

Reference

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APHIDS OF STRAWBERRIES IN BRITISH COLUMBIA¹

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Considerable interest is being taken in the aphids found on strawberries because of their importance in transmitting viruses. Since 1956 special attention has been given to collecting aphids from strawberries in British Columbia in connection with a major project on strawberry viruses. This paper reports data from the collections.

Methods

From 1956 to 1961, about 75 collections of aphids were made from strawberry fields on the lower mainland and Vancouver Island, which are major strawberry growing areas of British Columbia. Commercial varieties sampled included British Sovereign, Marshall, Siletz, and Puget Beauty. Several collections were also made from strawberries in greenhouses. Some rearing was done in the insectary at Vancouver.

The aphids were preserved in 80 per cent ethyl alcohol and mounted by the method of Hille Ris Lambers (Hille Ris Lambers, 1950; Spencer, 1959). Identifications were made by the author and by Dr. W. R. Richards, Taxonomy Section, Entomology Research Institute, Ottawa.

Only aphids that were actually reproducing on strawberries are discussed in this paper. The alate strays which were frequently found on the plants are not included.

Species Found

Nine species of aphids were found colonizing on strawberry: *Pentatrachopus fragaefolii* (Cockerell), *Pentatrachopus thomasi* H.R.L., *Macrosiphum euphorbiae* (Thomas), *Myzus ascalonicus* Doncaster, *Aulacorthum solani* (Kalt.), *Fimbriaphis fimbriata* Richards, *Myzus ornatus* Laing, *Aphis forbesi* Weed, and *Acyrtosiphon malvae* subsp. *rogersii* (Theobald). These are listed in their approximate order of abundance.

Discussion

P. fragaefolii and *P. thomasi* are the commonest aphids on strawberry in the area, one or both being present in large numbers in every field examined. Until 1953 both were identified as *P. fragaefolii*. Hille Ris Lambers then recognized two morphotypes: one with 6 marginal capitate setae on abdominal tergites II-IV and one with the 6 marginal plus 6 submarginal setae. Cockerell's type lacked the submarginal setae and so the name *fragaefolii* applied to this species. Hille Ris Lambers named the other *thomasi* (Hille Ris Lambers, 1953 pp. 72-73). *P. thomasi* was identified from British Columbia in 1957 (Forbes, 1959).

The chaetotaxy on which this separation is based is subject to variation however and Hille Ris Lambers recognized this in his description when he said: "In exceptional specimens the inner pair of marginal hairs [sub-

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marginals] is absent on most of the mentioned segments [II-IV]." Figure 1 shows the occurrence of these submarginal setae on the 3 abdominal tergites II-IV on 677 adult apterae collected in British Columbia. The variation is considerable but nevertheless populations of the two species can be distinguished.

Intraclonal variation also occurs. Several clones were reared at Vancouver. Of 20 adult apterae examined from one clone, 2 had 5 submarginal setae on abdominal tergites II-IV and 18 had 6; of 15 examined from another clone 2 had 0, 2-1, 2-2, 3-3, 3-5, and 3-6; of 21 from still another clone 1 had 0, 1-2, 2-4, 6-5, and 11-6.

Schaefers (1960) studied the chaetotaxy of these aphids in California and found the same range. This marked variation leads to confusion in separating these species and even raises the question of their validity as species. Further biological study is needed.

As for hosts other than cultivated strawberry in British Columbia, *P. fragaejolinii* has been collected from *Rosa* spp. and *P. thomasi* has been collected from *Potentilla anserina* L. and from *Fragaria glauca* (S. Wats.) Rydb.

Pentatrachopus minor (Forbes), which is common on strawberries in eastern Canada, and *Pentatrachopus jacobii* (H.R.L.), recorded on certain wild *Fragaria* species in the western United States (Schaefers, 1960), have not been collected here.

M. euphorbiae (= *solanifolii* Ashm.) occurred frequently on strawberries, usually on the petioles of young leaves or on the runners. In one field this species constituted about 40 per cent of the aphids of the sample but usually it accounted for less than 5 per cent. It was especially common on strawberry in May and it seems likely that it can hibernate on strawberry. This is a polyphagous species.

M. ascalonicus occurred each spring. Damage to strawberries by this polyphagous aphid was first recorded in the spring of 1955 (Andison, 1956). The aphids feed on the blossom trusses and young leaves distorting them and dwarfing the plants. When numerous these aphids cause severe damage from March to early May. It was a serious pest in 1955 and 1958.

When first found on strawberry this aphid was identified as *Myzus persicae* (Sulz.), which it resembles closely. In fact *M. ascalonicus* was collected by R. Glendenning from carrot at Chilliwack, B.C. in October, 1947 and he had tentatively labelled it as *M. persicae* (MacGillivray, 1954). This makes one wonder whether the published records of *M. persicae* on strawberry (e.g. Palmer, 1952) really refer to *M. ascalonicus*. Repeated attempts in the insectary at Vancouver failed to establish *M. persicae* on strawberry (H. R. MacCarthy, unpublished).

A. solani occurred fairly often, especially on strawberries in the greenhouse. Like *M. euphorbiae* it preferred new growth. It too is a polyphagous aphid.

F. fimbriata was described (Richards, 1959) from material collected by the author from Marshall strawberries on Lulu Island. They were first observed there in August, 1956, when a very heavy infestation was present. The species has since been collected from strawberry at Agassiz, Victoria, and Vancouver and from blueberry, *Vaccinium corymbosum* L., at Vancouver.

M. ornatus has been collected several times from strawberry in the greenhouse and in the field at Vancouver. In 1961 it became abundant in strawberry plots on the farm at the University of British Columbia and caused some deformity in the plants. This is another polyphagous species.

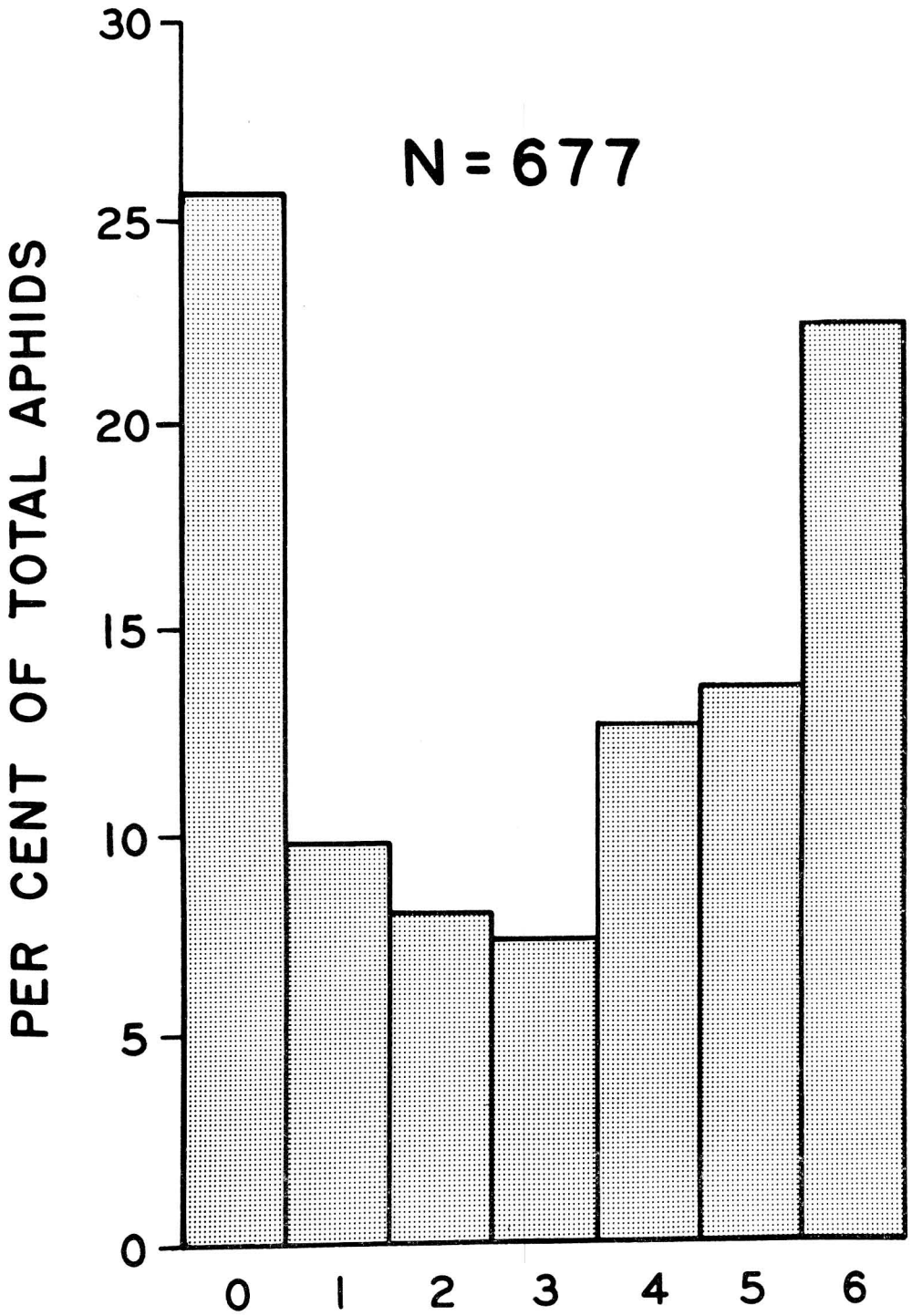


Fig. 1—Number of submarginal setae on abdominal tergites II-IV of *P. fragaefolii* and *P. thomasi* in British Columbia.

A. forbesi was collected in large numbers from the stems and crowns of British Sovereign strawberries in a garden at Vancouver in 1958 but has not been recorded elsewhere in the province. The only other Canadian records of this species according to Richards (1958) are from St. Catharines, Ontario. This species is apparently confined to strawberry.

A. malvae subsp. *rogersii* was collected in small numbers at Vancouver (April 24, 1959; May 5, 1959; May 18, 1960) and at Saanich (June 5, 1959). It is common on strawberry in England and the Netherlands (Hille Ris Lambers, 1947) but has not been recorded from North America before. This subspecies is apparently confined to strawberry.

Of the 8 aphids reported by Masee (1935) as having been recorded on strawberry, only 4 (*P. fragae-folii*, *A. malvae* subsp. *rogersii*, *M. euphorbiae*, and *A. forbesi*) are included in the present list. Three other species from Masee's list occur on other hosts in British Columbia but have not been taken on strawberry: *Macrosiphum rosae* (L.) is very common on species of *Rosa*; *Pentatrachopus potentillae* (Wlk.) has been collected from *Potentilla anserina* L.; and *Amphorophora rubi* (Kalt.) is common on species of *Rubus*. *Pentatrachopus brevipilosus* Baerg, the 8th aphid on Masee's list, is now thought to be *P. minor* (Schaefers, 1960).

Most of the species of the present list have also been identified from strawberries in the Netherlands (Klinkenberg, 1947). In addition she lists *Macrosiphum (Sitobion) fragariae* (Wlk.), which has been collected from *Rubus* spp. at Vancouver but has not been found on strawberry. Hille Ris Lambers (1939) states that it has as host plants *Rubus* spp. and Gramineae and more rarely *Rosa*, *Agri- monia*, and *Fragaria*.

Several of these aphids have been tested and found to be vectors of strawberry viruses (Mellor and Forbes, 1960).

Summary

Nine species of aphids were found colonizing on strawberry in British Columbia: *Pentatrachopus fragae-folii* (Cockerell), *Pentatrachopus thomasi* H.R.L., *Macrosiphum euphorbiae* (Thomas), *Myzus ascalonicus* Doncaster, *Aulacorthum solani* (Kalt.), *Fimbriaphis fimbriata* Richards, *Myzus ornatus* Laing, *Aphis forbesi* Weed, and *Acyrtosiphon malvae* subsp. *rogersii* (Theobald). These are listed in their approximate order of abundance.

F. fimbriata was described from strawberry in British Columbia in 1959. It also occurs on *Vaccinium*. *A. malvae* subsp. *rogersii* has not previously been recorded from North America.

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Resistance to insecticides in root maggots in British Columbia

Considerable experimentation by entomologists of the Victoria, Agassiz, Chilliwack, and Kamloops laboratories resulted in effective controls for onion maggots, *Hylemya antiqua* (Meig.), in onions; cabbage maggots, *Hylemya brassicae* (Bouche), in cole crops; and carrot maggots (carrot rust fly), *Psila rosae* (F.), in carrots, parsnips, and celery. Each control included one or more of the cyclodiene group of chlorinated hydrocarbons.

Until 1957, damage to onions was reduced below one per cent by using dieldrin applied to the seed. In 1957 damage at one location near Vancouver was above 75 per cent and great numbers of maggots were present. In 1958 damage was general wherever onions were grown commercially in B.C. Puparia sent to Oregon State University, Corvallis, for toxicological testing showed that maggots from Vancouver, Vernon, Kamloops and Kelowna were resistant to dieldrin and heptachlor but still susceptible to DDT and malathion.

In 1959 reports of poor control of cabbage maggots near Victoria on Vancouver Island indicated that resistance had developed. Puparia from the fields concerned and from fields near Vancouver were sent to the Entomological Laboratory, Chatham, Ont., for testing. The results showed that flies from the fields on Vancouver Island had a high

degree of resistance to cyclodiene hydrocarbons but were still susceptible to the phosphate Diazinon. Flies from the lower mainland were still susceptible to both types.

In 1961 loss of the first planting of carrots at Colony Farm, Essondale, signalled resistance in carrot maggots. Puparia from this field were sent to Chatham for testing. The results showed a high degree of resistance to the cyclodiene insecticides but susceptibility to phosphates.

Resistant cabbage and carrot maggots occurred only in isolated pockets until the summer of 1962. Then resistant cabbage maggots were reported and later confirmed from Abbotsford and Cloverdale, the two principal cole crop areas of the lower mainland. Uncontrolled damage in 1962 to first planting carrots at Colebrook and to second planting carrots at Cloverdale with later confirmatory tests showed that resistant carrot maggots had become established in those areas.

An alarming feature was the very large numbers of each species at locations where resistance developed. We are now faced with the problem of reducing the population to acceptably low numbers using control practices that are not entirely satisfactory.

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