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INTEGRATED PEST MANAGEMENT IN SWEET CHERRY (*Prunus avium* L.) ORCHARDS IN BULGARIA

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A B S T R A C T

Sweet cherry is one of the main fruit crops in Bulgaria. Effective control of insects and mites is necessary for high yield and fruit quality, yet contamination of the fruit and the environment should be avoided. A programme for integrated pest management designed for the needs of sweet cherry orchards in Bulgaria is proposed. Treatments for major cherry pests are suggested, taking into account the developmental stages and economic threshold values of particular species of insects and mites.

Key words: sweet cherry, pests, integrated pest management, IPM, pest control

INTRODUCTION

Sweet cherry is a major fruit crop in Bulgaria. Cherries are the first fresh fruits available each year (Jivondov and Manolova, 2001). In Bulgaria, 7000 hectares are planted with cherries, and total cherry production is between 25,000 and 100,000 tons. Production of high quality cherries is impossible without effective pest and disease control.

Environmental protection regulations and the disadvantages of using chemicals have prompted the development of environmentally friendly pest control methods. Consumers of sweet cherries and other stone fruits are justifiably concerned about the contamination of the fruit with pesticides. This

problem can be solved only by applying sophisticated technology based on the principles of integrated fruit production.

According to the IOBC, integrated fruit production is the economical production of high quality fruit, using ecologically safe methods, while minimising the harmful effects of agrochemicals on the environment and human health (Cross et al., 1997).

Integrated pest management has as many definitions as it has practitioners, but everyone agrees that its main feature is minimum use of synthetic pesticides and maximum reliance on natural regulatory mechanisms to keep pest populations below the level at which they can cause economic damage (Kadir and Barlow, 1992; Radcliffe, 2002; UC statewide IPM program, 2002).

In integrated pest management, pest populations must be regularly monitored and recorded. Scientifically established assessment methods, appropriate for a given region or locality, must be used. The level of infestation and the risk of damage must be established for each pest. Treatment decisions must be based on scientifically established economic thresholds (Karov and Andreev, 2000).

Biological, genetic or bio-technical methods such as *Bacillus thuringiensis* or yellow glue traps should be used if available and effective (Pelov et al., 1996). The method selected should be the one which poses the least hazard to humans, livestock and the environment, while providing effective pest, disease or weed control (Pelov et al., 1996, Tonev et al., 1999). The following criteria should be taken into account when classifying pesticides as "permitted", "permitted with restrictions", or "not permitted": toxicity to humans; toxicity to key natural enemies; toxicity to other natural organisms; pollution of ground and surface water; ability to stimulate pests; selectivity; persistence; incomplete information and necessity of use (Cross et al., 1997).

In Bulgaria, the most important elements of environmentally friendly integrated fruit production have been worked out for apples and pears (Pelov et al., 1996), but not for sweet cherries.

INSECT AND MITE PESTS IN BULGARIAN SWEET CHERRY ORCHARDS

The range of insects and mite pests encountered in Bulgarian cherry orchards is small in comparison to other fruit crops in Bulgaria. Major pests are presented in Table 1. The cherry fruit fly and the apricot weevil produce one generation, which feeds for a very short time. A few species of

tetranychid and bryobiid mites can infest cherry trees, but they are seldom economically significant.

T a b l e 1. Major pests of cherry trees in Bulgaria

Tree organs damaged	Species of pests
Fruits	cherry fruit fly (*Rhagoletis cerasi* L., *Diptera: Trypetidae*) apricot weevil (*Rhynchites auratus* Scop., *Coleoptera: Attelabidae*)
Leaves	leaf-chewing caterpillars (*Lepidoptera*) geometrid moths (*Geometridae*) gipsy moth (*Lymantria dispar* L.) brown-tail moth (*Euproctis chrysorrhoea* L. *Liparidae*) European lackey moth (*Malacosoma neustria* L., *Lasiocampidae*) leaf-rolling sawfly (*Neurotoma nemoralis* L., *Hymenoptera: Pamphilidae*) leaf beetles (*Coleoptera*) common European cockchafer (*Melolontha melolontha* L., *Scarabaeidae*) *Phillobius* sp. (*Curculionidae*); black cherry aphid (*Myzus cerasi* Fabr., *Homoptera: Aphididae*)
Blossoms	*Epicometis hirta* Poda (*Coleoptera: Scarabaeidae*)
Branches	San-Jose scale (*Diaspidiotus perniciosus* Comst.) mulberry scale (*Pseudaulacspis pentagona* Targ.) other scale insects (*Homoptera*: *Diaspididae* and *Coccidae*)

RECOMMENDED PROGRAMME FOR INTEGRATED PEST MANAGEMENT IN CHERRY ORCHARDS

Different pests appear and develop at different times of the growing season. Therefore, the precise timing of treatments is essential for effective pest control, and depends on the careful observation of the developmental stages of the particular pest encountered. In integrated pest management, trees may be treated during winter dormancy, or before, during or after bloom (Gautier, 1988). In Bulgaria, Zahareva et al. (1997) elaborated the threshold values for major pests. They were used in the recommended programme (Tab. 2).

Sound agricultural practices, such as fertilising at the right time with the right dose, soil management, and irrigation, ensure that the trees are healthy and able to resist the onslaught of pests.

In sweet cherry orchards, direct chemical control of pests is rarely necessary beyond the vegetation period. Pest control during winter dormancy

is limited to cutting and burning caterpillar nests and damaged branches. If pest populations exceed economical threshold values, mineral or paraffin oils may be applied during the winter to control scale insects, mites, geometrid moths, or aphids.

In the spring, before bloom, adult fruit weevils, tortricid moth larvae, and loopers may be detected by shaking branches. Chemical pesticides are applied when pest populations exceed the economical threshold. The insecticides usually used are contact insecticides such as phozalone and bensultap, which do not harm the beneficial entomofauna. Systemic aphicides such as pirimicarb and tebufenpyrad may be applied to control fundatrices of the black cherry aphid.

During blooming, *Epicometis hirta* is a very dangerous pest, which may damage 70% of the blossoms on young cherry trees. *Epicometis hirta* can be removed by hand or by shaking branches over a plastic sheet. If that is not possible, bensultap can be applied, which also helps control leaf-chewing pests and the apricot weevil. *Bacillus thuringiensis* may be used if the only pests detected are leaf-chewing caterpillars. *Bacillus thuringiensis* treatments should be carried out when average temperatures are over 16°C to ensure proper bacterial activity.

During fruit formation, the aim of pest control is to prevent the apricot weevil from laying eggs inside immature fruits. Selective contact insecticides may be used, and also help control leaf-chewing pests.

Growth regulators such as clofentezine and hexythiazox or contact acaricides such as amitraz and propargite may be used to control mites during the growing season, although this is seldom necessary. Systemic aphicides, such as pirimicarb and acetamiprid, may be used to control the black cherry aphid before it forms colonies.

Yellow glue traps or traps which use alimentary or pheromone attractants can be used to monitor adult populations of the cherry fruit fly. An economic threshold has not been established for the cherry fruit fly. Selective pesticides which are allowed for use shortly before harvest, such as thiocyclam hydrogen oxalate, may be applied to trees with ripening fruits, 10-12 days after the beginning of flight (Sredkov, 2000; 2002). Strategically placed yellow glue or attractant traps can be also used either alone or in combination with a single azadirachtin (Neem oil) treatment (Lecheva et al., 2001).

As chemical control ends early in the season and the number of insecticide treatments is low, naturally occurring zoophagous arthropods help minimise populations of many pests, such as leaf miners, tortricid moths, scales and mites.

CONCLUSION

Integrated pest management is the only way to improve yield and fruit quality in sweet cherry orchards in an effective and ecologically friendly way.

Table 2. Recommended programme for integrated pest management in sweet cherry orchards

Phenophase	Plant protection treatments	Pests	Economic threshold
Winter dormancy 	mineral or paraffin oils (Akarzin, Parazomer 0.3%)	geometrid moths	2-5 eggs per 2 m branch
		scale insects	20-30 per 10 cm branch *Presence of *D. perniciosus*
		mites	60-80 eggs per 10 cm branch
		black cherry aphids	5-10 eggs per 10 cm branch
	sanitary pruning	wood-dwelling pests egg clusters and nests of leaf-chewing caterpillars	
Before bloom 	phozalone (Zolone 350 C) – 2 l/ha, bensultap (Bancol 50 WP) – 1 l/ha	fruit weevils	3 adults per 10 branches
		loopers and other leaf-chewing caterpillars	10-12 caterpillars per 100 branches shaken
		tortricid moths	6-8 larvae per 100 buds, or 8-10% buds damaged
		leaf-rolling sawflies	2-3 wasps per tree
	pirimicarb (Pirimor 5 WG) – 1 kg/ha, tebufenpyrad (Pyranica 20 WP) – 1.5-2.5 kg/ha	aphids	10 aphids per 100 buds
During bloom 	manual removal bensultap (Bancol 50 WP) – 1 l/ha	*Epicometis hirta*	3-5 beetles per 100 rosettes, or 5% racemes damaged
		apricot weevils	3 adults per 10 branches
	microbial insecticides based on Bacillus thuringiensis if average temperatures are over 16-18^{0}C	leaf-chewing caterpillars	8-10 caterpillars per 100 branchesshaken
After bloom 	phozalone (Zolone 350 EC) – 2 l/ha, bensultap (Bancol 50 WP) – 1 l/ha	apricot weevils	3 adults per 10 branches
		leaf-rolling sawflies and other leaf-chewing caterpillars	8-10 caterpillars per 100 branches shaken, or 10-12% fruits damaged
		leaf beetles leaf-miners	
	pirimicarb (Pirimor 25WG) – 1 kg/ha, tebufenpyrad (Pyranica 20 WP) – 1.5-2.5 kg/ha	black cherry aphids	8-10% shoots colonized
	clofentezin (Apollo 50 SK) – 400 g/ha, hexythiazox (Nissorun 5 EC) – 500-600 ml/ha	mites – early in the season mites – later in the season	3-5 mites per leaf 5-7mites per leaf
	yellow glue and attractant raps	cherry fruit fly	8-10 days before flight
	thiocyclam hydrogen oxalate (Evisect S) – 750 g/ha. azadirachtin (Neem-azal) – 3 l/ha.		8-10 days after flight

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INTEGROWNA OCHRONA PRZED SZKODNIKAMI SADÓW CZEREŚNIOWYCH (*Prunus avium* L.)W BUŁGARII

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S T R E S Z C Z E N I E

Czereśnia jest jednym z najważniejszych gatunków sadowniczych uprawianych w Bułgarii. Efektywna ochrona czereśni przed szkodnikami jest niezbędna dla uzyskania wysokiego plonu dobrej jakości owoców. Dodatkowo należało zwrócić uwagę na ograniczenie skażenia owoców oraz środowiska naturalnego środkami ochrony roślin. W związku z tym zaproponowano dla warunków Bułgarii integrowany program ochrony czereśni przed szkodnikami. Ochrona przed najważniejszymi szkodnikami czereśni uzależniona jest od ich fazy rozwojowej, liczebności oraz progu ekonomicznego zagrożenia.

Słowa kluczowe: czereśnia, szkodniki, integrowana ochrona roślin