

PROCEEDINGS OF THE FIFTH MEETING OF  
THE COMMITTEE ON FOREST TREE BREEDING  
IN CANADA

September 19 and 20, 1957

PART I

MINUTES AND DISCUSSIONS

PROCEEDINGS OF THE FIFTH MEETING OF  
THE COMMITTEE ON FOREST TREE BREEDING  
IN CANADA

Held at Petawawa Forest Experiment Station,  
Forestry Branch, Department of Northern Affairs and  
National Resources, Chalk River, Ontario, on  
September 19th and 20th, 1957.

Attendance

J.S. Ball	Dept. of Lands and Forests, Reforestation Division, Toronto, Ontario.
R.M. Belyea	Dept. Agriculture, Forest Insect Laboratory, Sault Ste. Marie, Ontario.
A. Bickerstaff	Forestry Branch, Ottawa, Ontario.
A.J. Carmichael	Dept. Lands and Forests, Tree Seed Plant, Angus, Ontario.
W.H. Cram	Dept. of Agriculture, Forest Nursery Station, Indian Head, Saskatchewan.
B.W. Dance	Dept. of Agriculture, Forest Biology Laboratory, Maple, Ontario.
J.L. Farrar	Faculty of Forestry, University of Toronto, Toronto, Ontario.
D.P. Fowler	Dept. of Lands and Forests, Southern Research Station, Maple, Ontario.
D.A. Fraser	Forestry Branch, Petawawa F.E.S., Chalk River, Ontario.
M.J. Holst	Forestry Branch, Petawawa F.E.S., Chalk River, Ontario.
R.G. Hitt	University of Wisconsin, Madison, Wisconsin, U.S.A.
A.P. Leslie (Chairman)	Dept. of Lands and Forests, Southern Research Station, Maple, Ontario.

A.W. Khan Forestry Department, Government of East Pakistan.  
H.G. MacGillivray Forestry Branch, Fredericton, N.B.  
F. Mergen School of Forestry, Yale University,  
New Haven, Connecticut, U.S.A.  
R.J. Moore Dept. of Agriculture, Science Service,  
Ottawa, Ontario.  
I.C.M. Place Forestry Branch, Petawawa F.E.S.,  
Chalk River, Ontario.  
R. Pomerleau Dept. of Agriculture, Forest Biology Laboratory,  
Quebec, P.Q.  
M.L. Prebble Dept. of Agriculture, Forest Biology Division,  
Ottawa, Ontario.  
H.A. Senn Dept. of Agriculture, Division of Botany and  
Plant Pathology, Ottawa, Ontario.  
H.S.D. Swan Pulp and Paper Research Institute of Canada,  
Montreal, P.Q.  
C.W. Yeatman Forestry Branch, Petawawa F.E.S.,  
(Secretary) Chalk River, Ontario.

64. Welcome

Mr. Leslie welcomed the guests: Mr. R. G. Hitt, University of Wisconsin, Mr. A. W. Kahn, East Pakistan, and Dr. Francois Mergen, Yale University.

65. Minutes of the Last Meeting

The minutes of the last meeting had been prepared and distributed to members by the Department of Lands and Forests of Ontario under the direction of Mr. Leslie, Chairman of the meeting. The minutes were adopted with the following correction: the title and address of Dr. G. S. Allen, given in Appendix "P", Membership, should read "Dean, Faculty of Forestry, University of British Columbia, Vancouver, B.C."

66. Business Arising from the Minutes

(a) Membership - The following men were elected members of the Committee:

Dr. R. M. Belyea Officer-in-Charge,  
Forest Insect Laboratory,  
Sault Ste. Marie, Ontario.

Mr. D. P. Fowler	Research Division, Dept. of Lands and Forests of Ontario, R.R. No. 2, Maple, Ontario.
Dr. I.C.M. Place	Officer-in-Charge, Petawawa F.E.S., Chalk River, Ontario.
Dr. L.T. White	Officer-in-Charge, Forest Pathology Laboratory, Southern Research Station, R.R. No. 2, Maple, Ontario.

Mr. Bickerstaff gave notice that Mr. J.D.B. Harrison wished to stand down from the Committee, and that Dr. D. R. Redmond, Chief, Forest Research Division, Forestry Branch, Ottawa, would take his place.

Dr. Farrar gave notice that Mr. K. A. Armson wished to resign from the Committee.

(b) Lectures on Tree Breeding

A list of the names of Committee members who were prepared to give lectures at universities was sent to the University of Toronto, Laval University and the University of New Brunswick. Only one lecture was given during the past year; Mr. Holst spoke at the University of New Brunswick.

(c) Tree Breeding Substations

Two hundred acres have been set aside at Turkey Point, near St. Williams, Southern Ontario, for the establishment of frost susceptible species and races of interest in the eastern Canadian tree breeding program. Twenty acres had been selected by Dr. Heimburger for clearing for planting in 1958.

(d) Distribution of Proceedings

A lengthy discussion was held concerning the form of publication of the Proceedings for distribution to non-members of the Committee.

The following motion, moved by Dr. Cram, seconded by Dr. Moore, was adopted:

- "a) that the Proceedings should include the member reports in full,
- b) that the minutes and the reports should be bound separately to form two parts to the Proceedings,
- c) that the minutes be distributed to members only,
- d) that the reports receive a general distribution to interested parties,

- e) that the restriction "not for publication" be removed, and
- f) that in future members should provide the secretary with the required number of copies of their reports, prepared on 8 1/2 x 11 inch paper to a standard format."

(e) Genetics Society of Canada

It was reported in a circular of 27th April, 1957, that Dr. Boyes, Chairman X International Genetics Congress, had replied that careful consideration would be given to a request by the Committee that a section on Forest Tree Genetics be formed within the Congress.

After some discussion of the complexities and responsibilities involved in organising such a section, the Committee concluded that a separate section on Forest Genetics in the X International Congress was not warranted. Participation in the Congress by members was encouraged by the Committee.

Mr. Leslie read a letter from Dr. A.W.S. Hunter concerning proposed exhibits at the X International Genetics Congress, Montreal, 1958. Dr. Hunter suggested that the Forest Tree Breeding Committee, or certain members of it, might wish to set up an exhibit on forest genetics. The exhibition is to be staged in the Winter Stadium of McGill University and will be open to the public. Members expressed interest in the project and noted its publicity value.

The following motion, moved by Dr. Senn, seconded by Mr. Swan, was carried:

"that the executive be authorised to explore, by means of a circular letter, the possibility of members setting up exhibits."

(f) Exchange of Observers

Mr. MacGillivray attended the Fifth Northeastern Forest Tree Improvement Conference held at Orono, Maine, 22-23 August, 1957.

Dr. Cram reported his visit to the meeting of the Lake States Tree Improvement Committee.

The report "The Lake States Forest Tree Improvement Committee, Its Purpose and Activities" was received from Dr. Paul O. Rudolf, and tabled by the Secretary for inclusion in the Proceedings.

67. New Business

(a) Co-operation with the Forest Insect Laboratory, Sault Ste. Marie

Mr. Holst reported that discussions had been held on the 18th September with Dr. Belyea, Dr. Prebble and Mr. Fowler concerning co-operation with the Department of Agriculture in the testing of hard pines for resistance to European shoot moth.

Dr. Prebble pointed out that it is not the function of the Forest Biology Division to take part in tree breeding as such, but that they would be glad to help in tests that are of specific interest to tree breeders for assessing disease or insect resistance.

(b) Fifth Northeastern Forest Tree Improvement Conference

Mr. MacGillivray read the following report of the conference which he attended.

Notes on the Fifth Northeastern Forest  
Tree Improvement Conference  
(by H.G. MacGillivray)

The conference was held at the University of Maine, Orono, Maine, on the 22nd and morning of the 23rd August, 1957. The reports and technical papers as well as the discussions will be published at a later date.

22 August - Morning Session

The morning session, under the chairmanship of E.L. Giddings, consisted chiefly of brief outlines or summaries of the work being done in the (1) Northeast, (2) the Lake States, (3) the South, (4) in California, and (5) at Maple, Ontario. Reports for the Pacific Northwest and Canada will appear in the Proceedings.

R. I. Ashman, Professor of Forestry at the University of Maine, gave a talk on the possibilities of Norway spruce as a forest tree in Maine. Norway spruce, because of its good growth and adaptability to climatic and soil conditions in Maine, should do well in that area. Its growth generally exceeds that of native spruces. Damage to the leader by red squirrels and weevils is a limiting factor. Gall aphid damage is not serious in Maine.

Afternoon Session

A demonstration took place during the afternoon session on the Penobscot Experimental Forest of the Northeastern Forest Experiment Station. The possibilities and limitations of genetical mass selection in the spruce - fir type were discussed under the chairmanship of E. Schreiner.

The method demonstrated was referred to as "genetical improvement conversion". The object of this method is the continuous but possibly slow improvement of the genetical composition of the stand as a whole. To attain this aim the cutting is directed so as to remove the undesirable phenotypes leaving the best to supply seed for the regeneration. A further step is the introduction of "exotics" known to be of better genetical quality than any regeneration that would naturally be produced in the stand. These "exotics" could be turly exotic, such as Norway spruce which will grow faster than the local spruce or they could be the progeny of an elite strain of white spruce of quite local origin.

The possibilities of using several exotic species were discussed. Norway spruce seemed to be the most desirable species. A suggested measure to help eliminate weed species was to have the cutters drop the tops, during cutting operations, on undesirable regeneration thus crushing the weed species and not having the top occupy space that could be used in culturing desirable regeneration.

On the return to the campus, Professor Fay Hyland conducted a visit to the Botanical Plantation to examine the growth of several exotic species, some of which may have use in forestry in the northeast.

### Evening Session

A picture session was held immediately after the banquet. Interesting slides were shown by various workers. These pictures covered a wide range of subjects such as vegetative propagation, maple sugar studies, differences in needle retention between individual Christmas trees from the same plantation, the selection of superior trees, nursery work, and differences between the seedlings of various races and strains.

### 23 August - Morning Session

The morning session, under the chairmanship of H.C. Buckingham, consisted of the presentation of several technical papers.

Francois Mergen of the Yale Forestry Research Center gave a very interesting paper on air-layering Norway spruce and blue spruce. The trees used in this work appeared to be quite young. However, Dr. Mergen indicated to me after the session that he had successfully rooted flowering branches. Some branches bear flowers after having been severed from the parent tree.

P.O. Rudolf, Lake States Forest Experiment Station, presented a report prepared by himself and Hans Nienstaedt on spruce improvement research at the above-mentioned Station. The increased scion growth brought about by exposing rootstock and grafted plants to a long day in comparison to the growth produced by grafted scions exposed to a short day was quite striking. The combination of long day and low temperatures gave best results. Long days were 20 hours and short days 13 hours. Ordinary fluorescent lamps were used.

Lindane was credited with giving partial control of cone insects.

A paper entitled, "Relation Between Growth and Unit Rate of Photosynthesis in Forest Trees" was presented by Philippe Bourdeau of Yale Forestry Research Center. It was shown that the greater the efficiency of the photosynthesis mechanism of the leaf the greater would be the growth potential of the plant. One practical use of this work in tree breeding might be to predict the growth potential of trees while they are still seedlings. Dr. Bourdeau pointed out that tolerant trees have a lower light requirement for photosynthesis than intolerant trees and that they can therefore continue to grow in the shade.

J. R. McWilliams, Yale Forestry Research Center, presented a paper dealing with (1) germination tests of Pinus pollen at different temperatures and (2) the temperatures of receptive female flowers (strobili) (a) isolated by different methods as well as (b) non-isolated flowers as control.

The best pollen germination and tube length development was obtained at 30 to 32°C but good results were obtained over a fairly wide range of temperatures. In the field, the flowers isolated by sausage casings having the more exposed parts painted with aluminium paint gave temperatures which more closely approached those of the control than did the plain sausage casings or combination of sausage casing and kraft paper bag.

J. D. Diller of the Northeastern Forest Experiment Station gave a brief account of a survey made by requesting people to report the locations of old (mature) American chestnuts. Numerous mistakes in identification of this species were made by co-operators who reported on trees which turned out to be horse-chestnut, oriental chestnut or immature trees. Slides were shown of some promising tree breeding material. Scions from chestnut tree breeding material are distributed to co-operators for trial in different regions.

Dr. Graves, involved in breeding for resistance to the chestnut blight, gave a brief account of the success that he had in inducing early flowering on immature chestnut hybrids by using Karl Sax's phloem block method. Here the method inverting bark rings was used on branches rather than on the main stem. The treated branches were the only ones that produced flowers.

F.V. Klaehn of the College of Forestry, Syracuse, presented a paper on flower morphology of some important Fraxinus and Acer forest trees. Slides were used to illustrate the mixture of sexes that occurs in the flowers of these genera. It was indicated that some species of these genera are still in the process of evolving from insect pollinated species to wind pollinated species.

C.A. Bickford, Northeastern Forest Experiment Station, gave some practical advice on some considerations in designing experiments in forest genetics research. He warned that the statistician could be of much greater help if approached before the experiment was designed than after it had been started, and that statistics were no substitute for good common sense.

Two papers not presented at this time "Blister Rust Resistance in Eastern White Pine" by R.F. Patton and A.J. Riker, University of Wisconsin, and "Some Practical and Biological Considerations in Designing Experiments in Forest Genetics Research", by E.J. Schreiner, Northeastern Forest Experiment Station, will likely be published in the Proceedings.

The conference terminated following the re-organization of the standing committees and the presentation of resolutions.



An informal discussion followed of techniques which may be used for the induction of flowering in trees.

- (c) Letter from Dr. N.H. Grace, Director, Research Council of Alberta.

The following message from Dr. Grace was read to the Committee:

" Will you please convey my congratulations to the Committee members for their diligence, for the excellent work and the fine work spirit which they display".

- (d) International Co-operation for the Establishment of Test Plantings of Important Tree Species in Several Continents, with regard to Resistance to Disease and Pests.

A copy of a letter from Mr. J.D.B. Harrison, Forestry Branch, to Dr. J. E. Bier, Forest Biology Division, was received by the Chairman. The letter commented on a paper with the above title which had been prepared by Dr. Bier. However, no specific proposals were presented to the committee. Mr. Holst commented that he had reviewed the paper, but that he felt the program was too general and that particular problems should be taken up as they become evident.

- (e) International Botanical Congress, 1959

Dr. Senn brought to the attention of the Committee that the International Botanical Congress would be held in Montreal, August 19-29, 1959. The Congress would cover almost every aspect of plant science. No action was required by the Committee, but there were certain matters which were of interest:

- (i) At the last meeting of the Congress held in Paris it was recommended that the section on Forest Botany be discontinued at future meetings, and that papers should be heard in the appropriate sections of plant science such as physiology, ecology, etc. The program committee was looking for further guidance in this matter, the current impression being that a separate section on Forest Botany was still desired by many. Members were asked for their comments.
- (ii) The field trips constituted an important part of the Congress. At present the field trip subcommittee was considering the organisation of a forest botany trip in Quebec, and possibly another centering on Petawawa Forest Experiment Station. A third trip was being planned dealing primarily with the boreal forest in northern Ontario and Quebec. Other trips not of specific reference to forest botany were being planned.

The co-operation of everyone involved in forest botany was requested, including the forest industries.

The following resolution, proposed by Dr. D.A. Fraser, seconded by R. Pomerleau, was adopted:

"The Tree Breeding Committee is in favour of a Forest Botany Section at the 9th International Botanical Congress to be held in Montreal, August, 1959".

(f) Agenda

The following motion, proposed by W.H. Cram, seconded by M.J. Holst, was carried:

"That a formal agenda should be distributed in advance of future meetings of the Committee."

(g) Organisation of Committee Meetings

The following motion, proposed by J.L. Farrar, seconded by R. Pomerleau, was carried:

"That in future a business meeting of the Committee be held prior to and distinct from the conference, at which technical papers would be delivered and discussions held".

68. Location of Next Meeting and Election of Officers

The Committee decided that the Sixth Meeting should be held in British Columbia in 1958, tentatively in September.

Dr. A.L. Orr-Ewing was elected Chairman for the 6th Meeting, Mr. Yeatman to continue as Secretary.

69. Discussion Arising from Members' Progress Reports

Active members had distributed their annual reports in advance of the meeting. The following notes from the discussions arising from the reports are included in the minutes of the meeting in accordance with the motion proposed by Dr. Cram, seconded by Mr. Swan.

Reports were tabled as listed below, and are to be published as Part II of the Proceedings.

<u>Index</u>	<u>Name</u>	
A.	A.J. Carmichael	Angus, Ontario.
B.	W.H. Cram	Indian Head, Saskatchewan.
C.	B.W. Dance	Maple, Ontario.
D.	J.L. Farrar	Toronto, Ontario.
E.	D.A. Fraser	Chalk River, Ontario.
F.	C.C. Heimbürger	Maple, Ontario.

Index	Name (cont'd)	
G.	M.J. Holst	Chalk River, Ontario.
H.	A.H. Hutchinson	Vancouver, B.C.
I.	H.G. MacGillivray	Fredericton, N.B.
J.	R.J. Moore	Ottawa, Ontario.
K.	A.L. Orr-Ewing (in absentia)	Victoria, B.C.
L.	R. Pomerleau	Quebec, P.Q.
M.	W.A. Porter (in absentia)	Victoria, B.C.
N.	P.O. Rudolf (in absentia)	St. Paul, Minnesota, U.S.A.
O.	H.A. Senn	Ottawa, Ontario.
P.	W.H. Cram	Paper: Spruce Cone and Insect Problems
Q.	R.G. Hitt	Madison, Wisconsin, U.S.A.
	F. Mergen	Yale Forest Research Center, Valhalla, N.Y., U.S.A.
	M.J. Holst	Talk: Breeding of Spruce and Hard Pines.

A. A.J. Carmichael

Dr. Farrar congratulated Mr. Carmichael on the maps contained in his report. These showed clearly the layout and design of the field experiments, and the geographic locations.

A discussion arose concerning the arrangement of clones in seed orchards. Mr. Carmichael said that his original plan had been to plant clones in alternate rows, but this was now thought to be unsuitable because of the likelihood of self-pollination. It was now the intention to use the more elaborate systematic arrangements which have been developed in Germany. Dr. Mergen suggested that the 'knights jump' system might be useful. This was illustrated as follows:

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A B C D E F G H I J ..... Row 1.
D E F G H I J A B C ..... Row 2.
G H I J A B C D E F ..... Row 3.
J A B C D E F G H I ..... Row 4.
C D E etc.

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where each letter stands for a clone, whose members are scattered systematically throughout the seed orchard. Mr. Holst advocated the use of a wide distance between plants at the time of planting. This should allow adequate space for crown development and thinning should not be necessary.

It was suggested that 10 clones were too few to have in a seed orchard. Dr. Mergen said that 12 clones were commonly considered to be a minimum.

Dr. Cram introduced the question of the number of plants per plot and the number of replications which should be employed in provenance experiments. He stated that in a recent discussion at the Lake States meeting the feeling was for few plants and many replications. Mr. Holst pointed out that in Europe the approach was flexible. Mr. Fowler said that Dr. Heimbürger preferred larger plots, 1) to simulate stand conditions, and 2) to provide greater possibilities for the selection of individual trees within the plots. Mr. Holst commented that at Petawawa two types of plantations were established with provenances, 1) designed experiments in which statistical principles were followed, and 2) observation plots, which consisted of large plots within which selections could be made. It was generally agreed that the details of design must vary with the objectives of the particular experiment, and with the environment in which it is to be established.

#### B. W.H. Cram

Questions were raised on the problem of spruce provenances in Saskatchewan, cross compatibility in Caragana, and the rooting capacity of aspens. No work had been done on the last matter.

Mr. Carmichael and Dr. Cram discussed seed germination tests with respect to the period of time taken to determine the germination capacity of a seed sample. Dr. Cram had used 30 days for his standard, while Mr. Carmichael claimed that at Angus 12 - 15 days gave results more in line with the results obtained in the nursery seed beds.

In answer to Dr. Farrar's question on the need for stratifying black spruce seed, Mr. Carmichael said that after two or three years of cold storage germination was commonly 90 - 95 per cent without stratification.

#### C. B.W. Dance

On the question of vegetative propagation of aspens, Mr. Holst suggested that the constant mist propagation chamber may be effective for the promotion of roots.

In answer to a question by Dr. Pomerleau, Mr. Dance discussed the perfect and imperfect stages of poplar pathogens.

Mr. Holst mentioned the susceptibility of the Populus tremula x tremuloides hybrid to attack by Valsa nivea. It appears

that the triploid hybrid from a tetraploid P. tremula and diploid P. tremuloides was more resistant to the disease. The question was of great concern in Sweden where the diploid hybrids had been mass produced for sale. The disease does not become apparent in these hybrids until they are about 12 years of age.

A discussion was held of the pathogens which are to be found on Populus species and hybrids in Ontario.

D. J. L. Farrar

Dr. Farrar commented that he had been impressed by the variability of growth response of individual seedlings under the long day treatments. The question of forcing the growth of seedlings by extending the day length with artificial light was discussed at greater length. Dr. Mergen commented that attempts had been made to overcome the mutual shading effect of foliage by hanging bright metal streamers over the seed beds. These reflected a portion of the incident light at various angles into the foliage. Dr. Senn discussed the problem of separating the effects of temperature and light.

Mr. Holst introduced a discussion by asking how dormancy in trees might be overcome quickly. Dr. Senn referred to the work of Helmer in California who has been working on this problem.

E. D. A. Fraser

Replying to a question by Dr. Farrar, Dr. Fraser said that flower primordia in spruce are laid down in August, and that the female flower primordia preceded the male flower primordia. More flower primordia are laid down when both day and night temperatures are high, but with a difference between them.

F. C.C. Heimburger

Mr. Fowler offered to answer questions concerning Dr. Heimburger's report. In reply to a question by Mr. Holst, Mr. Fowler said that needle fascicles with shoot buds had been successfully bud grafted. He pointed out that after the top of a shoot is cut off to induce the formation of buds in the needle fascicles, the needles below the cut should be thinned. The thinning promotes bud formation along the length of the shoot. With no thinning, buds form only in the needles close to the cut, which results in crowding and makes it difficult to collect the fascicles with a little bark attached.

Mention was made of Dr. Slankis' success in rooting needle fascicles at Maple, but no buds were formed and hence no shoot growth could occur. Mr. Fowler had attempted to root needle fascicles with buds but so far without success. A discussion followed of techniques for propagating cuttings, including the use of hormones, constant mist chambers, time of collection, type of basal cut, etc.

On a question of stratification, it appeared that red pine seed from the south and from the north of the range of the species required a shorter period of stratification than did that from the middle of the range.

Mr. Fowler commented on other methods of overcoming seed dormancy. Cones were collected when still green and the seed excised, but embryo development was incomplete and the attempt failed. This year the seed coats were removed shortly after the seed was extracted from ripe cones and the naked seed germinated immediately.

Mr. Carmichael noted that it had been reported that asphalt emulsion when used for summer grafting had a depressing effect. Mr. Fowler outlined the procedure he had used for summer grafting. It was carried out in July when the current year's shoots were in a semi-succulent stage, buds beginning to form, the needles not fully elongated and the stem still quite soft. A cleft graft was employed, protected by a double bag, glassine inside, covered by a kraft paper bag. Asphalt emulsion was satisfactory with this combination of bags, but resulted in a lower survival when plastic protective bags were used. However, the effect was on survival only; the asphalt emulsion did not depress the growth of the successful grafts.

The question of field vs. greenhouse grafts for the establishment of seed orchards was debated. Mr. Carmichael suggested that if field grafts failed, significant gaps may occur in the seed orchard. Mr. Holst felt that it was cheaper and safer to graft in the greenhouse so that only healthy plants, which would be certain to survive, were planted in the seed orchard. However, the technique of grafting in the field is of value for rejuvenating mature material.

Mr. Fowler said he had grafted up to 40 scions of red pine into the crown of a single Scots pine, and in a relatively short time he expected to obtain a large crown of the grafted material.

Mr. Hitt preferred field grafting onto small stock for seed orchards. A number of scions may be grafted on each tree. Tests gave a satisfactory result with 65 per cent survival of the scions. He grafted red pine onto red pine. Further discussion ensued concerning methods of protecting grafts in the field, including bagging and dipping the scions in liquid latex.

#### G. M.J. Holst

Mr. Carmichael asked how much work was being done with birch at Petawawa. Mr. Holst said that little work was being done, beyond the acquisition and propagation of interesting lots of birch seed. The seedlings were transplanted to arboreta where he hoped that some day they would provide useful material for detailed study.

In response to a question by Dr. Cram, Mr. Holst replied that the results of control pollinations in spruce had been variable, but a few seedlings were obtained from most crosses, and some crosses yielded many seedlings. An important factor to be considered is the estimation of the crossing value of individual trees. This has yet to be worked out.

Mention was made of an attempt at Petawawa to isolate the top of the crown of a spruce with a specially constructed tent. This may be a very useful technique to facilitate self-pollination.

Dr. Farrar asked how seedlings were raised from hybrid seed. Mr. Holst said he preferred to sow in the fall, but this was not always practicable. More frequently the seed is stratified 8 - 10 days in slightly acid water, then sown in specially protected beds in the nursery, the soil of which had been steam sterilized shortly before sowing. This latter procedure practically eliminated damping off.

H. A.H. Hutchinson

As the author was not present at the meeting no discussion was held.

I. H.G. MacGillivray

In reply to a question by Mr. Carmichael, Mr. MacGillivray described the veneer graft, in which both the stock and scion are sliced on one side only; and the side graft, in which a slanting slit is made in the side of the stock, and the scion sliced on both sides to fit into the slit of the stock.

Dr. Prebble and Mr. MacGillivray discussed the selection of balsam fir for resistance to spruce budworm attack. Outstandingly green trees were selected, some may be misses or late flushing types.

J. R.J. Moore

Dr. Moore commented that since his report had been written he had obtained eight seeds from the polyploid branch Caragana arborescens, and now had two seedlings.

A discussion arose concerning the analysis of hybrids by the Anderson diagrams and other means.

Dr. Cram asked whether the polyploid branch was more vigorous than the normal diploid branches. This was not so. No practical advantages had been noted in the polyploid material which is only a curiosity so far. Dr. Cram commented that if genetic factors for vigour could be doubled in a tetraploid, which is then crossed with a diploid to obtain triploids, the sterile triploids may display outstanding vigour as they would not be subject to loss of production through flowering and seed formation. Difficulties often arose, however, with the viability of the tetraploids.

K. A.L. Orr-Ewing

As the author was not present at the meeting no discussion was held.