Monitoring for potential leafhopper vectors (Hemiptera: Cicadelloidea and Fulgoroidea) of the causal agent of Australian Grapevine Yellows

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Summary

Green pan traps containing ethylene glycol, were used to monitor leafhopper incidence in a Chardonnay vineyard at Karadoc, Victoria, in an attempt to suggest potential vector species of the causal agent of Australian Grapevine Yellows disease. The incidence and abundance of *Orosius argentatus* (Evans), *Batracomorphus angustatus* (Osborn) and *Austroagallia torrida* (Evans) suggests that they may be potential vectors and should be studied further.

Introduction

Australian Grapevine Yellows (AGY) disease is widespread in South Australia and the eastern states of Australia. Although there are seasonal fluctuations, the highest incidence of the disease and the greatest crop losses due to it occur in the warmer viticultural regions particularly in the Riverland, Sunraysia, Riverina and Hunter Valley. Premium white wine grape cultivars such as Chardonnay and Riesling are most affected (Magarey and Wachtel 1985).

AGY has many similarities to grapevine yellows diseases in Europe particularly Flavescence Doree (FD) (Magarey 1986). A leafhopper borne mycoplasma - like organism (MLO) has been implicated as the pathogen causing FD (Caudwell *et al*. 1973). A MLO causal agent has also been proposed for AGY because of its similarities with FD. The efficacy of broad spectrum antibiotics such as oxytetracycline - HCl, the lack of efficacy of antibiotics such as penicillin and the presence of phloem fluorescence are observations that support this theory (Magarey and Wachtel 1985).

Most MLO associated diseases are known to have insect vectors. These vectors belong to the superfamilies Cicadelloidea (leafhoppers), Fulgoroidea (planthoppers), Cercopoidea (spittlebugs) and Psylloidea (psyllids) (Osmelak 1987). In Australia, at least seven MLO associated diseases are known. All appear to be caused by the same agent (Osmelak 1987). The common brown leafhopper, *Orosius argentatus* (Evans) is the vector that transmits the causal agent of some of these diseases and is also implicated as the vector of others.

In S.W. France, the leafhopper *Scaphoideus titanus* Ball (syn. *S. littoralis* Ball) is the vector of FD (Belli and Osler 1977). As this leafhopper appears to feed specifically on grapevine (*Vitis* spp), strategic spraying with insecticides such as parathion has effectively reduced the incidence of FD in vineyards (Caudwell *et al*. 1974). Although *S. titanus* has not been reported in Australia, the genus *Scaphoideus* is present (Evans 1966, Osmelak 1987).

Monitoring of leafhopper incidence in grapevines in N.W. Victoria to determine potential vector species of the causal agent of AGY commenced in 1982. This was part of a larger research program directed towards determining the epidemiology of the disease.

Materials and Methods

Green pan traps containing ethylene glycol were used to trap leafhoppers in a commercial vineyard of Chardonnay grapevines (*Vitis vinifera* cv. Chardonnay) from 1982 to 1985 at Karadoc, in Victoria. The selected vineyard was located in the Sunraysia region of N.W. Victoria where AGY incidence and

Figure 1. Trap locations. Karadoc 1982-85 (Not to scale)

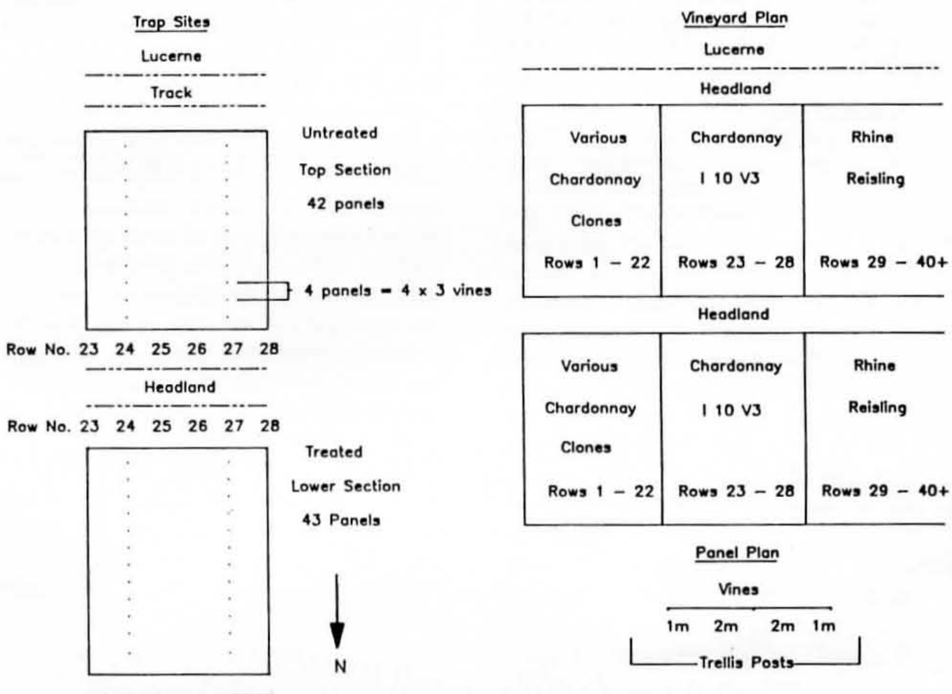

Figure 2. Comparison of the number of two leafhopper species trapped on grapevines (Vitis vinifera cv Chardonay)

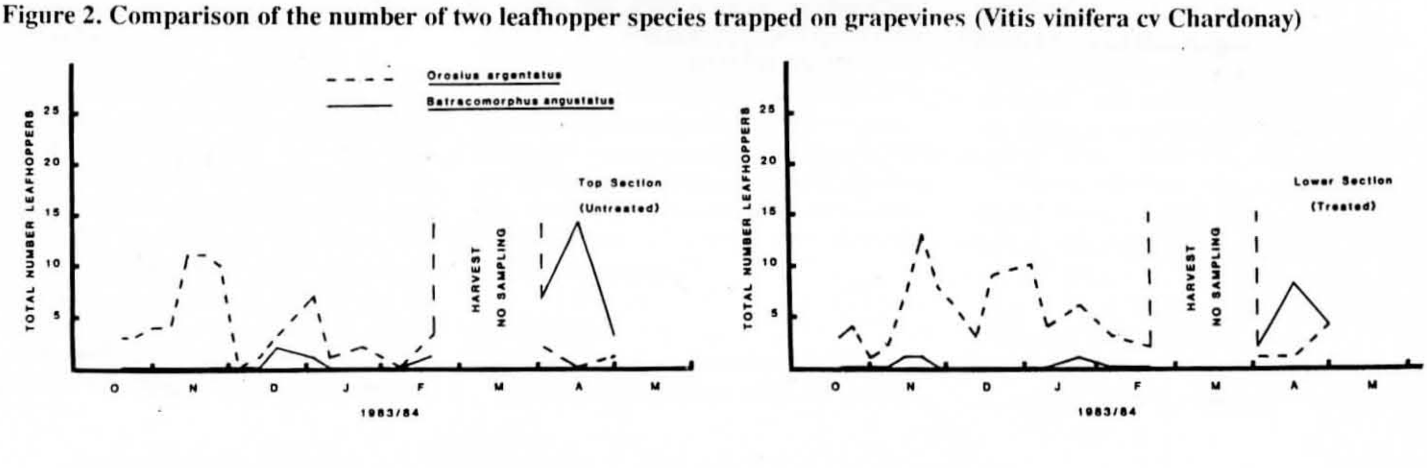

Table 1. Total number of cicadellids and fulgoroids trapped in a vineyard at Karadoc, Victoria from September 1982 to May 1985.

	Number			
	1982-83	1983-84		1984-85
Trap Numbers	6	22^{A}	20^{B}	16
Insect				
Cicadellidae				
Deltocephalinae				
Arawa sp.		1	2	
Balclutha saltuella (Kirschbaum)		10	6	
Deltocephalus hospes Kirkaldy			3	
Deltocephalus sp.		3		
Exitianus nanus (Distant)		5	3	
Exitianus plebeius (Kirkaldy)	1	2	1	
Limotettix incerta Evans			1	
Nesoclutha pallida (Evans)		3	4	
Opsius sp.	1			
Orosius argentatus (Evans)	11	84	111	18
Orosius canberrensis Evans		8	13	1
Unknown genus		1		
Typhlocybinae				
Austroasca viridigrisea (Paoli)		3	6	3
Kahaono viridis?	2			
Kahaono yarama Dwarakowska			1	
Kahaono sp.			1	1
Zygina zealandica (Myers)		7	9	14
Austroagalloidinae				
Austroagalloides karoondae? Evans	1			
Austroagalloides rosea Evans		1		
Agallinae				
Austroagallia torrida Evans		2	2	1
Idiocerinae				
Rosopaella sp.	1			
Jassinae				
Batracomorphus angustatus (Osborn)		30	18	2
Xestocephalinae				
Xestocephalus tasmaniensis Evans	1			
FULGOROIDEA				
Cixiidae				
Oliarus lilinoe Kirkaldy	1			
Oliarus lubra Kirkaldy	1			
Delphacidae				
Toya dryope (Kirkaldy)				1
Toya sp.			2	1
Meenoplidae				
Phaconeura caesa Fennah	2			

A. Top section: Untreated.

B. Lower section: Treated with parathion each growing season.

grapevine yield losses were high during 1982-83 (Emmett *et al.* 1983). Each pan trap consisted of an almost straight-sided green plastic bowl, 14 cm in diameter and 4.5 cm deep. The pan was fastened with wire ties to a 7 mm round mild steel hoop, which fitted under the lip of the top of the pan. The hoop had an extension handle with a 5 cm vertical section, then bent into a 14 cm long horizontal section. Traps were secured into position at a height of 1.5 m, by fixing the horizontal sections to the trellis posts. The pans were half filled with ethylene glycol. In an attempt to avoid specifically attracting insects to the traps, green pans were used so that leafhoppers moving onto the grapevine canopy, were caught. The colour spectrum of traps relative to crop canopy is discussed by Irwin (1980).

In 1982-83, six traps were placed in the top section of the vineyard, where no insecticide sprays were applied. Three traps were situated in rows 24 and 27 respectively. The traps were placed (on the trellis posts) along the rows at the end of every sixth panel 36 metres apart (Fig. 1). The distance between rows was approximately 3.4 metres. The sampling period was from 21 September 1982 to 14 June 1983.

In 1983-84, twenty traps (10 per row) were placed in the untreated (top) section and 22 traps (11 per row) were placed in the lower section where grapevines were sprayed with parathion at 20 ml/100L every 4 weeks commencing at bud-break in an attempt to control leafhoppers. The traps were placed in the same rows as the previous season and the entire length of the rows was monitored by altering the spacing between the traps along the rows to every fourth panel so that the traps were 24 metres apart (Fig. 1). The sampling period was from September 1983 to the end of May 1984. In addition, four traps were randomly placed in a lucerne field bordering the southern end of the vineyard during 1983-84.

In 1984-85, 16 traps (8 per row) were placed in the untreated (top) section along rows 24 and 27. Fewer traps were used as a labour shortage prevented any further monitoring. In each row, 8 traps were placed 24 metres apart.

The trap contents were collected weekly except during the 1984 harvest when collections could not be made. All leafhoppers and planthoppers were identified.

Results and Discussion

The total number of cicadellids and fulgoroids caught on Chardonnay vines between 1982-85, is shown in Table 1. No leafhoppers of the genus *Scaphoideus* were found. *O. argentatus* and *Batracomorphus angustatus* (Osborn) [syn. *B. punctatus* (Evans), (Knight 1983)] were the most abundant leafhoppers caught in the vineyard and their weekly incidence during 1983-84 is

Table 2. Total number of cicadelloids and fulgoroids trapped in lucerne at Karadoc Victoria from September. 1983 to May 1984.

Insect	Number
CICADELLOIDEA	
Cicadellidae	
Deltocephalinae	
Arawa sp.	4
Balclutha incisa Matsumura	2
Balclutha saltuella (Kirschbaum)	10
Deltocephalus hospes Kirkaldy	15
Deltocephalus vetus Knight	2
Exitianus nanus (Kirkaldy)	2
Exitianus plebeius (Kirkaldy)	2
Nesoclutha pallida (Evans)	3
Orosius argentatus (Evans)	49
Orosius canberrensis Evans	1
Typhlocybinae	
Austroasca viridigrisea (Paoli)	21
Kahaono sp.	1
Zygina zealandica (Myers)	4
Agallinae	
Austroagallia torrida Evans	85
Jassinae	
Batracomorphus angustatus (Osborn)	8
Tartessinae	
Tenuitartessus blundellensis (Evans)	1
Eurymelidae	
Ipoella brunneus (Evans)	1
Ipoella sp.	1
Katipo sp.	1
Membracidae	
Acanthucalis macalpini Evans	1
FULGOROIDEA	
Dictyopharidae	
Thanodictya praeferrata (Distant)	1
Nogodinidae	
Nurunderia chrysopoides (Walker)	1

shown in Fig. 2.

O. argentatus, a known vector of MLOs, is most abundant on vines during spring and summer. This leafhopper also occurs abundantly in spring and summer in tomato crops (Osmelak 1987) and in lucerne (Helson 1951). *B. angustatus* is a suspected, but as yet unproven vector of MLOs (Grylls 1979). The peak incidence of *B. angustatus* in vines in autumn may be important, as either a spring or an autumn infection of AGY has been postulated (P. A. Magarey, pers. comm.). This leafhopper is also abundant in lucerne during summer and autumn (Helson 1951). Lucerne can also be affected by 'little leaf' disease, which is caused by MLOs considered to be one of the 'type strains' of the Australian yellows disease complex (Bowyer 1974).

Austroagallia torrida Evans and *O. argentatus* were the most abundant leafhoppers trapped in the lucerne field (Table 2.). *A. torrida* is reported to transmit the causal agent of rugose leaf curl of clovers (Grylls 1954) and the disease has been shown to be associated with bacterium-like organisms (Behncken and Gowanlock 1976). Although *A. torrida* was not abundant on vines during the monitoring period, its abundance on lucerne, and its existing vector status, and the association of an Australian yellows disease agent with lucerne suggest that it should also be regarded as a potential vector of the causal agent of AGY and studied further.

A greater diversity of leafhoppers was trapped during the 1983-84 when compared to the other two seasons (Table 1), indicating that many traps are required for the monitoring if species composition and abundance in a crop are to be assessed adequately. The abundance of the various species caught in 1983-84 in the sprayed and unsprayed sections of the vineyard, indicates that the monthly parathion treatments for leafhopper control were ineffective.

The results indicate that three leafhoppers, *O. argentatus*, *B. angustatus* and *A. torrida*, should be considered as potential vectors of the causal agent of AGY and should be studied further.

It appears that longer term, more extensive monitoring of leafhopper incidence in grapevines is required to determine the vector of the causal agent of AGY and that a better understanding of the ecology of 'yellows' pathogens may lead to insights useful for control (Purcell 1985).

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