

USE OF *BACILLUS THURINGIENSIS* FOR INSECT CONTROL IN HUNGARY

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ABSTRACT

Products containing *Bacillus thuringiensis* are used regularly in Hungary for the management of field, horticultural and forestry crop pests, as well as for the control of mosquitoes. Their use is decided on when the protection of user and consumer health as well as that of the beneficial living organisms exclude or even prohibit application of the 'conventional' pesticides. In addition to its human health and environmental protection aspects, *B. thuringiensis* preparations have the advantage that no resistance has yet been developed to them in the pests in Hungary.

KEY WORDS: *Bt* and *Bti* products, organic farming, biological control of mosquitoes, environmental safety, safe insecticidal action.

The following *Bt* formulations have been registered in Hungary (Table 1): Thuricide HP (farm trees, maize, forestry), Dipel (forestry, apples, maize), Dipel ES (grapevines, forestry, maize), Bactucid B (apples, stone-fruits, small fruits, grapevines, cabbages, ornamental trees, bushes). To control mosquito larvae (*Aedes*, *Culex*, *Mansonia*, *Anopheles* spp.) the following *Bacillus thuringiensis* subsp. *israelensis* biopreparations are used with success: Teknar (HP-D), Skeetal and Vectobac 12 AS, Vectobac CG and Vectobac G.

Based on preliminary tests, *B. thuringiensis* products can be used for effective control of *Helicoverpa armigera* Hiibner present in Hungary since 1993 in maize and some vegetables (pepper, tomato, etc.). The formulation Bactucid B (a.i.: *B. thuringiensis* subsp. *kurstaki*) proved to be very promising. The *B. thuringiensis* preparations are used widely to control *Hyphantria cunea* Drury on public roads and parks because only environmentally safe chemicals can be used at these locations.

All over the world and in Hungary, too, there is an ever increasing demand for using selective and biological products which are harmless to users, consumers and wildlife, but are also able to kill harmful organisms and substitute for the conventional pesticides. Such environmentally friendly biological insecticides are the products containing *B. thuringiensis*. Some twenty years ago, the biopreparation Thuricide HP of Sandoz AG (Switzerland) was first registered in Hungary to control *Hyphantria cunea*, *Ostrinia nubilalis* Hiibner and *Lymantria dispar* Linne. Later, other formulations, such as Dipel, Dipel ES, Bactucid B and Novodor FC have been registered. They can be used safely in organic farming systems, on public areas and in woodlands.

TABLE 1
Biological insecticides containing *Bacillus thuringiensis* registered in Hungary

Formulation (manufacturer)	Use	Pests	Year of registration
Thuricide HP (Sandoz AG., Switzerland) <i>Bacillus thuringiensis</i>	Farm trees, maize, forestry	<i>Hyphantria cunea</i> , <i>Ostrinia nubilalis</i> , <i>Lymantria dispar</i>	1977
Dipel (Abbott AG., Belgium) <i>Bacillus thuringiensis</i>	Maize, forestry, apples	<i>H. cunea</i> , <i>L. dispar</i> , <i>Cydia pomonella</i> , leaf miners, <i>O. nubilalis</i>	1988, 1994
Dipel ES (Abbott AG., Belgium) <i>Bacillus thuringiensis</i>	Grapevines, forestry, maize	grape berry moth, <i>H. cunea</i> , <i>L. dispar</i> , <i>O. nubilalis</i>	1994
Bactucid B (Kwizda, Austria) <i>Bt</i> subsp. <i>kurstaki</i>	Apples, stone-fruits, grapes, berries, cabbages, ornamental trees, bushes	Fruit and leaf rollers, fruit moth, grape berry moth, <i>H. cunea</i>	1996
Novodor FC (Novo Nordisk A/S., Denmark) <i>Bt</i> subsp. <i>tenebrionis</i>	Potato, tomato	Potato beetle larvae	1992
Teknar HP-D (Sandoz AG) <i>Bt</i> subsp. <i>israelensis</i>	Mosquito breeding sites	<i>Culex</i> , <i>Aedes</i> , <i>Mansonia</i> , <i>Anopheles</i> spp.	1989
Skeetal (Abbott, USA) <i>Bt</i> subsp. <i>israelensis</i>	Mosquito breeding sites	<i>Culex</i> , <i>Aedes</i> , <i>Mansonia</i> , <i>Anopheles</i> spp.	1990
Vectobac 12 AS, CG, G (Sumitomo, Japan) <i>Bt</i> subsp. <i>israelensis</i>	Mosquito larvae	<i>Culex</i> , <i>Aedes</i> , <i>Mansonia</i> , <i>Anopheles</i> spp.	1994

It is also very important in the management of insect pests of human health importance to introduce and apply selective insecticides which are harmless to man and his environment. The control of mosquito larvae is a major application of *B. thuringiensis*. Teknar HP-D registered in 1989 contains the H-14 serotype of *Bacillus thuringiensis* subsp. *israelensis*. Skeetal (Abbott, USA) and Vectobac 12 AS, CG, G (Sumitomo, Japan) are also used with success in mosquito management. They have a sure and completely environmentally friendly action.

B. thuringiensis products provide a good effect against important insect pests spread by man, e.g. *Hyphantria cunea* and *Leptinotarsa decemlineata* Say, which are very harmful in Hungary.

The biopreparations are very effective in controlling *Lymantria dispar* and *Ostrinia nubilalis* widely spread in Europe.

A new insect, *Helicoverpa armigera*, has appeared in Hungary. Although cotton is not grown in this Central-Eastern European country, *H. armigera* causes heavy damage in maize, vegetables (tomato, pepper, pea, bean) and in ornamental plants (carnation, rose, geranium, gerbera). This migrating species has spread to, and damaged plants that had not been observed in its original habitat; moreover, it appeared in cereals and grapevines. The biopreparations have been used with success to control it, while it may develop resistance to some conventional insecticides.

The biopreparations containing *B. thuringiensis* subsp. *israelensis* (Teknar HP-D, Skeetal, Vectobac 12 AS, CG, G) are used effectively to control mosquito larvae (*Culex*, *Aedes*, *Mansonia*, *Anopheles*). The areas where large populations of mosquitoes are present (Lakes Balaton, Velence; Rivers Danube, Tisza) are also important for tourism. This fact makes mosquito management an important national task. In order to save the wildlife, there is an increasing demand to replace chemical mosquito control by effective biological techniques. For this purpose *B. thuringiensis* has been used in Hungary since 1989, in combination with aerial application of insecticides against adults. The objective is to spread biological control techniques and to reduce usage of chemicals.