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SEED DAMAGE OF FIELD BEAN (*VICIA FABA* L. VAR. *MINOR* HARZ.) CAUSED BY BEAN WEEVILS (*BRUCHUS RUFIMANUS* BOH.) (*COLEOPTERA: BRUCHIDAE*)

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Abstract: In the years 2000–2002, studies were carried out on susceptibility of 12 field bean (*Vicia faba* L. var. *minor* Harz.) cultivars to evaluate seed damage caused by bean weevil (*Bruchus rufimanus* Boh.). Seed analysis showed that determinate cultivars (Tim, Martin, Rajan and Optimal) were more susceptible to damage caused by bean weevils than other cultivars. In the course of the studies damage caused by bean weevils ranged from 18.5% to 28.9%. The average seed yield in the experimental period ranged from 2.88 t/ha to 6.62 t/ha.

Key words: *Bruchidae*, seeds, damage, cultivars, field bean, bean weevil

INTRODUCTION

Leguminous plants accumulate the largest amount of protein in comparison to other crops. Due to a high value of this basic nutrient in seeds, these plants constitute an important source of food for both humans and animals. They are also a relatively cheap source of protein rich in exogenous amino acids.

In the last few years, the area of pulse cultivation in Poland has shown a decreasing tendency. This has been influenced, among others, by a low yielding stability and a high sensitivity to unfavourable environmental factors. Seed producers have a serious problem with susceptibility of pulse species and cultivars to diseases and pests.

Observations conducted in many regions of Poland indicate that the dominating pest on seed and fodder plantations of field bean (*Vicia faba* L. var. *minor* Harz.) is field bean weevil (*Bruchus rufimanus* Boh.) (Błaszczak and Gontarska-Lacka 1995; Chodulska 1985; Matłosz 1991; 1993). Since larvae of this pest undergo the entire developmental cycle inside the seeds, they cause significant losses of seed mass and decrease sowing and fodder value of seeds. The annual increase of seed damage and significant quantitative and qualitative losses of yields caused by this pest pose an important economic problem. Seeds injured by bean weevils are more easily inhabited by phytopathogenic organisms (Adamczewski et al. 1992; Chodulska 1985;

Ciesielski et al. 1992; Epperlin 1992; Niezgodziński 1988; Sądej and Żurańska 1986; Sedivy 1972).

Harmful effects caused by bean weevils can be reduced by intensive plant protection using chemical plant treatment or by growing cultivars less susceptible to seed damage by this pest. In connection with the tendencies to reduce the application of plant protection agrochemicals, selection of field bean cultivars less susceptible to damage is important. Studies dealing with this problem were conducted by some authors in a limited range (Chodulska 1996; Kaniuczak and Matłosz 2001; Matłosz 1998).

The aim of the presented studies was to evaluate susceptibility of examined field bean cultivars to bean weevils.

MATERIALS AND METHODS

The studies on the experimental field in Boguchwała in 2000–2002 were carried out on the following field bean cultivars: Alen, Kodan, Martin, Nadwiślański, Neptun, Optimal, Rajan, Redos, Sonet, Tim, Titus, Tom. The experiment was conducted according to the method of random block design with four replications. The area of one plot covered 24 m^2. Before bean harvest, 100 pods were gathered from each plot (4 replication × 100 pods) to analyze seeds for damage caused by bean weevil. During the vegetation season of field bean no chemical treatments were performed. The plants were harvested at the phase of physiological seed maturity. Seeds gathered by a plot combine from particular objects of the experiment were also analyzed. The significance of differences was estimated by Student's t-test at significance level of 5%.

RESULTS AND DISCUSSION

The intensity of beetle occurrence of that pest was significantly influenced by meteorological conditions, particularly in the period of imago flight over plants and during egg laying. Weather conditions in the years 2000–2002 were diverse. They influenced the development of field bean plants as well as the occurrence of agrophages on plants. A moderate amount of precipitation during the vegetation season and optimal temperature rendered the intensity of bean weevils significant, which contributed to a significant damage of seeds of all bean cultivars by larvae of this pest.

In the year 2000, damage of bean seeds was medium. Low temperatures in the spring and large amount of precipitation, including those during storms, in the period of beetle flight and egg laying caused their washing out of plants, the effect of which was the decrease of seed damage in all examined field bean cultivars.

The percentage of damage of field bean seeds by bean weevil in 2000–2002 is presented in table 1 and seed yields in table 2.

In the year 2000, damage of field bean seeds ranged from 13.2% to 21.0%. The most damaged by bean weevil was determinate cv. Optimal (21.0% of damaged seeds). The least seed damage (13.2%) was recorded on cv. Neptun.

In 2001, it was noticed that signs of bean weevil feeding on field bean cultivars were more diverse. Seed damage ranged from 3.2% to 28.5%. Like in 2000, the low-

Table 1. Susceptibility of field bean cultivars to injuries caused by bean weevil

No.	Cultivar	% of seeds injured in the year			Average
		2000	2001	2002	
1	Alen	15.9	10.5	15.5	13.9
2	Kodam	15.0	6.2	11.5	10.9
3	Martin (s)	19.9	27.5	23.2	23.5
4	Nadwiślański	15.1	6.5	9.0	10.2
5	Neptun	13.2	3.2	12.0	9.4
6	Optimal (s)	21.0	21.5	26.2	22.9
7	Rajan (s)	19.5	22.0	23.0	21.5
8	Redos	14.2	8.5	9.5	10.7
9	Sonet	15.0	6.7	13.7	11.8
10	Tim (s)	18.5	25.6	28.9	24.3
11	Titus	15.5	28.5	28.7	24.2
12	Tom	13.6	12.5	15.5	13.8
	LSD (0.05)	4.91	6.45	7.82	

s – cultivar with terminal inflorescence

Table 2. Yields of field bean cultivars

No.	Cultivar	Yield t/ha in the year			Average
		2000	2001	2002	
1	Alen	5.39	3.95	3.99	4.44
2	Kodam	5.89	4.02	4.52	4.81
3	Martin (s)	5.02	3.16	3.99	4.06
4	Nadwiślański	6.46	4.03	4.49	4.99
5	Neptun	5.81	3.70	4.80	4.77
6	Optimal (s)	4.93	3.28	3.54	3.92
7	Rajan (s)	4.75	2.88	3.71	3.78
8	Redos	5.47	3.65	4.33	4.48
9	Sonet	6.62	4.13	4.55	5.10
10	Tim (s)	5.28	3.24	4.10	4.21
11	Titus	5.09	3.30	3.86	4.08
12	Tom	6.01	3.60	3.49	4.37
	LSD (0.05)	1.34	0.46	0.39	

s – cultivar with terminal inflorescence

est per cent of damaged seeds (3.2%) was found on cv. Neptun. Per cent of seed damage of the determinate field bean cultivars Optimal, Rajan, Tim and Martin was high and amounted to – 21.5%, 22.0% 25.6%, 27.5%, respectively. The highest per cent of seed damage was found on cv. Titus (28.5%).

In 2002, the highest seed damage was found on the determinate cv. Tim, which amounted to 28.9%. Like in the years 2000–2001, damaged seeds of the remaining determinate cultivars amounted to a high per cent (Rajan – 23.0%; Martin – 23.2%, Optimal – 26.2%). A high per cent of damaged seeds was also found on cv. Titus (28.7%). The lowest per cent of seed damage was found on cvs. Nadwiślański (9.0%) and Redos (9.5%).

The highest average seed yields were harvested from cultivars Sonet (5.10 t/ha), Nadwiślański (4.99 t/ha) and Kodam (4.81 t/ha). Yields of determinate cultivars were lower: Rajan (3.78 t/ha), Optimal (3.92 t/ha), Martin (4.06 t/ha).

The average mass of seed yields harvested in the course of the studies in 2001 was lower (3.57 t/ha) than that of seed yields in 2000 (5.56 t/ha) (Tab. 2). Diverse seed damage caused by bean weevils in different years of the studies and significant differences in seed yields could be caused by weather conditions during the vegetation season.

Damage of field bean seeds by bean weevils commonly occurs in production (Chodulska 1996; Juchnowicz et al. 1985; Matłosz 1998; Błaszczak and Gontarska-Lacka 1995). The authors found that damage can constitute from 3% to 70%. They noticed that there are also differences between cultivars. My personal present and earlier studies confirm this information (Chodulska 1996; Kaniuczak and Matłosz 2001; Matłosz 1998). As shown by the conducted studies, the average seed damage caused by bean weevils was higher in determinate cultivars than in remaining ones. This is corfirmed by investigations conducted by other authors (Chodulska 1996; Matłosz 1998).

Studies carried out by some authors on chemical control of bean weevils with the use of insecticides from different chemical groups have shown a low per cent of biological effectiveness and small economic effects as determined by seed yield increase. This is associated with a long period of this insect emergence on plantations and a high mobility of beetles.

CONCLUSIONS

1. The performed studies indicate that all cultivars under study were damaged by bean weevils to a different degree.
2. The average seed damage by bean weevil was the highest in 2002 (18.0%) and the lowest in 2001 (14.9%).
3. The percentage of seed damage by bean weevil was higher in determinate cultivars: Tim, Martin, Optimal and Rajan, than in cv. Titus with a normal type of growth.
4. The lowest yields of field bean seeds were harvested from cultivars the seeds of which were damaged by these insects to the highest degree.

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POLISH SUMMARY

USZKODZENIE NASION BOBIKU (*VICIA FABA* L. VAR. *MINOR* HARZ.) PRZEZ STRĄKOWCA BOBOWEGO (*BRUCHUS RUFIMANUS* BOH.) (*COLEOPTERA: BRUCHIDAE*)

W latach 2000–2002 wykonano badania nad podatnością 12 odmian bobiku na uszkodzenie nasion przez strąkowca bobowego. Analiza nasion wykazała, że odmiany samokończące (Tim, Martin, Rajan i Optimal) były bardziej podatne na uszkodzenie przez strąkowca bobowego od pozostałych. W okresie badań ich uszkodzenie wahało się od 18,5% do 28,9%. Spośród pozostałych odmian najsłabiej uszkodzoną w roku 2000 była Tom (13,6%) w 2001 roku –Neptun (3,2%) a w roku 2002 Nadwiślański (9,0%). Średni plon bobiku w badanym okresie wahał się od 2,88 t/ha do 6,62 t/ha.

Book Review

Credland, P.F., Armitage, D.M., Bell, C.H., Cogan, P.M., Highley, E. (Eds.). 2003. Advances in Stored Product Protection: Proceedings of the 8th International Working Conference on Stored Product Protection 22–26 July 2002, York, UK. CAB International, 1071 pp.

As indicated in the book preface the First International Working Conference on Stored Product Protection (IWCSPP) was held in Savannah (USA) in 1974 and followed every four years by: the 2nd – 1978 in Ibadan (Nigeria); the 3rd - 1982 in Manhattan (USA); the 4the - 1986 in Tel Aviv (Israel); the 5th – 1990 in Bordeaux (France); the 6th – 1994 in Canberra (Australia); the 7th – 1998 in Beijing (China). The conferences serve as the premier world forums for the presentation of research results and reviews bearing on the safe storage of durable foodstuffs.

The eighth conference held at York (UK) from 22 to 26 July 2002 was attended by over 400 participants form about 40 countries. They presented over 200 keynote, oral and poster presentations within five sessions that precisely correspond with the following five sections of the proceedings.

Section 1 "The Future of Stored Products Protection: Impacts and Global Issues" (p. 3–39) contains one oral and four poster papers,

Section 2 "Biology, Detection and Biological Control" (p. 43–419) contains three keynote, 16 oral and 57 poster papers.

Section 3 "Food Safety" (p. 423–549) contains one keynote, seven oral and fifteen poster papers.

Section 4 "Chemical and Physical Control" (p. 553–929) contains one keynote, nineteen oral and fifty-six poster papers.

Section 5 "Processing and Applications" (p. 933–1038) contains one keynote, seven oral and nine poster papers.

The scientific programme of the Conference consisted also six workshops on special topics and reports on their results are included into proceedings.

1. Workshop "Resistance to control measures" (p. 1041–1049).
2. Workshop "Museum pests" (p. 1050–1051).
3. Workshop "Intelligent automated grain management systems" (p. 1052–1053).
4. Workshop "Alternatives to methyl bromide" (p. 1054–1055).
5. Workshop "Trapping and spatial analysis for evaluating pest management practices in retail stores" (p. 1056).
6. Workshop "Biological control" (p 1057–1958).

I recommend this book to all specialists working on problems of protection of stored food products as well as to all agricultural libraries.

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