334.

13a. *Anisotes trisulcus* (Forssk.) Nees ssp. *trisulcus*

Leaves with petiole 0.5–1.3 (–1.9) cm long. Bracts narrowly obovate to narrowly oblong, apex acute; bract/bracteole-ratio: (1.5–) 1.8–2.4 (–2.5).

Corolla tube distally distinct funnel-shaped, 8–12 mm long; 5–6 mm in diameter at the apex. Upper lip 14–17 mm broad, apex 2-fid; lobes 1–2 mm long and 1–2 mm broad. Lower lip deeply 3-fid, lobes 4–7 (–9) mm long.

Pollen grains prolate, $53\text{--}60 \times 34\text{--}43 \mu\text{m}$; pores lalongate, $9 \times 7 \mu\text{m}$; trema area with two rows of insulae, $5.5 \mu\text{m}$ in diameter, may coalesce near the poles; NPC: 344. – Fig. 2L.

Ovary strigose at the transition to the style and on the suture or glabrate. – Fig. 18.

Distribution: Yemen, Dem. Rep. Yemen, Socotra, Saudi Arabia. – Fig. 19.

Ecology: From 250–2400 m a.s.l. Recorded from stony wadi beds, which are often dried up, deserts or dry mountains, on sandy or sandy rocky soil. Flowering specimens collected from all months of the year, but most commonly from December to April.

13b. *Anisotes trisulcus* (Forssk.) Nees ssp. *webi-schebeliensis* C. Baden

Anisotes trisulcus (Forssk.) Nees ssp. *webi-schebeliensis* C. Baden 1981a: 36 (Latin diagnosis). – Type: Ethiopia, Hararghe Province, 72 km from Shillavo to Kellafo, 19 June 1971, Gilbert 2122 (EA holotype, K isotype). The name refers to the Webi Schebeli river at the type locality. *A. sessiliflorus* auct. non (T. Anders.) Clarke: Lindau (1896) Clarke (1900), quoad Robechi 546, 553, 652.

Leaves with petiole 0.2–0.6 cm long.

Inflorescence develops when leaves are nearly fallen, sometimes a 4-flowered spike where the terminal bud continues the growth before terminating with a decussate repetition of the 2-flowered spike. Bracts narrowly oblong; apex acute-obtuse; bract/bracteole-ratio: 1.3–1.7 (–2.0).

Corolla tube distally weakly funnel-shaped, 9–11 (–13) mm long; 4–5 mm in diameter at the apex. Upper lip 11–15 mm broad; apex emarginate, lobes 0.5–1 mm long and 0.5–1 mm broad. Lower lip 3-fid, lobes 2–4 (–5) mm long.

Pollen grains with indications of colpi; prolate, $60\text{--}68 \times 36\text{--}48 \mu\text{m}$; pores circular, up to $10 \mu\text{m}$ in diameter; trema area with two rows of coalescing insulae, $5.5 \mu\text{m}$ broad; NPC: 344. – Fig. 2K.

Ovary densely hirsute over the entire surface. Capsules not seen. – Fig. 18.

Distribution: Ethiopia, Somalia. – Fig. 19.

Ecology: From 450–600 m a.s.l. Recorded from *Acacia-Commiphora* bushland on red sandy or rocky

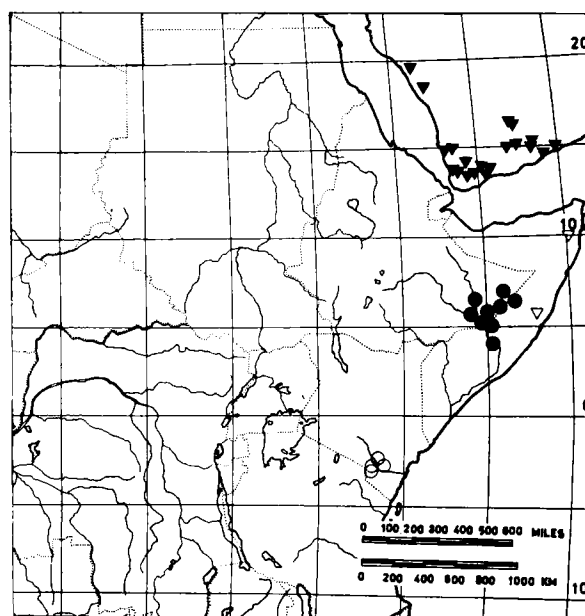


Fig. 19. Distribution of *Anisotes trisulcus* ssp. *trisulcus* (triangles), and *A. trisulcus* ssp. *webi-schebeliensis* (dots), *A. ukambensis* (open dots); *A. velutinus* (open triangles).

soil. Flowering specimens from April, June, July and October and from December to February.

14. *Anisotes velutinus* Lindau

Anisotes velutinus Lindau 1894: 76; Clarke 1900: 227; Cufodontis 1964: 978. – Type: Somalia, Al Mountain, March 1875, Hildebrandt 855^b, (not seen).

Shrubs, 0.5–1.2 m high; young branches terete to angled; tomentose to puberulent; older branches terete; glabrate; with opposite brachyblasts, tomentose to villous.

Leaves with petiole 0.2–0.5 cm long; half terete to carinate; villous; lamina ovate, 1.2–1.6 cm long and 0.7–1.0 cm broad; l/w-ratio: 1.4–1.9; apex obtuse; base cuneate; nervation pinnate; lamina densely tomentose.

Inflorescences 2-flowered spikes; axillary on brachyblasts sessile or subsessile to pedunculate; peduncles if present up to 1.5 mm long; bracts narrowly oblong, 3–5 mm long and 1–1.5 mm broad; l/w-ratio: 3.0–3.5; apex acute; puberulent; bracteoles narrowly triangular; 1.5–2.5 mm long and 1 mm broad; l/w-ratio: 1.0–2.5; puberulent.

Calyx 4.5–5.5 mm long; puberulent; lobes narrowly triangular, 3–3.5 mm long and 1–1.5 mm broad.

Corolla 4.2–4.6 cm long; flaming red; sericeous without; pilose within; in bud densely sericeous. Corolla tube 9–11 mm long; 2–3 mm in diameter at the base, 3–4 mm in diameter at the apex; lateral invaginations 5 mm from the base. Upper lip 33–35 mm long and



VCGF.

Fig. 20. *Anisotes tanensis*. A: habit. – B: branch with leaves and inflorescence. – C: bract. – D: bracteole. – E: flower. – F: calyx. – G: ovary, style and disc. – H: inside view of corolla. – J: capsule valve. – A, C–J: Gillett and Newbould 19180; B: Kirrika 114.

10–12 mm broad; apex 2-fid, lobes 0.5 mm long; lower lip narrowly oblong; 32–34 mm long and 4 mm broad; lobes 5 mm long, lateral lobes 2 mm broad, central lobe 2.5 mm broad.

Stamens. Filaments 3.0 cm long. Anthers 3–3.5 mm long. Pollen grains prolate.

Ovary 2–3 mm long, 1–1.5 mm broad and 1 mm thick; hirsute at the distal part and on the suture; hairs upward-pointing. Style 4.0–4.1 cm long; puberulent to strigose below the middle. Discus 1 mm high and 1.5 mm in diameter. Capsule 24–26 mm long, 7 mm broad and 4 mm thick; densely puberulent. Seeds 4 mm long, 4 mm broad and 1 mm thick; rugose.

Distribution: Only known from Somalia (Mijertein and Obbia). – Fig. 19.

Ecology: From 540–2000 m a.s.l. Recorded from limestone hill slopes with stones over a fine dusty soil. Flowering specimens from May and October.

15. *Anisotes tanensis* C. Baden

Anisotes tanensis C. Baden 1981a: 36 (Latin diagnosis). – Type: Kenya, Garissa Dist., Mado Gashi, 4–5 June 1970, Gillett and Newbould 19180 (M holotype, EA, MO, UPS isotypes).

A. parvifolius auct. non Oliv.: Dale and Greenway (1961) quoad Gillett 13285.

The name refers to the Tana River at the type locality.

Shrubs; 1.2–3.0 m high; young branches terete, villous to tomentose or puberulent; older branches terete, glabrate; bark dark grey and smooth; with opposite brachyblasts; villous.

Leaves deciduous, with petiole 0.2–0.7 cm long; carinate, villous; lamina ovate, 3.0–7.0 cm long and 2.0–4.0 cm broad; l/w-ratio: 1.4–1.9; apex obtuse; base shortly attenuate to cuneate; nervation pinnate; lamina when young velutinous to villous, later sparsely puberulent; nerves when young villous, later tomentose to puberulent.

Inflorescences 2-flowered spikes; sessile or subsessile; axillary on brachyblasts; often several together; flowers enclosed by two opposite bracts; narrowly obovate to obovate or narrowly oblong to oblong, 5–9 (–11) mm long and 2–5 (–6) mm broad; l/w-ratio: 2.3–3.6 (–4.0); apex acute; villous to tomentose when young, later more sparsely haired; bracteoles narrowly triangular or narrowly oblong, 2.5–4.5 (–6) mm long and 1–2 mm broad; l/w-ratio: 3.0–4.0, villous to tomentose, peduncle 0.5–1.5 mm long or absent.

Calyx 4–5 mm. long; villous to tomentose or puberulent without, hairs downward-pointing; puberulent within; lobes narrowly triangular, 2.5–3 mm long and 1–1.5 mm broad.

Corolla 45–55 (–59) mm long; yellow to orange-red, densely glandular without; with few hairs at the base;

glabrate within. Corolla tube 11–14 mm long; 2–2.5 mm in diameter at the base, 3–4 mm in diameter at the apex; lateral invaginations 7–9 mm from the base. Upper lip (31–) 33–41 (–46) mm long and 10–12 mm broad; apex 2-fid, 0.5–1 mm long and 0.5–1 mm broad. Lower lip at anthesis involute; narrowly oblong, 30–40 (–44) mm long and 3–4 mm broad; lobes 3–4 mm long, lateral lobes 1–1.5 mm broad, central lobe 1.5–2 mm broad.

Stamens. Filaments 2.9–3.7 (–4.0) cm long. Anthers 3–4 cm long. Pollen grains subprolate, 51–54 × 41–48 µm; pores circular, 9 µm in diameter, margin with small processes; trema area with two reticulate bands (colpoid streaks); NPC: 344. – Fig. 2E.

Ovary 1.5–2.5 mm long, 1–1.5 mm broad and 1 mm thick; hirsute at the distal part and on the suture. Style (3.8–) 4.2–5.2 (–5.4) cm long; glabrate or pilose at the base. Discus 1 mm high and 1–1.5 mm in diameter. Capsule 28–34 mm long, 8 mm broad and 5–6 mm thick; puberulent. Seeds 6 mm long, 5 mm broad and 1 mm thick; rugose. – Fig. 2.

Distribution: Kenya (Tana District, Garissa District, Isiolo District), and Ethiopia (Sidamo District). – Fig. 8.

Ecology: From 250–400 (–600) m a.s.l. Recorded from close to open *Acacia-Commiphora* bushland or from riverine thicket. Reported to grow on red sandy soil, pale limestone soil, pale buff sandy soil or alluvial soil. Flowering specimens from late December to February and from May to June.

16. *Anisotes involucratus* Fiori

Anisotes involucratus Fiori 1915: 59; Chiovenda 1916: 141; Cufodontis 1964: 977. – Type: Somalia, Margherita, 23/6 1913, Paoli and Stefanini 365 (FI lectotype, selected here), Paoli and Stefanini 80, 117, syntypes (FI).

A. parvifolius auct. non Oliv.: Chiovenda (1929) and Cufodontis (1965), quoad Paoli 616.

Anisotes trisulcus auct. non (Forssk.) Nees: Cufodontis (1964) quoad Bally 9526.

Illustration: Fiori 1915.

Woody shrublets or shrubs; 0.6–2.1 (–3.0) m high; young branches terete, densely tomentose; leaf scars continuing as two small ribs; older branches terete, without ribs; glabrate.

Leaves with petiole 0.4–0.8 (–2.0) cm long; carinate; farinaceous; lamina ovate to obovate, 2.0–4.0 (–6.0) cm long and 0.8–2.0 (–4.0) cm broad; l/w-ratio: (1.5–) 1.7–2.5 (–2.7), apex obtuse; base attenuate or rarely truncate; margin entire; lamina farinaceous or densely tomentose; nervation pinnate, often sparsely strigose below.

Inflorescences pedunculate, axillary 2-flowered spikes or 6-flowered synflorescences; two large opposite bracts near the end of the peduncles; each bract supporting 1 flower or a 3-flowered cyme; flowers of higher order may develop in the axils of the brac-

teoles; bracts ovate, (7–) 9–14 (–15) mm long and (5–) 7–11 mm broad; l/w-ratio: 1.3–1.8; apex obtuse with a short point; base cordate to subcordate or shortly attenuate; densely tomentose to villous; with 5 distinct nerves, palmately upwards ascending; midnerve and apex sometimes sparsely strigose; margin entire. First order bracteoles triangular, 2.5–3.5 mm long and 1 mm broad; l/w-ratio: 3.0–3.5; densely tomentose; curved; second order bracteoles 2 mm long and 1 mm broad; otherwise similar. Peduncles 3–7 (–9) mm long; farinaceous; subtetragonous, grooved.

Calyx 4–7 mm long; narrowing into a 1 mm long pedicel; densely puberulent to shortly hirsute and glandular without, puberulent within; lobes triangular, (2.5–) 3–5 mm long and 1 mm broad.

Corolla 3.7–4.2 cm long; wine red to orange, glandular-pubescent without, glabrate within. Corolla tube 8–11 mm long; 2.5 mm in diameter at the base, 3.5 mm in diameter at the apex; lateral invaginations 3–6 mm from the base. Upper lip 30–32 mm long and 9–12 mm broad; apex 2-fid, 1 mm long and 1 mm broad. Lower lip at anthesis twisted and sometimes involute; narrowly obovate, 30–31 mm long and 2–3.5 mm broad; lobes 2.5 mm long, lateral lobes 1–1.5 mm broad, central lobe 1.5–2 mm broad.

Stamens. Filaments 2.3–3.0 cm long glabrate. Anthers 3–3.5 mm long; with few hairs. Pollen grains prolate, $51\text{--}53 \times 31\text{--}34 \mu\text{m}$; pores lalongate, $7 \times 3.5 \mu\text{m}$; trema area with two rows of insulae, $4 \mu\text{m}$ in diameter, which may coalesce towards the poles; NPC: 344. – Fig. 2F.

Ovary 2–2.5 mm long, 1–1.5 mm broad and 1 mm thick; densely strigose, hairs upward-pointing. Style 2.8–3.4 cm long; puberulent below the middle and more densely so at the base. Discus 0.5–1 mm high. Capsule 25–26 mm long, 8 mm broad and 4 mm thick; densely puberulent. Seeds not seen.

Distribution: Somalia and Northern Kenya. – Fig. 8.

Ecology: From 10–600 m a.s.l. Recorded from *Acacia-Commiphora* bushland or from dunes in semi-desert vegetation. On sandy soil, sometimes near water holes. Flowering specimens from January–February and April–May.

Notes: The base of the bracts varies from cordate, a character correlated with large calyx (6–7 mm) and 3–6 flowered inflorescences, to shortly attenuate, correlated with smaller calyx (4 mm) and 2-flowered inflorescence. It seems that these characters are geographically correlated, because inland collections have 2-flowered inflorescences, smaller calyx and smaller bracts while specimens from the coast have more flowers and larger calyces and larger bracts, but the sample is too small to decide whether this represent a continuous variation or two varieties or even subspecies.

17. *Anisotes rogersii* S. Moore

Anisotes rogersii S. Moore 1919: 91; Schijff 1969: 89. – Type: Transvall, Zoutpansberg Div., Messina, 1918, Rogers 19349 (BM lectotype, selected here, G, S, Z isotypes).

Small woody shrublets or medium sized shrubs; 0.5–2.0 m high; young branches subtetragonous; villous to puberulent; older branches terete; glabrate, bark pale grey to grey; with opposite brachyblasts.

Leaves subsessile, or with petioles up to 0.2 cm long; lamina narrowly elliptic to elliptic or obovate, (3.0–) 3.4–5.7 (–8.0) cm long and 1.5–2.7 (–3.5) cm broad; l/w-ratio: (1.5–) 1.9–2.5; apex acuminate to obtuse; base attenuate to cuneate; nervation pinnate-reticulate, lamina light green; scabrate to strigose or puberulent to glabrate; margin entire, scabrate.

Inflorescences axillary, subsessile or pedunculate, flowers usually solitary with one abortive flower bud; inflorescences develop mostly on brachyblasts, usually in clusters; flowers enclosed by a pair of bracts and a pair of bracteoles; bracts narrowly oblong to narrowly triangular, (2.5–) 3–5 (–7) mm long and 1–2 mm broad; l/w-ratio: (1.7–) 1.9–3.5 (–3.7); apex acute to obtuse; tomentose to puberulent, hairs upward-pointing; bracteoles narrowly triangular, (1.5–) 2.5–4.5 (–7) mm long and 1–2 mm broad; l/w-ratio: (1.5–) 1.9–3.1; weakly keeled; otherwise similar to the bracts. Peduncles 1–2 mm long; tetragonous; densely tomentose.

Calyx (3.5–) 4–5 (–6) mm long; tomentose to densely puberulent without, sparsely strigose within; hairs upward-pointing; lobes narrowly triangular, 2–4 (–5) mm long and 1–1.5 mm broad.

Corolla (3.8–) 4.1–4.9 (–6.0) cm long; red-orange; glandular pubescent without and densely velutinous at the base; sparsely pilose within. Corolla tube (10–) 13–17 (–20) mm long; 2–3 mm in diameter at the base, 2.5–3.5 mm in diameter at the apex; lateral invaginations 5–9 mm from the base. Upper lip 28–33 (–40) mm long and 9–12 (–13) mm broad; apex 2-fid. Lower lip narrowly oblong, 26–32 (–35) mm long and (2–) 2.5–3.5 (–4) cm broad; lobes 1–3 mm long, lateral lobes 0.5–1 mm broad, central lobe 1–1.5 mm broad.

Stamens. Filaments 2.6–3.2 (–3.5) cm long; glabrate. Anthers 3–4 mm long. Pollen grain prolate, $58\text{--}63 \times 34\text{--}43 \mu\text{m}$; pores lalongate, $5 \times 3 \mu\text{m}$; trema area with two rows of insulae, elongated and finely coalesced towards the poles; NPC: 344. – Fig. 2J.

Ovary 2 mm long, 1.5 mm broad and 1 mm thick; densely strigose, hairs upwards pointing. Style 3.8–4.8 (–5.4) cm long, glabrate. Discus 1 mm high and 1–1.5 mm in diameter. Capsule 25–30 mm long, 8 mm broad and 6 mm thick; sparsely strigose. Seeds 6 mm long, 5 mm broad and 2 mm thick; rugose. – Fig. 21.

Distribution: Rhodesia (Gwanda District, Beitbridge District, Nuanetsi District, Melssetter District), South African Republic (Transvaal). – Fig. 23.

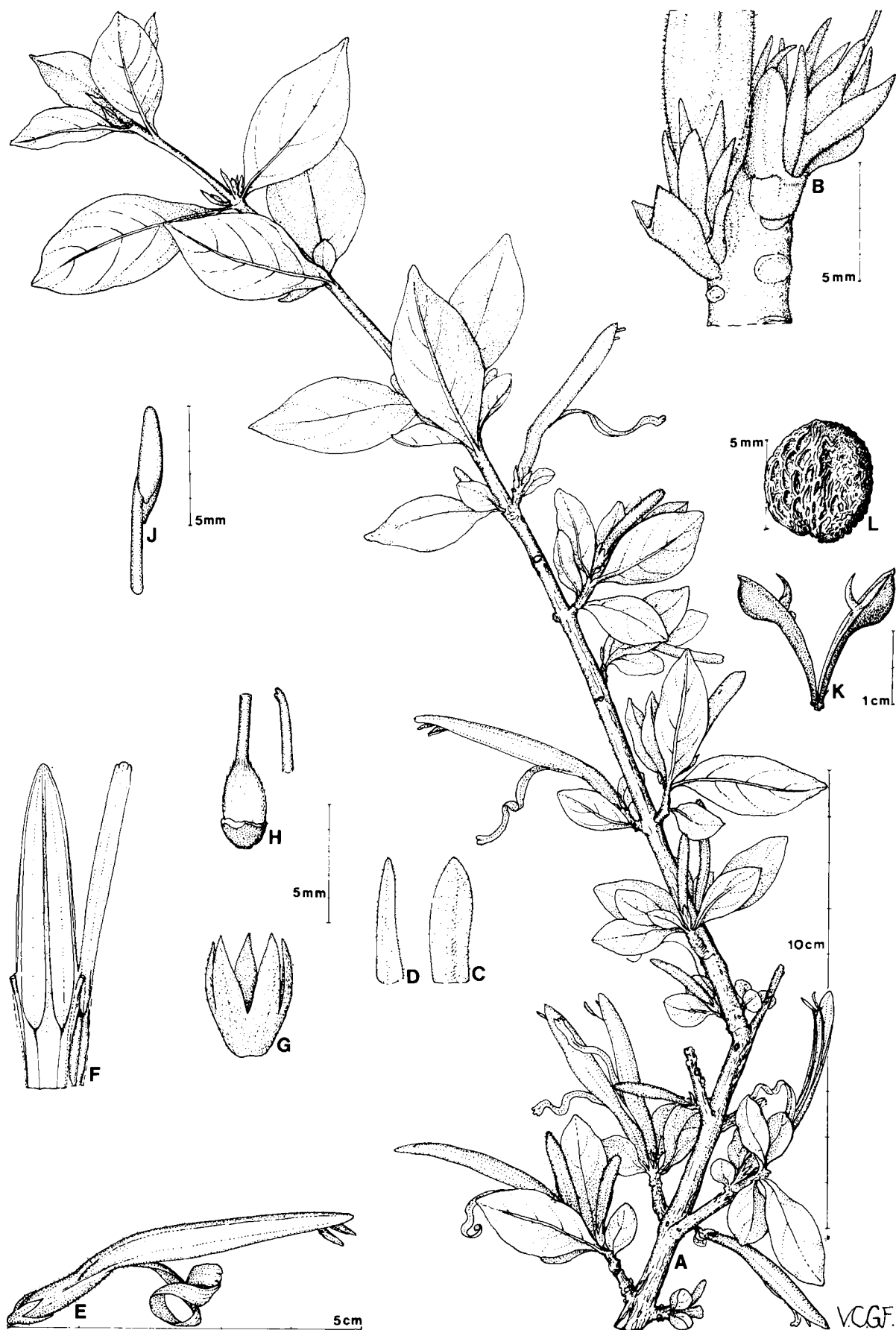


Fig. 21. *Anisotes rogersii*. A: habit. – B: inflorescence. – C: bract. – D: bracteole. – E: flower. – F: inside view of corolla. – G: calyx. – H: ovary, style and disc. – J: anther. – K: capsule. – L: seed. – A–J: Werdermann and Oberdieck 1985; K–L: Strey 3497.

Ecology: From 240–750 (–1300) m a.s.l. Recorded from *Colophospermum mopane* woodland, *Brachystegia* woodland or from *Acacia* bushland. Flowering specimens from all months of the year.

18. *Anisotes sessiliflorus* (T. Anders.) C. B. Clarke

Anisotes sessiliflorus (T. Anders.) C. B. Clarke 1900: 226; Chiovenda 1929: 269; Codd 1951: 168; Milne-Redhead 1954b: 26; Cufodontis 1964: 977; Schijff 1969: 89. – Basionym: *Himantochilus sessiliflorus* T. Anderson 1876: 1117; Lindau 1895b: 372; 1896: 82. – Type: Malawi, Shibisa (Chikwawa), on river Shire, Aug.–Sep. 1861, Meller s.n. (K holotype).

Woody perennials or many stemmed shrubs; 1.0–3.0 (–4.0) m high; young branches tetragonous to terete; rarely villous, puberulent or glabrate; older branches terete, glabrate, bark pale purplish or grey.

Leaves deciduous, sessile or subsessile; petiole when present, up to 0.15 cm long; semi-terete; lamina elliptic, 6.5–15.0 (–17.0) cm long and 3.0–5.0 (–5.6) cm broad; l/w-ratio: 1.7–2.8 (–3.5); apex acuminate to acute; base cuneate to attenuate or attenuate to subcordate; margin entire, with few hairs; nervation pinnate-reticulate; lamina dark green above; paler below; when young sparsely scabrate to strigose, later glabrate; nerves scabrate to strigose or glabrate.

Inflorescences axillary, sessile or subsessile; flowers solitary, enclosed by a pair of bracts and a pair of bracteoles; sometimes several inflorescences close together on suppressed axillary shoots or annual growth or main shoot; bracts triangular, (1.5–) 2–3.5 (–4) mm long and 1–1.5 mm broad; l/w-ratio: (1.3–) 1.4–2.2 (–2.7); keeled; tomentose, hairs upwards pointing; bracteoles bract-like, (1.5–) 2–3 (–4) mm long and 1–1.5 mm broad; l/w-ratio: 1.5–2.5 (–3.0); sometimes with a peduncle up to 1.5 mm.

Calyx 3–4 mm long. Corolla (4.4–) 4.5–5.3 (5.7) cm out, hairs upward-pointing; glabrate within; lobes nar-

rowly triangular to triangular, 2–3.5 mm long and 0.5–1.5 mm broad.

Corolla (3.7–) 4.2–5.3 (–5.7) cm long; red to orange-red; glandular strigose to velutinous. Corolla tube 13–16 mm long; 2–2.5 mm in diameter at the base, 2.5–3.5 mm in diameter at the apex; lateral invaginations 5–9 mm from the base. Upper lip 30–35 (–40) mm long and 10–12 mm broad; apex emarginate; lower lip narrowly oblong, 29–34 mm long and 2–3 (–3.5) mm broad, at anthesis involute; lobes 1.5–3 mm long; lateral lobes 0.5–1 mm broad, central lobe 1–1.5 mm broad.

Stamens. Filaments 2.9–3.3 (–3.5) cm long, glabrate. Anthers 3–4 mm long.

Ovary 2 mm long, 1.5 mm broad and 1 mm thick; densely strigose or glabrate; hairs upward pointing. Style 4.0–4.8 (–5.2) cm long; glabrate. Discus 1 mm high. Capsule 25–30 mm long, 6–8 mm broad and 4–6 mm thick; sparsely strigose. Seeds 5 mm long, 5 mm broad and 1 mm thick. – Fig. 23.

Distribution: Tanzania, Malawi, Mosambique, Rhodesia. – Fig. 24.

Ecology: From 45–250 and 600–1950 m a.s.l. In *Colophospermum mopane* woodland, *Acacia-Commiphora* woodland, dry riverine forest. More detailed information is given under the subspecies.

Notes: The distribution area had earlier been assumed to be larger and include the South African Republic (Transvaal) and Kenya, but this was based on misidentifications. Both Lindau (1896) and Clarke (1900) cite Robecchi-Brichetti 546, 652 and 553 from Somalia as *A. sessiliflorus*, but actually these collections are *A. trisulcus* ssp. *webi-schebeliensis*. Chiovenda (1929) cite Stefanini and Pucciono 124 (F1) as *A. sessiliflorus*, but this is probably a misidentification. I have not seen the specimen, but suggest that it belongs in either *A. tanensis* or *A. trisulcus* ssp. *webi-schebeliensis*.

Key to the subspecies

1. Ovary densely strigose, calyx 3–4 mm long, corolla 4.5–5.3 cm long, corolla tube 14–16 mm long ssp. *sessiliflorus*
1. Ovary glabrate or with simple hairs (strigose) at the transition to the style, calyx 4–5 mm long, corolla 4.2–4.8 cm long, corolla tube 13–15 mm long ssp. *iringensis*

18a. *Anisotes sessiliflorus* (T. Anders.) C. B. Clarke ssp. *sessiliflorus*

Leaves 8.0–15.0 (–17.0) cm long and 3.0–5.0 (–5.6) cm broad; l/w-ratio: (2.0–) 2.2–2.8 (–3.5).

Calyx 3–4 mm long. Corolla (4.4–) 4.5–5.3 (5.7) cm long. Pollen grains prolate, 61–71 × 37–43 µm; pores alongate, 8 × 5 µm; trema area with two rows of in-

sulae, 5.5 µm in diameter, elongate and coalesced towards the poles; NPC: 344. – Fig. 21. Ovary densely strigose over the entire surface. – Fig. 22.

Distribution: Malawi, Mosambique, Rhodesia. – Fig. 23.

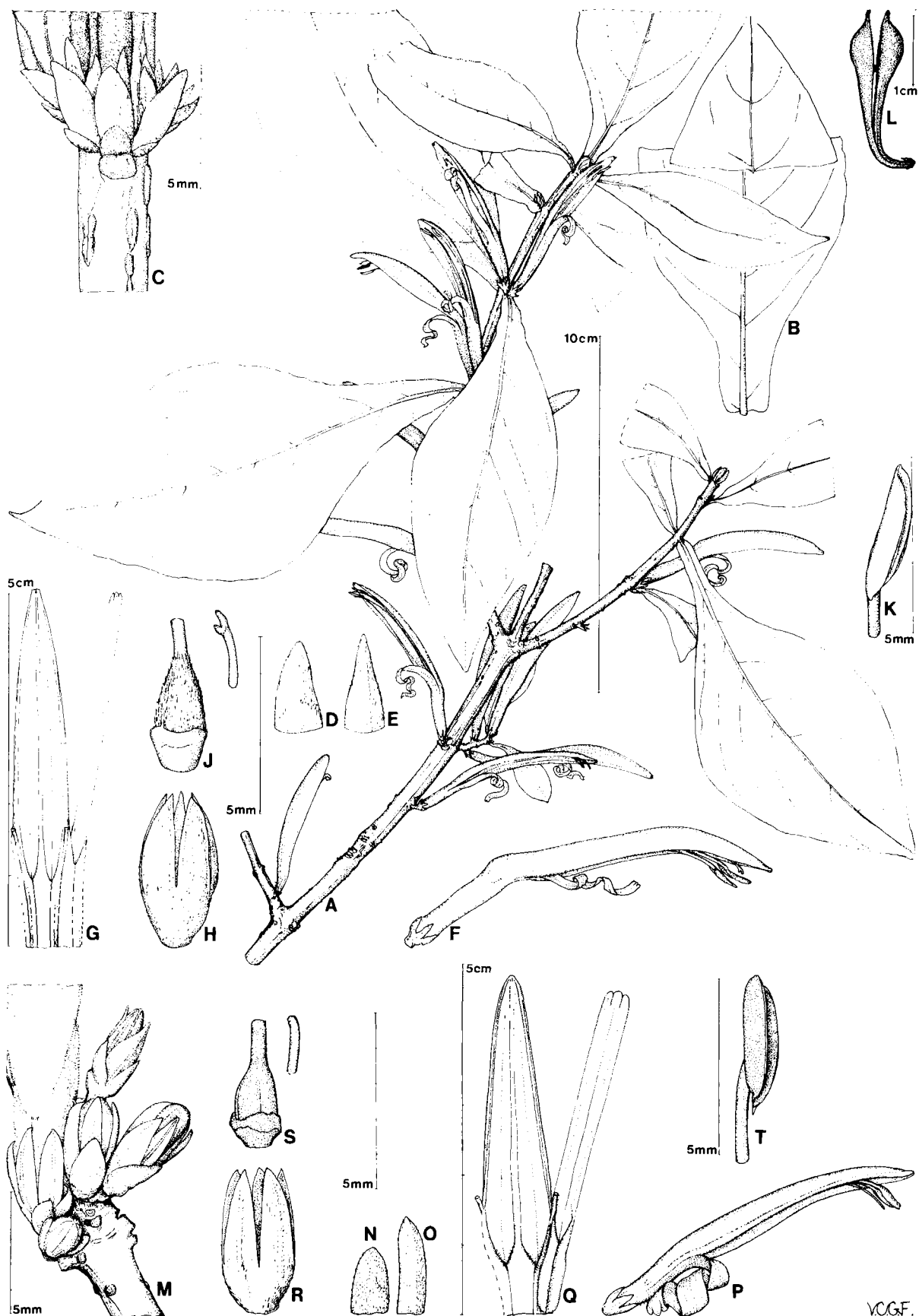


Fig. 22. *Anisotes sessiliflorus* ssp. *sessiliflorus* (A–L), and *A. sessiliflorus* ssp. *iringensis* (M–T). A: habit. – B: leaf. – C: detail of inflorescence. – D: bract. – E: bracteole. – F: flower. – G: inside view of corolla. – H: calyx. – J: ovary, style and disc. – K: anther. – L: capsule. – M: detail of inflorescence. – N: bract. – O: bracteole. – P: flower. – Q: inside view of corolla. – R: calyx. – S: ovary, style and disc. – T: anther. – A, D–K: Hall-Martin 416; Bond 9B110; C: Theron 2593; M–T: Mhoro 1236.

Ecology: From 45–250 m a.s.l. In *Colophospermum mopane* woodland (Rhodesia, Mosambique), dry forest or riverine thicket (Malawi, Mosambique). Flowering specimens from April–May–June and August–September.

18b. *Anisotes sessiliflorus* (T. Anders.) C. B. Clarke ssp. *iringensis* C. Baden

Anisotes sessiliflorus (T. Anders.) C. B. Clarke ssp. *iringensis* C. Baden 1981a: 36 (Latin diagnosis). – Type: Tanzania, Kilosa District, Ruaha, 16 May 1971, Mhoro 1236 (UPS holotype, EA, K, SRGH, WAG isotypes). The name refers to the Iringa District.

Leaves 6.5–13.0 cm long and 3.0–5.0 cm broad; l/w-ratio: 1.7–2.5 (–3.0). Calyx 4–5 mm long. Corolla (3.7–) 4.2–4.8 cm long. Pollen grains 3 (2)–porate, prolate, 56–59 × 34–37 µm; pores lalongate, 9 × 7 µm; trema area with two rows of coalesced insulae, up to 5 µm broad; NPC: 344. – Fig. 2H. Ovary glabrate or with simple hairs (strigose) at the transition to the style; capsule unknown. – Fig. 22.

Distribution: Tanzania. – Fig. 23.

Ecology: From 600–1950 m a.s.l. Recorded in *Acacia-Commiphora* woodland, grouped tree grassland or *Commiphora* bushland, on stony rocky ground. Flowering specimens from April to September.

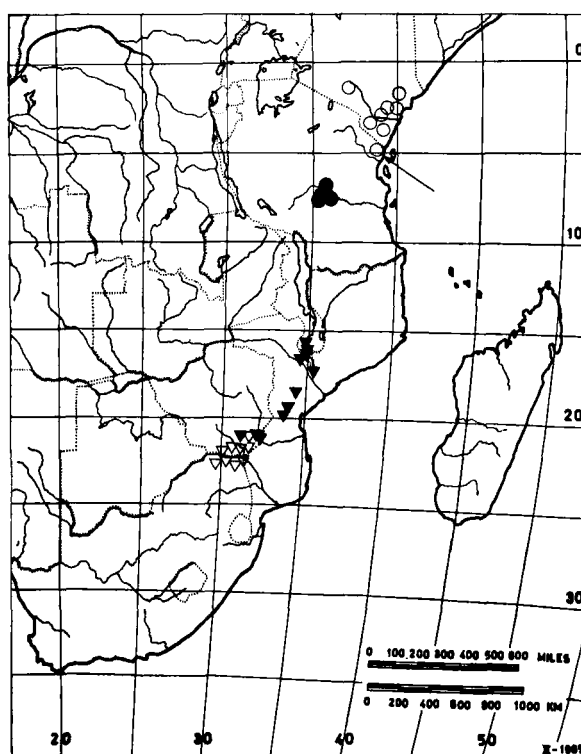


Fig. 23. Distribution of *Anisotes sessiliflorus* ssp. *sessiliflorus* (triangles), and *A. sessiliflorus* ssp. *iringensis* (dots). *A. parvifolius* (open dots, arrow cultivated); *A. rogersii* (open triangles).

19. *Anisotes parvifolius* Oliv.

Anisotes parvifolius Oliver 1886: t. 1527; 1887: 346; Lindau 1895b: 374; C. B. Clarke 1900: 227; Chiovenda 1929: 269; Brenan and Greenway 1949: 2; Dale and Greenway 1961: 17; Cufodontis 1964: 977. – Type: Tanzania, Kilimanjaro Expedition, 40–60 miles inland, H. H. Johnston s.n. (K lectotype, selected here).

Anisotes sessiliflorus auct. non (T. Anders.) C. B. Clarke: Clarke 1900: 226 quoad Wakefield s.n. et Hildebrandt 2375. Illustration: Oliver 1886: t. 1527.

Much branched shrubs, 1.5–3.0 m high; branches terete to subtetragonous; glabrate, bark whitish to pale brown; with opposite brachyblasts; strigose beneath the scars.

Leaves sessile or subsessile, developed on brachyblasts, rarely on long shoots; lamina obovate or rarely elliptic to ovate, 3.2–6.0 cm long and (0.8–) 1.3–2.5 (–4.3) cm broad; l/w-ratio: (1.5–) 2.1–2.7 (–2.8); subcoriaceous, glossy green above, pale green below; apex acute to obtuse; base attenuate; margin sometimes minutely involute; lamina glabrate above or with few simple hairs on the nerves; lamina shortly strigose below with simple hairs on the nerves or glabrate; nervation pinnate. Flowers solitary, axillary on brachyblasts; sometimes several clustered together, flowers always enclosed by 2 pairs of bracts; the lowest pair of bracts narrowly triangular to narrowly ovate with acuminate apex, 5–8 (–9) mm long and 1.5–2.5 mm broad; l/w-

ratio: (2.8–) 2.9–4.4 (–5.7); keeled; strigose sometimes only on the nerves or glabrate; the second pair of bracts narrowly triangular or narrowly ovate with acuminate apex, (5–) 6–8 (–9.5) mm long and 1.5–2.5 (–3) mm broad; l/w-ratio: (2.7–) 3.1–3.9 (–4.3); keeled; strigose or more sparsely haired to glabrate; with a distinct midnerve. Inflorescence subsessile or with a peduncle up to 3 mm long.

Calyx 5–7 mm long; with conspicuous midnerve and margin; densely strigose to more sparsely strigose; lobes triangular, 4–5.5 mm long and 1–2 mm broad; densely strigose to sericeous or more sparsely haired.

Corolla (4.0–) 4.4–5.6 (–6.5) cm long, reddish, at base yellow-green; densely glandular and pilose. Corolla tube (12–) 15–19 (–20) mm long; 2.5 mm in diameter at the base, 3.5 mm in diameter at the apex; lateral invaginations 6–9 mm from the base. Upper lip 29–37 (–40) mm long and 10–13 mm broad; apex acuminate, emarginate. Lower lip narrowly oblong, (24–) 26–34 (–37) mm long and 2.5–3.5 mm broad; lobes 1–3 mm long; lateral lobes 0.5–1 mm broad, central lobe 1–1.5 mm broad.

Stamens. Filaments 2.8–3.4 cm long. Anthers 3–4 (–4.5) mm long. Pollen grains prolate, 54–61 × 34–39 µm; pores lalongate, 4 × 3 µm, trema area with two

rows of insulae, may coalesce near the poles; NPC: 344. – Fig. 2G.

Ovary 2–3 mm long, 1–1.5 mm broad and 1 mm thick; glabrate or with few hairs at the apex and on the suture. Style (3.7–) 4.2–5.2 (–5.7) cm long; glabrate. Discus 1 mm high and 1.5 mm in diameter. Capsule 26–30 mm long, 8 mm broad and 6–6.5 mm thick; glabrate. Seeds not seen.

Distribution: Kenya (Coast Province, Northern Province). – Fig. 23.

Ecology: From 150–700 m a.s.l. Recorded from deciduous bushland and scattered tree grassland on red sandy soil. Flowering specimens from late April to July and September, November, January. Flowering plants in cultivation are recorded from August–October–November.

Notes: Chiovenda (1916) cites Paoli 616 from the Ethiopia–Somalia boundary area as *A. parvifolius*. It is later mentioned in Chiovenda (1929) and Cufodontis (1965). The specimen has been wrongly determined and the correct name is *A. involucratus*.

Doubtful taxa

Symplectochilus madagascariensis Lindau 1898: 39. – Type: Madagascar, Diego Suarez, 1833, Goudot s.n. (G). (Only the type seen; the condition of which makes it impossible to establish the position of this taxon. If it should be an *Anisotes*, then *A. madagascariensis* Benoist prevents the use of “madagascariensis” as an epithet).

Himantochilus comorensis Lindau 1894: 61; 1895a: 346. – Type: Comores, Humbolt 1584 (According to the description it is unlikely to be an *Anisotes*, but neither the type nor any specimens determined as *H. comorensis* have been seen).

Acknowledgements – I am very grateful to my tutor Ib Friis for many discussions, and to Bertel Hansen for his helpful suggestions. A visit to the Royal Botanic Gardens, Kew was granted by the Arnstedt Family Foundation. At Kew Herbarium I received much help from R. K. Brummitt; this is gratefully acknowledged. Victoria Gordon Friis, skilfully prepared the line drawings, and the Danish Natural Science Research Council met the expenses. G. E. Wickens at Kew checked the English text. Thanks are also due to the curators and directors of the herbaria from which material has been obtained on loan.

Index to scientific names

Names of taxa not recognized are in italics.

Acanthoideae 624
Adhatoda 625

A. formosissima 624, 647
Anisotes 623ff, 630ff
A. bracteatus 624, 627ff, 632, 644ff
A. diversifolius 624, 627ff, 633, 635
 var. *diversifolius* 636
 var. *brevicalyx* 636
A. dumosus 624, 627ff, 633, 636
 ssp. *dumosus* 636ff
 ssp. *galanae* 636ff
A. formosissimus 627ff, 632, 647ff
A. guineensis 624, 627ff, 633ff
A. involucratus 624, 626ff, 632, 655ff, 661
A. macrophyllus 627ff, 632, 640
A. madagascariensis 624, 627ff, 632, 649f
A. nyassae 627ff, 632, 646f
A. parvifolius 624, 627ff, 632, 655, 660ff
A. pubinervis 624
A. rogersii 624, 627ff, 633, 656ff
A. seretii 640
A. sessiliflorus 627, 633, 658, 660
 ssp. *sessiliflorus* 627ff, 658ff
 ssp. *iringensis* 627ff, 658ff
A. tanensis 627ff, 632, 654ff
A. tangensis 627ff, 632, 642ff
A. trisulcus 623f, 627, 632, 651, 655
 ssp. *trisulcus* 627ff, 651ff
 ssp. *webi-schebeliensis* 627ff, 651ff
A. ukambanensis 624, 638
A. ukambensis 624, 627ff, 633, 638ff
A. umbrosus 624, 627ff, 632, 644f
A. velutinus 624, 629, 632, 653f
A. zenkeri 627ff, 632, 640ff
Barlerieae 624
Beloperone 625
Dianthera 625, 630
D. trisulca 623, 630
Duvernoia 625
Ecbolium 625
Echmatacanthaceae 624
Eujusticieae 624f
Fittonia 625
Gendarusseae 624
Graptophyllum 625
Harpochilus 625
Himantochilus 624, 627, 629
H. comorensis 624, 661
H. macrophyllus 624, 640
H. marginatus 624
H. pubinervi 624, 629
H. sereti 624, 640
H. sessiliflorus 624, 629, 658
H. zenkeri 624, 642
Hypoestes 625
Isoglossa 625
Jacobinia 625
Justicia 625, 630
J. biflora 651
J. trisulca 623, 630, 651
Justicieae 624
Macrorungia 623ff, 630
M. batesii 624, 640
M. formosissima 624, 647, 649
M. macrophylla 624, 640
M. pubinervia 629
Mendoncioideae 624
Monothesium 625
Nelsonioideae 624
Polystachys 625
Rhinacanthus 625
Ruellioideae 624
Rungia pubinervia 624
Sect. Anisotes 625ff, 631, 651

Sect. Bracteati	625ff, 631, 644
Sect. Macrophylli	625ff, 631, 638
Sect. Spiciflori	625ff, 631, 647
Sect. Tetrapori	625ff, 631, 633
Sect. Thyrsoflori	625ff, 631, 635
Siphonoglossa	625
<i>Symplectochilus</i>	624, 630
<i>S. formosissimus</i>	624, 630, 647
<i>S. madagascariensis</i>	624, 661
<i>Tetrandrae</i>	624
Thunbergioideae	624
Trichocalyx	625
Typicae	624

List of specimens studied

The specimens are listed alphabetically according to the name of the collector. Herbaria from which each collection has been studied are indicated by the letter codes of Holmgren and Keuken 1974, and the figures in brackets refer to the corresponding number of the taxon in the text. Combinations such as (3–4) are used for doubtful collections.

J. Adamson 356 (15) EA, K; 11103 (19) EA, K. – T. Adamson s.n. (15) EA; 81 (19) EA. – Allaway 21 (3b) EA. – D'Al-leizette 5618 (12) L. – Andrada 1795 (11) LISC. – Archbold 1837 (9) K. – Archer 636 (19) K, EA. – Aubreville 8 oc (5) P. – Balfour 479 (2b) E, K; 506 (2a) K; 576 (2a) K. – Bally 588 (4) EA; 1251 (4) EA; 2020 (15) G, K; 3753 (13b) G, K; 6037 (3b) K; 7481 (4) EA, K; 7594 (3a) K; 7887 (8) EA, K; 8150 (3b) EA, K; 8336 (19) EA, K; 9526 (16) G, K; 10538 (19) EA, K; 12319 (4) G, K; 13382 (3b) EA, G, K; 16664 (19) EA; 16793 (19) EA, K; cult A (4) K; cult B (19) K. – Bally and Melville 15314 (16) EA, K; 16287 (13b) K, MO; 16310 (16) EA, K, MO. – Bally and Radcliffe-Smith 14948 (16) C, K; 14965 (15) C, K. – Barbose and Lemos 8590 (11) K, LISC. – Bates 687 (5) BM, MO, Z; 1155 (5) BM, MO, Z; 1276 (5) BM, MO, Z. – Beddome (2a) K. – Benoit 2280 (6) K. – Benson 478 (11) K, PRE. – Bent s.n. (2a) K; s.n. (13a) E. – Bequaert 1679 (5) BR. – Bigi in Corradi 56 (16) FI. – Bingham 1550 (8) BR, K, LISC, M, MO, PRE, SRGH. – Bjørnstad AB 1875 (8) EA, K, UPS. – Bond 9B 110 (18a) SRGH. – Bowbrick 220 (18a) BR, LISC, SRGH. – Brass 17905 (11) K; 17919 (18a) K, MO, SRGH. – Breijer 16082 (17) PRE. – Brenan 14162 (17) K. – Brenan and Greenway 8317 (19) BR, EA, K. – Breteler 761 (5) BR, K, WAG; 921 (5) WAG. – Breteler, Wilde and Leeuwenberg 2375 (5) WAG. – Brown 2036 (5) EA, K. – Bruce 42 (17) K, MO, PRE; 203 (17) K, PRE. – Buchanan 1407 (11) K. – Burtt 747 (8) EA, K; 3438 (3a) BR, K; 3917 (8) K; 4776 (9) EA, K; 5144 (3a) BM, BR, EA, K; 5183 (9) BM, BR, EA, K; 5221 (8) BM, BR, K. – Cannel 655 (17) SRGH. – Chase 257 (11) K, LISC, SRGH; 2272 (11) PRE, SRGH; 2403 (17) BM, K, SRGH; 2514 (11) MO, SRGH; 2521 (18a) BM, MO; 6624 (11) BR, K, PRE, SRGH; 8160 (11) BM, BR, EA, K, LISC, MO. – Chevalier 11056 (5) P; 13444 (1) K. – Cifevri 70 (16) FI, K. – Codd 3008 (17) MO, PRE; 5307 (17) BM, K, PRE, SRGH. – Codd and Dyer 3809 (17) EA. – Collenette 338 (13a) K. – Corradi 5512 (16) FI; 5530 (16) FI; 5542 (16) FI. – Dale 874 (18b) EA; 1059 (19) EA, K, PRE; 1261 (19) BM, PRE; 3652 (19) EA, K. – Davies 1255 (17) K, LISC, PRE; 2053 (11) K, PRE, SRGH; 2785 (11) SRGH. – Drummond 5753 (17) BR, COI, K, LISC, PRE, SRGH; 5995 (17) PRE, SRGH. – Drummond and Hemsley 4265 (19) B, BR, EA, K. – Drummond and Rutherford-Smith 7510 (8) BR, K, LISC; 7588 (11) K, PRE, SRGH. – Dyson 601 (4) EA. – Eaux Forets et Chasses 2077 (5) P. – Edwards 185 (3b) EA; 249 (15) EA. – Eggeling 3831 (5) BR, K; 6266 (3a) EA, K. – Ellis 334 (13b) K. – Emson 605 (18b) EA, K. – Evans 174 (17) PRE. – Exell, Mendonca and Wild 430 (17) BM, LISC, SRGH. – Eyles 8109 (11) K, SRGH. – Faden

74/781 (15) MO. – Fanshawe 4543 (8) BR, K, SRGH; 11546 (10) C, K, SRGH; 11623 (10) K. – Farrel 6 (17) SRGH. – Fleury 26127 (5) P. – Galpin 9187 (17) PRE, SRGH. – Gardner 3698 (4) BR, EA, K. – Gerstner 5468 (17) PRE; 5579 (17) PRE; 6080 (17) PRE; 6614 (11) K, PRE, SRGH; 7060 (18a) EA, K, PRE. – Gilbert 2122 (13b) EA, K. – Gill 26 (18b) EA. – Gillett 13285 (15) B, BR, EA, FI, K; 19496 (15) EA, K. – Gillett and Newbould 19180 (15) EA, K, M, MO, UPS. – Gilliland 4170 (13a) EA. – De Giorgie 78 (5) BR. – Goldsmith 34/63 (11) BR, K. – Goodier 604 (18a) K, SRGH. – Goudot s.n. (–) G. – van Graan and Hardy 514 (17) PRE. – Grant-Forbes 231 (2a) E; 233 (2a) E. – Greenway 2407 (8) EA, K; 15373 (18b) K, M, PRE. – Greenway and Kanuri 13688 (8) EA, K; 14417 (8) EA, K, M, MO, PRE. – Grichar KG/Had/7 (13a) EA; KM/Had/66 (13a) EA. – Grierson 164 (13a) E. – Grosvenor 595 + 595A (11) K, LISC, MO, PRE, SRGH; 620 (17) K, PRE, SRGH. – Grozovsky 55 (13a) BM. – Guy 85905 (17) K, M. – Hall 73 (11) K, PRE. – Hallé 348 (5) BR, K, P. – Hall-Martin 416 (18a) PRE; 642 (18a) PRE; 719 (11) K, SRGH; 720 (11) PRE; 1235 (18a) K. – Hammand 327 (3a) EA. – Hansen 57 (3b) C. – Hay 5 (13a) E. – Hedin 314 (5) P. – Hemming 541 (13a) EA, K; 1519 (13b) EA, K; 1772 (14) EA, K. – Hepper 5756 (13a) K. – Hildebrandt 2375 (19) W. – Hooper and Townsend 1154 (19) K. – Hornby 537 (9) EA, K; 707 (8) BR, EA, K; 707A (8) BR, K; 2901 (11) K, PRE. – Hucks 441 (3b) EA; 841 (3b) EA. – Humbert 2425 (12) G; 5164 (12) K. – Hummel 149 (13b) EA, K. – Iecama 21 (13b) K. – Isawa 322 (3–4) EA; 323 (3–4) EA. – Jackson 1711 (11) BR, K, SRGH; 2317 (18a) PRE, SRGH. – Jacobsen 2541 (17) PRE. – Jacques-Felix 1758 (1) BR, K, P; 1962 (1) K, P; 7099 (1) P. – Jex-Blake s.n. (19) EA; 19 (19) K. – Johnston s.n. (19) K. – Keet 6827 (17) PRE. – Kerfoot 3035 (13a) EA, K. – Khattab and Shabetai 5460 (13a) G; 5610 (13a) G. – Kirk s.n. (11) K. – Kirrika 114 (15) EA, K, PRE. – Kokwaro and Waithaka 1577 (3b) EA; 1578 (3b) EA. – Kosilshchonev 1691 (3a) EA. – Lavranos 1960 (13a) K, PRE. – Leach 10697 (17) MO, SRGH; 10699 (17) K, MO, SRGH. – Lebrun 1830 (5) BR, WAG; 2050 (5) BR, K, Z. – Leeuwenberg 6185 (5) WAG; 7384 (5) WAG; 7799 (5) BR, WAG. – Leonard 5765 (5) BR, K, LISC, WAG. – Letouzey 1418 (5) BR, K, P; 2627 (5) K; 3244 (5) BR, K, P, S, WAG; 11767 (5) K. – Letouzey and Villiers 10562 (5) P. – Leuthold 85 (3b) EA, K; 86 (3b) EA, K. – Luckert 14 (16) FI. – Lunt 116 (13a) K. – Lunz 39 (13a) BR, K, M. – Macédo 5251 (11) PRE, SRGH. – Magogo 659 (8) C, K. – Makin 14619 (4) EA. – Marsh 23 (3–4) EA. – Mathenge 133 (15) EA, K. – Meller s.n. (18a) K. – Menyhart s.n. (11) W; 753 (18a) W, Z; 949 (11) Z. – Mhoro 1167 (8) EA, K, UPS, WAG; 1236 (18b) EA, K, SRGH, UPS, WAG; 1877 (8) DSM. – Mildbraed 4124 (5) HBG; 4338 (5) HBG. – Mooney 7645 (13b) EA, K. – Mosnier 2993 (13a) ALF. – Müller 628 (17) K, LISC, PRE, SRGH; 1675 (10) C, K, SRGH. – Museum 7481 (4) K. – Napier TNP/E/40 (3b) EA, K. – Obermeyer 667 (17) K, PRE; 36564 (11) K, MO, PRE. – Osmaton s.n. (5) EA. – Paoli and Stefanini 80 (16) FI; 117 (16) FI; 365 (16) FI; 616 (16) FI. – Parker GM/518/H (19) EA, K. – Parry 150 (7) EA, K. – Pedro and Pedonger 2138 (11) PRE. – Perrier de la Bathie 9494 (12) P. – Peters s.n. (11) K. – Phelps 249 (11) K, LISC, PRE, SRGH. – Philby 76 (13a) BM; 110 (13a) BM. – Pleva 21 (18b) EA, MO. – Pobeguini 2136 (1) P. – Poisson 277 (12) P. – Polhill and Paulo 465 (4) B, BR, EA, K, S. – Pollanie 77 (16) FI, K. – Popov 133 (13a) EA; 1021 (13b) EA, K; 4170 (13a) K. – Powel 12 (4) K. – Procter 3307 (18b) BR, EA, K, LISC, PRE. – Puccioni and Stefanini 565 (14) FI; 341 (16) FI. – P. akk 615 (15) EA. – Radcliffe – Smith and Henchie 4449 (13a) K. – Rauh and Lavranos 13116 (13a) K; 13339 (13a) G, K. – Raynal 9451 (6) P. – Rippenstein 1005 (15) ALF. – Robecchi-Brichetti 553/119 (13b) FI; 546/263 (13b) FI; 652 (13b) FI; 653 (13b) FI. – Roberty 16454 (1) K. – Rogers 17734 (17) PRE; 18424 (17) PRE; 19349 (17) BM, G, K, S, Z. – Rowland-Jones 53 (11) G, K, M, PRE, Z. – Rouyen 5518 (5) L. – Rushworth 388 (17) BR, SRGH. –

Rutherford-Smith 704 (17) B, SRGH. – Sacleux 2375 (19) P. – Salubeni 1976 (11) SRGH. – Sanford 6130 (6) K. – Savory 356 (11) SRGH; 825 (17) SRGH. – Scheffler 181 (4) BM, E, G, HBG, L, PRE, S, W, Z; 455 (4) BM, E, K. – Schenkel 39 (3b) EA. – Schiff 646 (11) EA, K; 3082 (17) PRE; 3575 (17) PRE; 5200 (17) K, PRE. – Schinz 112 (17) Z. – Schweinfurth XII 92 (13a) M; 193 (13a) G; 477 (2a) K, P, W; 703 (13a) BM; 1788 (13a) BR, G, K, Z; 1789 (13a) G. – Semsei 558 (9) BR, EA, K; 2529 (10) EA, K. – Senni 60 (16) FI. – Seret s.n. (5) BR; 458 (5) BR. – Simmons 228 (13b) EA. – Sita 1481 (5) BR, P; 1424 (5) BR, K, P; 2560 (5) P. – Smith and Lavranos 24 (13a) K. – Smuls s.n. (11) PRE; 305 (11) PRE, K; 2193 (11) K. – Stokes 29 (11) SRGH. – Strey 3497 (17) BM, K, M, PRE, SRGH, W. – Surcouf s.n. (11) L; ser B 27 (18a) K; ser B 70 (11) K, P; 129 (18a) K, P; ser B 166 (11) K. – Swart 321 (17) PRE. – Synnott 488 (5) K; 1344 (5) EA. – Testu 1605 (5) BM, BR; 7304 (5) BM, P; 7368 bis (5) BR, K, P; 8143 (5) K, P. – Theron 2593 (18a) PRE. – Thulin and Mhoro 632 (8) DSM, K, UPS. – Tinley 1924 (18a) SRGH; 2569 (11) K, SRGH. – Tisserant s.n. (5) K; 594 (5) BM, BR, K, P, WAG; 1996 (5) BM, BR, K; 3475 (5) BM, BR, K, P. – Torre s.n. (11) LISC; 3123 (11) LISC; 6783 (11) LISC. – Torre and Paiva 12181 (18a) LISC. – Vahrmeijer and Joynt 179 (17) PRE. – Vasse 386 (18a) P. – Verdcourt 1844 (4) BR, EA, K, PRE; 2353 (19) EA, K, SRGH. – Wahab s.n. (13a) E. – Wakefield s.n. (19) K. – Wakefuld 10A (13a) K. – Ward 41 (8) EA, K; 7754 (11) PRE. – Vatova 49 (16) FI. – Weir 7300A (11) M, MO. – Werdermann and Oberdieck 1985 (17) B, K, PRE, WAG. – Werger 989 (17) EA, K, PRE. – West 3936 (11) LISC, M; 4910 (11) SRGH; 5361 (16) EA, PRE; 7238 (17) EA, SRGH; 7524 (17) SRGH. – Wigg 38 (8) EA. – Wild 3362 (11) B, BR, K, LISC, PRE, S, SRGH; 3401 (17) K, PRE; 3499 (11) B, BR, K, LISC, S, SRGH; 5431 (17) K, MO, PRE. – Wilde 1644B (6) B, BR, EA, K, MO, WAG, Z. – Winter 7740 (17) B, K, M, PRE, Z; 7808 (17) B, K, M, PRE. – Wissmann 525 (13a) HBG; 526 (13a) HBG; 527 (13a) HBG; 1355 (13a) HBG; 1376 (13a) HBG; 1752 (13a) HBG; 2403 (13a) HBG. – Whellan 1284 (11) K, SRGH. – Wright 313 (8) K, LISC, SRGH. – Young 66A (18a) SRGH. – Zenker 647 (6) K. – Zenker and Staudt 194 (6) BM, S; 675 (6) BM, BR, COI, K, S, Z.

References

- Agnew, A. D. G. 1974. Acanthaceae. – In: Agnew, A. D. G., (ed.), *Upland Kenya wild flowers*. Oxford, pp. 573–611.
- Anderson, T. 1863. African Acanthaceae. – *Proc. Linn. Soc. Bot.* 7: 13–54.
- 1876. Acanthaceae. – In: Bentham, G. and Hooker, J. D.: *Genera Plantarum* 2,2. London, pp. 1060–1122.
- Baden, C. 1981a. New taxa in *Anisotes* (Acanthaceae). – *Nord. J. Bot.* 1: 35–36.
- 1981b. The genus *Macrorungia* (Acanthaceae), a taxonomic revision. – *Nord. J. Bot.* 2: 143–153.
- Balfour, I. B. 1884. Diagnoses plantarum novarum Phanoroganarum Socotrensium Pars IV. – *Proc. Roy. Soc. Edinburg* 12: 88.
- 1888. Botany of Socotra. – *Trans. Roy. Soc. Edinburg* 31: 1–446.
- Benoist, R. 1928. Acanthaceae. – In: Pelegrin, J., (ed.), *La flore du Mayombe* 11. – *Mem. Soc. Linn. Norm., Sect. Bot. N.S.* 1,3: 1–83.
- 1929. Descriptions d'especes nouvelles d'Acanthacees de Madagascar. – *Bull. Soc. Bot. France* (Paris) 76: 1031–1038.
- Bjørnstad, A. 1976. The vegetation of Ruaha Nat. Park, Tanzania. – Oslo.
- Borzi, A. 1908. Sulla flora della Somalia Italiana Meridionale. – *Boll. R. Orto Bot e Giardini Coloniale di Palermo* 7: 29–36.
- Bremekamp, C. E. B. 1944. Materials for a monograph of the Strobilanthinae (Acanthaceae). – *Verh. Akad. Wet., 2. Sect.*, 41,1: 1–300.
- 1948. Notes on the Acanthaceae of Java. – *Verh. Akad. Wet., 2. Sect.*, 45,2: 1–78.
- 1965. Delimitation and subdivision of the Acanthaceae. – *Bull. Bot. Surv. India* 7: 21–30.
- Brenan, J. P. M. and Greenway, P. J. 1949. Checklist of the forest trees and shrubs of the British Empire, Tanganyika Territory, 5,2: 1–319. – Oxford.
- Chevalier, A. 1920. Exploration botanique de l'Afrique occidentale Francaise 1: 1–798. – Paris.
- Chiovenda, E. 1916. Risultati scientifici della Missione Stefanini-Paoli. Le collezioni botaniche 1916: 1–242. – Florence.
- 1929. Flora Somalia. – Roma.
- Clarke, C. B. 1900. Acanthaceae. – In: Thiselton-Dyer, W. T., (ed.), *Flora of Tropical Africa* 5. London, pp. 1–262.
- Codd, L. E. W. 1951. Trees and shrubs of the Kruger National Park. – *Mem. Bot. Surv. S. Afr.* 26: 4–192.
- Cufodontis, G. 1964. Enumeratio Plantarum Aetiopiae Spermatophyta. – *Bull. Jard. Bot. Etat.* 34, suppl.: 977–979.
- 1965. Enumeratio Plantarum Aetiopiae Spermatophyta. – *Bull. Jard. Bot. Etat.* 35, suppl.: 979.
- Dale, I. R. and Greenway, P. J. 1961. Kenya trees and shrubs. – London.
- Defflers, A. 1889. Voyage au Yemen. – *Journal d'une Excursion botanique faite en 1887 dans les montagnes de l'Arabie Heureuse*: 1–246. – Paris.
- Dietrich, A. 1831. *Species Plantarum* 1. – Berlin.
- Dyer, R. A. 1976. Acanthaceae. – In: Dyer, R. A. (ed.), *Genera of Southern African flowering plants* 2: 581–600.
- Erdtmann, G. 1952. Pollen morphology and plant taxonomy. – Stockholm.
- Fiori, A. 1915. Missione scientifica Stefanini-Paoli nella Somalia Meridionale (1913). *Plantae Somalenses Novae*. – *Boll. Soc. Bot. Ital. (Florence)* 5–6: 49–59.
- Forbes, H. O. 1903. The Natural History of Socotra and Abd El Kuri. – Liverpool, pp. 449–531.
- Forsskål, P. 1775. *Flora Aegyptiaco Arabica*. – Copenhagen.
- Greenway, P. J. 1973. A classification of the vegetation of East Africa. – *Kirkia* 9: 1–68.
- Heine, H. 1963. Acanthaceae. – In: Hutchinson, J. and Dalziel, J. M. (eds.), *Flora of West Tropical Africa*: 391–432.
- 1966. Acanthaceae. – In: Aubreville, A. (ed.), *Flore du Gabon* 13. Paris, pp. 3–241.
- Holmgren, P. K. and Keuken, W. 1974. Index herbariorum. Part I. The herbaria of the world. – Utrecht.
- Klotzsch, J. F. 1862. – In: Peters, W. C. H. (ed.), *Naturwissenschaftliche Reise nach Mossambique-Botanik*, 1. Abtheilung. Berlin, pp. 1–304.
- Lamarck, J. B. A. P. 1788. *Encyclopedie Methodique* 2. – Paris.
- Lawrence, G. 1955. An introduction to plant taxonomy. – New York.
- 1956. Taxonomy of vascular plants. – New York.
- Lindau, G. 1893. Beiträge zur systematik der Acanthaceae. – *Bot. Jahrb. Syst.* 18: 36–64.
- 1894. Acanthaceae africanae II. – *Bot. Jahrb. Syst.* 20: 1–78.
- 1895a. Acanthaceae. – In: Engler, A. and Prantl, K. (eds.), *Die natürlichen Pflanzenfamilien* 4,3b. Leipzig, pp. 274–354.
- 1895b. Acanthaceae. – In: Engler, A. (ed.), *Die Pflanzenwelt Ost-Afrikas und der Nachbargebiete*. – *Deutsch Ost-Africa* 5, C: 365–374.
- 1896. Contribuzioni alla conoscenza della flora dell'Africa orientale. Acanthaceae Somalenses. – *Annuario Reale Ist. Bot. Roma* 6. Milano: 67–83.
- 1898. Einige neue acanthaceen. – *Ann. Cons. Jard. Bot. Geneve*: 1–140.

- 1908. *Novitas flora africana*. – *Mem. Soc. Bot. France* 55 mem. 8. Paris: 48–53.
- 1913. *Acanthaceae africanae*. – *Bot. Jahrb. Syst.* 49: 399–409.
- 1920. *Acanthaceae africanae*. – *Bot. Jahrb. Syst.* 57: 399–409.
- Linné, C. 1742. *Genera Plantarum*, II ed. – Leiden.
- 1753. *Species Plantarum* 1. – Stockholm.
- Melchior, H. 1964. *Acanthaceae*. – In: Melchior, H. (ed.), Engler, A. *Syllabus der Pflanzenfamilien* II. – Berlin, pp. 456–460.
- Milne-Redhead, E. 1935. – In: Prain, D., Hill, A. W., Salisbury, E. and Taylor, G. (eds), *Hooker's Icones Plantarum*. London, Pl. 5,3: t. 3201–3300.
- 1936. *Tropical African Plants*. – *Kew Bull.* 9: 469–489.
- 1954a. Distribution ranges of flowering plants in Tropical Africa. – *Proc. Linn. Soc. London* 165,1: 25–35.
- 1954b. Plants collected by the Vernay Nyassaland Expedition of 1946. – *Mem. N.Y. Bot. Gard.* 9: 1–132.
- Moore, S. 1919. *Albastra diversa*, Part 30. – *J. Bot.* 57: 86–91.
- Nees, C. G. D. ab Esenbeck, 1847. *Ordo CXLV. Acanthaceae*. – In: De Candolle, A. P. (ed.), *Prodromus systematis naturalis* 11. Paris, pp. 46–519.
- Oliver, D. 1886. – In: Hooker, J. D. (ed.), *Icones Plantarum*. London, t. 1527.
- 1887. *Enumeratio of the plants collected by Mr. H. H. Johnston on the Kilimanjaro Expedition, 1884*. – *Trans. Linn. Soc. Ser. 2*: 327–355.
- Rolfe, R. A. 1894. *Botany of the Hadramaut Expedition*. – *Kew Bull.* 1894: 328–343.
- Schijff, H. P. van der, 1969. A checklist of the vascular plants of the Kruger National Park. – Pretoria.
- Schwartz, O. 1939. *Flora des tropischen Arabien*. – *Mitteilungen aus dem allgemeine Botanik im Hamburg* 10: 1–393.
- Stearn, W. T. 1973. *Botanical Latin* 2. ed. – David and Charles, Newton Abbot.
- Vahl, M. 1791. *Symbolae botanicae* 2. – Copenhagen.
- 1804. *Enumeratio plantarum* 1. – Copenhagen.
- Wernham, H. F. 1916. *New gamopetalae from South Cameroun*. – *J. Bot.* 54: 226–231.
- White, F. 1962. *Forest flora of Northern Rhodesia*. – Oxford.
- 1965. *The savanna woodlands of the Zambesian-Sudanian Domains*. – *Webbia* 19: 651–681.
- 1971. *The taxonomic and ecological basis of chorology*. – *Mitt. Bot. Staatssml. München* 10: 91–112.
- Wildemann, E. De, 1910. *Etudes de Systematique et de geographie sur la flores Bas et du Moyen Congo*. – *Ann. Mus. Congo ser.* 5,3: 1–533.
- Willdenov, C. L. 1797. *Caroli a Linné Species plantarum* 1. – Berlin.