HETEROPTERA STRANDED AT HIGH ALTITUDES IN THE PACIFIC NORTHWEST

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The problem of dispersal is of particular interest to students of insect distribution and there has been a great deal of discussion on the main modes by which, for example, insects have colonized oceanic islands (see Zimmerman, 1948). It is now generally agreed that aerial dispersal, be it active flying or passive drift, has played a significant part in the colonization of new areas. The recent trapping research by the Hawaiian B. P. Bishop Museum indicates aerial dispersal of many groups of insects in remote areas (Gressitt, 1961; Gressitt & Nakata, 1958; Gressitt, Leech & O'Brien, 1960; Yoshimoto & Gressitt, 1959, 1960; Yoshimoto, Gressitt & Wolff, 1962; Gressitt, Coatsworth & Yoshimoto, 1962). Johnson (1953, 1954, 1962) demonstrated that the dispersal of aphids and many other insects was by passive drift, and captures of aphids on snow in Spitzbergen (Elton, 1925) shows that they can be carried long distances. Spread by active flight is well documented (Williams, 1958; Rainey, 1962) and reference to the spread of the spruce budworm, *Choristoneura fumiferana* (Clem.), shows the part played by prevailing winds in blowing pests in predictable directions (Henson, 1962).

Indeed, the evidence for aerial dispersal of insects and spiders is now so great that Bristowe (1958) was able to write, after mentioning additional records of spread to Krakatau and Jan Mayen, that 'we can now play havoc with much of the former evidence advanced in support of landbridges which were sometimes imagined to explain the distribution of spiders and other invertebrates'.

In a study of insect (particularly Heteroptera) distribution in British Columbia, we are attempting to obtain information on dispersal. Most of this work is concerned with various trapping procedures, but it seemed possible that trapping records might be supplemented from various other sources. This paper is concerned with one such source, namely snowfield and glacier stranded insects.

Mani (1962) reviewed the occurrence of insects stranded on snowfields and glaciers and noted that these forms are distinct from the nival fauna and characteristically belong to the fauna of lower elevations. He noted that insects from low altitudes often get carried up by thermals and in the upper atmosphere and currents become chilled and are blown onto snowfields and glaciers where they become stranded. Here they form a source of food for the foraging nival fauna, but they also provide valuable records for students of insect distribution. The process of getting stranded on such areas might at first glance seem rather infrequent or unimportant and to provide little information, but familiarity with the records show this not to be the case. The famous grasshopper glacier in Montana (Gurney, 1953; Williams, 1958) demonstrates the possible magnitude of the process.

A number of records of insects stranded on snowfields include Heteroptera. Caudell (1903) found Pentatomids, Coreids, Lygaeids and one species belonging to each of the Aradidae and Miridae, on Pike's Peak snowfields in central Colorado. Van

Dyke (1919) reports Pentatomids, Coreids and Mirids on Mt. Rainier snowfields in west-central Washington, and Lygaeids, Coreids and Mirids on snow in the High Cascades and Sierra Nevada of eastern California. Howard (1918) records 'Coreid' bugs on snow at 13,000 ft on Sierra Blanca in south Colorado, but since these insects are said to have been bright green in color, they may have belonged to another family. I know of no published records of Heteroptera on snowfields in British Columbia, although other insects are recorded from such areas, for example in Currie (1904).

The records reported here are specimens collected by a group of energetic students who are mountaineers. The captures are detailed with remarks on each: the Garibaldi localities are around 5000-6500 ft. elevation.

Family Acanthosomidae

Elasmostethus cruciatus (Say). B.C.: Golden Ears, on snow at 4,500-5,800 ft., 19. v. 1963 (I. Stirling). WASH.: Mt. Sahale, Cascade Pass, 6,000 ft., on snow, 31. vii. 1960 (E. Adams). Widely distributed and taken from many conifers.

Family Pentatomidae

Banasa dimidiata (Say). B.C.: Garibaldi, on glacier, 15. ix. 1961 (J. B. Foster). WASH.: Mt. Sahale, Cascade Pass, 6,000 ft., on snow, 31. vii. 1960 (E. Adams). The above specimens are identical with material from Saanich District determined by H. M. Parshley as *dimidiata*. The species is fairly common and widely distributed in British Columbia.

B. sordida (Uhler). B.C.: Golden Ears, on snow at 5,500 ft., 12. vi. 1960 (E. Adams). In British Columbia this species to date has been taken on Vancouver Island and in the Lower Fraser Valley. It has been found on *Thuja* sp. in British Columbia.

Zicrona caerulea (L.). WASH.: Mt. Rainier, 5,300 ft., 3. vii. 1960 (E. Adams). A predaceous species also found in Europe, Asia, Dutch East Indies and the United States. Parshley (1923) reports that this species occurs occasionally on the summit of Mt. Washington in New Hampshire and notes that adventitious specimens have been taken in Connecticut in boxes of nursery stock imported from France. In British Columbia specimens have been studied from the Kootenays, Fraser Valley and southern Vancouver Island.

Family Coreidae

Theognis occidentalis (Heid.). B.C.: Garibaldi Neve, 7,000-7,500 ft., 25. ix. 1960 (J. B. Foster); Garibaldi, on snow, 15. ix. 1961 (J. B. Foster). WASH.: Mt. Sahale, Cascade Pass, 6,000 ft., abundant on snow, 31. vii. 1960 (E. Adams). Widely distributed in British Columbia.

Family Lygaeidae

Lygaeus kalmi kalmi (Stal.). WASH.: Mt. Sahale, Casade Pass, on snow at 6,000 ft., 31. vii. 1960 (E. Adams) — a teneral specimen. Common in warm interior districts of British Columbia, but scarce at the coast; occasionally taken on the south-eastern part of Vancouver Island.

Kleidocerys resedae (Panz.). B.C.: Golden Ears, very abundant on snow, 4,500-5,800 ft., 19. v. 1963 (I. Stirling). WASH.: Mt. Sahale, Cascade Pass, on snow at 6,000 ft., 31. vii. 1960 (E. Adams); Mt. Shuksan, on snow above 7,000 ft., 11. ix. 1960 (E. Adams). A widely distributed species reported from many hosts, but most probably

overwintering ones: usually on *Alnus, Betula* or *Rhododendron*. This is a species taken by Caudell (1903) on snow on Pike's Peak, but recorded under a synonymic name, *Ischnorhynchus didymus* Zett.

Of the 30 odd families of Heteroptera represented in the Pacific Northwest, these records involve only four. Caudell (1903) found in Colorado that the most common families found on snow were also the Lygaeidae, Pentatomidae and Coreidae: only one species of Miridae was found and so far none of this family have been obtained in our collecting.

Leston (1957) has suggested that for the Heteroptera at least, each taxon differs in regard to its spread potential; it seems that taxa differ in their intrinsic ability to spread and colonize. Leston (loc. cit.), after studying the Heteroptera of four oceanic island groups, the Azores, Hawaii, Guam and Samoa, listed families with decreasing spread potential. The Miridae headed this list, closely followed by the Lygaeidae and Pentatomidae, but the Coreidae were near the bottom. Analysis of light trap captures showed much the same picture. It would appear that in the Pacific Northwest, the Miridae may not be such strong migrants as their representatives in other parts of the world. Further collecting may clarify this point.

Westdal *et al.* (1961) and Medler (1962) have shown that the six-spotted leafhopper *Macrosteles fascifrons* (Stal.) cannot overwinter in the North as adults, yet every year is carried into northern areas of its range by winds and here reaches pest proportions. Likewise, Robinson & Hsu (1963) note that some of the aphids on cereal grains and grasses in Manitoba cannot overwinter in this Province and hence appear to invade Canada each year from the south. The records of insects stranded on snow indicate a high spread potential, and point out a feature which may be important if they are pests and need control. *Theognis occidentalis* is a pest of coniferous seed in the West (Koerber, 1963) and *Banasa dimidiata* is a potential serious pest of blueberries and currants in New England (DeCoursey, 1963): the late W. Downes left notes indicating that *B. dimidiata* is sometimes numerous on raspberry fruit on Vancouver Island.

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The Eastern Larch Beetle, DENDROCTONUS SIMPLEX Lec. In British Columbia and Yukon Territory

The occurrence of the eastern larch beetle, **Dendroctonus simplex** Lec., in British Columbia was established June 1, 1960, when the writer collected adults and young larvae from a felled estern larch, **Larix laricina** (Du Roi) K. Koch, four miles west of Chetwynd on the Hart Highway. In mid-July 1960, adults and larvae were found in two flood-damaged trees 19 miles south of Fort Nelson. Dead parent adults, living pupae, and teneral adults were collected from these trees on August 18.

Further records were obtained by E. Pottinger on June 6, 1962, five miles east of Chetwynd. Adults were collected from two larch logs averaging 10 inches d.b.h. A month later an adjacent standing larch that had been heavily attacked in the spring was discovered. The foliage was beginning to fade and adults, large larvae, and teneral adults were found beneath the bark. On September 4, teneral adults were already taking on the dark colour of mature beetles.

The eastern larch beetle was found near Watson Lake, Yukon Territory in 1962 by J. V. C. Holms. Adults and larvae were recovered on July 19 from an 8-inch trap tree which had been felled on May 26. The attack had been much heavier on the stump than on the log.

Judging by the distribution of our records, it seems probable that the eastern larch beetle occurs throughout the range of its host in northeastern British Columbia and southeastern Yukon Territory.

Identification of the beetles collected has been verified by G. R. Hopping of the Calgary Forest Entomology and Pathology Laboratory.

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