(Reeks, W. A. Can. Jour. Agr. Sci. 33: 405-429. 1953), but this opinion was questioned by Turnbull and Chant (Can. J. Zool. 39: 697-753. 1961) in their account of biological control in Canada. These authors erroneously state that "*D. fuscipennis* is not a parasite of *D. hercyniae* or *D. polytomum* in its native home", and suggested that this reason, rather than low host density, accounts for "the failure of the parasite in Canada." Actually, *D. fuscipennis* was reported as a primary parasite of *D. polytomum* in Europe when *polytomum* and *hercyniae* were synonymous (Morris, R. K. S., E. Cameron, and W. F. Jepson. Bull. Ent. Res. 28: 341-393. 1937), and absence of the parasite from European collections before 1935 was attributed to the solitary habits and comparative scarcity of *D. polytomum*. Recent studies on the European pine sawfly, *N. sertifer*, by L. A. Lyons and K. G. Griffiths (unpublished report), suggest that *D. fuscipennis* may be no more successful on *N. sertifer* in Ontario than it was on *D. hercyniae*. Fall counts of new cocoons of *sertifer* on a study plot near Chatsworth averaged 3.4, 2.6, and 0.6 per sq. ft. in the years 1960, 1961, and 1962, respectively. None of the cocoons were parasitized by *D. fuscipennis* in spite of the fact this species was recovered from cocoons placed artificially on the forest floor in 1960 and 1961. Whether density is a requisite for the successful establishment of *D. fuscipennis* has been neither satisfactorily proved nor disproved, but there is growing evidence that accessibility of host cocoons is important to the success of this parasite.

Although Turnbull and Chant (*op. cit.*) caution against introducing many species of organisms to control a single pest species, the danger of multiple introductions is not confirmed by field studies on *D. hercyniae* in eastern Canada. Admittedly, some of the parasite introductions against *hercyniae* cannot be justified, but Bird and Burke (*op. cit.*) showed very clearly that control of *D. hercyniae* was more effective in New Brunswick by virus and introduced parasites combined than in Ontario by virus alone. The advantages and disadvantages of the single species over the multiple species concept in biological control is an intriguing subject that warrants much more study.—W. A. Reeks.

Excessive Red Oak Mortality Following Ice-storm Damage.—During the summer of 1963, heavy mortality and severe deterioration were observed in a 250-acre, two-storied, mixed hardwood stand about 25 miles north of Toronto. Red oak, black cherry, and white ash were the species most seriously affected. The site has a southeasterly aspect and the exposure is open. It is situated on rolling sand dunes covered by a layer of humus 2-8 inches thick. The site is rated very good for red oak and growth has been rapid. Stocking density based on stems per acre and including all species is high. The stand originated from a fire about 80 years ago, and today the oaks average 14.0 inches d.b.h. and 90 feet in height. Oak is estimated to comprise 65% of the basal area of the stand. Light selective thinning has been carried out during recent years.

In a one-acre sample representative of oaks in the area, mortality was 42%. The remaining oaks were stag-headed or showed serious dieback symptoms. The most seriously diseased trees were characterized by browning and dying of all leaves and by numerous adventitious shoots particularly on the lower parts of their stems. The adventitious shoots also showed foliar symptoms and dieback. Stem cores from representative specimens of severely diseased trees showed that a sharply reduced increment (approximately 50%) had occurred between the 1959 and the 1960 growing seasons and that this decline had continued so that very little growth was made in 1963. Similar, but less pronounced reductions were observed in cores taken from trees representative of healthier oaks in the stand.

Examination of the roots and stems of dying and recently dead trees revealed signs of the shoestring root rot fungus, *Armillaria mellea* (Vahl ex Fr.) Kummer. These consisted of mycelial fans and rhizomorphs which occurred consistently in the cambial region of the roots of all trees examined and the mushroom-type fruiting structures which were generally present at the base of the most decadent trees throughout the area. Two ascomycetous fungi consistently associated with the dieback condition in the crowns were *Pseudovalsa longipes* (Tul.) Sacc. and *Diatrypella quercina* (Pers. ex Fr.) Nits. *P. longipes* is usually considered a weak parasite capable of causing cankers and dieback in weakened oak; *D. quercina* is a saprophyte.

In 1959, this stand was in a healthy condition. However, during the winter of 1959-60 an unusual series of three ice storms occurred in rapid succession throughout the south-central region of southern Ontario. The resulting heavy accumulation of ice caused widespread and severe breakage of large branches in the crowns of dominant and co-dominant hardwoods. Besides providing infection courts for fungi such as *P. longipes* and *D. quercina* this damage caused an abnormally small crop of new leaves to be formed in the spring of 1960. Undoubtedly, this reduced the vigour of the oaks and other dominant species by curtailing photosynthesis, food production, and wood formation and so predisposed them to infection by *A. mellea*. This predisposition was aggravated by overstocking combined with the root-grafting habit of oak which is conducive to the spread of this root-transmissible pathogen.

When the natural thinning process now in progress has been completed, it can be expected that the residual trees will regain vigour and benefit from the reduced competition.—B. W. Dance and D. F. Lynn.

BRITISH COLUMBIA

The European Pine Shoot Moth in British Columbia.—The European pine shoot moth, *Rhyacionia buoliana* (Schiff.), was first observed in British Columbia at Victoria in 1927. Its discovery in Vancouver in 1938 resulted in an eradication program in 1939. During the past 20 years it has been collected only in occasional samples from the Vancouver and Victoria areas.

The moth was first found in the Interior of British Columbia on two ornamental pine trees at Kelowna in 1961, and again in 1962. By this time the insect had been detected in Washington and Oregon, and entomologists were particularly concerned about its presence in Spokane. If the moth became established there is might accept ponderosa pine as a host, possibly becoming a problem in the important pine stands of the Inland Empire. An eradication program was initiated, and all known infested pines in the Spokane area were destroyed.

In 1963, a comprehensive survey was carried out in the southern part of British Columbia. More than 11,000 pine trees were examined during May and June. Over 5,100 of these were from major population centres in the Okanagan Valley, 200 were in the Trail and Creston areas, and the remainder in Vancouver and Victoria. All infested pine shoots were collected and caged for rearing.

A number of shoot-boring insects were recorded from the reared material, but the European pine shoot moth was identified only in 16 collections from the coastal region; eight from greater Vancouver and eight from greater Victoria. Six of these collections were from nurseries and ten from trees in private and public gardens. The number of records indicates that the species is established in the two major urban centers although the intensity of attack is quite light.

In the Interior, no insects were present on trees examined at Trail and Creston, but shoot moth adults were reared from collections made at Kelowna, Westbank, Summerland, and Penticton. One mugho pine in a retail outlet at Vernon was also infested, and another pine in Polson Park contained evidence of an old attack, but no adults were obtained for positive identification. All but three of the records from the Okanagan Valley were from nurseries.

The most significant record was an European pine shoot moth female reared from a mature ponderosa pine collection from the Summerland Experimental Station. The female mated with a male from mugho pine and laid eggs on a caged ponderosa pine at Vernon. At least three larvae hatched and mined into shoots. The female was identified by T. N. Freeman, Entomology Research Institute, Ottawa, as *R. buoliana*.

The presence of the European pine shoot moth in the Okanagan Valley represents a potential danger for several reasons. Although no extensive infestations were found either on native or ornamental host species, there is evidence that the insect is capable of overwintering in the Interior climate.

Although only a single record of the shoot moth on ponderosa pine was obtained, it does show that the insect will accept ponderosa pine as a host in its native habitat.

There is a possibility that the shoot moth could be more prevalent than the survey indicated. The time during which the major portion of the survey was conducted, April and May, is now regarded as too early in the season to detect all infested shoots. This was indicated when a re-examination of a nursery on May 27 and 28, over a month after the initial survey during which four infested trees were found, resulted in the detection of a dozen more infested trees. In addition less than 300 ponderosa pine were examined as the survey was concentrated on the preferred ornamental hosts.

The use of pines for landscaping is becoming more widespread, thus increasing the risk of introducing more shoot moth into the region. In some localities the number of trees in nurseries is greater than the number already planted out. In Kelowna, where the survey was conducted on a systematic street by street basis, less than 400 ornamental pines were found. Nurseries in the Kelowna-Westbank area had over 2,700 ornamental pines in stock.

It is possible that the European pine shoot moth might not develop into an economic problem in the Interior. Further surveys and studies will be required to determine the population trend, but it could be several years before

the significance of this pest in British Columbia has been adequately assessed. In the meantime officials of the Plant Protection Division, the Department of Forestry, the British Columbia Forest Service, and the Provincial Entomologist are studying the situation to determine if preventive measures should be taken to reduce the likelihood of establishment of this pest.—G. T. Silver and D. A. Ross.

Use of Organic Residues in Forest Nurseries.—Residues such as sawdust, cereal straw, mushroom manure, and hay have been added as soil amendments and as mulches to reduce frost heaving in British Columbia nurseries. Several instances have been noted recently which suggest that the indiscriminate addition of organic residues to seedling beds is potentially a dangerous practice.

In Douglas-fir beds at the Duncan nursery, a prolific crop of a mushroom, *Hebeloma sordidulum* (Peck) Sacc., occurred in the autumns of 1961 and 1962 following the application of mushroom manure. Other species of this genus have been reported as mycorrhiza formers in conifer seedlings (Trappe, Bot. Rev. 28: 538-606, 1962) but the possibility of parasitic invasion of roots should not be dismissed. At the Chilliwack nursery, an unidentified mushroom grew prolifically following the use of hardwood sawdust as a mulch. In Douglas-fir and white spruce beds at the Cranbrook nursery, extensive patches of dead seedlings were observed after alfalfa hay was applied. There were no such patches in beds to which the mulch was not added. A high count of *Rhizoctonia* colonies was recorded in agar plates in which samples of the hay and of the dead seedlings were plated. This fungus is often found associated with damping-off disease. It seems probable that in all three cases the fungus population was either introduced or increased by the organic residue. In addition, it is possible that toxic decomposition products of the hay predisposed the seedlings to attack by the fungus (Patrick and Koch, Can. J. Bot. 36, 621-647, 1958).

Of the types of mulches currently in use at the nurseries, fresh sawdust from sound conifer logs seems to be preferable to the others. For example, hemlock sawdust yielded less than one-half the number of fungus colonies that wheat straw did when plated on malt agar using sterilized sand dilution. *Trichoderma* predominated in the sawdust plates; this fungus is believed to restrict the growth of pathogenic fungi (Wood and Tveit, Bot. Rev. 21: 441-492, 1955). *Alternaria* was the main fungus in the wheat straw; it is often found in damped-off seedlings (Hartley and Merrill, J. Agr. Res. 15: 521-558, 1958; Vaartaja and Cram. Phytopath. 46: 391-397, 1956; Peace, Clarendon Press, Oxford. 1962) and may be pathogenic under some conditions. In view of the experience so far with organic residues as mulches, it is proposed to carry out routine assays of the microbial content of materials intended as additives in the nurseries.—W. J. Bloomberg.

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ROGER DUHAMEL, F.R.S.C., Queen's Printer and Controller of Stationery, Ottawa, 1964