

Raphionacme sylvicola (Apocynaceae, Periplocoideae), a New Species from Zambia

Hendrik J. T. Venter* and Rudolf L. Verhoeven

Department of Botany and Genetics, University of the Free State, P.O. Box 339, Bloemfontein 9300, South Africa. venterhj@plk.nw.uovs.ac.za; verhoerl@plk.nw.uovs.ac.za.

*To whom correspondence should be addressed.

ABSTRACT. *Raphionacme sylvicola* is recognized by its climbing habit, long-petioled leaves that are large, soft, and thin-textured, and flowers with tri-segmented corona lobes. The central coronal segment is strap-shaped and bifid, with the lateral segments subulate and fused to the filament bases. *Raphionacme sylvicola* resembles *R. monteiroae* (Oliver) N. E. Brown and *R. flanaganii* Schlechter in the climbing habit and flowers. *Raphionacme* is the largest genus in the Periplocoideae and consists of geophytic herbs with a few climbers that inhabit savanna, grassland, and semi-desert scrub. The occurrence of this new climbing species in mesophytic forest is thus uncommon and noteworthy.

During a recent visit to the Kew Herbarium (K), the first author found a specimen that resembled *Raphionacme* Harvey in floral structure, but it could not be identified as belonging to one of the known species. This specimen was collected by a MO team in northern Zambia. What makes the specimen unique is its uncommon habit and habitat.

Raphionacme is a large genus, and the majority of its species are herbaceous geophytes from drier habitats such as semi-desert scrub, savanna, and grassland. Only a few species are climbers, but none exhibit the soft, thin-textured leaves of the new species, *R. sylvicola*, which was collected in a forest, probably wet, near a waterfall. Although it shows relationship to the other climbers by its habit, it remains a unique *Raphionacme* species, particularly by its leaves and the structure of the corona in the flower.

Raphionacme, with 37 species, is the largest genus in the Periplocoideae; it is widespread over Africa and has one species in Arabia. As can be expected, such a large genus is rather polymorphic and is adapted to a variety of environmental conditions in savanna, grassland, and dry scrubland. This new species represents a new niche, namely the mesophytic forest, for the genus and contributes to our knowledge concerning the survival strategies

of *Raphionacme*. The epithet "*sylvicola*" means "inhabitant of woods."

MATERIAL AND METHODS

An Olympus Stereo Microscope was used to study the external morphology of the new species. As no fresh, or spirit, material was available, one flower from each of the two *Merello et al.* 962 (K, MO) specimens was rehydrated and examined. For light microscopy (LM), pollen from these flowers was acetolyzed according to Erdtman's (1960) method, mounted in glycerine jelly, and sealed with paraffin wax. Samples were examined using a Zeiss photomicroscope. All measurements were made with the light microscope. For scanning electron microscopy (SEM), pollen was acetolyzed, air-dried on stubs, coated with gold, and examined under a Jeol Winsem 6400 microscope at 10 kV. For transmission electron microscopy (TEM), the rehydrated pollen was fixed in 1% osmium tetroxide, stained with 0.5% uranyl acetate, dehydrated in ethyl alcohol, and embedded in Spurr's low-viscosity resin. Sections were cut with a glass knife, stained with uranyl acetate followed by lead citrate, and examined with a Philips CM 100 microscope at 60 kV.

RESULTS

POLLEN

The most common tetrad arrangement is rhomboidal (Fig. 1A, B), but tetragonal and decussate arrangements also occur. The rhomboidal tetrads vary from 70 to 85 (length) \times 56–73 (width) μm with an average of $77 \times 63 \mu\text{m}$. Individual tetrad grains have 8–14 pores.

The pollen wall is typical of that of the other *Raphionacme* species (Verhoeven & Venter, 1988). The exine is smooth and consists of an outer distal stratum (tectum) subtended by a granular stratum consisting of granules of unequal size (Fig. 1C). The inner walls separating the individual grains of the tetrad have the same structure as the exterior wall. Wall bridges (Fig. 1D, arrowhead) consisting of in-

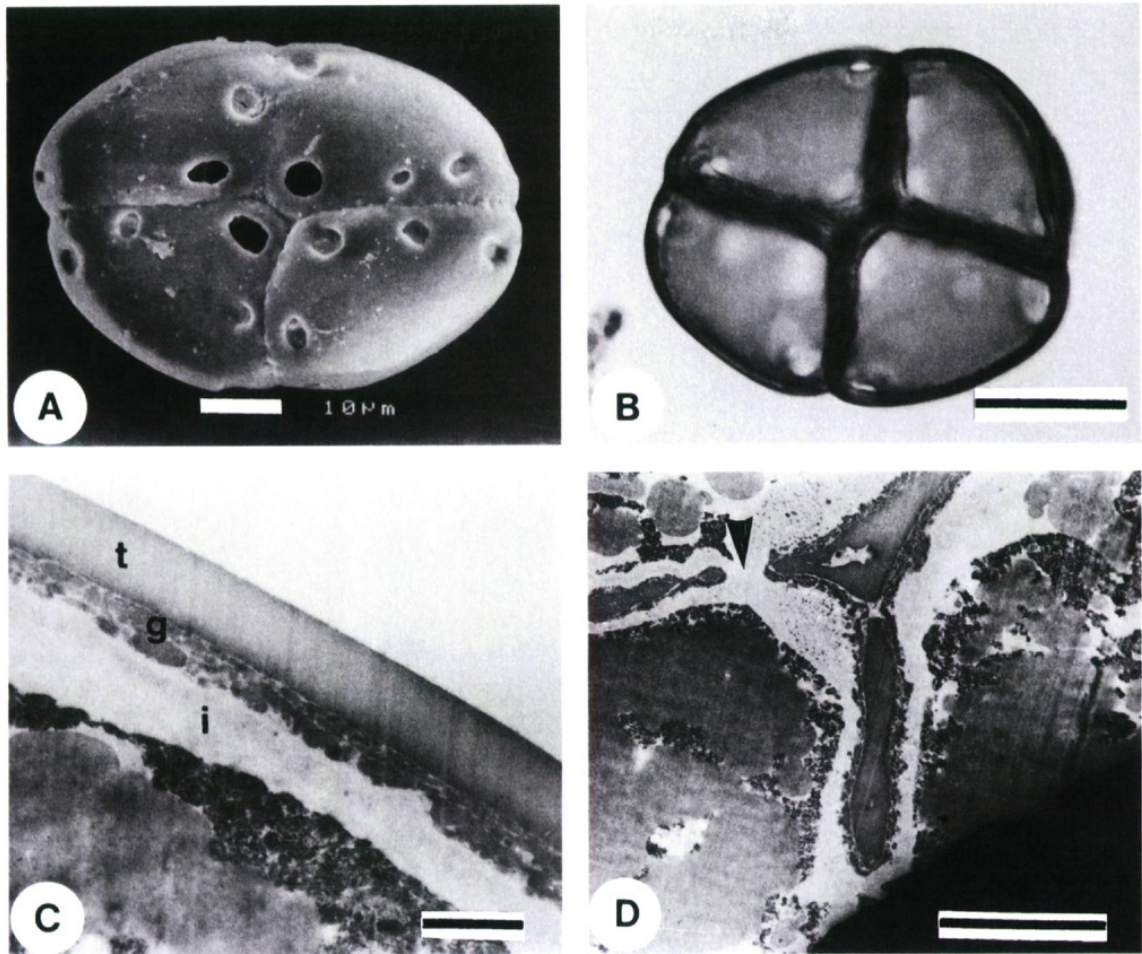


Figure 1. *Raphionacme sylvicola* Venter & R. L. Verhoeven. —A. Rhomboidal tetrad (SEM). —B. Rhomboidal tetrad (LM). —C. Section of pollen wall showing the tectum (t), granular stratum (g), and intine (i). —D. Inner wall, with wall bridges (arrowhead), consisting of granular stratum and intine. Scale bars: 1A = 10 μ m, 1B = 50 μ m, 1C = 1 μ m, 1D = 5 μ m. All from Merello *et al.* 962 (MO).

tine and granular stratum occur between adjacent grains. The intine is well developed.

LEAF ANATOMY

The leaves are dorsiventral and hypostomatic with radiating striae around stomata (Fig. 2A). The cuticle on the adaxial epidermis is randomly oriented with striae running across anticlinal walls (Fig. 2B). Trichomes (Fig. 2C, D) are multicellular and appear on both leaf surfaces.

Although thin, the leaves did not rehydrate well, resulting in sections of poor quality. However, it is clear from these sections that the leaves are dorsiventral with a single palisade layer, comparable to that found in *Raphionacme flanaganii* Schlechter, *R. galpinii* Schlechter, *R. monteiroae* (Oliver) N. E. Brown, and *R. procumbens* Schlechter from moister savanna and grasslands. Isobilateral leaves occur in species such as *R. lanceolata* Schinz, *R. velutina* Schlechter, and *R. zeyheri* Harvey from more arid habitats.

TAXONOMY

Raphionacme sylvicola Venter & R. L. Verhoeven, sp. nov. TYPE: Zambia. Kaputa Region, Nsumbu (Sumbu) National Forest, Nkamba Bay Valley Area (08°36'S, 30°29'E), *Mary Merello, D. K. Harder, C. N. Nkhoma & M. Mulimo* 962 (holotype, MO; isotype, K).

Haec species habitu scandente et aliquanto structura florali *R. monteiroae* et *R. flanaganii* similis, sed ab eis foliis mesophyticis mollibus atque coronae lobulorum tri-segmentatorum segmento centrali loriformi profunde bifido differt.

A climber. *Roots* unknown. *Stems* woody, twining; bark pale brown, pubescent. *Leaves* petiolate; petiole 2–3 cm long, slender, pubescent, with a few reddish dentate colleters on adaxial side, with interpetiolar ridges and reddish, dentate axillary colleters; lamina ovate to elliptic, (9–)11–13 \times 4.5–6.5 cm, apex acuminate, base cuneate, green above, somewhat paler green below, herbaceous and thin-textured, midrib conspicuous, lateral

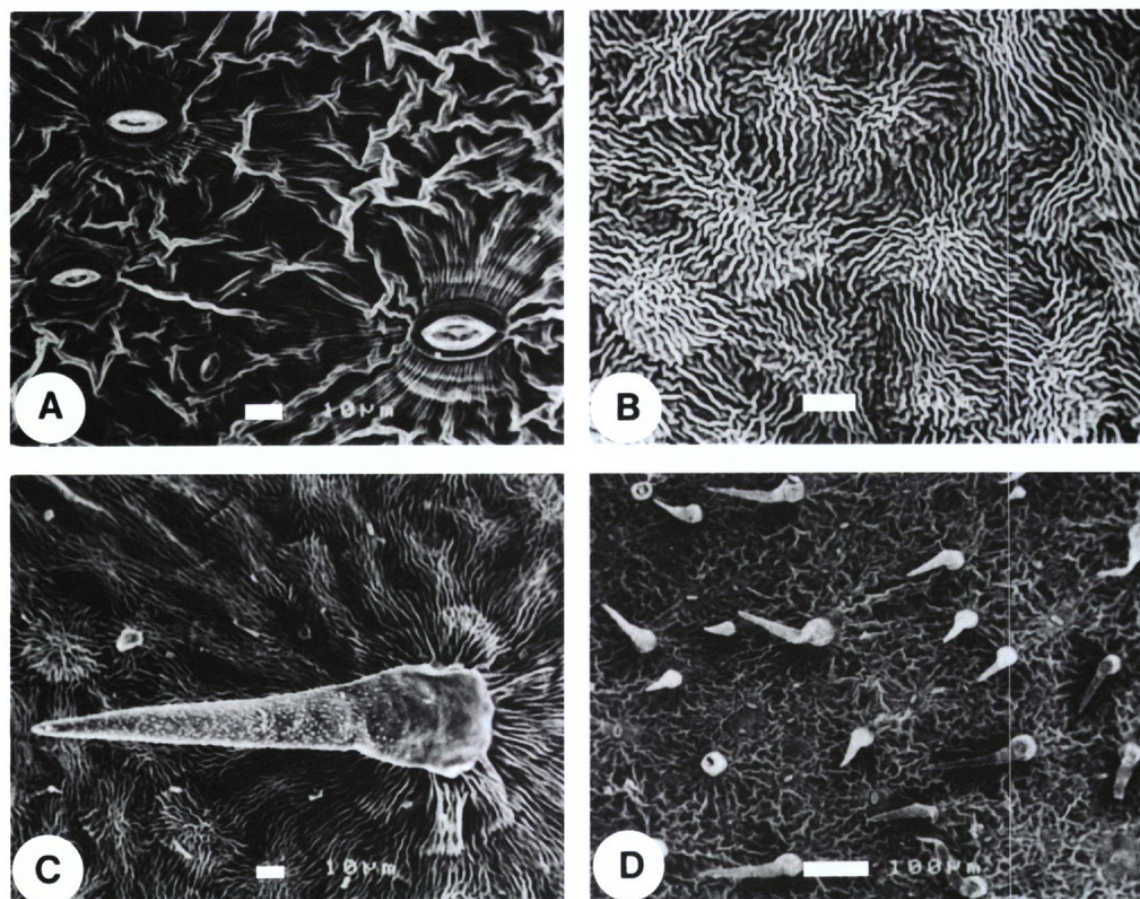


Figure 2. *Raphionacme sylvicola*.—A. Abaxial epidermis showing radiating striae around the stomata. —B. Adaxial epidermis with randomly oriented cuticle striae. —C. Multicellular trichome on adaxial epidermis. —D. Pubescent abaxial epidermis. Scale bars: 2A–C = 10 μ m, D = 100 μ m. All from Merello *et al.* 962 (MO).

veins looping toward apex, 7 to 10 per side. *Inflorescences* axillary and subterminal, 5- to 8-flowered, pubescent; peduncles slender, 1.5–3.5 cm long; pedicels 8–12 mm long, slender; bracts narrowly ovate, 2×1 mm, apex acuminate, membranous, margins fimbriate. *Buds* with tube funnel-shaped, upper part ovoid, lobes contorted to the left. *Flowers* with gynostegium exerted from the corolla mouth. *Sepals* free, ovate to triangular, 1.5×1 mm, apex acuminate, membranous, pubescent. *Corolla* with lower annular tube around ovary; upper tube distinct, funnel-shaped, 3 mm long, glabrous; lobes oblong-ovate, $4-5 \times 1.5-2$ mm, apex obtuse, outside sparsely pubescent, inside glabrous. *Corona* arising from upper corolla tube mouth, antisepalous, trisegmented; central segment strap-shaped with apex deeply bifid, 8 mm long, glabrous; lateral segments inside central segment, fused laterally to filament bases, subulate, 1 mm long. *Stamens* free, glabrous; filaments filiform, 1 mm long, fused to inner base of corona lobes; anthers basally fused with stigmatic head, free from one another, ovate with apiculate apices connivent over stigmatic head; pollen in tetrads.

Nectaries interstaminal, from apex of lower corolla tube, shelf-like, greenish. *Ovaries* 2, free, semi-inferior, many-ovuled; styles basally free, fused toward stigmatic head, ca. 2 mm long; stigmatic head pentangular ovoid; pollen translators arising from upper surface of stigmatic head, alternating with anthers, spatulate with receptacle broadly ovate, stipe terete, viscidium sub-discoid. *Follicles* and *seed* unknown. Figures 3 and 4.

Distribution and ecology. *Raphionacme sylvicola* was found climbing in forest vegetation around a steep, rocky waterfall at an altitude of ca. 915 m. The Nsumbu (or Sumbu) National Park falls within the Itigi deciduous thicket, which is a smaller unit of the wetter Zambezian miombo woodland (White, 1983). The collectors regarded *R. sylvicola*, which was collected in December, as “uncommon.”

DISCUSSION

Raphionacme sylvicola is similar to *R. monteiroae* and *R. flanaganii* in the climbing habit, and to a certain extent in floral structure. However, the new species differs in having soft mesophytic

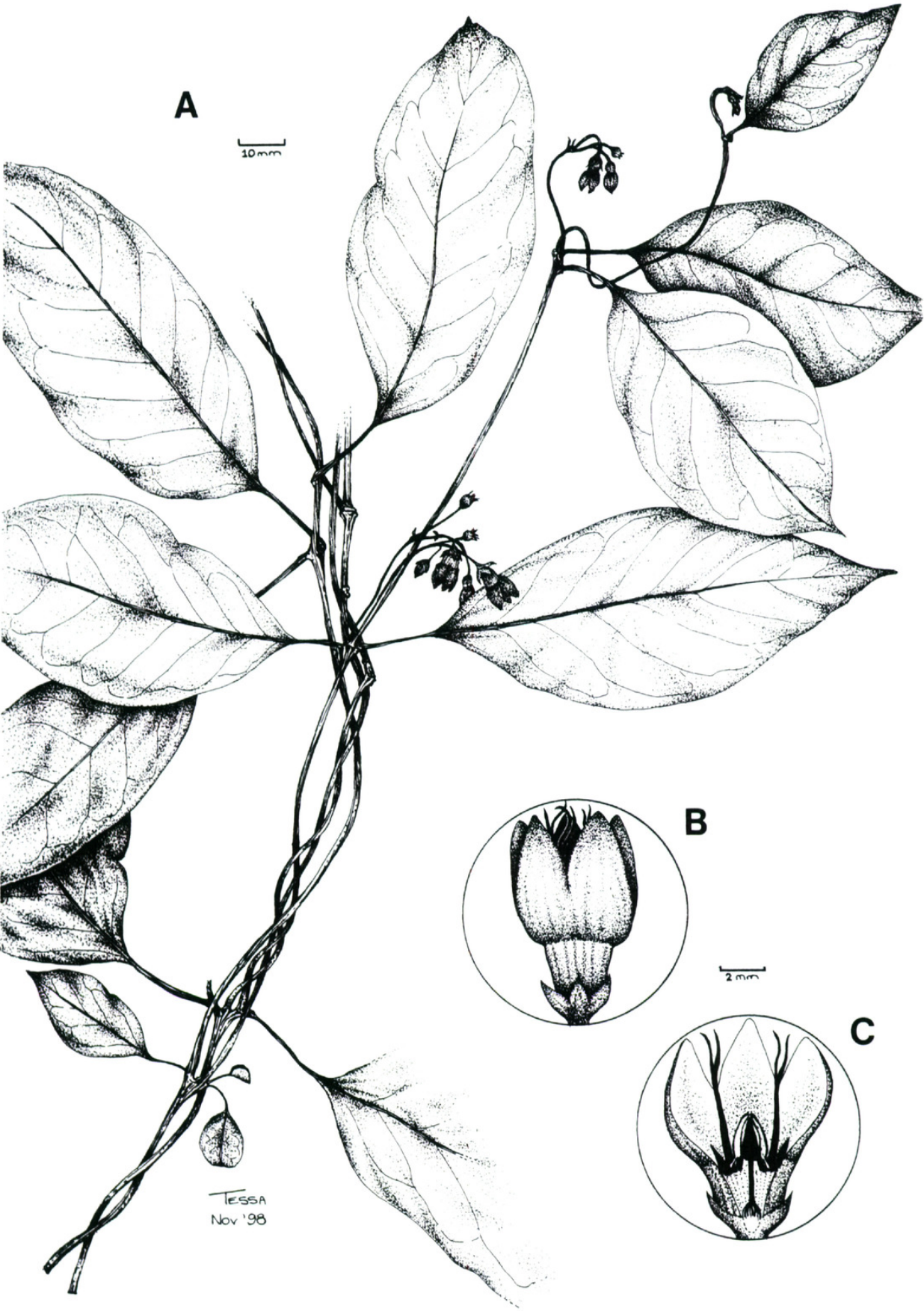


Figure 3. *Raphionacme sylvicola*.—A. Stem with leaves and flowers. —B. External view of the flower. —C. Flower opened showing pistil, stamens, and corona lobes. All from Merello et al. 962 (K).

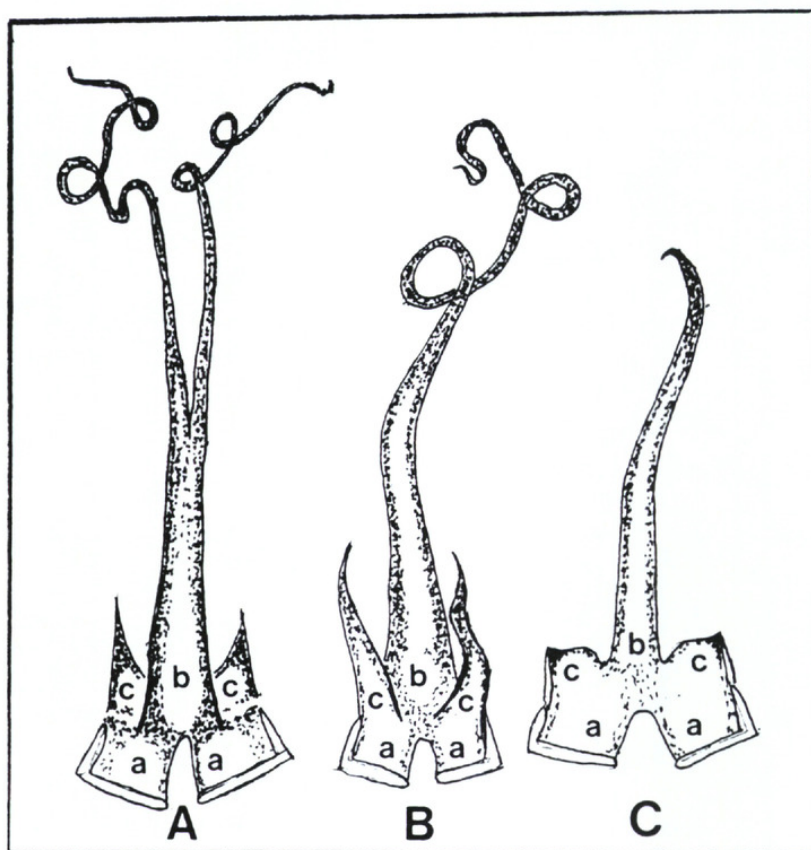


Figure 4. Structure of corona lobes of *R. sylvicola* (A), *R. flanaganii* (B), and *R. monteiroae* (C) (a: petal stubs, b: central segment, and c: lateral segments of one corona lobe). (A: Merello *et al.* 962 (K), B: Nichols 190 (BLFU), C: Venter UNIN-6839 (UNIN).)

leaves and in the form of the corona lobes. *Raphionacme sylvicola* can be discerned by its climbing habit, its large, thin, pubescent leaves, and its trisegmented corona lobes of which the central segment is strap-shaped and deeply bifid.

Raphionacme sylvicola belongs to the group of about 20 *Raphionacme* species that exhibit trisegmented corona lobes. However, these trisegmented corona lobes vary quite extensively. The most common segmentation is the *R. globosa* type, in which the central segment is long and filiform and the lateral segments short and subulate and fused laterally to the central segment. The less common *R. flanaganii* type (Fig. 4B) has a long filiform central segment with the two lateral segments curved coriculate and outside the central segment. In the rare *R. monteiroae* type (Fig. 4C) the central segment is shorter and the lateral segments fused with the corolla lobes' bases forming sinus pockets. *Raphionacme sylvicola* (Fig. 4A) is unique in having the central segment strap-shaped and bifid, with the two lateral segments inside the central segment and these fused to the filament bases instead of directly to the central segment. Of the six climbing species, including *R. sylvicola*, all except one belong to the group having trisegmented corona lobes.

Three groups are discernible in the Periplocoideae with regard to floral structure. Two of these groups have a very distinct upper corolla tube, comparable to that found in the Apocynaceae *sensu stricto*. In the first group the upper corolla tube is well developed and the gynostegium included near the base of the corolla (tribe Cryptolepideae Venter). The second group also has a distinct upper corolla tube, but the stamens arise at the corolla mouth and the gynostegium is thus exerted from the corolla mouth (tribe Gymnanthereae Venter). The third group of genera is characterized by the absence of an upper corolla tube, and the stamens are thus completely exposed (tribe Periploceae Venter). The authors regard the Cryptolepideae as least advanced (plesiomorphic) in the Periplocoideae, and the last two tribes as advanced (apomorphic). *Raphionacme* belongs to the Gymnanthereae, and *R. sylvicola* is thus regarded as an advanced species with respect to its floral structure, but as less advanced in the genus because it is a climber.

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