ported from Queensland, Australia. Severe damage was found only on clones 21, 55 and 65. Thirteen species of pine were checked for scale attack. C. rubens was found on six species; considerable damage was present only on P. caribaea.

C. rubens attacked the upper crown of P. caribaea more frequently than the middle crown. The lower crown portions were least heavily attacked. No correlation was found between height of trees and attack density.

Heavily infested trees were characterized by sparse crowns, considerable darkening of foliage by a dense covering of sooty-molds, and reduced height increment.

Key words: Ceroplastes rubens, Pinus caribaea, Clonal Resistance, Damage, Sooty-mold, Papua New Guinea.

Zusammenfassung


Literature Cited


Effect of Seed Extracts on Radiosensitivity

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Introduction

It is known that soaking seeds in water immediately before treatment with ionizing radiations and chemical mutagens greatly increases the sensitivity of seeds to mutagenic treatment. The increased sensitivity of pre-soaked seeds was attributed to leaching out of radioprotective substances, Kamra et al. 1960 a, b. The absence of oxygen has been reported to cause chromosomal aberrations in Vicia faba (Merz, 1959) but an aerobiosis is not effective in barley (Rieger and Michaelis, 1958). On the other hand, D’Amato and Hoffmann-Ostenhof (1956) have postulated the production of automutagens inside the seeds after soaking in water which increases the frequency of spontaneous chromosomal aberrations (Michaelis and Rieger, 1958) as well as spontaneous mutations.

Preliminary experiments have demonstrated the radiosensitivity of the 48 hours pre-soaked Douglas-fir seeds in maximum (El-Lakany and Sziklai, 1969). The present experiments were undertaken to investigate whether the extracts from soaked Douglas-fir and lodgepole pine seeds contain active substance(s) which would modify sensitivity to gamma-irradiation when it is used as a medium of pre-soaking other seed samples of the same species, or the radiosensitivity is affected by in situ systems.

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Materials and Methods

Seeds of Douglas-fir (Pseudotsuga menziesii (Merr.) Franco) collected near Duncan, B.C. in 1968 and those of lodgepole pine (Pinus contorta Douglas) collected near Shuswap Lake, B.C. (Canada) in 1971 were cleaned, equilibrated for moisture content of 8 per cent, and stored at 0–4°C at George Allen’s Tree Seed Laboratory, U.B.C., Vancouver. Seed samples were given the following treatments:

(A) Dry seeds were exposed to different doses of γ-radiation, soaked in tap water for 48 hrs. then germinated.

(B) Seeds were pre-soaked in tap water for 48 hrs., irradiated, then germinated.

(C) Seeds were pre-soaked in seed extracts for 48 hrs., irradiated then germinated. The seed extract was prepared from seeds of the same species that had been soaked for 48 hrs. in water, crushed in a mortar and a paste was made by adding 50 ml of water per 100 seeds. The paste was filtered through muslin cloth then used to soak the seeds immediately.

(D) Seeds were soaked in pre-irradiated extracts prepared by the same method mentioned above, then germinated without further irradiation.

At the end of the pre-soaking period, the seeds were washed thoroughly in running water for 2–3 min. The following doses of γ-radiation were given to the seeds of Douglas-fir and lodgepole pine respectively: 0 (Control), 1, 5 and 10 kR and 0, 1, 5 and 15 kR at 140 R/sec. A220

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Gamma — cell that contained 60Co was used as a source of radiation. Every treatment was replicated 5 times. Each replication contained 50 seeds and were placed on the Jacobsen germinating table at the same time.

The germinator was set to provide 12 hrs. of light and 12 hrs. of dark periods per day for the 28 days test period. The temperatures were 25° C during the light and 15° C during the dark periods for Douglas-fir. Corresponding temperatures were 24° C and 15° C for lodgepole pine. Germinants were counted every two days and germination percentages were calculated and analyzed statistically. Germination as a percent of control was also calculated in order to estimate LD 50’s (Dose of radiation that reduces germination by 50% of the control). Douglas-fir germinants representing each treatment were grown in a “Percival” growth chamber in order to follow seedling growth and to score the somatic mutations if they appear.

Results and Discussion

The results of the germination are presented in Table 1, and further these average germination values are expressed as percent of the controls in Figures 1 and 2 for Douglas-fir and lodgepole pine respectively. Douglas-fir dry seeds gave a typical response to increasing doses of \( \gamma \)-radiation and their LD\(_{50} \) value was about 5600 R which is close to the LD\(_{50} \) value of 525 R previously reported by El-Lakany and Sheikl (1969) for the same species. Soaking the seeds in water before irradiation increased their radiosensitivity sharply with an LD\(_{50} \) value of 900 R. Gustafsson and Simak (1958) reported that seed stored in moist air were more radioresistant than seed stored in dry air. However, Sharma (1970) found that water pre-soaked barley seeds produced a higher mutation rate than dry ones.

Table 1. — Average germination percentages of Douglas-fir and lodgepole pine seeds at the end of 28 days germination period

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dose of irradiation (kR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>A</td>
<td>68.21</td>
</tr>
<tr>
<td>B</td>
<td>70.63</td>
</tr>
<tr>
<td>C</td>
<td>71.32</td>
</tr>
<tr>
<td>D</td>
<td>69.18</td>
</tr>
</tbody>
</table>

Soaking the seed in extracts before irradiation had a variable effect on germination (Fig. 1) depending on the dose. At 1000 R there was a marked increase in germination but above that level radiation. This data also reveals that pre-soaking in water resulted in less radiosensitization than pre-soaking in seed extracts, which is the case in the present study. Soaking Douglas-fir seed in irradiated extracts slightly reduced germination and the dose had no effect, however.

The results of lodgepole pine seed germination are shown in Fig. 2. The trend of response was similar to that of Douglas-fir except that lodgepole pine was more radioresistant than Douglas-fir. The LD\(_{50} \) for dry seed, water-soaked seed and extract-soaked seed were 11,500, 4,500 and 4,000 R respectively. To the best of our knowledge these values are the first reported LD\(_{50} \) for lodgepole pine (Dugle and El-Lakany, 1971). In lodgepole pine, unlike Douglas-fir, soaking the seed in irradiated extract stimulated the germination slightly irrespective of the dose. Sharma (1970), proposed that the metabolic activity initiated by soaking seeds gives rise to certain sensitizing substances. It could be added that the progressive decrease in the germination of extract-pre-soaked seed with increasing dose of \( \gamma \)-radiation provides an indication that the phenomenon of sensitization has several components, and the metabolic products of seed extract act on some processes.
which are affected less by water or not affect at all. The sensitization also appears to be related to the soil system as it had little or no effect when the extracts were irradiated outside the seed.

**Summary and Conclusions**

The effects of seed extracts on radiosensitivity were studied in Douglas-fir and lodgepole pine and compared with water-soaked and dry seed irradiation.

At a lower dose of radiation (1,000 R), soaking the seed in extract before irradiation stimulated the germination relative to the control.

Seed extracts appeared to have a radiosensitizing effect at higher doses of radiation in both species. This effect appears to be related to the soil processes as it was minimal when the seeds were soaked in irradiated extracts.

Experiments will be conducted to investigate whether these effects are related to systems in the embryo or in the endosperm.

**Key words:** Radiosensitivity, Seeds, *Pseudotsuga menziesii* (Mirb.) Franco, *Picea contorta* Dougl. ex Loud.

**Zusammenfassung**


Es zeigte sich in einigen Fällen, daß eine niedrige Dosis an radioaktiver Bestrahlung das Keimpotenz entsprechend vermindern kann, während höhere Dosen im allgemeinen eine deutliche Herabsetzung der Keimzahl bewirken.

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Störende Umweltinflüsse auf das teilungsfähige Geweb, wie sie bei Verwendung des haploiden Endosperms unvermeidlich sind, lassen sich bei der Samenkeimung unter gleichbleibenden kontrollierten Laborbedingungen weitgehend ausschließen. Außerdem ist bei der Verwendung des Merismas der Keimwurzel die Durchsicht eines umfangreichen Materials möglich, als bei der Einsammlung von

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