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Tolerance of lucerne varieties to *Apion seniculus* Kirby (Coleoptera: Curculionidae)

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Abstract. During the 2007-2009 period in IFC, Pleven (Bulgaria) a field trial was carried out with the purpose of studying the tolerance of 8 lucerne varieties to attack by *Apion seniculus* Kirby. It was found that the attack of weevil was the strongest at primary growth. The damaged plants varied from 21.1 to 45.8%. Attacked plants were the most in the second and third year of cultivation of alfalfa (34.1-48.4%). *Apion seniculus* attacked the least varieties Europe and Multifoliolate lucerne. The degree of the damaged stems were respectively 9.10 and 8.16%. These varieties occupied the first two places in the list of varieties ranging. The most sensitive were Prista 3 (20.03%), Obnova 10 (18.21%) and Pleven 6 (18.24%). The parameters that had the most influence on the degree of the damaged stems by larvae of *Apion seniculus* were: the rate of regrowth in the spring, respectively the height of stems ($r = +0.830$) and number of stems of a plant ($r = -0.703$). With a good tolerance to tracked parameters were Europe and Multifoliolate lucerne, which determined their phenological and morphological tolerance.

Keywords: lucerne varieties, *Apion seniculus*, tolerance

Introduction

Lucerne is the most valuable herbaceous forage and perennial legume crop in our country (Topalov et al., 1989). Owing to its great productive capacities, it has a considerable share in satisfaction of the needs of animal production (Radeva et al., 2005). Obtaining of high forage yields is indisputably connected with lucerne protection from insect pests. One of the permanent insect pests, the damage degree of which is associated with duration of lucerne cultivation, is *Apion seniculus*. This species was also reported as a pest of clover and sweet clover (Batiashvili et al., 1952; Glushtenko, 1961).

Variety, as a powerful means, influences the abundance and physiological state of phytophagous insects. The tolerant varieties suppress their reproduction and the nonresistant ones favour it. The use of tolerant varieties decreases the application of insecticides, increases the activity of entomophages, reduces the negative effect of anthropogenic factor on the agroecosystems.

The objective of this study was to investigate the tolerance of some lucerne varieties to *Apion seniculus* Kirby.

Material and methods

The study was conducted during the 2007-2009 period in the Experimental field of Institute of Forage Crops (IFC), Pleven, Bulgaria on slightly leached chernozem, on a natural background of soil supply with major elements and under nonirrigated conditions. The trial was laid out by the block method with 8 lucerne varieties: Europe (France), Prista 2 (Obraztsov chiflik, Ruse), Prista 3 (Obraztsov chiflik, Ruse), Prista 4 (Obraztsov chiflik, Ruse), Obnova 10 (IFC, Pleven), Pleven 6 (IFC, Pleven), Dara (IFC, Pleven), Multifoliolate (Obraztsov chiflik, Ruse).

The sowing was conducted at an interrow spacing of 11.5 cm and a sowing rate of 2.5 kg/da, with 4 replications and a trial plot size of 10 m². Study started from second year of growing alfalfa. At the flowering stage of primary growth every year were counted stems

and measured plant height.

Before the decimation of growth were taken down samples by the *Apion seniculus* failure. Longitudinal cut through the stems are reported indicators: number of damaged stems with tunnels, tunnel length (mm) and distance of tunnel from the root crown (mm). Arranging varieties of degree of damaged stems was done in Lindanski (1988). The varieties with the lowest absolute values are in the first rang and these with the highest values are in the eight rank. Determination of the species *Apion seniculus* was confirmed by Prof., Ivanka Lecheva – Agriculture University, Plovdiv, Bulgaria.

Results and discussion

The damage caused by the *Apion seniculus* larva was expressed in gnawing of a thin oblong tunnel in the stem along its length. The tunnels are clean and there were no shavings and excrements. As a result of the damage done to the plants they break and lodge. Similar picture of damage caused by this injurious insect was also reported by Roktanen (1957) in clover.

The results of survey showed that the attack of weevil was the strongest at primary growth. The damages in the second growth were single and have no economic significance. The degree of attacked plants increased gradually and was highest in the third year of growing alfalfa. Average for the period of study it reached 37.9% (Table 1). Analogous data was reported by Petruhi and Krishtal (1949) and Kokorin (1957) in clover. Attacked plants by *Apion seniculus* in different varieties varied from 21.1 to 45.8% average for the period 2007-2009. The least attacked plants by the insect with values below the average for the study (37.9%) were the varieties Europe (23.6%) and Multifoliolate (21.1%). The studied parameter did not reflect exactly and clearly the preference of the insect pest for the studied varieties.

The main trait characterizing the degree of attack by the weevil was the degree of damaged stems. The reason for that was the difference in stem number for the different varieties, as well as the

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picture of damage. Data shown in Table 1 show that the average for study the damaged stems were 8.70% for 2009 to 23.27% for 2008 and for the study period – 15.36%. *Apion seniculus* attacked the least varieties Europe and Multifoliate lucerne, where an average of three years damaged stems were 9.10 and 8.16% and by 6.25 and 7.20% less than the average for the period of study. In the varieties ranging in terms of damaged stems with the most stable positions are Europe and Multifoliate lucerne, which in years and average 2007-2009 they were with a rank 1 and rank 2 (Table 1). It should be

emphasized that these varieties before harvest of the primary growth were with the smallest height of the stems (61.1 and 60.5 cm). Strong positive correlation existed between percentage of damaged stems and plant height ($r = + 0.830$) -Table 2. In addition, the slow rate of regrowth in the spring did not coincide with the earlier appearance of the weevil. This explains the somewhat lower attack and underlined tolerance of varieties Europe and Multifoliate lucerne to *Apion seniculus*, that tolerance was related to the phonological development of different varieties. The enemy attacked in the

Table 1. Attack by *Apion seniculus* in different lucerne varieties

Varieties 2007	% plants with damaged stems	Number of analyzed stems	Damaged stems		Rank
			Number	%	
2007					
Europe	8.5	323	20	6.1	1
Prista 2	43.9	283	47	16.6	3
Prista 3	46.7	264	45	17.1	4
Prista 4	37.2	225	43	19.1	7
Obnova 10	40.9	152	30	19.4	8
Pleven 6	43.6	262	48	18.3	6
Dara	34.1	226	40	17.5	5
Multifoliate	17.5	274	19	6.9	2
x	34.1	251.1	36.5	15.1	-
2008					
Europe	42.2	170	30	17.6	1
Prista 2	54.7	118	28	23.7	5
Prista 3	56.8	154	47	30.5	8
Prista 4	46.4	124	27	21.8	3
Obnova 10	52.1	139	31	22.3	4
Pleven 6	51.1	143	34	23.8	6
Dara	50.4	118	33	28.0	7
Multifoliate	33.8	121	23	19.0	2
x	48.4	135.9	31.6	23.3	-
2009					
Europe	20.0	166	10	6.0	3
Prista 2	20.0	152	11	7.2	5
Prista 3	34.0	141	20	14.2	7
Prista 4	17.8	120	8	6.7	4
Obnova 10	16.0	203	29	14.3	8
Pleven 6	14.0	143	18	12.6	6
Dara	14.0	121	6	5.0	2
Multifoliate	12.0	217	8	3.7	1
x	18.5	157.9	13.8	8.7	-
Average for 2007-2009					
Europe	23.6	219.66	20.0	9.10	2
Prista 2	39.5	184.33	28.6	15.54	3
Prista 3	45.8	186.33	37.3	20.03	8
Prista 4	33.8	156.33	26.0	16.63	4
Obnova 10	36.3	164.66	30.0	18.21	6
Pleven 6	36.2	182.66	33.3	18.24	7
Dara	32.8	155.00	26.3	16.98	5
Multifoliate	21.1	204.00	16.6	8.16	1
x	37.9	181.62	27.3	15.36	-

x – average value for the trial

highest degree the varieties Prista 3, Obnova 10 and Pleven 6. For the period 2007 to 2009 damaged stems were 20.03, 18.21 and 18.24%. They were with the highest ranking – 8, 6 and 7 in comparison with other varieties. These varieties had a higher rate of regrowth in the spring, and stems were higher (67.7, 64.2 and 66.2 cm). This provides a good feeding medium and appropriate conditions for the development of the weevil, which was associated with high attack.

The stem number of a plant was a parameter varying within narrower limits, as compared to height, but nevertheless has an effect on the weevil preference. Europe and Multifoliate lucerne, with the least pronounced damage, were distinguished for the greatest stem number (3.5 number) and the varieties showed tolerance to

the damage caused by the weevil (Table 2). Expressed tolerance of these varieties were associated with morphological parameter number of stems. Correlation with strong negative relationship was found between these two parameters ($r = -0.703$). The larger number of stems of a plant diffculted access insect to them, which explains the lower percentage damaged stems.

Irrespective of variety feature with regard to stem number per plant, the plants with one stem damaged by the weevil had the highest percentage, varying from 16.7 to 33.9% in the different years. The percentage of plants with two damaged stems was almost three times lower (varying from 1.5 to 11.0%). Plants with three damaged stems were found only in 2008 (3.6%).

Table 2. Correlation relationships between percentage of damaged stems of different lucerne varieties and some characteristics

On average for 2007-2009	% plants with damaged stems	Number stem of a plant	Height stem cm	Tunnel length mm	Distance of tunnel from the crown, mm
Europe	9.9	3.5	61.1	18.6	22.7
Prista 2	15.8	2.3	67.3	17.4	27.3
Prista 3	20.6	2.7	67.7	18.1	31.9
Prista 4	15.9	3.5	62.4	19.5	30.5
Obnova 10	18.7	2.9	64.2	16.2	29.1
Pleven 6	18.2	2.4	66.2	16.7	28.0
Dara	16.8	2.6	65.3	16.9	27.7
Multifoliate	9.9	3.5	60.5	21.6	28.6
x	15.73	2.93	64.34	18.13	28.23
r =	-	- 0.703	+ 0.830	- 0.692	+ 0.665

Another indicator, which described in a weaker degree of sensitivity to *Apion seniculus* variety was the tunnel length in the stems. It ranged from 16.2 to 21.6mm in various species. The relationship between indicators was negative ($r = -0.692$).

In varieties with slower rate of regrowth (Europe and Multifoliate lucerne) the distance of tunnel from the root crown was larger (18.6-21.6mm), and in varieties with faster rate of regrowth and greater sensitivity to *Apion seniculus* (Prista 3; Obnova Pleven 10 and 6) the distance was less (18.1-16.2mm). Between the degree of the damaged stems and the placement of the tunnels from the root crown had a positive average correlation ($r = +0.665$).

Among the studied varieties were not found completely resistant to *Apion seniculus*. With a good tolerance to tracked indicators were Europe and Multifoliate lucerne, which were interested for the selection of resistance to *Apion seniculus*.

Conclusion

Apion seniculus Kirby damaged most in primary alfalfa growth. Damaged plants ranged from 21.1% in Multifoliate lucerne up 45.8% in Prista 3. Attacked plants were the most in the second and third year of cultivation of alfalfa (34.1-48.4%). *Apion seniculus* attacked the least varieties Europe and Multifoliate lucerne. The degree of the damaged stems were respectively 9.10 and 8.16%. The most sensitive were Prista 3 (20.03%), Obnova 10 (18.21%) and Pleven 6

(18.24%). The parameters that had the most influence on the degree of the damaged stems by larvae of *Apion seniculus* were the rate of regrowth in the spring, respectively the height of stems ($r = +0.830$) and number of stems of a plant ($r = -0.703$).

With a good tolerance to track parameters were Europe and Multifoliate lucerne, which determined their phenological and morphological tolerance. They had stable positions in the list of ranged varieties and interested for the selection of resistance to *Apion seniculus*.

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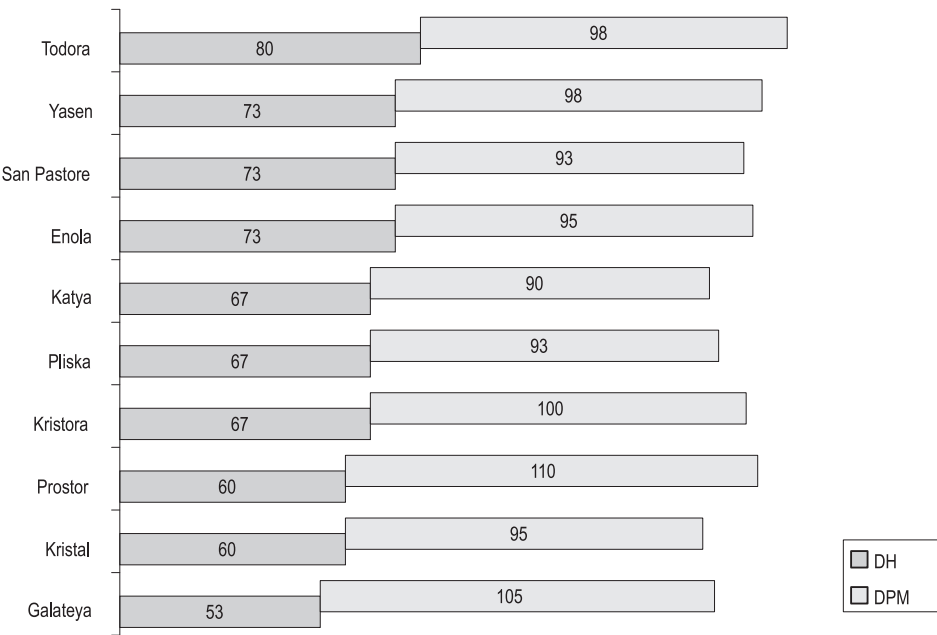
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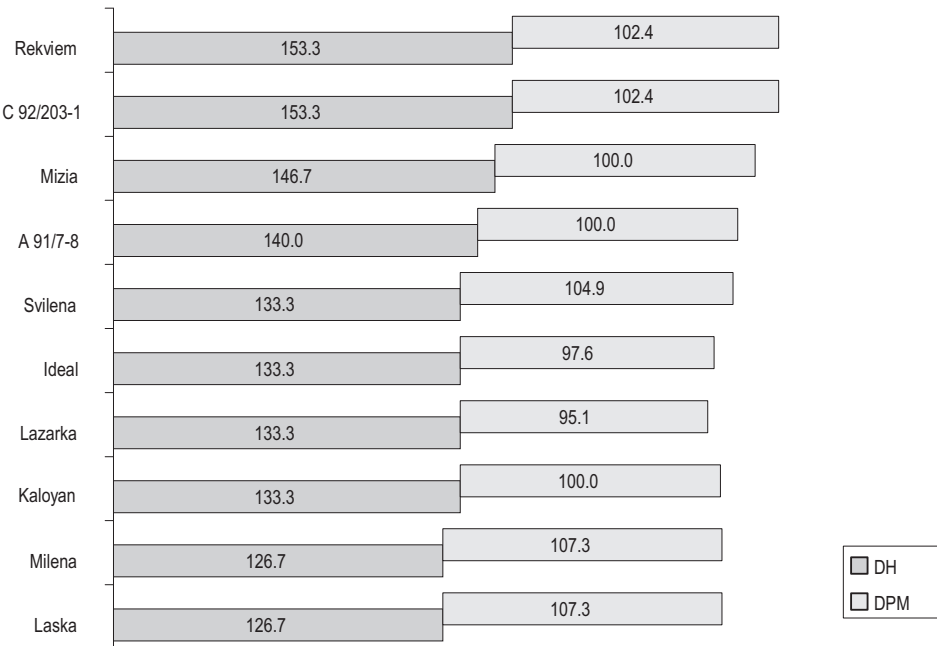


Figure 4. Duration of the period to heading and maturity in the group of late varieties expressed as relative value from the standard

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