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Surveying the leaf arthropod community in Médoc vineyards under mating disruption against the European grapevine moth

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Abstract: Mating disruption (MD) is a well known efficient technical crop protection against grape berry moths used allover European vineyards. The method is specific and requires observations of non target pests like microscopic arthropods under the foliage. In 2010, a skill transfer between INRA and an agricultural supplier started in Medoc AOC region near Bordeaux. Three fauna monitoring occurred during the growing season: flowering, bunch closure and maturity. Biodiversity was always important in the monitored vineyards, and this concerned both beneficials and pests. Typhlodroms were the most represented in the leaf communities. The history of MD did not seem to influence the biodiversity observed, and we found no clear effect of weed cover occurrence. We report the others species which were counted by our methodology.

Key words: mating disruption, grape berry moths, fauna monitoring, microscopic arthropods, foliage

Introduction

Mating disruption (MD) is an efficient and expanding crop protection technique against grape berry moths used allover European vineyards (Hoffman & Thiéry, 2009; Thiéry & Delbac, 2011). The method was developed in the 80-90s in different European countries (Roehrich *et al.*, 1979; Stockel *et al.*, 1994). It is specific to these pests but like single pest targeted techniques it needs to be surveyed for the others (Delbac & Thiéry, 2010; Stockel *et al.*, 1997). In that respect, leaf insect community should receive specific attention to leaf pests and also disease vectors, principally leafhoppers in vineyards. The present study focuses on the leaf arthropods community and here we consider the microscopic arthropods under foliage: mites, thrips, aphids, scale insects and leafhoppers. In 2010, a skill transfer between INRA and an agricultural supplier was developed in the Médoc AOC region in the north of Bordeaux.

Material and methods

Study vineyards

Our study was located in the well known Médoc near Bordeaux wine-growing zone. The vineyards borders the Gironde estuary and extends over *ca.* 80km from the Bordeaux suburbs (Blanquefort) in its southern, Talais being its northern limit and cover very large areas, 16,500ha divided in eight "Appelations d'Origine Controlée". In its large majority, it produces red wines based on two main cultivars merlot and cabernet sauvignon. It represents also interesting climat variations from the north to the south, but also as a function of distance from the estuary. In this large production area, MD is well represented, 60% of the MD treated vineyards from Gironde being located there (Thiéry & Delbac, 2011). We selected five vineyards in this study along the entire length of the Médoc (Figure 1), each vineyard providing one monitored site.

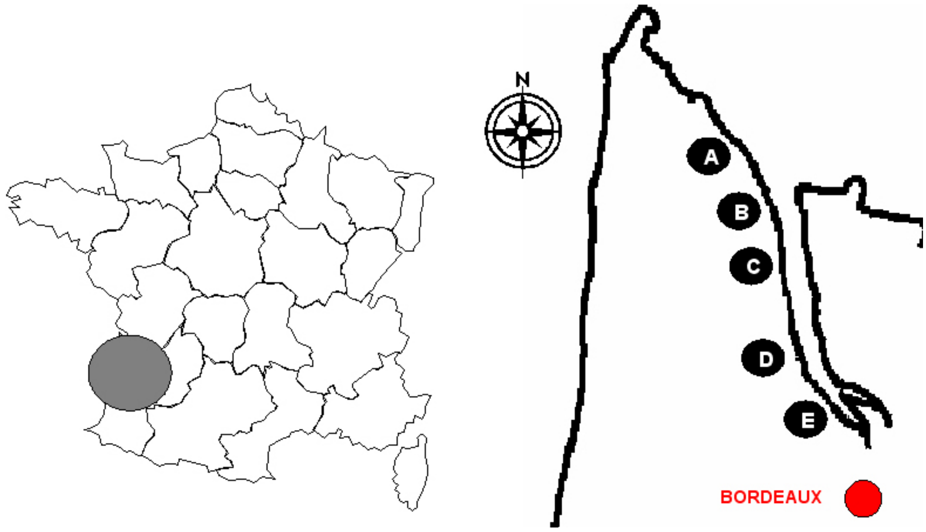

Figure 1. Localisation of the different sites.

These vineyards were selected on the basis of viticulture practices and their different history in MD (Table 1). Site A corresponded to compulsory pesticides application against Flavescence Dorée vector's: *Scaphoideus titanus*. Only one application was imposed in this area in 2010. The other sites were free of insecticides.

Table 1. Characteristics of the vineyards.

Sites	Localisation	Latitude	Longitude	Area under MD	Weed cover	MD history
A	Saint-Estèphe	45°16'02''N	0°46'27''W	174ha	Yes	2007
B	Pauillac	45°10'35''N	0°44'44''W	240ha	No	2000
C	St Julien	45°09'15''N	0°45'28''W	439ha	No	2001
D	Margaux	45°02'04''N	0°39'51''W	209ha	Yes	1998
E	Ludon	44°59'47''N	0°37'24''W	184ha	Yes	2000

Population sampling
The survey was conducted during the complete growing season 2010. One plot per location was sampled in the middle of the area. Three fauna monitoring occurred during season: flowering, bunch closure and maturity (Delbac *et al.*, 2006). On each plot, fifty leaves were collected from the centre of the vegetation at the rate of one leaf per vinestock and several rows assess, ensuring even coverage of the plot (Delbac *et al.*, 2005). Leaves were put in a manilla envelope (in order to avoid condensation) and stored in a cold room (4°C) before analyse. This storage did not exceed seven days. Population assessment was done in the lab

using a Labover® brush mites. With this classical brushing technique, arthropods were recovered to a disk stuck in sectors and quantification of their abundance was done under a binocular microscope at a magnification of X20.

Results and discussion

Mites

Pest mites. Spider mites (*Panonychus ulmi*) were the main pests observed (Table 2) representing in total 86.8% of the surveyed species. Their number varied during the season with different population levels according to development vine stages and areas. Sites C and E were the most infested with amounts near or exceeding one mobile form per leaf. The population levels of *P. ulmi* increased in general between spring and summer with a rise in egg laying in July and a stabilization of mobile forms at the end of the season. These ratings were similar to those that can be commonly observed in this region (Delbac & Thiéry, unpublished data).

Table 2. Different categories, eggs (E) or mobile instars (MI) and species counted (number per 50 leaves).

		Typhlodroms		*Panonychus ulmi*		Thrips	Scale insects	Acariosis	Grape Erineum
Sites	Date	E	MI	E	MI	MI	MI	MI	MI
A	6/9	64	32	8	8	0	0	0	0
	7/19	4	76	12	32	0	0	0	0
	8/31	12	16	16	16	0	0	0	0
B	6/7	48	32	8	32	0	0	0	0
	7/13	36	108	48	116	0	0	0	0
	8/26	4	16	0	24	0	0	0	0
C	6/9	120	152	0	0	0	0	0	0
	7/19	40	104	4	0	0	0	0	0
	8/31	0	24	12	32	28	0	28	0
D	6/8	208	224	24	40	8	0	8	0
	7/15	36	156	8	32	0	4	0	4
	8/27	0	36	8	28	16	0	16	0
E	6/4	0	40	0	24	0	0	0	0
	7/15	12	32	64	54	0	0	0	0
	8/27	12	20	28	56	0	0	0	0

We also observed wormlike mites (Eryophyids), responsible from grape *Acariosis* and *Erineum,* respectively at sites C and D and only D. The first mite, *Calepitrimerus vitis*, occurs mainly late in the season when vine stop growing in bunch closure stage. Population levels well above the 0.56 individual per leaf observed, and no specific damage was noticed because of it. For both species, because of their very small size, the observation required a high magnification (X50).

Predatory mites. Predatory mites were found in all samples and zones (Table 2). Their population levels varied according to the site but were never lower than 0.4 mobile forms per leaf. They all members of the Phytoseiidae family which are considered as good regulatory mites populations (Kreiter *et al.*, 1991) and whose populations grow easily under MD (Delbac *et al.*, 1996b).

Typhlodrom species present were not identified during the study. From population dynamics and the early presence at the beginning of the season, we concluded that these populations of predatory mites were "protective type", like *Typhlodromus pyri*. This species is nearly 95% of the predatory mite population of our others studies in the region (Delbac *et al.*, 1996b; Delbac *et al.*, 2005). It is corroborated by others studies: it was showed that *T. pyri* represented nearly 80% of individuals collected in Bordeaux vineyards (Coulon, 1995) and it was the dominant species in all the French vineyards (Kreiter *et al.*, 2000).

Red spider mites vs *predator.* The number of mobile forms (larvae + adults) of typhlodroms was either higher or similar to spider mites (Figure 2). A drop in predator populations classically appeared during the season due to the dilution of the populations in the vegetation or the effect of fungicide treatments (Baillod *et al.*, 1982). Low occurrence of the foliage of these beneficials is sufficient to ensure effective biological control, and the threshold of 0.5 mobile forms per leaf early in the season was quantified as a threshold allowing successful control for the complete year in Gironde (Lemaitre, 1995). The five areas were all above this threshold (Table 2). This couple pest-predator has long been known and its timely evolution does not show major problems in Médoc area. Typhlodroms ensure their role as natural regulation without the need for intervention. This region, historically known to damage of *P. ulmi* a few decades ago, is now under cover thanks to beneficial mites. However, the current extension of Flavescence dorée disease associated with the extension areas of compulsory treatment, (mainly large range pyrethrinoids) are problematic for their significant side-effects on populations of Typhlodroms (Delbac *et al.*, 2005). Thus accurate future monitoring of the red spider mites / typhlodroms will be needed.

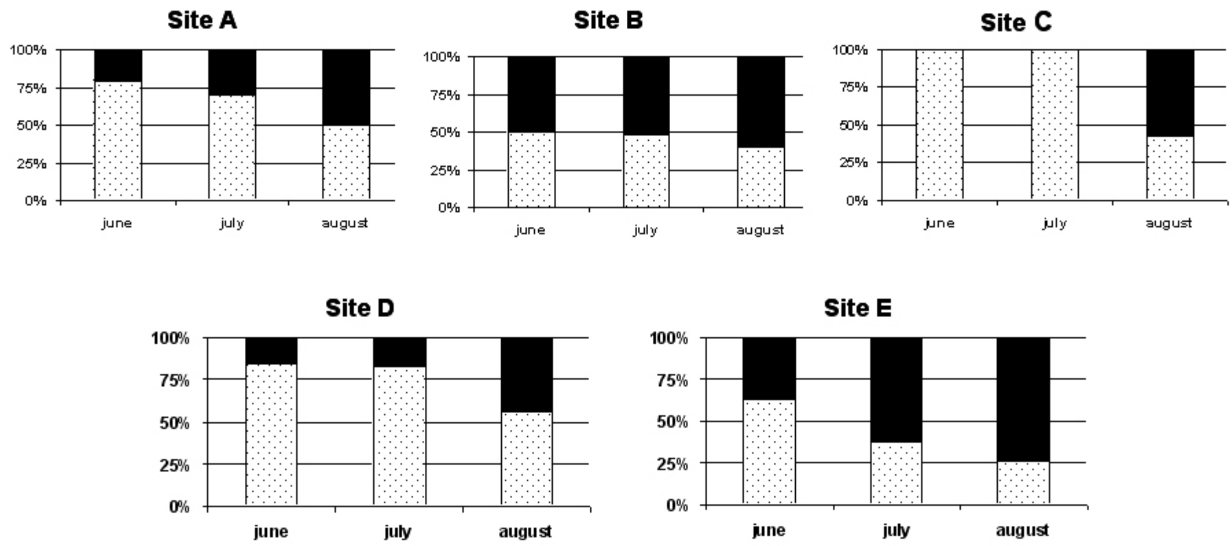

Figure 2. Evolution of proportion of typhlodroms (white with black points) *vs Panonychus ulmi* (black) per site during 2010.

Insect pests

We could easily observe the Thrips of the vine, *Drepanothrips reuteri*, as well larvae and adults. It is generally anecdotal, often present during the counting. But for this species, the brushing technique is not the most adapted compare to the dip-wash-filtration technique (Boller, 1984).

Larvae of scale insects (Diaspididae) were scored but not identified. Juvenile instars observed in the summer period corresponded to the Diaspines colonizing phases on the vine. Outbreaks of these pests, so far considered secondary, were found in the Medoc in 2009. In 2010, population levels were significantly lower and higher levels of parasitism were counted on some plots (M. Anneraud, pers. comm.).

For information, other insects were noticed during the counting, like leafhopper larvae (*Zygina rhamni*, so called the "Italian grape leafhopper" especially this summer) and aphids (undetermined, often related to weed plots) or of *Scaphoideus titanus* exuviae.

It is easy to observe these species by others methodology such as *in situ* larval counts, techniques most suitable and sure for these macroscopic species.

Complementary notes

Limited observations on the above species will not be enough because other arthropods can be viewed in the counts. Commonly in Gironde, we could observe:

- larvae of aphid Phylloxera, *Daktulosphaira vitifoliae*, whose populations have often been recorded in 2010 on *Vitis vinifera* (Anonymous, 2010),
- larvae of green leafhopper (*Empoasca vitis*)
- eggs of Chrysops, Neuroptera generalist predators whose action on green leafhopper is reported in MD (Delbac *et al*., 1996a),
- eggs and larvae of Anystidae, predatory mites, red-orange to trapezoidal (Rambier, 1958),
- larvae and adults of Tydeidae, mites often very numerous in the bud, not phytophagous (Rambier, 1958) and served as alternative food for Typhlodroms (Kreiter *et al*., 1991). The brushing technique used is well adapted to the last two types of mites.

Conclusion

Rather important diversity in leaf arthropod community was found under MD, and thus this control technique can be considered as non noxious, eventually favorable for such biodiversity. Prey-predator mite model is stable in our study area during the season without specific phytosanitary intervention. However, such surveys should continue several successive years to ensure this stability. Because the technical means of observation and the skills in systematic are rarely accessible to the vine grower, it is important to transfer this technology to phytosanitary councillors who will be better able to meet the needs of farmers.

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