

host larvae originating from eight locations in Manitoba and Saskatchewan were experimentally parasitized. No evidence of encapsulation was found in 60% of these groups and parasitism of 594 larvae in which eggs were deposited was again approximately 90% successful. In controls parasitized by Canadian *M. tenthredinis* the successful parasitism was 25%.

Studies on Bavarian-Canadian and Austrian-Canadian crosses of *M. tenthredinis* showed a high degree of successful parasitism when the female parent was European (61 of 76 parasitized hosts in 1961 and 29 of 31 parasitized hosts in 1962) and a lower degree of successful parasitism when the female parent was Canadian (13 of 34 parasitized hosts in 1961 and 7 of 13 parasitized hosts in 1962). However, some evidence was obtained that the characteristic conferring greater success in hatching was transmitted to female progeny from the male parent in Bavarian male-Canadian female crosses.

Because of these promising results, a total of 1,151 male and 1,870 female Bavarian *M. tenthredinis* were released near Riverton, Manitoba, in 1963. Austrian *M. tenthredinis* received in 1963 were not released because European workers had found encapsulated eggs in certain Austrian larch sawfly populations but not in Bavarian populations.

Simmonds (Can. Ent. 95: 561-567, 1963) considers that "the most important factor . . . in the material liberated for biological control (is) the maximum possible genetic variability, from which by natural selection in the given environment, the most suitable strain for that environment would be developed." The release of the Bavarian genotype of *M. tenthredinis* is an attempt to increase the genetic variability of this parasite in Canada and will be closely studied to determine if benefit occurs.—J. A. Muldrew.

Liberations of Additional Species of Parasites Against the Larch Sawfly.—In 1958 a program was initiated to discover additional parasites of the larch sawfly, *Pristiphora erichsonii* (Htg.), for release in Canada. This program involves the co-operation of several agencies: the Forest Entomology and Pathology Branch, Department of Forestry, initiated the program and is responsible for the release of parasites and assessment of results; the Entomology Research Institute for Biological Control, Department of Agriculture, is responsible for the importation of exotic species; and the Commonwealth Institute of Biological Control is responsible for overseas exploration, research, and collections.

Parasite releases have been restricted to Manitoba, beginning in 1961 near Pine Falls (sec. 12, twp. 20, rge. 10 EPM) and continuing in 1962 and 1963 near Riverton (sec. 21, twp. 26, rge. 4 EPM) as shown in Table I. The species liberated to date have all been of central European origin except *Vibrissina turrita*, which was obtained from Japan.

TABLE I. EXOTIC PARASITES RELEASED AGAINST THE LARCH SAWFLY IN MANITOBA, 1961-63

Species	Locality and Numbers					
	Pine Falls		Riverton			
	1961	1962	1962	1963	1963	1963
	♂	♀	♂	♀	♂	♀
Ichneumonidae						
<i>Holocremnus</i> sp. nr. <i>nemoratum</i> Tschek.	56	158	65	152	910	1,245
<i>Hypamblye</i> spp.	—	—	—	—	80	134
Tachinidae						
<i>Hyalurgus lucidus</i> Mg.	99	154	48	61	—	692*
<i>Myzeoristops stolidus</i> Stein.	—	—	—	281*	—	77*
<i>Vibrissina turrita</i> (Mg.)	—	—	—	—	—	149*

*Not sexed.

Evaluation of the results of the 1961 and 1962 releases showed that *Holocremnus* sp. passed through a full generation on the larch sawfly at both release points and offers promise of becoming permanently established. Evidence of establishment came from cocoons collected in the fall of 1962 in larch sawfly study plots at the release points: 337 from Pine Falls and 1,121 from Riverton. These cocoons were kept under near-natural conditions until adult emergence was completed the following summer. Four *Holocremnus* sp. adults emerged: two females from the Pine Falls cocoons and one male and one female from the Riverton cocoons. These specimens have been deposited in the Canadian National Collection, Ottawa. No evidence was obtained of the establishment of the tachinids *H. lucidus* or *M. stolidus*.

Efforts to obtain evidence of the establishment of species released in 1963 are continuing and further releases of these species and studies on the spread and impact of *Holocremnus* sp. are planned.—W. J. Turnock and J. A. Muldrew.

Mealy Bug Damage in Conifers.—A localized but heavy infestation of *Puto cupressi* (Coleman) discovered 12 miles northwest of Princeton by F. Baker of the B.C. Forest Service apparently constitutes the first record of mealy bug damage in the forests of Interior British Columbia. The infestation covers about 15 acres of open-growing, immature lodgepole pine, alpine fir, Engelmann spruce, and a few Douglas-fir seedlings at an elevation of 4900 ft.

Damage symptoms were (a) blackened foliage and branches caused by a fungus growing on deposits of "honey dew", (b) atrophy of the main leaders, frequently accompanied by degeneration of the upper crown into a rounded, broom-like mass, and (c) gross malformation of main stems and branches caused by numerous tumour-like swellings. Alpine fir exhibited all three types of damage, and a few trees ranging up to 5 in. d.b.h. had been killed. Lodgepole pine, having sparser foliage than the other conifers, was not as heavily smothered in fungus growth, but many of the understory trees were disfigured by growth abnormalities. Tumours were scarce on Engelmann spruce, although the infestation had resulted in dense brooming of the upper crowns. The scattered Douglas-fir seedlings in the stand appeared to have been less severely affected than the other tree species, but a few had nodules on the branches.

Stages present on September 12, 1963, were motile nymphs (or females) feeding on the smaller twigs, and pre-adults enclosed in white cottony "cocoons" which occurred singly or in clusters amongst the needles, in lichens and accumulated debris amongst the brooms, and in bark crevices.

Although examination of growth rings of four trees indicated that mealy bug feeding had begun to retard growth about 10 years ago, the infestation appears to be confined to an open stand on the southwestern exposure of a low knoll. Reasons for its failure to spread into the adjacent forest are not known.—J. Grant.

Host Ranges and Taxonomy of the Poplar Rusts of the World.—The discovery of *Melampsora* rust on seedlings of ponderosa pine (*Pinus ponderosa* Laws.) in a forest tree nursery at Telkwa, British Columbia, in 1960, led to intensive surveys and experimentations, because it was feared that the rust might be a foreign disease recently introduced to the North American continent. In the course of these investigations, Molnar and Sivak (Can. J. Bot. 42: 145-158, 1964) showed that the disease on ponderosa pine was not caused by European pine twist rust (*Melampsora pinitorqua* Rostr.) as suspected, but by the well-known indigenous poplar rust *M. albertensis* Arth. Previously, Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) was considered to be the only aecial host of *Melampsora albertensis*. Molnar and Sivak showed, furthermore, that seedlings of ponderosa pine are susceptible to another well-known indigenous poplar rust, *M. occidentalis* Jacks., which was also, like *M. albertensis*, considered to be restricted to Douglas-fir in its aecial state.

In view of these findings it seemed reasonable to expect that other *Melampsora* rusts throughout the world might likewise have a wider host range than presently assumed. For that reason, and because poplar rusts can cause damage to valuable timber (species of *Populus*, *Pinus*, *Larix*, *Pseudotsuga* and *Tsuga* are known suspects), it was decided that investigations into their host ranges and taxonomy were warranted on an international scale. Consequently, the collaboration of three eminent forest pathologists was obtained: Dr. A. Biraghi, University of Florence, Italy; Dr. N. Hiratsuka, University of Tokyo, Japan; and Mrs. E. v.d. Pahlen, Instituto de Fitotecnia, Argentine. A joint program was designed with the following principal objectives:

- to carry out inoculation experiments designed to test economically important conifers for their susceptibility to poplar rusts occurring in each of the following regions of the world: Italy, Japan, eastern Argentine, and western Canada;
- to review the taxonomy, host ranges, and geographical distribution of poplar rusts on a worldwide basis in the light of experimental results, regional observations, and specimens obtained in (a), above.

The conifers selected for testing represent species of six genera: *Abies*, *Larix*, *Picea*, *Pinus*, *Pseudotsuga*, and *Tsuga*. The conifers are grown from seed distributed to each of the collaborators. In each of the four regions of the world, *Melampsora* rusts occurring locally on poplar leaves are used to inoculate the conifer seedlings to test their susceptibility to each of the rusts. The inocula used and the specimens of infected conifers obtained by inoculation are preserved for comparative study of the rusts on a worldwide basis.

It is hoped that the results of the program will aid in controlling these rust parasites and lead to fundamental taxonomic revisions in the genus *Melampsora*.—W. G. Ziller.