FAO/CIP/36

I - REPORT of the FIFTH SESSION

of the

INTERNATIONAL POPLAR COMMISSION

FAO/52/2/664

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS
Rome

ORGANISATION DES NATIONS UNIES POUR
L'ALIMENTATION ET L'AGRICULTURE
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INTERNATIONAL POPLAR COMMISSION

REPORT of the FIFTH SESSION
of the
INTERNATIONAL POPLAR COMMISSION

and

PROCEEDINGS of the FOURTH
INTERNATIONAL POPLAR CONGRESS

Rome, Italy
December 1951

FAO/52/2/664

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A - GENERAL REPORT

The International Poplar Commission held its 5th Session at the Imperial Forestry Institute, Oxford, England, from 1 - 2 May 1951, during the course of the Fourth International Poplar Congress.

The following member countries of the Commission were represented: AUSTRIA, BELGIUM, FRANCE, ITALY, NETHERLANDS, SWITZERLAND and UNITED KINGDOM. Observers attended from CANADA, GERMANY (Western Zone), LEBANON, INDIA, IRELAND and SPAIN. The following countries regretted being unable to send delegates: Czechoslovakia, Israel, Luxembourg, Norway, Pakistan, Portugal, Sweden and Turkey. The International Union of Forest Research Organizations was also represented. (A full list of the participants appears in Annex 1).

Professor Ph. GUINIER, the Chairman of the Commission, assisted by Professor HOUTZAGERS, the Vice-Chairman, presided over the meeting. Mr. R.G. FONTAINE, FAO, Secretary of the Commission, represented the Director of FAO's Forestry Division, Mr. GAILLARD (Switzerland) was appointed rapporteur.

At the beginning of the Session the Chairman made it clear that all delegates present might take part in the discussion of technical questions, but that only the delegates from member countries would be permitted to participate in the discussion of statutory questions.

The Commission adopted the Agenda, drafted by the Secretariat after consultation with the Chairman, with the following modifications:

1) introduction of the study on Wood Tension under item 5;

2) introduction of a new item "Election of new members" between items 7 and 8 items 8 and 9 becoming respectively 9 and 10.

The Commission then commenced work on its Agenda and took the decisions and made the recommendations as set out below:

I - ACTIVITIES OF THE SECRETARIAT

The Secretary reported on the activities of the Secretariat since the last Session, and pointed out in particular the drafting of the Report of the Fourth Session, the preparation of the Fifth Session and the conversations held in Paris with the Organization for European Economic Cooperation (O.E.E.C.), which aimed at securing the distribution to all the member countries of the Commission, of the Report of the Mission of Experts to the United States.

The Commission expressed its satisfaction with the work of the Secretariat and thanked the Director-General of FAO for the assistance given to the Commission by that Organization.

II - REPORT BY THE CHAIRMAN ON ACTION ARISING FROM THE PROPOSALS ON NOMENCLATURE PRESENTED TO THE INTERNATIONAL BOTANICAL CONGRESS AT STOCKHOLM -

The Chairman informed the Commission of the reception by the International Botanical Congress at Stockholm of the proposals concerning the nomenclature of the Populus of the Aigeiros Section, already unanimously approved by the member countries of the Commission. The Congress at Stockholm considered this nomenclature as being of a horticultural nature and believed that it should take no decision.

The Commission decided to insist upon the implementation in the member countries of the nomenclature mentioned above, and to submit the reports again in 1954 to the International Botanical Congress at Paris. The following resolution was adopted:

"The Commission -

> Considering that its proposals concerning the nomenclature of the Populus of the Aigeiros Section could not be taken into consideration by the Nomenclature Commission of the International Botanical Congress at Stockholm;
>
> Considering, on the other hand, that such proposals have been unanimously adopted by the member countries of the Commission and are actually being applied in the majority of them;
>
> Decides to maintain its resolution and to present its proposals again to the next International Botanical Congress which will be held in Paris in 1954".

III - REPORT OF THE WORKING GROUP ON THE UTILIZATION OF POPLAR WOOD

Convened by the Chairman of the International Commission, the Working Group on the Utilization of Poplar Wood - established during the last Session - met in Paris from 19 - 20 April 1951 at the Central Wood Testing Laboratory (Laboratoire Central d'Essais des Bois), 14 Avenue de Saint-Mandé. Mr. GIORDANO, Professor of Technology at the University of Florence, was elected Chairman and Mr. JANIS, "Ingénieur en Chef des Manufactures de l'Etat" was appointed rapporteur.

After Mr. JANIS had introduced the Report of the Working Group (Annex 2) pointing out the advisability, first of all, of defining certain tests and then of deciding how the liaison between laboratory and industry could be effected, the Commission unanimously adopted the following motion:

> "The Commission approves the Report of the Working Group on the Utilization of Poplar Wood which met in Paris from 19 - 20 April 1951 and which was convened by the Chairman of the Commission, and recommends that National Commissions study the suggestions made in this report and submit their opinions to the Secretariat not later than 15 January 1952. The largest possible Working Group will be convened by the Chairman prior to the next Session with a view to examining these different opinions.
>
> The Commission suggests that the respective National Commissions should each establish a small Committee to promote systematic studies of poplar wood, and that each such Committee should include at least one representative of Industry and one of the Laboratories".

The Commission also expressed the wish that representatives of wood users should be included in all delegations to the International Poplar Commission.

IV - MISSION OF EXPERTS TO THE UNITED STATES

As a result of the initiative taken by the Commission's Secretary the Council of the Organization for European Economic Cooperation had recommended, at its meeting on 20 January 1950 and as proposed by its Timber Committee, that a mission of experts should be sent to the United States under the auspices of the Technical Assistance Program to study:

(a) the indigenous types of Populus deltoides Marsh;

(b) the natural stands of aspens and balsam poplars;

(c) the rapid growth hybrids obtained and planted by paper manufacturers;

(d) the possibility of selecting the hybrids best adapted to European conditions (type of land on which grown and resistance to disease);

(e) besides the problems mentioned above, conditions of production and use of poplars in the United States.

As a result of this decision a Mission of six European experts visited the Eastern part of the United States from 3 May to 9 June 1950. The Mission consisted of: MM. O. BORSET (Norway), A. HERBIGNAT (Belgium), Dr. G. HOUTZAGERS (Netherlands), R. ROL (France), Dr. W. WETTSTEIN (Austria), and S. WIJKSTROM (Sweden).

The experts - under the chairmanship of Dr. HOUTZAGERS - subsequently prepared a report which was submitted to OEEC but which has not yet been published.

MM. HOUTZAGERS and ROL, therefore, who participated in this mission, could not inform the Commission of the conclusions reached by the mission as a whole but only of some personal observations which they had made at the time. Following a resolution of the Commission, the accounts of MM. HOUTZAGERS and ROL are attached to this Report (Annexes 3 and 4).

V - REPORTS BY DELEGATES ON THE ACTIVITIES OF NATIONAL COMMISSIONS

The reports of Belgium, France, the Netherlands and the United Kingdom, distributed prior to the meeting, were briefly commented on by the delegates of those countries. The delegates of Austria and Italy also reported on the activities of their National Commissions. The delegate from Switzerland gave an account of activities in his country concerning Poplar, and pointed out the establishment of a Poplar Committee. These statements will be reproduced as documents of the Commission.

The Chairman, having emphasized the results obtained in the various countries, thanks to the collaboration achieved, as envisaged by the International Commission: congratulated the rapporteurs and requested them to convey the International Commission's thanks and congratulations to the National Commissions.

VI - OTHER BUSINESS

During the discussion of Item 7 "Other business", the Commission decided to refer consideration of Thinning of Poplar Stands and Utilization of their Products to one of the meetings of the Congress and to discuss in the meetings of the Commission only the Exchange of Plants and Cuttings, including measures to be taken against pests and diseases, as well as the economic aspects of Poplar cultivation.

(1) Exchange of plants and cuttings, from the Plant Protection standpoint -

The matter was raised by Mr. PEACE, who referred to a paper by Mr. GRAVATT, American pathologist, on the risks of infection and the necessity of taking preventive measures.

The Commission considered that, as it would be undesirable to stop the exchange of material, measures should be studied to prevent the spread of disease. It was, therefore, decided to form a Working Party the members of which should keep in touch through correspondence and then meet prior to the next session, with a view to examining the whole problem. MM. PEACE, ROL and Van VLOTEN were elected members of the Working Party.

(2) Economic aspects of Poplar Cultivation

Mr. HOUTZAGERS having presented a paper on the economic aspects of Poplar cultivation in the Netherlands (Document FAO/CIP/31), the Commission advised the member countries to undertake similar studies and asked the Secretariat to place this matter on the Agenda for the next Session. It also requested the National Commissions to give special consideration to the question and to devote a paragraph to it in the annual reports which will be presented at the next Session.

VII - STATEMENT OF THE DELEGATE FROM THE LEBANON

Mr. SALHA, Director of Forests for the Lebanon, made a statement declaring the interest which his country took in the work of the Commission, and expressed the wish to have twenty-five samples of the best poplar clones of each country sent to him. After the Chairman had drawn attention to the importance which tests carried out in the Lebanon have for all the countries of the Middle East, the Commission took note of the statement of the Lebanese delegate.

VIII - STATEMENT OF THE FAO REPRESENTATIVE

The Commission took note of a statement by the FAO representative on the advisability of organizing in certain cases Regional Working Groups in view of first, the problems arising from the cultivation of the Poplar in other parts of the world, and, second, the financial difficulties confronting the majority of the member countries of the Commission if required to send delegations to other regions.

IX - ELECTION OF NEW MEMBERS

Western Germany was unanimously elected a member of the International Poplar Commission, subject to ratification and establishment of a National Poplar Commission by the government of that country.

X - RE-ELECTION OF MEMBERS OF THE PERMANENT COMMITTEE

The Commission decided to maintain the Permanent Committee in its present form until the next Session in view of the absence of two members of the Permanent Committee, MM. PICCAROLO and REGNIER. The election of new countries during the last two years might subsequently entail an enlargement of the Permanent Committee.

XI - ELECTION OF THE CHAIRMAN AND VICE-CHAIRMAN

MM. GUINIER and HOUTZAGERS were unanimously re-elected Chairman and Vice-Chairman respectively, for a further term of three years.

XII - DATE AND PLACE OF NEXT MEETING

The Commission having been informed by the Secretariat of the invitation from the Syrian government to hold the next meeting at Damascus, and having also been invited by the Chief of the German delegation, on behalf of the German government, to organize the next Congress in Germany, it unanimously adopted the following resolution:

> "The Commission takes note of the invitations extended by the Syrian and German governments and expresses its most grateful thanks to those countries for offering the Commission the opportunity to complete, in countries where Poplar cultivation plays an important role, the information already collected in the countries previously visited.
>
> It considers, however, in view of the advantage both to the above mentioned countries and to the participating countries of bringing together the greatest possible number of experts and individuals concerned with Poplar problems, that meetings in the above mentioned countries should be organized in the form of Congresses.
>
> In accordance with the decision taken at the Third Session - that Congresses organized in connection with the meetings of the Commission should not take place every year - the next Congress will only be held in 1953.
>
> The Commission therefore expresses the wish that an ordinary session should be held at FAO Headquarters in Rome in May 1952, and directs the Chairman, in liaison with the Secretariat, to continue discussions with the aforesaid countries so that Congresses may be organized there starting in 1953".

XIII - PRODUCTION AND DISTRIBUTION OF REPORT

In accordance with the usual procedure, the Commission decided to attach to the General Report of the Fifth Session and the resolutions adopted, two reports collating the observations made during the study tour in England: one on the Identification and Cultivation of Poplar and the other on Pests and Diseases.

MM. HOUTZAGERS and PEACE were appointed rapporteurs for the former, and MM. ROL and Van VLOTEN for the latter.

The Commission also expressed the wish that the Director-General of FAO would consider the issue of a larger number of copies of the report so that it might be given a wider distribution.

XIV - STUDY TOUR

In connection with the Fifth Session of the International Poplar Commission the Government of the United Kingdom organized the Fourth International Poplar Congress and a study tour. All participants received full documentation on the excursions which took place. The report of the Congress, of the visits paid and of the observations made is attached.

The Commission desired to express its thanks to the Forestry Commission for organizing the Congress and the Study Tour, thus enabling the Commission to complete the documentation already collected in other countries and to hold fruitful discussions on the spot; and also to thank the Imperial Forestry Institute, which generously offered the use of its buildings for the meetings.

General Report - ANNEX 1

LIST OF PARTICIPANTS

Chairman : Prof. Ph. GUINIER
Vice-Chairman: Prof. Dr. G. HOUTZAGERS
Secretary : Mr. R. G. FONTAINE

Mr. R.G. FONTAINE represented the Director of the Forestry Division of FAO.

DELEGATES -

a) Member countries:

AUSTRIA : Mr. W. WETTSTEIN, Professor.

BELGIUM : Mr. A. HERBIGNAT, Inspecteur des Eaux et Forêts.

FRANCE : Mr. Ph. GUINIER, Directeur Honoraire de l'Ecole Nationale des Eaux et Forêts.
Mr. R. ROL, Sous-Directeur de l'Ecole Nationale des Eaux et Forêts.
Mr. J. de VAISSIERE, Conservateur des Eaux et Forêts.
Mr. J. POURTET, Ingénieur des Eaux et Forêts.
Mr. A. JANIS, Ingénieur en Chef des Manufactures de l'Etat.
Mr. J. CHARDENON, Contrôleur Principal du S.E.I.T.A.

ITALY : Mr. G. SACCHI, Directeur Général des Forêts.
Mr. L. FUNICIELLO, Inspecteur Supérieur des Forêts.
Mr. G. MELOCCHI, Inspecteur Chef des Forêts.
Mr. L. CHIANESE, Directeur des Services de l'Agriculture et des Forêts de l'Organisation Nationale pour la Cellulose et le Papier, Rome.

NETHERLANDS : Mr. G. HOUTZAGERS, Professor of Forestry at the Agricultural Institute at Wageningen.
Mr. Dr. H. van VLOTEN, Director, Bosbouwproefstation T.N.O., Wageningen.
Mr. F.W. BURGER, Engineer in Chief, State Forest Service, Bilthoven.
Mr. H.J. GERRITSEN, Nederlandsche Heidemaatschappij, Arnhem.

SWITZERLAND : Mr. E. GAILLARD, Inspecteur Fédéral des Forêts.

UNITED-KIMGDOM : Mr. T.R. PEACE, Forest Pathologist, Forestry Commission.

b) Non-Member countries:

WESTERN GERMANY: Regierungspräsident Dr. W. WARSCH, Vorsitzender des Deutschen Pappelvereins.
Professor Dr. H. HESMER, Leiter des Forschungsrates des Deutschen Pappelvereins.
Professor Dr. H. HILF, Director of the Institut für forstliche Arbeitswissenschaft.
Dr. F. KIEL, Technical Director, Zellstoff fabrik, Waldhof.
Professor Dr. E. ROHMEDER, Forstl. Facultät der Universität.

IRELAND : Mr. N. MORRIS, Forest Inspector, Department of Lands.

LEBANON : Mr. A. SALHA, Directeur des Eaux et Forêts.

OBSERVERS

CANADA : Dr. C. HEIMBURGER, Southern Experiment Station.

CZECHOSLOVAKIA : Mrs. O'COTTON, Czechoslovak Embassy, London.

INDIA : Dr. S. KRISHNA, Indian Scientific Liaison Officer.

SPAIN : Mr. S. SABUCEDO, Professor.

International Organization:

INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS:

Mr. H. van VLOTEN.

General Report - ANNEX 2

REPORT OF THE WORKING GROUP ON THE UTILIZATION OF POPLAR TIMBER

Convoked by the President of the International Poplar Commission, the group, which had already been formed at the last session, met at Paris on 19th and 20th April, 1951, on the premises of "Laboratoire Central d'Essais des Bois", 14, Avenue de Saint-Mandé, at Paris.

The following countries were represented:

BELGIUM : M. FOUARGE, Directeur du Laboratoire Forestier de l'Etat à GEMBLOUX

FRANCE : Mr. JANIS, Ingénieur en Chef des Manufactures de l'Etat, Directeur de la Manufacture d'Allumettes de SAINTINES (Oise)

M. CAMPREDON, Directeur de l'Institut National du Bois

ITALY : Professor GIORDANO, Professeur à l'Université Forestière de FLORENCE

HOLLAND : Ingénieur BIENFAIT, Directeur de l'Institut du Bois T.N.O. à DELFT

SWITZERLAND : M. GAILLARD, Inspecteur Fédéral des Forêts à BERNE

M. Guinier, President of the Commission, opened the session, and M. Fontaine, Secretary of the Commission, represented FAO. MM. Jacquiot and Villiere took part in the discussions.

M. Giordano was elected Chairman, and M. Janis, recorder.

The meeting was convoked in order to obtain an exchange of views, and data concerning the execution of the first industrial tests on the utilization of poplar, correlated with laboratory tests, persuant to the recommendations made during the fourth session of the International Poplar Conference.

It seemed opportune to tie in the laboratory tests more closely with the industrial ones, in order to allow the technological laboratories to fulfil more effectively their functions of liaison between production and utilization problems.

One of the first results was to show the necessity of suggesting modifications in the wording of the standard test form for samples of poplar wood, as adopted during the first to third sessions of the Commission.

The new wording would carry details enabling one to:-

(1) Lay down the method of selection of trees and samples and their quantity.

(2) Determine by chemical and microchemical methods the presence of tension wood.

(3) Detail the physical and mechanical tests and add tests on samples taken from rotary-cut veneer.

(4) Consider the peeling tests provided for on the form as 'notes on peeling', and detail the conditions for such notes.

NOTES MADE ON THE FORM AND SUGGESTED MODIFICATIONS

A) Selection and Number of samples

Select as clones to be tested those that give the best results in cultivation in the region concerned, or those reputed to give the best satisfaction to the consumers.

Each clone must be the subject of a large number of successive tests.

A sampling batch for a test should not comprise less than five trees for laboratory tests, and less than ten, for industrial tests. These trees should be well grown and free from injuries, or accidental defects, such as ring shakes and frost cracks, etc. Avoid the marginal trees of stands, and those which do not measure at least 1 m. in girth at breast height.

Three series of samples will be taken: the first in the portion of the stem suitable for peeling; the second in that portion of the stem normally destined for sawmilling; the third in that portion of the stem usable as pulpwood. The first series would comprise: for physical and mechanical tests a log of one metre minimum length, for veneer tests a log of the same length. The second series would comprise: for sawmilling and mechanical processing tests a log three metres long, from which would be taken the samples necessary for the physical and mechanical tests. The third series would comprise the remaining round wood.

Identification of samples

In the batch concerned each tree would carry a number, which would be repeated on the butt end of every log; this number would be followed by a letter a, b, c, etc. showing the position of the logs in the trees starting from the base.

On the cross section of each log, a black arrow would be marked indicating the north position in the standing tree, and a red arrow indicating the direction of the prevailing winds (arrow in the same direction as wind action).

The trees should have been felled when dormant, and good storage conditions should be assured (method and duration of storage to be indicated).

B) Laboratory Tests (para. II of the form)

Para. II - 1: Chemical Analysis: Color reaction to be made as a test for tension wood (phloroglucin with HCl)

Para. II - 2: Anatomical Study: Measure the diameter of the fibres and not that of the vessels. Mention in this among the details the presence or absence of gelatinous fibres, fungal hyphae, and any other detail of interest.

Para. II - 3: Physical and Mechanical Study: Shrinkage, measure volumetric, tangential, radial and longitudinal R (shrinkage) in normal wood. Strength, measure on samples of 5 x 5 and 2 x 2 for compression, and, if possible, for bending. Useless to measure tension parallel to grain. So far as possible followed by a factory test.

Tests on Rotary-cut Veneer. These tests will apply to veneer peeled to 10-15 mm. thickness using a pressure bar, on a width of 2.5-5 cm. (minimum clear width between grips three times the breadth). The test will be made on a sheet brought to a moisture content of approximately 12%.

On these sheets will be made a test of tension parallel to the grain, and a bending test permitting of the determination of the minimum radius of curvature of the sheet without breaking. This determination should be made in both directions (natural curvature and reverse curvature).

C) Industrial Tests (Para. III of the form)

Para. III - 1: General Characteristics: In the paragraph 'appearance of the samples' note the presence or absence of tension wood visible to the naked eye.

Para. III - 2: Machining Tests: Note details as follows on the nailing tests:

A test will be made of a board 20 mm. in thickness and a minimum length of 10 cm., by means of nails 2 mm. in diameter driven in more than 2 cm. from the edge of the board, or from neighbouring nails. The minimum distance will be determined of the point, measured from the end of the board, at which the nail can be driven in without causing splitting. The effort necessary to drive in and withdraw the nail will be measured.

Para. III - 3: Peeling Tests: This paragraph will be entitled 'Observations during peeling'.

Moisture. This will be measured on samples of the sheet of veneer taken at the beginning, middle and end of the peeling of the log.

The note 'wood brittle or not' may be suppressed, but an indication should be added of the coloration of the wood, and any anomaly in this respect, oxydation phenomena, Staining Fungi, micro-organisms, pithflecks.

Recovery on Peeling. The following volume ratios to be given

Logs trimmed to true cylindrical shape / unbarked wood	Core / unbarked wood	Sheet of veneer / unbarked wood

By a sheet of veneer is to be understood only the volume of utilizable green sheets, free of all defects.

Recovery on Utilization. Every industrial producer should give his figures relating to unbarked wood converted and the quantity of finished products obtained, with an appraisal of the quality of these products.

Appraisal of the quality of the wood for Peeling. The lot will be graded as bad or poor, passable, good, or very good.

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It is desirable that every National Committee should be able to communicate to the next meeting the results, which it has been able to obtain in this direction and its opinion on the need for perfecting the wording of these forms.

The Working Group renews its suggestions concerning the necessity of entrusting to a permanent organization the task of summarizing the documentation, giving the results obtained in the spheres of production and utilization, making particular use of the work done by the laboratories to secure liaison between these two spheres.

Each National Committee will be able to examine, according to the conditions of its own country, the question whether this work should be entrusted to some existing organization, or whether there is occasion for constituting an organization specially devoted to this task.

The Working Group regards it as necessary to meet later to re-examine the matters detailed above and any other relevant questions.

General Report - ANNEX 3

ARTIFICIAL HYBRIDS AND DISEASES OF POPLAR TREES IN THE UNITED STATES

by Professor R. ROL

I. ARTIFICIAL HYBRIDS

One of the main purposes of the mission was to study artificial poplar hybrids produced and grown by the paper companies. Part of our trip was devoted to this study and we had the good fortune to be escorted, at Beltsville first and in New England later, by Dr. Ernst J. SCHREINER, Geneticist of the Northeastern Forest Experiment Station, who has been devoting most of his efforts to this work since 1924.

The idea of improving forest trees by hybridization, following the results obtained in agricultural and horticultural crops, is very old. However, because of the particular characteristics of most forest trees, namely, their considerable growing capacity, their very long life and the difficulty of their vegetative reproduction, it seems that only very few experiments have been made along these lines until comparatively recently. However, among wood producing trees, the poplar is a favorite species of geneticists because of the rapidity of its growth and the facility with which it can be reproduced asexually.

The first artificial poplar hybrids were obtained about 1912 by A. HENRY, at that time Professor of Silviculture at the Royal College of Science at Dublin. Among the hybrids obtained, one was particularly vigorous and was called Populus generosa. It was the result of crossbreeding between P. trichocarpa Hooker ♂ and P. angulata Ait ♀.

In the United States, the American Breeders Association has, since the beginning of the century, considered the possibility of improving forest trees by selection. In 1916, Mr. Ralph Mac KEE, then Director of the Paper-Making School of the University of Maine, took up this idea again and on the basis of the results achieved by A. HENRY, decided to apply it to the poplar. His aim was to produce cheap cellulose for paper manufacture. He obtained the collaboration of A.B. STOUT, Director of the Laboratories of the Botanical Garden of New York and a famous breeder, and of Ernst J. SCHREINER, at that time recently graduated from Syracuse University. A program of work was laid out: the Oxford Paper Company, a large paper-making company located at Runford Falls (Maine), provided ample financial means and the experiments were initiated in 1924. Hybridizations were effected by using the collection

of poplars in Highland Park at Rochester (New York). For two years cross-breedings were made among 34 different species of poplar of the following sections:

Section Leuce	:	8
Section Aigeros	:	17
Section Tacamahaca	:	9

Over 13,000 hybrids were thus obtained as a result of 99 different combinations of the 34 species used. During their second year of growth, a first selection was made from among these hybrids, mainly on the basis of the vigor of their growth. 600 plants were chosen. A second, stricter selection reduced this number to 69. It should be noted that all the hybrids thus selected were breeds between balsam poplars on the one hand, and between black or balsam poplars on the other.

Among these hybrids, 10 were studied particularly and were given the following horticultural names:-

Frye	-	P. nigra x P. laurifolia
Rumford	-	P. nigra x P. laurifolia
Strathglass	-	P. nigra x P. laurifolia
Roxbury	-	P. nigra x P. trichocarpa
Andover	-	P. nigra betulifolia x P. trichocarpa
Geneva	-	P. Maximowiczii x P. berolinensis
Oxford	-	P. Maximowiczii x P. berolinensis
Rochester	-	P. Maximowiczii x P. nigra plantierensis
Androscoggin	-	P. Maximowiczii x P. trichocarpa
Maine	-	P. candicans x P. berolinensis

All the parent trees, except P. nigra, belong to the Tacamahaca Section; P. berolinensis is doubtless a hybrid derived from P. nigra var. italica x P. laurifolia.

According to STOUT and SCHREINER, this second selection was made considering the following four factors: vigor of growth, rooting capacity of cuttings, and resistance to adverse climatic conditions and to disease.

However, this selection was made from among plants which were still too young and therefore neither the sex nor the habit of the adult tree could be considered. On the other hand, these points were of merely secondary importance because the sole purpose was to produce the maximum amount of cellulose in the shortest possible time. However, we might ask how the authors were able within such a short period of time to judge the climatic requirements and the immunity to parasites of their hybrids. We will see further on, that, in our opinion, this was the chief mistake which they committed.

The large number of hybrids which had not been chosen during the two successive selections were used on a vast experimental plot in the vicinity of Frye near Rumford, where the hybrid nurseries were already established.

Unfortunately, these experiments were practically halted after 1930. mainly because of the economic depression which hit the United States of America at that time.

Toward 1936, the experiments were resumed by the Federal Forest Service and placed under the supervision of the Northeastern Forest Experiment Station, and actually in charge of Dr. Ernst J. SCHREINER, who had become the geneticist of this Federal agency. However, the Second World War broke out and again the experiments were interrupted. They were started again in 1947 by Dr. SCHREINER at the Beltsville Experiment Station (Maryland), about 20 km. north of Washington, D.C., under conditions apparently better from all standpoints than at Rumford. The experimental material consists of 200 hybrids selected from the Frye plantations, which have to a certain extent stood the test of time.

Furthermore, experimental plots have been established at different times in various parts of the United States, using some of these artificial hybrids, in order to determine their behaviour under varying soil and climatic conditions.

On our mission we visited some of these sites, namely those set up in the Tennessee Valley (near Norris), in Michigan near Midland by the Dow Chemical Company, at Saratoga (New York) and at Williamston (Massachusett).

We were also able to make a more thorough study of the Frye experimental plots which are naturally the most interesting, both because of their size and age. The hybrids selected had been planted in 1927-1928 on the bottomlands and, initially, they were supposed to constitute the parent-stock and make possible a rapid propagation of the best clones. The other hybrids were planted not far off on hillside land, formerly cultivated and subsequently planted with hardwoods; clearcutting preceded the planting of the hybrids, which were spaced at 2 x 2 metre intervals. No thinnings were effected in order to give full play to the process of natural selection. It was in this plantation that a detailed study of the results was made in 1946. The 200 best trees were chosen for further research work.

At present this plantation does not appear very promising. Many trees have dried out or broken off at the tops and all have more or less plainly visible cankers.

The bottomland plantations are slightly more satisfactory. There, trees have a decidedly larger diameter than trees of the same age in the other plantations, but damage due to parasitic diseases is almost as severe. A few clones, however, seem better than others, particularly the hybrid P. Maximowiczii x P. trichocarpa. At 20 years of age it has an average

diameter of 30 cm. (the largest being 35 cm.) and some of them seem to be free from canker. We should note in passing that the climate in Maine does not appear to be particularly favorable to poplar cultivation. Winter frosts are very severe and the growing period is very brief. Moreover, the soil is poor. In fact, no natural growth of poplar is found there except for P. Tacamahaca and that only very rarely.

Results obtained from other experimental plots are hardly more satisfactory. Failures are everywhere mainly due to the damage caused by fungi. We will revert to this point when speaking of diseases of poplars. In some experimental plots in Michigan, however, frost damage is to some extent responsible for failure.

The large-scale Beltsville experiments will be very interesting to follow. They are being conducted in two different stages, starting with the stock selected at Frye. First, as homogenous as possible experimental plots are established, each test plantation being composed of 50 clones of 16 trees each, set 1.20 x 1.20 m. apart and arranged at random. These are called the sapling tests. The best are selected after a few years and replanted at 2 x 2 m. intervals in new plots which are known as crop-tree tests. Those crop-tree tests covering one acre (or 0.4 hectare) are thinned out progressively until there remain only about 100 trees per plot. In this way, it is hoped to determine the potential growth of the various clones under the site conditions. The crop-tree tests are too recent to draw any valid conclusions from them, but it may be noted that some of the clones have grown remarkably high: 3.5 m. by the end of the first growing season and 6 m. by the end of the second year.

Ralph Mac KEE first worked in collaboration with A.B. STOUT and Ernst J. SCHREINER, from 1924 to 1930. After that he worked alone and patented, under American law, several hybrid poplars. His nursery is located at Gansevoort, a few kilometres east of Saratoga, New York, where he chiefly grows a patented hybrid called "Mac Kee Hybrid Poplar F"; this is the result of a crossbreeding of P. angulata and P. trichocarpa and which he considers his best effort.

The oldest trees which we have seen there are 14 years old and are dying off under fungi attacks. The plantations from 4 to 6 years old which we were shown did not appear any better. Most of the tree tops are either dried out or broken and the trunks are covered with suckers, themselves already diseased.

It should be noted that the soil in these nurseries consists of almost pure sand (once maritime dunes) and is therefore very unsuitable for poplar cultivation.

Every year thousands of cuttings from these nurseries are sold by the Mac Kee Poplar Forestation Co. Inc. which exploits the Mac KEE patents.

Some instructive conclusions should be sought from these observations as a whole. Generally speaking, the results are undeniably far from being encouraging and the failures observed are almost entirely due to the spread of some fungus diseases.

Almost all the hybrids obtained are the result of crossbreedings between balsam poplars on the one hand and black poplars on the other. But although these balsam poplars are very rapid growth trees they are also very susceptible to fungus diseases. By selecting the plants during the first years of their growth and solely from the standpoint of the rapidity of growth, the clones obtained are extremely susceptible to diseases, particularly to Septoria musiva.

Furthermore, these quick-growing trees are very exacting in their soil and water requirements. The American poplar breeders, however, accustomed to their naturally growing stands and with no experience of the hybrid poplar plantations as we have them in Europe, have paid no attention either to soil or climatic conditions (the climate in the North-East of the United States, from Maine to Michigan, is particularly severe and only few poplar species can endure it) nor to the fight for existence. Very dense plantations have always been established, usually with a 2 x 2 m. spacing and sometimes even less. Ernst SCHREINER is himself well aware of this and has apparently decided to use spacings of from 2.50 to as much as 3 m. which for us Europeans still seem most inadequate. Furthermore, the preparation of the land before planting was as a general rule inadequate and nothing was done to keep it clear of weeds, very serious competitors in the struggle for existence, particularly on these comparatively poor and light soils, with a resulting inadequacy of water supplies. SCHREINER has understood perfectly the need for thorough land preparation and has made conclusive experiments along these lines.

As a result of these mistakes, most of the trees grown are poorly shaped, under-nourished and a ready prey to fungus diseases.

There is another serious criticism to make: the stock used for crossbreeding, that is the 34 species of poplars from the collection at Highland Park, Rochester, were not sufficiently known either from the systematic or the ecological standpoints.

It therefore appears that the experiments now on hand should be resumed after a more thorough preliminary study of the trees used as parent stock, particularly taking much greater account of the various ecotypes existing in the large species of poplars. It is along these lines that Scott S. PAULEY has recently started some research work at Harvard University collecting, in its Weston nursery, many geographical races of North American poplars with a view to studying them. The first observations made showed the considerable value of the intra-specific hybrids of elite trees belonging to very different ecotypes.

Moreover, both E.J. SCHREINER and Scott S. PAULEY understood perfectly the need for selecting disease-resistant types, starting first with resistant parents and then with resistant hybrids. Research along these lines is being done in collaboration with Phytopathological Services. Finally, experiments have been initiated with already well-known clones, in order to determine the correlation which may exist between the characteristics of the young plant and the adult tree. Such research should make it possible to establish the criteria to be adopted in further selections.

In conclusion, the Americans have been conducting very interesting experiments for the past 25 years to obtain rapid growth poplars. Results achieved so far may have been somewhat disappointing if only their immediate application is considered, but they should not be judged useless. On the contrary, as often happens in forestry, much can be learned from these failures, and they give an indication of the way in which future work should be performed.

II. DISEASES

The importance is well-known in Europe of studying the various poplar diseases inasmuch as they affect the culture of poplar. It is therefore natural that in the course of their mission to the United States, the attention of the members of the mission was particularly directed to this point.

In the natural stands visited (Populus deltoides Bartr.) we did not detect any parasites, whether animal or vegetable, which might endanger the life of the trees. A considerable quantity of timber, however, is destroyed each year by parasitic fungi, and most of the damage is doubtless due to the development of wood decay Polyporaceae.

This damage is largely due to the present working methods in the poplar stands which we visited, particularly those on the banks of the Mississippi. Only those trees having a commercial value are removed and the considerable amount of woodwaste left on the felling site constitutes an excellent breeding ground for wood destroying fungi. This is all the more serious since when the felled timber is removed numerous wounds are inflicted upon the standing trees, either by the mechanical equipment used or by the dragging of cables and logs.

We should also mention a wood rot which seems to be fairly widespread: wetwood or slime flux. This disease appears to be the same as that known in France as "bois d'eau". Usually in spring or in wet weather a viscous and evil-smelling liquid flows out from the tree attacked through pruning scars, small wounds or simply through cracks in the bark. This liquid contains fragments of mycelium or fungi spores, bacteria and even microscopic animals such as nematodes. Where the liquid runs out the wood deteriorates to a certain extent and the beginnings of canker can sometimes be detected. This may be due to a bacterial disease. A similar disease has been found in other wood species, in particular among elms.

Natural stands of aspens (Populus tremuloides Michx. and Populus grandidentata Michx.), like those of poplars, suffer heavy losses through wood decay fungi, and for the same reasons. The heaviest damage appears to be due to Fomes igniarius. This polyporus is known to be very widespread and to cause a white rot in the trunk of a number of hardwoods, but in North America it appears to have developed a sub-species peculiar to aspens. In the east of the United States a canker is also frequently found on aspens, due to an Xylariacea : Hypoxylon pruinatum Cke, which causes serious damage.

Plantations of hybrid poplars are prey to a number of parasites which endanger the life of the tree. These parasites are mainly fungi causing cankers on the branches or trunk. Each tree attacked reacts in a varying degree according to a number of factors and the result may be either a simple local necrosis or a more or less pronounced deformation of the trunk which may cause the death of the whole of the upper part of the tree. The most harmful parasite in this category appears to be Septoria musiva Pk, a fungus native to North America, which is a parasite of the leaves of Populus monilifera and which, as is often the case, found particularly favorable growing conditions in certain introduced species and in artificial hybrids. The lesions caused were first noted in experimental plantations of Russian poplars (P. berolinensis Dipp.), but the fungus responsible was only identified in 1939 and again found by Mrs. Alma M. WATERMAN on the artificial hybrids of STOUT and SCHREINER.

The infection seems to attack young branches through lenticels or tiny wounds or even through the leaves. During the year in which the tree is infected the branch is ringed and dies, but the fungus continues to spread and reaches the trunk of the tree, causing a canker which grows more or less rapidly. In addition, encouraged by the canker, other parasitic fungi develop and accelerate the withering of the tree.

Another canker which at first sight is rather similar, is due to Dothichiza populea Sacc. and Behr., a poplar parasite well-known in Europe. It seems to have been imported from Europe because it is still unknown in natural poplar stands. It infects most types of introduced poplars as well as artificial hybrids. The Lombardy poplar (Italian poplar) is particularly susceptible whereas P. Maximowiczii is rather resistant to this disease.

It should be noted that these two parasites are said to be capable of attacking poplars which are in perfect condition and which grow rapidly.

On the contrary, Valsa sordida Nit., which is better known in its conidial form, Cytospora chrysosperma Fr., is normally a saprophyte of the bark and dead branches of poplars. It can, however, become a parasite on weak trees and in this form sometimes attacks natural poplars which have suffered from drought, frost or fire. It is, therefore, essentially a parasite which feeds on weakness.

The die-back wilt in poplars may result from the attack of a number of parasitic fungi, but the symptoms are always the same: progressive wilting of the summit, production of shoots, and more or less marked weakening of the tree.

Some of these fungi are Cytospora, Nectria, Valsa, Napicladium. They chiefly attack trees which are not doing very well for some reason or other and the infection takes place through wounds. The damage caused is generally slight.

Our attention was especially drawn to die-back in a number of Lombardy poplars, a species which is much cultivated in the east of the United States as an ornamental tree. This is a disease of the vessels (vascular wilt) which provokes withering and even the death of numerous trees; the origin of this disease is still unknown.

A number of fungi attack the leaves. Some cause spots on the surface of the leaves which are a form of localized necrosis. Damage is generally slight.

To sum up, by far the most dangerous parasites for poplars are fungi, but whereas wood decay fungi cause damage of a technological order in natural stands, parasitic fungi are very dangerous for experimental plantations of artificial hybrids, in which these attacks often assume the proportion of a disaster.

The oldest plantations of hybrids, those established at Frye, near Rumford, Maine, are very much attacked by fungus diseases and it is at present almost impossible to find there a single tree which is not cankered; this is also true of all the plantations of artificial hybrids which we visited.

We have already pointed out that hybrid poplars in the experimental plantations that we visited were all in a state of poor resistance because of the conditions under which the experiments were being carried out: plantations were much too dense for very quick growing clones; the soil was often too poor, too dry or too acid; there was too heavy a competition of natural vegetation, etc., and it may be supposed that because of these very deficiencies there was an excessive development of fungus diseases. On the other hand, it would have been very interesting to be able to compare the resistance of hybrids with that of natural poplars by establishing control plots of the latter under conditions as nearly similar as possible to those of the former. It therefore appears that from this point of view, experiments should be started again along new lines.

From the European standpoint, the question of the parasitic diseases of hybrid poplars is a very important one.

In fact, Septoria musiva which appears to be the most dangerous parasite of poplars in the United States has, as far as we know, never been observed in Europe.

Dothichiza populea, on the contrary, is probably native to Europe, where it was described in 1884, but is at present considered as being essentially a parasite which feeds on weakness and which cannot attack vigorous trees. The American species, which is more virulent, therefore appears different physiologically, if not morphologically, from the European fungus.

Cytospora chrysosperma is not generally considered as a parasite in Europe. Finally, Hypoxylon pruinatum seems to be unknown in Europe.

We would also point out that most of the hybrid poplars which have been selected for their rapid growth have poplars of the Tacamahaca section among their ancestors. These poplars are known to be generally very susceptible to fungus diseases and when grown in Europe they are frequently attacked by bacterial canker.

Consequently:

(1) The introduction into Europe of cuttings of artificial hybrid poplars seems to us extremely dangerous since it would entail the risk of introducing the germs of serious and as yet unknown diseases.

(2) Such an introduction would be a grave mistake as the trees concerned would run the risk of contracting bacterial canker.

We therefore consider that the attention of the governments concerned should be drawn to this point so that appropriate measures may be taken.

General Report - ANNEX 4

THE POPLARS DELTOIDES, TREMULOIDES AND GRANDIDENTATA IN THEIR NATURAL HABITAT

By: Professor Dr. G. Houtzagers

As can readily be imagined, the members of our International Poplar Commission expected to hear at this Congress some reports on our poplar mission sent to the U.S.A. in 1950. We, the members of this mission, had hoped that the final report could be published before the Congress opened. This would have enabled us to discuss our findings more fully. Unfortunately the writing of the report took longer than we had expected, and although the final text is now in Paris, the report has not yet been published by the O.E.E.C. (Organization for European Economic Cooperation) and consequently we cannot yet discuss it. This does not prevent us, however, from giving some of our personal impressions, and, in addition, the members of the International Commission may be sure that the full report will be distributed to them.

Under these circumstances, my colleague on the mission, Mr. Rol, and I, agreed to report on our personal impressions of some phases of our mission. Fortunately other persons who took part in it are also present and may add their comments whenever necessary.

As far as I am concerned, I have decided to report on some special aspects of the first part of our mission, more specifically, "The poplars deltoides, tremuloides and grandidentata in their natural habitat", and first of all I shall deal with Populus deltoides.

The bottomlands are the best place for studying this species in its natural habitat. These are the alluvial soils found along the large rivers of eastern North America and especially along the Mississippi. We travelled through these bottomlands from south of Vicksburg (Mississippi) to Wisconsin and later, on a second trip for other purposes, I also visited the State of Minnesota. These areas covered with deposits of alluvial soil are very vast, covering millions of acres. Although a large portion of these bottomlands have been saved from flooding by the construction of dykes and dams, the control of the tributaries' stream-flow, etc. there are still large areas which constitute the optimum habitat of the poplar.

When inundation coincides with the dispersal of the seed, all necessary conditions are fulfilled for the germination of the poplar and the willow and the forest community "cottonwood-willow" is the first to gain a foothold on these lands. We might say that this is the only community to grow on the new deposits along river banks. The great Mississippi,

particularly, is constantly eating away its banks in many places, seeking new and shorter outlets, while it deposits fairly fertile alluvion in other places as well as in the abandoned parts of its bed; thus new land is formed which is immediately occupied first by willows (Salix nigra and Salix longifolia) and then - sometimes even simultaneously - by poplars (Populus deltoides) providing the soil is somewhat drier.

This first phase of occupation is followed by a second one which is characterized by the disappearance of the slick-bark willow (Salix longifolia). Salix nigra offers more resistance but finally also disappears, leaving the area to poplar.

These poplars grow in large stands and it must be pointed out that the regeneration is so far almost entirely natural and that these large stands have grown without any silvicultural treatment. Since there are usually very many seedlings a very intensive selection occurs among the young trees. This is a totally inconceivable idea in Europe where poplars are never sown but planted, where plantations are based on vegetative reproduction generally from a single clone, and where the trees are spaced initially at the distances at which they remain throughout their lives, that is until they are felled. Furthermore, poplar plantations are always cultivated and artificially pruned.

In the U.S.A. the natural regeneration forms a forest with a large population of genotypes which have different habits and grow in closed stands and where, therefore, there is severe natural selection and the trees prune naturally.

First conclusion: The well-shaped trees which have survived selection in these natural forests are extremely valuable for genetic work and hybridization. When well-shaped trees, remarkable for their rapid growth, are selected from such natural stands, one can be sure of the excellent qualities of their progeny.

I should like to follow the evolution of these poplar forests a little further:

First stage:	Willow (Salix)
Second stage:	Willow-Poplar (Salix-Populus) community
Third stage:	The willow is gradually ousted by the poplar
Fourth stage:	Gradual raising of the soil with the result that other hardwood species begin to appear in varying proportions in the older stands, such as sweet gum (Liquidambar styraciflua), Platanus occidentalis, persimmon (Diospyros), black gum and water tupelo (Nyssa) and Carya, later followed by oaks such as Quercus Phellos, Quercus nigra, Quercus Nuttallii, Quercus lyrata, Gleditsia aquatica and triacanthos, and a few other species.

The climax community in these bottomlands seems to be Quercus Phellos, Liquidambar, Acer and on the richest soils, Quercus and Carya, the oak-hickory type. The rapidity of this evolution is sometimes astonishing. You will understand it if I tell you that we visited in these bottomlands 15-year old stands which had undergone a process of intensive natural selection due to their extreme density in the formative years, where the survivors of the early and severe fight for existence had, within this 15-year period, attained an average height of from 28 to 30 metres and a diameter at breast height of about 40 cm.

However, as I have already told you, the poplar, a light-requiring species to the highest degree, and which has found in these newly formed areas all the conditions under which it thrives (clear moist ground accessible to sunlight), is just a step in the natural succession. In the long run it brings about its own destruction by allowing the gradual infiltration of other less intolerant hardwood species. This natural evolution is, however, frequently intensified by the method of treatment. As soon as the poplars have attained a diameter of 22 inches, i.e. about 55 cm. at breast height, they are considered to have reached commercial size and in fact are felled. Since the young poplars cannot grow in the shade of other hardwood species, it is understandable that, if all the poplars of a commercial size are gradually cut, the natural result will be their disappearance from mixed stands in a short space of time.

The Forest Experiment Service has fortunately recognized this danger and since the poplar is a very valuable species and its wood is prized for many purposes, it is trying, by means of selective thinnings and eventually of artificial regeneration by planting, to maintain a permanent place for the poplar.

However, although this natural evolution of the poplar stands in the bottomlands and the efforts being made towards the establishment of a standard treatment which would maintain the poplar, are very interesting, and would afford material for discussion for an entire conference, I cannot dwell on these subjects now because they are of no direct value or concern to European growers.

This is why, after having stressed the extraordinary significance of the process of natural selection of this species in the bottomlands, I would like to pass on to another matter which, as you know, has always been of particular concern to us, namely the matter of the various sub-species of Populus deltoides. In Europe we know P. carolinensis ♂, P. angulata ♀, P. monilifera ♂, P. virginiana ♀, P. missouriensis ♂, which are all forms of P. deltoides. In America, however, all eastern cottonwoods of the Aigeiros section have always been confused and grouped together under the collective name of P. deltoides Marsh.

The study of the natural forests in the Mississippi bottomlands and in other areas, has confirmed our opinion that at least three sub-species can be distinguished, but that their geographic distribution does not correspond entirely to the ideas accepted so far in Europe.

In the State of Mississippi and in South Tennessee, only the sub-species angulata was encountered. In North Tennessee, Kentucky and Missouri (on the other side of the Mississippi) this sub-species gives way almost imperceptibly to the sub-species known in Europe as missouriensis. In fact the angulata becomes more fastigiate; its trunk straighter, its bark darker, its leaves smaller with a sharper tip and a straighter base; and as a result its crown looks more compact. This sub-species missouriensis is found particularly on better drained ground. We have seen it growing in natural stands from Charleston in Missouri (between Memphis (Tennessee) and Cairo (Kentucky)). Moving northward (Illinois, Wisconsin) we again found angulata and missouriensis and, only north of Madison did we occasionally find a few monilifera. Travelling from Rhinelander across Lake Michigan toward the east, through New England up to Maine (Rumford Frye) and Boston, Philadelphia, we frequently saw Populus angulata and missouriensis, but very seldom monilifera. Fortunately, I had the opportunity, on a second different mission to the State of Minnesota, to see the bottomlands of the Mississippi and Minnesota (a tributary of the Mississippi), and there I found P. monilifera exclusively, without the other two sub-species.

We can consequently conclude:

a. that the present idea of a geographic distribution from south to north, angulata - missouriensis - monilifera, is true on the whole; but

b. that angulata, which chiefly grown on moist soils, is found throughout the East of the U.S.A. and particularly on moist soils along rivers where it finds the most favorable conditions;

c. that missouriensis is not found in the south and begins to appear midway between the north and the south; like angulata it is found in many places in the north-east:

d. that monilifera is found exclusively in the north (Minnesota and North Dakota) along rivers.

Our trip also showed us why the differentiation between these three sub-species, easily recognized by Europeans, often escapes the notice of American experts.

Importations of poplar cuttings into Europe were haphazard. On each occasion just a few clones or even one alone were imported, which were sometimes male (carolinensis, monilifera), sometimes female (angulata, virginiana), and were taken from areas which might be thousands of kilometres apart. As a result the difference between the various types imported could be great and therefore easy to describe botanically by Europeans. In the United States, however, these species and their sub-species are highly polymorphic with a great many intermediate forms, and therefore the differences do not strike the Americans as they do Europeans, who observe only the clones which are very different from one another.

Again, the fact that the most common southern form of the angulata is found throughout the whole of the north-east, further explains why the Americans overlooked any subdivision into sub-species.

Of what value is all this for the poplar cultivation in Europe? would sum up by drawing the following conclusions: (1) the current idea of using the sub-species angulata only for the southern part of Europe and the sub-species missouriensis and monilifera only for the more northern areas should be dropped, since soil conditions (particularly moisture) and ecological conditions of the place of origin are much more significant factors to consider. Since angulata is of a particular value in crossbreeding, I think that this conclusion is extremely important for all poplar growers in Europe, particularly for those in countries like England, Belgium, Northern France, Scandinavia, Germany, Austria and the Netherlands. (2) Notwithstanding, the ecological situation of the importing countries must be thoroughly investigated and as accurate a study as possible made of the growth and shape of the trunk of the mother tree. Once accomplished, the sub-species angulata may be able to provide material, taken of course from different sources, for both northern and southern areas of Europe. (3) To date, American research workers have given too little consideration, particularly in their hybridizations, to strict selection of the various forms of native trees crossbreeding naturally. (4) The natural stands in the american bottomlands showed us that a poplar plantation consisting of several clones may be planted more closely with a good chance of natural pruning. This will never be possible in our poplar plantations as we have them now, consisting of only one or two clones. The study, therefore, of the proper spacing of poplars must be based on the use of more clones, otherwise all efforts in this direction will be valueless.

I will now report a few personal impressions from the mission's work in the natural habitat of the aspens.

We studied this species in the Lake States and especially in Wisconsin. In the Lake States, approximately 40% of the commercial forest area, or 20 million acres (8 million hectares), is covered by aspens.

The word "aspen" is used here for two species - Populus tremuloides (quaking aspen) and P. grandidentata (bigtooth aspen).

Populus tremuloides grows on the side of the globe diametrically opposite to that of our European Populus tremula, and together they form the circle limiting the vegetation of trees around the pole. Consequently, it has a much larger natural habitat than P. grandidentata which is found only in the Lake States and in the North East of North America.

On the other hand, Populus grandidentata is less exacting than P. tremuloides and chiefly grows on drier soils.

Like Populus deltoides, aspens in their natural habitat are merely a step in the natural succession and not the climax community. They are found as a first association after clear-cutting or disasters such as

forest fires, forming what they call in the United States a temporary forest association which, in due course, is replaced on the best soils by hardwood species (main species: Acer saccharum, Betula lutea, Fagus grandifolia, Tilia americana, Ulmus americana) and on very poor and dry soils by softwoods (Pinus resinosa, Pinus strobus, Pinus banksiana, Abies balsamea, Tsuga canadensis).

Formerly looked upon as a weed, this species in the past few decades has proved to be commercially valuable, with the result that foresters have begun to develop silvicultural measures to maintain aspen, not only as a temporary type, but also as a permanent management type, even involving, where necessary, artificial regeneration.

Aspens are classified into five sites, in accordance with their growth and taking as a basis their height when reaching the age of 50 years:

Site I	80 ft.
Site II	70 "
Site III	60 "
Site IV	50 "
Site V	40 "

Sites I and II will be more economically managed when covered with their climax community consisting of maple, yellow birch (Betula lutea), basswood, etc. The same is also true for sites IV and V, whose climax community is composed of softwood species like Pinus resinosa, banksiana, strobus. For all those four sites, the aspen is and should remain a temporary type.

It is, however, on site III that the Experiment Stations are making increasing recommendations for the permanent management of aspen. To achieve this, it is necessary to reduce competition from other species by selective thinnings. On these sites, such thinnings are first made from below; the reconstitution of the aspen stands, when the trees are from 35 to 50 years old, is achieved by first felling the best-formed trees, whose root-sprouts are then allowed to develop sufficiently before the poorly shaped trees are removed.

In this way the best selection will be made for the following generations; on the contrary no selection is feasible in performing reproduction cuttings of most other species.

Plantations of this species, such as are already being made on a small scale in Europe, are never established in the U.S.A. Natural regeneration occurs almost exclusively from root-sprouts and not by natural seedlings. For this reason it is recommended that all felling operations be carried out in the winter-time and not during the growing season.

In conclusion, it may be said that Populus tremuloides has the same requirements and qualities as our P. tremula and that the culture of this species is, generally speaking, less advanced in the U.S.A. than in Europe. Consequently, there is no valid reason for importing P. tremuloides into Europe.

As for P. grandidentata, this species is less exacting and can still grow fairly well on poorer and drier soils: therefore, small-scale experiments with this species are to be recommended for Europe.

An entirely different question, and a far more important one, is the hybridization of European and American forms, which have already shown good examples of heterosis.

However, this is an entirely different question which, nevertheless, was an important object of our mission to the U.S.A.: Mr. Rol, who also participated in the mission, will give you his personal impressions on this subject.

B -- SPECIAL REPORTS

a) " Observations on Poplar Diseases made during the Field Research Days of the 4th International Poplar Congress in England - April 25th - May 2nd 1951 ", by :

Prof. R. ROL and
Dr. H. Van VLOTEN.

b) " Observation on Poplar Cultivation and Identification of Poplars visited during the Field Research Days of the 4th International Poplar Congress in England, April 25th - May 2nd 1951 ", by :

Prof. G. HOUTZAGERS and
Mr. T. R. PEACE.

OBSERVATIONS ON POPLAR DISEASES

MADE DURING THE FIELD RESEARCH DAYS OF THE 4TH INTERNATIONAL POPLAR CONGRESS IN ENGLAND

April 25th - May 2nd, 1951

by

Prof. R. ROL, Nancy, and H. von VLOTEN, Wageningen.

Four aspects of special interest concerning the pathology of poplars have been elucidated by the useful information gathered during this Congress. They will contribute to the development of the efforts made to select and breed disease-resistant poplars.

I - The study of bacterial poplar canker and its pathogen;

II - The tests for resistance to diseases;

III - The importance of environmental factors in causing diseases;

IV - The prevention of spreading parasitic organisms by the exchange of material.

I - BACTERIAL CANKER STUDY

Pathogenic character:

The experimental research on Pseudomonas syringae f. sp. populea by Mr. K.A. Sabet, working with Dr. W.J. Dowson at the Botany School, Cambridge, shows conspicuously the pathogenic character of the bacterium. Open cankers, similar to those found in nature, are obtainable by inoculation of susceptible poplars with the pure culture of Pseudomonas, if the sterile filtrate of the slime is added to the suspension. The sterile slime itself is not able to cause canker. Inoculation with the pure culture and sterile slime separately may result in closed cankers only.

Symptoms:

The attack by Pseudomonas is shown by three different types of symptoms: leaf blight, dieback and cankers (closed and open). Typical leaf blight and dieback have also been obtained by inoculation with the pure culture provided sterile slime is added.

Toxic substances:

The slime contains a toxic substance which causes the green shoots to wilt.

Associated fungi:

Several fungi associated with normal cankers, have been tried separately in pure culture in inoculation experiments. They proved to be incapable of causing canker (Cytospora sp., 3 species of Nectria and 2 species of Fusarium). Inoculation with Dothichiza populea resulted in a slight pathogenic effect in 3 out of 200 inoculations only, but not in typical cankers.

Environmental factors:

Certain environmental factors have been found important for the establishment and the development of the bacterial canker. A high relative humidity and a high water table favour the disease.

Frost:

By artificial freezing Sabet obtained leaf blight and dieback similar to those caused by the bacterium. No indication has been found that frost promotes or favours the development of real cankers.

II - RESISTANCE TESTS

One of the most important problems in the breeding of new valuable poplars is the test for resistance to disease. In fact this is an outstanding problem with tree breeding in general.

Two different ways may be distinguished:

1. Test plantations, where the trees are left to natural infection; eventually with the addition of infected material of susceptible trees, or in some cases of the causal organism as spores or fruiting bodies;

2. test plantations, where the trees are inoculated artificially with the parasitic organism, combined eventually with laboratory tests.

The advantages of number 1 are:

a) The determination of the field resistance, which is the final aim. It is well known that this field resistance does not always give the same result as the artificial test;

b) the method is relatively simple and cheap;

c) in some cases, like rust resistance tests, it provides good possibilities. But it is an essential condition of this method to provide for the presence of all species and biotypes of the rust available in the test plantation.

The disadvantages of the method number 1 are:

a) It takes a long time to obtain results suitable for its practical application.

b) The results may be doubtful, because the necessary conditions are not realised. (In the case of the elm tree disease i.e. no bark beetles available);

On the other hand, the advantages of the artificial tests are:

a) the results are reliable and certain (if the methods of inoculation are sufficiently developed);

b) if a tree proves to be resistant this will also hold for the field;

c) a comparison can be made by using separately different biotypes or isolations of the causal organism.

Its disadvantages are:

a) the cost is relatively high!

b) the impossibility to predict, whether a tree qualified susceptible by this test, would be field-resistant.

When demonstrating work on poplar canker Mr. Peace showed an experimental test plantation at Alice Holt when the Congress visited the Forest Research Station of the Forestry Commission. Young trees to be tested have been planted between rows of cankered trees, grown from live branches taken from naturally cankered poplars. Up to now practically no natural infection has been obtained. So artificial inoculations on the trial trees have, in addition, been carried out in the spring of 1950. These clearly proved the susceptibility of 4 out of the tested clones (Androscoggin, Northwest A., trichocarpa H.T. and tremula x tremuloides from Denmark.)

This result points to the conclusion that in the case of poplar canker, and very probably of similar diseases by wound-parasites, it is not advisable to limit the test to natural infection. The artificial inoculation test, as used in the Netherlands, cannot be omitted. Under the next heading it will be shown that there is an added complication due to environmental factors, clearly demonstrated by several sites visited during the Congress.

III - IMPORTANCE OF ENVIRONMENTAL FACTORS.

If bacterial canker is present at Kew Gardens, it has not developed to any noticeable extent. Among the poplars at Kew is P. Eugenei without canker. The clone of at least one of these trees has been introduced by Prof. Houtzagers (Mededeling Ned. Heidemij No.13: 2, 1951) into the Netherlands and proved to be susceptible by artificial inoculation tests.

Another clone, also belonging to P. Eugenei Simon Louis (x) seems to be resistant to bacterial canker; this is a clone originally introduced from the

(x) The question might be raised as to whether both clones, the susceptible and the resistant one, are really identical with P. Eugenei.

nursery of Simon Louis in 1916, and is believed to be resistant because of its freedom from canker in the original and younger plantations at Rystom Hall, where bacterial canker is occuring in a heavy form on several of the other poplars, and also at Ling Heath where this clone is adjacent to cankered trees of other varieties.

At Ling Heath Brandon, in plantations established from 1925-1939, the first evidence of canker was found in 1942. Here P. tremula originally introduced from Poland was still free from canker in 1951 (cankers, certainly bacterial, but subsequently colonized by Fusarium, have since been found). Among those not attacked are trees belonging to the P. berolinensis-group, P. Eugenei (resistant variety introduced by Colonel Pratt in 1916), marilandica, robusta and serotina; but P. candicans, Eugenei (a highly canker-susceptible clone, differing from both the others in latter foliation) and trichocarpa are attacked by canker.

An example at Ryston Hall was seen in the "Two Acres Wood", where P. regenerata has canker and P. robusta and Eugenei are free from this disease. (planted in 1943).

Near Harlow, P. trichocarpa of various ages is found. No canker occurs but this does not necessarily indicate a resistant clone.

At Little Hallingbury Park, P. generosa is free from bacterial canker. P. candicans (probably this variety), taken from trees from bacterial canker, is not attacked at Display Nursery, Danbury, Essex. Usually, in Great Britain, this tree is badly cankered. Further evidence is needed.

The healthy growth of poplars in Kew Gardens and on some other sites on the one hand and the occurrence of heavy infections of bacterial canker on the several sites visited is a clear indication that environmental factors attribute to both the occurrence of the disease and to its prevention. Experiments will have to take into account local conditions as well as general climatic factors, as pointed out by Brink and Van den Ende (Verslag van het onderzoek naar de populierenkanker in 1948 en 1949, Meded. Ned. Heidemij 1951). "It is desirable, that in testing new varieties their behaviour should be compared with that of the older, previously tested species. The reaction of these species to experimental inoculations-.....simply supplies a standard."

IV - PREVENTION OF THE SPREADING OF DISEASE BETWEEN COUNTRIES

Another point of general importance, brought to the attention of the Congress, is the proposal of Dr. Gravatt, Beltsville, Maryland, U.S.A., that care should be taken to prevent the spreading of diseases when exchanging material.

A committee has been appointed for the preparation of a report on this question. In a publication of a list of poplars by the Forestry Commission Research Branch (Mr. Peace), the following measures are reported as being already taken:

a) surface sterilizing of cuttings before dispatch;

b) further sterilizing upon receipt of material;

c) cutting half a centimetre from each end and burning these parts as a precaution against the transmission of any disease;

d) growing of the introduced cuttings under special observation during a year or two;

e) introduction into Great Britain is possible with a special licence fastened to the outside of the parcel before dispatching and no health certificate, or by the usual methods which require a certificate issued in the exporting country;

f) the test plantation at Alice Holt is only temporary. This and similar plantations will be moved to isolated nurseries.

OBSERVATIONS ON POPLAR CULTIVATION AND IDENTIFICATION OF POPLARS VISITED DURING THE FIELD RESEARCH DAYS OF THE 4TH INTERNATIONAL POPLAR CONGRESS IN ENGLAND

April 25th - May 2nd 1951

by
Dr. G. Houtzagers and Mr. T.R. Peace

INTRODUCTION

In former times the commercial cultivation of poplars in England has been more or less neglected. This neglect is partly to be attributed to lack of suitable ground but notwithstanding there are in Great Britain many moist uplands, river valleys and fens where the combination of poplar cultivation with agriculture or pasture could be profitably practiced.

Part of the difficulty has certainly also been lack of understanding of the requirements of poplars as a timber crop. Those who have attempted the commercial planting of poplars have often been deceived by its rapid early growth and its known liking for water, thinking that it would survive neglect and bad drainage. Moreover they often used canker susceptible clones, the neglected thinning and pruning and without doubt also many promising plantations on better soils have been spoilt by the neglect of these two essentials. The nursery trade has never sold poplars in large quantities but only in small numbers and chiefly for ornamental and shelterbelt plantings. So they have never studied the large scale production of good quality poplar plants, as has been done in so many countries of the continent of Europe.

This certainly does not mean that there was not enough in England for the Poplar Congress to see. In this connection we should first and foremost record the Ryston Hall estate visited on Saturday, April 28th and belonging to Lt. Col. E.R. Pratt, where commercial poplar cultivation has been in progress for a long time and where, moreover, there is an Arboretum of Poplars which, together with that at the Royal Botanic Gardens of Kew, enabled us to study as older trees a number of less common poplars. In addition a few individual plantings of poplars less common in our countries, such as P. Lloydii, P. nigra betulifolia, P. Eugenei, were visited during our trips.

Since in the past there has been no large demand for any particular varieties such as P. serotina, robusta, marilandica or gelrica, and since until recently there was not any supply of certified stocks, there has been much confusion in nurseries and often several varieties have been supplied to meet a single order. These mixed plantings were often to some extent infected with bacterial canker and now provide valuable living evidence of the susceptibility or resistance of different varieties. A good example of this in a mixed planting was shown at Ling Heath (Brandon) on Sunday morning, April 29th.

Before the war, the Forestry Commission began to take an interest in poplar cultivation and started nurseries for the production of rooted plants. At first, however, the amount of interest shown by private estates was not large and so they were compelled to restrict planting to their own ground. As the Forestry Commission had little ground really suitable for poplars, nearly all these plantings were either on woodland between old coppice (Yardley Chase Forest near Northampton visited on Monday, April 30th) or in badly drained valleys considered too wet for any other species.

Before the war 1939-1945 a considerable collection of clones had been made. Apart however from the above mentioned coppice plantation at Yardley most were still only in the nurseries when the outbreak of war brought matters almost to a standstill. A few trials were however started during the war and on Tuesday, May 1st we visited one at Bagley wood near Oxford, now 10 years old.

Since the war, interest in poplars has increased considerably. Many private landowners are now showing active interest in poplar growing and certified cuttings of the four varieties P. robusta, gelrica, serotina and serotina erecta are much in increasing demand from year to year.

In addition the Forestry Commission has taken a measure extremely important for enlargement of poplar cultivation, by paying a grant to private landowners towards the cost of planting poplars, not only for plantations but also for individual trees in lines or groups, provided a sufficient number are planted in any one year. These payments are £8 per acre (20 pounds per ha.) for planting in blocks with a minimum area of 2 acres (0,80 ha.) and 2 shillings per tree for line or avenue plantings with a minimum of 200 trees. Only good and canker resistant varieties may be used. Half the grant is paid after planting and the remainder after 5 years, provided that the trees have been properly established and maintained. Research work on poplars has led to a large collection of clones which now numbers already over 200. We saw a collection of these clones at Alice Holt.

In general the nursery methods seen were satisfactory, but it was suggested by several delegates that the growth of the poplars in the Forestry Commission Nurseries was too rapid and would lead to attack by Dothichiza after transplanting into their final sites. This extremely rapid growth was of course to some extent a reflection of the wet weather in 1950.

The rate of growth in some of the plantations seen was disappointing. At Rendlesham this may be attributed to underthinning and at Yardley to competition with the coppice. Indeed, although it is obviously possible to establish poplars on such coppice sites or heavy soils, it may be doubted if it is an economic proposition.

IDENTIFICATION OF VISITED TREES

The following places were visited:

Thursday, April 26th

Morning: Visit to the Forestry Commission Research Station at Farnham, Surrey. (Poplar nursery, research on bacterial canker of poplars, forest nursery experiments and work on forest genetics).

Afternoon: Visit to the Royal Botanic Gardens, Kew. (Arboretum of poplars).

Friday, April 27th.

Morning: Visit to the English Timber Supply Co., Danbury, Essex, (poplar and willow nursery, raising and utilization of cricket bat willows, poplar and other timber).

Afternoon: Visit to the Old Rookery, Eyke, Suffolk (large trees of P. Lloydii) and to the Forestry Commission Research Nursery at Randlesham (poplar nursery, and plantations of poplar).

Saturday, April 28th:

Visit to Lt. Col. E.R. Pratt's Ryston Hall Estate, Downham, Norfolk (poplar arboretum and plantations of poplar).

Sunday, April 29th.

Morning: Visit to Ling Heath, Brandon (bacterial canker on different varieties of poplar), and to Lynford Hall Forester Training School (talk on research on bacterial canker of poplar by Mr. Cabet of the Botany School, Cambridge; exhibit of poplars).

Afternoon: Visits to Cranwich and Weeting Hall (large specimens of P. nigra). Forestry Commission Central Conversion Depot (timber depot of Thetford Chase forest).

Monday, April 30th.

Morning: Visit to Yardley Chase Forest near Northampton (varietal trial of poplars).

Tuesday, May 1st.

Afternoon: Visit to Binsey (large specimens of P. serotina), Kennington Nursery (forest nursery experiments) and Bagley Wood (varietal trial of poplars).

Wednesday, May 2nd.

Afternoon: Visit to Courtauld's Research Station at Maidenhead (small trial of German poplar hybrids and selections) and Eton College (large specimens of P. deltoides angulata and other poplars).

When summarizing the various species and clones of poplars visited, it will not be necessary to mention species and hybrids such as Populus euramericana formae serotina, gelrica or serotina erecta, which as a result of the rapid development of poplar cultivation, without doubt in England also will show an increasing significance in poplar plantations. So it will be sufficient merely to state here this important fact. But as we have already indicated, the older types of less common poplars, though often less known than on the continent, do sometimes give important indications.

In this connection we should first mention Populus euramericana forma Eugenei Simon Louis, a hybrid originating in the nursery of Simon Louis at Plantières near Metz, raised from seedlings in 1832, the mother-tree probably being Populus euramericana forma regenerata Henry, which was probably pollinated by the Italian poplar. On the continent of Europe this hybrid, up till now, was not regarded as having much value, not being fully canker-resistant and showing no extraordinary growth rate. But the trees seen in England show that besides canker-susceptible clones there also exist clones which in practice appear to be highly resistant. The splendid examples of this hybrid seen, and especially those on the estate of Col. Pratt, often surpassing even Populus robusta in rectitude, growing-rate and semi-fastigiate shape, must compel us to include this hybrid again in our research work. P. Eugenei is a male clone, with very small catkins, time of foliation being somewhat later than P. robusta. There is a difference in foliation between the canker susceptible and resistant clones of P. Eugenei in England. The real identity of the former requires further investigation.

Populus Lloydii Henry is probably a hybrid of Populus nigra betulifolia, which is not uncommon in England, and an unknown father-tree. We saw old specimens near Rendlesham. It has no special value for commercial cultivation. It is a female tree with two stigmata and fruits that open with two valves; resembling more than any other poplar, P. nigra, but with fewer spur shoots and with the upper part of the stem darker coloured. It is a hybrid which comes into leaf very late and that did not flower in 1951 until the end of April.

P. robusta was represented by three different clones in the young plantings or Messrs Courtaulds at Maidenhead. It is of interest to note that they were already showing different growth rates.

P. trichocarpa and P. candicans were seen in several places, but always attacked by bacterial canker. In the demonstration planting of young poplars at Alice Holt Canadian hybrids of P. Trichocarpa with P. tacamahaca and P. koreana showed very rapid growth. But nothing is known yet of their susceptibility to canker or of their behaviour in plantations.

At Rendlesham, near the nursery of the Forestry Commission, we saw a plantation of relatively young trees, the time of leafing was irregular, but in general late and they all resembled P. serotina to some extent. Like P. serotina they are all male, in general straight and upright in habit, often having more upright branches than typical P. serotina. It is possible that they are all Populus euramericana forma serotina Hart., if we consider this form not to be a single clone but a mixture of clones, and consequently selection being still possible.

As young trees we found here and there in nurseries and sample-plots Populus rubra Poiret, a species unknown to us and also not mentioned in Rehder, the name originating probably from Dode. The eldest specimens of this P. rubra we saw in the test-plantation of the Forestry Commission at Yardley Chase (30th April) planted in 1937. P. rubra comes into leaf in the spring before P. serotina, about the same time as or somewhat later than P. marilandica. It has a red midvein and red petioles and leaf-shoots; it resembles mostly P. regenerata erecta, also in shape of leaves, though its habit is nearer to P. marilandica. We did not see this form as an older tree.

Populus laevigiata which we saw as an older tree in the arboretum of Col. Pratt and also in two younger trial plantings at Yardley Chase appears very similar to the Dutch Populus deltoides missouriensis. It is a male form, not resembling in any way the Populus laevigiata of Dode which we visited before at Versailles (1947) a female tree which resembles P. marilandica.

The specimens of Populus Fremontii Wats. which we saw were almost certainly not the true species of South-west America (California, Sierra Nevada) with its typical broad and short, very large toothed leaves reniform at the base. The trees seen resemble P. euramericana forma marilandica.

Populus Carrierii. This form has sometimes been considered as a P. regenerata erecta (vide Dr. G. Houtzagers. The Genus Populus). The specimens we saw here were clearly distincted from P. regenerata by their straighter and more upright growth. A good tree worth further trials, if it were not for its susceptibility to bacterial canker.

Populus euramericana forma regenerata Henry. Nearly everywhere the P. regenerata trees we have seen were heavily affected by canker. This fact proved once more that the common English provenance of this form is worthless. It must be borne in mind that in Belgium and Germany there exist good resistant clones of P. regenerata with very good growth capacity and habit.

Populus nigra L. and especially the form P. nigra betulifolia Torrey occur quite frequently in England, mainly as old trees. They are very striking because of the many typical burrs that sometimes entirely cover the stems of older trees. Very old examples of this species were seen near Cranwich, and an enormous barked log at Weeting.

A very large tree of P. deltoides angulata was seen at Eton. It was interesting as having bisexual catkins.

Populus generosa, Henry, occurs here and there as young and middle-aged trees, but is a form which on the continent is much too canker-susceptible; this is also the case in England.

Populus Petrowskyana, Schroeder, which we saw not only in the arboreta at Kew and Ryston Hall, but also in some test plantations as young trees (e.g. Yardley Chase) is probably a hybrid of P. Laurifolia x P. deltoides. It comes into leaf very early (before P. berolinensis and P. deltoides angulata). We do not consider that P. petrowskyana will be of great value

for culture, but it may be that it has value for road plantations. In this matter it can be put on about a same level as Populus Berolinensis Dippel, also a hybrid of P. laurifolia and probably the Lombardy poplar.

Populus charkowiensis Schröder is probably a seedling from P. nigra. We saw this hybrid as somewhat older trees in the test plantation at Yardley Chase. It resembles P. nigra very much in habit, but grows straighter and has a narrower crown.

Though it is not a poplar, but belongs to a closely related genus, it is important to mention here the cricket-bat willow. (Salix alba var.calva G.W.F. Mey; Salix alba coerulea Sm.). Half a day out of the tour was devoted to its cultivation (Friday April 27th) at Danbury, where Mr. Playde, a director of the English Timber Supply Company (Essex) Limited, conducted the party. This company concerns itself not only with felling and converting timber but also with re-afforestation of felled areas. So they buy large areas of woodland with the obligation to re-afforest after felling. Poplars are used on a large scale.

But in the area where they operate, the cricket-bat-willow is also an important species, the company supplying clefts for the manufacture of cricket bats to the bat manufacturers. This willow timber has to be of extremely high quality, pure white in colour, elastic and light. Salix alba calva appears to be most suitable, far more so than the common Salix alba. For this reason the company raises this species on a large scale, partly for its own use, partly for sale. The young trees are raised on pollards or stools and remain in general 3 years on the stool; after that they are sometimes kept during one year in the nursery to take root. During these first years they are pruned, so as to produce a three-year old set with about two thirds of its length clear of all lateral branches, because the lower part of the stem, used later on for the fabrication of bats, must be absolutely free from knots. Afterwards they are planted at a distance of about 9 m. (for plantations in a single row this could, in our opinion, be somewhat less) and felled with a rotation of 12-16 years. After this period they may have a circumference of about 48 inches = 1,20 m., a size very suitable for felling. Out of one stem of 3 m. length, supposing that the quality of the wood is good, theoretically 4 x 16 = 64 bats can be made. The trees, during their growth, are kept free from branches only to a height of 2.25-3 m. at the most because it is believed that the wood of the higher part of the trunk is unsuited for cricket bats and that a large broad crown above the height of 3 m. gives a better and more rapid growth of the whole stem and thus is advantageous. The minimum length of the branchless bole is 2.25 m. giving three 2 ft 4 inches bat lenghts; 3 meters bole gives four bat lengths. The cleaver must have 2 1/4 inch at the thickest portion of the bat, so that 3 inches at the circumference will make one cleft and a circumference of 48 inches should give 48:3 = 16 bat clefts per bat length. After felling, the boles are sawn into lengths of 2 ft 4 inch = 70 cm. = one bat length, cleft in a triangular shape and piled, well ventilated, in the open air for about half a year, for drying. It must be noted here that if a tree of 1.20 m. circumference (48 inches) is still growing vigorously it is well worth while to delay cutting and let it grow for another two years or more. For instance a 54 inch (1.35 m.) circumference gives for a 3 meters butt theoretically 4 x $\frac{54}{3}$ = 72 bat clefts, which means 8 more.

A small exhibition of various injuries, variations in colour and parasitic attacks of the wood, which immediately make it unsuitable for bat manufacture, demonstrated clearly the importance of high quality. Supposing that the quality is good, the trees can have an annual increase of value of a £1 per year.

II - PROCEEDINGS OF THE FOURTH

INTERNATIONAL POPLAR CONGRESS

PROCEEDINGS OF THE FOURTH INTERNATIONAL POPLAR CONGRESS

The Fourth International Poplar Congress was held in Great Britain between 25 April and 2 May on the invitation of the British Government, and was organized in conjunction with the Fifth Session of the International Poplar Commission.

Numerous experts from the following countries attended: Austria, Belgium, Canada, Eire, France, Western Germany, Italy, Lebanon, Netherlands, Switzerland, India, Czechoslovakia, Spain and the United Kingdom.

The United Kingdom was represented by the Forestry Commission, representatives of the Timber Trade, the Match Industry, the Royal Forestry Society of England and Wales, Kew Gardens, and the Forest Products Research Laboratory.

FAO and the International Union of Forest Research Organizations were also represented (see list of participants - Annex 1).

Apologies for being unable to attend were received from the U.S.A., Finland, Luxembourg, Australia, U.S.S.R., Portugal and Norway.

The delegates were received on the first day at a government reception at Lancaster House, by the Earl of Listowel, Parliamentary Secretary to the Ministry of Agriculture and Fisheries, and Lord Robinson, Chairman of the Forestry Commission. At Oxford the delegates also attended a dinner presided over by Lord Robinson.

Professor Guinier, assisted by Professor Houtzagers, the Chairman and Vice-Chairman respectively of the International Poplar Commission, presided over the Congress.

The delegates took part in a study tour, the program of which is attached hereto (Annex 2).. In the course of this tour they were received by the Forest Research Section of the Forestry Commission at Alice Holt; the administration of the Royal Botanical Gardens at Kew; the English Timber Supply Co. at Danbury, Essex; Lt. Col. E.R. Pratt at Ryston Hall; the Educational Section of the Forestry Commission at Lynford Hall; and the Imperial Forestry Institute.

They also attended the meetings of the International Poplar Commission, held in the Imperial Forestry Institute at Oxford on 1 and 2 May, of which a report is also to be found in this document, and the two meetings also held in the Imperial Forestry Institute during which talks were delivered by Mr. WETTSTEIN on the reaction of poplars to the daylight duration; Professor HILF on the thinning of poplars; Professor HOUTZAGERS on Dothichiza populea; and Dr. HEIMBURGGER on the cultivation of poplar in Canada. The two latter talks are reproduced in Annex 3 since they had not been distributed to participants during the meeting.

The Congress was organized by the Forestry Commission, and an appreciable amount of documentation was prepared in advance for the use

of participants. Two officers of the Forestry Commission acted as interpreters during both the study tour and the meetings of the Congress.

During the congress the delegates succeeded in assembling some very useful documentation and in exchanging numerous ideas; they did not, however, consider it advisable to adopt any precise recommendations, leaving this to the International Commission, which was meeting simultaneously. The delegates to the Congress attended and took part in the discussion of the International Commission.

Proceedings of the 4th International Poplar Congress

ANNEX I

ITINERARY AND PROGRAMME OF THE STUDY TOUR

April 25th to May 2nd 1951

Wednesday, April 25th.

Morning: - Delegates assemble in London.

Afternoon: - 2 p.m.: Meeting of Permanent Committee of the International Poplar Commission at the Headquarters of the Forestry Commission, 25 Savile Row, London.

Evening: - Government Reception.

Thursday, April 26th

Morning: - Visit to the Forestry Commission Research Station at Farnham, Surrey. (Poplar nursery, research on bacterial canker of poplars, forest nursery experiments and work on forest genetics).

Afternoon: - Visit to the Royal Botanic Gardens, Kew. (Arboretum of poplars).

Friday, April 27th. - From London to Ipswich.

Morning: - Visit to Little Hallingbury Park (avenue of P. generosa) and to "The English Timber Supply Co.", Danbury, Essex (poplar and willow nursery, raising and utilization of cricket bat willows, poplar and other timber).

Afternoon: Visit to the Old Rockery, Eyke, Suffolk (large trees of P. Lloydii) and to the Forestry Commission Research Nursery at Rendlesham (poplar nursery, and plantations of poplar).

Saturday, April 28th.: - From Ipswich to Cambridge.

Morning: - Visit to Ryston Hall Estate, Downham, Norfolk (poplar arboretum and plantations of poplar).

Afternoon: - Continuation of visit to Ryston Hall Estate.

Sunday, April 29th.:

Morning: - Visit to Ling Heath, Brandon (bacterial canker on different varieties of poplar), and to Lynford Hall Forester Training School (talk on research on bacterial canker of poplar by Mr. Sabet of the Botany School, Cambridge; exhibit of poplars).

Afternoon: - Visits to Cranwich and Weeting Hall (large specimens of P. nigra).

Monday, April 30th.: - From Cambridge to Oxford

Morning: - Visit to Yardley Chase Forest near Northampton (varietal trial of poplars).

Afternoon: - Visit to the new building of the Imperial Forestry Institute, Oxford.

Tuesday, May 1st.: - At Oxford

Morning: - 9 a.m.: First Meeting of the 5th Session of the International Poplar Commission at the Imperial Forestry Institute.

11 a.m.: First Meeting of the 4th International Poplar Congress.

Afternoon: - Visit to Binsey (large specimens of P. serotina and an unknown hybrid), Kennington Nursery (Forest nursery experiments), and Bagley Wood (varietal trial of poplars).

Wednesday, May 2nd.: From Oxford to Eton

Morning: - 9 a.m.: Second Meeting of the 5th Session of the International Poplar Commission at the Imperial Forestry Institute, Oxford.

11.30 a.m.: Second meeting of the 4th International Poplar Congress, at the Imperial Forestry Institute, Oxford.

Afternoon: - Visit to Courtaulds' Research Station at Maidenhead (small trial of German poplar hybrids and selections) and Eton College (large specimens of P. deltoides angulata and other poplars).

Proceedings of the 4th International Poplar Congress - ANNEX 2

LIST OF PARTICIPANTS

AUSTRIA : - Professor Dr. W. WETTSTEIN, Bundes-Versuchsanstalt Mariabrunn, Hadersdorf-Weidlingau, bei Wien.

BELGIUM : - Mr. A. HERBIGNAT, Inspecteur des Eaux et Forêts, 101, rue des Horticulteurs, Bruxelles.

- Mr. C. MUHLE LARSEN, Directeur de l'Institut de Populiculture, 230, rue Buizemont, Grammont.

CANADA : - Dr. C. HEIMBURGER, Southern Experiment Station, Maple, Ontario.

CZECHOSLOVAKIA :- Mrs. O'COTTON, Czechoslovak Embassy, 9, Grosvenor Place, London.

FRANCE : - Mr. Professeur Ph. GUINIER, Chairman of the International Poplar Commission, Directeur Honoraire de l'Ecole Nationale des Eaux et Forêts, 11, rue de la Planche, Paris.

- Mr. J. POURTET, Ingénieur des Eaux et Forêts, Ecole Nationale des Eaux et Forêts, 14, rue Girardet, Nancy.

- Mr. Prof. R. ROL, Sous-Directeur de l'Ecole Nationale des Eaux et Forêts, 14, rue Girardet, Nancy.

- Mr. J. de VAISSIERE, Conservateur des Eaux et Forêts, Chef du Service de la Forêt Privée à la Direction Générale des Eaux et Forêts, 1 ter, Avenue de Lowendal, Paris.

- Mr. J. CHARDENON, Contrôleur Principal du S.E.I.T.A. à Saintines (Oise).

- Mr. A. JANIS, Ingénieur en Chef des Manufactures de l'Etat, Manufacture des Allumettes, Saintines (Oise).

GERMANY :

- Regierungspräsident Dr. W. WARSCH, Vorsitzender des Deutschen Pappelvereins, Mommsenstr. 102, Köln-Lindenthal.
- Professor Dr. H. HESMER and Frau HESMER, Leiter des Forschungsrates des Deutschen Pappelvereins, Beethovenstr. 30, Bonn.
- Oberlandforstmeister Dr. BAUER, Sternwaldstr. 14, Freiburg.i.Br.
- Dr. J. GREHN, Inst. for Forstgenetik und Forstpflanzenzuchtung, Schmalenbeck, bez. Hamburg.
- Professor Dr. H. HILF, Director of the "Institut für Forstliche Arbeitswissenschaft" (24a) Reinbek, bei Hamburg, Vorwerkbusch (Iffa).
- Dr. F. KIEL, Technical Director, Zellstuff fabrik, Waldhof, Wiesbaden.
- Forstmeister H. LUCKE, Harsefild, bez Hamburg.
- Landforstmeister Dr. R. MULLER, Leiter des Wissenschaftlichen Institute des Deutschen Pappelvereins, (22c), Bruhl bei Köln.
- Professor Dr. E. ROHMEDER, Forstl. Facultät der Universität, Amalienstr. 52, München 13.
- Oberforstmeister SCHAFER, Managing Director of the Fachausschutz Faserholz der Treuhandstelle der Zellstaff -und Papierindustrie, Kleine Wilhelmstr. 7, Wiesbaden.
- Forstmeister B. SCHMITZ-LENDERS, (22a) Düsseldorf-Benrath, Uhdenbacherallee 25-1.
- Forstmeister K.H.F. ULRICH, Forstamt Danndorf über Vorsfelde, Braunschweig.

INDIA :

- Dr. S. KRISHNA, Indian Scientific Liaison Officer, Africa House, Holborn, London, W.C. 2.

IRELAND :

- Mr. N. MORRIS, Forest Inspector, Department of Lands, Dublin.

ITALY : - Mr. Dr. G. SACCHI, Directeur Général des Forêts, Ministère de l'Agriculture, Rome.

- Mr. Ing. L. FUNICIELLO, Inspecteur Supérieur des Forêts, Direction Générale des Forêts, Ministère de l'Agriculture, Rome.

- Mr. Dr. G. MELOCCHI, Inspecteur Chef des Forêts, Direction Générale des Forêts, Ministère de l'Agriculture, Rome.

- Mr. Dr. L. CHIANESE, Directeur des Services de l'Agriculture et des Forêts de l'Organisation Nationale pour la Cellulose et pour le Papier, Via Cornelio Celso, 7 Rome.

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Proceedings of the 4th International Poplar Congress - ANNEX 3

COMMENTS ON THE PREVENTIVE CAMPAIGN AGAINST DOTHICHIZA POPULEA IN THE NETHERLANDS

By: Professor Dr. Houtzagers

Dothichiza is a disease affecting young and weak poplar trees and it has for the past few years, and probably because of special climatic conditions, been causing a great deal of damage in nurseries and young stands of this species. We have, therefore, set up in our country a Working Party charged especially with studying this disease and finding methods for its control.

This Working Party is composed of representative of our Agricultural University, Forest Experiment Station, Directorate of Waters and Forests, the Netherlands Heath Exploitation Company, the Phytopathological Service, the Institute for Phytopathological Research and the Seed and Plant Inspection Service.

The species most susceptible to this disease is Populus deltoides missouriensis; P. serotina is also frequently attacked.

In the first experiments made, the plants were sprayed with 1 - 1 1/2% Bordeaux mixture and 1/10 - 2/10 of 1% Aaventa (organic mercury). The first year's results were not very significant, but the first sprayings (in mid-August) proved to be more effective than the later ones; it may also be stated that, generally speaking, Aaventa was more efficacious than Bordeaux mixture. This encouraged us to make a second series of experiments in 1951, using the same chemicals in the same percentages, but spraying for the first time in the middle of May and not of August.

Both in 1950 and in 1951 the experiments were made on Populus deltoides missouriensis, as it is the species most susceptible to this disease.

The program of work for 1951 was such that it enabled frequent sprayings to be made, at one-month intervals, with not more than three sprayings per plot and, as in the previous year, on two-year old nursery poplars.

The schedule was as follows:

May	X	X	X						
June		X	X	X					
July			X	X	X				
August				X	X	X			
September						X	X		
October								X	
November								X	

The original cuttings are always soaked in a Bordeaux mixture solution prior to being delivered to the nurserymen by the Netherlands Heath Exploitation Company.

A second series of experiments, started this year (1951), consists in the spraying of fertilizers containing varying quantities of phosphate, potash and nitrogen. We are under the impression that phosphate and potash will benefit the plants by making their young trunks more resistant but that nitrogen might have a detrimental effect by inducing too rapid growth.

We have already found that the disease is more severe and dangerous in sandy nurseries than in clayey ones. In fact, almost no damage, or very little, is reported to have occurred in the latter. Also, the plantations established with poplars grown in clayey nurseries are much less damaged than those established with poplars grown in sandy nurseries.

Proceedings of the 4th International Poplar Congress - ANNEX 4

COMMUNICATION ABOUT POPLARS IN CANADA

By: C. Heimburger

Your Secretary has asked me to give a short account of my work with poplars in Canada. At present I am engaged in forest tree breeding, working chiefly with white pine (Pinus Strobus L.) and with aspen poplars. Dr. Houtzagers has already given an account of his trip to the U.S.A. during last summer, and about the poplars there. The additional information about the poplars of Canada is presented here mainly from a tree breeding standpoint. I would like to tell something about the black poplars, the aspens, and also about Melampsora pinitorqua.

The black poplars (P. deltoides) or cottonwoods, as we call them, are found only in the southern part of eastern Canada, in southern Ontario as far north as Ottawa, and down the St. Lawrence River as far as Three Rivers, or about half-way between Montreal and Quebec City. In respect to growth form and growth rate the trees are not as good as further to the south, along the Mississippi River. Along the northern fringe of its natural range P. deltoides often comes in contact with P. tacamahacca and natural hybrids, called P. Jackii, are found occasionally.

P. tacamahacca is a more northern species than P. deltoides and replaces it on similar habitats. In addition, it is capable of growing on a wider variety of sites than P. deltoides, on wetter, more acid and peaty soils, on drier sandy soils, and on heavy clay. The growth form and size are often excellent, especially in the north, but the wood is inferior in quality to the wood of P. deltoides. The hybrids, P. Jackii, are in most cases completely worthless in that they are short-lived and liable to become top-heavy and broken by the wind in a manner somewhat similar to the occasional wind-breakage observed here in P. generosa. Back-crosses to both parent species are found, and these are much more valuable. The P. candicans planted in England is probably such a back-cross to P. tacamahacca. Around Ottawa forms of P. deltoides have been found that show some introgression of P. tacamahacca. They have young branches of darker color than the typical form, more sticky buds and thicker leaves with a slightly paler under surface. Such forms could possibly be produced artificially, by selecting parents of good growth form and with good rooting capacity from stem cuttings which show wide variation in wild material. These could be used in areas with a cooler and longer photo-periods than is found within the main natural range of P. deltoides.

In western Canada, in the southern portion of the prairies, P. deltoides is found again, growing along the rivers. Here this species shows very poor rooting capacity from stem cuttings. Young plants of seedling origin are usually collected on sand bars along the rivers, grown for a

year in a nursery and then planted out in windbreaks and shelterbelts. Many of these show good drought resistance. At Indian Head, Saskatchewan, some breeding work with poplars is in progress. The so called Russian poplars, P. berolinensis, Petrowskyana, Rasumowskyana and others, have been introduced from Europe and are often planted. Natural and artificial hybrids of these with the native forms of P. deltoides form the raw material from which superior clones are being selected. Further to the north, the Northwest poplar, a male clone derived from P. Jackii, is much planted and hybrids between this and the Russian poplars show promise. In this manner the genes found in the native P. tacamahacca and P. deltoides are being utilized for several useful purposes.

In southwestern Ontario the so-called Carolina poplar, a mixture of clones consisting mainly of forms similar to P. robusta, is used in windbreaks in connection with the growing of tobacco. Natural hybrids between Carolina poplar and the native P. deltoides are found occasionally. These and some of the Italian hybrids produced by prof. Piccarolo offer promise for further selection and breeding work for this particular purpose. Several wood-using industries in southern Canada have recently shown increased interest in poplar wood for the production of artificial silk, pulp, matches and core stock for veneer. Since this area also has a more dense population than in the north and a more favorable climate, the growing of poplars for these purposes has economic possibilities.

The aspen poplars are found mainly in the northern part of eastern Canada. The industries using aspen wood are located mostly to the south of the main range of the aspens and it is becoming desirable to grow aspens near the mills, mainly because of rising costs of transportation. This can be accomplished through the introduction of good aspen forms from outside areas and through the breeding of new forms. As Dr. Houtzagers has mentioned, there are two native species of aspen in eastern North America, and of these P. tremuloides is distributed from coast to coast. It has its widest range of biotypes in the west, being found from New Mexico to Alaska, thus in areas having a wide range of photoperiods. The western P. tremuloides vary from fairly large-leaved and succulent types along the west coast to smaller-leaved forms with more or less glaucous leaves and twigs in the dry Interior, and scrubby types adapted to still drier climates to the east of the Rocky Mountains. The range of biotypes is much more restricted in eastern Canada, and like P. tremula in western Europe, the best forms are found in the north. After being moved to the south these grow very poorly and often become crooked and pendulous, probably in response to an unfavorable photoperiod. We have seen this at Alice Holt with the P. tremula x tremuloides hybrids. Western forms of P. tremuloides obtained from areas with a photoperiod similar to southern Ontario often suffer from heavy attacks of Melampsora rust. Some of this can possibly be explained by the history of this species in North America. The original range is most probably in the west from where it migrated to the east during the present or some past interglacial period. The migration could only take place over the northern part of the prairies where there is sufficient moisture for this species to reproduce itself from seeds. Thus mainly northern biotypes, adjusted to long summer days, could migrate to eastern Canada and these gave difficulties in migrating to the south. The poor adjustment to the short summer days of the south is shown by poor growth rate and growth form.

The other aspen species, P. grandidentata, shows quite different relationships in these respects. It usually occupies somewhat drier sites than P. tremuloides, prefers good drainage and can grow on somewhat sandier soils. Its range is much restricted being confined to eastern North America and not extending much to the west of the Great Lakes. It most probably came to us from the southeast and survived the last glaciation in the Appalachian Mountains, in the same manner as red spruce, beech, linden and other tree species. The poor forms of this species in southern Ontario are probably the result of exploitation by man rather than poor adaptation to photoperiod. In marked contrast to P. tremuloides and P. tremula, it is quite possible to bring the good forms found in the north to the south without any ill effects on growth form and growth rate. This species has thus probably not had sufficient time to evolve long-day biotypes.

Through the courtesy of Dr. Scott Pauley of Harvard University several clones have been obtained from the presumably original range in the Appalachian Mountains. These clones, when grown in southern Ontario, show an adaptation to a shorter growing season by early leafing out and early leaf-fall and lignification of the shoots, earlier than the northern Canadian biotypes grown in the same environment. There is thus probably a biological vacuum for this species in northern Ontario, to where such short-season biotypes could no longer migrate from their original range because of too warm a climate in the intervening lowlands after the last glaciation. One of the purposes of my breeding work with aspens is to produce new forms suitable for growing in southern Ontario. It is also of great importance to propagate these forms in an economic manner. This can be accomplished by further research into suitable methods of raising aspens from seeds or by developing new forms that lend themselves readily to propagation by vegetative means, chiefly from woody stem cuttings, Certain clones of P. alba possess good rooting capacity from stem cuttings and it is the aim to transfer this character to the aspens. In eastern Canada we have only a very few female clones of P. alba in cultivation and these show moderately good rooting capacity from stem cuttings. Of the 6 possible combinations between P. tremula, tremuloides, grandidentata and alba the combinations tremula-tremuloides, alba-grandidentata and alba-tremula have yielded heterosis in the hybrids; the other 3 combinations have thus far not yielded anything of promise. The combination tremula-tremuloides usually yields many pendulous and crooked hybrids with us, probably because one or both parents come from areas with longer photoperiods than ours. Forms of P. tremula from eastern Europe, such as Poland and Czechoslovakia, have shown good straight growth and look promising for future crosses with our P. tremuloides. The combination alba-grandidentata occurs as natural hybrids throughout the settled portions of eastern Canada wherever P.alba is planted and there is a chance for the seedlings to come up without competition from other vegetation, such as on exposed mineral soils. The hybrids often show pronounced heterosis but vary rather widely in their growth form and longevity. Some of the best and largest have been taken into cultivation and additional hybrids of this kind are being produced artificially by using different forms of the parent species. Therefore, we are interested in obtaining additional P.alba materials from their native range around the Mediterranean. The forms that are

of value for this purpose are those which combine well with P. grandidentata in yielding vigorous, long-lived hybrids of good growth form and which have good rooting capacity from cuttings that could be transferred to the aspens in the course of further breeding work. Similar requirements hold true for the combination P. alba-tremula, but it is still unknown if good combining ability of a clone of P. alba with P. grandidentata also means good combining ability with P. tremula.

Melampsora pinitorqua is a heteroecious fungus that causes rust on the leaves of P. tremula in Europe and serious lesions on the shoots of Pinus silvestris. In spite of all possible precautions, I believe this fungus will eventually be introduced into Canada. At present we are entirely unprepared for an outbreak by it, that may well prove disastrous to young pine plantations in Ontario and elsewhere in North America if and when this fungus is introduced. Pinus resinosa is a pine species related to Pinus silvestris and is one of our most important species used in forest planting. Under natural conditions it often grows together with aspens especially with P. grandidentata. We would like to know just how susceptible our Pinus resinosa and aspens are to this fungus, so that, if possible, resistant material can be selected and propagated before an outbreak. Following an example of Dr. Peace working with bacterial canker of poplars before the War, I would like to invite the cooperation of European workers in the testing of Pinus resinosa and our aspens for resistance to Melampsora pinitorqua in areas where this may be most convenient. In this manner we could obtain at least a basis for the evaluation of the situation prior to an outbreak in eastern North America. I believe the International Poplar Commission would be a suitable organization to promote such an investigation. We now know that, for instance, P. berolinensis is highly susceptible to Septoria musiva native to North America and you could very well eliminate this variety from cultivation if and when this fungus is introduced to Europe. Similar information in respect to Melampsora pinitorqua would be highly desirable for the continued cultivation of Pinus resinosa and our aspens in eastern North America and eventually, also in Europe.