TABLE 1

Effects of surface sterilants, their concentrations, and duration of treatment on isolation of *Geniculodendron pyriforme* and incidence of contaminants on Sitka spruce seeds

Parameters measured and treatment times	Surface sterilants and their concentrations[a]					
	H_2O_2 30%	H_2O_2 6%	H_2O_2 1.2%	NaOCl 5%	NaOCl 1%	NaOCl 0.2%
G. pyriforme, %						
60 min	13.9 abc	11.6 abcd	17.9 a	8.4 cd	10.0 bcd	10.4 bcd
30 min	17.2 a	12.0 ab	10.8 bcd	12.1 bcd	7.6 d	11.2 cd
5 min	10.3 bcd	9.5 bcd	9.3 bcd	11.1 bcd	11.6 bcd	9.6 bcd
Other filamentous fungi, %						
60 min	5.1 a	9.2 b	36.9 de	10.8 b	9.3 b	10.4 b
30 min	68.8 f	85.9 g	88.6 gh	24.0 c	20.0 c	27.6 cd
5 min	89.2 gh	90.5 g	90.0 gh	68.4 f	43.1 e	34.3 de
Bacteria and yeasts, %						
60 min	0 a	0.1 a	0.5 a	0.1 a	0.4 a	0.3 a
30 min	1.3 a	0.5 a	0.5 a	0.4 a	1.1 a	0.3 a
5 min	0.5 a	0 a	1.2 a	1.1 a	5.1 b	9.9 c

[a] Values are for the triple interaction of treatment (surface sterilant), concentration, and treatment duration (min); valid comparisons can be made only within each of the three parameters where all means followed by a letter in common are not significantly (P = 0.5) different. Values are cumulative data for the 15-day incubation period.

time increased (Table 1). The best treatments for *G. pyriforme* isolation were 30 and 1.2% H_2O_2 for 30 and 60 min respectively, i.e. the long exposure–lower concentration treatment was as good as the high concentration–short exposure treatment. Seeds treated with 30% H_2O_2 for 1 h had the fewest filamentous fungus contaminants, while the next best treatments were 6% H_2O_2 and 5, 1, or 0.2% NaOCl, all for 1 h. In general, lengthening the exposure period was more beneficial than increasing the concentration of the surface sterilant for reducing numbers of filamentous fungus contaminants. The numbers of bacterial and yeast contaminants were unaffected by any of the H_2O_2 treatments, but the numbers of these contaminants decreased as NaOCl concentration increased at the 5-min exposure period.

This study has shown that surface sterilization with 30% H_2O_2 for 1 h is the best overall treatment for isolating *G. pyriforme* from diseased seeds and for reducing filamentous fungus and bacterial and yeast contamination (Table 1). This procedure yields more *G. pyriforme* and fewer contaminants than does surface sterilization with 1% NaOCl for 5 min (Table 1) as recommended by Salt (1974). Reduction of contamination facilitates detection of the characteristic mycelium of *G. pyriforme* and allows the pathogen, whose growth is frequently inhibited by seed coat microorganisms, to grow from diseased seeds. Strong H_2O_2 reduced Sitka spruce seed germination, but this is of no concern to those interested in determining *G. pyriforme* incidence. Although various concentrations of H_2O_2 have been used to stimulate seed germination or to reduce or eliminate seed coat microflora (e.g. Barnett, Tree Plant. Notes 27:17-19, 24, 1976; Ching and Parker, Forest Sci. 4:128-134, 1958; Riffle and Springfield, Forest Sci. 14:96-101, 1968; and Trappe, Forest Sci. 13:121-130, 1967) or for both, this is the first report of H_2O_2 being used to surface-sterilize seeds for isolating a pathogenic fungus. Recently, we have isolated *G. pyriforme* from stored *P. glauca* (Moench) Voss, *P. engelmannii* Parry, *Abies grandis* (Dougl.) Lindl. and *Pseudotsuga menziesii* (Mirb.) Franco seeds after surface sterilization with 30% H_2O_2 for 1 h. — Jack R. Sutherland, T.A.D. Woods, W. Lock, and Denis A. Gaudet, Pacific Forest Research Centre, Victoria, B.C.

Slugs Feeding on *Cronartium* in British Columbia. — Slugs *(Gasteropoda pulmonata)* are land molluscs that have evolved from snails by reduction or loss of their shells. Common in the humid Pacific Northwest, they are primarily vegetarians, feeding on fungi, fruit, and foliage of herbaceous plants during the night or on overcast days (Kozloff, Plants and Animals of the Pacific Northwest, J.J. Douglas Ltd., Vancouver, 1976).

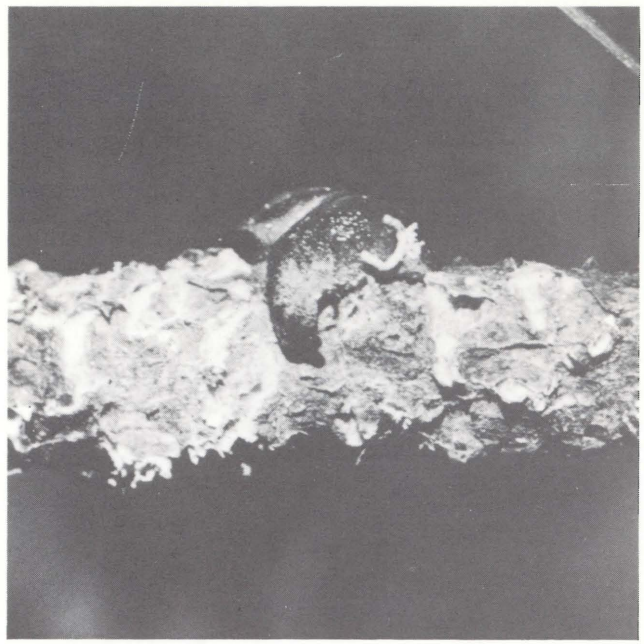

Figure 1. The slug *Prophysaon andersoni* feeding on a *Cronartium comptoniae* canker. Note the tendril of egested aeciospores on the side of the slug.

Early observations in eastern North America noted slugs feeding on *Cronartium ribicola* J.C. Fisch. ex Rab. telia (Gravatt and Marshall, Phytopathology 7:368-373, 1917) and on pycnia and aecia (Snell, Phytopathology 19:269-283, 1929). To date, in western North America, only arthropods and mammals have been associated with coniferous stem rusts (Hiratsuka and Powell, Dep. Environ. Can. For. Serv. For. Tech. Rep. 4, 1976).

During the past 3 years, while pine rust cankers were being observed on Vancouver Island, slugs were occasionally noticed feeding on aeciospores and infected bark tissues. They fed in characteristic patches or trails as they moved across the cankers, removing nearly all aeciospores from individual aecia. Slime trails and tendrils of egested bleached spores were common. Feeding wounds on infected bark were characteristically shallow and bore radula marks.

Slugs collected were identified as *Prophysaon andersoni* (Cooper) on *Endocronartium harknessii* (J. P. Moore) Y. Hirat. and *Cronartium comptoniae* Arth. (Fig.1), *Ariolimax columbianus* (Gould) and, tentatively, as *Hemphillia glanulosa* (Bland and Binney) on *C. ribicola*. (They were identified by D. Rollo, of the Department of Plant Science, University of British Columbia.) Also, *P. andersoni* was observed feeding on the secondary fungus *Tuberculina maxima* Rostr. on a *C. comptoniae* canker, and *T. maxima* on a *C. ribicola* canker had been partially consumed by an unknown slug.

In a lodgepole pine plantation, 10 or more slugs were frequently observed feeding on individual *C. comptoniae* cankers, but only in the early mornings or on wet days. During warm days, slugs were found under the duff or, occasionally, under the exfoliating bark of *E. harknessii* galls.

The spores of some species apparently do not pass through slugs intact, while others are still capable of germination (Wolf and Wolf, Bull. Torrey Bot. Club 66:1-5, 1939). Snell (1929) hinted that fecal aeciospores were nonviable. However, in water droplets on slides and on water agar. I obtained germination of *E. harknessii* and *C. comptoniae* aeciospores egested by *P. andersoni*, and *C. ribicola* aeciospores egested by an unknown slug.

Slugs probably reduce the inoculum potential of rusts, for tendrils of aeciospores are unlikely to be airborne, and their feeding wounds possibly provide infection courts for secondary fungi, which may further limit rust development. — Richard S. Hunt, Pacific Forest Research Centre, Victoria, B. C.