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NATIONAL RESEARCH COUNCIL OF CANADA

PROCEEDINGS

OF THE

FIFTH MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

OTTAWA

8 APRIL, 1941

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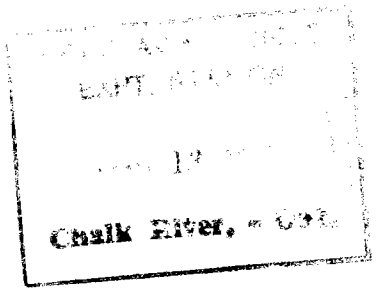

OTTAWA

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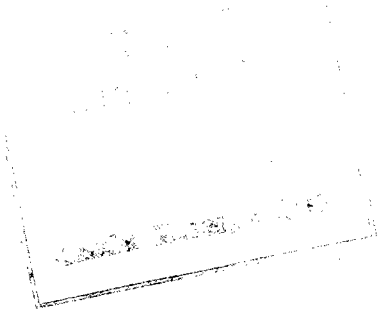

NATIONAL RESEARCH COUNCIL

P R O C E E D I N G S

of the

Fifth Meeting

of the

SUBCOMMITTEE ON FOREST TREE BREEDING

Held at the National Research Laboratories, Ottawa,
8 April, 1941.

Present:

Members: Mr. W. M. Robertson (Acting Chairman)
Dr. N. H. Grace
Dr. C. Heimburger
Dr. J. G. Malloch
Mr. M. B. Morison
Mr. C. G. Riley
Dr. H. A. Senn
Dr. L. P. V. Johnson (Secretary)

Visitors:

Mr. J. L. Farrar
Mr. A. J. Skolko
Dr. J. M. Swaine

- -

59. Minutes — The minutes of the fourth meeting of the Subcommittee on Forest Tree Breeding were read and approved without change.

60. Report on project organization — Dr. Johnson reported on the recommendations of the Special Committee on Project Organization (Minute 53, Fourth Meeting) which met on 11 December, 1940. The Special Committee decided that the Project Outline previously recommended (see Appendix A, Proceedings of Second Meeting) should be modified to take the form set forth in Appendix B of these

Proceedings. Further recommendations of the Special Committee respecting outlines of and annual reports on individual experiments are represented by the instructions given in Appendix A of these Proceedings.

61. Report on breeding and related work

Dr. Johnson summarized his activities during the winter months, which included work on control of damping-off in the greenhouse, and studies on the relation of growth rate to wood quality in Populus hybrids. Reports on these may be found (V-Z-1 and III-A-1) in Appendix C of these Proceedings.

Dr. Johnson stated that interspecific hybridization in Populus, carried out in the greenhouse during the winter had been very successful. It was considered that the favorable results were in a large degree due to the environmental conditions provided for the detached branches. Branches were collected in January and early February, set in jars of water (frequently flushed out), and placed in a greenhouse control room having a daily temperature variation of from 50° F. at midnight to 70° F. at noon. The room was kept very humid by keeping saturated peat on floor and benches.

62. Report on vegetative propagation at Petawawa

Mr. Farrar in outlining the propagation experiments at Petawawa stated that the results of completed experiments are to be found in reprints already distributed. (A list of these reprints is given in Appendix E). He also stated that current and prospective experiments are covered by the outlines given in Appendix C.

In a brief summary of his work during the past year, Mr. Farrar said that the vegetative propagation of Norway spruce has advanced to the point where the methods worked out could be satisfactorily applied to practical propagation. He believed that the same could be said, with some reservations, of the work on white spruce and white pine. On the other hand, vegetative propagation work on basswood, poplar and birch was considered to be still very much in the experimental stage.

63. Vegetative propagation general

Dr. Grace discussed several fundamental questions relating to the work on vegetative propagation. One of the more interesting of these problems has to do with the factors underlying the highly beneficial effects of Alfred peat on rooting. This peat, which is of sedge origin, is far superior to other peats tried in the vegetative propagation work. A special study is being made of the factors involved. Other questions brought up by Dr. Grace were: the greater efficiency of outdoor beds as compared to greenhouse beds in producing rooted cuttings; and, the matter of growth form (branch-like or tree-like) of rooted conifer cuttings. These problems are also receiving special study.

64. Report on pathology

Mr. Riley, after referring the meeting to the report given in Appendix D went on to summarize some of the more important results of the pathological work during the summer of 1940. Observations were continued on the diseases occurring naturally on the breeding material at Petawawa. Artificial inoculations were made but the results were not entirely satisfactory. It was felt that the inoculation technique could be perfected and the work continued. The pathogene causing the leaf rust of poplar was definitely established as being Melampsora medusae Thum.-- the aecial stage of which occurs on larch. It was proposed to investigate whether or not this pathogene could complete its life cycle on the poplar.

65. Petawawa nursery materials

Dr. Heimburger outlined the work on plant introduction and strain testing carried on at Petawawa. The results of this work are given in Appendix C.

Dr Heimburger also summarized his work on vegetative propagation in Populus. He stressed the need for experiments on methods of heeling-in, a point upon which Dr. Senn was in complete agreement.

66. Woody species at Dominion Arboretum

Dr. Senn reported that the Dominion Arboretum, Ottawa, had during the past two years obtained some 10,000 additional woody plants, involving 1665 species and varieties. Details are given in Appendix F.

67. Summer meeting

It was decided to hold a Summer meeting of the Subcommittee at the Petawawa Forest Experiment Station. It was further agreed that the meeting should be held concurrently with the Summer meeting of the Dominion Forest Service.

Memorandum to:

I am enclosing instructions, decided upon at recent conferences, for outlining the experiments coming under the Subcommittee on Forest Tree Breeding. It will be noted that headings having to do with classification number, title, etc., are to be standardized, while headings concerned in the actual writing-up of the experiment are to be decided upon by the research worker himself. The parenthesized statements following the headings are given to provide an example of a completed form.

It is hoped that all research workers will be able to submit outlines and annual reports of all important experiments to the secretary before the Spring meeting, which will be held early in April.

L. P. V. Johnson,

Secretary,
Subcommittee on Forest
Tree Breeding.

(Form to be followed in writing up outlines of experiments)

CLASSIFICATION NUMBER: (IV-A-1)

CLASSIFICATION SUBJECT: (Vegetative propagation: stem cuttings)

TITLE OF EXPERIMENT: (Response of Norway spruce cuttings to Alfred peat)

SCHEDULE: (Commenced May, 1940, finished ----)

CONDUCTED BY: (J.L.Farrar and N.H.Grace)

(The above headings are to be standardized. After "Classification Number" give: The Roman number of the main division, as IV for Vegetative propagation; the letter of the subheading, as A for Stem Cuttings; and, the Arabic number of the experiment, as 1 for "Response of Norway spruce cuttings to Alfred peat." Numbers of experiments will run consecutively under each subheading. After "Classification Subject" name the main division and subheading concerned.)

(It is suggested that the experiments be written-up under a system of additional headings similar to the following:

OBJECTIVES

METHODS

EQUIPMENT AND MATERIALS

RESULTS - to be filled in at completion of experiment since annual reports will take care of results during course of experiment.)

APPENDIX "B"

Classification of Investigations, Sub-committee on Forest Tree Breeding

1. General Outline

I.	Breeding	- Dr. Johnson and Dr. Heimburger
II.	Genetics and Cytology	- Dr. Johnson and Dr. Peto
III.	Wood Technology	- Dr. Johnson
IV.	Vegetative Propagation	- Dr. Grace, Mr. Farrar.
V.	Pathology	- Mr. Riley
VI.	Entomology	- Dr. Atwood
G.	General	-

2. Main Divisions and Subheadings

I. Breeding
- A. Selection and breeding general
- B. Hybridization
- C. Production of polyploid forms
- D. Nursery tests
- E. Disease garden tests
- F. Plantation tests
- G. Reforestation and afforestation
- Z. General

II. Genetics and Cytology
- A. Inheritance studies
- B. Cytology of induced polyploids
- Z. General

III. Wood Technology
- A. Histological studies
- B. Physical tests
- C. Chemical analyses
- D. Pulp and paper tests
- E. Experimental manufacture
- Z. General

IV. Vegetative Propagation
- A. Stem cuttings
- B. Root cuttings
- C. Grafting
- D. Layering
- E. Development of vegetatively propagated material
- Z. General

V. Pathology
   A. Poplar
   B. White pine
   Z. General

VI. Entomology
   (no subheadings

3. Outlines of Experiments

Outlines of experiments coming under the above subheadings are given in Appendix C.

APPENDIX "C"

Report on Breeding and Related Work

CLASSIFICATION NUMBER: I-A-1 (I-E-a-1*)

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of spruce.

SCHEDULE: Commenced spring 1935.

CONDUCTED BY: C. Heimburger and Entomologists.

OBJECTIVES

Testing of strains of native and exotic species of Picea to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere, and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to diseases, and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated one year in advance and submitted to the Superintendent, Petawawa F.E.S.

RESULTS

Found in seed lot transplant and plantation records of the Petawawa Forest Experiment Station and in annual reports on nursery work there. Data on clones are kept on index cards.

Summary of Previous Work:

(* Classification numbers given in parentheses are those of the Dominion Forest Service or Department of Agriculture which also apply to these projects or experiments.)

(a) SOWINGS

Spring 1935

Seed Lot	
2	Picea ajanensis, Rafn, Denmark, cancelled.
3	" excelsa, Jutland, planted in P.S.P. 152, spring 1936, good.
4	" glauca, Coalspur, Alta., transplanted spring 1936, 1939 slow in growth.
5	" " Petawawa, cancelled.
7	" pungens Kosteri, C.E.F., cancelled.

Fall 1935

8	Picea glauca, Petawawa, transplanted spring 1938, plantation 41, spring 1940, good.
9	" excelsa, Terraak, Norway, cancelled, because of slow growth.

Fall 1936

13	Picea excelsa, Riga, Latvia, transplanted spring 1939, good.
14	" " Norway, transplanted spring 1939, very variable, culled.
15	" " " " " " " "
16	" " " " " " " "
17	" " " " " " " "

Fall 1937

28	Picea pungens Kosteri, C.E.F., germination very poor, cancelled.
29	" Engelmannii, Blue River, B.C., transplanted spring 1939, slow growth
30	" glauca, Bruce County, Ont., transplanted spring 1939, good.
31	" " , Aleza Lake, B.C., transplanted spring 1939, fair, slow growth.
32	" " , Lake Edward, F.E.S., transplanted spring 1939, good.
33	" Hondoensis, Vienna, transplanted spring 1939, slow growth.
34	" obovata, Vienna, transplanted spring 1939, excellent.
35	" excelsa, Norway, transplanted spring 1939. uneven, some very good
36	" Glehnii, Vienna, transplanted spring 1939, slow growth.
37	" excelsa, Minsk, USSR, poor germination, cancelled.
38	" " Norway, no germination, cancelled.
39	" " " " " "
40	" " " " " "
41	" " Laurentide plantations, transplanted spring 1939, good.

Fall 1937, continued

42 Picea excelsa, Petawawa, no germination, cancelled.
43 " glauca Fort William, Ont., transplanted spring 1939, slow growth.
44 " " Nipawin, Sask., transplanted spring 1939, slow growth.
45 " " Harlan Forest, Sask., transplanted spring 1939, slow growth.
46 " " Grandview, Man., transplanted spring 1939 and 1940.
47 " " Nipawin, Sask., transplanted spring 1939, slow growth.
48 " mariana, Fort William, Ont., transplanted spring 1940, very good.
52 " " Petawawa swamps, transplanted spring 1940, good.
53 " glauca, Terrace, B.C., transplanted spring 1939, slow growth.
54 " " Lesser Slave Lake, Alta., transplanted spring 1939, slow growth.

Spring 1938

56 Picea Schrenckiana, USSR, transplanted spring 1939, slow growth.
58 " obovata, Denmark, no germination, cancelled.
59 " mariana, Notakim Depot, Que., very poor germination, cancelled.
60 " " Petawawa swamps, transplanted spring 1939, good.

Fall 1938

81 Picea glauca, Kananaskis, F.E.S., slow growth.
82 " sitchensis x glauca F_2 and x sitchensis, many not hardy, some very good.
83 " glauca, Les Eboulements, Que., fair.
84 " excelsa, Laurentide plantations, not uniform but very good.
85 " glauca, Valcartier, F.E.S., rather slow growth.
86 " excelsa, Latvia, very good.
87 " glauca, Denmark, rather slow growth.
93 " " seed tree 1, Petawawa, good.
94 " " " " 2, " "
95 " " " " 3, " "

Spring 1939

107 Picea asperata, Nancy, France, very good.
109 " mariana, Notakim Depot, Que., slow growth.
146 " obovata, Harbin, very good.

Fall 1939

188 Picea jezoensis, Harbin, good.
189 " sitchensis, Kitimat, B.C., fairly good.
190 " " Courtenay, B.C., " "
191 " Engelmannii, Salmon Arm, B.C., good, slow growth.
192 " excelsa, Finland, good.
193 " " Yugoslavia, good.
194 " " Roumania, excellent.
195 " " France, fair.
196 " " Poland, excellent.
197 " " Finland, good.
198 " " Switzerland, good.
199 " " Sweden , fairly good.
200 " " Germany, good.
203 " " Germany, very good.
204 " " Norway, good.
205 " " Roumania, good.
206 " " Roumania, fairly good.
207 " " USSR, fair.
208 " rubra Berthierville, Que., poor.
209 " glauca, Notakim Depot, Que., good.
210 " excelsa, Petawawa, good.

Spring 1940

217 Picea koraiensis, Keijo, good.

Fall 1940

226 Picea yezoensis, Keijo.
227 " glauca, Petawawa.
228 " rubra, Berthierville, Que.
229 " glauca, Angus, Ont.

(b) VEGETATIVE PROPAGATION

Spring 1937 cuttings

Picea excelsa SN-15, Petawawa, F.E.S. 162, transplanted spring 1940
" pungens #1, Petawawa, F.E.S. 97, transplanted spring 1940.

Fall 1939 cuttings

Picea excelsa SN-15, Petawawa F.E.S. 188, cuttings.
" " SN-17, " " 136, "
" " SN-18, " " 123, "
" " SN-19, " " 152, "
" " SN-20, " " 147, "
" " SN-21, " " 145, "
" " SN-22, " " 148, "
" " SN-23, " " 135, "
" pungens #1, " " 128, "

Fall 1940 cuttings

Picea excelsa	SN-17, Petawawa, F.E.S.	513	cuttings.
"	" SN-19, "	440	"
"	glauca, Albertiana #7006, C.E.F.	27	"
"	omorika #4024, C.E.F.	37,	cuttings
"	" #6192, "	32,	"
"	pungens Kosteri #2, C.E.F.	17	cuttings.
"	" " #3, "	19	"
"	sitchensis, St. Williams, Ont.,	26	"

(c) OBSERVATIONS TO DATE

Picea excelsa of central European origin planted in eastern Canada is not fully winter-hardy.

Some striking individual differences in susceptibility to white pine weevil (Pissodes Strobi Peck) can be observed in plantations. These differences may be inherent with some biotypes. Strains from different altitudes and latitudes in Norway generally show slower growth and shorter growth periods with increasing altitude and latitude of place of origin. All the strains tested so far are much more heterogeneous in this respect than strains from different altitudes in the Alps described previously by Cieslar and Engler. Most of the strains from Norway show several abnormalities in their growth form when grown at Petawawa. This is not the case with P. excelsa and P. obovata from Latvia and from Siberia, which are quite homogeneous in their growth form and growth rates. In Picea glauca, Engelmannii and related forms, the size of the 1-year seedlings appears to depend a great deal on the size of the seeds; later this is obscured by inherent growth factors, as well as by soil differences. Eastern strains have smaller seeds than the western strains, as a rule, but the latter show a slower growth in the nurseries after their first year. The expression of dominance among seedlings in seed beds is far greater than in Picea excelsa and is much favoured by good soil. It is greater in the eastern strains, showing more rapid seedling development than in western strains. Some of the latter are not ready for setting out in plantations until they are 5 years old. After their second year in the seed beds, seedlings of some eastern strains of P. glauca are larger than seedlings of P. excelsa of the same age. The marked differences in several morphological characters found in mature material in the Rocky Mountains have so far not been reflected in the seedlings grown from it at Petawawa. The existence of upland ecotypes of P. mariana in western Ontario and northern Quebec, distinct from the more commonly occurring swamp ecotypes, is rendered highly probable by recent tests in the nurseries. The former are more drought-resistant and show much better transplantability in mineral soils. Several strains from rich swamps at Petawawa compare very favourably with the best strains of P. glauca and P. excelsa in their growth rate after their second year. P. rubra has so far yielded rather slow growing material.

CLASSIFICATION NUMBER: I-A-2 (I-E-a-2)

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of hard pines.

SCHEDULE: Commenced spring 1935.

CONDUCTED BY: C.Heimburger

OBJECTIVES

Testing of strains of native and exotic species of Pinus of the sections Lariciones and Insignes (Australes) to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture on poor soils in eastern Ontario and elsewhere, not suitable for growing more valuable species and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and the special site conditions, susceptibility to disease and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material; for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated for one year in advance and submitted to Superintendent of Petawawa F.E.S.

RESULTS

Found in seed lot, transplant and plantation records of the Petawawa F.E.S. and in annual reports on nursery work there. Data on clones are kept on index cards.

Summary of Previous Work:

(a) SOWINGS

Spring 1935

1 Pinus silvestris, Karelia, transplanted spring 1936, out in plantation 39, spring 1938, good form.

Fall 1936

12 Pinus silvestris, Norway, poor germination, cancelled.
18 " " " transplanted spring 1938, out in plantation 42 spring 1940.
19 " " " transplanted spring 1938, out in plantation 42 spring 1940.
20 " " Riga, Latvia, transplanted spring 1938, out in plantation 42 spring 1940, good form.
21 " Banksiana, Fort William, Ont., transplanted spring 1938, out in plantation 42, spring 1940.
22 " silvestris, Norway, transplanted spring 1938, out in plantation 42 spring 1940.
23 " " Norway, transplanted spring 1938, out in plantation 42 spring 1940.

Fall 1937

49 Pinus contorta var. latifolia, Terrace, B.C., transplanted spring 1939, good.
50 " silvestria, Minsk, USSR, transplanted spring 1939, good.
51 " " Czechoslovakia, transplanted spring 1939, good.

Spring 1938

152 Pinus silvestris, Ladoga, transplanted spring 1939, good.
153 " " Bugnet, " " 1939, "
65 " " Leningrad, " " 1939, "

Fall 1938

73 Pinus contorta, Lower Fraser Valley, transplanted spring 1940, good.
74 " silvestris x montana F_3, Denmark, transplanted spring 1940, variable.
77 " " , Griva, Latvia, transplanted spring 1940, good.

Fall 1939

162 Pinus silvestris, Norfolk County, Ont.
163 " " Scotland.
164 " " Griva, Latvia, (same as No. 77).
165 " " Latvia
166 " " USSR
167 " " Hungary
168 " " Poland
169 " " USSR
170 " " East Prussia
171 " " Roumania
172 " " Scotland
173 " " Lapland
174 " " Sweden
175 " " France

Fall 1939 continued.

176 Pinus silvestris, Finland
177 " " Sweden
178 " " Pyrennees
179 " " S.W. Germany
180 " " Norway
181 " " "
182 " " "
184 " resinosa Petawawa
185 " silvestris Norway
186 " Banksiana, Orange Road, Petawawa
201 " densiflora, Harbin
202 " leucosperma, "

Spring 1940

215 Pinus contorta var. latifolia, Salmon Arm, B.C.
216 " " " " Kitwanga, B.C.
218 " " " " Prince George, B.C.

Fall 1940

235 Pinus ponderosa, Falkland, B.C.
238 " Banksiana, Racehorse, Petawawa
239 " contorta, Comox, B.C.
240 " Banksiana, Notakim Depot, Que.
241 " contorta, Fraser River Delta, B.C.
242 " Banksiana, Highview, Petawawa.
243 " contorta var. latifolia, Kananaskis, F.E.S.
244 " nigra, Hungary.
245 " densiflora, Korea.
246 " Banksiana, Massey, Ont.

(b) VEGETATIVE PROPAGATION

Fall 1940 cuttings

Pinus austriaca No. 319, C.E.F.,17 cuttings.
" contorta var. latifolia No. 1625 C.E.F.,24 cuttings.
" montana var. Mughus No. 1024 C.E.F.,18 cuttings.
" " " uncimata No. 5887 C.E.F.,20 cuttings.
" ponderosa No. 702, C.E.F.,10 cuttings.
" rigida No. 7015 C.E.F.,19 cuttings.
" (Thunbergiana) No. 1774, C.E.F.,10 cuttings.

(c) OBSERVATIONS TO DATE

The usually cultivated strain of P. silvestris in eastern Canada has the well-known poor growth form, although it is quite winter-hardy, resistant to disease and maintains a fairly rapid growth rate even when planted on rather poor sites.

Strains from eastern Finland and from Latvia have so far shown much superior growth form but slightly inferior growth rate. Strains from Norway are very heterogeneous, material from high altitudes as a rule being slower growing and more branchy than strains from lower elevations. The latter are slightly inferior in growth form as compared with strains from eastern Europe, but grow faster. The material obtained recently from various other parts of Europe has shown marked differences in susceptibility of the seedlings to damping-off according to place of origin. Some strains from northern Europe and from high altitudes in the mountains of central Europe appear more resistant than the rest. Strains from central Sweden and East Prussia suffered more than other strains. Strains of P. Banksiana and P. contorta and its var. latifolia has so far not shown any marked fifferences beyond the expected slower growth and shorter growth period of northern and high-altitude strains as compared with strains of more southern origin and lower elevations.