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VIRUS DISEASES OF PRIMROSES*

R. M. Bond

Regional Biologist, Soil Conservation Service, Portland, Oregon

Among the most bothersome troubles of Primroses are virus diseases, yet very little has been written about them. The books on Primroses, whether written in this country or in England, ordinarily do not mention virus, yet informants tell me it is common in Great Britain, too. Many of the gardens I have seen in the Northwest show at least a few examples. An occasional garden is riddled with it, nearly every Primula being infected. As will be seen, however, for most people who grow Primroses, virus disease is rather a nuisance than a menace. You can control it, or you can stick to some of the kinds of Primroses that are little harmed by it, or you can even start all over without much loss of time or money.

On the dark side are (1) the danger of losing special strains that must be propagated vegetatively, (2) the danger to the reputation of a commercial grower if he should inadvertently distribute diseased plants, (3) the loss of "key" ornamental plants that leave an unsightly space until they are replaced, and (4) the damage to one's pride caused by ratty-looking plants in what should be a vigorous, healthy garden.

Viruses are often considered sub-microscopic organisms, smaller than bacteria. Some of them cause important diseases of both animals and plants. Some of the well known virus diseases are smallpox, measles, curly-top of beets, tobacco mosaic tomato yellows, western x-disease of peaches, etc. The same virus may attack several different plants, sometimes producing quite different symptoms, and the same plant may be susceptible to several viruses, and even have several at the same time. Or a virus may grow in a "carrier" plant species or variety without apparently affecting it at all.

Apparently the commonest virus disease of outdoor Primroses in the Northwest is Western Cucumber Mosaic, though Alfalfa Mosaic may well be important also. Importation of all species of Primula from the British Isles or Australia is prohibited because of the presence of Tobacco Necrosis Virus there. Greenhouse grown P. obconica and P. malacoides are subject to Primrose Mosaic, but this has not been found in outdoor varieties. Primulas are also known to be susceptible to Tomato Spotted Wilt, Sugar Beet Curly Top, and Aster Yellows, but at present it does not seem likely that any of these is of much practical importance to Primrose growers. It is notable that all but one of the

*I want to acknowledge assistance from Dr. Philip Briely, Senior Pathologist, Bureau of Entomology and Plant Quarantine, and particularly from Dr. F. P. McWhorter, Research Pathologist, Agricultural Experiment Station, Corvallis, Oregon.
virus diseases found so far in Primroses are found also in other plants. This means that if all the virus diseased Primroses in the world were destroyed, there would soon be new infections unless a considerable number of other kinds of plants were subjected to the same treatment at the same time. It also means that we have been growing Primroses successfully for years with just as much danger of virus disease as we have now or are ever likely to have in the future.

The usual way for plant viruses to spread is by means of sucking insects such as leaf hoppers and aphids. They become infected by feeding on a diseased plant, then move to a healthy one and infect it with the virus. Not all kinds of sucking insects can spread all kinds of viruses even though they feed on diseased plants, and of course insects that could spread a virus are not necessarily infected with it. Although it has been possible to cure a few plant virus diseases, we must conclude that at least for the present, there is no practical cure for Primroses, and that a Primula once infected by a virus is permanently diseased in all its parts.

A few viruses may be passed on through the seed, so that the seedlings sprout already infected. Unfortunately, this appears to be the case with Western Cucumber Mosaic in Primroses, and seed from diseased plants is perhaps the most likely way for this virus to get into your garden. At least one virus is known to be passed to the next generation by pollen, but whether or not this occurs in Primroses appears to be not yet known. Most species and varieties of Primroses that have been grown in quantity have been found susceptible to virus disease. If any Primrose ever turns up which is “immune,” the chances are good that it may actually be able to get the disease without showing symptoms—in other words, be a possible carrier. This seems to be the case with at least some strains of Polyantha, in which the symptoms may be scarcely recognizable.

Primroses differ in susceptibility to attack by virus according to variety, and age. P. japonica and the Bartley strain of P. pulverulenta seem to suffer as frequently as any kinds, and perhaps the garden Auricula is least often affected, though this may be an example of suppressed symptoms as in Polyanthas rather than real resistance.

Young seedlings of most plants are much more susceptible to virus diseases than older plants. The fact that seedling Primroses from clean seed are seldom found infected is probably because they are usually grown under conditions protecting them from aphids.

The most nearly universal symptoms of virus in Primulas is leaf distortion. The amount and kind varies with the species. In the section including Polyantha, Acaulis, and Juliae the leaves are irregularly misshapen, more wrinkled than usual, occasionally creased, and often undersized. In the candelabras, in addition to dwarfing, the leaf edges may be shorter than the midrib, and one edge is usually shorter than the other. This results in the leaf's never flattening out, and the midrib's being curved down and to one side. Another candelabra symptom is for the leaf to "fall to fill in" between the points on the margins, the result being a narrow leaf with extra long points. In severe cases there may be so little leaf tissue that there is not enough pull on the midrib to deform it as described above. In Auriculas, the leaf deformation is less easily seen, though the leaves may be asymmetrical.

Flower distortion, in the kinds in which I have noted it, consists in the florets being smaller, the petals narrower, the notch at the ends of the petals deeper, and in a tendency for one or more of the individual petals of a floret to lie in a different plane from the others, or make a different angle with the central axis of the floret.

Flower color-breaks have been noted in Bullesiana hybrids, in P. japonica, P. pulverulenta, and in Auriculas. The color may be streaked or blotched (sometimes with minute flecks of off-color), or flowers may be irregularly darker or paler toward the margins. In Auriculas streaking may be very marked.

Leaf blotching in the soft leaved Primulas may be well marked, but the blotches are usually only a little lighter than the ground color, and seldom yellow or white. In Auriculas, yellowish streaks may follow the main veins of the leaves. Except for the irregularity of leaf and flower color, which in many diseased plants with virus never appear, all these symptoms can be almost exactly duplicated by causes other than virus. The commonest cause of leaf distortion is attack by aphids which, of course, may be infecting the plant at the same time. Winter injury will sometimes deform early leaves in much the same way. It is only if these causes can be excluded that leaf distortion by itself should be considered a proof of virus infection. Lack of water at a critical period can deform flowers, and this possibility should be considered, especially in plants that have been transplanted in bud.

Since it appears that all the viruses to which outdoor Primroses are subject are spread by sucking insects, and since Western Cucumber Mosaic (and quite possibly others) is spread by infected seed, the following steps should be taken to minimize virus troubles of Primroses:

1. Select seed (and pollen) only from perfectly healthy plants which show no symptoms that might be due to virus. If you have seed of which you are at all suspicious, don't start it near your other Primulas, and use special care to keep the seedlings free of pests. If virus is present, it should show up in the seedlings by the time they have five or six leaves.

2. Species and varieties that come true from seed should be frequently replaced. Always have a new crop of seedlings, from healthy parents, coming along. Old Polyantha clumps are often infected without showing much evidence of disease, and should be frequently replaced even if they look healthy.

3. Primroses that must be increased by divisions or cuttings should be grown in two or more well separated beds. Because of the way aphids spread, virus sometimes hits every plant on an area of several square yards, and a whole variety can be lost where all the plants are grown together.

4. By regular and frequent spraying, dusting, picking and baiting keep your Primroses as free from insect pests as is humanly possible. Slugs and snails should also be guarded against.

5. Do not grow Primroses, especially seedlings, within at least 100 feet of cucumbers, or on land where alfalfa has recently been grown.
6. Dig and burn all plants with definite symptoms of virus. If you have good reason to think that symptoms may have been caused by winter injury or aphids, spray thoroughly, give the plant good care, and watch while two or three new leaves develop. If the new leaves appear perfectly normal, the plant may be taken off the suspected list. But do not wait too long—you may be keeping a source of infection.

7. A plant or seed to which any suspicion of virus attaches should never be sold or given away, unless perhaps the receiver wants it for some special purpose, and is fully informed of the dangers involved.

8. Virus symptoms should disqualify any plant from competition, no matter how perfect the flowers may be.

It seems to me that we are prone to make trouble for ourselves when we consider the sowing of Primula seed. We can fuss around, trying to insure all the perfect conditions, treating seeds and flats in special ways, worrying about the proper soil, and after all this stewing we are forced to observe that another gardener who merely throws his seed out on a piece of plowed-up ground gets approximately the same—or, in many cases—better results. Proper conditions, seed and flat treatment, and proper soil are all fine and should be undertaken, but not to the point of making a ritual out of them; rather they should only be done in advisable cases.

A seed is merely an egg, and similar in construction to a hen's egg. It has its embryo, (yolk), endosperm, (white), to furnish food for the embryo until it can manufacture its own, and the seed coat, (shell). Under the proper conditions of warmth, etc., the yolk of a fertile egg will develop into a chick; similarly when the embryo of a seed receives the proper moisture and air, at the proper temperature, it will germinate into a plant. The sole purpose of any treatment is to insure that the embryo and young plant receive these proper conditions.

We don't often stop to think that the only reason for covering seed is to insure a constant moisture supply to the embryo. The limiting factor then, as to the proper depth to plant a seed is that the seed should not be planted so deep that it does not receive the proper supply of air. This proper depth of planting cannot be stated accurately for it will depend entirely on the type of covering used. The rule of thumb of a planting depth of three times the diameter of the seed is good, although it can be exceeded many times if a material that will not shut off the air supply, such as sand or peat moss, is used.

Keeping the factor of an adequate moisture supply in mind, we can see that it is not absolutely necessary to cover seed at all if they can be kept moist, and with finer sorts such as P. floribunda, it is preferable not to cover with soil since we will have a hard time in keeping from burying them too deep, and thus cutting off air supply. In these cases it is best to merely press the seed into the damp surface of the flat or pot, and cover them with paper or cloth, laid on the surface of the seed bed. This covering serves two purposes; it will aid in keeping the moisture supply constant, and will further tend to prevent "washing out" of the seeds when watering, or from the drip of condensation of a cover glass. This covering should, of course, be removed when the seeds commence to germinate.

In Primulas we are plagued with two difficult types of seeds. Nature provides all seeds with a coat of thick, so-called "cutinized," or horny cells. This is our seed coat, and is provided to prevent the embryo and endosperm from drying out, and to prevent mechanical damage to the seed. In our first difficult group of seed nature provides an extra heavy coat; a good, and larger example of this type of coat is found in the Lupins. If this type of seed is planted immediately upon ripening, germination is effected rather easily, but if this coat is allowed to harden it will take a protracted period under ordinary conditions of soil mois-
ture before the seed coat will soften sufficiently to admit moisture and air to the embryo. By using any of several means we can shorten up this softening up period. The two best that I know of are eroding the seed coat by soaking in full strength sulphuric acid, (adequate caution should be used in handling this material), for a period of 15-30 minutes; or softening the seed coat by pouring boiling water over the seed and letting them stand for 24 hours. My experience has been that treating the flat with water at 110 degrees as is sometimes advocated does not significantly shorten germination time, probably because it does not soften the seed coat a great deal.*

The second difficult groups of seeds are those that require a definite rest period after ripening in order that chemical changes may occur in the endosperm. It is this group of seeds which generally do not germinate until the second year after planting. It has been proven that in many cases, this chemical change may be accelerated, and the resting period broken, if the seeds are stored at low temperatures, (33-45 deg.F) for a period of from 1-4 months. Thus while freezing seeds for short periods is beneficial, it is my experience that in this type of seed prolonged storage, (2-4 weeks) in the freezing compartment of a refrigerator is better.

We can see by the above that there is good scientific evidence that the man who merely throws his seed out on a piece of tilled land may have something. While it is difficult to set up a controlled experiment and thus gain statistical evidence, my experience has been that in the Puget Sound country the optimum germination of most seed can be obtained by sowing them in flats out of doors from the middle of October to the first of January. This method will secure long contact with soil moisture so that when spring and warmth arrive the seed coat is softened and admits moisture and air; furthermore it will secure prolonged storage at cold temperatures to aid in enzymatic changes. Since it is not possible to lay down any hard or fast rule as to whether a certain seed is one that requires a resting period, has a hard coat, or both, or will, like Topsy, just grow, I would recommend to anyone faced with a new type of seed, or where fall sowing is not possible, that they try the above methods or a combination of them, dividing the seed into groups. One or more of these methods should work, whereas using a single method is liable to produce poor results.

Within certain limits as to acidity-alkilinity, (Ph 5-7), I have found that most any good friable soil containing plenty of humus will do for starting Primula seed. Optimum conditions would probably be a soil slightly on the heavy side, with a Ph of 6. My favorite soil is a mixture of compost, peat moss, and top soil, in equal parts, passed through a ¼” screen. When I cover the seed I use the same material, or peat moss, dusted over the seed with a flour sifter, and pressed down firmly. All soil used in seeding should, of course, be sterilized if the best results are to be obtained. Probably the easiest method of doing this is to place a pot full of the soil up to its rim in water and boiling for 15-20 minutes. This will kill most of the seeds and harmful organisms found in the soil.

While soil sterilization will be helpful in eliminating damp-off, it will do nothing to prevent another great enemy of the grower of Primula seed, the common bread mold. The formation of this mold on the coating of the seed must be prevented, and several chemicals such as cuprous oxide, Semesan, Arasan*, and Fermate have been developed that will inhibit both the development of this evil, and of damp-off.

All of these materials have had more or less serious drawbacks for me, and I could not write on this subject without touching on a new chemical for which I have great enthusiasm, and which seems to me to have a great deal to offer the gardener. This material, called Carco-X, is a direct development from the British “tar washes,” and contains hexachlorocyclohexane. Applied in the strength of 1/200 to seed flats after the seeds are sown it will inhibit the growth of both mold and damp-off. (I have never observed either on a treated flat.) Applied in the same strength around growing plants it will apparently keep off both slugs and cut worms, and such soil treatment is seemingly a preventative against organisms feeding on roots such as nematodes, wire worms, and strawberry weevil. I have no interest in selling this product, but I certainly recommend it to all Primula growers, for it has worked marvelously for me the last two years.

It does not seem to me that a great deal need be said about prickling out seedlings, for this is an ordinary garden procedure. It can, of course, be done at anytime after one or more pairs of true leaves have formed. That is convenient to the gardener. I have found it best to use a mixture of Transplantone and a plant food such as Plant-Chem or HyponeX as a watering solution when transplanting. These will materially decrease shock, besides getting the young plants off to a more rapid start. On extremely sensitive seedlings, additional concentrations of Thiamine, (Vitamin B-1) seem to have some beneficial effects, although more conclusive experiments are needed here.

In concluding this brief paper I should like to say I have no quarrel with any method of treating seed that produces results. I have approached this subject with some reluctance, for any gardener will defend his pet methods to the last gasp, and can easily show that his methods produce excellent results for him. I have merely tried to outline the broad basis from which results may be expected, and should urge everyone to experiment with available seed so that eventually

*Note: For directions in the use of Semesan for control of common bread mold see pages 9 and 10 of the July, 1940 Quarterly (Vol. 7, No. 1). For the adverse effects of Arasan on seedlings and its inhibiting influence, see page 8 of the same issue. A footnote to that story could now be added after the below zero weather of last winter coupled with the effect of snow and ice on the Arasan treated seed sown in February, 1940 which lay a year without normal germination. Those types which showed the least germination—Acaulis, Polyanthus in shades of blue, red, bronize and yellow, Julianas and candelabras are beginning to germinate indicating a long retardation rather than permanent damage to the seed.
definite methods for treating the various species may be worked out. The genus Primula is probably as complex as any found in nature, and it is quite certain that the methods used on one section or species, will not work as well on another section. It is well to remember, though, that nature designed the Primula to live under fairly adverse conditions, and that horticulturally, it, along with most plants, is tougher than it is generally given credit for. While moderation is advisable in all things, a plant can be babied to death easier than it can be neglected to death.

Notes from the Secretary

The passing winter has been a trial in many parts of the country. Even with snow protection, we hear of heavy losses of Primrose seedlings. As we go to press, we hear in the East of a "host of seedlings, over which we are praying this bitter winter day." Then Mrs. Henry M. Lewis in Alabama reports of a "right warm Valentines Day, with Primrose buds peeping out at me from all directions at once."

We are all eager for real spring. John Glyn Davies of Scranton, Pennsylvania, a new member, writes, "I would appreciate very much if you would mail the back issues to me as soon as you possibly can as I am very anxious to learn as much as possible about the Primrose species before the arrival of spring and, I am a very impatient man and Spring is so slow in coming. You probably know how I feel at this time of year, just can't wait."

Mr. R. H. Briggs in England says they have not had a severe winter, just two falls of snow, about three inches, and no prolonged frost, but it has been a very chilly winter.

Mrs. Helen Hendershot of Aloha, Oregon writes, "My adopted family in Germany is sending me some German Primula seeds, a token of appreciation for food packets. It will be interesting, certainly a link in the chain of 'international understanding'. However, I do not expect anything more outstanding than our growers here offer." Also she says, "Noted several small Primroses blooming in the gardens at Mt. Vernon this past April, when we were in the east."

Mr. Baldwin of the Onondaga Society, Syracuse, N. Y., says they are hoping to hold a show this year, if the weather doesn't play the same trick this year as it did last.

Speaking of shows; don't forget to plan to help, and display in your show if you can. Don't be one of those who says, "I could have brought plants as good as those." And if you have choice plants, why not increase your joy in them by sharing? The one hesitates to disturb plants, do as Mrs. Henry Lucas of Chehalis, Washington. "I try to make a show and do my part and take care of them right away when I bring them home, and they seem to stay happy."

We hope this year to have more entries from out of town, and even from a distance. You may recall that last year Mrs. J. C. Lamb of Kentucky shipped some plants to Portland. Later she sent a package of Candelabra blooms in orchid tubes, which came thru quite presentably.

(Continued on page 70)
The cultivation of Primulas in gardens of the eastern states was until very recently surrounded with such an aura of mystery and difficulty that enthusiasts could be counted on the fingers of one hand—with a few fingers to spare. At present a constantly increasing band of devotees is proving that throughout the Northeast, and at least as far south as Washington, Primulas in wide variety can be grown without unreasonable care or special treatment. These growers are so widely scattered that they rarely contact each other except by letter, but visitors to their gardens usually become admirers also, and continue to spread the enthusiasm. In the Midwest, too, a small group of ardent fans is proving that Primulas “do” there also. Perhaps we in the East cannot grow some of them as lushly as they are done in the magic climate of the Northwest, but we do at least grow, and flower quite well, fully as large a range of species as in more favored climates.

In reporting the conditions under which Primulas are grown in my own garden, in south-central New York, I must confess to certain advantages of climate, and to other disadvantages. The garden is perched high on a windswept ridge, at 1,375 feet (quite an altitude for the East). Normally the summers are not extremely hot, with cool nights, rather cloudy days and frequent showers. The past two summers have, however, presented conditions of heat and drought comparable with those usually encountered at sea-level much farther south. Under the rules, all Primulas should have perished in such trying weather; instead, the losses were of desert- and heat-loving plants, while most Primulas grew with unusual luxuriance. These seasons have proved beyond question that given proper conditions for growth, in normal seasons perhaps sixty species and hybrid strains of Primula can be relied on to give a creditable performance anywhere in the Northeast. In raising my plants, I do at present have the decided advantage of using both an unheated alpine house and a lath house, but for many years was dependent entirely on cold frames.

The three requirements of a Primula seem to be suitable soil, correct amounts of light and shade, and an adequate water supply. Of these, the first appears to be by far the most important. Except for European species of the Auricula section, the prime desire seems to be for a soil rich in humus, although the plants can be made happy in a rather light loam. My best results have come, especially with Polyanthus, from beds where the soil is essentially a rich black muck, heavily fertilised with rather fresh stable manure only a few weeks before planting. Hundreds of Polyanthus, and some Asiatic species, came through the drought of 1949 in such a bed, with no artificial watering whatever. For a time they looked rather parched, but with the first fall rains they became as thrifty as ever and so far as I could check, without a single plant lost. This bed, by the way, received full sun throughout the afternoon. Plantings in light loam, not manured, in shade of Azaleas and flowering Crabs, suffered much more and were much slower in recuperating. Leafmold soil is ideal, especially for P. denticulata, but is at a premium
here, and I have never attempted to use peat moss on open-ground plantings.

Shade is a great boon, but not entirely indispensable, for in my early days I flowered, in full sun, a number of species, some fairly easy, but including such difficult ones as P. chionantha. However under such treatment they were all short-lived.

At present the younger plants, and the more precious mature ones, spend their summers in the lath house, a life-saver for shade loving plants, but as yet little appreciated in the East. Anyone living near a sawmill can construct one at very little cost from the discarded narrow strips of lumber. Such a house is at first no object of beauty, but can be covered in a short time with a variety of flowering vines, whose additional shade will be welcome during the heat of the summer. Older plants, so far as room permits, are grown in open beds on the north side of the house, in shade of Crabs and even of Sugar Maples, and at times in almost full exposure to sun. The type of shade that really saves the plants during hot weather is one that the neat gardener will not tolerate: WEEDS! During the early part of the 1949 drought I kept certain beds weed-free and well watered, but losses mounted rapidly, the water supply threatened to play out, and from the first of July on, weeds were allowed to have their way till cooler weather and rains came in mid-September. Losses were checked, and the plants soon were in much better condition than they had when tended carelessly. Henceforth in hot weather my Primulas will enjoy themselves under a dense thicket of weeds, and visitors may be shocked if they wish.

A few species are grown in more or less specially designed beds: Auriculas have a well-drained, sloping one, in rather rocky light soil to the north of the house, and various European species have found this same bed as much to their liking as anything I can provide for these rather reluctant guests. P. sieboldii, by the hundreds, grow under cinnamon and other ferns, and among Hepaticas.

Water, of course, all Primulas love, and the bog species are supposed not to grow without it. But I lack either running water or pools, except in remote boggy corners of the farm, and my plants must make out as best they can without these attractions. In the lath house, in heavy black soil but with only normal watering, not only candelabras, which of course do not require the lath house, but also PP., yargonensis, involucrata, and some Nivalisids prosper. P. rosea has, though, been more or less of a failure here, and I fear that it needs a greater amount of moisture than I have yet provided.

Wintering is perhaps the most serious problem that I have yet encountered, particularly the winter care of young seedlings. The great problem is not that of cold, but of heaving and of providing suitable protection so that evergreen species are not scalded by high winds, nor rotted by excessive moisture. I have found buckwheat straw excellent, but in most regions this is not available, and experiments this winter indicate that a very thin layer of dry cornstalks is an even better covering, not disturbed by wind, not inclined to pack under weight of snow. Heaving cannot be avoided, but a piece of rock wool over a plant lying out of the ground protects it till it can be replanted.

Methods of raising from seed are many, but after trial of most, I have returned to the usual treatment given alpine seeds, that of sowing in pots containing a peat soil mixture. I find that fall-sown seeds are less likely to germinate well than those held over till the first mild days of spring—usually late March in this climate. In April I set the pots in frames, expose them to late snows, and as soon as the snow stops falling, cover the pots with black building paper and put sash over the frames. This snow treatment works marvels in speeding up germination.

The handling of seedlings presents more of a problem than does their germination, and many a pot of priceless rarities was lost before I evolved a satisfactory routine. The experiences of the past summer have made me feel that gardeners in warm climates will probably have much better results from purchased plants than from seeds, for seedlings are far more sensitive to heat than are mature specimens. I have had most success with seedlings when they have been kept in a frame set in the shade of a plum tree. Watering is always done by setting the pots of seedlings in a pan or tub containing several inches of water, and the frames are always covered in rainy weather. This year I shall try similar treatment, but with the frame set inside the lath house. I believe that there it will be possible to avoid occasional high temperatures from which seedlings have suffered under the tree.

The usual advice is that seedlings should be transplanted when they have two or three true leaves. This may be a success in some climates with all species, but with all too many here it has resulted in loss of the transplants, while untransplanted babies continued to flourish in the seed-pots. Polyanthus may be moved successfully even while still in the cotyledon stage. As we have already verified after spilling pots that had just germinated. They, and of course P. vulgaris, as well as PP., japonica, Sieboldii, denticulata, and perhaps many of the candelabras, are better transplanted to flats of rich humus-filled soil when less than one inch across. This should be done only in cool weather, however. Most other species have very delicate root systems while young, and these I find should be left in the seed-pots, until the first fall at least, and preferably until they are a year old. By then they can be moved with relatively little loss. In this climate almost all transplanting is done best in early spring, before the end of May, or after the first of September. However, I dislike to disturb any Primulas later than mid-September, but have divided Auriculas successfully as late as the middle of October, and have wintered the divisions in the open, with no protective covering. A few kinds, including Polyanthus, and PP., japonica, denticulata, Sieboldii, saxatilis, if started early, will usually flower at one year of age; but most species require two or three years to reach blooming size here.

To show the possibilities of Primula culture in the East, a list is appended of the species which were growing here, mostly in good condition, in the fall of 1949. A number of other kinds, especially Europeans, lost during the neglect imposed by my wartime absence, were formerly grown with fair success, but have become impossible to replace. The rarer kinds are for the most part wintered in the alpine house (at least a few of each kind, as a precaution) while P. Forrestii is not reliably hardy even there, and as a precautionary measure, P. Sherriffae and
the petiolaris have not been risked out of the basement greenhouse during cold weather. Temperatures in the alpine house remain around 20 degrees for weeks at a time, and plants in pots are more inclined to suffer from low temperature than those in the ground, so that it may be assumed that all the following are hardy to zero at least.

In addition to a considerable assortment of Polyanthus, Acaulis, and Julianas hybrids, including a few doubles and hose-in-hose, I had last fall (and hope to have in spring, but whether I shall is a question that only a Primula can answer):

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<tr>
<th>Primulas</th>
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<tbody>
<tr>
<td>Alionili</td>
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<tr>
<td>alpincola alba and violacea</td>
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<td>apocita</td>
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<td>Asthor hybrids</td>
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<td>aurantica</td>
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<td>aurantica hybrids</td>
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<td>Auricula—garden vars.</td>
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<td>Beesiana</td>
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<td>Belvedere hybrids</td>
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<td>x biflora</td>
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<td>Bulleyana</td>
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<td>capitata Mooreana</td>
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<td>chionantha</td>
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<td>chrysopa</td>
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<td>Clarkii</td>
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<td>Cockburniana</td>
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<td>dariaica</td>
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<td>dentelculata, lavender, white, pink</td>
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<td>Edgeworthii</td>
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<td>eliator (or-hybrids of it)</td>
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<td>Elliaiae</td>
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<td>farinosa</td>
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<tr>
<td>Florinda</td>
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<td>Forrestii</td>
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<td>frondosa</td>
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<tr>
<td>genniffera</td>
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<tr>
<td>glaucescens</td>
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<td>helodoxa</td>
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<tr>
<td>x helvetica alba</td>
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<td>heucheriafollia</td>
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<td>hirsuta</td>
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<td>involucrata</td>
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<td>Inverieri hybrids</td>
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<td>Itton Court</td>
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<td>japonica</td>
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<td>josaena</td>
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<td>Juliae</td>
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<td>kisanoa</td>
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<td>x Linda Pope</td>
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<td>Liassael hybrids</td>
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<td>longiflora</td>
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<td>lutecola</td>
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<td>minima</td>
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<tr>
<td>Moorcroftiana (?)</td>
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<td>x murettiana</td>
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<td>nutans</td>
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<td>palnouri</td>
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<td>polynura (including</td>
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<td>Ichliangenss and</td>
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<td>Veitchii</td>
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<td>pubescens alba</td>
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<td>pubescens The General</td>
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<td>pubescens Rae S. Berry</td>
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<td>pulverulentia</td>
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<td>reticulata</td>
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<tr>
<td>rosa</td>
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<td>x Salisburghensis</td>
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<td>Sherrifiae</td>
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<td>Sieboldi in variety</td>
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<td>sikkimensis</td>
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<td>spectabilis</td>
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<td>tyrolensis</td>
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<td>Vail (Litoniana)</td>
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<td>Waltonii</td>
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<td>Wulfeniana</td>
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<td>yargonensis</td>
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PP. bhutanica and scapigera perished of heat toward the end of summer; P. speculicola probably did likewise. There are probably a few species growing here whose names have been overlooked in a rather hasty check-up.

There Are Trophy Winners Among Your Plants

The eye-catchers in the garden are those which will win the attention of the judges and the public on the show tables. Select plants of vigour and health, well-grown, of neat form, floriferous and clear colored. There is no limit as to the number of entries by any exhibitor in any class.

How to select plants, pot and groom for the show is outlined in detail on page 69 of the April, 1949 Quarterly. Plants should be lifted for potting not more than a day or two before entry date, April 21st. Earlier potting decreases size of blooms. The April, 1947 Quarterly carries an article on "How Polyanthus Are Judged," with score; the January, 1946 issue contains scores for Garden Polyanthus, Garden Auriculas, Acaulis and Julianas; Show Auriculas, and show (Gold Lace) Polyanthus. The R.H.S. score for Alpine Auriculas, based on six points, is given herewith: Well-formed flat pip (floret) 2 points; thrum-eyed 1 point; center, yellow, cream or white, free of farina 1 point; ground color shading from dark to light towards the rim of floret 2 points.

Certain benefits might accrue if the grower of Primulas could devise a method to keep a reasonably accurate record of the bloom of his plants from year to year. If such a project were undertaken, florets would be sufficient to form a comprehensive record, but if for any reason the gardener felt it necessary to keep a record of the foliage of any given plant, or its clones, it probably would be best to make this a matter of the preservation of parts of the plants, rather than to make an effort to preserve the entire plant intact.

At least an interesting starting point for such a project is to closely examine a floret. If one has never observed flower coloration under the glass of a strong hand-lens, or better, beneath the lenses of a reasonably strong microscope a highly interesting phenomenon has been missed. The grower can learn much concerning the placement of coloring matter, and the texture of the petal by such an examination. Besides one can spend an evening wholly engrossed in such an interesting experiment, and feel that such time has not only been well spent, but through this broadening and enlarging of the visual power, he has stepped quite beyond the boundary of his previous knowledge.

These notes can be termed but a possible method of keeping a year to year record of bloom of particularly treasured plants, and not a positive method. Regardless of what method might be devised there would always be the possibility of fading, for like dyes, the pigments of flowers are not imperishable. So far as known, speaking of my own knowledge, there is no method that could possibly be warranted to preserve the color of any flower indefinitely.

Often it is noticeable that flowers which have been detached from their stems and for some reason mounted individually on herbarium sheets hold color more steadfastly and for longer periods than the flowers on the same sheet but remaining attached to the plant.

Always the best floret to choose for preservation is one which is just barely reaching full maturity. The mission of flowers is not to excite the admiration of bipedal observers, although fortunately they do, but regardless of what misfortune may overtake it during its existence, it survives stoutly to fructify. A flower which has passed the culmination of maturity, even in a press, maintains valiantly the effort to fulfill its natural function, and if remaining attached to a plant often succeeds. The collector is sometimes amazed upon examining his finished specimens to discover rarely some that are not plants in flower as he supposed, but have successfully become plants bearing seed heads. Younger, more callow plants have a tendency to become discouraged when placed in press and remain more static.

An experiment which has been resorted to, and at times with success, is to press specimens in powdered borax, of the common household kind. Whether or not borax exercises a preserving action upon the pigments I cannot say. It is possible that the powder is but dry and thus speeds the drying action, and the faster a flower dries the more color it retains.
If this is true, flour or any other dry, finely powdered material might act as well, but others I have not tried.

In drying florets, or entire plants, extremely heavy pressure is not necessary. In fact, too much pressure is detrimental, for this action flattens the material, crushing it until it has little resemblance to its original form, and this intermingles the pigments of the petal, giving a smeared appearance to the finished product. An instrument of torture such as an ancient letter copying press with its extreme pressure is much too powerful in its action and much better specimens come from lighter pressing. A volume of an encyclopedia or an unabridged dictionary is much better.

A floret will always keep both color and form more perfectly if pressed in some absorbent material. Blotting paper usually lacks absorbent qualities and is too hard and lacking in resiliency for such use. Certain cellulose materials prove out much better. There is a kind of paper used as a packing material by manufacturers shipping electrical appliances, which is excellent, for it is plain on one side and to the other is affixed a layer of soft cellulose, highly absorbent and pliable in texture, so that a flower may be embedded without losing its form. I regret that I do not have any name at all for this type material.

If borax is used in the process of pressing the operator should contrive to have a layer of powder on both sides of the petals. A cardboard, rather heavy, should be laid down and sprinkled with a generous amount of powder, the floret placed in position, covered generously with the powder, a second cardboard placed over the whole, and the arrangement then should be subjected to light pressure, something like that exerted by half a brick. It isn't necessary to disturb the arrangement for a number of days for the borax does prevent molding or decay.

A logical method to use in preserving finished specimens would be to place them on notebook sheets. Notebook sheets individually bound in clear plastic on both sides can be found at any stationery store. A pressed floret is rather a delicate affair but the plastic will prevent wear and at the same time the sheet may easily be referred to for comparisons. The flowers, being frail, should be cleaned with a camel hair brush, if preserved in powder, and mounted on the sheets with gummed stamp hinges, such as philatelists use in mounting specimens. This method is not messy, it is simple, and if a specimen should be removed from a sheet no damage results.

If one really cared to go into the matter earnestly, this procedure might satisfactorily be followed. After specimens are mounted, or to be more exacting when first plucked, every detail of color might be carefully checked through the use of the more elaborate color chart systems, and these notes and color keys carried on the sheet with the specimen. If through the year color of the specimen faded, an accurate check could be made by comparing the notes with the color chart and the colors of the floret could easily be wholly reconstructed. The most comprehensive color table, published for the use of gardeners and botanists was prepared in France under the name, as I recall, "Repertoire de Couleurs," but the name of the publisher is not known to me. Any dealer in out-of-print books undoubtedly would be alert in securing a copy for anyone interested. There is currently offered a chart based on this earlier work, somewhat less extensive in scope, simplified, and possibly easier to use. It is bound loose-leaf, a feature which makes it easier to use.

Color photography might be suggested to serve the purpose of recording the color of florets, but when the colors are transferred to film the recording passes from the concrete to the abstract, and the record becomes but a flat image, and something which cannot be critically examined. The skillful use of light and the recording instrument is essential to make an accurate record and the so-called pastel colors such as lilac, lavender, light pink, and associated hues are always illusive, but not impossible to record. Fading of dyes has ceased to be a problem in such recordings. A color film record could, by the use of ingenuity, be correlated with the record of actual florets to make a highly satisfactory year to year record.

Correction, Page 71, Art Service

Last minute word from Mrs. Hamilton states that no fee will be charged those members sending florets for painting during the month of April.
HISTORY OF THE PACIFIC STRAIN OF POLYANTHUS

Interest in the history of various Polyanthus strains sharpens each year as new developments are achieved in color, type, form or whatever set of characteristics occupy the originators' attention. Each originator visualizes the ideal Polyanthus according to his perception of perfection and to fit a particular cultural purpose. For these reasons a gardener may collect every strain of Polyanthus in commerce today and have no two alike, each one moving towards a floral perfection which has been approached from a different angle.

Mr. Frank Reinelt, Vetterle and Reinelt Hybridizing Gardens, Capitola, California was invited to lead off on this series of strain histories and very obligingly forwarded the following review. The question as to the underlying purpose dominating the Pacific Strain of Polyanthus was not asked Mr. Reinelt. However it has been said that the strong colors have been selected to withstand the California sun and all familiar with the rich purple, carmine and red shades, no matter whether they garden in California or elsewhere, can attest to their enduring brilliance. Every hybridizer is in agreement on the matter of strong stalks and Californians say that Polyanthus in the Los Angeles area have become one of the most popular cut flowers. But here is Mr. Reinelt's story.

"Regarding the development of the strain, the original few plants came from a package of seed sent to Dr. Sydney B. Mitchell by one of his amateur friends in England who bred Primroses and pigs as a hobby. I selected some eight plants from the patch. I also grew large lots of seedlings from Sutton and Blackmore & Langdon seed.

"Mr. Logan from Inverness, California, who had a large collection of Polyanthus, gave me some of his named varieties of Acaulis which I used in the beginning to breed size. In the spring I used to comb all the estates on the Peninsula, and when I saw a fine specimen I usually talked the gardener out of it. Cross breeding and selecting from these over the past nineteen years I finally reached the standard we have today.

"I made one sowing of Colossea, and while they were nice Polyanthus, they did not, in my opinion, come up to the standard we had then already reached so I never used it for breeding.

"From many thousands of seedlings grown each year we select a percentage of the most outstanding for seed parents, immediately inter-cross them and raise a new patch. The progress this way is far more rapid and every plant so far has been rapidly superceded so that I have never felt justified in propagating or naming any of the individuals."

Trophies Additional to Those Listed in Enclosed Schedule

Mrs. A. C. U. Berry is offering one of her famous Auricula Spode plates for the Rarest or Oddest Primula in Division I. Mrs. Lathrop, scheduled for a painting in this Division, found her time too limited for completion of the picture. Mrs. Berry's plate is one that attracted widespread admiration when displayed at an earlier show with others of the set. The hand-painted Auricula on this particular plate is a beautiful pink Show on a white background, edge of plate turquoise.

Mr. Henry Wessinger is giving a silver shell, probably for the best (Concluded next page)
COLOR AND PERSONALITY
Lulu Mae Hamilton, Setro Woolley, Wn.

Did you ever walk into a strange room and feel you'd been there before? The friendliness, the comfort of it, just wrapped itself about you as you cast around for a place to let yourself down. You certainly hadn't meant to stop—but there you were—and you couldn't pry yourself loose. Looking back you couldn't remember the kind of furniture or the color of the wallpaper. It was just—the room. You do recall that the paper on the ceiling sagged a bit in places, but it didn't matter.

You have also walked in gardens so stately, so cruelly severe, so well groomed and pompous that you paused in suspended anticipation, fearful lest your very soul be dissected by the marble statue guarding the goldfish pond. The room had personality, warmth, and color, a complete blending of harmonious interests. The garden was so well organized, so stiff and unyielding that it was devoid of a rich, full personality. It was too well integrated for comfort.

Whether we realize it or not, color plays a tremendous role in our lives. It either lifts us up or presses us down. Much of our mental and physical well being depends in large measure upon the combination of colors with which we surround ourselves. The colors we choose today, however, may not be the ones we'd need tomorrow, and let no man call us fickle. Change and new choices become our inalienable right in our pursuit of happiness.

When we depart from neutral colors we should take heed. We should know color and study the colors which harmonize with our personality. No color is discarded, there is no waste in nature, each has its true value in its own specific field. Colors, as well as personalities may clash violently with no blame placed on either offender. All nature, animate and inanimate, radiates color. Each color has its own true value in vibrations according to the recording instrument in this specific field of scientific research.

All Primrose lovers, as I have known them, fall into a definite pattern. They are sensitive, highly responsive to color and to music. This is their refuge and retreat. I know of no plant which gives the varied type of satisfaction to both amateur and professional grower. It runs the full gamut of color diversion. There is challenge and romance in each seed. You hear a strain of music which arouses memories, and breaks your heart, you have also come upon a "dash" of color which either makes you want to weep or sing. I have known individuals whose musical possibilities had been frustrated. Later I have met those persons and they unconsciously had gathered around them color. Such a person was a chemist, a manufacturer of colors; another, a famous artist. They revel in the vibration of color. They are satisfied.

How often we have said "Those two people just belong together."
"Complementary" is the term to use—one completes the other, strengthens the other, so in color one complements the other. When grouped closely they seem to belong. We speak of such a combination as a "symphony" in color. When we strike a chord in music each tone complements the others, a true blending of harmonious tones, or vibrations. I have known experts on color vibrations who could not carry a tune, but when the ear for sound failed, the eye took up the issue and compensated in full measure.

In planning our gardens, in working out our color schemes, we should follow our own impulses. Our gardens should be very personal, reflecting us. It may be only a plot ten feet square, a window box, or a "knock-kneed" Geranium in the kitchen window—yours might be red—mine would be coral. This color business is of great therapeutic value, more thought should be given to it—correct color combinations are as needful to the soul as food to the body.

NORTHWEST PRIMROSE SHOW DATES, 1950
Portland, Oregon (9th Annual National Show) Masonic Temple, April 22-23.
Grants Pass, Oregon (3rd Annual) Jerome Prairie Community Hall, April 12-13.
Tacoma, Washington (1st Annual) Crawford's Seagrill, 505 Broadway, Tacoma, April 15-16.
Mt. Angel, Oregon (3rd Annual) City Hall, April 30th.

National Society Plaques for Sweepstakes Winners
The American Primrose Society announces the awarding of a plaque to each of the sweepstakes winners of the Primrose shows held outside of Portland.

The sponsoring garden clubs and affiliated societies extend a cordial invitation to everyone to visit their shows and exhibit if possible. A general congratulatory feeling prevails among these groups, each wishing the other the best show to date.

Each show chairman is specially requested by the editor to appoint two reporters to forward to that office in Gresham, as soon after the show as practical, pertinent facts about plants, both prize winning and otherwise, sweepstakes winners, the design of show in general, names of show chairmen, all show highlights, everything that is thought to be of interest to the international audience comprising the membership of the Society.

Another Change in Nomenclature
Word has just come from England that the selected form of P. rosea known as Micla Visser de Geer (a Dutch selection) has been changed to the less cumbersome P. rosea 'Delight'. This particular variety of P. rosea is even more lovely than the variety generally grown as P. rosea grandiflora being stronger growing, exceptionally brilliant and intense in its carmine coloring and with larger blossoms.
"BUY SEED FROM A RELIABLE DEALER"
Lewis J. Cullen, Great Kills, N. Y.

Altho' our interest in Primroses dates back about ten years, our first serious attempt at raising them started but a mere eleven months ago. In view of this fact, it seems presumptuous to say the least, that I should be writing about Primroses. I feel somewhat like an acquaintance who bought a piece of every kind of cheese he could find—ate them, and then wrote an article for Esquire with the amazing title . . . ."*

We write, not so much to advise, but rather to defend some of the seemingly ridiculous things we have done with the seeds of Primroses. Eleven months ago we had not heard of the American Primrose Society, nor its excellent advice to buy seeds from "a reliable dealer who knows how to harvest and cure them." And so, we bought seeds from wherever we found them—from twenty seed dealers in four countries and, at the moment, we have sixty-eight flats of seeds with more to follow later. It was our idea to learn where reliable seeds could be secured and what types of Primula could be raised in our goshawful New York climate where politics seem to thrive on 40% salary boosts but Primroses are said to be a bit on the difficult side.

Of course, it is rather early (January) to predict or write about, the outcome of our seed rampage, but, to date, seeds have germinated in only twelve flats and it is interesting to note, that all these are seeds from "reliable dealers."

In those early days of eleven months ago, we knew of no recommended seeding medium, so we set seeds in everything we could lay our hands on—seaweed, sawdust, ground glass, French's Bird Gravel, etc., etc. It may be of interest to note that in the majority of these twelve germinated flats, sphagnum moss was used.

Also, a rather distracting fact is that, we had one large packet of seed which we set in five flats, each with a different seeding medium, and they have germinated in all five! Is it possible that good seed will germinate even if laid on a steel plate? If this is so, and it's beginning to look that way, then our problem boils down to one logical conclusion—"buy seed from a reliable dealer."

"Censored by the editor. Those interested may secure the title by sending a self-addressed stamped envelope (no postcard please) to Mr. Cullen."

A New and Unique Art Service for Members

Mrs. Maurice Hamilton, Art Director for the Quarterly, is able to match any color in Primroses with her new pigments. A petal is taken from the floret, laid on the board and the missing petals painted in so exactly that the effect is perfect. Each color will be registered by number which will be returned to the sender together with the color specimen. The service is designed to stimulate interest in rare colors, record your favorite specimens and eventually build a Primula color chart.

Mailed florets should be placed on moist cotton or moss in a wax-paper lined container to preserve freshness in transit. Fee is 50c the first floret and 25c each additional floret to cover costs. Write Mrs. Maurice Hamilton, Friendly Acres Studio, Sedro Woolley, Wn. A self-addressed stamped envelope would be appreciated.

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*Secretary's Notes continued from page 56

Our Portland show chairman, Mrs. M. A. Lawrence, assures us that a place will be made for all Primroses sent in, so they can be judged. This is regardless of whether or not a suitable class is published in the schedule.

Prim Roses for the Quarterly: from Berg Madison, Moline, Ill., "I am enjoying the Quarterlies a great deal and wonder how long we can keep on getting so much for so little." From Roland G. Gamwell, Bellingham, Wash., "The Primula Manual in October Quarterly should be printed in leaflet form for distribution. It is very complete!" Now there is an idea. Mrs. J. R. Nasholm of Eugene, Oregon says that the Quarterly is more than worth the dues, "I do enjoy it very much." Jos. F. Deschamps of Forest Grove, Penna., "I would like to compliment you on the October Quarterly." Mrs. Robert C. Maris of Smith River, California writes "I enjoyed the article on Primula verticillata in the July number. Mine still are thrifty after all our snow and ice."

Mrs. O. J. Zach's hand-awrought Alaskan copper pitcher to be awarded the exhibitor who has not previously shown Primroses in competition and who scores the highest number of points.
Seattle, Washington
Syracuse, New York
Berry, Mrs. A. C. U.
Collins, Dean
Levy, Florence

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Jordan, D., Fred A.
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Lucas, Mrs. Henry
McElroy, Mrs. Walter E.
Mckean, Miss Margaret
Olson, Mrs. O. A.
Rogers, Mrs. Blossom R.
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Wessinger, Mrs. Henry

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12317 S. E. Madison
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11125 N. E. Halsey
3453 N. W. Thurman
4014 N. Massachusetts
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3275 S. E. Ankeny St.
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9000 S. E. 82nd Ave.
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3644 S. W. Canby St.
2946 N. E. 8th Ave.
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7080 S. W. Canyon Crest
1377 West 3rd, Santa Rosa
1509 N. 26th St., Boise
Rt. 2, Payette
Lakeside
Big Sandy
Regan, Mrs. Wm. J.

BERRY, Mrs. A. C. U.
Collins, Dean
Levy, Florence

SUSTAINING MEMBERS

Portland, Oregon

Levy, Florence

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Myrick, Mrs. R. E.
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Nelson, W. C.
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Parker, Robert E.
Parker, Mrs. Sarah
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Perrine, Lois F.
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Stokes, Mrs. Mary A.
Sullivan, James W.

Swanson, Mrs. E.
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White, Mrs. Jonson
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