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Revision of the Malagasy genera *Pentopetia* and *Ischnolepis* (Apocynaceae s.l., Periplocoideae)

JENS KLACKENBERG

ABSTRACT

KLACKENBERG, J. (1999). Revision of the Malagasy genera *Pentopetia* and *Ischnolepis* (Apocynaceae s.l., Periplocoideae). *Candollea* 54: 257-339. In English, English and French abstracts.

The Malagasy representatives of the closely related genera that hitherto have been known as *Acustelma* Baill. sensu auct. div., *Cryptolepis* R. Br., *Gonocrypta* Baill. sensu auct. div., *Ischnolepis* Jum. & H. Perrier, *Pentopetia* Decne. and *Pentopetiopsis* Costantin & Gallaud, are revised. Two genera, *Ischnolepis*, which is monotypic, and *Pentopetia*, with 21 species and one subspecies, are accepted. One new combination of *Ischnolepis*, *I. graminifolia* (Costantin & Gallaud) Klack., and two of *Pentopetia*, *P. albicans* (Jum. & H. Perrier) Klack. and *P. ovalifolia* (Costantin & Gallaud) Klack., are made. In *Pentopetia*, seven new species and a new subspecies are described: *P. bosseri* Klack., *P. calycina* Klack., *P. dolichopodia* Klack., *P. ecoronata* Klack., *P. intermedia* Klack., *P. longipetala* Klack., *P. urceolata* Klack., and *P. ovalifolia* subsp. *glabrata* Klack. A key, typifications, and descriptions as well as drawings and distribution maps of all taxa are given. Their morphology, phylogeny and phytogeography are also discussed. A recently proposed tribal classification of the *Periplocoideae* is discussed and shown to be unnatural.

RÉSUMÉ

KLACKENBERG, J. (1999). Révision des genres malgaches *Pentopetia* et *Ischnolepis* (Apocynaceae s.l., Periplocoideae). *Candollea* 54: 257-339. En anglais, résumés anglais et français.

Cette révision traite des taxons malgaches des genres voisins connus sous les noms *Acustelma* Baill. sensu auct. div., *Cryptolepis* R. Br., *Gonocrypta* Baill. sensu auct. div., *Ischnolepis* Jum. & H. Perrier, *Pentopetia* Decne. et *Pentopetiopsis* Costantin & Gallaud. Deux genres sont reconnus, *Ischnolepis*, monotypique, et *Pentopetia*, comprenant 21 espèces et une sous-espèce. Une nouvelle combinaison dans *Ischnolepis*, *I. graminifolia* (Costantin & Gallaud) Klack., et deux dans *Pentopetia*, *P. albicans* (Jum. & H. Perrier) Klack. and *P. ovalifolia* (Costantin & Gallaud) Klack., sont validées. Dans *Pentopetia*, 7 nouvelles espèces et une nouvelle sous-espèces sont décrites: *P. bosseri* Klack., *P. calycina* Klack., *P. dolichopodia* Klack., *P. ecoronata* Klack., *P. intermedia* Klack., *P. longipetala* Klack., *P. urceolata* Klack., and *P. ovalifolia* subsp. *glabrata* Klack. Une clé de détermination, les descriptions, les typifications, ainsi que les illustrations et les cartes de répartition sont données pour chaque taxon. La morphologie, la phylogénie et la phytogéographie de chacun est discutée. Il est démontré qu'une classification tribale récente des *Periplocoideae* n'est pas naturelle.

KEY-WORDS: APOCYNACEAE – *Periplocoideae* – *Pentopetia* – *Ischnolepis* – *Cryptolepis* – *Gonocrypta* – Taxonomy – Phylogeny – Madagascar.

Introduction

The goal of the present study is to achieve a better understanding of the taxonomy and systematic position of the Malagasy representatives of the closely related genera that hitherto have been known as *Acustelma* Baill. sensu auct. div., *Cryptolepis* R. Br., *Gonocrypta* Baill. sensu auct. div., *Ischnolepis* Jum. & H. Perrier, *Pentopetia* Decne. and *Pentopetiopsis* Costantin & Galaud.

Material and methods

This study is based on herbarium material from the BM, G, K, MO, P, S and WAG herbaria (abbreviations according to HOLMGREN & al., 1990). All specimens cited have been studied unless otherwise stated.

The species concept used in this revision conforms to KLACKENBERG (1992b: 597) and the spellings of geographical names are in accordance with the guidelines given in KLACKENBERG (1992a: 7).

Measurements of floral parts were made from boiled material; vegetative parts and fruits, from dry material. Note that the leaf characters, e.g. venation of the leaves, may look different on living material. Calyx and corolla lobes were measured at their widest parts. The "length of the style" is the distance between the ovary and the style head, i.e. including both the true style and the pseudostyle according to the terminology used by SWARUPANANDAN & al. (1996: 343). For the descriptive terminology of the translators (pollen carriers) KUNZE (1993) and SCHICK (1982) are followed.

Historical background and taxonomic notes on genera

DECAISNE (1844: 500) described the genus *Pentopetia* in Candolle's "Prodromus" and included three species, *P. androsaemifolia*, *P. cotoneaster* and *P. gracilis*, based on a handful of specimens collected by Bojer and Commerson. The genus was placed together with *Periploca* L. and *Ectadium* E. Mey. in the second subgroup of *Periploceae*, which was distinguished by almost always having dorsally hairy anthers (DECAISNE, 1844: 497). It was, in addition, characterized by its short and funnel-shaped corolla tube, five subulate or filiform corona lobes situated at the sinuses of the corolla lobes, and by its abaxially finely reticulate leaves. However, *Pentopetia* was not compared diagnostically to any other genus in the protologue. In particular it should be noted that no comparison was made with *Cryptolepis*, a genus with which it has later been confused. *Cryptolepis* was in fact not mentioned at all in the "Prodromus" treatment, although it had been described already in 1810 by R. BROWN.

Cryptolepis was described by R. BROWN (1810: 58) in his "On the Asclepiadeae" but was erroneously placed in *Apocineae* and not in *Asclepiadeae*. It was characterized by a funnel-shaped corolla with five obtuse corona lobes inserted in the tube, i.e. with both form and position of the corona lobes different from Decaisne's genus. BENTHAM & HOOKER (1876) listed both *Cryptolepis* and *Pentopetia* in "Genera Plantarum" but the descriptions are similar and no diagnostic character was given to separate the genera. It is therefore not surprising that BAILLON (1889: "83" [803]), who had a broad generic concept, proposed *Pentopetia* be included in *Cryptolepis* as a section.

A few years later SCHUMANN (1895: 219) in "Die natürlichen Pflanzenfamilien" accepted both *Cryptolepis* and *Pentopetia*, and correctly distinguished the two genera by the corona morphology, thick and club-shaped in *Cryptolepis* and filiform in *Pentopetia*, i.e. in accordance

with the descriptions of R. BROWN (1810: 58) and DECAISNE (1844: 500), respectively. He mixed up the positions of the coronas, however, as he stated that in *Cryptolepis* the corona lobes are situated by the sinuses of the corolla lobes, contrary to *Pentopetia*, where they are placed below the sinuses (SCHUMANN, 1895: 219).

In a series of revisions of African *Asclepiadaceae* Bullock accepted both *Cryptolepis* (BULLOCK, 1955: 279) and *Pentopetia* (BULLOCK, 1956: 611), but did not note any distinguishing features. Earlier COSTANTIN & GALLAUD (1908: 346) had commented on Baillon's merging of the two genera by stating that it would be unfortunate to suppress such a natural genus as *Pentopetia*; they did not, however, present any distinguishing characters.

JUMELLE & PERRIER DE LA BATHIE (1908b: 179) described *Cryptolepis albicans* from Madagascar. They decided to place this species in *Cryptolepis* due to the very short corona lobes. In the same article they also described several new species of *Pentopetia*. They concluded, however, that they, like many other authors, could see no character that would allow them to easily separate the genera *Cryptolepis* and *Pentopetia* (JUMELLE & PERRIER DE LA BATHIE, 1908b: 179). They agreed with BAILLON (1889: "83" [803]) that the length of the corona lobes in *Pentopetia* does in fact vary considerably and that there is only a difference in degree between *Cryptolepis* and *Pentopetia*. Baillon, however, had simplified the question when he proposed to merge *Pentopetia* and *Cryptolepis*. Baillon reduced the difference between the genera to be a question of the length of the corona lobe only, not the form and position described by R. BROWN (1810) and DECAISNE (1844), respectively. As mentioned above, this unfortunate focus by Baillon on the length of the corona only, has influenced the following taxonomic discussion of these genera in Madagascar and has lead to confusion. True *Cryptolepis*, however, does not exist in Madagascar, which becomes evident if *Cryptolepis* from Asia and continental Africa is compared with the Malagasy species (see discussion under "Generic delimitation"). In the present revision Malagasy species described as *Cryptolepis* are included in *Pentopetia*.

Gonocrypta was first mentioned by BAILLON (1889: "84" [804]) as a section of *Cryptolepis*. It included only one species and was characterized by its 5-lobed urceolate corolla tube. Later authors considered *Gonocrypta* described as a genus, and the species *Gonocrypta grevei* Baillon has been widely accepted. *Gonocrypta* was validated at the generic level by COSTANTIN & GALLAUD (1908: 359). However, if accepted as a separate monotypic genus, the first valid generic name for this taxon is in fact *Kompitsia*, which was published by the same authors already two years earlier (COSTANTIN & GALLAUD, 1906a: 1555). Recently VENTER & VERHOEVEN (1997: 714) correctly transferred this species to *Pentopetia*.

Besides *Pentopetia* and *Gonocrypta*, BAILLON (1889: "84" [804]) created a third section, *Acustelma*, which was also considered to be monotypic. It was characterized by its short corona lobes. In this character section *Acustelma* was thought to be an intermediate form between the short-lobed Asian section *Cryptolepis* and the long-lobed Malagasy section *Pentopetia* (BAILLON, 1889: "85" [805]). Later authors reduced the taxon *Acustelma* to a subspecies (COSTANTIN & GALLAUD, 1908: 344; CHOUX, 1931: 7) or a variety (COSTANTIN & GALLAUD, 1907: 442) of *Pentopetia cotoneaster*, or included it in that species (CHOUX, 1914: 5). Recently, however, in an article on tribal delimitations in *Periplocoideae*, VENTER & VERHOEVEN (1997: 709, 712) treated *Acustelma* as a genus, which was characterized by having both corona lobes and stamens inserted at the mouth of a distinct corolla tube as well as by having hairy filaments combined with a hairy corolla mouth, a combination stated to be unique. It was furthermore dissociated from *Pentopetia* and put in a different tribe, *Gymnantheae* Venter (VENTER & VERHOEVEN, 1997: 712). As will be shown below, however, *Acustelma* and *Pentopetia* cannot be separated as two monophyletic groups. In the present revision *Acustelma* is included in *Pentopetia*.

The monotypic *Pentopetiopsis* was described by COSTANTIN & GALLAUD (1906b: 416). The justification for creating a new genus was that the corona lobes were much reduced to almost lacking. Costantin and Gallaud were obviously at first influenced by earlier authors who had treated Malagasy *Asclepiadaceae*, Decaisne and Baillon included, and consequently the

length of the corona lobes was considered to be of major taxonomic importance (COSTANTIN & GALLAUD, 1906b: 417). However, the only species included in this genus, *Pentopetiopsis ovalifolia*, was reduced to a subspecies of *Pentopetia cotoneaster* by the authors themselves just a year later (COSTANTIN & GALLAUD, 1908: 346), a view which has subsequently been followed (CHOUX, 1914: 5, 1931: 7). In the present revision *Pentopetiopsis* is included in *Pentopetia* but recognized as a species of its own, *Pentopetia ovalifolia*.

The most recently described genus in this group of closely related periplocoids from Madagascar is *Ischnolepis* (JUMELLE & PERRIER DE LA BATHIE, 1909: 53). It was characterized by large underground tubers and whorled, narrow leaves. Subsequent authors have accepted *Ischnolepis* as a distinct monotypic genus (CHOUX, 1914: 242, 1914: 4, 1931: 6; VENTER & VERHOEVEN, 1997: 712) and it is treated as such in the present revision.

In the present article two genera are accepted, *Pentopetia* and the monotypic *Ischnolepis*. Seven new species are added to *Pentopetia*: *P. bosseri*, *P. calycina*, *P. dolichopodia*, *P. ecoronata*, *P. intermedia*, *P. longipetala* and *P. urceolata*. Also included are the recently described *P. lutea* (KLACKENBERG & CIVEYREL, 1997: 267) and *P. glaberrima* Choux, of which only scarce material is present and which is of uncertain status. In total 21 species are accepted.

Historical background and taxonomic notes on species

Pentopetia androsaemifolia was described by DECAISNE (1844) and was characterized by its glabrous leaves, filiform corona lobes being longer than the corolla lobes, and yellowish corolla. In the same article *P. gracilis* and *P. cotoneaster* were described, and all three were known from the central plateau of Madagascar. *Pentopetia cotoneaster* was characterized by its red flowers, tomentose leaves, long style and central longitudinal ridge on the corolla lobes, and groups together with *P. pinnata* and *P. boivinii*. On the other hand, Decaisne distinguished *P. gracilis* from *P. androsaemifolia* by its narrower leaves, which also turn almost black on the upper surface when dry, as well as by its shorter corona lobes. These three characters, leaf form, leaf colour and corona filament length, have proved to be extremely variable in *P. androsaemifolia*. In fact the flowers of *P. gracilis* show the same structure as in *P. androsaemifolia* and should be included in that species. This variation in corona and leaf morphology was discussed by COSTANTIN & GALLAUD (1907, 1908), who, based on the material available in the herbarium of the Muséum National d'Histoire Naturelle in Paris, described four subspecies and three varieties within what they called the *P. androsaemifolia* stirpe (\approx species s.l.). They also included *P. gracilis* in this stirpe but kept it as a separate species for historic reasons (i.e. being one of Decaisne's original species).

One year later, JUMELLE & PERRIER DE LA BATHIE (1908a, 1908b), who worked with specimens from the Kew herbarium and with their own material collected in NW Madagascar, commented that the different forms of the leaf, although present on different sheets in the herbarium, in fact could be found in the field on the same individual, varying with age and position of the branches (JUMELLE & PERRIER DE LA BATHIE, 1908b: 166). They concluded that Costantin & Gallaud were probably too hasty in giving subspecific and variety status to this leaf variation. In the same article, however, they describe six new species of *Pentopetia* from NW Madagascar, as well as *Cryptolepis albicans*, which is transferred here to *Pentopetia*. In the light of new material, one of these, *P. boinensis*, is included in the polymorphic *P. androsaemifolia*; two, *P. bidens* and *P. mollis*, are accepted as species closely related to *P. androsaemifolia*; *P. elastica* and *P. alba* are considered to be conspecific; and *P. reticulata* is recognized as a distinct species, which shows affinity to both *P. androsaemifolia* and *P. albicans*.

CHOUX (1914), in his revision of Malagasy *Asclepiadaceae*, paid much attention to *Pentopetia*. He discussed at length and in detail (CHOUX, 1914: 221-229, 1923: 6) the morphological variation in *P. androsaemifolia*. After examining all material available, Choux came to the conclusion that the morphological variation of *P. androsaemifolia* did not fit into the synoptic key

given to the subspecies and varieties by COSTANTIN & GALLAUD (1907: 443), and showed several examples using both leaf size, form and colour, as well as flower characters (corona length, pubescence of anthers). CHOUX (1914: 227) stated that if the variation would be expressed in nomenclature it would be necessary to create a new variety for each specimen. Consequently he grouped the subspecies and varieties of Costantin and Gallaud all under the name *P. androsaemifolia*. Choux added three new species to *Pentopetia*, *P. glaberrima* (insufficiently known species), *P. linearifolia* (= *Secamone geayi* Costantin & Gallaud) (CHOUX, 1914: 235, 238), and *P. dasynema* (CHOUX, 1930: 98).

As can be seen above, the seven subspecific taxa of *P. androsaemifolia* described by COSTANTIN & GALLAUD (1908) have been much criticized. With more and more material accumulating this criticism has proved to be relevant. In the same article Costantin & Gallaud, however, did describe several other Periplocoid taxa. Three species, *P. boivinii*, *P. pinnata* and *P. graminifolia* (= *Ischnolepis graminifolia*, see below), are all accepted in the present revision, and *P. cotoneaster* subsp. *pentopetiosis* is elevated to species (= *P. ovalifolia*).

Pentopetia grevei was placed in *Cryptolepis* by BAILLON (1889). *Pentopetia grevei* is characterized by a rather large urceolate corolla tube, reddish-violet flowers, long-stiped translators and fleshy corona lobes. The corona lobes, however, although being somewhat similar to those observed in *Cryptolepis* in their shape, differ from this genus by being situated in the sinuses of the corolla lobes and by having few vascular bundles, both characters that ally this taxon to *Pentopetia*. It has a large translator with a broad stipe similar to that seen in *P. dolichopodia*. *Pentopetia grevei* has usually been considered sufficiently different morphologically from *Pentopetia* to merit the rank of a separate genus, *Gonocrypta*. The thick corona lobes, however, should be regarded as an autapomorphy; thus this species is best included in *Pentopetia*, to which it was recently correctly transferred by VENTER & VERHOEVEN (1997: 714).

Morphology

Habit

All species of *Pentopetia* seem to be ± scrambling lianas, some of which might reach several metres high. *Ischnolepis*, on the contrary, is a shrub up to ca two metres high, with upright branches fasciculated from underground tubers. These tubers might sometimes attain a total weight of up to 100 kg (JUMELLE & PERRIER DE LA BATHIE, 1909: 52). No tubers have been reported from *Pentopetia*.

Stem

The stems of *Pentopetia* are suffrutescent, terete, and glabrous to sometimes covered by reddish, one-celled hairs (Fig. 24.7) particularly on younger parts. The bark is whitish brown (e.g. *P. dasynema* and *P. lutea*, sometimes *P. grevei*) to usually pale or dark brown, usually with an opaque surface. Numerous lenticels are present. In *P. dolichopodia* the bark is shed in stripes. *Ischnolepis* differs considerably from the rather uniform *Pentopetia* by its upright glabrous stems with glossy reddish bark. In both genera the stems as well as the rest of the plants have milky latex.

Leaves

The leaves are always decussate in *Pentopetia*, although sometimes gathered on brachyblasts, in *Ischnolepis* decussate to usually whorled. The whorled condition in *Ischnolepis* is due to sections of several extremely reduced internodes that are interspersed within internodes of normal length. This was correctly observed by COSTANTIN & GALLAUD (1907: 341), who in the protologue described this taxon as having fascicles with up to eight or more leaves. JUMELLE & PERRIER DE LA BATHIE (1909: 52) and CHOUX (1914: 243) more precisely stated that three leaves are inserted at each node. There is, however, no fixed number of leaves at each node.

Young branches usually have decussate leaves. Older nodes have three or four leaves each, and the number of leaves seems to be age dependent. This mode of leaf insertion is not known in *Pentopetia*.

The leaves of both *Ischnolepis* and *Pentopetia* are usually herbaceous but in *Pentopetia* semi-coriaceous leaves can also be found. The leaf blades are usually ovate, elliptic or obovate to almost circular, but narrow, \pm linear leaves are found in *P. bosseri*, *P. dasynema* and *P. lutea*, and particularly in *I. graminifolia*, which always has linear grass-like leaves. The leaf lamina is cordate to truncate or cuneate to tapering at the base into a distinct petiole, and rounded and sometimes retuse and apiculate to usually acute or acuminate at the apex. The margins are always entire. The lamina of some species, e.g. *P. albicans*, *P. bidens*, *P. cotoneaster*, *P. ecoronata*, *P. lutea*, and *P. ovalifolia* are always hairy, and others, e.g. *P. calycina*, *P. grevei*, *P. intermedia*, *P. longipetala*, *P. urceolata* and *I. graminifolia* are always glabrous, but often both glabrous to \pm hairy leaves are present within a species. *Pentopetia albicans*, *P. cotoneaster*, *P. lutea*, and *P. ovalifolia* are densely, and when dry whitish, hairy underneath. The hairs are one- to few-celled, short and straight to long and flat as well as distinctly curved or wavy (Figs. 8.7; 24.8). The leaves are usually \pm equally green on both sides but sometimes they are distinctly darker above when dry, or variegated. In *P. androsaemifolia* leaves with a dark pigmentation above but with pale margins, as well as leaves being equally green on both sides are present, but also populations showing an intermediate state, i.e. leaves with darker patches covering parts of the leaf surface only, are found. However, in other species within the yellow-flowered *P. androsaemifolia* group (ssp. 1-10) only the dark pigmented type has been seen, e.g. in *P. bosseri*, *P. dasynema*, *P. intermedia*, *P. longipetala*, *P. mollis*, *P. reticulata* and *P. urceolata*. In the red-flowered *P. boivinii*, which also has distinctly darker upper side, the paler leaf margins are complemented with pale areas along the main nerves, which gives the leaves a variegated appearance when dry (Fig. 25.2).

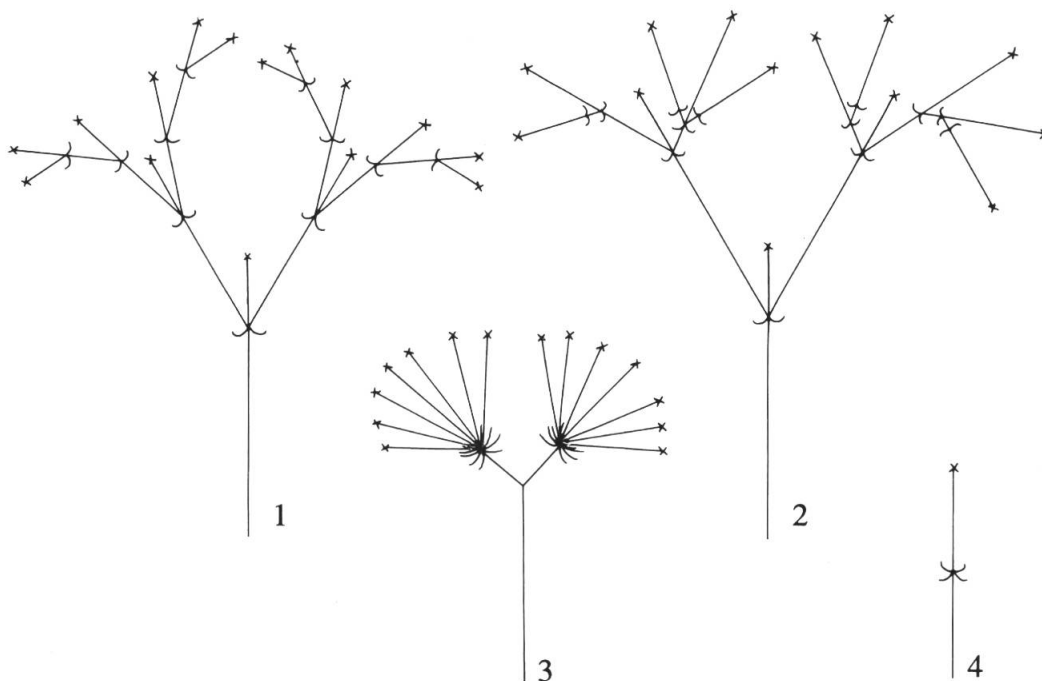


Fig. 1. – Diagrams of inflorescence types in *Pentopetia*. – 1, Cyme with pedicels and internodes becoming symmetrically shorter towards the end of the branches, usually dichasial at the base but monochasial towards the apex (*P. grevei*); 2, Irregular cyme with both long and short internodes with di- or monochasial branches (*P. longipetala*); 3, Umbel-like cyme with the internodes \pm completely reduced, often divided at the base (*P. cotoneaster*); 4, Reduced cyme with solitary flower (*P. lutea*).

The venation is pinnate and looped to arched. The tertiary veins are usually reticulate when dry at least underneath. The species in the *P. cotoneaster* group (spp. 15-18), *P. boivinii* excepted, are characterized by very distinct and fine reticulation on the lower leaf surface between distinctly raised secondary nerves (Fig. 27.2). Distinctly raised nerves are also characteristic for the *P. albicans* group (spp. 11-14), *P. ecoronata* included. *Pentopetia dolichopodia* almost lacks reticulation.

The petiole is always distinct, although sometimes very short. The vasculature is one-traced and \pm flatly U-shaped, a condition also found in several other genera within *Periplocoideae* (SWARUPANANDAN & al., 1996: 351). SWARUPANANDAN & al. (1996: 357) stated that colleters at the base of the petiole are lacking in *Periplocoideae*. However, in *Pentopetia* and *Ischnolepis* colleters are present, which in fact seems to be the usual state within *Apocynaceae* s.l. (see e.g. KUNZE, 1990: 13), including the periplocoids.

In *Pentopetia* the stomata are concentrated on the abaxial side of the leaves but the grass-like leaves of *Ischnolepis* are amphistomatic.

Inflorescences

The inflorescences are axillary or terminal cymes, usually with several of the internodes distinctly shortened. The cymes are both mono- and dichasially branched (Figs. 1.1-2). Sometimes the cymes are umbel-like on a peduncle, i.e. all internodes are suppressed except the basal one (Fig. 1.3). There are usually 3 to 9 flowers in each inflorescence but up to 15 have been observed. *Pentopetia bidens*, *P. calycina* and *P. lutea* have short, much reduced one- to two-flowered inflorescences with all internodes, including the peduncle, suppressed (Fig. 1.4).

Flowers

The flowers are small to medium-sized, from about 5 mm to 35 mm in diameter. They are pentamerous and actinomorphic save in *P. calycina* where they are slightly asymmetric due to unequal calyx lobes.

Calyx

The calyx lobes are free from the base, usually triangular to oblong or elliptic to broadly ovate, with an obtuse to acute or acuminate apex. The lobes are the same size and shape and not or only slightly overlapping, with the exception of *P. calycina*, which has distinctly overlapping elliptic lobes of different sizes. The narrowly triangular and acute calyx lobes in *P. elastica* are also characteristic. The upper half of the lobes are often recurved. The calyx is about as long as the corolla tube or usually longer, and only in *P. dolichopodia*, *P. grevei* and *P. urceolata* it is distinctly shorter. The calyx is hairy to glabrous, in *P. boivinii* and *P. pinnata* warty at base. Five to ten small colleters are present at the bases in the sinuses between the calyx lobes.

Corolla

The corolla lobes are fused for 1/12 – 2/5 of their length at the base into a long or short but always distinct tube. The aestivation, contorted with the right lobe margins overlying and usually \pm twisted, is similar in all species of *Pentopetia* and *Ischnolepis*. This is in accordance with other Malagasy *Periplocoideae*, i.e. *Baroniella* (KLACKENBERG, 1997), *Camptocarpus* (KLACKENBERG, 1998) and *Cryptostegia*. Constant aestivation within larger taxonomic groups is the common state in *Gentianales* in general (BREMER, 1987: 42) but contrasts with the situation in the *Secamonoideae*, a close relative of the *Periplocoideae*, where different types of aestivation sometimes can be seen even within a single species (KLACKENBERG, 1992a: 59, 1992b: 605).

The tube is usually funnel- or bell-shaped to cylindric. Three species have \pm urceolate corolla tubes: *P. elastica*, *P. urceolata* and *P. grevei*. *Pentopetia calycina*, *P. cotoneaster* and *P. pinnata* in the *P. cotoneaster* group are characterized by long (usually more than 3 mm) and \pm cylindric tubes. *Pentopetia longipetala* and *P. reticulata* have a short and cylindric tube at base but which is widely funnel-shaped at mouth.

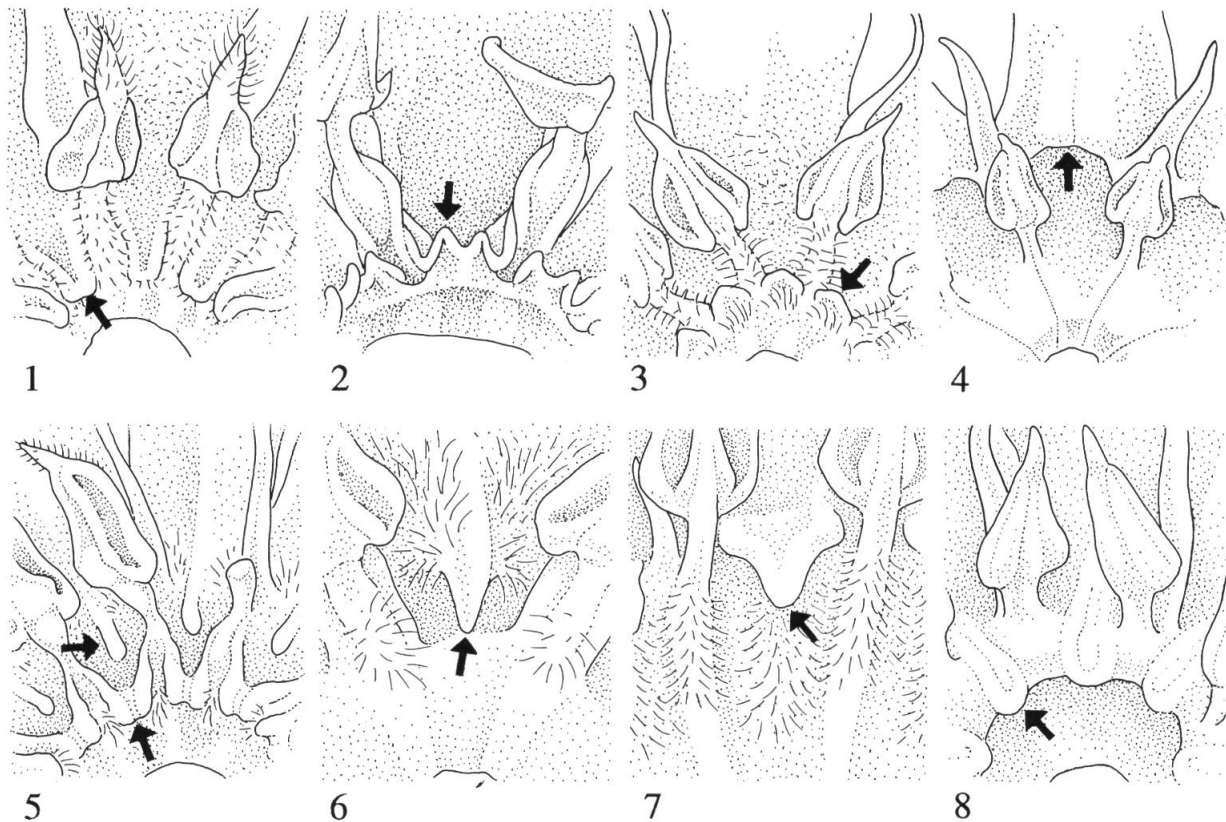


Fig. 2. – Morphology of corolla mouth and tube of *Pentopetia* and *Ischnolepis*. Discussed structures are indicated by arrows. – 1, Tube with channel-formed alternistaminal nectar lobes directed downwards (*P. androsaemifolia* [Jongkind & Andriantiana 3628]); 2, Tube with thick and reflexed alternistaminal nectar lobes (*P. dolichopodia* [Croizat 28985]); 3, Tube with thin and reflexed alternistaminal nectar lobes (*P. mollis* [Perrier de la Bâthie 963, from Ankirihitra]); 4, Tube with ridge at the mouth, without distinct alternistaminal nectar lobes (*P. elastica* [Jongkind & al. 3434]); 5, Tube with a short longitudinal ridge at the mouth and with channel-formed alternistaminal nectar lobes directed downwards (*P. reticulata* [Perrier de la Bâthie s.n., N.O. Madagascar]); 6, Tube with short longitudinal ridge at the mouth, without alternistaminal nectar lobes (*P. albicans* [Jongkind & Andriantiana 3743]); 7, Tube with triangular ridge at the mouth, but without alternistaminal nectar lobes (*P. cotoneaster* [Afzelius s.n., Moramanga]); 8, Tube with flat or centrally somewhat elevated alternistaminal nectar lobes directed downwards (*I. graminifolia* [Werff & McPherson 13561]).

KUNZE (1990) discussed the homology of coronas in *Apocynaceae*, *Periplocaceae* and *Asclepiadaceae*. He stated that the elevation of the stamens to the level of the stigma head (style head) is accomplished in *Apocynaceae* s.s. by the lower corolla tube subtending the stamens but in *Periplocaceae* and *Asclepiadaceae* s.s. the stamens sit on a special tubular base and the corolla does not take part in this function (KUNZE, 1990: 36, 38, Figs. 122-127). This, however, seems not to be true in *Pentopetia*. The structure of the corolla and the position of the corona and stamens on the tube is in accordance with what is seen in *Apocynaceae* s.s., not *Asclepiadaceae* s.l. All species have a short or long but always distinct style (Figs. 3.9-12) and several species have both long tube and style (Figs. 24.3, 24.5, 28.3). Obviously here the corolla does take part in the elevation of the stamens to the style head in an apocynaceous manner, different from what is seen in *Asclepias* (KUNZE, 1990: Figs. 122, 127). It is uncertain, however, if this is a truly primitive character within *Periplocoideae*, or a reversal in *Pentopetia*.

The corolla tube is rarely totally smooth inside, without hairs or distinct outgrowths (*P. ecoronata*). Usually some kind of guiding structures to serve pollination are present and these provide several important characters for the taxonomy of the group. In the *P. androsaemifolia* group (spp. 1-10) lobes in the tube alternating with the staminal filaments and always below them, are usually present. These lobes seem to secrete nectar and are in this revision called alternistaminal

nectar lobes. In *P. androsaemifolia*, *P. dasynema*, and *P. reticulata* they are shallowly channelled, flat, situated immediately below or at a distance from the stamens, united with the two nearest filament bases by two lines or small ridges (Fig. 2.1). These lobes are directed downwards in the tube and usually narrowing towards the base. *Pentopetia bosseri* and *P. mollis* (Fig. 2.3) from the same species group, as well as the red-flowered *P. dolichopodia* (Fig. 2.2) and *P. grevei*, are also furnished with this type of alternistaminal nectar lobes, but in these species the lobes are longer and recurved, in *P. mollis* very thin, in the other three thick. *Pentopetia urceolata* is furnished with well developed alternistaminal nectar lobes, which are densely covered by hairs basally (Fig. 13.4). Of the remaining taxa in the *P. androsaemifolia* group, *P. longipetala* shows a similar structure but in this species the lobes jut out as five separate, isolated knobs in the tube (Fig. 18.4). In *P. bidens* the nectar lobes are reduced to diffuse transverse ridges. *Pentopetia intermedia* and *P. elastica* (Fig. 2.4) lack typical interstaminal nectar lobes but are furnished with shallowly U-shaped ridges uniting the filaments. A similar structure is also seen in *P. calycina*. The remaining red-flowered species, *P. boivinii*, *P. cotoneaster* and *P. pinnata* as well as the yellow-flowered *P. albicans*, *P. lutea* and *P. ovalifolia*, all lack true alternistaminal nectar lobes but have other types of coronal outgrowths. They all have \pm pronounced ridges below the staminal filaments that indistinctly unite at the very base of the tube. In addition, a long or short narrow ridge or \pm triangular boss is present just above or below the mouth of the tube between the corona lobes and staminal filaments. In *P. albicans*, *P. ovalifolia* and *P. pinnata* the ridges are long and often wing-like (Fig. 2.6), in *P. pinnata* they run almost to the base of the corolla tube (Fig. 27.5), and *P. boivinii* and *P. cotoneaster* are furnished with \pm triangular bosses (Fig. 2.7). *Pentopetia longipetala* and *P. reticulata* have, as mentioned above, alternistaminal nectar lobes in the tube but at the same time short ridges at the petal lobe bases of the same type as in *P. albicans* and in *P. cotoneaster* groups (Fig. 2.5). The alternistaminal nectar lobes in *Ischnolepis* are \pm flat and situated immediately below the stamens, similar to what is seen in *P. androsaemifolia*. Instead of being slightly channelled, however, they differ by being centrally somewhat longitudinally elevated (Fig. 2.8).

The corolla lobes are oblong to triangular or ovate to obovate in outline. Most species have \pm oblong lobes and the shape of the corolla lobes seem to be of rather limited taxonomic value. The usually triangular lobes seen in *P. elastica*, however, as well as the distinctly narrowly oblong lobes of *P. longipetala*, are characteristic. The shape of the apex of the corolla lobes usually varies between acute and obtuse but is rather uniform throughout all species. The *P. albicans* and *P. cotoneaster* group, however, are characterized by having usually asymmetrical apices, i.e. rounded but notched somewhat laterally to the right (seen from above) near the apex (Fig. 20.4).

It is often difficult to judge the form of the flowers from dried material. Nevertheless some general observations can be made. Both erecto-patent corolla lobes and distinctly recurved ones are present within the genus. It seems that \pm horizontal to erecto-patent lobes are characteristic of *P. androsaemifolia* and allied species (sp. nos. 1-7), as well as in *Ischnolepis*. The remaining yellow-flowered taxa (sp. nos. 8-14) probably have rotate corollas or slightly recurved lobes. Among the red-flowered species, *P. boivinii*, and *P. pinnata* have flowers with distinctly reflexed corolla lobes at least when fully mature, contrary to the erecto-patent lobes observed in *P. dolichopodia* and *P. grevei*.

In most species the corolla is covered by hairs in different patterns, usually in the mouth, below the filaments and below the nectar lobes. All corolla hairs are one-celled and, when dry, white (Fig. 6.6, 22.9). *Pentopetia dolichopodia*, *P. ecoronata*, *P. grevei*, *P. intermedia* and *Ischnolepis graminifolia* have totally glabrous corollas.

Most of the species (spp. 1-14) have white to yellow flowers, usually pale when young becoming more yellowish with age. Among these, *P. bidens*, *P. ecoronata*, *P. elastica* and *P. longipetala* are hitherto known only with white flowers. The remaining species all have red-coloured flowers (for *P. calycina*, however, no information on colour is available), usually with a tinge of violet. *Pentopetia cotoneaster* has a reddish violet corolla and the closely related *P. boivinii* and *P. pinnata* have a corolla that is white inside but reddish violet outside. The opposite is

known from *P. dolichopodia*, where the corollas are purple inside and paler, reddish to white, outside. The same pattern can be observed in the corolla tube of *P. grevei*, which is purple inside and pink outside. The lobes in this species are purple, often becoming paler towards the base.

Corona

The corona lobes are, as in other *Periplocoideae*, of corolline origin (PURI & SHIAM, 1966: 200; KUNZE, 1990: 24) and are inserted at the corolla lobe sinuses in all species of *Pentopetia*; in *Ischnolepis* they are situated a short distance below the sinuses. In addition to the five ordinary antisepalous corona lobes discussed here, several species are also furnished with other corona-like outgrowths, i.e. alternistaminal nectar lobes near the base of the corolla tube and/or longitudinal ridges or knobs in or near the corolla mouth, both discussed above under "Corolla".

The corona lobes are usually vascularized with few vessels. Most commonly the lobes are filiform from base to top, often long and then also twisted, sometimes longer than the corolla lobes, or shorter and straight (Figs. 3.1-4). The length can vary much within a species, e.g. in *P. androsaemifolia*, where it varies between ca 1 and 17 mm (Fig. 7.2). All yellow-flowered species in the *P. androsaemifolia* group as well as the red-flowered *P. cotoneaster* group are furnished with this type of filiform corona lobes. In *P. bosseri* and *P. calycina* the filiform and twisted corona lobes are flat and distinctly broadened at base (Fig. 3.2). A broad base is rarely present also in *P. androsaemifolia*.

The four species in the *P. albicans* group have small or completely reduced corona lobes. In *P. lutea* the lobes are distinct but rather short and subulate, slightly bent inwards (Fig. 3.5). Very small, triangular and scale-like corona lobes are seen in *P. albicans* and *P. ovalifolia* (Fig.

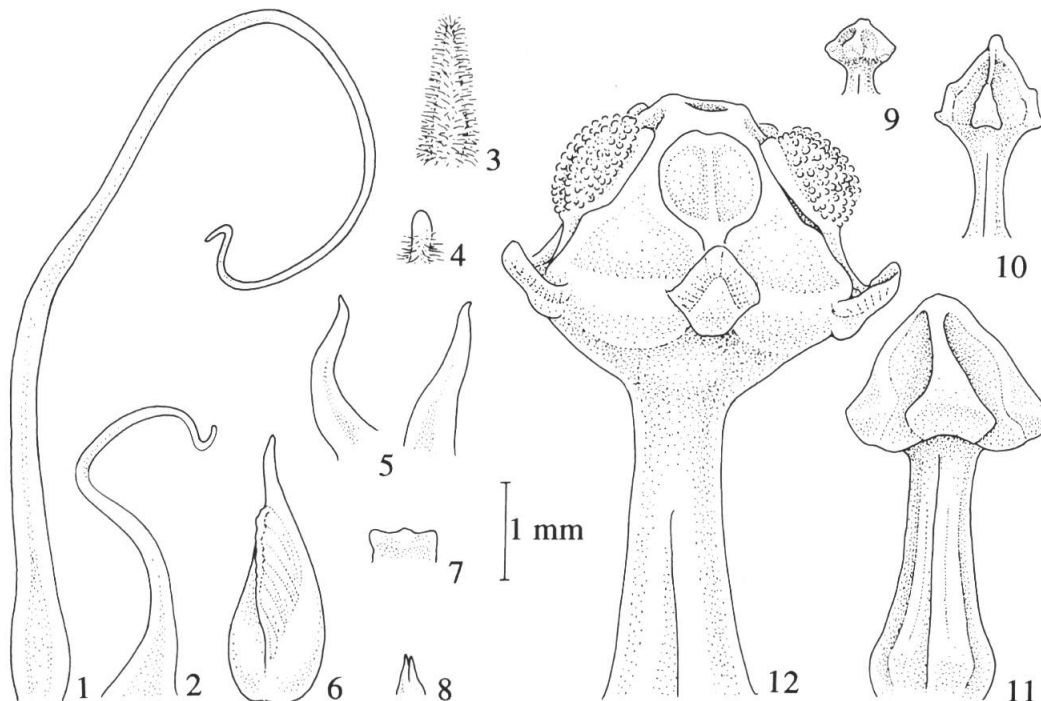


Fig. 3. – Morphology of *Pentopetia*. – 1-8, Variation of corona lobes. – 1, Filiform and twisted, *P. androsaemifolia* [Jongkind & Andriantiana 3628]; 2, Filiform and twisted, and with broadened base, *P. bosseri* [Bosser 10251]; 3, Densely hairy, *P. dasynema* [Humbert & Perrier de la Bâthie 2533]; 4, Short and sparsely hairy, *P. bidens* [Perrier de la Bâthie 16813]; 5, Subulate and curved, lateral (left) and ventral view, *P. lutea* [Civeyrel 1243]; 6, Fleshy with dorsiventrally flattened basal part and \pm triangular laterally flattened free lobe, ventral view, *P. grevei* [Civeyrel 1112]; 7, Fleshy and short with somewhat dentately truncate apex, *P. dolichopodia* [Croat 28985]; 8, Delicate and thin, dorsiventrally flattened, with slightly bifid apex, *P. ovalifolia* [RN-2096]. – 9-12, Variation of style and style heads – 9, *P. bidens* [Perrier de la Bâthie 16813]; 10, *P. androsaemifolia* [Peltier 5604]; 11, style with longitudinal ridges, *P. ovalifolia* [Phillipson 2875]; 12, style head with translators in situ, *P. pinnata* [Civeyrel 1346].

3.8). These lobes are not vascularized. *Pentopetia ecoronata*, and sometimes also *P. albicans*, totally lack corona lobes.

Thick corona lobes can be observed in the two species *P. dolichopodia* and *P. grevei*, but, they are of quite different shapes. *Pentopetia grevei* has a dorsiventrally flattened basal part and a \pm triangular laterally flattened free lobe (Fig. 3.6). *Pentopetia dolichopodia* has short and truncate lobes with somewhat dentate apex, about as broad as long (Fig. 3.7). The filament and the corona lobe are united at base and sometimes also slightly above the corolla sinuses.

The corona is always glabrous except in *P. dasynema*, which has densely hairy, filiform but rather short lobes (Fig. 3.3) and *P. bidens*, which has its short lobes basally furnished with sparse, rather long hairs (Fig. 3.4).

Androecium

The anthers form a cone around the style head. The cone is triangular in outline to usually ovoid. The anthers are completely hidden in the corolla tube, which is closed by the corona lobes (*P. elastica*, *P. grevei*), hidden in the tube but not by the corona lobes (*P. urceolata*), \pm protruding (*P. androsaemifolia*, *P. bidens*, *P. bosseri*, *P. dasynema*, *P. mollis*) or completely exposed outside the corolla tube (*P. albicans*, *P. boivinii*, *P. calycina*, *P. cotoneaster*, *P. dolichopodia*, *P. ecoronata*, *P. intermedia*, *P. longipetala*, *P. lutea*, *P. ovalifolia*, *P. pinnata*, *P. reticulata*).

The filaments are very short to several mm long, filiform or flattened. Usually the short filaments are inserted in the corolla tube and long ones are inserted at the corolla mouth. Furthermore, long filaments are often distinctly curved inwards. Long to intermediately long, distinctly curved and filiform filaments that are inserted at the corolla lobe sinuses are found in the yellow-flowered *P. intermedia*, *P. lutea* and *P. ovalifolia* as well as the red-flowered *P. boivinii*, *P. cotoneaster* and *P. pinnata*, and in *P. calycina* (colour unknown). *Pentopetia albicans* has rather short and flat filaments, which are, however, inserted in the lobe sinuses. However, some species have short and straight filaments inserted at the lobe sinuses (*P. dolichopodia* and *P. ecoronata*) or above the mouth at a flat part of the corolla tube (*P. longipetala* and *P. reticulata*).

The basal parts of thecae are sterile and empty, and are often bent outwards in order to serve as guidance for visiting insects. The pollen is produced in the upper part, which is situated above the spoons of the translators. In *Ischnolepis*, however, the whole theca is fertile.

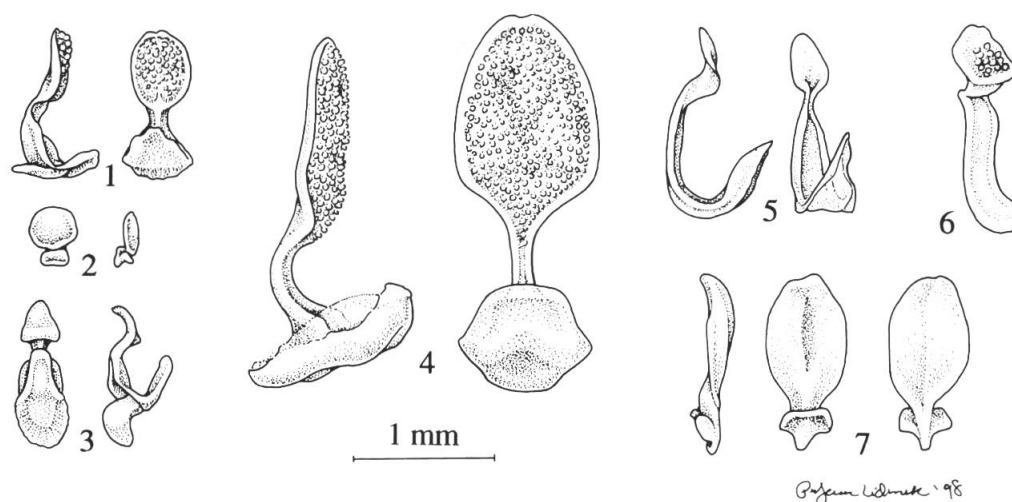


Fig. 4. – Morphology of translators of *Pentopetia* and *Ischnolepis*. – 1, Stipe distinctly narrowed below the spoon but broadened at lower part, *P. urceolata* [Perrier de la Bâthie 11670]; 2, Small and with almost lacking stipe, *P. bidens* [Perrier de la Bâthie 16813]; 3, With triangular spoon, *P. elastica* [Jongkind & al. 3434]; 4, Large and with distinct narrow stipe broadened only at the very base, *P. lutea* [Civeyrel 1243]; 5, With long and broad U-shaped stipe but folded and narrow just below the spoon, *P. grevei* [Civeyrel 1112]; 6, With long and broad stipe with subpeltate spoon, *P. dolichopodia* [Capuron 5835]; 7, With short and pointed stipe, *I. graminifolia* [Werff & McPherson 13561].

The connective is often prolonged above the thecae and sometimes covered with a tuft of hairs. Although usually \pm constant within a species, the prolongations in e.g. *P. androsaemifolia* vary from short and glabrous to long and hairy (Figs. 7.3a-b).

The translators in *Pentopetia* usually consist of a spoon that narrows abruptly into a stipe. The stipe is narrow only briefly below the spoon and then broadens gradually into a flat basal part that usually has a longitudinal ridge centrally (*P. androsaemifolia*, *P. bosseri*, *P. ecoronata*, *P. elastica*, *P. intermedia*, *P. longipetala*, *P. reticulata*, *P. urceolata*) (Figs. 4.1, 4.3), or is narrow and cylindrical for a longer part with a distinctly demarcated basal part (*P. albicans*, *P. boivinii*, *P. lutea*, *P. ovalifolia*, *P. pinnata*) (Fig. 4.4). In *P. bidens* and *P. mollis* the narrow part of the stipe is lacking (Fig. 4.2). The base is furnished with an adhesive disc. *Pentopetia dolichopodia* and *P. grevei* have large translators, particularly the stipe and adhesive disc. The large broad stipe and adhesive disc jut out from the anther cone, and in *P. grevei* is furthermore reflexed (Fig. 4.5), exposing a large adhesive surface. *Pentopetia dolichopodia* has translators with a large stipe and adhesive disc without any constriction between them. This broad stipe-disc is sub-peltately united with the cup-shaped spoon (Fig. 4.6). This is a unique structure not observed in other periplocoideae, although a similar morphology is found in *Hemidesmus* R. Br. (NILSSON & al., 1993: Fig. 5I; KUNZE, 1993: 103, Fig. 2). The *Hemidesmus* spoon, however, although seemingly peltate, differs by being split on one side all the way to the stipe, and thus is not truly peltate.

In *Ischnolepis* the spoon tapers at the base into a very short stipe. The stipe narrows into a beak, and is furnished with an adhesive disc as two wings (Fig. 4.7).

The pollen grains in both *Ischnolepis* and *Pentopetia* are shed in tetrads. VERHOEVEN & VENTER (1994: 296) studied pollen morphology of Malagasy taxa of *Periplocoideae*. The sample included four species of *Pentopetia*: *P. albicans* (*Cryptolepis*), *P. androsaemifolia*, *P. cotoneaster* (*Cryptolepis grandidieri*), *P. grevei* (*Gonocrypta*), as well as *Ischnolepis graminifolia* (*I. tuberosa*). The grains were arranged rhomboidally, decussately or, more rarely, tetragonally, and furnished with four to six pores. The differences between the examined species turned out to be small, except for the size of the grains. They showed a variation between (43-55) 48.7×32.6 (28-36) in *P. androsaemifolia* and almost the same, (40-53) 46.7×36.4 (29-43), in *P. grevei*. In *P. albicans* and *P. cotoneaster*, however, the grains were larger, (59-69) 63.9×46.5 (41-54), and particularly large in *I. graminifolia* (64-92) 75×46.3 (36-57).

Gynoecium

The gynoecium consists of two carpels that are united at the base and apex, but with styles and upper part of ovaries free in between. The style is furnished with a swelling at or below the top – the style head – and the difference in sizes between species is up to tenfold (Fig. 3.9-12).

The ovaries in *Ischnolepis* and *Pentopetia* are semi-inferior and show little morphologic variation. However, in some species the ovaries and the base of the styles are furnished with longitudinal ridges (*P. albicans*, *P. boivinii*, *P. calycina*, *P. elastica*, *P. pinnata*, *P. ovalifolia*) (Fig. 3.11). The ovules are usually many but *P. elastica* has few ovules concentrated close to the base.

All species of *Pentopetia* are furnished with a distinct style, although it is sometimes very short (Figs. 3.9-12). SWARUPANANDAN & al. (1996: 342) made a distinction between true styles, two in number and derived from the ovary, and pseudostyles, which are derived from the stigmatic segment and constitute the fused part just below the style head. True styles were said by SWARUPANANDAN & al. (1996: 346) to be absent in *Periplocoideae*. Several taxa of the subfamily, however, obviously deviate in this respect. In *Pentopetia*, *P. albicans*, *P. boivinii*, *P. calycina*, *P. cotoneaster*, *P. intermedia*, *P. lutea*, *P. ovalifolia* and *P. pinnata* all have narrow styles more than 1 mm long, composed mostly of the two free true styles (Figs. 3.11-12). Also other genera like *Raphionacme* have long styles but here the styles are postgenitally fused (NILSSON & al., 1993). This is also the usual condition in *Apocynaceae* s.s. (FALLEN, 1986; ENDRESS & al., 1996: 67). On the other hand, a two-styled gynoecium is characteristic for many taxa in *Asclepiadaceae* s.s. (SWARUPANANDAN & al., 1996: 342), and in *Pentopetia* this feature is

probably best considered derived. Furthermore, VENTER & VERHOEVEN (1997: 709) characterized their new tribe *Gymnanthereae* (including eight genera) by long styles (see below).

The style heads in *Ischnolepis* and *Pentopetia* are usually conical and usually narrow abruptly at base into the pseudostyle. They are furnished with five vertical grooves that are \pm formed after the translators (Figs. 3.9-12). No reliable distinguishing style-head characters between the species have been observed, although *P. grevei* seem to have a more ellipsoid style head than other species.

Fruit

The general structure of the follicle wall, i.e. a rather few-layered epicarp, a sometimes multi-layered mesocarp and a few-layered but hard and glossy fibrous endocarp, is in accordance to what is known for the family in general (SWARUPANANDAN & al., 1996: 347; KURIA-CHEN & al., 1992; DAVE & KURIACHEN, 1991). Contrary to many other genera in *Asclepiadaceae*, the follicles are usually paired. This condition is also prevalent in subfamily *Secamonoideae*, e.g. in *Secamone* R. Br. (KLACKENBERG, 1992b: 12), in *Genianthus* Hook. f. (KLACKENBERG, 1995: 422) and in *Pervillea* Decne. (KLACKENBERG, 1996: 174). However, although rather limited material has been studied, *Pentopetia albicans*, *P. elastica* and *P. ovalifolia* usually develop a single follicle in each flower. The follicles vary considerably in both shape and texture within the genus. This is seen also in other *Periplocoideae*, e.g. *Tacazzea* and *Raphionacme* (VENTER & VERHOEVEN, 1997: 710).

The placenta is marginal. It is composed of a hard glossy fibrous wall-like part that adheres along the suture of the carpel and a somewhat cylindric part bearing the seeds (Fig. 5.1-6, left). In dehiscent follicles the placenta is separated from the fruit wall. The fibrous part is thin or thick and \pm grooved, moulded by appressed seeds. The cylindric part is covered by longer narrow ridges with or without visible seed-bearing denticles, or by distinct flat papery flaps.

Most commonly follicles are long and narrow, linear and entire, with thin mesocarp 0.1-0.3 mm thick. The placenta has a thin fibrous part, which is only shallowly grooved, and a cylindric part, which is covered by narrow smooth ridges (Fig. 5.1). The follicles are sometimes shallowly constricted between the seeds. They can be either glabrous or finely pubescent. Pubescent follicles have hitherto been found in *Ischnolepis graminifolia*, in the yellow flowered *Pentopetia androsaemifolia* and *P. bosseri*, as well as in the red-flowered *P. cotoneaster*. It is also known from other Malagasy *Periplocoideae*, e.g. *Baroniella* (KLACKENBERG, 1997) and *Camptocarpus* (KLACKENBERG, 1998), which, however, does not exhibit the same placenta structure as in *Pentopetia* and *Ischnolepis*.

A similar structure is found in *P. grevei*, which has slightly shorter and \pm distinctly 5-ribbed follicles (Fig. 5.2).

Pentopetia reticulata and *P. urceolata* also have follicles that are similar to those found in *Ischnolepis graminifolia*, but they are shorter and more narrowly ovate in outline and with a thick and distinctly grooved fibrous part of the placenta. The cylindric part of the placenta has distinct ridges, sometimes slightly flap-like. The mesocarp of the follicle wall is thicker, 0.5 mm or more, and the outer surface is covered by small ridges in a longitudinal but indistinct pattern (Fig. 5.4), in *P. reticulata* also with a couple of larger ridges.

In *P. elastica* the follicles are short, narrowly ovate with a long narrow beak from a thick basal fertile part. The seeds are concentrated at the base. It has a thin mesocarp and is furnished with three to five longer longitudinal ribs and sometimes also some shorter ones in between. The fibrous part of the placenta is distinctly grooved and thick (Fig. 5.3).

Pentopetia albicans has rather large, narrowly ovate or boat-shaped follicles with thick walls (mesocarp ca 1 mm). It is \pm triangular in cross section, with three distinct ribs or narrow wings from base to apex along the edges. The placenta has a thick fibrous part and the central part is furnished with distinct papery flaps (Fig. 5.5).



Fig. 5. – Morphology of fruits of *Pentopetia*. Placentas (left) and follicle walls (right). – 1, \pm linear and thin-walled follicle, and with thin and entire placenta, *P. androsaemifolia*; 2, Somewhat fusiform, longitudinally ribbed and thin-walled follicle, and with thin and entire placenta, *P. grevei*; 3, Fusiform longitudinally ribbed follicle with long beak, and with entire placenta, *P. elastica*; 4, Fusiform rather thick-walled follicle with irregular ribs, and with thick placenta with somewhat denticled margins, *P. reticulata*; 5, Narrowly ovate and thick-walled follicles with three thick ribs, and with thick placenta with distinct flaps, *P. albicans*; 6, Narrowly ovate and thick-walled follicles with five distinct wings, and with thick placenta with distinct flaps, *P. ovalifolia*.

The last type of follicle to be described is seen in *P. ovalifolia*, and is similar to that found in *P. albicans*. The follicles are narrowly ovate with thick mesocarp (ca 0.5 mm) but rounded in cross section and with at least five distinct wings from base to apex and sometimes also with narrower ribs in between. The placenta is structured as in *P. albicans* (Fig. 5.6).

SWARUPANANDAN & al. (1996: 347, 350) stated that the placenta of mature fruit in *Periplocoideae* is a thick and solid structure to which the seeds are attached on denticles in definite rows, contrary to what is found in *Asclepiadaceae* s.s., where the placenta has lost its solid structure and consists of a thin cylindrical structure to which several flat and papery flaps are attached. These differences are said to be absolute and useful in the supra-generic delimitation of *Asclepiadaceae* s.l. (SWARUPANANDAN & al., 1996: 357). The follicles examined in *Ischnolepis* and *Pentopetia* do not, however, fit this description. The placenta structure, with its distinct flaps in *P. albicans* and in *P. ovalifolia* (Figs. 5.5-6), is similar to what is seen in *Asclepiadaceae* s.s. With its prominent fibrous marginal part the placenta differs from most taxa of *Periplocoideae*, but a similar structure is found e.g. in *Tacazzea*.

The follicles of *Periplocoideae* dehisce through the ventral suture (ventricidal or more correctly marginicidal dehiscence) (KURIACHEN & al., 1992: 191; DAVE & KURIACHEN, 1991: 65). *Ischnolepis* and *Pentopetia* are in accordance with this observation.

Fruit and seed material have not been seen of the following species: *P. bidens*, *P. boivinii*, *P. calycina*, *P. dasynema*, *P. dolichopodia*, *P. ecoronata*, *P. intermedia*, *P. longipetala*, *P. lutea*, *P. mollis* and *P. pinnata*.

Seeds

The seeds are flat and ovate with a long silky coma and lack seed wings. This is in accordance with other *Periplocoideae* (SWARUPANANDAN & al., 1996: 347). All studied taxa in both *Pentopetia* and *Ischnolepis* have a \pm smooth seed coat (Fig. 6.5), except *P. grevei*, which has seeds with a finely tuberculate surface (Fig. 29.9). Tuberculate testa has also been observed e.g. in the African genus *Curroria*, which is often included in *Cryptolepis*, but has a different morphology. In this taxon the tubercles are sparser and larger, sometimes slightly ridge-like. In *P. elastica* the surface is covered by \pm elongate pits or short grooves (Fig. 14.9).

Generic delimitation

Pentopetia species in Madagascar have narrow, acute, subulate or filiform corona lobes, except for *P. albicans* and *P. ovalifolia*, hitherto known as *Cryptolepis albicans* and *Pentopetia* *cotoneaster* subsp. *ovalifolia*, respectively, and *P. ecoronata*, which all lack or have minute corona lobes. The corona lobes are always situated in the sinuses of the corolla lobes. They can be very short to almost missing or up to 2 cm long, shorter or longer than the corolla lobes. On the other hand, representatives of *Cryptolepis* in Asia (including the type *C. buchananii* R. Br.) and from continental Africa, have usually thick, obtuse and cylindric corona lobes inserted in the middle of the corolla tube. Furthermore, the corona lobes of *Pentopetia* seem to be less vascularized, with one or up to ca 10 vessels as an unbranched central cylinder. The corona lobes of both African and Asian *Cryptolepis* are usually much vascularized with numerous branched vessels. Furthermore, at least one species of *Cryptolepis* from Africa, *C. nigriflora* N. E. Br., possesses both a typical thick corona located within the corolla tube, and a small flat corona in the corolla lobe sinuses. Consequently the homology of the corona lobes in *Pentopetia* and *Cryptolepis* could be doubted. *Pentopetia* should be accepted as a distinct and endemic genus in Madagascar, distinguished from *Cryptolepis* by the structure of the corona lobes and particularly by their position in the corolla tube. The traditional delimitation between Malagasy *Cryptolepis* and *Pentopetia* based on the length of the corona should be discarded.

Ischnolepis is here treated as a separate monotypic genus. It shows several derived characters, such as its upright branches fasciculated from underground tubers, whorled as well as dis-

tinctly linear leaves, stomata also on the adaxial side of lamina, and corona lobes positioned in the tube at a distance from the lobe sinuses. However, all of these turn out to be autapomorphies (corona position probably a plesiomorphy) for *I. graminifolia*, and do not unite it with any species of *Pentopetia*. Furthermore, *I. graminifolia* does not exhibit characters considered derived within *Pentopetia*, such as red corollas, long staminal filaments, thick or short coronal lobes, longitudinal ridge on the corolla lobes, and placental flaps. Consequently the similarity between *Ischnolepis* and *Pentopetia*, e.g. yellow corolla, long filiform corona lobes, linear follicles with the fruit placenta lacking distinct flaps, are mostly due to plesiomorphic characters. Consequently, as *Ischnolepis* most probably is not an apomorphic ingroup in *Pentopetia*, and as an inclusion of *Ischnolepis* in *Pentopetia* would render the description of *Pentopetia* wide and unnecessarily cumbersome, *Ischnolepis* is best kept as a separate genus.

The genus most closely related to *Pentopetia* is not *Cryptolepis*, but should probably be sought, in addition to *Ischnolepis*, among continental African genera, such as *Raphionacme* Harv. and particularly *Tacazzea* Decne. *Raphionacme* clearly differs from *Pentopetia*, however, by having erect aerial stems and large underground tubers. Furthermore, *Raphionacme* is the only genus that stands out from the generally similar pollen morphology within *Periplocoideae*, by having a large number of pores per pollen grain (8 to 16), (VERHOEVEN & VENTER, 1994: 307; NILSSON & al., 1993: 18, Fig. 10; SCHILL & JÄKEL, 1978: 26, Figs. 9.2-3, 9.5). *Tacazzea* has the same reticulate leaf venation as *Pentopetia* as well as the same general appearance of the flowers with long filiform corona lobes. In fact N. E. BROWN (1907: 541) stated that he could see no diagnostic character that would separate *Pentopetia* from *Tacazzea*, but *Pentopetia* studied by Brown was the continental African species *P. natalensis*, which deviates from the Malagasy *Pentopetia* and is discussed in the next paragraph as *Petopentia natalensis*. *Tacazzea* differs from true, Malagasy, *Pentopetia* by having the corona lobes inserted close to the staminal filaments at the centre of the corolla tube united by shortly but distinctly projecting interstaminal corona lobes. These interstaminal lobes are probably homologous with the nectar lobes inside the corolla tube in *Pentopetia* and *Ischnolepis*.

Pentopetia natalensis from southern continental Africa was described by SCHLECHTER (1894: 257). Rather soon it was transferred to *Tacazzea* by N. E. BROWN (1907: 541), and later a monotypic genus, *Petopentia*, was created for this species (BULLOCK, 1954: 362). This was supported by VENTER & al. (1990: 393) in a taxonomic-morphological treatment of the genus. *Petopentia natalensis* probably has its closest relative in *Ischnolepis*, with which it shares both floral characters (corona lobes inserted inside the corolla tube at a distance from lobe sinuses) and vegetative structures (underground tubers, glossy red bark, amphistomatic leaves). *Ischnolepis* differs, however, by its whorled and linear leaves (as opposed to decussate and broad), its thin-walled linear follicles (as opposed to thick-walled and fusiform) and by the flat interstaminal nectar lobes (as opposed to projecting somewhat recurved) as well as the shape of the adhesive disc of the translators. However, except for the insertion and shape of the leaves, the differences are not more important than the ones accepted between species within *Pentopetia* in this revision, and it is possible that *Petopentia* should be included in *Ischnolepis*. All other taxa that have been described as *Pentopetia* are restricted to Madagascar.

Interrelationships within *Pentopetia*

Four main morphological groups can be identified, here named after the most common species of the taxa included.

- 1) *Pentopetia androsaemifolia* group (spp. 1-10), a probably paraphyletic group characterized by having white to yellow flowers and short staminal filaments that are inserted somewhere in the tube but not together with the corona lobes in the corolla lobe sinuses. Alternistaminal nectar lobes inside the corolla tube are often present.

- 2) *Pentopetia albicans* group (spp. 11-14), a probably monophyletic group of yellow-flowered species with usually long staminal filaments that are inserted at the mouth of the corolla tube in the lobe sinuses. Five ridges or bosses are usually present at the mouth of the tube.
- 3) *Pentopetia cotoneaster* group (ssp. 15-18), a probably monophyletic group characterized by reddish violet flowers with long staminal filaments that are inserted at the mouth of the corolla tube in the lobe sinuses. Five ridges or bosses are usually present at the mouth of the tube.
- 4) *Pentopetia grevei* group (spp. 19-20), a most probably unnatural group characterized by reddish violet flowers with short staminal filaments and somewhat fleshy corona lobes. Alternistaminal nectar lobes inside the corolla tube are present.

Pentopetia androsaemifolia group s.str. (spp. 1-5). In addition to the widespread and polymorphic *P. androsaemifolia*, this group includes *P. bidens*, *P. bosseri*, *P. dasynema*, and *P. mollis*. This is probably a plesiomorphic assemblage recognized by the white to often pale yellow flowers and by having short staminal filaments and styles (usually not more than 1/2 mm long). *Pentopetia bidens* and *P. mollis* are probably local segregates of the wide-spread and polymorphic *P. androsaemifolia* with *P. bidens* differing mainly by the smaller size of its flowers, and *P. mollis* by having the alternistaminal nectar lobes basally thin and reflexed. The alternistaminal nectar lobes are also reflexed at the base and cover the ovary in *P. bosseri*, but in this species the lobes are fleshy. The same type of rather fleshy alternistaminal nectar lobes are also present in the red-flowered *P. dolichopodia*. *Pentopetia bosseri* and *P. dasynema* show a remarkable resemblance in habit, sharing the rare character within the genus of narrow, often linear, leaves, but the two taxa show distinct differences in corona and other flower morphology. The corona in the *P. androsaemifolia* group is \pm filiform. Fruit material of this group has been studied only for *P. androsaemifolia* and *P. bosseri*, and on incomplete material for *P. mollis*. The two former species have long and linear follicles with thin slightly undulate walls, similar to what is seen in some other Malagasy *Periplocoideae* genera, e.g. *Baroniella* (KLACKENBERG, 1997), *Camptocarpus* (KLACKENBERG, 1998) and *Ischnolepis*. The fruit placenta has a rather thin fibrous part and the seed-bearing cylinder with low ridges, lacking prominent papery flaps.

The remaining species in the *P. androsaemifolia* group (spp. 6-10, except for *P. intermedia*, which is of uncertain affinity), i.e. *P. elastica*, *P. longipetala*, *P. reticulata* and *P. urceolata*, are characterized by a thicker fruit placenta (material of *P. longipetala* has not been studied) with distinct ridges sometimes narrowly flap-like. Although in general appearance these species are similar to *P. androsaemifolia*, in addition to the placenta structure, which suggests a relationship to the *P. albicans* group, *P. elastica* and *P. urceolata* have urceolate corolla tubes, and *P. longipetala* and *P. reticulata* are characterized by having an outgrowth on the corolla near or in the mouth, above the alternistaminal nectar lobes. *Pentopetia intermedia* is intermediate in several characters between the *P. androsaemifolia* and *P. albicans* groups. The leaves and corolla are similar to *P. androsaemifolia*. The staminal filaments are inserted in the tube, near the corona lobes but not in direct connection with them, i.e. in an intermediate position between the groups. The styles are rather long and the filaments are rather long and curved, both characters also found in the *P. albicans* group. It lacks alternistaminal nectar lobes in the corolla tube, seen in most species in the *P. androsaemifolia* group, but also the five longitudinal ridges in the mouth of the tube, characteristic for *P. albicans* group. It is instead furnished with a transverse ridge between the filament bases, a structure observed also in *P. elastica* and *P. calycina*.

A ridge or boss basally on the corolla lobes unites *P. longipetala* and *P. reticulata* with *P. albicans*, *P. lutea* and *P. ovalifolia* in the *P. albicans*-group (spp. 12-14). The species in this group are yellow-flowered and have rather long and curved staminal filaments (almost straight in *P. albicans* and short in *P. ecoronata*) that are inserted at the mouth of the corolla tube. They are also, together with the *P. cotoneaster* group, distinguished by having long tubes and styles. Although *P. ecoronata* shares characters with the *P. androsaemifolia* group by its short staminal filaments and probably \pm erecto-patent corolla lobes, it shows most affinity to the *P. albicans*

group by lacking corona lobes, by the asymmetrical apex of the corolla lobes, by having raised secondary nerves on the lower leaf surface, and by having the stamens inserted at the corolla lobe sinuses. The most striking difference that distinguishes *P. ecoronata* from both the *P. androsaemifolia* and *P. albicans* groups, however, is the lack of pollination guiding structures in form of alternistaminal nectar lobes or a longitudinal ridge in the mouth of the corolla tube. *Pentopetia albicans* and *P. ovalifolia* have thick follicle walls with longitudinal ribs or wings (no follicles of *P. ecoronata* and *P. lutea* have been seen) as well as distinct placental flaps, particularly well developed in *P. ovalifolia*. The species in the *P. albicans* group, as well as in the *P. cotoneaster* group, *P. boivinii* excepted, are furthermore characterized by having distinctly raised secondary nerves on the lower, usually hairy, leaf surface when dry.

Pentopetia cotoneaster group (spp. 15-18). A similar androecial and gynoecial structure to that found in the *P. albicans* group, i.e. long curved filaments attached at the mouth of the corolla tube and long styles, is also seen among the red-flowered species, e.g. *P. boivinii*, *P. cotoneaster* and *P. pinnata* as well as in *P. calycina* (colour unknown). Furthermore they also have a longitudinal ridge or \pm triangular boss at or just below the base of the corolla lobes. *Pentopetia calycina*, however, is instead furnished with a transverse ridge between the filaments, similar to the structure seen in *P. intermedia*. The *P. cotoneaster* group differs, however, from the *P. albicans* group, not only by the colour of the corolla, but also by having linear follicles with thin walls and rather thin fruit placenta furnished with narrow ridges lacking distinct seed denticles, i.e. follicles similar to those seen in *P. androsaemifolia* and *Ischnolepis*. It is difficult to judge if thin-walled and linear follicles represent the primitive state within the genus or not. The variation in fruit structure in *Periplocoideae* is sometimes considerable (see e.g. VENTER & VERHOEVEN, 1997: 710), and within Malagasy representatives of the subfamily both thick and thin walled as well as elliptic and linear follicles exist. With their red flowers and long protruding anther columns, *P. boivinii*, *P. calycina*, *P. cotoneaster* and *P. pinnata*, however, most probably constitute a monophyletic group. A tendency towards reflexed corolla lobes is observed, and is particularly distinct in *P. boivinii* and *P. pinnata*.

The two remaining species, *P. dolichopodia* and *P. grevei* are grouped together by their long-stiped translators and thick corona lobes. Both have reddish purple corollas, but contrary to what is observed in the *P. cotoneaster* group, the flowers are more violet inside and more whitish outside, the opposite being the case in the *P. cotoneaster* group. They also lack the long staminal filaments and long styles found in the *P. cotoneaster* group. The corolla tube in both is furnished with somewhat recurved and fleshy alternistaminal nectar lobes, which is particularly distinct in *P. dolichopodia*. These two species show several differences inter se, however, and obviously do not constitute a monophyletic taxon. *Pentopetia grevei* is characterized by its distinctly urceolate corolla with the stamens included deep in the tube. Furthermore, it has seeds with a warty surface, differing from the smooth seeds of all other species. Other derived characters are the long, folded stipes of the translators and the form of the fleshy corona lobes, and *P. grevei*, although best placed in *Pentopetia*, is somewhat deviating within the genus. Besides the flower colour, long-stiped translators and thick corona lobes, *P. dolichopodia* in addition differs from *P. grevei* by its campanulate corolla tube and by having the stamens inserted at the mouth of the tube, distinctly exerted. In contrast to the similarly red flowered *P. cotoneaster* group, however, the filaments and the style in *P. dolichopodia* are short and the corolla lobes are not reflexed. Furthermore, the structure of the translators, and the fleshy, broad and truncate corona lobes, both being unique characters in *Pentopetia*, give this species an isolated position within the genus.

A tribal classification of *Periplocoideae* was recently presented by VENTER & VERHOEVEN (1997: 710). The subfamily was divided into three tribes: (1) *Periploceae* characterized by an open corolla lobed almost to its base, stamens and outer corona inserted at corolla base and a completely exposed gynostegium, (2) *Gymnantherae* characterized by a well defined corolla tube, stamens and outer corona inserted at the mouth of the corolla tube, and an exerted gynostegium, and (3) *Cryptolepideae* characterized by a well defined corolla tube, stamens inserted anywhere from the base to the middle of the corolla tube, and outer corona inserted anywhere

from the base to the mouth of the tube. *Ischnolepis* was placed in *Gymnanthereae* (VENTER & VERHOEVEN, 1997: 712), based probably on an incorrect observation of the corona lobes and stamens as being inserted at the mouth of the corolla tube. On the other hand *Pentopetia* was placed in tribe *Cryptolepideae* (VENTER & VERHOEVEN, 1997: 714), probably based on the observation of the stamens being inserted in the lower half of the corolla tube in *P. androsaemifolia* and *P. grevei*. The authors also recognized the genus *Acustelma* represented by *A. grandidieri* (= *Pentopetia cotoneaster*), which was placed in tribe *Gymnanthereae* (VENTER & VERHOEVEN, 1997: 712), due to the insertion of the stamens and the corona lobes at the mouth of a long corolla tube in this species. Stamens inserted in the corolla mouth occur not only in the red-flowered *P. cotoneaster* group, but also in the yellow-flowered *P. albicans* group, *P. ecoronata* included, as well as in the red-flowered *P. dolichopodia*. In the tribal classification of VENTER & VERHOEVEN (1997) these taxa would belong to *Cryptolepideae*, most of the remaining taxa to *Gymnanthereae*. However, some species of *Pentopetia*, e.g. *P. elastica*, *P. intermedia*, *P. longipetala* and *P. reticulata* have the stamens inserted in the upper half of the tube in an intermediate position between *P. androsaemifolia* and *P. cotoneaster*. This structure falls outside the three tribes presented. Consequently some representatives of *Pentopetia*, with its present circumscription, should be placed in different tribes, and others in an intermediate position outside the presented tribes. Thus this classification is of questionable value. Stamens inserted at the corolla mouth seems to have evolved several times within *Pentopetia*, and this character is probably not useful at tribal level.

In addition to the position of the stamens at the corolla mouth, a long corolla tube in *Periplocoideae* as well as a long style were considered apomorphic and this was used as a criterion for tribal delimitation (VENTER & VERHOEVEN, 1997: 708, 709). These characters, however, are not discrete in *Pentopetia*, and furthermore are not always linked. It could also be argued that a long corolla tube and style are common in *Apocynaceae* s.s., a possible outgroup to *Periplocoideae* (see e.g. molecular studies of CIVEYREL, 1998; SENNBLAD, 1998; SENNBLAD & BREMER, 1996) and consequently it could not be excluded that the long tube and style in *P. cotoneaster* and part of *P. albicans* groups are plesiomorphic characters.

There is also a connection between the *P. androsaemifolia* group and the more long-tubed taxa of *P. cotoneaster* and *P. albicans* groups. The short-tubed, yellow-flowered *P. longipetala* and *P. reticulata* are in most characters similar to *P. androsaemifolia*. However, they have a longitudinal ridge at the corolla base, a pollination-guiding feature also seen in *P. albicans*, *P. lutea*, *P. pinnata* and *P. ovalifolia*, and in a slightly modified more triangular form also in *P. boivinii* and *P. cotoneaster*. This guiding structure is absent from other taxa of the genus. As mentioned above, the stamens of *P. longipetala* and *P. reticulata* are inserted near the corolla mouth, although not directly in the lobe sinuses, which is also similar to the situation in *P. albicans*.

The taxa included in *Pentopetia* in the present article are thought to be phylogenetically closely related. I hesitate to split *Pentopetia* into smaller genera of doubtful monophyly, as it would neither facilitate the understanding of this group, nor reflect the phylogeny of the taxa. The opinion of separating certain representatives in different genera or even tribes is considered ill-founded.

Phytogeography

The most wide-spread species of *Pentopetia* is *P. androsaemifolia*, which is found in all phytogeographical domains of Madagascar, except the Eastern one, from sea level up to 2000 m, and is known also from the Comoro and Seychelles (Aldabra) Islands. It is considered to be absent from the more humid Eastern Domain of Madagascar, although one specimen is known from this area. This is, however, an old collection and its provenance, Ile Ste Marie, is doubtful. Of the remaining species in the *P. androsaemifolia* group, *P. bidens* and *P. mollis* are local endemics in the northwestern part of Madagascar, collected only a couple of times. *Pentopetia bos-*

seri and *P. dasynema* are sympatric with *P. androsaemifolia* but restricted to the Southern Domain, with *P. dasynema* as a local endemic in the Fiherenana River basin. In contrast, *P. bosseri* is distributed throughout most of the Southern Domain, and has been confused with narrow-leaved *P. androsaemifolia*. *Pentopetia urceolata* is known from the central plateau only, where it has been confused with the sympatric *P. androsaemifolia*. *Pentopetia urceolata* and the other yellow-flowered and urceolate species, *P. elastica*, which is distributed in the western and southern parts of Madagascar, are vicariant taxa.

Pentopetia reticulata and *P. longipetala*, hitherto known from a couple of collections only, are regarded as local endemics in the Sambirano and Mahajanga areas, respectively. The distribution of *P. intermedia* is poorly known. It has been collected once only in northernmost Madagascar.

Pentopetia albicans, *P. lutea* and *P. ovalifolia*, which most probably form a monophyletic group, are all restricted to the drier western and southern parts of the island, and are to a great extent sympatric. *Pentopetia ecoronata*, also from the dry southwest, is known only from the type locality.

Among the red-flowered species, *P. cotoneaster* and *P. pinnata* are distributed sympatrically in the Central Plateau and are vicariant with *P. boivinii*, which is the only species of *Pentopetia* that is distributed in the more humid Eastern phytogeographical Domain. *Pentopetia calycina* is known only from the type, which was collected at a mountain just south of Antsiranana in the far north of Madagascar. Also *P. dolichopodia* is known only from the type locality, the Ankaratra Mt in Central Madagascar. The remaining species, *P. grevei*, is the only red-flowered taxon that is found outside the Eastern phytogeographical region. It has a rather wide distribution in the southern and western parts of the island.

Ischnolepis is widespread in Madagascar but is most common in dry habitats at the central plateau.

Taxonomy

Key to the genera

1. Suffrutescent liana with decussate, usually broad, leaves; corona lobes inserted in the corolla lobe sinuses, or, if a corona is lacking, then with anther filaments inserted in the lobe sinuses **1. *Pentopetia***
- 1a. Shrub with whorled linear leaves; corona lobes and anther filaments inserted some distance below the sinuses of the corolla lobes **2. *Ischnolepis***

1. *PENTOPETIA* Decne. in A. DC., Prodr. 8: 500. 1844; Benth. & Hook. f., Gen. Pl. 2: 741. 1876; Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 439. 1907; Choux in Ann. Mus. Colon. Marseille ser. 3, 2: 221. 1914.

≡ *Cryptolepis* R. Br. sect. *Pentopetia* (Decne.) Baill. in Bull. Mens. Soc. Linn. Paris 1: "83" [803]. 1889.

Type: *Pentopetia androsaemifolia* Decne., vide Bullock in Kew Bull. 10: 611. 1956.

= *Cryptolepis* sect. *Acustelma* Baill. in Bull. Mens. Soc. Linn. Paris 1: "84" [804]. 1889.
 = *Pentopetia* subg. *Acustelma* (Baill.) Jum. & H. Perrier in Caoutchouc & Gutta-Percha 15 sept.: 6, 8. 1908. = *Acustelma* (Baill.) Venter in Taxon 46: 712. 1997. – **Type:** *Cryptolepis grandidieri* Baill. (= *Pentopetia cotoneaster* Decne.).

- = *Cryptolepis* sect. *Gonocrypta* Baill. in Bull. Mens. Soc. Linn. Paris 1: “84” [804]. 1889. = *Gonocrypta* (Baill.) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 359. 1908. – **Type:** *Cryptolepis grevei* Baill. (= *Pentopetia grevei* (Baill.) Venter).
- = *Kompitsia* Costantin & Gallaud in Compt. Rend. Hebd. Séances Acad. Sci. 142: 1555. 1906; Bull. Mus. Hist. Nat. (Paris) 12: 417. 1906. – **Type:** *Kompitsia elastica* Costantin & Gallaud (= *Pentopetia grevei* (Baill.) Venter).
- = *Pentopetiopsis* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 12: 416. 1906. – **Type:** *Pentopetiopsis ovalifolia* Costantin & Gallaud (= *Pentopetia ovalifolia* (Costantin & Gallaud) Klack.).

Suffrutescent scrambling liana with hairy to glabrous stems and milky latex. Leaves decussate, sometimes on brachyblasts, herbaceous to semi-coriaceous; blade linear, ovate, elliptic or obovate to almost circular, cordate to truncate or cuneate to tapering at the base into a distinct petiole, rounded and sometimes retuse and apiculate to usually acute or acuminate at the apex, with entire margins, \pm equally green on both sides when dry or darker above, sometimes pale along the margins and midnerves, glabrous to densely hairy; hairs, if present, straight to curled; venation pinnate, looped to arched, with tertiary veins usually finely reticulate when dry at least underneath.

Inflorescences axillary or terminal irregularly branched cymes, shorter or longer than the adjacent leaves; cymes often with much shortened internodes, sometimes umbel-like on a peduncle. Flowers pentamerous, actinomorphic, solitary or up to ca 15 in a cyme.

Calyx lobes free from the base, narrowly triangular to oblong or elliptic to broadly ovate, rarely of different sizes, rounded to acute or acuminate at the apex, longer to shorter than the corolla tube, hairy to glabrous, sometimes recurved, with 5-10 colleters at the sinuses. Corolla contorted with the right lobe margins overlying, twisted or not in bud, with the lobes fused for $1/12 - 2/5$ of their length into a tube; tube campanulate or cylindric to urceolate, hairy to glabrous inside, sometimes with 5 ridges below the anther filaments, and/or with 5 longitudinal ridges or short bosses between the stamens, sometimes with 5 alternistaminal nectar lobes; nectar lobes, if present, in the form of short and broad, often channelled bosses directed downwards but sometimes slightly longer and recurved or rarely as U-shaped ridges; lobes narrowly oblong or triangular to ovate to obovate, acute to obtuse and sometimes asymmetrical at the apex, sometimes with a boss or longitudinal ridge near the base inside, erecto-patent to recurved, hairy, particularly near base, to entirely glabrous, white to yellow and sometimes greenish or purple to mauve. Corolline corona present or rarely absent; lobes, if present, inserted at the sinuses of the corolla lobes, short and subulate, triangular to usually filiform and if long tortuous towards apex, rarely broad and truncate, sometimes rudimentary, glabrous but sometimes hairy at the very base to rarely entirely hairy. Stamens with the anthers forming a narrow or ovoid cone over the top of the style head, totally included in the tube or distinctly exerted; filaments free, filiform to flattened, straight to distinctly arched, inserted in the corolla tube from near the base to the mouth of the tube in the sinuses of the corolla lobes just below/inside the corona lobes; anthers with basal part of thecae without pollen, without or sometimes with a long protruding connective, hairy to glabrous; protruding connective very short to up to ca $1/2$ of the length of the thecae, hairy to glabrous. Translators placed in 5 shallow depressions to deeper vertical grooves on the style head; spoon \pm rectangular or elliptic to discoid, rarely ovate, sometimes impressed along mid-line on the dorsal side but usually with an even surface or rarely with a slightly raised mid-line, truncate to rarely peltate at the base to usually tapering into a narrow or broad stipe or rarely not tapering with a broad and flat stipe; adhesive disc flat or cylindric. Gynoecium of 2 mostly separate carpels united near the base and apically into a style head, sometimes ovary and styles with longitudinal ridges; ovary semi-inferior, with few to usually numerous ovules; styles 2, free at the base but united just below the style head, sometimes very short but always distinct, glabrous to rarely hairy; style head conical to ovoid or campanulate, rarely with a sterile prolongation above the translator spoons.

Follicles straight to slightly curved, linear to fusiform to narrowly ovoid, sometimes with slightly sinuate margins, acute to acuminate, thin- or thick-walled, finely striate and sometimes with longitudinal ribs and/or wings, opening by a slit with straight margins, sometimes recurved up to 90° at the base, glabrous to hairy. Seeds narrowly ovate, smooth but rarely with \pm elongate pits or short grooves or verrucose, with a tuft of hairs.

Key to the species of *Pentopetia*

The most common species in all areas except the east coast is *P. androsaemifolia* (sp. no 1). From the east coast only *P. boivinii* (sp. no 16) is known. In addition to *P. androsaemifolia*, *P. cotoneaster* (sp. no 15) is common on the central plateau, *P. bosseri* (sp. no 4) and *P. ovalifolia* (sp. no 13) in the dry southwestern Madagascar, and *P. albicans* (sp. no 12) along the west coast. *Pentopetia grevei* (sp. no 19) seems to be quite common in both the southern and western parts of the island.

Synoptic key (spp. nos 8, 11, 18 and 21 are excluded due to intermediate character combinations and insufficient data):

Corolla white to yellow;

staminal filaments ca 0.5 mm or shorter;

corolla lobes without ridge at base **spp. 1-7** (*P. androsaemifolia* group)

Corolla white to yellow;

staminal filaments ca 0.5 mm or shorter;

corolla lobes with longitudinal ridge at base **spp. 9-10** (*P. androsaemifolia* group)

Corolla white to yellow;

staminal filaments ca 1 mm long or more;

corolla lobes with longitudinal ridge or boss at base **spp. 12-14** (*P. albicans* group)

Corolla reddish violet;

staminal filaments ca 1 mm long or more;

corolla lobes thin;

corolla lobes with longitudinal ridge or triangular boss at base
. **spp. 15-17** (*P. cotoneaster* group)

Corolla reddish violet;

staminal filaments ca 0.5 mm or shorter;

corolla lobes fleshy;

corolla lobes without ridge at base **spp. 19-20** (*P. grevei* group)

Main key

(sp. No. 21 *Pentopetia glaberrima* is omitted due to lack of information):

1. Calyx lobes of different sizes, larger ones $> 5 \times 2.5$ mm; flowers single or in pairs on long pedicels seemingly in leaf axils at top of branches **18. *P. calycina***

- 1a. Calyx lobes \pm equal-sized, usually $< 5 \times 2.5$ mm but if larger, then corona lobes shorter than the staminal cone and subulate, not twisted; inflorescences 1 to many-flowered2
2. Corolla white or yellow3
- 2a. Corolla purple or reddish, on at least one face of lobes17
3. Corona lobes conspicuously hairy from base to apex4
- 3a. Corona lobes glabrous or rarely with a few scattered hairs5
4. Leaves polymorphic but often narrow, almost linear; corona densely hairy **.5. *P. dasynema***
- 4a. Leaves elliptic; corona with few long hairs**2. *P. bidens***
5. Corolla entirely glabrous on both tube and lobes6
- 5a. Corolla hairy at least below the staminal filaments inside the tube or on either side of corona lobe bases8
6. Corona absent**11. *P. ecoronata***
- 6a. Corona present7
7. Corolla tube urceolate, narrowed at mouth; anthers mostly included in tube and hidden by the corona lobes**7. *P. elastica***
- 7a. Corolla tube \pm cylindric or broadened towards mouth, not urceolate; anthers distinctly exerted**8. *P. intermedia***
8. Staminal filaments inserted in lobe sinuses together with, if present, the corona lobes, usually 1 mm long or more; corolla with 5 ridges or bosses at or above tube mouth9
- 8a. Staminal filaments inserted some distance below the corona lobes, usually 1/2 mm long or less; corolla tube with or without ridges at mouth11
9. Leaves linear to narrowly obovate, always < 1 cm broad; anthers > 2.5 mm long
.....**14. *P. lutea***
- 9a. Leaves elliptic to broadly ovate, rarely narrowly obovate but then large, > 1 cm broad; anthers < 2.5 mm long10
10. Ridge at base of corolla lobes prolonged into the tube; staminal filaments filiform; follicles with 5 longitudinal wings at least 1-3 mm broad**13. *P. ovalifolia***
- 10a. Ridge at base of corolla lobes abruptly disappearing at mouth of tube; staminal filaments flattened, broad; follicles with 3 ribs sometimes up to 2 mm broad**12. *P. albicans***
11. Leaves much varying in shape in the same individual but longer ones narrow, often linear or very narrowly obovate**4. *P. bosseri***
- 11a. Leaves broader, never linear or very narrowly obovate12
12. Corolla tube with five distinct erecto-patent knobs inside and 5 smaller longitudinal ridges at mouth**10. *P. longipetala***
- 12a. Corolla tube without projections inside or usually with \pm channelled flat bosses directed downwards or membranaceous pocket-shaped structures inside (alternistaminal nectar lobes), without or rarely with 5 small ridges at mouth13
13. Corolla tube urceolate, hairy inside below corona lobes and staminal filaments but not between corona lobes, nor outside corolla tube at lobe bases**6. *P. urceolata***
- 13a. Corolla tube not urceolate, hairy between or at least on each side of the corona lobe bases, usually also at the corolla lobe bases just above the tube14
14. Corolla near mouth with 5 longitudinal ridges above 5 channelled bosses in tube directed downwards; corolla with a small patch of hairs at each side of the corona filaments
.....**9. *P. reticulata***

- 14a. Corolla lobe without longitudinal ridge at base but tube with $5 \pm$ channelled flat bosses directed downwards or with 5 membranaceous pocket-shaped structures inside or without distinct outgrowths altogether; corolla finely hairy at central part of lobe bases just outside corolla tube15
15. Corolla tube with pocket-shaped structures inside**3. *P. mollis***
- 15a. Corolla inside with \pm channelled flat bosses directed downwards or without distinct outgrowths16
16. Corolla lobes more than 3×1.5 mm; tube inside with $5 \pm$ channelled flat bosses directed downwards**1. *P. androsaemifolia***
- 16a. Corolla lobes small, $< 3 \times 1.5$ mm; tube without distinct bosses inside**2. *P. bidens***
17. Corolla tube urceolate with the stamens included**19. *P. grevei***
- 17a. Corolla tube not distinctly urceolate; staminal cone distinctly exerted18
18. Corona lobes short and broad, thick and truncate; corolla tube with 5 reflexed bosses near base inside covering the ovary**20 *P. dolichopodia***
- 18a. Corona lobes subulate to filiform; corolla tube with longitudinal ridges inside19
19. Corolla tube with 10 ridges inside; corolla lobes $> 4.5 \times 2.0$ mm; staminal filaments distinctly arched, > 3 mm long**17. *P. pinnata***
- 19a. Corolla tube with 5 sometimes indistinct ridges inside and with $5 \pm$ triangular bosses at mouth; corolla lobes $< 4.5 \times 2.0$ mm; staminal filaments slightly bent only, < 2 mm long20
20. Leaves glabrous, variegated when dry with a distinctly paler margin and midnerve; corolla tube < 2.5 mm long**16. *P. boivinii***
- 20a. Leaves pubescent at least beneath, not variegated; corolla tube > 2.5 mm long**15. *P. cotoneaster***

1. *Pentopetia androsaemifolia* Decne. in A. DC., Prodr. 8: 500. 1844; Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 335. 1908; Choux in Ann. Mus. Colon. Marseille ser. 3, 2: 222. 1914 (Figs. 6, 7, 9.A (map)).

Type: MADAGASCAR, “*Cynanchum androsaemifolium* Vahl”, Commerson s.n. (lecto-, P, here selected).

= *Pentopetia gracilis* Decne. in A. DC., Prodr. 8: 500. 1844. – **Type: MADAGASCAR**, Bojer s.n. (holo-, P; iso-, G-DC).

= *Pentopetia androsaemifolia* var. *cordifolia* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 12: 416. 1906; Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 336. 1908. – **Type: MADAGASCAR**, Mahovaliviaky, 1891, Douillot s.n. (lecto-, P, here selected).

= *Pentopetia androsaemifolia* var. *cowanii* Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 336. 1908. – **Type: MADAGASCAR**, Ankafana, 1880, Deans Cowan s.n. (lecto-, P, here selected; iso-, BM).

= *Pentopetia cotoneaster* var. *glabra* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. = *Pentopetia cotoneaster* subsp. *glabra* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 343. 1908. – **Type: MADAGASCAR**, Baron 5431 (holo-, P; iso-, K, P).

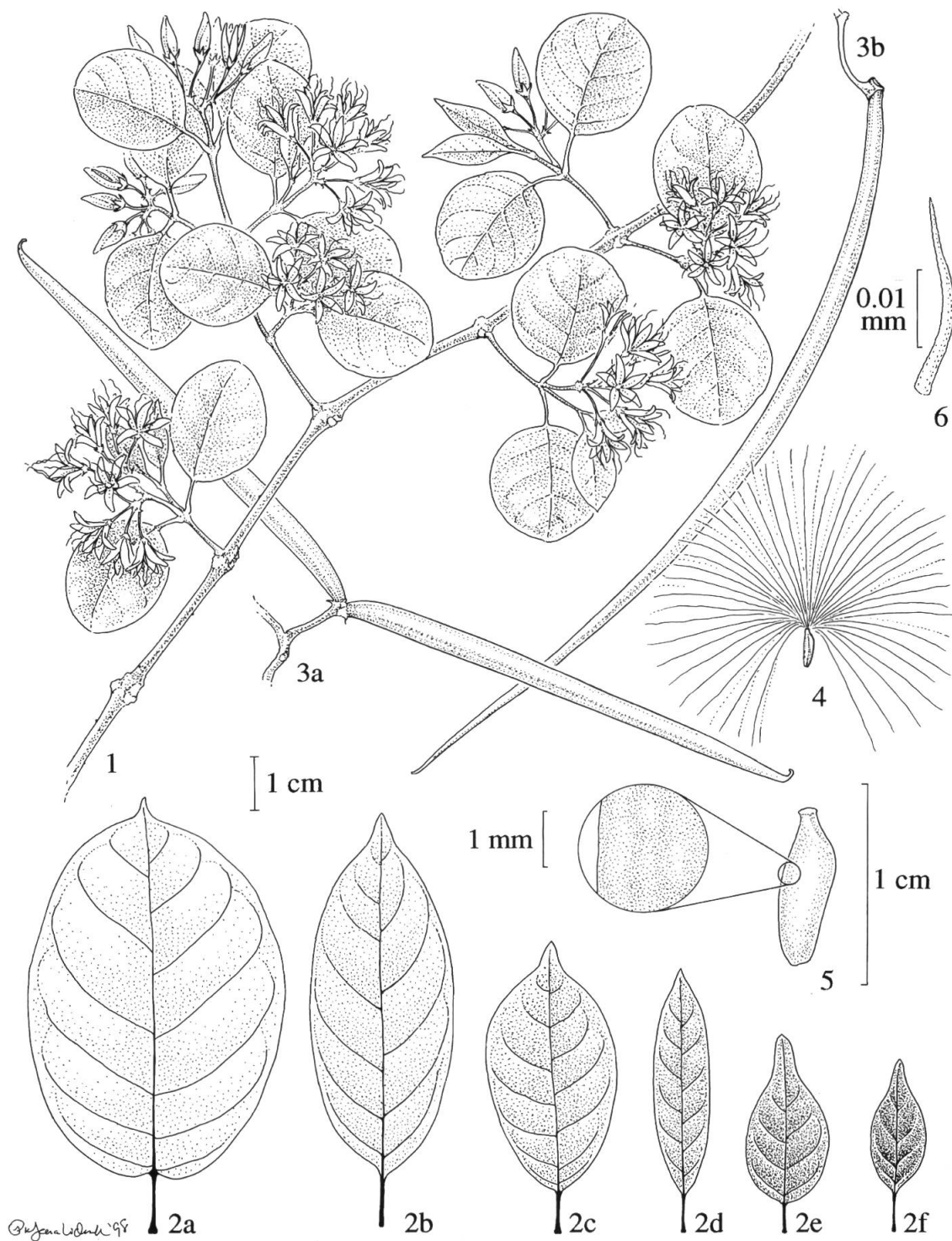


Fig. 6. – *Pentopetia androsaemifolia* Decne. – 1, Habit; 2a-f, Leaf variation; 3a-b, Follicles; 4, Seed; 5, Seed and magnification of seed surface, coma detached; 6, Hair from corolla lobe base. – [1, Jongkind & Andriantiana 3628; 2a, Malcomber 1103; 2b, Perrier de la Bâthie 8984; 2c, Bosser 13531; 2d, Humbert 13040; 2e, Perrier de la Bâthie 16794; 2f, Humbert 7049; 3a, 4-5, Decary 2800; 3b, Turnour 17; 6, Seyrig 187].

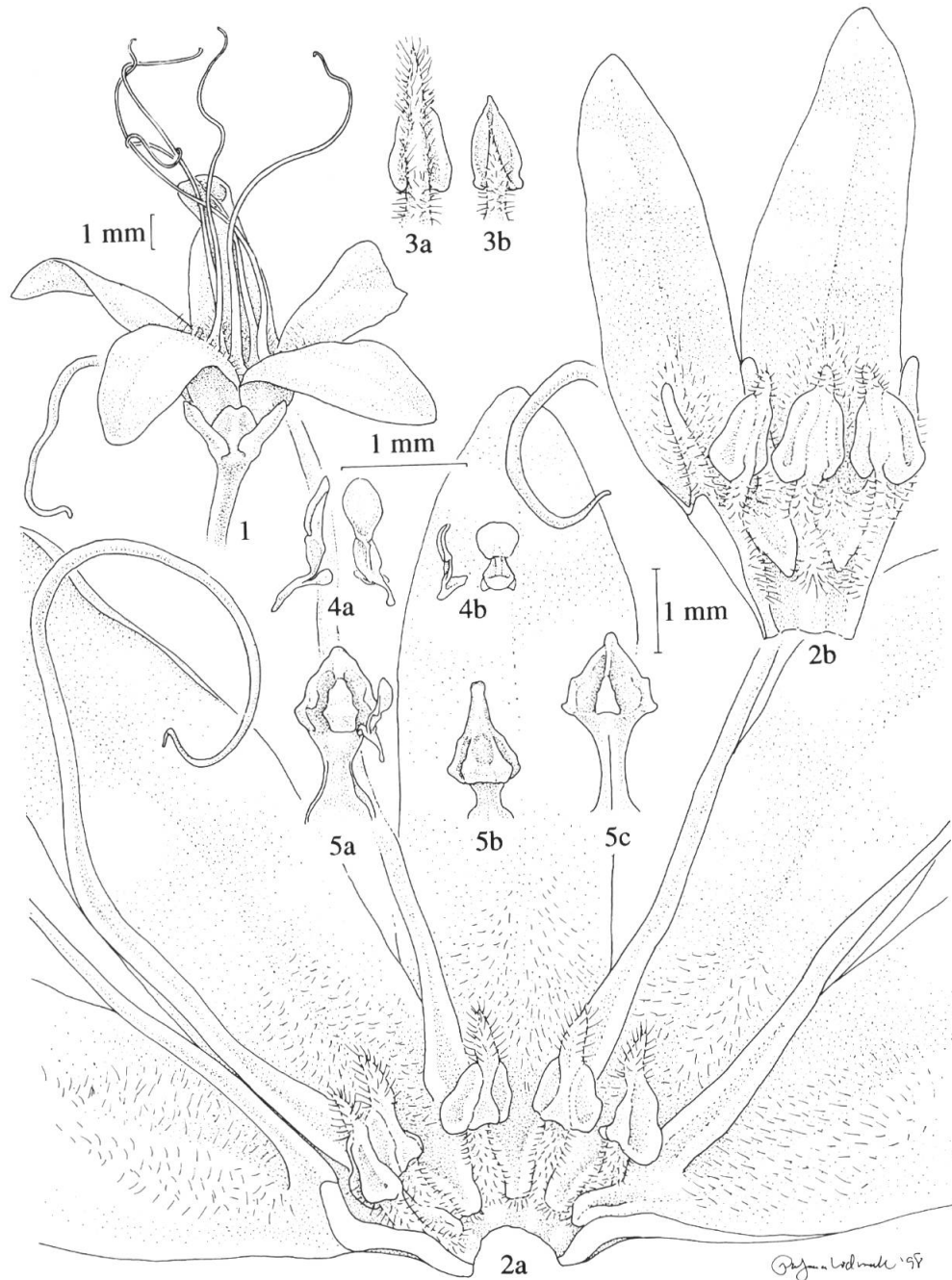


Fig. 7. – *Pentopetia androsaemifolia* Decne. – 1, Flower; 2, Flower from within with gynoecium removed (2a, specimen with long corona lobes; 2b, specimen with short corona lobes); 3, Anthers (dorsal side) (3a, specimen with long projecting hairy connective; 3b, specimen with short connective); 4, Translators; 5, Style and style head (5a, with short style; 5b, with long projecting part above style head; 5c, with long style). – [1, 2a, 4a, 5a, Jongkind & Andriantiana 3628; 2b, Humbert 7049; 3a, Phillipson 2342; 3b, Jongkind & Andriantiana 3678; 4b, 5b, Schatz & Miller 2454; 5c, Peltier 5604].

- = *Pentopetia androsaemifolia* var. *lanceolata* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. = *Pentopetia androsaemifolia* subsp. *lanceolata* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 339. 1908. – **Type:** **MADAGASCAR**, Baron 1940 (holo-, P; iso-, BM, P).
- = *Pentopetia androsaemifolia* var. *multiflora* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. = *Pentopetia androsaemifolia* subsp. *multiflora* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 337. 1908. = *Pentopetia multiflora* Boivin, in sched. – **Type:** Nord de **MADAGASCAR**, Diego Suarèz (Antsaranana), baie de Ringy, 1848, Boivin 2465 [NB same no as var. *scabra*] (holo-, P).
- = *Pentopetia androsaemifolia* var. *ovalifolia* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. = *Pentopetia androsaemifolia* subsp. *ovalifolia* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 340. 1908. – **Type:** **MADAGASCAR**, Baron 2792 (holo-, P; iso-, BM).
- = *Pentopetia androsaemifolia* var. *pilosa* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. = *Pentopetia androsaemifolia* subsp. *pilosa* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 338. 1908. – **Type:** **MADAGASCAR**, Baron 1741 (holo-, P).
- = *Pentopetia androsaemifolia* var. *scabra* Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 337. 1908. – **Type:** **MADAGASCAR**, Ste Marie, 1849, Boivin 2465 [NB same no as subsp. *multiflora*] (holo-, P).
- = *Pentopetia boinensis* Jum. & H. Perrier in Caoutchouc & Gutta-Percha 15 sept.: 4. 1908, nomen; Ann. Mus. Colon. Marseille ser. 2, 6: 169. 1908. – **Type:** **MADAGASCAR**, Haut Bemarivo (Boina), 1907, Jumelle & Perrier de la Bâthie 8990 (lecto-, P, here selected).

Nomenclatural notes. – *Pentopetia gracilis*. DECAISNE (1844: 500) based this species on Bojer material collected in province Emirna. A sheet from this collection is present in the De Candolle herbarium in Geneva. Nevertheless, a Bojer specimen in the Natural History Museum in Paris, without an annotation about Emirna, is considered to be the holotype, as Decaisne clearly stated in the protologue that he based this species on material he saw in Paris. The holotype has an annotation “*Pentopetia gracilis*” written on it by Decaisne’s hand.

Pentopetia androsaemifolia var. *cordifolia*. In the protologue, COSTANTIN & GALLAUD (1906b: 416) mentioned three specimens in formaldehyde (*Geay* 4920, 4923, 4924), which cannot be found in the Natural History Museum in Paris, as well as a Douillot specimen collected in 1891 in fruit, which is chosen as lectotype.

Pentopetia boinensis. In the protologue the type collection was stated to be in flower and from Ampombo, haut Bemarivo. No such specimen has been traced. I have chosen as lectotype a specimen in fruit from haut Bemarivo that corresponds to the drawing in the protologue (JUMELLE & PERRIER DE LA BATHIE, 1908b, tab. 1)

Liana with mostly glabrous stems, but younger stems often hairy. Leaf blade narrowly ovate or narrowly elliptic to broadly ovate or broadly elliptic, rarely almost rounded, 1.5–8 × 1–6 cm, tapering to usually truncate or cordate at the base, rounded and rarely notched to acute or acuminate at the apex, usually glabrous but sometimes with short hairs on one or both sides or along veins only, ± equally green on both sides when dry or with darker upper side but if darker still often green along the margins; venation looped to arched, with tertiary veins finely reticulate when dry at least below; midrib impressed above, raised below when dry; petiole 2–10 mm long, glabrous, rarely finely hairy.

Inflorescences axillary, much shorter to about as long as the adjacent leaves, up to 4 cm long; cyme irregularly branched with much shortened internodes, usually ± umbel-like on an up

to 1 cm long peduncle, 1-15-flowered; pedicels 4-15 mm long, glabrous to sometimes hairy; bracts up to 2 mm long, linear to narrowly elliptic, glabrous to hairy.

Calyx lobes narrowly triangular to oblong to ovate, $1.3-3.4 \times 0.9-2.1$ mm, rounded to acute at apex, about as long as to usually longer or rarely slightly shorter than the corolla tube, often recurved, hairy to usually glabrous, whitish to usually green. Corolla twisted in bud, with the lobes fused for $1/5 - 2/7$ of their length into a tube; tube 0.9-3.0 mm long, with ridges below the filaments, which unite into 5 flat alternistaminal slightly channeled nectar lobes that narrow towards the base, hairy inside mainly between the bases of the corona lobes and between the bosses at the base; lobes narrowly oblong to elliptic, $3.0-11.4 \times 1.5-2.8$ mm, acute to obtuse at apex, probably erecto-patent, usually hairy at base between the coronal lobes, white to yellow and sometimes greenish but usually pale yellow, rarely somewhat reddish towards base. Corona lobes 1.2-17.0 mm high if straightened out, filiform, if long tortuous towards apex, rarely broadened towards base, slightly to usually much overtopping the staminal cone, shorter or longer than the corolla lobes, glabrous or hairy at base, white to yellow or sometimes violet. Staminal cone 1.0-2.7 mm high, \pm exserted from the corolla tube; filaments 0.3-0.6 mm long, filiform, straight to slightly curved, inserted in the lower part of the corolla tube, with long hairs inside; anthers 1.0-2.1 mm long including a protruding connective 0.1-1.0 mm long, dorsally slightly to very hairy, rarely glabrous; protruding connective up to ca $1/3$ of the anther length and, if long, densely hairy, to, if short, usually glabrous. Translators 0.4-1.0 mm long; spoon elliptic to rounded, 0.2-0.6 mm long; stipe rather narrow just below the spoon but flat and broad at base, with a distinct midrib. Style 0.2-1.1 mm long, glabrous; style head conical to ovoid, without or with a sterile prolongation above the translator spoons.

Follicles $5-20 \times 0.3-0.7$ cm, usually paired, straight to slightly curved, linear to narrowly ovoid, sometimes with slightly sinuate margins, acuminate, rather thin-walled with mesocarp 0.1-0.3 mm thick, without ribs or wings, recurved $45-90^\circ$ at the base, glabrous; placenta with narrow smooth ridges. Seeds 5-8 mm long, smooth; hairs 2-3.5 cm long.

Distribution and habitat. – *Pentopetia androsaemifolia* is distributed from the far north to the far south of Madagascar on the central plateau and in the western part of the island, but is known only from one old doubtful collection (*Boivin s.n.*, Ste Marie) from the eastern rain forest. It is also known from Mayotte in the Comoro Islands, as well as from Assumption Is in the Aldabra group (Seychelles). *Pentopetia androsaemifolia* is common in several places and is somewhat weedy. It is usually found in dry forest or savannah and scrub vegetation in siliceous sand, but is also reported from seasonal forest on basalt, on sand with chalk, lateritic soil or rocks, and also along rivulets. It grows from sea level up to 2000 m.

Flowering specimens seen from August to June.

Note. – *Pentopetia androsaemifolia* is a polymorphic species in both vegetative and floral characters. It is closely related to *P. urceolata* but differs by having a short, \pm cylindric or funnel-shaped tube, and by the corolla being pubescent also at the lobe bases, i.e. not only in the tube. It also shows affinity to *P. bidens*, which, however, has smaller flowers and usually smaller leaves. The leaves are sparsely hairy to usually glabrous. The longer follicles are born on the large- and green leaved morphological form (see below).

Leaf variation in *Pentopetia androsaemifolia* is illustrated in Figure 6.2. Figure 6.2a shows a morphological variant with broad leaves that are equally green on both sides when dry, large flowers with a corona longer or shorter than the corolla lobes, and with long protruding hairy connectives. Both hairy and glabrous leaves exist. This morphological variant was originally described as *P. androsaemifolia* from the central plateau, but it is widely distributed and has been collected in the far south as well as along the west and northwest coasts. One old collection is said to have come from the island Ste Marie off the east coast, but no recent collections from the eastern humid lowland forest below Lac Alaotra and Moramonga have been observed. This morphological variant grades (Figs. 6.2b-d) into another widely distributed variant, which is characterized by more narrow, usually acuminate leaves (Figs. 6.2e-f). The adaxial side of the leaves

is covered by a pigment that turns the leaves dark when dry. The same is seen on the abaxial side of the corolla lobes. The corona lobes and connectives are similar to the first morphological variant. This morphological variant is also known from the north, south and western parts of the island as well as from the central plateau. Decaisne's *P. gracilis* belongs to this variant. Some specimens from NW Madagascar have rather small flowers, often short corona lobes with broadened bases as well as short and glabrous tips of the connectives. The back of the anthers is almost glabrous. The leaves are in accordance with the second variant described above with dark pigmented adaxial side when dry. This includes Jumelle and Perrier de la Bathie's *P. boinensis* as well as a collection from the dunes of Mahajanga. Much the same morphological traits can be seen in the southern part of the island south of the Horombe plateau around Betroka and Beraketa and west to Sakaraha. As in the NW both glabrous and hairy leaves are observed. In this area Ampandrandava is located. Here several specimens of *Pentopetia* have been collected by A. Seyrig in the 1920's, which are now kept in Paris. All morphological variants described above are present in this area (Fig. 6.2). Several intermediate forms can be observed in Seyrig's material between the morphological variants, with different character combinations.

Although some general morphological types can be described as above, there are many intermediate forms and combinations, and this morphological variation does not merit any taxonomic rank. Furthermore, JUMELLE & PERRIER DE LA BATHIE (1908b: 166) found that different leaf types of *P. androsaemifolia* in nature might belong to the same individual but look different according to age or position of the branches (see also the chapter "Historical background and taxonomic notes on species").

The flowers are white to yellow, often with a green tinge. The corona lobes are of the same colour as the corolla lobes or sometimes violet. Although it seems that the dark-leaved individuals often have a paler corolla which sometimes goes together with violet corona lobes, in other characters similar individuals from Ampandrandava (A. Seyrig) have yellowish flowers with either yellowish or violet corona lobes. From Ambovombe a larger collection of the broad- and green-leaved type exist, collected by R. Decary. Also here the same colour variation is observed, from white to yellow, but usually pale yellow with a tinge of green. This variation in colour seems to have no taxonomic importance.

Specimens collected west of Ambositra (Itremo, *Du Puy & al. M631*) and east of Fianarantsoa (Ranomafana, *Daniels 118*, *Schatz & Miller 2454*) have slightly pigmented leaves and large flowers similar to the typical broad-leaved specimens but the style head is furnished with a thick protruding sterile part above the translators (Fig. 7.5b), which is completely covered by the anthers. This upper protruding part can also be seen in other populations but is nowhere such a salient feature. Endemic taxa in the quartzitic Itremo Mts are known also from other genera, e.g. *Kalanchoë*, *Senecio*, *Helichrysum* and orchids (KOECHLIN & al., 1974: 495). Also in *Tachia-denus longiflorus* Griseb. (*Gentianaceae*) a somewhat aberrant form was observed from Itremo (KLACKENBERG, 1990: 132) and in the Ranomafana area subsp. *latifolium* (Klack.) Klack. of *Exacum divaricatum* (Baker) Schinz (*Gentianaceae*) is distinguished (KLACKENBERG, 1987: 66) as well as a slightly atypical form of *Camptocarpus acuminatus* (Choux) Venter (*Periplocoideae*) (KLACKENBERG, 1998). *Pentopetia androsaemifolia* seems to have spread recently throughout Madagascar and small isolated populations are now starting to segregate. *Pentopetia bidens*, although with characters similar to *P. androsaemifolia* in quality, differs considerably in degree. It is considered to be an already isolated and distinct species.

Two of the northernmost collections (*Herb. Jard. Bot. Tananarive 5471* from Betsitindry-Befandriana Ava. and *Keraudren-Aymonin & Aymonin 25481* from near Antsiranana) have broad obovate corolla lobes. The specimen *HJBT 5471* is said to have violet flowers. This is, however, doubtful.

Additional specimens studied. – **MADAGASCAR:** *Afzelius s.n.*, Moramanga, 5 Oct. 1912 (S); *Barnett & al. 287*, prov. Antananarivo, 3 km E of the village of Bory-bepoaka, 52 km NW of Tsiroanomandidy, 1985 (K, MO, P); *Barnett & al. 395*, prov. Antananarivo, between Ambaranala and Tsiroanomandidy, 1985 (K, P); *Baron 21*, Madagascar (P); *Baron 4787*, Madagascar, 1889 (P); *Benoist 202*, route de Tamatave km 20, 1950 (P); *Bernier 284*, Madagascar (P); *Boiteau s.n.*, Antananarivo, Jardin Botanique, 1935 (P); *Boiteau & Cours 3982*, Lac Alaotra (P); *Boivin 2465*, s.loc., 1846-1852 (G);

Boivin s.n., Madagascar, côte orientale, 1853 (G); *Bojer s.n.*, Madagascar, prov. Emirna (P); *Bosser 4345*, Ifotaka (Sud), 1952 (P); *Bosser 10312*, 10313, 50 km avant Beraketa, 1956 (P); *Bosser 10195*, Ambovombe, 1956 (P); *Bosser 13531*, env. d'Antananarivo, Ambohimanga, 1959 (P); *Bosser 13932*, 22 km Sud de Betroka, 1959 (P); *Bosser 13933*, 20 km Sud de Betroka, 1959 (P); *Bosser 15873*, sous-préf. Bekily, bords de la Linta, Vohiteny, 1962 (P); *Bosser 16625*, Miarinarivo, NO d'Andilamena, 1962 (P); *Cloisel 21*, Tôlanaro (P); *Croat 29210*, prov. Antananarivo, 5 km N of Antilarisona N of Antsirabe, 1250-1300 m alt., 1975 (MO); *Croat 30867*, prov. Toliara, 1975 (P); *Croat 31110*, prov. Toliara, along Route Nationale 10 between Andranovory and Tongobory at PK 25, 250 m alt., 1975 (MO); *Croat 31247*, prov. Toliara, along Route Nationale 10 between Betioky and Ejeda, 175-225 m alt., 1975 (MO); *Croat 31284*, vicinity of Ejeda, 240 m alt., 1975 (MO); *Croat 31305*, along Route Nationale 10 between Ejeda and Linta river, 180-200 m alt., 1975 (MO); *Croat 31357*, along Route Nationale 10 between Ejeda and Ampanihy, between PK 200-250, 200-250 m alt., 1975 (MO); *Croat 31375*, vicinity of Ampanihy, ca 180 m alt., 1975 (MO); *Daniels 118*, prov. Fianarantsoa, 7 km W of Ranomafana, just S of Namorona riv., 1000 m alt. (MO); *Debray s.n.*, PK 270 route Ampanihy-Beloha, 1972 (P); *Decary 2695*, 2800, 3258, 3434, 3474, 3598, 3807, Ambovombe, 1924, 1925 (P); *Decary 4690*, prov. Tôlanaro, vallée du moyen Mandrare, 1926 (P); *Decary 5471*, chaîne de l'Ambinda à l'ouest d'Ivohibe, 1200-1400 m alt., 1926 (P); *Decary 5967*, env. d'Antananarivo, Fenoarivo, 1927 (P); *Decary 6024*, Carion, 1100 m alt., 1927 (P); *Decary 6071*, prov. Antananarivo, Mantasoa, 1927 (P); *Decary 8396*, Ambovombe, 1931 (P); *Decary 8885*, vallée de l'Ikonda, au N d'Ambovombe, 1931 (G, P); *Decary 9146*, vallée de l'Ikonda (K, P); *Decary 9362*, Beteny, limite NE de l'Androy, 1931 (P); *Decary 15984*, distr. Betioky, vallée de la Sakoa, 1940 (P); *Decary 16174*, 16183, distr. Morombe, Lac Ihotry, 1940 (P); *Decary s.n.*, Beloha, janv. 1918 (P); *Descoings 3559*, env. de Mahajanga, Boanamary, 1958 (P); *Dorr 3941*, prov. Toliara, Route Nationale 13, 26.8 km S of Betroka, 1985 (K, MO, P, WAG); *Dorr & Barnett 3151*, Antananarivo, Parc de Tsimbazaza, 1984 (K, P, WAG); *Du Puy & al. M631*, prov. Fianarantsoa, W of Ambositra, Eastern margin of the Itremo Massif, 1380 m alt., 1993 (K, P); *Geay 16*, 18, prov. Toliara, 1906 (P); *Geay 3337*, prov. Toliara, bas Fiherena (P); *Geay 6074*, plains de Bevoay (P); *Geay 6146*, Bevoay sur l'Onilahy (P); *Guillaumet s.n.*, Andringitra, nov. 1920 (P); *Grandidier s.n.*, Toliara, 1868-69 (P); *Herb. Jard. Bot. Tananarive 5471*, Betsitindry-Befandriana Nord, 1942 (P); *Humbert 2950*, plateau de l'Horombe, 900-1100 m alt., 1924 (P); *Humbert 3121*, chaîne du Vohibory, à l'ouest d'Ivohibe, 1000-1300 m alt., 1924 (P); *Humbert 3164*, forêt à l'est d'Ivohibe, ca 1000 m alt., 1924 (BM, G, P); *Humbert 3681*, Massif de l'Andringitra (Iratsy), vallée de la Riambava et de l'Antsifotra et montagnes environnantes, 2000 m alt., 1924 (P); *Humbert 3945*, env. d'Ambalavao, 1500 m alt., 1924 (K, P); *Humbert 4050*, env. de Mahajanga, 2-15 m alt., 1924 (P); *Humbert 6490*, haute vallée du Mandrare, 600-900 m alt., 1928 (P); *Humbert 6782ter*, bassin supérieur du Mandrare, du col de Vavara à la vallée de la Manambolo, 700-1200 m alt., 1928 (P); *Humbert 6818*, bassin supérieur du Mandrare, Mt Amboahangy près d'Esira, 1000-1150 m alt., 1928 (P); *Humbert 6841*, idem. (K, P); *Humbert 7049*, bassin supérieur de l'Onilahy (Mangoky), vallée de l'Andranomiforitra, 1000-1200 m alt., 1928 (P); *Humbert 7087*, entre Ambalavao et Ihosy, restes de la forêt d'Ivandrika (haute Fandramanana, ca 900 m alt., 1928 (P); *Humbert 11665*, Mt Vohipolaka au N de Betroka, 1100-1200 m alt., 1933 (P); *Humbert 11728*, 11729, haute vallée de l'Onilahy (Mangoky), une dizaine de km au S de Betroka, ca 900 alt., 1933 (P); *Humbert 12304*, de Tsimbavy à Anadabolava (Mandrare Moyen), 300-400 m alt., 1933 (P); *Humbert 12617*, vallée moyenne du Mandrare près d'Anadabolava, Mt Vohibaria, 500-810 m alt., 1933 (P); *Humbert 12770*, vallée de la Manambolo (bassin du Mandrare) au NW de Maroaomby (Betsioky), 300-400 m alt., 1933 (P); *Humbert 12825*, vallée de la Manambolo, rive droite (bassin du Mandrare) aux env. d'Isomono (confluent de la Sakamalio), Mt Kotriha et Isomonobe, 400-600 m alt., 1933-1934 (P); *Humbert 13040*, vallée de la Manambolo, rive droite (bassin du Mandrare) aux env. d'Isomono (confluent de la Sakamalio), 400-900 m alt., 1933 (P); *Humbert 19691*, bassin moyen du Fiherenana entre Lambomakandro et Sakaraha, ca 400 m alt., 1946 (P); *Humbert 19766*, forêt d'Analavelona, bassin du Fiherenana, 1000-1200 m alt., 1946 (P); *Humbert 19703*, bassin moyen du Fiherenana entre Lambomakandro et Sakaraha, ca 400 m alt., 1946 (P); *Humbert & Perrier de la Bâthie 2349*, vallée de la Betsiboka, collines de Marovoay, ca 50 m alt., 1924 (P); *Humbert & Perrier de la Bâthie 2547*, env. de Toliara, delta du Fiherenana, 2-10 m alt., 1924 (G, P, S); *Humbert & Swingle 5247*, bassin inférieur de l'Onilahy, aux env. de Betioky, ca 300 m alt., 1928 (P); *Humbert & Swingle 5548*, prov. Toliara, env. d'Ampanihy, 200-300 m alt., 1928 (G, P); *Humbert & Swingle 5683*, env. de Tôlanaro, près de Bevilany, 200-300 m alt., 1928 (P); *Jongkind & Andriantiana 3628*, 3678, 3722, prov. Toliara, N of Morondava, 50 m alt., 1996 (WAG); *Keraudren 299*, a quelques km d'Ambalavao sur la route d'Ihosy, 1960 (P); *Keraudren 1432*, SE de Betioky, près du village d'Evoatana, 1962 (P); *Keraudren & Aymonin 25481*, env. d'Antsiranana, sud d'Orangea-Andavakonko, 1970 (P); *Keraudren & Aymonin 25910*, route Belo à Morondava, 1970 (P); *Keraudren & Aymonin 25916bis*, env. de Morondava, 1970 (P); *Keraudren & Aymonin 26011*, Antananarivo, Jardin de Tsimbazaza, 1970 (P); *Léandri 686*, Antsalova, 1932-1933 (P); *Léandri & Saboureaux 4318*, massif de l'Andohahela, entre Imonty et le col de Tsilotsilo, 1960 (P); *Liede & al. 2623A*, prov. Antananarivo, Behenjy, 1400 m alt., 1990 (K, P); *Malcomber 1103*, prov. Toliara, R.N. 11, Andohahela, NE of Amboasary, 100 m alt., 1991 (G, K, P, S, WAG); *Miller & Randrianasolo 6267*, prov. Fianarantsoa, 35 km S of Ambalavao on Route Nationale 7, 890 m alt., 1991 (WAG); *Peltier 943*, Antandrokomby, Lac Alaotra, 1957 (P); *Peltier 1225*, Imady, route d'Ambositra à Ambohimanga du Sud, 1959 (P); *Peltier 5604*, vers Zazafotsy, 1965 (P); *Perrier de la Bâthie 8983*, prov. Mahajanga, ?Ampaniforo près Madriavalo, 1902 (P); *Perrier de la Bâthie 8984*, prov. Mahajanga, Ankirihitra, près du Mt Tsitondrina, 1901, (K, P); *Perrier de la Bâthie 8985*, 8987, vallée du Sambirano, 1909 (P); *Perrier de la Bâthie 8988*, sommet du Mt ?Manainampongo entre le Bemarivo et Anjobona, 1905 (K, P); *Perrier de la Bâthie 8989*, chutes du Betsiboka à Ambodiroka, en amont de son confluent avec l'Ikopa, 1902 (P); *Perrier de la Bâthie 8989bis*, Ankirihitra près du Mt Tsitondrina, 1904 (P); *Perrier de la Bâthie 8990bis*, Ampanihy sur le H. Bemarivo (P); *Perrier de la Bâthie 11671*, Manankazo au NE d'Ankazobe, 1500 m alt., 1913 (P); *Perrier de la Bâthie 11680*, 11681, Soahanina, près de la mer, 1914 (P); *Perrier de la Bâthie 11758*, Lac Alaotra, ca 800 m alt., 1912 (P); *Perrier de la Bâthie 11759*, env. d'Ambositra, 1911 (P); *Perrier de la Bâthie 12314*, 12314D, 13480, 16794, dunes de Mahajanga, 1918-1924 (P); *Perrier de la Bâthie 14949*, SW de l'Alaotra, 900 m alt., 1922 (P); *Perrier de la Bâthie 14959D*, env. d'Anzozorobe, 1400 m alt., 1922 (P); *Perrier de la Bâthie 16571*, vallée d'Ihosy, 700 m alt., 1926 (P); *Perrier de la Bâthie 16794*, Dunes de Mahajanga, 1924 (P); *Pervillé 284*, N.O. de Madagascar, Andravine, 1841 (P); *Phillipson 1805*, prov. Toliara, Beza Mahafaly Reserve near Betioky, 1987 (MO, P); *Phillipson 2342*, ibid. (K, MO, P); *Phillipson 2523* ibid (K, MO, P, WAG); *Phillipson 2868*, 45 km N of Toliara on road to Morombe E of junction to Manombo, 25 m alt., 1988 (K, P); *Poisson 222*, prov. Toliara, 1921 (P); *Randriamampionona*

138, 154, Toliara distr., Réserve intégrale 11, Andohahela, Ihazofotsy, 50-200 m alt., 1993 (S); *Réserves Naturelles*: RN-146 *Jean de Dieu*, distr. Ankazobe, cant. Maridaza, Manankazo, forêt d'Ambohitantly, 1948 (P); RN-1618, distr. Ambatondrazaka, Manakambahiny-Est, 1948 (P); RN-2405 *Razafindrakoto*, distr. Ambalavao, Soarano, 1950 (P); RN-3436 *Ramarokoto*, distr. Androy, Esira, R.N. 11, 1951 (P); RN-5823 *Rakoto*, distr. Ivohibe, R.N. 5 (P); RN-6406 *Rakotovao*, distr. Soalala, R.N. 8, 1954 (P); RN-10132, RN-10182, distr. Soalala, Andranomavo, 1958 (P); RN-11414, distr. Ambato-Boeni, Tsaramandroso, 1960 (P); RN-11910 *Rakotovao*, Distr., Ambatondrazaka, Manakambahiny-Est, 1961 (P); Schatz & Miller 2454, prov. Fianarantsoa, 7 km W of Ranomafana, just S of Namorona riv., 1000 m alt., 1988 (K, P, WAG); Schlieben 8082, Moramanga, 900 m alt., 1959 (BM, G); *Service Forestier*: SF-7620, Ihosy, 1953 (P); SF-26515, distr. Antsalova, Berano, 1968 (P); Seyrig 184, 184B, 187, 187B, 219, 228, 228B, 228C, 228D, Ampandrandava entre Bekily et Tsivory, 1942 (P); Turnour 3, prov. Toliara, Tongobory, Betioky, Onilahy riv., 1986 (P); Turnour 7, prov. Toliara, Maroamalona, lower Onilahy riv., 1986 (K, P); Turnour 12, prov. Toliara, Andombiry, Tanandava, Mangoky riv., 1986 (MO); Turnour 17, prov. Toliara, Miary, 1986 (K, P). **COMORO ISLANDS**: Humblot 361, Mayotte, 1884 (BM, P). **SEYCHELLES**: Frazier 717, Aldabra group, Assumption Island, 200 m inland of South Settlement, sea level, 1973 (US).

2. *Pentopetia bidens* Jum. & H. Perrier in Ann. Mus. Colon. Marseille ser. 2, 6: 177. 1908 (Figs. 8, 9.B (map))

Type: MADAGASCAR, Ambongo, Andranomavo, 1903, *Perrier de la Bâthie 1648* (holo-, P; iso-, P).

Liana with younger stems hairy. Leaf blade ovate to broadly ovate, 1.5-2.5 × 1.0-1.5 cm, rounded or cordate at base, rounded and rarely notched to usually acute and acuminate at apex, hairy on both sides, with ± dark upper side when dry; venation looped to arched, with tertiary veins finely reticulate when dry at least below; midrib ± even with leaf surface above, raised below when dry; petiole 1-3 mm long, with rather dense erect hairs.

Inflorescences axillary, about as long as the adjacent leaves, 1-2 cm long; cyme 1-3 flowered, usually with 1 top- and 1 lateral flower present, on a thin 2-8 mm long peduncle; pedicels 5-15 mm long, hairy; bracts less than 1 mm long, linear, hairy.

Calyx lobes ovate to broadly ovate, 0.9-1.7 × 0.9-1.2 mm, rounded to acute at apex, about as long as the tube, straight, hairy, yellowish. Corolla not or slightly twisted to the right in bud, with the lobes fused for 1/3 – 2/5 of their length into a tube, white; tube 1.0-1.7 mm long, with 5 indistinct transverse ridge-like alternistaminal nectar lobes near the base, hairy inside mainly between the bases of the corona lobes and with some hairs between the bosses at the base; lobes oblong, 2.0-2.3 × 1.0-1.3 mm, subacute to obtuse at apex, erecto-patent, usually hairy at base between the coronal lobes. Corona lobes 0.4-0.6 mm high, narrowing from flat and broadened base, sometimes bifid, not or slightly overtopping the staminal cone, much shorter than the corolla lobes, glabrous or hairy, violet. Staminal cone 0.8-1.0 mm high, ± exserted from the corolla tube; filaments 0.2-0.3 mm long, filiform, inserted in the middle of the corolla tube, hairy inside; anthers 0.6-0.8 mm long, dorsally hairy or glabrous; connective shortly protruding. Translators 0.3-0.5 mm long; spoon elliptic to roundish, 0.2-0.3 mm long; stipe almost as broad as the spoon, with a longitudinal rib. Style 0.2-0.3 mm long, glabrous; style head conical.

Follicles not seen.

Distribution and habitat. – *Pentopetia bidens* is an endemic of Ambongo region in NW Madagascar. It is found in, probably dry, forest.

Flowering specimens seen from August, September, November and December.

Note. – JUMELLE & PERRIER DE LA BATHIE (1908b: 177) wrote in the protologue of this species, that due to the deeply bifid corona lobes some botanists would without doubt elevate this species to rank of genus. The question is not, however, if this is a separate genus or not, but if it is a distinct species or not. The bifid corona lobes are not found in all specimens, and are actually present mainly in the type material, but even here not all corona lobes are bifid within a single flower. *Pentopetia bidens* is morphologically closely related to the previous species, *P. androsaemifolia*, of which much material has been gathered. This species expresses a considerable polymorphism in vegetative as well as floral structure. Specimens of *P. androsaemifolia*

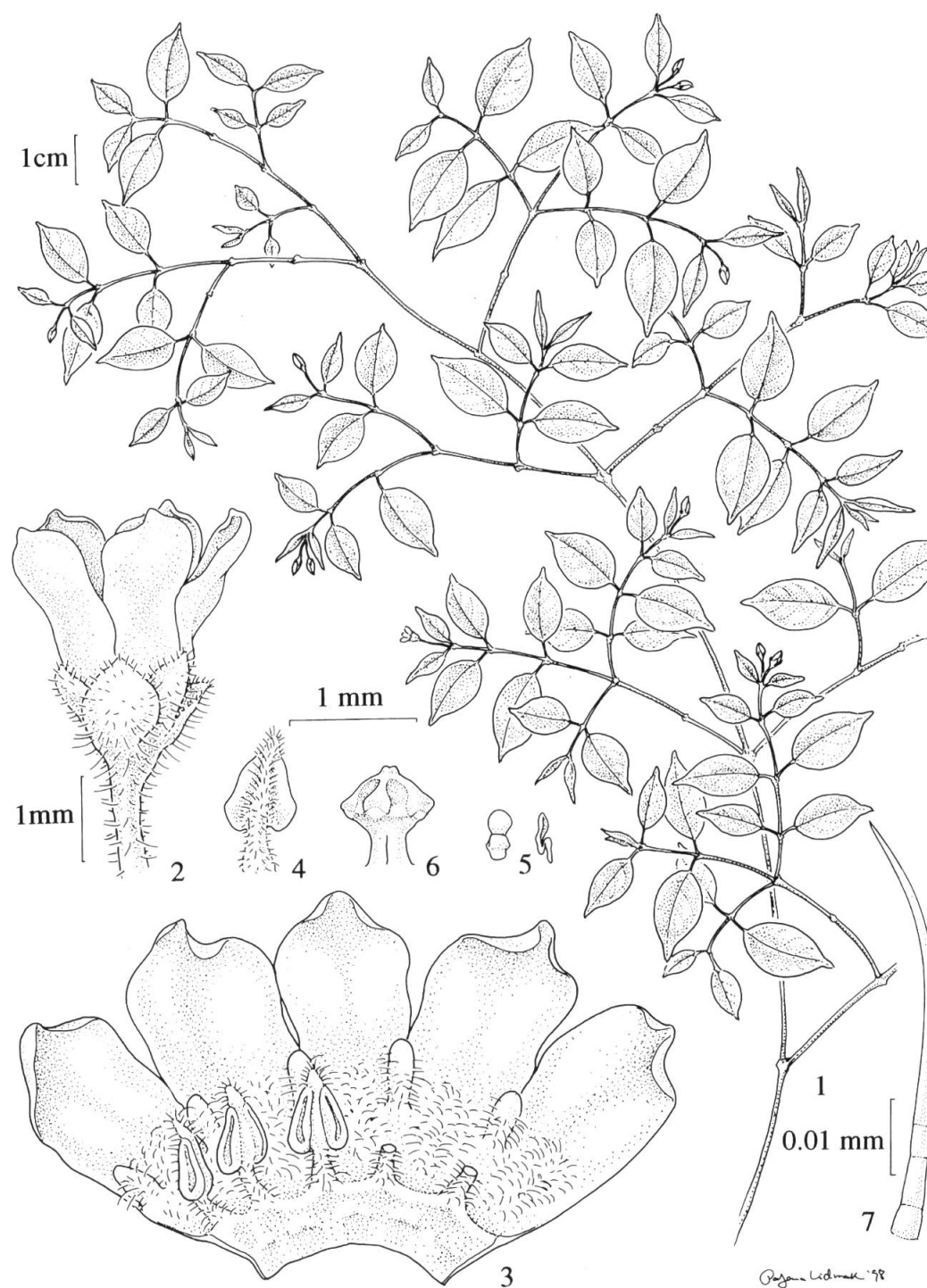


Fig. 8. – *Pentopetia bidens* Jum. & H. Perrier. – 1, Habit; 2, Flower; 3, Flower from within with gynoeceum and two anthers removed; 4, Anther (dorsal side); 5, Translators; 6, Style and style head; 7, Hair from abaxial side of leaf. – [1-7, Perrier de la Bâthie 16813].

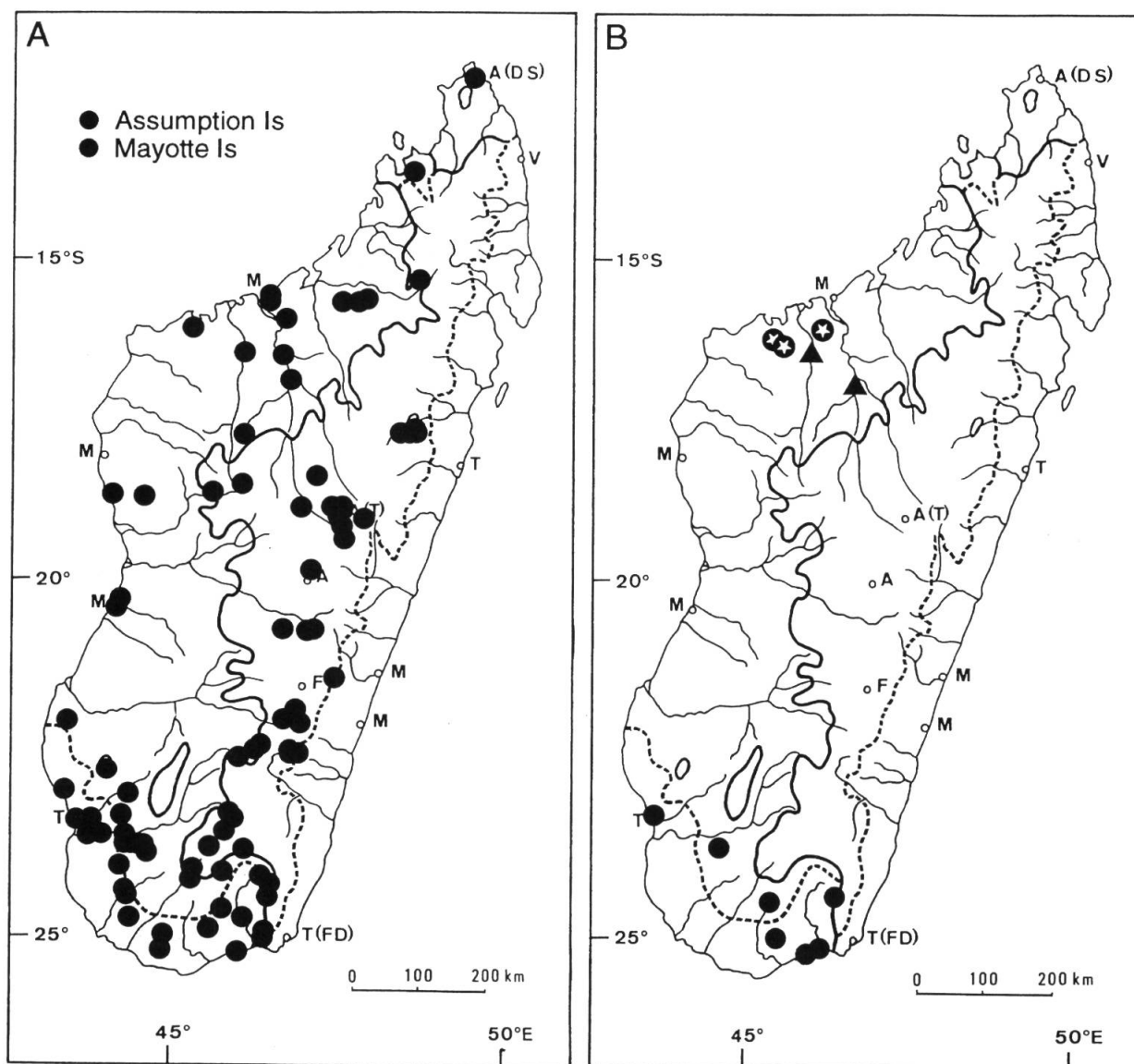


Fig. 9 – Distribution maps of *Pentopetia*. – A, *P. androsaemifolia* Decne. (●); B, *P. bosseri* Klack. (●), *P. mollis* Jum. & H. Perrier (▲), *P. bidens* Jum. & H. Perrier (●).

with small flowers (corolla lobes 3-3.5 mm long) have been collected at sand dunes on the west coast of Madagascar (*Jongkind & Andriantiana* 3678, *Perrier de la Bâthie* 12314, 13480). The flowers of *P. bidens* are even smaller (corolla lobes 2-2.5 mm long), however, and the alternistaminal nectar lobes are almost lacking. It also differs by having hairy corona lobes. Furthermore, in the Ambongo region *Pentopetia bidens* is sympatric with the morph of *Pentopetia androsaemifolia*, which has large leaves, large flowers and long filiform corona lobes, and no intermediate individuals have been observed in this area. Consequently *P. bidens* is thought to be an isolated endemic population from *P. androsaemifolia*.

Additional specimens studied. – **MADAGASCAR:** *Decary* 15694, 15832, 15845, distr. Soalala, Namoroka, R.N. 8, 1940 (P); *Perrier de la Bâthie* 16813, Anlanimena, 1926 (P); *Réserves Naturelles:* RN-8130, Soalala, 1956 (P).

3. *Pentopetia mollis* Jum. & H. Perrier in Caoutchouc & Gutta-Percha 15 sept.: 4. 1908, nomen; Ann. Mus. Colon. Marseille ser. 2, 6: 172. 1908 (Figs. 9.B (map), 10).

Type: MADAGASCAR, Belambo, rive gauche de l'Ikopa, près de Maevetanana, 1900, Perrier de la Bâthie 963 (holo-, P; iso-, P).

Liana with glabrous stems. Leaf blade elliptic to ovate, $2-3.5 \times 1-1.5$ cm, cuneate to rounded at base, acuminate at apex, glabrous on both sides or with sparse short hairs above, with dark upper side when dry; venation looped to arched, with tertiary veins finely reticulate below when dry; midrib \pm even above, raised below when dry; petiole 3-7 mm long, glabrous.

Inflorescences axillary, about as long as the adjacent leaves, up to 4 cm long; cyme irregularly branched with much shortened internodes, usually \pm umbel-like on a ca 1 cm long peduncle, 3-7-flowered; pedicels 10-17 mm long, glabrous to sometimes hairy; bracts up to 2 mm long, linear to narrowly elliptic, glabrous or with a few hairs.

Calyx lobes ovate, 1.5×1.3 mm, rounded to subacute at apex, slightly longer than the corolla tube, straight, hairy along margins. Corolla not to slightly twisted in bud, with the lobes fused for $1/5 - 1/4$ of their length into a tube, yellowish; tube ca 1.3 mm long, with 5 thin recurved alternistaminal nectar lobes just below the filament bases, hairy inside below the anthers and at the underside of the recurved nectar lobes; lobes elliptic, ca 4.4×2.0 mm, subacute at apex, probably erecto-patent, hairy at base between the coronal lobes and with thin somewhat lacinate margin. Corona lobes 2-3 mm high if straightened out, filiform, twisted towards apex, broadened at the very base, much overtopping the staminal cone, shorter than the corolla lobes, glabrous. Staminal cone ca 1.6 mm high, \pm exserted from the corolla tube; filaments ca 0.4 mm long, filiform, straight to slightly curved, inserted in the lower part of the corolla tube, with long hairs inside; anthers ca 1.3 mm long including a 0.5 mm long protruding connective, glabrous. Translators ca 0.5 mm long; spoon roundish, 0.3 mm long; stipe short and broad, with a longitudinal rib. Style ca 0.5 mm long, glabrous; style head conical.

Follicles (only detached ones seen) ca 5×0.7 cm, straight, somewhat spindle-shaped, acuminate, rather thick-walled with mesocarp ca 0.6 mm thick, when dry with small ridges in a longitudinal but indistinct pattern, glabrous; placenta not seen. Seeds ca 6 mm long, smooth.

Distribution and habitat. – *Pentopetia mollis* is endemic to NW Madagascar. It is found in, probably dry, forest.

Flowering specimens seen from October and November.

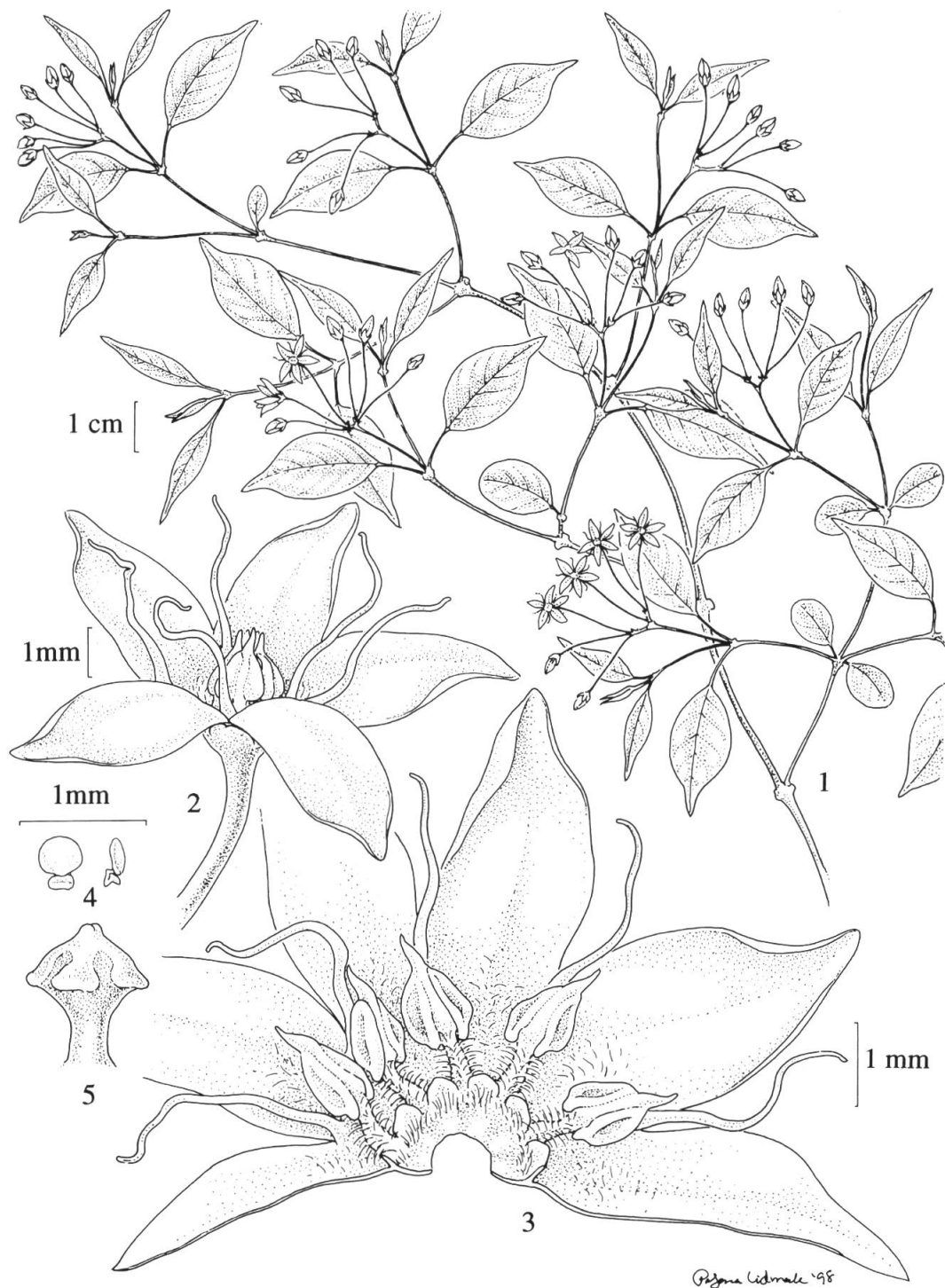
Note. – *Pentopetia mollis* is closely related to *P. androsaemifolia* but differs by having pocket-like alternistaminal nectar lobes in the corolla tube. These lobes cover the ovary. They are homologous to the channeled bosses found in *P. androsaemifolia*, but are in *P. mollis* thin and prolonged and turn upwards. *Pentopetia mollis* furthermore differs by having small translators with the spoon twice as long as the stipe, and thin and somewhat lacinate margins of the corolla lobes.

Additional specimens examined. – MADAGASCAR: Perrier de la Bâthie 963 [sic!, same no. as type] Ankirihitra, env. du Mt Tsitondrina, 1899 (P).

4. *Pentopetia bosseri* Klack., spec. nova (Figs. 9.B (map), 11).

Type: MADAGASCAR, bifurcation Beraketa Imanombo, 1956, Bosser 10251 (holo-, P; iso-, P).

Species haec habitu cum P. dasynemate optima congruens, sed differt coronae lobis glabris; morphologia floris P. androsaemifoliae similis, sed differt nectarii lobis majoribus reflexisque, et foliis angustis.



Pentopetia mollis '98

Fig. 10. – *Pentopetia mollis* Jum. & H. Perrier. – 1, Habit; 2, Flower; 3, Portion of flower from within with gynoecium removed; 4, Translators; 5, Style and style head. – [1-5, Perrier de la Bâthie 963, from Ankirihitra].

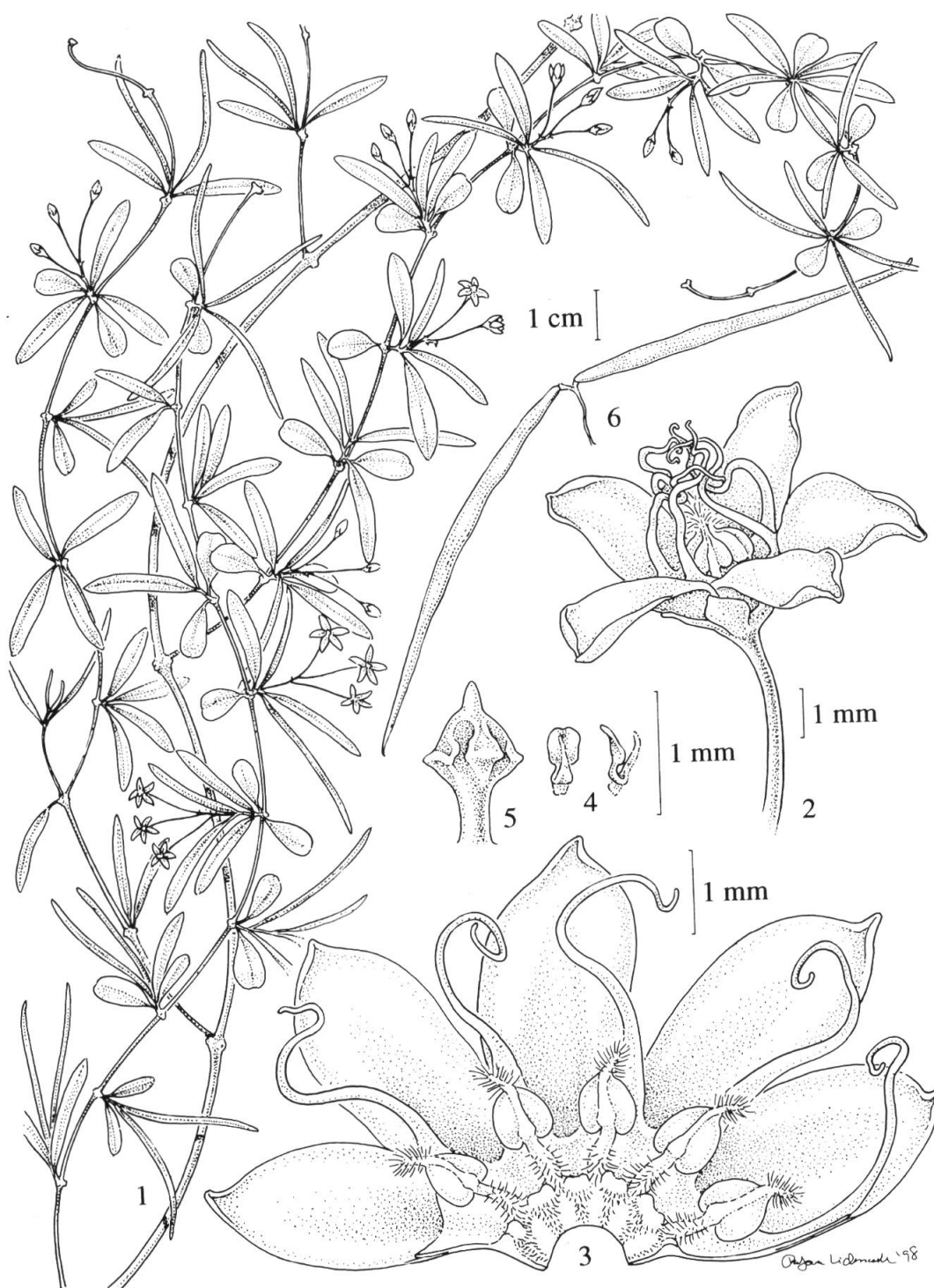


Fig. 11. – *Pentopetia bosseri* Klack. – 1, Habit; 2, Flower; 3, Flower from within with gynoecium removed; 4, Translators; 5, Style and style head; 6, Follicles. – [1-5, Bosser 10251; 6, Croat 30774].

Liana up to 4 m high with glabrous stems. Leaves mostly on brachyblasts of which usually only one is present at each node; blade polymorphic, linear to elliptic to broadly obovate, 0.5–6 cm × 1–8 mm, truncate to tapering at the base, acute to rounded or retuse and often apiculate at the apex, usually glabrous except for a few hairs at the very tip and rarely also some hairs along the midrib near base, with darker upper side when dry; venation looped to arched with long basal pairs, sometimes faint with midrib visible only; midrib and secondary nerves even to slightly impressed above, even below when dry; petiole 1–5 mm long, glabrous to shortly hairy above.

Inflorescences axillary or terminal on usually short lateral branches, shorter or longer than the adjacent leaves, up to 2 cm long; cyme usually umbel-like with some reduced internodes on a longer basal stipe, usually 2–5-flowered; pedicels slender, 3–15 mm long, glabrous; bracts usually several, narrow, 1–1.5 mm long.

Calyx lobes ovate to very broadly ovate, 1.0–1.8 × 0.8–1.3 mm, rounded to usually acute at apex, about as long as the corolla tube, straight, glabrous. Corolla not twisted in bud, with the lobes fused for 2/9–2/7 of their length into a tube, white to usually pale yellow or yellow; tube 0.8–1.3 mm long, with 5 thick recurved alternistaminal nectar lobes arranged close together forming a ring hiding the ovary, usually hairy just below the filaments and in a ring just below the alternistaminal nectaries to almost glabrous; lobes oblong to elliptic, 3.0–4.2 × 1.5–2.1 mm, acute to rounded at apex, rotate, glabrous. Corona lobes 3–7 mm high, dorsiventrally compressed and broad at base but filiform towards apex, straight to slightly bent inwards or with filiform part variously twisted, about as long as to much longer than the staminal cone, glabrous. Staminal cone 1.3–1.7 mm high, ± exserted from the corolla tube; filaments 0.3–0.7 mm long, filiform, ± straight to slightly arched, inserted in the lower part of the corolla tube, usually with long hairs inside; anthers 1.0–1.4 mm long including a 0.3–0.7 mm long narrow and protruding connective, glabrous except for a hairy connective. Translators 0.5–0.6 mm long; spoon roundish to ovate, ca 0.3 mm long, subpeltately adhering to a broad and flat stipe with a longitudinal ridge. Style 0.4–0.8 mm long, glabrous; style head conical, sometimes with a narrow protruding part above the translators.

Follicles 6–10 × 0.4–0.5 cm, usually paired, straight and linear with slightly sinuate margins, acuminate, rather thin-walled with mesocarp 0.1–0.3 mm thick, without ribs or wings, recurved 45–90° at the base, glabrous; placenta with narrow smooth ridges. Seeds ca 8 mm long, smooth; hairs ca 2 cm long.

Distribution and habitat. – *Pentopetia bosseri* is distributed in southwestern Madagascar and has been collected in sand dunes and gneissic rocks in dry forest and xerophytic shrub vegetation from sea level up to 1200 m altitude.

Flowering specimens seen from October to December.

Note. – *Pentopetia bosseri* is distinguished from *P. androsaemifolia* by its recurved and thick alternistaminal nectar lobes in the corolla tube. The lobes are close together covering the ovary. Similar recurved alternistaminal nectar lobes are also present in *P. dolichopodia*. It is also distinguished by its variable but always narrow leaves, that usually widen from a narrow base with a truncate and apiculate or mucronate tip. The leaves are always dark pigmented on adaxial side when dry. *Pentopetia bosseri* is vegetatively similar to the sympatric *P. dasynema* in its narrow and, when dry, dark pigmented leaves. It differs from this species, however, by its glabrous and usually twisted corona lobes, which furthermore are widened at base.

Paratypes. – **MADAGASCAR:** Boiteau 398, Anolamavohitra, 1966 (P); Bosser 10250, Ambovombe, ferme vétérinaire, 1956 (P); Croat 30774, 8 km N of Toliara on road to Morombe, 10–20 m alt., 1975 (MO); Decary 3171, Ambovombe, 1924 (P); Decary 3223, distr. Ambovombe, Amboasary, 1924 (P); Decary 4635, prov. Tôlanaro, Antanimora, 1926 (K, P); Decary 9337, limite Nord-Est de l'Androy, Beteny, 1931 (BM, P); Humbert 6782, bassin supérieur du Mandrare, du col de Vavara à la vallée de la Manambolo, 700–1200 m alt., 1928 (P); Humbert 12788, vallée de la Manambolo (bassin du Mandrare), au NW de Maroaomby (Betsioky), 300–400 m alt., 1933 (P); Phillipson 2427, prov. Toliara, Beza Mahafaly Reserve near Betsioky, 180 m alt., 1987 (K, P, S, WAG).

This species is named after J. Bosser, Paris, a French botanist who collected extensively in Madagascar during the 1950' and 60'.

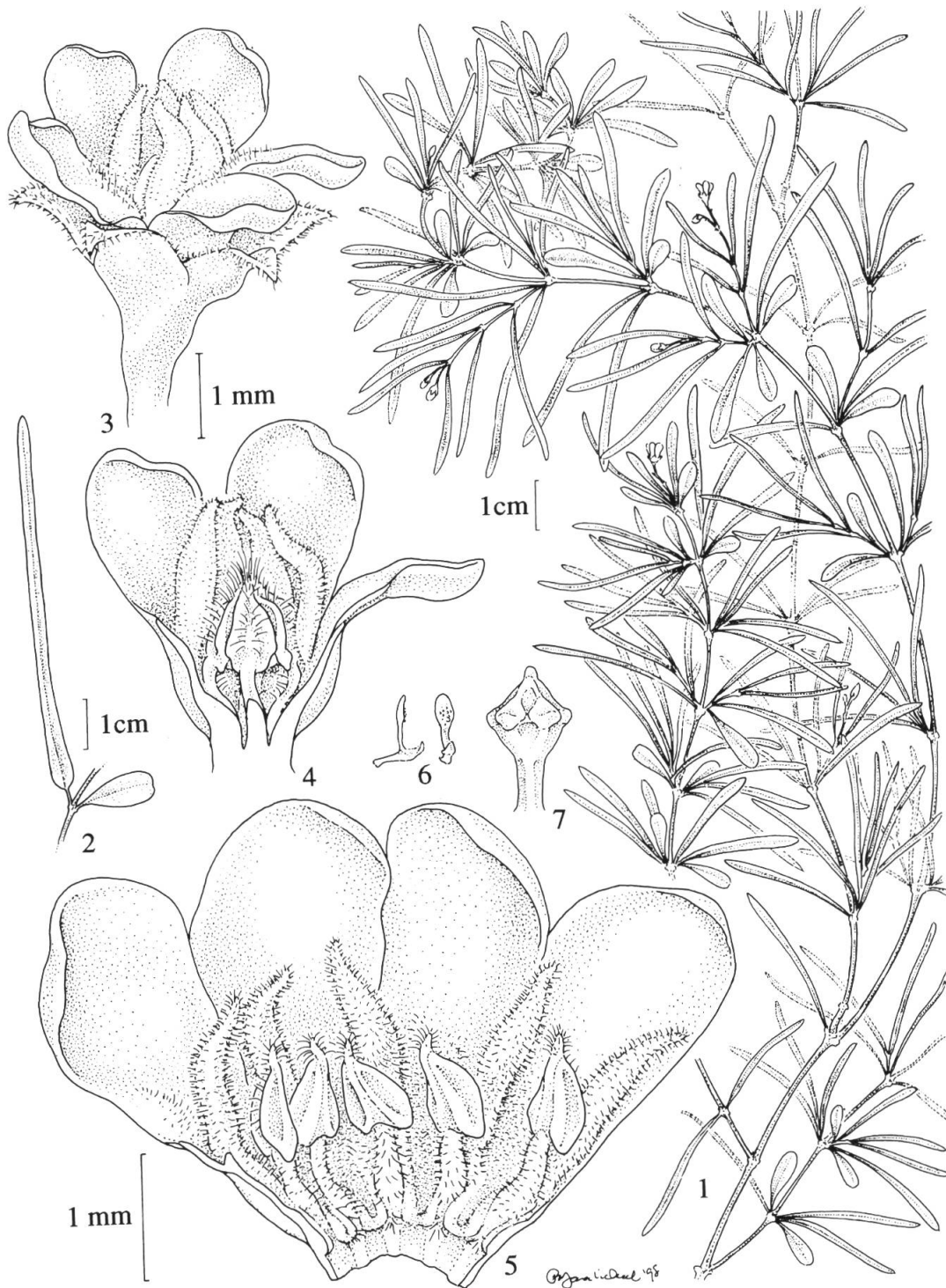


Fig. 12. – *Pentopetia dasynema* Choux. – 1, Habit; 2, Leaf variation; 3, Flower; 4, Longitudinal section of flower with calyx removed; 5, Portion of flower from within with gynoecium removed; 6, Translators; 7, Style and style head. – [1, Perrier de la Bâthie 16625; 2, Keraudren 696; 3-7, Humbert & Perrier de la Bâthie 2533].

5. *Pentopetia dasynema* Choux in Arch. Bot. Bull. Mens. 4: 98. 1930 (Figs. 12, 15.A (map)).

Type: MADAGASCAR, Tulear (Toliara), *Perrier de la Bâthie* 16625 (lecto-, P, here selected; iso-, P).

– *Pentopetia trichonema* Choux in sched.

Liana with youngest branches hairy. Leaves mostly on brachyblasts of which usually only one is present at each node; blade linear to obovate, 0.5–8 cm × 1–8 mm, truncate to cordate at the base, acute to rounded or retuse at apex, with few hairs at the very tip and usually also with sparse short hairs above and along the midrib below; venation looped with long basal pairs but usually faint with midrib visible only; midrib and secondary nerves even to slightly impressed above, even to slightly raised below when dry; petiole distinct, 0.5–2 mm long, with short erect hairs.

Inflorescences axillary or terminal on usually short lateral branches, shorter than the adjacent leaves, up to 4 cm long; cyme usually umbel-like with some reduced internodes on a short or up to 2.5 cm long basal stipe, usually 1–5-flowered, glabrous to hairy; pedicels slender, 2–7 mm long; bracts narrow, 1–2 mm long.

Calyx lobes ovate to broadly elliptic, 1.5–2.0 × 0.6–1.2 mm, rounded to acute at the apex, about as long as or longer than the tube, glabrous except for a hairy margin and sometimes hairy near the apex inside, usually recurved. Corolla not twisted in bud, with the lobes fused for 1/3 to 2/5 of their length into a tube, pale yellow or yellow; tube 1.3–1.4 mm long, with ridges below the filaments, which unite into 5 flat alternistaminal, slightly channeled nectar lobes narrowing towards the base, hairy around the filament bases; lobes oblong to obovate, 2.0–2.4 × 1.3–1.7 mm, acute to rounded at the apex, rotate, hairy at both sides of the bases of the corona lobes. Corona lobes 1–2 mm high, filiform, ± straight to slightly bent inwards, not broadened towards base, overtopping the staminal cone, shorter than the corolla lobes, densely hairy. Staminal cone 1.1–1.3 mm high, only slightly exserted from the corolla tube but hidden by the corona lobes; filaments very short, 0.1–0.2 mm long, filiform, straight, inserted in the lower part of the corolla tube, with long hairs inside; anthers 1.8–2.0 mm long including a ca 0.3 mm long protruding narrow and hairy connective, dorsally hairy. Translators ca 0.5 mm long; spoon elliptic, 0.2–0.3 mm long, tapering into a broad and flat stipe. Styles 0.4–0.5 mm long, glabrous; style head conical, with a short narrow prolongation above the translators.

Follicles not seen.

Distribution and habitat. – *Pentopetia dasynema* is distributed in southwestern Madagascar and has been collected in sand dunes near Toliara at low altitudes.

Flowering specimens seen from September, October and March.

Note. – *Pentopetia dasynema* is vegetatively similar to the sympatric *P. bosseri*. It differs from this species as well as from all other species of *Pentopetia*, however, by its corona lobes, which are densely hairy from base to apex. The lobes, furthermore, are cylindric at the base (not distinctly widened), and the alternistaminal nectar lobes are flat and directed downwards (not recurved).

The type specimen has detached fruit material in an envelope. It is doubtful, however, that this follicle belongs to *P. dasynema*.

Additional specimens studied. – **MADAGASCAR:** *Humbert & Perrier de la Bâthie* 2533, env. de Toliara, delta du Fiherenana, 2–10 m alt., 1924 (P); *Keraudren* 696, env. de Toliara, l'embouchure du Fiherenana, 1960 (P).

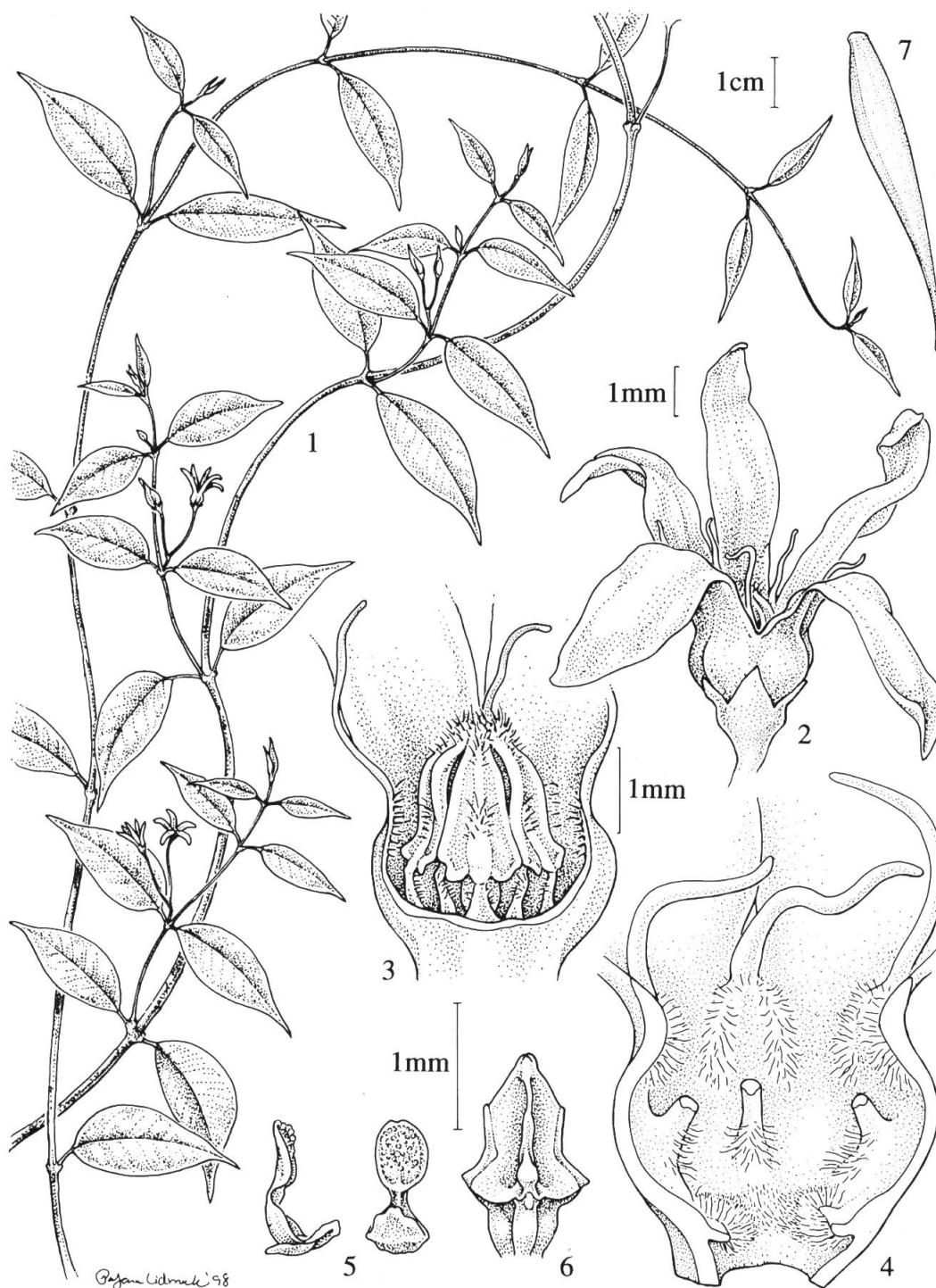


Fig. 13. – *Pentopetia urceolata* Klack. – 1, Habit; 2, Flower; 3, Central part of flower with three corolla lobes removed; 4, Portion of corolla from within with anthers and gynoecium removed; 5, Translators; 6, Style and style head. – [1-6. *Perrier de la Bâthie* 11670].

6. *Pentopetia urceolata* Klack., spec. nova (Figs. 13, 15.A (map)).

Type: MADAGASCAR, Manankazo au NE d'Ankazobe, 1500 m alt., 1913, *Perrier de la Bâthie* 11670 (holo-, P; iso-, P).

Species habitu cum P. androsaemifolia optime congruens, sed differt tubo corollae urceolato et lobis corollae basi glabris.

Liana up to 15 m high with glabrous stems. Leaf blade ovate to usually narrowly elliptic or elliptic, 30-45 × 7-20 mm, cuneate to truncate at the base, acuminate at the apex, often glossy and darker above than below when dry but usually lacking darker pigment along the margins, glabrous on both sides, sometimes revolute at the very margin; venation distinctly looped at both sides, with tertiary veins reticulate below when dry; midrib ± even above when dry, raised below; petiole 3-5 mm long, glabrous.

Inflorescences axillary or seemingly terminal, shorter than adjacent leaves, up to 2 cm long; cyme irregularly branched with much shortened internodes, usually ± umbel-like on a very short or up to 4 mm long peduncle, 1-5-flowered; pedicels 7-10 mm long, glabrous; bracts minute or up to 1.5 mm long at the base of the umbel.

Calyx lobes triangular, 0.8-2.0 × 0.9-1.2 mm, acute at the apex, shorter than the corolla tube, straight, glabrous. Corolla not or slightly twisted to the right in bud, with the lobes fused for 2/7-1/5 of their length into a tube, yellowish green; tube urceolate, 1.9-2.7 mm long with longitudinal ridges below the filaments, which unite at the base into thin slightly recurved alternistaminal nectar lobes, with 2 small patches of short hairs at each side just below the corona lobes and a ring of longer hairs near the base; lobes narrowly oblong, 5.0-8.0 × 1.3-1.9 mm, acute but sometimes rounded at the very apex, glabrous. Corona lobes 1.2-5.4 mm high, filiform, erect, longer than the staminal cone but shorter than the corolla lobes, glabrous. Staminal cone 1.5-2.3 mm high, included in the corolla tube to slightly exserted; filaments very short, up to 0.3 mm long, filiform, inserted in the middle of the corolla tube, glabrous; anthers 1.2-1.8 mm long, glabrous with a short or up to 0.3 mm long protruding flat, hairy connective. Translators 1.1-1.6 mm long; spoon broadly elliptic to roundish, 0.5-0.6 mm long; stipe rather narrow just below the spoon but flat and at least as broad as the spoon at the base, with a distinct midrib. Styles 0.3-0.5 mm long, glabrous; style head conical to acutely semi-ovate.

Follicles 6-7 × 0.6-0.8 cm, paired, straight, narrowly ovoid, acuminate, rather thick-walled with mesocarp 0.5-0.7 mm thick, without wings, recurved 45°-90° at the base, glabrous; placenta with distinct and sometimes slightly flap-like ridges. Seeds 7-9 mm long, smooth; hairs 2.5-4 cm long.

Distribution and habitat. – *Pentopetia urceolata* is distributed in the central plateau of Madagascar and has been collected in rocky habitat on granitic inselberg and on gneiss in forest between 900 m and 1600 m altitude.

Flowering specimens seen from October to March.

Note. – *Pentopetia urceolata* is in habit similar to *P. androsaemifolia*. The leaf lamina is usually distinctly darker on the upper side when dry, except for the margin, which usually remains pale green. It differs from *P. androsaemifolia* primarily by its urceolate corolla tube, which is much longer than the calyx and only sparsely hairy except for a ring of dense hairs near the base of the tube inside. Furthermore, unlike *P. androsaemifolia*, the anther filaments are glabrous, except for a patch of hairs at and just below the filament bases. The lobes of the corolla are glabrous but there is a patch of hairs below each corona lobe in the corolla tube. In contrast, in *P. androsaemifolia* the corolla lobes are hairy between the corona lobes. A urceolate corolla tube is also present in *P. elastica* and the reddish-violet flowered *P. grevei*. From *P. elastica* it differs by its short, at most 2 mm long, calyx lobes that furthermore are shorter, not distinctly longer, than the corolla tube.

Paratypes. – **MADAGASCAR:** Bosser 8592, Manankazo, PK 130 route Mahajanga, 1955 (P); Bosser 8928, env. d'Antananarivo, Antongana, 1956 (P); Bosser 16786, env. d'Antananarivo, PK 44, route de Mahajanga, 1963 (P); Decary 7518, restes de forêt au Nord d'Ankazobe, 1930 (P); Decary 15057, Ihosy, 1939 (P); Keraudren-Aymonin & Aymonin

25710, entre Ivato et Ambatofitorahana, 1970 (P); *Léandri & al.* 1738, 1777, restes de forêt du Mont Ambohiby, S.E. de Tsiroanomandidy, ca 1600 m alt., 1952 (P); *Perrier de la Bâthie* 14992, près d'Andilamena, ca 1000 m alt. (P); *Perrier de la Bâthie* 15063, entre Andilamena et Mandritsara, vers 900 m alt., 1923 (P); *Pettersson & Nilsson* 536, Antananarivo prov., Manjakandriana distr., SE of Nandihizana, Angavokely Forest Reserve, Mt Ambatolava, 1600 m alt., 1992 (UPS); *Schatz & al.* 3576, prov. Antananarivo, réserve speciale Ambohitantely, 1530 m alt., 1993 (P).

The species epithet alludes to the urceolate corolla tube.

7. *Pentopetia elastica* Jum. & H. Perrier in Caoutchouc & Gutta-Percha 15 sept.: 4. 1908; Ann. Mus. Colon. Marseille ser. 2, 6: 174. 1908 (Figs. 14, 15.B (map)).

Type: MADAGASCAR, environs de la baie de Bombetoke, 1907, *Perrier de la Bâthie* 11651 (holo-, P; iso-, P).

= *Pentopetia alba* Jum. & H. Perrier in Ann. Mus. Colon. Marseille ser. 2, 6: 176. 1908.
– **Type:** Belambo, rive gauche de l'Ikopa, près de Maevetanana, 1901, *Perrier de la Bâthie* 1269 (holo-, P; iso-, P).

Liana up to 5 m high with younger stems shortly pubescent. Leaves often on brachyblasts; blade elliptic or ovate to broadly ovate, 15-50 × 0.7-30 mm, cuneate to rounded or cordate at the base, rounded to truncate or apiculate but usually acuminate at the apex, usually darker above than below when dry, covered on both sides with short usually slightly bent hairs, sometimes glabrescent or slightly hairy along the midrib only; venation arched to looped, with tertiary veins reticulate below when dry, indistinctly so above; midrib ± even above when dry, raised below; petiole 1-7 mm long, hairy.

Inflorescences axillary or seemingly terminal on brachyblasts, shorter to much shorter than adjacent leaves, 1-1.5 cm long; cyme with much shortened internodes and often umbel-like on an up to 2 mm long peduncle, 3-9-flowered; pedicels 1-3 mm long, hairy; bracts conspicuous at the base of pedicel, ± linear, up to 5 mm long.

Calyx lobes narrowly triangular, 2.0-3.8 × 0.7-1.1 mm, acute at the apex, longer to much longer than the corolla tube, straight, hairy outside and sometimes also inside and particularly along the margins. Corolla twisted to the right in bud, with the lobes fused for 1/4 – 1/3 of their length into a tube, pale green to usually whitish; tube urceolate, 1.1-1.8 mm long, without longitudinal ridges but with indistinct transverse ridge at the very base, glabrous; lobes oblong to usually triangular, (2.7-)3.3-4.5 × (0.7-)1.2-1.8 mm, rounded to acute at the apex, with a small ridge-like boss at the very base just above the tube, glabrous to rarely hairy outside. Corona lobes 1.3-2.4 mm high, narrowly triangular, flattened but rather thick, straight, forming a cone above the gynostegium, sometimes bifid, longer than the staminal cone but shorter than the corolla lobes, glabrous or with few long hairs. Staminal cone 0.9-1.3 mm high, included in the corolla tube to slightly exerted but always covered by the corona lobes, entirely glabrous; filaments short, 0.2-0.3 mm long, filiform, inserted in the middle of the corolla tube; anthers 0.8-1.2 mm long, with shortly protruding flat connective. Translators 0.7-1.0 mm long; spoon rhomboid, 0.3-0.4 mm long, without distinct mid-line; stipe rather narrow just below the spoon but flat and at least as broad as the spoon at the base, with distinct midrib, with broad and recurved viscidium. Ovary flat at the top, together with styles with longitudinal ridges; ovules rather few, ca 10. Styles 0.5-1.0 mm long, glabrous. Style head conical.

Follicles 2-4 × 0.3-0.5 cm, usually single, straight, narrowly ovoid at base and with a long and narrow apical part, rather thin-walled with endocarp ca 0.3 mm thick, with ca 5 narrow longitudinal ribs, not recurved to recurved ca 45° at base, glabrous; placenta with narrow smooth ridges. Seeds 5-7 mm long; seed surface with ± elongate pits or short grooves; hairs 1.5-2.0 cm long.

Distribution and habitat. – *Pentopetia elastica* is distributed from north to south in the western part of Madagascar. It has been collected in gallery and dry forest on rocks or sand between 50 to 1000 m altitude. It seems to prefer calcareous soil.

Flowering specimens seen from September to January and April.

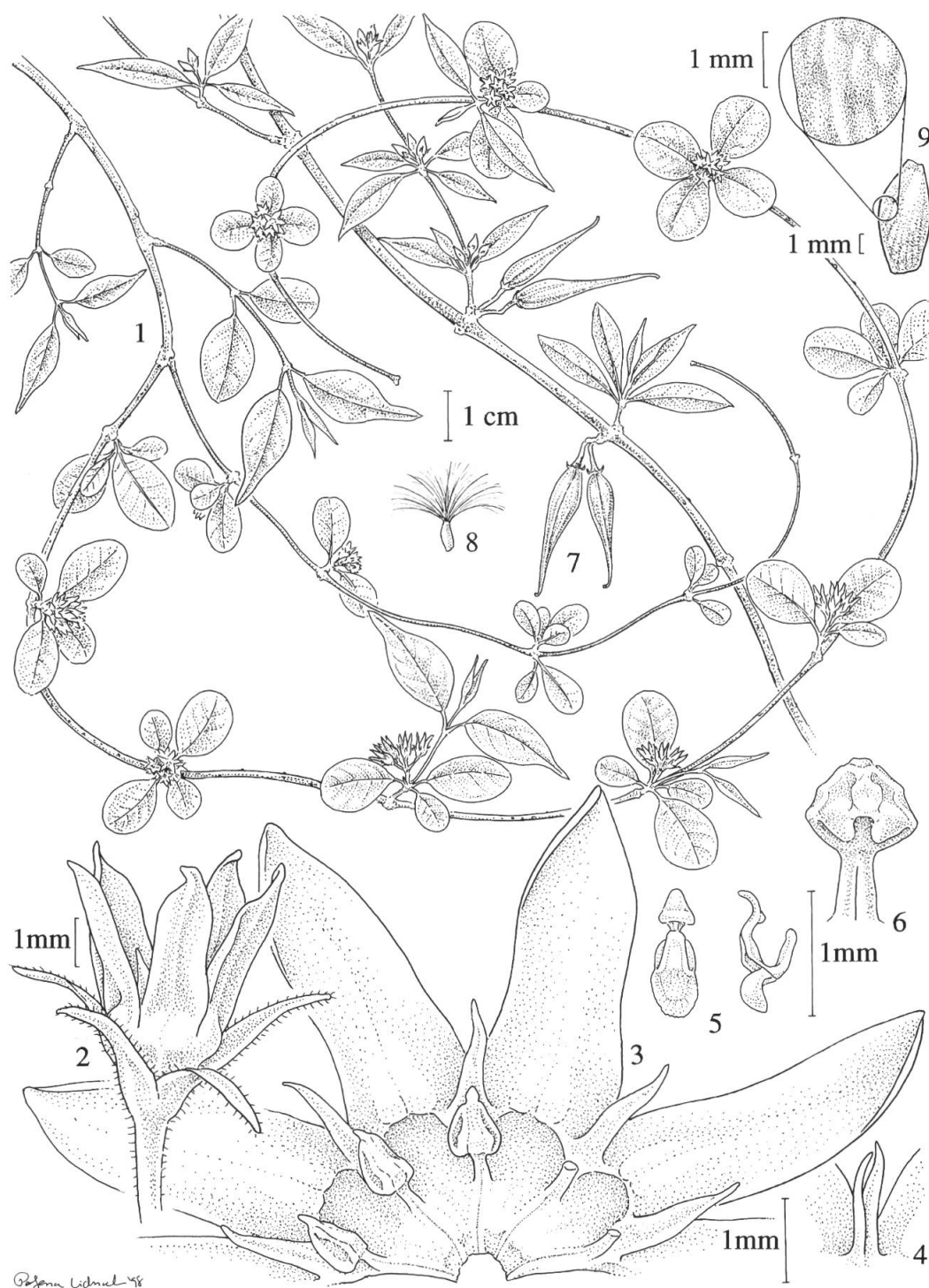


Fig. 14. – *Pentopetia elastica* Jum. & H. Perrier. – 1, Habit; 2, Flower; 3, Portion of flower from within with two anthers and gynoeceum removed; 4, Cleft corona; 5, Translators; 6, Style and style head; 7, Follicles; 8, Seed; 9, Seed and magnification of seed surface, coma detached. – [1-3, 5-6, Jongkind & al. 3434; 4, Leeuwenberg & Rapanarivo 14677; 7, Alluaud 46; 8-9, Perrier de la Bâthie 12321].

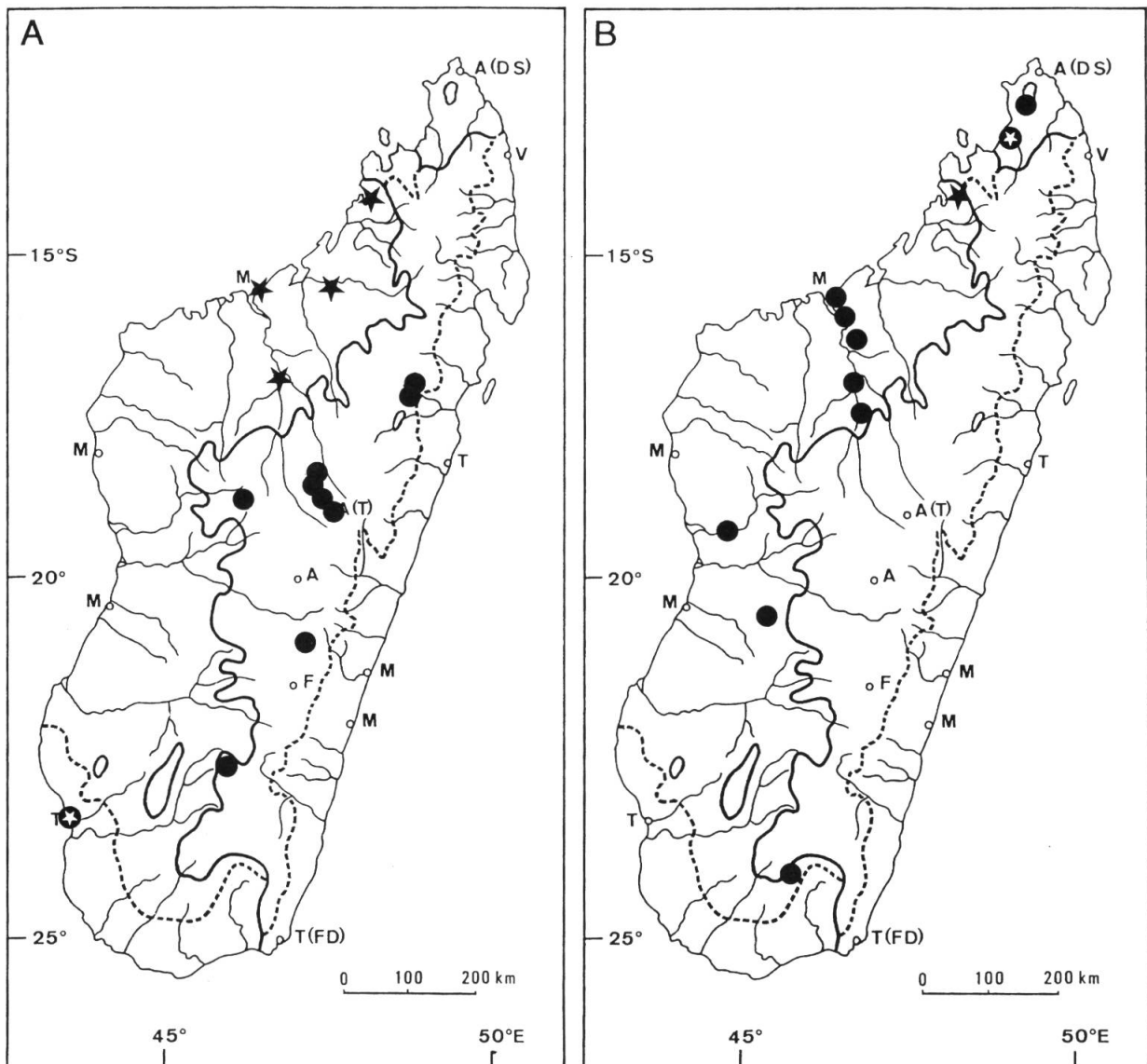


Fig. 15. – Distribution maps of *Pentopetia*. – A, *P. urceolata* Klack. (●), *P. dasynema* Choux (⊗), *P. reticulata* Jum. & H. Perrier (★); B, *P. elastica* Jum. & H. Perrier (●), *P. intermedia* Klack. (⊗), *P. longipetala* Klack. (★).

Note. – *Pentopetia elastica* differs from the sympatric *P. androsaemifolia* by its urceolate corolla tube and by its narrowly triangular and acute calyx lobes. The form of the calyx also distinguishes it from *P. urceolata*, also with an urceolate corolla, which, however, is known only from the central plateau. From both it differs also by its entirely glabrous corolla. The straight corona lobes are often bifid.

The specimen from Ankarana (Malcomber & al. 1920) is more densely pubescent and has smaller corollas (lobes 2.7×0.7 mm) with the lobes hairy outside.

Additional specimens studied. – **MADAGASCAR:** Alluud 46, Imanombo, 1900 (P); Decary 15008, 15014, Malaimbandy, Sakalava, 1939 (P); Descoings 3565, env. de Mahajanga-Boanamary, 1958 (P); Dorr & Koenders 3013, prov. Mahajanga, station forestière d'Ampijoroa, ca 3 km N d'Andranofasika, 1984 (P); Jongkind, Andriantiana & Razanatsoa 3434, 3556, Mahajanga, Tsingy de Bemaraha north of the Manambolo river, 50 m alt., 1996 (WAG); Leeuwenberg & Rapanarivo 14677, Mahajanga, 6 km S of Begisa, S of Begisa river, tributary of Ikopa river, 1000 m alt., 1996 (WAG); Malcomber & al. 1917, 1920, prov. Antsiranana, southwest of Antsiranana, réserve spéciale de Ankarana, 100-200 m alt.,

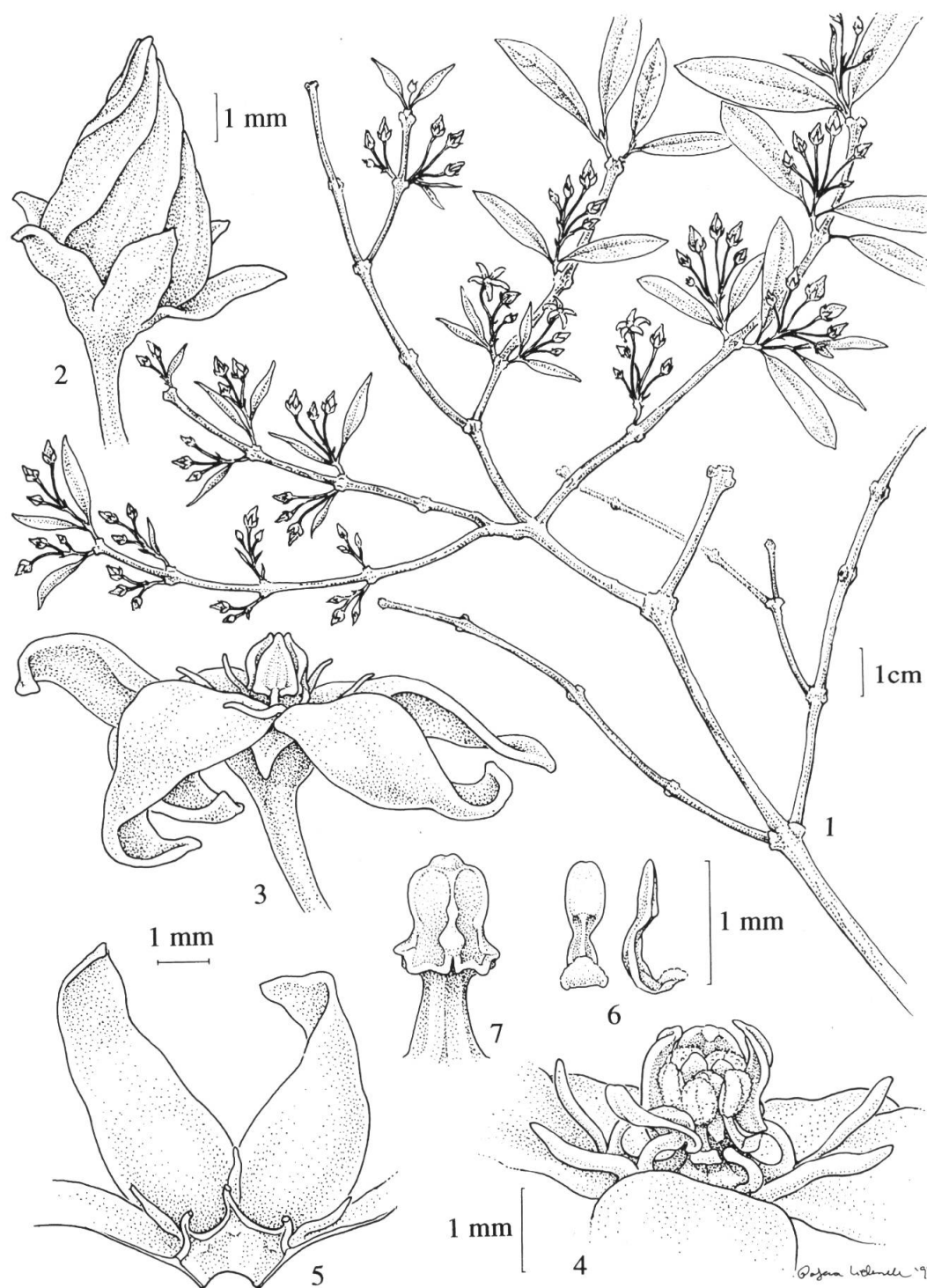


Fig. 16. – *Pentopetia intermedia* Klack. – 1, Habit; 2, Flower in bud; 3, Mature flower; 4, Central part of flower showing corona and anther cone with translators; 5, Portion of corolla from within with anthers and gynoecium removed; 6, Translators; 7, Style and style head. – [1-7. Decary 14847].

1992 (K, P); *Perrier de la Bâthie* 12321, env. de Mahajanga, 1918 (P); *Seyrig* 189, env. d'Ampandrandava entre Bekily et Tsivory, crête de Morafeno, crête de Pisopiso, 700-800 m alt., 1943 (P).

8. *Pentopetia intermedia* Klack., spec. nova (Figs. 15.B (map), 16).

Type: MADAGASCAR, sud d'Ambilobe, 1939, *Decary* 14847 (holo-, P).

Species haec P. androsaemifoliae similis sed corolla omnino glabra, et corollae tubo late aperto sine nectarii lobis differt.

Probably a suffrutescent scrambling liana with glabrous stems. Leaf blade narrowly elliptic, ca 3×1 cm, cuneate at the base, acuminate at the apex; glossy and darker above than below when dry but lacking darker pigment along the margins, glabrous on both sides, sometimes revolute at the very margin; venation looped to arched, with tertiary veins reticulate below when dry; midrib \pm even above when dry, raised below; petiole 4-5 mm long, glabrous.

Inflorescences on short axillary branches, shorter than adjacent leaves, ca 2 cm long; cyme with short and long internodes interspersed, 3-7-flowered; pedicels 10-15 mm long, glabrous; bracts large, 3-7 mm long, linear to narrowly elliptic.

Calyx lobes ovate to triangular, ca 2.9×1.3 mm, subacute to acute at the apex, longer than the corolla tube, probably recurved, glabrous except for some short marginal hairs at and below the tip. Corolla twisted to the right in bud, with the lobes fused for 1/7 of their length into a tube, glabrous, yellow; tube ca 1.1 mm long, with 5 flatly U-shaped ridges between the filament bases; lobes ovate, ca 6.0×2.5 mm, subacute at the apex, probably rotate. Corona lobes ca 1.2-1.6 mm high, filiform, sometimes bifid, erect, shorter than the staminal cone, glabrous. Staminal cone ca 2.0 mm high, distinctly exserted, entirely glabrous; filaments distinctly arched, ca 1.0 mm long, filiform, inserted in the upper part of the corolla tube; anthers ca 1.4 mm long, with a shortly protruding flat connective. Translators ca 1.1 mm long; spoon elliptic, ca 0.6 mm long; stipe flat and broad, at the base about as broad as the spoon, with distinct midrib. Styles ca 0.6 mm long, glabrous; style head ovoid.

Follicles not seen.

Distribution and habitat. – *Pentopetia intermedia* is known only from the type specimen, which was collected in flower in August near Ambilobe in northernmost Madagascar. Ecology not known.

Note. – The general impression of *Pentopetia intermedia* places this species near *P. androsaemifolia*. It has, however, a totally glabrous corolla with an open and broad corolla tube, has a flatly U-shaped ridge between the corona lobes at the mouth. The broadly ovoid shape of the staminal cone as well as the distinctly arched filaments are similar to what is seen in the *P. albicans* and *P. cotoneaster* groups. However, in these taxa the filaments are inserted together with the corona lobes in the sinuses between the corolla lobes. In *P. intermedia* they are inserted some distance below the corona lobes, although still in the upper part of the tube, i.e. not near the base as in *P. androsaemifolia*. Leaf characters are similar to the *P. androsaemifolia* group.

A fruiting specimen without flowers from near Ambilobe (*Humbert & Cours* 32866) might belong to this taxon. It has lanceolate leaves and rather short follicles with 3-5 narrow longitudinal ridges.

The species epithet alludes on the uncertain position of this species.

9. *Pentopetia reticulata* Jum. & H. Perrier in Caoutchouc & Gutta-Percha 15 sept.: 4. 1908, nomen; Ann. Mus. Colon. Marseille ser. 2, 6: 167. 1908 (Figs. 15.A (map), 17).

Type: MADAGASCAR, Belambo, env. de Maevetanana, sur la rive gauche de l'Ikopa, 1900, *Perrier de la Bâthie* 1043 (lecto-, P, here selected; iso-, P).

Liana with glabrous stems. Leaf blade ovate to elliptic to oblong, $2-8 \times 1-4$ cm, cuneate to tapering at the base, acute or acuminate at the apex, rarely notched, glossy and darker above than below when dry but lacking darker pigment along the margins, glabrous on both sides or hairy along the nerves below, flat to revolute at the very margin; venation arched to looped, with tertiary veins reticulate on both sides when dry; midrib impressed above when dry, raised below; petiole 5-10 mm long, hairy to usually glabrous.

Inflorescences axillary, usually shorter than the adjacent leaves, ca 2-3 cm long; cymes irregularly branched with much shortened internodes, often umbel-like on up to 3 mm long peduncles, 3-9-flowered; pedicels 10-15 mm long, glabrous; bracts linear to narrowly ovate, 1-3 mm long.

Calyx lobes oblong to ovate, $2.3-4 \times 1.1-1.7$ mm, acute at the apex, longer than the corolla tube, recurved, glabrous. Corolla twisted to the right in bud, with the lobes fused for $1/7 - 1/9$ of their length into a tube, yellowish; tube short and cylindric but widely funnel-shaped at mouth, 1.1-1.5 mm long, with ridges below the filaments, which unite into 5 rather thick shallowly channeled alternistaminal nectar lobes that are narrowed towards the base, slightly hairy below the nectar lobes at the base, with a short longitudinal ridge above each nectar lobe; lobes narrowly oblong, $7.6-9.2 \times 2.2-2.7$ mm, subacute, probably rotate to recurved, with a patch of long hairs at each side of the corona lobes. Corona lobes 10-14 mm high, filiform, erect but tortuous towards the apex, about as long as the corolla lobes, glabrous. Staminal cone 1.5-1.9 mm high, distinctly exserted; filaments short, 0.3-0.5 mm long, filiform, inserted in the upper part of the corolla tube, glabrous or with a couple of hairs inside; anthers 1.4-1.6 mm long, dorsally hairy and with a protruding flat, hairy or glabrous connective. Translators ca 1.0 mm long; spoon broadly elliptic, 0.6-0.7 mm long, about as broad or broader than the stipe and viscidium; stipe rather narrow just below the spoon but flat and broad at base, with a distinct midrib. Styles short, ca 0.3 mm long, glabrous; style head ovoid.

Follicles $5-6 \times 0.7-1.0$ cm, paired, straight, almost spindle-shaped, acuminate, rather thick-walled with endocarp ca 0.8 mm thick, with 3-5 rather indistinct longitudinal ribs, recurved ca 45° at the base, glabrous; placenta with distinct sometimes slightly flap-like ridges. Seeds 3-8 mm long, smooth; hairs 2-2.5 cm long.

Distribution and habitat. – *Pentopetia reticulata* is distributed in NW Madagascar in dry forest on sand.

Flowering specimens seen from October and January.

Note. – *Pentopetia reticulata* much resembles the sympatric *P. longipetala*, for diagnostic characters see that species.

Additional specimens studied. – **MADAGASCAR:** Leeuwenberg & Rapanarivo 14691, prov. Mahajanga, N of Grand Pavot N of Mahajanga, Cirque Rose, 10 m alt., 1996 (S, WAG); Perrier de la Bâthie 11650, Ampanihy, haut Bemarivo (Boina), 1907 (P); Perrier de la Bâthie 11652, env. de Maromandia, 1909 (P).

10. *Pentopetia longipetala* Klack., spec. nova (Figs. 15.B (map), 18).

Type: MADAGASCAR, Bejofo près d'Analalava, 1908, Perrier de la Bâthie 11757 (holo-, P).

Species haec corollae lobis basi cum crista longitudinali ad P. cotoneastrum accedens sed differt corollae tubo brevi, filamentis brevibus rectisque, coronae lobis longe filiformibus, et corolla alba; cum P. androsaemifolia optime congruens sed differt crista longitudinali prope basin lobiorum corollae.

Liana with glabrous stems. Leaf blade ovate to elliptic, $25-40 \times 15-20$ mm, cuneate to rounded at the base, acute or acuminate at the apex, often glossy and darker above than below when dry but lacking darker pigment along the margins, glabrous on both sides; venation looped to arched, with tertiary veins distinctly reticulate below when dry; midrib impressed above when dry, raised below; petiole 5-10 mm long, glabrous.

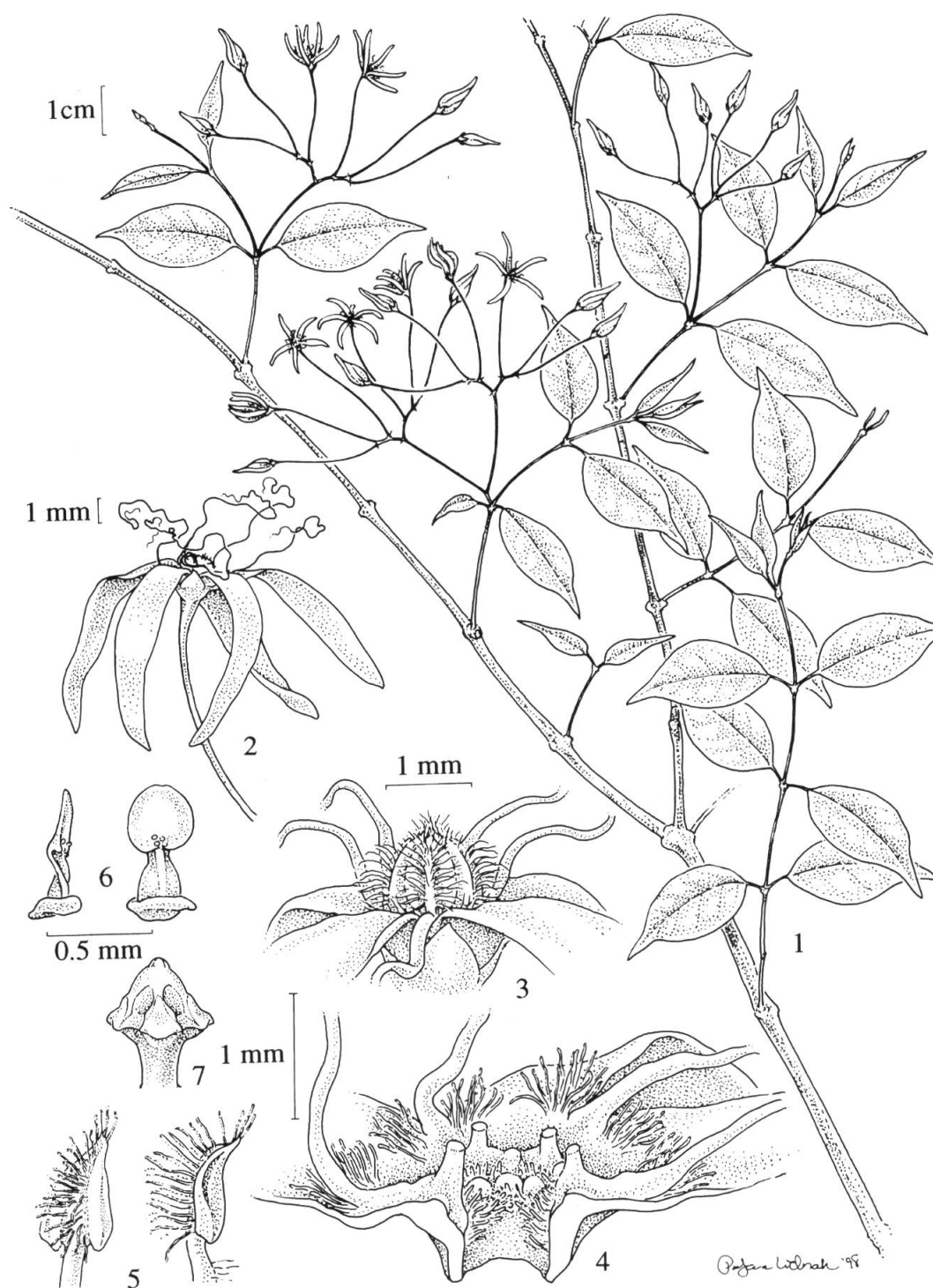


Fig. 18. – *Pentopetia longipetala* Klack. – 1, Habit; 2, Flower; 3, Central part of flower showing corona and anther cone; 4, Portion of corolla from within with anthers and gynoecium removed; 5, Anthers; 6, Translators; 7, Style and style head. – [1-7. Perrier de la Bâthie 11757].

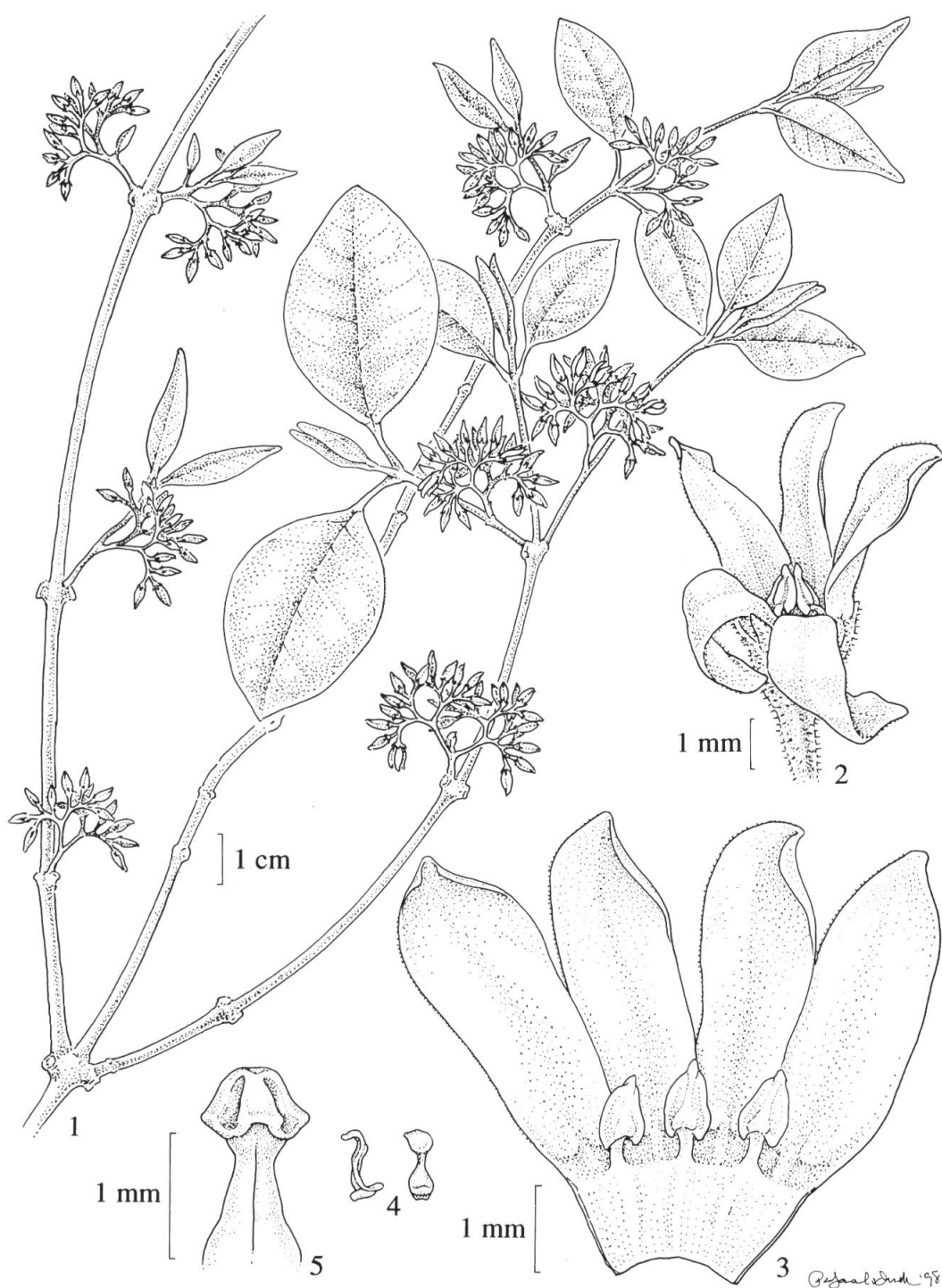


Fig. 19. – *Pentopetia ecoronata* Klack. – 1, Habit; 2, Flower; 3, Portion of flower from within with gynoecium removed; 4, Translators; 5, Style and style head. – [1-5 Phillipson 2341].

Inflorescences axillary, longer than the adjacent leaves, ca 4-5 cm long; cymes irregularly branched with some longer and some very short internodes, often umbel-like on up to 2.5 cm long peduncles, 7-11-flowered; pedicels 15-25 mm long, glabrous but verrucose just below the calyx lobes; bracts minute, narrow, up to 1 mm long.

Calyx lobes triangular to ovate, ca 1.6×0.8 mm, acute at the apex, about as long as the tube, \pm straight, glabrous. Corolla twisted to the right in bud, with the lobes fused for ca 1/9 of their length into a tube, white; tube short and cylindric but widely funnel-shaped at the mouth, ca 1.2 mm long, with 5 alternistaminal nectar lobes in the form of distinct knobs covering the ovary and with 5 longitudinal ridges above each knob, with a patch of long hairs at each side of the corona lobes and a ring of erecto-patent hairs between and below the nectar lobes; lobes narrowly oblong, ca 10.1×1.8 mm, subacute at apex, probably rotate, glabrous. Corona lobes ca 12-16 mm high, filiform, erect but tortuous towards apex, longer than the corolla lobes, glabrous. Staminal cone ca 1.3 mm high, distinctly exserted; filaments very short, ca 0.2 mm long, filiform, inserted in the upper part of the corolla tube, glabrous; anthers 0.9 mm long, dorsally with long straight hairs and with protruding flat connective. Translators ca 0.6 mm long; spoon roundish, ca 0.3 mm long; stipe narrow just below the spoon but flat and broad at base, with a distinct midrib. Styles short, ca 0.3 mm long, glabrous; style head conical.

Follicles not seen.

Distribution and habitat. – *Pentopetia longipetala* is known only from the type collected in flower in October at Bejofo near Analalava in northwestern Madagascar. Although on the label this area was stated to be situated in Sambirano, the site of collection seems to be outside this phytogeographical domain. It was found in dry forest on gneiss.

Note. – *Pentopetia longipetala* is related to *P. cotoneaster* by its corolla's five longitudinal ribs, but has a short corolla tube and short, straight filaments inserted some distance below the corona lobes, as well as long and filiform corona lobes, all characters also found in *P. androsaemifolia*. It is most similar to *P. reticulata* but differs by having five conspicuous erecto-patent knobs instead of channelled downwards-directed bosses (alternistaminal nectar lobes) inside the tube. Furthermore it has a much smaller calyx.

Paratype. – *S. coll. s. no. (?Perrier de la Bâthie 11757), s. loc., "Pentopetia androsaemifolia" (P).*

The paratype is most probably an isotype. This material is better preserved than the type.

11. *Pentopetia ecoronata* Klack., spec. nova (Figs. 19, 26.A (map)).

Type: MADAGASCAR, prov. de Tulear (Toliara), Beza-Mahafaly Reserve, near Betioky, 140 m alt., 1987, *Phillipson 2341* (holo-, P; iso-, MO, P, WAG).

Species haec a P. androsaemifolia corona nulla, floribus glabris, et staminibus ad orem tubi corollae insertis differt; a P. albicans et a P. ovalifolia corollis minoribus et glabris differt.

Liana ca 4 m high with hairy stems. Leaf blade elliptic, $3-4 \times 1.5-3$ cm, tapering to truncate at the base, acute at the apex, with short hairs on both sides, \pm equally green on both sides when dry; venation arched, with tertiary veins finely reticulate when dry; midrib \pm even with leaf surface above, raised below when dry; petiole ca 10 mm long, hairy.

Inflorescences axillary, shorter than the adjacent leaves, up to 2 cm long; cyme irregularly branched with much shortened internodes interspersed with some longer ones, 10-20-flowered; pedicels 2-5 mm long, hairy; bracts up to 2 mm long, linear, hairy.

Calyx lobes narrowly triangular, ca 1.7×0.8 mm, acute at the apex, about as long as the corolla tube, densely hairy outside, glabrous inside, straight. Corolla twisted in bud, with the lobes fused for 1/3 of their length into a tube, white; tube 1.7 mm long, without alternistaminal nectaries, glabrous; lobes oblong, ca 3.7×1.3 mm, obtuse to subacute and \pm asymmetrical at the apex, at the base with a shallow cavity with two small bosses above, probably erecto-patent, glabrous inside but usually with some hairs along the right margin and the midnerve outside. Corona

absent. Staminal cone ca 1.1 mm high, distinctly exserted, entirely glabrous; filaments ca 0.2 mm long, filiform, slightly curved, inserted in the mouth of the corolla tube just below the lobe sinuses; anthers ca 1.0 mm long with a short protruding connective. Translators ca 0.6 mm long; spoon \pm oblong, ca 0.3 mm long; stipe narrow just below the spoon but flat and broad towards the base, with longitudinal rib. Style ca 0.7 mm long, glabrous; style head conical, rounded at apex without a sterile prolongation above the translator spoons.

Follicles not seen.

Distribution and habitat. – *Pentopetia ecoronata* is known only from the type, which was collected in flower in October near Betioky in SW Madagascar in *Tamarindus indica* forest at 140 m altitude.

Note. – *Pentopetia ecoronata* is at first glance similar to *P. androsaemifolia*, but is totally lacking a corona and has hairy vegetative parts. A closer examination, however, reveals a close affinity to the *P. albicans* group. Both *P. albicans* and *P. ovalifolia* have very small, almost lacking, corona lobes. Furthermore, the stamens are inserted in the corolla lobe sinuses, not in the lower part of the tube, as is the case in *P. androsaemifolia*. Also the shape of the corolla lobe apex, i.e. asymmetrical by being slightly unilaterally notched just below the apex is in accordance with what is seen in the *P. albicans* group. *Pentopetia ecoronata* differs, however, from *P. albicans*, *P. lutea* and *P. ovalifolia* by having a small corolla that is totally glabrous inside, a corolla tube without ribs inside and probably \pm erecto-patent corolla lobes. Furthermore it has short staminal filaments as in the *P. androsaemifolia* group. Finally, although *P. ecoronata* has small projections near the base of the corolla lobes, which are characteristic for the *P. albicans* group but lacking in *P. androsaemifolia*, these projections consist of two small bosses with a groove centrally in between, contrary to the centrally \pm long longitudinal ridge found in the *P. albicans* group. Although *P. ecoronata* does not exhibit all the characters that unite the *P. albicans* group, it shows some of them, notably the insertion of the stamens in the tube mouth, the notched corolla lobes and reduced corona, and is thus best placed in this group.

12. *Pentopetia albicans* (Jum. & H. Perrier) Klack., **comb. nov.** (Figs. 20, 21.A (map)).

\equiv *Cryptolepis albicans* Jum. & H. Perrier in Ann. Mus. Colon. Marseille ser. 2, 6: 179. 1908.

Type: MADAGASCAR, Belambo près Maevetanana, 1902, *Perrier de la Bâthie* 1042 (lecto-, P, here selected; iso-, K, P).

Nomenclatural note. – The illustration in the protologue (JUMELLE & PERRIER DE LA BATHIE, 1908b: Tab. 3) is mixed. The fruit is of *Pentopetia ovalifolia*.

Taxonomic note. – BULLOCK (1955: 279) correctly excluded *Cryptolepis albicans* from the genus *Cryptolepis*, but failed to transfer it to any other genus.

Liana up to 4 m high with also rather old stems hairy but eventually glabrescent. Leaves mostly on brachyblasts of which usually only one is present at each node; blade oblong to broadly elliptic or narrowly obovate to obovate, $2\text{--}7 \times 1\text{--}6$ cm, cordate to tapering at the base, rounded to acute at the apex, with usually long and wavy or curled dense hairs below, with short straight or curved sparser hairs or rarely glabrescent above; venation indistinctly looped, when dry faint or covered by the indumentum; midrib and secondary nerves \pm even above, distinctly raised below when dry; petiole 1–7 mm long, as hairy as the blade underneath.

Inflorescences axillary or terminal on usually short lateral branches, shorter or longer than the adjacent leaves, up to 3 cm long; cyme usually with reduced internodes and umbel-like but sometimes irregularly branched with a few 1–2 mm long internodes, usually 5–10-flowered; pedicels 2–8 mm long, with long straight dense hairs; bracts one at the base of petiole, 2–3.5 mm long, soon dropping off.

Calyx lobes elliptic to usually ovate, $3.3\text{--}5.0 \times 2.1\text{--}3.0$ mm, acute to usually acuminate at the apex, longer than the corolla tube, \pm straight, densely hairy outside, rather densely hairy on

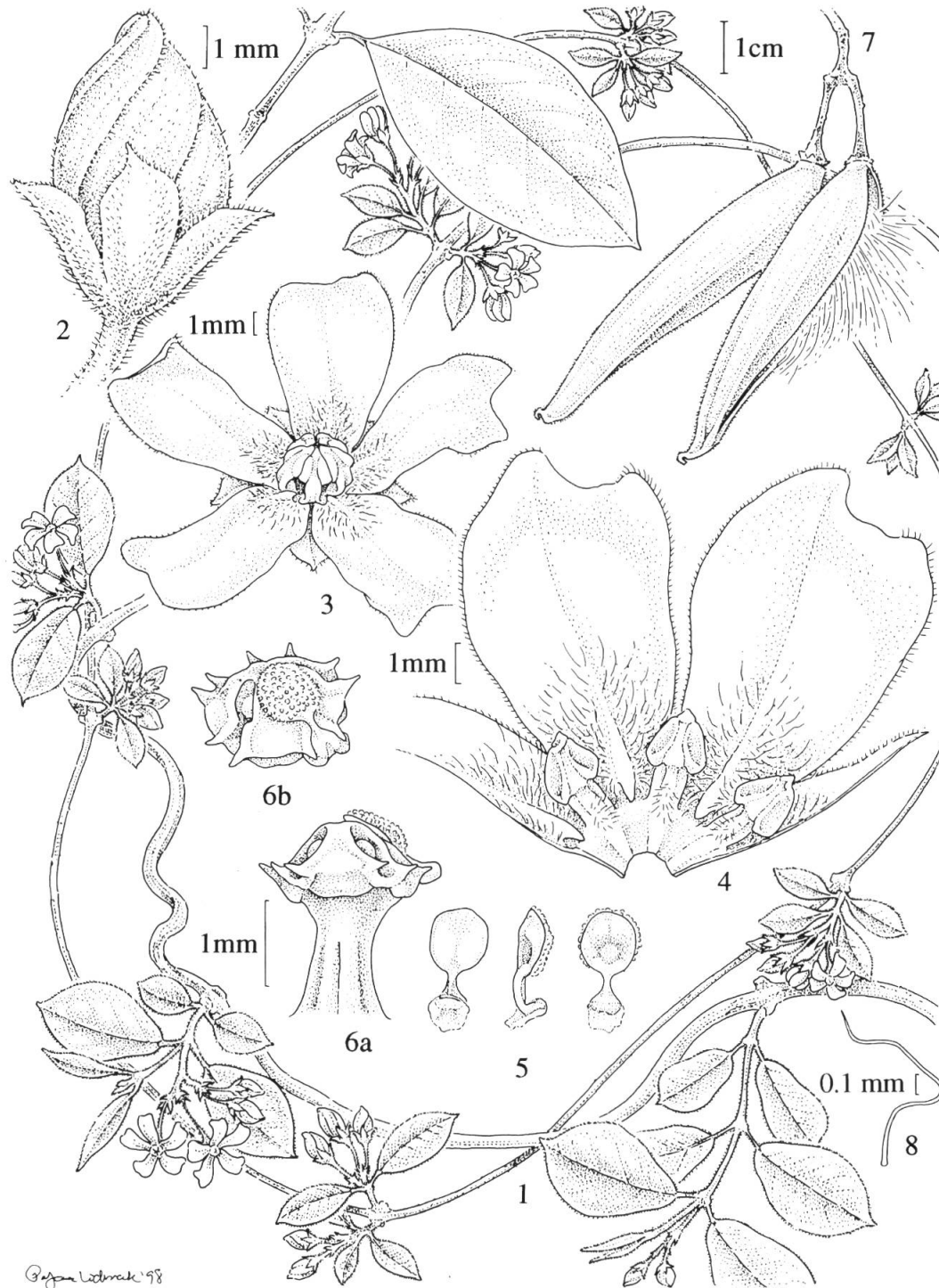


Fig. 20. – *Pentopetia albicans* (Jum. & H. Perrier) Klack. – 1, Habit; 2, Flower in bud; 3, Mature flower; 4, Portion of flower from within with gynoeceum removed; 5, Translators; 6, Style and style head with one translator in situ (6a, lateral view; 6b, from above); 7, Follicles. – [1-6, Jongkind & Andriantiana 3743; 7, Phillipson 1709].

the upper half inside to almost glabrous, sometimes also with hairs at base inside. Corolla not to slightly twisted in bud, with the lobes fused for 1/5-1/12 of their length into a tube, white to usually yellowish white, fragrant; tube 1.3-1.6 mm long, without alternistaminal nectar lobes but with a longitudinal ridge below each filament, which indistinctly unite at the very base, hairy at the mouth and below the anther filaments; lobes elliptic to obovate, $6.7-15.5 \times 3.2-6.8$ mm, acute to rounded and sometimes asymmetrical at the apex, slightly recurved, with a distinct but short longitudinal ridge near the base inside, with long straight hairs at both sides of the ridge directed towards the lobe apex and along both margins and additionally submarginally along the right side of the lobes outside. Corona lobes absent or minute, 0.1-0.2 mm high, \pm triangular, sometimes bifid, straight, much shorter than the staminal cone, glabrous. Staminal cone 1.9-2.7 mm high, distinctly exserted; filaments 0.7-1.2 mm long, flattened and broadened towards the anther, slightly curved, inserted at the mouth of the corolla tube just below the minute corona lobes, with long hairs near base; anthers 1.2-1.4 mm long, dorsally often hairy near base, with shortly pro-

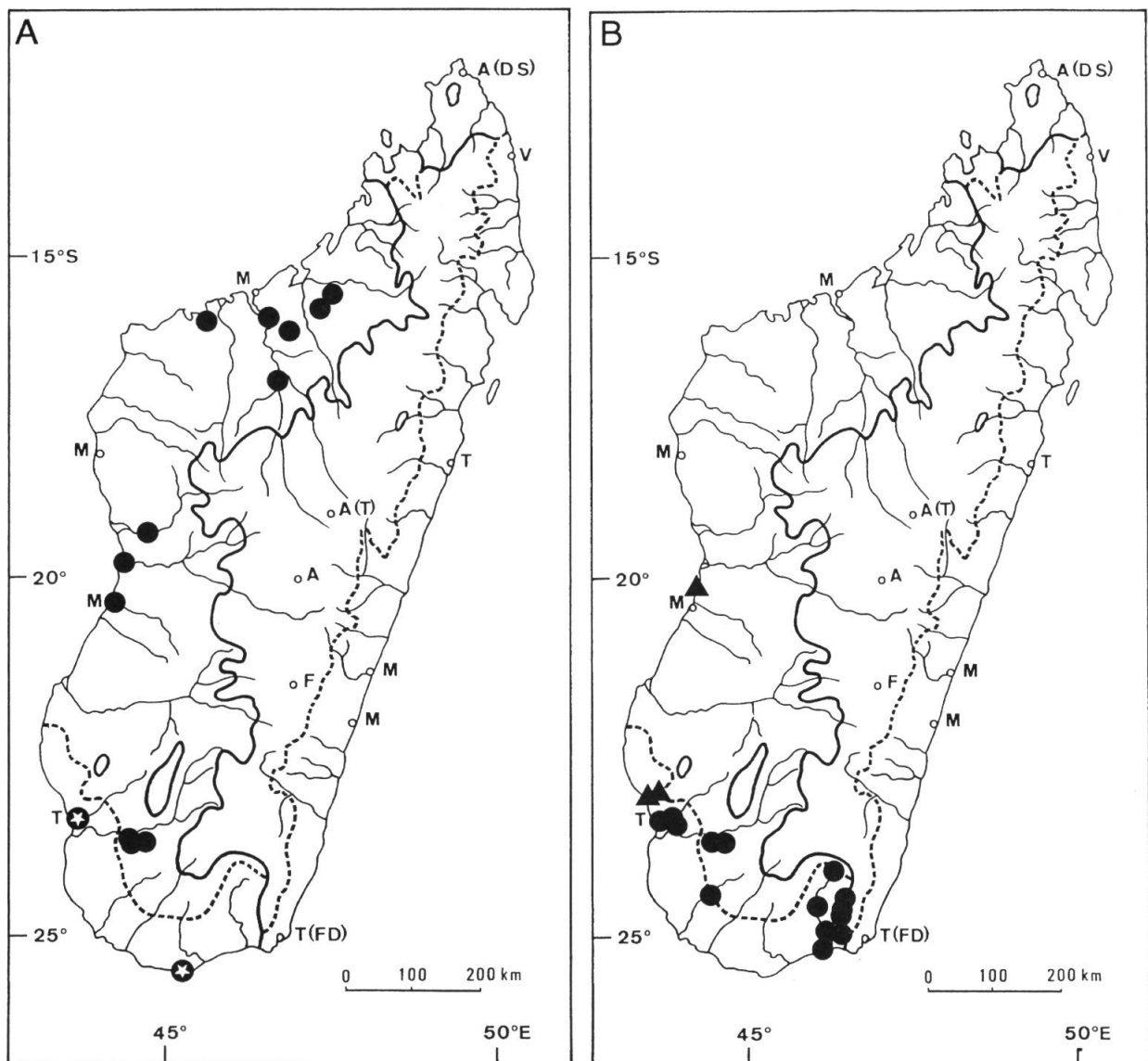


Fig. 21. – Distribution maps of *Pentopetia*. – A, *P. albicans* (Jum. & H. Perrier) Klack. (●), *P. lutea* Klack. & Civeyrel (⊗); B, *P. ovalifolia* (Costantin & Gallaud) Klack. subsp. *ovalifolia* (●), *P. ovalifolia* subsp. *glabrata* Klack. (▲).

truding connective. Translators 0.9–1.1 mm long; spoon roundish, 0.6–0.7 mm long, larger than stipe and viscidium; stipe distinctly demarcated, \pm cylindric. Ovary and lower part of styles with longitudinal ridges. Style 0.9–1.0 mm long, with a few long hairs; style head semi-circular in outline.

Follicles 6–8 \times 1.1–1.5 cm, usually single, \pm straight, narrowly ovate, acute, thick-walled with mesocarp ca 1 mm thick, with 3 longitudinal ribs or up to 2 mm broad wings, recurved 45–90° at base, finely but rather densely hairy; placenta with distinct papery flaps. Seeds 5–6 mm long, smooth; hairs 2.0–2.5 cm long.

Distribution and habitat. – *Pentopetia albicans* is distributed in the western part of Madagascar. It is found in shrub or dry forest areas, from sea level to probably a couple of hundred metres altitude.

Flowering specimens seen from September to November, January, April and May.

Note. – *Pentopetia albicans* is characterized by its white to yellow flowers, distinctly exserted staminal cone with the filaments inserted at the corolla mouth, characters it shares, however, with *P. ecoronata*, *P. lutea* and *P. ovalifolia*. *Pentopetia albicans* differs by a combination of broad and densely hairy leaves beneath, corolla lobes being hairy at the base, and flat staminal filaments. See also *P. ovalifolia*.

Atypical specimens. – Two specimens with narrow corolla lobes that are also acute at the apex and lack a sub-apical notch are present in the Paris herbarium (*Keraudren-Aymonin & Aymonin 25285bis*, 25866). They deviate from *P. albicans* also by having a sparser pubescence of shorter hairs, as well as by the much longer peduncles. The two specimens are said to come from Ankazobe on the central plateau and from Belo-sur-Tsiribihina north of Morondava on the west coast, respectively. The two specimens, however, seem identical and confusion of labels is probable. Consequently the collection site is not known. The specimens may represent a new taxon.

Another atypical specimen (*RN-7782*) with affinity to *P. albicans* and *P. ovalifolia* has been collected at Soalala. It has shorter, flat and dense hairs, as well as ribbed ovary and style, characters also found in *P. ovalifolia*, and is obviously closely related to this species. However, the staminal filaments are short and with a flat dorsal side, a character seen also in *P. albicans*. It differs from both *P. albicans* and *P. ovalifolia* by the structure of the ridge at the base of the corolla lobes. In these two species the ridge is distinct, narrow and high, and longitudinally extended. The Soalala specimen, however, has a short and broad hump-like structure, similar to what is observed in *P. lutea*. Also this specimen may represent a new taxon.

The discussion above demonstrates a certain polymorphism in character combinations of the three species recognized in the *P. albicans* group. In this context, however, it should be pointed out and emphasised 1) that *P. albicans*, as recognized in this revision, is homogenous from north to south, and 2) that in the southern part of the island, where *P. albicans*, *P. ovalifolia* and *P. lutea* are sympatric, no intermediate forms have been observed. Consequently, three distinct species should be recognized. In order to further evaluate the variation, as indicated by the deviating specimens, more information is needed.

Additional specimens studied. – **MADAGASCAR:** *Decary 14906*, Ankarafantsika, 1939 (P); *Decary 15979*, distr. Betioky, vallée de la Sakoa, 1940 (P); *Du Puy & al. MB352*, prov. Mahajanga, Boina region, 7 km W of village Analalava from Mistinjo toward Soalala, 1989 (P); *Humbert & Capuron 29497*, plateau Mahafaly à l'ouest de Betioky, 100–300 m alt., 1955 (P); *Jongkind & Andriantiana 3743*, prov. Toliara, north of Morondave, 50 m alt., 1996 (WAG); *Léandri 410*, gorges du Manambola, 50–100 m alt., 1932 (K, P); *Le Mignon 5439*, Andettry-Befandriana Nord, 1942 (P); *Malcomber & al. 1701*, Mahajanga, north of Mampikony south of Boriziny, 100 m alt., 1992 (P); *Peltier 1376*, distr. Betioky, Besatrana, 1959 (P); *Perrier de la Bâthie 9020*, Ampanihy, Boina, 1907 (P); *Perrier de la Bâthie 11655*, env. de Marovoay, 1908 (P); *Perrier de la Bâthie 11679*, Beloha sur Tsiribihina (P); *Phillipson 1709*, prov. Toliara, Beza Mahafaly Reserve near Betioky, 160 m alt., 1987 (K, P); *Réserves Naturelles: RN-1118*, R.N. 7, Bevazaha, cant. Tsaramandroso, distr. Ambato-Boeni, 1947 (P); *RN-2559*, R.N. 7, cant. Tsaramandroso, distr. Ambato-Boeni, 1947 (P).

13. *Pentopetia ovalifolia* (Costantin & Gallaud) Klack., **comb. nov. (Figs. 21.B (map), 22).**

= *Pentopetiopsis ovalifolia* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 12: 416. 1906. = *Pentopetia cotoneaster* var. *pentopetiopsis* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. = *Pentopetia cotoneaster* subsp. *pentopetiopsis* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 346. 1908.

Type: MADAGASCAR, plaines du Fiherana, 1904, *Geay* 4795 (holo-, P).

Liana up to 5 m high with rather old stems also hairy but eventually glabrescent. Leaves mostly on brachyblasts of which usually only one is present at each node; blade elliptic to oblong or ovate to broadly obovate, 10-35 × 5-25 mm, cordate to tapering at the base, rounded to acute or acuminate at the apex, sometimes apiculate, with usually long and curled dense hairs below, with short curved sparser hairs above; venation indistinctly looped, when dry faint or covered by the indumentum; midrib and secondary nerves ± even above, distinctly raised below when dry; petiole 1-6 mm long, as hairy as the blade underneath.

Inflorescences axillary or terminal on usually short lateral branches, shorter or longer than the adjacent leaves, up to 2 cm long; cyme with reduced internodes and umbel-like but sometimes irregularly branched with a few up to 1 mm long internodes, usually 3-5-flowered; pedicels 3-9 mm long, hairy; bracts linear to elliptic, up to 5 mm long, hairy.

Calyx lobes narrowly ovate to ovate, 2.4-5.2 × 1.1-1.9 mm, acute at the apex, longer than the corolla tube, straight to recurved, hairy to densely hairy outside and along the margins, often with appressed hairs inside near the apex. Corolla slightly twisted in bud, with the lobes fused for 1/4-1/7 of their length into a tube, white to yellowish; tube 1.3-2.3 mm long, without an interstaminal corona but with a longitudinal ridge below each filament, which unite at the very base and with 5 distinct longitudinal ridges that run from the basal part of the lobes to about half-way or more down the tube, with long straight hairs at the mouth and inside particularly below the anther filaments and on both sides of the longitudinal ridge; lobes elliptic to oblong, 5.4-10.1 × 2.0-4.1 mm, rounded to subacute and often asymmetrical at the apex, often sparsely hairy particularly along the margins, slightly recurved. Corona lobes minute, ca 0.5 mm high, narrowly triangular, straight, much shorter than the staminal cone, glabrous. Staminal cone 2.0-3.7 mm high, distinctly exserted; filaments 1.0-2.0 mm long, filiform, curved, inserted at the mouth of the corolla tube just below the corona lobes, with long hairs near the base inside; anthers 1.3-2.3 mm long, broadly ovate, dorsally often slightly hairy below, with shortly protruding narrow connective. Translators 1.3-1.4 mm long; spoon elliptic, 0.8-1.0 mm long, larger than the stipe and viscidium; stipe distinctly demarcated, ± cylindric. Ovary and lower part of styles with longitudinal ridges. Styles 1.3-2.7 mm long, hairy to glabrous; style head ovate in outline.

Follicles 4-6 × 0.8-1.0 cm, ± straight, usually single, narrowly ovate, acuminate and often curved at the very apex, rather thick-walled with mesocarp ca 0.5 mm thick, with at least 5 longitudinal ribs and 1-3 mm broad wings, recurved 45-90° at base, finely hairy to glabrous; placenta with distinct papery flaps. Seeds 4-6 mm long, smooth; hairs 1.5-2.5 cm long.

Distribution and habitat. – *Pentopetia ovalifolia* is distributed in the southern and western parts of Madagascar. It is known mostly from calcareous soil but is also reported from gneiss, in dry forest or sand dunes, from sea level to probably a couple of hundred metres altitude.

Flowering specimens seen from September to December, February and April.

Note. – *Pentopetia ovalifolia* is similar to *P. albicans*. They are both characterized by having a longitudinal ridge at the base of each corolla lobe. In *P. ovalifolia*, however, this ridge continues into the tube, but in *P. albicans* it disappears abruptly at the mouth. *Pentopetia ovalifolia* is also characterized by its broadly at least 5-winged follicles, contrary to the more narrowly 3-winged to 3-ridged follicles of *P. albicans*. It has leaves with a usually very dense indumentum of short curled hairs when dry underneath. In *P. albicans*, also covered by a dense indumentum, the hairs are much longer and thicker, but less curled. *Pentopetia ovalifolia* has filiform staminal filaments contrary to the broad and flat ones of *P. albicans*.

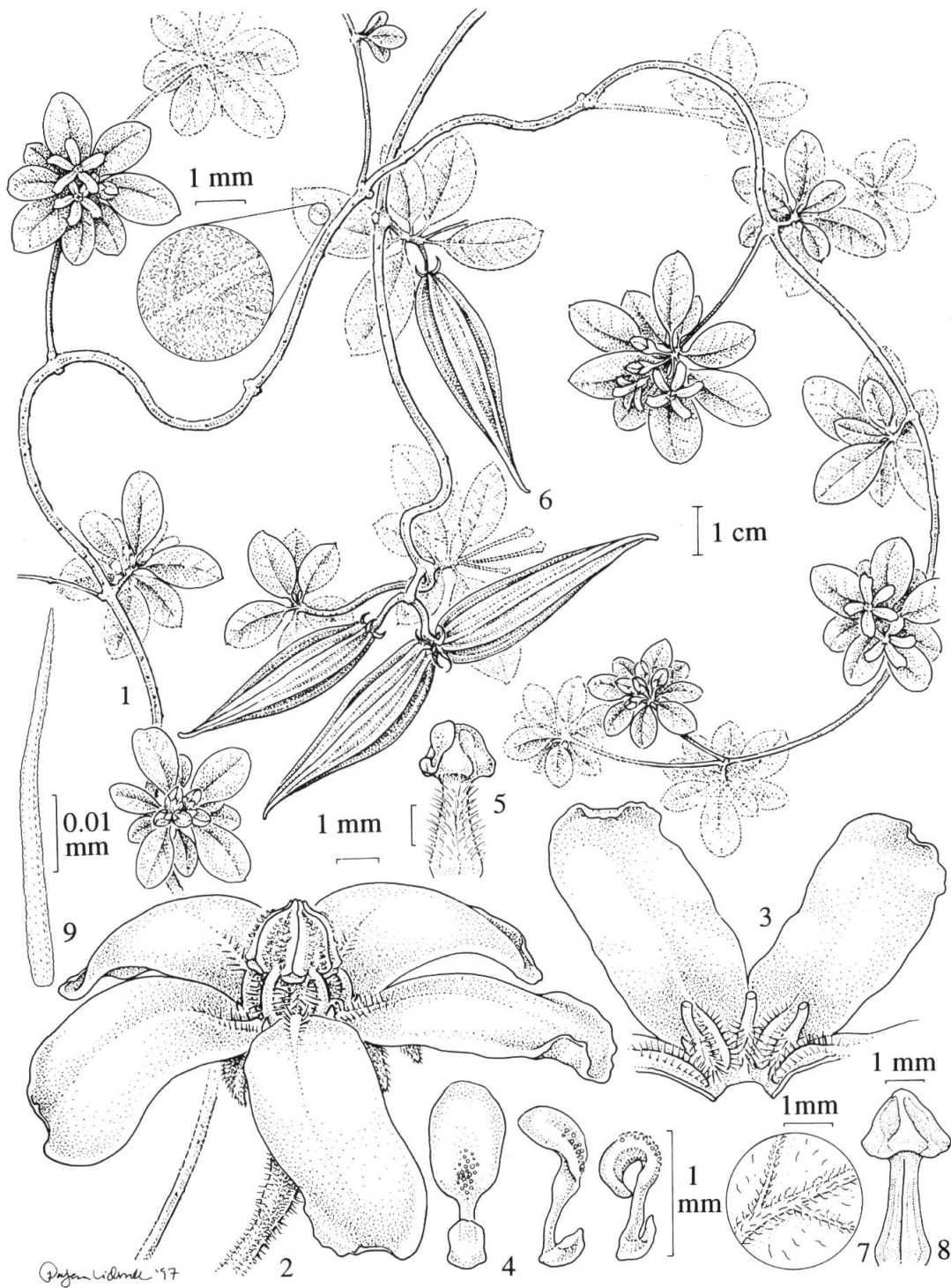


Fig. 22. – *Pentopetia ovalifolia* (Costantin & Gallaud) Klack. (1-6, subsp. *ovalifolia*; 7-8, subsp. *glabrata* Klack.). – 1, Habit and abaxial leaf pubescence; 2, Flower; 3, Portion of corolla from within with anthers and gynoecium removed; 4, Translators; 5, Style and style head; 6, Follicles; 7, Abaxial leaf pubescence; 8, Style and style head; 9, Hair from corolla lobe base. – [1-5, Phillipson 2418; 6, Phillipson 3425; 7-8, Phillipson 2875; 9, Phillipson 2833].

Pentopetia ovalifolia subsp. *glabrata* differs from subsp. *ovalifolia* by having glabrous styles and follicles, as well as by its leaves, which are less densely pubescent. Furthermore, the corolla is usually larger with the tube more than 2 mm and the lobes more than 9 mm long.

Atypical specimen. – One collection from Manombo River north of Toliara (*Turnour 64*) has totally glabrous leaves below except for a few hairs along the main nerves, i.e. different from both subspecies. The style is glabrous as in subsp. *glabrata*. Except for these differences the flower morphology is in accordance with subsp. *ovalifolia*. The flowers, however, are said to be purple, contrary to the white to cream-coloured ones known within *P. albicans* and *P. ovalifolia*. This specimen may represent a new taxon.

Key to the subspecies

1. Style \pm hairy; follicles finely pubescent with short erect hairs subsp. *ovalifolia*
1. Style and follicles glabrous subsp. *glabrata*

Pentopetia ovalifolia* subsp. *ovalifolia (Fig. 21.B (map), 22).

Leaves below when dry grey to white by a dense indumentum. Corolla tube 1.3–2.0 mm long, with the long central longitudinal ridges usually protruding almost to the base of the tube; corolla lobe $5.4\text{--}9.0 \times 2.0\text{--}3.4$ mm long. Style \pm pubescent with long hairs. Follicles finely pubescent with short erect hairs.

Distribution and habitat. – *Pentopetia ovalifolia* subsp. *ovalifolia* is distributed in the southern and southwestern parts of Madagascar, south of the town Toliara.

Additional specimens studied. – **MADAGASCAR:** *Bernardi 11484*, Madagascar, iter australe, 1967 (G); *Bosser 14218*, Toliara, colline de la Table, 1960 (P); *Bosser 15811*, moyen Mandrare, Anadabolava, 1962 (P); *Croat 31322*, along Route Nationale 10 S of Ejeda between second and third branches of Linta river, ca 200 m alt., 1975 (MO, WAG); *Decary 3126*, distr. Ambovombe, Ampasimpolaka, 1924 (P); *Decary 9387*, SE de Madagascar, haute vallée du Manambolo, 1931 (P); *Decary 9447*, moyenne Mananara, sur la limite orientale de l'Androy, 1931 (BM, P); *Decary 9582*, Ambatomainty au nord d'Ambovombe, 1932 (P); *Dequaire 24254*, s. loc. (P); *Dequaire 27327*, Toliara, la Table (P); *Dorr 4163*, prov. Toliara, Route Nationale 7 ca 35 km E of Toliara, 1985 (K, MO, P); *Geay 4795*, plaines du Fiherena, 1904 (P); *Geay 6020, 6021*, montagne de la Toheza (P); *Humbert 13705*, bassin de réception de la Mananara, affl. du Mandrare, pentes occidentales des montagnes entre l'Andohahela et l'Elakelaka entre Ampahiso et Mahamavo, 500–700 m alt., 1934 (P); *Humbert 19897*, gorges du Fiherenana entre Beantsy et Anjamala, 30–300 m alt., 1947 (P); *Léandri & Saboureau 4220, 4560*, haut bassin de la Mananara, au N d'Imonty, R.N. 11, 1960 (P); *Miller & Randrianasolo 6163*, Toliara, along Route Nationale 7, 25 km SE of Toliara, 160 m alt., 1991 (K, WAG); *Montagnac 112*, SO Madagascar (P); *Peltier 1395*, distr. Betioky, au sud d'Ambatoveve, Tranombazo, 1959 (P); *Perrier de la Bâthie 16623*, Toliara, 1924 (P); *Phillipson 2418*, prov. Toliara, Beza Mahafaly Reserve, near Betioky, east of Sakamena river near Ambinda, 150 m alt., 1987 (K, P, WAG); *Phillipson 2833*, distr. Toliara, réserve d'Andohahela, NE of Amboasary near Hazofotsy, 100 m alt., 1988 (K, P); *Phillipson & al. 3425*, prov. Toliara, 16 km S of Ejeda on Route Nationale 10, 300 m alt., 1990 (G, K, P, WAG); *Poisson 140, 671*, Toliara, dunes de Befanamy, 1921–1923 (P); *Réserves Naturelles: RN-2096 Ramarokoto*, cant. Behara, distr. Ambovombe, 1950 (P).

Pentopetia ovalifolia* subsp. *glabrata Klack., **subsp. nova** (Fig. 21.B (map), 22).

Type: **MADAGASCAR**, 45 km N of Toliara on road to Morombe E of junction to Manombo, 25 m alt., 1988, *Phillipson 2875* (holo-, MO; iso-, K, P, WAG).

Subspecies haec stylo folliculisque glabris, et foliis minus pubescentibus differt.

Leaves below when dry greyish green; indumentum not entirely covering the leaf surface. Corolla tube 2.0–2.3 mm long, with the central longitudinal ridges protruding only half way down the tube or less; corolla lobe $8.8\text{--}10.1 \times 2.7\text{--}4.1$ mm. Style glabrous. Follicles glabrous.

Distribution and habitat. – *Pentopetia ovalifolia* subsp. *glabrata* is distributed in the southwestern and western parts of Madagascar, north of the town Toliara.

Paratypes. – Decary 16228, prov. Toliara, Manombo, 1940 (P); Decary 18815, vallée du Manombo, 1943 (P); Geay 22, prov. Toliara (P).

The epithet of the subspecies alludes to the much less hairy leaves than in subsp. *ovalifolia*, as well as to the glabrous styles.

14. *Pentopetia lutea* Klack. & Civeyrel in *Adansonia* ser. 3, 19: 267. 1997 (Figs. 21.A (map), 23).

Type: MADAGASCAR, prov. Toliara, 17 km à l'est de Toliara sur la Route Nationale 7, est de la "Montagne de la Table", 110 m alt., 1994, *Civeyrel 1243* (holo-, P; iso-, K, S, TAN).

Liana up to 1 m high, sometimes with short hairs but older stems glabrous. Leaves mostly on brachyblasts of which usually only one is present at each node; blade linear to narrowly elliptic or narrowly obovate, 20-45 × 1-7 mm, tapering at the base, rounded to usually acute at the apex, glabrous and bright green above, densely hairy below but with midrib almost glabrous; margin revolute; venation faint above, indistinctly looped to somewhat reticulate below when dry; midrib even to usually impressed above when dry, distinctly raised below; petiole 0.5-1 mm long, with short erect hairs in two lines laterally.

Inflorescences very short, terminal on brachyblasts, shorter than adjacent leaves. Flowers pentamerous, actinomorphic, usually solitary or in pairs; pedicels 2-8 mm long, glabrous or with small sparse hairs just below the flower; bracts missing or 1 or 2 at base of pedicel, 1.5-3.5 mm long.

Calyx lobes ovate, 4.0-4.7 × 2.3-2.8 mm, acute at the apex, longer than the tube, straight to recurved, glabrous to sparsely hairy on both sides. Corolla not or slightly twisted to the left in bud, with the lobes fused for ca 1/5 of their length into a tube, bright yellow; tube ca 2.7 mm long, without alternistaminal nectar lobes, with 5 short hairy ridges below the filaments; lobes elliptic, 10.0-11.0 × 5.0-6.0 mm, acute at apex, slightly recurved, with a distinct but short longitudinal ridge ending abruptly at the corolla mouth, glabrous on the inside but with sparse short hairs on the right half of the lobes outside. Corona lobes 1.7-1.8 mm high, narrowly triangular, filiform, slightly bent inwards, much shorter than the staminal cone, glabrous. Staminal cone 4.0-4.4 mm high, distinctly exserted, pale brown; filaments 2.0-2.2 mm long, filiform, arched, inserted at the mouth of the corolla tube just below the corona lobes, glabrous; anthers 3.0-3.3 mm long, dorsally hairy, with a slightly protruding flat connective. Translators 2.3-2.7 mm long; spoon elliptic-ovate, ca 1.3 mm long, impressed along mid-line; stipe distinctly demarcated, narrow and ± circular due to recurved margins. Styles 2.0-2.7 mm long, glabrous. Style head conical.

Follicles not seen.

Distribution and habitat. – *Pentopetia lutea* is distributed in the dry southwestern part of Madagascar in rather sparse shrub and spiny vegetation on limestone soil, and is probably restricted to the Southern Domain.

Flowering specimens seen from November and December.

Note. – *Pentopetia lutea* differs from the other species in the *P. albicans* group by its short though well developed corona lobes. It differs from *P. albicans* also by the cylindric, not flat, distinctly arched staminal filaments and the few-flowered inflorescences. *Pentopetia lutea* furthermore differs from all species of *Pentopetia*, except *P. bosseri* and *P. dasynema*, by its narrow leaves. It is easily separated from the latter species, however, by its thick indumentum of the leaves below and by its much larger flowers.

Additional specimens studied. – Phillipson 2989, prov. Toliara, Cap Ste. Marie Reserve, SW of Tsiombe, 200 m alt., 1988 (K, P); Phillipson 3039, Toliara, SE of Toliara on Route Nationale 7, 15 km from town near La Table, 75 m alt., 1988 (K, P).

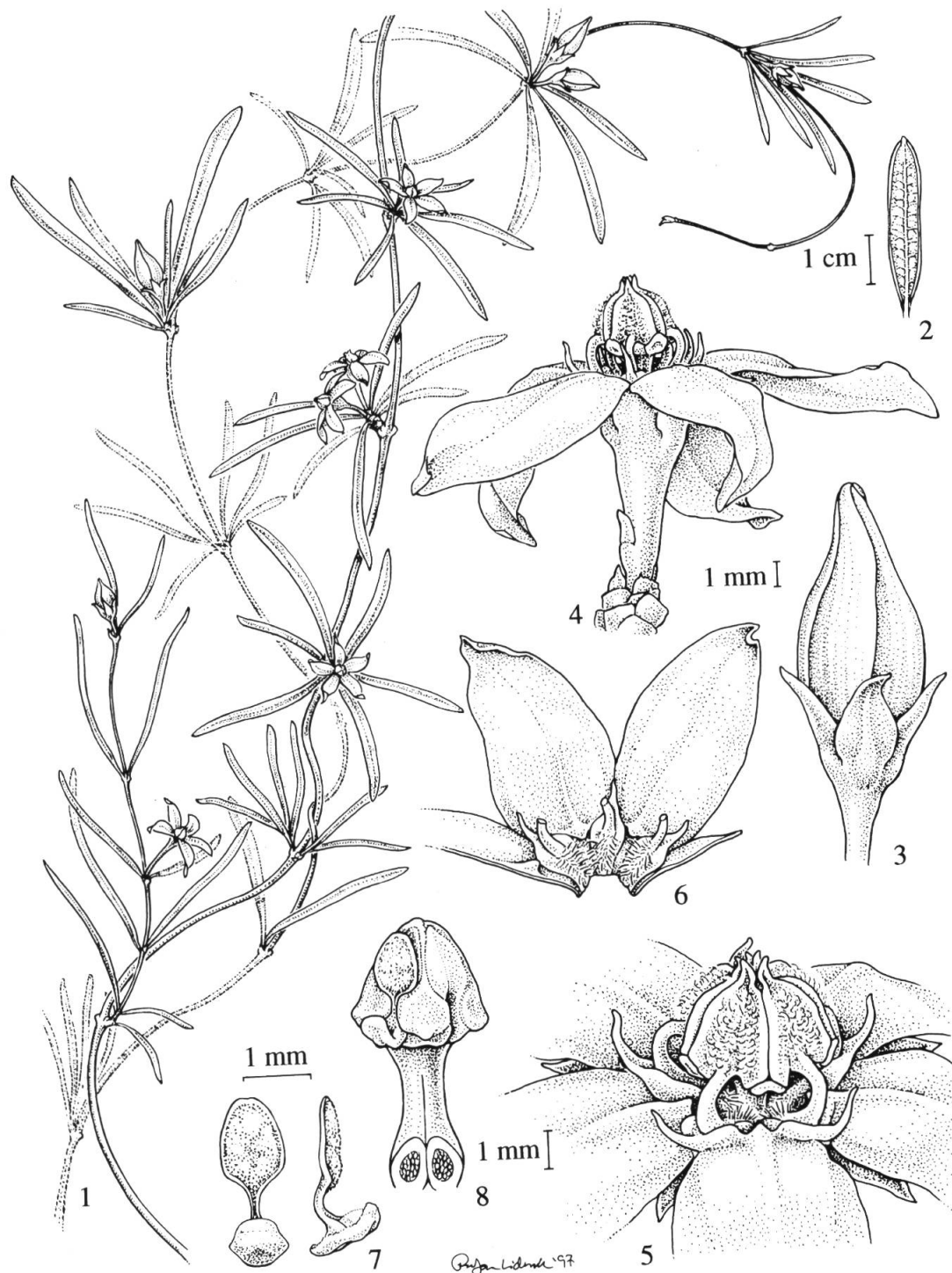


Fig. 23. — *Pentopetia lutea* Klack. & Civeyrel. — 1, Habit; 2, Leaf, abaxial side; 3, Flower in bud; 4, Inflorescence; 5, Central part of flower showing corona and anther cone with translators; 6, Portion of corolla from within with anthers and gynoecium removed; 7, Translators; 8, Gynoecium showing style head with one translator, style and sectioned ovaries. — [1, Phillipson 3039; 2, Phillipson 2989; 3-8, Civeyrel 1243, spirit material].

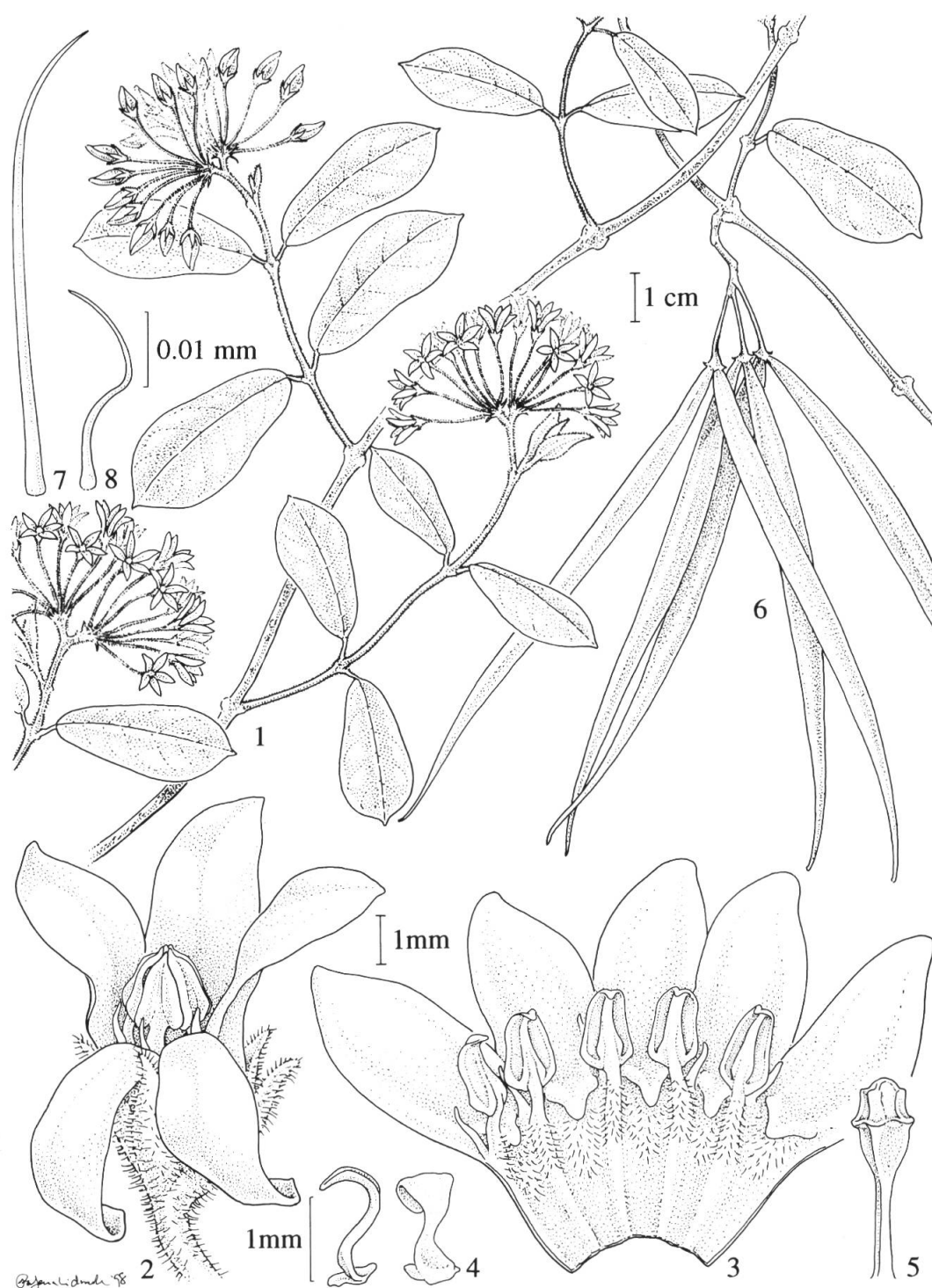


Fig. 24. – *Pentopetia cotoneaster* Decne. – 1, Habit; 2, Flower; 3, Flower from within with gynoecium removed; 4, Translocators; 5, Style and style head; 6, Follicles; 7, Hair from stem; 8, Hair from adaxial side of leaf. – [1, Decary 7424; 2-5, Afzelius s.n., Moramanga; 6, Baron 3022; 7-8, Civeyrel 1380].

15. *Pentopetia cotoneaster* Decne. in A. DC., Prodr. 8: 500. 1844; Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 342. 1908; Choux in Ann. Mus. Colon. Marseille ser 3, 2: 230. 1914 (Figs. 24, 26.A (map)).

Type: MADAGASCAR, sur les bords de la Rivière Chazak dans la prov. d'Imamon, 1839, Bojer s.n. (holo-, G-DC, microfiche seen).

- = *Cryptolepis grandidieri* Baill. in Bull. Mens. Soc. Linn. Paris 1: "84" [804]. 1889. = *Pentopetia cotoneaster* var. *acustelma* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. = *Pentopetia cotoneaster* subsp. *acustelma* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 344. 1908. = *Pentopetia grandidieri* (Baill.) Jum. & H. Perrier in Caoutchouc & Gutta-Percha 15 sept.: 8. 1908. – *Acustelma grandidieri* (Baill.) Venter in Taxon 46: 712. 1997, comb. non rite publ. – **Type: MADAGASCAR**, côte sud-ouest de Madagascar, *Grandidier* s.n. (lecto-, P, here selected).

Liana up to 6 m high, with younger stems usually densely hairy, glabrescent. Leaf blade elliptic to obovate, 1.5–4.5 × 1.0–3.0 cm, truncate to usually cordate at the base, rounded and sometimes notched but usually apiculate at the apex, with dense curved to wavy hairs below, with sparse erect and bent hairs above, grey below and darker above when dry; margins ± revolute; venation arched to looped, with tertiary veins reticulate below when dry; midrib and secondary nerves ± even or slightly impressed above, distinctly raised below when dry; petiole 1–5 mm long, hairy.

Inflorescences axillary or seemingly terminal, usually longer than the adjacent leaves, up to 3.5 cm long; cyme irregularly branched with much shortened internodes, umbel-like on a 3–8 mm long peduncle, usually 5–10-flowered; pedicels 10–20 mm long, hairy; bracts up to 5 mm long, linear to narrowly elliptic, hairy.

Calyx lobes narrowly triangular to ovate, 2.4–4.2 × 1.0–1.5 mm, acute at apex, about as long as the corolla tube, straight, reddish, hairy outside and along the margins as well as near the tip inside. Corolla slightly twisted to the right in bud, with the lobes fused for ca 1/3 of their length into a tube, reddish violet; tube 2.7–4.1 mm long, without alternistaminal nectar lobes but with an indistinct longitudinal ridge below each filament, which unite at the very base and with 5 shorter even more indistinct ridges in between, hairy inside just below the mouth; lobes oblong to elliptic, 5.4–6.8 × 2.2–3.2 mm, rounded to subacute and usually asymmetrical at the apex with a triangular boss or V-shaped ridge at the base, probably rotate, glabrous. Corona lobes 1.1–2.3 mm high, filiform, straight to curved inwards, much shorter to about as long as the staminal cone, glabrous. Staminal cone 2.4–2.7 mm high, distinctly exserted; filaments 0.7–1.3 mm long, filiform, arched, inserted at the mouth of the corolla tube just below the corona lobes, with long dense hairs inside; anthers 1.7–2.0 mm long, with a slightly protruding glabrous connective, glabrous. Translators 1.0–1.3 mm long; spoon elliptic, 0.6–0.8 mm long; stipe flat and rather broad, without midrib. Styles 2.3–2.7 mm long, united for ca 1/3 of their length, glabrous; style head ovate in outline, conically tapering below into the style.

Follicles 7–11 × 0.3–0.4 cm, usually paired, straight to slightly bent, linear, gradually tapering towards apex, thin-walled with mesocarp 0.1–0.3 mm thick, without ribs or wings, recurved up to ca 45° at the base, covered with short erect hairs; placenta with narrow smooth ridges. Seeds ca 11 mm long, smooth; hairs ca 2.5 cm long.

Distribution and habitat. – *Pentopetia cotoneaster* is distributed in central Madagascar. There is also one collection (*Grandidier* s.n.) said to be from SW Madagascar. This, however, is doubtful. *Pentopetia cotoneaster* is found in forest along banks of rivers and lakes. It has been collected between 750–1500 m altitude.

Flowering specimens seen from September to November and from January to March.

Note. – *Pentopetia cotoneaster* is characterized by its reddish violet flowers, distinctly exserted staminal cone with the filaments inserted at the corolla mouth, characters it shares with *P. boivinii*, *P. pinnata* and probably also with *P. calycina* (colour unknown). The distinctly exserted

ted staminal cone is seen also in the yellow-flowered *P. albicans*, *P. lutea* and *P. ovalifolia*. In addition to the flower colour, however, *P. cotoneaster* also differs by its \pm linear and thin-walled fruits, similar to the structure seen in *P. androsaemifolia*, but different from the narrowly elliptic thick-walled and winged follicles of *P. albicans* and *P. ovalifolia*.

Pentopetia cotoneaster differs from *P. boivinii* and *P. calycina* by its \pm densely hairy leaves below, and from *P. pinnata* by its glabrous anthers and by having only five ridges in the corolla tube instead of ten.

Additional specimens studied. – **MADAGASCAR:** *Afzelius s.n.*, Moramanga, 1912 (P, S); *d'Alleizette* 500, forêt de la Mandraka, 1905 (P); *Baron* 3022, Central Madagascar (BM); *Baron* 5937, Madagascar (P); *Boiteau* 2261, Antsihanaka, 1936 (P); *Boiteau* 3077, Analamazaotra, 1937 (P); *Boiteau* 3225, Mandraka, 1938 (P); *Bosser* 2272, Andasibe (Périnet), 1951 (P); *Bosser* 2350, 5108, env. d'Antananarivo, distr. Anjozorobe, Analabe, 1951-1953 (P); *Bosser* 16480, lac Alaotra, est de Vohimenakely, 1962 (P); *Campeñon s.n.*, bords du Mananara près Vonjomantira, 80 km NE de Bemarivo (P); *Civeyrel* 1380, prov. Antananarivo, route de Lakato au sud d'Andasibe entre Antananarivo et Toamasina, 1020 m alt., 1994 (S); *Cours* 10, distr. Ambatondrazaka, Ambatomofana, près ?Kinrimandroso, 740 m alt., 1937 (P); *Cours* 778, distr. Amba-

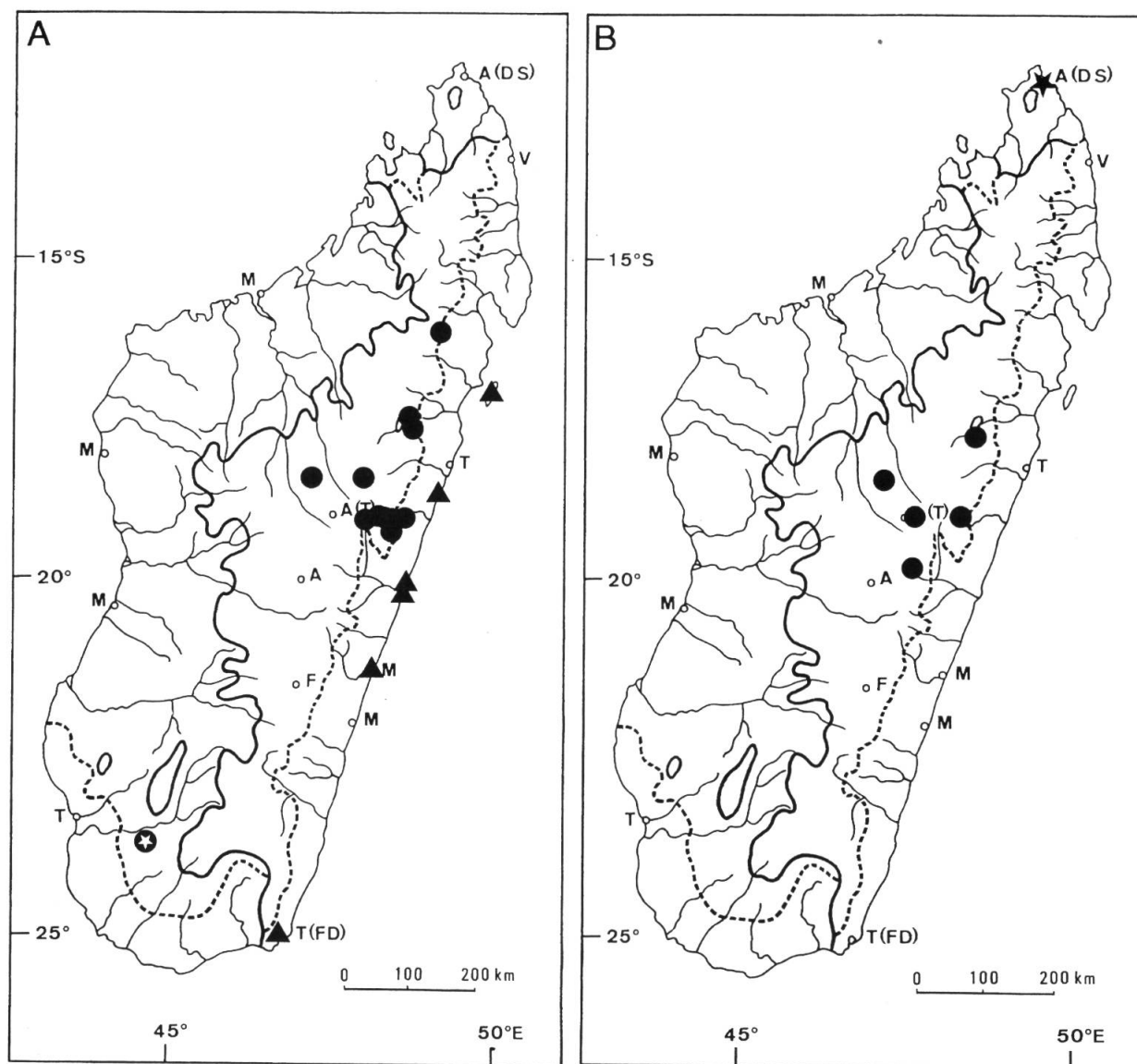


Fig. 26. – Distribution maps of *Pentopetia*. – A, *P. cotoneaster* Decne. (●), *P. boivinii* Prain (▲), *P. ecoronata* Klack. (★); B, *P. pinnata* Costantin & Gallaud (●), *P. calycina* Klack. (★).

tondrazaka, Menaloha, 900 m alt., 1938 (P); *Decary* 7424, restes des forêt au nord d'Ankazobe, 1930 (K, P); *Grandidier s.n.*, côte sud-ouest de Madagascar (P); *Keraudren-Aymonin & Aymonin* 25285, tampoketsa d'Ankazobe, bord de la Manankazo, 1970 (P); *Perrier de la Bâthie* 8970, Moramanga, 850 m alt. (P); *Perrier de la Bâthie* 11669, Manankazo au NE d'Ankazobe, 1500 m alt., 1913 (P); *Perrier de la Bâthie* 17200, bords du Mangoro entre Beparosy et Moramanga, 800 m alt., 1925 (P); *Réserves Naturelles: RN-9686, RN-11315 Rakotovo*, distr. Ambatondrazaka, cant. Manakambahiny Est, 1958-1960 (P); *Viguier & Humbert* 1013, prov. Andovoranto, distr. Moramanga, bords de la Sahamarirana, entre Ampa-simpotsy et Bevalanirano, ca 900 m alt., 1912 (G, P); *Viguier & Humbert* 1175, prov. Andovoranto, distr. Moramanga, berges du Mangoro près d'Ankarefo, 800 m alt., 1912 (P).

16. *Pentopetia boivinii* Prain, Index Kew. Suppl. 4: 176. 1913 (Figs. 25, 26.A (map)).

≡ *Pentopetia boivinii* Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 349. 1908 [nom. inval. prov.].

Type: MADAGASCAR, Ste Marie de Madagascar, *Boivin* 1787 (holo-, P).

= *Pentopetia cotoneaster* var. *thouarsii* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907. ≡ *Pentopetia cotoneaster* subsp. *thouarsii* (Costantin & Gallaud) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 343. 1908. – **Type:** MADAGASCAR, *Du Petit-Thouars* 33a (holo-, P)

Liana with glabrous stems or younger branches with very sparse short hairs. Leaf blade elliptic to obovate or narrowly obovate, 25-65 × 15-40 mm, abruptly tapering to truncate or finely cordate at the very base, rounded to usually acuminate or apiculate at the apex, glabrous but sometimes with a hairy margin, when dry pale below and darker above but with a distinct and pale margin as well as midrib; venation looped, with tertiary veins reticulate when dry; midrib ± impressed above when dry, raised below; secondary nerves ± even on both sides when dry; petiole 2-7 mm long, glabrous or with short hairs along upper side.

Inflorescences axillary or terminal on short lateral branches, shorter than the adjacent leaves, up to 3 cm long; cyme irregularly branched with some longer internodes up to a few mm long and some very short ones, umbel-like, 5-15-flowered; pedicels 8-20 mm long, with very sparse short hairs or usually glabrous but tuberculate just below the calyx lobes; bracts several, narrow, 1-2 mm long.

Calyx lobes narrowly ovate, 2.1-4.3 × 1.1-1.5 mm, acute to rounded at apex, about as long as to usually longer than the corolla tube, often recurved, slightly hairy along the central part to usually glabrous, ciliate along the margins, tuberculate at base. Corolla not or slightly twisted in bud, with the lobes fused for ca 1/4-1/5 of their length into a tube, white or particularly on the outside reddish violet; tube 1.4-1.9 mm long, without alternistaminal nectar lobes but with a longitudinal ridge below each filament, which unite at the very base, ± densely hairy inside and particularly below the anther filaments; lobes oblong, 5.7-7.8 × 2.4-2.8 mm, rounded at apex, with a ± triangular boss or short ridge at the base, recurved, glabrous. Corona lobes 3.3-5.4 mm high, filiform, ± straight to twisted, about as long as to longer than the staminal cone, glabrous. Staminal cone 2.3-3.0 mm high, distinctly exserted; filaments 1.1-1.6 mm long, filiform, slightly curved, inserted at the mouth of the corolla tube just below the corona lobes, with long hairs near base inside; anthers 1.2-2.1 mm long, glabrous or dorsally with a few short hairs, with slightly protruding flat connective. Translators 1.1-1.8 mm long; spoon usually roundish, 0.8-1.0 mm long, larger than the stipe and viscidium, with slightly impressed midline; stipe distinctly demarcated, ± cylindric. Ovary and lower part of styles with longitudinal ridges. Style 1.0-1.7 mm long, glabrous; style head ovate in outline.

Follicles not seen.

Distribution and habitat. – *Pentopetia boivinii* is distributed along the east coast of Madagascar. It is found in coastal forest, often in sand.

Flowering specimens seen from September to November and March and April.

Note. – *Pentopetia boivinii* shows affinity to *P. cotoneaster* and *P. pinnata* from the central plateau. It differs, however, by having glabrous leaves that are pale below and darker above but with a distinct, pale margin as well as midvein clearly visible when dry. Furthermore, the corona

lobes are longer and often twisted. Both *P. boivinii* and *P. cotoneaster* differ from *P. pinnata* by having a \pm triangular boss at the base of the corolla lobe, contrary to the long ridge present in *P. pinnata*.

Additional specimens studied. – **MADAGASCAR:** Dumetz 827, Tôlanaro distr., forêt de Petriky, 0-10 m alt., 1989 (K, MO); Geay 7411, 7441, 7649, 7996, 7997, 8011, 8100, 8101, 8102, 8104, prov. Mananjary, 1909 (P); Perrier de la Bâthie 11693, Fenerive, 1912 (P); Perrier de la Bâthie 11694, Mananjary, 1911 (P); Perrier de la Bâthie 13301, Tampina, 1920 (P); Perrier de la Bâthie 14215, sud de l'embouchure du Mangoro, 1921 (P); Perrier de la Bâthie 18177, Ambilo, 1927 (P); Perrier de la Bâthie 18239, près de Mahanoro, 1927 (P); Viguiet & Humbert 364, env. de Tamatave, près d'Ampanalana, 1912 (P).

17. *Pentopetia pinnata* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907; Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 347. 1908 (Figs. 26.B (map), 27).

Type: MADAGASCAR, Campenon s.n. (holo-, P).

Liana up to 8 m high with younger stems hairy, glabrescent. Leaf blade \pm elliptic, 4-8 \times 2-4 cm, tapering to usually truncate or cordate at the base, rounded to usually acuminate at the apex, with short sparse hairs on both sides but sometimes glabrous below or only very sparsely hairy along the veins, green with reddish veins below, darker green and shining above; margins \pm revolute; venation looped, with tertiary veins reticulate below when dry; midrib and secondary nerves \pm even above, distinctly raised below when dry; petiole 4-9 mm long, hairy as blade.

Inflorescences axillary or terminal, about as long as to shorter than the adjacent leaves, up to 4 cm long; cyme irregularly branched with some longer internodes up to 8 mm long and some very short ones, usually 5-10-flowered; pedicels 8-15 mm long, hairy; bracts 4-8 mm long, linear, with distinct midnerve, hairy particularly along the margins.

Calyx lobes narrowly ovate to ovate, 4.8-7.7 \times 2.0-3.0 mm, acute at apex, longer than the corolla tube, straight, glabrous to slightly hairy near the base outside, sometimes with some short hairs near the tip inside, ciliate along the margins, tuberculate at base and at upper part of pedicels, reddish violet. Corolla twisted in bud, with the lobes fused for 2/7-1/4 of their length into a tube, with reddish violet buds; tube 3.1-3.7 mm long, without alternistaminal nectar lobes but with a longitudinal ridge below each filament, which unite at the very base and with 5 shorter ridges in between, usually densely hairy inside at least along the ridges below the stamens; lobes oblong, 8.4-10.8 \times 4.1-5.5 mm, rounded to subacute and often asymmetrical at apex, recurved, glabrous, white to yellowish white inside, reddish violet outside. Corona lobes 1-2 mm high, filiform, curved inwards, much shorter than the staminal cone, glabrous. Staminal cone 3.3-5.0 mm high, distinctly exserted; filaments 3.0-3.4 mm long, filiform, distinctly arched, inserted at the mouth of the corolla tube just below the corona lobes, with long hairs near base inside; anthers 2.4-2.7 mm long, dorsally slightly hairy, with a slightly protruding connective topped by a few hairs. Translators ca 1.9 mm long; spoon roundish, 1.3 mm long, larger than the stipe and viscidium, with impressed midline; stipe distinctly demarcated, \pm cylindric. Ovary and lower part of styles with longitudinal ridges. Styles 2.9-3.4 mm long, glabrous; style head ovate in outline.

Follicles not seen.

Distribution and habitat. – *Pentopetia pinnata* is distributed in central Madagascar. It is found in forest over gneiss probably mostly between 1000-1500 m altitude.

Flowering specimens seen from October to February.

Note. – *Pentopetia pinnata* is related to and sympatric with *P. cotoneaster*, but is distinguished by sparsely hairy leaves, larger corollas, more shortly fused corolla lobes, anthers dorsally hairy, thick and distinctly curved filaments, and by having ten distinct ridges in the tube.

Additional specimens studied. – **MADAGASCAR:** d'Alleizette 926, Betsitra, 1906 (P); Bosser 17096, env. d'Antananarivo, Angavokely, 1963 (P); Civeyrel 1346, prov. Antananarivo, massif forestier avant Moramanga, Route Nationale 2, 1340 m alt., 1994 (S); Cours 1981 & Homolle 1981, env. d'Ambatondrazaka, forêt de la Menaloka au bord de la pente de Nickel-Ville, 1944 (P); Perrier de la Bâthie 11668, Manankazo au NE d'Ankazobe, 1500 m alt., 1913 (P); Perrier de la Bâthie 17095, village au sud de Tsinjoarivo, rive droite de l'Onibe, 1925 (P); Service Forestier: SF-93 Capuron, Angavokely, 30 km E d'Antananarivo, 1949 (P)

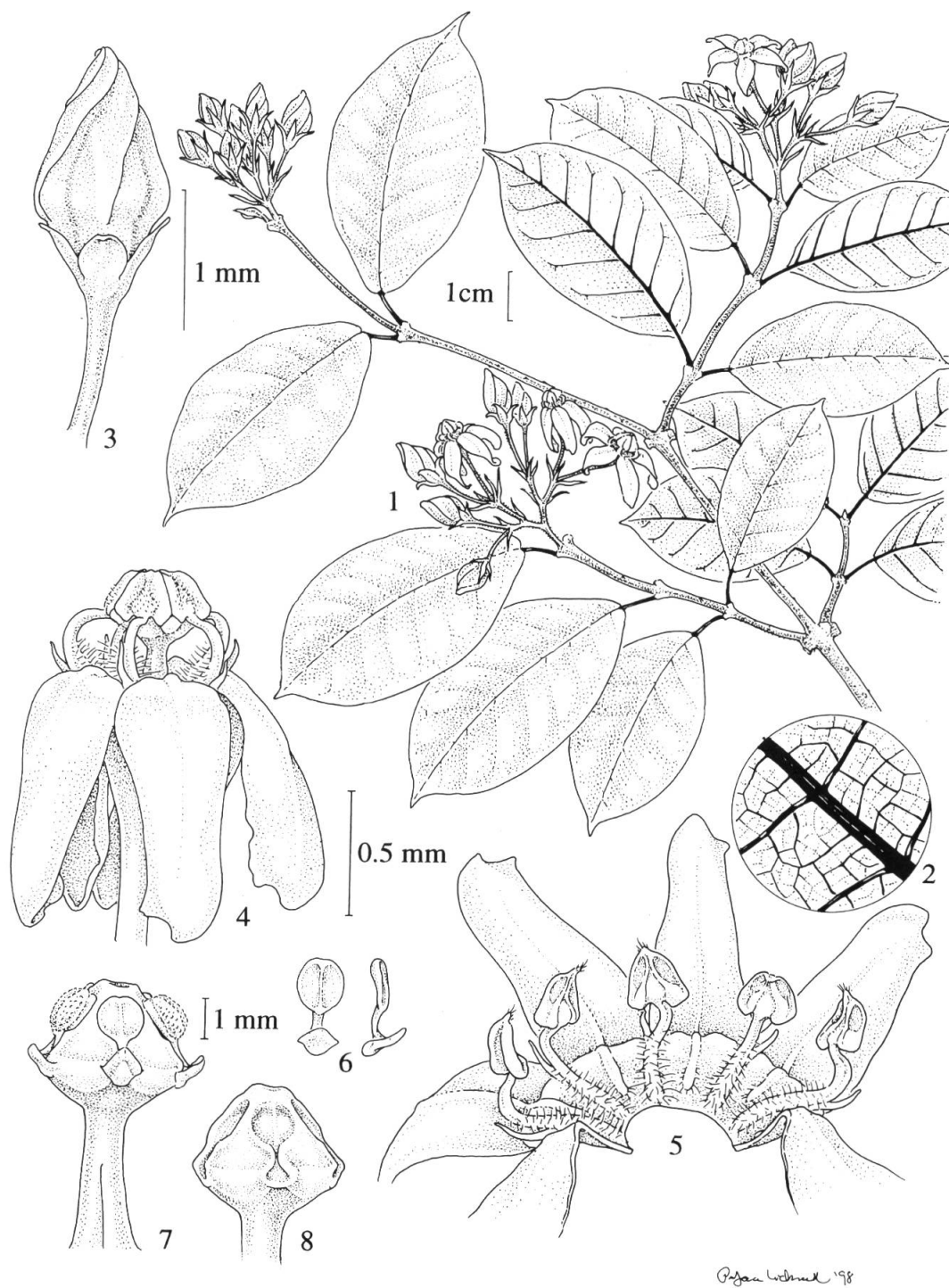


Fig. 27. – *Pentopetia pinnata* Costantin & Gallaud. – 1, Habit; 2, Leaf, detail of lower side; 3, Flower in bud; 4, Mature flower; 5, Flower from within with gynoecium removed; 6, Translators; 7, Style and style head with translators in situ; 8, Style head without translators. – [1-2, Bosser 17096; 3-8, Civeyrel 1346, spirit material].

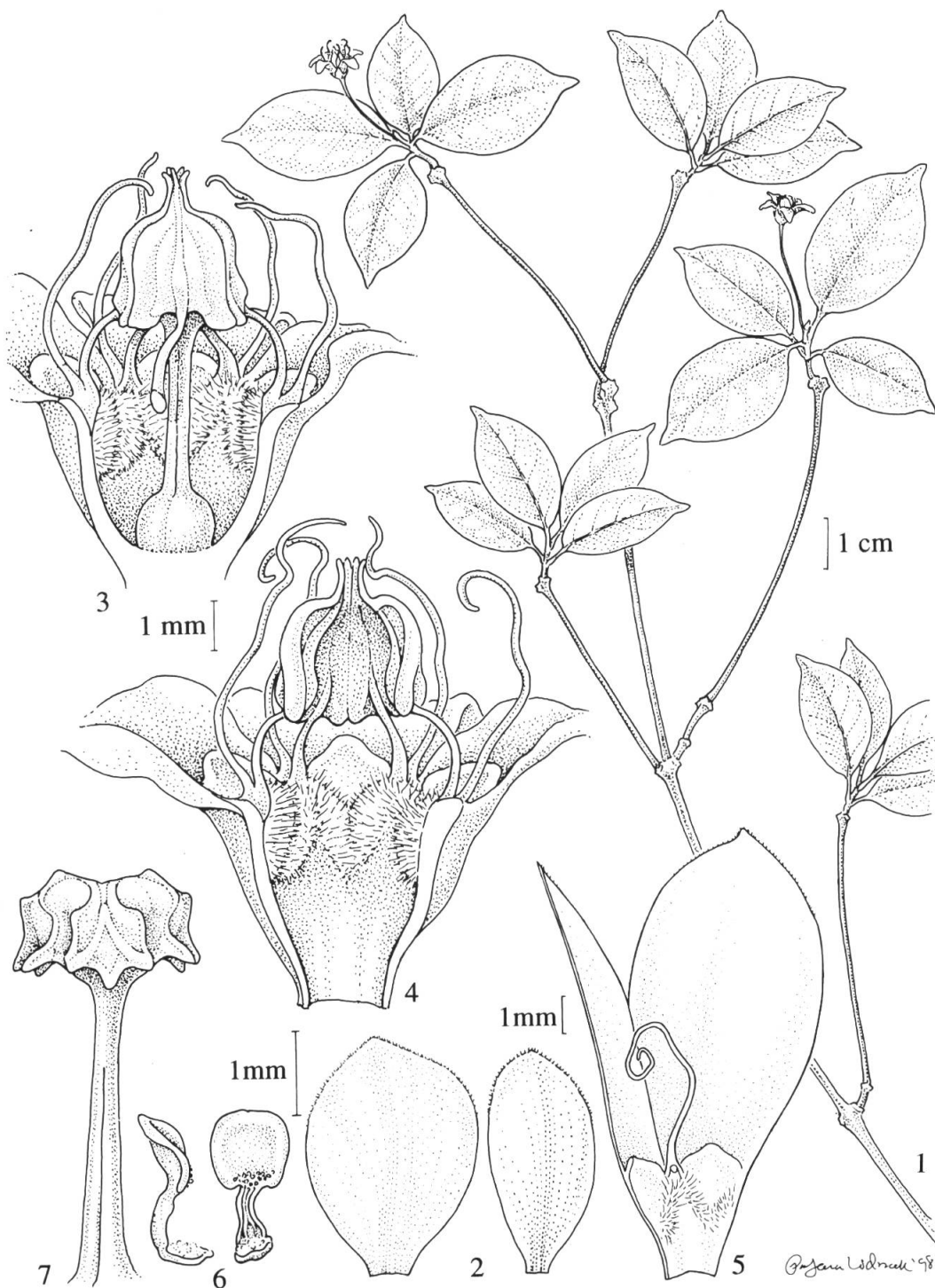


Fig. 28. – *Pentopetia calycina* Klack. – 1, Habit; 2, Calyx lobes; 3, Longitudinal section of central part of flower with calyx and two corolla lobes removed; 4, Central part of corolla with calyx, two corolla lobes, one anther and the gynoecium removed; 5, Detached corolla and corona lobe with an anther removed; 6, Translator; 7, Style and style head. – [1-7, Homolle s.n., 8 nov. 1944].

18. *Pentopetia calycina* Klack., **spec. nova** (Figs. 26.B (map), 28).

Type: MADAGASCAR, Province de Diégo-Suarez (Antsiranana) – Sakaramy – Montagne des Français, 8 nov. 1944, *Homolle s.n.* (holo-, P).

Species haec calycis lobis grandibus valde superpositisque, et inflorescentiis uno- vel bifloris a Pentopetiae speciebus ceteris differt, etiam corollae tubo longo, antheris ad orem tubi corollae distincte excertis, et coronae lobis longis filiformibusque dignoscenda.

Probably suffrutescent scrambling liana with glabrous stems. Leaf blade elliptic, ca 3-3.5 × 2 cm, truncate to cordate at the base, acuminate at the apex, glabrous; venation arched to looped, with tertiary veins distinctly reticulate below when dry; midrib and secondary nerves below distinctly raised, above even with the leaf surface or midrib impressed near base; petiole 2-3 mm long.

Inflorescences seemingly in leaf axils but actually inserted on a very short peduncle between 2 pairs of leaves; cymes with suppressed internodes, with 1 or 2 flowers on ca 10-15 mm long, glabrous pedicels; bracts elliptic, 2-3 mm long.

Calyx lobes of different sizes with overlapping margins, elliptic, ca 5.9-8.1 × 2.7-4.5 mm, obtuse at apex, much longer than the corolla tube, ± straight, with short hairs along and near the margins particularly towards the tip. Corolla with the lobes fused for ca 1/4 of their length into a tube; aestivation and colour not known; tube ca 3.0 mm long, without alternistaminal nectar lobes but hairy in 5 V-formed patches between the staminal filament bases; lobes elliptic, ca 9.4 × 5.2 mm, obtuse at the very apex, with a distinct transverse ridge just above the tube mouth, with short hairs along and near the margins particularly towards the tip. Corona lobes ca 6 mm high, filiform but distinctly broadened at the very base, erect but probably somewhat twisted, longer than the staminal cone but shorter than the corolla lobes, glabrous. Staminal cone ca 3.4 mm high, distinctly exserted; filaments ca 2 mm long, filiform, arched, inserted at the mouth of the corolla tube just below the corona lobes, hairy at base inside; anthers ca 2.7 mm long, dorsally hairy, with protruding glabrous connective. Translators ca 1.9 mm long; spoon roundish, ca 1 mm long, larger than the stipe and viscidium, without a distinct midline; stipe distinctly demarcated, flattened but much narrower than the spoon, with 2 short ribs below the spoon. Ovary and lower part of styles with longitudinal ridges. Styles ca 3.7 mm long, glabrous; style head broad with truncate apex.

Follicles not seen.

Distribution and habitat. – *Pentopetia calycina* is known only from the type specimen, which was collected in flower in November at Montagne des Français just south of Antsiranana. Ecology not known.

Note. – *Pentopetia calycina* is probably related to the *P. cotoneaster* group. It has the much protruding broadly ovoid staminal cone which is inserted at the mouth of the tube, that is characteristic for the group, but lacks the longitudinal ridge at the base of the corolla lobes. Instead it has a transverse U-shaped ridge in the mouth between the corona lobes. *Pentopetia calycina* differs distinctly from all other species of *Pentopetia* by its large calyx lobes of different sizes. It is also characterized by the much reduced, 1-2 flowered inflorescences.

The species epithet alludes to the calyx, which is unusually large for this genus.

19. *Pentopetia grevei* (Baill.) Venter in Taxon 46: 714. 1997 (Figs. 29, 30.A (map)).

≡ *Cryptolepis grevei* Baill. in Bull. Mens. Soc. Linn. Paris 1: “84” [804]. 1889. ≡ *Gono-crypta grevei* (Baill.) Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 359. 1908.

Type: MADAGASCAR, Mouroundava (Morondava), *Grevé* 88 (lecto-, P, here selected; iso-, P).

- = *Kompitsia elastica* Costantin & Gallaud in Compt. Rend. Hebd. Séances Acad. Sci. 142: 1555. 1906; Bull. Mus. Hist. Nat. (Paris) 12: 417. 1906. = *Pentopetia elastica* (Costantin & Gallaud) Venter in Taxon 46: 714. 1997 [non Jum. & H. Perrier in Caoutchouc & Gutta-Percha 15 sept.: 4. 1908]. – **Type:** MADAGASCAR, plaines du Fiherena, 1904, Geay 4788 (lecto-, P, here selected).
- *Cryptolepis grandidieri* auct. non Baill.: Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 359. 1908, pro syn.

Nomenclatural note. – BAILLON (1889: “83” [803], “84” [804]) stated clearly that he considered *Pentopetia*, *Gonocrypta* and *Acustelma* to be sections of *Cryptolepis*. BAILLON (1889: “83” [803]) wrote: “Nous ne ferons des *Pentopetia* qu’une section du genre *Cryptolepis*”, and on page “84” [804]: “il y a aussi à Madagascar d’autres types qui représentent le genre *Cryptolepis*. Ils appartiennent à deux sections *Gonocrypta* et *Acustelma*”. He added, however, that one (e.g. not himself, Baillon) could perhaps consider *Gonocrypta* and *Acustelma* as having the rank of genera. Consequently, *Gonocrypta*, as well as *Acustelma*, were validly described as sections of *Cryptolepis* but not as genera, as they were not accepted by the author as such. However, the species *Cryptolepis* (*Gonocrypta*) *grevei* and *Cryptolepis* (*Acustelma*) *grandidieri*, were validly described (BAILLON, 1889: “84” [804]).

In 1889, the year Baillon described this species, there seems to have been four collections of *Pentopetia grevei* present in the Paris herbarium, three collected by Grandidier and one by Grevé. BAILLON (1889: “84” [804]) indicated no type material, but as he named this species after Grevé, the Grevé 88 collection (2 sheets) is the logical choice of lectotype.

Liana up to 4 m high with glabrous stems. Leaf blade polymorphic, linear to elliptic to broadly obovate or spatulate, 15-90 × 5-30 cm, tapering at base, acute to acuminate and sometimes apiculate or rounded to retuse at apex, glabrous; venation arched to looped, with tertiary nerves distinctly reticulate when dry; midrib when dry raised below near base but even or impressed near apex, impressed to even above; secondary and tertiary nerves ± even above; petiole 1-7 mm long, glabrous.

Inflorescences axillary or terminal, shorter to usually longer than the adjacent leaves, 2-7 cm long; cyme dichasial with all internodes ± elongated and erecto-patent, 3 to often many-flowered; pedicels 2-8 mm long, glabrous; bracts soon dropping off, 1.0-1.5 mm long.

Calyx lobes narrowly triangular to ovate, 2.7-4.7 × 0.9-2.0 mm, rounded to acute at apex, about as long as or shorter than the corolla tube, recurved, glabrous on both sides but sometimes hairy along the margins. Corolla not twisted to twisted in bud, with the lobes fused for 1/4 – 2/5 of their length into a tube, glabrous; tube urceolate with 5 bulbous swellings between the corona and filament bases, with 5 ridges below the anther filaments and with 5 distinct rounded to truncate alternistaminal nectar lobes near the base close together forming a ring hiding the ovary, 3.5-5.3 mm long, pink outside, purple inside; lobes narrowly ovate to elliptic, 7.1-14.2 × 2.3-4.1 mm, rounded to acute at apex, erecto-patent, purple or mauve but often white towards the base. Corona lobes with a broad dorsiventrally flattened base and a laterally flattened and in outline ± triangular 1.3-2.6 mm high free lobe, rather fleshy, acuminate at apex, erecto-patent, overtopping the staminal cone, glabrous, mauve. Staminal cone 2.3-3.0 mm high, included in the corolla tube to only slightly exerted but always covered by the corona lobes, entirely glabrous; filaments 0.3-0.7 mm long, filiform, straight, inserted at the lower half of the tube; anthers 1.7-2.6 mm long, with a narrow much protruding connective. Translators 1.3-2.3 mm long, folded at base and up to 2.7 mm long if straightened out; spoon ovate, 0.4-0.6 mm long, without distinct midline, tapering at base into a long indistinctly separated stipe and adhesive disc; stipe narrow with outwards recurved margins just below the spoon but for most of its length flat and broad with the margins U-shapedly turned inwards, flat near base. Style 0.7-1.5 mm long, glabrous; style head narrow, cylindric, with very short usually bifid tip above the spoons.

Follicles 3-8 × 0.3-0.4 cm, usually paired, ± straight, linear to usually narrowly ovate, acuminate, rather thin-walled with mesocarp ca 0.1-0.3 mm thick, with ca 5 ± distinct longitudinal

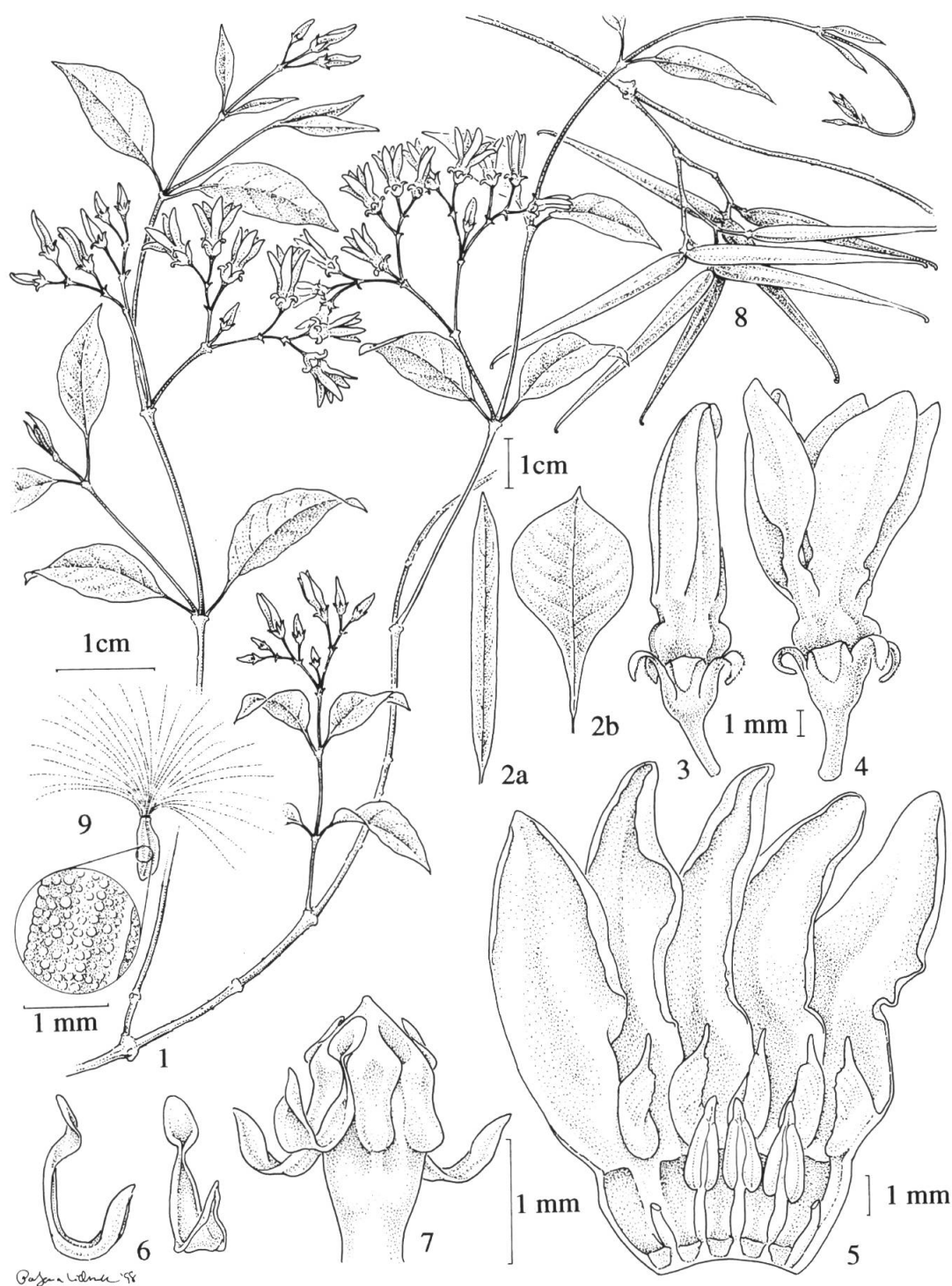


Fig. 29. – *Pentopetia grevei* (Baill.) Venter. – 1, Habit; 2, Leaf variation; 3, Flower in bud; 4, Mature flower; 5, Flower from within with two anthers and gynoecium removed; 6, Translators; 7, Style head with three translators in situ; 8, Follicles; 9, Seed and magnification of seed surface. – [1, Sussman 303; 2a, Bosser 10291; 2b, Léandri & Saboureaux 3907; 3-6, Civeyrel 1112, spirit material; 7-8, Liede & al. 2677; 9, Turnour 63].

ribs, recurved 45-90° at base, glabrous; placenta with narrow smooth ridges. Seeds 5-8 mm long, verrucose; hairs 1.5-3 cm long.

Distribution and habitat. – *Pentopetia grevei* is distributed in the drier southern and western parts of Madagascar, known from near Ihosy in the south and north to Maintirano and Antsalova in the west. It is also found in the Isalo Mts. *Pentopetia grevei* is probably common in several places. It is usually found in dry forests or savannah and shrub vegetation, in sand dunes near the sea or along rivers or roads. It grows in both siliceous and limestone areas and has been found from sea level up to 1000 m.

Flowering specimens seen from July to February, April and May.

Note. – *Pentopetia grevei* is unique in the genus by combining reddish-violet flowers and a staminal cone included in the corolla tube. The leaf variation is considerable (Fig. 29.1-2; CHOUX, 1914: Pl. 6), but seems to have no geographical correlation. There is also a rather large

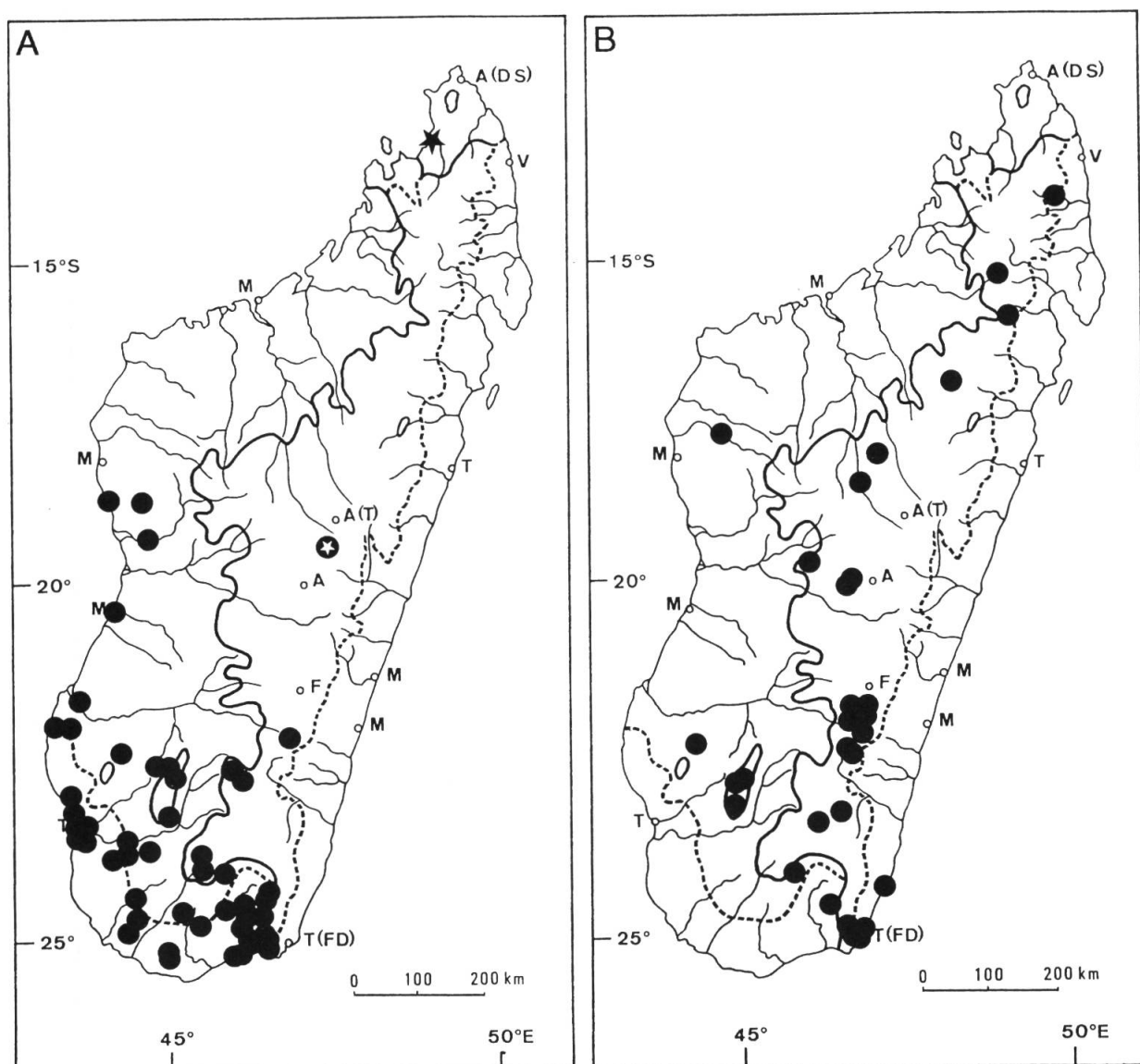


Fig. 30. – Distribution maps of *Pentopetia* and *Ischnolepis*. – A, *P. grevei* (Baill.) Venter (●), *P. glaberrima* Choux (★), *P. dolichopodia* Klack. (⊙); B, *I. graminifolia* (Costantin & Gallaud) Klack. (●).

variation in size of floral parts. The lobes in the northern part of the distributional area are usually longer than 1 cm and narrowly elliptic, the ones to the south are shorter and narrowly elliptic to often elliptic. It has verrucose seeds, a character which is not present elsewhere in *Pentopetia*.

Additional specimens studied. – **MADAGASCAR:** *Alluaud 44*, Bekitro, 1900 (P); *Alluaud 59*, Behara, 1900 (P); *Bernardi 11204*, de Ihosy, 47-49 km ad viam ad Ivohibe, 650-700 m alt., 1967 (G, K, P); *Bosser 10291*, Ambovombe, 1956 (P); *Bosser 15833*, Imonty, bassin de la Mananara, affl. du Mandrare, 1962 (P); *Brooks 1*, prov. Toliara, Beza Mahafaly Special Reserve, 1984 (K, P); *Cloisel 16*, Tôlanaro (BM); *Croat 30987*, 8-16 km E of Toliara on road to Antananarivo, ca 50 m alt., 1975 (MO); *Croat 31292*, prov. Toliara, vicinity of Ejeda, 240 m alt., 1975 (MO, P); *Croat 32077*, prov. Toliara, along route 13 between Beraketa and Isoanala, 250-660 m alt., 1975 (MO); *Decary 2675*, Ambovombe, 1924 (P); *Decary 3153*, distr. Ambovombe, Behara, 1924 (P, S); *Decary 3208*, distr. Ambovombe, Ampasimpolaka, 1924 (P); *Decary 3808*, distr. Ambovombe, 1925 (P); *Decary 4658*, prov. Tôlanaro, massif du Vohitsiombe, 1926 (P); *Decary 8529*, Ambovombe, 1931 (MO, P); *Decary 8894*, vallée de l'Ikonda au N d' Ambovombe, 1931 (P); *Decary 9325*, limite Nord-Est de l'Androy, Fangedratry (Fangidraty), 1931 (P); *Decary 10537*, distr. Tôlanaro, Ranopiso, 1932 (G, P); *Decary 10679*, distr. Tôlanaro, Andrahomana, 1932 (P); *Decary 10714*, distr. Tôlanaro, Sambovana, 1932 (P); *Decary 18796*, vallée du Manombo, 1943 (P); *Decary s.n.*, Beloha, 1917 (P); *Dequaire 27370*, s.loc. (P); *Du Puy & al. MB464*, prov. Toliara, ca 27 km south of Androvo on Route Nationale 10 to Betioky, ca 800 m alt., 1989 (P); *Exp. col. Marseille s.n.*, vallée de l'Isoanala (P); *Geay 599*, Ankazoabo (P); *Geay 4788, 4788bis*, plaines du Fiherana, 1904 (P); *Geay 6019*, collines de Sakamare (P); *Grandidier s.n.*, Toliara, 1868-1869 (P); *Grandidier s.n.*, de Morombe à Morandava, fév. 1868 (P); *Grandidier s.n.*, pays des Antanosse à forêt de Lavanala, oct. 1869 (P); *Grevé 88*, Morondava (P); *Humbert 3027*, vallée de la Menarahaka, bassin du Mananara, 700-800 m alt., 1924 (G, P); *Humbert 4896*, env. d'Ihosy, 850-1000 m alt., 1928 (P); *Humbert 11268*, forêt de Besomaty entre le Fiherenana et l'Isahena (Mangoky), 750-800 m alt., 1933 (P); *Humbert & Capuron 29473*, plateau Mahafaly à l'ouest de Betioky, 100-300 m, 1955 (P); *Humbert & Perrier de la Bâthie 2386*, Morandava, 2-5 m, 1924 (P); *Humbert & Swingle 5189*, env. de Toliara, delta du Fiherenana, 1-10 m alt., 1928 (P); *Humbert & Swingle 5556*, env. d'Ampanihy, 200-300 m alt., 1928 (P); *Humbert & Swingle 5644*, bassin inférieur du Mandrare, env. de Behara, 20-100 m alt., 1928 (G, K, P, WAG); *Jongkind & al. 3352*, prov. Mahajanga, near Bekopaka, 50 m alt., 1996 (P); *Lam & Meeuse 5437*, Z.W. van Ifotaka, 100 m, 1938 (P, WAG); *Léandri & Ratoto Jean de Dieu 3725*, env. de Toliara, chemin au sud vers Anantsona (Saint-Augustin), 1960 (P); *Léandri & Saboureau 3907*, massif de l'Isalo, Bekijoly, 1000-1300 m alt., 1960 (P); *Liede & al. 2677*, prov. Toliara, Ampanihy to Androka, 40 km SW of Ampanihy, 150 m alt., 1990 (MO, P); *Malcomber 1129*, prov. Toliara, R.N. 11, Andohahela, NE of Amboasary, near Hazofotsy, 100 m alt., 1991 (G, K, P, WAG); *Malcomber 2645*, NW of Tôlanaro, Andohahela Réserve Intégrale, 30 m alt., 1993 (P, S); *Methuen s.n.*, Tongobory, 1911 (K); *Morat 2445*, Bezaha, Tongobory, 1967 (P); *Morat 2964*, Ankazoabo, piste de Berenty à Ilemby, 1968 (P); *O'Connor 37, 86*, Madagascar (K); *Perrier de la Bâthie 11598*, env. de Maintirano près de Soahanina, 1914 (P); *Perrier de la Bâthie 11599, 11600*, env. de Toliara, 1910 (P); *Perrier de la Bâthie 11601*, entre Fiherena et le Manombo, 1910 (P); *Perrier de la Bâthie 11603*, bassin du Fiherenana, 1910 (P); *Perrier de la Bâthie 11604*, bassin entre du Menandra-Linta-Fiherenana (P); *Perrier de la Bâthie 11692*, entre Betioky et Tongay, 600 m alt., 1919 (P); *Perrier de la Bâthie 12856*, Bas-Mangoky, 1919 (P); *Phillipson 1669*, prov. Toliara, Beza Mahafaly Reserve near Betioky, 1987 (K, MO, P, WAG); *Phillipson 2336*, prov. Toliara, 10 km NW of Amboasary, Berenty Reserve, Malaza Forest, 30 m alt., 1987 (G, K, P, S, WAG); *Phillipson 2382*, prov. Toliara, Beza Mahafaly reserve near Betioky, 1987 (K, MO, P); *Poisson 283*, prov. Toliara, Befanamy, 1921 (P); *Poisson 473*, prov. Toliara, entre Ejeda et ?Andravotsy, 1922 (P); *Randriamanantena & Durbin 41*, prov. Toliara, région de la R.N. 11 Andohahela, Esomony, 70 km NW de Tôlanaro, à la côté W de la réserve, 1991 (MO); *Réserves Naturelles: RN-5868 Rakoto*, distr. Ivohibe, R.N. 5, 1953 (P); *RN-7809 Randriambelo*, distr. Antsalova, Ampomonambe, 1955 (P); *Richey 5*, env. de Toliara (P); *Roussel 32*, Mts of Androy, 1912 (K); *Schlieben 8212*, Ranohira, 800 m alt., 1959 (G, K, P); *Service Forestier: SF-338 Capuron*, entre Bekitro et Antanimora, 1949 (P); *Seyrig 86*, env. d'Ampandrandava (P); *Stuart s.n.*, Raymonde Estate, near Tôlanaro, 1911 (K); *Sussman 229*, prov. Toliara, 40 km NE of Betioky, near Analafaly, 1987 (MO); *Sussman 303*, Toliara, 40 km NE of Betioky, along road between Parcel 1 of the Beza Mahafaly Reserve and the village Analafaly, 1987 (MO); *Turnour 1*, prov. Toliara, Fenoarivo, lower Onilahy River, 1985 (K, P); *Turnour 2*, prov. Toliara, Tongobory, 1985 (K, MO, P); *Turnour 8*, prov. Toliara, Maroamalona, lower Onilahy River, 1986 (K, MO, P); *Turnour 10*, prov. Toliara, Antongo, lower Mangoky river, 1986 (MO); *Turnour 15*, prov. Toliara, Morombe, Befasy, 1986 (MO); *Turnour 29*, prov. Toliara, Miary, 1986 (K, MO, P); *Turnour 61*, prov. Toliara, Manombolo river, 1986 (K, P); *Turnour 62*, prov. Toliara, Tanandava, Mangoky river, 1986 (MO, WAG); *Turnour 63*, prov. Toliara, Tanandava, Mangoky River, 1986 (K, MO, P, WAG); *Willing 2*, prov. Toliara, 2 km S of Tsimilofo on Beloha Road, 1985 (MO);

20. *Pentopetia dolichopodia* Klack., spec. nova (Figs. 30.A (map), 31).

Type: MADAGASCAR, Manjakatampo, E. Ankaratra, 25 Déc. 1948, *Service Forestier SF-35 Capuron* (holo-, P).

Species haec a speciebus omnibus Periplocoideis madagascariensibus lobis coronae latis vel brevibus ad orem tubi corollae insertis differt. Gerulus pollinis peltatus cum stipite atque corpusculo viscido simillimo necnon complanato et grandi.

Liana with younger branches finely hairy. Leaf blade elliptic to usually obovate, 5.0-6.0 × 2.0-3.5 cm, cuneate at base, rounded to apiculate or shortly acuminate, glabrous on both sides except for the sparsely hairy major veins below; venation looped with tertiary veins reticulate,

although only faintly visible when dry; midrib and secondary veins slightly raised below when dry, \pm even or with midrib slightly impressed near the base above; epidermis \pm smooth on both sides; petiole distinct, 3-5 mm long, pubescent.

Inflorescences axillary, much shorter than the subtending leaves, ca 1-1.5 cm long; cyme irregularly branched with internodes up to 3 mm long or much shorter, 3 to 5-flowered, finely hairy; pedicels ca 3 mm long, finely hairy; bracts narrow, up to 1.5 mm long, finely hairy.

Calyx lobes ovate to broadly ovate, $2.0-2.4 \times 1.3-1.7$ mm, acute at the apex, shorter than the corolla tube, straight, finely hairy outside. Corolla not twisted in bud, fused for ca 1/3 of their length into a tube, glabrous, purple inside, white to reddish or yellowish green outside; tube ca 3.0 mm long, with distinct ridges below the anther filaments, which unite into 5 thick bifid recurved alternistaminal nectar lobes near the base that stand closely together forming a ring above the ovary; lobes elliptic to oblong, ca 6.0×3.5 mm, acute at apex, erecto-patent. Corona lobes shorter than broad, 0.5-0.7 mm high, dentately truncate, dorsiventrally compressed, straight, much shorter than the staminal cone. Staminal cone 1.4 mm high, distinctly exserted, entirely glabrous; filaments ca 0.3 mm long, filiform, curved, inserted at the mouth of the corolla tube and at the bases of the corona lobes; anthers ca 1.4 mm long with distinctly projecting flat connectives. Translators ca 1.5 mm long; spoon rounded, ca 0.5 mm long, peltately inserted on a broad stipe which is indistinctly separated from a large, flat, spatulate adhesive disc ca 1.0 mm long. Styles ca 0.9 mm long, glabrous; style head ?globular.

Fruits not seen.

Distribution and habitat. – *Pentopetia dolichopodia* is hitherto known only from Manjakatempo in the eastern foot-hills of the Ankaratra Mountains in Central Madagascar, collected between 1640-1740 m altitude.

Flowering specimens seen from December and January.

Note. – *Pentopetia dolichopodia* is recognized by the unique combination of reddish-purple flowers, exserted stamens, fleshy, shorter than broad corona lobes, and distinct alternistaminal nectar lobes near the base of the corolla tube.

All known genera of *Periplocoideae* in Madagascar possess either free and filiform corona lobes, e.g. *Cryptostegia* R. Br., *Ischnolepis* and *Pentopetia*, or corona lobes fused into an annular ring, e.g. *Baroniella* Costantin & Gallaud (including *Baseonema* Schltr. & Rendle), *Camptocarpus* Decne. (including *Harpanema* Decne., *Symphytonema* Schltr. and *Tanulepis* Balf. f. ex Baker). *Pentopetia dolichopodia*, however, has flowers with five broad but free corona lobes of corolline origin near the sinuses of the corolla lobes. The staminal filaments and corona lobes are fused at their bases, and inserted at the mouth of the corolla tube, i.e. similar to what is found in e.g. the *P. cotoneaster* group. A second circle of five smaller bifid lobes inserted near the base of the corolla tube are also present (alternistaminal nectar lobes). They are close together forming a ring around the style hiding the ovary, a structure seen distinctly also in *P. bosseri*. The stipe and the adhesive disc of the translators are fused together into one flat and large basal part which protrudes well below the bases of the thecae. This is similar to what is found in *P. grevei*, where this feature is even more conspicuous. The spoon is furthermore discoid and peltate, a unique character that separates *P. dolichopodia* from other periplocoid species.

In asclepiad taxonomy much emphasis has been given to corona morphology. *Pentopetia dolichopodia* has broad and truncate or rounded corona lobes, a feature not found in other taxa in Madagascar, but which is characteristic of *Baeolepis* Decne. ex Moq. and *Gymnanthera* R. Br. in Asia and Australia. *Pentopetia dolichopodia* differs from *Baeolepis* and *Gymnanthera*, however, in other characters, notably by the morphology of the translator and by lacking the alternistaminal nectar lobes, and there is probably no close affinity of these genera.

The Asian *Hemidesmus* shares with *P. dolichopodia* alternistaminal nectar lobes that hide the ovary as well as a translator with cup-shaped spoon. However, this spoon, although seemingly peltate (KUNZE, 1993: 103, Fig. 2), differs in fact by being split on one side all the way to the stipe, and thus is not truly peltate. *Hemidesmus* also differs in several other characters, e.g.

by having the pollen grains agglutinated into four pollinia, while *P. dolichopodia* has pollen tetrads (rhomboidal and decussate), and thus it is probable that there is no close affinity between these taxa.

With the circumscription of *Pentopetia* given in this revision, *P. dolichopodia* is best placed in this genus. The double circles of corona lobes, i.e. distinctly recurved alternistaminal nectar lobes are also present in *P. bosseri* and *P. mollis*, and to some extent also in *P. grevei* and *P. longipetala*. The staminal filaments and the corona lobes located together at the corolla lobe sinuses are characteristic for *P. albicans*, *P. boivinii*, *P. calycina*, *P. cotoneaster*, *P. lutea*, *P. ovalifolia* and *P. pinnata*. *Pentopetia dolichopodia*, however, differs from these taxa by having a short corolla tube, anther filaments and style. A long and broad translator stipe is present also in *P. grevei*, where it is even longer and distinctly exposed outside the anther column, usually also folded upwards. The peltate spoon of the translator, however, seems to be a unique character. Neither has the shape of the corona lobes, i.e. broad, short and with a usually dentate upper margin, been observed elsewhere. The corona lobes in *Pentopetia* are filiform, usually long but sometimes short, rarely rudimentary or missing. These two characters are considered to be autapomorphies for *P. dolichopodia*, but this is not considered to merit elevation of this species to generic rank, all the more as all other characters are similar to what is found in *Pentopetia*.

Paratype. – **MADAGASCAR**: Croat 28985, prov. Antananarivo, Station Forestière de Manjakat(i)ompo on Massif l'Ankaratra, W of Ambatolampy, along road to sommet Hosiarivo, elev. 1640-1740 m, 1975 (MO).

The species epithet alludes to the large stipe and viscidium of the translator.

[21.] *Pentopetia glaberrima* Choux in Ann. Mus. Colon. Marseille ser. 3, 2: 235. 1914 (Fig. 30.A (map)).

Type: **MADAGASCAR**, vallée d'Ambomalandy, 1909, *Perrier de la Bâthie* 11718 (holo-, P; iso-, P).

Twinner. Leaves ovate, acute to acuminate, 2.7-4 × 1.2-1.6 cm, glabrous; petiole 4-6 mm long. Pedicels 8-12 mm long. Calyx lobes triangular, 3.8-4.5 × 1 mm, acute. Corolla lobes oblong, 7-7.5 × 2-2.5 mm, obtuse, at base (1.5 mm) coalescent; corona lobes shorter, 3 mm long. Stamens entirely glabrous; filaments 1-1.2 mm long; connective prolonged, triangular, acute. Style head conical.

Note. – The type specimen contains at present only leaves and flowers with persistent calyx. In Choux's protologue, however, the corolla and gynostegium are also described. Combining the protologue and the incomplete type specimen give a picture of a species not described elsewhere. No other material fit into this taxon. The description above is from CHOUX (1914: 235) (translation from Latin).

2. *ISCHNOLEPIS* Jum. & H. Perrier in Rev. Gén. Bot. 21: 53. 1909.

Type: *Ischnolepis tuberosa* Jum. & H. Perrier (= *Ischnolepis graminifolia* (Costantin & Gallaud) Klack.).

Ischnolepis graminifolia (Costantin & Gallaud) Klack., **comb. nov.** (Figs. 30.B (map), 32).

= *Pentopetia graminifolia* Costantin & Gallaud in Bull. Mus. Hist. Nat. (Paris) 13: 443. 1907; Costantin & Gallaud in Ann. Sci. Nat. Bot. ser. 9, 6: 341. 1908.

Type: **MADAGASCAR**, Horombe, Ibara, Imerina, 1880, *Deans Cowan s.n.* (holo-, P; iso-, BM).

= *Ischnolepis tuberosa* Jum. & H. Perrier in Rev. Gén. Bot. 21: 54. 1909. – **Type**: **MADAGASCAR**, Masakoamena, Haut-Bemarivo, ca 500 m alt., *Perrier de la Bâthie* 8982 (holo-, P).

Shrub up to 2 m high with whorled leaves; branches rather few, reddish purple when young, with a flaking waxy surface when older, glabrous. Leaves seemingly verticillate but actually stems with leafy areas of several very short internodes alternating with leafless elongated internodes, sometimes decussate; blade linear and often falciform, 10-25 cm \times 1-5 mm, tapering at the base into an indistinct petiole, acute to subulate at the apex, glabrous; venation with midrib visible only; midrib impressed above, raised in the centre of a wider channel when dry; petiole ca 1 mm long, glabrous.

Inflorescences axillary, shorter than the adjacent leaves, 3-15 cm long; cyme monochasially branched with alternating longer and shorter internodes, 1-7-flowered; pedicels 5-15 mm long, glabrous; bracts narrow, 2-7 mm long.

Calyx lobes triangular to broadly ovate, 2.0-3.4 \times 1.1-2.1 mm, acute, about as long as to slightly longer than the corolla tube, glabrous, with 2 conspicuous colleters at each sinus. Corolla contorted with the right lobe margins overlapping, not or slightly twisted in bud, with the lobes fused for 1/5 – 1/10 of their length into a tube, pendent in bud, glabrous, green to yellowish with a usually star-shaped reddish purple centre; tube 1.2-2.5 mm long, with five short and broad 3-ridged flat alternistaminal nectar lobes just below the staminal filaments; lobes ovate, 7.4-11.8 \times 2.8-4.8 mm, acute but rounded at the very apex, probably erecto-patent. Corona lobes inserted in the corolla tube some distance from but near the sinuses of the corolla lobes, 2.7-5.0 mm high, filiform, \pm straight, broadened at the very base and with 2 lines running towards the corolla lobe bases, about as long as to usually longer than the staminal cone, yellow to brownish violet, glabrous. Staminal cone 2.2-2.7 mm high, exserted, entirely glabrous; filaments 0.3-0.5 mm, filiform, straight, inserted just below the corona lobes; anthers 1.7-2.4 mm, with distinct and narrow up to 0.7 mm long protruding connectives. Translators 0.9-1.3 mm long located in 5 cavities on the style head; spoon elliptic, 0.7-1.0 mm long, tapering at the base into an indistinct stipe; midline of the spoon dorsally distinctly channeled, on the pollen side with a ridge; adhesive disc as two broad wings on the short stipe and narrowing at the base into a beak. Style distinct, 0.5-1.0 mm long; style including style head 1.4-1.8 mm long; style head conical and with 5 broad knobs at the base, not protruding above the translators.

Follicles 7-16 \times 0.4 cm, usually paired, straight and linear with slightly sinuate margins, acuminate, thin-walled with mesocarp 0.1-0.3 mm thick, recurved 45-90° at base, glabrous; placenta with narrow smooth ridges. Seeds 5-8 mm long, smooth; hairs 1-1.5 cm long.

Distribution and habitat. – *Ischnolepis graminifolia* has been found in all phytogeographical domains of Madagascar except Sambirano. It is most frequent in the central plateau at about 1000 m altitude but grows from sea level up to 2000 m. It is usually found in savannah, grassland or on almost bare granitic, gneissic or sandstone rocks.

Flowering specimens seen from February to December.

Note. – *Ischnolepis graminifolia* is unmistakable with its straight upright reddish branches with whorled grass-like leaves.

Ischnolepis was first described as *Pentopetia graminifolia* by COSTANTIN & GALLAUD (1908), who stated that the flower morphology is similar to that of other species of *Pentopetia*. However, JUMELLE & PERRIER DE LA BATHIE (1909: 53) correctly stated in their protologue of *I. tuberosum*, which was described independently of *P. graminifolia*, that *Ischnolepis* differs considerably from *Pentopetia*. It is an erect shrub with underground tubers, which sometimes can weigh ca 100 kg in one individual (JUMELLE & PERRIER DE LA BATHIE, 1909: 52), in contrast to the twining habit of *Pentopetia* with no tubers reported. It is also unique in its linear and whorled leaves, which furthermore have stomata also on the adaxial side. The corona is located in the corolla tube some distance below the sinuses, not directly below the sinuses, which is the position found in *Pentopetia*. Pollen is produced along the whole of the thecae. In *Pentopetia* the basal parts of the thecae are sterile. The translators consist of a large spoon narrowing into a very short stipe, and the spoon has a distinctly impressed midline, both characters seen also in *Pentopetia*. The adhesive disc, however, consists of two broad wings on the short

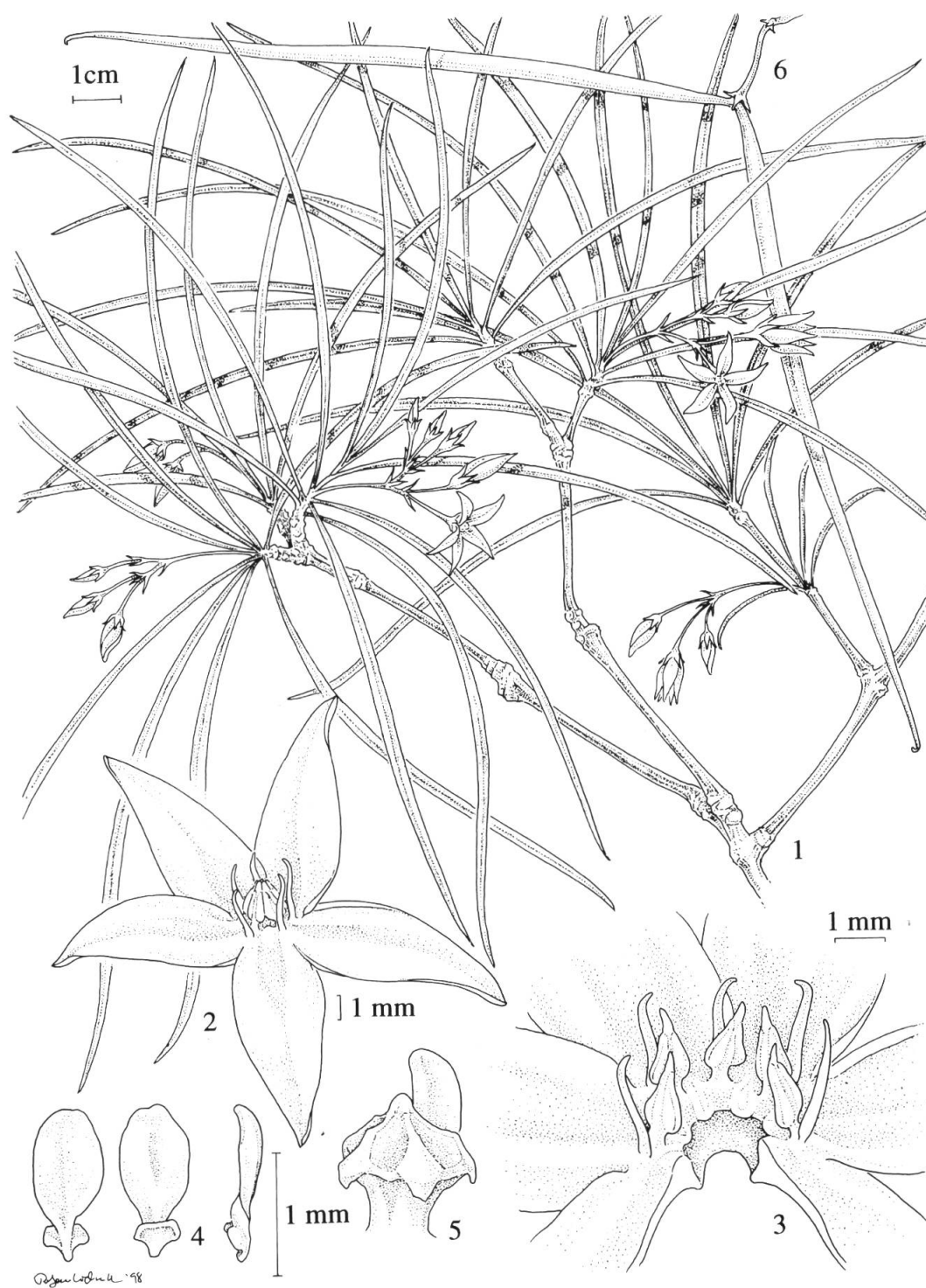


Fig. 32. – *Ischnolepis graminifolia* (Costantin & Gallaud) Klack. – 1, Habit; 2, Flower; 3, Central part of flower from within with gynoeceum removed; 4, Translators; 5, Style and style head with one translator in situ; 6, Follicles. – [1, Leeuwenberg & Rapanarivo 14618; 2-5, Werff & McPherson 13561; 6, Morat 83].

stipe narrowing at base into a beak. This type of adhesive disc has not been observed in *Pentopetia* or *Cryptolepis*. In addition, *Ischnolepis* has pollen grains ca 75 µm large, distinctly larger than any hitherto examined *Pentopetia* (VERHOEVEN & VENTER, 1994: 307). I agree with JUMELLE & PERRIER DE LA BATHIE (1909: 53) that the morphological distinctness of this taxon merits generic rank.

Additional specimens studied. – **MADAGASCAR:** *Allorge & Veyret 613*, Massif de l'Isalo, 1992 (P); *Boiteau 6163*, Bongolava, 1943 (P); *Bosser 16726*, env. de Mandritsara, 1962 (P); *Bosser 17286, 17901*, env. de Betroka, 1963 (P); *Bosser 18195*, 100 km avant Miandrivazo, 1963 (P); *Catat 222*, Ankadivavala, 1889 (P); *Cours 3943*, cant. Antsakabary, Ambalavay, 550 m alt., 1951 (P); *Decary 2348, 2350*, env. de Morafenobe, 1923 (P); *Decary 4102*, Tôlanaro, 1926 (P); *Decary 5494*, Pic d'Ivohibe, ca 1000 m alt., 1926 (P); *Decary 7573*, vallée de l'Ikopa au nord ouest d'Ankazobe, 1930 (G, P); *Decary 9828, 10002, 10228, 10273*, Toliara, 1932 (P); *Decary 10516*, Amboasaritelo, 1932 (MO, P); *Decary 10641*, distr. Tôlanaro, vallée de la Fanjahira(na), 1932 (BM, P); *Decary 14123*, Tôlanaro, 1939 (P); *Decary 15086, 15919*, Ambalavao, 1939 (P); *Decary 16268*, prov. Toliara, Ankazoabo, 1940 (P); *Descoings 3619*, près Ambalavao, km 500, 1958 (P); *Descoings 3787*, Iankora, Ihosy, 1958 (P); *Dorr 4177*, prov. Fianarantsoa, Isalo, Route Nationale 7, ca 10 km SW of Ranohira (MO, P, WAG); *Du Puy, Labat & Andriantiana M656*, prov. Fianarantsoa, Itremo Massif West of Ambositra, near Col d'Itremo, 1620 m, 1993 (P); *Fosberg 52586*, 3 km SE of Mandromodromotra, 30-100 m alt., 1970 (MO); *Jacquemin H360J*, Isalo, est du plateau de Korobe, 1967 (P); *Humbert 2911*, plateau et vallées de l'Isalo, 400-1000 m, 1924 (G, P); *Humbert 3058*, chaîne du Vohibory, à l'ouest d'Ivohibe, 1000-1300 m, 1924 (P); *Humbert 11610*, Centre-Sud, Mt Vohipolaka au N de Betroka, à la base NW de la montagne, ca 950 m, 1933 (P); *Humbert 13413*, vallée de la Sakamalia, affluent de la Manambolo, bassin du Mandrare, 900-1100 m, 1933 (P); *Humbert 20429*, env. de Manantenina, côte sud-est, 5-20 m, 1947 (P); *Humbert & Capuron 24017*, vallée inférieure de l'Androranga, affluent de la Bemarivo aux env. d'Antongodriha, Mt Anjenabe, 1950 (P); *Humbert & Swingle 4943*, vallée d'Ihosy, bassin du Mangoky, 850-1000 m (P); *Humbert & Swingle 5011*, plateaux de l'Isalo à l'ouest de Ranohira, 800-1000 m, 1928 (BM, G, P); *Humbert & Swingle 5749*, env. de Tôlanaro, forêt de Manantantely, 60-300 m, 1928 (P); *Keraudren-Aymonin & Aymonin 24629*, 10 km au sud d'Ambalavao, 1970 (P); *Keraudren-Aymonin & Aymonin 24650*, Isalo, bord de route, 1970 (P); *Keraudren-Aymonin & Aymonin 25000*, aux env. de Tôlanaro, 1970 (P); *Leeuwenberg & Rapanarivo 14618*, Fianarantsoa, S of km 11 Ranohira-Sakara, 900 m alt., 1995 (P, WAG); *Leeuwenberg & Rapanarivo 14667*, prov. Mahajanga, 17 km S of Mahatsinjo, along Route Nationale 4, 1490 m alt., 1996 (S, WAG); *LeMignon 5347*, Befandriana, Nord Ampotaka, 1942 (P); *Lewis & al. 545*, prov. Toliara, W of Isalo Nat. Park, 10 km W of Ranohira, ca 700 m alt., 1993 (P); *Malcomber 1168* (K); *Miège 91M*, dôme granitique 13 km d'Ambalavao, 1970 (G); *Miège 191M*, prov. Tôlanaro, Mandena, 1970 (G); *Morat 83*, 100 km de Miandrivazo, 1963 (P); *Peltier, J. & M. 2479*, Ilakaka, Isalo, 1960 (P); *Perrier de la Bathie 8982*, Masakoamena, Haut-Bemarivo, ca 500 m alt. (P); *Perrier de la Bathie 11733*, vallée d'Ihosy, Bassin Mangoky, 1911 (P); *Perrier de la Bathie 11755*, Isalo, bassin de l'Onilahy, ca 600 m, 1910 (P); *Perrier de la Bathie 12522*, env. de Midongy de l'ouest, ca 900 m, 1919 (P); *Perrier de la Bathie 15077*, env. d'Antsakabary, haute Sofia, 600 m alt., 1922 (P); *Perrier de la Bathie s.n.*, Massif d'Andringitra, 4.1921 (P); *Perrier de la Bathie s.n.*, N.O. Madagascar (P); *Phillipson, Elisette & Randrianasolo 4042*, Fianarantsoa, Itremo massif, on Route Nationale 35, 10.7 km W of Ambatofinandrahana, 1150 m alt., 1992 (S); *Réserves Naturelles: RN-3524 Razafindrakoto*, distr. Ivohibe, cant. Antambohobe, R.N. 5, 1951 (P); *RN-4867, RN-6571*, distr. Ambalavao, cant. Vohitsaoka, R.N. 5, 1952-1954 (P); *RN-6766 Rakotoson*, Tôlanaro, 1954 (P); *RN-8085*, distr. Ambalavao, cant. Antambohobe, 1956 (P); *RN-11668 Rakotoson*, distr. Ambalavao, cant. Vohitsaoka, 1961 (P); *Scott-Elliott 3083*, Tôlanaro (P); *Service Forestier: SF-21049*, distr. Ambalavao, cant. Fenoarivo Sud, Vohitromby, 700 m, 1962 (P); *Seyrig 152*, env. d'Ampandrandava, entre Bekily et Tsirovory, 1000-1100 m, 1942 (P); *van der Werff & McPherson 13561*, prov. Antananarivo, massif d'Itremo, W of Ambositra, 1500 m, 1994 (S).

Excluded taxa

Pentopetia linearifolia Choux in Ann. Mus. Colon. Marseille ser 3, 2: 238. 1914 [= *Secamone geayi* Costantin & Gallaud]

Pentopetia natalensis Schltr. in J. Bot. 32: 257. 1894 [= *Petopentia natalensis* (Schltr.) Bullock].

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