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Variabibility of Glutamate-Oxalate-Transaminase (GOT—2.6.1.1) isoenzymes in open- pollinated progeny of homozygous Scots pine (*Pinus sylvestris* L.) trees

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Abstract

The progeny of the two homozygotic Scots pine (*Pinus sylvestris* L.) plus-trees was investigated as regards the GOT enzyme system to check the influence of 18 trees growing in the nearest neighbourhood. The experiment proves cross-fertilization only in almost 40 per cent.

INTRODUCTION

Sexual reproduction in natural populations of Scots pine occurs generally by way of wind-pollination and cross-fertilization is highly preferred (Koski, 1973). However, different methods of evaluation and measurement have established that the share of own pollen is several to several tens per cent (Ehrenberg and Simak, 1956; Sarvas, 1967; Koski, 1970; Müller, 1977a), and parthenocarpy is also known (Plym Forshell, 1953), but well developed seeds with viable embryos come only from cross-fertilization (Plym Forshell, 1974; Nilsson, 1964; Barnes, 1964; Przybylski et al., 1976; Koski, 1973).

Among the 22 Scots pine plus-trees studied previously (Krzakowa et al., 1977) in respect to variability of four enzyme systems (acid phosphatase, glutamate-oxaloacetate transaminase, alcohol dehydrogenase, leucine amino peptidase), two trees were found to be homozygous in all 12 loci investigated. Under the assumption that the heterozygotic progeny of these trees if existent, should be the result (and indicator) of cross-fertility, these two homozygous plus-trees were selected for the study.

MATERIAL AND METHODS

The examined plus-trees are marked by foresters as nos 329 and 773. They stand about 600 m apart. Among trees growing in the nearest neighbourhood of each plus-tree, 9 trees were marked (Fig. 1). These trees grow at different distances from 3 to 12 metres from the plus-trees studied.

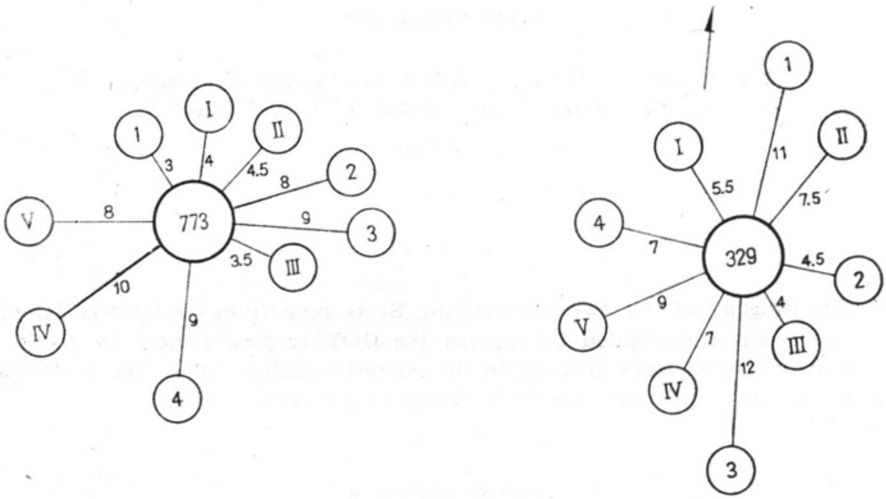

Fig. 1. Distribution of the examined plus-trees nos. 329 and 773 and trees (distances indicated in metres) encircling each of them

Starch gel electrophoresis and staining procedure were the same as described in the previous paper (Krzakowa et al., 1977). Genotypes were determined for GOT (glutamate-oxalate-transaminase) isozymes, both in the endosperm and in embryos. The GOT enzyme system was applied for examination of control-pollinated progeny and described by Rudin (1975). He proved also that in the heterozygotic B zone of the diploid needle tissue (in our investigations alleles *H* and *h* — Krzakowa et al., 1977), there appears a hybrid band. Therefore, all embryos with three-band phenotypes have been classified as the result of cross-pollination (Fig. 2).

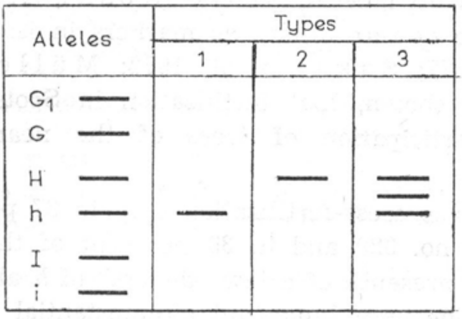

Fig. 2. Types of genotypes: homozygote *hh* (type 1), homozygote *HH* (type 2) and heterozygous embryos (type 3)

RESULTS AND DISCUSSION

In respect to the GOT enzyme system, the genotypes of homozygotic plus-trees were as follows: no. 329 = *GG hh II* and no. 773 = *BB hh ii*. After examination of the genotypes of trees growing in the nearest neighbourhood, it appeared that no two trees had the same genotype under all loci of GOT. Around each of the 2 trees under investigation, there grew trees having the same locus *h* in the homozygotic stage, namely around the tree no. 329 were nos. 329_3, 329_I and 329_{II} and around the tree no. 773 were nos. 773_{III} and 773_{IV}.

The tree no. 329, besides the three homozygotic trees mentioned above, has three homozygotes *HH* (329_4, 329_{IV}, 329_V) and three heterozygotes *Hh* (329_1, 329_2, 329_{III}). In the case of plus-tree no. 773, the situation is very similar. There are 4 homozygotes *HH*, i.e. trees 773_2, 773_4, 773_I and 773_{II} and 3 heterozygotes *Hh* (773_1, 773_3 and 773_V). As seen, 6 trees "help" to keep the homozygotic state *hh* in the progeny of the plus-tree no. 329 and 5 trees in the progeny of no. 773, so, it is only natural that their frequencies in both examined instances are almost the same (Table 1).

Table I

Number and proportions of the examined embryos

Plus-tree	Number of examined embryos	Embryos		Proportions	
		hh	*Hh*	*hh*	*Hh*
329	187	118	69	63.10%	36.89%
773	244	149	95	61.06%	38.93%

Investigations with labelled pollens (Koski, 1970; Moore, 1976) as well as the use of rare alleles as markers in isozyme investigations (Rudin et al., 1977; Sakai et al., 1972; Müller, 1976, 1977a and 1977b) have been shown, that fertilization in Scots pine is due first of all to the participation of trees of the nearest neighbourhood (Strand, 1957).

This work proves cross-fertilization only in 37 per cent of the progeny of plus-tree no. 329 and in 39 per cent of the progeny of plus-tree no. 773. The presence of a few "donors" of *h* alleles in the nearest vicinity seems to be very important circumstantial evidence that these 60 per cent homozygotic embryos of genotype *hh* are not, at least in part, derived from self-fertilization.

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Zmienność aminostransferazy asparaginowej (GOT — 2.6.1.1) w potomstwie homozygotycznych drzew sosny zwyczajnej powstałym w wyniku swobodnego zapylenia

Streszczenie

Wokół dwóch homozygotycznych drzew doborowych sosny zwyczajnej (*Pinus sylvestris* L.) wytypowano po 9 drzew najbliżej stojących i oznaczono ich genotypy pod względem GOT. Okazało się, że około 40% zarodków dostarcza pełnych dowodów zapylenia obcym pyłkiem. Reszta potomstwa powstała prawdopodobnie także w wyniku obcopylności, ponieważ wokół drzew doborowych znajdują się drzewa o takim samym jak one genotypie *hh*.