ISSN 1606-9773

ЗАХИСТ І КАРАНТИН РОСЛИН

МІЖВІДОМЧИЙ
ТЕМАТИЧНИЙ
НАУКОВИЙ
ЗБІРНИК

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Надійшла 17.08.2021 р.

UDC 632.768:633.854.78(477.5)
DOI: https://doi.org/10.36495/1606-9773.2021.67.337-348

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DISTRIBUTION AND HARMFULNESS OF *MORDELLISTENA PARVULIFORMIS* BEETLE IN THE LEFT BANK STEPPE OF UKRAINE

Harmfulness and spread of a new dangerous pest of Mordellistena parvuliformis Stshegol.-Bar, 1930 have been recorded in the north-east of Ukraine. The results of researches of the reasons of occurrence, harmfulness and distribution of this dangerous pest of sunflower are generalized.

It was found that the larvae of the sunflower Mordellistena parvuliformis from the diapause occur from the end of the third decade of April after feeding on dead stem tissue. Depending on the time of hatching, the presence of pupae is observed until the end of May. From the third decade of May, you can see the flight of adults and after a short additional feeding on flowering vegetation — the beginning of mating. Adult flight lasts a little more than 1.5 months — until the second decade of July. Embryonic development lasts about two weeks. The last eggs laid were observed in early August. From the second decade of June there was a revival of larvae, which are in an active state inside the stems until mid-September until the end of feeding and transition to a state of rest for further wintering. Thus, the development of one complete generation of toadstools per year is established.

***Mordellistena parvuliformis*; sunflower; harmfulness; plants; imago**

Sunflower is one of the most popular crops in Ukraine. Pests are one of the most serious causes of crop failure. About 60 species of phytophagous, most of which are polyphagous insects, pose a danger to sunflower crops in Ukraine.

In the entomofauna of sunflower agrocenoses in the steppe of Ukraine at present the most common pests should be identified: *Mordellistena parvu-*

liformis Stscheg.-Bar., *Loxostege sticticalis* L., *Tanymecus palliates* F., *Lethrus apterus* Laxm., *Opatrum sabulosum* L.

Among sunflower pests, the *Mordellistena parvuliformis* Stshegol.-Bar, 1930 is currently the most important.

This insect was first described in 1930 by T.I. Shchegolev-Borovska and, although V.N. Shchegolev and others in 1934 mention it as one that occurs on sunflower, it has practically not harmed this culture and in the entomological literature since 1930, there is a mention of the southern sunflower thistle as a species and not as a malicious pest [4, 10].

Materials and methods. The researches were conducted in 2012—2019 on the private farms and research areas in the educational — scientific — production complex «Kolos».

The research was conducted in the laboratories of the Department of Entomology. Professor M.P. Dyadechko of the National University of Life and Environmental Sciences of Ukraine. Partial research was conducted at the Department of Plant Breeding and Protection of Luhansk National Agrarian University.

In field experiments based on industrial crops of sunflower, the appearance of migrating beetles on crop plants, the beginning and duration of egg laying, the revival of the *Mordellistena parvuliformis* Stscheg.-Bar.

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

Black soil is usually low-humid, 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.

Determined the degree of damage to plants, the number of preimaginal stages of thorns (eggs, larvae), inspecting and dissecting the stems with a knife and counting the detection of insects.

Results and discussion. According to V.K. Odnosum the *Mordellistena parvuliformis* Stscheg.-Bar. inhabits the south-eastern regions of Ukraine.

Since 2004, reports of sunflower damage by an unknown pest have been received from various parts of the southern and eastern regions of Ukraine.

In 2006, during expeditionary research on large areas of sunflower in many southern regions of Ukraine, researchers of the Institute of Plant Protection V.P. Fedorenko and A.V. Fedorenko the larvae of the sunflower tumbling beetle (*Mordellistena parvuliformis* Stscheg.-Bar.), which inhabited their stems, were found en masse. After detecting the larva in 2006 and removing an adult insect from it in 2007, it was identified by a researcher at the Institute of Zoology of NASU V.K. Odnosum as a *Mordellistena parvuliformis.*

This appearance of *Mordellistena parvuliformis* is quite natural, because since 2003, the sown area under sunflower in Ukraine has almost doubled, which was the main reason for the sharp increase in the number of this pest,

whose aggressiveness in such conditions has increased to a critical limit [2, 5—8, 9, 16—19].

About 2600 species of the family Mordellidae have been described so far. The fauna of humpback beetles in some regions of Eurasia, North and Central America, Central and South Africa, Southeast Asia, and Australia is relatively well studied. Along with this, large areas remain «white spots» in the study of the family [1, 3, 11, 12—15].

During our observations during 2012—2019, it was found that the larvae pupate in early May by pre-gnawing the passages in the stem environmental humidity. Established atypical behavior for pupae — a high degree of their mobility in the stems. With the help of a pair of urogomphalic growths and lateral motor corns with pronounced hetotaxia, they achieve a reliable inoculation of the body with the walls of the course, which allows the pupa with abrupt translational movements to move quickly in the plant cavity back and forth. The high degree of activity provides an optimally favorable location (especially in hollow and thin stems) when choosing temperature conditions.

The earliest emergence of *Mordellistena parvuliformis* was observed from last year's dry remains of plants growing in the southern exposures of open areas, and are observed from mid-late April for the steppe and early May for the forest-steppe zone of Ukraine.

Thus, the release of imago from the wintering grounds was observed on 21.05 in 2012, 26.05 in 2013 and 23.05 in 2014, 20.05 in 2015, 22.05 in 2016, 24.05 in 2017, 27.05 in 2018, 20.05. in 2019.

Thus, *Mordellistena parvuliformis* appear mainly in late spring — early summer, and are concentrated in wintering grounds. The the beginning of flowering of their main fodder plants begins mass summer, which lasts from late July and lasts until early August.

The exit of the pest from wintering grounds ended in 2013 and 2014 at the beginning of the third decade of June, and in 2012 at the end of the third decade of June. The lifespan of beetles was quite short and lasted up to — 2 months. The first, usually dying females (Table 1).

In 2012—2019, it was noted that from mid-April to early May, the larvae hatch at the end of their gnawed and slightly expanded course.

It was found that depending on the humidity and ambient temperature, the pupa stage lasted 12—14 days.

Examining sunflower stalks, it was found that the pupae of the *Mordellistena parvuliformis* are quite mobile. After cutting the sunflower stalks, it was noted that the larve in this phase of development with the help of special shoots and lateral mobile calluses had a strong grip of the body with the walls of the course, which allowed it to move abruptly, translationally quickly in the stem cavity provide optimal conditions for development.

The beetles hatch from last year's dry plant remains on the southern slopes of the hills from the second decade of May.

1. Biology of the Mordellistena parvuliformis in the research areas in the educational — scientific — production complex «Kolos» (2012—2019)

Phases of pest development		Exit from wintering grounds	Laying eggs	Revival of larvaes
2012	beginning	21.05	09.06	16.06
	the end	28.06	04.08	05.09
	SET	53	115	137
2013	beginning	26.05	14.06	21.06
	the end	24.06	08.08	11.09
	SET	52	90	134
2014	beginning	23.05	07.06	18.06
	the end	21.06	05.08	09.09
	SET	57	101	125
2015 p.	beginning	20.05	08.06	16.06
	the end	25.06	02.08	04.09
	SET	51	96	122
2016	beginning	22.05	05.06	13.06
	the end	26.06	04.08	08.09
	SET	49	100	133
2017	beginning	24.05	07.06	15.06
	the end	22.06	09.08	06.09
	SET	59	100	127
2018	beginning	27.05	10.06	17.06
	the end	28.06	06.08	09.09
	SET	46	86	122
2019	beginning	20.05	05.06	12.06
	the end	25.06	02.08	04.09
	SET	60	98	120

New beetles, after their release, at first slowly, and later, during the mass flowering of the main fodder crops, inhabited them more intensively.

The exit of the pest from wintering grounds ended in 2013 and 2014 at the beginning of the third decade of June, and in 2012 at the end of the third decade of June.

After additional feeding and mating, females began to lay eggs under the epidermis of sunflower stalks, often in the axils of the leaves.

As can be seen from Table 1 in 2012, starting from 09.06 to 04.08, the laying of eggs by female toadstools was observed; in 2013, the first egg-laying was marked on 14.06 and ended on 08.08; in 2014, from 07.06 to 05.08, eggs were laid.

After 10—14 days, small (not more than 1 mm) pale yellow larvae are revived, which immediately penetrate into the middle of the stem. Having penetrated into the core, they make numerous elongated, narrow, tortuous passages, filling them with grayish-white wormholes.

Intensively feeding on the tissues of the stem, the larvae gradually inhabit most of it and can even penetrate below the root collar into the underground organs. In some years, under favorable weather conditions for the migration of beetles and egg laying, the number of larvae can increase to several dozen per plant.

Examination of control plants after 14 days in the inner parenchymal tissue revealed the revival of small (no more than 0.1—0.2 mm) larvae of the first age.

The *Mordellistena parvuliformis* were found during surveys of research sites and farms. Thus, in the surveyed area of educational — scientific — production complex «Kolos» was found damage to each stem of sunflower.

The larvae fed on the inner contents of sunflower stalks and gnawed galleries while moving downward to the root (Fig. 1).

Fig. 1. Galleries gnawed by the larva of the Mordellistena parvuliformis (original photo, 20.09.2019)

All galleries gnaw towards the root. Already in the fall inside the lower part of the stem, root collar and main root of the larvae eat the entire core.

Sunflower stalks damaged by the larva sunflower tumbling beetle are broken by the wind. Yields are significantly reduced (Fig. 2).

Fig. 2. Damaged sunflower stalks by larve Mordellistena parvuliformis and broken by the wind (original photo, 15.09.2019)

Given the almost identical temperature conditions of hatching and the release of beetles was observed for eight years (2012—2019) in the same period.

During 2012—2019 the study of the phenology of the imaginal stage of the *Mordellistena parvuliformis* on sunflower crops was based on studied the stages of seasonal dynamics of flight of beetles (beginning of flight, mass flight, flight completion). Table 2 shows the data of the study of seasonal dynamics of flight phenology of Mordellistena parvuliformis in 2012—2019 and shows the average number of adults detected by the pheromone trap,

2. Seasonal dynamics of the flight of the Mordellistena parvuliformis on pheromone traps in educational — scientific — production complex «Kolos» (2012—2019)

Date	The average number of adults detected by pheromone traps, sp./ trap							
	Years							
	2012	2013	2014	2015	2016	2017	2018	2019
21.05.	0,0	4,0	0,0	2,0	2,2	1,8	2,0	4,0
28.05.	8,0	12,0	6,0	8,2	10,6	8,4	8,2	6,8
04.06.	12,2	20,2	10,2	14,0	18,8	12,6	12,0	10,6
11.06.	18,0	26,0	16,4	18,4	20,4	16,0	18,4	16,2
18.06.	24,0	24,4	22,6	25,0	24,0	20,2	22,8	22,0
25.06.	26,0	22,0	20,2	26,8	22,0	20,0	24,2	20,0

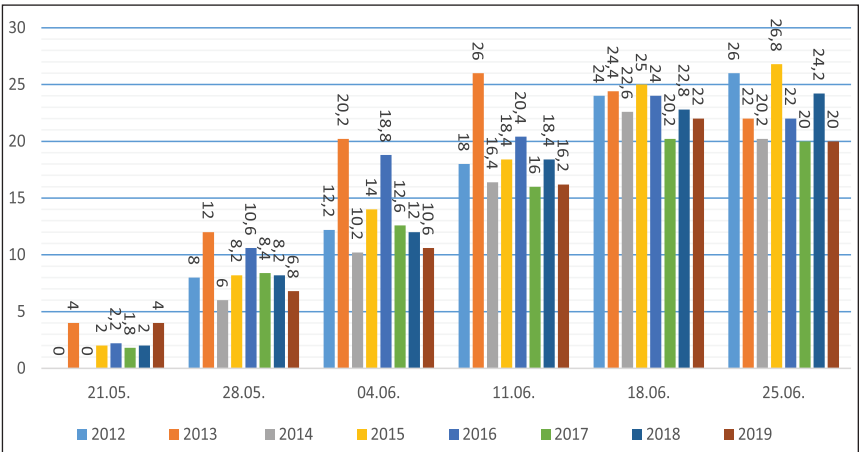

Fig. 3. Seasonal dynamics of flight of the Mordellistena parvuliformis on pheromone traps in NNVK «Kolos» (2012—2019)

which allowed to summarize the results and supplement the database to predict the occurrence and harmfulness of this pest (Fig. 3).

From the phenogram of the *Mordellistena parvuliformis* (Table 3) in the Left Bank Steppe of Ukraine (2012—2019) we found that usually, the awakening of larvae after overwintering, should be expected from the end of the third decade of April, after which they feed for some time dead tissue stems, completing additional nutrition and pupate. Depending on the time of hatching, the presence of pupae is observed until the end of May.

The *Mordellisstena parvuliformis* is especially dangerous when the number of larvae is over 15 per stem. With such density of its population the

3. Perennial phenogram of the development of the Mordellistena parvuliformis in the Left Bank Steppe of Ukraine (2012—2019)

IV			V			VI			VII			VIII			IX		
(–)	(–)	–	–	–													
			0	0	0												
					+	+	+	+	+	+							
						●	●	●	●	●	●	●					
							–	–	–	–	–	–	–	–	–	–	(–)
Symbols: ● — egg; — larva; 0 — pupa; + — imago;																	

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 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.

CONCLUSION

Long-term studies (2012—2019) are likely to suggest that from the third decade of May, and in more southern areas in early May, a mass flight of adults is expected after a short additional feeding on flowering vegetation — mating begins. Adult flight lasts about 1.5 months — until the second decade of July. Embryonic development lasts about two weeks. The last eggs laid were observed in early August. From the second decade of June there was a revival of larvae, which until mid-September were observed in an active state inside the stems until the end of feeding and transition to dormancy for further wintering. Thus it is established that the development of one complete generation of toadstools occurs in one year. The obtained research results for the first time provide an opportunity to build a realistic forecast for planning and conducting effective protective measures.

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Поширення та шкідливість південної соняшникової шипоноски (*Mordellistena parvuliformis*) у Лівобережному Степу України

Шкідливість і поширення нового небезпечного шкідника Mordellistena parvuliformis Stshegol.-Bar, 1930 зафіксовано на північному сході України. Узагальнено результати досліджень причин появи, шкідливості та поширення південної соняшникової шипоноски.

Встановлено, що личинки шипоноски з діапаузи виходять з кінця третьої декади квітня після живлення відмерлими тканинами стебла. Залежно від часу виходу спостерігається наявність лялечок до кінця травня. З третьої декади травня відбувається виліт дорослих особин і після нетривалого живлення квітучою рослинністю розпочинається спарювання. Політ дорослої особини триває трохи більше 45-ти діб, до другої декади липня. Ембріональний розвиток триває близько двох тижнів. Останнє відкладання яєць спостерігали на початку серпня. З другої декади червня відбулося відродження личинок, які перебувають у активному стані всередині стебел до середини вересня — до закінчення живлення та переходу в стан спокою для подальшої зимівлі. Таким чином, відбувається розвиток одного повного покоління шкідника впродовж року.

південна соняшникова шипоноска; соняшник; шкідливість; рослини; імаго

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Распространение и вредоносность южной подсолнечниковой шипоноски (*Mordellistena parvuliformis*) в Левобережной Степи Украины

Вред и распространение нового опасного вредителя Mordellistena parvuliformis Stshegol.-Bar, 1930 зафиксированы на северо-востоке Укра-

ины. Обобщены результаты исследований причин возникновения, вредоносности и распространения южной подсолнечниковой шипоноски.

Установлено, что личинки шипоноски из диапаузы выходят с конца третьей декады апреля после питания мертвой тканью стебля. В зависимости от времени вылупления наблюдается наличие куколок до конца мая. С третьей декады мая можно наблюдать вылет взрослых особей и после непродолжительной подкормки цветущей растительностью — начало спаривания. Полет взрослой особи длится не более 45-ти суток, до второй декады июля. Эмбриональное развитие длится около двух недель. Последние отложенные яйца наблюдали в начале августа. Со второй декады июня произошло возрождение личинок, которые находятся в активном состоянии внутри стеблей до середины сентября — до окончания питания и перехода в состояние покоя для зимовки. Таким образом, развитие одного полного поколения вредителя происходит в течение года.

южная подсолнечниковая шипоноска; подсолнечник; вредоносность; растения; имаго

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Наукове видання

ІНСТИТУТ ЗАХИСТУ РОСЛИН
НАЦІОНАЛЬНОЇ АКАДЕМІЇ АГРАРНИХ НАУК УКРАЇНИ

ЗАХИСТ І КАРАНТИН РОСЛИН

Міжвідомчий тематичний науковий збірник
Заснований у жовтні 1964 р.
Видається один раз на рік

Випуск 67, 2021 р.

Редактор *Волянська Т.І.*
Редактор текстів англійською мовою *Власова М.О.*
Комп'ютерна верстка *Гончарук Н.І.*

Підписано до друку 19.11.2021.
Формат 60 × 84 1/16. Папір офс. Гарнітура 1251 Times.
Друк офс. Обл. вид. арк. 17,4. Ум. друк. арк. 21,39.
Наклад 200.

Свідоцтво про державну реєстрацію видання
Серія КВ №19085-7875ПР від 08.05.2012 р.

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