

ENTOMOLOGY

Studies on the Fat Content of the Douglas-Fir Beetle.—

Insects that occupy temporary or widely and unevenly spaced habitats must have a great capacity to disperse if they are to locate new breeding sites. Many scolytids are in this category, and any factor that reduces their capacity to disperse would, therefore, restrict the population. A recent investigation showed that fat accumulated within the insect provides much of the energy used by the Douglas-fir beetle during flight. Young adults that were flown on a flight mill for an average of 210 min had significantly less fat than similar unflown individuals. Therefore, the amount of stored fat in newly emerged beetles available as fuel for flight must be considered as a factor affecting population movements and fluctuations.

Atkins (unpublished data) showed that the behaviour of the Douglas-fir beetle is related to their fat content. Beetles with more than 20% of their dry weight composed of fat usually rejected suitable host material and displayed a strong inclination to fly (disperse). Those with less than 10% fat usually failed to fly continuously for more than a few minutes. Beetles with between 10% and 20% fat, although capable of sustained flight, usually responded readily to suitable host material.

After the relationship between fat content and behaviour was established, factors that influence the accumulation of fats were investigated. For example, young adults that developed slowly under cool conditions contained significantly more fat than those that developed rapidly in logs from the same tree under warm conditions. Ninety-six per cent of the progeny reared at the low temperature contained more than 20% fat, while only 22% of the progeny that developed under warm conditions had more than 20% fat, and 38% had less than 10% fat. The adult brood from logs containing two galleries per square foot of bark surface had a mean fat content of 30.3% compared to 21.3% for the adult brood from logs containing 10 to 12 galleries per square foot. Eighty-five per cent of the adults reared at the low level of competition contained more than 20% fat and only 1.4% had less than 10% fat. At the high level of competition, 51% of the young adults had more than 20% fat, whereas 22% had less than 10% fat.

Thus temperature and intraspecific competition affect a population both directly and indirectly; they cause direct mortality, and also influence the effectiveness of the survivors to reproduce by affecting their physiological processes. As the prediction of population trends and movements, and attempts to manipulate populations must be based on the behaviour and physiology of survivors, the indirect action of environmental factors must be considered.—M. D. Atkins, Forest Research Laboratory, Victoria, B.C.

The Effect of Wild Carrot on a Common Parasite of the

European Pine Shoot Moth.—Since 1955, studies have been conducted on the European pine shoot moth, *Rhyacionia buoliana* (Schiff.) in southern Ontario. In the course of these studies, the role of parasites and predators in the population dynamics of the shoot moth have been investigated, and it has been found that *Orgilus obscurator* (Nees), is one of its most effective parasites. Recent studies have been orientated towards an understanding of the ecological factors influencing the effectiveness of this parasite.

Van Emden (Entomol. Mon. Mag. 98, 1963) found that the presence of flowers along the edges of fields greatly increased trap catches of parasites. Leius (Can. Entomol. 92, 1960) showed that *O. obscurator* fed on flowers of only the Umbelliferae in laboratory experiments. In 1964, examinations of all shoot moth study plots in southern Ontario were begun with a view to discovering relationships between the presence of flowering Umbelliferae and parasitism of the shoot moth by

O. obscurator. These surveys established that wild carrot, *Daucus carota* L., a common biennial species, was the only abundant species of Umbelliferae blooming in shoot moth plots during the flight period of *O. obscurator*.

O. obscurator emerges during the latter half of the emergence period of shoot moth adults and, for the most part, attacks the needle mining stages (Juillet, J. A., Can. Entomol. 92, 1960), although laboratory studies (Arthur, A. P. et al., Can. Entomol. 96, 1964) indicate that it will attack larvae in the buds. Studies at Elmira, Ontario, have shown that the parasite is present when the first host larvae become available but that it ceases flying several weeks before the last larvae leave the needles and enter the buds. Ohnesorge (unpublished report, 1962) showed that parasitism by this species in the field was increased from 28 to 50% by releasing laboratory reared *O. obscurator* adults from 1 to 2 weeks after the natural population of this parasite ceased flying. It seems, therefore, that the effectiveness of *O. obscurator* could be increased if its flight and oviposition period could be extended.

In experiments at Elmira, ten *O. obscurator* females were introduced into each of two cages, one containing flowering wild carrot and one containing non-flowering plants. The longevity of parasites confined with the flowering wild carrot was 20.0 ± 5.3 days while that of parasites confined with non-flowering plants was only 4.2 ± 2.1 days. Although the numbers involved in the foregoing experiment are small, the results are striking and it seems likely that if wild carrot flowers were available and were utilized by adults of *O. obscurator* in the field, the latter's longevity (and oviposition period) would be increased significantly. This, in turn, should increase its effectiveness against the European pine shoot moth.

Surveys in 1964 and 1965 showed that although wild carrot was common in the general area, it was not present in permanent shoot moth sampling plots at Elmira, Waterloo County; Mansfield, Dufferin County; and Port Elgin, Bruce County. Presumably, it was not present in these plots in 1962 and 1963. During the period 1962-1965, parasitism by *O. obscurator*, as determined from fall samples, varied from about 25 to 50% in these areas. At a fourth plot, near Dorcas Bay, Bruce County, a very high population of the shoot moth began an abrupt decline in 1961 and reached such a low level in 1965 that sampling it for *O. obscurator* became impossible. *O. obscurator* was absent from this plot prior to 1960, but was released there in that year. Although the decline in the host population subsequent to the release was too rapid to be attributed entirely to *O. obscurator*, parasitism by this species rose from 20% in 1961 to 90% in 1964. In this plot, wild carrot was blooming abundantly during the flight period of *O. obscurator* in 1964 and 1965 and, therefore, presumably in earlier years. It is possible that wild carrot contributed to the success of *O. obscurator* at Dorcas Bay.

Since wild carrot in Ontario is a noxious weed under the Weed Control Act (Revised Statutes of Ontario, 1960, Chapter 427 as amended by Statutes of Ontario, 1965, Chapter 141), it cannot legally be encouraged, or indeed, allowed to flower. However, because wild carrot is a plant of open spaces, it will persist in a pine plantation only until closure occurs, at a time when damage by the shoot moth also becomes less severe. If future studies confirm the foregoing data, the status of wild carrot as a purely noxious weed may bear reviewing.—Paul D. Syme, Forest Research Laboratory, Sault Ste. Marie.

First Record of the Larch Casebearer in Manitoba.—

The larch casebearer, *Coleophora laricella* (Hbn.), is considered to be a European species. It was first recorded in North America at Northampton, Massachusetts in 1886, and since then it has spread throughout most of eastern Canada and the neighbouring United States as far west as Minnesota on tamarack, *Larix laricina* (Du Roi) K. Koch, and to parts