ORCHIDS OF NILGIRIS

DR. J. JOSEPH

BOTANICAL SURVEY OF INDIA

The Nilgiris–the blue mountains, so called because of the rich azure-blue blossome of the monocarpic strobilanth (*Phlebophyllum kunthianum* Nees) flowering once in a decade and covering the whole area, form a noeus of the Western Ghats, the mountain ranges lying parallel to the Arabian Sea in a South-West direction. Grassy downs with their characteristic densely wooded gorges (locally called Sholas-montane evergreen forests) are rich in species diversity. This book deals with 120 species of orchids belonging to 49 genera, so far known from the area with upto date nomenclature, synonymy, descriptions and analytical sketches of individual species. It is the result of author's intensive field studies and observations. Nilgiri Flora, in general, shows striking affinities with that of the far distant cooler regions of North-Eastern India.

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FOREWORD

The second revised edition on the Orchids of Nilgiris has become necessary owing to the addition of species, nomenclatural changes and arrangement of illustrations for quick reference. The first edition of the book was well received by the public and all the books were sold out. There is a constant demand from the orchid enthusiasts and scientists for this book.

Orchidaceae is one of the largest families of the flora of India. Since the species are adapted to diverse climatic and topographic conditions, exhibiting epiphytic, terrestrial and saprophytic habits, it is one of the most interesting families with wide floral adaptations. Dr. Joseph has worked on the Orchids of Nilgiris for a number of years and later on he worked on the Orchids of Northeastern India. He has revised this book and I am sure this book will be a useful identification manual for students, botanists and horticulturists.

Botanical Survey of India
CALCUTTA.
16 March 1987

M.P. NAYAR
DIRECTOR

PREFACE

This illustrated book in its second edition on the Orchids of Nilgiris is to facilitate easy identification of this fascinating group of flowering plants of this region which is being visited regularly by students of Botany of various colleges, national and international botanists, tourists and amateur orchid growers. More than 50% of the species dealt by Fischer in Gamble's Flora of Madras Presidency are available in this region itself.

The uncommonness of the Orchids, though they form one of the largest families of flowering plants of the world, is owing to paucity of individual plants representing each species, the epiphytic habit of majority of them on wild forest trees, the preference, though not specificity, of hosts or perch-plants and narrow endemism. These unique characteristics make them more vulnerable, and even the felling of a single tree might cause destruction of many well-established individuals if not species. Orchids are not only a highly evolved group of flowering plants but also form a group under active speciation process through intergeneric and interspecific hybridization both in nature and under cultivation, betraying thereby, the classical definition of a species.

In the time-space continuum, species are more of time but individuals, of space and both species and individuals move both in space and time. Change and transformation are laws of nature. Just like an individual is born, does grow, reproduce, disperse and die (disappear), the species too, with the elapse of long time, disappear or become extinct, after begetting distinct species, with variations necessary to inhabit the changed environment. As individuals and species change, the pattern of different stands of vegetation too undergo changes just like the design of a cloth in the loom, according to the threads. A river is changing, though looks same, so is the vegetation.

More the number of species in a unit of time and space, less will be the number of individuals representing each species and vice versa. In other words, species is inversely proportionate to individuals. Orchidaceae exemplifies this phenomenon adequately and forms one of the largest families of flowering plants comprising of above 17,000 species for the world (and an equal number if not more of hybrids) with more than 1500 species belonging to 150 genera in India.

As mentioned earlier, the number of plants in each species, even in a very congenial environment is minimum, guaranteeing thereby less competition within the population. In the recent past (1985) we could gather about 40

different epiphytic species belonging to about 15 different genera from a single lofty tree of Namdapha Biosphere of Arunchal Pradesh (N.E. Himalaya). But one could come across hardly even half a dozen on a single tree in South Indian forests.

Thus it is paradoxical to note, that in spite of the fact that South Indian land mass is as old as earth, in terms of Geological times and fostering very dense both Tropical and Subtropical forest stands with high relative atmospheric humidity, conducive for the prolific production of epiphytic orchids, still there is paucity of species as compared to N.E. India (less than 250 spp. in South, while in N.E. India more than 700 spp.). One of the reasons attributed for this high incidence of taxa in different groups of plants is that N.E. India forms the junction of the immigratory elements from the neighbouring regions like Tibet, China, Burma and other regions. The other reason is that N.E. India is an active zone of speciation, while Peninsular India is not. It falls in the tremor belt and according to the tremor theory (Joseph 1982) the electromagnetic and other forms of invisible energies, released by the occasional tremors, bombard the genome, effecting large scale natural mutation which ultimately leads to speciation. Such sudden changes in the genotype, as for orchids are concerned if not for other groups, perhaps, remove the incompatibility for both interspecific and intergeneric natural hybridization, within a wider range of taxa, harboured by the land-mass being the confluence of the neighbouring elements.

Orchhids can be protected and perpetuated by adopting the formula C = P + R (Conservation is equal to Protection and Preservation plus Regeneration and Rehabilitation). Steps must be taken to protect them in their natural habitats— *in situ* and preserve them by cultivating in suitable environment—*ex situ*. Multiply those which are under the danger of extinction owing to many reasons, for reintroduction into their natural habitats as well as for *ex situ* cultivation, through mass-scale seed and meristem culture. Lastly the programme of rehabilitating the dislodged ones, owing to the clearance of climax forests for development projects is absolutely necessary especially in developing tropical countries, where forests are cleared very fastly and hence well-established orchids both epiphytic and terrestrial are destroyed as weeds. Inordinate delay in the implementation of the rehabilitation programme would lead to wanton destruction of well-grown individuals and thus might lead to the extinction of many a hitherto unknown species and definitely the well-known species would become very rare. It is true that development without destruction is impossible, but it is also true protection of virtues by ignorance is dangerous.

In this revised edition, efforts have been taken to reorient the illustrations for easy identification besides revising the text where necessary.

My grateful thanks are due to the Director, Botanical Survey of India for his encouragements, to Dr. Gunnar Seidenfaden of Denmark for his munificent supply of information on the study of the orchids of Asiatic region and also for his helpful suggestions. I am also thankful to Mr. C. Sathish Kumar of Tropical

Botanic Garden, Kerala for his service in the preparation of the revised manuscript. My grateful thanks are also to Dr. N.P. Balakrishnan, for proof corrections and other helps in bringing out this.

BOTANICAL SURVEY OF INDIA J. JOSEPH
CALCUTTA
OCTOBER 2, 1986

INTRODUCTION

Nilgiris or the blue mountains, located in peninsular India (Lat. 11° 12′ & 11° 43′ North and Long. 76° 14′ & 77° East) form the nexus of three mountain systems, the Sahyadri (Western Ghats) in the North (opposite Mukurti Peak), the Southern Ghats joining across the Palghat Gap in the South, and the Eastern Ghats, in the North-eastern corner. The Nilgiris, with altitudes of 500-2000 m and rainfall of 900-7620 mm from both the Northeast and the Southwest monsoons, nourish about 2500 sq. km of forests, which contain a rich orchid flora, representing nearly half the total number of species known for peninsular India. The need for a distinctive account of these orchids has been acutely felt by botanists, students, orchid hobbyists, amateur gardeners and tourists. This fascinating group of flowering plants has been awaiting detailed study. Fyson (1932) in his Flora of South Indian Hill Stations dealt with about 60 species in 25 genera. Kammathy *et al.* (1967) have listed for the Biligirirangan Hills, in the northern vicinity of the Nilgiris only 68 species. Fischer (1928) has treated this family including 190 species in 60 genera, as part of the Flora for the then Madras presidency. With the revival of the Botanical Survey of India, and the increased exploration and plant collection programmes of its southern circle at Coimbatore, a large herbarium collection has been built up. Further, with the starting of the second National Orchidarium at Yercaud, near Salem, a live collection of wild orchids has been brought together for study, giving new impetus to the study of these biologically complex, naturally ornamental plants which attract the laymen as well as the Scientists, alike. Using all these sources, this illustrated work on the Orchids of Nilgiris, presents descriptions of 120 species in 49 genera. Only for a few species, earlier literature sources had to be depended on, as no fresh collection has been possible, due to changes in the habitat and the very likely disappearance of the already rare species. The description here would enable fresh collection by interested and enthusiastic conservationists. In the past, due to inadequate appreciation of the range, extent and significance of variation, or due to difficulty of interpreting the somewhat sketchy descriptions, themselves based often on inadequate material, either several botanical names have been given to what is really only one kind of plant or entity, species or taxon, or the opposite, of one name being given to realy different but superficially similar plants. Such confusion is less likely to happen when visual representations of the plant and its critical parts are available, along with the verbal descriptions. This work on the Orchids of Nilgiris, with the supporting analytical line drawings of every species, should assist in a correct understanding of the different species dealt with. It should also stimulate the naturalists and other

orchid enthusiasts to explore for new species that may still be in hiding in the forests of these mountains.

ORCHID ECOLOGY AND CONSERVATION

It is in the forests of the Western mountain ranges along the border of Kerala that orchids are more abundant. However, in the 'Shola' forests of Niligiris, amidst grasslands at elevations of 1700 m and above the Orchid flora is comparatively poor, particularly in comparison with forests at comparable altitudes in the Eastern Himalayas and in the Khasi & Jaintia Hills ofMeghalaya. Recent phytosociological and pollen analysis studies show that the sholas are progressively receding and form a 'living fossil plant community'. This environmental situation seems to be adversely affecting the spread of orchids. In other parts of India (the North-eastern region) the orchids have been threatened in their natural habitat, by repeated collection for ornamental and commercial purposes in the past. However, this cannot be said of the Nilgiri orchids. In all the surrounding states in the entire peninsula, the traditional flowers for ornamenting, personal decoration and ritual use are the Jasmine, the Champak, the Lotus, the Rose, *Hibiscus*, *Eranthemum*, *Crossandra* and *Tagetes*. Here, people hardly know of the orchid flower commercially. It is only a minority of the sophisticated elite that fancy orchids in their gardens and in their drawing rooms. Hence, the orchids of Nilgiris cannot be said to be threatened by man. Their dwindling and in some cases possible disappearance has been due to the ecological changes taking place in the shola vegetation of these mountains. It is essential to take urgent conservation measures by demarcating orchid sanctuaries for certain species, protecting the host trees and the general vegetation as also to undertake extensive cultivation of several species in Botanical Gardens. This should not be a very difficult task as orchids are comparatively easy to cultivate. Further, notwithstanding their biological complexity and special flower structure, flowers of different species and even genera can be hybridised and new creations with various combinations of colours and other characters of the concerned parents can be obtained. By the use of laboratory methods of seed culture and meristem culture millions of these 'cultivars' can be commercially grown. This has started an Orchid Industry in other countries, and even small countries like Thailand and Singapore have a thriving orchid trade supplying orchid flowers to western countries where there is a high demand for these. India with its natural orchid wealth is yet to tap this resource for large scale commercial operations.

ORCHID DISTRIBUTION

Orchidaceae is one of the largest flowering plant families with a cosmopolitan distribution. Orchids are profuse, particularly in the humid tropics and subtropics. 17,000 species have been so far known in the world, with about 1,500 in India. In peninsular India there are about 200 species in 60 genera, the Nilgiris having about 120 species in 49 genera. 72 species are found to be ende-

mic, i.e. only confined to peninsular India. The Nilgiris contain 33 species that are reported from Himalayas, and 35 species have a common distribution in Malaya or Thailand or Java. Further, a fuller knowledge of Sri Lanka (Ceylon) orchids may reveal some more common species to that Island and peninsular India including the Nilgiris. Increased plant exploration and a critical taxonomic analysis of orchids in different regions with comparable climate and elevation is bound to throw more light on the inter- and intraspecific variations of orchids and a better knowledge of their distribution pattern. Illustrated orchid floras like the present one should help in stimulating such efforts.

ORCHID CULTIVATION

Successful orchid cultivation depends upon an artificial provision of near natural growth conditions. Terrestrial orchids, thriving in the damp decaying thick humus of the forest floor are best grown in pots in deep shade in green houses. Epiphytic orchids flourishing on tree trunks and branches amidst moss, lichens and ferns, are best grown on bark-covered log pieces with moss cushioning and suitably hung in appropriate place. Orchids do not tolerate over watering. Their water needs in cultivation should more or less follow the rainfall rhythm in nature. For all orchid enthusiasts it is essential to observe the ecological conditons under which orchids grow in nature and to keep adequate notes on such observations.

Orchid seeds are minute, and will only germinate in association with the appropriate fungus or mycorrhiza. On the other hand, orchids can be propagated and multiplied easily by vegetative methods. Orchid roots should not be cleaned before planting so as to retain the concerned fungal partner.

In view of the unusual range of variation in the orchid flower, orchids are bound to become increasingly popular in Floriculture and in Home gardens. Orchid hobbyists would find 'Orchids of India' by A.S. Rao, published by the National Book Turst, of much interest. Other books that are useful in cultivation and/or identification of orchids have been listed in the bibliography.

ORCHID HABIT AND HABITATS

Orchids are biologically very specialised. They grow on land, like other plants, but the majority of them prefer to perch on other plants—mostly trees—and sometimes on moss covered rocks. Accordingly, they are described as terrestrial, epiphytic or epilithic.

The high biological complexity exhibited by orchids must have taken a long span of time in evolution, but so far there is no clear report of fossil orchids. Excepting for a small group of leafless orchids briefly growing on decaying organic matter (saprophytes) all orchids are autophytes. There are no parasites. Even though, epiphytic orchids grow on other plants, there is no physiological or organic connection between the orchid and the host plant. There are also no water-orchids or Hydrophytes and no insect eating or insectivorous orchids.

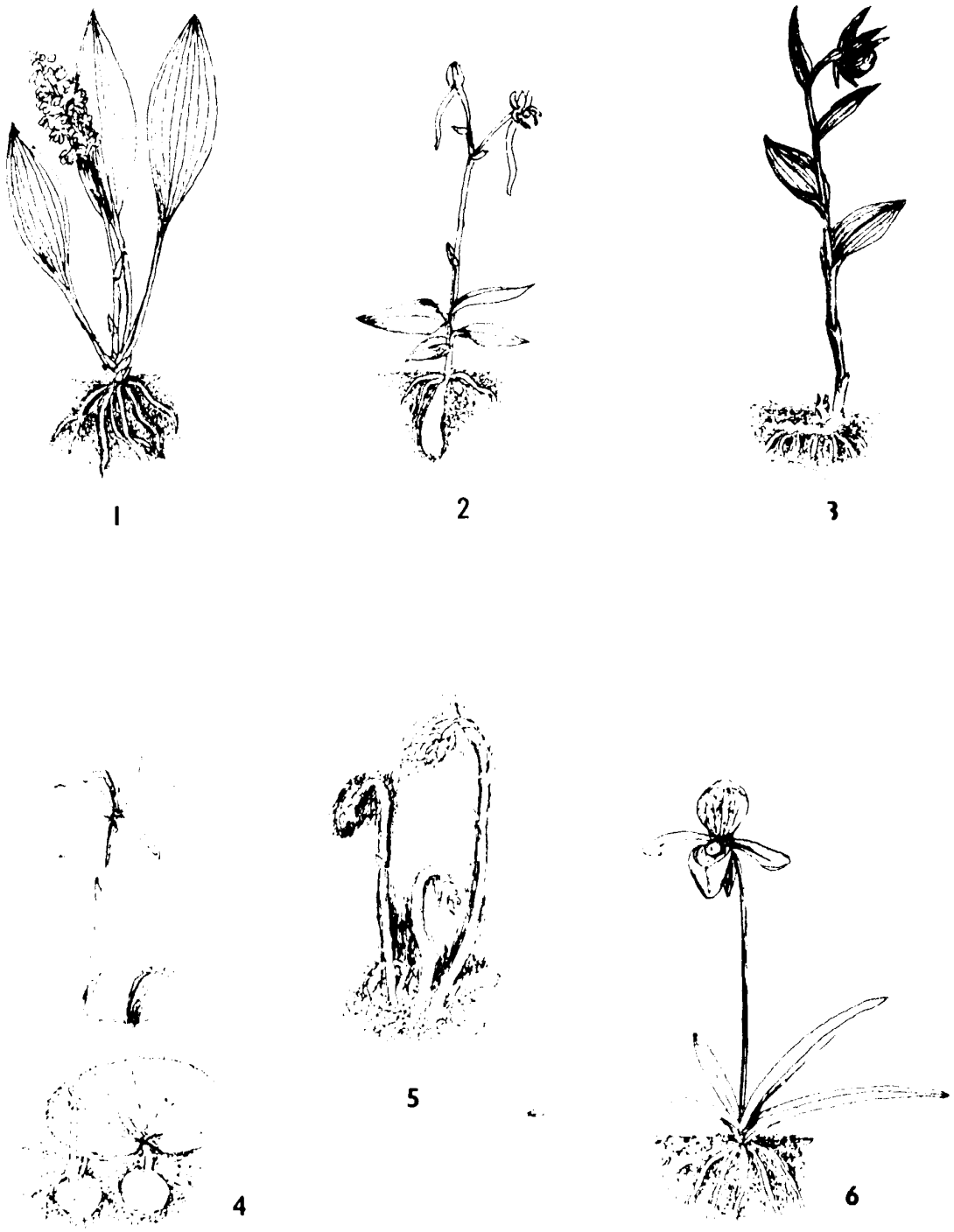

PLATE 1

HABIT OF ORCHIDS:— TERRESTRIALS.

1. *Calanthe* sp.; 2. *Habenaria* sp.; 3. *Cypripedium* sp.; 4. *Nervilia* sp.; 5. *Epipogium* sp.; 6. *Paphiopedilum* sp.;

PLATE 2

HABIT OF ORCHIDS: EPIPHYTES.

1. *Vanilla* sp. (climber); 2. *Dendrobium* sp.; 3. Oberonia sp.; 4. Coelogyne sp.; 5. *Vanda* sp.; 6. Bulbophylum sp.

ORCHID MORPHOLOGY

Orchids are perennial herbs. Land orchids have rhizomes, root stocks or tubers and a bunch of roots. Very few of them have a climbing stem with roots at nodes. Several of the epiphytic orchids have fleshy roots with a special spongy water absorbing tissue called *velamen*. The stem may be branching, creeping or erect. Leaves are parallel-veined, simple, varying from one to several, either in a bunch or spread all along the stem. Mostly the leaf has at its base a fleshy, swollen, bulbous part called the *pseudobulb*. In a few orchids the leaves are deciduous. In some of them the leaf and the flower appear at different times from the same tuber. Such orchids have caused confusion in identification (Pls. 1 and 2, Figs. 1-6).

Orchid flowers are either in varying kinds of bunches or inflorescence or solitary, appearing at the top of the leafy stem or in the axils of leaves or in separate, distinct flower bunches. Orchid flowers vary in size from the microscopic to fairly large ones measuring almost 15 cm across. All the same, they all exhibit the same 3-merous pattern showing their relationship to the Lily flower. There are three *sepals* and three *petals*, one of which is strikingly different and is called the *lip* or the *labellum*. At the center is a stumpy part which represents the much modified fused style, stigma and stamen. This is known as *column*. At the tip of the column is the *anther* with a mass of sticky pollen grains called *pollinia*. These may be in 2, 4, or 8. The stigmatic tip or the *rostellum* is atop the anthers. The column leads below to the ovary, which is below the rest of the floral parts, sunk inside the long stalk and hence called inferior or pedicellate ovary. In many orchids, this stalk with pistil, twists round 180° from the bud to the blossom, bringing the lip from the back to the front, facilitating pollination and fertilisation. This gyration is called resupination. The sepals, the petals and the lip together with the column display an unparalleled range of variation in relative size, shape and colour. Further, the lip itself seems to compete with the rest in its diversity. It displays various kinds of lobation, patterns or ridges, grooves, pubescence and extensions in the form of spurs which themselves further display variations. All these astonishing variations help the orchid classifier in identifying and naming them (Pl. 3, Figs. 1-10). In one group of orchids there are two stamens and the pollen is granular. The lateral sepals are fused, and the lip is like a vase or old fashioned Lady's slipper. This feature has earned these orchids the popular name of Lady's slipper orchids (incidentally it should be mentioned that there is only one species of this in South India—*Paphiopedilum druryi*, which has become extremely rare or almost extinct in Nature).

The lip structure in some orchid species representing a female insect has misled male insects into pseudocopulation and thus effecting pollination. Orchid floral structure and biology of pollination and fertilization is an extremely fascinating field in which amateur naturalists can greatly contribute by their observations. Orchid fruits (capsules) split when ripe into 3 or 6 parts and release an enormous number of dust-like tiny seeds. The seed lacks any

PLATE 3

Fig. 1-3. *Coelogyne* sp.:— 1. Flower front view; 2. Flower lateral view; 3. Ovary with column; *Fig. 4-7. Lips with ovary*:— 4. Saccate Lip (Eulophia sp) 5. Lobed lip with one spur (Calanthe sp); 6. Lip with two spurs (Satyrium sp).; 7. Deeply trifid Lip with one spur (Habenaria sp); Fig 8-10. Fruits.:— 8. *Cymbidium* sp.; 9. *Thrixspermum* sp.; 10. *Vanilla* sp.; Fig.11. Pollinia:— I. *Acampe* sp.; II. *Habenaria* sp.; III. *Eria* sp.;

An. Anther; C. Column; D. Disc; L. Lip; O. Ovary; Pe. Petal; Po. Pollinia; S. Sepals; Sa. Sac; Sp. Spur; St. Stipe.

nourishing tissue like endosperm of other seeds. There is only an embryo. The seed germinates on a chance coming together of the needed fungal partner or mycorrhiza. There is a large wastage of seeds. It takes from 8-12 years for the seedling to become an adult plant. The common method of multiplication of orchids even in nature is by breaking off of parts of the parent plant. This is vegetative propagation.

Plant physiologists have now been able to provide the essential nutritives for the seed in a culture medium. Also, tiny bits of orchid tissue can be similarly grown in the laboratory. This is called meristem culture. These processes are used in large scale cultivation of ornamental orchids by nurserymen in foreign countries. A start has been made in India also.

An orchid gathered in the Nilgiri area can be recognised as an orchid and further identified to the respective genus and species with due familiarity with the general description and illustrations provided here. With this background the key which gives repeatedly two alternatives and choice of characters, will eventually lead the reader to the name of the orchid. This could be further confirmed by the detailed description of that particular species and the related illustrations. If the reader finds that he cannot decide, either his plant is not an orchid or he has one, not covered by this book or likely even a new species ! Every naturalist has a chance to find new orchids.

ORCHIDS OF NILGIRIS

KEY TO THE GENERA

The keys are artificial meant to aid identification of Orchids of Nilgiris

1a. Terrestrial

2a. Climbers (with long green aerial stem) ... VANILLA 1

2b. Non climbers

3a. Leafless, either during flowering time or throughout

4a. Leafless throughout, (and only inflorescence appearing seasonally)

5a. Flowers with slender ovary, erect; lip without spur, deeply constricted about the base and with a triangular wing on either side at the very base ... APHYLLORCHIS 2

5b. Flowers with very swollen ovary, drooping; lip with a saccate spur and bereft of wings ... EPIPOGIUM 3

4b. Leaf appearing only after flowering time, disappearing before the next flowering

6a. Flowers glandular pubescent ... PACHYSTOMA 4

6b. Flowers glabrous

7a. Leaves orbicular to broadly ovate, solitary ... NERVILIA 5

7b. Leaves linear, two or more ... EULOPHIA 6

3b. Leafy plants

8a. Lip with two spurs ... SATYRIUM 7

8b. Lip with one spur or none

9a. Lip neither saccate nor spurred

10a. Flowers solitary or in racemes, axillary or lateral

11a. Flowers solitary (in the axil of leaves progressively reduced in size upwards) ... EPIPACTIS 8

11b. Flowers in simple racemes or panicles

12a. Pseudobulbous; leaves 2 or 3 tapering into a long petiole; racemes simple, lateral, from the side of the pseudobulb; flowers with sepals united to form a gibbous tube ... ACANTHEPHIPPIUM 9

12b. Not pseudobulbous; leaves 5 or more, sessile to the sheath; inflorescences spreading panicle from the axils of the upper leaves; flowers not gibbous ... CORYMBORKIS 10

10b Flowers in spikes or racemes, terminal

13a. Leaves at distant nodes; flowers two (rarely 1 or 3); lip much smaller than the sepals and petals, T- or Y-shaped, adnate to the front of column ... DISPERIS 11

13b Leaves radical or subradical or scattered; flowers many; lip larger or subequal with the sepals and petals, neither T- or Y-shaped

14a. Inflorescence a lax raceme; dorsal sepal and lateral petals distinct, and held in various ways; lip broad and strongly reflexed from the base; margins of sepals and petals often curved

15a. Column very short, straight ... MALAXIS 12

15b. Column long, hooded at apex ... LIPARIS 13

14b. Inflorescence a dense spike; dorsal sepal and lateral petals adhere to form a hood; lip not reflexed, inferior; margins of sepals and petals not curved

16a. Leaves many, large (11—18 x 1.5—3.0 cm) with long sheathing petioles, scattered; lip setose within, entire, with 2 subterminal calli on dorsal side and the apex strongly recurved ... GOODYERA 14

16b. Leaves a few, small (3—12 x 0.5—0.9 cm) sessile, crowded at the base; lip trilobed with 2 calli at the base within, geniculate about the middle ... SPIRANTHES 15

9b. Lip distinctly saccate at the base or spurred

17a. Lip with saccate base

18a. Inflorescence glabrous; lip entire

19a. Scape lateral from the base; raceme decurved; bracts linear; lip retuse ... GEODORUM 16

19b. Apical portion of the plant itself flower bearing, erect; bracts foliaceous; lip obcordate ... BRACHYCORYTHIS 17

18b. Inflorescence glandular pubescent; lip lobed

20a. Lip margin uneven but deeply forked at the apex; lateral sepals free ... ZEUXINE 18

20b. Lip margin lobed and also with a deep cleft at the apex, lateral sepals connate ... CHEIROSTYLIS 19

17b. Lip spurred

21a. Spur long cylindric

22a. Non-tuberous; leaves plaited, long petioled; base of the lip adnate all along the column; midlobe of the lip deeply cleft CALANTHE 20

22b. Tuberous; leaves not plaited, sessile or subsessile; lip free from the column; midlobe entire

23a. Flowers large, more than 5 cm across; stigma sessile — PECTELIS 21

23b. Flowers small, less than 3 cm across; stigma with distinct appendages ... HABENARIA 22

21b. Spur scrotiform or conical or vermiform

24a. Non-bulbous, non-tuberous, decumbent plants; inflorescence glandular pubescent; lip with basal pectinate segments ... ANOECTOCHILUS 23

24b. Bulbous or tuberous, erect herbs; inflorescence glabrous; lip without basal segments

25a. Bulbous caespitose herbs; inflorescence lateral ... EULOPHIA 6

25b. Tuberous simple herbs; inflorscence terminal ... PERISTYLUS 24

1b. Epiphytic

26a. Plants with terete leaves

27a. Flowers many in a pendulous raceme; lip with large spur and inconspicuous lobes ... SCHOENORCHIS 25

27b. Flowers a few (2-5) on an erect raceme; lip with inconspicuous spur or without it, with large lobes

28a. Lip without spur ... LUISIA 26

28b. Lip with a spur ... PAPILIONANTHE 27

26b. Plants without leaves or leaves flat or keeled or subterete and sulcate

29a. Leaves absent (only roots green and assimilatory)

30a. Column with a distinct foot, (bearing lateral sepals); ovary puberulous ... CHILOSCHISTA 28

30b. Column without a foot; ovary glabrous ... TAENIOPHYLLUM 29

29b. Leaves present

31a. Leaves equitant, ensiform — OBERONIA 30

31b. Leaves otherwise

32a. Plants with pseudobulbs

33a. Pseudobulbs with single leaf

34a. Pseudobulbs at irregular intervals on an elongate pendulous nodose stem; flowers 1—3 at the base of the leaf on the pseudobulb ... FLICKINGERIA 31

34b. Pseudbulbs in clusters or at regular intervals on a horizontal creeping stem; flowers many on long scapes

35a. Pseudobulbs in clusters; inflorescence terminal on the pseudobulb, pendulous; bracts many closely

bifarious; perianths more or less equal in size; lip distinctly 3-lobed, firmly attached ... PHOLIDOTA 32

35b. Pseudobulbs on creeping stem; inflorescence lateral to the pseudobulb, erect; bracts a few, more or less crowded; perianth very unequal, lip unlobed or obscurely lobed, mobile (lateral sepals larger, often cohering along margins and twisted) ... BULBOPHYLLUM 33

33b. Pseudobulbs with two or more leaves

36a. Pseudobulbs discoid with reticulate sheath-covering; sepals connate into a campanulate tube ... PORPAX 34

36b. Pseudobulbs ovoid or oblong or elongate (rarely discoid with reticulate sheath), sepals free

37a. Flowers with lateral sepals adnate to the foot of the column to form a mentum

38a. Lip lobed; midlobe much larger than the sidelobes (and often crenulate to pectinate); pollinia 4, ovoid or oblong ... DENDROBIUM 35

38b. Lip entire or obscurely lobed, when lobed midlobe shorter than the lateral ones; pollinia 8, pyriform ... ERIA 36

37b Flowers without a mentum

39a. Pseudobulbs with two terminal leaves, with or without sheathing bracts at the base; column hooded and winged at apex

40a. Pseudobulbs *ca* 7 cm long,ovoid-elongate, slender; flowers small, pale green; lip entire, strongly reflexed from the base, without dorsal ridges LIPARIS 13

40b. Pseudobulbs *ca* 4 cm long, ovoid-oblong, swollen; flowers large, white; lip trilobed, straight with dorsal longitudinal ridges ... COELOGYNE 37

39b. Pseudobulbs with four or more leaves, covered with sheathing bracts or sheathing bases of leaves; column neither hooded nor winged at apex

41a. Plants large (leaves *ca* 70 x 3 cm); pseudobulbs globose; inflorescence up to 50 cm, lateral, axillary, pendulous; sepals and petals subequal; lip inferior with 2 parallel ridges ... CYMBIDIUM 38

41b. Plants small (leaves *ca* 25 x 3 cm); pseudobulbs ovoid, slender; inflorescence up to 20 cm, terminal, erect; petals much narrower than the sepals; lip superior, with a single ridge ... POLYSTACHYA 39

32b. Plants without pseudobulbs (but with short or long, slender or stout stems)

42a. Lip with two spurs ... DIPLOCENTRUM 40

42b. Lip with one spur or none

43a. Plants short, less than 10 cm high (1.5—8.0 cm)

44a. Leaves flat obliquely bilobed at tip; inflorescence (a corymb) much shorter than the leaves ... GASTROCHILUS 41

44b. Leaves subterete, sulcate, obliquely acute at tip; inflorescence longer than the leaves

45a. Inflorescence a simple raceme; lip glabrous; spur laterally compressed ROBIQUETIA 42

45b. Inflorescence a condensed spike (at the end of a long scape); lip glandular hairy; spur scrotiform ... THRIXSPERMUM 43

43b. Plants tall, more than 10 cm high (up to 30 cm or more)

46a. Lip without spur

47a. Leaves ovate-lanceolate, usually three to five times longer than broad, obuse or acute at tip; inflorescence of simple, short racemes; flowers with a mentum; perianth spreading; lip without callus ... DENDROBIUM 35

47b. Leaves linear, ten times or more longer than broad, unequally forked at tip; inflorescence a sparsely branching long panicle; flowers without a mentum; perianth strongly reflexed over the ovary; lip with two auricular calli ... COTTONIA 44

46b. Lip with spur

48a. Leaves at long internodes (on slender elongate stem) small (1.5—8.0 cm long), oblong, flat, two to four times longer than broad

49a. Leaves 0.5—5.0 cm long, obtuse; flowers in a condensed raceme; racemes shorter than the leaves ... TRICHOGLOTTIS 45

49b. Leaves 3.5—8.0 cm long, obliquely cleft; flowers on a long erect raceme; racemes much longer than the leaves ... VANDA 46

48b. Leaves in vertical rows with the base of the lower sheathing, that of the upper, long (9—25 cm) linear, more or less keeled, more than 5 times longer than broad

50a. Leaves praemorse at apex ... VANDA 46

50b. Leaves retuse or cleft at apex

51a. Inflorescence drooping; lip deeply cleft at tip ... RHYNCHOSTYLIS 47

51b. Inflorescence erect; lip trilobed

52a. Inflorescence racemose, much longer than the leaves; spur conical or cylindrical ... AERIDES 48

52b. Inflorescence corymbose, much shorter than the leaves; spur gibbous ... ACAMPE 49

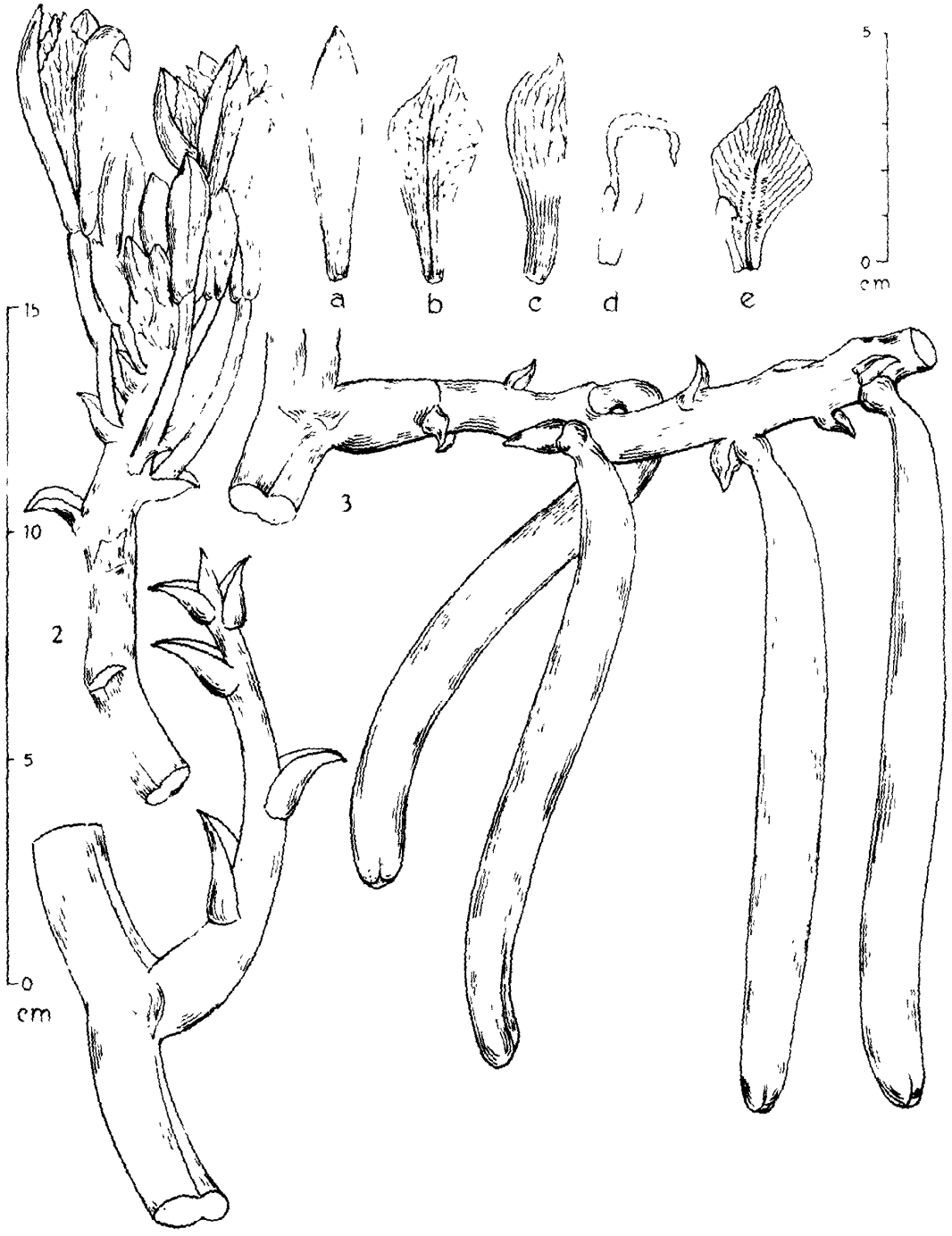

PLATE 4

Vanilla walkeriae Wt.: 1. Growing tip; 2. Inflorescence; 3. Fruits; a. Dorsel sepal; b. Lateral petal; c. Lateral Sepal; d. Lip (Lateral view) with column; e. Lip (spread out.)