

Revision of the *Clinopodium abyssinicum* group (Labiatae)

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A tropical African group of species commonly included in the genus *Satureja* is revised and moved to the genus *Clinopodium*. *Satureja abyssinica* (Benth.) Briq. ssp. *abyssinica* and ssp. *condensata* (Hedberg) Seybold, *S. paradoxa* (Vatke) Engl. ex Seybold, *S. robusta* (Hook.f) Brenan and *S. vernayana* Brenan should be known under the following names: *Clinopodium abyssinicum* (Hochst. ex Benth.) Kuntze var. *abyssinicum* and *C. abyssinicum* var. *condensatum* (Hedberg) Ryding, *C. paradoxum* (Vatke) Ryding, *C. robustum* (Hook.f) Ryding and *C. vernayanum* (Brenan) Ryding, respectively. *Satureja cacondensis* (G. Taylor) Brenan, *S. masukuensis* (Baker) Eyles and *S. myriantha* (Baker) Brenan, including its varieties, are amalgamated and should be known by the name *Clinopodium myrianthum* (Baker) Ryding. © 2006 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2006, 150, 391–408.

ADDITIONAL KEYWORDS: Lamiaceae – *Satureja* – systematics – taxonomy – tropical Africa.

INTRODUCTION

Brenan's (1954) *Satureja vernayana* group and the species commonly known under the names *S. abyssinica* (Benth.) Briq. and *S. paradoxa* (Vatke) Engl. were originally placed in several different genera, and were later included in *Satureja s.l.* for many years, along with the other tropical African members of the *Satureja*-complex (Seybold, 1988). In accordance with the original classifications, Doroszenko (1985) placed *S. abyssinica* in *Micromeria* and *S. paradoxa* in *Calamintha*, but wanted to move the species of Brenan's (1954) *S. vernayana* group to a new genus called *Brenaniella*. Harley *et al.* (2004) placed the tropical African *Satureja s.l.* in *Micromeria* and *Clinopodium*. They did not mention the generic position of each species, but refer to Morales Valverde (1993) who places *S. abyssinica* in *Micromeria* sect. *Pseudomelissa* Benth. Due to similarities in the shape of the anthers, Ryding (unpubl. data) suggested that the above-mentioned species may be closely related, but was uncertain about their generic position. He inferred that it was difficult to distinguish between *Clinopodium* and *Micromeria*, and that the above-

mentioned species resemble both these genera. However, Bräuchler *et al.* (2005) have now presented a cpDNA phylogeny showing that *Micromeria* is polyphyletic. On the basis of their result, they propose that the divergent section *Pseudomelissa* should be moved from *Micromeria* to *Clinopodium*. Their modification of the genus classification will apparently rectify the polyphyly of *Micromeria* and make the two genera more distinctive in morphological characters. However, *Clinopodium* may remain paraphyletic with some American and Macaronesian genera as subgroups. After the inclusion of section *Pseudomelissa* in *Clinopodium*, there is no doubt about the affinities of the above-mentioned tropical African species. They are close to *Clinopodium s.l.*, and differ from the characteristic *Micromeria s.s.* in having the leaves dentate and thin instead of entire and thickened at the margin. Moreover, the proposed transfer of the tropical African species in this paper (here called the *C. abyssinicum* group) receives additional support from the results of more recent studies of cpDNA. According to Bräuchler (pers. comm.), the *C. abyssinicum* group emerges as monophyletic and topologically close to the type species of *Clinopodium* and the section *Pseudomelissa*.

Brenan (1954) revised his '*Satureja vernayana* group', but his species delimitation seems to break

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down when more recent collections are taken into consideration. Seybold (1988) revised the Ethiopian material of '*S. abyssinica*' and '*S. paradoxa*', but did not study the material from other parts of the distribution area. The *C. abyssinicum* group is here revised in all parts of its distribution area. Together the studies of the *C. simense* (by Ryding, unpubl. data) and *C. abyssinicum* groups constitute a revision of all *Clinopodium* in tropical Africa. The *C. abyssinicum* group differs from the *C. simense* group in having the calyx tube straight or almost so, usually having sessile glands on the upper surface of the leaves, and often having the anther thecae parallel and tightly arranged.

The taxonomic treatment is part of the preparation of the Flora of Tropical East Africa, Flora Zambesiaca and Flora of Somalia. In the collection lists, the Ethiopian regions, East African districts and the provinces in the Zambesiaca area are defined according to Hedberg & Edwards (1989), Polhill (1988) and Pope (1998).

TAXONOMY

1. *CLINOPODIUM MYRIANTHUM* (BAKER) RYDING, COMB. NOV. (FIGS 2A–M, 3A).

Leucas myriantha Baker, Bull. Misc. Inform. 1898: 163. 1898; Baker in Dyer, Fl. Trop. Afr. 5: 475. 1900. *Satureja myriantha* (Baker) Brenan, Mem. New York

Bot. Gard. 9: 49. 1954. TYPE: MALAWI. Northern Region, Nyika Plateau, '6000–7000 ft.', *Whyte* 214 (LECTOTYPE here designated: K!). Chosen from syntypes: *Whyte* 214, *Whyte* 178 (K!), *Whyte* s.n. (K!).

Leucas masukuensis Baker, Bull. Misc. Inform. 1898: 162. 1898; Baker in Dyer, Fl. Trop. Afr. 5: 476. 1900. *Calamintha masukuensis* (Baker) S. Moore, J. Linn. Soc. Bot. 40: 179. 1911. *Satureja masukuensis* (Baker) Eyles, Trans. Roy. Soc. S. Afr. 5: 462. 1916; Brenan, Mem. New York Bot. Gard. 9: 46, 48. 1954. TYPE: MALAWI. Northern Region, 'Masuku Plateau, alt. 6500–7000 ft.' (Misuku Hills, 1981–2436 m), *Whyte* s.n. (HOLOTYPE: K!).

Nepeta usafuensis Gürke, Bot. Jahrb. Syst. 30: 394. 1901. TYPE: TANZANIA. Mbeya Distr., 'Usafua, an steilen Anhängen auf Lavaboden am Ngosi- oder Poroto-Berg, um 2300 m ü.M.'. *Goetze* 1131 (HOLOTYPE: B destroyed; LECTOTYPE here designated: BR!).

Nepeta huillensis Gürke, Bot. Jahrb. Syst. 36: 121. 1905. TYPE: ANGOLA. Benguela Region, Huilla, *Antunes* 73 (HOLOTYPE: B destroyed). NEOTYPE: ANGOLA. Benguela Region, Quilemba – Chela, *Gossweiler* 10991 (NEOTYPE here designated: BM!; ISONEOTYPE: K!).

Nepeta wellmanii C. H. Wright, Bull. Misc. Inform. 1909: 380. 1909. *Satureja myriantha* (Baker) Brenan

KEY TO THE TROPICAL AFRICAN *CLINOPODIUM*

- 1a. Calyx tube \pm curved; leaves with sessile glands on the lower surface only; anther thecae diverging *C. simense* group (Ryding, unpubl. data)
- 1b. Calyx tube straight or almost so; leaves with sessile glands on both surfaces or on lower surface only; anther thecae parallel and tightly arranged or diverging 2
- 2a. Thecae 3.5–8 times as long as broad, tightly arranged and parallel (Fig. 1J); stamens and style included or protruding from the corolla tube; plants perennial or annual, herbs or subshrubs; petiole 0.05–0.8 times as long as the leaf blade; corolla pink, purple, violet, blue or white 3
- 2b. Thecae 1.5–3.5 times as long as broad, \pm diverging or rarely tightly arranged and parallel (Fig. 2V); stamens and style protruding from the corolla tube but stamens sometimes dwarfed and only very shortly protruding in the female flowers; plants woody perennial herb or subshrubs; petiole less than 0.25 times as long as the leaf blade; corolla white, cream or pale yellowish green 5
- 3a. Creeping herb; posterior calyx lip 3-lobed along 35–55% of its length, central lobe 0.8–1.7 times as long as broad; thyrses with upper verticillasters crowded 5. *C. paradoxa*
- 3b. Erect or ascending herb or subshrub; posterior calyx lip 3-lobed along 70–100% of its length, central lobe 1.5–5 times as long as broad; thyrses with upper verticillasters spaced or crowded 4
- 4a. Pedicels up to 3 mm long (Fig. 3C); stamens and style at least half as long as the posterior corolla lip (or stamens shorter in female flowers); leaf blade 0.6–2.0 times as long as broad 4a. *C. abyssinicum* var. *condensatum*
- 4b. Longest pedicels 3–12 mm long (Fig. 3B); stamens and style included in the corolla tube or up to half as long as the posterior corolla lip; leaf blade 1.0–3.5 times as long as broad 4b. *C. abyssinicum* var. *abyssinicum*
- 5a. Upper leaves acute or acuminate at the apex, hardly bullate; nutlets rounded (Fig. 2J) to shortly rostrate (Fig. 2M) at the apex 1. *C. myrianthum*
- 5b. Upper leaves rounded, obtuse, subacute or rarely acute at the apex; acute leaves bullate; nutlets acute to rostrate (Fig. 2Y) at the apex 6
- 6a. Leaves with venation forming a conspicuous network, with 5–15 prominent teeth at each side (Fig. 2N), largest leaves 11–25 mm broad; stem hairs spreading, longest stem hairs 1–2 mm long 3. *C. robustum*
- 6b. Leaves with venation obscure, subentire or with up to 5 prominent teeth at each side (Fig. 2R), largest leaves 5–14 mm broad; stem hairs upcurved, longest stem hairs 0.3–0.6 mm long 2. *C. vernayanum*

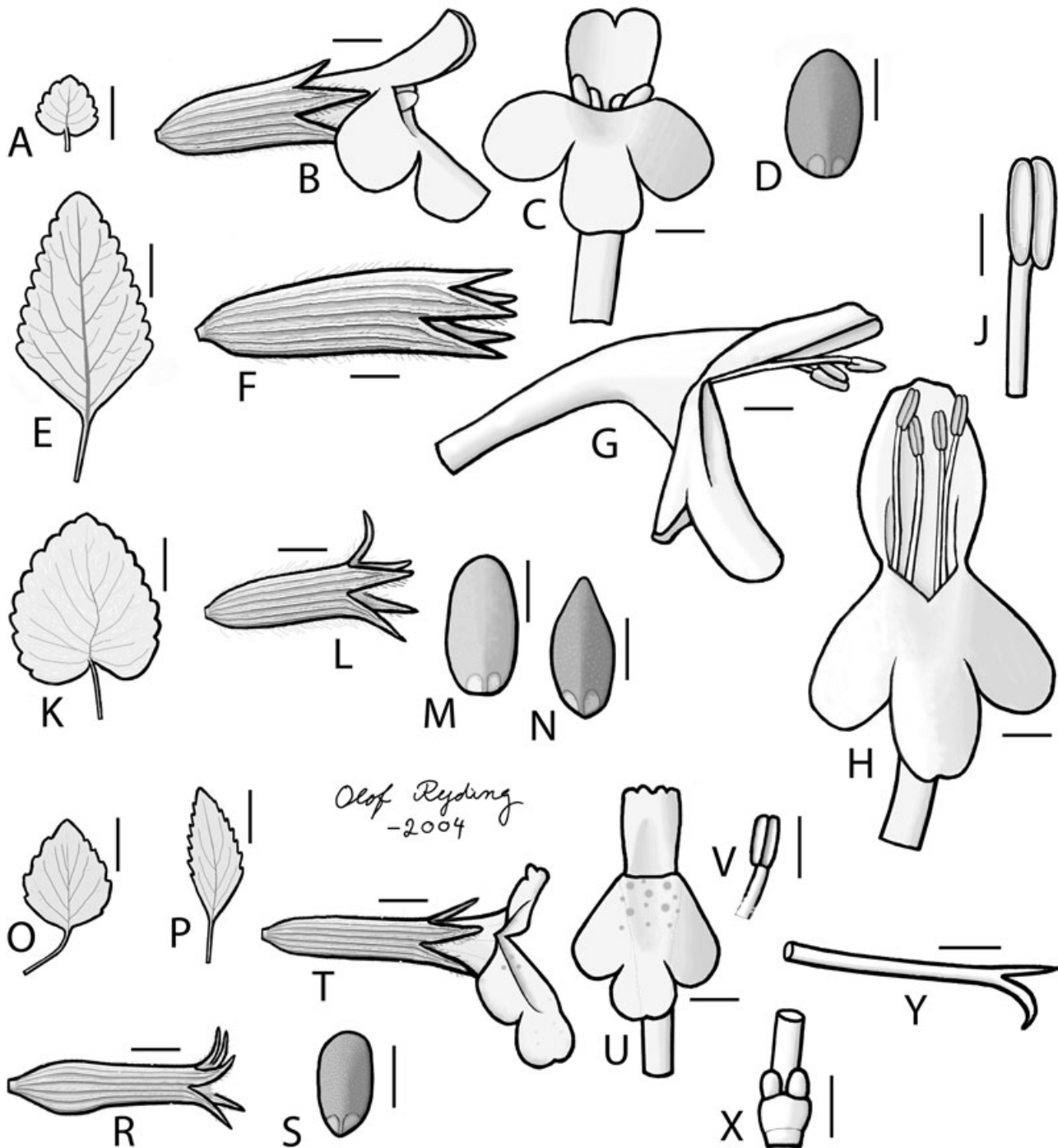


Figure 1. *Clinopodium abyssinicum*. A–D, intermediate between var. *abyssinicum* and var. *condensatum* from northern Kenya. E–J, intermediate between var. *abyssinicum* and var. *condensatum* from southern Tanzania. K–M, var. *condensatum* from Ethiopia. N, Var. *condensatum* from western Kenya. O–Y, var. *abyssinicum* from Ethiopia. A, leaf. B, flower. C, corolla. D, nutlet seen from the central side. E, leaf. F, calyx. G, H, corolla in different orientations. J, apical part of anterior stamen with anther. K, leaf. L, fruiting calyx. M, N, nutlets seen from central side. O, P, leaves. R, fruiting calyx. S, nutlet. T, flower. U, corolla. V, apical part of anterior stamen with anther. X, basal part of pistil with style, ovary lobes and disc. Y, apical part of style. (A–D from Bally 5504; E from Magogo 2401; F–J from Lovett & Kayombo 405; K from Friis *et al.* 1430; L, M from Gillett 14597; N from Hepper & Field 5015; O from W de Wilde 8514; P–S from Friis *et al.* 8212; T–Y from Friis *et al.* 8404). Scale bars: A, E, K, O, P = 10 mm; B, C, F–H, L, R, T, U = 1 mm; D, J, M, N, S, V–Y = 0.5 mm.

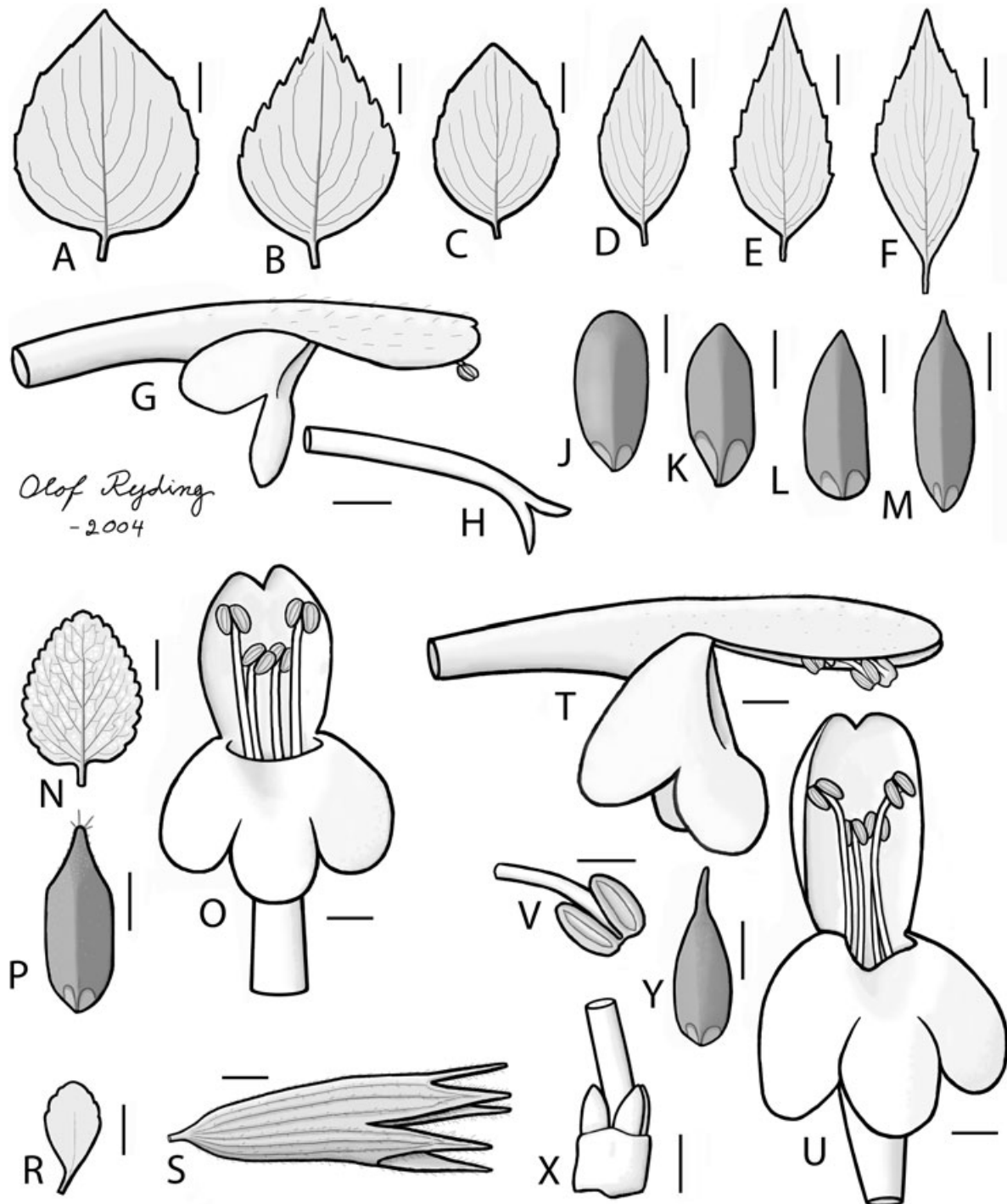


Figure 2. A–M, *Clinopodium myrianthum*. N–P, *C. robustum*. R–Y, *C. vernayanum*. A–F, leaves belonging to different forms of the species. G, corolla. H, apical part of style. J–M, nutlets seen from the central side, belonging to different forms of the species. N, leaf. O, corolla. P, nutlet seen from the central side. R, leaf. S, flower calyx. T, U, corolla in different orientations. V, apical part of anterior stamen. X, basal part of pistil with style base, ovary lobes and disc. Y, nutlet seen from the central side. (A from Goyder *et al.* 3260; B from Blackmore *et al.* 1419; C from Ferar *et al.* s.n.; D from Milne-Redhead 824; E from da Silva 1958; F from Fanshawe 11449; G, H from Blackmore *et al.* 1419; J from Mutimushi 2626; K from Pawek 2865; L from Swynnerton 1991; M from Greenway 3551; N–P from Breteler *et al.* MC17; R from Jackson 1911; S–X from Richards 16667; Y from Newman & Whitmore 115). Scale bars: A–F, N, R = 10 mm; G, O, S–U = 1 mm; H–M, P, V–Y = 0.5 mm.

var. *wellmanii* (C. H. Wright) Brenan, Mem. New York Bot. Gard. 9: 49. 1954. TYPE: ANGOLA. Benguela Region, Bailundo District, *Wellman* s.n. (HOLOTYPE: K!).

Calamintha cacondensis G. Taylor, J. Bot. 69 (suppl. 1): 167. 1930. *Satureja cacondensis* (G. Taylor) Brenan, Mem. New York Bot. Gard. 9: 49. 1954. TYPE: ANGOLA. Benguela Region, near Caconda, *Gossweiler* 2861 (HOLOTYPE BM!; ISOTYPE: K!).

Satureja myriantha (Baker) Brenan var. *brachytricha* Brenan, Mem. New York Bot. Gard. 9: 49. 1954. TYPE: ANGOLA. Benguela Region, Bailundo, *Wellman* s.n. (HOLOTYPE: K!).

Woody HERB with a woody rootstock or weak shrub, erect or ascending, 0.5–2.5 m tall, with hermaphrodite or sometimes female flowers, with a mint-like fragrance. Young STEMS \pm 4-angled, sparsely or densely hairy with spreading or rarely upcurved eglandular hairs, longest hairs 0.2–1.2 mm long, old stems mostly terete, up to 2–7 mm in diameter. LEAVES shortly petiolate or subsessile; petiole less than 10 mm long, less than 0.25 times as long as the blade; blade broadly ovate, ovate or elliptic–rhombic, up to 20–60 \times 15–40 mm, 1.1–4 times as long as broad, mostly gradually smaller towards the inflorescence, above sparsely hairy, subglabrous or rather densely hairy with eglandular hairs and mostly sparsely glandular with sessile glands, below paler, more densely glandular with \pm sunken orange sessile glands, more densely hairy with eglandular hairs on raised veins, apex acute, acuminate or sometimes subacute or obtuse in lower leaves, base rounded or cuneate, margin remotely and obscurely to rather densely and distinctly serrulate to crenulate with 0–12 distinct teeth at each side, mostly \pm revolute. INFLORESCENCES thyrsoid, with the upper verticillasters mostly crowded and the lower mostly \pm spaced; bracts similar to the ordinary leaves but smaller towards the apex of the inflorescence; cymes (1–)7–31-flowered; peduncle less than 3 (–5) mm long; bracteoles very variable within the same cymes due to their position, larger bracteoles rhombic–elliptic, mostly acuminate, up to 5–9 \times 1.5–3 mm, upper bracteoles smaller and narrower than the basal bracteoles; pedicels less than 2 mm long. CALYX prominently 13-veined, only slightly enlarging after anthesis, slightly 2-lipped, 5–8 mm long, hairy with eglandular hairs and sessile glands, sparsely hairy inside near the mouth; tube narrowly funnel-shaped to almost tubular; posterior lip 3-lobed along 60–85% of its length, lobes narrowly triangular or slightly acuminate, central lobe 1.0–3.6 \times 0.55–0.8 mm; anterior lip deeply 2-lobed, lobes 1.5–4.3 \times 0.6–0.9 mm. COROLLA strongly 2-lipped, white, cream or pale yellowish green, 8–12 mm long in hermaphroditic flowers, 7–9 mm long in female flowers; tube slightly

widened towards the mouth, 4–7 mm long; posterior lip emarginate, 2.5–5 mm long; anterior lip 3-lobed with subequal lobes. STAMENS 4, thecae divergent to almost parallel, 1.5–3.5 times as long as wide; hermaphroditic flowers with anterior pair slightly shorter than to almost as long as the posterior corolla lip, with the anthers 0.4–0.65 \times 0.4–0.7 mm; posterior pair shorter with the anthers 0.35–0.6 \times 0.35–0.65 mm; female flowers with stamens shorter. Pollen grains ellipsoid, *c.* 39–50 \times 36–46 μ m. STYLE mostly becoming about as long as the posterior corolla lip, or sometimes much longer in female flowers, 2-branched with the anterior branch 1–2 times as long as the anterior branch; disc small, indistinctly 4-lobed. NUTLETS narrowly ovoid or oblong, trigonous, rounded to shortly rostrate at the apex, with a distinct areole at the scar, 1.2–1.8 \times 0.4–0.75 \times 0.3–0.6 mm, 2–3.5 times as long as broad, brown, slightly mucilaginous or hardly mucilaginous.

Distribution and habitat: The highlands of Congo Kinshasa (Katanga), southern Tanzania, Angola, Zambia, Malawi and Zimbabwe (Fig. 4A). Woodland, forest margins, upland grassland; alt. 1100–2500 m.

Affinities and variation: *Clinopodium myrianthum* is undoubtedly very closely related to *C. vernayanum* and *C. robustum*. If these species need to be amalgamated, the combined species should be known under the oldest name, *C. robustum*.

The variation in *C. myrianthum* is to some extent geographically correlated. The material from Tanzania has broad and moderately to rather densely hairy leaves. The material from eastern Zambia and Malawi has similar but often more sparsely hairy leaves (Fig. 2A, B). Brenan (1954) retained the Malawian and Tanzanian *S. masukuensis* as a species, and claimed that it differs from *C. myrianthum* (as *S. myriantha*) in having the leaves smaller, more densely pubescent and less tapering at the apex. Different plants do indeed differ considerably in these respects, but Brenan's observation may be based on comparisons between nonhomologous parts of the plants. The type of *S. masukuensis* and several other collections identified by this name only consist of small-leaved upper parts of the plants, but as seen in more complete specimens (e.g. *Milne-Redhead & Taylor* 10517, 10517A and *Mgaza* 481), the leaves are often much larger in the lower part of the plants. Smaller leaves also tend to be more densely hairy than larger leaves in the same plants. The material from Zimbabwe has the leaves broad but mostly rather small and moderately or sometimes rather densely hairy and sometimes apically subacute rather than acute (Fig. 2C), and the nutlets apically pointed (Fig. 2L). The material from western Zambia has the



Figure 3. Scanning images of herbarium specimens. A, *Clinopodium myrianthum* from Malawi. B, *C. abyssinicum* var. *abyssinicum* from Tanzania. C, *C. abyssinicum* var. *condensatum* from Tanzania. (A from Brummitt 10834; B from Simon 56; C from Richards 25617). Scale bars = 5 cm.

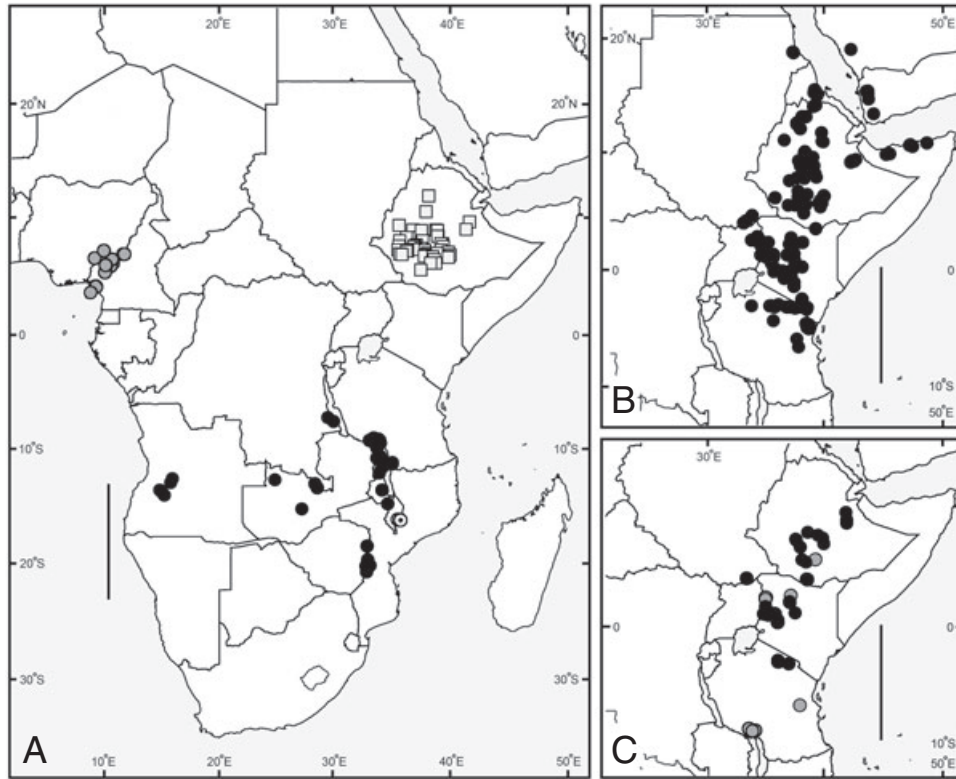


Figure 4. Known distributions of *Clinopodium* spp. A, *C. robustum* (grey dots); *C. paradoxum* (squares); *C. myrianthum* (black dots); *C. vernayanum* (bird's eye dots). B, *C. abyssinicum* var. *abyssinicum*. C, *C. abyssinicum* var. *condensatum* (black dots) and intermediates between var. *condensatum* and var. *abyssinicum* (grey dots, some hidden behind black dots). Scale bars = 1000 km.

leaves slightly or much narrower and sparsely hairy to subglabrous (Fig. 2F), the stem hairs often upcurved, and the nutlets apically rounded (Fig. 2J). The material from Angola is rather heterogeneous and may be divided into two vaguely defined main forms with partly sympatric distributions. One of these forms (e.g. *Teixeira et al.* 5340 and *Moreno* 174) resembles the material from Tanzania; it is moderately to densely hairy and has broad apically acuminate leaves. The other form (including the types of *S. cacondensis*, *S. myriantha* var. *wellmanii* and var. *brachytricha*) resembles the material from western Zambia in being moderately hairy to subglabrous and having comparatively narrow leaves (Fig. 2E). However, it differs from most other plants of *C. myrianthum* s.l. in having the flowers slightly smaller. Although this form appears to be locally distinctive in some areas, the author does not regard it as sufficiently distinctive to be recognized as a taxon. The following entities, based on different collections of this form, seem to be even less distinctive. Brenan (1954) applied the name *Satureja myriantha* var. *wellmanii* for specimens with moderately long and spreading stem hairs, the name *S. myriantha* var.

brachytricha for similar plants with shorter hairs, and *S. cacondensis* for similar plants with the calyx hairs conspicuously short. However, there is no discontinuity in the variation in stem indumentum. The two collections with the calyx hairs reduced to papillae (the type of *S. cacondensis* and *da Silva* 1958) differ in having the stems moderately and very sparsely hairy, respectively.

Brenan (1954: 48) mentioned that his '*Satureja vernayana* group' has female and hermaphrodite flowers on different plants, but in *C. myrianthum*, the variation in androecium fertility seems to be more complicated. Most plants seem to have hermaphrodite flowers only, while some plants seem to have female flowers [e.g. *de Menezes* 525 (LISC), *da Silva* 3745 (LISC) and *Stolz* 376 (K) p.p]. However, other plants have flowers with well-developed fertile stamens (with pollen grains stainable in lactic blue), as well as flowers with the stamens more or less reduced and apparently sterile [e.g. *Blackmore et al.* 1419 (C, WAG); *Goodier* 987 (K); *Milne-Redhead & Taylor* 10517 (LISC)].

The neotypification of N. huillensis: Gürke's (1905) description of the Angolan *N. huillensis* undoubtedly

matches *C. myrianthum* s.l. However, Brenan (1954), who divided *C. myrianthum* into five taxa, was uncertain about the exact identity of the destroyed type. As the leaves were described as glabrous, while the 'bracts' (bracteoles) were described as hairy, Brenan (1954: 49) suspected that the leaf indumentum was not very precisely observed. However, some of the collections from Angola have indeed a similar combination of characteristics, although their leaves are not quite glabrous. Such a collection is here designated as neotype, although the leaves are slightly hairy and slightly narrower than mentioned in the description.

Specimens examined (in addition to the types): CONGO KINSHASA: Katanga: 'Kariki' (Kasiki), *de Witte* 417 (BM); Lusaka, *Kassner* 2895 (BM, K); Marungu Kisinde, *Dubois* 1056 (BR, K). TANZANIA: Mbeya/Rungwe/Njombe Distr. W. Mporotos – Rungwe, *Greenway* 3551 (EA, K); N of lake Nyaza, *Geilinger* 2234 (K); Rorenza Peak, *Mhoro & Mashala* 3384a (K); *Mhoro & Mashala* 3384b (K); Mbeya Distr. Mbosi, *Horsbrugh-Porter* s.n. (BM); Mbeya Mt., just N of Peak, *Milne-Redhead & Taylor* 10223 (EA, K); Mbeya Peak Forest Reserve, *Gaetan Nyembe* 51 (K); E of Itimba Village, Kwamwondo forest, *Lovett & Kayombo* 454 (K); Mbeya Range, *Kerfoot* 373 [EA. Njombe Distr. Kikondo, *Richards* 6728 (K). Rungwe Distr. c. 2 km W of Igoma on top of Mporoto Ridge, *Gereau et al.* 4591 (EA, K); Upper Kiwira Ruin, illegible 458 (BM); Kiwira Forest Reserve, *Mgaza* 481 (EA, K); Lower western slope of Mt. Rungwe, above Rungwe Secondary School, *Perdue & Kibuwa* 11675 (EA); Rungwe, *Stolz* 376 (BM, K, S)]; unterhalb Rungwe Wald, *Geilinger* 2413 (K); Rungwe, Upper Lupata, *Davies* 269 (K). Songea Distr. Matengo Hills, 3 km NE of Mpapa by River Lutheka, *Milne-Redhead & Taylor* 10517 (BR, EA, K, LISC); Matengo Hills, Lupembe Hill, *Milne-Redhead & Taylor* 10517 A (BR, K). ZAMBIA: West (ZAM-W): Mwinilunga Distr., Camp 13. W of Kasangiko, *Milne-Redhead* 824 (BM); Kitwe, *Fanshawe* 2289 (BR, K); Luanshya, *Fanshawe* 11449 (K, SRGH); Luanshya, *Mutumushi* 2626 (K). Central (ZAM-C): Mumbwa, *Fanshawe* 6630 (K). East (ZAM-E): Nyika Plateau, *Dowett-Lemaire* 113 (K); *Fanshawe* 7272 (K); *Benson* NR191 (BM); *Fanshawe* 9734 (K); *Croockewit* 206 (WAG); Nyika Plateau, Chowo Forest, *Goyder et al.* 3260 (K). ANGOLA: Benguela Region: Chianga, *Teixeira et al.* 5340 (BM); *da Silva* 1958 (LISC); Nova Lisboa, *da Silva* 3745 (LISC); arredores de Nova Lisboa, serra do Cussava, *Moreno* 174 (LISC); Quilemba – Chela, *Gossweiler* 10991 (BM, K); Cuina, *Gossweiler* 12467 (LISC); near Chicala, *Exell & Mendonça* 3039 (BM); Caputo wilundo, *Teixeira & Andrade* 8192 (LISC); entre Duma e Calucipa, *de Menezes* 525 (K, LISC); Hochland zwischen Ganda und Caconda, *Hundt* 7 (BM); *Hundt* s.n. (BM).

MALAWI: Northern Region (MAL-N): Misuku Hills, Matipe Forest, *Chapman* 311 (BM, BR, SRGH); between Mpata and the commencement of the Nyasa-Tanganyika Plateau, *Whyte* (K); Nyika Plateau, *Brass* 17248 (BM, BR, K); *Pawek* 9986 (K); *Whyte* 178 (K); Nyika Plateau, N'Ganja, *Phillips* 1782 (K); Nyika Plateau, near Nganda Hill, *Tyrer* 860 (BM, BR); Nyika Plateau, 8 km NW of Lake Kaulime, *Brummitt* 10834 (K); Nyika Plateau, just S of Kasaramba View Point, *Brummitt* 11900 (K, LISC, UPS); Nyika Plateau, below Chowo Rock, *Chapman* 735 (BM, K); Nyika rain forest, *Pawek* 2865 (K); Nyika, Chowo Rock, *Pawek* 4975 (K); N Vipya, Uzumara rain forest, *Pawek* 5626 (K); Mzimba Distr., N Vipya, Marymount, *Pawek* 9798 (K); Nkata Bay Distr., 4 km SW Chikangawa, *Phillips* 3531 (K). Central Region (MAL-C): Ntchisi Mt., *Blackmore et al.* 1419 (C, K, WAG); Ntchisi forest reserve, just below rest house, *Brummitt* 9452 (K); Chirobwe Mt., on W side, *Iwarsson & Ryding* 852 (K, UPS). ZIMBABWE: East (ZIM-E): Inyanga, *Ferrar* s.n. (K); between Cashel and Melsetter, *Schelpa* 4021 (BM); Himalaya, *Wild* 4511 (K); Melsetter, *Swynnerton* 1991 (BM, K); Fairview, *Rattray* 13523 (BM, SRGH); Melsetter Distr., between 'Silverstream' wattle factory and junction of Chipinga-Melsetter & Umtali Roads, *Goodier* 987 (K); Chimanimani Mountains, E of National Parks Office, *Philcox et al.* 9023 (K).

2. *CLINOPODIUM VERNAYANUM* (BRENNAN) RYDING, COMB. NOV. (FIG. 2R–Y)

Satureja vernayana Brenan, Mem. New York Bot. Gard. 9: 46. 1954. Type: MALAWI. Southern Region, Mlanje Mt., Tuchila Plateau, *Purves* 13 (HOLOTYPE: K!).

Woody rhizomatous HERB or SUBSHRUB, erect or ascending, 0.5–1.2 m tall, with short lateral shoots at most of the nodes, with hermaphrodite and rarely also female flowers, with a mint-like fragrance. STEMS \pm 4-angled, densely or moderately hairy with upcurved, often adpressed, eglandular hairs, often glandular with a few sessile glands, longest hairs 0.3–0.6 mm long, old stems up to 2–4 mm in diameter. LEAVES shortly petiolate or subsessile; petiole less than 4 mm long, less than 0.2 times as long as the blade; blade elliptic or sometimes suborbicular, up to 8–23 \times 5–14 mm, 1.1–3 times as long as broad, above hairy with short eglandular hairs and sparsely glandular with sessile glands, below paler, more densely glandular with sunken orange sessile glands, hairy with short eglandular hairs on raised veins, apex obtuse or rounded, base cuneate, margin crenulate with up to 5 teeth at each side or subentire, \pm revolute. INFLORESCENCES thyrsoid, with the upper verticillasters usually crowded and the lower mostly \pm spaced;

bracts similar to the ordinary leaves but smaller towards the apex of the inflorescence; cymes (3–)7–31-flowered; peduncle less than 2 mm long; bracteoles very variable within the same cymes due to their position, largest bracteoles narrowly rhombic–elliptic, mostly acuminate, up to $6\text{--}9 \times 1\text{--}2$ mm, upper bracteoles smaller and narrower; pedicels less than 2 mm long. CALYX prominently 13-veined, only slightly enlarging after anthesis, slightly 2-lipped, 6–7 mm long, hairy with eglandular hairs and sessile glands, sparsely hairy inside near the mouth; tube narrowly funnel-shaped to almost tubular; posterior lip 3-lobed along 55–80% of its length, lobes narrowly triangular or slightly acuminate, central lobe $1.4\text{--}2 \times 0.5\text{--}0.7$ mm; anterior lip deeply 2-lobed, lobes $2.5\text{--}3.3 \times 0.7\text{--}0.9$ mm. COROLLA strongly 2-lipped, white or cream, 10–13 mm long; tube slightly widened towards the mouth, 5.5–7 mm long; posterior lip emarginate, 3–5.5 mm long; anterior lip 3-lobed with subequal lobes. STAMENS 4, thecae divergent to almost parallel, 1.3–2.5 times as long as wide; anterior pair slightly shorter than to almost as long as the posterior corolla lip, with the anthers $0.5\text{--}0.65 \times 0.45\text{--}0.7$ mm; posterior pair shorter with the anthers $0.4\text{--}0.5 \times 0.5\text{--}0.6$ mm; female flowers with stamens shortly exerted from the corolla tube. Pollen grains ellipsoid, $c. 46 \times 41$ μm . STYLE mostly becoming as long or sometimes slightly longer than the posterior corolla lip, 2-branched with the anterior branch 0.9–1.2 times as long as the posterior branch; disc small, indistinctly 4-lobed. NUTLETS ellipsoid–rostrate or ellipsoid–acute, with a distinct areole at the scar, $1.5\text{--}1.7 \times 0.50\text{--}0.65 \times 0.35\text{--}0.45$ mm, 2.4–3 times as long as broad, brown, hardly mucilaginous.

Distribution and habitat: Only known from Mount Mlanje in southern Malawi (Fig. 4A). Upland grassland, woodland, often near rocks; alt. 1800–2200 m.

Variation and affinities: The material of *C. vernayanum* shows little variation. It is very close to the more widespread *C. myrianthum*. It differs from *C. myrianthum* in having the leaves obtuse or rounded at the apex and usually smaller (Fig. 2R), and differs from most material of this species in having the stem hairs upcurved. Only some *C. myrianthum* from the remote western Zambia have a similar stem indumentum. *C. vernayanum* also tends to have the nutlet longer and narrower at the apex (Fig. 2Y).

Most specimens of *C. vernayanum* seem to have hermaphrodite flowers only. The collection Wild 6193 (K) consists of specimens with hermaphrodite flowers, but also has two dissected flowers in a convolute, of which one is female. Thus, the species seem to be gynomonoeious.

Specimens examined (in addition to the type): MALAWI: Southern Region (MAL-S): Mt. Mlanje: Wild 6193 (BR, K); Pawek 3856 (BR); Iversen & Martinsson 89192 (UPS); Iwarsson & Ryding 804 (K, UPS); Lucheny Plateau, Brass 16643 (BR, K); Chambe Plateau, Chapman 596 (K); Salubeni 1584 (K); Goodier 263 (K); Lucheny plateau – Chembe Basin path, Richards 16667 (K); Chambe Peak, Hardy & Maclachlan 70 (BR, K); 1–2 km S of Tuchila Hut, Brummitt 9753 (K); Ruo Valley, Newman & Whitmore 115 (BM, WAG); mountain between Tuchila and Ruo Valley Divide, Jackson 1911 (BR, K); Tuchila Shelf, Chapman & Chapman 7592 (K); Chapman 5675 (BR, K); by Little Ruo Hut, Brummitt 12336 (K); edge of Sombani Basin, Brummitt 11343 (K, LISC, UPS).

3. *CLINOPODIUM ROBUSTUM* (HOOK.F) RYDING, COMB. NOV. (FIG. 2N–P)

Nepeta robusta Hook.f., J. Linn. Soc. Bot. 7: 212. 1864; Baker in Dyer, Fl. Trop. Afr. 5: 460. 1900; Perkins in Mildbr., Wiss. Erg. deut. Zentr.-Afr. Exped., Bot. 552. 1913; Hutch. & Dalziel, Fl. W. trop. Afr. 2: 280. 1931. *Satureja robusta* (Hook.f) Brenan, Mem. New York Bot. Gard. 9: 48. 1954; J.K. Morton in Hepper, Fl. W. Trop. Afr. ed. 2, 2: 467. 1963. TYPE: CAMEROON. Sud-Ouest, Cameroon Mountain, Mann 1294 (HOLOTYPE: K!).

Small SHRUB or woody HERB with a woody rootstock, erect or ascending, 0.5–1.8 m tall, gynodioecious, with a mint-like fragrance. Young STEMS 4-angled, densely hairy with spreading hairs, longest hairs 1–2 mm long, old stems mostly terete, up to 4–9 mm in diameter. LEAVES shortly petiolate or sessile; petiole less than 4 mm long, less than 0.15 times as long as the blade; blade elliptic or ovate, up to $18\text{--}35 \times 11\text{--}25$ mm, 1.1–1.6 times as long as broad, above \pm bullate, sparsely or moderately hairy with short eglandular hairs and sparsely glandular with sessile glands, below paler, more densely glandular with \pm sunken sessile glands, more densely hairy with eglandular hairs on strongly raised veins, apex rounded, obtuse, subacute or sometimes acute, base rounded–truncate or shallowly cordate, margin densely crenate or crenate–serrate with 6–15 distinct teeth at each side, mostly minutely revolute. INFLORESCENCES thyrsoid, with the verticillasters crowded or the lower spaced; bracts similar to the ordinary leaves but smaller towards the apex of the inflorescence; cymes (1–)5–15(–31?)-flowered; peduncle less than 2 mm long; bracteoles very variable within the same cymes due to their position, largest bracteoles rhombic–elliptic, mostly acuminate, up to $3\text{--}7 \times 1\text{--}2$ mm, sometimes with a few teeth, upper bracteoles smaller and

narrower; pedicels less than 2 mm long. CALYX prominently 13-veined, only slightly enlarging after anthesis, slightly 2-lipped, 3.5–5.5 mm long, hairy with eglandular hairs and sessile glands, sparsely hairy inside near the mouth; tube narrowly funnel-shaped to almost tubular in the distal part; posterior lip 3-lobed along 45–70% of its length, lobes narrowly triangular or slightly acuminate, central lobe 0.8–2.0 × 0.5–0.7 mm; anterior lip more deeply lobed, lobes 1.6–2.3 × 0.6–0.9 mm. COROLLA strongly 2-lipped, white, 7–10 mm long in hermaphrodite flowers, 5–8.5 mm long in female flowers; tube slightly widened towards the mouth, 3.5–6 mm long; posterior lip emarginate, 1.5–4.5 mm long; anterior lip 3-lobed with subequal lobes. STAMENS 4, thecae divergent to almost parallel, 1.9–3 times as long as wide; hermaphroditic flowers with anterior pair slightly shorter than to almost as long as the posterior corolla lip, with the anthers 0.45–0.65 × 0.45–0.65 mm; posterior pair shorter with the anthers 0.35–0.5 × 0.35–0.55 mm; female flowers with stamens shortly exerted from the corolla tube. Pollen grains ellipsoid or globose, *c.* 41–52 × 37–52 µm. Style mostly becoming as long or longer than the posterior corolla lip, 2-branched with the anterior branch 0.9–2 times longer than the anterior branch; disc small, indistinctly 4-lobed. NUTLETS ellipsoid–rostrate or ellipsoid–acute, with a distinct areole at the scar, 1.4–1.9 × 0.5–0.6 × 0.3–0.4 mm, 2.8–3.2 times as long as broad, brown, at least sometimes hairy and papillose in the apical part, slightly mucilaginous.

Distribution and habitat: South-east Nigeria, Cameroon and Equatorial Guinea (Bioco Island) (Fig. 4A). Upland grassland, open woodland; alt. 1800–3000 m.

Affinities and variation: *Clinopodium robustum* is closest to *C. myrianthum* and *C. vernayanum*, but is geographically isolated from these species (Fig. 4A). Most of the material of *C. robustum* differs from *C. myrianthum* in having the leaves rounded to subacute rather than acute at the apex (Fig. 2N), bullate above and more densely and more distinctly crenate, and having the flowers and fruiting calyces smaller, the stems thicker and often more densely hairy, and as far as is known, the nutlets hairy at the apex (Fig. 2P). The last difference is only based on a few observations, and none of the other differences are completely consistent. However, the two species can easily be distinguished by a combination of these differences. The collection *Hepper* 2122 is rather atypical in having the leaves as acute as in *C. myrianthum*, and also resembles that species in being only moderately hairy. On the other hand, it differs from *C. myrianthum* in having the leaves strongly bullate, and having the calyces shorter. *C. robustum* is more distinct from

C. vernayanum, and can be distinguished from this species by having the leaves bullate above and more prominently and densely crenate.

Clinopodium robustum seems to be genuinely gynodioecious. Female and hermaphrodite specimens seem to be almost equally common, and to occur in most parts of the distribution area.

Specimens examined (in addition to the type): COUNTRY UNKNOWN: without locality, *Mann s.n.* (S); Buea, *Talbot s.n.* (BR); above Jakiri Live-stock Improvement Center, *Brunt* 559 (K). NIGERIA: Taraba, Obudu Plateau, *Tuley* 1053 (K); Chappel Waddi, Gangirwal, *Tuley* 2045 (K); Gotel Mountains, *Gbile & Daramola* FHI 63280 (K, WAG); Saudauna P., Gangirwal, *Chapman* 3393 (K). CAMEROON: Region unknown: near Dschang, *Sanford* 5600 (K); Kumbo area, *Meurillon* 1419 (K). Nord-Ouest: Bamenda Highlands, 6°35'N 10°40'E, *Hepper* 1942 (K, S); Bafut-Ngemba Forest Reserve, *Hepper* 2122 (K, S); *Tiku* FHI122204 (K); *Ujur* FHI130021 (K); 15 km N of Bamenda, *Baldwin* 13850 (K); path from Bambukulue from Bamenda – Santa road, *Keay & Lightbody* FHI28354 (K); about 2 km on the road from Santa to Bamenda, *J. de Wilde* 8618 (BR, WAG); near Bamenda, *Migeod* 381 (K); Mt. Okou, *Meurillon* 1810 (WAG); près Kishong, 10 km NNE Kumbo, *Letouzey* 13144 (BR, HBG, K, WAG). Sud-Ouest: Cameroon Mountain: *Dundas* FHI20357 (K); *Keay* FHI28586 (K); *Brenan* 9530 (BM, K); *Etuge et al.* 103 (K); NE slopes, *Neba et al.* 925 (K); 4°12'N 9°13'E, *Thomas* 2639 (BR, K); Bulu side, *Linder* 3444 (K); Johann-Alberechtshütte, *Breteler et al.* MC17 (K, WAG); NW de Buèa, *Meijer* 15405 (WAG). EQUATORIAL GUINEA: Bioco Island, cumbre del pico Basilé, *Fernández Casas* 11176 (BR, K).

4. *CLINOPODIUM ABYSSINICUM* (HOCHST. EX BENTH.) KUNTZE (FIGS 1, 3B, C)

Melissa abyssinica Hochst., *Flora* 24, 1, *Intell.* 2: 23. 1841, nom. nud. *Micromeria abyssinica* Hochst. ex Benth. in A. DC., *Prodr.* 12: 224. 1848; Schweinf., *Beitr. Fl. Aethiop.* 123. 1867; Gürke in Engl., *Hochgebirgsfl. Afrika* 365. 1892. *Avetta*, *Ann. Ist. Bot. Roma* 6: 60. 1897; Baker in Dyer, *Fl. Trop. Afr.* 5: 453. 1900; F. W. Andrews, *The Flowering Plants of the Sudan* 3: 217. 1956; J. R. I. Wood., *A Handbook of the Yemen Flora* 252. 1997; Chaudhary & Hedge in Chaudhary, *Flora of the Kingdom of Saudi Arabia Illustrated* 2: 337. 2001. *Calamintha abyssinica* (Hochst. ex Benth.) A. Rich., *Tent. fl. abyss.* 2: 191. 1850. *Clinopodium abyssinicum* (Hochst. ex Benth.) Kuntze, *Revis. General pl.* 2: 515. 1891. *Satureja abyssinica* (Hochst. ex Benth.) Briq. in Engl. & Prantl, *Nat. Pflanzenfam.* 4,

3a: 301. 1896; Cufod., Enum. 821. 1962; Agnew, Upland Kenya Wild Flowers 626. 1974; Seybold, Stuttg. Beitr. Naturk. Ser. A 421: 15. 1988; Agnew & S. Agnew, Upland Kenya Wild Flowers (ed. 2) 288. 1994. TYPE: ETHIOPIA. Tigray Region, 'M. Scholoda', *Schimper* I/326 (HOLOTYPE: K!; ISO-TYPES: B, BM!, BR!, HBG!, HOH, JE, M!, S!, STU, TUB, UPS!).

Perennial or annual HERBS or SUBSHRUBS, erect or ascending, 0.05–2 m tall, often with a woody root-stock, gynodioecious but female plants rare, with a mint-like fragrance. Young STEMS 4-angled or almost terete, hairy with spreading or recurved hairs or papillae and sometimes also shortly stalked glands, longest hairs 0.05–1.2 mm long, old parts of stems mostly terete, up to 0.5–4 mm in diameter. LEAVES petiolate; petiole 1–28 mm long (0.05–)0.1–0.8 times as long as the blade; blade ovate, or rarely elliptic or obovate, up to 7–45 × 4–35 mm, 0.6–3.5 times as long as broad, above eglandular hairy or papillose and sparsely glandular with sessile glands, below paler, usually more densely glandular with sessile glands and mostly with the eglandular hairs or papillae concentrated on the raised veins, apex rounded, obtuse, subacute or sometimes acute or acuminate, base rounded, cuneate–attenuate, rounded–truncate or cordate, margin crenate, often slightly revolute. INFLORESCENCES thyrsoid, with the verticillasters spaced or crowded; bracts similar to the ordinary leaves but smaller and less distinctly petiolate towards the apex of the inflorescence; cymes (1–)3–c. 31-flowered; peduncle 0–1 (–15) mm long; bracteoles subsessile, narrowly ovate, elliptic or linear, less than 6 × 2 mm (or rarely larger and leaf-like), apex acuminate, acute or subacute; pedicels 0.5–1.2 mm long. CALYX prominently 13-veined, only slightly enlarging after anthesis, 5-lobed with ± hygroscopic lobes, indistinctly or slightly 2-lipped, 3.5–8 mm long, hairy with eglandular hairs and sessile glands, hairy inside near the mouth; tube tubular to narrowly funnel-shaped, fruiting calyx often becoming widened in the basal part; posterior lip 3-lobed along 70–100% of its length, central lobe narrowly triangular–ovate, triangular or triangular–acuminate, 1.0–2.1 × 0.3–0.6 mm; anterior lip deeply 2-lobed, lobes ovate–triangular, triangular or triangular–acuminate, 1.3–2.2 × 0.4–0.7 mm. COROLLA strongly 2-lipped, pink, purple, mauve, violet or white, 6–12 mm long; tube tubular in the basal part and strongly broadened near the mouth, 4–8 mm long; posterior lip shallowly hooded with the margins mostly upcurved, 1–4.5 mm long, apex subequally 4-toothed to emarginate or entire; anterior lip 3-lobed with subequal lobes. STAMENS 4, thecae parallel and tightly arranged, 3.5–7 times as long as wide; anterior pair included in the corolla tube or up to as long as

the posterior corolla lip, with the anthers 0.35–0.9 × 0.2–0.35 mm; posterior pair shorter than the anterior pair, with the anthers 0.3–0.85 × 0.15–0.3 mm; female flowers with stamens shorter. Pollen grains ellipsoid, 29–38 × 25–33 µm. STYLE included in or protruding from the corolla tube and up to as long as the posterior corolla lip, 2-branched with the anterior branch 0.8–1.3 times as long as the posterior branch; disc small, indistinctly 4-lobed. NUTLETS ellipsoid or ovoid, with a distinct areole at the scar, 0.8–1.3 × 0.4–0.7 × 0.3–0.5 mm, 1.5–2.2 times as long as broad, brown or grey, slightly mucilaginous.

Delimitation of the species and subspecific division: Some forms of *C. abyssinicum* are superficially similar to *C. myrianthum*, *C. vernayanum* and *C. robustum*, but *C. abyssinicum* differs from these species in having the anther thecae narrower (3.5–8 times as long as broad; Fig. 1J, V), petioles mostly longer (Fig. 1E, K, O, P), posterior calyx lip mostly more deeply 3-lobed and the corollas mostly pink to purple or violet rather than whitish.

Hedberg (1957), who studied the alpine flora of East Africa, described var. *condensata* as a new variety under the earlier known *C. abyssinicum* (as *S. abyssinica*). Seybold (1988), who studied the Ethiopian material of the same species, found it conspicuously divergent, noted the presence of a few intermediates, and changed the status of this taxon to subspecies. However, Doroszenko (1985) treated it as a synonym under *C. abyssinicum* (as *Micromeria abyssinica*).

The material of *C. abyssinicum* is very variable in habit, leaf shape, indumentum length, pedicel length, calyx length, number of flowers per cyme, shape of the calyx lobes, stamen length and anther size. The variations in these characters are all clearly correlated. When the variations in the most informative characters are considered in combination (Fig. 5A), the material from Ethiopia, Eritrea and Somalia falls into two evident, but not quite distinct, groups that correspond to Hedberg's (1957) and Seybold's (1988) two infraspecific taxa, '*abyssinica*' and '*condensata*'. The few intermediates in this area (e.g. *Westphal & Westphal-Stevels* 2735, *Gillett* 14290, *Mooney* 10003) occur in southern Ethiopia close to East Africa, where the two groups are more difficult to distinguish. Unlike in Ethiopia, it has not been possible to receive any resolution in the material from East Africa (Fig. 5B). The East African material is less variable in most of the above-mentioned characters, and contains rather typical representatives of the two Ethiopian groups as well as many intermediates. There are no indications suggesting that the intermediates are sterile hybrids. The Ethiopian *Westphal & Westphal-Stevels* 2735 and the Tanzanian *Magogo* 2401 have been found to have

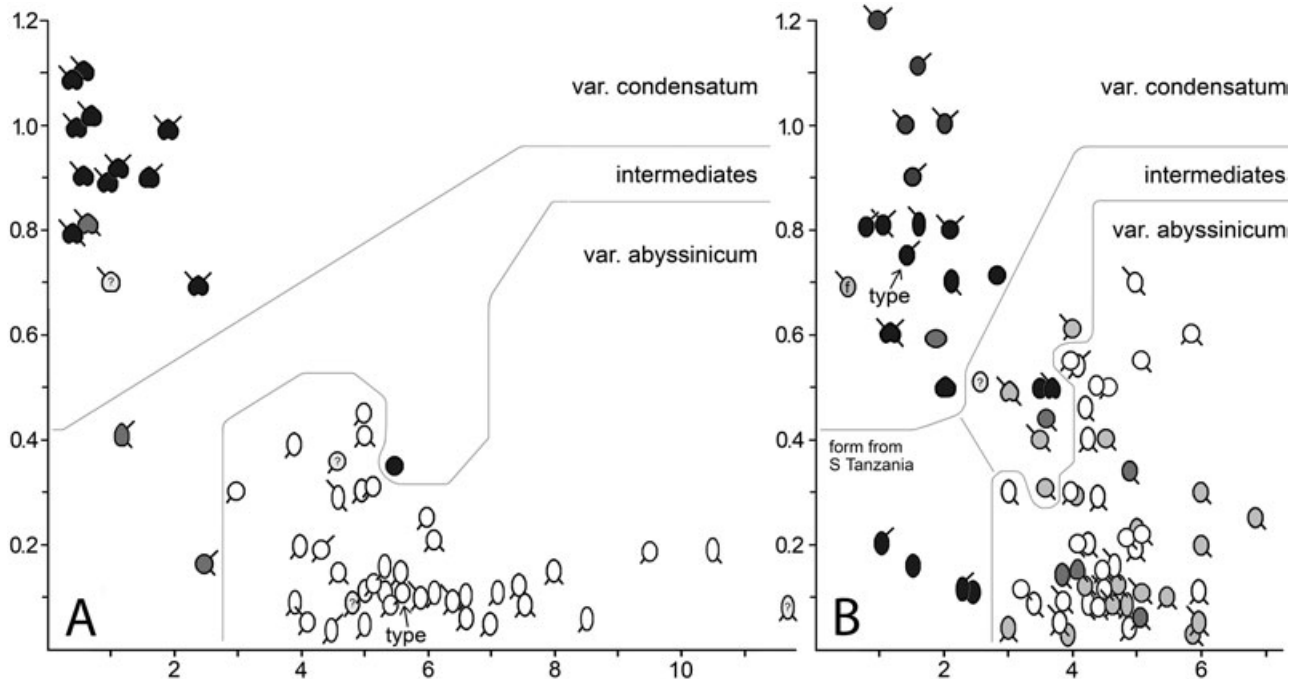


Figure 5. Scatter plots showing the combined variation in the most informative characters within *Clinopodium abyssinicum*. A, Eritrea, Ethiopia and Somalia. B, Sudan, Uganda, Kenya and Tanzania. Each dot represents one collection. The length of the longest pedicels is represented on the horizontal axes. The length of the longest stem hairs is represented on the vertical axes. The length/width relationship of the dots approximately represents the same length/width relationship of the leaf blades. Cordate dots represent collections with cordate leaves. The colour of the dots represents the length of the stamens: white, stamens included in the corolla tube; light grey, anterior stamens shortly protruding beyond the mouth of the corolla tube; dark grey, anterior stamens about half as long as the posterior corolla lip; black, anterior stamens about as long as the posterior corolla lip; ?, stamen length unknown; f, stamens short because the plant is female. The line above to the left represents calyces up to 5 mm long; other dots represent collections with longer calyces. The line above to the right represents at least some cymes with more than seven flowers; other dots represent collections with fewer flowers per cyme. The line below to the left represents fruiting calyces becoming distinctly swollen in the basal part. The line below to the right represents the posterior corolla lip deeply emarginate; other dots represent collections with an entire or 4-toothed posterior corolla lip.

almost 100% fertile pollen grains (stainable in lactic blue), and several of the East African intermediates (such as the *Wilson* 1345, *Bally* 5504 and *Kerfoot* 4169) have been found to have fully developed nutlets.

The great differences, as well as the condition that they are rather distinct in Ethiopia, strongly suggest that two main groups should be retained as infraspecific taxa. However, as the two groups are very indistinct in East Africa, and their geographical distribution and altitudinal ranges strongly overlap, the author prefers to treat them as varieties, while the intermediate collections are left unclassified at the infraspecific level.

VAR. CONDENSATUM (HEDBERG) RYDING,
COMB. NOV. (FIGS 1A–H, 3C)

Satureja abyssinica (Benth.) Briq. var. *condensata* Hedberg, *Symb. Bot. Upsal.* 15, 1: 164. 1957; Cufod.,

Enum. 821. 1962. *Satureja abyssinica* (Benth.) Briq. ssp. *condensata* (Hedberg) Seybold, *Stuttg. Beitr. Naturk. Ser. A* 421: 18. 1988. TYPE: KENYA. Baringo Distr., Katinok Forest, *Dale* 2417 (HOLOTYPE: K!).

SUBSHRUBS or woody perennial HERBS, 0.3–2 m tall. STEM apparently single at the base of the plant, densely or moderately hairy with up to 0.5–1.2 mm long eglandular hairs. LEAF blade 0.6–2 times as long as broad, base cordate, rounded–truncate, rounded or rounded–cuneate. INFLORESCENCE lax or dense; cymes (1–) 5–c. 30-flowered; pedicels 0.5–3 mm long. CALYX 3.5–6.5 mm long, basal part hardly becoming swollen in the fruiting stage; posterior lip 3-lobed along 70–95% of its length; central lobe 1.5–3.5 times as long as broad. COROLLA 6–10 mm long; posterior lip entire, subequally 4-toothed or sometimes 4-toothed with the sinus between the central teeth much deeper. STAMENS and STYLE at least half as long as the posterior corolla lip, or rarely shorter in female plants; anthers

of the anterior stamens 0.5–0.9 mm long. NUTLETS 0.9–1.3 mm long, 1.7–2.2 times as long as broad.

Distribution and habitat: South Sudan, Ethiopia, Uganda, Kenya and Tanzania (Fig. 4C). Open shrubland, shrub grassland, open forest, forest margins or upland heather, often on rocky or steeply sloping ground; alt. 1400–3100 (–3950) m.

Variation: Most of the Ethiopian material of var. *condensatum* (e.g. *Friis et al.* 1430; *Gillett* 14895) belongs to a characteristic and rather homogeneous form that is particularly different from var. *abyssinicum* in most respects. It is densely hairy with the longest stem hairs at least 0.6 mm long, has the leaves cordate and less than 1.1 times as long as broad (Fig. 1K), inflorescences dense, calyces mostly less than 5.5 mm long, the posterior calyx lobe less than twice as long as broad, posterior corolla lip mostly 4-toothed to entire, and the stamens almost as long as the posterior corolla lip.

The material from Sudan, Uganda, Kenya and northern Tanzania is more heterogeneous, and within this area, the variation seems not to be clearly geographically correlated. Many of the collections (e.g. *Dummer* 3380, *Tweedie* 3375 and *Bytebier et al.* 29) resemble the Ethiopian form, but approach both var. *abyssinicum* in having the leaves noncordate and the calyces slightly longer. The *Bytebier et al.* 192 is close to these specimens, but has very broad leaves. The other collections from East Africa are even more similar to var. *abyssinicum*, which they approach in having the eglandular stem hairs shorter (e.g. *Eggeling* 2709), the leaves smaller and narrower (e.g. *Tweedie* 3923), and/or the posterior corolla lip deeply emarginate (e.g. *Newbould* 13554). There is one obviously female collection, the *Hepper & Field* 5015 from the Elgeyo District western Kenya. Unlike the other material of var. *condensatum* it has short stamens, but differs from the other material with short stamens (var. *abyssinica*) in having a long style, and the corolla comparatively small. The female *Hepper & Field* 5015 also diverges in having the nutlets pointed instead of rounded at the apex (Fig. 1N), but the records of nutlet shape are sparse, and the *Tweedie* 3923 from the neighbouring Baringo District has been found to be intermediate in nutlet shape.

Specimens examined: SUDAN: Ecuatoria Region: Dongotona Mts., Imogadung, *Myers* 14191 (K). ETHIOPIA. Shewa: 10 km NE of Butajira, *Sebsebe* 3335 (ETH). Arsi: W slope of Mt. Chilalo, *Mooney* 5168 (ETH, K); Mt. Chilalo, *Scott s.n.* (K). Harege: Kulubi area, *IECAMA, Amere Getahun* 1–1 (ETH, K); Gara Mullata Mtn., *Burger* 2395 (ETH, K); road Bedeno-Longhe, 13 km from Bedeno, along road, *Westphal & Westphal-Stevels* 2426 (K, WAG). Kefa: Mt. Maigudo,

Friis et al. 1430 (C, ETH, K); Mt. Maigudo, *Friis et al.* 490 (BR, C, ETH, K); Dekano, *Mooney* 8280 (ETH, K). Sidamo: Agheremariam, *Gillett* 14597 (K, S); Mt. Delo, Amaro Mts., *Gillett* 14895 (BR, K); Mt. Damota, near Soddu, *Scott* 74 (K); 4–8 km N of Mega, *Mesfin et al.* 3396 (ETH); Sahagannet, *Mooney* 5410 (K). Bale: road from Adaba to Dincho (= Gurie), 64 km from Adaba, *Westphal & Westphal-Stevels* 3130 (K). UGANDA: Karamoja Distr., Mt. Debasien, *Eggeling* 2709 (BR, K). Mbale Distr. Mt. Elgon, *Dummer* 3380 (K). UGANDA/KENYA: Elgon Nature Reserve, *Tweedie* 2337 (K). KENYA: Northern Frontier: Mount Nyiru, *Bytebier et al.* 29 (BR, EA); *Bytebier et al.* 192 (BR, EA, K). Trans-Nzoia Distr. Kitale-Elgon distr., *Jex-Blake* 1295 (EA); Elgon Nature Parc, ridge S of Kimothon River, *Gillett* 20954 (EA). Elgeyo Distr. Cherangani Hills, Kaibibich, *Tweedie* 3375 (K); near Kapsowar Village, *Hepper & Field* 5015 (EA, K). Baringo Distr. Tugen Hills, *Tweedie* 3923 (K). Naivasha Distr. Kipiri Link Road, Aberbaver, *Lind* 2934 (K). TANZANIA: Masai Distr. W slopes of Empakaai Crater, *Pocs & Chuwa* 88275/M (K). Mbulu/Masai Distr. Ngorongoro Highlands, Loolmalassin Mt., *Newbould* 13554 (EA, K). Arusha Distr. Mt. Meru Crater, bas of N wall, *Richards* 25617 (K).

VAR. *ABYSSINICUM* (FIGS 1O–Y, 3B)

Perennial or annual HERBS or sometimes SUBSHRUBS, 0.05–1 m tall. STEMS single or several from a woody rootstock, herbaceous or woody, sparsely, moderately or sometimes densely hairy with up to 0.05–0.6 mm long eglandular hairs. LEAF blades 1.0–3.5 times as long as broad, base rounded, rounded–cuneate or cuneate–attenuate. INFLORESCENCE ± lax; cymes 1–c. 20-flowered; pedicels 1–12 mm long, the longest pedicel at least 3 mm long. CALYX 4.5–8 mm long, basal part often becoming distinctly swollen in the fruiting stage; posterior lip 3-lobed along 80–100% of its length; central lobe 2–4.5 times as long as broad. COROLLA 7–12 mm long. STAMENS and STYLE included in the corolla tube or up to half as long as the posterior corolla lip; anthers of the anterior stamens 0.35–0.8 mm long. NUTLETS 0.8–1.2 mm long, 1.5–2 times as long as broad.

Distribution and habitat: Sudan, Eritrea, Ethiopia, Somalia, Kenya, Tanzania, Yemen and south-west Saudi Arabia (Fig. 4B). Open wood- or shrubland, shrub grassland, mostly on rocky, stony or steeply sloping ground, rarely on bare ground at roads and buildings; alt. 900–2700 (–3000) m.

Variation: The Ethiopian, Eritrean and Somali material of var. *abyssinica* differs from the East African material of this variety in tending to be more herba-

ceous, having the pedicels longer (Fig. 5), fruiting calyces more swollen in the basal part (Fig. 5), the calyx lobes slightly narrower and the anthers smaller. Annuals (e.g. *Ryding & Sileshi* N. 1867, *Friis et al.* 6741) are very common and perhaps more frequent than perennials in north-east Africa, are also known from central Kenya (*Gilbert* 4880), but seem to be rare or absent south of the equator. Probable perennials with rather thin subterranean parts (e.g. *Hughes* 8 and *Jansen* 4474) seem to occur in most parts of the distribution area, but perennials with an over 1 cm thick rootstock (e.g. *Carlborg* 22 and *Drummond & Hemsley* 2869) are only known from East Africa. Whereas the material from Ethiopia, Eritrea and Somalia has the anthers included in the corolla tube, the material from East Africa and the Red Sea hills in Sudan often has the anthers protruding beyond the mouth of the tube. In the above-mentioned characters, the material from north-east Africa is particularly different from var. *condensatum*, while the East African material approaches this variety. However, the opposite is true for the following aspects of the variation. As with most material of var. *condensatum*, the var. *abyssinicum* from Eritrea, Somalia and northern to central Ethiopia has the posterior corolla lip entire, subequally 4-toothed or 4-toothed with the sinus between the two central teeth only slightly deeper (Fig. 1U). The material from East Africa and southern to eastern Ethiopia diverge in having the posterior corolla lip emarginate (as in Fig. 1C) rather than 4-toothed or entire. A few collections from Kenya and northern Tanzania (*Archer* 691, *Ivens* 2265, *Janssens* s.n.) diverge from the rest of the species in having the peduncles well over 2 mm long. *Archer* 691 also diverges in having the flowers slightly longer than in the rest of the species.

Female plants have not been observed in this variety, but due to practical reasons, only a few plants have been sex-determined.

Specimens examined (in addition to material cited by Seybold, 1988: 17–18): SUDAN: Red Sea Region: Erkowit, *Jackson* 2724 (K); Erkowit, *Waffer* 22 (K); Erkowit, *Aylmer* 562 (BM); Erkowit (Jebel Idsib), *Ibainah*, *Andrews* 3603 (K); Erkowit (Jebel Imasait), *Andrews* A3498 (K); Erkowit, *Jebel Seila*, *Andrews* 3574 (K); Red Sea Hills, *Diris Pass*, *Jackson* 2895 (K); Red Sea Hills, *Gedein*, *Jackson* 2939 (K). Equatoria Region: Gilo, near the Bridge across Ngairigi River, *Friis & Vollesen* 289 (C, K, WAG); Iwova, *Didinga Mts.*, *Myers* 11043 (K); *Dongotona Mts.*, *Imogadung*, *Myers* 14191 (K). ERITREA: Mogo, *Nastasi* 1119 (ETH); *Imbatkala*, 39 km from Asmara on road to Mitsiwa, *Ryding & Sileshi* N. 1867 (C, ETH, UPS); Mt. Bizen, *Schweinfurth & Riva* 1538 (BR); Asmera town, *Ryding* 1685 (ETH). ETHIOPIA: district unknown: *Schimper*

379 (BM); *Schimper* 948 (K). Tigray: 14°13'N 39°03'E, *Friis et al.* 6741 (BR, C, ETH, K); Adoua, *Quartin-Dillon & Petit* s.n. (K). Gondar: in Monte Scholada prope Adoam, *Schimper* III/1846 (BM); 9 km on the way to Humera from Gondar following the bank of Angereb river, *Sebsebe* 369 (C, ETH); about 90 km from Bahir Dar to Gondar, Infaz area, *Sebsebe* 425 (ETH); 1.5 km N of Gonder on road to Axum, *Seegeler* 2201 (WAG). Welo: *Woldiya D.*, *Getaneh Belachew* 52 (ETH); Dessie Awraja, Haregu, *Mesfin T.* 7097 (ETH); 5–6 km from Kombolcha to Yegot State, *Sebsebe* 4333 (ETH). Gojam: Strada per Chagni, al passo in uscita dalla valle del Beles, *Bigazzi & Tardelli* 529 (ETH); near Flikflik, *Edwards & Tewolde* 5340 (ETH); Abbay Gorge, Deyen, *Tewolde & Getahun A.* 2403 (ETH). Shewa: Debre Libanos, *Davidson & Jemal Defar* 81 (ETH); 100 km N of Addis Abeba towards Gojam, 3 km from turn to Debre Libanos, *Sebsebe & Ermias* 2392 (C, ETH); slopes of Mugur Valley, 30 miles N of Addis Abeba, *Sandford* 12 (BM); Mountains above Guder, *Ryding* 2415 (ETH); Guder, *Chojnacki* 95 (WAG); Addis Allen, *Omer-Coper* s.n. (K); between Addis Abeba and Addis Allem, *Omer-Cooper* s.n. (K); Mulu farm, 30 km from Addis Abeba, *Curle* 180 (BM); Abay Gorge, Ensermu K. 1483 (ETH); 9°03'N 38°35'E, *Friis et al.* 6311 (BR, C, ETH, K); 8°59'N 37°44'E, *Friis et al.* 8212 (C, ETH, K); Menagesha State Forest, *Lisane-work N. & Michelsen* 6350 (BR, C, K); near the Bole International Airfield, *Mesfin T. & Mercier* 1211 (ETH); Mount Bora, 17 km from Allem-tena, *Tewolde* 1315 (ETH). Harege: 5 km from Harar city, on the Fedis road, *Bos & Jansen* 9872 (WAG); Giri Kochere, c. 40 km W of Jijiga, *Boulus* 10549 (ETH); 28–29 km from Harer (13–14 km from Kolbolcha) on the road to Jarso/Gursum, *Ensermu & Petros* 1921 (ETH); 28–29 km from Harer on the road to Jarso/Gursum, *Ensermu & Petros* 1921 (K); Hakim Gara near Harrar, *Seegeler* 2107 (WAG). Kefa: about 90 km from Jimma on the Addis Abeba road, *Bos* 8642 (WAG); 63 km from Gibe River Bridge along road from Addis Abeba to Jimma, *Ensermu & Aschalew* 4212 (ETH). Gamo Gofa: 12 km S of Chenchu along the road to Arba Minch, *Ryding et al.* 1651 (UPS); 38 km from Jinka on road to Konso, *Gilbert & Phillips* 8974 (K); 2 km below Dorse on road to Arba Minch, *Gilbert & Phillips* 9241 (K); 2 km below Dorse on road to Arba Minch, *Gilbert et al.* 9241 (ETH). Sidamo: 2 km after Humbo along the old Sodo-Chenchu road, *Ryding et al.* 1597 (UPS); 7 km W of Yavello, *Mesfin & Tewolde* 2722 (ETH); c. 5 km W of Yavello on the road to Teltele and Konso, *Friis et al.* 8504 (C, ETH, K); Yavello, *Bally* 9390 (K); c. 2 km from turnoff from Negelle-Kebre Mengist towards Sidambal bridge, *Friis et al.* 11066 (C, K); Sidama Awr., Dibicha, c. 13 km N of Dilla, *Mesfin et al.* 3176 (ETH); 4 km N of Wadera, *Mooney* 9961 (ETH). Bale: 6°25'N 39°47'E, *Friis et al.* 3442 (C, ETH, K, WAG);

6°25'N 39°45'E, *Friis et al.* 5560 (BR, C, ETH); 6°25'N 39°45'E, *Friis et al.* 5674 (BR, C, K); 13 km N of Genale River on road from Negele & Biata to Dolo Menna, *Gilbert & Ermias* 8467 (ETH, K). SOMALIA: Woqooyi Galbeed Region: Wogr near Sheikh, *Wood S/72/94* (K). Togdheer Region: Wagger Mt., *Bally* 10249 (K); Wagga Mt., *Lort Phillips s.n.* (BM, K). Sanaag Region: N side of Tabaa (Mait) Pass over the Al Mado Escarpment of the Golis Range, N of Erigavo, *Bally & Melville* 15972 A (C, K, UPS, WAG); Baloh, NE of Erigavo, *Bally* 11258 (K); N face of Surud, 6 mls W of tunnel on Erigavo-Mait road, *Boaler* 49 (K); Shimba Beris, Surud, *Colinette* 358 (K); Meid, Serrut Geb., *Hildebrandt* 1424 (BM); Dol, *Newbould* 945 (K). UGANDA: Karamoja Distr. Morongole, *Thomas* 3286 (K); Kalapata, *Philip* 727 (K); Mt. Moroto, *Katende* 420 (BR, K); Napak, *Eggeling* 5946 (K). Mbale Distr. on road between Kapchorwa and Kabururoni, about 6 miles E of Kapchorwa, *Wood* 425 (EA); S.W.A. Mt. Elgon, *Ross* 1353 (BM); Bulago, Bugishu, *Thomas s.n.* (EA, S); Sebei, *Norman* 275 (BR); UGANDA/KENYA: Mt. Elgon, *Lindblom s.n.* (S). KENYA: district unknown: *Bogdan* 456 (EA); Mt. Kenya, ?*Machmus* 74 (BM); Aberdare, Mts. Kinangop, *Synge* 1143 (BM); Kapsiliat?, *Starzenski* III/36 (BR). Northern Frontier Distr. Moyale, *Gillett* 13593 (BR, K, S); Kulal, *Oteke* 115 (K); Mt. Kulal, *Bally* 5504 (K); Mt. Kulal, Getab village, *Hepper & Jaeger* 6839 (K); Mt. Nyiro, *Kerfoot* 2060 (K); W slopes of Mt. Nyiro, *Archer* 691 (EA, K); Nyiro, *Adamson* 567 (K); 24 km N of Maralal on road to Baragoi, *Gilbert et al.* 5151 (K, WAG); above Marsabit Sec. School, *Faden* 68/382 (BR); Dunyus, *Bally* 3633 (K); Nduto Mt., Sirwan, *Newbould* 3390 (K). Trans Nzoia Distr. 50 km N of Kitale on road to Lodwar, *Bonnefille* 349 (EA); in monte Elgon, in latere orientali, *Andersen* 266 (S); Mt. Elgon, Endeless, *Irwin* 60 (S); Mt. Elgon Lodge, *Lavranos & Newton* 17791 (C, WAG). Elgeyo/W Suk Distr. Cherangani Hills, Kipsait, *Holm* 6503 (UPS); Cherangani Hills, Kibwabich, *Hughes* 8 (EA). Elgeyo Distr. Cherangani Hills, Lelan Forest, *Bridson* 101 (K); Cherangani Hills, Kaisungur, *Verdcourt* 2439 (EA); summit Ridge of Kaisungur, *Townsend* 2362 (K); above Forest Station Kaisungur, *Symes et al.* 2439 (EA, K). Uasin Gishu Distr. Uasin Gishu, *Harvey* 44 (EA). Ravine Distr. Timboroa, *Ivens* 2265 (EA). Nakuru Distr. Ndoroto, *Bally* 7419 (K); Lolderoto Escarpment, *Gardner* 2017 (K); Menengai Crater slopes, *Honoré* 217 (K); Tinderet Forest, near Malaget Forest Station, *Perdue & Kibuwa* 9200 (BR, K). Naivasha Distr. Gilgil, *Dowson* 600 (EA); Gilgil, Naivasha, *McDonald* 1342 (K). N Nyeri Distr. 18 km NE of Nanyuki, Cedarvale Farm, *Gilbert* 4880 (K, UPS, WAG); Nanyuki, *Beckley* 2091 (K); Mt. Kenya, Nyeri, *Rogers* 391 (BM, BR); Mt. Kenya occid., pr. Forest Station, *Fries & Fries* 609 (K, S, UPS); Nanyuki-Meru, *van Someren* 1729 (EA). Fort Hall Distr. inter

Thika et Fort Hall, *Fries* 32 (UPS). Macharkos Distr. Macharkos Distr, Donyo Sabuk, *Bally* 9818 (K). Mua hills, *Benson s.n.* (BM); Macharkos Distr., Kamungala, *Mwanganga* 878 (K). Kisumu-Londiani Distr. Lumbwa, Gononguru, *Carlborg* 22 (BR, S); Shoulder of Limutit, Londiani – Fort Ternan road, *Drummond & Hemsley* 4470 (BR, K, S). Nandi/N Kavirondo Distr. Central Nyanza, Nandi Esarpment near Miwani, *Bie* 66373 (UPS). Machakos/Masai Distr. Chyulu Hills, *Bally* 8370a (EA, K). Teita Distr. Teita Hills, *Beentje et al.* 1160 (K); Teita Hills, Mrugua, *Mwachala et al.* 3192 (EA). TANZANIA: Masai Distr. about 6 miles W of Ngorongoro Crater, *Bally* 11613 (BR, K, S); Ngorongoro Crater, *Margwe & Simon* 11 (K); Ngorongoro, *Tanner* 884 (K); Lerong, side of Lemagrut, *Newbould* 5635 (K). Mbulu/Masai Distr. Mt. Ngorongoro, Loolmalassin, *Newbould* 13.554 (EA). Mbulu Distr. Mt. Hanang, Katish to Nangwa, *Greenway* 7573 (EA, K). Arusha Distr. Legumashira Crater, Ol Doinyo & *Bigger* 1920 (K); Ol Doinyo, Loldadwenye, *Newbould* 2902 (K); Momela gate to main Arusha – Moshi road, *Richards & Arasululu* 26964 (BR, C, EA, K); Mukula Hill in Imbibia Village, *Simon* 56 (C). Moshi Distr. E slope of Kilimanjaro, Rombo-Useri, *Greenway* 7841 (K); Kilimanjaro, *Janssens s.n.* (BR); Kilimanjaro, *Haarer* 723 (K); Kilimandscharo, Marungu, *Volkens* 268 (BM, BR, HBG); Marangu, *Archbold* 2876 (K); Marangu, *Revell* 307 (K); Kilimanjaro, Legumishira hill, *Grimshaw* (K); Moshi, *Marchall* 17 (K). Lushoto Distr. Lushoto Dist., Vugiri, *Archbold* 244 (K); W Usambara Mts, below Baga, between Mgwashi and Mtai above Mzinga village, *Borhidi et al.* 85367 (K, UPS); Usambara, *Buchwald* 122 (BR); W Usambaras, Escarpment near Gologolo-Mkumbala footpath, *Drummond & Hemsley* 2869 (BR, EA, K, S); W Usambara, Korogwe Distr., Dindua, *Faulkner* 2051 (BR, K, S); Usambara, Kwa Mshuza, *Holst* 9160 (HBG, K); W Usambaras, Makuyuni Dist., *Koritzchoner* 812 (K). Tanga Distr. W Usambara Mts, NW of Mashindei Village, *Borhidi et al.* 841109 (UPS); W Usambara Mts., Ndelemai, *Borhidi et al.* 84631 (UPS). Morogoro Distr. Nguru Mts., *Schlieben* 4122 (BM, BR); Nguru Mts., near Maskati Mission, *Thulin & Mhoro* 2997 (C, EA, K, UPS). SAUDI ARABIA: Jabal Tayfa, 100 km NE of Jigan Middle Area, *Collenette* 9030 (K). YEMEN: 5 km E of Mahwit, *Miller & Long* 3348 (K); Taizz, Wadi Sabir, *Scott & Britton* 328 (BM).

Intermediates between var. condensata and var. abyssinica, and other unclassified material: The intermediates between the two varieties constitute a very heterogeneous assemblage of collections. Most of the East African collections are intermediate between the two varieties in most characters (see Fig. 5B), but some of these intermediates have different combinations of characteristics. The two collections from Mt.

Kulal in northern Kenya (*Bally* 5504 and *Hepper & Jaeger* 7115) have the leaves cordate, as in the Ethiopian form of var. *condensatum* (Fig. 1A), but agree well with var. *abyssinicum* in only having up to five flowers per cyme. The Ethiopian *Gillett* 14290 agrees with var. *abyssinicum* in pedicel length and hair length, but agrees with var. *condensatum* in having the stamens as long as the posterior corolla lip, and the fruiting calyces thin at the base.

The geographically rather isolated material from southern Tanzania (e.g. *Greenway* 8385) constitutes a rather well-defined form (Fig. 5B) that is rather divergent from both var. *abyssinicum* and var. *condensatum*. The four collections from this area agree with var. *condensatum* in consisting of large and densely hairy plants, having the pedicels short, the posterior calyx lip rather shallowly lobed, the anterior stamens about as long as the posterior corolla lip, and the posterior corolla lip entire or shallowly 4-lobed. On the other hand, they agree with var. *abyssinicum* in having the eglandular hairs very short (up to 0.2 mm long), the leaves narrow (over 1.5 times as long as wide; Fig. 1E) and the calyces long. Doroszenko (1985: 293) wanted to describe this form as a new species (*Brenaniella runguensis*) close to *C. myrianthum* and its allies, but he did not compare it to *C. abyssinicum*, to which it is undoubtedly conspecific.

Specimens examined: ETHIOPIA: Sidamo: road Kibre Mengist to Neghelli, *Westphal & Westphal-Stevels* 2735 (C, WAG); 20 km E of Adola, *Mooney* 10003 (WAG); Mega, *Gillett* 14290 (BR, K, S).

UGANDA: Karamoja Distr. Sogolime, Moroto Mt., *Wilson* 1345 (K); Mt. Moroto, *Eggeling* 2911 (K); Moroto Mt., Imgit Peak, *Wilson* 247 (BR, EA). KENYA: Northern Frontier: Mt. Kulal, *Hepper & Jaeger* 7115 (EA, K); Mt. Kulal, *Bally* 5504 (C, K). Meru Distr. Maua near Karama, *Mwangangi & Fosberg* 591 (K, LISC). TANZANIA: Morogoro Distr. Morogoro, *Schlieben* 4128 (LISC). Mbeya Distr. Mbeya Peak Forest Reserve, *Kerfoot* 4169 (EA); Kwamwondo E of Itimba Village, *Lovett & Kayombo* 405 (K); Maniswela Mts., *Magogo* 2401 (EA, K, UPS). Rungwe Distr. Lower Fishing Camp, Kiwara River, *Greenway* 8385 (BM, EA, K).

5. *CLINPODIUM PARADOXUM* (VATKE) RYDING,
COMB. NOV. (FIG. 6)

Calamintha paradoxa Vatke, *Linnaea* 37: 327. 1872; Gürke in Engl., *Hochgebirgsfl. Afrika* 366. 1892; Baker in Dyer, *Fl. Trop. Afr.* 5: 456. 1900. *Satureja paradoxa* (Vatke) Engl., *Veg. Erde* 9, 1: 109. 1910, nom. nud.; Cufod. *Enum.* 822. 1962. *S. paradoxa* (Vatke) Engl. ex Seybold, *Stuttg. Beitr. Naturk. Ser. A* 421: 13. 1988. TYPE: ETHIOPIA. Gondar Region, 'in montibus Dewra Tabac' (in the mountains at Debre Tabor), *Schimper* 1546 (LECTOTYPE here designated: K!; ISOTYPE: E).

Perennial, creeping HERB, rooting at the nodes, gynodioecious but female plants uncommon, with a mint-like fragrance, about 0.15–1.5 m long. STEMS \pm 4-angled, slightly or densely hairy with eglandular hairs, longest hairs up to 0.5–2 mm long. LEAVES

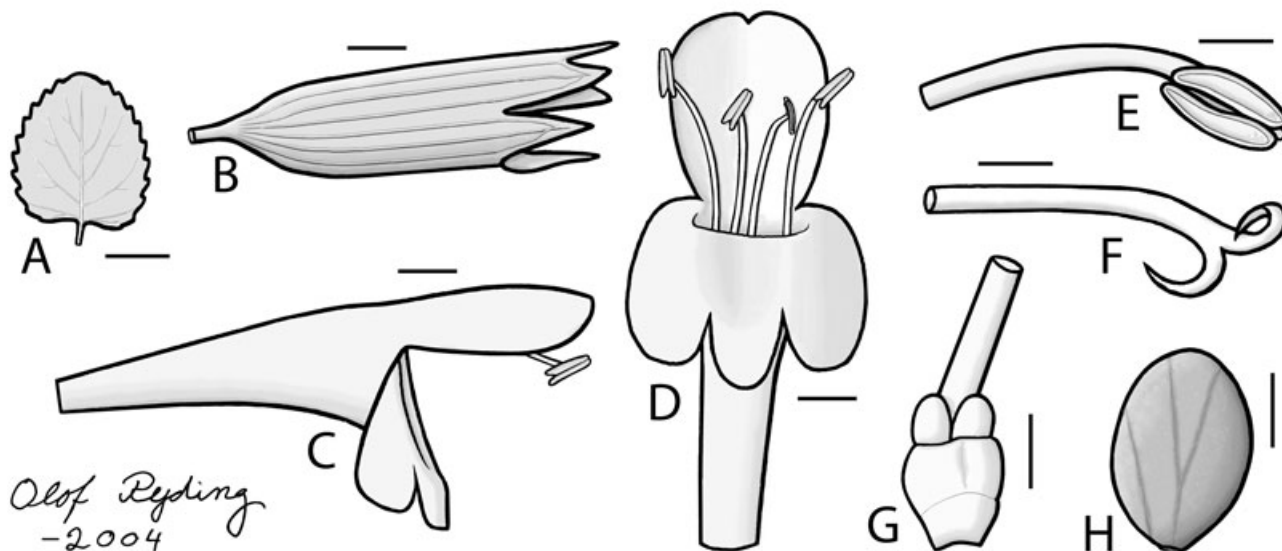


Figure 6. *Clinopodium paradoxum*. A, leaf. B, calyx. C, D, corolla in different orientations. E, apical part of anterior stamen with an anther. F, apical part of style. G, basal part of pistil with style, ovary lobes and disc. H, nutlet seen from distal side. (A–G from *Friis et al.* 26; H from *W. de Wilde* 6801). Scale bars: A = 10 mm; B–D = 1 mm; E–H = 0.5 mm.

shortly petiolate; petiole less than 8 mm long, 0.05–0.3 times as long as the blade, often densely hairy; blade thin, broadly ovate, broadly elliptic, broadly elliptic-oblong or suborbicular, up to 10–50 × 8–40 mm, 1.0–1.7 times as long as broad, above papillose near the margin, otherwise glabrous or more sparsely papillose, often with longer hairs near the petiole, below with sunken orange sessile glands and mostly sparsely hairy with short eglandular hairs on raised paler veins, apex rounded or sometimes obtuse, base cordate, rounded or truncate, ± attenuate along the petiole, margin crenate, mostly minutely revolute. INFLORESCENCES thyrsoid, with all the verticillasters crowded or with the lower verticillasters slightly spaced; less than 10 cm long; bracts similar to the ordinary leaves but smaller and narrower and less distinctly petiolate towards the apex of the inflorescence; cymes 5–15(–31?)-flowered; peduncle 0–1 mm; bracteoles linear, less than 4 mm long; pedicels 1–4 mm long. CALYX 13-veined, 2-lipped, only slightly enlarging after anthesis, tubular along the central part, 5–7 mm long, often ± purplish-violet, hairy with eglandular hairs and sessile glands, sparsely hairy inside near the mouth; posterior lip 3-lobed along 35–55% of its length, lobes ovate-triangular, triangular or sometimes slightly acuminate, obtuse, central lobe 0.7–1.1 × 0.8–1.1 mm, 0.8–1.7 times as long as broad; anterior lip deeply 2-lobed, lobes narrowly triangular, 2–2.5 × 0.9–1.2 mm. COROLLA strongly 2-lipped, 6.5–9.5 mm long, violet, purplish or sometimes white, usually with darker markings on the anterior lobe; tube narrowly funnel-shaped, 4–6 mm long; posterior lip 2–3 mm long, emarginate; anterior lip 3-lobed with subequal lobes or mostly with the central lobe slightly narrower. STAMENS 4, thecae parallel, elongate, and tightly arranged, 3.5–8 times as long as broad; anterior pair about as long as the posterior corolla lip, with the anthers 0.65–1 × 0.25–0.4 mm; posterior pair shorter with the anthers 0.6–0.95 × 0.25–0.35 mm; female flowers with stamens hardly exerted from the corolla tube, filaments about as long as the anthers, anthers *c.* 0.3 × 0.2 mm. Pollen grains *c.* 43–48 × 38–43 µm. STYLE mostly becoming longer than the posterior corolla lip, 2-branched with the anterior branch 1–1.3 times longer than the anterior branch; disc small, indistinctly 4-lobed. NUTLETS ellipsoid or ovoid, without a distinct areole at the scar, 1.1–1.4 × 0.9–1 × 0.45–0.55 mm, 1.2–1.4 times as long as broad, brown, mostly with darker lines along the veins, slightly mucilaginous.

Distribution and habitat: Known only from the Ethiopian highlands, where it is known from most of the Flora regions (excluding Tigray, Welo and Afar). It is particularly frequent in the comparatively wet western part of the highlands (Fig. 4A). Moist grassland,

margins of evergreen forest, near stream banks; alt. 1300–3500 m.

Affinities and variation: *Clinopodium paradoxum* is a very distinctive species. It differs from the other species of the *C. abyssinicum* group in being creeping to decumbent, having the posterior calyx lip more shallowly divided (Fig. 6B), lacking a distinct areole near the nutlet scar (Fig. 6H), and often having the central lobe of the anterior corolla lip narrower than the lateral lobes.

The material of *C. paradoxum* shows rather little variation. The number of female specimens is low in relation to the total number of studied records (four of 70), and such plants are only known from the Kefa and Sidamo regions. The three collections containing more than one specimen (e.g. *J. de Wilde* 5584, *Friis et al.* 26 and *Seegeler* 2479) contain hermaphrodite as well as female plants. As in many other gynodioecious species, the female flowers tend to be slightly smaller than the hermaphrodite flowers.

Specimens examined (in addition to material cited by Seybold, 1988: 13–15): ETHIOPIA: Welega: 8 km NW of Nejo, *Sebsebe & Erich* 534 (ETH). Shewa: 25 km from Soddo along the road from Shashamane, *Jansen* 3697 (C, WAG). Harege: 80 km before Asbe Tefari, along the road from Kulubi, *Jansen* 3498 (WAG); Gara Ades, *Jansen* 7176 (C, WAG). Ilubabor: 55 km S of Gore along the road to Tepi, *Ryding & Mesfin* T. 2152 (ETH, UPS). Kefa: Mt. Maigudo, *Friis et al.* 1445 (BR, C, ETH, K, WAG); Jimma, *Seegeler* 2479 (C, WAG); Bonga, *Jansen* 2092 (WAG); road from Jimma to Bonga, 15 km before Bonga, *Jansen* 5641 (WAG); 5 km from Bonga, Jimma Road, *Bos* 8418 (C, WAG); Bonga Catholic Mission, *Bos* 9335 (C, WAG); 18 km E of Mizan Teferi along the road to Jima, *Ryding & Mesfin* T. 2169 (ETH, UPS). Shewa: between Ejaji and Gedo, *Ryding* 2413 (ETH, K). Bale: Bale Mts., 5 km N of Rira, *Friis et al.* 5551 (C, ETH, K); Bale Mts., 6°56'N 39°56'E, *Friis et al.* 5645 (C); Bale Mts., Harenna Forest, *Mesfin* T. 4819 (C, ETH).

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REFERENCES

- Bräuchler C, Meimberg H, Abele T, Heubl G. 2005.** Phylogeny of the genus *Micromeria* Benth. (Lamiaceae) – evidence from cpDNA sequence data. *Taxon* **54**: 639–650.
- Brenan JPM. 1954.** Plants collected by the Vernay Nyasaland expedition of 1946. *Memoirs of the New York Botanical Garden* **9**: 1–132.
- Doroszenko A. 1985.** Taxonomic studies on the *Satureja* complex. PhD thesis, Edinburgh University and Royal Botanic Garden.
- Gürke M. 1905.** Labiatae africanae. VI. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* **36**: 120–136.
- Harley RM, Atkins S, Budantsev AL, Cantino PD, Conn BJ, Grayer R, Harley MM, de Kok R, Krestovskaja T, Morales R, Paton AJ, Ryding O, Upson T. 2004.** Labiatae. In: Kubitzki K, ed. *The families and genera of vascular plants*, Vol. 7. Berlin: Springer, 167–275.
- Hedberg I, Edwards S. 1989.** *Flora of Ethiopia*, Vol. 3. Addis Abeba: Addis Abeba University.
- Hedberg O. 1957.** Afroalpine vascular plants – a taxonomic revision. *Symbolae Botanicae Upsalienses* **15** (1): 1–411.
- Morales Valverde R. 1993.** Sinopsis y distribución del género *Micromeria* Benth. *Botanica Complutensis* **18**: 157–168.
- Polhill D. 1988.** *Flora of tropical East Africa – index of collecting localities*. Kew: Royal Botanic Gardens.
- Pope G. 1998.** *Flora Zambesiaca – collecting localities in the flora Zambesiaca area*. Kew: Royal Botanic Gardens.
- Seybold S. 1988.** Die Arten der Gattung *Satureja* L. (Labiatae) in Äthiopien. *Stuttgarter Beiträge zur Naturkunde, Serie a (Biologie)* **421**: 1–38.