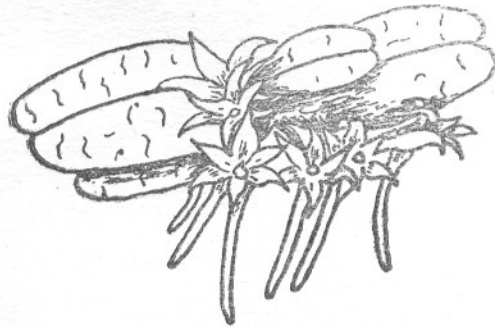


Sphyrarchynchus sp.



Cyrtorchis crassifolia Schltr.

AN INTRODUCTION TO THE EPIPHYTIC ORCHIDS OF EAST AFRICA.

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1. INTRODUCTION.

Over fifteen thousand species of orchids have been described, the vast majority of them tropical, and the greater part of them epiphytic, that is, normally growing on trees without deriving sustenance from them. But little more than ten per cent of the majestic total belong to Tropical Africa and moreover, so far as is known at present, within that area ground orchids predominate over epiphytic in the proportion of more than three to one.

There is reason to believe that these figures are a reflection rather of our ignorance than of the truth. Because the Tropical African epiphytic orchids are not characterised by the magnificence and opulence of those of other regions, they have not attracted the commercial collector and certainly are most imperfectly known. Yet the local orchids display a delightful diversity of adaptation and of form. None are flamboyant, but many are beautiful, some are exquisitely dainty and a few are bizarre. They appeal to the same feelings and are capable of arousing the same enthusiasms as succulents or alpine plants. Moreover, anyone who takes the comparatively little trouble required to collect and grow them has the additional satisfaction of knowing that he is contributing to scientific knowledge.

No general work on African orchids is available, and for our own information we have recently compiled a list of the species authentically recorded within the East African territories, namely, Uganda, Kenya, Tanganyika, Nyasaland, Northern

Rhodesia, and the Zanzibar Protectorate.* Eliminating synonyms, the total for the whole area of roughly one million square miles is only 710 species, of which 209 are epiphytic. It is some indication of how much remains to be discovered that within two years we have collected, with much most generous help from friends, and have been able to maintain alive, about 270 different epiphytic species, most of them from the fifty thousand square miles of north-eastern Tanganyika Territory. While this area is perhaps geographically more favourable than any other, comparable results are to be expected from elsewhere, especially the Mount Kenya-Jombeni area and the Uluguru-Usagara. Unfortunately identification by specialists and description of new species cannot be hoped for until after the war.

Species appear to be localized to a high degree, especially on the isolated mountain blocks of ancient crystalline rock that still carry forest, so that every one of these merits exploration and is likely to yield something new. The indications are, for example, that the epiphytic orchids of the Usambara Mountains are 75% different from those of the Nguru Mountains, ecologically very similar and only 100 miles away to the south-west. The same degree of difference apparently holds good between Usambara and Kilimanjaro, which is, of course, volcanic, 150 miles to the north-north-west.

Nothing could show more forcibly the amount of exploration waiting to be done, than that, after collating all the published records and adding unpublished, the numbers of epiphytic orchids that can be listed for each of the great East African mountains are only: Ruwenzori, 17; Elgon, 19; Kenya, 5; Kilimanjaro, 10. (More than half of these belong to the genus *Polystachya*.) These figures may be compared with the 32 recorded in literature for the Usambara Mountains and the fact that we now know this to be less than one-quarter of the true total.

We have undertaken the compilation of this article with a diffidence appropriate to the fact that we know others in East Africa have been studying the subject for longer than ourselves. But we have been encouraged to proceed by the peculiar advantages of our situation, access to the excellent botanical library at Amani, the generous personal assistance of Mr. P. J. Greenway, and the abundance of our local orchid flora. We are indebted to Dr. W. J. Eggeling and Mr. J. Glover, as well as Mr. Greenway, for reading and discussing our draft from their several points of view, and to Mr. G. R. Cunningham van Someren for criticizing the key.

*The "British East Africa" of the *Flora of Tropical Africa* includes the Niam-niam country, now part of the north-east Belgian Congo and not within our purview.

2. NOMENCLATURE AND CLASSIFICATION.

Scientific nomenclators are so often thought to move in a mysterious way, with irritating and perverse results, that a brief indication of the principles of botanical nomenclature may assist those who are not systematic botanists.

Each species bears a generic, followed by a specific, name, to which in a formal citation we suffix the name of the person who first gave the plant that specific name. For a name to be "good", that is, acceptable by subsequent workers, it must comply with two requirements:—

- (a) When first published it must have been accompanied by an adequate description. Otherwise it is stigmatized as a *nomen nudum* and is worthless.
- (b) The name must not be "pre-occupied", i.e., the same combination of generic and specific names must not have been given already, in due form, to a different kind of plant. This difficulty of "pre-occupied" names arises not only from a describer's overlooking earlier work, but also when a plant is transferred to another genus. In such a case of "pre-occupation", and in no other circumstances, the specific, as distinct from the generic, name can legitimately be changed.

When a plant described under name A is demonstrated to be identical with a plant described at an earlier date under name B, name A is stated to be a synonym of name B and should no longer be used.

So far botanists and zoologists use the same conventions. Now for the differences:—

- (i) It often happens that a later worker does not agree with the original describer in his allocation of a particular plant to a particular genus. If he transfers it to another genus he must retain the original specific name and publish the "new combination" ("*comb. nov.*"). Thereafter the first author's name is retained, but in brackets, and followed by the second author's. Thus the plant originally described by Rolfe as *Angraecum floribundum* is now known as *Aerangis floribunda* (Rolfe) Summerhayes. Such full citations will be given in the list of species below, but in the text the authors' names will, for convenience, be omitted.
- (ii) Under the international rules of botanical nomenclature specific names derived from personal names, and certain others also, are recommended to be spelt with a capital. That such a refinement is unnecessary is shown by the

fact that zoologists have felt no need for it. It certainly is a great nuisance to amateur botanists and in copying. The Imperial Forestry Institute check-lists have given a lead in ignoring this tiresome convention. Since we have no botanical reputation to lose we thankfully follow them.

- (iii) In botany the term "variety" ("var.") is used much more often than "subspecies", and for either the author should be cited as well as the author of the specific name.

Owing to the great changes that have been found desirable in the classification of the orchids in the last fifty years, bracketed names of authors are exceedingly numerous in the East African epiphytics. When the *Flora of Tropical Africa* was written, apart from the genera *Oberonia*, *Ancistrochilus*, *Polystachya*, *Bulbophyllum* (with *Megaclinium*), *Ansellia*, and *Saccolabium* (now *Acampe*), the whole of the rest of the epiphytics, which are collectively known as "the Angraecoids", were included in the genera *Angraecum*, *Listrostachys*, and *Mystacidium*. With the increasing number of known orchids, however, these genera had been forced to take a wide range of forms not contemplated by their original authors many years before. Their limits had become so vague that species were bandied about between the three genera by successive authors in a bewildering way. When finally Schlechter undertook the revision of the Angraecoids he was faced with the alternative of "lumping" them all in one genus, which would have been most unwieldy, or of dividing them into many more than three genera, some of which would inevitably tend to intergrade. He chose the latter alternative and his system of 32 genera (*Beihefte Botanisches Centralblatt*, Bd. 36(2), 62-181, 1918) has been generally accepted. His conclusions, and the "new combinations" made necessary by the transfer of so many species to new genera, were made more generally accessible by a translation in the *Kew Bulletin* for 1926 (pp. 323-337). So far as East Africa is concerned, few species remain in the genus *Angraecum*, and the genera *Listrostachys* and *Mystacidium* practically disappear. Unfortunately, although Schlechter's genera form fairly natural groupings on general characters, the criteria he designated are mostly minute details of the anatomy of the flower, and his key and other formal keys based on his classification are correspondingly difficult for the amateur to work. In the key we give on page 15 below we have sought only characters obvious to the naked eye: its admitted imperfection is in part due to its convenient criteria.

3. GENERAL ECOLOGY.

While all orchids are perennial herbs, of relatively very slow growth, there is a fundamental difference in mode of development between, on the one hand, *Acampe* and the Angraecoids, and on the other hand plants of the genera *Ancistrochilus*, *Polystachya*, *Stolzia*, *Bulbophyllum*, *Cirrhopetalum*, and *Ansellia*. The former group is monopodial, that is, the growth of the main stem continues indefinitely, by a terminal bud, any lateral branches remaining subsidiary. Growth is usually interrupted seasonally, but not with wholesale shedding of leaves. By contrast the *Polystachya* group is sympodial, that is, the growth of each shoot is completely terminated, with loss of leaves, after one or two seasons. The plant as a whole remains alive, however, periodically making a fresh start by the emergence of a new shoot from the base of an old one. In some species, especially of *Bulbophyllum*, a horizontal runner connects successive shoots; in others, especially of *Polystachya*, the bases of the shoots are agglomerated.

In most of our epiphytic orchids sympodial growth is accompanied by the formation of thickened stems, called pseudobulbs, which provide reservoirs of plant food for subsequent seasons to draw upon. In the dormant stage, the leafless pseudobulbs of some species are covered with dead brown sheaths and present a particularly depressing and hopeless appearance. In some *Polystachyas* this effect is heightened by the long dried-up spikes emerging from the pseudobulbs: but out of them, when all seems lost, flowers burst without warning. In its extreme form, e.g., in *Bulbophyllum*, the pseudobulb is developed from a single internode of the stem into a tetrahedron or almost a cube, with accentuated angles. In other species pseudobulbs are nearly hemispherical or cylindrical, the vestiges of two or more nodes still being visible. In *Ansellia* and in some species of *Polystachya* the stem is merely thickened into something like a spindle-shape, the nodes remaining well apart. From the tips of all the pseudobulbous stems leaves arise, but usually no more than one or two on each.

The high gloss on the surface of so many pseudobulbs is not an accidental feature. From microscopic examination it appears that the shine is due to a layer of wax, which would not only seal the surface against loss of water by transpiration but also hinder the invasion of the tissues by harmful micro-organisms. Both these means increase the efficiency and longevity of the pseudobulbs as storage organs. Their powers of survival are illustrated by a leafless stem of *Ansellia*, one end of which we have kept bound in moss and occasionally watered for nearly two years: it shows no signs of rooting but is as firm and sound as the day it came off the parent plant.

The roots of mature orchids, which in most epiphytic species are thickened into a blunt process shaped like an earthworm, differ from those of most plants in being devoid of assimilating root-hairs. It has been thought that their function is performed by a minute fungus (mycorrhiza) carried on the external cells of the root. Some doubt has been cast on this opinion, but it is certain that an orchid seed cannot develop unless the embryo is infected with its correct mycorrhiza. When a root is actively growing its tip is brightly coloured, often pea-green or raw-sienna, shiny, and mucilaginous when wet. In that state the root is capable of adhering very closely to its host, or even pushing under the outer layers of bark; but if once detached or damaged that sensitive tip seems incapable of adhering again and a fresh start is often made by a side-branch of the root. A fraction of an inch behind the tip the living colour and texture change abruptly to the dull opaqueness of cortical cells, usually, in exposed roots, more or less grey-green. These cells form a thick spongy envelope, the "velamen", capable of absorbing and storing moisture for the "true" root, tough and thread-like, that runs through their midst. A peculiarity of the root-system of many epiphytic orchids is that as the stem elongates new roots are thrust out at intervals among the leaves.

Since the roots merely adhere to their support without drawing anything from its surface—and indeed some species have a large proportion of their total root-surface entirely aerial and can live with no adhesion at all—it is a matter of endless wonder to us that they should be able to secure the nutrients necessary for even their slow rate of growth. Some species, it is true, evidently prefer hollows and mossy surfaces where there is some accumulation of humus, however slight. But *Acampe*, for example, seeks no such advantage, and yet in the course of years builds up an appreciable weight of tissue. In general, it seems that for epiphytic orchids nutrients may be in part directly air-borne, e.g., pollen, comminuted plant débris, mineral dust and bird-droppings, trapped in the convolutions of the roots, in part water-borne, transported by rain along the surface of the host and including the breakdown products of that surface. The mineral elements required for growth would seem to be the hardest to come by; especially in rain-forest, where epiphytic orchids are more plentiful than anywhere else, accretions of air-borne inorganic matter must be altogether smaller than in dusty regions.

Plants of epiphytic species may on rare occasions grow in soil (or on rocks) and ground orchids may find sufficient humus in a tree hollow, but on the whole the division between epiphytic and ground orchids is clear-cut. Each genus of East African orchids falls in its entirety into one category or the other except that an abnormal group in *Liparis* is epiphytic and the species

forming a small section of *Polystachya* are typically terrestrial. Certain *Angraecums*, including *A. infundibulare* and *A. giryamae* seem to occupy a somewhat intermediate position, capable of living without ground connection but doing better with it. The *Vanillas* more certainly originate in soil, though they may live independently later, and they are not regarded as epiphytics for the present purpose.

There can be very few epiphytic orchids in East Africa, that are not faced from time to time with periods of at least a month when no rain falls. In some areas, indeed, like much of Southern Tanganyika, an unbroken drought of five months each year can be counted upon. The full effects of such periods are doubtless to some extent mitigated by what has been called "occult precipitation", from mist and dew. Especially where the orchids are growing amongst loose moss or beard-lichen in situations such as scarp-edges, the amount of moisture so condensed and made available to the absorbent root-envelope is astonishingly high. It will often be found that on a wooded hillside in dry country, or in a grove of trees, epiphytic orchids are very narrowly localized indeed, and the probable cause is that the favoured site has a slight advantage of cold-air drainage from above or of sharply cooled up-current from below.

For economizing the moisture they can secure, our epiphytic orchids have several expedients, often in combination. For one thing, most of them have leathery or succulent leaves; and even those are shed periodically in many species. The most drastic device is to dispense entirely with leaves at all seasons, as the *Gussonea* species do. Others have reduced their leaf-surface very greatly, either by retaining few and small narrow leaves, as in *Rhipidoglossum xanthopollinium* and *Aerangis graminifolia*, or reducing them to mere needles, as in some species of *Tridactyle*. The pseudobulb system, too, is effective against seasonal drought, especially in those species in which all leaves are shed. Some plants grow in such a form as to entrap moisture: this applies especially to certain of the leafless species the roots of which, instead of spreading, as in *Gussonea chiloquistae* or *G. megalorrhiza*, form a densely interwoven mass. The most notable device of this kind has been perfected by *Ansellia*, the "Leopard Orchid", which forms a clump, weighing ultimately many pounds, in situations that are usually hot and subject to long droughts with desiccating winds. An *Ansellia* seedling first of all puts down roots that adhere closely to the bark of the host tree in the ordinary way. Once anchorage is secured, each season's growth consists of a forest of slender roots all thrusting vertically upwards. Each dies after a few inches growth, but the woody remains persist, so that in the course of years a great fibrous mass is formed, the constituents of which are so directed as to trap the maximum of rain.

Their tough tissues and their various adaptations for water economy give most epiphytic orchids an astonishing power of survival. Kept dry, they stand transport well and they can be moved at the beginning of their flowering, which would in most plants be a highly vulnerable time, without suffering and with hardly a check in the development of their flowers—a striking testimony to the powerful buffer effect of their storage organs.

Most epiphytic species have a rather restricted range of altitude. Subject to further information it seems to us that as a rule a species is more or less confined to one of the zones that may be designated Highland, Intermediate and Lowland, the lower limits of the first two being in most areas about 5,500 ft. and 3,000 ft. respectively, but lower near the coast. Species are fewest in the Lowland Zone, even in rain-forest. A few, e.g., *Acampe*, are very strictly Lowland, and two of these, *Tridactyle wakefieldii* and *Angraecum dives*, are usually close to the sea. On the whole, epiphytic orchids seem most plentiful, in both individuals and species, between about 3,000 ft. and 5,000 ft. in rain-forest. It is very noteworthy how rare they are in forests dependent upon ground-water, such as the Rau at Moshi. On the other hand, at Amani (at 3,000 ft. in Usambara and with a rainfall of 80 ins.) a dozen or more species can be collected from the crown of a single fallen forest tree. Above 5,000 ft. in Usambara, species become less numerous again, with the genus *Polystachya* predominating.

From the fact that they grow on trees, practically all epiphytic orchids receive some shade, at any rate during their active season. No species, however, are commonly found in the ground- and mid-stratum of really tall dense rain-forest. In such a place the abundant orchids all occupy the canopy or the outside edges of the forest: but in poor and more open forest, especially at high altitudes, epiphytics may be found near the ground.

There is little evidence of specific relation between orchid and tree-host; except that certain aberrant *Polystachyas* that are otherwise terrestrial also grow on the curiously fibrous stems of *Vellozias*, but on no other host. In general, rough bark is naturally more favoured than smooth and it is remarkable how very rarely an orchid is found on any fig-tree (*Ficus* sp.). On the other hand, given a favourable climate, many orchids colonize exotic trees, e.g., camphor (*Cinnamomum camphora*) and conifers, such as *Juniperus bermudiana*, with surprising enthusiasm. A few small species, e.g., *Angraecum viride*, are found always on twigs rather than branches. Somewhat contrary to expectation, orchids do not occur in association with the coarse epiphytic ferns *Asplenium nidus* and *Dryopteris laurentii*, which would seem to offer favourable foothold; but orchids often have their roots closely interwoven with those of

smaller ferns and naturally are often more or less embedded in moss and lichens. A few species bear specific names, e.g., *musciicola* (inhabiting moss), *rhipsalisocia* (living with *Rhipsalis*), that indicate associations of this nature; but the original field-notes on which the names were based were probably casual and not really significant.

4. THE ORCHID FLOWER.

In most familiar garden flowers the petals provide the showy part and the sepals are entirely subordinated, forming an inconspicuous green calyx. In the Orchidaceae this does not hold good. The flower consists of three petals so arranged inside three sepals that if all were pointed and of equal length they would form a regular six-pointed star, sepal alternating with petal, as is practically achieved in some *Cyrtorchis* species. In general, the sepals are at least as conspicuous as the petals.

As the unopened flower lies in its sheathing bract, that part pressed against the main flowering stem (rhachis) is the "odd petal", "lip" or "labellum", and in the opened flower the part directly opposite to this is the so-called dorsal sepal. In the various genera of the Orchidaceae the shapes and the relative proportions of the sepals and petals are subject to infinite and fantastic variation, but the lip undergoes the most astonishing development of all. In the orchids that have been commercialized it is often the most conspicuous part of the flower, its biological justification being that it is the alighting board for insects and besides often bears direction-marks to the nectary. As it happens, the East African epiphytics include among them no species with flamboyant lip, except *Ancistrochilus*; but the surface may be adorned with ridges and cushions as in *Polystachya*, or it is stiff, fleshy, repeatedly curved and delicately hinged, so that a touch sets it moving (as in *Bulbophyllum*). In some genera, as *Angraecopsis*, the lip is deeply cut into three lobes, while in *Tridactyle* it is often also fringed.

In our monopodial orchids the nectary at the base of the lip is progressively developed, in the first stage into a slight external bulge (*Acampe*), next into a cone (*Bolusiella*) or a bubble-like sac (e.g., *Gussonea chiloichistae*), then into a conspicuous tapered spur (as *Cyrtorchis*) and finally into a thread-like appendage several inches long, not all of it holding nectar (as in *Aerangis*).

The other two petals are simple compared with the lip, usually smaller than the sepals, and sometimes greatly reduced. Among the epiphytics the most curious modification is in a *Bulbophyllum* (obviously allied to *B. tentaculigerum* of West Africa), where each petal looks exactly like the clubbed antenna

of a butterfly, the resemblance being heightened by the erect way in which they are carried.

The dorsal sepal is always comparatively simple, but the laterals show some interesting modifications. In *Polystachya*, their lower edges are bent forwards and inwards until the basal parts unite: the result is the "hood", so characteristic of the genus, with the lip, which, it will be remembered, is the odd petal, sheltered within it. In *Cirrhopetalum* the lateral sepals are elongated and brought forward so that the *terminal* two-thirds of their lower edges is fused, but a gap is left at the base.

In all the African Orchidaceae the anthers-cum-filaments and stigmas-cum-styles of more familiar flowers are represented by only a single one of each and, moreover, they are fused together to form a comparatively stout column rising immediately above the nectary. The anther element, capped with a lid (operculum) liable to fly off at a touch, forms the highest part of the column. Immediately under the lid are the pollinia, minute membranous bags of pollen-grains. The surface on which they lie, which is practically the top of the column, is in many species produced in front, in its simplest form into a little shelf, in others into a complicated projection, called the rostellum, which serves to keep the pollinia from dropping on to the stigma below. The pollinia are connected, usually by exceedingly slender threads (stipites) to the viscidium, an easily detachable sticky patch designed to adhere to an insect visiting the nectary and to be carried away, complete with pollinia. The stigmatic surface, so arranged as to receive and retain transplanted pollinia, is lower down the column, and, as in other flowers, is in direct communication with the ovary, which is immediately below the junction of the foot of the column with the bases of the petals and sepals. The ovary merges into the pedicel, the little stalk supporting the individual flower. After fertilization this swells into a capsule, often of a size surprisingly large for its flower, and containing thousands, or hundreds of thousands, of very minute seeds.

In considering the general anatomy of an orchid flower it is necessary to bear in mind that the flower may have twisted on its pedicel or, botanically speaking, that "resupination has taken place". In all orchids, so long as the flower is completely enclosed in its sheathing bract, the lip and spur (if any) are pressed against the rhachis (the main stalk of the flower spray) with the spur pointing towards the base of the rhachis. If the pedicel merely pivoted outwards as it cleared the bract, the flower when it opened would have its lip on the side nearest the tip of the rhachis, that is, on an upright rhachis, uppermost in relation to the ground. This is what happens in the *Polystachyas*. But in many orchids as the flower emerges from the bract its pedicel not only lengthens but twists, so that eventually

the lip and spur point towards the base of the rhachis, that is, in an erect flower-spray, downwards. In *Angraecum giryamae* the twisting may be well seen in every stage and a record of the movements is preserved in the contorted lines of the individual pedicel. The latter, when the flower eventually opens after turning through more than 300 degrees, is wrapped round the base of the spur in what looks like a strangle-hold. The whole phenomenon was discussed by the late Sir Arthur Hill in *Ann. Bot. (N.S.)*, Vol. 3, pp. 871-887, 1939. The usual explanation of resupination is that as a result the flower is so arranged that a visiting insect finds a convenient landing place, on the lip. But the *Polystachyas* succeed without bringing the lip to the lower side of the flower and *Angraecum giryamae* in its contortions passes through that position and by the time it opens is well beyond it.

Scent.

Most of the East African epiphytic orchids have a smell, but practically nothing is recorded on the subject. The smell is provided by aromatic oils in the superficial cells of the petals and sepals. It appears that the active substance may be derived from an inert compound, such as a glucoside, from which the fragrant oil is gradually developed by the action of an enzyme (ferment) when the flower is open. Vanillin is understood to be the basis of many orchid scents, and this would account for the fact that almost identical scents are possessed by highly dissimilar flowers. For example, both *Rhipidoglossum rutilum* and a *Polystachya* have a sweet heavy smell of the richest vanilla-flavoured chocolate; *Polystachya imbricata* and several other species resemble bay-rum. There are, however, a great number of delicate variations, for example:—

Acampe mombasensis and *A. pachyglossa*: hyacinth.

Polystachya near *P. cultriformis*: primrose.

Aerangis kotschyana: narcissus.

Aerangis sp.: mignonette.

Tridactyle sp.: woodruff (new-mown hay).

Cyrtorchis spp.: sun-warmed gorse.

A few specific names refer to the scent: we have *Polystachya odorata* and *Chamaeangis odoratissima*, but these are not pre-eminent in their genera. *Bulbophyllum cocoinum* is said to be so-called because the scent is like that of coconut milk: but Amani specimens of the species strike us as merely faintly sweet. Local variation is a factor to reckon with in any attempt to define scents.

It will be found that many orchids have a scent-rhythm with time of day. Thus, while the *Cyrtorchis* spp. for the most part are sweet-scented throughout the twenty-four hours, the *Aerangis* spp. give out their perfume wholly or most strongly

at night. Certain *Diaphananthe* and *Angraecum* spp. are quite odourless until dusk, while *Angraecum viride*, for example, is diurnal. In Ceylon, certain orchids are known to change the nature of their scent with the hour of the day, but this has yet to be demonstrated for any East African species.

A minority of the local epiphytic orchids have a definitely unpleasant smell. *Polystachya polychaete* and *Diaphananthe kirkii*, for example, have a sickly fermented sweetish smell. Certain *Bulbophyllums* stink like carrion, and it is noteworthy that, as in the *Stapelieae*, such foul smells are linked with dull purple coloration.

It may be assumed that the function of the various orchid smells is to attract the visits of pollinating insects. Power of scent is not, however, in inverse proportion to degree of conspicuousness. The big *Cyrtorchis* spp., with masses of white flowers, are as fragrant as any, while the tiny *Bolusiella* spp. and the little green *Angraecum dives* flowers seem to us practically without scent at all hours. Presumably the sweet scents attract mainly *Lepidoptera*, and we have observed that the bad ones attract *Diptera*: but nothing is recorded of the specific relations of plants and insects in East Africa. Special attention may, however, be drawn to the fact that the magnificent *Angraecum (Macroplectron) sesquipedale*, with its 15-inch spur, was recorded by Engler (1895) from the East African coast. The existence of this orchid in Madagascar led Darwin to predict that a moth would be discovered with proboscis longer than any known in the island and capable of reaching the nectary. This was realised many years later in the person of the giant hawk-moth, *Xanthopan morgani praedictum*.

5. PUBLISHED AND UNPUBLISHED SOURCES.

For all ordinary purposes the literature begins with the *Flora of Tropical Africa*, Vol. 7 (1898), where Rolfe gave descriptions, in English, of all the Tropical African species known up to that date. Since then the great majority of the new species and most of the taxonomic work published have been in successive volumes of the *Kew Bulletin* (especially by Summerhayes since 1927), of *Engler's Botanische Jahrbücher*, and of the *Notizblatt des Botanisches Gartens Berlin*. Schlechter's important work in *Beih. Botan. Centrabl.*, 1918, has already been especially mentioned.

Other works containing numerous records of East African orchids (most of them, however, ground species) are:—

- (a) Engler's *Die Pflanzenwelt Ost-Afrikas Teil C* (Berlin, 1895). This publication was earlier than that of the *Flora of Tropical Africa*, Vol. 7, but it does not seem

to have been fully utilized in the later work. Engler's is not a very satisfactory source: some of the localities are vaguely stated and, in the light of present knowledge, some of the identifications are doubtful.

- (b) Rendle's account of the orchids obtained on Ruwenzori and in extreme south-west Uganda by the Anglo-German Boundary Commission (*J. Linn. Soc. Bot.*, Vol. 37, No. 259, pp. 215-223, 1905).
- (c) Engler's *Pflanzenwelt der Erde*, Vol. 9: *Die Pflanzenwelt Afrikas*, Bd. 2(1) 1908, and Bd. 5(1) Teil 1 (1925). These are compilations, in the first of which the several genera, as then conceived, are dealt with discursively. The other volume, that of 1925, brings together most of the records then known for Kenya, Northern Tanganyika Territory, and Ruwenzori. It contains obvious mistakes.
- (d) Milbraed's contribution to the flora of Ruwenzori in *Wiss. Ergeb. Deutsch Zentral-Africa-Expedition*, 1907-08, Bd. 2 Botanik Lfg. 1 (Leipzig, 1910).
- (e) Fries (Rob. E.) in *Wissenschaftliche Ergebnisse der Schwedischen Rhodesia-Congo-Expedition*, 1911-12: Bd. 1. *Botanische Untersuchungen*, Heft 2 (Stockholm, 1916) provides many records for Northern Rhodesia.
- (f) Chiovenda's *Raccolte botaniche fatte dai Missionari della Consolata nel Kenya* (Modena, 1935) contains a number of records for the mountains of Kenya, but there is some reason to doubt whether the identifications were made after comparing the specimens with authenticated material.
- (g) Summerhayes in dealing with the Orchidaceae in the *Flora of West Tropical Africa*, Vol. 2, Part 2 (1936) mentions, by territories, those parts of East Africa in which individual West African species occur, but incidentally and not exhaustively.

The publications cited above are, apart from certain systematic works, all those published during the last fifty years that are of importance for a study of the East African orchids: they contain more or less complete descriptions of 98% of the species on the list and nearly as great a proportion of the published local records, though in them the amateur will find very few illustrations to help him. Both Engler's book of 1908 and the *Flora of West Tropical Africa* provide, however, a drawing of one or more selected species, not necessarily East African, of some of the more important genera.

Especially if one judges solely from the published information on East African orchids, field work on them has been excessively patchy in both time and place. In the Nyasaland Protectorate there have been practically no new records in the

present century. In Northern Rhodesia nearly every record is either from Lake Bangweolo or from within a few miles of the Tanganyika border; and they are mostly due to the collectors before 1900 and to the Swedish expedition of 1911.

In Tanganyika Territory collecting has been more continuous, but extremely localized. From the whole of that huge area, nearly 200,000 square miles, between Kilimanjaro, Lake Victoria, Lake Tanganyika, the Southern Highlands, and the Ulugurus, barely half-a-dozen orchid records have been published. On the other hand much is known about the area immediately north of the head of Lake Nyasa, where in the years prior to 1914, Stolz made the finest collection of African orchids ever described, including 146 new species out of the 207 he obtained. Between his area and extreme north-eastern Tanganyika, hardly any orchids were known until the 1930's, when Schlieben produced some striking novelties from the Ulugurus. In Northern Tanganyika attention was concentrated exclusively on the Usambara Mountains and Kilimanjaro, where one collector after another has worked; but we are in a position to say that they discovered only a fraction of the epiphytic species even in those localities.

In Kenya Colony extremely few orchids had been recorded from anywhere but the neighbourhood of Mombasa right up till 1924, when the account appeared of the Fries collection made in 1922, on Mount Kenya, Elgon and the Aberdares (*Notizbl.*, Vol. 9, pp. 16-22). Since then there have been several additions to the knowledge of those mountains, especially Elgon, but to this day there seems to be not a single record of either ground or epiphytic orchid on the coast anywhere north of Mombasa, or in the Northern Frontier Province; while the published records for Central and Western Kenya, including such familiar areas as Nairobi, Ngong, Mau, Sotik, hardly reach one dozen. In Uganda, the great majority of the early records came from Ruwenzori and the south-west. Latterly collecting has been much better distributed, but many of the published records are not localized, being represented merely by "Uganda" in the *Flora of West Tropical Africa*.

In the check-list that follows, we have been able to supplement the published records to an important extent from lists of unpublished Kew identifications most kindly put at our disposal by a number of correspondents. The sources of the unpublished records are indicated in the check-list by initials, as follows:—

AH=Amani Herbarium.

BDB=Herbarium of the late Mr. B. D. Burtt, communicated by Dr. C. H. N. Jackson.

CMH=Coryndon Museum Herbarium, comm. Mr. P. R. O. Bally.

ILLUSTRATIONS.

All except diagrams 12—15 on Plate 1 are natural size.

- PLATE 1. Diagrams illustrating parts of flower, etc.
- PLATE 2. *Aerangis kirkii* (Rolfe) Schltr.
- PLATE 3. *Angraecum verrucosum* Rendle.
- PLATE 4. *Calyptrochilum orientale* Schltr.
- PLATE 5. *Cyrtorchis* sp.
- PLATE 6. *Tridactyle teretifolia* Schltr.
- PLATE 7. *Bulbophyllum platyrhachis* (Rolfe) Summerh.
- PLATE 8. *Cirrhopetalum africanum* Schltr.

The drawings facing page 1 illustrate *Sphyrarhynchus* sp. (above) and *Cyrtorchis crassifolia* Schltr. (below).

EXPLANATIONS OF PLATE 1.

Angraecum giryamae Rendle, parts (natural size).

1. Rhachis ~
2. Dorsal sepal.
3. Petal
4. Lateral sepal.
5. Lip (or labellum), upper side.
6. Under side of lip with spur (containing nectary).
7. Column.
8. Pedicel containing ovary (twisted by resupination).
9. Bract.
10. Twisted pedicel in relation to spur and rhachis (resupination).
11. Disc or cushion.

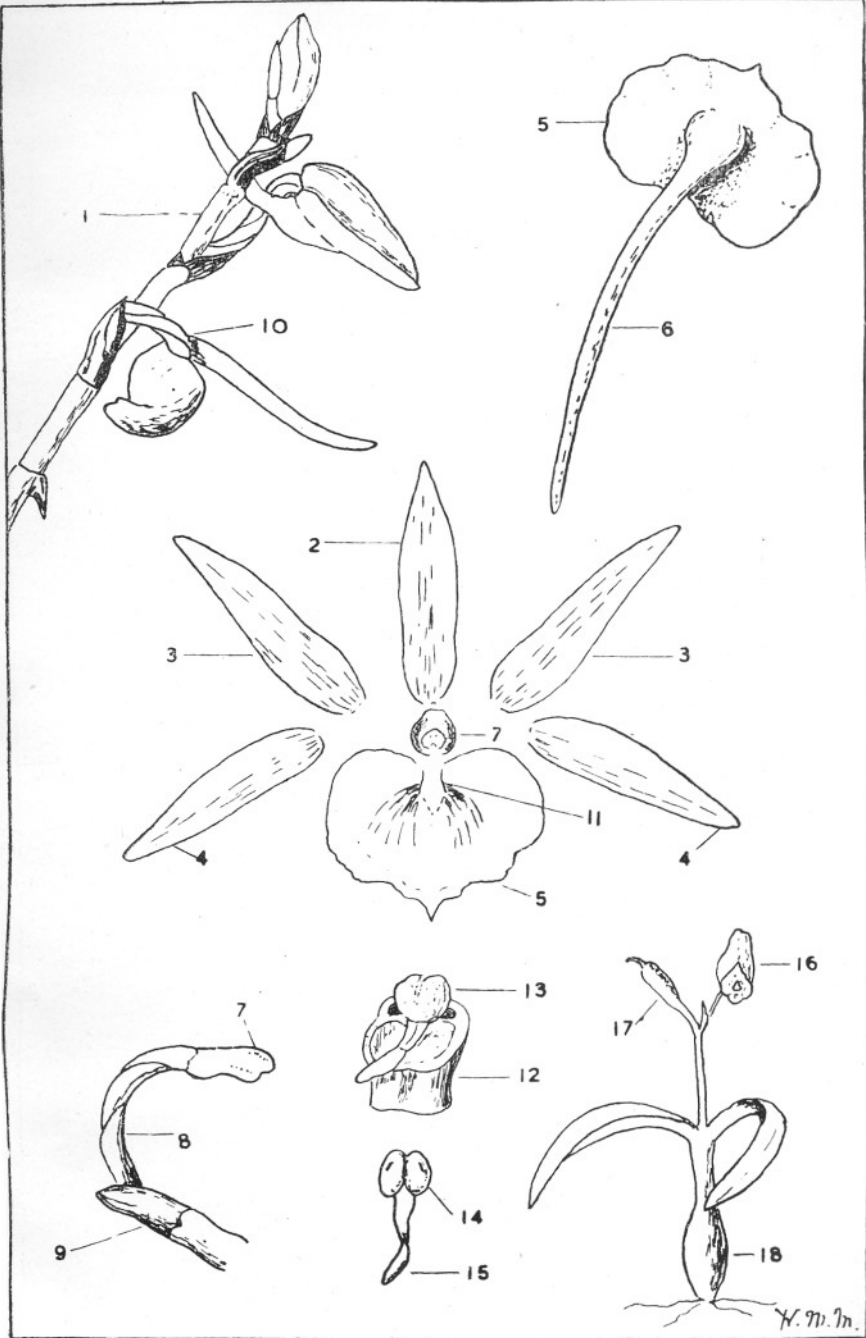
Aerangis kotschyana (Rchb.f.) Schltr., parts (enlarged).

12. Column entire, with rostellum and pollinia superimposed.
13. Operculum or lid covering (and hiding) pollinia.
14. Pollinia, connected by their stipites (singular "stipes") with:—
15. Viscidium.

Polystachya ottoniana var. *confusa* (Rolfe) Krzl.
(natural size).

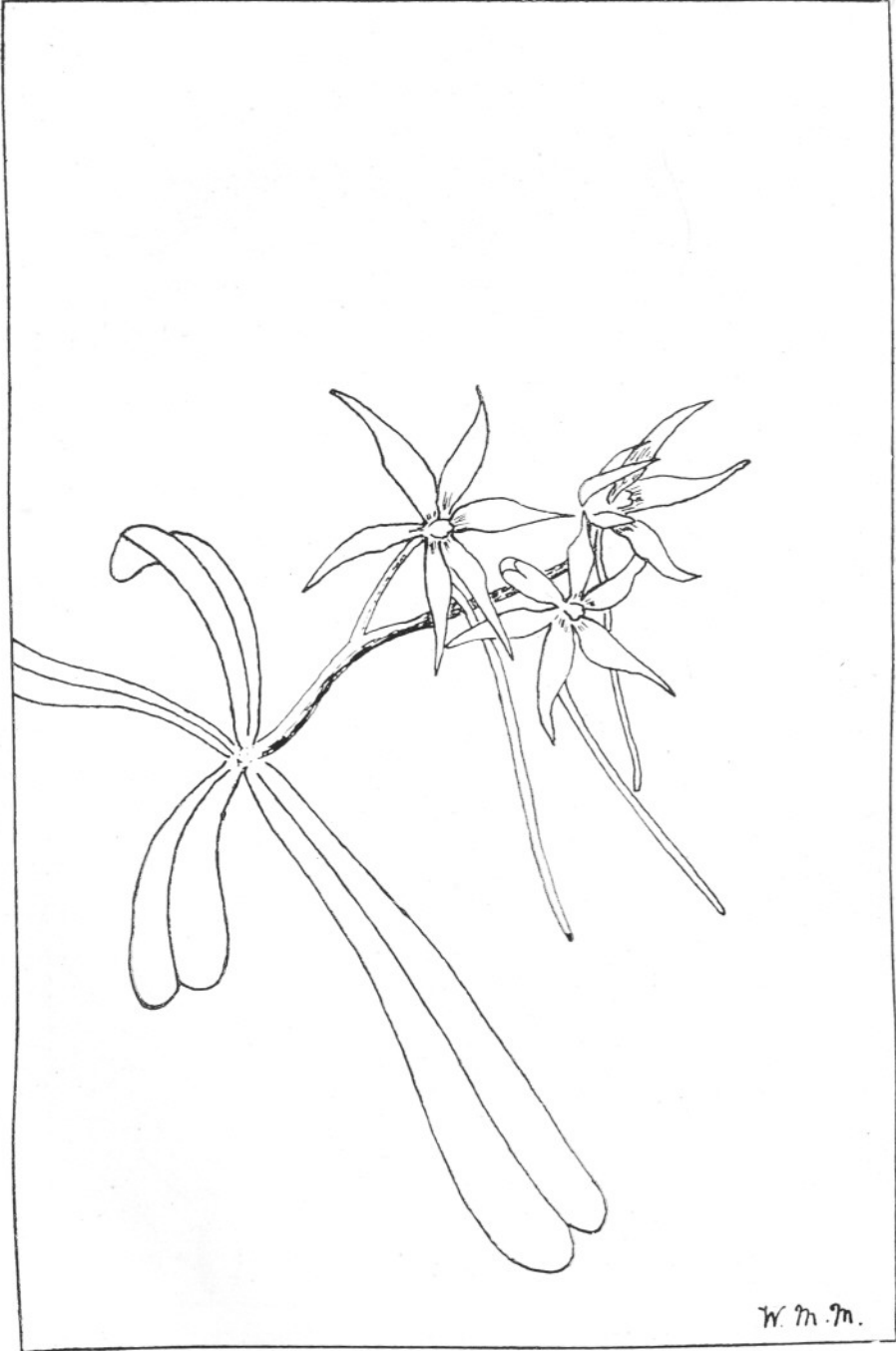
16. Hood formed by the junction of the lateral sepals, which are not on the lower side of the flower as they are in *Angraecum giryamae*, but on the upper.
17. Seed capsule.
18. Pseudobulb—thickened base of stem.

PLATE 1.



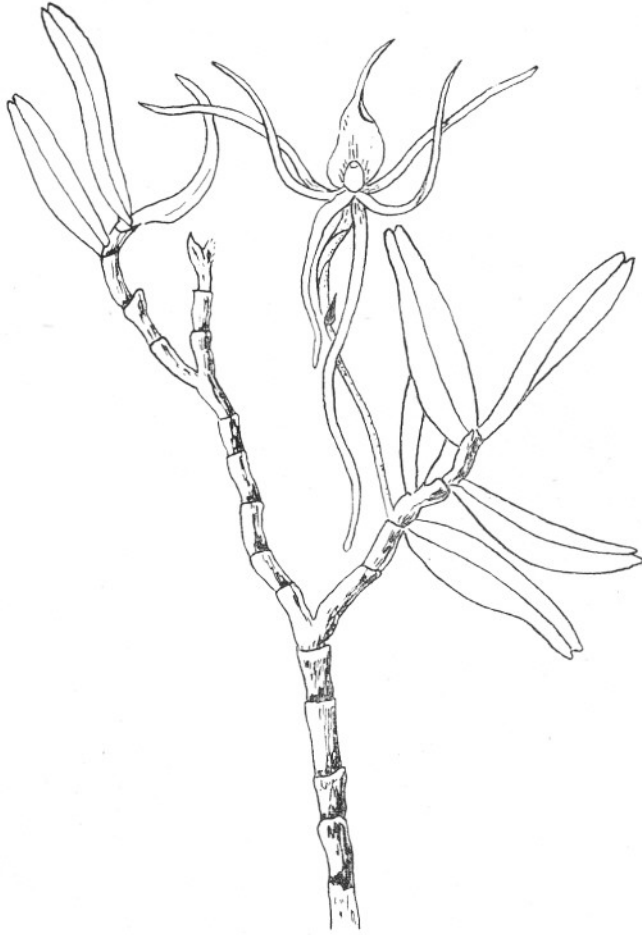
Diagrams illustrating parts of flower, etc.

PLATE 2.



Aerangis kirkii (Rolfe) Schltr.

X



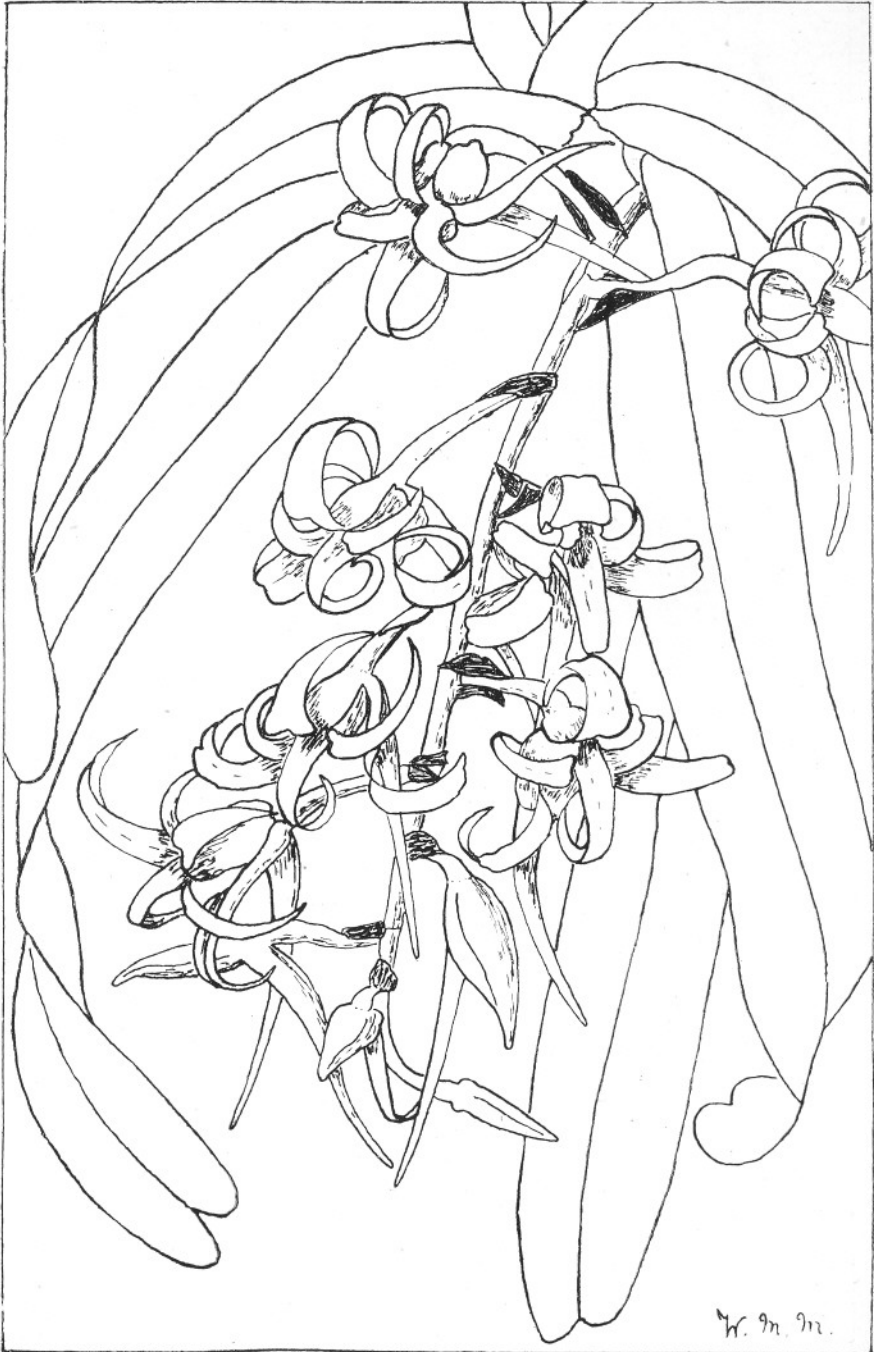
W. M. M.

Angraecum verrucosum Rendle.



W. M. M.

Calyptrochilum orientale Schltr.

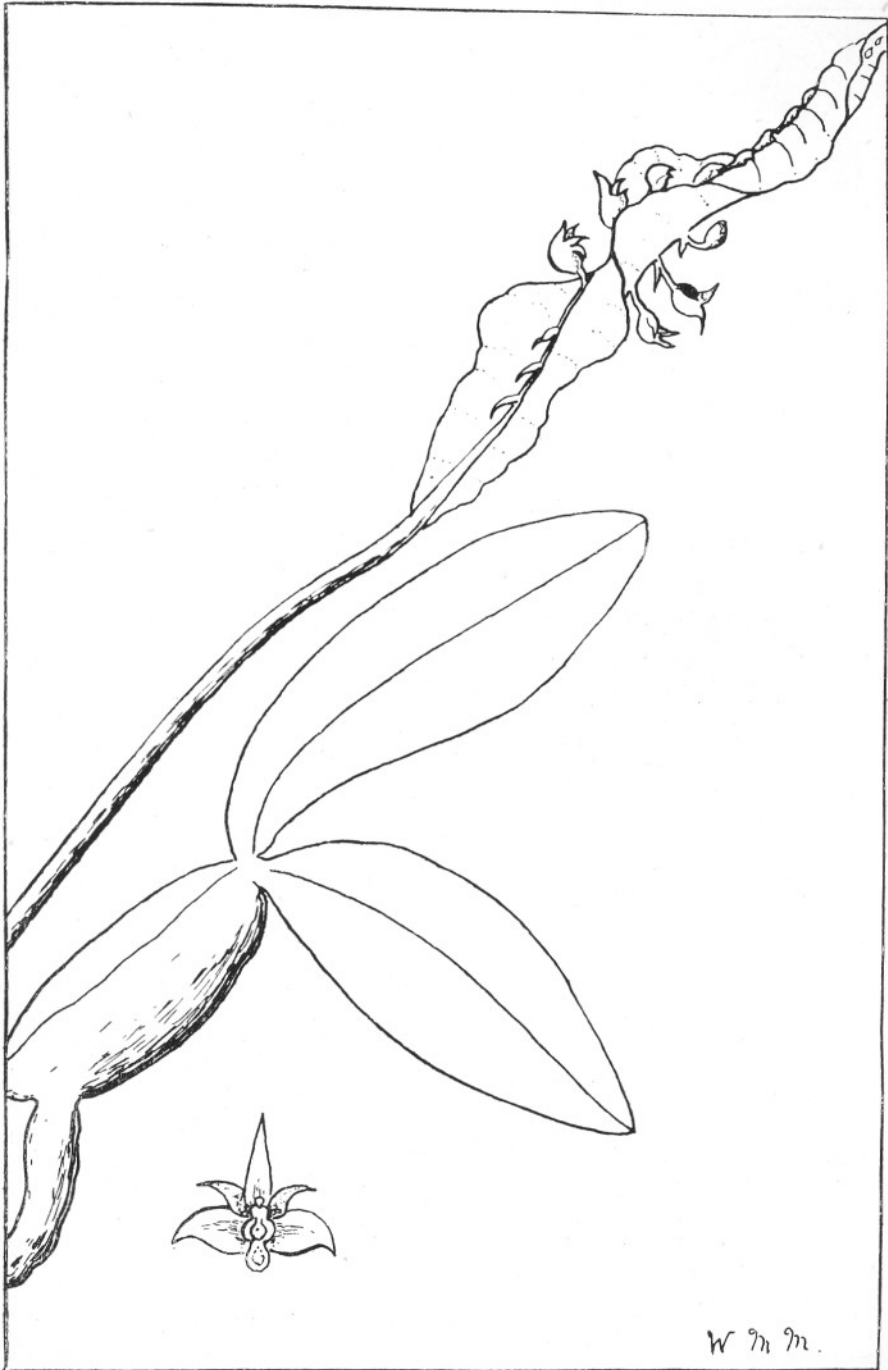


Cyrtorchis sp.



Tridactyle teretifolia Schltr.

PLATE 7.



Bulbophyllum platyrhachis (Rolfe) Summerh.



Cirrhopetalum africanum Schitr.

- CS=Coll. Mr. G. R. Cunningham van Someren, personally comm.
- EBC=Miss E. Bruce collection, comm. Mr. A. D. Cotton, Kew.
- GBW=Coll. Dr. G. B. Wallace, personally comm.
- KFH=Kenya Forest Department Herbarium, comm. Mr. H. M. Gardner.
- UAH=Uganda Agricultural Department Herbarium, comm. Mr. A. S. Thomas.
- UFH=Uganda Forest Department Herbarium, comm. Dr. W. J. Eggeling.
- VH=Herbarium of Lieut.-Col. J. H. Vaughan, personally comm.

Between them the above must include a large proportion of the fully authenticated, but unpublished, records available. We would emphasize that while, of course, a definitive check-list can be achieved only after much more collecting and much more taxonomic work (and only in the distant future) the inclusions in this interim compilation have not been uncritically made. The Uganda data can be taken as especially sound, because they have been sifted independently by Dr. Eggeling. Records, such as our own, for which there has been no chance to obtain Kew verification, are excluded.

6. TENTATIVE FIELD KEY TO THE GENERA.

Of necessity this key is quite unorthodox because it cannot use the microscopic characters that form the theoretical bases of orchid classification. (Incidentally, a certain character used by Schlechter for a primary division of the Angraecoids has already been found unworkable—Summerhayes, *Blumea*, Suppl. 1, 78-87, 1937.)

We cannot emphasize too strongly that this key is intended to cover only those species included in the check-list that follows. It will not necessarily, and in fact cannot hope to, serve to run down into their genera all the other species, hitherto regarded as extra-limital or actually undescribed, that occur in East Africa.

For reasons given in the check-list, *Listrostachys*, *Mystacidium*, and *Sarcorrhynchus* do not appear in the key and no attempt has been made to separate *Rangaeris* from *Aerangis*.

- (1) Perennially devoid of leaves. *Gussonea* (*Microcoelia*). p. 22.
Not as above see (2).
- (2) Flower very small and green, with column nearly as long and conspicuous as sepal or petal. *Liparis*. p. 28.
Not as above see (3).

- (3) Flowers very large, yellow and brown, in long showy sprays. *Ansellia*. p. 26.
Not as above *see* (4).
- (4) Old stems forming obvious pseudobulbs *see* (5).
No obvious pseudobulbs *see* (7).
- (5) Flower stem arising from base of pseudobulb *see* (6).
Flower stem arising from tip of pseudobulb. *Polystachya*, *Stolzia*. p. 28, 32.
- (6) (a) Flower large and open; lip purple, with long narrow tip. *Ancistrochilus*. p. 26.
(b) Lateral sepals elongated, joined together towards tip but not at base. *Cirrhopetalum*. p. 27.
(c) Not as (a) or (b). *Bulbophyllum*. p. 26.
- (7) Plant strong and stiff, with short heads of fleshy flowers, yellow-green barred red. *Acampe*. p. 25.
Not as above *see* (8).
- (8) Plant greatly compressed; leaves flat, not folded, all arranged in same upright plane and appearing fused at the base *see* (9).
Leaves not as above *see* (11).
- (9) Inflorescence arising from tip of plant. *Oberonia*. p. 28.
Inflorescence arising from base of plant *see* (10).
- (10) Inflorescence shorter than the leaves but pedicels not very short. *Podangis*. p. 24.
Inflorescence not shorter than leaves but pedicels extremely short. *Bolusiella*. p. 21.
- (11) Lip with no rudiment of "spur". *Polystachya*. p. 28.
Lip with "spur", either bubble-like or more pronounced *see* (12).
- (12) Inflorescence extremely short, less than one-sixth of leaf *see* (13).
Inflorescence not so short *see* (15).
- (13) Inflorescence forming a dense, round bunch of flowers. *Cephalangraecum*. p. 21.
Inflorescence sparser and more elongated *see* (14).
- (14) Leaves thick and fleshy. *Cyrtorchis refracta*.* p. 22.
Leaves not fleshy. *Ancistrorrhynchus*. p. 20.

*A plant very unlike other species of *Cyrtorchis* and in all probability wrongly allocated to that genus.

- (15) Lip deeply cleft or with sharply projecting prongs, side-lobes or teeth *see* (16).
Lip simple, or with only rounded or oblong lobes *see* (17).
- (16) Lip divided into three nearly to base; flower pure white. *Angraecopsis*. p. 20.
Lip trident-like or with sharply projecting side lobes; inflorescences at intervals on woody stem. *Tridactyle*. p. 25.
- (17) Spur bent in the middle at right angles. *Calypstrochilum*. p. 21.
Spur straight, curved or with corkscrew twist *see* (18).
- (18) Spur thread-like or slightly thickened towards tip, usually several times as long as the lip, sepals and petals pure white or rarely tinted *see* (19).
Spur not thread-like *see* (20).
- (19) Lip with side lobes and sharp narrow tip; spur over 6 inches long. *Leptocentrum*. p. 23.
Lip simple or with irregular edge, but no projecting side lobes. *Aerangis*, *Rangaeris*. p. 19, 24.
- (20) Lip of varying shapes, pointed or almost square-ended, but always deeply concave. *Angraecum*. p. 20.
Lip not deeply concave *see* (21).
- (21) Lip longer than broad with sides tending to roll back to enclose spur; a tubercle on the lip in front of the spur opening. *Diaphananthe*. p. 22.
Lip not tending to roll back; no tubercle *see* (22).
- (22) Inflorescence made up of many dull-coloured flowers *see* (23).
Flowers wholly or mainly pure white or waxy white *see* (24).
- (23) Flowers opposite or in whorls. *Chamaeangis*. p. 21.
Flowers not arranged as above, but spirally on the rhachis. *Rhipidoglossum*. p. 24.
- (24) Flower with dark blotch in throat (spur funnel-shaped). *Eurychone*. p. 22.
Flower without blotch *see* (25).
- (25) Flower green inside, spur no longer than lip. *Sphyrarhynchus*. p. 25.
Flower entirely waxy white (ochreous when old); spur tapered, longer than lip. *Cyrtorchis*. p. 21.

7. LIST OF SPECIES.

Within each of the two main groups, Angraecoids and Non-Angraecoids, the genera are arranged alphabetically, and within each genus the species are also alphabetical. Synonyms have been dealt with as follows. A synonym with a different specific name is given immediately after the valid name with which it is identical. To save both work and space, a name that has been sunk in another appears only once in the list, under that other, and not in its own alphabetical order. Moreover, alternative names due to changes in generic allocation, which, as already mentioned, are excessively numerous, have not been included. Thus *Listrostachys maialis* Chev. is given as a synonym of, and on the line with, *Cyrtorchis sedeni* (Rchb.f.) Schltr., but *Listrostachys sedeni* Rchb.f. does not appear. We think that, with this limitation, we have given practically all the synonyms based on records from within our area and most of those from outside.

Localities are indicated by the initial letters of the territories, K, N, NR, T, U, Z, supplemented by other abbreviated indications where the information is available and the plant concerned seems to be local, viz.:— NT=Tanganyika north of the Central Line; ST=Tanganyika south of the Central Line and, if no locality is added, within 70 miles of the head of Lake Nyasa; Usamb=Usambara; Ulug=the Uluguru Mountains.

It might have been interesting to compare the number of orchid species recorded for each of the territories but this is impracticable for several reasons:—

- (a) Elgon and Ruwenzori are bisected by territorial borders.
- (b) Some of the early records from between Lake Nyasa and Lake Tanganyika cannot be allocated between Tanganyika, Northern Rhodesia, and Nyasaland.
- (c) A number of the early "Zanzibar" records most probably relate to the mainland coast and are not insular.
- (d) Records for "Nyasa" in German publications are as a rule not from Nyasaland but north and east of Lake Nyasa, in what is now Tanganyika Territory.

In any case such a comparison by territories would really be of no phyto-geographical significance because the political boundaries for so much of their length follow no natural features. On the other hand a comparison between the orchid floras of the great mountains is both more practicable and more worth while. Consequently, Ruwenzori, Elgon, Mt. Kenya, and Kilimanjaro records are shown separately, as Ruw, Elg, Mk, Kmj, respectively. It is unfortunate that almost nothing is known of Mount Meru, which is actually higher than Elgon.

ANGRAECIDS.

AERANGIS Rchb.f.

Perhaps the most popular and best-known genus of African epiphytic orchids. The flowers are mostly pure white with thread-like spur several times the length of the lip. *A. rhodosticta* is notable in the genus for its red column which adds greatly to the attractiveness of the flower. *A. friesiorum* is well distinguished by its blunt fleshy flower with long spur slightly thickened towards the tip. *Rangaeris* was recently split off from *Aerangis* by Summerhayes on microscopic characters (*Kew Bull.*, 1937, 227), and it will doubtless be found when all those species at present in *Aerangis* have been studied that some need to be transferred. This applies especially to the small species (flower less than 1 in. across, leaf-area less than 3 sq. ins.), marked *. On the other hand there are certainly "new" large-flowered species that are undescribed.

- A. biloba* (Lindl.) Schltr. ST (Fig. *Flor. W. Trop. Afr.*, 459).
- A. calodictyon* Summerh. T (60 miles west of Dar es Salaam).
- A. collum-cygni* Summerh. U.
- **A. engleriana* (Krzl.) Schltr. Ruw.
- **A. falcifolia* Schltr. ST.
- **A. floribunda* (Rolfe) Summerh. Elg (CMH), U.
[Extremely like *Rangaeris muscicola* (Rolfe) Summerh.]
- **A. graminifolia* (Krzl.) Schltr. NT (Usamb).
- A. grantii* (Batem.) Schltr. U.
(Flowers not described.)
- A. kirkii* (Rolfe) Schltr. (syn. *Angraecum apiculatum* Hook. var. *kirkii* Rchb.f., *Angraecum bilobum* Lindl., var. *kirkii* Rchb.f.) K, NT (Usamb).
- A. kotschyana* (Rchb.f.) Schltr. (syn. *Angraecum kotschyi* Rchb.f., *Angraecum semipedale* Rendle) NR, N, Kmj, NT, K, U (UAH). (Fig. in Engler, 1908, 423.)
- **A. lutambae* Mansf. ST (Lindi).
- A. luteo-alba* (Krzl.) Schltr. Elg. (Kmj, Engler, 1925, 258, is suspected to be an error due to a mistranscription from Engler, 1895, 158.)
- A. mystacidioides* Schltr. ST.
- **A. oligantha* Schltr. ST.
- **A. pachyura* (Rolfe) Schltr. N.
- **A. parvula* Schltr. NT (Usamb).
- A. rhodosticta* (Krzl.) Schltr. U (CS), K (KFH).
- A. thomsoni* (Rolfe) Schltr. Elg, K.
- A. ugandensis* Summerh. Elg. U (UAH), K (Kakamega CS).

ANCISTRORRHYNCHUS Finet

A very small genus doubtfully distinguishable from *Cephalangraecum* (see Mansfeld, *Notizbl. Bot. Gart. Berlin*, 12, 705).

A. laxiflorus Mansf. T (Morogoro).

ANGRAECOPSIS Krzl.

A small genus with a most graceful inflorescence. The lip of the flower is divided into three lobes almost to the base.

A. gracillima (Rolfe) Summerh. U, K.

A. tenerrima Krzl. NT (Usamb). We believe *Angraecum amaniense* Krzl. to be a synonym.

ANGRAECUM Bory

As Braid remarked (*Kew Bull.*, 1926, 324), even in its attenuated form the genus *Angraecum* is "not yet split up as it probably will be". It includes a bigger range of flower-size than any other genus, with shape of lip varying from almost lanceolate in the little *A. dives* and *A. viride* to almost square-ended in *A. giryamae*.

A. alcornae Rchb.f. N.

[*A. amaniense* Krzl. we believe to be a synonym of *Angraecopsis tenerrima* Krzl.]

A. chamaeanthus Schltr. ST.

A. distichum Lindl. U.

A. dives Rolfe K (Mombasa), T (Dar es Salaam VH). *Flor. Trop. Afr.* gives also "Kmj, cultivated specimen", but it most probably came from the coast.

A. giryamae Rendle (syn. *A. eburneum* Rchb.f. non Thou.) Kmj, K (Mombasa), Z, NT (Usamb).

A. infundibulare Lindl. U.

A. keniae Krzl. Mk (base).

A. laciniatum Krzl. U.

A. parcum Schltr. ST.

A. sesquipedale Thou. NT (Usamb), Z. Both localities need confirmation. This is a Madagascar species with white flower several inches across and spur 15 inches long, which has not been reported in Africa since before the end of last century. (Fig. Engler, 1908, 420.)

A. stolzii Schltr. ST.

A. verrucosum Rendle (syn. *A. scabripes* Krzl.) N, NT (Usamb).

A. viride Krzl. non (Ridl.) Schltr. NT (Usamb). *A. braunii* Schltr. was a new name given to this plant presumably under the impression that the new combination *A. viride* (Ridl.) Schltr., which refers to a Madagascar species, had priority over Krzl.'s name; but on dates of

publication this appears erroneous, *A. braunii* a straight synonym of *A. viride* Krzl., and the Madagascar plant the one in need of a new name.

BOLUSIELLA Schltr.

Small plants with flattened leaves all in one vertical plane.
B. imbricata (Rolfe) Schltr. U (UFH), K.

Specimens in our collection show that the East African representation of this peculiar and dainty little genus will be much increased.

CALYPTROCHILUM Krzl.

A small genus of plants with short spur wide at the base, wide at the tip, sharply constricted and usually bent at right angles in middle.

- C. christyanum* (Rchb.f.) Summerh. (syn. *A. moloneyi* Rolfe, *A. ivorense* Chev.) U.
- C. mombasense* (Rolfe) Schltr. K (Mombasa).
- C. orientale* Schltr. ST.

CEPHALANGRAECUM Schltr.

No definitely identified species of this typically West African genus can be recorded for East Africa, but specimens have been returned from Kew as

- C. sp. near glomeratum* (Ridl.) Schltr. U (UFH).

At least one other species with the typical dense round heads of almost sessile flowers occurs in East Africa (Usamb).

CHAMAEANGIS Schltr.

Leaves drooping, long and narrow, flowers minute, green or ochre, opposite or in whorls.

- C. odoratissima* (Rchb.f.) Schltr. Elg, U. Although this species was originally described nearly 90 years ago and although its range has recently (*Kew Bull.*, 1933, 103) been given as "Cameroons, Congo, Uganda", it is not included in *Flor. Trop. Afr.* The reason for the omission is presumably that when the species was originally described no locality was given.
- C. sarcophylla* Schltr. ST.
- C. urostachya* (Krzl.) Schltr. NT (Usamb).
- C. vesicata* (Rchb. f.) Schltr. K (CS), U.

CYRTORCHIS Schltr.

A genus of plants having racemes of attractive waxy white flowers, which turn pale ochre before they wither. One character given for the genus is the tapering spur; another, lost in pressed

specimens and mentioned in hardly any of the specific descriptions, is the strongly 3-angled pedicel. It is remarkable that no new species attributable to this genus has been described since last century except from the head of Lake Nyasa, but the diversity of forms is much greater than appears from the list of names. There are half-a-dozen in Usambara alone.

- C. aberrans* Mansf. ST.
- C. aschersonii* (Dur. and Schinz) Schltr. U (UFH).
- C. bracteata* Schltr. ST.
- C. brownii* (Rolfe) Schltr. U.
- C. chailuana* (Rchb. f.) Schltr. U. (A West African species; record for Usambara, Engler, 1895, 157, probably erroneous.)
- C. crassifolia* Schltr. NR. Unique in having a greenish-grey, felted, surface to the leaves.
- C. monteirae* (Rchb.f.) Schltr. (syn. *Angraecum antenatum* Krzl., *A. aschersonii* Rendle non Krzl., *Listrostachys ignoti* Krzl.) U.
- C. refracta* (Krzl.) Schltr. NT (Usamb). We cannot understand the inclusion of this species in *Cyrtorchis*. Its bent spur with inflated tip entirely fails to conform with the prime character of the genus as given by Schlechter himself.
- C. sedeni* (Rchb.f.) Schltr. (syn. *Listrostachys maialis* Chev.) NT, K, U.
- C. whytei* (Rolfe) Schltr. N, K (KFH), U (UAH), Elg.

DIAPHANANTHE Schltr.

Plants with more or less pendulous racemes of pale dull-coloured flowers, often with the sides of the lip rolled back round the spur.

- D. bidens* (Rolfe) Schltr. (syn. *Listrostachys ashantensis* Rchb.f.) U. (Fig. *Flor. W. Trop. Afr.*, 455.)
- D. fimbriata* (Rolfe) Schltr. U, NT (Mwanza BDB).
- D. kirkii* (Rolfe) Schltr. NT (Usamb).
- D. quintasii* (Rolfe) Schltr. K (Aberdares UAH).
- D. stolzii* Schltr. ST.

EURYCHONE Schltr.

A small, typically West African, genus of plants with white flowers nearly 2 inches across and short funnel-shaped spur.

- E. rothschildiana* (O'Brien) Schltr. U.

GUSSONEA A. Rich.

As stated previously, in his revision of the Angraecoids, Schlechter used this genus for all the leafless species, but in *Fl. W. Trop. Afr.* all the West African leafless orchids have been

put in *Microcoelia* Lindl. We have not been able to find the reasons for this change and since, in any case, the necessary combinations with *Microcoelia* have not been published for most of the East African species we here keep them all in *Gussonea*. It is, of course, questionable whether absence of leaves is a good generic character, but this will only be determinable after much more study of the flowers, most of which are minute.

Some species (e.g., *G. aphylla*) have a long stem, on which racemes are borne at intervals. In others the stem is reduced to a mere wart, no more than enough to carry the closely-packed bases of the roots; and, from this, abundant racemes of white flowers arise, having the appearance of white heather.

G. aphylla A. Rich. K (coastal S.E.), T (Dar es Salaam AH).

G. chilochistae (Rchb.f.) Schltr. (syn. *Angraecum aphyllum* Krzl. non Thou., *Microcoelia exilis* Lindl.) K (coastal S.E.), NT (Usamb—Kilosa BDB).

G. friesii Schltr. NR.

G. globulosa (Ridl.) Schltr. (syn. *A. guyonianum* Rchb.f., *Saccolabium radicosum* A. Rich., *Microcoelia* ? *taenio-phyllum* Hochst.) ST, NT (Usamb, AH), K (S.E. corner).

G. koehleri (Schltr.) Schltr. NT (Usamb).

G. megalorrhiza (Rchb.f.) Schltr. N, NT.

G. smithii (Rolfe) Schltr. Kmj, NT (Usamb AH).

G. stolzii Schltr. ST.

It will be noted that not a single record can be included for U or for K except round Mombasa, though the genus is certainly represented in the interior.

LEPTOCENTRUM Schltr.

A small East African genus with long-spurred white flowers nearly 2 inches across, very like *Aerangis*, but lip with an irregular, almost serrate, edge and sharp point.

L. amaniense (Krzl.) Schltr. NT (Usamb).

L. schliebenii Mansf. ST (Mahenge).

LISTROSTACHYS Rchb.f.

L. cirrhosa Krzl. NT (Usamb). The original description gives, in detail, all the characters of a *Tridactyle* and we can only think the species has been left in *Listrostachys* through inadvertence.

MYSTACIDIUM Lindl.

This genus formerly accommodated many of the Angraecoids. Schlecter in his revision maintained the genus for a few species, but the characters given are microscopic. It may be

doubted whether all the following species, especially the first, are to be kept in *Mystacidium*.

<i>M. duemmerianum</i> Krzl.	U.
<i>M. longifolium</i> Krzl.	Mk.
<i>M. pedunculatum</i> Rolfe	N.
<i>M. ugandense</i> Rendle	U.

PODANGIS Schltr.

A small, typically West African, genus with iris-like leaves but (unlike *Bolusiella*) spur longer than lip.

P. dactyloceras (Rchb. f.) Schltr. (syn. *Listrostachys forcipata* Krzl.) U (UFH), NT (Mwanza BDB).

RANGAERIS Summerh.

See remarks under *Aerangis*.

R. brachyceras Summerh. Elg, U.

R. muscicola (Rolfe) Summerh. (syn. *Mystacidium batesii* Rolfe) K, U, T.

RHIPIDOGLOSSUM Schltr.

A small genus, mainly West African, revised by Summerhayes in *Blumea* Suppl. 1, 78-86, 1937.

R. rutilum (Rchb.f.) Schltr. (syn. *Listrostachys gabonensis* Rolfe, *L. multiflora* Rolfe, *Angraecum woodianum* Schltr., *Listrostachys margaritae* De Wild., *Chamaeangis schliebenii* Mansf.) U, K, NT (Usamb), ST (Mahenge; Lindi), N.

R. xanthopollinium (Rchb.f.) Schltr. (syn. *Aeranthus erythropollinius* Rchb. f., *A. gerrardi* Rchb. f., *Listrostachys scheffleriana* Krzl., *Mystacidium mahonii* Rolfe, *R. woodianum* Schltr. in part). U, NT (Usamb).

These two species produce masses of aerial roots that are often more prominent than the leaves: the small flowers, arranged on the raceme in spirals, vary in colour from whitish to dull red. Those of *R. rutilum* are also occasionally green.

SARCORRHYNCHUS Schltr.

A genus consisting only of one West African species and the following, the original description of which (*Notizbl.*, 13, 413) is faulty, in that the spur is given as hanging, curved, but only ".18 mm." long. The 2-3 green flowers are stated to be barely $\frac{1}{4}$ inch across.

S. orientalis Mansf. NT (Nguru Mountains).

SPHYRARHYNCHUS Mansf.

A monotypic genus. Plant almost stemless, leaves barely 1 inch long, but flowers up to 1½ inches across, white outside, green inside, with spur no longer than lip.

S. schliebenii Mansf. T (Ulug).

TRIDACTYLE Schltr.

An easily recognized genus. The plants develop long woody stems; leaves often remain only at the tip, but flower sprays are produced at intervals along the stems. The flowers, which are greenish, whitish or ochreous, have the lip divided into three, the side lobes often breaking up into brittle hairs.

- T. armeniaca* (Lindl.) Schltr. (syn. *Angraecum whitfieldii* Rendle) Ruw.
- T. brevifolia* Mansf. ST (Ulug).
- T. filiformis* (Krzl.) Schltr. U (UFH).
- T. fimbriata* (Rendle) Schltr. NT, K, Elg, U.
- T. frommiana* (Krzl.) Schltr. Between Lake Tanganyika and Lake Nyasa.
- T. goetzeana* (Krzl.) Schltr. ST.
- T. lepidota* (Rchb. f.) Schltr. U.
- T. linearifolia* (De Wild.) Schltr. U (UFH).
- T. nyassana* Schltr. ST.
- T. pulchella* Schltr. ST.
- T. sarcodantha* Mansf. ST (Ulug).
- T. schumannii* (Krzl. Summerh. ST (Ulug)—otherwise West African.
- T. scottellii* (Rendle) Schltr. U (UFH), Ruw, K (KFH).
- T. teretifolia* Schltr. NR.
- T. tridactylites* (Rolfe) Schltr. (syn. *Aeranthus deistelianus* Krzl.). N.
- T. unguiculata* Mansf. ST (Iringa).
- T. virgula* (Krzl.) Schltr. Ruw.
- T. wakefieldii* (Rolfe) Summerh. K, T (Dar es Salaam VH).

NON-ANGRAECIDS.

ACAMPE Lindl.

A genus mainly Indo-Malayan and Mascarene, formerly included under *Saccolabium* Blume.

- A. pachyglossa* Rchb.f. K (Mombasa), T (Dar es Salaam VH; Uluguru GBW).
- A. mombasensis* Rendle K (Mombasa).
- A. nyassana* Schltr. ST.

All much alike, with short heads of fleshy flowers, yellow-green dotted and barred with red. *A. pachyglossa* has narrower

and less spatulate petals than *A. mombasensis* and *A. nyassana* is said to have a ridged lip.

Considering how conspicuous these plants are along the coast it is amazing that both the first two species should be recorded in literature from nowhere but Mombasa. Our evidence is that they occur together south at least to Dar es Salaam and *A. mombasensis* up to 160 miles inland from there. No record more than 2,000 ft. above sea-level. Schlechter (*Bot. Jahrb.*, **53**, 494) says the genus occurs in Uganda, but Uganda botanists are of opinion that this is wrong.

ANCISTROCHILUS Rolfe

A typically West African genus consisting only of:—

A. rothschildianus O'Brien (UFH).

A. thomsonianus Rolfe U (UFH).

Summerhayes (*in litt.*) thinks the second may be only a synonym of the first. Flowers practically white, 2 inches across, with an attenuate purple lip an inch long (fig. Engler, 1908, 417).

ANSELLIA Lindl., "Leopard Orchid".

A. africana Lindl. (syn. *A. confusa* N. E. Brown) Elg (UAH), U. (A predominantly West African species.)

A. gigantea Rchb. f. var. *nilotica* (Baker) Summerh. (syn. *A. humilis* Bull). U, K "south to Transvaal".

The above conclusions were reached by Summerhayes in a recent review of this small, purely African, genus (*Kew Bull.*, 1937, 462). Those who have seen the striking range of forms occurring in Kenya will find it difficult to believe that all should bear not only the same specific, but even the same varietal, name.

BULBOPHYLLUM Thou.

The genus, which now includes *Megaclinium* Lindl., extends throughout the tropics and contains several hundred species.

B. amanicum Krzl. NT (Usamb).

B. bequaertii De Wild. U (UFH).

B. cochleatum Lindl. (syn. *B. talbotii* Rendle) K, U.

B. cocoinum Batem. ex Lindl. U (UAH).

B. coriscense Rchb.f. NT (Usamb) in Engler (1895, 157) needs confirmation: species otherwise recorded only from Gulf of Guinea.

B. cupuligerum Krzl. U (UFH), Mk. Fig. Milbraed, 1910, pl. 9.

B. falcatum (Lindl.) Rchb. f. (syn. *B. leptorrhachis* Schltr., *Megaclinium endotrachys* Krzl.) U.

B. gilgianum Krzl. ST (Uhehe).

B. gravidum Lindl. (syn. *B. monticolum* Hook.f.) K (Kericho CMH).

- B. mahonii* Rolfe. N.
B. melleri Rchb.f. N.
B. nyassanum Schltr. ST, T (Dar es Salaam VH).
B. oreonastes Rchb. f. (syn. *B. fuscum* Rendle, *B. obanense* Rendle) U (UFH), NR (BDB).
B. oxypterum (Lindl.) Rchb.f. ST. (Fig. Engler, 1908, 413).
B. platyrhachis (Rolfe) Summerh. non De Wild. N, NT (Usamb AH), U.
B. pobequinii (Finet) De Wild. (syn. *B. chevalieri* De Wild., *Megaclinium clarkei* Rolfe) U (UFH).
B. pusillum (Rolfe) Summerh. T.
B. schimperianum Krzl. (syn. *B. xanthoglossum* Schltr.) U (UAH).
B. schlechteri De Wild. U (UFH).
B. stolzii Schltr. ST.
B. ugandae Rolfe U.
B. usambarae Krzl. NT (Usamb).
B. winkleri Schltr. (syn. *B. imogeniae* K. Hamilt.) U (UAH), ST.

On published records the genus *Bulbophyllum* is altogether better represented in West Africa than in East Africa, where moreover a large proportion of the records relate to Uganda and to typically West African species. This impression may need to be modified: we have actually in cultivation already from the north-eastern quarter of Tanganyika as many species of *Bulbophyllum* as there are on the whole East African list.

Many of the species are bizarre and within the genus there is great variation. At one extreme *B. cupuligerum* is a minute plant with solitary flowers and with leaves and pseudobulbs all flat on the surface of the host. At the other extreme *B. platyrhachis* has its flower stalk expanded into what looks like a narrow olive-green leaf up to a foot long and carrying a hundred or more flowers.

CIRRHOPETALUM Lindl.

- C. africanum* Schltr. ST.

A small genus ranging east across the Indian Ocean to Tahiti. Some years before *C. africanum* was described the genus was recorded from NT (Usamb), where it is common, under the name of the Madagascar species, *C. thouarsii* Lindl. This identification has never been corrected, but if *C. africanum* really is distinguishable, the Amani plants doubtless also belong to that form. When not in flower the plant would pass as a *Bulbophyllum*.

EULOPHIOPSIS Pfitz

- E. lurida* (Lindl.) Schltr. U.

Eulophia longicollis Lindl., *Eulophia virilis* Lindl. are cited as synonyms in *Flor. Trop. Afr.* but not in *Flor. W. Trop. Afr.*

LIPARIS Rich.

A widespread genus predominantly terrestrial, but with a few epiphytic species.

L. epiphytica Schltr. (syn. *L. lloydii* Rolfe). U.

In the original description (*Bot. Jahrb.*, 38, 6) the species is said to have ovoid pseudobulbs, but they are not shown in the figure (*ibid.*). Another, undescribed, epiphytic species with prominent yellow-green pseudobulbs occurs in Usambara.

OBERONIA Lindl.

O. disticha (Lam.) Schltr. (syn. *O. brevifolia* Lindl.) NT (Usamb), U, K (Kakamega CS).

A typically Far Eastern genus with one species in Madagascar and one, very similar, occurring across Africa to the Gulf of Guinea. The tiny orange flowers form a fox-tail spike.

POLYSTACHYA Hook.

This mainly African genus, with many attractive forms, was monographed by Kraenzlin (*Repert. spec. nov. regni veget. Beih.* Bd. 39, 1926). He divided the genus, mainly on vegetative characters, into 12 sections, of which the following occur in Africa, but, so far as we know at present, the first and the last not within our limits. In any case the accepted classification of the species in the last section, *Bulbophylloidae*, is as a separate genus, *Genyorchis* Schltr.:—

- (a) *Aporoidae*.
- (b) *Caulescentes*.
- (c) *Elasticae*.
- (d) *Calluniflorae*.
- (e) *Eupolystachyae*.
- (f) *Grandiflorae*.
- (g) *Affines*.
- (h) *Superpositae*.
- (i) *Cultriformes*.
- (j) *Dendrobianthe*.
- (k) *Bulbophylloidae*.

Summerhayes (*Kew Bull.*, 1931, 387) regards this classification into sections as generally satisfactory, but it is by no means devoid of difficulties and a number of changes in Kraenzlin's allocation have been made since his monograph was published. Since the presence or nature of pseudobulbs is used as a main criterion it is important that in collecting herbarium material pseudobulbs should be included if any can be found on the plant. The following sections are immediately recognizable:—

- (h) *Superpositae*. The new season's growth emerges from one of the internodes of the old one, not from its base.

- (i) *Cultriformes*. Only a single leaf is borne by the swollen stem (which emerges from the base of an older one).

The species in *Dendrobianthe* are peculiar in having comparatively flat open flowers, less fleshy in texture than most *Polystachyas*. The plants are either terrestrial (some were originally ascribed to the genus *Eulophia*) or epiphytic on *Vellozia*. Although nearly a dozen species have been described there seems such a tendency for them to intergrade that Schlecter (*Bot. Jahrb.*, 53, 568) has considered lumping them.

- (d) *P. adansoniae* Rchb.f. Elg.
 (i) *P. angustifolia* Summerh. Ruw (UAH).
 (d) *P. ashantensis* Krzl. U.
 (i) *P. bicarinata* Rendle Ruw, U (UFH).
 (e) *P. buchananii* Rolfe N, ST, K (doubtful).
 (i) *P. caespitifica* Krzl. NT (Usamb).
 (d) *P. calluniflora* Krzl. (syn. *P. trogonochila* Krzl.) U (UFH).
 (e) *P. candida* Krzl. "E. Trop. Afr."
 (i) *P. coelogynochila* Krzl. "E. Afr."
 (i) *P. convallarroidea* Mansf. ST (Ulug).
 (i) *P. cultriformis* (Thou.) Spreng. (syn. *P. cultrata* Lindl.) Kmj, NT (Usamb) Elg, Ruw, K (CS), U (UFH). *P. galericulata* Rchb. f. is also cited as syn. by Krzl. (*Monog.*, p. 128) but wrongly—Summerh. *Kew Bull.*, 1935, 197.

P.c. var. *autogama* Schltr. Mk.

P.c. var. *africana* Schltr. Mk, N.

These varieties are not mentioned in Kraenzlin's monograph.

- (j) *P. dendrobiiflora* Rchb. f. Cultivated, purporting to come from Dar es Salaam; also ST (Ulug EBC).
 (f) *P. doggetti* Rendle and Rolfe Ruw.
P. duemmeriana Krzl. U. (Section not known to us. The species was described after the monograph in a publication that is not available.)
 (d) *P. erythrosepala* Summerh. NR.
 (c) *P. eurychila* Summerh. Elg, U (Debasien).
 (i) *P. fallax* Krzl. U.
 (g) *P. fischeri* Rchb. f. Kmj, NT (Usamb AH).
 (j) *P. flexuosa* (Rolfe) Schltr. Kmj. Terrestrial: but perhaps not correctly allocated to section *Dendrobianthe* (*Kew Bull.*, 1934, p. 211).
 (h) *P. fusiformis* Lindl. (syn. *P. minutiflora* Ridl.) NT (Usamb), ST (Ulug EBC).
 (f) *P. goetzeana* Krzl. ST.
 (d) *P. golungensis* Rchb.f. (syn. *P. johnsonii* Krzl., *P. coriacea* Rolfe, *P. mayombensis* De Wild., *P. spiranthoides* Krzl.) N, NT (Usamb AH), Elg, K (CS), U (UFH).

- (i) *P. gracilentata* Krzl. Ruw.
- (f) *P. heckmanniana* Krzl. ST (Ulug).
- (j) *P. holtzeana* Krzl. NT (Nguru).
- (b) *P. imbricata* Rolfe (syn. *P. kraenzlinii* Rolfe, *P. rendlei* Rolfe, *P. shirensis* Krzl. non Rchb.f.) N, NT (Usamb), Ruw (UAH), Elg (UAH), K (KFH), U (UFH). (*P. nigrescens* Rendle was in Krzl. Monog. treated as another synonym, but this finding was reversed in *Kew Bull.*, 1933, 102.)
- (f) *P. inconspicua* Rendle U.
- (f) *P. ionocharis* Krzl. (mis-spelt *P. conocharis* in Engler, 1908). ST (Ulug).
- P. isochiloides* Summerh. NT. Section uncertain.
- (g) *P. johnstonii* Rolfe NR, N.
- (f) *P. kilimanjari* Rchb.f. (syn. *P. holstii* Krzl.) K (behind Mombasa), not from Kmj.
- (i) *P. kirkii* Rolfe K.
- (f) *P. lawrenciana* Krzl. N.
- (b) *P. laxiflora* Lindl. (syn. *P. dixantha* Rchb. f., *P. galericulata* Rchb.f.) U.
- (e) *P. lepidantha* Krzl. U.
- (e) *P. lettowiana* Krzl. ST.
- (h) *P. lindblomii* Schltr. U. (Omitted from Krzl. Monog. but evidently one of the *Superpositae*.)
P. longiscapa Summerh. ST (Ulug). Terrestrial and not allocable to any of Kraenzlin's sections (*Kew Bull.*, 1934, p. 211).
- (f) *P. minima* Rendle N.
- (j) *P. miranda* Krzl. (syn. *P. busseana* Krzl., *P. holochila* Schltr.) N, ST (also Ulug EBC). Terrestrial and on *Vellozia*.
- (e) *P. mukundaensis* De Wild. (syn. *P. dorotheae* Rendle, *P. huyghei* De Wild., *P. plehniana* Schltr.) U.
- (b) *P. musozensis* Rendle U.
- (b) *P. nigrescens* Rendle N, ST (Ulug EBC), Elg, Ruw, K (Aberdares UAH).
- (i) *P. nyanzensis* Rendle U.
- (i) *P. obanensis* Rendle K.
- (e) *P. odorata* Lindl. (syn. *P. usambarensis* Schltr.) U, NT (Usamb).
- (b) *P. oligophylla* Schltr. ST.
- (f) *P. ottoniana* Rchb.f. var. *confusa* (Rolfe) Krzl. Kmj. The name *P. campyloglossa* Rolfe, sunk by Kraenzlin in *P. ottoniana*, has recently been applied by Kew to specimens from the Kenya Highlands. The type of *P. campyloglossa*, flowered in England, is supposed to have come from Mombasa, but was probably from Kmj, or Kenya Highlands.

- (b) *P. paniculata* Rolfe U.
 (d) *P. polychaete* Krzl. (syn. *P. euspatha* Krzl.) U, NT (Bukoba, Usamb AH). (In Krzl. Monog. p. 38, *P. nigerica* Rendle is given as another syn. of *P. polychaete*, but in *Fl. W. Trop. Afr.* as syn. of *P. albo-violacea* Krzl.)
 (c) *P. pseudo-disa* Krzl. U (doubtful — see *Kew Bull.*, 1939, 492).
 (i) *P. purpureo-alba* Krzl. Ruw.
 (d) *P. ramulosa* Lindl. U.
 (f) *P. repens* Rolfe U.
 (e) *P. rufinula* Rchb.f. Apparently known only from cultivated specimens supposed to have come from "Zanzibar".
 (h) *P. ruwenzoriensis* Rendle Ruw, Elg.
 (i) *P. schinziana* Krzl. Ruw.
 (d) *P. seticaulis* Rendle U or K (UAH).
 (d) *P. shega* Krzl. NT (Usamb; Mt. Meru).
 (b) *P. shirensis* Rchb. f. non Krzl. N.
 (h) *P. simplex* Rendle (syn. *P. aristulifera* Rendle, *P. pachyrhiza* Krzl.) Kmj, Elg, Ruw, K, U. (Kraenzlin's allocation of this species to Section *Calluniflores* has been altered in *Kew Bull.*, 1939, 499.)
 (h) *P. spatella* Krzl. (syn. *P. elliotii* Rendle) Elg, Ruw, K.
 (b) *P. stauroglossa* Krzl. (syn. *P. graminoides* Krzl.) U.
 (d) *P. steudneri* Rchb.f. (syn. *P. beccarii* Rchb.f., *P. ellenbeckiana* Krzl.) Elg, U (Debasien), K (Kipkarren CHM). (*P. bennettiana* is in Krzl. Monog. also cited as syn., but this is reversed in *Kew Bull.*, 1939, 492.)
 (d) *P. stricta* Rolfe NT (Arusha AH), K, Elg, U. (Perhaps this should be in Section *Caulescentes*—*Kew Bull.*, 1939, 492.)
 (d) *P. stuhlmannii* Krzl. NT (Bukoba), U (UFH), K (KFH).
 (j) *P. tayloriana* Rendle (syn. *P. kaessneriana* Krzl., *P. macropetala* Krzl.) N, T, Kmj, K. Terrestrial and epiphytic on *Vellozia*; at one time put in *Eulophia*.
 (e) *P. tessellata* Lindl. (syn. *P. praealta* Krzl., *P. gracilis* De Wild., *P. latifolia* De Wild.) U.
 (h) *P. ugandae* Krzl. U, "Zanzibar" (which needs to be confirmed and defined).
 (g) *P. villosa* Rolfe NR, N, ST.
 (i) *P. vulcanica* Krzl. U (UFH).
 (d) *P. woosnamii* Rendle (syn. *P. longevaginata* Krzl.) Ruw.
 (j) *P. xerophila* Krzl. NT (Usamb).
 (g) *P. zambesiaca* Rolfe (syn. *P. malilaensis* Schltr.) N, ST.
 (e) *P. zanguebarica* Rolfe "Zanzibar" ?insular.

STOLZIA Schltr.

A genus said by its author to have the habit of a *Polystachya*, that is, with the inflorescence arising from the top of the pseudobulb, and the flowers of a *Bulbophyllum*. The limited distribution is remarkable.

- S. angustifolia* Mansf. ST (Ulug).
- S. atrorubra* Mansf. ST (Ulug).
- S. nyassana* Schltr. ST.
- S. oligantha* Mansf. ST (Ulug).