

## Hardy, Terrestrial Orchids From Seed: Some Tentative Suggestions

By JAMES C. ARCHIBALD

OF THE many groups of plants which we are able to grow in our gardens, the family *Orchidaceae* contains, to my mind, more fascinating and beautiful species than any other. To the layman, the name 'orchid' immediately is associated with the tropical *Cymbidiums*, *Cypripediums* and *Cattleyas*, which for the majority of us must remain, standing aristocratic and aloof, in the windows of the florists' shops. To the alpine-gardener, the fine pans of *Pleione spp.*, which have now become rather a cliché on the show bench, or perhaps some of the hardy *Cypripediums*, may come to mind. Nevertheless, out of approximately one thousand species of the family *Orchidaceae*, which stand a good chance of succeeding in the alpine houses, frames and gardens of us rock-gardeners, only a tiny handful are, or for that matter ever have been, in cultivation.

There is no doubt that many orchids are difficult to grow, but if we are prepared to struggle to grow a plant like *Raoulia eximia*, for instance, which has never looked, even at its best, like anything more than a curiosity in cultivation, how much more rewarding for us it would be to have thriving plants of some of the exquisite orchids of the Southern Hemisphere in our alpine houses. Before we can attempt these species, the first essential is to obtain plants, and there we are faced by a seemingly insurmountable wall. In these days, importation is costly and fraught with many hazards. Even if we can acquire plants from abroad, the difficulty in keeping them is great and the resulting mortality is often high, a discouraging factor. A few firms offer imported roots, mainly from Japan, the Himalayas and North America, but these plants are suffering a severe climatic shock and usually require careful treatment before they flower. In any case, the number of species at present available is comparatively restricted. The obvious answer to all this is to raise the plants, which we want, from seed, and it is in a modest attempt to supply this answer, along with the very complex implications which it must involve, that I offer this article, which is, by necessity, regrettably inadequate.

Before proceeding any further, I should state that I have never raised any species of orchid from seed. Like many other gardeners, I have been deterred from any attempt that I might have made by strange tales of certain 'endotrophic mycorrhiza' and weird rumours that have leaked out about "hours dreadful and things strange" involved in the science-fiction-like processes used to propagate the tropical, florists' orchids by seed. It will be of the greatest advantage to anyone contemplating raising the hardy, terrestrial species from seed both to have a rough idea about this technique, used with the tropical species, and to know the reasons which make it necessary.

It is first necessary to understand that the seed of an orchid, any orchid, is different from the seeds of the other plants which we grow in our garden. Whereas with the majority of seeds a supply of food material is stored in the cotyledons, which soon make the fact of germination obvious by their appearance, in the case of orchids the fine dust-like seeds are so small that there is not sufficient room for a food supply. The results of this deficiency are twofold : initial growth is very slow ; special conditions are essential for any growth to take place at all. The time taken before a conventional-looking seedling appears varies between a month and several years. Even then their progress is slow and several years must usually elapse before flowers are produced. A. W. Darnell provides one of the few accounts of the propagation of hardy, terrestrial species by seed, but this, like most available information on this subject, is extremely vague and, I fear, mostly insubstantiated. Darnell makes the following statement : "The various species differ greatly in the length of time they take to form flowering plants from seed, for instance several *Disas* blossom in eighteen months or two years from the germination of the seed, whilst some members of the genus *Orchis* require six or more years to become sufficiently robust to flower." On the surface, neither of these times seem particularly unreasonable, but when we compare the periods which are known to elapse before the flowering of our native British species, we are faced with the possibility that Darnell's times are a gross underestimation. The British spotted and marsh orchids have flowered in 4-5 years from seed ; the native *Ophrys spp.* take 5-8 years ; *Cephalanthera damasonium* 9-11 years ; *Orchis ustulata*, 13-15 years ; *Cypripedium calceolus*, over 16 years. However, the possibility of there being some truth in Darnell's information, coupled with V. S. Summerhayes' statement that "the few examples in which plants have been raised from seed indicate, however, that perhaps the estimated periods of development suggested by some authorities are somewhat excessive," provides a glimmer of hope for us, especially with some of the S. African, S. American and Australasian species about which we know comparatively little.

The fact we know so little about the times taken by the various species to flower from seed is due to the great difficulty in germinating orchid seeds at all. The lack of a satisfactory food supply within an orchid seed makes it necessary for the minute, germinating seed to find its nutrition in another way. This the orchid does by taking part in an association with a mycorrhizal fungus. This association is by no means uncommon in nature. Mycorrhiza is found in the roots of many woodland plants, forest trees and in *Calluna vulgaris*, the common heather. In orchids, however, it plays an indispensable part in the nutrition of the seedlings and in a few instances even of the adult plants. Mycorrhizal fungi are saprophytes, living on the humus in the soil. The association between them and the orchid seedling starts off as a parasitic attack by the fungus, which advances within the orchid until the seedling limits the area of its infection. A delicate balance

between the two is then established, a balance which is continually swaying to either one side or the other. The fungus with a food supply derived from the surrounding soil advances within its host, which then proceeds to digest parts of the invader, thus nourishing the seedling, and so it continues until the tiny mycorrhizome, the small subterranean body heavily infected by the fungus, is sufficiently robust to produce a normal-looking green leaf. All this most improbable struggle has, of course, been taking place beneath the surface of the soil and it is only with the appearance of the first leaf that the orchid plant begins to lead a normal life, enabling it to be treated as any other garden plant. The majority of adult orchids are completely free from fungal infection, but a few saprophytic species are dependant throughout their lives on mycorrhiza. Fortunately, these species are for the most part of no garden value whatsoever.

Under natural conditions the infection of the germinating seed is absolutely necessary, but it has long been known that the presence of the fungus can be dispensed with as long as the seedling is provided with food from another source. It is this fact which has been much exploited by the growers of the tropical species in the raising of hybrids. In the nineteenth century orchid growers found that success attended their attempts at seed raising only when the seeds were sown at the base of an adult plant, which appeared to be the one place where seed would germinate and grow, but even here pests and harmful fungi accounted for a large number of the resulting seedlings. Then, in 1909, two independent investigators, one in France, the other in Germany, both accounted for this by discovering the presence of mycorrhiza. Thereafter, this conclusion was used by several cultivators in developing the 'pure culture' method of sowing the seed on sterilised peat, which had been inoculated with the fungus found in the crushed roots of the adult plants. Although the British grower, Charlesworth, and others used this system with some success, it was wasteful and did little to prevent attacks from deadly fungi and other pests. It was not until 1922 that Dr. Lewis Knudson discovered that the fungus was dispensable and formulated his noted method for germinating and feeding orchid seedlings. The system used by modern growers follows lines similar to those outlined below :

Before commencing sowing operations, hands and utensils are disinfected. Seed is also sterilised by exposure to a solution of calcium hypochlorite, 10 gm. to 140 c.c. of distilled water, for fifteen minutes. Test tubes or flasks are sterilised in an autoclave or pressure cooker at 15 lb. pressure for thirty minutes (see Note 1). The sowing medium is then prepared. Commercial media may be available but I am uncertain. The following formula is very reliable :

*Knudson's Solution 'C'*

1	gm.	Calcium nitrate, $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$
0.25	gm.	Monobasic potassium phosphate, $\text{K}_2\text{HPO}_4$

0.25	gm.	Magnesium sulphate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$
0.50	gm.	Ammonium sulphate, $(\text{NH}_4)_2 \text{SO}_4$
0.025	gm.	Ferrous sulphate, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
0.0075	gm.	Manganese sulphate, $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$
20	gm.	Sucrose
15	gm.	Agar
1 litre Distilled water		

Add 0.1. normal HCl—sufficient to bring pH up to 4.8 to 5.2.

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The agar is dissolved in a little water in a double boiler, stirring to avoid burning. The chemicals are dissolved in a small amount of the distilled water, then added to the rest of the water, to which the agar and sugar are also added, while the whole mixture is kept just below boiling point. After being mixed thoroughly and tested for pH, it is poured with the aid of a funnel into the test tubes or flasks, which are again sterilised in the autoclave. The sterilised seed is now floated on a little distilled water, taken up with a pipette or eye-dropper and scattered over the surface of the medium. A stopper of rolled cotton-wool, flamed to destroy fungus spores, which has been kept in the mouth of the receptacle and removed only to admit the seed, is replaced and the mouth of the flask is wrapped with paper. The flasks are then kept in a temperature of about 70°F. until the tiny roots are around a quarter of an inch long, that is from eight months to a year later. The seedlings are now potted in a mixture of Polypodium fibre and vermiculite, twenty-five to a three-inch pot. Thereafter treatment is no different from that which should be accorded to any delicate seedlings.

*Note 1* : K. L. McAlpine in the *Orchid Review* advises adding 1.0 c.c. of hydrogen peroxide C.P. 30 per cent. to 1000 c.c. to the planting medium. This procedure is said to dispense with the sterilising of the seed and the elaborate precautions taken by many growers in addition to the above.

The method outlined in the previous paragraph is obviously beyond the capabilities of most of us. To the uninitiated it reads like something out of Huxley's "Brave New World" and, I must confess, that I feel portions of it might have been written by that estimable Victorian lady, Mrs. Isabella Beeton. However, I considered that it was essential to include it in this article as it offers the only absolutely reliable way to raise orchids from seed. I have no doubt the same procedure could be applied to the hardy terrestrial species and in their case the sustained high temperature would not be necessary for germination. A Wardian case or propagating case in the alpine house would probably offer an ideal position for the flasks containing the seeds. Here is an unequalled opportunity for those members who

either belong to the medical profession or have laboratory facilities at their disposal, to realise that spirit of adventure which is reputed to lie latent in all of us, and break the virgin soil in this fascinating field.

Meanwhile, we less fortunate beings will just have to struggle on in our comparatively crude and unhygienic attempts at raising these perverse and beautiful plants from seed. The system mentioned by A. W. Darnell in his previously quoted book on hardy orchids is worth recounting, although it is a little different from that used with any other plants. Darnell advises sowing the seed on a prepared bed of soil similar to that in which the adult plant grows, but more finely graded and mixed with a little chopped sphagnum-moss in an open position but one away from the direct rays of the sun and covered with a cloche. The bed should be kept moist by spraying with a fine spray until germination takes place, according to the author, from a month to a year later. Thereafter, the treatment is more or less routine : more ventilation is given as the young plant develops ; careful attention is paid to watering ; protection from frost is given during the first winter ; the seedlings are transferred to their permanent positions when they are large enough to handle. However, it is necessary to add that the author does not mention any of his successes and his concluding sentence casts a certain doubt over the reliability of his statements : 'Seeds of those species which grow in decaying vegetable debris should be sown around the parent plant and not in seed beds, as they need the aid of minute fungi to enable them to germinate ; these are found in the soil around the parent plant.' As we now know that every member of the family *Orchidaceae* which has been examined requires 'the aid of minute fungi' to develop into a flowering plant from seed, the present-day reader is compelled to regard the simplicity of Darnell's method with a large amount of suspicion.

Nevertheless, I do not think that the prospect is altogether hopeless for us gardeners who are unable to undertake the raising of seed by the asymbiotic method on agar jelly, and it is in this aura of vague optimism that I offer the following two rather hypothetical and sanguine suggestions. There is an excellent leaflet available through the Seed Distribution in which Mr. A. Duguid describes 'propagation by sphagnum.' This method, which is fully described in the leaflet, making it unnecessary to repeat the description here, has been used with great success in the raising of many seeds often considered difficult to grow and in particular in the growing of Ericaceous plants from seed. As many members of the *Ericaceae* with which this method has been used, like *Diapensia lapponica*, *Cassiope hypnoides* and *Harrimanella stelleriana*, are well-known as indulging in a mycorrhizal association, similar to that found in the orchids though probably to a lesser extent, it seems possible that a like method could be used to germinate orchid seed. In the case of *Orchidaceae*, however, I fancy that more efficient sterilisation of the sphagnum should be undertaken by baking for some time in an oven or by applying the method

used to sterilise small quantities of soil. Neither of these procedures, incidentally, is absolutely fool-proof, as fungal spores possess remarkable powers of survival and anyway the sphagnum is going to become recontaminated on exposure to the air. Before sowing orchid seed in all cases, a simple microscopic examination is advisable, if not essential, to ensure fertility—the dark nucleus is easily discernible—as most orchids have the frustrating habit of producing fat seed pods containing infertile seeds indistinguishable to the naked eye from fertile ones. After sowing, dipping the uncovered seeds in a nutrient solution instead of ordinary water is a possibility. The commercial plant food, ‘Phostrogen,’ seems to contain everything except the ‘body-building’ carbohydrates, so the addition of sugar or glucose to it might help it to build healthy baby orchids, as well as, I fear, encouraging the growth of harmful organisms, which could in turn be controlled by the addition of hydrogen peroxide to the solution, as in *Note 1*. But here, I am afraid, I must leave off as my imagination is taking us nearer and nearer to Mrs. Beeton and the complexities of the asymbiotic method.

It would be a far simpler possibility for anyone who already grows hardy, terrestrial orchids to try sowing seed at the base of plants belonging to the same genus as the seed-parent. This, of course, makes the number of species which can be attempted very restricted. Many growers will testify that several species have the welcome habit of coming up in the garden from self-sown seed and seedlings can often be found at the base of established plants. Personally, as a general rule, I do not allow my orchid plants to set seed at all and the old flower-head is nipped off immediately after flowering. I think that this goes a long way in ensuring the next season’s flowers and in some cases I believe that it is an essential procedure to prolong the life of the plant. Many tuberous species, particularly belonging to the genera *Ophrys* and *Serapias* as well as the Mediterranean members of the genus *Orchis*, have tubers of annual duration only and the strain of setting seed frequently prevents a sufficiently robust tuber forming to continue the plant’s life. In fact, the great fluctuation in the numbers of certain wild species from year to year to be found in the same locality is due to this tendency towards monocarpism. This failing is particularly notable in several of our native species such as *Ophrys apifera* and *Gymnadenia conopsea*. Here, may I digress for a moment to include a word of what I hope is not redundant advice to any members who are fortunate to possess a plant of the Patagonian *Codonorchis lessonii*, collected by Mrs. Tweedie (there are still one or two in cultivation, I believe, though I was never lucky enough to call myself the owner of one). This extreme fluctuation in the numbers of plants in a single colony in successive years is one of the features of this orchid in the wild state in Patagonia and the Falkland Islands, so it would seem most prudent to remove the old flower-heads as soon as flowering is over; *if* anyone has been skilful enough to flower it in the first place, that is. This action might help to prevent the habit

of the plant to split up, like *Iris danfordiae*, into many small tubers, which would probably be difficult to bring to maturity, and to check any monocarpic inclinations.

Although I do not allow seed to form on the few orchid plants which I have, late last Spring I noticed quite a number of seedlings in a large pan of that delightful rich Indian-red form of the Early Marsh Orchid, usually found in damp hollows among sand-dunes, *Orchis latifolia* var. *coccinea*. The young plants closely resembled blades of grass and, I must confess, I almost thoughtlessly uprooted them. Anyhow, they progressed well last year and I look forward to their flowering in the future. As to the apparently paradoxical phenomenon of their appearance, the reason is easily explained and the deduction which can be made from it is quite an interesting one. The plants were collected in May 1958, and as they have not been allowed to set seed since their flowering in the wild state in 1957, the seed which produced the seedlings appearing in 1960 must have remained in the soil kept around the roots of the collected plants for at least three years, though when the subterranean processes of germination started cannot be ascertained. The seedlings, while welcome, would have been far more exciting if they appeared in the pans of some of my other orchids, like *Cypripedium macranthum* var. *ventricosum* or *Orchis papilionacea*, which are much more precious and slow of increase than the native species.

It seems unnecessary to the practically minded gardener to go to the trouble of attempting to raise orchid species from seed which are already in cultivation and are known to lend themselves readily to increase by vegetative means. Into this category fall the ubiquitous Pleiones, certainly among the very best of the near-hardy species, which are most gratifyingly easy of increase among orchids. Apart from the fact that in most species the pseudo-bulbs double their number each year, in many, little pseudo-bulbils are produced on the top of the old pseudo-bulb and a few species are so profuse in bearing these that the minute, copiously clustered bulbils closely resemble a miniature version of a Pulsatilla's Struwelpeter seed head. The occurrence of these pseudo-bulbils and the mistaking of the resulting plants for seedlings led to a large amount of most interesting correspondence in the *Gardeners' Chronicle*, *Gardening Illustrated* between July and December 1958. This discussion was instigated, by the way, by Mr. Will Ingwersen's remark, referring to Pleiones, that 'it seems impossible to raise them from seeds except on a culture in test tubes.' The writer goes on to add, however, that the tiny pseudo-bulbs, 'if taken as soon as they detach at a touch and dibbled in sandy soil, will grow into pleasing young plants, reaching flowering size in approximately three years' time.' It therefore seems unnecessary for us to bother about growing the cultivated *Pleione* spp. from seed, although fine colour forms might occur, especially from the rich tones of a plant like *Pleione limprichtii*. I also believe that a little work is being, or has been, done in the raising of hybrid Pleiones.



*Photo—S. Mitchell*

Fig. 27—*Pulsatilla vulgaris rubra* (see page 247)



*Photo—S. Mitchell*

Fig. 28—*Potentilla nitida* (see page 248)



Similarly, species which lend themselves to increase by division of the roots, like the shy-flowering *Bletilla striata* and several *Orchis*, *Calanthe* and *Cypripedium spp.*, would be impracticable from seed, particularly in the *Cypripediums*. It is far better for us to concentrate our efforts in germinating seeds of the species about which we know so little, as, apart from the fact that there can be a great deal of hope in the unknown, statements that *Disas* bloom in two years from germination and that the tropical *Phalaenopsis spp.* have flowered in eighteen months are quite encouraging. As to acquiring seeds of these plants, I shall have to leave this to the ingenuity of my fellow members. Many species from the Southern Continents should survive in the alpine house or frame, for whereas they are quite temperature-hardy, in general they could not withstand the alternate freezings and thawings of our soaking-wet winters. Herein lies the failing of several pre-war authors, like Clay, Darnell and Grey, who paid attention only to temperatures in gauging the hardiness of a plant. Quite a few species of orchids are usually available through the Seed Distribution and of course there was that superb offering of seed of some of the Tasmanian *Orchidaceae* in the 1959-60 Seed List. It would be most interesting to see the results of anyone who had *any success whatsoever* with this seed, especially with the Tasmanian material, published in a future issue of the *Journal*. I thought that the following notes on the orchid species, which have been offered in the S.R.G.C. Seed Distribution over the past three years, i.e. from the 1958-59 to the 1960-61 Seed Lists, might be of a little assistance to any member contemplating an attempt to grow hardy terrestrial orchids from seed, as these seem to be the species most likely to occur in future Seed Lists.

*Aplectrum hiemale* (North America from Quebec south to Carolina, west to Saskatchewan and Kentucky) : about 1 ft. tall ; not a very attractive, purplish-green and brown flowered species, inhabiting the rich soil of deciduous woods ; shy-flowering, even in nature.

*Caladenia carnea* (Eastern Australia from Queensland to Tasmania) : 1 ft. ; a very beautiful species with large, elegant, pink flowers ; lip, white barred with crimson and tipped yellow ; grows in poor sandy patches in grassland and thin woodland ; cool, sandy soil in alpine house.

*Caladenia patersonii* (New South Wales, Victoria, South and Western Australia, Tasmania) : 1 ft. ; huge, spidery flowers 5 ins. across, varying from yellow to pink ; lip, yellow marked purple ; usually found in open woodland ; leafy sand in alpine house ; would be a great acquisition.

*Calypso borealis* (North America from Labrador to Alaska, south to British Columbia ; also Northern Europe) : 4 ins. ; lilac-purple blooms with a wonderfully intricate lip marked deep rose and yellow ; inhabits deep, mossy woods especially of white cedar, spruce and fir ; complete shade in cool fir-needle soil and sand ; one of the most exquisite terrestrial orchids but difficult in cultivation.

- Corallorhiza trifida* (Northern America, Europe and Asia ; native to Britain) : 9 ins. ; an anaemic-looking, yellowish brown, leafless saprophyte quite unworthy of cultivation and probably impossible in any case ; seeds require the presence of the necessary mycorrhiza before even the first stage of germination can occur and the plant is entirely dependent on the fungus throughout its life.
- Cryptostylis longifolia* (E. Australia from Queensland to Tasmania) : 18 ins. ; quite an imposing plant bearing very curious pale green and mahogany crimson flowers ; it lives naturally in wet places ; should be quite worth cultivating in rich soil, kept moist, in the alpine house.
- Cypripedium* spp. As *C. calceolus* requires sixteen years or more to flower from seed, at the present this method of propagation is likely to be impracticable for all members of this genus. Division of the rhizome offers the best means of increase, if plants can be obtained.
- Cypripedium acaule* (North America from Newfoundland and North Carolina west to Manitoba) : 1 ft. ; a sinisterly beautiful species with large flowers of greenish brown lined pink ; lip, large, pink shaded red and netted with rose veins ; habitat is in wet sphagnum swamps or strongly acid soil under conifers ; not easy in gardens ; kept wet in Spring, dryish when dormant.
- Cypripedium calceolus* (Europe and Northern Asia ; doubtful native of Britain) : 1 ft. ; the well-known, chestnut-brown flowered species with a large, rich yellow lip ; grows in calcareous woodlands ; not difficult in limy loam and leafmould.
- Cypripedium guttatum* (Siberia, Alaska and N.W. Canada) : 9 ins. ; white flowers blotched crimson ; grows at the edges of swamps and in damp patches in birch woods ; not, to my knowledge, in cultivation at the moment, but is certainly well worth growing in cool, birch leaf-soil.
- Cypripedium passerinum* (North America from Gulf of St. Lawrence west to British Columbia and the Yukon) : 1 ft. ; pale green or white flowers ; lip, white dotted purple ; found in the region of water and in deep, mossy woods, usually associated with conifers ; as the flowers are smallish, this species is not quite so worthy of cultivation as some others in this genus.
- Cypripedium spectabile* (North America from Newfoundland to Manitoba, south to Georgia) : 2 ft. ; soft, pure white flowers ; lip, pale pink marked with rose ; its natural habitat is in swamps and wet woodlands ; the best-known and most handsome of the N. American species.
- Dipodium punctatum* (whole of Australia excepting Western Australia) : 2 ft. ; a very beautiful leafless species with large crimson-pink flowers. Regrettably, this is a saprophyte and probably a parasite, growing in moist, sandy soil on the roots of Eucalypti. Darnell suggests planting this at the base of one of the hardy *Eucalyptus*

*sp.*, but I fear that it will always be absolutely intractable in cultivation.

*Epipactis pubescens* : I think this is a synonym of *Goodyera pubescens*, q.v., but I am not certain.

*Gastrodia sesamoides* (whole of Eastern Australia) : 1 ft. ; a strange, not unattractive, leafless parasite with bell-shaped flowers, golden brown without, white within ; like *Dipodium punctatum*, I fancy that this will be impossible to cultivate.

*Glossodia major* (whole of Eastern Australia) : 6 ins. ; a very beautiful little orchid bearing large, solitary, uniform mauve-purple blooms ; common on poor but moist, sandy soil in open country ; sandy loam in the alpine house.

*Goodyera pubescens* (North America from Quebec south to North Carolina, west to the Mississippi Valley) : 1 ft. ; spike of very small, white flowers ; from dry woodlands under hardwoods, pine and hemlock ; not a very exciting plant, but would be worth growing for the beauty of its bluish-green leaves, which are delicately reticulated with a network white ; probably very difficult from seed.

*Gymnadenia conopsea* (Europe across Siberia to Japan ; native to Britain) : 1 ft. ; dense spike of pink or lilac-red flowers ; a most attractive native species often found in very large numbers in a great variety of situations ; not demanding of any special requirements in cultivation.

*Gymnadenia odoratissima* (Western and Central Europe ; very doubtful native of Britain) : 1 ft. ; a slender plant closely resembling *G. conopsea* and from our point of view may be regarded as an inferior form of it ; not difficult in moist loamy soil.

*Microtis porrifolia* (Eastern Australia and New Zealand) : this is likely to be the plant listed as 'Common Leek Orchid' ; not really worth growing for its long spike of tiny green flowers, but might succeed in rich moist soil in the alpine house.

*Orchis foliosa* (Madeira Islands) : 2 ft. ; a very robust and specious plant bearing solid spikes of rich-purple flowers over glossy green foliage ; grows by the banks of streams and in other moist places in its native islands ; absolutely hardy and easy in damp rich soil ; will come like some other members of the genus *Orchis* from seed sown around the parent plant but it can be increased quite easily, if slowly, by division.

*Orchis fuchsii* (whole of Europe ; native to Britain) : 1 ft. ; a member of the old *O. maculata* aggregate ; a common, variable species usually with pale lilac flowers and spotted leaves ; easy in damp loam ; the 'giant form,' listed this year, sounds interesting and would probably come from seed sown around a plant of the ordinary form.

*Orchis maculata* : *O. fuchsii*, q.v.

*Orchis strictifolia* : I regret that I know nothing of this. It may be a synonym or form of *O. latifolia*, though the two names seem to be a direct contradiction of this.

*Pleione humilis* }  
 „ *maculata* } see previous paragraph on Pleiones.  
 „ *pricei* }

*Pterostylis aphylla* (Tasmania) : 4 ins. ; a very curious plant with hooded, 'madcap' little flowers of green and white, stained crimson ; inhabits open grassy spots ; likely to be worth growing in moist, sandy loam in the alpine house.

*Pterostylis parviflora* (whole of Eastern Australia) : 6 ins. ; pale green flowers shaded with brown ; found in shady, sandy places ; possibly not so worth while as the above, but should merit growing in the alpine house in a damp mixture of sand and leafmould.

*Thelymitra* spp. : possibly the finest of the Australasian orchids, which are likely to be near-hardy in Britain. Three species were included in the 1959-60 Seed Distribution, two of them unnamed. All members of this genus are beautiful plants worthy of cultivation, with flowers varying from yellow to blue, through purple to pink and red.

*Thelymitra pauciflora* (whole of Australia and New Zealand) : 1 ft. ; a variable and exquisite plant with large, regularly shaped, purple-blue flowers ; it occurs in several situations, but generally in damp, open, grassy locations ; moist, sandy loam in the alpine house.

The real answer to the complex problem posed in the raising of the hardy terrestrial orchid species from seed can only be supplied by those gardeners who are both courageous and willing enough to undertake this uncertain task. For their benefit, I append a list of species which I think would be worth attempting to cultivate in this country. Some are only suitable for cultivation in frames or the alpine house and it would be advisable if all the Southern species were collected at a high altitude. I did not include any Himalayan or European species as these may be more easily obtained as imported tubers ; nor are there any orchids listed which grow within Communist occupied territories, as these will probably remain unobtainable for some time. Finally, then, may I wish anyone trying to grow these very worthwhile plants from seed the very best of luck and end with the confession that I think that I shall *still* try to obtain tubers of these plants before attempting them from seed.

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PATAGONIA AND THE CHILEAN ANDES : *Asarca glandulifera*, *A. acutiflora* ; *Chloraea alpina*, *C. aurantiaca*, *C. aurea*, *C. bergii*, *C. campestris*, *C. chica*, *C. cholilensis*, *C. chrysantha*, *C. crispa*, *C. crocata*, *C. cylindrostachya*, *C. discoides*, *C. ferruginea*, *C. grandiflora*, *C. homopetala*, *C. hookeriana*, *C. incisa*, *C. lagunae pacis*, *C. nervosa*, *C. leucojiflora*, *C. longipetala*, *C. magellanica*, *C. multiflora*, *C. pencillata*, *C. philippii*, *C. phoenicea*, *C. piquichen*, *C. rypalo-*

*glossa*, *C. semibarbata*, *C. speciosa*, *C. xerophila*; *Codonorchis lessonii*, *C. poeppigii*, *C. skottsbergii*.

FALKLAND ISLANDS: *Chloraea falklandica*, *C. gaudichaudii*; *Codonorchis lessonii*.

NEW SOUTH WALES, VICTORIA AND TASMANIA: *Acianthus caudatus*, *A. exsertus*, *A. reniformis*; *Bulbophyllum elisae*; *Caladenia carnea*, *C. caerulea*, *C. clavigera*, *C. congesta*, *C. deformis*, *C. latifolia*, *C. filamentosa*, *C. menziesii*, *C. patersonii*, *C. testacea*, *C. suaveolens*; *Calochilus campestris*, *C. paludosus*, *C. robertsonii*; *Corysanthes fimbriata*; *Cryptostylis longifolia*; *Diuris longifolia*, *D. maculata*, *D. palustris*, *D. pedunculata*, *D. punctata*, *D. sulphurea*; *Eriochilus aphylla*, *P. curta*, *P. longifolia*, *P. obtusa*; *Thelymitra antennifera*, *T. aristata*, *T. carnea*, *T. cyanea*, *T. flexuosa*, *T. ixioides*, *T. longifolia*, *T. macmillanii*; *Chiloglottis diphylla*, *C. gunnii*.

JAPAN: *Calanthe torifera*; *Cephalanthera chloidophylla*, *C. elegans*; *Cremastra mitrata*, *C. unguiculata*; *Cypripedium thunbergii*; *Dactyloctenium ringens*; *Orchis cyclochila*, *O. matsumurana*; *Pogonia japonica*.

NEW ZEALAND: *Acianthus oblongus*; *Caladenia lyallii*, *C. minor*; *Chiloglottis bifolia*; *Corysanthes macrantha*, *C. oblonga*, *C. rivularis*, *C. trilona*; *Lyperanthus antarcticus*; *Thelymitra pulchella*, *T. uniflora*.

ORANGE FREE STATE: *Brownleea monophylla*; *Disa fragrans*, *D. frigida*, *D. thodei*; *Disperis fanniniae*; *Eulophia sankeyi*; *Huttonaea grandiflora*; *Neobolusia virginea*; *Satyrium woodii*.

TRANSVAAL: *Brachycorythis pubescens*; *Brownleea coerulea*, *B. nelsonii*; *Disa aconitoides*, *D. laeta*, *D. cooperi*, *D. macowanii*; *Disperis anthoceros*, *D. fanniniae*, *D. nelsonii*; *Eulophia aemula*, *L. bakeri*, *E. engleri*, *E. rehmannii*, *E. stenantha*; *Habenaria schlechteri*; *Herschelia baurii*; *Satyrium neglectum*; *Stenoglottis fimbriata*.

NATAL: *Disa cephalotes*, *D. chrysostachya*, *D. nervosa*, *D. oreophila*, *D. patula*, *D. pulchra*, *D. rhodantha*; *Disperis allisonii*, *D. anomala*, *D. bicolor*, *D. concinna*, *D. flava*, *D. kermesina*; *Eulophia calanthoides*, *E. inaequalis*, *E. subintegra*; *Huttonaea pulchra*, *H. fimbriata*, *H. woodii*; *Satyrium sphaerocarpum*, *S. woodii*.

BASUTOLAND: *Brownleea recurvata*; *Disa cooperi*, *D. porrecta*; *Eulophia robusta*.

CAPE PROVINCE: *Bartholina pectinata*; *Ceratandropsis grandiflora*; *Disa capricornis*, *D. crassicornis*, *D. draconis*, *D. glandulosa*, *D. longicornu*, *D. macowanii*, *D. montana*, *D. marlothii*, *D. porrecta*, *D. racemosa*, *D. sanguinea*, *D. uniflora*; *Disperis oxyglossa*; *Eulophia aculeata*, *E. barbata*, *E. hians*, *E. violacea*; *Evota bicolor*; *Herschelia charpentieriana*, *H. graminifolia*, *H. lugens*, *H. multifida*, *H. purpurascens*, *H. spathulata*; *Monadenia comosa*, *M. ophrydea*; *Orthopenthea elegans*, *O. minor*, *O. richardiana*; *Pterygodium catholicum*; *Satyrium carneum*, *S. cordifolium*, *S. coriifolium*, *S. cristatum*, *S. macrophyllum*, *S. maculatum*, *S. membranaceum*, *S. princeps*, *S. sphaerocarpum*; *Schizodium clavigerum*, *S. obtusatum*.