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INSECT POPULATIONS IN CARIBOO POTATO FIELDS[1]

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From late June to early September of 1951, 1952, and 1953, insect populations were sampled regularly on 3 farms, 10 miles apart, near Soda Creek, B.C. The objective was to correlate the populations, particularly of leafhoppers, with the natural incidence of witches'-broom virus disease of potato. Little or no disease appeared, but the populations and their dynamics are of interest both in themselves and economically.

Comparative freedom from virus-carrying insect pests has led to the establishment of a thriving seed potato industry in the Cariboo district. The montane climate and swift grow-season ensure that the greatest pest of all, *Myzus persicae* (Sulz.), the green peach aphid, is not often seen and seldom becomes numerous. Most of the growers have never had occasion to use insecticides, nor do they own the necessary equipment.

Since 1949 the western potato flea beetle, *Epitrix subcrinita* (Lec.), has become established in the area, moving northward to Quesnel in 1954. From occasional specimens taken at Soda Creek in 1950 (Prof. G. J. Spencer, University of British Columbia, personal communication), it has increased almost to outbreak proportions, at one site killing the vines and severely damaging the tubers in 1952. In the 3 seasons under review, 85 samples of insects were taken, totalling upwards of 84,000 specimens, of which 91 per cent were adults of *E. subcrinita.* Randomized subsamples of flea beetles, submitted to Dr. L. G. Gentner, Medford, Oreg., confirmed the identity of the species. Of the remaining 7,200 insects, representative samples only were determined.

During the period, recorded monthly temperatures showed very little variation from year to year or from the long-term average, although in 1951 precipitation was below normal.

Methods

An average of about 2.5 samples were taken per week, each of 100 strokes with a standard 15-inch net. The samples were stratified into 4 subsamples of 25 strokes, taken in each quarter of a field. The subsamples were put together in the killing bottle and the total catch, including immature forms, was counted into the broad, easily recognized categories shown in Figs. 1 and 2.

Exploratory plotting suggested that populations of the insects were similar for corresponding weeks in the 3 years. With this in mind, the 3-years' data in each insect category were grouped into weekly subtotals, divided by the number of samples and

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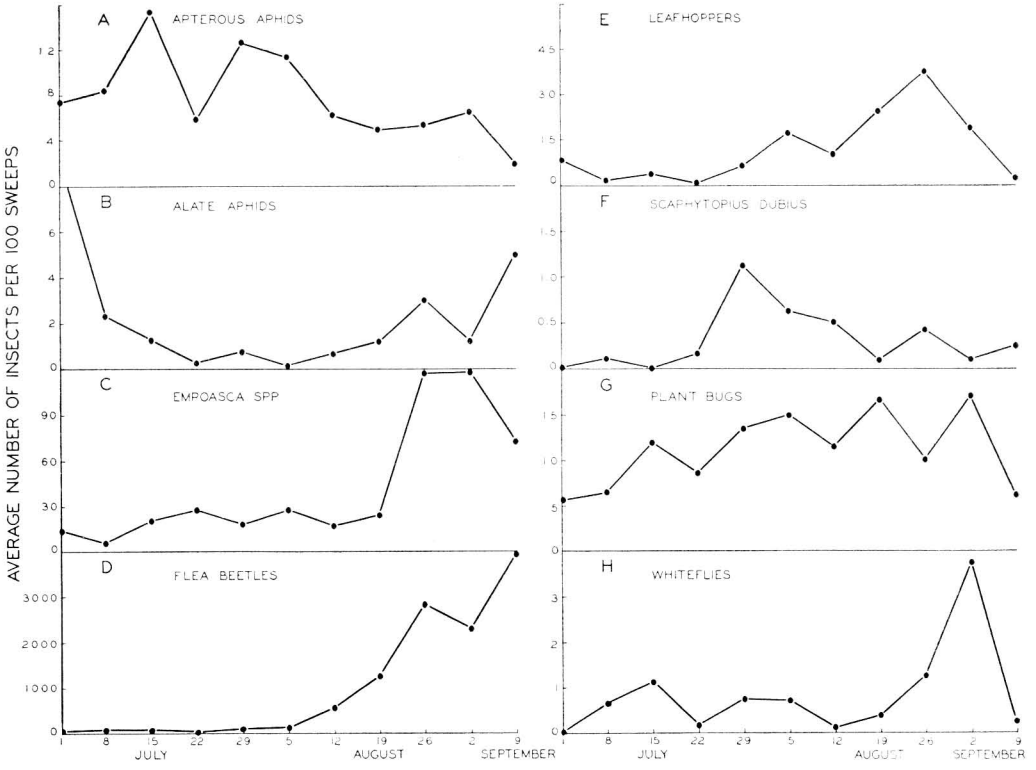

Fig. 1.—Populations of insects collected by sweeping in potato fields at Soda Creek, B.C., during 3 seasons, 1951-1953.

plotted on a common base-line with appropriate *y* axes. Since the sampling and treatment were uniform, the graphs give a fairly reliable picture of the simultaneous development of populations.

Results and Conclusions

Three groups, normally breeding on potatoes are potentially of major importance to growers. These are: aphids, *Empoasca* spp. of leafhoppers, and *E. subcrinita*. Seven groups, which may or may not breed on potatoes, are of minor importance. These are: leafhoppers other than *Empoasca* spp., plant bugs, whiteflies, psyllids, lacewings, ladybird beetles, and predatory Hemiptera. Four groups are incidental, or were during the years in question. These are: spittlebugs, treehoppers, grasshoppers, and caterpillars.

Examination of alate and apterous aphid samples in alcohol showed them to be overwhelmingly of the potato aphid, *Macrosiphum solanifolii* (Ashm.). The green peach aphid may well have been in the fields, failing to show up because the samples were perforce swept from the upper two-thirds of the vines, thus missing the preferred feeding site of *M. persicae* on the basal leaves, but including that of *M. solanifolii* on the growing tips. The typical hot-weather decline of the apterae (Fig 1, A), and the fall and rise of the alates are well illustrated (Fig. 1, B).

Empoasca spp. showed the high peak in late summer expected of prolific insects breeding within the crop (Fig. 1, C). Large, well-irrigated fields had the highest populations, but no crop was appreciably damaged by hopperburn.

Small, unirrigated fields had the highest populations of flea beetles. At these sites, the adults were at their

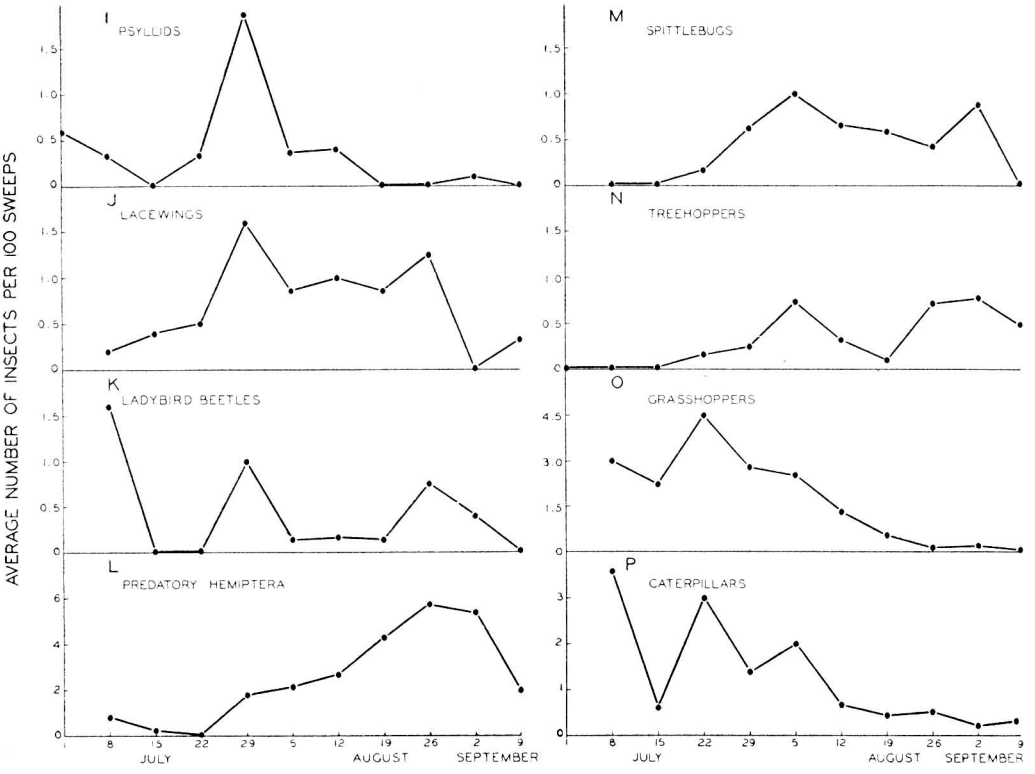

Fig. 2.—Populations of insects collected by sweeping in potato fields at Soda Creek, B.C., during 2 seasons, 1952-1953 (J-M, O, P) or 3 seasons, 1951-1953 (I, N).

peak in early September (Fig. 1, D), to be found not only in the remnant of the crop but also in the brush and on wild land surrounding the potato fields.

A number of leafhopper spceies other than *Empoasca* bred in the crops, producing a similar curve on a lower scale (Fig. 1, E). Determinations made so far indicate that about half of these fall into the genus *Macrosteles*, which includes known and suspected virus vectors. One species instantly recognizable is *Scaphytopius dubius* (Van Duzee), the sharp-nosed leafhopper (Fig. 1, F). This insect is a proved vector of witches'-broom virus disease of alfalfa (Menzies, J.D., 1946. Phytopathology *36*: 762-774), and is suspected of carrying others. It will breed on potato plants in cages, and will do so in the field, to judge by the nymphs sometimes caught well out from field borders.

The plant bugs, with overlapping generations breeding on a variety of plants and fairly strong fliers, show a uniform curve (Fig. 1, G). The number of bugs taken, particularly adults of *Lygus* spp., increased whenever any nearby hay crop was cut.

Most of the whitefly records were made during the dry season of 1951. Neither these nor psyllids constituted much of a threat to the crop (Figs. 1, H, and 2, I). Immature forms of these groups were not taken.

Numbers for the 3 groups of predators combined show a low negative correlation (−.311) with numbers of apterous aphids. The predatory Hemiptera were mostly species of *Geocoris* and *Nabis* (Fig 2, L.).

Treehoppers were most often taken in small fields with brushy borders, but spittlebugs occurred in larger fields, usually close to stands of alfalfa (Fig. 2, M and N).

Grasshoppers in all instars (Fig. 2, O) would be a potential threat to potatoes in the Cariboo were it not that they appear to feed on other plants more readily. Caterpillars Fig. 2, P) taken in 1952 and 1953 were usually of the bertha armyworm, *Mamestra configurata* Wlkr., a species that may approach damaging numbers in small areas, as in 1951. In that summer a disease, a polyhedrosis to judge by the symptoms, reduced the numbers to insignificance within a few days. Growers report this as occurring whenever the bertha armyworm becomes locally numerous.

The following list gives the insect groups other than flea beetles in order of average percentage of total numbers taken; *Empoasca* spp., 48.0; other leafhoppers, 15.4; plant bugs, 14.4; apterous aphids, 9.7; predatory Hemiptera, 2.4; grasshoppers, 2.2; caterpillars, 1.7; alate aphids, 1.2; whiteflies, 1.2; psyllids, 1.2; lacewings, 0.8; *Scaphytopius dubius*, 0.5; spittlebugs, 0.5; treehoppers, 0.4; ladybird beetles, 0.4. The order bears little relation to their importance to the crop, however, and the list is given as a record only.

Although the populations in fields fluctuated in concert, there was nonetheless a tendency for individual fields to have distinctive populations, influenced by size, surroundings, condition of the potato plants, and the presence of weeds.

The population graphs indicate that the most effective period for a single application of a general insecticide is probably the last week in July, when most of the groups were at or approaching a subpeak, as the first summer generations matured. Control measures in the week of July 15 would be equally effective, especially against aphids, but would probably need repeating about August 19. An application at this time would be especially useful against *E. subcrinita*, for it is larvae from eggs laid by adults emerging in mid August that have caused commercial damage.

Numbers of Collembola in a Swarm

At a previous meeting of this society I mentioned the way in which Collembola sometimes aggregate.

On 23 April, 1951, I was given a glass jar containing Collembola with the report that they were taken from a cabin on the North Shore Mountains of Vancouver, the day before. The owners of the cabin, going up for the week-end, had found the floor covered, as they said, by a layer of these insects one half inch deep. With a piece of paper, they scooped some into a glass jar and brought the jar down next morning. They were terrified of the carpet of insects and sat up in chairs all night for fear of being eaten alive if they dared to lie down on beds to sleep. The winter's snow lay deep on the ground and the Collembola must have moved up through it and invaded the cabin.

The insects were spread out on a large sheet of paper and air-dried under laboratory conditions. When thoroughly dry, they were weighed and counted. They were 56 c.c. in volume, and weighed 14.207 grams. Six samples of 100 at a time were weighed on a chain balance and averaged, and a total of 1,261,369 was reached for the entire mass. The insects were kindly identified for me by Mr. Lionel Wade of our University (who wrote a Master's thesis on the Collembola of the lower Fraser Valley), as "*Hypogastrura pseudarmata* (Folsom), family Poduridae, a mottled dark blue species extending from British Columbia to California".

What I take to be this species was sent in in quantity some years ago in early spring from a greenhouse near New Westminster and from Stanley Park Greenhouses; in both places the insects were reported to form so thick a layer on the floor that they gummed up the ordinary corn brooms and had to be shovelled out with a coal shovel.

It is of interest to speculate on the causes of such vast numbers of this insect suddenly appearing from apparently nowhere and as to their final disposition.—*G. J. Spencer. University of British Columbia.*