

rejets de greffe constatés au cours des quelques années précédant les prélèvements soient aussi à l'origine de l'effet défavorable attribué au climat observé sur le cerne 1977.

3. Conclusion

Ces résultats assez originaux apportent des informations qui confortent les observations empiriques sur l'anatomie du bois de *Quercus robur* et les études assises sur un matériel végétal et une méthodologie „sérieuse“ déjà menées au Département des Recherches Forestières de l'INRA. On n'oubliera cependant pas la nature bien particulière du matériel végétal et la faible taille de l'échantillonnage, notamment en ce qui concerne le nombre d'années étudiées.

Il apparaît nettement qu'on peut expliquer une bonne partie de la variabilité des caractéristiques anatomiques étudiées, avec un comportement assez différent suivant les cas: contrôle génotypique étroit pour la largeur de la zone de bois initial, effets du milieu (effets individuels non génétiques et effets dus à l'année) importants dans les deux autres cas avec un contrôle clonal assez léger.

En outre, on observe qu'à la différence de la largeur de la zone de bois initial insensible aux effets annuels, les autres caractères (en particulier la largeur de la zone de bois final et la proportion de fibres dans le bois) étaient sous une certaine dépendance des conditions climatiques précédant la formation du cerne considéré.

Remerciement

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Short Note: Relationship between the Total Phenol Content of Scots Pines and Browsing by the Arctic Hare

By M. ROUSI and J. HÄGGMAN¹⁾

(Received 27th November 1983)

Abstract

The difference in total phenol content of pines browsed and not browsed by the arctic hare was investigated within the framework of a larger research project for investigating the reason why mammalian herbivores prefer certain individual trees. The sample comprised 157 Scots pine grafts and 45 pole stage pines.

It was found that the total phenol content in both intact ramets and pole stage pines was significantly higher than in browsed ones. The total phenol content in grafts was higher than in pole stage pines. Preliminarily it seems that the phenol content of Scots pine is not strictly determined by the genotype.

Key words: Scots Pine, phenols, arctic hare.

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Zusammenfassung

Es wurde der Unterschied im Gesamt-Phenol-Gehalt bei Kiefern, die von Schneehasen (*Lepus timidus* L.) verbissen werden oder unbeschadet bleiben im Rahmen eines größeren Forschungsprojektes untersucht, d. h. um die Ursachen zu erforschen, warum manche pflanzenfressende Säugetiere bestimmte Einzelbäume bevorzugen. Der Versuch umfaßte 157 Kiefernpropflinge und 45 Einzelbäume im Stangenholzalder.

Es wurde herausgefunden, daß der Gesamtphenolgehalt sowohl bei intakten, als auch bei Bäumen im Stangenholzalder signifikant höher lag, als bei den geschädigten. Der Gesamtphenolgehalt der Propflinge war höher als der der Bäume im Stangenholzalder.

Vorläufig scheint es so, als ob der Phenol-Gehalt bei *Pinus sylvestris* nicht streng vom Genotyp bestimmt wird.

Introduction

In northern Finland the arctic hare (*Lepus timidus* L.) occasionally browses Scots pines (*Pinus sylvestris* L.) (GRANIT 1900). Attempts have been made to discover why arctic hares prefer certain individual trees. Is a choice actually made or do they browse any trees they come across (ROUSI 1983)? As part of a broader investigation we tested the role of total phenol content of pines in their defence system against arctic hares. The preliminary results of this investigation are presented here.

Materials and Methods

The samples were collected from two places in northern Finland, where arctic hare had browsed Scots pines rather severely: 1) from a clonal collection of pines growing on drained peat land (Teuravuoma), where the grafts were c. 3 m tall, and 2) from a natural pine stand growing on mineral soil (Ruokojärvi), where the trees were c. 6 m tall. The graft collection was founded in 1968. The grafts are from plus trees originating from North Finland. In spring 1982, a total of 801 grafts of 365 clones were alive (for further details of the experimental area and the severity of arctic hare browsing in winter 1981/82 see ROUSI 1983). The samples, which were taken in April 1983 with a knife, included some cambium (similar to what the hare would have eaten) from the same height at which the hares ate (50–80 cm). All the samples of ramets were taken above the grafting point.

The total phenol measurement was made from the dried bark samples using the Folin-Denis method (see A.O.A.C. 1960).

Results

In the graft collection the difference in total phenol content of browsed and untouched grafts was statistically highly significant (*Table 1 a*). In the natural stand the difference was not so great (*Table 1 b*).

The phenol content of normal intact trees growing in the forest was lower than that of the intact grafts. Phenol content in browsed grafts was higher than in browsed trees ($t = 2.74$; $P = 0.009$).

The variation between ramets within clones studied in 17 cases. In some cases the phenol contents in the grafts of the same clone were close to each other. In some cases the difference was nearly three-fold. Thus the variation between the clones was of the same magnitude as the variation between randomized grafts (*Table 2*).

In some cases the phenol content of grafts damaged by arctic hare in winter 1981/82 was much lower in 1983 than those intact. A few contradictory cases were also found.

Table 1. — The difference in total phenol content in the bark of Scots pines damaged and unaffected by arctic hare.

	a. TEURAVUOMA (grafts)		b. RUOKOJÄRVI	
	67°15'N; 23°45'E		67°10'N; 24°30'E	
	damaged	intact	damaged	intact
Mean (mg/g)	74.8	102.7	60.2	72.2
S.D.	25.5	30.9	23.8	21.8
Sample size	99	58	25	20
	$t = 5.82$; $P = 0.000$		$t = 1.70$; $P = 0.084$	

Table 2. — The comparison of phenol content in pairs of ramets of same clone.

CLONE no	PHENOL CONTENT (dry weight) Mg/g
437	78,38
	47,20
462	98,60
	93,75
2119	54,40
	25,53
2360	93,25
	60,94
2297	42,46
	70,97
1855	79,95
	82,56
2000	53,20
	58,57
2284	62,70
	50,00
2177	41,87
	136,36
2518	48,04
	122,67
2268	101,35
	122,67
2233	54,18
	88,28
2286	75,00
	80,67
204	103,25
	75,00
2278	145,35
	79,70
2001	138,00
	61,88
326	46,88
	83,33

Discussion

In material obtained from a natural stand the difference between damaged and intact trees was not very high. In the Teuravuoma graft collection the sample was rather large and the difference in phenol content was convincing. The phenol content of the grafts was somewhat larger than in pole stage pines. At the moment, an investigation is being undertaken into whether for example, different sites or different nutrient status of the soil have had any effect on the results.

If pines are felled, arctic hares seem to prefer the crown parts of the trees as their winter forage. When grafted, the crown parts maintain their former status (cyclophysis and topophysis) (SARVAS 1970). If trees are able to allocate their defensive metabolites, the deterrent secondary metabolites were expected to be situated in the part of the tree which is within the reach of herbivorous mammals (RHOADES and CATES 1976). Accordingly the defensive system of grafts should be less developed than in naturally regenerated young trees. In any case, these results could also be explained by the possibility that the grafting process leads to an increased amount of phenol.

Preliminary it seems that grafts browsed by arctic hares in previous winter (1981/82) have not been able to increase their phenol content for the next winter. More data is anyhow needed for final conclusions.

The variation between the grafts of the same clone is so big that it seems that the phenol content in trees is not strictly controlled by genotype. It is however also possible that the genetically different roots had an effect on the

above ground part of the grafts. This subject is also under the study at the moment. According to these results the difference in the amount of phenolic substances obviously play a role in the protection of the Scots pine against the arctic hare.

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News

The 1984 Marcus Wallenberg Prize

The Marcus Wallenberg Foundation has on the unanimous recommendation of its International Selection Committee, awarded Mr. LEOPOLDO G BRANDAO, Mr. EDGARD CAMFINHOS, JR., Mr. NEY M DOS SANTOS, Miss YARA K IKEMORI of Aracruz, Brazil the 1984 Marcus Wallenberg Prize for their pioneering work leading to significant scientific and technological break-throughs in developing commercial forests based on cloned Eucalyptus. Their methods have stimulated world-wide emulation. The high productivities achieved will reduce pressures on natural forests.

Falun, Sweden, March 29, 1984

US-AID Supports Study of Honduras Pine in the Caribbean

Large reforestation efforts are being undertaken with exotic forest plantation tree species in the Caribbean region. Often, specific site requirements for best growth are not known for the individual species planted. Excessive foxtailing, crooked stems, poor form, and dieback are general indicators of "off site" plantings. Such observations are now quite extensive for the widely planted species, *Pinus caribaea* var. *hondurensis*, known locally as Honduras or Caribbean pine. However, there has traditionally been little technical information exchange for over 30 years between Caribbean countries where this pine has been planted.

In early 1983 a major step towards resolving this problem was the awarding of a \$ 150,000 research grant from US-AID to study growth and site relationships of Caribbean pine in Jamaica, Surinam, Trinidad, and Venezuela. Methodologies were developed in Puerto Rico by LEON H. LIEGEL. He and counterparts in all four cooperator countries will undertake four major grant objectives over a 3-year period ending December 1985: 1) collect, analyze

and synthesize existing but unpublished data on Caribbean pine, 2) identify and complete various forestry training activities for local technical or scientific staff of cooperator institutions, 3) conduct new field research to refine soil/site interpretations for Caribbean pine, and 4) publish and disseminate results from synthesis and new field research activities.

The grant fosters integrated forest development in all cooperator countries. It will develop comprehensive site interpretations for Caribbean pine that have regional as well as world-wide significance. Data synthesis, training, and cooperative research efforts will provide quantitative data that can be used by managers, foresters, ecologists, and economists for rational decision making.

To make interpretations and analyses as complete as possible, LIEGEL is soliciting information from others in the Caribbean region and elsewhere. Of particular interest are unpublished data on Caribbean pine growth and yield as related to local soils or other environmental variables and seed production, foxtailing, and wind damage in plantations of known age and seed source.

L. H. LIEGEL, USDA Forest Service,
P.O. Box AQ, Rio Piedras,
Puerto Rico 00928

Positions available

Kerala Forest Research Institute, Peechi (Pin: 680 653) Kerala, India requires qualified Scientists in the following disciplines of Forest Science. Persons with experience in tropical forestry research preferred. Salary negotiable.

SILVICULTURE, GENETICS, PHYSIOLOGY, WILDLIFE, TAXONOMY, PATHOLOGY

Send resume to the Director of the Institute.

S. KEDHARNATH

Announcement

Die **Arbeitsgemeinschaft für Forstgenetik und Forstpflanzenzüchtung** in der Bundesrepublik Deutschland wird ihre diesjährige Arbeitstagung in Form einer öffentlichen Vortragsveranstaltung vom 9.—11. Oktober in Göttingen abhalten.

Die Veranstaltung steht unter dem Generalthema „Beiträge von Forstgenetik und Forstpflanzenzüchtung zur Minderung von Immissionschäden?“ Dabei sollen alle genetischen und züchterischen Aspekte des „Waldsterbens“ behandelt werden. Das endgültige Programm wurde im Laufe des Monats Juni versandt.

Interessenten wenden sich bitte an die Abteilung für Forstgenetik und Forstpflanzenzüchtung der Universität Göttingen, Büsgenweg 2, D-3400 Göttingen, Tel. 0551-393532.

Der Fakultätentag der Forstlichen Fakultäten hat die Rahmentermine für die nächsten forstlichen **Hochschulwochen** festgelegt:

— Frühjahr 1984: Bundesforschungsanstalt für Forst- und Holzwirtschaft in Hamburg-Reinbek

— Herbst 1984: Forstwissenschaftliche Fakultät der Universität München in München

— Herbst 1985: Forstwissenschaftlicher Fachbereich der Universität Göttingen in Göttingen

Buchbesprechungen

Manual general sobre uso de semillas forestales (General manual on the use of forest seeds): Por E. TRUJILLO U.

Ministerio de Agricultura, Instituto Nacional de los Recursos Naturales Renovables y del Ambiente (INDERENA); Subgerencia de Fomento, Bosques y Aguas, Estación Forestal La Florida, Banco Nacional de Semillas, 35 pag., 1 anexo, Bogotá, D. E., Colombia (sin fecha).

In addition to definitions taken from the OECD scheme for forest reproductive material, the publication represents a short but useful description on methods to define the time of ripeness of forest tree seeds, equipment and techniques used for seed collection of tropical forest trees. Techniques for the extraction and cleaning of various types of fruits and seeds and their optimal storage methods known so far are mentioned. Seed quality control based on the ISTA rules is described. Unfortunately most of the photos of seeds were printed rather dark. A table with data on fruits, cleaning, storage, viability, pregerminative treatments

and comments on germination and cultivation of seedlings of more than 30 tropical tree species complements the spanish text.

G. H. MELCHIOR

Merkblatt über fremdländische Baumarten: Prunus serotina Ehrhardt, Spätblühende Traubenkirsche. Herausg.: Landesanstalt für Ökologie, Landschaftsentwicklung und Forstplanung Nordrhein-Westfalen (Oktober 1983).

Nach der früher dargestellten Gliederung wird die in einem Verbreitungsgebiet im Osten von Kanada und USA bis Mexiko und Guatemala vorkommende, in ihren Bodenansprüchen eher besonders bescheidene Art, dargestellt. Ihre Besonderheit liegt auch in der bereitwilligen und problemlosen Verjüngung und leichten Vegetativvermehrung aus Stockausschlag in allen Altersstadien.

Hohes Schattenertragnis, rasches Jugendwachstum als Pionierart, geringe Wasserreiserbildung, Reinbestände mit 380 m³ im Alter