SUSCEPTIBILITY OF SOME FIELD PEA (*PISUM ARVENSE* L.) CULTIVARS TO POD DAMAGE CAUSED BY PEA MOTH (*LASPEYRESIA NIGRICANA* STEPH.)

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Abstract: Field studies were carried out during 2005–2007 growing seasons on susceptibility of the following nine varieties of field pea: Eureka, Hubal, Kos, Marych, Pomorska, Milwa, Sokolik, Winerek, Zagłoba to infestation caused by larvae of pea moth. The experiment included four replications and was set up in a randomised block design. The following cultivars as: Milwa, Kos and Pomorska demonstrated the highest percentage of damaged pods by pea moth larvae, ranging from 3.7 to 69.0%. The lowest per cent of damaged pods was shown by cv. Zagłoba and Sokolik (21.0 and 29.0%, respectively) in 2005, Winerek (3.7%) in 2006 and Sokolik (13.5%) in the 2007. The average yield of tested cultivars ranged from 16.0 dt/ha to 49.8 dt/ha, average 36.2 dt/ha.

Key words: field pea, pea moth, damage, cultivar

INTRODUCTION

The most important pests that damage leguminous plants in Poland are following species: pea leaf weevil (*Sitona lineatus* L.), pea aphid [*Acyrthosiphon pisum* (Harris)], pea weevil (beetle) (*Bruchus pisorum* L. and pea moth (*Laspeyresia nigricana* Steph.). One of the main reasons of a low yield of peas are improper fertilization and lack of adequate protection against pests (Sypniewski 1986; Burnoville 1991; Nalborczyk 1993; Williams *et al.* 1995; Wnuk and Pobożniak 2002; Księżak 2004).

Pea moth belongs to one of the most dangerous pests damaging field pea and garden pea in the regions where these crops are grown commercially. In the southern and south-eastern parts of Poland pea moth inflicts heavy economical losses every year (Kagan 1969a; Chodulska 1977; Niezgodziński 1986). The pest infests mainly garden pea (*Pisum sativum* L.) and field pea (*Pisum arvense* L.), broad bean (*Vicia faba major* L.) and green pea (*Lathyrus* spp.) (Kagan 1962, 1969a; Niezgodziński 1986; Walczak 2001). Caterpillars feed inside pods and damag kernels. The outside covers of pods show irregular spots made by young larvae whilst inside part of pods and kernels are bored out and surrounded with a thread of silk and caterpillar droppings. Damaged kernels are useless both for consumption and processing.

On plantations pea moth poses a serious problem because damaged pods lower seed suitability as a sowing material (Kagan 1969b; Chodulska 1977). Plants grown of damaged seeds live shorter and have fewer seeds in pods.

Harmfulness of pea moth can be reduced by chemical protection or by growing less susceptible cultivars (Chodulska-Filipowicz 1992; Kagan 1969a; Wiatr 1999; Wiatr *el al.* 1989).

The aim of the conducted studies was to determine susceptibility of some cultivars of field pea to the seed damage caused by pea moth in the region of south-eastern Poland.

MATERIALS AND METHODS

The studies were carried out in 2005–2007 on the experimental field of a field pea plantation in Boguchwała. The experiment was conducted according to the method of random block design in four replications on plots covering 16.5 m^2. The previous crop were spring cereals in rotation. The applied mineral fertilization was as follows: N – 39 kg, P_2O_5 – 64 kg, K_2O – 95 kg/ha. Seeds before sowing were dressed with Sarfun 65 DS (karbendazim, tiuram) at the dose 400 g/100 kg of seeds, Wisar 70 WG (metrybuzyn) was applied to control weeds at 0.4 kg/ha in a mixture with Command 480 EC (chlomazon) at the dose of 0.2 l/ha. During vegetation no fertilization was applied on pea field. The following cultivars were included in the experiment: Eureka, Hubal, Kos, Marych, Pomorska, Milwa, Sokolik, Winerek, Zagłoba. Before harvest, one hundred pods were collected from each plot for seed analysis damage caused by pea moth larvae. After crop collection by a plot harvester, the kernel yield was measured from particular treatments. The significance of differences be-

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tween seed damage (in %) caused by pea moth and the seed yield of tested cultivars were estimated by Tukey's test at the level of significance 5%.

RESULTS AND DISCUSSION

In the 2005 and 2007 growing seasons, weather conditions were favorable for the development of the pest. While in 2006 cool and rainy weather from the middle of May until the first week or so of June disturbed the flight of pea moth adults and the process of egg lying. In consequence the pod damage was relatively low at the end of the season (Table 1).

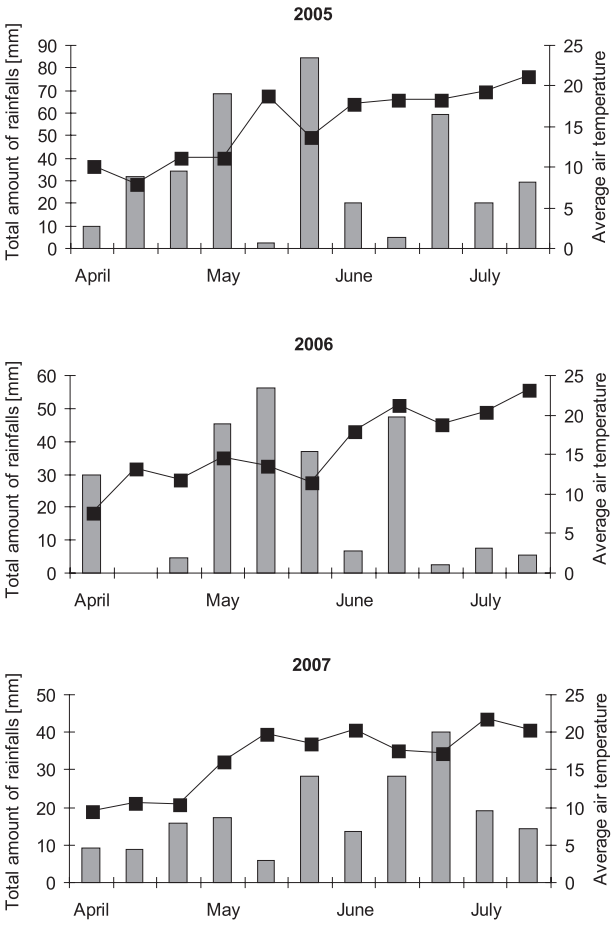

Fig. 1. Average decade air temperature and total amount of rainfall in the months: April–July 2005–2007

The level of pod damage by pea moth caterpillars varied from 21.0 to 69.0% in the 2005 experiment. The highest damagee was observed for cv. Milwa with 69.0% of damaged pods. The least injuries were found in the pods of the cv. Zagłoba (21.0%) (Table 1).

In 2006 symptoms of feeding of pea moth larvae on the tested field pea cultivars were lower and more diverse. The pod damage ranged from 3.7 to 13.5%. The lowest per cent of damaged pods was found for the cv. Winerek (3.7% of damaged pods). A high per cent of damage was noted on the cultivars: Milwa and Sokolik – 13.5% and 13.2% respectively (Table 1).

In 2007 pods of all studied cultivars were damaged to a significantly higher per cent in comparison with the previous year. The highest pod damage was noted for the cv. Pomorska, which amounted to 40.2%. A high per cent of damaged pods was noted for the cvs Kos (38.7% of damaged pods) and Milwa (36.2%). The cv. Sokolik (13.5%) was found to have the lowest pod damage (Table 1).

The data presented in table 1 demonstrate consistency in relative ranking of the level of sustainability of majority tested cultivars to the pea month damage (Table 1). In the case of two cultivars: Sokolik and Winerek their relative ranking varied between 1st to 6th place in the damage level (Table 1). The lowest (3.7%) damage – the 1st grade in 2006, 5th and 6th grade in 2007 and 2005, respectively, were observed for the cv. Winerek. In two years (2007 and 2005) the damage level on cv. Sokolik was classified as the lowest or the second lowest, but in 2006 – on the 8th position (Table 1).

The observed variation in a relative susceptibility of the tested field pea cultivars confirmed observations of other authors that screening crop cultivars for resistance/susceptibility under natural field infestation may be affected by other factors (Dąbrowski 1988). It was earlier established that the location of an experimental plot near a cultivar of higher/lower preference for the females of a pest may affect the selection of a suitable plant for oviposition. Therefore the previous classification of one mechanism of resistance defined as "non-preference" (Painter 1968) was changed to "antixenosis" (Dąbrowski 1988; Smith 1989). A collected data on the pod damage did not confirm that the two tested field pea cultivars expressed the antibiosis mechanism of resistance. The relatively high variation in the pod damage of cv. Sokolik and Winerek between consecutive seasons is an example.

The experiment also confirmed that screening for susceptibiolity/resistance under higher natural infestation gave more reliable values than under lower pest pressure. The mechanism called "escape" related to spatial distribution of a pest on the tested crop may be responsible for variation in a cultivar damage level in consecutive years of experimentation (Dąbrowski 1988).

Damage of field pea seeds by larvae of pea moth is common under commercial production conditions. Some authors found that this damage can constitute from 0.2 to 20.0% and in extreme cases it can reach 90.0% (Kagan 1962, 1969a; Niezgodziński 1986; Chodulska-Filipowicz 1992).

According to Walczak (2001), pea moth in the last dozen of years or so did not pos a serious danger for field pea. On the basis of accumulated data the average pod damage according to the author constituted 4.3%. This pest was more dangerous in the south-eastern part of the country, e.g. in the Podkarpacie province with the average infestation equal to 6.3%.

In a period of 3-year of our studies conducted in Podkarpacie the average pod damage was markedly higher and amounted to 26.3%.

Studies on the susceptibility of cultivars to seed damage by pea moth were conducted in several regions of the country in the past years (Kagan 1969b; Wiatr *et al.* 1989; Chodulska-Filopowicz 1992). According to these authors the damage caused by pea moth was diverse between the cultivars used in their studies. Wiatr *et al.* (1989) car-

Table 1. Damage (in %) and its relative ranking of pea field pods by pea moth (*L. nigricana*) in 2005–2007

No.	Cultivar	Pods injured							
		2005		2006		2007		average	
		[%]	ranking	[%]	ranking	[%]	ranking	[%]	ranking
1.	Eureka	42.0	4	6.0	2	24.2	3	24.0	3
2.	Hubal	–	–	6.7	4	21.7	2	14.2	3
3.	Kos	51.0	7	7.2	5	38.7	6	32.3	6
4.	Marych	40.0	3	10.2	6	33.0	4	27.7	4.3
5.	Milwa	69.0	8	13.5	9	36.2	6	39.5	7.6
6.	Pomorska	44.0	5	12.0	7	40.2	7	32.0	6.3
7.	Sokolik	29.0	2	13.2	8	13.5	1	18.5	3.6
8.	Winerek	48.0	6	3.7	1	34.0	5	28.5	4.0
9.	Zagłoba	21.0	1	6.2	3	33.5	4	20.2	2.6
LSD (0.05)		10.3		3.6		4.3			

Explanations: 1 – the relative lowest infestation; 7–8 – the highest pod damage between tested cultivars

Table 2. Yields of pea field cultivars in 2005–2007

No.	Cultivars	Yield of pea seeds in dt/ha			
		2005	2006	2007	average
1.	Eureka	37.1	41.9	35.2	38.0
2.	Hubal	–	48.3	38.8	43.5
3.	Kos	19.1	37.7	32.8	29.8
4.	Marych	38.7	33.6	21.8	31.3
5.	Milwa	33.6	47.6	39.9	40.3
6.	Pomorska	42.4	46.4	49.8	46.2
7.	Sokolik	30.1	41.0	40.8	37.3
8.	Winerek	16.0	25.2	27.6	22.9
9.	Zagłoba	35.2	34.9	41.8	37.3
LSD (0.05)		2.5	3.3	5.8	

rying out investigations in the vicinity of Poznań found that seeds of field pea were damaged by pea moth from 1.09 to 13.18%. The highest damage of field pea was found for the cvs Nieznanicka (9.13%) and Kosieczyńska (8.6%), whereas the lowest damage – for the cvs Pergo (1.09%) and Gomik (1.51%). Results of our studies indicate that pod damage of field pea in Podkarpacie was significantly higher and ranged from 14.2 to 39.5%. The lowest average pod damage was noted for the cvs. Hubal (14.5%) and Sokolik (18.5%), whereas the highest one for the cv. Milwa (39.5%) and Kos (32.3%).

The reasons for diverse seed damage caused by pea moth larvae between the studied years could be related to favourable weather conditions during vegetation seasons in the region. High seed yield was harvested from cultivars: Pomorska (44.4 dt/ha), Milwa (40.6 dt/ha) and Eureka (39.5 dt/ha).

The lowest average seed yield was collected from the cultivars: Winerek (20.6 dt/ha) and Kos (24.8 dt/ha) in the period of 3-year studies (Table 2).

Seed yield harvested during the 2005 growing season had a lower average weight (31.5 dt/ha). The highest average seed yield from the studied cultivars was obtained in 2006 (39.6 dt/ha). The reasons for a diverse seed damage caused by pea moth larvae in the studied years as well as significant differences in seed yield could be related to weather conditions during the vegetation period of field pea.

According to Księżak (2004) the level of field pea yield depends first of all on weather conditions in June, when plants start flowering and pod filling. Due to favourable weather and moisture conditions during this period plants set more nodes with pods, more pods and seeds, which led to higher yield. Studies conducted by other authors (Kotecki 1990; Nalborczyk 1993; Rajs *et al.* 1994) confirmed the fact that meteorological conditions (rainfall) are one of the major factors limiting yield of leguminous plants, including field pea.

CONCLUSIONS

1. The south-eastern region of Poland faced in the experimental period the field pea infestation by pea moth ranging from 3.7 to 69.0%.
2. The field studies showed that all analyzed field pea cultivars were damaged by larvae of pea moth but at a different level.
3. The average pod damage by pea moth in the experimental period was the highest in 2005 (43.0%) and the lowest in 2006 (8.7%).
4. The highest seed yield was obtained from the cultivars: Pomorska, Hubal and Milwa. The average seed yield of the tested cultivars was equal to 36.2 dt/ha.
5. In the regions of a high occurrence of pea moth such cultivars as: Hubal, Sokolik, Zagłoba, Eureka should

be grown as they are less susceptible to the damage caused by this pest.

6. A relative ranking of the damage level of tested pea cultivars in consecutive years may indicate that some environmental factors related to the spatial distribution of the pest on the experiomental field could affect the pod infestation level by pea month.

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POLISH SUMMARY

WRAŻLIWOŚĆ WYBRANYCH ODMIAN PELUSZKI (*PISUM ARVENSE* L.) NA USZKODZENIA PRZEZ PACHÓWKĘ STRAKÓWECZKĘ (*LASPEREYRESIA NIGRICANA* STEPH.)

W latach 2005–2007 wykonano badania, których celem było określenie wrażliwości badanych odmian peluszki na uszkodzenie nasion w strąkach, powodowane przez pachówkę strąkóweczkę w Boguchwale. Doświadczenia założono metodą losowanych bloków w czterech powtórzeniach. Badaniami objęto 9 odmian peluszki, tj.: Eureka, Hubal, Kos, Marych, Pomorska, Milwa, Sokolik, Winerek i Zagłoba.

W 2005 roku najwyższy procent uszkodzonych strąków zanotowano u odmiany Milwa – 69,0%. Odmiana Zagłoba była najsłabiej uszkadzana – 21,0%. Średni plon nasion peluszki w analizowanym okresie wahał się od 16,0 dt/ha do 42,4 dt/ha.

W 2006 roku najbardziej uszkodzone strąki obserwowano u odmian Milwa – 13,5%. Strąki odmiany Winerek były, w najniższym procencie, uszkadzane przez larwy pachówki strąkóweczki – 3,7%. Średni plon nasion peluszki wyniósł 39,6 dt/ha.

W najniższym procencie uszkadzane strąki na odmianie Sokolik (13,5%) odnotowano w 2007 roku. Najwyższy procent uszkodzonych strąków stwierdzono u odmiany Pomorska – 40,2%. Plon nasion peluszki w analizowanym okresie wahał się od 21,8 dt/ha do 49,8 dt/ha, średnio 36,5 dt/ha.