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APHIDS TRAPPED IN OKANAGAN CHERRY ORCHARDS AND THE FAILURE OF NINE SPECIES TO TRANSMIT LITTLE CHERRY DISEASE

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ABSTRACT

In a search for possible vectors of little cherry disease (LCD) more than 118 aphid species, including 13 new records for B.C., were trapped in yellow-pan water traps set out in Okanagan cherry orchards. Eleven species were trapped more than 250 times. In descending order of occurrence, they were *Aphis pomi* de Geer, *Aphis nasturtii* Kaltenbach, *Myzus persicae* (Sulzer), *Pemphigus populivenae* Fitch, *Aphis citricola* van der Goot, *Hyperomyzus lactucae* (Linnaeus), *Capitophorus horni* Borner, *Metopolophium dirhodum* (Walker), *Rhopalosiphum padi* (Linnaeus), *Capitophorus hippophaes* (Walker) and *Hayhurstia atriplicis* (Linnaeus).

Nine species of aphids reproducing on *Prunus* spp. including *Aphis pomi*, *Asiphonaphis pruni* Wilson & Davis, *Brachycaudus cardui* (Linnaeus), Brachycaudus helichrysi (Kaltenbach), *Dysaphis plantaginea* (Passerini), *Hyalopterus pruni* (Geoffroy), *Myzus cerasi* (Fabricius), *Myzus persicae*, and *Rhopalosiphum cerasifoliae* (Fitch) failed to transmit LCD to test trees of c.v. Sam.

INTRODUCTION

As part of a search for the possible vectors of little cherry disease (LCD), we made a survey of the aphids occurring in Okanagan cherry orchards from June to October in 1975 and 1976. This paper reports more than 118 species collected during the survey, including 13 new records for B.C. We also include a record of attempts to transmit LCD with 9 species of aphids from *Prunus* spp.

METHODS

Survey

Traps similar to those used by Moericke (1951) and Taylor (1960) were used in the survey. They consisted of 29 x 13 cm bright yellow, round plastic pans each with a screened 2.5 cm hole about 2.5 cm below the rim to prevent overflow and loss of specimens in the event of rain. Each pan was filled with about 8 cm of water and a few drops of liquid detergent were added to reduce surface tension and to cause any aphids alighting on the surface of the water to sink. The pans were set on adjustable stands and were maintained at the same height as the orchard undercover. Aphids were removed from the pans at weekly or semiweekly intervals and preserved in 70% alcohol for later identification. When the pans were cleaned, fresh water and detergent were added. Identifications were made by A. R. Forbes and C. K. Chan. Some specimens were submitted to W. R. Richards, Biosystematics Research Institute, Ottawa, Ontario, for confirmation of identifications.

Six traps were placed in each of 3 cherry orchards in 1975 and 6 were placed in each of 11 cherry orchards in 1976. Half of the traps were placed within the orchards and half were placed on the periphery. The orchards were located in the Penticton, Naramata and Summerland areas where LCD was still spreading. One orchard was located about 1.5 km east of the centre of Penticton, where the disease was first detected; 5 were located 2.5 to 10 km north of Penticton toward Naramata and 5 more were located in the Summerland area, 2 at the Research Station and 3 located 1.5 to 5 km north of the Station.

The orchards in which the traps were located were of mixed sweet cherry varieties, including Bing, Lambert, Van and Sam. The ground cover varied from dense to sparse and consisted mainly of mowed grasses and broadleafed weeds; a few orchards were clean cultivated or with sparse weed growth. Flora adjacent to the orchards consisted of grasses or other fruit trees including apples, pears, plums, peaches and apricots or sometimes, shrubs such as chokecherry, saskatoon, snowberry, rabbitbush, sagebrush, Oregon grape and sumac. Occasionally, Douglas fir, ponderosa pine, maple and poplar were also nearby.

Transmission tests

More than 700 transmission tests were conducted with 9 species of aphids reproducing on cherry and other *Prunus* species. For each test 50 or more aphids were confined in small cylindrical leafcages, first on LCD source trees for 2 or 3 days then on Sam indicator trees for 4 or 5 days.

The indicator trees were then sprayed to kill the

aphids and observed for red-leaf symptoms characteristic of LCD (Welsh and Cheney 1976). The species of aphids used and the number of tests conducted (in brackets) were as follows:

Aphis pomi de Geer (4): *Asiphonaphis pruni* Wilson & Davis (81); *Brachycaudus cardui* (Linnaeus) (19); *Brachycaudus helichrysi* (Kaltenbach) (99); *Dysaphis plantaginea* (Passerini) (35); *Hyalopterus pruni* (Geoffroy) (21); *Myzus cerasi* (Fabricius) (176); *Myzus persicae* (Sulzer) (138); and *Rhopalosiphum cerasifoliae* (Fitch) (130).

RESULTS AND DISCUSSION

Survey

Table 1 summarizes the total numbers of alate aphids trapped in the survey of Okanagan cherry orchards in 1975 and 1976. The traps caught 43,758 aphids during the 2 year period. More than 40 percent of them were trapped in August. Most of the species trapped were migrants from diverse hosts other than cherry (Forbes and Chan 1978b). Only *Hyalopterus pruni*, *Myzus cerasi*, *Nearctaphis bakeri* (Cowen), and *Rhopalosiphum nymphaeae* (Linnaeus) are known to reproduce on sweet cherry, *Prunus avium*, in British Columbia (Forbes and Chan 1978b).

Eleven species were trapped more than 250 times. In descending order of occurrence, they were *Aphis pomi*, *Aphis nasturtii* Kaltenbach, *Myzus persicae*, *Pemphigus populivenae* Fitch, *Aphis citricola* van der Goot, *Hyperomyzus lactucae* (Linnaeus), *Capitophorus horni* Borner, *Metopolophium dirhodum* (Walker), *Rhopalosiphum padi* (Linnaeus), *Capitophorus hippophaes* (Walker) and *Hayhurstia atriplicis* (Linnaeus).

Thirteen of the species trapped were new records for B.C. (Forbes and Chan 1978a, 1980, 1981, 1983). They were: *Aphis craccae* Linnaeus; *Brachycolus asparagi* Mordvilko; *Chaitophorus nigricentrus* Richards; *Chaitophorus pusillus* Hottes & Frison; *Chaitophorus saliciniger* (Knowlton); *Colopha ulmicola* (Fitch); *Cryptaphis bromi* Robinson; *Forda formicaria* von Heyden; *Kakimia polemonii* (Gillette & Palmer); *Macrosiphoniella ludovicianae* (Oestlund); *Rhopalomyzus lonicerae* (Siebold); *Therioaphis trifolii* (Monell); and *Uroleucon hieracicola* (Hille Ris Lambers).

Transmission tests

Aphid species that are known to colonize cherry or related *Prunus* spp. (Forbes and Chan 1978b) were considered to be the best vector candidates and were chosen for testing. Transmission tests with *Aphis pomi*, *Asiphonaphis pruni*, *Brachycaudus cardui*, *Brachycaudus helichrysi*, *Hyalopterus pruni*, *Myzus cerasi*, *Myzus persicae* and *Rhopalosiphum cerasifoliae* failed to transmit LCD. Thus 8 of the 13 species of aphids known from *Prunus* spp. in British Columbia (Forbes and Chan 1978b) were tested.

TABLE 1. Total number of alate aphids trapped in Okanagan cherry orchards 1975 and 1976.

Species	June	July	August	Sept.	Oct.	Total
Acyrthosiphon lactucae (Passerini)	12	9	-	-	-	21
Acyrthosiphon macrosiphum (Wilson)	8	4	1	1	-	14
Acyrthosiphon pisum (Harris)	23	58	1	3	-	85
Acyrthosiphon spp.	8	53	79	17	12	169
Amphorophora agathonica Hottes	9	8	-	-	-	17
Amphorophora parviflori Hill	-	1	-	-	-	1
Amphorophora spp.	23	7	8	17	18	73
Anoecia corni (Fabricius)	-	9	15	34	3	61
Aphis citricola van der Goot	-	-	1789	-	-	1789
Aphis craccae Linnaeus	1	-	6	-	-	7
Aphis fabae Scopoli	8	11	3	58	20	100
Aphis helianthi Monell	-	1	-	34	-	35
Aphis nasturtii Kaltenbach	27	2445	5593	-	-	8065
Aphis pomi de Geer	198	3551	9470	437	3	13659
Aphis spp.	120	121	24	67	60	392
Appendiseta robiniae (Gillette)	19	108	6	-	-	133
Asiphonaphis pruni Wilson & Davis	1	-	-	-	-	1

TABLE 1. (continued)

Species	June	July	August	Sept.	Oct.	Total
Asiphum sp.	-	1	-	-	-	1
Aulacorthum solani (Kaltenbach)	5	-	2	-	-	7
Aulacorthum spp.	6	9	13	12	5	45
Boernerina occidentalis H.R.L. & Hottes	1	-	-	-	-	1
Brachycaudus cardui (Linnaeus)	2	2	1	7	11	23
Brachycaudus helichrysi (Kaltenbach)	100	32	-	11	3	146
Brachycaudus sp.	2	-	-	-	-	2
Brachycolus asparagi Mordvilko	4	2	1	-	-	7
Brevicoryne brassicae (Linnaeus)	7	38	46	5	-	96
Cachryphora sp.	-	1	-	-	-	1
Calaphis spp.	1	2	-	-	-	3
Capitophorus elaeagni (del Guercio)	-	-	-	3	-	3
Capitophorus hippophaes (Walker)	49	119	97	23	5	293
Capitophorus horni Borner	89	182	95	95	26	487
Cavariella aegopodii (Scopoli)	26	10	-	-	-	36
Cavariella pastinacae (Linnaeus)	2	-	-	1	-	3
Cavariella spp.	36	13	-	1	-	50
Ceruraphis viburnicola (Gillette)	-	-	-	1	-	1
Chaetosiphon fragaefolii (Cockerell)	35	10	-	14	-	59
Chaitophorus nigrae Oestlund	3	1	-	-	-	4
Chaitophorus nigricentrus Richards	1	-	-	-	-	1
Chaitophorus populicola Thomas	-	1	-	-	-	1
Chaitophorus populifolii (Essig)	-	2	-	-	-	2
Chaitophorus pusillus Hottes & Frison	-	1	-	-	-	1
Chaitophorus saliciniger (Knowlton)	-	1	-	-	-	1
Chaitophorus spp.	-	1	2	-	-	3
Chaitophorus viminalis Monell	1	3	1	-	-	5
Colopha ulmicola (Fitch)	-	-	-	1	-	1
Cryptaphis bromi Robinson	3	-	-	-	-	3
Cryptaphis sp.	-	1	-	-	-	1
Cryptomyzus galeopsidis (Kaltenbach)	1	-	-	-	-	1
Cryptomyzus ribis (Linnaeus)	-	-	-	1	-	1
Cryptomyzus spp.	3	-	-	2	-	5
Diuraphis frequens (Walker)	2	1	-	-	-	3
Dysaphis plantaginea (Passerini)	3	-	-	-	-	3
Dysaphis sp.	1	-	-	1	-	2
Eriosoma lanigerum (Hausmann)	1	1	1	-	-	3

TABLE 1. (continued)

Eriosoma spp.	5	1	-	5	5	16
Essigella sp.	-	-	-	1	-	1
Euceraphis gillettei Davidson	2	2	3	-	-	7
Euceraphis sp.	1	-	-	-	-	1
Fimbriaphis spp.	1	3	5	288	-	297
Forda formicaria von Heyden	2	-	-	-	-	2
Forda sp.	2	-	-	-	-	2
Hayhurstia atriplicis (Linnaeus)	6	54	209	10	1	280
Hyadaphis sp.	1	2	-	-	-	3
Hyalopterus pruni (Geoffroy)	1	-	2	1	-	4
Hyperomyzus lactucae (Linnaeus)	23	83	119	328	114	667
Illinoia davidsoni (Mason)	-	-	1	-	-	1
Illinoia spp.	18	3	13	19	7	60
Kakimia polemonii (Gillette & Palmer)	3	-	-	-	-	3
Kakimia wahinkae (Hottes)	-	1	-	-	-	1
Lipaphis erysimi (Kaltenbach)	1	2	-	-	-	3
Macrosiphoniella ludovicianae (Oestlund)	2	-	-	-	-	2
Macrosiphoniella sp.	-	1	-	-	-	1
Macrosiphum euphorbiae (Thomas)	8	4	2	-	-	14
Macrosiphum rosae (Linnaeus)	5	3	-	4	2	14
Macrosiphum spp.	52	33	18	14	5	122
Metopolophium dirhodum (Walker)	1	2	5	213	182	403
Myzaphis sp.	1	-	-	-	-	1
Myzocallis coryli (Goeze)	5	3	-	-	-	8
Myzocallis spp.	2	37	5	1	-	45
Myzodium modestum (Hottes)	1	1	-	-	-	2
Myzus ascalonicus Doncaster	-	-	-	5	-	5
Myzus cerasi (Fabricius)	42	98	1	3	1	145
Myzus persicae (Sulzer)	4706	2717	164	161	108	7856
Myzus spp.	-	-	1	1	2	4
Nasonovia spp.	2	2	1	-	-	5
Nearctaphis bakeri (Cowen)	1	1	-	4	-	6
Nearctaphis sensoriata (Gillette & Bragg)	1	-	1	5	-	7
Nearctaphis spp.	3	1	-	-	-	4
Oestlundiella flava (Davidson)	3	3	6	-	-	12
Pemphigus bursarius (Linnaeus)	-	1	-	-	-	1
Pemphigus populivenae Fitch	3802	787	5	3	-	4597
Pemphigus spp.	389	85	8	8	18	508
Periphyllus brevispinosus Gillette & Palmer	1	1	-	-	-	2

TABLE 1. (continued)

Periphyllus testudinaceus (Fernie)	-	-	1	-	-	1
Phorodon humuli (Schrank)	63	42	7	-	-	112
Phyllaphis fagi (Linnaeus)	1	-	-	-	-	1
Prociphilus spp.	-	2	-	44	8	54
Pterocomma bicolor (Oestlund)	1	-	-	-	-	1
Rhopalomyzus lonicerae (Siebold)	-	-	-	1	-	1
Rhopalomyzus poae (Gillette)	-	-	-	5	8	13
Rhopalomyzus spp.	2	-	-	22	5	29
Rhopalosiphoninus staphyleae (Koch)	-	1	-	-	-	1
Rhopalosiphum insertum (Walker)	-	-	-	-	146	146
Rhopalosiphum padi (Linnaeus)	-	-	1	177	149	327
Rhopalosiphum spp.	-	-	-	1639	116	1755
Sipha elegans del Guercio	1	-	-	1	-	2
Sitobion avenae (Fabricius)	4	40	9	18	-	71
Sitobion manitobense (Robinson)	1	-	-	-	-	1
Therioaphis trifolii (Monell)	-	2	1	-	-	3
Tinocallis platani (Kaltenbach)	3	13	15	-	-	31
Tuberculatus annulatus (Hartig)	-	1	-	-	-	1
Uroleucon cirsii (Linnaeus)	-	1	-	-	-	1
Uroleucon hieracicola (Hille Ris Lambers)	-	3	-	-	-	3
Uroleucon spp.	7	29	13	53	8	110
Uroleucon taraxaci (Kaltenbach)	4	10	-	6	1	21
Utamphorophora humboldti (Essig)	3	1	-	-	-	4
Utamphorophora spp.	-	-	1	1	1	3
Wahlgreniella nervata (Gillette)	3	11	9	4	-	27
Total	10,027	10,907	17,880	3,891	1,053	43,758
% of total	22.9	24.9	40.9	8.9	2.4	

Dysaphis plantaginea from apple was also tested. It too failed to transmit LCD.

More recently it was shown by R. D. McMullen, that the apple mealybug, *Phenacoccus aceris* (Signoret) is a vector of LCD (Agr. Can. 1982). It is unlikely, therefore, that any aphid species can transmit the disease.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the help of C. Chong and W. Hurdal who made trap collections and assisted in the aphid transfers at Summerland.

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SEASONAL ACTIVITY OF ICHNEUMONID PUPAL PARASITOIDS OF *OPEROPHTERA* SPP. (LEPIDOPTERA:GEOMETRIDAE)

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ABSTRACT

Field placement of cocoons of *Operophtera* spp. was used to determine the timing of attack by pupal parasitoids of the winter moth, *Operophtera brumata* (L.), and the Bruce spanworm, *O. bruceata* (Hulst). *Coccygomimus hesperus* Tow. & Tow., the most abundant parasitoid recovered, attacked *Operophtera* pupae from early June until the end of August. At least two generations of *C. hesperus* occur each season. *Buathra dorsicarinata* (Pratt) was not recovered in numbers large enough to determine its timing of attack and no pupae parasitized by *Cratichneumon* sp. were recovered.

INTRODUCTION

Three native species of Ichneumonidae, *Coccygomimus hesperus* Tow. & Tow., *Buathra dorsicarinata* (Pratt) and an undescribed species of *Cratichneumon* are known to attack pupae of the introduced winter moth, *Operophtera brumata* (L.), and the native Bruce spanworm, *O. bruceata* (Hulst), on southern Vancouver Island (Humble in press). Over their range both *C. hesperus* and *B. dorsicarinata* have long flight seasons; the former is active from mid-May to late Dec., and the latter from mid-May to late Aug. (Townes and Townes 1960, 1962). In the Victoria area, the flight season for both species begins in mid-May. *Buathra dorsicarinata* flies until early Aug. (Humble in press), and *C. hesperus* until late Aug. (Humble unpub. data). The range and flight season of *Cratichneumon* sp. are unknown.

The timing of attack by these parasitoids on *Operophtera* pupae is unknown. Both winter moth and Bruce spanworm larvae mature between late May and early June, drop to the ground and pupate in silken cocoons. Pupae are present from mid-June to mid-Nov., and adults begin to emerge in early Nov. Although *Operophtera* pupae are present, they may not be suitable as hosts throughout the flight seasons of the parasitoids, since increasing host age can reduce the suitability of a host for parasitoid development (Schultz and Kok 1979). This study was carried out to determine the timing of attack by the pupal parasitoids on *Operophtera* pupae.

MATERIALS AND METHODS

Operophtera pupae were obtained by beating mature larvae from willow, broad-leaf maple and Garry oak on the University of Victoria campus. The larvae were provided with a substrate of moistened sand:vermiculite:peat moss (2:1:1) in screen-covered 25.4 cm plastic plant pots for pupation. The pots were held indoors at 15°C and 70% RH. The substrate was periodically sprayed with a 1% solution of sodium proprionate to inhibit the growth of mould (Maybee and Wylie 1961). Cocoons were sieved from the substrate as needed for field placement.

Pupae were placed in the field in four-mesh wire cages similar to those used by Price (1970) to prevent predation by small mammals or birds. Five cages were placed along the margins of a small (0.12 ha) stand of heavily defoliated willows growing in association with arbutus, Douglas fir, broad-leaf maple and red-osier dogwood. A thick shrub layer of snowberry, salmonberry, thimbleberry, Pacific blackberry, ocean spray and *Rosa* spp. was present along the margins of the stand.