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DAMAGE OF SUNFLOWER CAUSED BY THE COTTON BOLLWORM (*Helicoverpa armigera*, Hübner) IN THE REGION OF KECSKEMÉT AND BÁCSALMÁS IN 2003

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SUMMARY

Damage caused by the cotton bollworm (*Helicoverpa armygera* HÜBNER) was first observed in the southern part of Bács-Kiskun County in 1994. This observation was made in Bácsalmás, in a sunflower field of 150 ha was used for hybrid seed multiplication. Several insecticide applications were necessary to effectively control the pest. In 1995, this type of protection had to be applied in a field of 1200 ha in Bácsalmás. In the southern part of Hungary, this insect is present in high numbers every year. Protection of sunflower seed fields would not be possible without the integrated protection technologies developed against this insect. En masse occurrence of the species was examined in the regions of Kecskemét and Bácsalmás towns, in commercial sunflower fields. According to our large-scale investigation, 322 sunflower heads of the 500 examined (64.4%) were found to be infected on 3 August 2003. The level of infection was as high as 418 heads (83.6%) in the Bácsalmás region. Concerning the number of larvae found per single head, the situation was similar. The average numbers of larvae found per single sunflower head were 5.22 and 8.09 in the regions of Kecskemét and Bácsalmás, respectively. Simultaneously, *Rhizopus* spp. fungi infections were found in 22.2% and 27.8% of the sunflower heads in Kecskemét and in Bácsalmás, respectively. Parasitoid ichneumons (ectoparasites) were observed in 9 and 7.4% of the larvae. The extent of damage due to cannibalism was 1-2% of larvae. This rate was not considered as significant. The study provides important technical information for the integrated protection against this insect species, which causes significant damage.

Key words: ***Helicoverpa armygera*, *Rhyzopus arrhizus*, *Rh. oryzae*, *Rh. stolonifer*, *Rhizopus*/*Erwinia* syndrome**

INTRODUCTION

The cotton bollworm (*Helicoverpa armygera* Hübner) is found in the tropical and sub-tropical regions of Eurasia and Africa (Bergmann, 1954; Koch, 1894; Scsegolev, 1951). According to Scsegolev (1951) it is one of the most dangerous

pests of cotton both in the old and new cotton-growing areas in Central Asia and in the Trans-Caucasian region. More than 120 plant species were found to be damaged by this insect on the territory of the former Soviet Union. Its occurrence in the former Yugoslavia was reported in the monograph of Čamprag (1994). According to this monograph, two or three populations of the insect existed in the former Yugoslavia (Dalmatia, Herzegovina, Macedonia).

In Hungary, this butterfly species was observed occasionally and sporadically as an "ad hoc immigrant" species (Szeõke at al., 1995). Its en masse occurrence was first observed by Bezsilla (1951) and later by Ubrizsy and Reichart (1958). Subsequently, no damage had been reported in Hungary until 1986, when damage on sweet corn was observed in the region of Kecskemét (Szeõke and Dulinafka, 1987). The pest's damage on sunflowers and its role in the formation of the *Rhizopus/Erwinia* syndrome were described - among others - by Horvath (1998, 1999, 2002).

MATERIAL AND METHOD

Our observations were carried out in industrial-scale sunflower fields in the region of the towns Bácsalmás and Kecskemét on 3rd and 4th August 2003. Five hundred sunflower heads were thoroughly examined in each region. Our examinations included the determination of the number of larvae per sunflower head, the percentage distribution of the heads damaged by the larvae and, simultaneously, the percentage of the *Rhizopus* spp. fungi infection of the heads. By taking the opportunity, we also examined the cannibalism of the larvae and their parasitoid infection. We also made investigations aimed at finding methods for successful protection against the pest's larvae. These investigations were performed in areas of 100 m^2. Ten-meter wide separating zones were kept between the areas where different treatments were made.

RESULTS

Infection status

Serious damage caused by *Helicoverpa armygera* Hübn. was observed at both locations (Tables 1 and 2). We found 322 infected sunflower heads out of the 500 examined (64.4%) on 3 August 2003 in Kecskemét, while the number of the infected heads was as high as 418 (83.6%) in the Bácsalmás region on 4th August 2003. Concerning the number of the larvae found in a single head, the situation was similar. The average numbers of larvae found on one sunflower head were 5.22 and 8.09 in the regions of Kecskemét and Bácsalmás, respectively. (This fact is originating from the biology of *Helicoverpa armygera* Hübn.). Most of the larvae were feeding on the seeded side of the head and on leaves; a few of them managed to

penetrate into the spongy internal part of the head (Figure 1). Some of these larvae entered into chrysalis state within the head.

Table 1: Infection status of 500 sunflower heads damaged by *Helicoverpa armygera* HB. larvae, (3 August 2003, Kecskemét)

Examined sunflower heads	Of the examined 100 heads								
Sample no.	No. of heads	Damaged by larvae	%	Infected with *Rhizopus* spp.	%	Observed in 100 heads		Of this, infected by parasites	
						No. of larvae	%	No.	%
1	100	63	63	32	32	615	6.15	37	6.0
2	100	97	97	24	24	483	4.83	46	9.5
3	100	48	48	16	16	603	6.03	58	9.6
4	100	53	53	21	21	541	5.41	33	6.0
5	100	61	61	18	18	368	3.68	63	7.1
Total	500	322	64.4	111	22.2	2610	5.22	237	9.0

Table 2: Infection status of 500 sunflower heads damaged by *Helicoverpa armygera* HB. larvae, (4 August 2003, Bácsalmás)

Examined sunflower heads	Of the examined 100 heads								
Sample no.	No. of heads	Damaged by larvae	%	Infected with *Rhizopus* spp.	%	Observed in 100 heads		Of this, infected by parasites	
						No. of larvae	%	No.	%
1	100	87	87	38	38	730	7.3	24	3.2
2	100	91	91	41	41	640	6.4	36	5.6
3	100	78	78	27	27	980	9.8	48	4.9
4	100	83	83	14	14	683	6.8	92	13.4
5	100	79	79	19	19	1013	10.1	103	10.1
Total	500	418	83.6	139	27.8	4046	8.09	303	7.4

Trend in the percentage infection by *Rhizopus* spp. fungi

In approximately 90% of the cases where insect damage was observed, *Rhizopus* spp. fungi infection was also found. In Bácsalmás, wet rotting and alcoholic fermentation, followed by the formation of the characteristic grayish-white mycelium tissue was observed in 27.8% of the heads (Figures 2 and 3). This tissue soon becomes black, due to the formation of sporangia (Walcz, 1989). Based on laboratory examinations, it was established that the thermophilic *Rhizopus arrhizus* Fischer (its optimal temperature is 37°C) and the *Rh.oryzae* Went et Prinsen Geerlings (its optimal temperature is 30°C) were found in most of the cases. At the same time, *Rh.stolonifer* Ehr. et Fries (its optimal temperature is 22°C) was hardly found. This fact can be explained by the weather conditions in the summer of 2003. The alcohol-containing exudates (characteristic alcoholic or acetone smell) attracted a number of insects feeding on fermentation materials. Such insects include the longicorn (*Cerambyx scopolii* Fuessly, *Col., Cerambycidae*), different

types of flower bugs (*Cetonia spp., Col. Melolonthydae*) and - the most frequent species - the European bark beetle predator species (*Glischrochilus quadripunctatus L., G. quadrisignatus L., Col., Nitidulidae*), *Nitidula hipunctata* L. and their related species. Due to this, the attack of *Rhizopus* species can be identified easily by the naked eye. However, the *Rhizopus/Erwinia* syndrome may occur in 10-15% of the cases (Horváth, 1998). This infection - especially in wet weather - causes very bad-smelling rotting.

Figure 1: Cotton bollworm larva feeding on the spongy part of a sunflower head

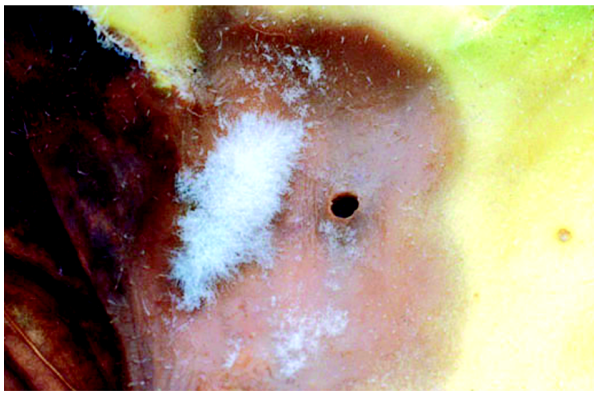

Figure 2: Colony of Rhizopus spp fungi formed as a secondary infection after pest feeding

Figure 3: Characteristic mycelium tissue of Rhizopus spp. fungi

Parasitoid infection of *Helicoverpa armygera* Hübn. larvae

During our examinations it was found that ectoparasitoid ichneumons infected 9 and 7.5% of the larvae found in Kecskemét and Bácsalmás, respectively. Of the ichneumons, the most frequent species was the *Habrobracon hebetor* Say. (*Hym., Bracondiae*). This species is replaced by the European sunflower moth (*Homoesoma nebulellum* Hübn.) in August. The number of both insects - and their importance - are getting higher and higher (Charlet-Horváth, 1991, Horváth-Bujáki, 1992, Horváth, 1992). The peak swarming time of the ichneumons - depending on age group - is the middle of September. However, besides the growing habit of ectoparasitoid ichneumons, we feel that the examination of the diminishing effect of endoparasitoid ichneumons (*Hym., Chalcididae*) is also important. As a special element, simultaneously with the examination of the parasitoid ichneumon species, one of our goals was to examine the cannibalism of cotton bollworm larvae in a quantitative way. Examinations of some authors (Záreczky and Vörös, 1994; Szeõke *et al.*, 1995) showed this fact as an important limiting factor for larval number. In our examinations, we observed *"in situ"* cannibalism which reached only 1-2% of the number of larvae.

Result of the protection by insecticides

Of the insecticides used, the following provided adequate results in the field (neither was harmful to bees): Mospilan 20 Sp. 0.3 kg/ha + Biofilm additive of 0.15 l/ha; and Sumi-Guard 0.2 l/ha + Biofilm additive of 0.15 l/ha.

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LOS DAÑOS CAUSADOS POR LA ORUGA DEL ALGODÓN *(Helicoverpa armigera)* EN EL AÑO 2003 EN LA ZONA DE BÁCSALMÁS Y KECSKEMÉT

RESUMEN

En el Sur de la provincia de Bács-Kiskun, los daños causados por la oruga del algodón (*Helicoverpa armigera*) se observaron por primera vez en 1994 en Bácsalmás, en un cultivo de 150 hectáreas para reproducción de híbridos de girasol. El deterioro se ha podido abolido únicamente con la múltiple aplicación de insecticidas. Ya en el año 1995 en Bácsalmás fue necesario luchar contra la plaga en 1,200 hectáreas de maíz industrial. En la parte Sur del país, esta plaga cada año se presenta en masa. La protección de los cultivos de reproducción de híbridos de girasol sería imposible sin las tecnologías de protección integradas, desarrolladas específicamente contra esta especie. La gradación en masa de la especie en el año 2003 se examinó en cultivos de girasol industrial en las cercanías de las ciudades de Bácsalmás y Kecskemét. Según los estudios realizados el 3 de agosto 2003 en Kecskemét, de 500 platos de girasol examinados 322 (64,4%) han sido encontrados como dañados, mientras en Bácsalmás este valor alcanzó los 418 (83,6%). En cuanto al número de las larvas encontradas en un plato, la situación fue similar. En Kecskemét se registraró un promedio de 5,22 larvas por plato, mientras en Bácsalmás el promedio era de 8,09. Paralelamente a eso, también se observó una grave infección por el hongo *Rhizopus* ssp. en Kecskemét en el 22,2% y en Bácsalmás en el 27,8% de los platos examinados. Las avispas parasitoides (extoparásitos) afectaron el 9 y el 7,4% de las larvas, respectivamente. Las larvas de la oruga del algodón muertas por el canibalismo entre ellas se registraron en 1 a 2%, lo cual no es una proporción considerable. El presente estudio proporciona información profesional útil para la protección integral contra una especie de insectos que causa graves daños en los cultivos.

DOMMAGES CAUSÉS AU TOURNESOL PAR LA NOCTUELLE DU COTON (*Helicoverpa armigera*, HÜBNER) DANS LES RÉGIONS DE KECSKEMÉT ET BÁCSALMÁS EN 2003

RESUME

La première fois en 1994 à Bácsalmás, sur une culture de 150 hectares de reproduction d'hybrides de tournesol que les dommages causés par la noctuelle du coton *(Helicoverpa armigera)* ont été observés dans le Sud du département de Bács-Kiskun. Cette détérioration n'a pu être arrêtée que grâce à l'utilisation des insecticides à plusieurs reprises. A Bácsalmás en 1995, les exploitants ont dû lutter contre ces organismes nuisibles sur 1,200 hectares de maïs industriel. Au sud de la Hongrie, ces insectes apparaissent en masse chaque année. La protection des cultures de reproduction d'hybrides de tournesol se serait avéré impossible sans recours aux technologies de protection intégrées, développées spécifiquement contre cette espèce. La gradation en masse de l'espèce en l'an 2003 a été examinée dans des cultures de tournesol industriel dans la zone des villes de Bácsalmás et de Kecskemét. Selon les constations des mesures du 3 août 2003 effectuées à Kecskemét qui portait sur 500 plats de tournesol, nous avons démontré 322 (64.4%) plats endommagés, tandis qu'à Bácsalmás cette valeur a atteint les 418 (83.6%). Les constatations étaient similaires pour les nombres des larves recensées sur un plat de tournesol. A Kecskemét nous avons relevé une moyenne de 5.22 larves par plat, tandis qu'à Bácsalmás la moyenne était de 8.09. Au même moment, nous avons également observé une infection aiguë due à des fungi *Rhizopus* ssp., à Kecskemét dans le 22.2% des plats et à Bácsalmás dans le 27.8% des plats examinés. Les guêpes parasitiques (ectoparasites) ont affecté respectivement les 9% et les 7.4% des larves. La mort recensée de 1 à 2% des larves de la noctuelle du coton est due au cannibalisme parmi les larves, cette valeur ne représente pas un pourcentage élevé.

L'étude présentée ci-dessus fournit des informations professionnelles utiles pour la protection intégrale contre une espèce d'insecte qui cause des dommages considérables dans les cultures.