# The Propagation of Rhododendron Section Vireya from seed

by J. L. Rouse

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ABSTRACT. The pollination process is briefly described and compatible pollinations within sect. *Vireya* are examined, including the anomalous behaviour of *R.kawakamii* var. *flaviflorum*. The morphology, storage and germination of pollen are illustrated, and seed harvesting techniques described. Details are given of seed morphology, its longevity, storage and the requirements for germination. The germination process is illustrated by following the progress of *R.konori* from seed to small seedling. The characteristics of seedlings within sect. *Vireya* are illustrated and the environmental conditions favouring rapid growth are tabulated. The development from seed to flowering plant is described for *R.lochiae.*



## INTRODUCTION

In 1972, seed of (*R.phaeopeplum* x *R.lochiae*) x (*R.leucogigas*) was obtained from Strybing Arboretum, San Francisco. Fig.1A shows one of the seedlings in flower. There is little sign of the presence of *R.lochiae* in its parentage which usually results in flowers coloured a uniform shade of pink. The corolla is white, 7-lobed and there are 14 stamens and the inflorescence is beautifully perfumed, all characteristics of *R.phaeopeplum* and *R.leucogigas*.

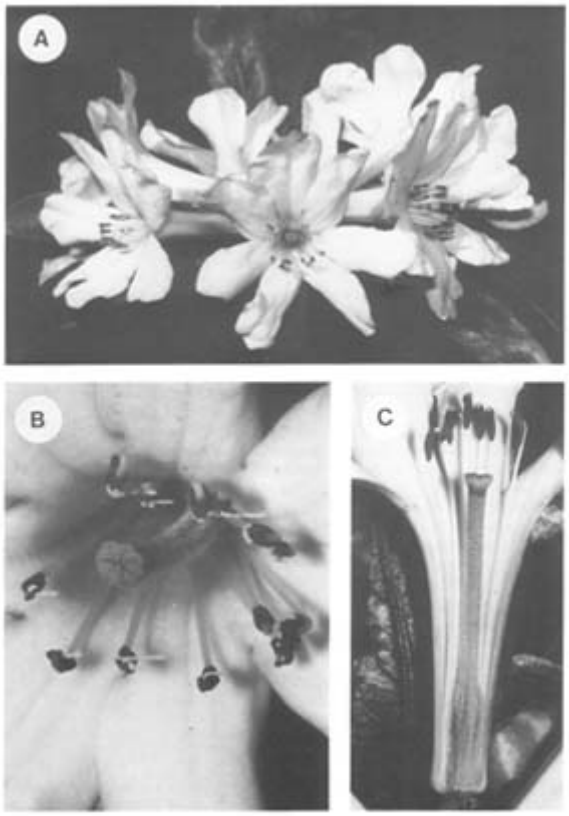


Fig.1. (*R.phaeopeplum* x *R.lochiae*) x *R.leucogigas*:
A, inflorescence; B & C, enlargements showing 7-partite stigma,
hairy style and dehiscing anthers.



With a closer look at the central region of one of the newly opened flowers (Fig.1B) we see that the anthers have started to dehisce with a thread of pollen hanging from them. The stigma is dry and non-receptive. Removal of half the corolla and half the stamens (Fig.1C) discloses the style, which connects the stigma to the ovary. With time, the style elongates, sometimes curving up or down as well, and the stigma becomes wet with a liquid exudate which indicates that it has become receptive to pollen which alights on it and germinates there. A close up view of the wet stigma of *R.orbiculatum* (Fig.2B) shows it to be 5-partite to match its floral structure, unlike the above Strybing hybrid whose stigma is 7-partite.

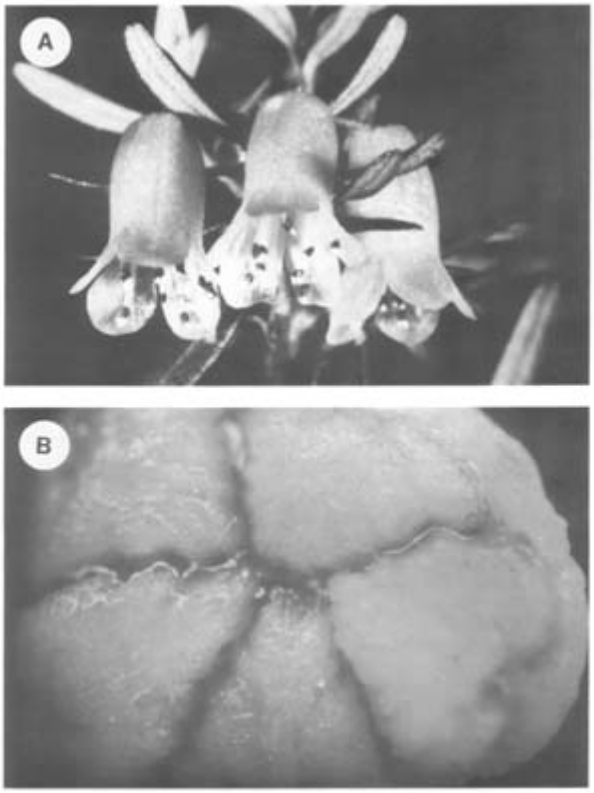


Fig.2 A, *R.quadrasianum* var.*rosmarinifolium*, inflorescence.
B, *R.orbiculatum*, surface of 5-partite stigma.



In the pollination process, compatible pollen is placed on a receptive stigma, the pollen germinates and within 24 hours the pollen tubes enter the style. The pollen tubes grow down the style to the ovary within about 7 days and subsequently the ovules are fertilized. Here, our interest is in the development of the fruit leading to the production of viable seed.

## COMPATIBILITIES WITHIN SECTION VIREYA

Taxonomically, within sect. *Vireya* there are seven subsections (Sleumer, 1966) of which one, subsect. *Pseudovireya*, is atypical in that it contains six species from temperate regions which are more than 20° north of the equator. My observations on compatibility within *Vireya* are based on relatively few species within subsect. *Pseudovireya*, as I only have the following large enough to flower.

From temperate regions
*R.kawakamii* var. *flaviflorum* from Taiwan
*R.santapaui* from NEFA
From tropical regions
*R.quadrasianum* var.*rosmarinifolium* (Fig.2A) from Luzon, Philippines
*R.retusum* from Sumatra

Of these four, *R.kawakamii* var.*flaviflorum* is exceptional in that it does not appear to cross with any other member of sect. *Vireya* as either the seed parent or the pollen parent. Excluding subsect. *Pseudovireya*, what evidence I have suggests that, in general, successful crosses can be made between any two species, and that overall within sect. *Vireya* the species are self-fertile. On this latter point, I have self-pollinated most sect. *Vireya* species which I have flowered and obtained viable seed, which can be compared with Cox (1973:249) who states for *Rhododendron* in general 'I have found that the majority of species are self-sterile'. I have also found that the seedlings obtained by selfing sect. *Vireya* species or hybrids do not usually lack vigour, which can be compared with Leach (1961) who states for *Rhododendron* 'My experience with seedlings grown from self-pollination has been rather unfavourable, the plants having shown a marked lack of vigour'.

Members of sect. *Vireya* are found over a wide range of altitudes (Sleumer, 1966; Stevens, 1976): *R.brookeanum* down to sea-level in Borneo (Swisher, 1979); *R.intranervatum* at c.1000m in Borneo; *R.stenophyllum* at c.2000m in Borneo; *R.yelliottii* up to c.3000m in New Guinea, and at higher altitude again *R.commonae* up to 4000m and *R.saxifragoides* at c.4000m. My largest plant of *R.saxifragoides* is over 10 years old but has never flowered; however in a batch of *R.saxifragoides* seed collected by P. Kores on Mt. Siluwe at 4000m, which I received in 1976, there appeared a rogue seedling which is now 50cm tall compared to its siblings which are 5cm tall. This apparent hybrid produces a single red flower at irregular intervals. For all this wide range of altitudes

above sea-level, I have found no barriers to compatibility associated with species from different altitudes.

Similarly the tropical members of sect. *Vireya* cover a wide region; from the Philippines in the north to Queensland in the south, to Sumatra in the west and the Solomon Islands in the east where *R.loranthiflorum* is found at c.1000m; but again, I have found no barriers to compatibility associated with species from well separated tropical localities.

The style lengths in sect. *Vireya* vary over a wide range, with two extremes being *R.anagalliflorum* (4mm) and *R.leucogigas* (100mm). It is possible that pollen from a species with a very short style produces tubes which are unable to grow the full length of the very long style. This is still under investigation.



*R.quadrasianum* var.*rosmarinifolium* is very difficult to emasculate without it being selfed. Well before the flower opens, the stigma is receptive, the anthers have dehisced and pollination has occurred. Because of this, I have to date been unable to make satisfactory hybrids using this *Rhododendron* as the seed parent.

I have obtained no seed from *R.kawakamii* var.*flaviflorum* in pollinations where it is the seed parent except when it is selfed. (Note added in proof - More recently, viable seed has been obtained from the cross *R.kawakamii* var.*flaviflorum* x *R.santapaui* made both ways.) Part of the reason for this appears to be the rapid abscission of the pistil at the base of the pedicel. If unpollinated, this occurs in about 18 days after the stigma has become receptive, if pollinated by another species in sect. *Vireya*, abscission occurs within 18-24 days. In particular, the pollination *R.kawakamii* var.*flaviflorum* x *R.santapaui* using pollen supplied by L. A. Craven and R. M. Withers resulted in abscission of the pistils within 3 weeks. Mostly, these results were obtained using a plant of *R.kawakamii* var.*flaviflorum* grafted on to R.'Fragrantissimum', though occasionally one grafted onto a sect. *Vireya* hybrid was used. The former plant is larger, more vigorous and more floriferous than the latter. The

success of this graft is unusual; I have made other sect. *Vireya* grafts on to R.'Fragrantissimum', but all have developed incompatibilities resulting in death within a year.

Examples of pollinations within sect. *Vireya* that I have made include: *R.santapaui* x *R.kawakamii* var.*flaviflorum*; *R.santapaui* x *R.quadrasianum* var.*rosmarinifolium*; and *R.santapaui* x *R.lochiae;* these three pollinations were made earlier this year on a plant belonging to R. M. Withers, but the pistils abscised before the seed matured. In the case of *R.retusum* x *R.kawakamii* var.*flaviflorum* seed was obtained but it contained no embryos, while *R.retusum* x *R.javanicum* and (*R.laetum* x *R.aurigeranum*) x *R.retusum* seedlings were obtained but their hybridity is as yet unconfirmed. If unpollinated, the pistils of *R.retusum* abscise in about 30 days; if pollinated with sect. *Vireya* pollen, or many other *Rhododendron* pollen, there is no abscission, the capsule develops and seed is obtained, though it may not contain embryos. Thus, in this respect, the behaviour of *R.retusum* is just the opposite to that of *R.kawakamii* var.*flaviflorum*.



Fig.3 shows, in an idealized fashion, how temperature and humidity vary with altitude in New Guinea. The temperature is based on a lapse rate of 5.5°C per 1000m and the data incorporates climatic conditions measured at a number of weather stations (McAlpine *et al.*, 1975; McAlpine, 1970), temporary observation points (Hope *et al.*, 1976) and information supplied by the Commonwealth Bureau of Meteorology. I have included it here, as it serves as a guide, not only to the conditions Vireyas receive in the wild, but also as an aid in determining conditions suitable for their propagation. In addition, in New Guinea the day length is constant at about 12 hours and the annual rainfall lies in the range 1500 to 6000mm.

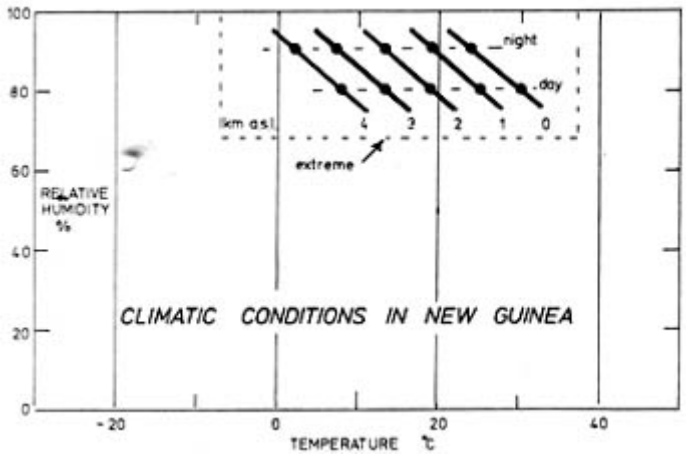


Fig.3. Variations of temperature and relative humidity with altitude in New Guinea. The solid circles represent mean maximum day temperature or the mean minimum night temperature. The solid lines represent normal variation. In any given region, the microclimate may differ considerably from this idealized chart.



## THE PRODUCTION OF SEED

In *Rhododendron*, pollen grains adhere together in fours to form a pollen tetrad with a size of about 100µm. These tetrads, characteristic of the Ericaceae (Knox, 1979), are joined together by a fine thread which helps to bind them to the surfaces of pollinators and the stigma. Stained, normal pollen tetrads of *R.macgregoriae* are shown in Fig.4A. When making a pollination, the required pollen is frequently not available fresh when the stigma becomes receptive, so pollen needs to be collected in advance, free from contamination, and stored until required. Following the procedure of Mayer (1976), I dry the pollen over calcium chloride at +4°C for two days, then transfer the pollen still over the desiccant to -20°C. In this store, sect. *Vireya* pollen retains its viability for at least a year if it is collected fresh to start with. I find that difficulties arise in getting the fresh pollen into the -20° store. As suggested by the climate of New Guinea, fresh pollen will remain viable for some days if kept at 15° - 25°C and in an atmosphere with relative humidity greater than about 70%. Drying the pollen at +20°C over calcium chloride destroys it rapidly. It is possible that some of the difficulty of storage entry is that the pollen has started to germinate prior to storage. Fig.4B shows a tetrad of non-viable pollen of *R.ellipticum* (subgen. *Azaleastrum*) taken from the -

20°C store with what appear to be pollen tubes emerging from three of the grains.

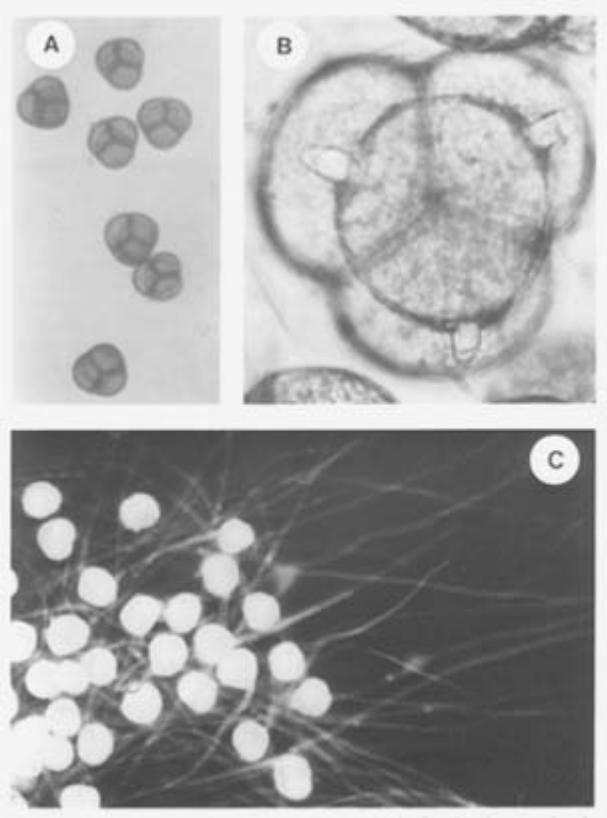


Fig.4. A, *R.macgregoriae*, stained normal pollen tetrads; the fine threads connecting the tetrads are not visible in the photograph.
B, *R.ellipticum*, a non-viable pollen tetrad taken from the -20°C store. The pollen appears to have started germinating as three pollen tubes are visible.
C, *R.arboreum*, pollen germinating on an agarose coated slide.

The most reliable though not necessarily the most convenient test for pollen viability is to place some on an otherwise unpollinated, compatible, receptive stigma. The pollen can however be germinated *in vitro* using 10% sucrose solution in a hanging drop or agarose coated on a slide. Both these techniques provide the pollen with plenty of air which is a requirement for germination. Fig. 4C, produced by E. Williams, shows *R.arboreum* (subgen. *Hymenanthes*) pollen germinated on an agarose coated slide and using two fluorescent stains with ultraviolet microscopy.

In preparing the stigma for pollination, the chief requirement is to keep unwanted pollen from contaminating it. Usually this requires each of the flowers to be emasculated prior to them opening and then enclosing them in a bag. The pollination is then made when the stigma is receptive and the bag is retained for at least a further two weeks. When I have left the stigma unpollinated, no seed has been obtained, suggesting that apomixis does not occur within sect. *Vireya*, a conclusion in agreement with Kehr (1972) who considers apomixis does not occur within the genus. The time taken from pollination for the seed to ripen is 2 to 6 months. In general, the shorter time applies when the capsule is small and the longer time when it is large. High ambient temperatures decrease the ripening time. For comparison, the ripening time for *R.dalhousiae* is 10 months and for *R.ellipticum* 9 months.

The life-time of sect. *Vireya* seed is short so that it is preferable to collect the seed as soon as it is ripe. This occurs as the capsule starts to split open at the top. I slice the capsule longitudinally along its five fracture lines, thus separating the valves, then dry for 24 hours at room temperature and extract the dry fresh seed free of chaff. Early harvesting of *Rhododendron* seed from unripe capsules has been described by Bohnson (1976). If this technique is applicable to sect. *Vireya*, it may result in seed with a longer storage life.



## SEED MORPHOLOGY STORAGE & GERMINATION

It is of interest to examine sect. *Vireya* seed since part of the key to subgenera and sections of *Rhododendron* in Sleumer (1978) reads for sect. *Vireya* 'Seeds with more or less elongate, generally tail-like appendages at both ends'; and in the drawings of *Rhododendron* seed by Hedegaard (1980), the only sect. *Vireya* seed illustrated is that of *R.lochiae*. *R.malayanum* seed, Fig. 5A, has two well-defined tails 2-3 times as long as the seed proper. These tails are characteristic of all sect. *Vireya* seed that I have examined other than seed from subsect. *Pseudovireya* where the tails are more variable. *R.santapaui* seed (Fig. 5B) and *R.vaccinioides* seed (Fig. 5C) both have very long, thin tails, in particular the overall length of *R.santapaui* seed ranges from 10 to 18mm. On the other hand, seed of *R.kawakamii* var.*flaviflorum* (Fig. 5D), *R.retusum* (Fig. 5E), *R.quadrasianum*

var.*rosmarinifolium* and *R.perakense* have very short tails, which in the case of *R.retusum* amount to little more than two 'tufts' not dissimilar to those in *R.wrayi* (subgen. *Hymenanthes*, Fig. 5F) or the seed of *R.nipponicum* (subgen. *Pentanthera*) as illustrated by Hedegaard (1980).

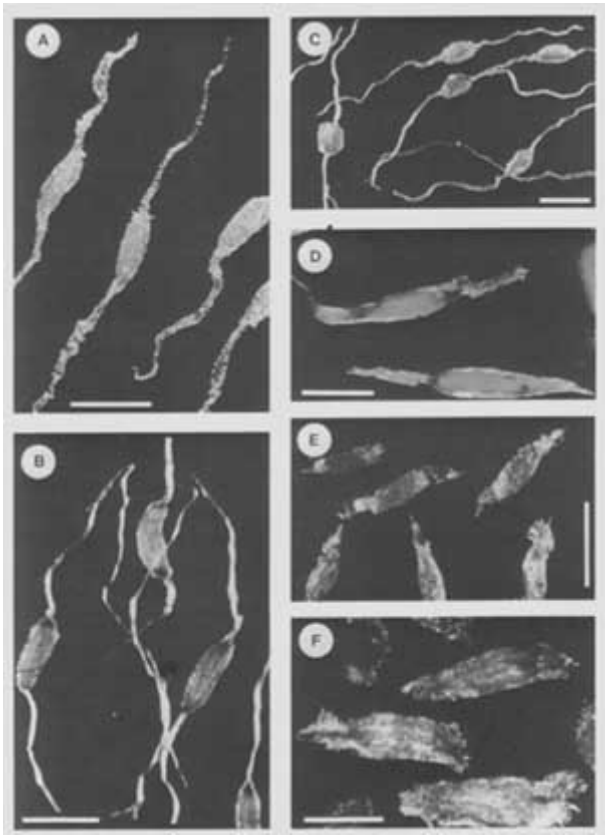


Fig.5. *Rhododendron* seeds: A, *R.malayanum*; B, *R.santapaui*; C, *R.vaccinioides*; D, *R.kawakamii* var.*flaviflorum*; E, *R.retusum*; F, *R.wrayi* (subgen. *Hymenanthes*)

Under normal circumstances, sect. *Vireya* seed is characteristically short-lived compared to other *Rhododendron* seed. In Table 1, the result of measurements made on longevity of sect. *Maddenia* seed and sect. *Vireya* seed are tabulated for both normal and storage conditions and with the seed freshly harvested. Here, the seed in the -20°C store has been kept in the +4° store for a few days before being transferred.

TABLE 1

Seed Longevity

| Storage conditions | | Life-time | |
|---|---|---|---|
| Room Temp °C | Room Humidity % | Maddenia | Vireya |
| 30 | 80 | | 2-3 weeks |
| 20 | 80 | | 6-8 weeks |
| 20 | 50 | 1 year | 8-10 weeks |
| 20 | over Cal.Chlo | 3-5 years | 4-6 months |
| 4 | over Cal.Chlo | | 1-2 years |
| -20 | over Cal.Chlo | 10 years | 3-5 years |

Seed Tested
Maddenia: *R.maddenii; R.nuttallii; R.dalhousiae; R.lindleyi*
Vireya: *R.javanicum; R.laetum; R.lochiae*,
and for temperatures of 4° and less in addition
*R.konori; R.aurigeranum; R.malayanum*



The requirements for the germination of sect. *Vireya* seed are as follows: (a) The temperature should be in the range 15° - 30°C, though occasional extremes of 10° and 35° produce no harmful effects.

(b) The relative humidity should be above 90% and there must be adequate water for imbibition.

(c) In general, air is required for seed germination (Mayer & Poljakoft-Mayber, 1975) but sect. *Vireya* seed requirements are low as I found when I sowed *R.konori* x *R.javanicum* seed in distilled water that had been boiled to remove air. The seed germinated after 3 weeks and the seedlings appeared to develop satisfactorily under water for a further 3 weeks.

(d) Radiation as light is essential for germination of sect. *Vireya* seed and possibly *Rhododendron* seed in general. Low levels of light result in a poor percentage germination of seed and seedlings with small etiolated cotyledons and elongated hypcotyls. I find high light levels also result in a low percentage germination of seed, but this may be due to the lighting producing abnormally high temperatures. The light I use is a mixture from fluorescent tubes and

tungsten globes together with sunlight incident through translucent plastic. For *R.konori, R.javanicum* and *R.lochiae,* I found the optimum illumination to lie in the range 2klux to 8klux and the germination decreased to 10% of the optimum at 20klux and 30klux. Currently, I use a standard illumination of about 4klux for the germination of all *Rhododendron* seed and for the subsequent development of small seedlings.

It is convenient but unessential to dry sect. *Vireya* seed before sowing, and no special treatment, such as stratification, is either necessary or beneficial. The requirements of the germinating medium are that it does not possess inhibitors and retains water. Peatmoss, finely ground, partially decayed pine bark and filter paper are all equally satisfactory though the first two are preferable for growing on the seedlings. Care must be taken with pine bark since when fresh it may contain phytotoxic components (Yazaki & Nikols, 1978). The method which I use for germinating seed is essentially that of Valder (1971).



The germination process is illustrated in the following figures, which show seed of *R.konori* (New Guinea form) germinating. Fig.6A shows the seed 17 days after sowing with the radicle just emerging. Fig.6B shows the seed 21 days after sowing with one of the seedlings completely removed from the seed coat but with the cotyledons still together. By 34 days after sowing, the seedlings are as shown in Fig.6C with full size cotyledons. Fig.6D shows how after 58 days from sowing the first foliage leaf has appeared with juvenile scales round its edge and a root has developed. Little further development of the seedling occurs without the presence of fertilizer, and Fig.6E shows a seedling 207 days after sowing with no fertilizer, just water, light and air. The first foliage leaves have developed but not to their normal size, and the scales have matured and become coloured. In general, for sect. *Vireya* seed, the time taken for the cotyledons to appear is 3 +/- 1 week after sowing, but occasionally it takes as long as 5-6 weeks. Once the cotyledons appear, the seedlings should be ventilated to reduce the relative humidity.

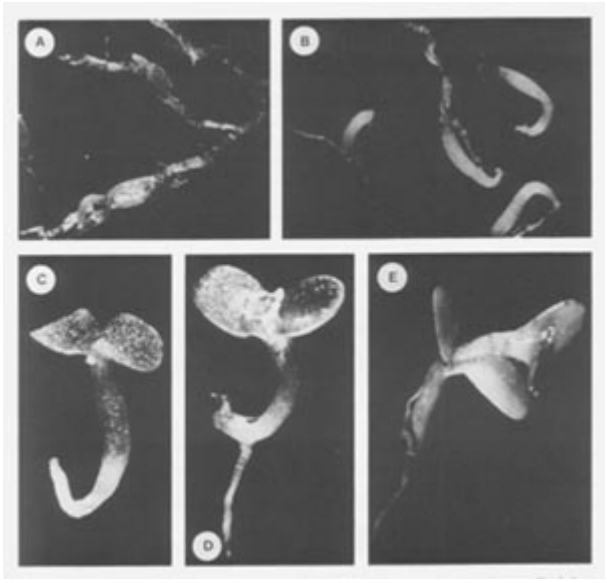

Fig.6. *R.konori*, germinating seed and seedlings:
A, 17 days after sowing, radical just emerging; B, 21 days, one seedling is completely detached from the seed coat but its cotyledons remained joined; C, 34 days, seedling with fully developed cotyledons; D, 58 days, the first foliage leaf is visible with juvenile scales on the rim, and a root has developed; E, 207 days, unfertilized seedling - this represents the limit of development without fertilizer.



If given adequate light, the length of sect. *Vireya* cotyledons is usually in the range 1 +/- 0.5mm with the width 70% of the length. Both surfaces are glabrous and the venation when I have been able to see it, is as Philipson (1978) says '... simple mid-rib without lateral venation'.

The chief difficulty which can arise during seed germination is the development of fungi, and to a lesser extent algae. Control measures are: (i) Harvest the seed correctly so that it contains little chaff. (ii) Sterilize the containers and substrate and use boiled or distilled water. (iii) Water the seed in with a fungicide such as Thiram or Captan. Even at half strength, these fungicides tend to increase the germination time and decrease the percentage germination, but it is preferable to control fungal growth with fungicide rather than by decreasing the relative humidity of the air. Some seed (e.g. *R.konori*) seems to be particularly sensitive to these fungicides and in

such cases it may be preferable to surface sterilize the seed in 70% ethanol prior to sowing it without a fungicide present.

## SEEDLING DEVELOPMENT

Once the seedlings are ventilated, I aim to keep them developing as rapidly as possible, not just because it results in a plant of flowering size sooner, but also because rapidly growing plants are healthier and less prone to succumb to disease. After ventilation, I water the seedlings weekly with 10% normal strength liquid fertilizer containing macro- and micronutrients with additional chelate of iron at 0.1g/l and a surfactant. The surfactant improves the wetting, water retention and drainage of the peatmoss but needs to be chosen with care since some surfactants are phytotoxic to small seedlings (Bunt, 1976).

Usually the first foliage leaves appear 3-8 weeks after sowing and develop to become larger than the cotyledons. From their first appearance they have transparent juvenile scales (Seithe, 1978) round the edge of the blade with an occasional scale more central on the upper surface. Scales also occur on the epicotyl. The scales mature and develop colour between 7 and 20 weeks after sowing the seed. Fig.7A shows a seedling of (*R.intranervatum* x *R.*'Souvenir de J. H. Mangles') selfed, 33 days after sowing. It is a typical sect. *Vireya* seedling with cotyledons 1.5mm long. It has no simple hairs on either side of the first foliage leaf or the epicotyl, both of which are characteristic of all sect. *Vireya* seedlings which I have examined. By comparison *R.dalhousiae* (sect. *Rhododendron*) which has characteristic juvenile scales on the first foliage leaf and the epicotyl, also frequently has simple hairs on one or the other or both as shown in Fig.7C. Fig.7B shows a seedling of *R.kawakamii* var.*flaviflorum*, 37 days after sowing, with cotyledons 1.2mm long. Again it is a typical sect. *Vireya* seedling. The *R.saxifragoides* seedling shown in Fig.7E, 57 days after sowing, has cotyledons only 0.6mm long while the seedling of *R.quadrasianum* var.*rosmarinifolium* (Fig.7D), 126 days after sowing, has relatively fewer and smaller scales on the margins of the first foliage leaves. Both these two seedlings are initially slow to develop. With sect. *Vireya* seedlings, the first root usually appears within 6 weeks of sowing and by 12 weeks there are frequently up to 10 root branches.

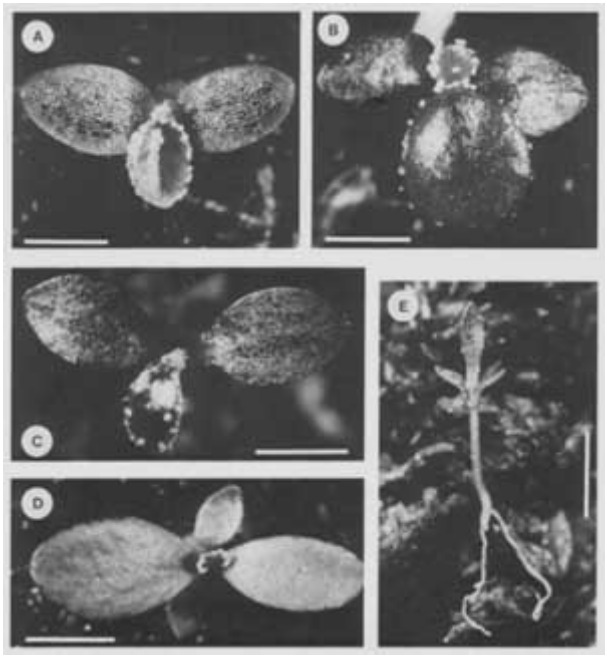

Fig.7. *Rhododendron* seedlings: A, (*R.intranervatum* x R.'Souvenir de J.H.Mangles') selfed, 33 days after sowing, showing juvenile scales on first foliage leaf; B, *R.kawakamii* var.*flaviflorum*, 37 days after sowing; C, *R.dalhousiae*, 43 days after sowing, showing juvenile scales and simple hairs on first foliage leaf; D, *R.quadrasianum* var.*rosmarinifolium*, 126 days after sowing; E, *R.saxifragoides*, 57 days after sowing.



During seedling development, environmental conditions are most important and are conveniently provided in a growth chamber. My chamber is solar assisted and uses a mixture of sunlight and artificial light. To ensure a high humidity, the seed is germinated in containers covered with glass, which is removed once the seed has germinated and the seedlings require ventilation. I will not discuss the particular design of this chamber since it is suitable only for regions having a climate like that of Melbourne, but just list some of the important points:

(i) Temperature: by day 20-30°C, by night 10-20°C.

(ii) Relative humidity: 80-95%.

(iii) Misting: this appears to be beneficial if given for 10 seconds once or twice per day in hot weather.

(iv) Ventilation and stirring: The air in the chamber must be circulated with some throughput of air from outside.
(v) Insecticide: a dichlorvos fumigant strip in the incoming air supply prevents contamination by small insects which can penetrate fly wire.
(vi) Light: a day length of 15h and an illumination of 2-10klux by day is satisfactory.

Provided the seedling leaves are dry by nightfall, then under the above conditions I very seldom find it necessary to use a fungicide within the chamber, except for the germination of seed.

I prick the seedlings out between 20 and 30 weeks after sowing when they are about 1cm tall. The compost used is 50:50 by vol. peatmoss and pelleted styrene foam to which has been added a base fertilizer which at full strength consists of 3g John Innes base fertilizer (hoof and horn 2 parts, potassium sulphate 1 part, superphosphate 2 parts by weight), 6g gypsum and 1.5g dolomite lime, all per litre of compost, with calcium carbonate lime added if required to bring the pH up to 5 (see Rouse, 1978, 1979). For tender seedlings, or when being cautious, I use the base fertilizer at half strength. The addition of gypsum to the case fertilizer (Kehr, 1972) not only improves the drainage and aeration of the substrate and possibly the resistance of seedlings to some pathogenic root-infecting fungi, but adds calcium to the medium without changing the pH. This added calcium appears to improve the health and vigour of small seedlings as well as larger plants of *Rhododendron* as reported by Ticknor & Long (1978) and Wookey (1980) for sect. *Vireya*. These authors showed that the leaves of healthy plants contain about 1% dry weight as calcium. For details of such artificial, loamless peat-lite composts, see Bunt (1976). I continue to give the pricked-out seedlings a weekly watering with liquid fertilizer with the same formulation as for the newly ventilated seedlings. After some 9 months, when the seedlings are about 15cm tall, I transfer them from the growth chamber into a glasshouse.

As an example of seedling development, I sowed seed of *R.lochiae* in June 1978 and kept records of its development. This seed was collected at 1100m

on Mt. Finnigan, North Queensland, by D. Teese 2 weeks earlier. Fig.8 shows how the height (h) of the seedlings increased with time (t) under my standard conditions. The seedlings were all ventilated 6 weeks after sowing. A total of nearly 120 seedlings was involved in the measurements. It can be seen that there is little advantage in pricking out the seedlings early. As a measure of seedling vigour (V), I use dh/dt in mm week-1 which in this example is 4.5. Small sect. *Vireya* seedlings after pricking out usually have V in the range 2-5mm week-1, which is rather less than the growth rate of many non-*Vireya* seedlings. The above measure of vigour is satisfactory for most sect. *Vireya* seedlings because they do not normally branch until at least 10cm tall. Exceptions are *R.perakense* whose seedlings commence branching when about 1.5cm tall and *R.quadrasianum* var.*rosmarinifolium* where branching commences at about 3cm.



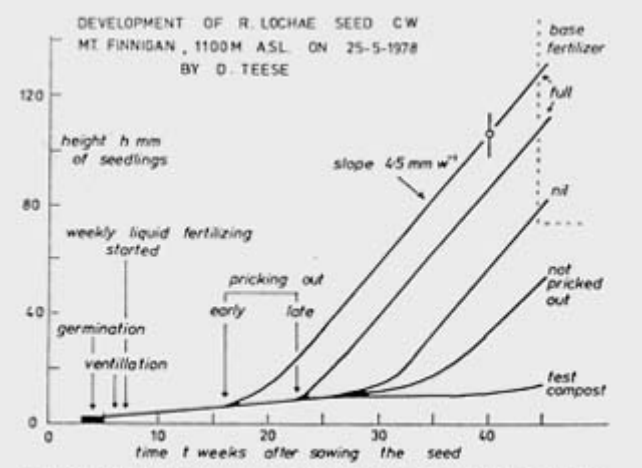


Fig. 8. Germination of *R. lochae* seed and initial seedling development with various fertilizer regimes.

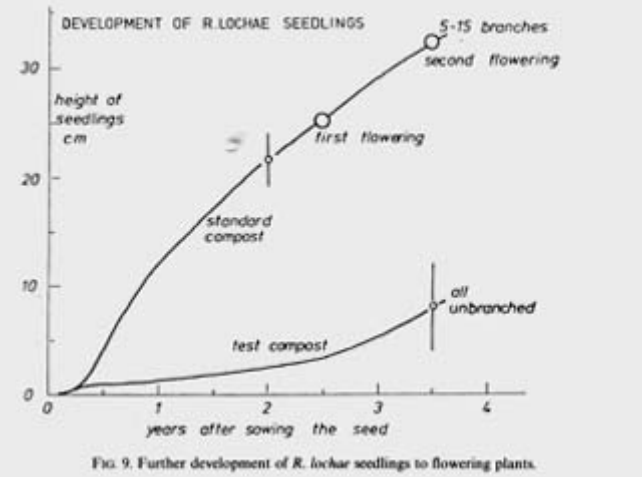


Fig. 9. Further development of *R. lochae* seedlings to flowering plants.

On occasions, small sect. *Vireya* seedlings <30mm high lose their vigour completely. They look healthy but cease to grow and this may continue for some years, a phenomenon not observed with any other *Rhododendron* seedlings. I have tried to induce this stagnation in growth by removing some requirement - light, fertilizer, warmth, water and low compost pH. Although temporarily set back, provided the seedlings survive this treatment, on being returned to normal conditions their vigour also returns rapidly to normal. It would appear that stagnation is produced not by a lack of some requirement but by the presence of some form of growth retardant. This is illustrated in Fig.8 where 9 seedlings were pricked out into a compost under test. It contained normal amounts of fertilizer and its pH was about 5 but, as can be seen, after 45 weeks, the vigour of the seedlings was only 0.5mm week-1.



The continued development of *R.lochiae* seedlings is shown in Fig.9. The upper curve represents the 4 or 5 plants which continued to be given optimum treatment, 3 of which flowered after 2 1/2 years from seed, and the lower curve the 9 seedlings which stagnated and remained unbranched, with a mean height of 10cm after 3 1/2 years.

## CONCLUSIONS

Current observations support the following general conclusions: *Vireya* species are self-compatible, and within *Vireya* there are no barriers to compatibility if temperate species in subsect. *Pseudovireya* are excluded; apomixis does not occur within *Vireya*; vireya pollen can be stored for at least a year and can be germinated in vitro; vireya seed can be stored for 3 to 5 years; light is essential for the germination of vireya seed; the first true leaves of *Vireya* seedlings have juvenile scales and no hairs.

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