North-east Scotland at as least as great a degree as was reported from Sweden. Although minimum winter temperatures were mainly above the reported threshold of —2.5° C, warm winter periods did not appear to stimulate the progress of meiosis as has been reported in Sweden. It should be noted that the winter of 1973—74 was considerably milder than normal. The fact that meiosis in parent clones at Newton and their progenies at Teindland was comparable indicates that genetic control and photoperiodic control of meiosis is stronger than any temperature effects experienced in North-east Scotland.

A relatively high proportion of ovules were pollinated with viable pollen and the viability of pollen had a very small effect on the potential yield of seed in controlled crosses.

The low yield of seed in hybrid larch seed orchards was not attributable to temperature conditions during microsporogenesis and work is continuing on the post-pollination stages to determine the causes of empty seed.

Key words: Meiosis, Winter temperatures, Larix decidua MILL., Larix kaempferi (LAMB.) CARR.

Zusammenfassung

Zur Erzielung möglichst hoher Samenerträge in sog. Samenplantagen wird den klimatischen Bedingungen des Standortes großes Gewicht beigemessen. In der vorliegenden Arbeit wurde zu diesem Problem untersucht, inwieweit die inneren Vorgänge bei der Ausbildung männlicher und weiblicher Blüten von ***Larix decidua*** und ***Larix kaempferi*** auf Temperaturänderungen reagieren bzw. ihren Rhythmus ändern. An Hand von wöchentlich entnommenen Blütenknospen von Lärchenklonen unterschiedlicher Herkunft und deren Nachkommenschaften, in der Zeit von Ende Oktober — Anfang November 1973 bis zum 27. März 1974, konnte festgestellt werden, daß der Ablauf der Meiose etwa Anfang November beginnt und bis in das zeitige Frühjahr hineinreicht, wobei Hybridnachkommen bezüglich der einzelnen Phasen intermediär zu den Elternarten zeitliche Verschiebungen aufweisen. Auf den Versuchsstandorten in Schottland konnte nicht nachgewiesen werden, daß die Vorgänge bei der Blütenbildung wesentlich durch die Temperatur beeinflußt werden, so daß auch niedrige Samenerträge dort nicht auf Temperaturstörungen zurückzuführen sind.

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Spontaneous chlorophyll mutations in Bombax L.

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Introduction

Spontaneous chlorophyll mutations have been reported in several temperate tree species (MCKAY, 1956; FRANKLIN, 1970) but so far in few tropical ones (POSNETTE, 1950; VENKATESH a. SHARMA, 1974). The prasent note records the occurrence of such mutations in ***Bombax ceiba*** L. (***n*** = 36, 46, 48) and ***B. insignis*** SCHOTT et ENDL. (n = 36), two tropical broadleaved forest tree species which constitute India's principal industrial matchwood resource and hence are included in a genetic improvement programme at this Institute (VENKATESH, 1974). As per the standard procedure adopted in such forest tree improvement work, phenotypically superior plus trees (so far of only ***B. ceiba)*** have been selected and assembled as grafts in clonal banks and seed orchards (VENKATESH a. ARYA, 1973).

Material

The present study is based on progenies raised from time to time at the Institute's forest genetics nursery and mostly from open pollinated seeds of individual tree or clone origin.

Observations

Initially when one-parent progenies were raised out of some ***B. ceiba*** trees chosen at random on the New Forest estate, some seedlings with yellow-green mottled cotyledons had been noticed in certain of the families. Iodine test

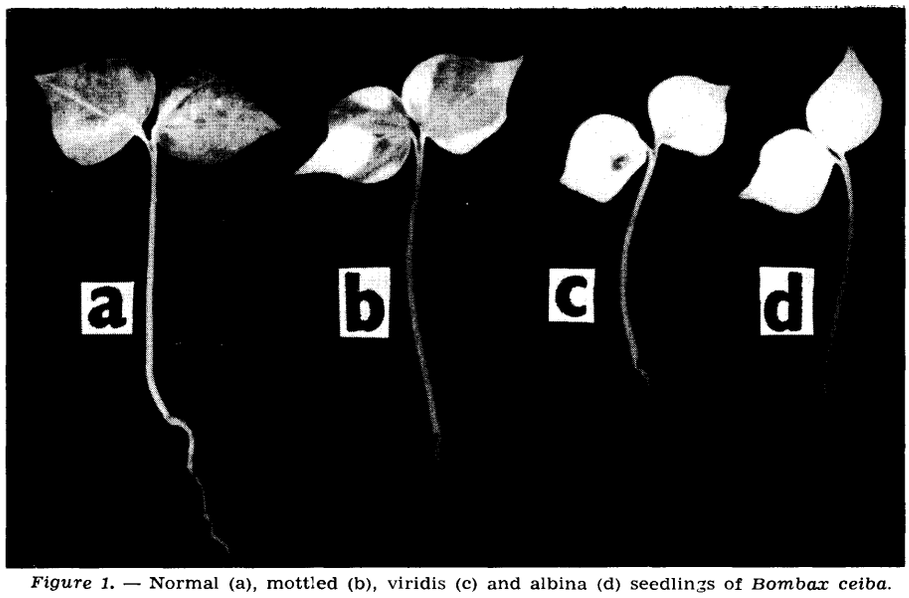

Figure 1. — Normal (a), mottled (b), viridis (c) and albina (d) seedlings of *Bombax ceiba*.

revealed the presence of starch only in the green, and not the yellow regions of such mottled cotyledons. Seedlings possessing such cotyledons were seen to grow up into normal plants. Again when nursery stock was raised out of *B. insignis* seed sample from Maharashtra state, two albino seedlings totally lacking in chlorophyll were recovered and these did not survive beyond the cotyledon stage.

Much later when half-sib progenies of selected plus trees of *B. ceiba* were raised from open pollinated seed of clone bank and seed orchard origin (15 clones, A-O, Uttar Pradesh), the following three kinds of chlorophyll deficient seedlings were recovered which are illustrated in *Fig. 1.*

Mottled: The stem is green but the cotyledons have irregular yellow patches along the margin and tip; the size and number of patches depending upon the degree of mottling. These seedlings survive and develop normal fully green leaves.

Viridis: The stem is greenish but the cotyledons are yellow except for a patch of green in the middle. The seedlings survive for some time and then die away.

Albina: These seedlings are totally lacking in chlorophyll both in the cotyledons and the stem, which on that account are white in colour. They die within 15—20 days of seed germination.

In *Table 1,* are enumerated such of the plus tree clones whose progenies contained one or more of the three aforementioned kinds of mutant seedlings. The percentage frequencies of the latter are also given.

Table 1. — The kind and percentage of mutant seedlings recovered in open-pollinated progenies of different plus tree clones.

Clone		Mottled	Viridis	Albina
A	—	2.67	0.67	...
B	—	1.78	0.67	2.00
C	—	0.67	...	...
D	—	2.40	...	...
F	—	2.00	...	...
G	—	2.00	...	0.80
I	—	2.67	0.67	...
J	—	0.67	...	...
L	—	...	...	0.67
M	—	2.67	...	...

It can be noted from *Table 1,* that six plus tree clones carry the gene for only one kind of putative chlorophyll mutation, three for two and only one (Clone B) for all the three mutations which latter therefore appear to be independently controlled by different mutant genes. Since all the clones listed are apparently heterozygous for at least one kind of mutant chlorophyll trait, the observed recovery of such variant seedlings in open-pollinated progenies can be explained as due partly to natural crossing *inter se* of clones heterozygous for the same mutation and partly to natural selfing of such clones.

Discussion

It is significant that some of the chlorophyll deficient seedling types reported here are very similar to those recorded in cultivated Cotton (Butany a. Singh, 1965) which belongs to the closely allied family *Malvaceae.*

Spontaneous chlorophyll mutations are among the few characters known in forest trees, which may be inherited in a simple Mendelian fashion. Whether this is also true of *Bombax* in the present instance, remains to be tested by future controlled breeding experiments. Once the exact nature of genetic control has thus been established, it will then be possible to estimate, using the frequency of chlorophyll deficient seedlings as genetic markers, the exact degree of natural outcrossing and inbreeding that occurs in *Bombax* seed orchard layouts as has been done by Squillace and Kraus (1963) in the case of Slash pine.

Acknowledgement

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Summary

Three kinds of chlorophyll mutant seedlings — mottled, viridis and albina — have been reported in open pollinated progenies of orchard and clone bank origin. Of these the first which is nonlethal is of the most frequent occurrence. The potential value of such chlorophyll deficient seedlings as early genetic markers in estimating the extent of natural selfing/outcrossing in seed orchard layouts, is indicated.

Key words: Bombax ceiba, Bombax insignis, Chlorophyll mutant seedlings, Seed Orchards.

Zusammenfassung

In Nachkommenschaften frei abgeblühter Pfropflinge von *Bombax ceiba* und *Bombax insignis* in Samenplantagen wurden sowohl gelb-grün gefleckte als auch total gelbe Chlorophyllmutanten festgestellt, was als Inzuchteffekt erklärt wird. Es überlebten nur Sämlinge mit hinreichender Chlorophyllausstattung.

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* Not seen in the original.

Supernumerary Chromosomes and Growth Rate in *Picea sitchensis* (Bong.) Carr.

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Introduction

Picea sitchensis shows a widespread polymorphism for supernumerary (B-) chromosomes throughout the southern half of its natural range (MOIR and FOX, 1972; MOIR and FOX, submitted to Silvae Genetica, 1976). In view of the importance of *Picea sitchensis* as a timber crop (FLETCHER and FAULKNER, 1972) and the frequent reports of B-chromosomes having detrimental effects on growth and fertility in some plant species (see JONES, 1975, for review) it is important to assess the effects of B-chromosomes on the economically-important characters of this species.

In this paper we have attempted to evaluate the effects that B-chromosomes have had on growth rate in three experimental plots of 14 year-old trees. In 1961 the Forestry Commission set up provenance trials near New Deer, Aberdeenshire. Each plot consisted of 195 trees and the provenances tested ranged from North Bend, Oregon (43° N) to Cordova, Alaska (60° 30′ N.). Plots 25, 12 and 7 were derived from Sooke, Vancouver Island, close to a seed origin (66) used in a previous paper (MOIR and FOX, submitted to Silvae Genetica, 1976) which had a particularly high B-chromosome frequency of 1.52/plant. These plots thus constitute an excellent opportunity to assess the effects of various numbers of B-chromosomes on growth rate in *Picea sitchensis*.

Materials and Methods

(i) *Determination of B-chromosome status.* B-chromosome status was determined from chromocentre counts in interphase nuclei of the shoot basal meristem. In each block the outer two rows were not sampled, thus leaving 99/plot. One bud was sampled at random from each tree. Four trees from plot 25, which on casual observation appeared to contain 0, 1, 2 and 3 B-chromosomes respectively, were sampled in detail. Either the terminal bud or a lateral bud situated next to the terminal one was sampled from each branch of each whorl. In this way buds were sampled throughout these trees. Buds were collected in April and May, either just prior to flushing or at the time of flushing. Buds were fixed overnight in 6 parts alcohol : 3 parts chloroform : 1 part acetic acid prior to squashing in 2% lactopropionic orcein (MOIR and FOX, 1972). Chromocentre counts (100 cells/bud) were made only for the four trees sampled extensively.

ii) *Determination of growth rate.* Two characters were recorded for each tree, number of whorls and tree height. Height was measured by placing a pole, marked at 30 cm intervals by different colours, as near as possible to and parallel with the tree trunk and reading to the nearest 15 cms.

Results

i) *Chromocentre frequency in presumptive 0, 1, 2 and 3 trees. Table 1* summarises the chromocentre frequencies observed in these four trees. No major differences were found in different parts of the same tree.

ii) *B-Chromosome distribution between plots. Table 2* records the numbers of trees with different B-chromosome constitutions found in each plot. A j × j contingency χ^2 shows no significant differences between the plots ($\chi^2_{(6)} = 4.2918$, $P = 0.7 — 0.5$).

iii) *Growth rates in the three plots.* Data on whorl number and height are given for each B-chromosome class of each plot in *Table 3.* Analyses of variance for each parameter are given in *Tables 4* and *5.*

Discussion

i) *The validity of the method for estimating B-status.*

MOIR and FOX (1972) showed that in the primary root meristem there is a close relationship between number of

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