

POLISH ACADEMY OF SCIENCES

INSTITUTE OF
DENDROLOGY

KÓRNIK
(NEAR POZNAŃ)



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1989

POLISH ACADEMY OF SCIENCES
DIVISION OF BIOLOGICAL SCIENCES

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DENDROLOGY

KÓRNIK
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INSTITUTE OF DENDROLOGY

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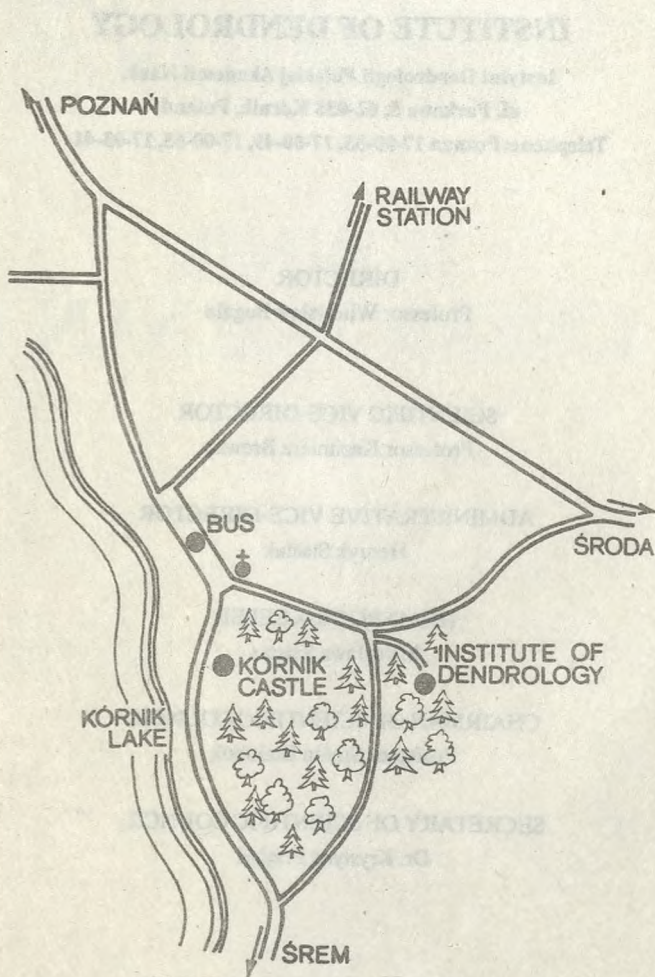
CHAIRMAN OF SCIENTIFIC COUNCIL

Professor Stefan Białobok

SECRETARY OF SCIENTIFIC COUNCIL

Dr. Krystyna Przybył

The Institute of Dendrology is located in Kórnik about 25 km south-east of Poznań. You can reach from Poznań by bus or train (railway station 4 km from city away; bus connection).



HISTORICAL NOTE

The scientific center in Kórnik which studies trees and shrubs is strictly connected with the Arboretum established there by Tytus and Jan Działyński in 1829-1880. The collections of trees and shrubs, also of fruit trees, have been substantially increased after establishment in 1925 of the Kórnik Foundation (Fundacja Zakłady Kórnickie), one of the aims of which was to run a scientific research center in the field of dendrology. This aim was achieved only to a limited extent due to lack of funds. Antoni Wróblewski (1881-1944) who was in charge of the "Kórnik Gardens" since 1926 substantially increased and enriched the collection of trees and shrubs, developed nursery production and, in 1933, established the division of Dendrology and Pomology of the planned Institute for the Study of Trees and Forests. Further organizational work was stopped by the outbreak of war in 1939 and the removal of A. Wróblewski by the German authorities in occupation of Poland.

In 1945 the scientific activity of the center was resumed, at first within the framework of the still existing Kórnik Foundation. However, rapid development of the institution acting at the time under the name of the Center for Dendrology and Pomology became possible only when, in 1952, it became affiliated with the Polish Academy of Sciences. The possibility of employing a larger number of scientists, building of living quarters and expanding laboratory facilities allowed for the creation of new laboratories in the center.

In 1975 the Center for Dendrology and Kórnik Arboretum obtained the rank of Institute and assumed the name of the Institute of Dendrology.

In 1945-1979 the Center and later the Institute was headed by Professor Stefan Białobok. Since 1980 Professor Władysław Bugała is the Director.

At present, the Institute employs 120 people, 37 of whom are research scientists, (12 professors and assistant professors), 47 are technical staff and 36 work in the administration and maintenance.

STRUCTURE OF THE INSTITUTE

SCIENTIFIC SECTOR

Department of Systematics and Plant Geography

Head: Professor Kazimierz Browicz

Laboratory of Systematics and Chorology - Head: Assist. Professor Jerzy Zielinski

Editorial Committee: Monographs *Our Forest Trees* - Head: Professor Stefan Białobok

Herbarium

Department of Introduction and Acclimatisation

Head: Professor Władysław Bugała

Laboratory of Applied Dendrology and Museum - Head: vacat

Arboretum - Head: Dr. Tomasz Bojarczuk

Laboratory of Vegetative Propagation - Head: Dr. Krystyna Bojarczuk

Department of Genetics

Head: Professor Maciej Giertych

Laboratory of Population Genetics - Head: Assist. Professor Władysław Chalupka

Laboratory of Biochemical Genetics - Head: Assist. Professor Leon Mejnartowicz

Laboratory of Anatomy - Head: Assist. Professor Alina Hejnowicz

Department of Seed Biology

Head: Professor Bolesław Suszka

Seed Laboratory - Head: Dr. Tadeusz Tylkowski

Phytotron - Head: Barbara Bujarska-Borkowska

Department of Physiology

Head: Assist. Professor Zofia Szczotka

Laboratory of Growth and Development - Head: Dr. Stanisława Pukacka

Laboratory of Mycorrhizae and Pathogenesis - Head: Dr. Maria Rudawska

Department of Trees Resistance

Head: Professor Ryszard Siwecki

Laboratory of Biotic Diseases - Head: Dr. Antoni Werner

Laboratory of Abiotic Diseases - Head: Dr. Jacek Oleksyn

Laboratory of Frost Resistance - Head: Dr. Paweł Pukacki

Library

Head: Elżbieta Nowak

ADMINISTRATIVE, FINANCIAL AND TECHNICAL SECTOR

Director: Henryk Stasiak

DIVISION OF PRACTICAL APPLICATIONS

Director: Janusz Waligóra

SCIENTIFIC ACTIVITY

DEPARTMENT OF SYSTEMATICS AND PLANT GEOGRAPHY

Studies in the field of systematics and geography of trees and shrubs were started at the Institute in 1956. Initially studies centered on woody plant species occurring in the wild state in Poland. This produced resulting monographic studies concerned various genera and species, particularly those the knowledge of which was inadequate, e.g. genera *Cotoneaster*, *Staphylea*, *Crataegus*, *Cytisus*, *Rosa*, or species *Sorbus intermedia*, *Daphne cneorum*, *Genista pilosa*, *Acer pseudoplatanus*, *Spiraea salicyfolia*, *Ligustrum vulgare*.

In early sixties was started the publication of the *Atlas of distribution of trees and shrubs in Poland*. It appeared in 1963-1981 in the form of folders, each with point maps of distribution for 5 species, with the text in Polish, English and Russian. The Atlas consists of 32 folders. This is the first atlas of this kind in Poland and one of the first in Europe. At present studies are conducted in the Department on the systematics and chorology of indigenous species from the genus *Rubus* and on the vertical and horizontal distribution of trees and shrubs in the Sudety Mountains.

In mid-sixties studies of this type were extended to regions outside of Poland, particularly to south-west Asia and eastern Mediterranean region. Close cooperation was established with such floristic publications as *Flora Europaea* (Cambridge), *Flora of Turkey* (Edinburgh), *Flora Iranica* (Vienna), *Mountain Flora of Greece* (Copenhagen). Also two world wide systematic monographs were produced for the genera *Colutea* and *Periploca*.

A very important contribution from the Department is the publication of an original atlas entitled *Chorology of trees and shrubs in South-West Asia and adjacent regions* planned to appear in eight volumes. In 1982-1988 six volumes were published with point maps of distribution for 350 species. Studies were also conducted on the

chorology of whole families. One such study for the family *Betulaceae* was published and another, for the family *Ulmaceae* is in preparation.

The Department organized dendrological expeditions to Turkey, Iran and Greece (seven times). The latter ones permitted the start on an *Atlas of distribution of trees and shrubs in Greece* in cooperation with The Goulandris Natural History Museum, Kifissia. Three volumes of this atlas have been prepared already and are in print; each of them contains 50 maps of distribution made on the same principles (point maps) as the previously mentioned two atlases.

At present we are continuing the publication of popular-scientific monographs from the series *Our forest trees*. Out of 21 planned volumes 9 were published so far; each of them is devoted to a single genus or species.

The Herbarium of the Institute (only trees and shrubs) currently has about 55 000 sheets. It is divided into three parts: 1) trees and shrubs of Poland, 2) trees and shrubs growing wild outside Poland, 3) trees and shrubs cultivated in Poland.

Currently at the Department there are 10 people employed, among them 2 professors and 1 assistant professor.

DEPARTMENT OF INTRODUCTION AND ACCLIMATIZATION

Work on the introduction and acclimatization of trees and shrubs has been conducted at the Institute since 70 years, basing on the rich collections of trees and shrubs gathered in the Kórnik Arboretum. At present it has about 2000 species and varieties and with time new collections are being established for the needs of current studies conducted. In the Arboretum various types of observations and studies are being conducted and their results constitute the first evaluations of the utility of various trees and shrubs for the climatic conditions of Poland. This concerns primarily ornamental species which could be used for various types of plantings, also in forests (*Larix*, *Abies*, *Populus*) and in conditions of a polluted environment. On the basis of the observations conducted so far more than 40 new species or varieties of trees and shrubs were introduced into cultivation in Poland.

The Department maintains the documentation of the dendrological collection, replaces and tends the woody plants and participates in the international exchange of seeds and plants. Contacts are maintained with about 300 botanical gardens and arboreta in various countries, particularly in temperate zone of the northern hemisphere them. A specialized nursery was established supplementing the collections and expanding them.

Studies at the Department are being developed on the concern also vegetative propagation of trees and shrubs. Technology was developed for the propagation of various trees and shrubs using compounds stimulating root formation in cuttings. Currently, work is concentrated on micropropagation of selected groups of trees and shrubs by the method of tissue cultures.

A special group of studies concentrates on the growth and development of larches occurring in Poland in forest conditions. Particular note is taken of the value of some provenances of *Larix decidua* and *L. kaempferi*. In addition on comparative research plots established in previous years, the value of various cultivars of poplars is evaluated for the needs of plantations.

The Department has very rich dendrological collections in the form of large-, medium-, profiled and standard samples of wood (2400 samples), fruits and cones (about 600 samples) and seeds. The samples come from own dendrological collections made in the Arboretum and from other botanical institutions as well as from natural stands of various species.

Results of studies performed at the Department are published in various scientific and popular-scientific periodicals, particularly in the annual publication of the Institute *Arboretum Kórnickie*.

At the Department there are 14 employees, among them 1 professor and 1 assistant professor.

DEPARTMENT OF GENETICS

In 1950-1965, basing on a rich collection of poplars and following the general trend of that time to develop fast growing trees efforts were made to obtain hybrids from crosses of selected parental pairs within various sections of *Populus* and from open pollination. More than 180 crosses were made from which about 15 000 hybrids were obtained. The progeny obtained was subject to many years of selection, particularly from the point of view of wood productivity and resistance to various diseases. The variability and heritability of various morphological traits were studied. The selected hybrids were introduced into cultivation on a semi-commercial scale. A wide range of studies in the field of genetics and breeding, physiology, phytopathology and anatomy of poplars have been conducted till the end of the seventies, and made studies on poplars something of a speciality of the Institute.

Since 1963 the Department is engaged in provenance research on indigenous tree species in the experimental areas in Forest Range Zwierzyniec. It established also

experimental areas throughout the country, primarily for Polish provenances of Scots pine, Norway spruce and, to a lesser degree, *Larix decidua*, *Abies alba*, *Alnus glutinosa*, *Quercus robur* and some exotics. Some of the work was carried out in cooperation with international experimental projects coordinated by IUFRO (International Union of Forest Research Organisations). This includes the IUFRO Douglas fir experiment, a trial with Norway spruce and one with Scots pine. Also we have found and brought into usability an older trial from the IUFRO 1938 series on Scots pine and the 1912 trial on Scots pine organized by the St. Petersburg Faculty of Forestry in Russia. Our interest in older provenance experiments is reflected also in a whole series of papers reviewing results from older international trials on Scots pine, Norway spruce and European larch, for whole experimental series.

In early sixties the Department started work on the selection and vegetative propagation of plus trees of the more important forest species. These were the first efforts in the field of forest tree breeding in Poland and they led to the establishing of first experimental seed orchards. Progressively our interests changed to progeny testing (after open and controlled pollinations) and trials with second generation seed orchards. This is a major concern of ours at the moment, the idea being to base new orchards as much as possible on genotypes that have been as far as possible tested in progeny trials and in provenance experiments.

Concurrently with the seed orchard work we have been conducting an extensive programme of research into the problem of floral induction in our seed orchards. This is a major concern due to quite inadequate cone production, particularly in Norway spruce seed orchards. This research proved very rewarding when combined with anatomical studies of bud and flower development. Such combined studies were conducted on Scots pine and European larch. Currently, a similar programme is in progress for Norway spruce. This project, though practically oriented, provided numerous interesting results concerning the physiology of flowering and, in particular, concerning the role of light in the process of floral induction.

Since 1967 a minor project is being conducted on the relation between mineral nutrition and genetic variation in Norway spruce seedlings. Work is also conducted on biochemical variation in tree populations. For the purpose, use is made of electrophoretic techniques for isoenzymes. It was shown that tree populations exhibit considerable polymorphism, with the help of which it is possible to demonstrate affinities between varieties, provenances and populations. Also, it proved possible to demonstrate the direction of changes taking place in the genotype composition of forest populations as a consequence of industrial pollution. At the Department there are 15

employees, among them 1 professor and 3 assistant professors .

DEPARTMENT OF PHYSIOLOGY

The Department was started in 1955 and developed from the laboratory of biochemistry and physiology. Till 1980 it was headed by Professor Mirosław Tomaszewski. At the time the main projects of the Department concerned the phenolase enzymatic system and its relation to the processes of respiration, lignification, growth, leaf abscission and resistance of plants to diseases, as well as regulation of these processes by auxin. Around 1971 the problems associated with mycorrhizal relationships were introduced into the work of the Department. In 1981, together with changes on the position of head of the Department, its topics of interest were extended to include the physiology of dormancy breaking in seeds and of seed ageing. Since that time three major projects are in progress at the Department.

1. Physiology and biochemistry of dormancy breaking and ageing of tree seeds, including studies on some enzymes, ATP, respiration, protein synthesis and its regulation (elongation factor 1), the formation of polysomes, and lately on the metabolism of endogenous and exogenously acting polyamines. This last is studied during dormancy breaking in seeds also in the context of action of classical growth regulators and substances having the nature of secondary carriers of information such as cyclic mononucleotides. Studies on the polyamines in the dormancy of seeds and on the mononucleotides are pioneer in character and the Department was the first in Poland to start such studies. Studies on the ageing of seeds are being continued primarily in the sphere of lipid content and metabolism in connection with changes of membrane permeability in ageing seeds.

2. Studies in the field of mycorrhizae concern endo- and ecto-mycorrhizae of Scots pine, taking into particular consideration the influence of nitrogen nutrition. Their aim is to determine the sequence of metabolic steps in both symbionts (fungus and host species) in the little studied process of mycorrhizae establishment. The studies cover an analysis of growth regulators (auxins and cytokinins) produced by the host and mycorrhizal fungus, determination of the enzymatic activity associated with the synthesis of IAA, metabolism of nitrogen, hydrolases and the oxidation-reduction system. The aim of the studies is to find for the pine the most satisfactory symbionts, which could be used in forest nurseries.

3. The topic of pathogenesis is studied through an analysis and determination of the role of toxins from root rot, with particular consideration of the sugar component.

Additionally studies are being conducted on the influence of the fungus *Trichoderma* in relation to some pathogens in the trees.

In the realisation of its scientific projects the Department cooperates closely with the Institute of Bioorganic Chemistry of the Polish Academy of Sciences in Poznań, with the Department of Plant Physiology of the Poznań Agricultural Academy and with the University of New Jersey in U.S.A. The Department has 12 employees with one assistant professor.

DEPARTMENT OF TREES RESISTANCE

Studies and observations in the field of woody plant phytopathology have been conducted at the Institute occasionally since the very beginning of its existence. However, a systematic engagement in these topics started only in mid-sixties when an independent laboratory was established which in 1980 was transformed into the Department of Trees' Resistance.

Initially the work concentrated primarily on the problems of resistance of trees to diseases and the studies developed in three basic directions.

1. Determination of the mechanisms of poplar resistance to its main fungal, bacterial and viral diseases caused by *Dothichiza populea*, *Xanthomonas populi*, *Pseudomonas syringae*, *Ceratocystis fimbriata*, *Fusarium solani*, *Venturia tremulae*, *Melampsora laricipopulina*, *Marssoniana brunnea* and others. The extensive studies concerning *Melampsora larici-populina* deserve special mentioning.

2. Studies on the resistance of Scots pine to root rot - *Heterobasidion annosum*.

3. Determination of the causes of massive decline of oaks in some regions of Poland, considering in particular the role of fungi from the genus *Ceratocystis*.

With the increasing forest decline due to industrial pollution of air, the Department started to develop studies in this field, the work concentrating on two aspects: 1) study of the mechanisms of inter- and intra-species differentiation of trees in sensitivity to the toxic industrial gases (SO₂, NO₂, HF, O₃) and heavy metals, and 2) selection of appropriate species, populations and clones of trees for planting in industrial regions in the protection zones of industrial plants that are troublesome to the environment.

Simultaneously studies are being conducted on the frost resistance of the basic forest forming tree species, Scots pine and Norway spruce and of selected species of trees used for planting in towns. The aim of these studies is, on one hand, to select individuals as well as whole populations tolerant to this stress factor, and on the other

to identify the factors determining the differentiation in sensitivity to low temperatures of the studied plants.

The Department of Trees' Resistance is an organiser of national symposia on the *Biological reaction of trees to industrial pollution* and it cooperates with international organisations (IUFRO and FAO).

The employees of the Department are authors of scientific expert opinions made on order from the State Forests, industrial plants and other institutions.

At the Department there are 18 employees with one professor.

DEPARTMENT OF SEED BIOLOGY

The present Department originally functioned as a small laboratory started in mid-fifties, but it was already then that it was furnished with a set of phytotron chambers for studies in the field of seed physiology of woody plants. With years the facilities were expanded to include cold chambers with negative temperatures for storing and freezing seeds, sets of coolers for seed stratification in differentiated thermal conditions, germinators, cleaning machine etc. In this manner was established the only laboratory on this scale in Poland which had the facilities to conduct complicated research on the seeds of trees and shrubs.

The topics handled by the Department concern primarily the long term storage of woody plant seeds (trees and shrubs), in particular of such forests forming species as oak, beech ash, sycamore, fir, etc. The second basic topic were the studies on the overcoming of dormancy of tree seeds, particularly of broadleaf species, under fully controlled conditions.

Studies on the storing of seeds and on the overcoming of their dormancy include also: 1) development of thermal and time patterns for the presowing treatment of seeds, 2) study of the optimal conditions for the germination of already afterripened seed, taking into particular consideration the cyclically variable temperatures; 3) determination of conditions favouring the induction of secondary dormancy, this induction being treated as a means of increasing the ability of seeds to germinate; 4) work on the inhibition of the after-ripening process in seeds through freezing or partial dehydration of already afterripened seed; 5) storage of freshly collected seed belonging to the "orthodox" group (sustaining drying) and "recalcitrant" ones (not able to sustain dehydration below a specific, very high value), 6) storage of seeds already prepared for sowing.

The Department cooperates in this respect with an analogous research center of

INRA in France (Orlean and Nancy).

One of the major achievements of the Department is the technological project for the long term storage and preparation for sowing of beech seeds, which currently, after the patent has been purchased by the State Forest is being realized, in the form of two seed stations which are under construction. Similar studies have been conducted on the storage of mazzard cherry seeds (*Prunus avium*).

At the Department there are 8 employees with one professor.

LIBRARY

The Library of the Institute collects books and periodicals in the field of tree biology.

The collections include at the moment 37 500 volumes comprising:

books 22,500 volumes,

periodicals 13,500 volumes,

special publications. . . 1,500 volumes.

The Institute publishes the following periodicals and serial editions:

Arboretum Kórnickie - since 1955, 31 volumes have appeared;

Index seminum - list of seeds of trees and shrubs offered for exchange among botanical gardens and arboreta;

Chorology of trees and shrubs in South-West Asia and adjacent regions - so far 6 volumes were published;

Our forest trees - monographs (so far 9 volumes were published);

Atlas of distribution of trees and shrubs in Poland - 32 volumes appeared for 160 species with point maps of distribution and short characteristic of each plant; this series has been completed.

Besides, in addition 8 occasional volumes have been published (materials from symposia and conferences).

DIVISION OF PRACTICAL APPLICATIONS

Till 1968 the Division was an integral part of the Institute. Since 1968 it is an independent economic unit with a separate director who is not subordinated to the director of the Institute. The division performs various services to the Institute for payment, particularly maintaining the dendrological collections, nurseries for the needs of the arboretum and experimental areas.

The Division has 680 ha of land comprising:

dendrological collections (arboretum) . . .	50 ha,
nurseries	40 ha,
experimental forest	200 ha,
arable land	390 ha.

