RESEARCH CONCERNING CONTROL OF THE LARGE CABBAGE WHITE (*PIERIS BRASSICAE*) LARVA IN THE OILSEED RAPE CROP FROM SOUTH-EAST ROMANIA

Emil GEORGESCU[1], Lidia CANĂ[1], Luxița RÂȘNOVEANU[2,3]
emilgeorgescu2013@gmail.com

Abstract

Large cabbage white (*Pieris brassicae*) was considered a secondary pest of the oilseed rape (OSR) crop during the autumn period in Romania and a primary pest of the cabbage crop. This study monitored the attack of the *P. brassicae* larva on both OSR untreated and treated seeds with cyantraniliprole active ingredient (625 g/l) at the experimental field from NARDI Fundulea, located in the southeast of Romania between 2019 and 2021. In the autumn of 2019, on 28 October, at OSR untreated plants, the attack degree was 12.49 %, while at the seed-treated variant, the attack degree was 4.30 %. On 6 November, the attack degree was 38.58 % in the untreated variant, while in the treated variant, it was 8.77 %. In the autumn of 2020, it registered higher attacks from this study. On 11 November, the attack degree was 53.07% in the untreated variant, while in the treated variant with cyantraniliprole a.i. the attack degree was 22.14%. In 2021, it didn't register the attack of this pest in the experimental field. A possible explanation is the delayed emergence of the OSR plants at the end of October. Regarding pest density, this study shows that in the autumn of 2019, on 6 November, the untreated variant registered 4.24 larvae/m^2 and 2.32 larvae/m^2 in the treated variant. In the autumn of 2020, on 2 October, the untreated variant registered 4.82 larvae/m^2 and 2.57 larvae/m^2 in the treated OSR variant. On 11 November, the pest density was higher than the economic damage threshold at both variants. This study reveals a higher attack of the large cabbage white at OSR crop in southeast Romania, compared with results from the previous studies. At the same time, it registered higher pest' attacks in November.

Key words: oilseed rape, pests, higher attack

Oilseed rape (OSR) is one of the most important crops in Romanian agriculture due to its multiple advantages, such as the attractive price for the farmers and good previous crop for cereals (Hăjmăjan H. *et al*, 2012; Popescu A., 2020; Micu M.M. *et al*, 2023). The area cultivated with OSR in Romania ranged from 352622 ha in 2019 to 641425 in 2023 (MADR data, 2024). OSR crops have many abiotic challenges for Romanian farmers, such as drought from the sowing period or frosts during the winter (Grosz D., Tabără V., 2012; Hess L. *et al*., 2015; Marinică, 2019; Pullens, J.W.M., *et al*., 2021). Pests represent one of the most limiting biotic stress factors for this crop in the geographical space of Romania (Popov C., Bărbulescu A., 2007; Râșnoveanu L., 2011a,b; Buburuz A.A. *et al*, 2013; Buzdugan L., Nastase D., 2013; Georgescu E. *et al*, 2015, 2020; Trotuș E. *et al*, 2001, 2011, 2019, 2020; Trașcă F. *et al*, 2019). Research made in our country concluded that higher pest pressure for OSR crops occurred in the autumn, after the plants' emergence and early vegetation stages, but in the spring too, when plants are in buds formation-flowering stage-early maturity stage (Popov C., Bărbulescu A., 2007; Trotuș E. *et al*, 2009; Râșnoveanu L., 2010; Buburuz A.A. *et al*, 2012; Buzdugan L., Nastase D., 2013; Ursache P.L. *et al*, 2017). In the last 20 years, in Central Moldavia, Romania, and the southern parts of this country, the flea beetles (*Phyllotreta* spp. and *Psylliodes chrysocephala*) represent more than 25 % of harmful insect species from OSR crops and one of the predominant species that attack in the autumn (Trotuș E. *et al,* 2009; Bucur A., Roșca I., 2011; Georgescu E. *et al*, 2015, Trașcă F. *et al*, 2019). In some years, with warm autumns, sawfly larvae (*Athalia rosae*) can produce higher damage at OSR plants (Râșnoveanu L., 2011b; Buburuz A.A. *et al*, 2012; Răileanu M.P., Tălmaciu M., 2013; Raicu A.D, Mitrea I., 2020; Trotuș *et al*, 2020, 2022). However, there were not many Romanian papers concerning the large cabbage white larva (*Pieris brassicae*) attack on the OSR crop in the autumn. Only a few studies have mentioned the presence of this pest in the OSR fields but with lower densities (Bucur A., Roșca I., 2011; Râșnoveanu L., 2011b; Trotuș *et al*., 2020, 2022). It was considered a primary pest for cabbage crop (Patriche G. *et al*, 2005; Mustață G., Mustață M., 2013; Iabloncik

[1]National Agricultural Research Development Institute (NARDI), 1Nicolae Titulescu, 915200 Fundulea, Romania
[2]Bucharest University Economic Studies, Faculty of Agri-food & Environmental Economics, 6Romana Square, District 1, 010374 Bucharest, Romania
[3]Agricultural Research Development Station Braila, Viziru km. 9 str., 818008 Braila, Braila County, Romania

A.R. *et al*., 2022; Iosob G.A. *et al*, 2020, 2023). In recent years, our previous research has revealed that in the south-east of Romania, in autumn, there was a higher attack of the green peach aphid (*Myzus persicae*) and diamondback moth larva at OSR crops (Georgescu E. *et al*., 2020, 2023). The higher pest population of these pests was in late autumn, in November, and even in the first half of December, in the years with warm autumns. Climate change was a possible explanation for the higher attack of the pest species, which is considered secondary for OSR crops (Courson E. *et al*., 2015; Fricke U. *et al*., 2022). In Romania, in the last years, in many areas, the average air temperatures during the autumn season were higher than multiyear averages while rainfall decreased (Marinică I., Marinică A., 2019; Tudose T., Moldovan F., 2020). High temperatures and drought can increase the pest attack on main crops, including pests at OSR (Popov C. *et al*, 2006; Deutsch C.A. *et al*, 2018). In the Romanian literature, there wasn't information concerning high atrak of the the large cabbage white larva at OSR crops in warmer autumn conditions. In this paper, the authors present a study regarding the behavior of this pest in autumn in southeast Romania; at OSR untreated plants and OSR seeds treated with cyantraniliprole active ingredient.

MATERIAL AND METHOD

Experimental design

The field trial was carried out at the Agricultural Engineering Laboratory from the National Agricultural Research and Development Institute (NARDI) Fundulea, Călărași County, Romania (latitude: 44.46; longitude: 26.32; alt.: 68.00 m), in the autumn, three years, between 2019 and 2021.
Each year, the OSR crop was sown using the Wintersteiger Plotseed TC, A-4910 machine. The previous crop was barley. The distance between rows was 25 cm, the sowing depth was 3 cm, and the sowing density was 60 seeds/m^2. In this experience, it has planted a PT275 hybrid.
In 2019, OSR was sowed on 6 September, the beginning of plants' emergence was on 24 September, while full plant emergence was on 12 October. In 2020, OSR was sowed on 10 September, the beginning of plants' emergence was on 14 September, while full plant emergence was on 14 September. In 2021, OSR was sowed on 10 September; the beginning of plants' emergence was on 21 October, while full plant emergence was on 27 October. Because of the drought, OSR full emergence was registered at 35 days from the sowing.
This study has two variants: untreated plants (control variant) and seed treatment with the ***cyantraniliprole*** active ingredient, a diamide insecticide from the ryanoid class (Selby T.P. *et al*, 2013). Each variant has an area of 2500 m^2. *Table 1* presents the experimental variants and active ingredients.

Table 1

Experimental variants at OSR crop, during autumn, at NARDI Fundulea, 2021

Nr. crt.	Variant	Active ingredient	Dose
1	Untreated (control)	—	—
2	Lumiposa (seed trt.)	cyantraniliprole (625 g/l)	0.114 l/To seeds

Assessments in the field

Assessments concerning large cabbage white larva *(P. brassicae)* **attack degree (AD%)** at the OSR crop were made four times:

- when plants were in the 1-2 leaves stage (BBCH 11-12);
- when plants were in the 2-3 leaves stage (BBCH 12-13);
- when plants were in the 4-5 leaves stage (BBCH 14-15);
- when plants were in the 6-8 leaves stage (BBCH 16-18).

Each variant was established with 10 assessment points. At each point, it assessed 100 plants from 4 rows in the stair system (25 plants/row). The distance from the first assessment point and plot margins was 10 m. Plants were photographed with a Panasonic Tz-200 camera in Macro mode. The camera lens was placed 10 cm from the OSR plants. Photos of all OSR plants from the assessment points were downloaded and analyzed on a computer desk.
The pest attack degree, AD (%), was calculated after the formula presented below, where F(%) is attack incidence (number of the attacked plants from the total number of analyzed plants), and **I**(%) is large cabbage white larva attack intensity:

$$AD(\%)=[F(\%)*I(\%)]/100$$

The assessments concerning the large cabbage white **larvae counting** from the OSR field experiment were made simultaneously with those concerning the pest attack degree.

Meteorological data

It was provided by Meteo station of the NARDI Fundulea, placed at 2000 m from the experimental field. It has monitored daily air temperature and rainfalls during the autumn of 2019-2021 (September-November).

Statistical analysis

Data from the field assessments were **statistically analyzed** with the Student-Newman-Keuls test (Student, 1927; Neuman D., 1939; Keuls M., 1952) using ARM 2022 software (Gylling Data Management, 2022). The results of this field trial were presented as the mean values for flea beetles' attack intensity or attack degree, plant density, the standard deviation from the average values (SD), and the coefficient of variation (CV).

Table2

Attack degree (%) of large cabbage white (*Pieris brassicae*) at OSR trial in the autumn of the year 2019

Nr. crt.	Variant (active ingredients)	Attack degree (AD %)							
		15 October		23 October		28 October		6 November	
1.	Check (untreated)	0	a	0	a	12.50	a	38.58	a
2.	cyantraniliprole (625 g/l) seed treatment	0	a	0	a	4.30	b	8.77	b
LSD (P=0.05)		0		0		2.896		6.121	
Standard deviation (SD)		0		0		1.287		2.721	
Variation coefficient (C.V.)		0		0		15.330		11.490	

Means followed by the same letter do not significantly differ (P=.05, Student-Newman-Keuls test)

Table 3

Population density (%) of large cabbage white (*Pieris brassicae*) at OSR trial in the autumn of the year 2019

Nr. crt.	Variant (active ingredients)	Number of larva/m^2							
		15 October		23 October		28 October		6 November	
1.	Check (untreated)	0	a	0	a	3.26	a	4.24	a
2.	cyantraniliprole (625 g/l) seed treatment	0	a	0	a	2.28	b	2.32	b
LSD (P=0.05)		0		0		1,449		0,687	
Standard deviation (SD)		0		0		0,644		0,305	
Variation coefficient (C.V.)		0		0		23,250		9,320	

Means followed by the same letter do not significantly differ (P=.05, Student-Newman-Keuls test)

Table 4

Attack degree (%) of large cabbage white (*Pieris brassicae*) at OSR trial in the autumn of the year 2020

Nr. crt.	Variant (active ingredients)	Attack degree (AD %)							
		24 September		2 October		12 October		11 November	
1.	Check (untreated)	6.54	a	45.71	a	48.32	a	53.07	a
2.	cyantraniliprole (625 g/l) seed treatment	2.36	a	7.16	b	9.24	b	22.14	b
LSD (P=0.05)		1.480		8.533		9.257		8.320	
Standard deviation (SD)		1.463		8.435		9.151		8.225	
Variation coefficient (C.V.)		32.890		31.910		31.800		21.870	

Means followed by the same letter do not significantly differ (P=.05, Student-Newman-Keuls test)

Table 5

Population density (%) of large cabbage white (*Pieris brassicae*) at OSR trial in the autumn of the year 2020

Nr. crt.	Variant (active ingredients)	Number of larva/m^2							
		24 September		2 October		12 October		11 November	
1.	Check (untreated)	0.78	a	4.82	a	4.03	a	3.53	a
2.	cyantraniliprole (625 g/l) seed treatment	0.51	b	2.57	b	2.31	b	2.81	b
LSD (P=0.05)		0.373		0.719		0.542		0.450	
Standard deviation (SD)		0.368		0.711		0.536		0.444	
Variation coefficient (C.V.)		57.090		19.250		16.920		14.020	

Means followed by the same letter do not significantly differ (P=.05, Student-Newman-Keuls test)

Table 6

Attack degree (%) of large cabbage white (*Pieris brassicae*) at OSR trial in the autumn of the year 2021

Nr. crt.	Variant (active ingredients)	Attack degree (AD %)							
		12 November		19 November		26 November		3 December	
1.	Check (untreated)	0	a	0	a	0	a	0	a
2.	cyantraniliprole (625 g/l) seed treatment	0	b	0	b	0	b	0	b
LSD (P=0.05)		0		0		0		0	
Standard deviation (SD)		0		0		0		0	
Variation coefficient (C.V.)		0		0		0		0	

Means followed by the same letter do not significantly differ (P=.05, Student-Newman-Keuls test)

Table 7

Population density (%) of large cabbage white (*Pieris brassicae*) at OSR trial in the autumn of the year 2021

Nr. crt.	Variant (active ingredients)	Number of larva/m²							
		12 November		19 November		26 November		3 December	
1.	Check (untreated)	0	a	0	a	0	a	0	a
2.	cyantraniliprole (625 g/l) seed treatment	0	b	0	b	0	b	0	b
LSD (P=0.05)		0		0		0		0	
Standard deviation (SD)		0		0		0		0	
Variation coefficient (C.V.)		0		0		0		0	

Means followed by the same letter do not significantly differ (P=.05, Student-Newman-Keuls test)

RESULTS AND DISCUSSIONS

During the assessment period, weather conditions at the experimental site from NARDI Fundulea were favorable for pest development and attack. In 2019 and 2020, average temperatures registered in September, October, and November were higher than the 50-year average (*figure* 1). The highest deviation from the average was recorded in November (+4.9 °C) 2019, September (+3.3 °C), and October (+3.4 °C) 2020.

Figure 1. **Average temperatures registered at NARDI Fundulea in autumn between 2019 and 2021**

In 2021, the average temperature registered in September was slightly lower than the 50-year average (-0.2 °C), while in October, the same year, the average temperature was lower than the average (-1.1 °C). These were only two autumn moons with a negative deviation from the average temperature value from this study period (2019-2021). Meteorological data registered at NARDI Fundulea, the experimental site, reveal that, generally, rainfalls from autumn months were below the average from 2019 to 2021 (*figure 2*). A higher negative deviation from the average was registered in September 2019 and 2021. Only in two autumn months from the three-year study were rainfalls higher than the averages. However, in September 2020, more than 86 % of the rainfall from this month was registered only in one day (4 September). The draught from the autumn can delay the OSR emergence and intensify the attack of the pests (Olesen J.E., 2010; Buzdugan L., Nastase D., 2013; Fricke U. *et al.*, 2022).

Data from *Table 2* show a large cabbage white larva attack degree of 12.50 %, while in the variant with treated seeds, the attack was low. On 6 November, it registered a higher pest attack on plants from the control variant (AD=38.58 %).

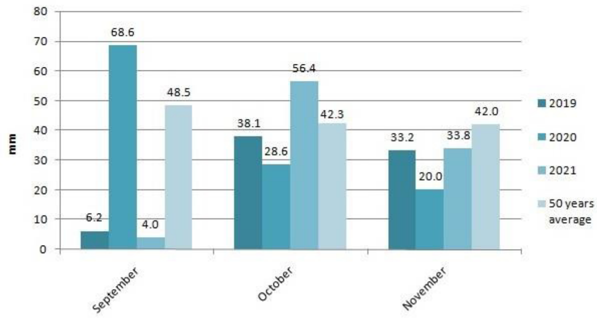

Figure 2. **Average rainfalls registered at NARDI Fundulea in autumn between 2019 and 2021**

At the same time, the pest attack degree at the treated seeds variant was 8.77 %. In both cases, there were significant statistical differences between the attack degree registered at the control variant and the attack registered at the variant with treated seeds ($p<0.05$). In 2019, on 28 October, pest density was 3.26 larva/m^2 in the control variant and 2.28 larva/m^2 in the treated variant, while, on 6 November, it registered 4.24 larva/m^2 in the control variant and 2.32 larva/m^2 in treated variant (*table* 3). In both cases, significant statistical differences were registered between the control and treated variants ($p<0.05$). In the autumn of 2020, it registered higher attacks of the large cabbage white larva from this study period. At the end of September, the attack degree was 6.54 % in the control variant, while in the treated variant, it was 2.36 %. At the beginning of October, the pest attack degree increased to 45.71 %, while at the treated seeds variant, the attack degree was 7.16 % (*table 4*). In the first half of November, the attack degree was higher than 53 % in the control variant, while in the treated variant, the attack degree was 22 %. All assessments from the autumn of 2020 have registered significant statistical differences between the two variants ($p<0.05$). Data from *Table 5* show high pest density at the control variant in the first half of

October and November. Also, the treated variant registered high pest density in October and the first half of November. Even though it has registered higher statistical differences between pest density at the control and treated variant, in October and November, in both cases, the pest population on OSR crop was higher than the economic damage threshold for this species (>2-3 larva/m^2). In the autumn of 2021, it didn't register an attack of the large cabbage white larva (*tables 6 and 7*). A possible explanation is the late emergence of the OSR plants because of the drought from September and less favorable conditions for the pests in the last half of November when plants were in the BBCH 14-16 stage. This is the first paper from the Romanian literature that shows a higher attack of the large cabbage white larva (*P. brassicae*) at an oilseed rape crop in the southeast of Romania. At the same time, the first paper from the Romanian literature reveals high pest attacks and population density at OSR plants in the first half of November in warm autumns.

CONCLUSIONS

In this study, the weather conditions from autumn were favorable for large cabbage white larva attacks at OSR plants. Generally, the average month temperature in September, October, and November (2019-2021) was higher than the 50-year average, while rainfall was below the average. In the autumns of 2019 and 2020, it registered high pest attacks at OSR plants in October and the first half of November. In 2021, it didn't register pest attacks on OSR crops from this study.

Seed treatment with the active ingredient *cyantraniliprole* effectively protects OSR plants in the first vegetation stages. However, in the warm autumn of November 2020, the larva attack was also higher in the treated variant. If larva density is higher than the economically damaging threshold, foliar treatment with an insecticide is needed to protect the plants against this pest.

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