

## **Experience with mating disruption technique to control grape berry moth, *Lobesia botrana*, in Trentino**

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**Abstract:** The efficacy of mating disruption for controlling grape berry moth, *Lobesia botrana*, was evaluated from 1991 to 1999 in Trentino. Tests began on a surface of 14 ha in 1991 and reached 1537 ha in 1999. This surface is divided in 6 different areas, ranging from 10 ha to 1100 ha. The results are quite promising, and during these 10 years we collected, especially in the large area of 1100 ha, a lot of experience about different controls, reduction of pheromone-dose/ha, behaviour of the population, new pests, organisation of the vine-growers, contacts with cooperatives and the Province of Trento.

**Key words:** grape moth, *Lobesia botrana*, mating disruption

### **Introduction**

During the last decades research has provided a very promising method of control of the grape moth, the mating disruption technique. Experiences with this technique are being increasingly gained all over Europe. In Italy, about 2000 ha are subjected to mating disruption and the province with the largest area is the Province of Trentino with about 1550 ha, equivalent to about 20% of the total wine producing area.

The area subjected to mating disruption increased between 1991 and 1999 from 14 to 1537 ha and during those years a considerable amount of information could be gathered. The technique proved to be very efficient particularly in the case of the following two basic conditions: (1) large areas involved, (2) low pest population density.

During all those years different behaviours and consequences as a result of the application of the mating disruption technique were observed and we consider it interesting pointing out some of the results. The farming world starts to get acquainted to the mating disruption technique and the affected areas are increasing because the growers themselves are getting convinced of the advantages.

Modern viticulture requires an increasingly constant presence of the grower in the field for an increasing number of manual operations. The growers themselves which are enabled to work in a cleaner ecosystem are therefore the first beneficiaries of the mating disruption technique.

### **Materials and methods**

#### ***Mating disruption and area involved***

As already mentioned, the area of mating disruption expanded from the initial 14 ha of the "Sottodossi di Mezzocorona" to most of the viticultural area of the "Piana Rotaliana" and of Lavis. Further areas are the hills around Trento, Dro and Arco in the Sarco valley, Ala and

Rovereto in Vallagarina and Telve in Valsugana. Most of the observations refer to the "Piana Rotaliana", where in 1999, 1164 ha (76,1% of the total area of mating disruption) were located.

### ***Mating disruption and number of growers involved***

Viticulture in Trentino is characterized by a high degree of fragmentation of the farm units, and this aspect would constitute a severe limitation to the applicability of mating disruption, if there were not the co-ordinating activity of the growers' co-operatives.

Table 1. Area and number of growers involved in mating disruption in viticulture

| Year | Area (ha) | Number of Growers |
|------|-----------|-------------------|
| 1991 | 14        | 36                |
| 1992 | 75        | 158               |
| 1993 | 179       | 276               |
| 1994 | 217       | 341               |
| 1995 | 137       | 254               |
| 1996 | 177       | 321               |
| 1997 | 233       | 386               |
| 1998 | 653       | 749               |
| 1999 | 1537      | 1447              |

Table 1 shows the area and the number of growers involved in mating disruption. In 1999 the area of 1537 ha comprised 1447 different growers. The most important duties of the growers are the timely and correct placement of the dispensers and the avoiding of sprays against the grape moth unless under specific authorisation.

### ***Dispensers***

Until 1995 ampoules (RAK 2) provided by the German producer BASF were used. From 1996 onwards, we have used the "spaghetti" of the Japanese company Shin-Etsu.

About 500 dispensers are placed per ha and one "spaghetti" therefore serves about 20 m<sup>2</sup>. The timing of the placement coincides with the beginning of the flight of the first generation and needs to be as regular as possible over the whole area. In the border areas a higher degree of protection is required. This is achieved either by increasing the density of the dispensers in the border area of 15-20 m, or by extending the protected area for further 15-20 m towards the exterior. The dispensers are subjected to a series of quality controls for the assessment of the correct release of the pheromones into the vineyard.

### ***Mating disruption and evaluations***

In order to assess the efficacy of this method, an accurate control of a series of traps inside the "disruption"-zone was carried out. Absence or presence of flight are fundamental parameters to be taken into account: if the method works, there shouldn't be captures in the traps. During the 9 years, increasing the area, there has never been a capture in the traps inside the "disrupted" zone; a few captures, however, took place in the border areas.

In addition to this evaluation, visual controls were carried out to estimate the incidence of damage of the first generation and the presence or absence of second generation eggs. In a fi-

nal assessment the real efficacy of the method was evaluated. The assessment of oviposition and final damage were carried out in distinct areas separating the border areas from the central areas. The assessment of the oviposition of the second generation is decisive for the achievement of an efficient control. According to this assessment, the growers will be advised on the necessity of carrying out a further treatment.

With increasing areas, the assessment of oviposition of the second generation in the whole area within a short period of time becomes difficult. For this reason since 1998 the method proposed by Dr. Charmillot of the Federal Agricultural Research Station in Changins in Switzerland has been applied.

The controls are being carried out on the first generation: at least 100 grapes are examined in different areas and the population quantified; in case the incidence of the grape moth exceeds 5-8% of grapes with nests control measures on the second generation will become necessary.

### ***Mating disruption and evaluations on the first generation***

In 1998, on the basis of the evaluation of the first generation about 75 ha were sprayed with a single treatment against the second generation. This represents 12% of the total area of 656 ha of mating disruption. These 75 ha were under mating disruption for the first year and have always been areas of high population densities of the grape moth.

One of these treated areas was "Vizinia" at Mezzocorona; the only varieties grown there were Chardonnay and Pinot Gris, the most susceptible varieties in our environments, and the evaluation on the first generation revealed on average an incidence of 5.6% of grapes with larvae, with the highest values reaching 39.5%.

Nevertheless, the effect of mating disruption was already visible during the first year also in this area. Table 2 shows the first generation population outside the disruption area (34.7% of grapes with nests), in the border area (13.1% of grapes with nests), in the disruption area next to the border (30 m: 9.1% of grapes with nests) and in the centre of the disruption area (2.5% of grapes with nests). In 1999 about 30 ha were sprayed (1.9% of the area covered by mating disruption).

Table 2. Evaluation of first generation in the area "Vizinia" at Mezzocorona

| outside disruption area | % of grapes with nests of grape moth |                                    |        |
|-------------------------|--------------------------------------|------------------------------------|--------|
|                         | border area<br>(0 - 10 metres)       | area next to border<br>(30 metres) | centre |
| 34,7                    | 13,1                                 | 9,1                                | 2,5    |

## **Results and discussion**

The results were generally promising, showing a very low incidence of damage. Table 3 shows the mean damage (% of grapes with larvae) at harvest in the area "Piana Rotaliana". The figures in the table speak for themselves and don't require much comment.

### ***Mating disruption in areas of high population density***

In two areas of high population density where the control was carried without chemical means using only mating disruption the evolution of damage was monitored.

Table 3. Final evaluation - % of grapes with larvae in the area "Piana Rotaliana"

| Year | % grapes with larvae |
|------|----------------------|
| 1991 | 0,9                  |
| 1992 | 4,4                  |
| 1993 | 3,2                  |
| 1994 | 1,3                  |
| 1995 | 1,8                  |
| 1996 | 0,9                  |
| 1997 | 1,2                  |
| 1998 | 0,9                  |
| 1999 | 1,0                  |

*Area "Camorzi" at Mezzocorona.* This area is covered by mating disruption since 1993. The incidence of damage near the inhabited area was initially high (up to 16,3% at the border). During the years this incidence got considerably reduced resulting in a very low population density.

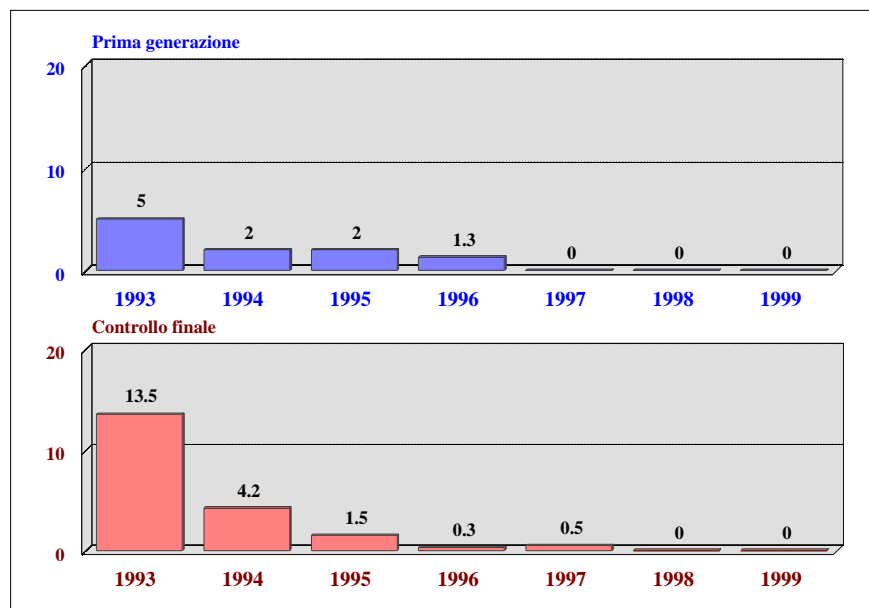


Figure 1. Percent grapes with larvae of first and second generation in the area Camorzi at Mezzocorona from 1993 to 1999.

*Area S. Michele a/A.* On the estate of the Istituto Agrario di S. Michele all'Adige, mating disruption is being applied from 1997 on ca. 21 ha of vineyards. In 1997, the results were promising (on average 3.6% of grapes with larvae) with the exception of some areas bordering to forests (*e.g.* the alluvial fan "Rauti") with a very high incidence of damage at

harvest. The damage in those areas was distributed as follows: border area 22.2%, centre 4,5%. The mean value was 9.8% of grapes with larvae of the grape moth.

In 1998 and in 1999, the situation changed considerably: the mean damage on the estate was 0.05% and 0.21%, respectively, but also in the area with high incidence of damage in 1997 (alluvial fan "Rauti") there was a reduction of the damage with the following distribution: (1) border 0.5% and centre 0% in 1998, (2) border 1.7 % and centre 0.5% in 1999.

Table 4. Final evaluation "alluvial fan Rauti" S.Michele a/A. Percent grapes with larvae

| Year | Border<br>(0 - 10 metres) | Centre | mean damage |
|------|---------------------------|--------|-------------|
| 1997 | 22.2                      | 4.5    | 9.8         |
| 1998 | 0.5                       | 0      | 0.15        |
| 1999 | 1.7                       | 0.5    | 0.9         |

The varieties grown in this area are Sauvignon Blanc, Rheinriesling and Pinot Gris, which are all extremely susceptible varieties; the obtained results therefore assume even further significance. This confirms that problems would be more likely during the first year of application with a reduction to follow thereafter.

#### ***What happens when mating disruption is halted?***

From 1992 to 1994, mating disruption was increasingly applied on an area cultivated with "Teroldego" grapes between the urban centres of Mezzocorona and Mezzolombardo. From 1995, the application has continued in the area of Mezzocorona, whereas it was interrupted in the municipality of Mezzolombardo. Thus it was possible to compare the pest populations during the following years performing evaluations on the first generation. The results show that an interruption of mating disruption is automatically followed by an increase of the pest population.

It can be observed that at Mezzocorona with continued mating disruption the population is constantly kept at very low levels with a trend to further decline, whereas at Mezzolombardo with the interruption of the application the population resumes to increase.

This underlines the general validity of the mating disruption technique, which shows the best results after application over a number of years, as could be confirmed on various occasions; in fact it is so far the only known method able to reduce the population in the long term. From 1999 mating disruption has been applied again in the area of Mezzolombardo.

#### ***Mating disruption and new pests***

With the application of this strategy of control and the reduction of the use of chemical pesticides new problems may arise in the respective areas. This is what happened in 1998. In some areas located between 350 m and 450 m on the hill of Faedo damages caused by *Argyrotaenia pulchellana* were detected, reaching a maximum of 8% in some vineyards.

This insect is very polyphagous and completes three generations a year. Normally it is the second generation which can cause damages on the vines in restricted areas. The larvae feed on the berries and on the stalks of the grapes with common erosions and an abundant production of silk as compared to the grape moth. In general, the sprays against the second generation of the grape moth control also this pest.

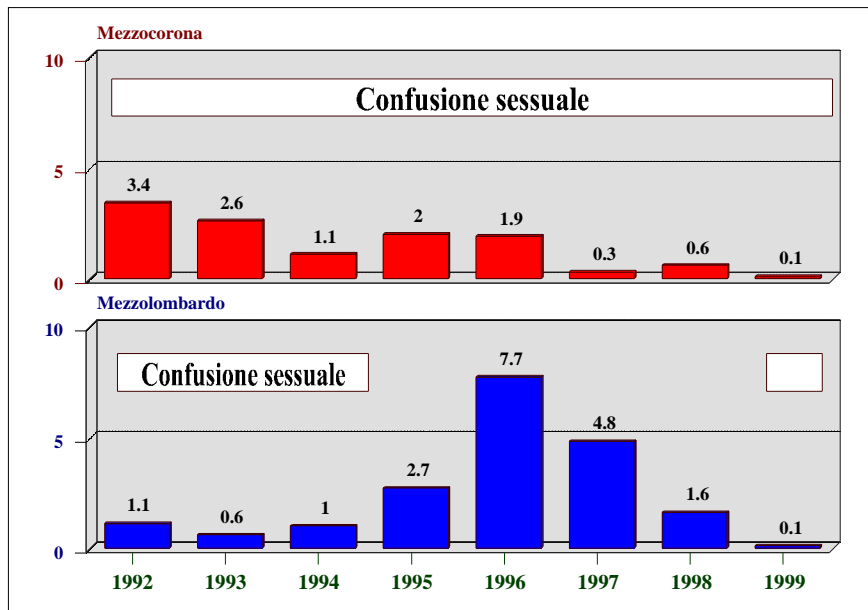


Figure 2. Effect of mating disruption on the population of *Lobesia botrana*. Percent of grapes with first generation larvae

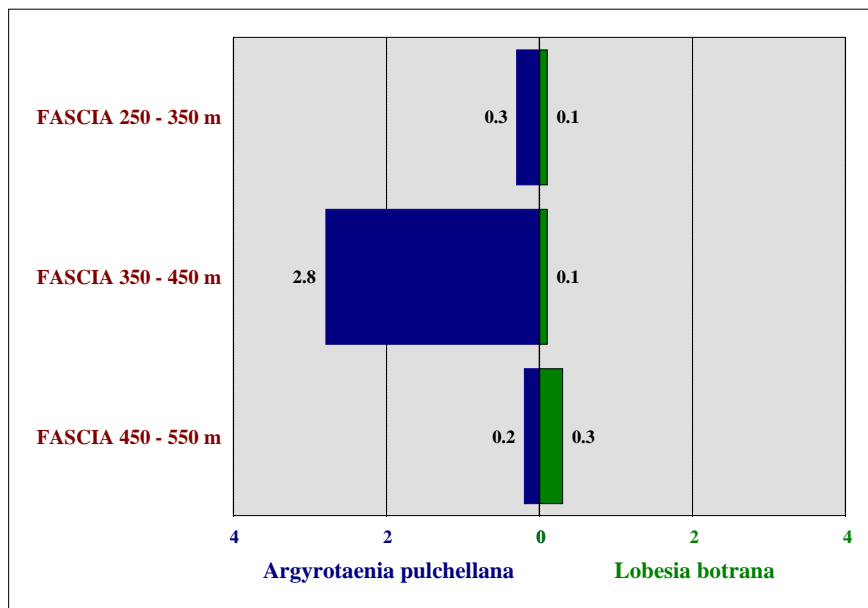


Figure 3. Hill of Faedo. Percent of grapes with larvae of *Argyrotaenia pulchellana* and *Lobesia botrana* at harvest in 1998.

Since the beginning of the mating disruption programme (1991) *Argyrotaenia pulchellana* appeared for the first time in 1998. In 1999 this pest appeared in some restricted areas, but

with lower intensities than in 1998. This shows us that a certain level of attention should always be maintained, not only in order to control the grape moth, but also in order to prevent possible new problems.

*Mating disruption in future.* This interesting method requires some efforts in the next future. The first point is, that on the basis of the achieved results, the area of applied mating disruption can be considerably extended leading to a viticulture with reduced impact on the environment in general and on the human population and the growers in particular.

A further possibility derives from the cooperation with Dr. Charmillot in Switzerland, who has worked for some years with reduced dosages of pheromones (reducing the number of dispensers up to 1/3 of the full number) on areas with very low pest population densities or on areas covered by mating disruption for several years.

From 1998 reduced mating disruption (250 dispensers/ha instead of 500) has been applied on an area of 47.5 ha at Mezzocorona, which had been covered by mating disruption for the previous 7-8 years and which showed very low pest population levels. The results were very promising both in 1998 and 1999. The long term effect however still needs to be evaluated.

This confirms that after determining the validity of a method there is never an end to the quest for improvement, and the cooperation with foreign partners in research is a useful way for achieving this purpose.

Table 5. Total number of taxa (taxa is a parameter used for summarising the diversity of the fauna; it becomes thus possible to concentrate in a single concept various taxonomic levels, including order, family, subfamily, genus, species). Comparison of 3 orchards with different control strategies (1991 to 1994).

|                      | harmful species | useful species | indifferent species |
|----------------------|-----------------|----------------|---------------------|
| organic orchard      | 36              | 28             | 11                  |
| pilot orchard        | 32              | 21             | 10                  |
| conventional orchard | 30              | 14             | 6                   |

## Conclusions

These last 9 years of research on mating disruption in viticulture have yielded valuable results for the control of the grape moth. The work is intense, but also satisfactory, and in future we will even require a stronger participation of the growers during the evaluation of the first generation.

With an increasing extension of the areas covered by mating disruption some general aspects need to be further investigated. The observations carried out in horticulture from 1991 to 1994 revealed that the application of mating disruption (pilot orchard) together with the reduction of the amount and spectrum of fungicides used (only Ziram, Delan and IBS) leads to an increase of the biodiversity of the agro-ecosystem particularly in favour of the "useful" organisms. The impoverishment of the ecosystem in conventional horticulture affects mainly the "useful" species. The more a system is complex, the more it becomes stable in time.

Much more research at various levels is still necessary, however an increasing interest of the cooperatives and the growers can be mentioned as a positive aspect, which will facilitate the acquisition of further knowledge.

The control of *Empoasca vitis* still remains to be improved, after which the "problem of the phytophagous organisms of vines (grape moth, red spider mite and vine leafhopper)" will be fully managed through an integrated approach.

Maybe this is too big a statement for the moment, but who approaches the problem with enthusiasm, conviction and the spirit to create deeds rather than words still believes in an integrated control based on values and principles and not on chatter. Time is always an inexorable judge!

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