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Short Note: Studies on Antigenic Proteins of Pinus sylvestris from Six Swedish Provenances –A Pilot Study

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Abstract

Six populations of *Pinus sylvestris* (L.) from latitude 56—67° were analysed by the immunodiffusion technique. The samples (20—22) from each population were collected in a provenance trial belonging to the Institute for Forest Improvement at latitude 64°. The main results were as follows:

* One fraction of antigens (3) is twice as frequent in the northern samples (0.90) as in the southern ones (0.43)
* The range of variation within each group of samples is less than 10% of each mean value
* The sample from central Sweden takes an intermediate position (0.73)
* The latter sample also shows the highest level of polymorphism
* These results give a slight support to the hypothesis that there are two varieties of *Pinus sylvestris* in Sweden

Key words: Pinus sylvestris, provenances, antigenic proteins, serological methods.

Zusammenfassung

Sechs Populationen von *Pinus sylvestris* L. aus 56—67° geographischer Breite wurden mittels Immundiffusionstechnik untersucht. 20—22 Proben von jeder Population wurden in einem Provenienzversuch, der zum Institute for Forest Improvement auf 64° geographischer Breite gehört, gesammelt. Die Hauptresultate waren wie folgt:

— Eine Fraktion von Antigenen (3) ist in den nördlichen Proben zweimal so häufig (0,90) wie in den südlichen (0,43).
— Der Umfang der Variation in jeder der Probengruppen beträgt weniger als 10% des Mittelwertes.
— Die Probe von Zentralschweden nimmt eine mittlere Position ein (0,73).
— Die letzte Probe zeigt den höchsten Grad an Polymorphismus.
— Diese Resultate unterstützen die Hypothese, daß es in Schweden zwei Varietäten von *Pinus sylvestris* gibt.

Introduction

Pinus sylvestris is considered to have invaded Sweden from both the north and the south (KIELLANDER 1974). The migration streams seem to have met in central Sweden between the latitudes 60°—61°. In this region, a large and well-known variation in morphological characteristics can be found such as crown shape. Certain forest scientists consider Sweden to have two originally and morphologically different varieties of *Pinus sylvestris* (SYLVEN 1916, KIELLANDER 1974). The northern Swedish variety with a narrow and finebranched crown is called var. *lapponica,* while the southern Swedish broadcrowned variety is called var. *septentrionalis.* Other forest scientists such as SCOTT (1907) and LANGLET (1936) considered Sweden to have a single stepwise clinal variation of *Pinus sylvestris* from the south to the north of Sweden without any zone of introgression showing increased varibility of any kind.

Isozyme studies give som indications of an introgression zone between lat. 61°—61° (RUDIN unpubl.) by showing a higher proportion of heterozygotes. The serological methods and their great sensitivities open up further possibilities of casting some light on the two opposing hypotheses.

Serological techniques in plant protein investigations have been mostly used in chemotaxonomy for detecting the differences between species (for review see SMITH 1976). However, the serological differences have been detected not only at the level of different species, but also between populations of the same species as reported by LEE and FAIRBROTHERS (1969), CLARKSON and FAIRBROTHERS (1970) in *Typha* and in *Abies balsamea* var. *balsamea* and *A. fraseri.*

Investigations by HAGMAN (1977) and other authors, including PRUS-GLOWACKI and SZWEYKOWSKI (1979) (1980), additionally demonstrated the serological differences between individuals of the same species. This great sensitivity of serological methods, offers us the possibility of studying the variability of antigenic proteins at the level of single trees in some Swedish populations of *Pinus sylvestris,* and to cast some light on the two hypotheses referred to above.

Materials and Methods

Proteins from needles of 20 to 22 eight-year-old plants from each of six Swedish provenances *(Table 1)* were studied by means of immunodiffusion. Extraction of proteins from the needles, immunodiffusion procedures and interpretation of results were done as described in previous papers, (PRUS-GLOWACKI and SZYEYKOWSKI 1979, PRUS-GLOWACKI and SZWEYKOWSKI 1980). Antisera for immunodiffusion analysis was produced against needle proteins from 30 pine

Table 1. — Frequency of antigenic proteins and polymorphic index in six investigated Swedish populations of *Pinus sylvestris*.

No.	Population	Lat.	Alt (m)	Number of trees	Frequency of antigens 1	2	3	4	5	6	7	8	9	P_i
1	Glimåkra	56°20'	90	20	0.80	1.0	0.45	1.0	1.0	0.55	0.15	0	0	0.11
6	Floda	59°02'	80	22	0.77	1.0	0.41	0.91	0.95	0.59	0.23	0.09	0.05	0.12
17	Lillhärdal	61°45'	625	22	0.86	0.95	0.73	0.95	0.77	0.27	0.23	0	0	0.14
30	Anundsjö	63°31'	150	22	1.0	0.95	0.95	0.86	0.82	0.05	0.23	0.23	0	0.10
43	Älvsbyn	65°05'	150	22	0.91	1.0	0.86	0.91	1.0	0.14	0.09	0.05	0	0.07
58	Vittangi	67°38'	370	20	0.80	1.0	0.90	0.95	0.95	0.10	0.10	0	0	0.08
				128	0.86	0.98	0.72	0.93	0.92	0.28	0.16	0.06	0.01	0.10

trees in a population located in Sudety Mountains at lat. 50°45' long. 16°50' and altitude 680—720 m near the village of Duszniki Zdroj.

The immunodiffusion banding pattern was systemized by identification of each precipiting band according to OUCHTERLONY (1967).

The protein extract from each individual tree was compared to an immunodiffusion plate as to a reference. This reference is a highly heterozygotic tree (No. W3040) from the central part of Sweden.

On the basis of individual trees, immunodiffusion patterns and polymorphic indexes (P_i) for each population were calculated according to a formula by JAIN and MARSHAL (1968) in LEUSCHENER (1974).

$$P_i = \Sigma qi(1-qi)\ 1/z$$

where z = number of antigenes in population "i"

qi = frequency of a particular band in the "i" population

Results and discussion

Some examples of immunodiffusion patterns obtained for individual trees in comparision to reference tree W3040 are shown in *Figure 1*, where the differences between individual trees within one population can be seen.

The frequency of each distinguished precipitin band is shown in *Table 1*. Two of the antigenic proteins, No. 3 and No. 6, show a tendency to increase and decrease respectively in frequency-distribution from the south to the north of Sweden. This tendency is shown in *Figure 2*. Two populations from the south (No. 1 and No. 6) have less than 45% of individuals which have the antigen No. 3. In a population from the central part of Sweden (No. 17) the presence of that protein is observed in more than 70% of the trees. In populations from northern Sweden the antigen 3 is noticed in approximately 90% of the individuals. Antigen No. 6 shows reverse tendency.

The morphological differences between the two putative varieties are in many cases obvious. They are carefully studied and described by SYLVEN (1916). The studies made by LANGLET (1936) were mainly based on such physiological characteristics as dry-matter content and activity of catalases in the needles. He found clinal variation in relation to these characteristics.

Our results indicate clear differences between the southern and the northern varieties. However, it must be pointed out that these differences could be even greater if it is taken into account that the plants for this study were grown to the age of eight years close to lat. 64°. This means

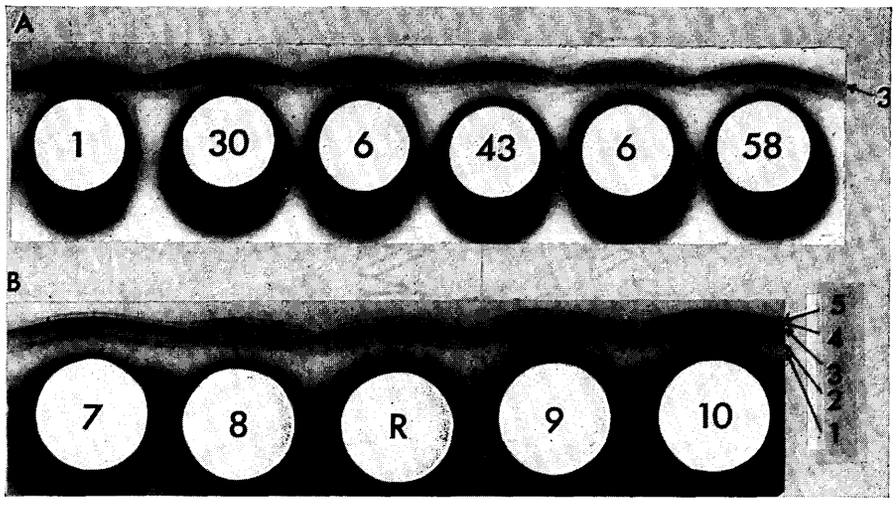

Figure 1. — Immunodiffusion plates of the serological patterns of *Pinus sylvestris*. 1 A shows the pattern from 20 mixed samples from five of the six studied populations. Encircled figures indicate provenance number *(Table 1)*. 1 B shows pattern from single trees of population No. 17. R indicates a reference tree (W3040) from central Sweden. Figures to the right indicate the number of the antigen fraction.

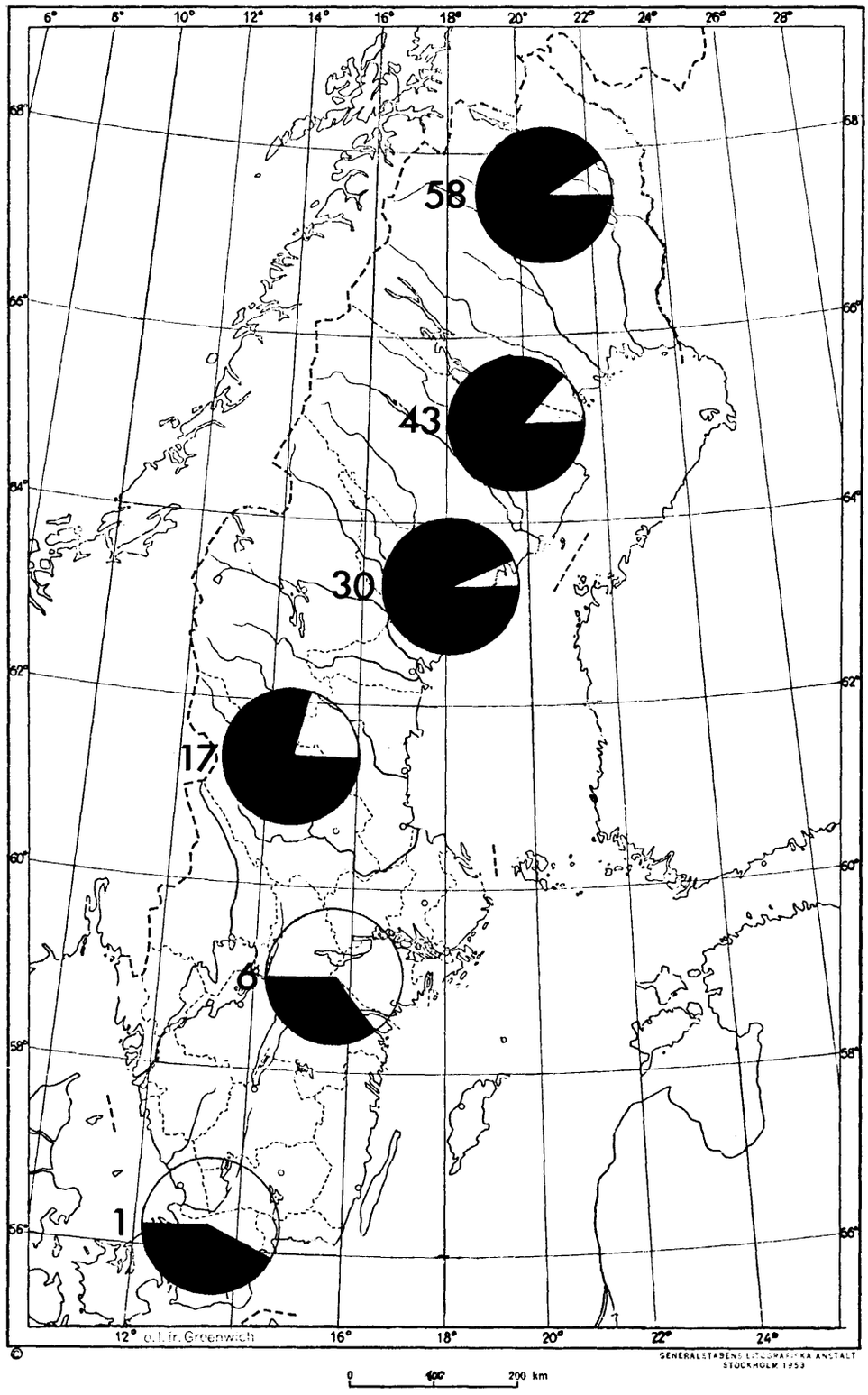

Figure 2. — Frequency of antigen No. 3 in six Swedish population of *Pinus sylvestris* shown by the filled circle sectors.

that there have been a great proportion of plants not hardy enough to survive at this latitude. If the studied antigenic protein is not associated with the genes for hardiness, there should be no interference of this transfer of plants with the interpretation of the results. In order to check if there is any connection between antigene protein No. 3 and hardiness it should be easy to grow some groups of plants from the investigated provenances under their local conditions and then analyze those progenies.

The polymorphic indexes (P_j) computed on the basis of frequency of preciptin bands show that the less polymorphic populations are populations from the north of Sweden. A population from the central part of Sweden (17) has the highest polymorphic index *(Table 1)*. The popula-

tions from the southern Sweden reach a relatively high value of polymorphic index as compared to the northern populations.

The higher polymorphic index in the south of Sweden as compared to the north is evidently based on the fact that there have been a lot of introduced *Pinus sylvestris* provenances from Germany into the south of Sweden. Added to that, the total pollen production is much more abundant in the south than in the north of Sweden.

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Buchbesprechungen

Cytogenetics. Plants, Animals. Humans. By JÜRGEN SCHULZ-SCHAEFFER. Springer Verlag Berlin, Heidelberg, New York. 1980. 446 pages, 219 figures, 11 tables XIII, 1050 g, Cloth. DM 69,—, approx. US $ 40.60.

Das vorliegende Buch ist aus Vorlesungen des Autors am Institute of Genetics an der Montana University, USA entstanden. Es umfaßt aber ein bei weitem größeres Gebiet als es für eine Vorlesung notwendig wäre, da zytogenetische Forschungsergebnisse der Botanik (auch an Forstpflanzen) und Zoologie ebenso wie die der Humanzytogenetik herangezogen werden. Der Lehrende kann daher die Schwerpunkte selber setzen, und auch der Wissenschaftler hat die Möglichkeit sich über dieses, sich rasch weiter entwikkelnde Forschungsgebiet unter den verschiedensten Aspekten rasch zu informieren.

Einleitend wird in chronologischer Reihenfolge ein Überblick über die in den letzten 400 Jahren gemachten, für die Entwicklung der Zytogenetik wichtigen Entdeckungen gegeben, beginnend mit der Konstruktion des ersten Mikroskops (1588—1631) bis zur Beschreibung der Pallindrome (1974). Der umfangreiche Stoff der karyologischen Vorgänge ist in 8 große Abschnitte gegliedert, dem ein weiterer, die extranuklearen Faktoren darstellender folgt. Die ersten 4 Abschnitte stellen das normale Geschehen im Zellkern dar: von der morphologischen Struktur der Chromosomen bis zu ihrer Ultrastruktur sowie ihrem Chemismus; die Funktion der Autosomen und der Geschlechtschromosomen; die Chromosomenbewegungen, sprich die Mitose und Meiose; die Fortpflanzung. Jeder dieser Abschnitte hat in den folgenden 2/3 des Bandes seine Entsprechung, die Variationen und Anomalien dieser karyologischen Gegebenheiten darstellend: Ausdifferenzierung der Gewebe bei pflanzlichen und tierischen Objekten; die Verhältnisse bei den Prokaryoten; Variationen und Anomalien der Chromosomenstruktur, —zahl (Polyploidie, Haploidie, Aneuploidie), und -funktion, sowie deren Konsequenzen bei der Bildung der Geschlechtszellen und nach der Fortpflanzung. Die herangezogenen Forschungsergebnisse werden durch zahlreiche, z. T. neu gezeichnete Abbildungen botanischer und zoologischer Objekte und humanzytogenetischer Befunde vervollständigt, somit die übergreifende Gesetzmäßigkeit dieser Vorgänge ebenso wie die Vielfalt des Forschungsgebietes betonend. Die 69 Seiten umfassende Bibliographie berücksichtigt nicht nur das anglo-amerikanische Sprachgebiet sondern auch weitere internationale Literatur bis 1979. Dies kommt dem Wunsch des Benutzers nach Vertiefung und Spezialisierung bestimmter Gebiete entgegen, sodaß das Buch auch einem angewandten Genetiker eine wertvolle Arbeitshilfe sein kann. Z. M. ILLIES

Pinus contorta as an exotic species. Proceedings of the IUFRO working party meeting 1980 on *Pinus contorta* provenances (S2.02.06) in Norway and Sweden. Swedish University of Agricultural Sciences, Department of Forest Genetics. Research Notes No. 30 (1980). 353 pp. Sw.Kr. 50.—.

The proceedings comprise papers presented to a meeting of the IUFRO Working Party S2.02.06 "Pinus contorta provenances" which was held 14th—22nd August 1980 in Norway and Sweden. The papers are arranged according to the following sessions: *Pinus contorta* in its native environments (1 title); Survival, height increment and growth rhythm (9 titles); Volume increment (1 title); Quality, including wood density (1 title); Stability against wind and snow (1 title); Diseases, insect pests and other damage (4 titles); Seed production (6 titles); Breeding beyond the provenance level (1 title). Most of the papers are dealing with results of trials in the Scandinavian countries where *Pinus contorta* is used as an exotic tree species in extensive reforestation work. B. R. STEPHAN

Proceedings of the 15th North American Quantitative Genetics Group Workshop. Copies are available from.

Dr. Floyd E. Bridgwater
Southeastern Forest Experiment Station
North Carolina State University
School of Forest Resources
Box 5488
Raleigh, North Carolina 27650

A charge of $ 3.00 (U. S.) per copy is made to cover costs of printing and mailing. Checks should be made payable to: North American Quantitative Genetics Group.

The objective of the workshop was to identify research needs in tree breeding. Representatives of eight tree improvement cooperatives in North America described their tree breeding programs and objectives, and identified research needed to achieve their goals. A panel of experts questioned the eight speakers, critiqued their programs and helped to elucidate researchable questions. The proceedings will be of value to those interested in tree improvement and tree breeding and genetics research. F. E. BRIDGWATER

Bodenkunde. Von Prof. Dr. H. KUNTZE, Prof. Dr. J. NIEMANN, Prof. Dr. G. ROESCHMANN und Prof. Dr. G. SCHWERDTFEGER. 2., völlig neubearbeitete Auflage. 1981. 407 Seiten mit 130 Abbildungen und 101 Tabellen. (UNI-Taschenbücher Band 1106). Verlag Eugen Ulmer, Stuttgart. DM 29.80.

12 Jahre nach der 1. Auflage erscheint dieses Bodenkunde- Lehrbuch in einer völlig neubearbeiteten 2. Auflage, bei der viele neue Erkenntnisse und Forschungsergebnisse zu berücksichtigen waren. Das Buch gliedert sich in 4 Hauptkapitel, die von jeweils einem der Autoren federführend bearbeitet wurden. Im 1. Kapitel wird