

these natural safeguards were amply covered by Mr. Bergh in his talk yesterday afternoon and need not further be discussed or mentioned.

Mr. Fordham presented his paper and sequence of colored slides.

## GERMINATION OF DOUBLE—DORMANT SEEDS

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The discussion will deal with the two stages of pretreatment necessary for seeds with epicotyl or shoot-bud dormancy, together with the method of shortening the usual time needed for germination. Due to the length of time normally required to germinate them they are in the category of so-called two-year seeds.

### CHIONANTHUS RETUSUS

Collection of *Chionanthus retusus* seeds was made in mid-October of 1959. After cleaning they were stored dry until January 18, 1960. This lot was then given five months warm stratification. In this period roots emerged, developed to some extent, and were then ready for cold stratification. If cold is not provided to ripen the shoot-bud the roots will continue to grow until the food stored in the seed is expended. Five months of warm stratification in this case proved to be more than was necessary.

The second lot from the same seed batch was given a three-month warm period followed by three months at 41° F. When sown after these pretreatments a general germination occurred in seven days.

As concerns the method of pretreatment, the seeds are distributed throughout a stratifying medium, which in this case was composed of half sand and half peat moss contained in a polyethylene bag. It is important that the bulk be kept small since at planting time the entire contents of the bag are sown. In proportion, the medium would be two or three times the volume of the seed. It is moistened but is not wet.

Where two stages of treatment are necessary to overcome double dormancy, the bags are first placed on a greenhouse bench to provide the warm stratification requirement. In this particular location the temperature ranged between 60 and 101° F. A maximum and minimum thermometer placed in a bag of medium and set on the bench registered this fluctuation. As routine procedure we check seeds with epicotyl dormancy about once a week to see whether or not radicles have emerged. When they do and it becomes a general condition, the bag is moved to the refrigerator to ripen the epicotyl. In the refrigerator a temperature of 41° F. is maintained. Wire baskets labeled by months simplify locating bags of seed due to be processed.

### VIBURNUM SARGENTI FLAVUM

*Viburnum sargentii flavum* has been exposed to five months warm stratification. As with *Chionanthus retuses* this length of time was

more than necessary as the radicles emerged and the seed was ready for cold treatment in three months.

### DAVIDIA INVOLUCRATA

The fruit of *Davidia involucrata* is an extremely hard, two to five seeded stone. It, too has epicotyl dormancy. Following four or five months of warm stratification these seams decompose and weaken to the point where the developing radicle forces out this segment. As a matter of interest *Nyssa* and *Davidia* are both in the family *Nyssaceae*. The fruit of *Nyssa* is a one seeded bony stone with single dormancy requiring two to three months of cold stratification to ripen the embryo. The structure of the seed coat is a modification of that found in *Davidia*. As the radicle develops the weakened section is forced out, but unlike the *Davidia* is hinged and remains attached.

We now have the stages of germination in *Davidia*. After four or five months of warm stratification, the weakened segment is pushed away and radicles develop partially. The seeds are then ready for cold stratification. After three months of cold have conditioned the epicotyl, the seedling starts to grow and withdraw from the stone.

### HAMAMELIS MOLLIS

*Hamamelis mollis* responded best when given three months of warm stratification followed by three months at 41° F. This does not have epicotyl dormancy but requires two stages of pretreatment for germination.

Incidentally, we keep our records right on our accession cards. All entries are made on four by six cards and each is assigned an accession number. The origin of the material together with any other information that might be pertinent is recorded. In this instance seeds were received from the University of Washington Arboretum and treatment was started on the fifteenth of February, 1960. Thirty-six seeds were involved. Lot #1 was given three months of warm stratification followed by three months at 41° F. On being sown, 88 per cent germination occurred in seven days. Lot #2 provided the same percentage of germination but required two months longer to do so owing to the longer period of warm stratification. As each movement of the seed is accomplished a note is entered on the card.

### KOELREUTERIA PANICULATA

A *Koelreuteria paniculata* seed lot was soaked in concentrated sulphuric acid for one hour. It was then divided into three groups. Lot #1 was sown at once, lot #2 was provided with cold stratification for one month and lot #3 was stratified for two months. Although *Koelreuteria* is supposed to be doubly dormant, a general germination occurred in 13 days when lot #1 was sown without a secondary treatment. In 1958, when this was tried, we found that after a one hour acid soak, the seed germinated in the refrigerator. So, in 1960, the same treatment was tried using seed from a different source. *Koelreuteria paniculata* seed, when collected in separate years from two different sources, showed the inhibiting condition to be only in the seed coat.

## CEDRUS LIBANI

*Cedrus libani* responded best with two months cold stratification. Lot #1 was sown without pretreatment, and germinated poorly and erratically. In fact, after two and one-half months some are now in the hat stage. Lot #2 germinated in 13 days after one month of cold treatment. Lot #3 produced a uniform germination in five days when stratified for two months at 41° F. Lot #3 would be the best treatment as Cedar of Lebanon is extremely susceptible to damping-off diseases. When induced to germinate quickly and in unison, they can be potted or boxed in a matter of days. By quickly separating them the spread of diseases is minimized.

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MODERATOR SHAMMARELLO. Thank you, Mr. Fordham, for your very informative talk. I am sure you will have a lot of questions from the audience.

MR. HOOGENDOORN: I would like to ask a question. Do you treat all seeds which have a dormant period first with a cold, and then with a warm period, or the reverse, or do you vary it with the type of seed?

MR. FORDHAM: It will vary with the type of seed that you have.

MR. HOOGENDOORN: How is *Davidia*, the Dove Tree, handled?

MR. FORDHAM: Four or five months of warm stratification followed by three months of cold.

MR. HOOGENDOORN: One other question. I see you have *Hamamelis mollis*. Do you think it is going to come true to type from seed?

MR. FORDHAM: I don't know. We just germinated it to get the information on germination.

MR. HANS HESS: How do you handle *Nyssa sylvatica*?

MR. FORDHAM: Give it two months of cold at 41 degrees.

MR. HANS HESS. Suppose, for example, you got seed in the fall, as most nurserymen do. We would like to stratify it in the fall and sow them in the spring. Generally, this seed comes in after the period when you can sow it outside. If it went beyond the two months cold treatment would that have any effect on germination?

MR. FORDHAM: No, it perhaps wouldn't. You could extend the period since there is quite a bit of latitude.

MR. HANS HESS: Do you have any record as to the percentage of good seed that you normally get from *Nyssa sylvatica*?

MR. FORDHAM: Yes. With us it generally comes as summer seed and is perhaps 100 per cent good.

MR. HOOGENDOORN: Have you treated *Pinus cembra* the same way?

MR. FORDHAM: We tried *Pinus cembra* this past summer 16 different ways. Some of these ways germinated better than others, but in such a pattern that it didn't make sense. We couldn't conclude anything.

MR. C. MAHLSTEDE (Cleveland, Ohio): How do you handle the seed after it has sprouted during stratification? This would be in regard to those that have double dormancy in which the root requires one period, and the shoot requires another period of stratification.

MR. FORDHAM: I am sorry, I don't understand the question.

DR. CHARLES HESS. In other words, when you have a seed with double dormancy and you allow the radicle to emerge, then you return it to the cold to give it the cold treatment to ripen the epicotyl. Can you still broadcast seed of this type that has its radicle already emerged? ?

MR. FORDHAM: Oh, yes, certainly you could. You would have to be very careful. The seeds would naturally orient themselves after they were put out.

MR. JIM WELLS. I would like to ask you if you have tried less than three months warm treatment on any of these seeds and whether you do need the full three months?

MR. FORDHAM: Yes, we have done this with some things but generally we treat it three months or more. I expect with many things a shorter period might work.

MR. WELLS: You don't know for sure but you believe shorter periods would be successful. Incidentally, *Hamamelis mollis* doesn't come true to type from seed.

MR. GEORGE HOYSIC. I find that tree peony seeds work this way. We used to use peat moss and we found out that we lost quite a few of them. We now just put sand over them.

MR. FORDHAM: They have the same type of dormancy that the *Davidia* has. They put the radicles out first.

MR. LOWENFELS: Have you done any work on holly?

MR. FORDHAM: Yes, some. We worked with *Ilex yunnanensis* and found you could germinate it very readily in high percentages by giving them a five months warm period followed by three months of cold.

MR. LOWENFELS: Now I intend to try *Ilex opaca* and *I. aquifolium* this way.

MR. FORDHAM. We tried those two. They are just as unpredictable with us as with everybody else. We can't seem to get uniform germination.

MR. HARVEY GRAY: Al, to go back to the *Davidia*, one of the problems, of course, is in getting the plant into existence because it is good. I tried it several times, not being too successful. You have pointed out the way now, so I look forward to getting a batch of plants by this particular treatment.

The question I have in mind relates to cleaning. The seeds I have

at the moment are still in the fruit. In other words, the pulp has not been taken off and the fruits are in a polyethylene bag. Do you think this would satisfy the stratification period or would you suggest cleaning the seed first?

MR. FORDHAM: No, they should be in the stratifying medium in order to do this.

MODERATOR SHAMMARELLO: Are there any more questions? If not, I wish to thank you again, Mr. Fordham.

The final scientific session adjourned, and the meeting continued in the annual business session.

## ADJOURNMENT

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## TENTH ANNUAL BANQUET

Past President, Harvey Templeton, Jr. and the newly elected President, Mr. Martin Van Hof, presided at the annual banquet held in the Ballroom of the Manger Hotel.

The evening gathering was thrilled when it was announced that Harvey Templeton was the recipient of the Plant Propagators Award. The award was presented as a tribute to his ingenuity which led to the development and perfection of the electronic leaf and control unit for mist propagation. As a faithful servant of the Society, for his willingness to share information, and for his expert leadership in executing the goals and aims of the Society, Harvey Templeton has rightfully been so honored.

The Annual Banquet was privileged to hear an address by Frederick G. Meyer, of the United States Department of Agriculture, who discussed, "Ornamentals in Italy, Southern France, Spain, and Portugal." Dr. Meyer drew on his keen knowledge of ecotypes in developing the flora found in these various Mediterranean areas.