REVISION OF THE GENUS MEDIOCALCAR (ORCHIDACEAE)

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(Drawings by the author)

SUMMARY

The genus *Mediocalcar* is revised. Fifteen species and five subspecies are recognized, of which the following are new: *Mediocalcar congestum* Schuit., *M. umboiense* Schuit., *M. versteegii* J.J. Smith subsp. *amphigeneum* Schuit., *M. versteegii* J.J. Smith subsp. *intermedium* Schuit. and *M. versteegii* J.J. Smith subsp. *vulcanicum* Schuit. All species are illustrated by line drawings, several also with colour plates. Aspects of the ecology, biogeography, morphology and systematics of *Mediocalcar* are discussed.

INTRODUCTION

Mediocalcar is a distinctive genus of small-flowered, colourful orchids, distributed from Sulawesi to Samoa, but occurring predominantly in the mountains of New Guinea.

The first species of *Mediocalcar* to enter botanical literature was discovered by Reinecke in Samoa in 1896 and described by Kraenzlin in 1899, as *Eria paradoxa,* now known as *Mediocalcar paradoxum* (Kraenzl.) Schltr. For this species Kraenzlin proposed a new section of *Eria*, which he rather inaptly named *Lycastiformes*, and in which he also included his *Eria ornithidioides* ('*ornithoides*'). The latter is now considered a synonym of *Epiblastus sciadanthus* (F. Muell.) Schltr.

J.J. Smith was apparently unaware of this in 1900, when he established the genus *Mediocalcar*. The only species he knew at that time, *Mediocalcar bicolor*, was based on one of his own collections from the island of Ambon in the Moluccas.

Only three other collections of *Mediocalcar* appear to have been made during the 19th century; two by Morrison from the New Hebrides, in 1896, and one by Lawes, in 1884, from eastern New Guinea. The latter, on which *M. lawesii* Schltr. (1911) was based, may well be the earliest material of *Mediocalcar* ever collected; it is probably no longer extant.

In 1903 Smith reduced *Mediocalcar* to *Cryptochilus* Wall., a genus from mainland Asia with superficially similar flowers. He also gave an improved description as well as a useful illustration of what was now called *Cryptochilus bicolor* (J.J. Smith) J.J. Smith. Kraenzlin (1911: 30) remarked that this illustration showed a plant that could hardly be distinguished from *Eria paradoxa*.

In 1905 Schlechter identified one of his own collections from Kaiser-Wilhelmsland as *Mediocalcar bicolor*. This was the first published record from New Guinea, which soon turned out to be the centre of diversity of the genus. Schlechter stated that in his opinion *Mediocalcar* and *Cryptochilus* ('*Cryptoglottis*') are two quite distinct genera. This remark may well have influenced Smith, who in 1908 published a new species, *Mediocalcar versteegii*, from New Guinea, without commenting upon his changed position regarding *Cryptochilus*.

Kraenzlin never recognized *Mediocalcar* as a genus in its own right. In 1911 the second part of his much criticized monograph of the Dendrobiinae appeared, containing among others a revision of *Eria*. Kraenzlin united the few species of *Mediocalcar* and *Epiblastus* known by then in a 'new' section of *Eria*, which he called *Ornithidiiformes*. Although the name is more appropriate, this section contains the type species of his own, earlier, *Lycastiformes*, which is not mentioned in the monograph. Kraenzlin's arguments were effectively refuted by Schlechter (1922: 67); no later botanist has ever questioned the validity of *Mediocalcar*.

Between 1900 and 1989, 52 species and 4 varieties (one of which was later raised to species level) have been described in *Mediocalcar*, most by Schlechter (21 species, 2 varieties) and Smith (19 species, 2 varieties), the majority from New Guinea. Rogers and Ames both contributed a single species, Ridley, Gilli, and Schuiteman described two species each, while Van Royen added four species from the high mountains of New Guinea. In the present revision 15 species are recognized, two of which are newly described, as well as 5 subspecies (not counting autonyms), three of which are also newly described, the others being based on former species. In all, *Mediocalcar* now comprises 20 taxa. Many names have been reduced to synonymy.

The reasons for this reduction are similar to those described by Reeve and Woods (1989: 164) for *Dendrobium* section *Oxyglossum*. Early authors often had only a limited amount of material at their disposal and thus were not able to judge the variability of these plants. Moreover, they were inclined to attach too much value to certain details of floral morphology, at the same time neglecting important vegetative characters. Some authors also seemed to assume *a priori* that mountain orchids in New Guinea are of very limited distribution. On this assumption they frequently published 'new' species without comparing them adequately with others already described from distant localities. It is now known that many mountain orchids in New Guinea are quite widespread.

The present revision should make it possible to properly identify most of the specimens of *Mediocalcar* encountered. It must be stressed, however, that some species, in particular *M. versteegii* and *M. paradoxum*, show a confusing variability, as if reflecting the complicated topography of their habitats. Extensive field studies are required to decide whether or not it is possible and desirable to give formal recognition to some of the more outstanding populations.

Several areas within the range of *Mediocalcar* are as yet poorly explored botanically, especially in Irian Jaya and the Bismarck Archipelago. It is quite likely that a few species of *Mediocalcar* still await discovery.

ACKNOWLEDGEMENTS

I am indebted to the directors and curators of the following institutions for the loan of dried or spirit material: AMES, B, BM, BO, CANB, E, G, HBG, K, L, LAE, P, PNH, S, SING, U. The Rijksherbarium, Leiden, provided working space and facilities, and I thank its successive directors Prof. C. Kalkman and Prof. P. Baas for their hospitality.

Dr. E.F. de Vogel taught me the practices of herbarium taxonomy, and for his continuous support and advice I am very grateful indeed.

Living material of several species of *Mediocalcar* is in cultivation at the Hortus Botanicus, Leiden, under the care of Mr. A. Vogel and his assistants. Part of this material was grown from cuttings donated by the Royal Botanic Garden, Edinburgh.

The wish to produce this revision originated during a visit to Papua New Guinea in 1982, when I encountered several species of *Mediocalcar* in the wild and became 'hooked'. At the Wau Ecology Institute Dr. A. Allison was most cooperative and at Laiagam Mr. T.M. Reeve organized some nice trips and generously donated several specimens of *Mediocalcar* from the impressive Highland Orchid Collection. Mr. M. Galore, then director of the Lae herbarium, and Mr. F. Ginate, of the National Capital Botanic Garden, Port Moresby, also contributed to the success of my first visit to PNG.

Mrs. T. Mulder-Roelfsema and the late Dr. D. Mulder enabled me to visit *Mediocalcar*-territory again, when they invited me to join them on their trip to PNG in 1990. Grants from Leiden University and from the Rijksherbarium are also gratefully acknowledged.

In Lae Mr. K. Kerenga, then director of the Forest Research Institute, was most helpful, for which I am much obliged. Dr. H.F. Hopkins and her assistants at the University of Papua New Guinea helped to accommodate the living collections during my stay in Port Moresby.

Dr. J.F. Veldkamp kindly translated the diagnoses into Latin.

MATERIAL

This revision is based upon the examination of some 600 collections, most of these with several duplicates, from the following herbaria: AMES, B, BM, BO, CANB, E, G, HBG, K, L, LAE, P, PNH, S, SING, U. Several species could be studied in the field during two visits by the author to Papua New Guinea, in 1982 and 1990. In addition, living specimens under cultivation in the Leiden Botanical Garden were available. These belonged to the following species: *Mediocalcar agathodaemonis*, *M. arfakense*, *M. bifolium*, *M. decoratum*, *M. geniculatum*, *M. subteres*, *M. umboiense*, *M. uniflorum*, and *M. versteegii*. Wherever possible, the descriptions were drawn up from live and spirit material. Of some taxa, however, only dried specimens could be studied. Where relevant, this is mentioned in a note following the description. Dried flowers of *Mediocalcar* species, especially when strongly pressed, are usually distorted beyond recovery; therefore in a few cases no reliable drawings depicting certain floral details could be prepared.

MORPHOLOGY

Root — In all species of *Mediocalcar* the roots are slender, at most about 1 mm across, and more or less noticeably covered with an indumentum of short, persistent root-hairs. They branch and rebranch frequently, especially when the root tip is damaged. When young, the root is purplish with a yellowish green tip. The rhizodermis soon dies and takes on a brown colour. Roots develop from the rhizomatous part of the shoot, in particular the part just below the pseudobulb.

Rhizome — Growth in *Mediocalcar* is sympodial, each individual shoot consisting of 3–11 nodes, of which the apical one is more or less elongated and swollen to form a pseudobulb. The remaining non-swollen nodes constitute the rhizome. This is from 1–6 mm across and is covered with dead, imbricating scales. The rhizome usually branches by lateral shoots from the base of the pseudobulbs, but sometimes, especially in *M. pygmaeum*, branches may develop from the rhizomatous node below the pseudobulb. In *M. decoratum* the branching pattern exhibits a remarkable regularity, with branches or inflorescences on successive shoots alternating in direction; in most species, however, there appears to be no consistent pattern, although there is a tendency for branches of subsequent shoots to alternate in direction.

Cataphylls — Young shoots are covered with 3–11 imbricating scales that normally do not carry a leaf blade. These cataphylls increase in size to the top of the shoot and are short-lived. Mostly they largely wither away, but sometimes they tend to be more persistent, probably partly depending on the environment. In seedlings the first few scales do carry non-articulate leaf blades and occasionally shoots are seen on mature specimens that share this character. The cataphylls are smooth to more or less warty, e.g. in *M. geniculatum*. As these warts tend to disappear in dried specimens it is possible that some species of which only dried material was available have been incorrectly described here as having smooth cataphylls. The size and shape of the cataphylls are usually quite variable within a single species, but sometimes, as in *M. paradoxum* subsp. *latifolium*, they are rather characteristic for the taxon.

Pseudobulb — Surprisingly, some of the most useful diagnostic characters in this genus are found in the pseudobulbs. The latter vary in shape from semiglobose to thinly terete. They are usually heteroblastic, i.e. consisting of one node, but in some species with 2-leaved pseudobulbs, e.g. *M. geniculatum* and *M. stevenscoodei*, the uppermost leaf is carried by a rudimentary second node.

The phenomenon of bud displacement (Rasmussen, 1982, 1986) is readily apparent in several species. In these species the terminal renewal bud is situated well above the base of the pseudobulb, without a subtending cataphyll. This is very clear for instance in *M. bifolium* and *M. decoratum*, where the terminal shoot appears near the top of the pseudobulb. It was noticed during this study that there are two types of bud displacement in *Mediocalcar*. In the first and most frequent type, the vascular cylinder leading to the terminal bud is entirely embedded inside the pseudobulb. In the second type the vascular cylinder remains partly exposed; it is clasped, but not enveloped by the pseudobulb (see Fig. B on page 76). This distinction was found to be fairly reliable. There is only one taxon in which both types may occur in the same specimen, namely *M. pygmaeum*. When in the key and descriptions the phrases 'base of pseudobulbs elongated, enveloping the rhizome', respectively, 'base of pseudobulb elongated, clasping the rhizome like a saddle' are used, it should be understood that this only describes the visual appearance, not the actual anatomy of this structure. What is enveloped or clasped is not the rhizome, but the vascular cylinder leading to the displaced terminal innovation of that particular pseudobulb.

Bud displacement is usually not apparent in the first few pseudobulbs of a seedling (later forming the basal part of the sympodium), but becomes more pronounced later on. The degree of displacement is related to the length of what is usually called the 'free top of the pseudobulb'. With the latter expression, also used in this revision, that part of the pseudobulb is indicated which extends above the terminal renewal bud. Both the relative and the absolute length of the free top may increase or decrease on subsequent mature shoots, without any apparent pattern. The relative length is hardly a reliable character, the absolute length is sometimes useful for identification purposes.

Leaf — The leaves are always more or less rigid; they are normally inserted on the top of the pseudobulb, without a sheathing base. The number of leaves per pseudobulb varies from 1 to 4, with up to 6 leaves sometimes seen on shoots of *M. decoratum*. It appears to be a reliable character in most species, e.g. in *M. geniculatum* and *M. uniflorum*; in some, however, this is not the case. For example, in *M. bifolium*, *M. crenulatum* and *M. versteegii* subsp. *intermedium* both 1- and 2-leaved pseudobulbs may occur with various frequencies.

The range of variation found in the shape of the leaves is considerable. Most frequently the leaves are lanceolate, but almost every simple shape from narrowly linear to suborbicular is encountered. In *M. subteres* the leaves are subterete, the other species have dorso-ventrally flattened leaves, sometimes semi-terete (i.e. upper surface flat, lower surface convex) in *M. bifolium* when growing in exposed places. The leaf shape may vary extensively in some species.

The leaf tips are usually minutely bilobed, with a mucro formed by the prolonged midrib between the lobes. Although sometimes rather characteristic, the exact shape of the leaf tip was found not to be very useful, being prone to variation seemingly uncorrelated with other characters. An inconspicuous but important character is found in the leaf margins. In most species these are entire and quite smooth, but in *M. geniculatum*, *M. crenulatum*, *M. stevenscoodei* and *M. pygmaeum*, the leaf margins are minutely crenulate and rough, especially near the tip.

The leaves usually taper towards the base. In some taxa there is a distinct petiole-like constriction of the leaf-base, e.g. in *M. geniculatum* and *M. paradoxum* subsp. *latifolium*.

Mostly the leaves are uniformly green, even when specimens are growing in exposed positions. *Mediocalcar geniculatum* and *M. uniflorum* typically have purplish leaf margins, apparently largely independent of light intensity. In *M. decoratum* the leaves may develop a purple tinge when growing in strong light.

Inflorescence — The terminal inflorescences occur either solitary or in pairs; in the latter case the two flowers usually open simultaneously. The inflorescence is always one-flowered. The uninodal peduncle is terminated by a small cupular bract, one side of which, corresponding with the dorsal side of the flower, is often drawn out in a triangular to subulate lobe. In some species the inflorescences are always solitary, e.g. *M. uniflorum*, in others they always appear in pairs, e.g. *M. arfakense*, and in some species solitary as well as paired inflorescences may be observed.

Inflorescences may be synanthous, i.e. they are produced together with the developing leaves on normal shoots that form pseudobulbs, or heteranthous, i.e. they are produced on specialized shoots that do not carry leaves and do not form pseudobulbs [see also Orchid Monographs 3 (1988) 3]. Heteranthous inflorescences are known from several other orchid genera, e.g. *Dendrochilum* and *Coelogyne*. In these genera only one type of inflorescence may occur in a given species. In *Mediocalcar*, however, species exist that normally produce heteranthous as well as synanthous inflorescences on the same specimen, such as *M. bifolium*, *M. decoratum* and *M. versteegii*. As far as could be ascertained this is a unique feature of *Mediocalcar*.

Flower — Floral diversity is remarkably limited in *Mediocalcar*, to the extent that species which are clearly different vegetatively may be almost indistinguishable florally. In all species the sepals are connate to form an urceolate or vase-shaped tube, the petals are narrow and inconspicuous. The lip is broadly clawed and at most obscurely 3-lobed and not provided with crests or calli. At the base of the claw there are usually two small, concave, reflexed auricles, which appear to be nectaries. The blade of the lip is concave to strongly saccate at the base. This 'spur' does not contain nectar.

The column is fairly stout, subclavate to spathulate, with a large, mostly subquadrate or reniform stigma and two rather large, obtuse wings that are connected by the simple or emarginate, membranous rostellum. The column-foot is usually well-developed, but al

ways much shorter than the column itself. The clinandrium is deeply cupular, with the dorsal margins emarginate, often with a mucro formed by the connective of the anther, and sometimes irregularly dentate.

The anther is mostly more or less cordate in outline. There are eight laterally flattened pollinia, usually more or less deltoid in lateral view, all of equal size, that are attached to a sticky, membranous structure formed by the flattened and mutually connate caudicles. There is no viscidium, nor a stipe.

All parts of the flower are glabrous. Diagnostic characters are mainly found in the blade of the lip, the relative length and orientation of the spur and the overall shape of the sepaline tube. Characters such as the number of veins in the petals, the shape of the latter (e.g. linear versus spathulate), or the size of the auricles, were found to be useless for taxonomic purposes, as they apparently vary independently of other characters.

Fruit — The fruits are unilocular, 3-valved capsules, which are always rather narrow, round in cross section, and either cylindrical, ellipsoid or subclavate. They contain numerous elaters.

Seed – The seeds are fusiform, c. 0.25 mm long.

NOTES ON ANATOMY

Living material of the following species, cultivated in the greenhouses of the Rijksherbarium/Hortus Botanicus, was microscopically examined: *Mediocalcar bifolium*, *M. decoratum*, *M. paradoxum* subsp. *latifolium*, *M. uniflorum* and *M. versteegii* subsp. *versteegii*.

In all these species the roots possess a single-layered velamen, as well as persistent, unicellular root hairs, which belong to the same layer. The velamen of *M. versteegii* subsp. *intermedium* was examined by Porembski and Barthlott (1988, as '*M. alpinum*') and was found to be of the *Calanthe*-type. This is the simplest type of velamen, lacking for instance helical wall thickenings. It can be said to be nothing more than an unspecialized rhizodermis, and is considered to be primitive (Porembski & Barthlott, 1988). However, as the assemblage of orchids showing this type of velamen is quite diverse, it seems likely that this character state may in some cases be the result of a secondary reduction, rather than a primitive condition. The velamen in its more elaborate forms is generally considered to be an adaptation to drought stress. *Mediocalcar*, and members of the subtribe Eriinae in general, most of which appear to have similar roots, mainly occur in habitats where drought stress is infrequent.

Porembski and Barthlott do not mention the prominent root hairs found in *Mediocalcar*. These are specialized rhizodermal cells, varying in shape from cylindrical to broadly conical; in the latter case they could be termed papillae. The size and shape of the root hairs varies considerably in the same specimen (in a root sample of *M. uniflorum* they ranged in size from 162 by 21 µm to 297 by 40 µm), but there may be a correlation between average size and species. In *M. subteres*, for example, the root hairs are predominantly of the papillae-type, in *M. decoratum* they are mostly cylindrical. The root hairs are short-lived, but their walls remain intact long after their death.

Idioblasts containing raphide bundles occur in all parts of the plant, but are especially numerous in the walls of the ovary. Tracheoid idioblasts (Foster, 1956) were not observed. This may be related to the lack of a prolonged dry season in the habitats of *Mediocalcar*, as

these idioblasts are also thought to be an adaptation to drought stress. According to Olatunji and Nemgin (1980), tracheoid idioblasts occur almost universally in West African epiphytic orchids; most or all of these are subjected to a dry season. I observed them in *Pleurothallis lilacina* Lindley, a xerophytic species from southern Brazil, but not in *Restrepia elegans* Karst., another member of the subtribe Pleurothallidinae, from the cloud forests of north Venezuela.

The parenchyma of the pseudobulbs of *M. decoratum* was found to have a high starch content; it would appear that water storage is not the principal function of these pseudobulbs. In most species of *Mediocalcar* the pseudobulbs are poorly developed anyway.

Leaves from the above-mentioned species of *Mediocalcar* were carefully scanned for the presence of stegmata, but these were not found by the author. Stegmata, silica bodies lining fibre bundles, are of considerable systematic interest (Møller & Rasmussen, 1984).

In all species examined a conspicuous layer of tissue consisting of large cells lacking chlorophyll is found in the leaves. This layer of 'water storage tissue' (Earnshaw et al., 1987) is always situated on the adaxial side of the leaf and may sometimes account for two thirds or more of the leaf-thickness. Stomata are present only on the abaxial side of the leaf.

NOTES ON PHYSIOLOGY

Earnshaw et al. (1987) investigated the correlation between the incidence of Crassulacean Acid Metabolism (CAM) and altitude in vascular epiphytes in Papua New Guinea. They found a sharp decrease in the relative number of obligate CAM epiphytes with increasing altitude. At high elevations (above 2600 m) all of the orchids they sampled (including two or three unidentified species of *Mediocalcar*) showed carbon isotope ratios indicative of C_3 photosynthesis (cf. Griffiths, 1989). Also positively correlated with altitude, and thus with C_3 metabolism, was the presence of water storage tissue (WST) in the leaves (the term 'water storage tissue' is used by these authors for the achlorophyllous layer of tissue situated on the adaxial side of the leaf). They suggest that this WST may not only serve to retain water in dry spells, but may also function as a filter against UV rays. Because of the longevity of the leaves of most high altitude epiphytes, these are, so they argue, longer exposed to the cumulative damaging effects of UV light; a UV filter may therefore have selective advantage.

It should be noted, however, that many epiphytic orchids that occur in montane forests grow in rather shady positions, where they have to compete with mosses and lichens that continuously threaten to overgrow the leaves. The negative effects of UV light on these plants can hardly be significant, especially as fog and overcast weather are the rule in these 'cloud forests'.

CYTOLOGY

Chromosome counts for four species of *Mediocalcar* were given by Lim (1985), based on material cultivated at Kew. They are reproduced in the following table. The names between brackets are those reported by Lim, they follow my own identifications of spirit material bearing the same Kew accession number, except for *M. agathodaemonis*, for which no such number was given.

species		2n
	(*M. agathodaemonis*)	38
M. arfakense	(*M.* aff. *latifolium*)	38
M. decoratum	(*M.* aff. *pygmaeum*)	85
M. uniflorum	(*M. sepikanum*)	38

Apart from the number recorded for *M. decoratum*, these figures are not remarkable; 2n = 38 is a common chromosome number in the Epidendroideae, e. g. in many species of *Eria*, *Dendrobium* and *Bulbophyllum*. The count for *M. decoratum* indicates that the specimen examined was a pentaploid, which, according to Lim, is very rare in the Orchidaceae. Considering that *M. decoratum* is a common and widespread species, it seems doubtful that pentaploidy, which would usually result in sterility, is the normal condition.

PHYTOGEOGRAPHY

The geographical distribution of *Mediocalcar* (Map 1), with its obvious centre in New Guinea, is similar to that of several other genera and sections in the Orchidaceae, for example *Aglossorhyncha*, *Cadetia*, *Diplocaulobium*, *Epiblastus*, *Glossorhyncha*, *Pedilochilus*, *Agrostophyllum* section *Dolichodesme*, *Dendrobium* section *Oxyglossum* and several sections of *Bulbophyllum*. This type of distribution was classified by Van Balgooy as East Malesian (Van Balgooy, 1971). Unlike some of the genera mentioned above, *Mediocalcar* is absent from New Caledonia and the Philippines. Particularly striking is the large agreement between the areas of *Mediocalcar* and *Epiblastus*. These coincide almost completely, except that *Epiblastus* has one species in the Philippines, and *Mediocalcar* has one species in Micronesia. To the West, Wallace's Line forms an abrupt boundary for *Mediocalcar*.

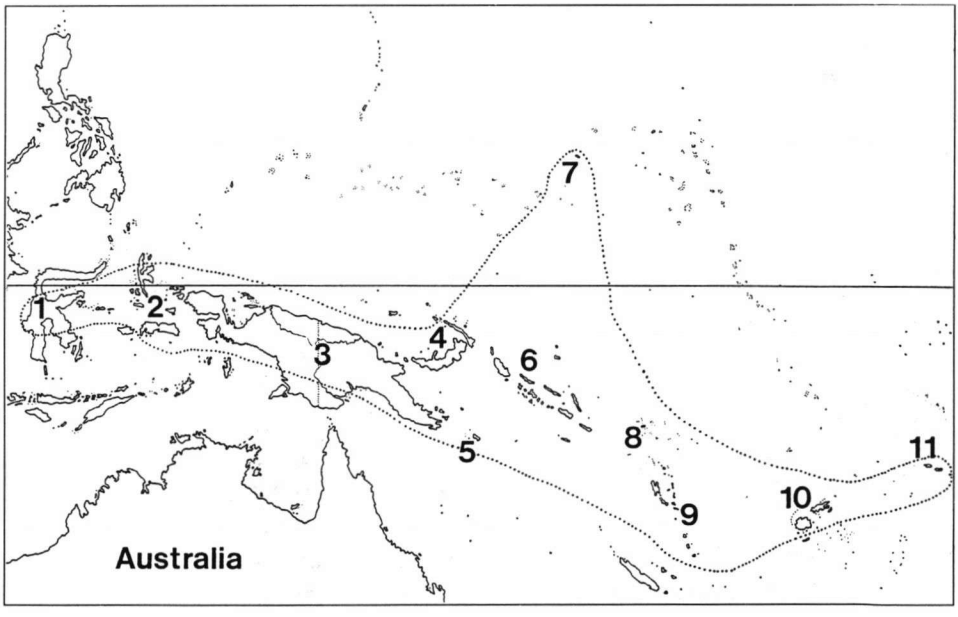
With one exception, no endemism above the subspecific level is recognized outside New Guinea. The exception is *M. umboiense*, which has only been collected once on Umboi Island, a small island somewhat closer to New Brittain than to New Guinea and here considered part of the Bismarck Archipelago. *Mediocalcar umboiense* is very closely related to *M. decoratum*, a New Guinea endemic.

From West to East, *Mediocalcar* is known to occur on the following islands or island groups:

1. Sulawesi (= Celebes) — *Mediocalcar paradoxum* subsp. *robustum* has been collected on three mountains in the central part of the island (but see note 2 under that taxon). No endemics.
2. Moluccas —Two taxa have been found on Seram: *M. paradoxum* subsp. *robustum* and *M. versteegii* subsp. *intermedium*. The former is also known from Ambon and Ternate. I have not seen any material from Buru or Halmahera. No endemics.
3. New Guinea (including the islands of Waigeo, Japen, Biak and the d'Entrecasteaux Archipelago, but excluding Umboi Island; the western part of New Guinea is called Irian Jaya, the eastern part Papua New Guinea) — All but one species of *Mediocalcar* (*M. umboiense*) are represented in New Guinea. The following taxa have been found: *M. agathodaemonis*, *M. arfakense*, *M. bifolium* (endemic), *M. bulbophylloides* (endemic), *M. congestum* (endemic), *M. crenulatum* (?endemic; see note 2 under this taxon), *M.*

dcoratum (endemic), *M. geniculatum* (endemic), *M. paradoxum* subsp. *latifolium* (endemic), *M. paradoxum* subsp. *robustum*, *M. pygmaeum* (endemic), *M. stevenscoodei* (endemic), *M. subteres* (endemic), *M. uniflorum*, *M. versteegii* subsp. *intermedium*, and *M. versteegii* subsp. *versteegii* (endemic). Ten or eleven endemics. The distribution within New Guinea is discussed below.

4. Bismarck Archipelago — *Mediocalcar arfakense* and *M. uniflorum* occur in New Britain. *Mediocalcar agathodaemonis*, *M. versteegii* subsp. *intermedium* and *M. ?crenulatum* (possibly an undescribed species; see note 2 under this taxon) are the only taxa known from New Ireland. *Mediocalcar umboiense* is apparently endemic on Umboi Island. One, or perhaps two, endemics.
5. Louisiades — *Mediocalcar versteegii* subsp. *amphigeneum* occurs on Tagula (= Sudest) Island. One endemic.
6. Solomon Islands — Four taxa: *M. paradoxum* subsp. *paradoxum*, *M. paradoxum* subsp. *robustum*, *M. versteegii* subsp. *intermedium*, and *M. versteegii* subsp. *vulcanicum* (Bougainville only). One endemic.
7. Ponape (Carolines) — Only *M. paradoxum* subsp. *robustum* has been found here. No endemics.
8. Santa Cruz Archipelago — The island of Vanikoro harbours *M. paradoxum* subsp. *paradoxum*. No endemics.
9. Vanuatu (= New Hebrides) — *Mediocalcar paradoxum* subsp. *paradoxum* and *M. versteegii* subsp. *intermedium* occur on nearly all the main islands. No endemics.
10. Fiji — Only *M. paradoxum* subsp. *paradoxum* is known from Viti Levu. No endemics.
11. Samoa — *Mediocalcar paradoxum* subsp. *paradoxum* has been collected on Upolu and Tutuila. No endemics.



Map 1. Known distribution of *Mediocalcar* J.J. Smith – **1**: Sulawesi (1 taxon) – **2**: Moluccas (2); **3**: New Guinea (16) – **4**: Bismarck Archipelago (6) – **5**: Louisiades (1) – **6**: Solomon Islands (4) – **7**: Ponape (1) – **8**: Santa Cruz Islands (1) – **9**: Vanuatu (2) – **10**: Fiji (1) – **11**: Samoa (1).

Within New Guinea, most species of *Mediocalcar* appear to be widespread. Local endemism is rare, only *M. bulbophylloides* (Map 5) and *M. stevenscoodei* (Map 8) are so far known from a single mountain range, the Arfak Mountains and the Wharton Range respectively. Several species, while being rather common in the central massive, are virtually absent from the northern mountain ranges, e. g. *M. agathodaemonis* (Map 2) and *M. decoratum* (Map 6). Some of the widespread species show large gaps in their distribution, e. g. *M. pygmaeum* (Map 10) and *M. crenulatum* (Map 5), but this may well be an artifact due to the low collecting densities in many parts of New Guinea. All over the island there are large tracts of mountainous country from which not a single specimen of *Mediocalcar* has been collected. There is no reason to believe that the genus is absent from these areas. Collecting densities are particularly low in parts of Irian Jaya. While Irian Jaya and Papua New Guinea are roughly of equal size, 419 collections of *Mediocalcar* were available from the latter, contrasted with only 116 from the former, a ratio of 3.6 : 1.

ECOLOGY

Habitat

Mediocalcar is essentially a montane genus. In New Guinea it is not known to occur below 700 m, while the greatest number of species is found between 1500 and 2500 m (see Fig. A on page 76), with four species extending to above 3000 m. Only *M. paradoxum* subsp. *paradoxum* descends down to sea level in part of its range (e.g. on Vanikoro Island), but this taxon is absent from New Guinea.

All species of *Mediocalcar* inhabit areas with an everwet climate and the great majority are epiphytes favouring tree trunks and thick branches, usually in shaded positions. They are especially frequent on logs, which they seem to colonize rapidly. Contrary to Schlechter's (1914: 224) assertion that species of *Mediocalcar* prefer 'moss-free' branches, they are usually observed rooting on bark clothed with a thick and mostly wet layer of moss. Their extensive and rather stiff rhizomes generally make them unable to grow on thinner branches. *Mediocalcar congestum* is one of the few species of which mature specimens may inhabit fairly thin branches; this species is atypical in having a very short rhizome. On Mt Kaindi (Papua New Guinea) I observed the robust *M. arfakense* exclusively at the base of trees; it has the longest rhizomes reported in the genus, up to 1.5 m or more.

There are no indications for host-specificity in *Mediocalcar*. *Nothofagus* is one of the dominant tree genera of the montane forests in New Guinea, often forming almost pure stands, and it is the most frequently reported host tree of *Mediocalcar*. Other hosts mentioned by collectors include *Araucaria*, *Artocarpus*, *Castanopsis*, *Cyathea*, *Dacrydium*, *Drimys*, *Ficus*, *Lithocarpus*, *Pandanus*, *Phyllanthus*, *Rhododendron*, *Schizomeria* and *Syzygium*.

Although *Mediocalcar* is mainly epiphytic, several species are sometimes found as terrestrials, for example *M. arfakense*, *M. uniflorum*, *M. versteegii* and *M. agathodaemonis*, nearly always in the shelter of trees and shrubs, rooting superficially in the leaf-litter and ground moss. The last mentioned species is frequently observed growing along tracks in subalpine forest; it is the only species of *Mediocalcar* that has been found on tree-fern trunks in subalpine grassland.

The most common species of *Mediocalcar* in New Guinea is undoubtedly *M. bifolium*; this is reflected in its wide ecological amplitude. Apart from being a locally abundant epiphyte, it can be found on mossy rocks, on road banks and even in swampy grassland.

Mediocalcar crenulatum seems to occur mainly, although not exclusively, as a terrestrial; it also has the distinction of reaching higher altitudes than any other member of this genus, up to 3640 m on Mt Trikora in Irian Jaya, where it was observed on the ridge of a rocky cliff (Mangen, 1993: 99, as *Mediocalcar* spec.). Lam (1929: 99) vividly described its habitat on the summit of Mt Doorman, likewise in Irian Jaya. Here *M. crenulatum* occurred in crevices between rocks on an open slope at 3500 m, together with e.g. *Nepenthes vieillardii* Hook. f., *Myrmecodia lamii* Merr. & Perry ('*Myrmecodia* spec.') and *Dendrobium vexillarius* J.J. Smith.

Pollination

It is not unusual to find two or more species of *Mediocalcar* growing in close proximity and flowering simultaneously. At about 2350 m in the summit zone of Mt Kaindi, a small mountain near Wau in Papua New Guinea, the author found the following four taxa to be plentiful: *M. uniflorum, M. geniculatum, M. agathodaemonis,* and *M. arfakense. Mediocalcar uniflorum* and *M. geniculatum* often inhabited the same tree trunk. These four species all have shiny red flowers with greenish tips, which to the casual observer look very much alike. No hybrids were observed and none were found among the more than 70 herbarium collections available from Mt Kaindi. Three additional species have been collected at lower altitudes on this mountain: *M. decoratum, M. versteegii* subsp. *intermedium* and *M. bifolium.* There is apparently a mechanism which prevents hybridization to occur or which at least makes it an unlikely event. None of the several species observed under cultivation appeared to be autogamous. Fruiting specimens are not uncommon in the field.

Unfortunately, no observations on pollinators in *Mediocalcar* were found in the literature. There can be little doubt, however, that *Mediocalcar* is ornithophilous (this was already suggested by Dressler, 1981: 222; I do not believe he is correct in including *Porpax* among the ornithophilous Eriinae, on the other hand he failed to include *Epiblastus* there). It displays all the characteristics for this syndrome, as listed by Van der Pijl and Dodson (1966). These are:

— diurnal anthesis;
— zygomorphy weakly expressed;
— flowers tubular;
— vivid colours, often scarlet or with contrasting parrot-like colours;
— absence of odour;
— nectar very abundant, often in medium-length, rather broad tubes and spurs;
— nectar guide absent;
— flowers horizontal or hanging freely in space;
— hard flower wall, with protected organs.

It should be noted that in *Mediocalcar* the sepaline tube, but not the spur contains nectar. It seems as if the spur's main function is to protect the nectar produced in the back of the flower against insects. A nectar-seeking bird must probably pierce the spur to reach the nectar behind it.

According to Beehler, Pratt and Zimmerman (1986) there are four families of birds containing nectariphorous species in New Guinea. Two of these, the Zosteropidae (White-eyes) and the Nectariniidae (Sunbirds), consist mainly of lowland species, none of their mem-

bers occur in the upper montane forests in which *Mediocalcar* is common. The Psittacidae (e.g. Lories) do occur at high altitudes, but as these birds use their brush-tongue rather than their bill to gather nectar and pollen they are unlikely candidates for being pollinators of *Mediocalcar*. The Meliphagidae (Honeyeaters), on the other hand, not only are frequent in the montane forests, but are known to pollinate species of *Dendrobium* (Reeve & Wood, 1982; Slade, 1980). Honeyeaters are thus the probable pollinators of *Mediocalcar*, at least in the highlands of New Guinea. It is perhaps worth noting, as supportive evidence, that the range of *Mediocalcar* is entirely contained in that of the Meliphagidae (data from Howard & Moore, 1980).

In the field, flowers of *Mediocalcar* are frequently found to be damaged by 'burglars'. In these flowers an irregular opening has been made laterally in the sepaline tube. This is probably done by birds. Could it be that the striking resemblance of *Mediocalcar*-flowers to certain berries misleads the birds?

To what extent the foraging behaviour of the Honeyeaters would limit the probability of hybridization in *Mediocalcar* is unknown to me. Perhaps the differences in vegetative architecture of sympatric species of *Mediocalcar* enable the pollinator to differentiate among them. Some kind of genetic barrier between the different species should also be considered, however. As cultivated specimens hardly ever set seed spontaneously it seems unlikely that species of *Mediocalcar* are autogamous.

Many plants in the highlands of New Guinea display the ornithophilous syndrome. The best known of these, and probably the main staple for the birds as far as nectar is concerned, are the Ericaceae, especially *Rhododendron* and *Dimorphanthera*. Some other genera to be mentioned in this context are *Aeschynanthus* (Gesneriaceae), *Tecomanthe* and *Pandorea* (Bignoniaceae), *Elaeocarpus* (Elaeocarpaceae), *Alpinia* and *Riedelia* (Zingiberaceae) and the following Orchidaceae: *Epiblastus*, *Glomera*, *Dendrobium* sections *Oxyglossum*, *Pedilonum* and *Calyptrochilus*, *Calanthe* sections *Caulodes* and *Rhodochilus*, and perhaps some of the high altitude species of *Agrostophyllum*. None of these resemble *Mediocalcar* in the shape of their flowers, except, superficially, *Epiblastus*. In the latter genus the flowers are not bicoloured, the sepals are not connate and the lip is not saccate. Certain neotropical Gesneriaceae as well as species of *Aloe* and *Erica* from southern Africa possess flowers which are similar to *Mediocalcar* in being urceolate and strikingly bicoloured. Most of these are known to be ornithophilous.

Phenology

Observations in cultivation have established that the flowers of *Mediocalcar* are by no means as long-lasting as those of the sympatric, ornithophilous species of *Dendrobium* sections *Calyptrochilus*, *Oxyglossum* (Reeve & Woods, 1989) and *Pedilonum*. Depending on weather conditions they may last from 5 to 14 days (usually about a week). As regards periodicity it seems that three patterns can be tentatively distinguished:

I. Flowering without periodic peaks; inflorescences synanthous only (e.g. *M. geniculatum*, *M. arfakense*).
II. Flowering with periodic peaks, several times a year; inflorescences usually both synanthous and heteranthous (e.g. *M. bifolium*).
III. Flowering once a year; inflorescences mainly heteranthous (*M. decoratum* and *M. umboiense*).

Most species of *Mediocalcar* grow fairly rapidly. Each branch of the rhizome may increase by several shoots in a single year, unlike many other orchids, of which a given rhizome-branch is only extended by one growth each year. Species exhibiting pattern I flower immediately when a new shoot appears, and as they grow all year round they may also flower throughout the year, but without distinct peaks. Species exhibiting patterns II and III largely forego flowering until several new mature shoots are present. At a certain point, which appears to be fixed in time in pattern III species and more environmentally determined in pattern II species, most of the growths produced since the last flowering, as well as some of the older ones, may emit flowering shoots simultaneously. In *Mediocalcar* flowers are never produced from the top of mature shoots (i.e. hysteranthous inflorescences do not occur). It is obvious that pattern II and III species can be more conspicuous at flowering time than those exhibiting pattern I, given that the individual flowers are roughly similar in all three groups. Presumably this advantage outweighs the disadvantage of being incapable of reproducing for a longer period of time.

Epiblastus, which I consider to be the sister-genus of *Mediocalcar*, only exhibits pattern I. This indicates that pattern I may be the primitive condition.

CULTIVATION

Generally speaking, *Mediocalcar* plants are easy to grow, as long as a few requirements are met.

First of all, it should be kept in mind that these 'cherry orchids', as they are popularly known, inhabit areas with an everwet climate. Notwithstanding the deceptively succulent appearance of some species, prolonged periods of drought are decidedly harmful. Their substratum should be kept moist throughout the year. An occasional drying out, as long as this does not last for more than a few days, is recommended, however, to check the development of fungi and algae. The humidity of the air should be kept as high as possible, but at the same time adequate air circulation must be provided. The atmosphere in the greenhouse should feel fresh and humid, not stale and oppressive.

Most species of *Mediocalcar* are mountain dwellers; temperatures should accordingly be kept on the low side. Day temperatures from 16 to 20 °C and night temperatures of circa 12 °C are recommended for these highland plants. Experience in Leiden has shown that higher temperatures, inevitable in Europe during the summer, are tolerated fairly well, but flowering, as well as the intensity of flower colouring, are adversely influenced by high temperatures.

Exposure to direct sunlight may in the greenhouse easily lead to desiccation and tissue damage. A certain amount of shading is therefore necessary. Some species, e.g. *M. decoratum*, develop an attractive purple or bronze tinge on the leaves and pseudobulbs when growing in strong light.

Because of their usually long, creeping or patent rhizomes, the plants are best grown on slabs of treefern. Pure cork is not suitable, as this dries out too quickly. They should do well in saucers, provided these are well-drained. In the latter case the compost should be fairly open, but at the same time be able to retain its moisture for more than 24 hours.

Vegetative propagation is particularly easy: the rhizomes usually branch extensively and, when large enough, can be divided using a pair of scissors. See also Webb (1990) for notes on the cultivation of *M. decoratum* in Australia.

SYSTEMATIC POSITION

Kraenzlin, as noted in the introduction, considered *Mediocalcar* to be congeneric with *Eria*, and thus implicitly included it in the subtribe Eriinae, which he did not keep apart from the Dendrobiinae. However, most authors, following Schlechter (1905, 1926), considered *Mediocalcar* to be a member of the Glomerinae, as for example Pfitzer (1908), Dressler & Dodson (1960, '*Glomera* alliance'), Brieger (1970) and Kores (1989). Grounds for this position are rarely stated explicitly, and they depend of course on the definition of the Glomerinae. In my opinion the only genera which unquestionably belong to that subtribe are *Glomera* Blume (including *Glossorhyncha* Ridley, *Giulianettia* Rolfe, *Ischnocentrum* Schltr. and *Sepalosiphon* Schltr.) and *Aglossorhyncha* Schltr.; these genera can be said to comprise the Glomerinae *sensu stricto*. Dressler (1990, 1993) also includes *Agrostophyllum* Blume and *Earina* Lindley, but I believe these genera are better placed in the Podochilinae. *Mediocalcar* and the Glomerinae (in the following always *sensu stricto*) agree in the possession of terminal inflorescences and in the similar geographical distribution. Habitually *Mediocalcar* is very different from all Glomerinae. The latter are slender-stemmed plants without pseudobulbs, with the stems clad in tubular leaf-bearing sheaths. The morphology of the column of *Mediocalcar* is quite unlike that of any member of the Glomerinae. All Glomerinae have four pollinia; *Mediocalcar* has eight pollinia. Finally, the fruits of *Mediocalcar* contain elaters, whereas those of *Glomera* and *Aglossorhyncha* do not, as far as could be ascertained.

Dressler (1981) followed Kraenzlin by including *Mediocalcar* in the subtribe Eriinae; unfortunately his arguments are rather inexact. Dressler believes that *Mediocalcar* possesses a viscidium, an observation which he attributes to Brieger, but Brieger (1970) correctly asserted that there is 'apparently' no viscidium. It is also not true to say that all Eriinae have eight pollinia: *Sarcostoma* Blume, which is certainly closely related to *Ceratostylis* Blume, has four pollinia, and is correctly included by Dressler in the Eriinae. However, *Mediocalcar* does share several character states with other genera within the Eriinae which are not found in the Glomerinae. For example, the presence of eight laterally flattened pollinia without viscidium is a character state occurring in *Eria* itself (e.g. *E. ignea* Rchb. f.) and in *Epiblastus* Schltr. The morphology of the column is rather similar in *Mediocalcar*, *Epiblastus* and several species of *Eria*. Persistently hairy roots appear to be a synapomorphy of the Eriinae; they do not occur in the Glomerinae. Heteroblastic pseudobulbs are present in several species in the Eriinae. Endocarpic elaters are found in the genera *Ceratostylis*, *Epiblastus*, *Mediocalcar* and *Eria*, but with exceptions in *Eria* section *Conchidium* [e.g. *E. karykouyensis* Schltr. (Hallé, 1986) and *E. bulbophylloides* C. Schweinf. (pers. obs.)]. I do not know whether they occur in the remaining genera *Cryptochilus* Wall., *Porpax* Lindley, *Sarcostoma* and *Stolzia* Schltr. Stegmata are either globose or absent in the Eriinae, 'conical' in the Glomerinae (Møller & Rasmussen, 1984). All evidence considered, *Mediocalcar* is probably best placed in the Eriinae.

Dressler (1981) divides the Eriinae into two tentative alliances:

1) *Cryptochilus, Eria, Mediocalcar, Porpax, Stolzia;*
2) *Ceratostylis, Epiblastus, Sarcostoma.*

Unfortunately no reasons for these groupings are given; inspection shows that group 1 contains, amongst others, those genera which have mutually connate sepals: *Cryptochilus,*

Mediocalcar and *Porpax*. I fail to see any rationale at all behind the assemblage of group 2. Nevertheless Dressler goes so far as to suggest that these three genera possibly should be placed in a separate subtribe. I cannot agree with that: *Ceratostylis* has clavate pollinia with a distinct viscidium, *Epiblastus* has laterally flattened pollinia without a viscidium. There are several other differences, but this is certainly a rather fundamental one.

I suggest that the sister-genus of *Mediocalcar* is *Epiblastus*: both genera have the same type of pollinia, both have glabrous, terminal, fasciculate 1-flowered inflorescences arising from immature heteroblastic pseudobulbs which often show bud displacement, and their geographic distribution is very similar. There are differences as well: in *Epiblastus* the sepals are free, the lip is not saccate, often calliferous, and longitudinally attached to the column-foot in a way not found in *Mediocalcar*. But these differences are probably of secondary importance, they may represent plesiomorphies or autapomorphies on the part of *Epiblastus*. *Mediocalcar* appears to be the more advanced genus of the two; this is suggested by the connate sepals, saccate lip, reduced number of inflorescences, and presence of heteranthous inflorescences.

SPECIFIC AND INFRASPECIFIC CONCEPTS

Some species recognized in the present revision are occasionally very difficult to distinguish, others are considered to be highly variable. Some readers may wonder why the former were not simply lumped together, or why the latter were not split up.

The species as recognized by the taxonomist is almost always a hypothetical entity, whatever species concept is followed. In practice, as in the present revision, morphological criteria, coupled with knowledge about the geographic distribution of the specimens involved, are used to assign specimens to species. One looks for consistent patterns, on the assumption that individuals belonging to the same species share a common ancestry, and therefore possibly share derived character states. But which characters are important? There is no absolute criterion to answer this question. In some cases, however, an answer can be found. This is when different species of the same genus occur sympatrically.

I agree with Gentry (1990), who wrote that there are situations where "the knowledge of the field botanist can and must take pre-eminence over that of the herbarium-based monographer. This is the case of closely related taxa that co-occur together in exactly the same forest, but *behave* as distinct species. In other words, they 'pass the test of sympatry'."

A good example of such a situation is provided by the species-pair *Mediocalcar agathodaemonis* and *M. bifolium*. These two species are frequently found together throughout the highlands of New Guinea, and from my own observations in the field I have no doubt that they are distinct. They were also recognized by T.M. Reeve, whose field experience with highland orchids of New Guinea much exceeds mine. Yet, the morphological differences are slight, and it is sometimes impossible to assign herbarium specimens to one species or the other when the flower colour is not recorded. On the other hand there is a species like *M. versteegii*, which is here considered to be a very polymorphic entity. Extreme forms of *M. versteegii* may look much more distinct than *M. bifolium* and *M. agathodaemonis*. However, they do not occur sympatrically, and they are connected by intermediate forms. Therefore I have taken a broad view of *M. versteegii* and a narrow one of *M. agathodaemonis* and *M. bifolium*.

I have applied the concept of subspecies in the case of parapatric sets of individuals which are distinguished by minor characters and which are possibly monophyletic. When their areas are not completely disjoint, these sets should intergrade in the overlapping part of their ranges. After all, they belong to the same species: they must fail the test of sympatry.

I have not recognized other categories below the rank of species. Varieties and forms are in my opinion best denoted on an informal basis, e.g. 'white-flowered form' instead of 'var. *alba*'. Such forms happen to agree for instance in the colour of the flowers, but may disagree in other respects, as they are usually not monophyletic.

INFRAGENERIC CLASSIFICATION

Schlechter (1911) recognized three sections in *Mediocalcar*, which he characterized as follows:

Eu-Mediocalcar: Pseudobulbs 1-leaved. Rhizome usually long-creeping. Flowers large, round in cross section.
Epicalcar: Pseudobulbs 2-leaved, equitant. Flowers as in *Eu-Mediocalcar*.
Microcalcar: Pseudobulbs 2-leaved. Rhizome long-creeping. Flowers small, almost triangular in cross section.

J.J. Smith (1929) did not approve of this classification. He pointed out that there are several species in which 1- and 2-leaved pseudobulbs may occur on the same specimen. It may also be noted that equitant pseudobulbs are not restricted to section *Epicalcar*, but occur in section *Eu-Mediocalcar* as well. Smith proposed an alternative classification, in which only two sections were recognized:

Eumediocalcar: Spur large, about as long as the claw of the lip. Pseudobulbs 1-leaved.
Brevicalcar: Spur saccate, much shorter than the claw of the lip. Pseudobulbs 1- or 2-leaved.

Smith's classification has been followed by Van Royen (1979), Kores (1989) and Lewis and Cribb (1991), using the name *Mediocalcar* instead of *Eumediocalcar* for nomenclatural reasons. It should be pointed out, however, that section *Brevicalcar* contains the types of both *Epicalcar* and *Microcalcar*, and a legitimate name for this section should therefore have been chosen from the latter two.

Schlechter's subdivision of the genus was clearly invalidated by Smith's criticism, but the alternative was hardly an improvement. There are at least two species, *M. paradoxum* and *M. versteegii*, of which different subspecies would be assigned to different sections in Smith's classification. Local intergradation between these subspecies clearly demonstrates that Smith's sections are equally untenable.

My own attempts at a sectional division have been unsuccesful; it seems best therefore not to distinguish any sections at all.

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Mediocalcar sect. *Epicalcar* Schltr. in Fedde, Rep., Beih. 1 (1911) 224. — *Mediocalcar* sect. *Brevicalcar* J.J. Smith, Nova Guinea 14(3) (1929) 381. — Type species: *M. agathodaemonis* J.J. Smith (see note 1).

Mediocalcar sect. *Microcalcar* Schltr. in Fedde, Rep., Beih. 1 (1911) 224. — Type species: *M. pygmaeum* Schltr.

Epiphytic, sometimes terrestrial or lithophytic herbs. Roots long and thin, branching, densely covered with root hairs of varying length, purple when young, soon becoming pale to dark brown, tips greenish yellow. *Rhizome* pendulous, creeping or erect, either or not frequently branching, rooting between pseudobulbs, terete. *Cataphylls* 3–11 per shoot, short-lived, more or less persistent or soon withering away, imbricate, distichous, smooth to verrucose, membranous, upper and largest ones enveloping the pseudobulb, the lower ones enveloping the rhizome. *Pseudobulbs* approximate to widely spaced, heteroblastic, either or not with more or less pronounced bud displacement, 1–6-leaved. *Leaves* duplicate, not sheathing, long-lived, smooth or weakly verrucose, sessile or petiolate, linear to almost orbicular, flat or semiterete or subterete, margin entire or crenulate, apex frequently bilobed and more or less distinctly mucronate; coriaceous to carnose. *Inflorescences* terminal, synanthous or heteranthous or both synanthous and heteranthous on the same specimen, single-flowered, solitary or in pairs, at the base with a small, short-lived, persistent scale. *Peduncle* thin, terete, short to relatively long, sometimes elongated when fruiting, consisting of a single node, at the apex with a small cupular, persistent bract. *Flowers* usually resupinate, small (5–16 mm long), glabrous, stiff, scentless, lasting 1–2 weeks. *Ovary* subsessile, 6-ribbed, smooth or slightly warty or punctate, cylindrical to narrowly clavate. *Sepals* fleshy, basally connate for at least half their length, forming an urceolate synsepalum in which the column and most of the labellum and the petals are hidden, 5-nerved, nerves rarely branching; free tips more or less triangular, those of the lateral sepals more or less oblique, often patent to recurved; ventral part of the synsepalum semicylindric to semiglobose to saccate. *Petals* free, entire, much narrower than the sepals, hyaline, 1–3-nerved, nerves sometimes branching. *Lip* entire or obscurely 3-lobed, clawed, the blade at its base with a shallowly saccate to distinctly cylindrical spur, which is frequently recurved towards the base of the lip, hyaline, 3- or 5-nerved, nerves either or not branching; claw inflexibly attached to the apex of the column-foot, frequently auricled at the base. *Column* semiterete,

short and stout to rather long and slender, oblong to clavate to spathulate, with a short to rather long foot, at the apex with a large incurved wing on either side of the stigmatic cavity. *Stigma* large, concave, simple, rectangular to reniform, lower margin thickened, the latter sometimes 2-denticulate. Rostellum membranous, simple or emarginate. *Clinandrium* deeply cupular, dorsal margin usually emarginate, frequently apiculate by the filament, thus appearing 2- or 3-lobed, margin sometimes irregular-denticulate. *Anther* cucullate, subquadrate to cordate, with 2 thecae, each divided into 4, sometimes obscure loculi. *Pollinia* 8, laterally flattened, obliquely ovoid to more or less deltoid, broadly attached to strap-shaped, mutually connate caudicles. Viscidium and stipe absent. *Fruit* cylindrical, narrowly ellipsoid or subclavate, 3-valved, usually much longer than the unfertilized ovary, containing numerous elaters. *Seed* minute (c. 0.25 mm long), fusiform, embryo ellipsoid.

Colours — Flowers brightly coloured (red, orange or yellow), with the tips often contrasting in colour (greenish, yellow or white). Pollinia white or pale yellow.

Distribution — Sulawesi to Samoa, predominantly in New Guinea. Map 1.

Habitat & Ecology — Usually epiphytic, sometimes terrestrial or lithophytic. Mainly in everwet primary montane forest. Altitude 0–3640 m.

Etymology — From the Latin *medium*, 'middle', and *calcar*, 'spur'. The blade of the clawed lip is provided with a more or less deeply saccate depression or spur. See note 2.

Notes — 1. The sections were typified by Van Royen [Alp. Fl. New Guinea 2 (1979) 659, 660].

2. Backer's (1936) monumental dictionary has been very helpful in tracing the etymology of several names.

KEY TO THE SPECIES OF MEDIOCALCAR

1a. Base of pseudobulb elongated, enveloping the rhizome (Fig. B1, p. 76); new shoot usually arising from near the middle to near the top of the pseudobulb; inflorescences synanthous or heteranthous 2

b. Base of pseudobulb not elongated or, if elongated, base saddle-shaped, clasping but not enveloping the rhizome (Fig. B2, p. 76); new shoot usually arising from the base of the pseudobulb; inflorescences synanthous only (possibly sometimes heteranthous in *M. congestum*; in that species the base of the pseudobulb is not elongated)..... 11

2a. Spur (almost) extending to the base of the claw of the lip (Fig. C1, p. 77) 3

b. Spur at most extending to about halfway the claw of the lip (Fig. C2, p. 77) (when in doubt try upper lead first)..... 7

3a. Pseudobulbs predominantly 3- or 4-leaved 4

b. Pseudobulbs at most 2-leaved 5

4a. Leaves 2–4 mm wide ..... **7. M. decoratum**

b. Leaves 4–10 mm wide, with at least some leaves more than 5 mm wide .... **13. M. umboiense**

5a. Leaves subterete ..... **12. M. subteres**

b. Leaves dorso-ventrally flattened..... 6

6a. Inflorescences in pairs, synanthous only; free part of pseudobulb 1–3.5 cm long .... **2. M. arfakense**

b. Inflorescences either solitary or, if in pairs, both heteranthous and synanthous; free part of pseudobulb 0.5–1 cm long ..... **15. M. versteegii**

7a. Leaves (broadly) elliptic, less than 2 cm long; flowers narrowly urceolate ..... **10. M. pygmaeum**
b. Leaves linear or more than 2.5 cm long; flowers narrowly urceolate to urceolate-globose 8
8a. Flowers with greenish or yellowish tips, or, if flowers white-tipped, at least some pseudobulbs more than 4 mm thick 9
b. Flowers with white tips, pseudobulbs less than 4 mm thick ..... **3. M. bifolium**
9a. Pseudobulbs 2- or 3-leaved; leaves elliptic, margins irregular; inflorescences solitary or in pairs, synanthous only; flowers narrowly urceolate; blade of lip ovate when flattened; claw sigmoid ..... **11. M. stevenscoodei**
b. Pseudobulbs 1- or 2-leaved; leaves elliptic to linear, margins entire; inflorescences solitary, synanthous or heteranthous; flowers urceolate-globose; blade of lip broadly ovate to subcordate when flattened; claw not sigmoid 10
10a. Pseudobulbs 2-leaved (some 1-leaved shoots may be present); leaves 2.5–10 cm long, broadly rounded at the top; inflorescences synanthous .... **1. M. agathodaemonis**
b. Pseudobulbs 1-leaved, some populations in the Solomon Islands 2-leaved; leaves 5–13.5 cm long, gradually tapering to the top; inflorescences predominantly heteranthous ..... **15. M. versteegii**
11a. Spur (almost) extending to the base of the claw of the lip (Fig. C1, p. 77) 12
b. Spur at most extending to about halfway the claw of the lip (Fig. C2, p. 77)..... 13
12a. Pseudobulbs (broadly) conical, inflorescences frequently in pairs **9. M. paradoxum**
b. Pseudobulbs terete; inflorescences solitary ..... **14. M. uniflorum**
13a. Pseudobulbs 1-leaved, approximate (internodes shorter than height of pseudobulbs), rhizome rather short to very short 14
b. Pseudobulbs 1–3-leaved, widely spaced on a long creeping rhizome (except sometimes in *M. pygmaeum*, which always has 2- or 3-leaved pseudobulbs) 15
14a. Leaves elliptic (index 2–3), less than 3 cm long ..... **4. M. bulbophylloides**
b. Leaves linear-lanceolate (index 5.5–19), more than 4 cm long .... **5. M. congestum**
15a. Pseudobulbs (broadly) conical, 1-leaved; leaves with entire margins, obtuse to subacute ..... **9. M. paradoxum**
b. Pseudobulbs narrowly conical to cylindrical, 1- to 3-leaved; leaves crenulate at least near the top, acute to acuminate when pseudobulbs 1-leaved 16
16a. Base of pseudobulb elongated; free part at most 0.5 cm long, 2- or 3-leaved; leaves less than 2 cm long ..... **10. M. pygmaeum**
b. Base of pseudobulb not elongated; free part at least 1 cm long, 1- or 2-leaved; leaves usually more than 2 cm long 17
17a. Pseudobulbs 2-leaved; leaves elliptic, petiolate, 2–8 cm long; spur shallowly cucullate; column-foot incurved ..... **8. M. geniculatum**
b. Pseudobulbs 1- or 2-leaved; leaves lanceolate, subsessile, 4–19 cm long; spur saccate; column-foot not incurved ..... **6. M. crenulatum**

1. Mediocalcar agathodaemonis J.J. Smith — Fig. 8; Plate 2b

Mediocalcar agathodaemonis J.J. Smith, Bull. Dép. Agric. Ind. Neérl. 39 (1910) 16; Nova Guinea 8 (3) (1911) 543, t. 84, fig. A. — *Eria agathodaemonis* (J.J. Smith) Kraenzl. in Engl., Pflanzenr. Heft 50B (Orch.–Monandr.–Dendrob. 2) (1911) 176. — Type: *von Römer 1266* (BO holo; L iso).

Mediocalcar luteococcineum Schltr. in Fedde, Rep., Beih. 1 (1911) 233; ibid. 21 (1923) t. 86, fig. 315, syn. nov. — Type: *Schlechter 18803* (B lost).

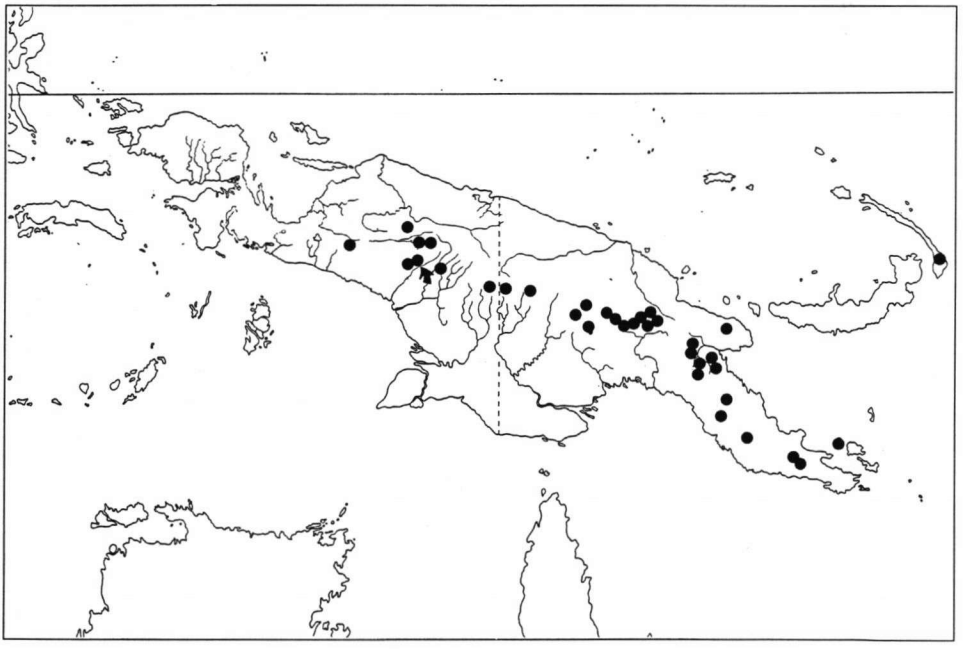
Mediocalcar bifolium J.J. Smith var. *validum* J.J. Smith, Nova Guinea 12 (1) (1913) 30. — *Mediocalcar alpinum* J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 13 (1914) 62; Nova Guinea 12 (3) (1915) 255; P. Royen, Alp. Fl. New Guinea 2 (1979) 670, fig. 237, syn. nov. — Syntypes: *de Kock 68* (BO lecto, chosen by Van Royen, spirit material, n.v.), *de Kock 143* (BO, L).

Mediocalcar dependens J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 13 (1914) 62; Nova Guinea 12 (3) (1915) 256, syn. nov. — Type: *Pulle 1059* (BO, spirit mat., n.v.).

Mediocalcar alpinum J.J. Smith var. *spathipetalum* J.J. Smith, Nova Guinea 12 (3) (1915) 256; P. Royen, Alp. Fl. New Guinea 2 (1979) 673, syn. nov. — Type: *Pulle (Versteeg) 2445* (BO holo; L, K, U iso).

Mediocalcar minjense P. Royen, Alp. Fl. New Guinea 2 (1979) 668, fig. 236, syn. nov. — Type: *Pullen 232* (L holo; AMES, BM, CANB, LAE iso).

Roots densely covered with root hairs, 0.5–1 mm thick. *Rhizome* creeping, patent or pendulous, laxly to frequently branching, 1.5–3 mm thick. *Cataphylls* 3–5, closely appressed, glabrous, subacute, keeled near the tip. *Pseudobulbs* 0–25 mm apart, cylindrical to ovoid, 1.5–3.5 cm long, 2.5–5 mm across; base elongated, enveloping the rhizome; free part prostrate to ascending, much shorter than the basal part, 1–8 mm long. *Leaves* 2, occasionally 1, per pseudobulb, sessile to subpetiolate, linear to more frequently elliptic [index 3–12.5], 2.5–8(–10) cm by (3–)5–15 mm; flat or rarely semiterete; glabrous; margins entire; apex rounded, more or less bilobed, mucronate, with the mucro about as long as the lobules; coriaceous to carnose. *Inflorescences* solitary, synanthous, at the base with an inconspicuous scale c. 1 mm long. *Peduncle* 1.5–3.5 cm long, at the apex with a triangular bract 1 mm long. *Pedicel* and ovary 10–14 mm long. *Flowers* urceolate-globose, oblique, 10–14 mm long. *Synsepalum* 10–16 mm long and 16–19 mm wide when cut



Map 2. Known localities of *Mediocalcar agathodaemonis* J.J. Smith (arrow indicates type locality).

open and flattened; free tips spreading or less often recurved, 2.5–4 mm long, subacute to acute. *Petals* linear, lanceolate or narrowly elliptic (index 4.5–8), 8–11 by 1–2 mm; apex acute; 1–3-nerved. *Lip* 8–11 by 3–3.5 mm in natural position, the blade broadly ovate-subcordate when flattened; claw 4–6 by 1.2–1.8 mm, auricles usually conspicuous, rarely obsolete, recurved; apex acute to acuminate, slightly recurved; margins erect, clasping the column; spur cucullate to saccate, 1.5–2 mm deep. *Column* broadly clavate, 5.5–6 mm long, 2.5 mm wide at the apex, foot 0.5–1(–2) mm long. *Fruit* narrowly ellipsoid to clavate, 20–30 by 3–4 mm.

Colour — Sepals bright red with green or yellowish green tips. Petals and lip pale orange with green or yellowish green tips. Column pale orange. Pollinia pale yellow. Very rarely the entire flower yellow (Brass 4026, AMES). Leaves green, pseudobulbs dull green to dull purple.

Distribution — New Guinea (Irian Jaya: Fakfak, Paniai and Peg. Jayawijaya; Papua New Guinea: widespread throughout the central mountains, also in the Sarawaket range), 98 collections (AMES, BM, BO, CANB, E, HBG, K, L, LAE, SING, U). New Ireland, 1 collection (K). Map 2.

Habitat & Ecology — Mostly epiphytic in montane forest, often on logs; also terrestrial in subalpine shrubberies and on trunks of tree ferns in subalpine grassland. Flowering probably throughout the year. Altitude 900–3500 m.

Etymology — Named after the type locality, Mt Agathodaemon ('Mountain of the Good Spirit'), in the Hellwig Mountains, Irian Jaya.

Notes — 1. *Mediocalcar agathodaemonis* is very similar to *M. bifolium*, with which it is often found growing together (the types are from the same locality). Herbarium specimens of the two species are sometimes morphologically identical, differing only in the colour of the flowers. I do not doubt, nevertheless, that *M. agathodaemonis* and *M. bifolium* are distinct species. When they are found together, *M. agathodaemonis* typically has a more robust habit, with broader leaves, thicker rhizomes and pseudobulbs, and slightly larger, more fleshy flowers. The rhizome of *M. agathodaemonis* is often creeping, more or less level with the substratum; that of *M. bifolium* is more often semi-erect, giving the plant a characteristic bushy appearance. The inflorescences of *M. bifolium* are often heteranthous; those of the numerous living specimens of *M. agathodaemonis* that I have seen were always synanthous only (specimens of *M. bifolium* with exclusively synanthous inflorescences are not uncommon, however; in herbarium material it is difficult to distinguish between heteranthous and proteranthous inflorescences). The flowers of *M. bifolium* have white tips, those of *M. agathodaemonis* have green or yellowish green tips.

In Fig. D on page 77 leaf-sizes of 50 randomly selected dried specimens each of *M. agathodaemonis* and *M. bifolium* are plotted. These specimens were determined only on the basis of flower colour. Although there is a large overlap in leaf width, it is readily apparent that narrow-leaved specimens predominantly belong to *M. bifolium*, whereas wide-leaved specimens predominantly belong to *M. agathodaemonis*. This subjective impression is supported by a simple statistical test performed with these data (Sachs, 1982: 271). At the 1% level of significance the hypothesis that *M. bifolium* and *M. agathodaemonis* have equal mean leaf width was rejected.

The problem remains that it is frequently impossible to identify a specimen when flower colour is not taken into account. This may have several causes. In the first place, hybridization may produce intermediate specimens that cannot be recognized as such in the her-

barium. Only biometric studies of whole populations can reveal their presence. It is my impression that such hybrids do occur, but infrequently. In the second place, when populations of *M. agathodaemonis* and *M. bifolium* are not sympatric, the differences between the two species may be obscured by genetic drift. In the third place, specimens may simply be mislabelled or be part of mixed collections.

Whatever the cause, there is no simple solution to the problem mentioned above. Certainly, lumping all material under one 'species' is not a solution. To repeat what I have stated elsewhere in this paper, following Gentry: *M. agathodaemonis* and *M. bifolium* have 'passed the test of sympatry'.

2. *Mediocalcar alpinum* is probably nothing more than a narrow-leaved, high-altitude form of *M. agathodaemonis*. These forms appear to be more common in Irian Jaya than in Papua New Guinea, but the material is scarce and mostly in poor condition. Some of these specimens have a rather longer column-foot than is usual in this species. I prefer to give them informal status only, as an entity '*alpinum*'. See also note 4 under *M. bifolium*.

In the recent orchid floras of Vanuatu (Lewis & Cribb, 1989) and the Solomon Islands (Lewis & Cribb, 1991), several collections from those regions have been identified as *M. alpinum*. There is indeed a distinct resemblance between certain specimens from the Solomon Islands (where *M. agathodaemonis* does not occur) and some specimens of *M. agathodaemonis*, but I believe that the former are better placed with *M. versteegii*. This matter is further discussed under *M. versteegii* subsp. *intermedium*.

3. It is possible that *M. papuanum* Rogers is a synonym of *M. agathodaemonis*. See under 'Species insufficiently known'.

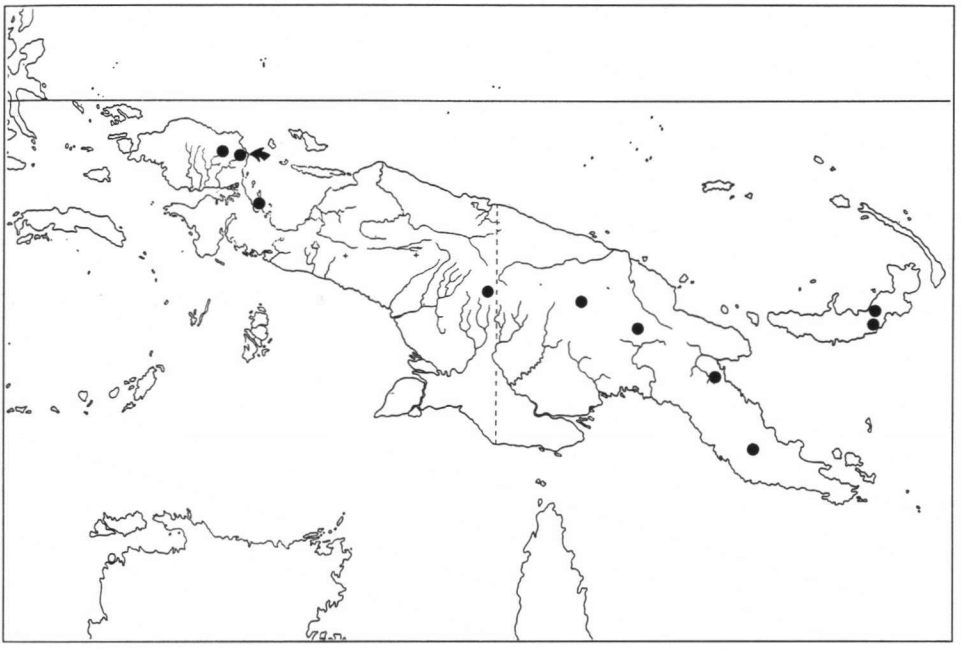
2. Mediocalcar arfakense J.J. Smith — Fig. 9

Mediocalcar arfakense J.J. Smith in Fedde, Rep. 11 (1913) 559; Nova Guinea 12 (3) (1915) 258, t. 93, fig. 158. — Type: *Gjellerup 1071*, p.p. (BO holo; L iso).

Roots densely covered with root hairs, 1 mm thick. *Rhizome* creeping, sparsely branching, 3.5–6 mm thick. *Cataphylls* 5–7, closely appressed, tubular, subglabrous, obtuse to subacute, slightly keeled near the tip. *Pseudobulbs* 1–6 cm apart, terete, 4–7 mm across; base elongated, enveloping the rhizome, 1.5–4 cm long; free part erect to suberect, (1–)2–3.5 cm long. *Leaves* 1 per pseudobulb, sessile, narrowly elliptic to very narrowly obovate [index 4–10.5], (6–)7–14(–20) cm by (10–)12–24 mm; apex obtuse, more or less unequally bilobed, mucronate, with the mucro shorter than the lobules; margins entire; keeled below; coriaceous. *Inflorescences* in pairs, synanthous, at the base with a narrow scale 3–4 mm long. *Peduncle* 2.5–3 cm long, at the apex with a triangular, acuminate bract 1 mm long. *Pedicel* and ovary 13–27 mm long. *Flowers* urceolate, oblique, more or less laterally flattened, 11–13 mm long. *Synsepalum* 11–13 mm long and 15–19 mm wide when cut open and flattened; free tips only slightly spreading, 3–4 mm long, acute. *Petals* narrowly oblong to linear [index 5–6.5], 8.5–10 by 1.5–1.7 mm; apex acute to acuminate; 3-nerved. *Lip* 9–10 by 3.5–4 mm in natural position, the blade broadly ovate when flattened; claw 3–4 by c. 2.5 mm, auricles rather inconspicuous, reflexed; the apex acute to acuminate, straight; margins erect, clasping the column; spur cylindrical, recurved, making a sharp angle with the column, 2.5–3.5 mm long, c. 2 mm wide just below the mouth. *Column* clavate, 5.5–6.5 mm long, c. 2 mm wide at the apex, foot conspicuous, c. 2 mm long. *Fruit* narrowly ellipsoid, 33 by 4 mm.

Colour — Flower deep pinkish red, or sometimes bright scarlet, with yellowish green tips to the sepals, petals and lip. Pollinia yellow. Pedicel and ovary red. Leaves more or less glossy dark green above, paler green below. Pseudobulbs green.

Distribution — New Guinea (Irian Jaya: Cenderawasih, Paniai and Peg. Jayawijaya; Papua New Guinea: Enga, Eastern Highlands, Morobe and Central Provinces), 19 collections (AMES, BM, BO, CANB, K, L, LAE). New Britain, 2 collections (L, LAE). Map 3.



Map 3. Known localities of *Mediocalcar arfakense* J.J. Smith.

Habitat & Ecology — Epiphyte in montane forest, usually at the base of trees or on logs. Sometimes terrestrial. Flowering throughout the year. Altitude 1250–2650 m.

Etymology — Named after the Arfak Mountains, a range in the Cenderawasih (Vogelkop) Peninsula of Irian Jaya, where the type material was collected.

Notes — 1. This is one of the largest species of *Mediocalcar*, with the rhizomes often more than one metre long. The terete pseudobulbs, more or less L-shaped, with the basal part enveloping the rhizome, distinguish *M. arfakense* from *M. paradoxum* subsp. *robustum*, which has obliquely conical pseudobulbs, with the basal part clasping but not enveloping the rhizome. I find no consistent differences in the flowers.

2. An interesting aberration is seen in *Cribb & Morrison 2268* (L, spirit mat.). One of the leaves is 6 cm long and only 3 mm wide and much thicker than usual. Although somewhat misshapen, it could be called subterete. It shows that the transition from flat to subterete leaves may require a relatively minor developmental modification.

3. **Mediocalcar bifolium** J.J. Smith — Fig. 10; Plate 2c and cover

Mediocalcar bifolium J.J. Smith, Bull. Dép. Agric. Ind. Neérl. 39 (1910) 17; Nova Guinea 8 (3) (1911) 544, t. 86, fig. A; ibid. 12 (3) (1915) 255; P. Royen, Alp. Fl. New Guinea 2 (1979) 683, fig. 242. — *Eria bifolia* (J.J. Smith) Kraenzl. in Engl., Pflanzenr. Heft 50B (Orch.–Monandr.–Dendrob. 2) (1911) 176. — Type: *von Römer 1322* (BO).

Mediocalcar diphyllum Schltr. in Fedde, Rep., Beih. 1 (1911) 230; ibid. 21 (1923) t. 85, fig. 312; Die Orchideen, ed. 3, 1 (1970) 376, fig. 230, 8, syn. nov. — Syntypes: *Schlechter 18227* (BM lecto; AMES, BO, K, L iso), *Schlechter 17285* (B lost).

Mediocalcar erectum Schltr. in Fedde, Rep., Beih. 1 (1911) 231; ibid. 21 (1923) t. 85, fig. 313; Die Orchideen, ed. 3, 1 (1970) 384, fig. 233, syn. nov. — Type: *Schlechter 20229* (B lost).

Mediocalcar monticola Schltr. in Fedde, Rep., Beih. 1 (1911) 232; ibid. 21 (1923) t. 85, fig. 314, syn. nov. — Type: *Schlechter 18801* (K lecto; AMES, BM iso).

?*Mediocalcar longipes* Ridley, Trans. Linn. Soc. Bot. II, 9 (1916) 200; P. Royen, Alp. Fl. New Guinea 2 (1979) 664, fig. 234, syn. nov. — Type: *Kloss s.n.*, 27-1-1913 (BM holo; K iso).

Mediocalcar montanum Ridley, Trans. Linn. Soc. Bot. II, 9 (1916) 201; P. Royen, Alp. Fl. New Guinea 2 (1979) 666, fig. 235, syn. nov. — Type: *Kloss s.n.*, 29-1-1913 (BM).

?*Mediocalcar brevisaccatum* Schltr. in Fedde, Rep. 16 (1919) 215; P. Royen, Alp. Fl. New Guinea 2 (1979) 680, syn. nov. — Type: *Keysser s.n.* (B lost).

Mediocalcar compressicalcar J.J. Smith, Nova Guinea 14 (3) (1929) 383, t. 55, fig. 39, syn. nov. — Type: *Lam 1827* (L).

Mediocalcar retusum J.J. Smith, Nova Guinea 14 (3) (1929) 382, t. 54, fig. 38; P. Royen, Alp. Fl. New Guinea 2 (1979) 681, fig. 241, syn. nov. — Type: *Lam 1828* (BO holo; K, L iso).

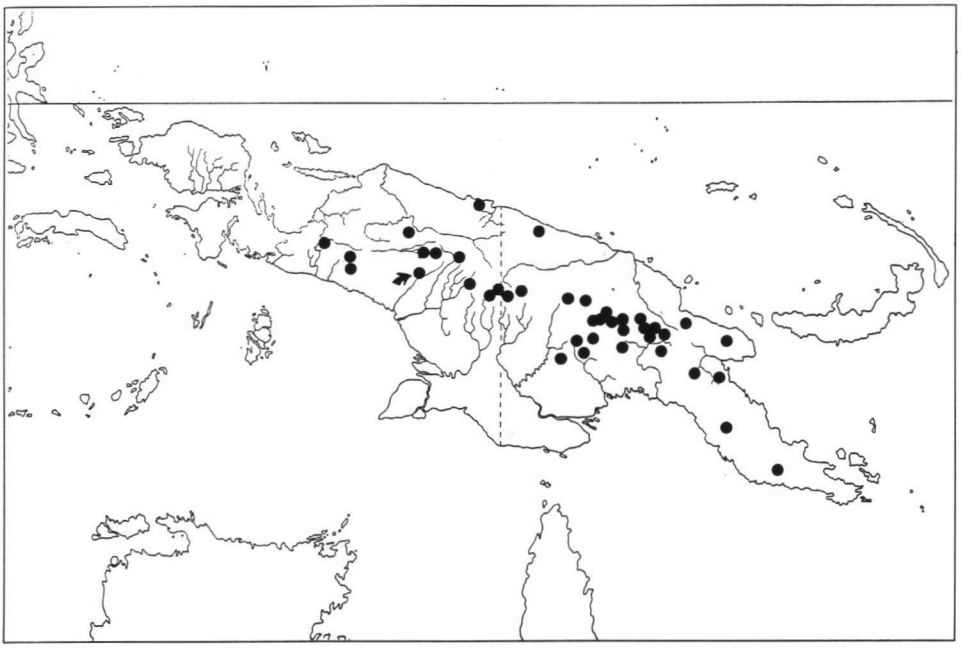
Mediocalcar angustum J.J. Smith, Bot. Jahrb. 66 (1934) 175, syn. nov. — Type: *Mayr 597* (L).

Mediocalcar albicoccineum P. Royen, Alp. Fl. New Guinea 2 (1979) 661, fig. 233, syn. nov. — Type: *Hoogland & Pullen 5602* (CANB).

Mediocalcar angustifolium Gilli, Ann. Naturhist. Mus. Wien 84 (1980, publ. 1983) 35, fig. 25, not Schltr. (1911), syn. nov. — Type: *Gilli 565* (W, n.v.).

Mediocalcar filopedunculatum Gilli, Ann. Naturhist. Mus. Wien 84 (1980, publ. 1983) 36, fig. 26, syn. nov. — Type: *Gilli 492* (W, n.v.).

Roots densely covered with root-hairs, 0.5 mm thick. *Rhizome* erect, patent or pendulous, usually frequently branching, the branches often becoming more numerous distally, 1–1.5 mm thick. *Cataphylls* of the young shoot 3–5, closely appressed, glabrous, subacute, keeled near the tip. *Pseudobulbs* 0–15 mm apart, terete, 1–2 cm long, 1–2.5 mm across; base elongated, enveloping the rhizome; free part ascending to prostrate, usually much shorter than the basal part. *Leaves* mostly 2 per pseudobulb, but 1-leaved pseudobulbs fairly frequent, rarely all pseudobulbs 1-leaved, sessile to subpetiolate, linear to narrowly elliptic, flat to semiterete [index (3.7–)5–16(–22)], (1.5–)2.5–6(–11) cm by (2–)3–7(–9) mm; glabrous; apex obtuse, rarely acute, minutely bilobed, mucronate; margins entire; coriaceous to carnose. *Inflorescences* solitary, synanthous or heteranthous, at the base with an inconspicuous scale c. 1 mm long. *Peduncle* 5–15 mm long, at the apex with a triangular bract 1–1.5 mm long. *Pedicel* and ovary 7–11 mm long. *Flowers* urceolate, oblique, 8–10.5 mm long. *Synsepalumum* 9–11 mm long and (13.5–)15–18 mm wide when cut open and flattened; free tips spreading to recurved, c. 3 mm long, subacute to acute. *Petals* linear to narrowly elliptic [index 4.5–10.8], 6.5–8 by (0.6–)1.2–1.5 mm; apex acute; 1–3-nerved. *Lip* (6–)7–9 by (2–)2.5–3.5 mm in natural position, the blade broadly ovate-subcordate when flattened; claw (2.5–)3–4 by c. 1.5–2.5 mm, auricles usually conspicuous, rarely hardly developed, subpatent to recurved; apex acute, slightly recurved; margins erect, clasping the column; spur cucullate to saccate, rarely recurved, at most half



Map 4. Known localities of *Mediocalcar bifolium* J.J. Smith.

as long as the claw, (1–)1.5–2 mm deep. *Column* broadly clavate to subspathulate, (4–)5–6.2 mm long, 2–2.7 mm wide at the apex, foot 0.6–1.5 mm long. *Fruit* narrowly cylindrical-clavate, 23–35 by 3 mm.

Colour — Sepals usually bright red, but not rarely orange-red or pinkish red or brownish red, with pure white tips, often only the margins of the tips white, sometimes the tips pink. Petals and lip pale orange with white or pinkish tips. Very rarely the entire flower yellow (see note 5). Leaves dull green, pseudobulbs dull green to dull purple.

Distribution — New Guinea (Irian Jaya: Fakfak, Paniai, Peg. Jayawijaya and Jayapura; Papua New Guinea: all provinces, except Gulf Prov.), 116 collections (AMES, B, BM, BO, CANB, E, K, L, LAE, PNH, S, U). Map 4.

Habitat & Ecology — Mostly epiphytic in montane forest, often on logs; also in subalpine shrubberies, on mossy rocks and road banks, rarely terrestrial in swampy terrain. Flowering periodic, several times a year. Altitude 800–3350 m.

Etymology — From the Latin *bi-*, 'two-', and *folium*, 'leaf', referring to the usually 2-leaved pseudobulbs in this species.

Notes — 1. *Mediocalcar bifolium* is by far the most common species of *Mediocalcar* in New Guinea; it is found in a wide range of habitats and is abundant in many localities. The large number of synonyms reflects both its abundance and its variability. Specimens growing in deep shade often have long, rather weak and sparsely branched, pendent rhizomes, with flat, relatively thin leaves. Specimens growing in exposed positions at high altitudes, on the other hand, often have short, stiff, densely branched, erect rhizomes, with semiterete, thick leaves. The extremes may look quite different, but as they are entirely connect-

ed by intermediates there can be no doubt that they represent the same species. Most of the synonyms are based on specimens hardly diverging from the average. Some are discussed below. *Mediocalcar bifolium* is certainly closely related to *M. agathodaemonis*, see under the latter species for a discussion.

2. *Mediocalcar brevisaccatum* Schltr. is known to me only from its description; as the colour is not recorded and the inflorescences are simply said to be apical, it is possible that it represents *M. agathodaemonis*. According to Van Royen, who has not seen the type or any other material of this species and states that his description is derived from Schlechter's, the flowers of *M. brevisaccatum* are scarlet with white tips and a white lip.

3. The two collections from the Cyclops Mountains in Irian Jaya (*Mayr 597, van Royen & Sleumer 6119*, both L), the first of which is the type of *M. angustum* J.J. Smith, have somewhat narrower flowers than usual, but the lip is hardly different from that of an average specimen of *M. bifolium*.

4. The flower colour of *M. longipes* Ridley and *M. montanum* Ridley was not recorded. *Mediocalcar montanum* clearly has heteranthous inflorescences, therefore it is likely to be conspecific with *M. bifolium*. *Mediocalcar longipes*, on the other hand, could also be referable to *M. agathodaemonis* (entity '*alpinum*') rather than to *M. bifolium*. The type material is rather poor.

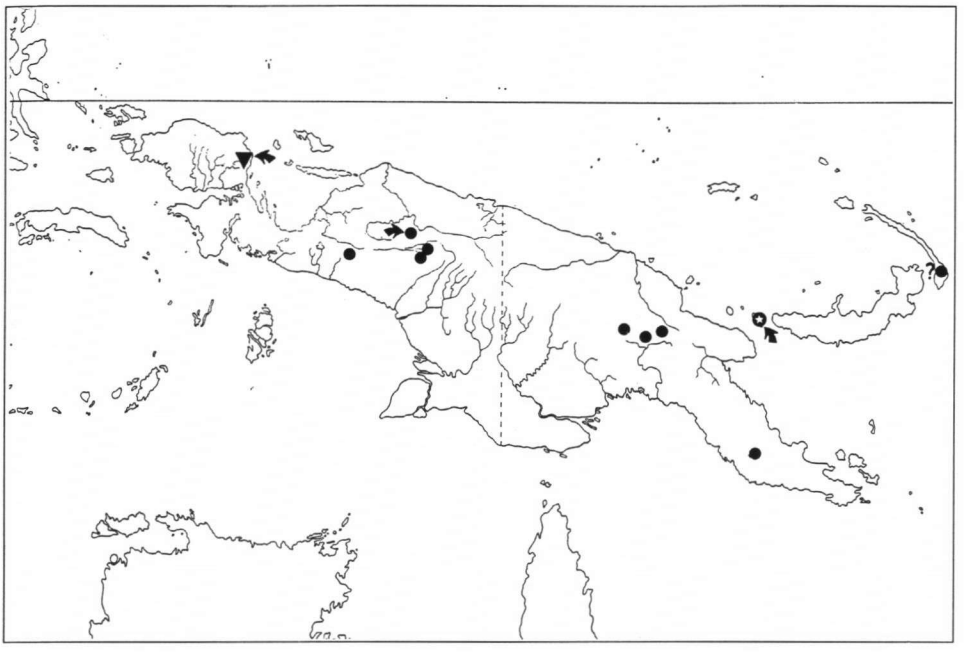
5. In *Streimann & Kairo NGF 27689* (K, LAE) the flowers are said to be yellow. The auricles at the base of the lip are more than twice as long as in any other specimen of *M. bifolium* that I have seen. In other respects it does not seem to differ from typical specimens of *M. bifolium* collected in the same area (Marafunga, Eastern Highlands, Papua New Guinea). Unfortunately, the material is too poor to decide if this is just an aberrant specimen or an undescribed taxon.

6. Vegetatively, *Darbyshire 454* (CANB, L, LAE) from the Torricelli Mountains in Papua New Guinea is conspicuous for its exceptionally long and narrow leaves, up to 11 cm by 5 mm (dried), but the flowers are typical for the species. Another collection from the same area, *Darbyshire 327* (CANB, LAE), is much closer to an average specimen of *M. bifolium*, thus bridging a gap that would otherwise appear to exist.

4. Mediocalcar bulbophylloides J.J. Smith — Fig. 11

Mediocalcar bulbophylloides J.J. Smith in Fedde, Rep. 11 (1913) 560; Nova Guinea 12 (3) (1915) 259, t. 93, fig. 159. — Type: *Gjellerup 1110* (BO).

Roots ?glabrous (see note 1 below), 0.5 mm thick. *Rhizome* creeping, sparsely branching, 2 mm thick. *Cataphylls* of the young shoot 3 or 4, closely appressed, subacute to acute, glabrous, keeled near the tip. *Pseudobulbs* suberect to erect, approximate, obliquely conical, 0.6–1 cm long, 3–4 mm across at the base, with the base clasping the rhizome like a saddle. *Leaves* 1 per pseudobulb, (sub)petiolate, elliptic [index 2–3], blade 1.8–2.8 cm long, 8–10 mm wide, petiole channelled, 2–3 mm long; glabrous; margin entire; apex obtuse, more or less unequally bilobulate, mucronate, with the mucro slightly longer than the lobules; carnose. *Inflorescences* solitary or in pairs, synanthous, at the base with an inconspicuous scale 0.5 mm long. *Peduncle* 15 mm long, at the apex with a triangular bract 1 mm long. *Pedicel* and ovary 10 mm long. *Flowers* vase-shaped, slightly oblique, 9.5 mm long. *Synsepalum* 9 mm long and 8 mm wide when cut open and flattened; free tips



Map 5. Known localities of *Mediocalcar crenulatum* J.J. Smith (●), *M. bulbophylloides* J.J. Smith (▼), and *M. umboiense* Schuit. (✪).

only slightly spreading, 3.8–4 mm long, obtuse. *Petals* linear-subspathulate [index 7.7], 7.7 by 1 mm; apex acute; 2-nerved. *Lip* 7.3 by 2.5 mm in natural position, the blade broadly ovate when flattened; claw 4.3 by 2 mm, auricles inconspicuous; apex acute, porrect; margins erect, clasping the column; spur shallowly saccate 1 mm deep. *Column* clavate, 4.5 mm long, foot conspicuous, 1.6 mm long. *Fruit* (immature) cylindrical, 20 mm long, 1.5 mm across.

Colour — Flowers red or pink, apparently without contrasting apices.

Distribution — New Guinea (Irian Jaya: Cenderawasih: Arfak Mts), 2 collections: *Gjellerup 1110* (BO), *Kostermans 2492* (BO). Map 5.

Habitat & Ecology — Epiphyte in montane forest. Altitude 1800–1900 m.

Etymology — From *Bulbophyllum*, an orchid genus, and the Greek *-ides*, 'resembling', hence: resembling a *Bulbophyllum*. Refers to the habit of this species.

Notes — 1. In the two collections seen the roots appear to be glabrous. It is possible, however, that an indumentum was present, which has disappeared due to the age and state of conservation of this material. This is a phenomenon frequently observed in older specimens.

2. Only dried material was available. The description of the flowers largely follows that of Smith, who had, besides dried specimens, spirit material at his disposal.

3. *Mediocalcar bulbophylloides* is easily distinguished by the closely spaced, 1-leaved pseudobulbs carrying small elliptic leaves not much larger than those of *M. pygmaeum*.

5. **Mediocalcar congestum** Schuit., *spec. nov.* — Fig. 12

Pseudobulbi approximati erecti unifoliati, folia anguste lanceolata, inflorescentiae solitariae, calcar breviter saccatum. — Typus: *Reeve 5049* (L holo; K, LAE, NSW iso, n.v.).

Roots densely covered with root hairs, 1 mm thick. *Rhizome* abbreviated, more or less frequently branching, 2–3 mm thick. *Cataphylls* of the young shoot 5 or 6, closely appressed, acute, glabrous, keeled near the tip. *Pseudobulbs* erect to suberect, approximate, narrowly conical to cylindrical, (1–)2–4 cm long, 5 mm across at base; base not elongated. *Leaves* 1 per pseudobulb, sessile, narrowly lanceolate [index 5.5–19], 3.5–12(–15) cm by (5–)8–15 mm; glabrous; margins entire; apex rounded, obscurely bilobed, mucronate, with the mucro as long as the lobules; coriaceous. *Inflorescences* solitary, synanthous and either heteranthous or proteranthous (see note 2); basal bract lanceolate, acuminate, 5–9 mm long. *Peduncle* 10–25 mm long, at the apex with a triangular bract 1.3 mm long. *Pedicel* and ovary 10–12 mm long. *Flowers* urceolate or vase-shaped, not or slightly oblique, 9–10.5 mm long. *Synsepalum* 9–10 mm long and 15 mm wide when cut open and flattened; free tips only slightly spreading, 4 mm long, subacute. *Petals* linear to lanceolate [index 4–8], 8 by 1–2 mm; apex acuminate; 3-nerved. *Lip* 7.5–8 by 3.5 mm in natural position, the blade broadly ovate when flattened; claw 3–3.3 by 2.7 mm, auricles rather inconspicuous to well developed, reflexed; apex acuminate, porrect; margins erect, clasping the column; spur short-saccate, 1.3 mm deep. *Column* 5.5 mm long, 2.2 mm wide at the apex, foot 0.7 mm long. *Fruit* not seen.

Colour — Flowers orange or orange-red with green or yellowish tips.

Distribution — New Guinea (Papua New Guinea: Enga, Southern, Western & Eastern Highlands and Morobe Provinces), 7 collections: *Coode & Katik NGF 32968* (LAE), *Cribb & Morrison 2197* (K, spirit mat.), *Millar & Garay NGF 18674* (LAE), *Millar & Garay NGF 18698* (LAE), *Reeve 5049* (K, L, LAE, NSW), *Schuiteman, Mulder & Vogel 90-49* (L, spirit mat.), *Wade ANU 7302* (CANB, LAE). Map 11.

Habitat & Ecology — Epiphyte in upper montane forest, sometimes on thin branches. Altitude 2150– 2850 m.

Etymology — From the Latin *congestus*, 'amassed'; referring to the closely spaced pseudobulbs.

Notes — 1. *Mediocalcar congestum* is well characterized by the closely spaced, erect, cylindrical pseudobulbs carrying a single narrowly lanceolate leaf.

2. In some specimens inflorescences arise from shoots in which the leaf is not visible. It is possible that these are heteranthous inflorescences, but they could also be proteranthous. If they are heteranthous, then *M. congestum* is the only species of *Mediocalcar* where heteranthous inflorescences co-occur with pseudobulbs not showing bud displacement.

6. **Mediocalcar crenulatum** J.J. Smith — Fig. 12

Mediocalcar crenulatum J.J. Smith, Nova Guinea 14 (3) (1929) 381, t. 54, fig. 37; H.J. Lam, Nat. Tijdschr. Ned. Indië 89 (1929) 81, 99; P. Royen, Alp. Fl. New Guinea 2 (1979) 673, fig. 238. — Syntypes: *Lam 1599* (BO lecto, chosen by Van Royen; K, L iso), *Lam 1642* (AMES, BO, L, P), *Lam 1998* (BO, spirit mat., n.v.).

Roots densely covered with root-hairs, 0.7–1 mm thick. *Rhizome* creeping, infrequently branching, 2–4 mm thick. *Cataphylls* 5–8, closely appressed to rather loose-fitting, ?gla-

brous (see note 4 below), subacute to acute, keeled near the tip; tips sometimes subpatent. *Pseudobulbs* erect to suberect, (1.5–)3–6(–10) cm apart, narrowly conical or obliquely ovoid to subcylindrical, (0.7–)1–2.5 cm long, 5–6.5 mm across at the base, c. 3 mm across at the top, base not elongated; predominantly 1-leaved, 2-leaved shoots not infrequent, at least in some populations; the second, uppermost leaf, if present, smaller than the first leaf. *Leaves* sessile to subpetiolate, narrowly elliptic [index 4–10], gradually narrowing toward the channelled base, (3.7–)5.5–11(–19) cm long, (7–)10–20(–26) mm wide; glabrous or verrucose above; margin minutely crenulate, often only near the apex; apex acute to acuminate, minutely bilobulate, mucronate, with the mucro longer than the lobules; coriaceous to carnose. *Inflorescences* usually in pairs, occasionally solitary, synanthous, at the base with a lanceolate scale 3–10 mm long. *Peduncle* 20–44 mm long, elongating to up to 70 mm in fruiting specimens, at the apex with a triangular to subulate bract 1.5–3 mm long. *Pedicel* and ovary 12–13 mm long. *Flowers* urceolate, slightly oblique, 13.5–15 mm long. *Synsepalum* 13–16 mm long and c. 19 mm wide when cut open and flattened; free tips only slightly spreading, 4.5–5.3 mm long, apices obtuse. Lateral sepals smooth. *Petals* lanceolate to narrowly elliptic [index 4.5–6.5], 11 by 1.7–2.5 mm; apex acute; 3-nerved. *Lip* by 11–12.5 mm long, the blade broadly ovate when flattened; claw 5 by 2.7 mm, auricles conspicuous, deflexed; apex acuminate, slightly recurved; margins erect, clasping the column; spur saccate, 1–2 mm deep. *Column* clavate, 8 mm long; foot conspicuous, c. 2 mm long. *Fruit* subclavate, c. 20 mm long, c. 4 mm across.

Colour — Flowers bright red to orange-red, with greenish or yellow tips. Leaves light green to purplish green.

Distribution — New Guinea (Irian Jaya: Paniai and Peg. Jayawijaya; Papua New Guinea: Chimbu, Western Highlands, Eastern Highlands, and Central Provinces), 12 collections (AMES, BM, BO, CANB, K, L, LAE, P). See note 2. Map 5.

Habitat & Ecology — Usually terrestrial or lithophytic in low subalpine vegetation and open ridge crest forest, also epiphytic on trees and shrubs in upper montane forest. Altitude 2400–3640 m.

Etymology — From the Latin *crenula*, 'a small notch'. Refers to the minutely crenated leaf margin.

Notes — 1. *Mediocalcar crenulatum* is a predominantly subalpine species that is probably most closely related to *M. geniculatum*. The latter differs in having constantly 2-leaved pseudobulbs (usually 1-leaved in *M. crenulatum*), mostly much shorter, elliptical leaves with a distinct petiole (versus lanceolate leaves that are not distinctly petiolate), thinner, sparsely hairy roots (against densely hairy roots) and an incurved (straight) column-foot. Also, in *M. geniculatum* the peduncles apparently do not elongate following fertilization, as they do in *M. crenulatum* (see note 3). *Mediocalcar geniculatum* has so far not been found in the subalpine zone.

2. An unfortunately sterile collection from New Ireland, *Sands et al. 2275*, is, at least habitually, more or less intermediate between *M. crenulatum* and *M. geniculatum*. The pseudobulbs are 1-leaved, the leaves are elliptic, larger than those of *M. geniculatum*, and distinctly petiolate. It was collected at 2000 m in the Hans Meyer Range. I am inclined to consider this to be an undescribed species.

3. In all fruiting specimens the peduncles carrying fruits are much longer than those carrying flowers. Apparently the peduncles elongate considerably after fertilization. This phenomenon may also occur in *M. paradoxum* subsp. *paradoxum*, but not, as far as now

known, in any other species of *Mediocalcar*. This recalls the observation by Schlechter (1914: xliv) that in the genus *Corybas* the pedicels of terrestrial species elongate after fertilization, which does not happen in epiphytic members of this genus (the latter point needs confirmation, however). Schlechter pointed out that this should increase the dispersal capacities of the terrestrial species, as these, being low-growing plants, would otherwise be at a disadvantage. It is perhaps significant that *M. crenulatum* is predominantly a terrestrial species, the flowers appearing less than 6 cm above the ground.

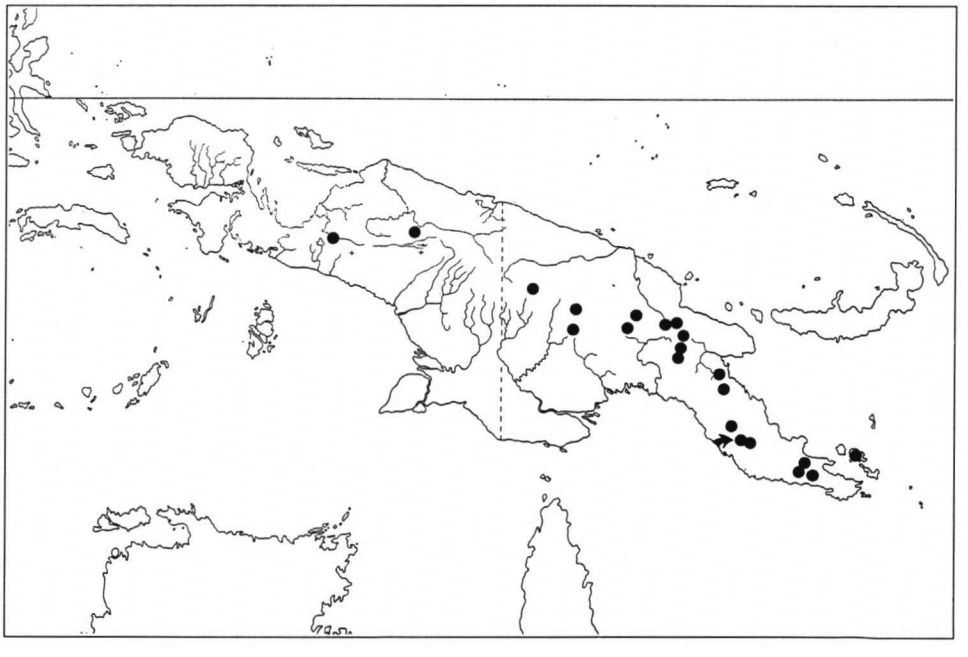
4. Only dried specimens were available. It is possible that the cataphylls are not smooth as described above, but have the same kind of warts as in *M. geniculatum*. There they tend to disappear in herbarium material. The description of the flowers is partly adapted from that by J.J. Smith, who had spirit material at his disposal.

7. **Mediocalcar decoratum** Schuit. — Fig. 14; Plate 2d

Mediocalcar decoratum Schuit., Blumea 34 (1989) 167; Reeve, Orchadian 9 (1990) 265. — Type: *Morrison 1659* (K, spirit mat.).

Mediocalcar erectum auct. non Schltr.: Senghas, 'Orchideen', (1993) 106 (colour photograph).

Roots densely covered with root hairs, 0.5 mm thick. *Rhizome* creeping, freely branching, mat-forming, 1 mm thick. *Cataphylls* 3–5, transparent, subacute, keeled. *Pseudobulbs* almost entirely enveloping the rhizome, 1–5 mm apart, cylindrical to slightly clavate, glabrous, (5–)10–15(–20) mm long, 3–6 mm across. *Leaves* usually 4, frequently 3, occasionally 2, 5, or 6 per pseudobulb, very shortly petiolate, spreading in one plane; convex on both sides; narrowly elliptic [index 3.5–6], (7–)10–18(–23) mm by 2–4 mm; margins



Map 6. Known localities of *Mediocalcar decoratum* Schuit.

entire; apex obtuse to subacute, rarely acute, obscurely bilobulate, minutely mucronate, with the mucro about as long as the lobules; carnose. *Inflorescences* normally solitary, heteranthous or infrequently synanthous, at the base with a rudimentary scale. *Peduncle* 3–7 mm long, at the apex with a triangular acuminate bract 1.5 mm long. *Pedicel* and ovary 5–7 mm long. *Flowers* urceolate-globose, oblique, 5–7 mm long. *Synsepalum* 6.5–8.5 mm long and 12–16 mm wide when cut open and flattened; free tips patent or reflexed, 2.5–3.5 mm long, acute to subacute; all sepals conspicuously gibbose. *Petals* linear-elliptic [index 5.5–7], 5.5–7 mm by 1 mm.; apex acute, 1-nerved. *Lip* 5–7 mm by 3 mm in natural position, the blade broadly ovate when flattened; claw 1 by 2 mm, auricles inconspicuous; apex acute, reflexed; margins erect, clasping the column; spur saccate, recurved, parallel to the column, 3 mm long, 3 mm wide just below the mouth. *Column* broadly clavate, 3 mm long, 2 mm wide at the apex, foot very short. *Fruit* cylindrical to subclavate, 10 by 3 mm.

Colour — Flower bright orange to orange-red with golden yellow tips to the sepals, petals and lip; rarely red with green tips, orange with white tips, or entirely orange or yellow. Enclosed parts of petals and lip cream colour or pale orange. Column cream colour. Pollinia white. Peduncle and ovary brownish red. Leaves bright green to dull green above, pale green below, often tinged purple when growing in strong light. Pseudobulbs yellowish green or purplish.

Distribution — New Guinea (Irian Jaya: Paniai and Peg. Jayawijaya; Papua New Guinea: West Sepik, Enga, Southern, Western & Eastern Highlands, Morobe, Central, and Milne Bay Provinces), 43 collections (AMES, CANB, E, K, L, LAE, S, SING). Map 6.

Habitat & Ecology — Epiphyte in montane forest, usually on trunks or large branches of *Nothofagus*, *Castanopsis*, *Dacrydium* etc. Altitude 900–2500 m [according to Reeve (l.c.) up to 2500 m in the Enga Province of Papua New Guinea, but I have not seen any specimens collected above 2000 m].

Etymology — From the Latin *decoratus*, 'decorated'. Refers to the leaves, mostly four per pseudobulb, which are arranged like a cross.

Notes — 1. *Mediocalcar decoratum* is a distinctive species with only one close ally, *M. umboiense*. See under the latter for comparative notes. These two species are the only ones in the genus that regularly produce four-leaved pseudobulbs.

2. *Womersley & Hoogland NGF 4963* (CANB, L, LAE) is an unusual collection in two respects. The flowers are said to have been white-tipped, unlike any other record. In addition, nearly all the heteranthous flowering shoots produced new heteranthous flowering shoots, forming short, unbranched sympodia of leafless and pseudobulb-less shoots.

8. **Mediocalcar geniculatum** J.J. Smith — Fig. 15

Mediocalcar geniculatum J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 3 (1912) 70; Nova Guinea 12 (1) (1913) 31, t. 8, fig. 21; ibid. 12 (3) (1915) 261. — Type: *Gjellerup 533*, p.p. (BO, spirit material, n.v.).
Mediocalcar abbreviatum auct. non Schltr.: R.L. Dressler, The Orchids (1981) pl. 10, fig. 58.

Roots covered with minute root-hairs, 0.5 mm thick. *Rhizome* creeping, rather sparsely branching, 2 mm thick. *Cataphylls* of the young shoot 5–8, closely appressed, densely verrucose (see note 2 below), subacute, keeled near the tip. *Pseudobulbs* erect to suberect, (0.5–)1.5–3.5(–6) cm apart, narrowly conical to subcylindrical, (0.5–)2–4 cm long, 3–5 mm across at the base; base not elongated. *Leaves* 2 per pseudobulb, petiolate, the blade elliptic [index 2–4.5], (1–)2–5(–6) cm by (7–)10–20(–25) mm, petiole (4–)10–20 mm

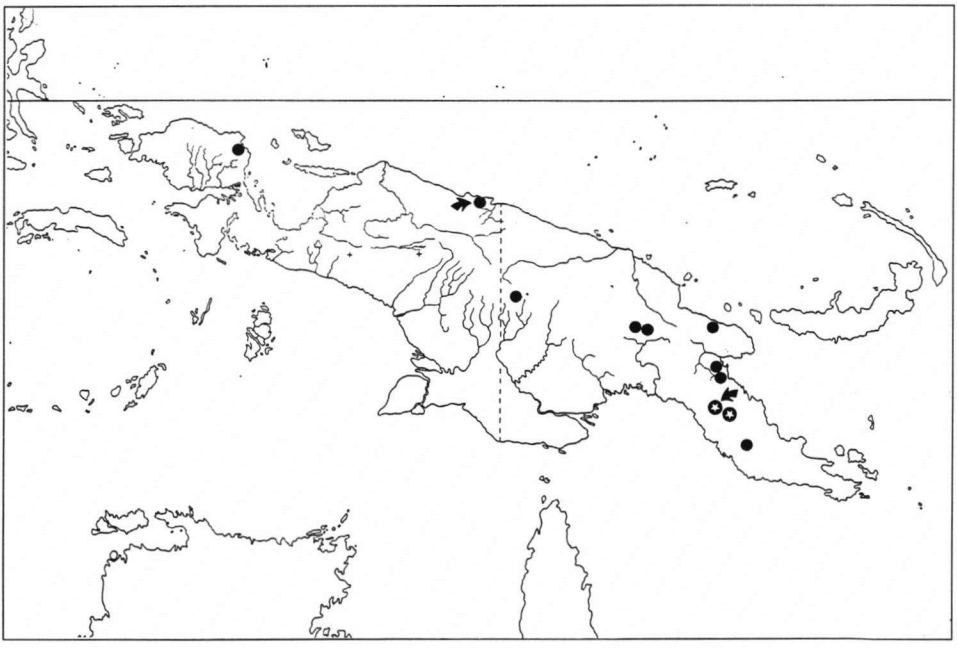
long; glabrous to slightly warty above, glabrous below; margin minutely crenulate; apex acute to subacute, rarely obtuse, minutely bilobulate, mucronate, with the mucro longer than the lobules; carnose. *Inflorescences* usually in pairs, occasionally solitary, synanthous, at the base with an inconspicuous scale 1 mm long. *Peduncle* 11–30 mm long, at the apex with a triangular to subulate bract 1.5–2 mm long. *Pedicel* and ovary 11–13 mm long. *Flowers* narrowly urceolate, slightly oblique, 10–11 mm long. *Synsepalum* 10–11 mm long and 11–13 mm wide when cut open and flattened; free tips only slightly spreading, 3 mm long, subacute. *Petals* linear to subspathulate [index 5.5– 6], 8–9 by 1.5 mm; apex acute to acuminate; 3-nerved. *Lip* 8–9 by 3 mm in natural position, the blade ovate when flattened; claw 4–5 by 2.5 mm, narrowing towards the base, auricles hardly developed; apex acute, somewhat recurved; margins erect, clasping the column; the blade with a shallow depression, 1 mm deep. *Column* clavate, 5–5.5 mm long, 2 mm wide at apex; foot conspicuous, 1.5 mm long, geniculate. *Fruit* cylindrical-subclavate, 23–25 mm long, 4 mm across.

Colour — Flowers bright red to orange-red with yellowish green to rather dark green tips. Peduncle and ovary red. Leaves olive-green, paler green below, usually with red-brown or purplish margins. Pseudobulbs olive-green to dull purple.

Distribution — New Guinea (Irian Jaya: Cenderawasih and Jayapura; Papua New Guinea: West Sepik, Madang, Enga, Eastern & Western Highlands, Morobe, and Central Provinces), 23 collections seen (AMES, BM, BO, CANB, E, K, L, LAE). Map 7.

Habitat & Ecology — Epiphyte on tree trunks in montane forest, usually in moss cushions; rarely terrestrial. Flowering probably throughout the year. Altitude 1600–2590 m.

Etymology — From the Latin *geniculum*, 'a small knee'. Refers to the abruptly bent column foot.



Map 7. Known localities of *Mediocalcar geniculatum* J.J. Smith (●) and *M. stevenscoodei* P. Royen (✪).

Notes — 1. *Mediocalcar geniculatum* was described from part of a mixed collection, *Gjellerup 533*. The type specimen, as illustrated in Nova Guinea, consisted of the apex of a pseudobulb with two inflorescences and two petioles; the leaves had been cut off by the collector. Two years later, Smith identified part of *Gjellerup 1071* as *M. geniculatum*, but failed to amplify his incomplete description. The specimens cited by Smith were preserved in formalin and have not been seen by me. However, among Smith's manuscript notes there is an excellent drawing by Natadipoera, depicting *Gjellerup 1071*. It shows a complete flowering shoot, with the leaves and pseudobulb intact. There is only one other collection from Irian Jaya, viz. *van Royen & Sleumer 6028* (L). This, like the type specimen, was collected in the Cyclops mountains.

2. The cataphylls are distinctly verrucose in living and pickled specimens, but in dried material they often appear glabrous.

3. *Mediocalcar geniculatum* may be recognized by the mostly erect, 2-leaved pseudobulbs carrying elliptic, petiolate leaves with crenulate margins.

9. **Mediocalcar paradoxum** (Kraenzl.) Schltr.

For literature, see under the subspecies.

Roots densely covered with root hairs, 0.5–1 mm thick. *Rhizome* creeping, rather sparsely branching, 3–4 mm thick. *Cataphylls* 5–7, glabrous. *Pseudobulbs* erect to suberect, obliquely conical to semiglobose, 0.7–2.5 cm long, base either or not elongated, if elongated then clasping but not enveloping the rhizome. *Leaves* 1 per pseudobulb, narrowly elliptical to suborbicular, either or not petiolate, keeled below, 2.5–17 cm by 8–33 mm; margins entire; apex obtuse to subacute, more or less unequally bilobed; coriaceous. *Inflorescences* solitary or in pairs, synanthous, at the base with a narrow scale 3–4 mm long. *Flowers* narrowly urceolate to broadly urceolate, 9–15 mm long. *Spur* less than half as long to about equally long as the claw. *Fruit* narrowly ellipsoid, 2.5–4 cm by 3–5 mm.

Distribution and Habitat & Ecology — See under the subspecies.

KEY TO THE SUBSPECIES OF MEDIOCALCAR PARADOXUM

1a. Spur (almost) extending to the base of the claw 2
b. Spur at most extending to about halfway the claw ..... **a.** subsp. **paradoxum**
2a. Cataphylls patent, laterally compressed, subfalcate; pseudobulbs usually subglobose, often dorso-ventrally compressed and 2-angled; leaves broadly elliptic to suborbicular, usually distinctly petiolate ..... **b.** subsp. **latifolium**
b. Cataphylls closely appressed, obliquely tubular; pseudobulbs obliquely conical, not angled; leaves (broadly) lanceolate to elliptic, at most indistinctly petiolate ..... **c.** subsp. **robustum**

a. subsp. **paradoxum** — Fig. 16

Mediocalcar paradoxum (Kraenzl.) Schltr. in Fedde, Rep. 9 (1910) 96; Cristoph., Bish. Mus. Bull. 128 (1935) 65; Lewis & Cribb, Orch. Vanuatu (1989) 76, fig. 13A–G, pl. 3B; Orch. Solomon Isl. & Bougainville (1991) 121, fig. 13A–G, pl. 7B; Kores, Allertonia 5 (1989) 105; Fl. Vitiensis Nova 5 (1991) 446, fig. 59. — *Eria paradoxa* Kraenzl., Bot. Jahrb. 25 (1898) 606; in Engl., Pflanzenr. Heft 50B (Orch.–Monandr.–Dendrob. 2) (1911) 30. — Type: *Reinecke 300* (HBG holo, n.v.; G iso).

Mediocalcar vanikorense Ames, J. Arnold Arbor. 13 (1932) 136. — Type: *Kajewski 641* (AMES holo).

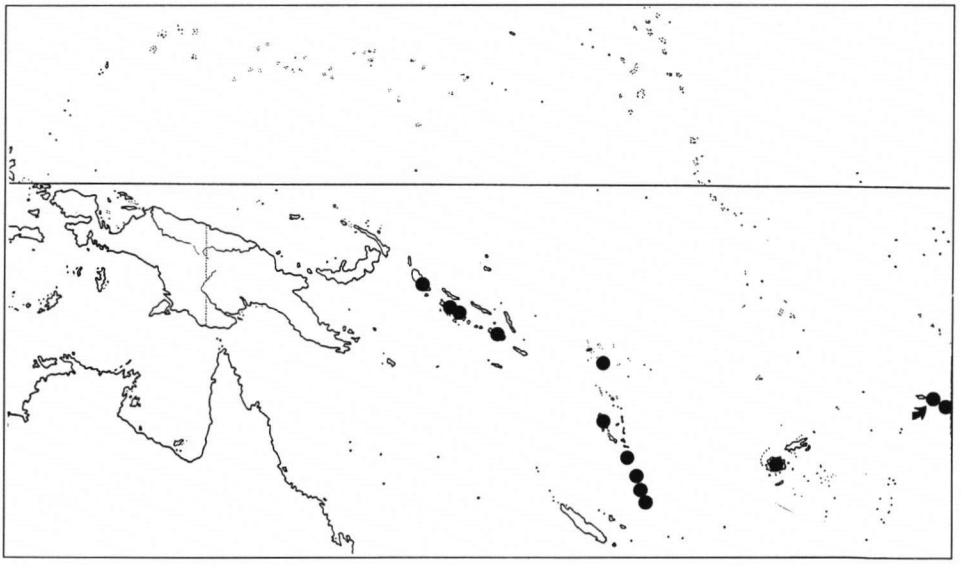
Roots 0.5–1 mm thick. *Cataphylls* closely appressed, tubular to more or less laterally flattened, glabrous, subacute, keeled. *Pseudobulbs* (1–)2–5 cm apart, (obliquely) conical, 0.5–2 cm long, 6–8 mm across at the base; base not or somewhat elongated. *Leaves* sessile to petiolate, elliptic or narrowly elliptic to narrowly obovate [index 2.7–11], (3.5–)5–12.5 cm by 8–24 mm; apex obtuse to subacute, mucronate, with the mucro longer than the lobules. *Inflorescences* solitary or in pairs. *Peduncle* 2.5–3.5 cm long (up to 5 cm long after fertilization), at the apex with a narrowly triangular, acuminate bract c. 2 mm long. *Pedicel* and ovary 11–12 mm long. *Flowers* vase-shaped, slightly oblique, 9–11 mm long. *Synsepalum* 9–11 mm long and 14.5–17.5 mm wide when cut open and flattened; free tips only slightly spreading, obtuse to subacute, 3.5–4.5 mm long. Lateral sepals smooth or indistinctly keeled near the tips. *Petals* lanceolate to narrowly elliptic [index 4.5–8], 8–9 by 1–2 mm; apex acute; 3-nerved. *Lip* 6.5–8.5 by 3–4 mm in natural position, the blade broadly ovate when flattened; claw 3–3.5 by 2 mm, auricles rather inconspicuous, reflexed; apex acute to acuminate, straight; margins erect, clasping the column; spur saccate, recurved, 1–1.5 mm long, c. 1.25 mm wide just below the mouth. *Column* clavate, 5–5.5 mm long, c. 2 mm wide at the apex, foot short, 1–1.5 mm long. *Fruit* narrowly cylindrical, 25–40 by 3 mm.

Colour — Flowers red, orange, or yellow, with greenish or yellow tips.

Distribution — Solomon Islands, 9 collections (K, L, LAE, SING). Santa Cruz Archipelago, 2 collections (AMES). Vanuatu, 17 collections (K, L, P). Fiji, 4 collections (AMES, K, L, P, S). Samoa, 5 collections (AMES, G, K). Map 8.

Habitat & Ecology — Epiphyte in lowland and montane rain forest and scrub-forest. Rarely terrestrial on vertical banks. Altitude 0–1500 m, mostly above 500 m.

Etymology — From the Greek *para*, 'against', and *doxa*, 'opinion', hence: unexpected, out of the ordinary. This taxon was first described as a species of *Eria*, in which genus it is indeed something out of the ordinary. As a species of *Mediocalcar*, however, it is one of the least remarkable.



Map 8. Known localities of *Mediocalcar paradoxum* (Kraenzl.) Schltr. subsp. *paradoxum*.

Note — *Mediocalcar paradoxum* subsp. *paradoxum* may be recognized by the 1-leaved, obliquely conical, widely spaced pseudobulbs with the base clasping the rhizome like a saddle, the obtuse to subacute leaves with entire margins and the short-spurred flowers. In the Solomon Islands, where the ranges of subsp. *paradoxum* and subsp. *robustum* overlap, intermediate forms exist. See under the latter subspecies for a discussion.

b. subsp. **latifolium** (Schltr.) Schuit., *stat. & comb. nov.* — Fig. 17; Plate 3a

Mediocalcar latifolium Schltr. in Fedde, Rep., Beih. 1 (1911) 228; ibid. 21 (1923) t. 84, fig. 309. — Syntypes: *Schlechter 17281* (B lost), *Schlechter 18981* (B lost). Neotype (here chosen): *Hoogland 9290* (CANB holo; LAE iso).

Mediocalcar conicum J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 3 (1912) 70; Nova Guinea 12 (1) (1913) 29, t. 7, fig. 21, syn. nov. — Type: *Gjellerup 533*, p.p. (BO holo, L iso).

Mediocalcar ericiflorum Schltr., Bot. Jahrb. 58 (1922) 67, syn. nov. — Type: *Ledermann 12419* (B lost).

Roots 1 mm thick. *Cataphylls* 5–8, patent, flattened, subfalcate, glabrous, acute, keeled. *Pseudobulbs* erect to suberect, 1.5–5.5 cm apart, broadly conical to semiglobose, dorsoventrally compressed, keeled, 0.7–1.5 cm long, 5–10 mm across at the base; base not or slightly elongated. *Leaves* petiolate, the blade (narrowly) elliptic to suborbicular, rarely narrowly obovate [index 1.3–5], (1.5–)2.5–8(–10) cm by (10–)15–33 mm, petiole 5–10 mm long; apex obtuse, more or less unequally bilobed, mucronate, with the mucro (much) longer than the lobules. *Inflorescences* almost always in pairs. *Peduncle* 2–3 cm long, at the apex with a triangular to subulate bract c. 3 mm long. *Pedicel* and ovary 12–22 mm long. *Flowers* vase-shaped to urceolate, more or less oblique, 10–15 mm long. *Synsepalum* 11–15.5 mm long and 16–19.5 mm wide when cut open and flattened; free tips only slightly spreading, obtuse to subacute, 3–6 mm long. Lateral sepals more or less keeled. *Petals* linear-lanceolate to narrowly elliptic [index 4–8], 7–12 by 1–1.7 mm; apex acute to acuminate. *Lip* 7–12 by 3–4 mm in natural position, the blade broadly ovate when flattened; claw 3.5–5 by 2–2.5 mm, auricles rather inconspicuous, reflexed; apex acute to acuminate, straight; margins erect, clasping the column; spur recurved, 2.5–4.5 mm long, 1.5–2.5 mm wide just below the mouth. *Column* clavate, 5–6.5 mm long, 2–2.5 mm wide at the apex, foot short, 1–1.5 mm long. *Fruit* narrowly cylindrical-ellipsoid, 20–34 by 3 mm.

Colour — Flowers bright to pinkish red with yellowish or greenish tips to the sepals, petals and lip. Leaves light to bluish green, sometimes with purplish veins when young.

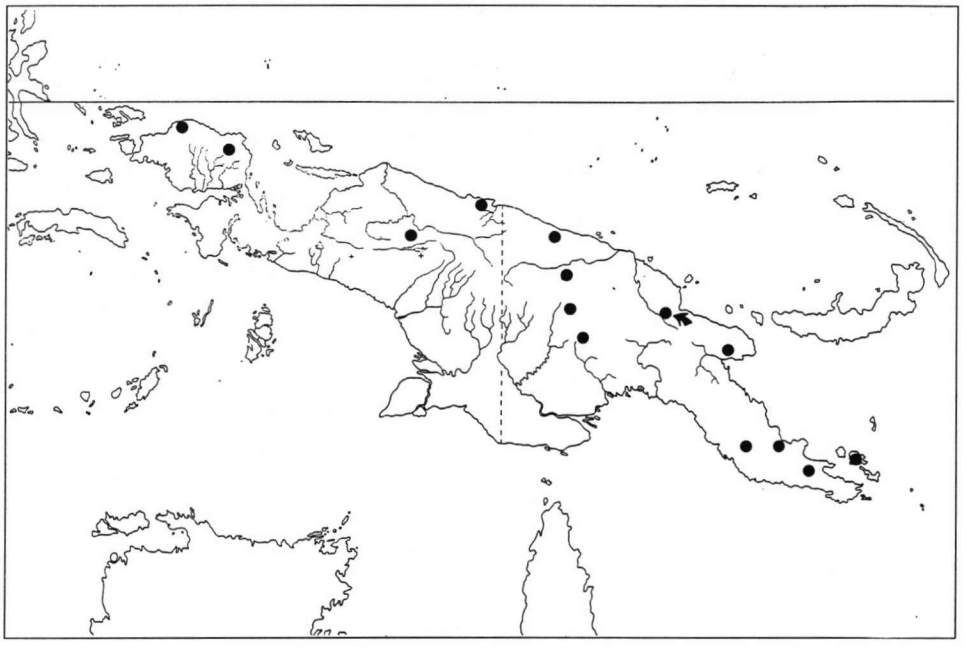
Distribution — New Guinea (Irian Jaya: Cenderawasih, Peg. Jayawijaya, Jayapura; Papua New Guinea: West Sepik, East Sepik, Enga, Southern Highlands, Madang, Morobe, Central, Northern, and Milne Bay Provinces, including Fergusson Island), 34 collections (AMES, BM, CANB, E, K, L, LAE, S). Map 9.

Habitat & Ecology — Epiphyte on logs and tree trunks in montane forest, rarely terrestrial in low open forest. Altitude 900–1900 m.

Etymology — From the Latin *latus*, 'broad', and *folium*, 'leaf', hence: broad-leaved.

Notes — 1. Typical specimens of subsp. *latifolium* are unmistakable, having short, thick, 2-angled pseudobulbs that are shorter than the persistent, patent, subfalcate cataphylls, and carrying a single, petiolate, broadly elliptic to suborbicular leaf with entire margins. The inflorescences almost always arise in pairs and the flowers have a spur about equalling the claw in length. Were it not for the existence of less characteristic specimens, with narrower leaves and less conspicuous cataphylls, that are very similar to subsp. *robustum*, I would have retained subsp. *latifolium* at species level.

2. *Mediocalcar ericiflorum* is undoubtedly based on one of the dwarfed specimens that are encountered now and then (e.g. *Cruttwell 421, Hoogland & Craven 10919*). Such specimens probably originate from exposed places or extremely nutrient-poor habitats.



Map 9. Known localities of *Mediocalcar paradoxum* (Kraenzl.) Schltr. subsp. *latifolium* (Schltr.) Schuit.

c. subsp. **robustum** (Schltr.) Schuit., *stat. & comb. nov.* — Fig. 18

Mediocalcar robustum Schltr. in Fedde, Rep., Beih. 1 (1911) 225, ibid. 21 (1923) t. 83, fig. 305; Lewis & Cribb, Orch. Solomon Isl. & Bougainville (1991) 120. — Type: *Schlechter 20278* (B lost). Neotype (here selected): *Ledermann 8880* (E holo; AMES, K iso).

?*Mediocalcar bicolor* J.J. Smith, Bull. Inst. Bot. Buitenzorg 7 (1900) 3; Pfitzer in Engl. & Prantl, Nat. Pflanzenfam., Nachtr. 3 (1908) 86. — *Cryptochilus bicolor* (J.J. Smith) J.J. Smith, Icon. Bogor. 2 (1903) 65, t. 112A. — *Eria tunensis* Kraenzl. in Engl., Pflanzenr. Heft 50B (Orch.–Monandr.–Dendrob. 2) (1911) 31, syn. nov. — Type: *Smith s.n.* (BO).

Mediocalcar kaniense Schltr. in Fedde, Rep., Beih. 1 (1911) 226; ibid. 21 (1923) t. 83, fig. 306; Die Orchideen, ed. 3, 1 (1970) 376, t. 230, fig. 9 (*'caniense'*), syn. nov. — Syntypes: *Schlechter 16714* (K lecto; AMES, BM, BO iso), *Schlechter 17715* (AMES, BM, BO, K).

Mediocalcar stenopetalum Schltr. in Fedde, Rep., Beih. 1 (1911) 226; ibid. 21 (1923) t. 84, fig. 307, syn. nov. — Type: *Schlechter 20204* (B lost).

Mediocalcar ponapense Schltr., Bot. Jahrb. 56 (1921) 475; Glassman, Bish. Mus. Bull. 209 (1952) 118, syn. nov. — Syntypes: *Ledermann 13359, 13712* (both B lost).

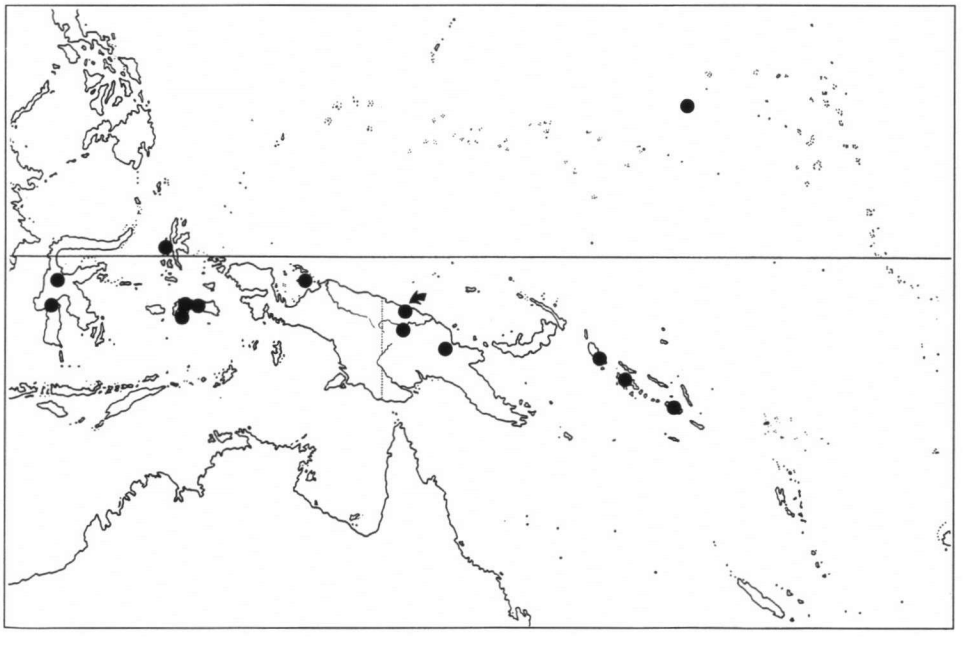
Mediocalcar ternatense J.J. Smith, Bull. Jard. Bot. Buitenzorg III, 9 (1927) 146; Reinwardtia 1 (1950) t. 185, fig. 2, syn. nov. — Type: *Beguin 1539* (L holo, BO iso).

Mediocalcar selebicum J.J. Smith, Bot. Jahrb. 65 (1933) 476; Reinwardtia 1 (1950) t. 185, fig. 1, syn. nov — Type: *Kjellberg 1505* (L holo; BO, S iso).

Roots densely covered with root-hairs, 1 mm thick. *Cataphylls* 5–7, closely appressed, tubular, subglabrous, obtuse to subacute, sometimes emarginate, keeled near the tip. *Pseudobulbs* (1–)3–7.5 cm apart, obliquely conical, 1–2.5 cm long, 5–10 mm across at base; base more or less elongated. *Leaves* sessile, (broadly) lanceolate to elliptic [index 4.5–11], (3–)6–17 cm by (8–)10–29 mm; apex subacute, mucronate, with the mucro as long as or longer than the lobules; coriaceous. *Inflorescences* solitary or more frequently in pairs. *Peduncle* 2.5–3 cm long, at the apex with a triangular, acuminate bract 1 mm long. *Pedicel* and ovary 15–30 mm long. *Flowers* urceolate to broadly urceolate, oblique, 11–13 mm long. *Synsepalum* 12–14 mm long and 17.5–23 mm wide when cut open and flattened; free tips only slightly spreading, obtuse to subacute, c. 4.5 mm long. Lateral sepals smooth or more or less keeled. *Petals* linear-lanceolate or oblanceolate [index 4– 5.5], 8–9 by 1.5–2 mm; the apex acute to acuminate; 3-nerved. *Lip* 8.5–9.5 by c. 4 mm in natural position, the blade broadly ovate when flattened, more or less obscurely 3-lobed; claw 2.5–3.8 by c. 2 mm, auricles more or less conspicuous, reflexed; apex acute to acuminate, straight or slightly reflexed; margins erect, clasping the column; spur recurved, 2–3.8 mm long, 1.5–2.5 mm wide just below the mouth. *Column* clavate, 4.5– 6 mm long, c. 2.5 mm wide at the apex, foot short to rather long, 0.5–2 mm long. Fruit narrowly ellipsoid, 27 by 5 mm.

Colour — Flowers red with yellow or greenish yellow tips.

Distribution — Sulawesi, 4 collections (BO, L, S). Moluccas (Ambon, Seram, Ternate), 6 collections (BO, L). New Guinea (Irian Jaya: Japen Island; Papua New Guinea: West Sepik, East Sepik, and Madang Provinces), 4 collections (AMES, BM, BO, E, K). Micronesia (Ponape), 2 collections (AMES). Solomon Islands, 3 collections (AMES, CANB, K, L, LAE). Map 10.



Map 10. Known localities of *Mediocalcar paradoxum* (Kraenzl.) Schltr. subsp. *robustum* (Schltr.) Schuit.

Habitat & Ecology — Epiphyte in montane forest and scrub-forest. In Sulawesi reported from *Agathis*-dominated forest, epiphytic on *Planchonella*. Altitude 400–2250 m.

Etymology — From the Latin *robustus*, 'robust'. Refers to the habit of this subspecies.

Notes — 1. The differences between subsp. *robustum* and subsp. *paradoxum* are small. They are mainly found in the flowers, which have a longer spur and a deeper mentum in subsp. *robustum*. There appear to be no reliable vegetative differences. Although the maximal dimensions of subsp. *robustum* exceed those of subsp. *paradoxum*, individual specimens of the latter may well be more robust than individuals of the former. The collections from the Solomon Islands assigned to subsp. *robustum* are more or less intermediate in having either a spur only little more than half as long as the claw or in lacking the deep mentum of typical specimens of subsp. *robustum*. When more, and better, material of subsp. *robustum* becomes available it may well be inevitable to unite the two taxa. It is possible that we have here an example of clinal variation, where spur length and mentum depth both decrease from West to East.

2. The material from Sulawesi includes two collections (*van Balgooy 3212*, p.p. and *de Vogel 5383*) that are vegetatively considerably smaller than any other specimen of subsp. *robustum* that I have seen. Although *Johansson et al. 250* from the same area is more or less intermediate in this respect, the possibility exists that there are two taxa in Sulawesi, of which the larger one includes the type of *M. selebicum*. There appears to be no difference in the flowers, but this is difficult to ascertain without spirit material. Mainly for the latter reason I have decided against establishing a new taxon.

3. The type of *M. bicolor* from the island of Ambon is a sterile fragment consisting of a short piece of rhizome with a few leafless pseudobulbs. Smith's drawing shows a flower with a rather short spur, not unlike some specimens from the Solomon Islands. The only other specimen from Ambon, *Buwalda 6193* (BO), has flowers more typical of the subspecies, as well as paired inflorescences. The latter were said to be solitary in *M. bicolor*. However, as Smith remarked that he had only studied a single flower, it is possible that he had a juvenile or perhaps abnormal specimen before him.

4. It is remarkable that subsp. *robustum* has not been recollected in Papua New Guinea since the days of Ledermann (1913).

5. The collection designated here as the neotype was already identified as *M. robustum*, undoubtedly by Schlechter himself, who studied Ledermann's material.

10. **Mediocalcar pygmaeum** Schltr. — Fig. 19

Mediocalcar pygmaeum Schltr. in Fedde, Rep., Beih. 1 (1911) 233; ibid. 21 (1923) t. 86, fig. 316. — Type: *Schlechter 19708* (K lecto; AMES, BO, L iso).

Mediocalcar pygmaeum Schltr. var. *altigenum* Schltr. in Fedde, Rep., Beih. 1 (1911) 234, syn. nov. — Type: *Schlechter 18746* (AMES lecto; BM, E iso).

Mediocalcar sigmoideum Schltr. in Fedde, Rep., Beih 1 (1911) 234; ibid. 21 (1923) t. 86, fig. 317, syn. nov. — Type: *Schlechter 19616* (B lost).

Mediocalcar crassifolium J.J. Smith in Fedde, Rep. 11 (1913) 559; Nova Guinea 12(3) (1915) 260, t. 94, fig. 160, syn. nov. — Type: *Gjellerup 1089* (BO holo; L iso).

Roots densely covered with root hairs, 0.5–1 mm thick. *Rhizome* creeping, sparsely to frequently branching, 1–1.5 mm thick. *Cataphylls* 5–11, subacute to acute, keeled, glabrous. *Pseudobulbs* largely adnate to the rhizome, 3–20 mm apart, ellipsoid to ovoid, base more or less elongated, 3–10 mm long, 2.5–4 mm across, enveloping or sometimes clasp-

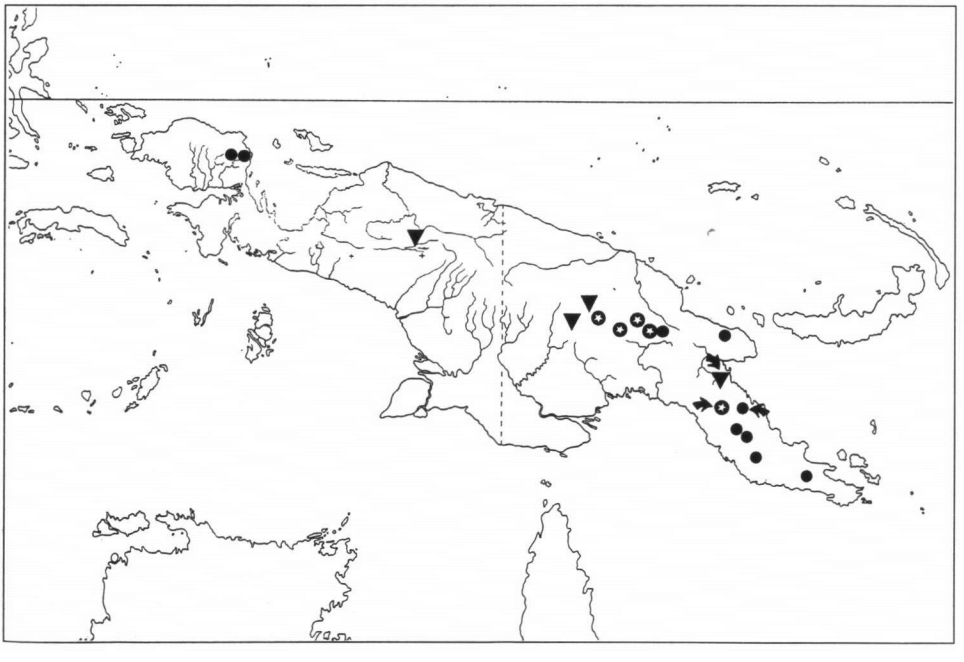
ing the rhizome, free top 1–5 mm long. *Leaves* 2, sometimes 3 per pseudobulb, sessile to shortly petiolate, elliptic to broadly elliptic [index 2–3.8], 1–2 cm by 4–6.5 mm; petiole less than 1 mm long; margins subentire to crenulate; apex rounded, bilobulate, with the mucro about as long as the lobules; coriaceous to carnose. *Inflorescences* solitary or in pairs, synanthous, at the base with an inconspicuous scale 1 mm long. *Peduncle* 3–12 mm long, at the apex with a triangular bract 1 mm long. *Pedicel* and ovary 9–10 mm long. *Flowers* narrowly urceolate, slightly oblique, 8–9 mm long. *Synsepalum* c. 9 mm long and c. 12.5 mm wide when cut open and flattened; free tips subpatent to reflexed, 3 mm long, obtuse. Lateral sepals smooth or keeled. *Petals* linear to oblanceolate [index c. 8.6], 8 by 1.2 mm; apex acute; 1-nerved. *Lip* 8 by 3.5 mm in natural position, the blade broadly ovate when flattened; claw more or less sigmoid, 4.6 by c. 2 mm, auricles inconspicuous; apex acute, straight; margins erect, clasping the column; spur cucullate to shortly saccate, c. 1 mm deep. *Column* clavate, 5.2 mm long; foot incurved, c. 1.5 mm long. *Fruit* not seen.

Colour — Flowers red, orange or orange-yellow with yellow, yellowish green or green tips. Pseudobulbs yellowish green, leaves olive-green.

Distribution — New Guinea (Irian Jaya: Cenderawasih; Papua New Guinea: Eastern Highlands, Morobe, Central, and Northern Provinces), 10 collections (AMES, BM, BO, CANB, K, L, LAE, SING). Map 11.

Habitat & Ecology — Epiphyte on *Drimys*, *Sloanea*, etc. in montane forest and shrubby vegetation. Altitude 1200–2850 m.

Etymology — From the Greek-Latin *pygmaeus*, 'dwarfish'. Refers to the small size of this species.



Map 11. Known localities of *Mediocalcar pygmaeum* Schltr. (●), *M. congestum* Schuit. (▼), and *M. subteres* Schuit. (✪).

Notes — 1. Only dried material was available. Part of the description of the flower follows that by J.J. Smith for *M. crassifolium*. In the protologue of *M. pygmaeum* very few measurements are given. It should be noted that Schlechter's descriptions are based on dried material and on his rather crude sketches [cf. J.J. Smith, Bull. Jard. Bot. Buitenzorg 8 (1912) 7].

2. The 3 collections from the Wharton Range in Papua New Guinea (*Carr 10544, van Royen NGF 10981, 20384*) differ from most of the other collections in the following respects: the pseudobulbs are all rather closely spaced (3–5 mm apart); some of them clasp but do not envelope the rhizome; some of the pseudobulbs are 3-foliate; the rhizome-scales are larger than usual; the leaves are more distinctly crenulate; some of the inflorescences occur in pairs. The rhizome is also more densely branched than in most, but not all, other collections. However, having seen so little material of this apparently widespread but uncommon species, I am not convinced that the differences are constant and not due to environmental factors. For the time being I have only distinguished these collections informally as an entity '*carrii*'.

3. Like most other species of *Mediocalcar*, *M. pygmaeum* is somewhat variable in the size of the spur (which in the present species can hardly be called a spur anymore) and the presence or absence of keels on the lateral sepals. I therefore do not doubt that *M. sigmoideum*, of which the type is lost, is conspecific.

4. *Mediocalcar pygmaeum* is easily recognized by the 2- or 3-leaved pseudobulbs carrying elliptic leaves mostly less than 1.5 cm long.

11. **Mediocalcar stevenscoodei** P. Royen — Fig. 20

Mediocalcar stevenscoodei P. Royen, Alp. Fl. New Guinea 2 (1979) 675, fig. 239. — Type: *Stevens & Coode LAE 51427* (LAE holo, incl. spirit mat.; CANB, K, L iso).

Mediocalcar viridicoccineum P. Royen, Alp. Fl. New Guinea 2 (1979) 677, fig. 240, syn. nov. — Type: *Paijmans 656* (CANB).

Roots densely covered with root hairs, c. 1 mm thick. *Rhizome* creeping, infrequently branching, 1.5–3 mm thick. *Cataphylls* 4–6, closely appressed, slightly verrucose, subacute, keeled near the tip. *Pseudobulbs* 2–3 cm apart, cylindrical to ellipsoid, 1–2 cm long, 3–5 mm across; base elongated, enveloping the rhizome, 10–15 mm long, free top ascending, 7–10 mm long. *Leaves* 2 or not rarely 3 per pseudobulb, subpetiolate, the blade elliptic to broadly elliptic [index 2–6], 2.5–3.5 cm by 6–13.5 mm, petiole up to 2 mm long; glabrous, keeled below; margin minutely erose; apex rounded, minutely bilobulate, mucronate, with the mucro about as long as the lobules; carnose. *Inflorescences* solitary or in pairs, synanthous, at the base with an inconspicuous scale c. 1 mm long. *Peduncle* 10–13 mm long, at the apex with an obscurely triangular bract c. 1 mm long. *Pedicel* and ovary c. 10 mm long. *Flowers* narrowly urceolate, slightly oblique, 12.5 mm long. *Synsepalum* c. 13 mm long and 16.5 mm wide when cut open and flattened; free tips only slightly spreading, 4.7 mm long, obtuse. Lateral sepals smooth on outside. *Petals* linear-oblanceolate [index 6.2], 12 by 1.9 mm; apex acute; 3-nerved. *Lip* 9.8 by 3.5 mm in natural position, the blade ovate when flattened; claw strongly sigmoid, when straightened c. 7 by 1.7 mm, narrowing towards the base, auricles not or hardly developed; apex acuminate, straight; margins erect; the blade with a shallow depression, c. 1 mm deep. *Column* clavate, 8.2 mm long, 2.5 mm wide at the apex; foot very short. *Fruit* ellipsoid, 15–20 mm long, 3–4 mm across.

Colour — Flowers red with green tips. Leaves shiny.

Distribution — New Guinea (Papua New Guinea: Central and Northern Provinces), 3 collections: *Brass 4692* (AMES, BO), *Paijmans 656* (CANB), *Stevens & Coode LAE 51427* (CANB, K, L, LAE). Map 7.

Habitat & Ecology — Epiphyte on tree trunks and branches in upper montane to subalpine forest. Altitude 2840–3200 m.

Etymology — Named after P.F. Stevens and M.J. Coode, who collected the type material of this species in 1971.

Notes — 1. Floral measurements in the above description were taken from spirit material of the type collection only.

2. *Mediocalcar stevenscoodei* appears to be one of the few narrowly endemic species in the genus, being only known from Mt Strong and Mt Albert Edward in the Wharton Range, Papua New Guinea.

3. Although superficially similar to *M. agathodaemonis*, *M. stevenscoodei* seems to be more closely related to *M. pygmaeum*, from which it differs mainly in size. The flowers of *M. agathodaemonis* are urceolate-globose rather than narrowly urceolate, the expanded lip is broadly ovate to subcordate rather than ovate, and the claw is much shorter and not sigmoid. The leaf-margins in *M. agathodaemonis* are entire, not minutely erose, and the inflorescences are always solitary.

12. **Mediocalcar subteres** Schuit. — Fig. 21; Plate 3b

Mediocalcar subteres Schuit., Blumea 34 (1989) 171, fig 2; Reeve, Orchadian 9 (1990) 265 (colour photograph). — Type: *Kairo NGF 44083* (LAE holo; AMES, K, L, SING iso).

Roots densely covered with very short root hairs, 0.5 mm thick. *Rhizome* creeping, sparsely to rather frequently branching, 2 mm thick. *Cataphylls* 5, closely appressed, tubular, glabrous, subacute, keeled near the tips. *Pseudobulbs* approximate, terete, (8–)15–25 (–35) mm long, 2.5–3.5 mm across, largely enveloping the rhizome, free top ascending, 3–7 mm long. *Leaves* 1, occasionally 2 per pseudobulb, sessile, subterete, straight, channelled above [index 5–23], (1.5–)3–5(–7) cm by 2–3 mm; margins entire; apex acute, mucronate. *Inflorescences* solitary, synanthous, at the base with a narrow scale c. 3 mm long. *Peduncle* 5–15 mm long, at the apex with a triangular, acute bract 1 mm long. *Pedicel* and ovary 7–10 mm long. *Flowers* urceolate, oblique, laterally flattened, 8–9 mm long. *Synsepalum* 8–9 mm long and 11–16 mm wide when cut open and flattened; free tips hardly spreading, 3–3.5 mm long, acute. *Petals* oblanceolate [index 5.5–6.5], 5.5– 6.5 by c. 1 mm; apex acute; 1- or 3-nerved. *Lip* 6.5–7 mm long, c. 3 mm wide in natural position, the blade broadly ovate when flattened; claw 2 by 1.5 mm, auricles rather conspicuous, reflexed; apex acute; margins erect, clasping the column; spur broadly cylindrical, c. 2.5 mm long, c. 2 mm wide just below the mouth. *Column* clavate, 3–4 mm long, c. 2 mm wide at the apex, foot very short. *Fruit* not seen.

Colour — Flowers bright yellow or orange-yellow, sometimes red at the base. Ovary bright greenish yellow. Leaves dull green, pseudobulbs yellow-green.

Distribution — New Guinea (Irian Jaya: Peg. Jayawijaya; Papua New Guinea: Enga and Morobe Provinces), 7 collections (AMES, BO, E, K, L, LAE, S, SING). Map 11.

Habitat & Ecology — Epiphyte in montane forest. Altitude 1200–2000 m.

Etymology — From the Latin *sub-*, 'almost', and *teres*, 'terete'. Refers to the leaves of this species, which are subterete.

Note — *Mediocalcar subteres* is the only species of *Mediocalcar* with subterete leaves (but see note 2 under *M. arfakense*). It is also one of the few species with yellow flowers.

13. **Mediocalcar umboiense** Schuit., *spec. nov.* — Fig. 22

Mediocalcari decorato similis, sed foliis pseudobulbisque duplo majoribus, sepalorum apicibus angustioribus. — Typus: *Argent s.n.*, cult. Royal Botanic Garden Edinburgh 721246 (E holo; L iso, both spirit mat.).

Roots densely covered with root hairs, 0.5–0.8 mm thick. *Rhizome* creeping, freely branching, mat-forming, 2 mm thick. *Cataphylls* 3–5, subacute, keeled. *Pseudobulbs* prostrate, 3–17 mm apart, cylindrical to slightly clavate, glabrous, 7–20 mm long, 4–6 mm across; almost entirely adnate to the rhizome. *Leaves* 3 or 4, occasionally 2, per pseudobulb, very shortly petiolate, spreading in one plane, narrowly elliptic [index 3.5–6.3], 2–3.5 cm by (4–)5–10 mm; broadly sulcate along the midvein; apex obtuse, bilobulate, mucronate, with the mucro about as long as the lobules; carnose. *Inflorescences* solitary, heteranthous or infrequently synanthous, at the base with a rudimentary scale. *Peduncle* 5–7 mm long, at the apex with a triangular, acuminate bract 1.5 mm long. *Pedicel* and ovary c. 6.5 mm long. *Flowers* urceolate-globose, oblique, 7.5–8 mm long. *Synsepalum* c. 12 mm long and c. 16 mm wide when cut open and flattened; free tips patent, narrowly triangular, 4.5 mm long, acute; sepals conspicuously gibbose. *Petals* linear [index c. 8], c. 7.2 by 0.9 mm; apex subacute, 1-nerved. *Lip* c. 7.6 by 5 mm in natural position, the blade broadly ovate when flattened; claw c. 1.1 by 2.3 mm, auricles inconspicuous; apex acute, reflexed; margins erect, clasping the column; spur saccate, recurved, parallel to the column, c. 1.6 mm long, c. 3 mm wide just below the mouth. *Column* broadly clavate, c. 3.1 mm long, 2.2 mm wide at the apex; foot very short. *Fruit* not seen.

Colour — Flowers bright orange with yellow tips to the sepals, petals and lip. Enclosed parts of petals and lip pale orange. Column cream colour. Pollinia white. Leaves mid green above, pale green below. Pseudobulbs pale green.

Distribution — New Guinea (Papua New Guinea: Morobe Prov., Umboi Island), 2 collections: *Argent s.n.*, cult. RBGE 721246 (E, L), *Argent s.n.*, cult. RBGE 721255 (E). Map 5.

Habitat & Ecology — Not known, probably epiphytic. Altitude 450–750 m.

Etymology — Named after Umboi Island, Papua New Guinea, from which the only known collections of this species originate.

Notes — 1. *Mediocalcar umboiense* is undoubtedly closely related to *M. decoratum*, from which it differs mainly in the size of the vegetative parts. The flowers are very similar, although the tips of the sepals are narrower in *M. umboiense*. It is unclear, however, whether this last difference holds against all specimens of *M. decoratum*, as it is difficult to ascertain in dried material, where the fleshy tips of the sepals are usually badly shrivelled. A living specimen received from the Royal Botanic Garden Edinburgh has for the past few years been cultivated alongside *M. decoratum* in the Hortus Botanicus at Leiden. There is no doubt that the differences between the two species cannot be attributed to environmental conditions. As *M. decoratum* has so far appeared to be quite stable in its characters, with the leaves never more than c. 4 mm wide, it seemed appropriate to recognize *M. umboiense* at species level.

2. *Mediocalcar umboiense* is so far only known from the small island after which it was named (which on older maps is called Rook Island). It should be looked for on nearby New Britain, which is still rather poorly explored botanically.

14. **Mediocalcar uniflorum** Schltr. — Fig. 23; Plate 3c

Mediocalcar uniflorum Schltr. in Fedde, Rep., Beih. 1 (1911) 227; ibid. 21 (1923) t. 84, fig. 308. — Type: *Schlechter 20074* (AMES lecto; BM iso).

Mediocalcar uniflorum Schltr. var. *orientale* Schltr. in Fedde, Rep., Beih. 1 (1911) 228 ('*orientalis*'), syn. nov. — Syntypes: *Schlechter 19568* (B lost), *19584* (BM lecto; AMES, K, L iso).

Mediocalcar rigidulum Schltr. in Fedde, Rep. 16 (1919) 118, syn. nov. — Type: *Kempter s.n.* (B lost).

Mediocalcar sepikanum Schltr., Bot. Jahrb. 58 (1922) 68, syn. nov. — Type: *Ledermann 9894* (L lecto; K iso).

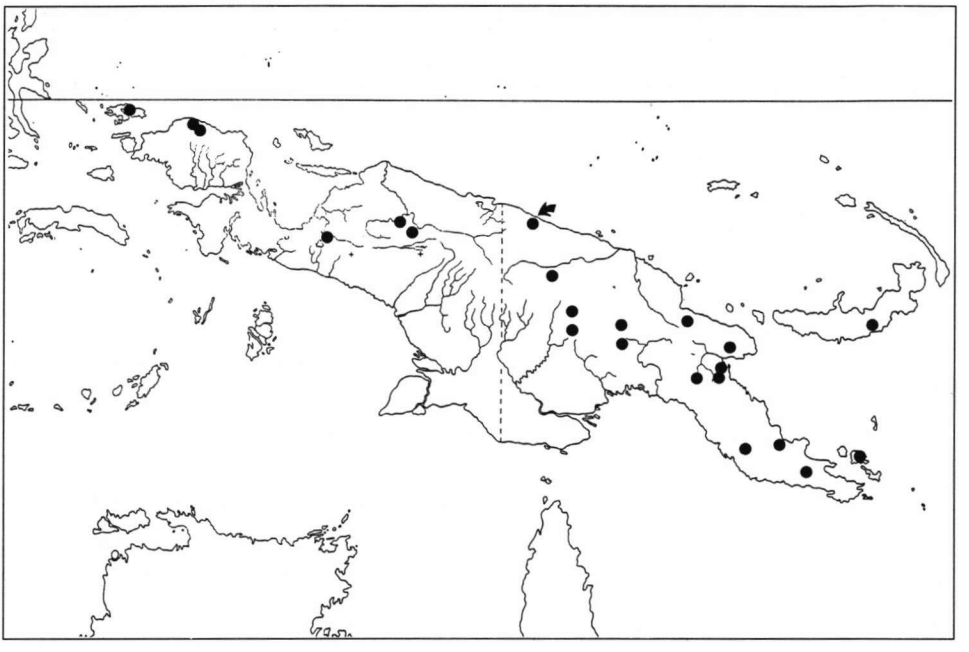
Mediocalcar abbreviatum auct. non Schltr.: Morley, J. Adelaide Bot. Gard. 1 (1977) 156.

Roots densely covered with minute root-hairs, c. 0.5 mm thick. *Rhizome* creeping, more or less frequently branching, 1.5–2 mm thick. *Cataphylls* 5, closely appressed, tubular, subglabrous, subacute to acute, apiculate, slightly keeled near the tip. *Pseudobulbs* erect to suberect, (1–)2–4(–6) cm apart, terete, often slightly rugose in living specimens, (1–)2–3 (–4) cm long, 2–2.5 mm across; base not or very slightly elongated. *Leaves* 1 per pseudobulb, sessile to subpetiolate, elliptic to linear-elliptic [index 3.5–12.5], (2–)2.5–6.5(–8) cm by (3.5–)6–15(–17) mm; apex obtuse, more or less unequally bilobed, mucronate, with the mucro shorter than the lobules; coriaceous. *Inflorescences* solitary, synanthous, at the base with a narrow scale c. 3.5 mm long. *Peduncle* 2–2.5 cm long, at the apex with a triangular, sometimes bifid or truncate bract 1–1.5 mm long. *Pedicel* and ovary 9–15 mm long. *Flowers* urceolate, more or less oblique, more or less laterally flattened, 9–14 mm long. *Synsepalum* 10–14 mm long and 14–19 mm wide when cut open and flattened; free tips only slightly spreading, 4–4.5 mm long; obtuse to subacute. Lateral sepals smooth or indistinctly keeled near the tips. *Petals* rather variable in shape, linear, elliptic or lanceolate [index 4–7.5], 7–8.5 by 1–2 mm; apex acute to acuminate; 2- or 3-nerved. Lip 7–9.5 by 3–4 mm in natural position, the blade broadly ovate when flattened; claw 3.2–3.75 by c. 2 mm, auricles rather inconspicuous, reflexed; apex acute to acuminate, straight; margins erect, clasping the column; spur broadly cylindrical, recurved, parallel to the column, 2.5–3.8 mm long, 1.5–2.8 mm wide just below the mouth. *Column* broadly clavate, 4.5–5 mm long, c. 2.5 mm wide at the apex, foot short, c. 1 mm long. *Fruit* narrowly cylindrical, c. 4 cm by 3 mm.

Colour — Flower bright red to orange-red, rarely pink, with yellowish green to lime-green tips to the sepals, petals and lip. Very rarely the entire flower yellow (see note 1). Enclosed part of petals and lip pinkish or cream colour. Column cream colour. Pollinia pale yellow. Peduncle and ovary red or purplish red. Leaves deep olive-green, paler green or purplish below, usually with dull purple margins. Pseudobulbs olive-green or dull purple.

Distribution — New Guinea (Irian Jaya: Cenderawasih, Paniai, Peg. Jayawijaya; Papua New Guinea: West & East Sepik, Madang, Enga, Southern & Western Highlands, Morobe, Central, Northern, and Milne Bay Provinces), 59 collections (AMES, BM, BO, CANB, E, K, L, LAE, NY, P, S, SING). New Britain, 1 collection (LAE). Map 12.

Habitat & Ecology — Epiphyte in montane forest, on logs and tree-trunks, less often high up in tree-crowns, frequently deeply embedded in moss. Sometimes terrestrial in a rather open, shrubby vegetation. Flowering throughout the year. Altitude 800–2400 m.



Map 12. Known localities of *Mediocalcar uniflorum* Schltr.

Etymology — From the Latin *unus*, 'one', and *flos*, 'flower'. Refers to the solitary inflorescences of this species.

Notes — 1. The collection from New Britain (*Sayers NGF 24179*, LAE) is the only one with yellow flowers. In other respects it is similar to specimens from New Guinea.

2. No material of *M. rigidulum* could be located. Schlechter's description fits entirely that of *M. uniflorum*, I therefore consider *M. rigidulum* to be conspecific.

3. *Mediocalcar uniflorum* is readily distinguished by the thin, terete, erect pseudobulbs without an elongated base.

15. Mediocalcar versteegii J.J. Smith

For literature, see under the subspecies.

Roots densely covered with root-hairs, 0.5–1 mm thick. *Rhizome* creeping or patent, laxly branching, 2–3.5 mm thick. *Cataphylls* 5, subacute to acute, closely appressed to subpatent, glabrous. *Pseudobulbs* terete or cylindrical to obliquely ovoid; 0.8–5 cm long; base elongated, enveloping the rhizome. *Leaves* 1 or 2 per pseudobulb, narrowly elliptic to lanceolate, rarely linear, sessile to subpetiolate, keeled below, 3–13 cm by 5– 29 mm; margins entire; apex obtuse to subacute, more or less conspicuously bilobulate; coriaceous. *Inflorescences* synanthous or more frequently heteranthous, at base with an inconspicuous scale 2–4 mm long, solitary or in pairs. *Flowers* urceolate-globose, oblique, 8.5–16 mm long. *Spur* less than half as long to a little longer than the claw. *Fruit* (immature) narrowly cylindric-ellipsoid, 24–30 by c. 2 mm.

Distribution and Habitat & Ecology — See under the subspecies.

KEY TO THE SUBSPECIES OF MEDIOCALCAR VERSTEEGII

1a. Spur about as long as the claw of the lip 2
b. Spur at most about half as long as claw of the lip ..... **c.** subsp. **intermedium**
2a. Flowers white- or pink-tipped; pseudobulbs usually 2-leaved ..... **d.** subsp. **vulcanicum**
b. Flowers with greenish or yellow tips; pseudobulbs 1-leaved (with an occasional 2-leaved pseudobulb on the same specimen) 3
3a. Inflorescences solitary; pseudobulbs 15–50 mm long ..... **a.** subsp. **versteegii**
b. Inflorescences mostly in pairs; pseudobulbs 8–14 mm long ..... **b.** subsp. **amphigeneum**

a. subsp. **versteegii** — Fig. 24, 25; Plate 3d

Mediocalcar versteegii J.J. Smith, Bull. Dép. Agric. Ind. Néerl. 19 (1908) 28; Nova Guinea 8 (1) (1909) 44, t. 16, fig. 50. — *Eria versteegii* (J.J. Smith) Kraenzl. in Engl., Pflanzenr. 50B (Orch.-Monandr.-Dendrob. 2) (1911) 31. — Type: *Versteeg 1640* (BO holo; K, L, P, U iso).

Mediocalcar abbreviatum Schltr. in Fedde, Rep., Beih. 1 (1911) 229; ibid. 21 (1923) t. 85, fig. 331, syn. nov. — Type: *Schlechter 20200* (B lost).

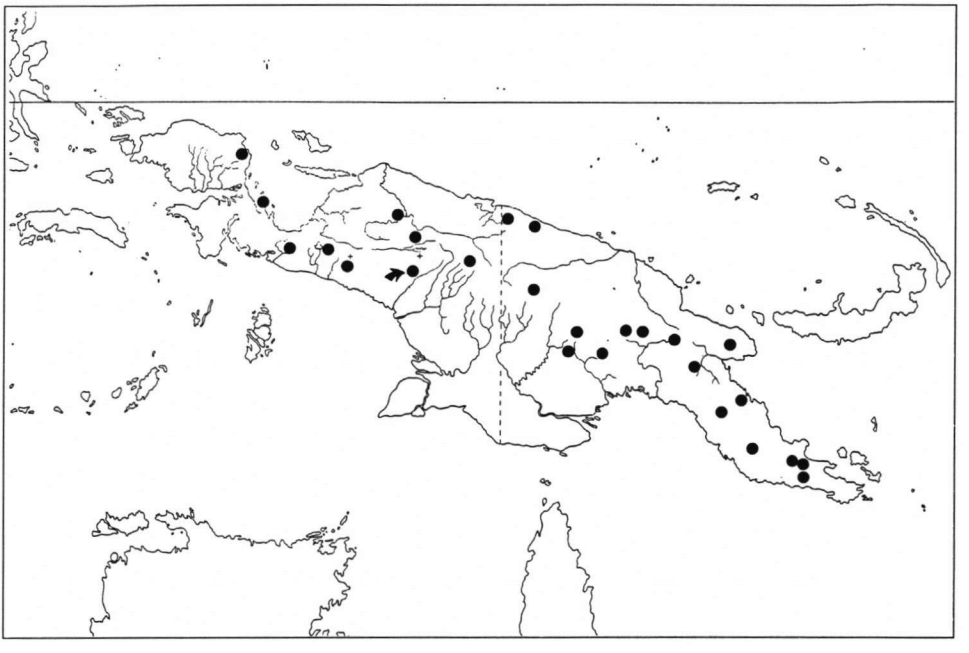
Mediocalcar angustifolium Schltr. in Fedde, Rep., Beih. 1 (1911) 229; ibid. 21 (1923) t. 84, fig. 310, syn. nov. — Type: *Schlechter 19503* (K lecto; AMES, BM, BO iso).

Mediocalcar cluniforme J.J. Smith, Meded. Herb. Leiden 23 (1915) 6; Nova Guinea 12 (3) (1915) 254, t. 93, fig. 157, syn. nov. — Type: *Janowsky 417* (BO).

Mediocalcar doctersii J.J. Smith, Nova Guinea 18 (1) (1935) 31, t. 7, fig. 18, syn. nov. — Type: *Docters van Leeuwen 10616* (L holo; BO iso).

Pseudobulbs terete to cylindrical, 3–25 mm apart, 1.5–3.5(–5) cm long, 3–6 mm across, largely enveloping the rhizome; free top prostrate to suberect, 1–7(–10) mm long. *Leaves* 1, occasionally 2 per pseudobulb (all specimens predominantly 1-leaved); sessile to subpetiolate, narrowly elliptic to lanceolate, rarely linear [index 4–11.5(–20)], (3–)5–10(–13) cm by (5–)9–14(–29) mm; flat; glabrous; apex obtuse, more or less obliquely bilobed, mucronate, with the mucro shorter than the lobules; coriaceous. *Inflorescences* solitary, synanthous or more frequently heteranthous, usually both on the same specimen. *Peduncle* 10–20 mm long, at the apex with a triangular bract 1 mm long. *Pedicel* and ovary 15–21 mm long. *Flowers* urceolate-globose, 8.5–13.5(–16) mm long. *Synsepalum* 9–16 mm long and 13–18 mm wide when cut open and flattened; free tips slightly spreading to reflexed, 3–4(–5.5) mm long, apices obtuse to subacute. Lateral sepals smooth or slightly keeled. *Petals* narrowly lanceolate or oblanceolate [index 4.6–6], 7–11.5 by 1.2–2 mm; apex acute to acuminate; 1- or 3-nerved. *Lip* 7–12.7 by 2–5 mm in natural position, the blade broadly ovate when flattened; claw 2.2–4.5 by 2–3 mm, auricles rather conspicuous to very conspicuous, 1–2 mm long, recurved; apex acute to acuminate, porrect to recurved; margins erect, clasping the column; spur broadly cylindrical, recurved, parallel to or making a small angle with the column, as long as the claw, or a little longer, or a little shorter; 2.5–4 mm long, 2–3.7 mm wide just below the mouth. *Column* broadly clavate, 3.5–5(–8) mm long, 2.5 mm wide at the apex, foot short to rather long, 1–2 mm long. *Fruit* (immature) narrowly cylindric, 3 cm by 2 mm.

Colour — Flowers orange-red to bright red with bright yellow or greenish yellow tips, occasionally red-brown with orange-yellow tips, red with green tips or entirely orange. Leaves and pseudobulbs dull green, the pseudobulbs sometimes bronze-green.



Map 13. Known localities of *Mediocalcar versteegii* J.J. Smith subsp. *versteegii*.

Distribution — New Guinea (widespread throughout the mountainous parts of the island, from the Cenderawasih Peninsula in Irian Jaya to the Milne Bay Province in Papua New Guinea), 40 collections (AMES, B, BM, BO, CANB, E, K, L, LAE, P, S, U). Map 13.

Habitat & Ecology — Epiphyte in (lower) montane forest. Occasionally terrestrial in open disturbed forest. Altitude 700–2000 m.

Etymology — Named after G.M. Versteeg (1876–1943), medical officer and botanist of the first Lorentz expedition to Dutch New Guinea (1907), during which he collected the type material of this species.

Note — *Mediocalcar versteegii* subsp. *versteegii* is quite variable in the size of the flowers, the shape of the spur, the development of the auricles, and especially in size and shape of the vegetative parts. Based on the material at hand, I do not believe it is possible to distinguish more than one taxon, in particular because there appears to be little correlation between the different character states. Specimens collected at higher altitudes tend to be more robust and the flowers usually have greenish yellow rather than bright yellow tips. However, intermediate forms between robust and more slender specimens are common, making it impossible to recognize discrete groups.

The following are two of the more exceptional forms:

a) entity '*stenophyllum*': leaves linear (10–13 cm by 5–7 mm), pseudobulbs with relatively long free top; 1 collection: *Brass 12854* (AMES, BM, BO, LAE), Irian Jaya, at 1200 m altitude. Specimens intermediate between '*stenophyllum*' and the usual broader leaved forms of *M. versteegii* subsp. *versteegii* are not uncommon.

b) entity '*cluniforme*': lip with very large auricles; 2 collections: *Janowsky 159* (BO, type of *M. cluniforme*) and *Darbyshire 327* (CANB, LAE). These two collections are not uniform in other respects.

b. subsp. **amphigeneum** Schuit., *subsp. nov.* — Fig. 26

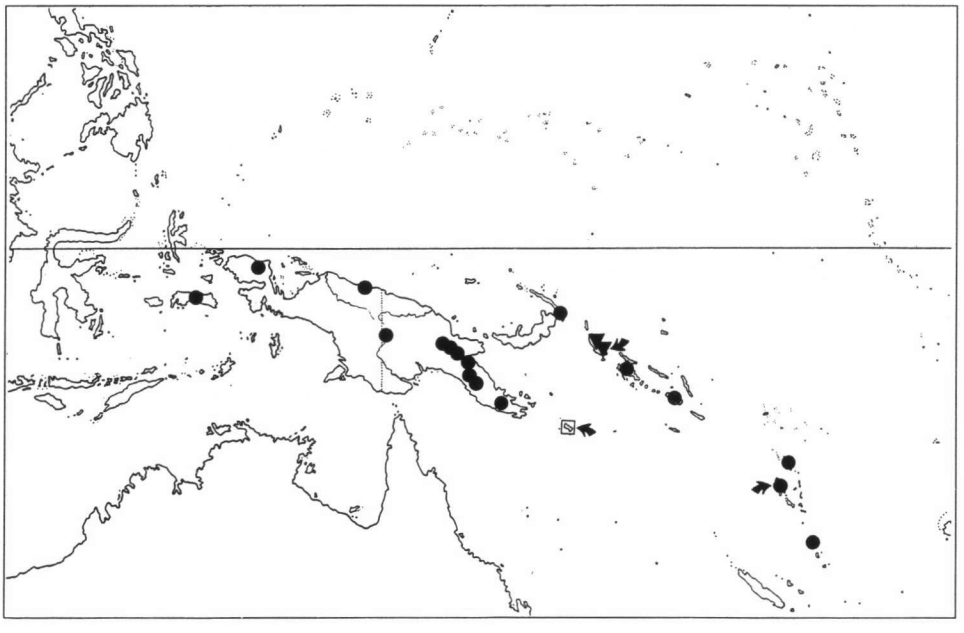
A subsp. *versteegii* in pseudobulbis 15 mm brevioribus, inflorescentiae plerumque geminatis differt. — Typus: *Brass 27859* (L holo; AMES, K, LAE, S iso).

?*Mediocalcar lawesii* Schltr. in Fedde, Rep. 9 (1911) 284. — Type: *Lawes s.n.* (B lost).

Pseudobulbs obliquely ovoid, 2–15 mm apart, 0.8–1.4 cm long, 3–5 mm across, largely adnate to the rhizome; free top prostrate to suberect, 2–4 mm long. *Leaves* 1 per pseudobulb, sessile, lanceolate [index 5.5–8.5], 5.5–8.5 cm by 8–15 mm; gradually narrowing towards the base, apex obtuse, unequally bilobed, mucronate, with the mucro about as long as the lobes; coriaceous. *Inflorescences* usually in pairs, sometimes solitary, both heteranthous and synanthous on the same specimen. *Peduncle* 8–12 mm long, at the apex with a triangular bract 1–2 mm long. *Pedicel* and ovary c. 10 mm long. *Flowers* urceolate-globose, oblique, c. 10 mm long. *Sepals* with the free tips slightly spreading to reflexed, these c. 4 mm long, apices subacute. *Petals* lanceolate [index c. 7], c. 7 by 1 mm; apex acute to acuminate; 3-nerved. *Lip* c. 7.5 by 2 mm in natural position, the blade broadly ovate when flattened; claw c. 1.8 by 1.5 mm; auricles 0.6 mm long, hardly recurved; apex acute to acuminate, porrect; margins erect, clasping the column; spur broadly cylindrical, recurved, parallel to the column, as long as the claw; c. 2 mm long, c. 2 mm wide just below the mouth. *Column* broadly clavate, c. 3.5 mm long, c. 1.5 mm wide at the apex, foot 0.5 mm long. *Fruit* not seen.

Colour — Flowers orange with yellow tips to the sepals, petals and lip.

Distribution — Only known with certainty from Tagula (Sudest) Island in the Louisiades (but see note 1 below), 2 collections: *Brass 27832* (AMES) and *27859* (type). Map 14.



Map 14. Known localities of *Mediocalcar versteegii* J.J. Smith subsp. *amphigeneum* Schuit. (□), subsp. *intermedium* Schuit. (●), and subsp. *vulcanicum* Schuit. (▼).

Habitat & Ecology — Epiphytic in montane forest (*Brass 27832:* in low forest of a ridge crest). Altitude 600 m.

Etymology — From the Greek *amphi-*, 'double', and *-geneus*, 'of a certain kind', hence 'of two kinds', referring to the fact that in this taxon paired inflorescences may originate from heteranthous as well as synanthous shoots. In other species with normally paired inflorescences these are synanthous only.

Notes — 1. It is possible that *M. lawesii*, of which the type material probably no longer exists, belongs to this taxon. From Schlechter's somewhat deficient description the only clear difference is in the leaves, which in *M. lawesii* are only about half as wide as in the type material of *M. versteegii* subsp. *amphigeneum*. *Mediocalcar lawesii* was collected by Lawes in 1884 and represents the earliest known collection of a *Mediocalcar* from New Guinea. The locality 'Port Morresby' [sic] cited by Schlechter cannot be correct, however, as the strongly seasonal climate near Port Moresby does not support the type of vegetation in which *Mediocalcar* occurs.

2. As only dried material was available it was not possible to make a reliable drawing of the flower. There appears to be no significant difference, however, between the flowers of subsp. *amphigeneum* and those of an average subsp. *versteegii*. The measurements given above undoubtedly underestimate somewhat the true sizes of the floral parts.

c. subsp. **intermedium** Schuit., *subsp. nov.* — Fig. 27; Plate 4a

A subsp. *versteegii* in calcari labelli ungue ut maximum dimidio longiore differt. — Typus: *McKee RSNH 24160* (K holo, P iso).

Mediocalcar seranicum J.J. Smith, Bull. Jard. Bot. Buitenzorg III, 10 (1928) 135; Reinwardtia 1 (1950) t. 185, fig. 3. — Type: *Rutten (Kornassi) 1481* (L holo, BO iso).

Mediocalcar alpinum auct. non J.J. Smith: Lewis & Cribb, Orch. Vanuatu (1989) 76, fig. 13; Orch. Solomon Isl. & Bougainville (1991) 120, fig. 27.

Pseudobulbs 2–25 mm apart, 1.5–3.2 cm long, 3–6 mm across, largely enveloping the rhizome; free top prostrate to suberect, 4–12 mm long. *Leaves* 1 or 2 per pseudobulb, sessile, (linear-)lanceolate [index 4.7–13.8], 5–13.5 cm by 5–15 mm; gradually narrowing towards the base, apex obtuse to subacute, minutely bilobed, mucronate. *Inflorescences* solitary, synanthous or more frequently heteranthous. *Peduncle* 12–15 mm long, at the apex with a triangular bract 1–2 mm long. *Pedicel* and ovary 10–19 mm long. *Flowers* urceolate-globose, oblique, 10.5–12.5 mm long. *Synsepalum* 11–13 mm long and 15–17 mm wide when cut open and flattened; free tips slightly spreading to reflexed, 3.5–4.5 mm long, apices obtuse to subacute. Lateral sepals smooth or slightly keeled. *Petals* lanceolate to linear-oblanceolate [index 5.4–8], 8–10.5 by 1–1.5 mm; apex acute; 3-nerved. *Lip* 8–9 by c. 4 mm in natural position, the blade broadly ovate when flattened; claw 3–3.5 by 2–2.5 mm, auricles rather conspicuous, reflexed; apex acute, straight to recurved; margins erect, clasping the column; spur shortly saccate, recurved, 0.6–1.5 mm deep, c. 2 mm wide just below the mouth. *Column* broadly clavate, c. 5 mm long, c. 2.5 mm wide at the apex, foot short, c. 1 mm long. *Fruit* (immature) narrowly cylindric, 24 by 2 mm.

Colour — Flowers red to orange with bright yellow to orange-yellow tips, in New Guinea also with greenish yellow tips. Rarely red with white tips.

Distribution — Moluccas (Seram), 1 collection (BO, L). New Guinea (Irian Jaya: Cenderawasih, Jayapura; Papua New Guinea: West Sepik, Western Highlands, Eastern High-

lands, Morobe, Central, and Milne Bay Provinces), 11 collections (AMES, BM, CANB, K, L, LAE, SING). New Ireland, 1 collection (K). Solomon Islands, 7 collections (AMES, CANB, K, L, LAE, P). Vanuatu, 10 collections (G, K, P). Map 14.

Habitat & Ecology — Epiphyte in montane forest. Altitude 700–2200 m.

Etymology — From the Latin *intermedius*, 'intermediate'. Refers to the fact that this subspecies is more or less intermediate in its characters between *M. versteegii* subsp. *versteegii* and *M. agathodaemonis*.

Notes — 1. *Mediocalcar versteegii* subsp. *intermedium* is the most problematic taxon recognized in this revision. In New Guinea, specimens can be found that are quite similar to subsp. *versteegii*, distinguished only by the slightly shorter spur and perhaps by the more or less obliquely ovoid rather than cylindrical pseudobulbs, a distinction which is often lost in herbarium specimens. In the Solomon Islands and Vanuatu, on the other hand, some specimens recall a narrow-leaved form of *M. agathodaemonis*, having 2-leaved pseudobulbs and a very short spur. These specimens differ from *M. agathodaemonis* by their usually heteranthous inflorescences, much more sparsely branched rhizomes, mostly much longer leaves (often more than 10 cm long) which are gradually narrowed to the top (rather than broadly rounded as in *M. agathodaemonis*), and flowers with bright yellow tips to the sepals (greenish in *M. agathodaemonis*). Most specimens, both from New Guinea and the islands further East, fall between the two extremes. These are characterized by 1-leaved, obliquely ovoid pseudobulbs, enveloping the rhizome with their basal half; solitary, often heteranthous inflorescences; a lip with the spur about half as long as the claw, and flowers with bright yellow to yellowish green tips (the latter only in New Guinea?). The many collections from the Solomon Islands and Vanuatu as well as most collections from New Guinea that I include here are very similar to *M. versteegii* subsp. *versteegii*, but readily distinguished from it by the much shorter spur; therefore it seems appropriate to recognize this taxon at the subspecific level.

2. *Henty et al. NGF 42731* from Papua New Guinea (Ok Tedi headwaters) is in all respects like a robust mountain form of *M. versteegii* subsp. *versteegii*, having cylindrical pseudobulbs enveloping the rhizome almost along their entire length and leaves more than 1.5 cm wide. It has, however, a spur much shorter than the claw.

3. *Mediocalcar seranicum* is less robust than most other collections of subsp. *intermedium*, but I can find no characters by which I can keep it apart. Smith's drawing may not be quite correct, as the relative length of the free tips of the sepals seems here to be exaggerated.

d. subsp. **vulcanicum** Schuit., *subsp. nov.* — Fig. 28

> A subsp. *versteegii* in pseudobulbis bifoliatis, floribus apice albis differt. — Type: *Schodde & Craven 3763* (CANB holo; AMES, K, L, LAE iso).

Pseudobulbs cylindrical, 10–25 mm apart, 1.5–2.5 cm long, 4–8 mm across, largely enveloping the rhizome; free top prostrate to suberect, 2–10 mm long. *Leaves* 1, or usually 2 per pseudobulb, sessile, narrowly elliptic to linear-lanceolate [index 4.5–15], 5.5–12.5 cm by 8–12 mm; gradually narrowing towards the base, apex subacute, minutely unequally bilobed, mucronate; coriaceous. *Inflorescences* solitary, synanthous or more frequently heteranthous. *Peduncle* 13–20 mm long, at the apex with a triangular acuminate bract 1 mm long. *Pedicel* and ovary 11–13 mm long. *Flowers* urceolate, oblique, 11–12.5 mm long.

Synsepalum 12.5–14 mm long and c. 18 mm wide when cut open and flattened; free tips slightly spreading to reflexed, 4.5–5.5 mm long, apices obtuse to subacute. Lateral sepals smooth or slightly keeled. *Petals* linear to narrowly elliptic [index 5–12], c. 9 by 0.7–1.8 mm; apex subacute to acute; 3-nerved. *Lip* 8–8.5 by c. 3 mm in natural position, the blade broadly ovate when flattened; claw c. 2.5 by c. 2.5 mm, auricles rather conspicuous, 1 mm long, recurved; apex acute to acuminate, porrect to recurved; margins erect, clasping the column; spur almost semiglobose, recurved, making a sharp angle with the column, as long as or a little longer than the claw; 2.5–4 mm long, 3–4 mm wide just below the mouth. *Column* broadly clavate, c. 5 mm long, c. 2.5 mm wide at the apex, foot rather short, 0.5–0.8 mm long. *Fruit* not seen.

Colour — Flowers red to pinkish red with white or pink tips to the sepals, petals and lip.

Distribution — Only known from Bougainville. Four collections: *Cruttwell 3249* (L, spirit mat.), *Kajewski 1717* (AMES, BO), *Schodde & Craven 3763* (type), *Waterhouse 619B* (K, SING). Map 14.

Habitat & Ecology — The type material was collected in montane cloud forest with *Pandanus*. The other collections do not include habitat notes. Altitude 100–1500 m.

Etymology — From the Latin *vulcanicus*, in allusion to the volcanic nature of the larger mountains on Bougainville, on the slopes of which the present subspecies occurs.

Note — *Mediocalcar versteegii* subsp. *vulcanicum* is very closely related to subsp. *intermedium*, but the longer spur appears to be a reliable difference. As all collections originate from Bougainville, and from different parts of the island, it seemed justified to recognize these populations at the subspecific level.

INSUFFICIENTLY KNOWN SPECIES

16. **Mediocalcar brachygenium** Schltr.

Mediocalcar brachygenium Schltr. in Fedde, Rep. 16 (1919) 117. — Type: *Kempter s.n.* (B lost).

"Epiphyticum, patulum, usque ad 25 cm longum, parum ramosum; rhizomate cauliformi cum pseudobulbis connato, flexuoso; radicibus filiformibus, flexuosis, tenuibus, glabris; pseudobulbis cum rhizomate omnino connatis, i.e. superpositis, cylindraceis, unifoliatis, 1–1.5 cm longis, 2.5 mm diametientibus; folio ligulato, obtusiusculo, interdum cum apiculo, basin versus sensim paululo angustato, textura pro genere tenuiorem, 5–7 cm longo, medio fere 6.5–8 mm lato, glabro; inflorescentiis ut videtur singulis, unifloris, terminalibus, pedunculo c. 8 mm longo; bractea deltoidea, minuta; flore in sectione mediocri, glabro, carnosulo; sepalis usque supra medium in tubum oblique ovoideum connatis, c. 8 mm longis, intermedio ligulato subacuto, lateralibus oblique semiovatis; petalis oblique linearibus, obtusiusculis, uninerviis, quam sepala paululo brevioribus; labelli ungue oblongo-quadrato, basi subauriculato-dilatato, nervis 3 parallelis incrassatis ornato, 2.5 mm longo, lamina ovata obtusiuscule acuminata, basi cucullato-excavata, intus nervis 3 parallelis incrassatis ornata, 5.5 mm longa, infra medium 4 mm lata; columna semitereti, apicem versus paulo dilatata, 5 mm longa, pede brevissimo; ovario pedicellato gracilli, c. 1 cm longo, glabro."

Distribution — New Guinea (Papua New Guinea, West Sepik Prov., hinterland of Angriffshafen [= Vanimo]).

Habitat & Ecology — Not known.

Note — According to the description this could be a 1-leaved form of *M. bifolium*.

17. **Mediocalcar papuanum** Rogers

Mediocalcar papuanum Rogers, Trans. Roy. Soc. S. Austr. 54 (1930) 37. — Type: *Lane-Poole 526* (AD, n.v.).

"Plant epiphytic. Rhizome terete, creeping, elongated, radicant, covered with fibrous tubular sheaths; roots elongated, filiform, almost straight, shortly pilose. Pseudobulbs minute, terete, up to 2 mm in diameter, very short, firmly adnate lengthwise with the rhizome, unifoliate, the free part disc-like. Leaves leathery, glabrous, elliptical-lanceolate or oblong-lanceolate, obtuse at the apex, slightly bilobulate with a minute mucrone interposed between the lobules, contracted at the base into a short petiole, carinate, multistriate, about 5–6 cm long, 0.7–1.7 cm wide. Inflorescences single flowered in my specimen, about 4.5 cm long, the peduncle completely covered with large voluminous acute foliaceous imbricate bracts increasing in size from below upwards. Floral bract adpressed, minute, acute, clasping the base of the pedicel. Flowers rather large for the genus, red on the outside at the base with a yellow labellum. Combined ovary and pedicel very slender, about 1.1 cm long. Sepals connate in the lower two-thirds forming an urn-like tube slightly ventricose at the base in front, subacute at the apices, about 1 cm long, rather wide, 5-nerved. Petals free, as long [as] but much narrower than the sepals, erect, linear, 3-nerved, subacute. Labellum about 9 mm long, adnate to the foot of the column by a rather wide claw, claw auriculate at each side of the base, suberect, thereafter somewhat oblong 5-nerved, dilated above the middle into a deeply concave widely oval saccate lamina, acuminate at the apex. Spur very short for the genus, rotund, sac-like. Column shorter than the labellum, produced into a very short foot, winged on each side of the stigma near the apex. Anther cucullate, bilocular; pollinia 8, two super-imposed pairs on each side."

Distribution — New Guinea (Papua New Guinea: Central Province, Owen Stanley Range).

Habitat & Ecology — Not known. Altitude 2100 m.

Note — Were it not for the unifoliate pseudobulbs, the description would apply quite well to *Mediocalcar agathodaemonis* (considering that this description was probably made after a dried specimen). As far as I know, however, *M. agathodaemonis* has consistently bifoliate pseudobulbs, apart from an occasional 1-leaved shoot. A few details in the description probably are incorrect. The peduncle is described as being covered in foliaceous bracts. I have little doubt that Rogers mistook a complete flowering shoot, with one or two(?) developing leaves, for an inflorescence. The pseudobulbs are said to be minute, but the author probably misinterpreted the elongated basal part of the pseudobulbs as a part of the rhizome.

18. **Mediocalcar** *spec. nov.*

The habit of this species is similar to that of *M. arfakense*, but with very thick, boat-shaped leaves. Flowers not seen.

Distribution — New Guinea (Papua New Guinea: Enga Prov.).

Habitat & Ecology — Epiphyte in montane forest. Altitude 2400–2500 m.

Note — Of this species I have only seen a few sterile living specimens collected by T.M. Reeve (*Reeve 750*). Unfortunately, a specimen kindly donated by him to the Leiden Botanical Garden in 1982 died before having flowered.

IDENTIFICATION LIST

(collections which are both unnumbered and undated have not been included)

Mediocalcar

ag = *agathodaemonis* J.J. Smith
ar = *arfakense* J.J. Smith
bi = *bifolium* J.J. Smith
bu = *bulbophylloides* J.J. Smith
co = *congestum* Schuit.
cr = *crenulatum* J.J. Smith
de = *decoratum* Schuit.
ge = *geniculatum* J.J. Smith
paradoxum (Kraenzl.) Schltr.
pal = subsp. *latifolium* (Schltr.) Schuit.
pap = subsp. *paradoxum*
par = subsp. *robustum* (Schltr.) Schuit.
py = *pygmaeum* Schltr.
st = *stevenscoodei* P. Royen
su = *subteres* Schuit.
um = *umboiense* Schuit.
un = *uniflorum* Schltr.
versteegii J.J. Smith
vea = subsp. *amphigeneum* Schuit.
vei = subsp. *intermedium* Schuit.
veu = subsp. *vulcanicum* Schuit.
vev = subsp. *versteegii*

ANU series (Wheeler) 6121 (ag), (Wade) 7302 (co), (Hope) 28063 (vei), (Hope) 28112 (de) — Aet & Idjan 3 (par) — Argent 1767 (bi), s.n. 20/7/1972 (bi).

van Balgooy 3212 (par?) — Beamish 34 (un) — Beguin 1539 (par) — Bergman 139 (un), 140 (de), 168 (su), 188 (vev), 209 (de), 282 (de), 339 (ag), 370 (ag), 423 (un), 430 (pal), 434 (de), 523 (ag), 620 (ag), 640 (ag), 695 (pal), 696 (ag), 742 (de), 820 (pal) — Bernardi 13129 (pap), 13346 (vei) — Bowers 83 (bi), 556 (bi) — Brass 4026 (ag), 4692 (st), 5065 (ag), 9227 (cr), 10293 (ag), 11060 (bi), 11887 (un), 12854 (vev), 22451 (ag), 22775 (ag), 27082 (pal), 27088 (de), 27832 (vea), 27859 (vea), 29580 (ge), 29727 (un), 30784 (bi), 30813 (bi), 30850 (ge), 30904 (bi), 30952 (cr), 31443 (bi), 31449 (bi) — Brass & Collins 31316 (bi), 32141 (ag) — BSIP series (Whitmore) 2063 (pap) — Bulmer 109 (bi) — Buwalda 6193 (par) — BW series (Vink & Schram) 8666 (de), (Versteegh) 12725 (vev), (Koster) 13750 (ar), (Koster) 13953 (py), (Sleumer & Vink) 14219 (py).

Cabalion 717 (vei), 2136 (pap), 2143 (pap), 2782 (vei) — Carr 10240 (vev), 10302 (pal), 10322 (vev), 10329 (un), 10334 (de), 10347 (vei), 10358 (un), 10364 (un), 10406 (pal), 10423 (vev), 10443 (vei), 10444 (pal), 10449 (vei), 10465 (ag), 10474 (ge), 10476 (ar), 10533 (cr), 10544 (py), 16655 (un), 16656 (vei), 16699 (pal), 16741 (vev), 16763 (pal), 16933 (pal), 16986 (pal) — Carstensen 50 (bi) — Chadim 19a (de) — Cheesman 1167 (un) — Christophersen 3488 (pap) — Clemens 12234 (py), 41221 (bi) — Cox 193 (pap) — Craig 76 (ag) — Craven & Schodde 1149 (un), 1406 (vev) — Cribb 2268 (ar); S 129 (su), S 145 (de), S 146 (un), S 157 (un), S 159 (su) — Cribb & Campbell 5119 (par), 5130 (pap), 5135 (vei) — Cribb, Dennis & Campbell 5052 (pap), 5052a (vei) — Cribb & Morrison 1941 (pap), 2197 (co), 2206 (ag) — Cribb & Wheatley 13 (pap), 39 (pap), 51 (vei), 60 (pap), 92 (pap), 131 (vei) — Cruttwell 347 (vev), 420 (de), 421 (pal), 729 (pal), 1091 (un), 1480 (vev), 2124 (bi), 2578 (bi), 3228 (ag), 3249 (veu), 3266 (ge), 3284 (bi), 3285 (ag), 3305 (ar).

Darbyshire 264 (vev), 317 (bi), 327 (vev), 454 (bi) — Demoulin 5630 (ag) — Demoulin & Smeets 5559 (bi) — Docters van Leeuwen 10616 (vev) — Dodd E 26 (de).

Edinburgh cult. C4656 (bi), C4910 (vev), 630526 (vev), 721246 (um), 721255 (um), 721370 (de), 721545 (de), 721572 (ag), 721680 (un), 752460 (vei), 761220 (ag), 761299 (bi) — Eichler 18252 (bi) — Eyma 4743a (vev), 4743b (un), 5248 (de), 5299 (bi).

Fallen & Kaupa 413 (un).

Gawi 64 (bi) — Gilliard 13 (bi) — Gillison 132 (ag), 151 (ag) — Gjellerup 533 p.p. (pal), 1071 p.p. (ar), 1089 (py), 1110 (bu) — Grubb & Edwards 23 (bi) — Gyldenstolpe 2/10/1951 (bi).

Hartley 11817 (ge), 11822 (ar), 12168 (de), 12740 (ag), 12778 (ag) — Hays 170 (vei) — Hiepko & Schultze-Motel 1079 (bi), 1157 (bi), 1344 (vev) — Hoock s.n. -/11/1974 (pap) — Hoogland 9290 (pal), 9334 (un), 9335 (vev), 9431 (ag), 9485 (ag) — Hoogland & Craven 10919 (pal) — Hoogland & Pullen 5602 (bi) — Hoogland & Schodde 6926 (bi) — Hoover 678 (un), 683 (un) — Hope 16088 (ag) — Hunt 2030 (vei), 2034 (vei), 2053 (par), 2472 (pap), 2959 (vei).

Idjan & Moehtar 46 (par) — Iserentant 9459 (bi).

Jacobs 8731 (vev), 8914 (bi) — Janowsky 417 (vev) — Jermy 4 (bi), 19 (ag) — Johansson et al. 250 (par).

Kajewski 632 (pap), 641 (pap), 1717 (veu) — Kalkman 4310 (bi), 4511 (ag), 4685 (bi), 5260 (bi) — Kalkman & Tissing 4202 (bi), 4265 (ar) — Kalkman & Vervoort 4144 (pal) — Kjellberg 1505 (par) — Kloss s.n. 27/1/1913 (bi?), s.n. 29/1/1913 (bi) — de Kock 68 (ag), 143 (ag) — Kostermans 2368a (vev), 2368b (ar), 2492 (bu) — Kostermans & Soegeng 681 (vei), 763 (vei), 763b (vei).

LAE series (Stevens) 51012 (bi), (Stevens & Coode) 51427 (st), (Kerenga) 56498 (vev), (Kerenga & Garki) 56855 (ag), (Kerenga & Baker) 56904 (cr), (Andrew) 57011 (ag), (Andrew) 57060 (bi), (Stevens & Lelean) 58292 (ar), (Vinas & Wiakabu) 59433 (bi), (Vinas & Wiakabu) 59514 (bi), (Vinas) 59721 (ar), (Croft et al.) 60746 (ag), (Katik & Larivita) 62068 (un), (Clunie) 63047 (vev), (Clunie et al.) 63441 (bi), (Croft & Lelean) 65807 (ag), (Croft & Lelean) 65852 (ag), (Croft et al.) 65985 (ag), (Barker & Wiakabu) 66915 (ag), (Barker) 66978 (ag), (Vinas) 67030 (bi), (Larivita) 67140 (bi), (Benjamin) 67953 (ag), (Croft et al.) 71030 (un?) — Lam 1599 (cr), 1642 (cr), 1827 (bi), 1828 (bi) — Ledermann 8880 (par), 9894a (un) — Leiden cult. 22604 (de), 22607 (bi), 26827 (de), 28108 (de), 30425 (de), 30669 (un), 30682 (um), 30683 (un), 30687 (de), 30688 (bi), 30689 (bi), 30694 (un), 31515 (vev), 31747 (pal), 32001 (bi) , 32075 (bi), 32094 (bi), 32130 (bi), 32147 (bi), 32151 (vev), 32258 (un), 930853 (ve), 940356 (ag), 940357 (su), 940362 (bi), 940429 (veu), 940461 (vei), 940496 (bi) — Lewis & McDonagh 55 (vei) — Lisowski s.n. 14/9/1979 (ag) — Lowe, Mallehose & Rendell 3 (bi), 18e (bi).

Maclennan 5a (vev), 5b (bi), 25 (bi), 26 (vev) — Mangen 603 (cr), 2130 (ag), 2291 (ag) — Mason 15 (vev), 35 (vei), 48 (bi), 1604 (de), 1753 (un), 2030 (vei), 2203 (vev), 2661 (vev), s.n. 30/10/1969 (de) — Mayr 351 (vev), 597 (bi) — Mitchell 9 (pap), 10 (vei), 70 (pap) — Morat 6037 (pap) — Morrison 782 (un), 1635 (un), 1659 (de).

NGF series (Womersley) 4405 (bi), (Womersley & Hoogland) 4963 (de), (Womersley) 6058 (de), (McKee & Floyd) 6386 (ag), (Womersley & Millar) 7707 (ag), (Womersley & Millar) 7708 (bi), (Millar & Womersley) 7742 (un), (Millar & Womersley) 7743 p.p. versteegii subsp., (Womersley) 9020 (bi), (Womersley) 9021 (bi), (Ford) 8987 (bi), (Millar) 9271 (un), (Millar) 9272 (un), (Womersley) 11346 (ag), (Womersley) 11445 (bi), (Millar) 12214 (bi), (Womersley & Thorne) 12833 (ge), (Womersley & Thorne) 12834a (de), (Womersley & Thorne) 12834b (ge), (Womersley) 14269 (bi), (Millar) 14693 (bi), (Millar & Holttum) 15754 (ag), (Millar) 15797 (bi), (Millar) 15956 (bi), (van Royen) 18112a (cr), (Millar & Garay) 18674 (co), (Millar & Garay) 18698 (co), (Millar & Garay) 18705 (bi), (Millar & Garay) 18725 (de), (Millar & Garay) 18733 (bi), (Sayers) 19815 (ge), (Sayers) 19981 (un), (van Royen) 20368 (ag), (van Royen) 20384 (py), (Buderus) 20752 (ag), (Taylor) 20966 (un), (Sayers) 21205 (ag), (Sayers) 21494 (bi), (Millar) 22572 (bi), (Millar) 22718 (de), (Millar) 22739 (un), (Millar) 22762 (un), (Millar) 22908 (un), (Millar) 23165 (bi), (Millar) 23606 (un), (Millar) 23608 (ge), (Millar) 23656 (ar), (Millar) 23662 (ag), (Sayers) 24179 (un), (Womersley & Dockrill) 24968 (ge), (Womersley & Dockrill) 24971a (un), (Womersley & Dockrill) 24971b (ag), (Streimann & Kairo) 27689 (bi?), (Streimann & Kairo) 27690 (bi), (Streimann & Kairo) 27719 (bi), (Streimann & Kairo) 27727 (ag), (Frodin) 28197 (ag), (Streimann) 28951 (de), (Streimann) 28962 (vev), (Streimann & Katik) 28981 (vei), (van Royen) 30031 (ag), (Coode & Katik) 32865 (un), (Coode & Katik) 32874 (ag), (Coode & Katik) 32968 (co), (Ridsdale, Henty & Galore) 33112 (bi), (Ridsdale & Galore) 33198 (bi), (Ridsdale & Galore) 33401 (ag), (Streimann) 35858 (ge), (Streimann) 35859 (ag), (Womersley & Wooliams) 37067 (bi), (Millar) 38371 (ag), (Vandenberg) 39673 (bi), (Vandenberg et al.) 39837 (bi), (Vandenberg et al.) 39861 (ag), (Millar) 40615 (ge), (Millar) 40642 (ag), (Millar) 40643 (bi), (Henty, Isgar & Galore) 41543 (de), (Henty, Isgar & Galore) 41668 (vev), (Streimann & Kairo) 42422 (ar), (Streimann & Kairo) 42428 (ar), (Henty et al.) 42731 (vei?), (Kairo) 44083 (su), (Foreman & Galore) 45840 (bi), (Johns & Noble) 47040 (cr).

Paijmans 656 (st) — Parks 20560 (pap) — Philipson & Philipson 3402 (ag), 3402a (bi) — Pugh & Dickson MP1 (pap) — Pulle 858 (bi) — Pulle (Versteeg) 2445 (ag) — Pullen 232 (ag).

Rau 9 (bi), 24 (ag), 105 (vei), 162 (bi), 168 (un), 277 (un), 576 (vei) — Raynal 17120 (bi), 17121 (ar) — Reeve 35 (bi), 185 (ag), 336 (bi), 663 (de), 751 (su), 755 (cr), 756 (pal), 758 (vei), 2581 (pal), 2829 (ag), 2875 (de), 4708 (un), 4909 (ag), 4944 (de), 4959 (vev), 5049 (co), 5260 (bi), 6215 (bi), 6300 (bi), 6304 (un), 6581 (de), 6583 (pal), 6584 (bi), 6616 (bi) — Reinecke 300 (pap) — Robinson K 197 (vei) — von Römer 1216 (ag), 1322 (bi) — van Royen 3906 (pal), 4433 (vei), 10981 (py), 11043 (ge),

11442 (ag) — van Royen & Sleumer 5991 (pal), 6027 (vei?), 6028 (ge), 6119 (bi), 6897 (un), 7115 (un), 7390a (pal), 7390b (vei?), 7771 (pal), 7871a (ar), 7871b (pal), 7955 (pal), 7955a (py), 7961 (ar), 8031a (pal), 8031b (ar) — RSNH series (Green) 1153 (pap), (Raynal) 16155 (pap), (Raynal) 16192 (pap), (Raynal) 16398 (vei), (McKee) 24160 (vei) — Rutten (Kornassi) 1481 (vei), 2256 (par).

Sands et al. 1523 (ag), 1832 (de), 1835 (vei), 1965 (vei), 2275 (cr?), 2452 (ag) — Saveur & Sinke 2662 (bi) — Sayers 1 (bi) — Schlechter 14338 (un), 16714 (par), 17715 (par), 18227 (bi), 18746 (py), 18801 (bi), 19503 (vev), 19584 (un), 19708 (py), 20074 (un) — Schodde 1669 (bi), 4851 (bi), 4891 (ag), 4898 (un), 5386 (de) — Schodde & Craven 3709 (par), 3763 (veu), 4892 (ar) — Schuiteman 2 (ge), 3 (un), 8 (ge), 9 (ag), 14 (ar), 69 (de) — Schuiteman, Mulder & Vogel 19 (vev), 36 (ag), 46 (vev), 47 (un), 49 (co), 73 (bi), 90-255 (bi), 90-638 (vev) — Setchell 402 (pap) — Sinke 19 (bi) — Sledge 1833 (pap) — A.C. Smith 5120 (pap), 5998 (pap) — J.J. Smith s.n. -/-/1899 (par) — Soegeng 546 (bi) — Sterly 80-92 (ag), 80-97 (bi), 80-308 (bi), 80-631 (ag), 1706 (ag) — Stresemann 3 (par) — Suprin 279 (vei) — Szent-Ivany BMF 77 (ag).

Takamatsu 685 (par), 690 (par), 958 (pap) — Taylor 19 (ag).

Veldkamp 6321 (ag), 6738 (bi), 6844 (bi), 6844a (ge) — Veldkamp & Stevens 5626 (ag) — Versteeg 1640 (vev) — Vinas 109 (ag) — Vink 16047 (ag), 16986 (bi) — de Vogel 5383 (par?).

Waterhouse 619a (pap), 619b (veu) — Watson 432 (su) — Wheatley 39 (vei), 498 (vei) — Wickison 22 (pap) — Wissel 175a (cr), 175b (ag), 179a (cr), 179b (ag) — Womersley s.n. 18/2/1975 (de), s.n. 30/10/1969 (de) — Womersley & Floyd 6931 (bi) — Woods 305 (bi), 1224 (ge), 1767 (un), 1792 (de), 1802 (ge), 1833 (un), 1939 (un), 2052 (bi), 2272 (un), 2252 (py), 2445 (de), 2922 (de), s.n. -/10/1962 (pal) — Woods & Howcroft 1206a (bi) — Woods et al. 1226 (ag) — Woods, Black & Reeve 1255 (bi) — Woods, Cruttwell & Galore 2218 (de) — Wooliams 41a (ag).

(For Figures A–D, see pages 76 and 77)

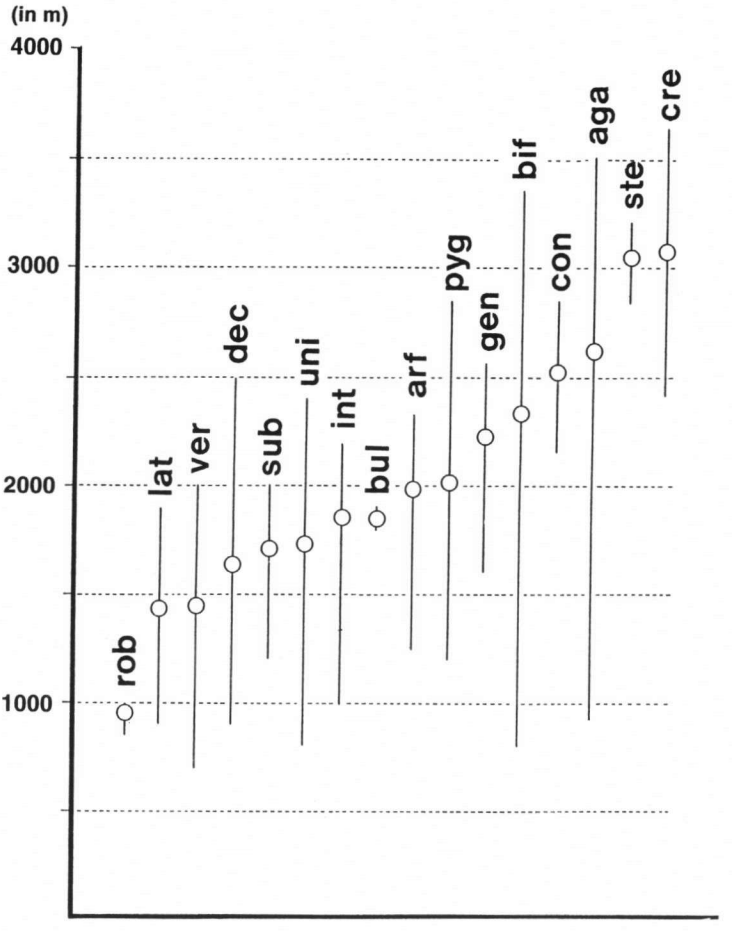


Fig. A. Altitudinal range of *Mediocalcar* in New Guinea (**aga** = *agathodaemonis*; **arf** = *arfakense*; **bif** = *bifolium*; **bul** = *bulbophylloides*; **con** = *congestum*; **cre** = *crenulatum*; **dec** = *decoratum*; **gen** = *geniculatum*; **int** = *versteegii* subsp. *intermedium*; **lat** = *paradoxum* subsp. *latifolium*; **pyg** = *pygmaeum*; **rob** = *paradoxum* subsp. *robustum*; **ste** = *stevenscoodei*; **sub** = *subteres*; **uni** = *uniflorum*; **ver** = *versteegii* subsp. *versteegii*). Circles indicate mean altitude of collections.

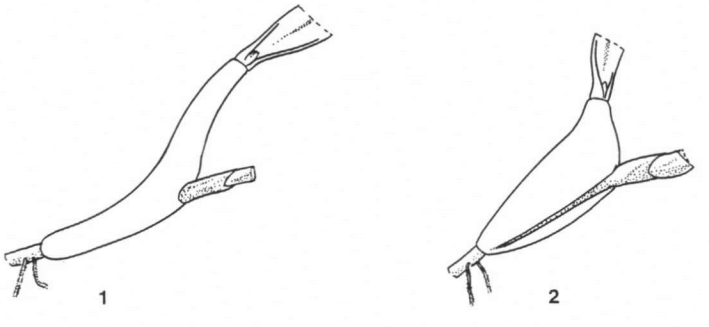


Fig. B. Pseudobulbs with elongated base. – 1. Enveloping the rhizome; 2. clasping the rhizome.

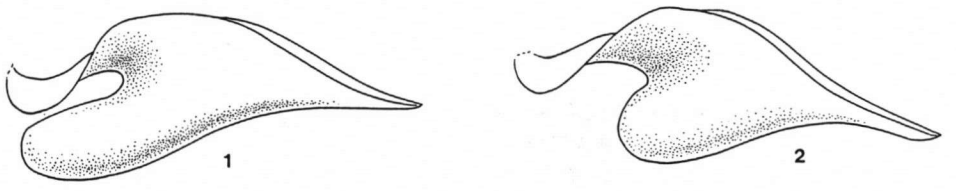


Fig. C. Relative length of spur. – 1. About as long as the claw; 2. at most half as long as the claw.

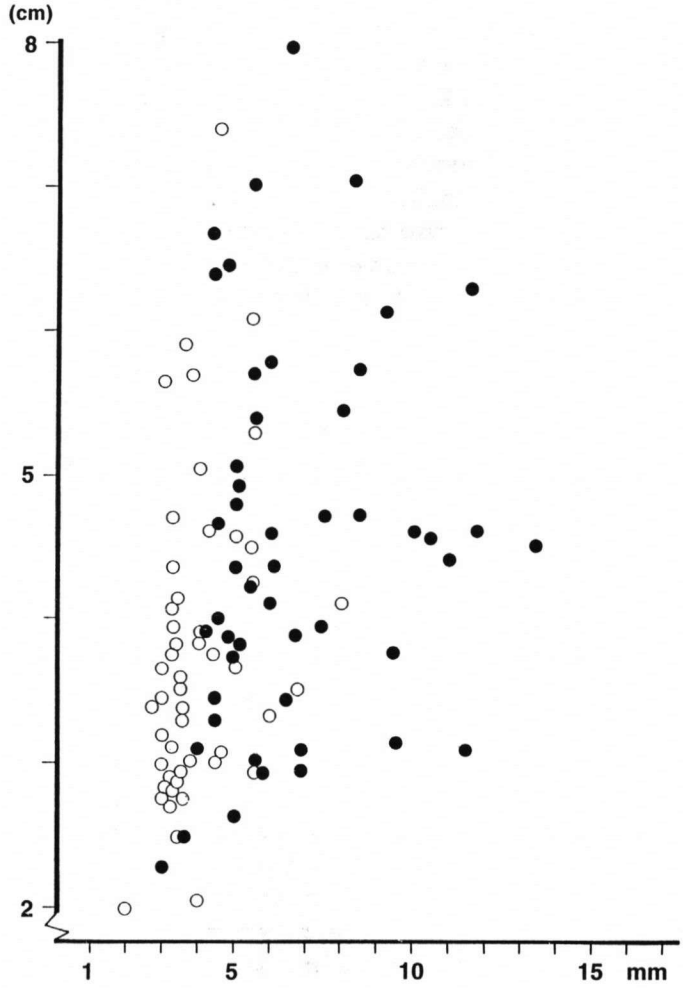


Fig. D. Scatter diagram of leaf length against leaf width in *Mediocalcar agathodaemonis* (●) and *M. bifolium* (○).