UDC 6327:633.85 (477.61)

S. V. GORNOVSKA, V. P. FEDORENKO

REASONS FOR THE APPEARANCE OF A NEW PEST – SUNFLOWER TUMBLING BEETLE (*MORDELLIDAE, MORDELLISTENA PARVULLIFORMIS*) – IN UKRAINE

National University of Life and Environmental Sciences of Ukraine, Kiev,
e-mail: dizr.gornovskaya@mail.ru

(Submitted to the editors 07.05.2014)

Entomofauna of sunflower agrocoenoses is mostly inhabited with: grey beet root weevils (*Tanumecus palliates F.*), elaterids (*Elateridae*), tenebrionid beetle (*Opatnim sabulosum*), plum aphid (*Brachycaudus helichrysi*), thrips, acridoids, beet webworms, cut and leaf-eating moths, sunflower moth (*Homoeosoma nebullelum*), sunflower tumbling beetle and Agapanthia dahli.

The sunflower tumbling beetle is still of the greatest interest among these pests.

This insect was firstly described in 1930 by T.I. Schegolieva-Borovska, and although V. N. Schegoliev and others in 1934 mentioned it as such one found on a sunflower, it actually did not harm that crop. In other words, the entomological literature beginning from 1930 contains references to the sunflower tumbling beetle as a species, but not as a harmful sunflower pest.

The sunflower tumbling beetle or treehopper belongs to the treehopper family, coleopterous order, coleopterans.

The tumbling flower beetle family is relatively small – it has over 130 species in the world fauna, more than 90 of which can be found within Ukraine.

Besides the larvae of some species can damage industrial and essential oil plants, the beetles carry viral and fungal diseases agents.

Since the beginning of 2004 the information on sunflower damage by unknown pests has begun to come from different places of the southern and eastern regions of Ukraine. After the larvae had been discovered in 2006 and raised as adult insects, they were identified by the research assistant of the Institute of Zoology of the National Academy of Science of Ukraine Odnosum V. K. as a sunflower tumbling beetle (treehopper) (*Mordellistena parvulliformis* Stshegol – Bar, 1930).

Such appearance of the sunflower tumbling beetle is quite natural as beginning from 2003 the sunflower growing areas in Ukraine have increased actually twofold and exaggerated a scientifically substantiated and recommended index – 8 % in the structure of the crops interchange system without hard crop rotation what has become the main reason for a great increase of the number of this pest and appearance of a new-old pest, aggressiveness of which has increased to the utmost under such conditions.

Dynamics of sunflower growing areas in Ukraine, mln. ha

Year	1913	1990	1995	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Area	0,1	1,6	2,0	2,8	2,8	2,4	2,7	4,0	3,5	3,7	3,9	3,6	4,3	4,2	4,5	4,5	4,8	5,7

Materials and methods. The researches were conducted in 2012–2013 on the private farms and "Kolos" complex of Lugansk National Agrarian University applying common methods.

Национальная академия наук Беларуси

The land-use territory of the farms is situated in Lysychansk-Lugansk region with the following climate conditions.

Black soil is usually low-humic, slightly eroded, hard-loamy, on loess. It has favourable physical and chemical properties for sunflower growing and it is typical of soil difference of black earth in Lugansk region.

Meteorological conditions during the years of researches. In December the weather was warm with cyclonic precipitation. At the beginning of January it remained analogous to the soil one with the increased thermal regime. At the end of January the air temperature was –14,8 °C and the minimum temperature reached –26 °C.

Soil surface cooled down to –30 °C. The snow cover lay unequally and on the last day of the month its height varied from 3 to 15 cm.

In February the territory of the region was ruled by anticyclone which conditioned very frosty weather with the temperature up to –33 °C. The snow cover reached 23 cm.

The permanent low air temperature and rough wind caused an unequal snow cover on the territory of the region, that led to unfavourable conditions for pest wintering.

The winter season ended on March, 16 as the air temperature was above 0 °C.

From March, 30 to April, 4 the average daily air temperature was +5 °C and higher.

In May the average daily temperature was +17,6...+21,8 °C, that is by 3,3–6,1 °C higher than the standard. The maximum air temperature in May reached +34 °C, the minimum one fell to +21 °C. Precipitation during the spring period was unequal.

The weather in June was very changeable. The average daily temperature was exceeding the standard by 4,9 °C, and the maximum air temperature reached +34 °C. Precipitation was unequal and varied from 8 % to 82 % of the standard, sometimes in the western part of the region – 196 %.

The temperature in July was higher. The average monthly temperature was +24,8 °C, that is by 5,1 °C higher than the standard.

There were rain showers during the period of atmospheric fronts in the first and second decades of the month. In the third decade the weather remained hot with dry winds. The maximum air temperature reached +39 °C. The agrometeorological conditions for sunflower sowing were unfavourable, and the plants lost the turgor because of insufficient humidity.

The warm weather with precipitation deficit prevailed in September. At the beginning of the first decade of October the average daily air temperature was +15 and lower what meant the end of meteorological summer. In October the air temperature fell to +10 and even lower.

Results and discussion. The sunflower tumbling beetle is (*Mordellistena parvulliformis*) small, 2.5–3.3 mm long, black, densely covered with beard. The lateral sides of the front back are straight. The tibiae of hind legs have two long sidelong incisures. The elytra do not cover the extended podex, and the abdomen protrudes over the front side of the front back like a spike.

Sideways the beetle resembles a pulled comma. The head is free, narrowed sharply behind the eyes. The elytra are 2.5 times longer than the width. The front breasts on each side are with sharp edging. The front and middle legs have 5 parts and the hind ones have 4 parts. The tibias and parts of the hind legs are with incisures.

The larva is vermiculous, cylindrical, its length is 7–10 mm, the length of the older one is 12–13 mm with a well developed head and 3 pairs of legs. The colour is lemon-white, the head is a little darker with brown jaws. The body is S-like, bended, covered with a thin yellowish beard with fixing parts on the tip. When looking from above the larva is like a triangle. The last segment of the abdomen is conic with a 5 ray anus and two big thorns on the tip. The legs are short.

Treehopper beetles are exclusively day-time insects inhabiting open meadows and forest biotypes. During the daytime, when the light is bright and the temperature is higher they accumulate in blooming flora (near 100 species per plant) emphasizing parsley family plants (Apiaceae) and (Asteraceae).

The beetles are extremely mobile, and when the slightest danger appears they try to fly away quickly and often turn their heads bending the front and middle legs to their body, push off rapidly with the hind legs, fall down from the plant turning several times over their heads. When they reach the ground they

Национальная академия наук Беларуси

tumble over, push off with their legs again, hide into litter or another protective cover and reach thanatosis for some minutes.

Taking into consideration the observations, it's possible to admit that the imago of sunflower tumbling beetles is polyphagous, it eats pollen of many plants and play a positive role in cross pollination of plants.

The sunflower tumbling beetle has a one-year circle of development. The larvae winter in the cores of sunflower stems or their residues.

In spring when the weather gets warmer the larvae become more active and move towards the periphery of the stem. They eat the dead tissues of plants, they gnaw through galleries near the outer walls, and passing woody tissues end their development.

In the southern regions beginning from April to the end of May the larvae pupate on the top of a bit widened gallery they've gnawed through. Irrespective of humidity and thermal environment the pupa phase lasts for 12–14 days.

As a rule, the pupa phase of the insect performs a function of the cardinal reconstruction of all the internal organs. But it does not refer to the sunflower tumbling beetle which even in this phase is quite mobile. Due to special spurs and lateral mobile callosities with expressed chaetotaxy the pupa body adheres to the walls of the channel what allows it to move quickly in the cavity of the stem. Such a movement makes it possible to choose the necessary thermal optimum for the development.

First of all, the beetles incubate from dry last year plant residues on the southern hills in the south of Steppe beginning from the middle of April and in the forest-steppe zone of Ukraine – at the beginning of May.

The newly appeared beetles are a little slow. They fly away from their places of wintering when the main feed crops are in bloom. Such a fly, as a rule, goes on till the end of July and sometimes the beginning of August.

In this period the insects are concentrated on blooming plants for additional feeding, copulation and laying eggs. The beetles live up to 2 months. Usually the males are the first to die.

The females lay eggs under the epidermis of a sunflower stem, quite often in leaf bases. Availability of egg laying can be identified due to small brown stains appearing on definite places. An inseminated female first gnaws the surface tissues of the plant and lays one oval light-yellow egg in each hole. It can lay 3–7 eggs per cycle on average.

For 10–14 days small light-yellow larvae (up to 0.2 mm) appear and immediately bite into the middle of the stem. Reaching the core they make numerous narrow, oblong, a bit winding galleries filling them with gray-white bore holes.

Eating intensively the tissues of the sunflower stem they gradually occupy most of the stem and can penetrate even lower the root neck into the subterranean organs.

In the years with favourable weather conditions for the migration of the beetles which lay eggs the number of the larvae can reach several dozens per plant. They complete their development before the harvest time, then they can be noticed along the whole length of the stem except the higher third part. When the cold weather sets in the majority of the larvae concentrate close to their lower parts where they winter in bore hole.

In the spring time the larvae move up feeding on the dead tissues of plants and gnawing through galleries near the outer walls. Microtunnels of the larvae in wide stems do not merge, as a rule, and they are situated very close to each other in narrower stems.

Born beetles gnaw rather rapidly the thin outer coating left by the larva and come onto the surface.

The sunflower tumbling beetle is especially dangerous when the number of larvae is over 15 per stem. With such density of its population the crop capacity is substantially reduced. The yield of the damaged plants is lower, there are a lot of plants with weak cores, blind-seed disease is observed. Moreover, the stems with destroyed cores cannot stand the gusts of wind, in August-September they often break because of the head mass what prevents mechanical harvesting.

Our field researches show that this phytophag is extended almost in all the regions of sunflower cultivation – in Mykolayiv, Kherson, Zaporizhzhya, Dnipropetrovsk, Donetsk, Lugansk regions and in the

Национальная академия наук Беларуси

Fig. 1. Damage to a sunflower by a sunflower tumbling beetle, cross section: one can see the galleries gnawed through by the larva.

Fig. 2. Larva of a sunflower tumbling beetle, 9–10 mm, the larva's head is white-brown

Fig. 3. Larva of a sunflower tumbling beetle. Sunflower stems damaged by a sunflower tumbling beetle and broken because of the wind. The yield is greatly reduced

north of the Crimea. But the zones of its most cultivation are considered to be the South-East Steppe – Lugansk, Donetsk and Zaporizhzhya regions.

While researching the lands and private farms the larvae of a sunflower tumbling beetle were found. So, on the researched land of Kolos complex of Lugansk National Agrarian University each stem of a sunflower was found to be damaged (fig. 1).

In September – October while researching the lands and private farms the larvae were found not only in the stems but also in the roots of sunflowers (fig. 2, 3).

All the galleries are gnawed through towards the root. Beginning from autumn the larvae eat out the whole core in the middle of a lower part of the stem, the root neck and the main root.

CONCLUSIONS

Since the beginning of 2004 the information on sunflower damage by unknown pests has begun to come from different places of the southern and eastern regions of Ukraine.

This insect was firstly described in 1930 by T. I. Schegolieva-Borovska, and although V. N. Schegoliev and others in 1934 mentioned it as such one found on a sunflower, it actually did not harm that crop. In other words, the entomological literature beginning from 1930 contains references to the sunflower tumbling beetle as a species, but not as a harmful sunflower pest.

Such appearance of the sunflower tumbling beetle is quite natural as beginning from 2003 the sunflower growing areas in Ukraine have increased actually twofold and they exaggerated a scientifically substantiated and recommended index – 8 % in the structure of the crops interchange system without hard crop rotation what has become the main reason for a strong increase of the number of this pest and appearance of a new-old pest, aggressiveness of which have increased to the utmost under such conditions.

References

1. *Борисоник, З. Б.* Об изменении технологии выращивания семян подсолнечника / З. Б. Борисоник // Селекция и семеноводство. – 1982. – № 6. – С. 39–42.

2. *Буряков, Ю. П.* Агротехника возделывания подсолнечника / Ю. П. Буряков. – М.: Высшая школа, 1977. – 175 с.

Национальная академия наук Бе

3. *Васильев, Д. С.* Агротехника подсолнечника / Д. С. Васильев. – М.: Колос, 1983. – 197 с.
4. *Вольф, В. Г.* Соняшник / В. Г. Вольф. – К.: Урожай, 1972. – 228 с.
5. *Демянюк, М. М.* Ефективність інсектицидів проти південної соняшникової шипоноски / М. М. Демянюк, Р. В. Яковлєв, М. Р. Хирлюк // Карантин і захист рослин. – 2009. – № 7. – С. 4–7.
6. *Добровольский, Б. В.* Сем. Горбатки Mordellidae / Б. В. Добровольский // Вредные жуки. – Ростов н/Д.: Россельхозиздат, 1951. – 455 с.
7. *Кириченко, В. В.* Селекция и семеноводство подсолнечника (Helianthus annus L.) / В. В. Кириченко. – Харьков, 2005. – 385 с.
8. *Кононюк, А. А.* Соняшник – провідна культура АПК України / А. А. Кононюк // Агровісник України. – 2007. – № 1(13). – С. 47–50.
9. Методики випробовування і застосування пестицидів / О. С. Трибель [та ін.]; за заг. ред. О. С. Трибеля. – К., 2001. – 448 с.
10. *Медведев, С. И.* К познанию фауны жуков (Coleoptera) Молдавской СССР и сопредельных районов Украины / С. И. Медведев, Д. С. Шапиро. – 1957. – С. 173–206.
11. *Никитчин, Д. И.* Подсолнечник / Д. И. Никитчин. – К.: Урожай, 1993. – 192 с.
12. *Односум, В. К.* Фауна Украины. Т. 19. Жесткокрылые. Вып. 9. Жуки-горбатки (Coleoptera, Mordellidae) / В. К. Односум. – К.: Наукова думка, 2010. – 264 с.
13. *Федоренко, В. П.* Загроза соняшникової шипоноски / В. П. Федоренко, М. М. Демянюк // Farmer. – 2009. – N 5–6. – С. 20–21.
14. *Федоренко, В. П.* Южная подсолнечниковая шипоноска в Украине / В. П. Федоренко, М. П. Секун, М. М. Демянюк // Защита и карантин растений . – 2009. – № 8.
15. *Щеголев, В. Н.* Насекомые, вредящие полевым культурам / В. Н. Щеголев, А. В. Знаменский, Г. Я. Бей-Биенко. – М.; Л.: Госиздат. колхоз. и совхоз. литературы, 1934. – 464 с.
16. *Щеголев, В. Н.* Защита растнеий от повреждений насекомыми и другими вредителям / В. Н. Щеголев. – М.; Л.: Госсельхозиздат, 1949. – 508 с.
17. *Щеголева-Боровская, Т. И.* Два новых вида из причерноморских степей (Coleoptera) / Т. И. Щеголева-Боровская // Рус. ентомол. обозр. – 1930. – Т. 24, XII-2. – С. 56–58.

С. В. ГОРНОВСКАЯ, В. П. ФЕДОРЕНКО

ПРИЧИНЫ ПОЯВЛЕНИЯ НОВОГО ВРЕДИТЕЛЯ ПОДСОЛНЕЧНИКА – ЮЖНОЙ ПОДСОЛНЕЧНИКОВОЙ ШИПОНОСКИ (*MORDELLIDAE, MORDELLISTENA PARVULLIFORMIS*) – В УКРАИНЕ

Резюме

Обобщены результаты исследований по появлению, вредоносности и распространенности этого нового опасного вредителя подсолнечника – подсолнечниковой шипоноски (Mordellistena parvulliformis Stshegol – Bar., 1930). Представлены результаты исследований посадок подсолнечника по выявлению подсолнечниковой шипоноски и инициации защитных мероприятий против данного вредителя в северо-восточной части Украины.

Национальная академия наук Беларуси