First record of the Western Grape Leafhopper, *Erythroneura elegantula* Osborn (Homoptera: Cicadellidae), in Canada

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ABSTRACT

Surveys conducted in the South Okanagan Valley, British Columbia, revealed that a new leafhopper pest of grapes, the western grape leafhopper (WGL), *Erythroneura elegantula* Osborn, was widespread and often abundant in vineyards on the east side of the valley from just north of Penticton south to the United States border. Infestations occurred on drier upland sites where most commercial grape production occurs. The largest populations of up to 40 nymphs per leaf were recorded from commercial vineyards that had applied reduced rates of the insecticide carbaryl for control of the Virginia creeper leafhopper, *E. ziczac* Walsh.

Key Words: Western Grape Leafhopper, *Erythroneura elegantula*, distribution

INTRODUCTION

The western grape leafhopper (WGL), *Erythroneura elegantula* Osborn, is often considered the most important insect pest of grapes in the western United States as far north as southern Washington State (Wolfe 1955, Jensen and Flaherty 1981). Believed to be native to coastal California where it feeds on a species of wild grape, *Vitis californica* Bentham (Doutt and Nakata 1965), WGL is now found in most commercial vineyards throughout the western U.S. (Wells and Cone 1989). Previous research and surveys of arthropod pests of grape did not record WGL in vineyards in the south Okanagan and Similkameen Valleys of British Columbia (Madsen and Morgan 1972, McKenzie and Beirne 1972), and it had not been found elsewhere in Canada (Beirne 1956). As recently as 2000, the BC Management Guide for Grapes did not include WGL in its list of grape pests (BCMAFF 2000).

While conducting research on parasitism of Virginia creeper leafhopper (VCL), *E. ziczac* Walsh, eggs by *Anagrus daanei* Triapitsyn (Hymenoptera: Mymaridae) in South Okanagan vineyards in 1998 (Lowery *et al.* 2007) an unusual leafhopper was discovered and later confirmed to be WGL. This paper reports on the results of a survey conducted in south central BC to establish the distribution and abundance of this new leafhopper pest of grapes.

MATERIALS AND METHODS

Following verification that WGL had invaded the south Okanagan, during 1998 to 2003, leaves from commercial, wild and backyard grapes located in the main production areas from Kelowna south to the United States border and in the Similkameen Valley near Cawston and Keremeous were collected and brought to the laboratory for examination. A smaller number of samples was also collected from Virginia creeper, *Parthenocissus quinquefolia* (L.) Planchon, and Boston ivy, *P. tricuspidata* (Siebold and Zuccarini), vines. Leaves were initially inspected in the field and only

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brought to the lab if leafhoppers were present. For commercial vineyards, a minimum of five leaves infested with leafhoppers was collected from five locations per vineyard, while five to 10 infested leaves were sampled from individual grape or ornamental vines.

Numbers of WGL and VCL were also monitored approximately weekly throughout spring and summer in vineyards located between Penticton and north Osoyoos where WGL was first discovered. Six yellow sticky traps (7.5 x 13 cm, PheroTech Inc., Delta, BC) per vineyard were used to monitor adult leafhoppers. Nymphs of WGL and VCL were also counted on leaves sampled randomly from the infested zone (BCMAL 2006) and inspected in the laboratory under a magnifying lens.

RESULTS AND DISCUSSION

WGL nymphs were first collected in early July, 1998, in a commercial vineyard south of Penticton on the east side of Skaha Lake, Okanagan Valley, BC (49º 23' 23" N, 119º 33' 24" W). By mid-July nymphs showed pale yellow spots on the dorsum of the thorax and eyes appeared pale rather than dark red as for VCL. When adults appeared at the end of July specimens were sent to Dr. K.G.A. Hamilton, Agriculture and Agri-Food Canada, Eastern Cereals and Oilseeds Research Centre, Ottawa, for species verification. Voucher specimens are retained in the Canadian National Collection of Insects, Ottawa.

Characters for distinguishing nymphs of WGL from VCL are included in Wells and Cone (1989). Briefly, WGL have a whiter body colour, paired diffuse yellow spots on the dorsum of each thoracic segment in the last instar, pronounced pairs of setae on the dorsum of each abdominal segment, and pale rather than red eye colouration. The paired markings on the thorax of last instar VCL nymphs are larger and brown or reddish brown in colour. Adult WGL retain the paler body colour and pale eyes, and markings on the body and wings are red or reddish brown rather than brown.

From 1998 to 2003, nearly 80 commercial vineyards and 20 locations having wild grapes, table grapes or ornamental *Vitaceae* were sampled at least once in the Okanagan and Similkameen Valleys for WGL. This new pest was found to be widely distributed throughout the east side of the Okanagan Valley from just north of the city of Penticton (49º 31' 24" N, 119º 34' 13" W) south to the US border (Fig. 1). Infestations occurred on the drier areas away from the valley bottom. The main production areas for commercial grapes also occur in the drier upland areas.

WGL infests grapes throughout south-central WA (Wells and Cone 1989), but we are not aware if this species occurs in the northern part of the state. McKenzie (1973) reported that VCL was the only leafhopper pest of grapes found in the Okanagan Valley, BC. Two of the sites in this 1972 study were located south of Oliver within the current WGL distribution zone (Fig. 1). He did not survey any vineyards located between Penticton and Okanagan Falls, however, where the largest populations of this leafhopper were located in 1998.

Reports of leafhopper damage likely attributable to WGL dating back to the mid 1990s and the relatively widespread current distribution of this leafhopper suggests that it arrived in the Okanagan Valley many years before 1998. It is possible that small numbers of WGL have existed in BC for a much longer period of time and that only recently has the population expanded in response to warmer weather and an industry shift from hybrid varieties to more favourable *vinifera* varieties. Prior to 1990, most Okanagan and Similkameen vineyards were of French hybrid and *Vitis labrusca* varieties, which were found to be more hardy, productive, and resistant to pests and diseases (Bowen *et al.* 2005). Oviposition by VCL is lower on American varieties of *V. labrusca* than on *V. vinifera*, and younger nymphs often become entangled in the hairs

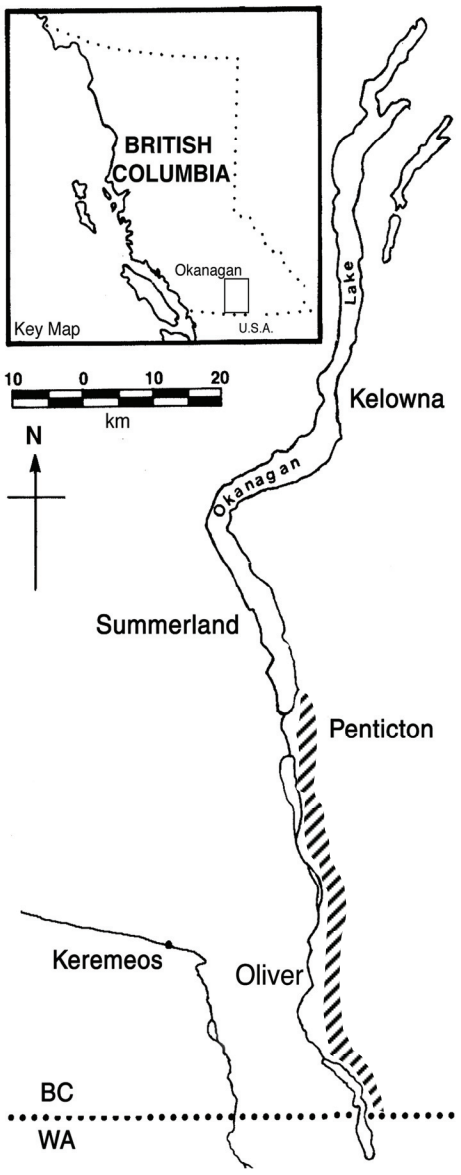

Figure 1. Current distribution of the western grape leafhopper, *Erythroneura elegantula*, on the east side of the Okanagan Valley.

of American grapes (McKenzie and Beirne 1972).

VCL have shorter developmental times than WGL and, therefore, occur more commonly at higher latitudes than WGL (Wells and Cone 1989). WGL is currently found in the upland portions on the east side of Okanagan and Similkameen viticultural regions 5, 3 and the southern portion of region 2, as designated by Bowen *et al*. (2005). The relatively higher temperatures in parts of these regions might partially explain the current distribution of this leafhopper, but it does not explain the absence of WGL from other areas, such as region 4 (Golden Mile), that are as warm as, or warmer than, infested areas farther north.

WGL was detected at only one of nine sites of non-commercial grapes or Virginia creeper vines located within the infested zone (data not shown). At this one site, only three nymphs were found on a sample of 10 leaves collected from one vine in north O.K. Falls. In certified organic vineyards and in unsprayed grapes and ornamental vines, populations were generally low, rarely exceeding one nymph per leaf (Table 1) or one adult per trap per day (Table 2). Numbers of WGL in the two organic vineyards might have been influenced by their close proximity to conventional vineyards that had large numbers of this pest. The highest densities of WGL were recorded in conventional vineyards. In certain areas of one vineyard located adjacent to the initial discovery site (north O.K. Falls 2), numbers of first generation WGL exceeded 40 nymphs per leaf in July. Very little green leaf material was evident on the leaves of these vines by the end of the season. Peak numbers in the monitored area of this vineyard were 24.1 nymphs per leaf (Table 1) and 15.9 adults per trap per day (Table 2). Discussions with this grower indicated that a serious leafhopper problem had occurred for several years previously. This and a second vineyard (south Penticton 1) with high numbers of WGL had both been sprayed repeatedly with reduced rates of carbaryl that had been used effectively to control VCL.

Monitoring of conventional vineyards suggested that recommended rates of carbaryl provided some control of WGL. Other than the two organic vineyards and the two conventional vineyards treated with reduced rates of carbaryl (south Penticton 1, north O.K. Falls 2), the vineyards were treated with carbaryl at full rates to at least

Table 1.

Numbers of western grape leafhopper (WGL), *Erythroneura elegantula,* and Virginia creeper leafhopper (VCL), *E. ziczac*, nymphs / leaf in commercial vineyards located on the east side of the Okanagan Valley ranging from Penticton in the north to Osoyoos in the south based on monitoring conducted during 1998 to 2003.

			Avg. no. nymphs/leaf	
Location	Date[1] (y/m/d)	Production practice	WGL	VCL
south Penticton 1	99/07/14	conventional	6.2	33.3
south Penticton 2	01/07/19	conventional	2.0	3.8
north O.K. Falls 1	98/07/06	organic	0.9	8.1
north O.K. Falls 2	99/07/15	conventional	24.1	18.3
north O.K. Falls 3	98/09/09	conventional	1.4	0.2
south O.K. Falls 1	01/08/30	conventional	1.5	<0.1
south O.K. Falls 2	01/08/30	conventional	1.7	0.6
south O.K. Falls 3	99/07/14	organic	0.7	22.3
north Osoyoos 1	02/06/24	conventional	0.1	1.1

[1]Except for north O.K. Falls 3, which was sampled only once, dates relate to peak numbers of WGL nymphs recorded during the year of monitoring when the leafhopper was first recorded at that location.

Table 2.

Numbers of adult western grape leafhopper (WGL), *Erythroneura elegantula,* and Virginia creeper leafhopper (VCL), *E. ziczac*, Adults / sticky trap / day in commercial vineyards located on the east side of the Okanagan Valley ranging from Penticton in the north to Osoyoos in the south based on monitoring conducted during 1998 to 2003.

			Avg. no. nymphs/leaf	
Location	Date[1] (y/m/d)	Production practice	WGL	VCL
north Penticton	02/05/23	conventional	0.1	0.5
south Penticton 1	99/06/16	conventional	10.1	51.7
south Penticton 2	01/05/16	conventional	0.1	30.4
south Penticton 3	01/05/16	conventional	0.1	4.1
south Penticton 4	01/05/16	conventional	<0.1	0.2
north O.K. Falls 1	98/07/31	organic	0.8	43.1
north O.K. Falls 2	99/06/16	conventional	15.9	14.3
north O.K. Falls 3	98/08/13	conventional	0.3	0.1
south O.K. Falls 1	01/08/07	conventional	1.4	8.5
south O.K. Falls 2	01/05/29	conventional	0.1	1.5
south O.K. Falls 3	99/08/18	organic	0.5	18.8
north Osoyoos 2	01/05/08	conventional	<0.1	0.6
north Osoyoos 3	01/07/23	conventional	<0.1	0.8

[1] All locations were monitored more than once. Dates shown relate to peak numbers of adult trapped during the year of monitoring when the leafhopper was first recorded at that location.

those portions where leafhopper numbers were damaging (Table 1, 2). Leafhopper populations in these vineyards were relatively low, but numbers of WGL often exceeded those of VCL, suggesting that the former species may be less affected by carbaryl. Resistance of WGL to various insecticides has been reported previously (AliNiazee *et al*. 1971). The first report concerned the failure of DDT to control this pest on grapes in California in 1952 (Stafford and Jensen 1953).

Parasitism of WGL by the egg parasitoid *Anagrus erythroneurae*, which overwinters in eggs of leafhoppers on plants in the families Rosaceae and Betulaceae (Lowery *et al*. 2007), might limit the range of WGL in the Okanagan Valley. Most vineyards on the east side of the valley that are infested with WGL are located adjacent to uncultivated areas dominated by sagebrush; there are few host plants that support overwintering *A. erythroneurae*. Reduced rates of carbaryl used to control VCL (BCMAFF 2000) likely caused the observed outbreaks of WGL in south Penticton 1 and north O.K. Falls 2. Reduced-rate sprays were ineffective for the control of WGL, but they would have reduced numbers of *A. erythroneurae*. Numbers of WGL quickly dropped below 1 nymph per leaf (data not shown) after the insecticide program was altered to a single well-timed spray to less than 10% of the vineyard where the heaviest infestation occurred. The effectiveness of insecticides for the control of WGL needs to be re-evaluated, and growers will have to consider altering their spray practices where WGL occurs.

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