ISONET L

A new approach to the control of European grapevine moth (Lobesia botrana)

Morphological and biological features of *Lobesia botrana*

Adults forewings sprinkled with small coloured areas (blue, greyish, reddish brown and yellowish).

Egg flat, lenticular, almost circular; yellowish when first laid, becoming pale grey in colour.

Newly hatched larva light hazel or almost white with a black head.

Mature larva (5th instar) (8 to 10 mm) yellowish green to dark green with a brownish yellow head.

The **European grapevine moth** is widely found throughout the whole of southern Europe and particularly infests the southernmost vineyards.

Although potentially polyphagous, the species generally infests vines (its original hosts), but also attacks the leaves and fruits of wild plants such as strawberry trees, jujubes etc.

European grapevine moths overwinter as diapausing pupae in silken cocoons in tree bark crevices or in other protected areas. The first adults usually emerge in April but emergence varies according to local mean temperatures. Male moths always emerge before females (proterandry).

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ISONET L – Technical notes

Three or four days after emergence of the moths, the mated females start to lay eggs on flower buds, sometimes on bracts, on vine-shoots and less frequently on leaves.
The incubation period varies from one to two weeks. After the larvae have hatched and completed the "strolling stage", they perforate the flower envelope and penetrate the bud.
Each larva attacks several buds (up to 6-8 different buds), wrapping them with a few silken threads and creating a sort of sheath or "nest".
The adults of this generation emerge between June and July.
After mating, female moths lay their eggs directly on the grapes.
After an incubation period of 4 to 7 days, the newly hatched larvae penetrate the grapes.

- Functioning of Isonet L dispensers with regard to the European grapevine moth

Isonet L is a controlled release dispenser containing a synthetic pheromone which is chemically identical to the natural pheromone of the female European grapevine moth.
Its effectiveness largely depends on population density, field dimensions, wind speed and mean temperatures.

If the number of female moths in the vineyard is low, the false scent trails produced by the synthetic pheromone released into the air simply "distract" the male moths and prevent them from locating the females and from mating.

If the number of female moths is high, then some additional chemichal treatments may be needed, in order to reduce the pest population in the vineyard.

These applications should target first generation moths in order to reduce the moth population density and to allow Isonet L to carry out its mating disruption activity.

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PRODUCT SPECIFICATION

Isonet L dispensers consist of two parallel brown-red polymer tubes. The wire-filled tube is designed to be twisted around the vine shoots, while the other sealed tube is filled with the specific pheromone. Isonet L twist-tie dispensers are supplied in vacuum packs of 500 units.
In case of left-over stocks, unopened packages can easily be stored in cold storage facilities at temperatures below 10 °C (50 °F).
If cold storage occurs, dispensers must be kept at room temperature for at least one month prior to field application in the following season.

Application rate

- 500 dispensers per hectare in the case of curtain training systems.
- 750 dispensers per hectare in the case of overhead arbour training.

Chemical structure

(E,Z)-7,9- Dodecadienyl acetate

Nominal field life

Average dispenser release life is 140 to 160 days (**ALWAYS** depending on local daily mean temperatures and average daily wind velocity).
Early rather than late application is recommended.
Research data show that bringing the date of application of the dispenser forward by one month, only reduces the field life of the dispenser by a few days.

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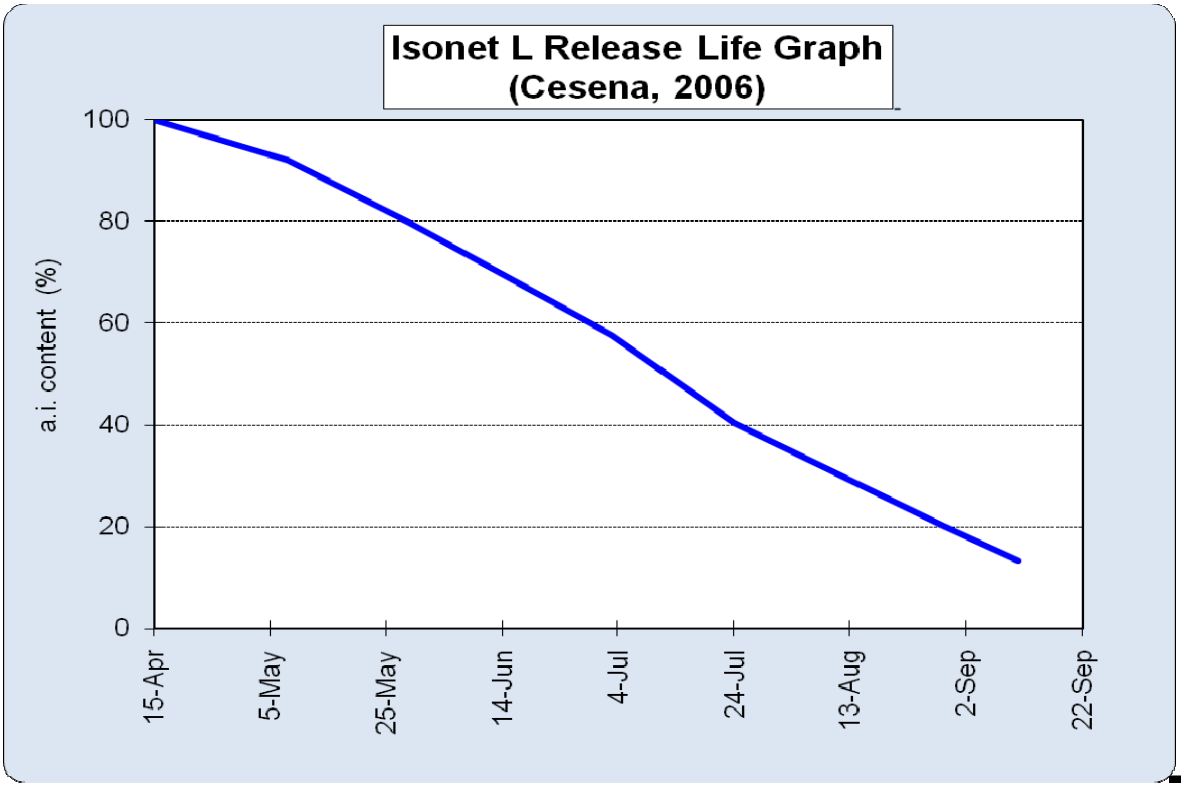

PLANNING AN ISONET L IPM PROGRAMME

Aims

The aims of an IPM programme using mating disruption techniques are following:

- To prevent significant damage by European grapevine moth,
- To reduce the population of European grapevine moth or mantain it at a very low level.

In case of **low pest population density** and if **no** migration of mated female moths from adjacent vineyards occurs, the first of these aims is readily achievable during the first year of application, while the other can be reached over a number of years (at least two) of uninterrupted application.
Once the European grapevine moth population has been reduced to a low level, mating disruption may be used alone to ensure pest management.

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Choosing the proper insecticide

The use of active ingredients with low impact on "beneficial insects" is recommended.
An example of the proper use and timing of application for some of these active ingredients is reported in the following table:

Lobesia botrana		
Following AI should be targeted at second generation moths		
Ovicides		
IGR	**Characteristics**	**Notes**
Flufenoxuron	IGRs are chitin synthesis inhibitor that prevent the N-glucisamine production essential for the chitin development in the insects cuticle.	These ovicides inhibit the development of the embryo inside the egg both in the case of direct spraying on eggs and in the case of oviposition on treated foliar surfaces. Persistence: 15-20 days.
Larvicides		
BACTERIA	**Characteristics**	**Notes**
Bacillus thuringiensis	Microbial insecticide acting by ingestion. When a susceptible insect ingests Bt, the protein toxin is activated by alkaline conditions and enzyme activity in the insect's gut. The toxicity of the activated toxin is dependent on the presence of specific receptor sites on the insect's gut wall. If the activated toxin attaches to receptor sites, it paralyzes and destroys the cells of the insect's gut wall, allowing the gut contents to enter the insect's body cavity and bloodstream.	*Bacillus*-based products must be applied close to egg-hatching in such a way that the crystal proteins are swallowed by the newly hatched larvae. Persistence: 7-10 days.
MAC	**Characteristics**	**Notes**
Tebufenozide	Insecticidal ecdysteroid agonist that cause insect larvae to moult prematurely and die (Moulting Accelerating Compound).	This insect growth regulator has no ovicide efficacy. Therefore it must be applied at the end of embryonic development or on newly hatched larvae. Persistence: 21 days.
Metossifenozide		
OXADIAZINE	**Characteristics**	**Notes**
Indoxacarb	Indoxacarb possesses ovi-larvicidal activity. Larval mortality is caused by exposure of the neonates to the residues deposited on the outer egg surface, from ingestion of the treated egg membrane or corion, during egg hatch.	Low ovicide efficacy. Therefore it must be applied at the end of embryonic development or on newly hatched larvae. The best application timing is beginning of oviposition and black head stage.
RYANODIN	**Characteristics**	**Notes**
Rynaxypyr (chlorantraniliprole)	Rynaxypyr's mode of action is activation of insect "ryanodine receptors" (RyRs), which stimulates the release of calcium from internal stores of smooth and striated muscle, causing impaired muscle regulation, paralysis, and finally death.	Rynaxypyr possesses ovi-larvicidal activity. Ovicidal activity consist in either killing the embryo or the completely developed larvae inside the egg, such that the egg membrane remains intact and the individual does not hatch. Larval mortality is caused by exposure of the neonates to the residues deposited on the outer egg surface, from ingestion of the treated egg membrane or corion, during egg hatch.

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SPYNOSIN	Characteristics	Notes
Spinosad	Spinosad acts on the post-synaptic nicotinic acetylcholine (Ach) and γ-aminobutyric acid (GABA) receptors, resulting in tremors, paralysis, and death of the target insects.	The product acts principally on larvae both by contact and ingestion. It is used at the end of embryonic development or on newly hatches larvae.
AVERMECTINE	**Characteristics**	**Notes**
Emamectina benzoato	The mode of action is similar to abamectin (GABA - and glutamate-gated chloride channel agonist), Emamectin benzoate acts by stimulating the release of r-aminobutyric acid, an inhibitory neurotransmitter, thus finally activating chloride channels. The target insect stop feeding within hours of ingestion, and die 2-4 day.	It possesses larvicidal activity by contact and ingestion. The optimal application timing ranges from pre-hatching egg to larvae late stage (L_4-L_5).
ORGANOPHOSPHATES	**Characteristics**	**Notes**
Clorpirifos etile	Organophosphates interfere with acetylcholine-mediated synaptic transmission in the nervous systems inhibiting the enzyme acetylcholinesterase (AChE) resulting in acute cholinergic over-stimulation at nicotinic and muscarinic synapses of the peripheral, autonomic and central nervous systems.	Organophosphates must be applied at the end of embryonic development or on newly hatched larvae. Some of these products are able to destroy larvae even in the first subepidermal strata of the fruit
Clorpirifos metile		

N.B.: In the application of various products, carefully follow the instructions and warnings on the label provided by the manufacturers.
Some a.i. may not be authorized in some IPM programs, therefore refer to local IPM Gudelines

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Side-effects of some pesticides on natural enemies

IOBCwprs Working Group "Pesticides and Beneficial Organisms & IOBCwprs Commission "IP Guidelines and Endorsement" (05.12.2005 Comm.)	**Type**	**Classification of side effects to beneficial organisms** **N** = harmless or slightly harmful (Reduction field, semi-field 0-50%, lab 0-30%) **M** = moderately harmful (Reduction field, semi-field 50-75%, lab 30-79%) **T** = harmful (Reduction field, semi-field > 75%, lab >80%) **Normal black entries** = laboratory data (IOBC) **Bold black face** = semi-field test data (IOBC) **Asterix * marked black entries** = Field test data (IOBC)															
Active ingredients	I = Insecticide A = Acaricide	Predatory mites (*Typhlodromus pyri*)	Predatory mites (*Phytoseiulus persimilis*)	Spiders (*Pardosa spp.*)	Spiders (*Cheiracanthium mildei*)	Flower bugs (*Anthocoris nemoralis*)	Flower bugs (*Orius laevigatus*)	Lacewings (*Chrysoperla carnea*)	Lady bird beetles (*Coccinella 7-punctata*)	Rove beetles (*Aleochara bilineata*)	Ground beetles (*Poecilus cupreus*)	Parasitoids (*Aphidius rhopalosiphi*)	Parasitoids (*Trichogramma cacoeciae*)	Hoverflies (*Syrphus corollae*)	Toxicity to bees	Toxicity to earthworms (*Eisenia foetida*)	Fish toxicity
Azadirachtine	I	N	T			T	N	M	N		**N**	**M**	T	M	-		
BT var. kurstaki	I	N*	**N**			M		**N**	**N**	**N**	N		N		-		-
Buprofezin	I	N	**N**		N	N		N	**N**	N			N		-		+
Chlorpyrifos-ethyl	I	T	**T**	T	T	M		**T**	**M**	**T**			T	T	+	+	+
Chlorpyrifos-methyl	I	M-T				M		**T**	**N**				T		+		+
Diflubenzuron (IGR)	I	N*	**N**		T	N	M	**T**	**N-M**	N			N		-	-	-
Fenoxycarb (IGR)	I	N*	**N**		N	N*	M	**M**	**N**	**N**		**M**	N		+		+
Flufenoxuron (IGR)	I	N*	N			M		M*		T	N						
Granulosis-Virus	I	Selective method of control without influence on beneficial arthropods															
Imidacloprid	I	N*	T			T	**T**	**M**	T		N	T	T		+	(-)	(-)
Indoxacarb	I	N				M		N	M	N			M	N	-	-	+
Lufenuron	I	N*	**N**			N	**M**	**T**	**T**			M	M		-		-
Methoxyfenozide (IGR)	I	N				N		**N**					N		-		-
Phosmet	I	T*	**T**					N*	**M**	**N**			T				
Pirimicarb	I	N				N		N	N				M	M	-	-	-
Rotenone	I	M				M		M					M		-		+
Spinosad	I	N*	N				N	N	N				M		+		-
Tebufenozide (IGR)	I	N*	N			N	**N**	**N**	**N**		N	N	N		-		
Teflubenzuron (IGR)	I	N				N		N	T				N	N	-		-
Thiacloprid	I	N		M					T	N	M	T			-		+
Triflumuron	I							T*							-		
Abamectine	A	N-T	**T**				**T**	**N**	**N**			T	T		+		+
Clofentezine	A	N*	**N**		N	N*		N	**N**	**N**			N	N	-		-
Etoxazolo	A	M						M					N		-		+
Hexithiazox	A	N*	**N**		N	N*		N	**N**	**N**			N		-		-
Fenazaquin	A	M				M									-		+
Fenpyroximate	A	N-M	T			N-M	**N**	N	T	N	N	T	M		-		+
Spirodiclofen	A	N-M				M		**N**	**M**				N	N	+		-
Tebufenpyrad	A	M*	T			T	**N**	N	**N**		N	T	T	M	-		+

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TIMING AND METHOD OF APPLICATION OF ISONET L IN THE VINEYARDS

Timing of application

Isonet L dispensers **must** be applied **before the first flight** of European grapevine moth in spring, i.e. before biofix, in order to prevent mating and the hatching of new larvae.
If dispensers are applied at second generation flight, their effectiveness will not be stable and good results may prove disastrous during the following year.

Method of application

Dispensers should be located at 1.4-1.6 metres from the soil in row- and curtain-trained vineyards. They should be hung on the vine shoots without twisting them too tightly in order to avoid cracking their surface.
Avoid hanging the dispensers on metal wire, particularly if it is not covered by shoots and leaves as the overheating of the wire in very hot temperatures may compromise the evenness of the pheromone emission.

Control of application scheme

In order to establish the application scheme it is important:

1) To know the overall surface of the vineyard in such a way as to be able to assess the total number of dispensers required. Once the number has been calculated, a further 5% should be added (according to the size of the vineyard) for additional applications in border rows.

2) To know the total number of plants per hectare (calculated on the basis of plant spacing).

3) To apply dispensers uniformly throughout the entire vineyard according to the recommended application rate. As far as European grapevine moth is concerned, the rate stands at 500 dispensers per hectare (in areas with prevailing winds from a particular direction, supplementary dispensers need only be implemented on leeward borders).

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4) To apply one dispenser per each of the first three plants of the vineyard and each of the plants in the first two border rows.

5) To place dispensers according to the application diagram without reducing application rate. Any left-over dispensers should be used in hot spots of the vineyard and windy areas (edges, high spots) in which pheromone concentration may be reduced. Download our dosage calculation software from www.cbceurope.it/biocontrol

IN-SEASON MONITORING OF THE VINEYARD

Mating disruption technique cannot be implemented in vineyards without adequate monitoring during the entire growing season. Indeed, careful and constant monitoring of the vineyard during the season in progress is fundamental.

Once the pheromone dispensers for mating disruption have been put in place, monitoring traps inside the vineyard should catch no or only a few occasional moths.
It is very important to place traps both in the central part of the vineyard and on the borders, which are the hottest spots for moths. This is not only due to the possible migration of mated female moths from other adjacent vineyards, but also because of the reduction of pheromone concentration in areas where the action of the wind is more intense.

Scouting of the vineyard by the time the **first generation** of moths emerge is very important in order to assess whether additional insecticide sprays are needed in order to reduce pest populations.
At least 100 grapes should be checked for damage, choosing samples from different areas of the vineyard. If more than 6-8% of the sample grapes have been attacked by the European grapevine moth, then a defense programme should be targeted at the second generation.

Second generation adult moths start to emerge in mid-June, depending on climatic conditions. Attacks by caterpillars may cause the rapid development of various moulds on the wounds, in particular *Botrytis* and rot, with a substantial loss in production. A damage threshold of 3 to 5% of damaged grapes should be considered for this generation of moths.

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