SOME PROBLEMS OF INSECT BIOLOGY IN THE CANADIAN ARCTIC*

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THE Northern Insect Survey was begun in 1947 as a joint project supported and administered by the Defence Research Board, Department of National Defence, and the divisions of Entomology and Botany, Science Service, Department of Agriculture, Ottawa. The main objects of the survey are to study the distribution, relative abundance, and biology of the species of biting flies and other insects in the arctic and subarctic regions of Canada. The results of this survey have not been completely compiled to date, although sufficient data have been analyzed to permit some general comments on the insects of the North. By the end of 1952 forty-six areas will have been investigated, including five areas in Alaska and one in Greenland for comparative purposes (see Fig. 1). Each year approximately 125,000 specimens are collected, including several new species and many extensions of previously-known ranges.

Our studies of the species of insects indigenous to the arctic tundra have clearly demonstrated the close relationship between the nearctic and palaearctic faunas and that many of the species have holarctic distributional patterns. The collections indicate two major and two minor faunal divisions in northern Canada, each division containing certain insects that are restricted to it. The major divisions may be defined as the northern boreal forest and the arctic tundra, the minor ones as the Cordilleran system and the Labradorian or Gulf of St. Lawrence area. Many insects of the boreal forest also occur in the Cordilleran and Labradorian regions, but it is significant that the phytophagous insect species of the northern forest do not invade the tundra. The northern boreal forest is inhabited by a great diversity of insect genera and species which are distributed from Alaska to southern Newfoundland. The arctic tundra, however, is inhabited by comparatively few species, most of which appear to be distinct from those in the northern boreal forest, although usually belonging to the same genera. For example, at least 38 species of mosquitoes occur in the boreal forest, whereas only 4 species are found in the tundra. This is typical for other insect groups. However, most of the tundra species occur in great abundance and the total insect population is large, although the number of species is relatively small. The Labradorian and Cordilleran regions are peculiar in that they have a few representative species, as well as many species of the boreal region. Within each region are many problems of inter- and intra-specific variability.

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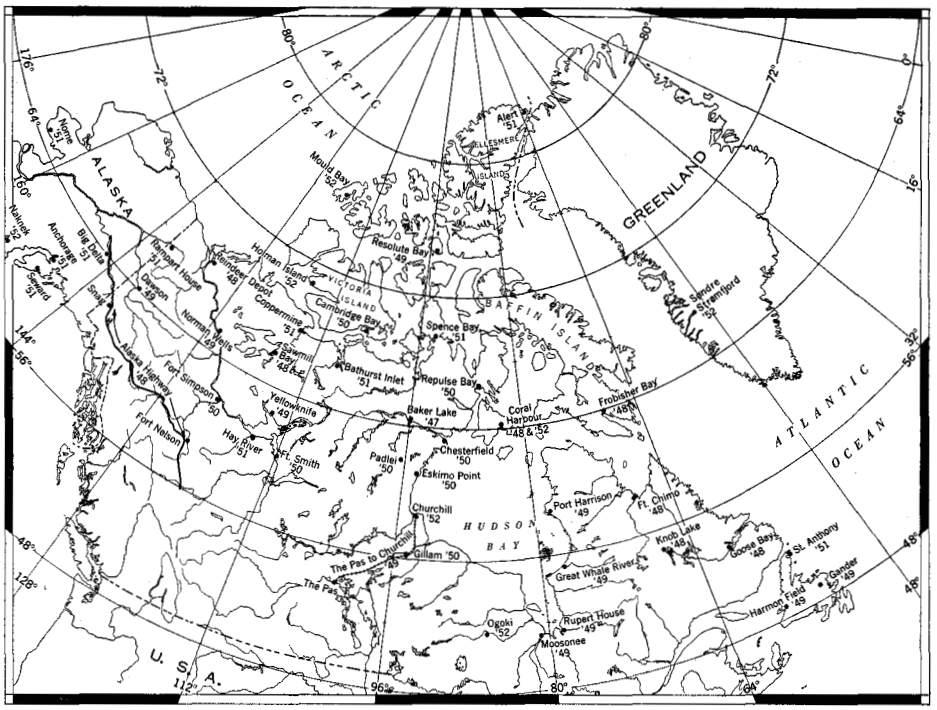

Fig. 1. Areas investigated on the Northern Insect Survey.

The insects of the Arctic, particularly the Lepidoptera, show a considerable amount of individual variation within the species—for example, some of the species of *Colias*, or sulphur butterflies. *Colias nastes* Bdv. is found throughout the Arctic on dry sandy or gravelly ridges. Another species, *Colias hecla* Lef., occurs at the bases of the ridges and hills. In the areas of Baker Lake, Southampton Island, and the Boothia Peninsula, another form or species called *Colias boothii* Curt. is found in the same habitats as *hecla*. Some specimens of *boothii* look like *hecla* and some like *nastes*, and because of the extreme variability of *boothii* it has been suggested that this species is a natural hybrid between the two other species. However, *boothii* and *nastes* have not been found to interbreed in all the areas investigated, and it is possible that *boothii* may be merely a geographical race of *hecla*. The dry hilltop species *nastes* also shows considerable variability, and certain variants of both *nastes* and *hecla* resemble each other, and perhaps it is this type of variation that represents the third form, *boothii*. It is hoped that further study and collecting will solve this puzzling complexity of the interrelationship of the *Colias* butterflies of the tundra.

It is obvious that the arctic insects have dispersed in the tundra region in the recent geological past, following the retreat of the Pleistocene ice sheets. This glacial epoch no doubt considerably affected insect distribution and speciation. The insects living at present in the Arctic are the progeny of those populations that lived in the refugia, which are known to have existed

in the ice from earlier botanical work. Huge tongues of ice, must have separated the existing species into isolated populations; and in part, because of this isolation and environmental pressure and selection, these eventually evolved into distinct species or subspecies. It is probable that those species in the coniferous zone evolved along the southern periphery of the ice sheet, well isolated from those living in the refugia in the ice. Present distributional patterns indicate that the major refugia were situated in the Yukon, in Alaska, and possibly in Siberia. Minor refugia, which produced the present Labradorian fauna, must have existed in Labrador, Newfoundland, or perhaps the Gaspé Peninsula. As the ice retreated the insects must gradually have increased their distributional ranges.

The arctic regions present a rather monotonous and uniform insect environment. It appears that since the ice retreated insufficient time has elapsed for the development of many diverse habitats, and specific dominance of plants in large areas is hardly noticeable. It is possible that this lack of variety of habitat is partly responsible for the small numbers of insect species in the arctic regions as compared with the number of species in the wooded areas farther south. However, many arctic insects, like the *Colias* butterflies, are remarkable migrants. As a result there is some gene interchange between geographically isolated populations. This genic interchange, as well as modifications of the local environmental pressure, is at least partly responsible for the phenotypic and genotypic variability within the species and may also, in part, perhaps explain the lack of evolution of many distinct species since the last glaciation.