Bulgarian Journal of Agricultural Science, 18 (No 5) 2012, 708-712
Agricultural Academy

FORAGE AND SEED PRODUCTIVITY IN ALFALFA, ATTACKED BY *PLAGIONOTUS FLORALIS* PALL. (COLEOPTERA: CERAMBYCIDAE)

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Abstract

PETKOVA, D. S. and E. D. ZHEKOVA, 2012. Forage and seed productivity in alfalfa, attacked by *Plagionotus floralis* Pall. (Coleoptera: Cerambycidae). *Bulg. J. Agric. Sci.,* 18: 708-712

During the period 2007 – 2010 at IASS "Obraztsov Chiflik", Rousse forage and seed productivity of 21 genotypes alfalfa varieties, lines and hybrids in two competitive variety trials and nine genotypes – free populations, lines, crosses and hybrids in polycross field was examined. The objective of the study was the degree of damages caused by larva of Lucerne longhorn beetle (*Plagionotus floralis* Pall.) to be determined also and its influence on forage and seed productivity of alfalfa varieties, lines and hybrids. Several economic traits and persistence of alfalfa genotypes were determined. At the end of the vegetation of the forth year for competitive variety trials and third year for polycross field eight variants of both competitive variety trials and nine variants of polycross field were removed and examined for damages caused by Lucerne longhorn beetle. It was registered that hybrid L – 114 showed the highest dry matter yield and seed yield, as the difference was very well proven. Alfalfa hybrids with the highest forage and seed productivity were the least attacked by Lucerne longhorn beetle. Infestation of Lucerne longhorn beetle was less in alfalfa stands with merged surface, compared with individual plants, located according to the scheme of polycross field (70 x 70 cm). For the first time eight live larvae were found in an alfalfa plant.

Key words: alfalfa, Lucerne longhorn beetle, polycross field
Abbreviations: CVT - Competitive Variety Trials, PF - Polycross Field

Introduction

Alfalfa, the main grass-forage crop in Bulgaria, has been attacked more often by pests, than by diseases. Recently a particularly strong spread, attacks and damages on alfalfa roots were registered caused by larvae of Lucerne longhorn beetle (*Plagionotus floralis* Pall.) (Petkova et al., 2005; Nikolova and Kertikova, 2008; Zhekova and Petkova, 2010). Chorbadzhiev reported about the pest for the first time in the country (Chorbadzhiev, 1930).

The specific reactions of varieties, lines and hybrids to the pest and the degree of infestation in merged stand for forage and in wide rowed stand for seed production have not been investigated yet.

The objective of the present research is the degree of damage by the larva of Lucerne longhorn beetle (*Plagionotus floralis* Pall.) to be determined, also and its influence on the forage and seed productivity of alfalfa varieties, lines and hybrids.

Material and Methods

In 2007 two Competitive Variety Trials (CVT) were planted at the Experimental field of IASS "Obraztsov Chiflik", Rousse. In the first CVT the forage and seed productivity of 13 genotypes were tested: three varieties – Prista 2, Dunavka, Europa and ten American hybrids – L-105, L-106, L-107, L-108, L-109, L-110, L-111, L-112, L-113, L-114, and in the second CVT:

two varieties – Prista 2 and Pleven 6 and six synthetic populations – SP – 05 (A+ B), SP – 05 A, SP – 05 B, SP – 05-Syn DP, Syn A and Syn B. The trials were planted in four replications in plots of 10 m^2 as the one half of the plot was for the registration of dry matter, and the other half – for seed yield. The stands were with merged surface. In the both CVT, Prista 2 variety was the standard.

In early spring of 2008 at the vegetation house under uncontrolled conditions 100 pcs. cuttings of nine alfalfa genotypes – free population 5A107 – KP_{98}, self-pollinated lines Banat – S_1, Dunavka – S_2, crosses (BH 330)x(KS 153); (Klaudia)x(Ax 93) and the American hybrids L – 108, L – 109, L – 112, L – 113 were branched, rooted and planted. After rooting in May, plants were placed out the Vegetation house and planted in Polycross Field (PF) at 70 x 70 cm according to a special scheme aiming a multiple crosspollination. 81 pcs. of each genotype were planted for determination of forage and seed productivity.

Yield of dry matter and seeds was registered in both CVT during the period 2007 – 2010 and in PF – in 2008 – 2009. Traits: plant height, number of stems, rate of growing, number of dead plants and fall dormancy in PF after the adopted methods were also determined. At the end of the vegetation during the forth year the plants from one m^2 of eight variants of both CVT were removed in order damages caused by Lucerne longhorn beetle to be determined. Selected variants included: varieties – Prista 2, Pleven 6, and Europe; the synthetic population Syn B; an inbred line of native population Dunavka (S_2) and 3 American hybrids – L – 108, L – 111, and L – 114, being of different genetic and geographic origin and typical representatives for high and low productivity. Some economic traits were determined – height (cm), number of stems, visual evaluation and rate of growing, according to 10-grade scale.

At the end of the vegetation of the third year, all the plants of PF were removed. Roots were washed and examined for damages caused by Lucerne longhorn beetle. MS Excel was used for dispersion analysis of the experimental data.

Results and Discussion

In first CVT average for the period of investigation, the hybrid L – 114 showed the highest dry matter yield – 14.20 $t.ha^{-1}$ (1 136 $g.kg^{-1}$) and height of 69.3 cm (Table 1). The difference of 2.49 $t.ha^{-1}$ was very well proven. The same hybrid exceeded the standard Prista 2 also in seed yield by 233 $g.kg^{-1}$, with statistically very well proven difference (Figure 1). The studied for attacks of Lucerne longhorn beetle six variants determined Europe variety as the most susceptible with 73 moves and 29 larvae per m^2 and 1.4 and 0.56 per a plant, re-

Table 1
Forage productivity of alfalfa genotypes, 2007 - 2010

№	Genotype	Dry matter yield, $t.ha^{-1}$					Relative yield	Height, cm
		2007	2008	2009	2010	average		
1	Prista 2 - St	5.60	17.48	11.63	15.29	12.50	100.0	71.0
2	Dunavka	5.21	17.44	11.34	16.48	12.62	109.0	71.0
3	Europe	6.75	17.21	12.46	14.15	12.64	101.1	55.3
4	L - 105	5.68	17.51	10.64	15.92	12.44	99.5	67.7
5	L - 106	5.78	17.04	11.50	16.11	12.61	100.9	64.4
6	L - 107	5.17	17.85	9.78	15.81	12.15	97.2	65.7
7	L - 108	6.82	18.35	12.90	17.78	13.96	111.7	65.9
8	L - 109	6.60	17.75	12.15	14.09	12.65	101.2	67.4
9	L - 110	6.08	17.86	12.01	15.90	12.96	103.7	61.5
10	L - 111	6.15	16.71	10.59	13.44	11.72	93.8	65.5
11	L - 112	7.01	18.18	13.73	16.78	13.93	111.4	68.9
12	L - 113	6.24	18.30	12.40	16.40	13.34	106.7	66.5
13	L - 114	5.95	18.06	12.99	19.78	14.20	113.6	69.3

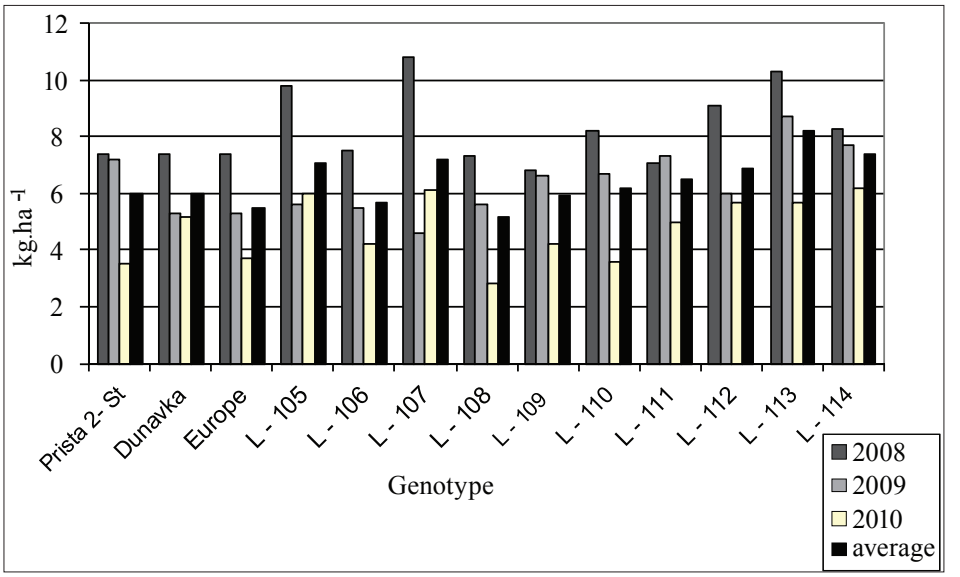

Fig. 1. Seed yield in first CVT Significant at P = 0.1%

spectively. According Ivanova et al. (2006), the variety also is strongly susceptible to rust. Hybrid L – 114 showed the lowest number of moves per a plant – 0.4 (Table 6). Alfalfa hybrids with the highest forage and seed productivity were the least attacked by Lucerne longhorn beetle.

In second CVT dry matter yield in Pleven 6 variety and Syn B in 2010 slightly exceeded the standard and the differences were not significant. That trend was kept and average for the period, although Pleven 6 variety was the highest – 70.9 cm (Table 2). Data about seed yield of populations Syn A, SP-05 B and SP-05 (A+B) showed strong excess of the standard – 1 317 g.kg^{-1}, 1200 g.kg^{-1} and 1 183 g.kg^{-1}, respectively (Figure 2). Results obtained about damages caused by Lucerne longhorn beetle in both examined germplasms Pleven 6 and synthetic population SP - 05 (A+B) showed high degree of infestation – the highest number of moves and number of larvae per a plant.

Average for the period 2007 – 2008, hybrids L – 108 and L – 109 showed the highest productivity of green mass – 397 g per a plant and 356 g per a plant, respectively (Table 3).

Alfalfa population 5A107 – KP_{98} demonstrated a high seed productivity – 25,40 g per a plant during the period 2008 – 2009, the population characterized with the highest visual grade – 10, and a very good rate of growing – nine (Table 4). All the genotypes in

Table 2
Forage productivity of alfalfa genotypes, 2007 - 2010

№	Genotype	Dry matter yield, t.ha^{-1}					Relative yield	Height, cm
		2007	2008	2009	2010	average		
1	Prista 2 - St	7.09	24.74	13.24	16.37	15.36	100.0	67.7
2	Pleven 6	6.63	25.90	13.32	16.72	15.64	101.8	70.9
3	SP - 05 (A+B)	5.84	20.30	13.53	15.66	13.83	90.1	66.7
4	SP - 05 A	5.66	20.50	13.33	15.13	13.66	88.9	63.5
5	SP - 05 B	6.42	23.43	13.36	15.86	14.77	96.1	65.2
6	SP - 05- Syn DP	6.20	20.56	10.25	15.95	13.24	86.2	64.9
7	Syn A	6.78	24.07	11.61	15.74	14.55	94.7	66.3
8	Syn B	7.02	23.47	14.29	16.55	15.33	99.8	64.7

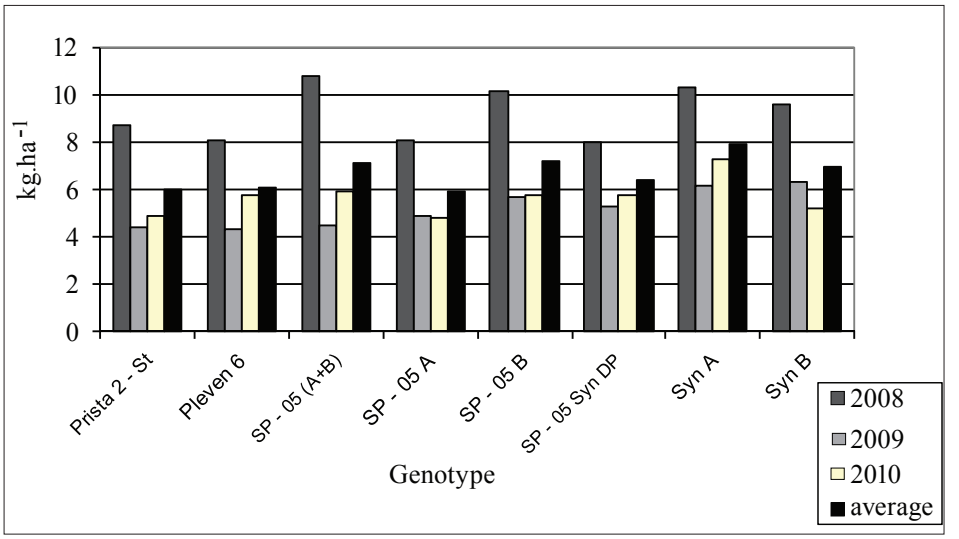

Fig. 2. Seed yield in second CVT Significant at P = 0.1%

Table 3
Productivity of nine alfalfa genotypes during the period 2008 – 2009

№	Genotype	Yield, g per a plant		
		Seeds		Green mass
		2008	2009	2009
1	5A107 - KP98	19.89	30.90	351
2	Dunavka 3 - S2	3.31	26.30	194
3	(BH 330)x(KS 153) - F1	11.19	25.00	313
4	Banat - S1	9.19	23.00	217
5	(Klaudia)x(Ax 93) - F1	13.19	25.80	178
6	L - 108	10.60	17.80	397
7	L - 109	19.42	21.20	356
8	L - 112	7.42	31.00	289
9	L - 113	8.62	34.60	329

polycross field had a very short life cycle. In 2008, 721 plants were planted and rooted. The survival trend indicated very low persistence that started from 675 plants, through 416 and ended at 41 plants at the end of vegetation in 2008, 2009, and 2010 (Table 5). One of the main reasons for plant death in all the variants was the strong attack of the pest. Lucerne longhorn beetle infestation was less in alfalfa stands with merged surface, compared with individual plants located according to the scheme of PF (70 x 70 cm). Individual plants formed more powerful root system, with larger diameter of root neck (Petkova et al., 2003), which favored egg laying and development of pest larvae.

5A107 – KP_{98} showed the highest number of larvae average (0.8) per a plant, where in autumn of 2010

Table 4
Economic characteristics of polycross field, 2008 – 2009

№	Genotype	Yield, g/plant				Economic traits			
		Seeds			Green mass	Height, cm	Number of stems	Visual evaluation	Rate of growing
		2008	2009	average	2009				
1	7105 - 5A107 - KP98	19.89	30.90	25.40	351	77.6	25.6	10	9
2	Dunavka 3 - S2	3.31	26.30	14.80	194	69.6	17.9	6	8
3	(BH 330)x(KS 153)	11.19	25.00	18.09	313	72.5	35.7	7	10
4	Banat - S1	9.19	23.00	16.09	217	75.4	19.5	6	8
5	(Klaudia)x(Ax 93)	13.19	25.80	19.50	178	82.9	17.8	6	8
6	L - 108	10.60	17.80	14.20	397	88.9	35.3	10	10
7	L - 109	19.42	21.20	20.31	356	78.0	33.2	9	10
8	L - 112	7.42	31.00	19.21	289	78.4	35.3	9	10
9	L - 113	8.62	34.60	21.61	329	84.9	38.5	10	9

Table 5
Persistence of nine alfalfa genotypes during the period 2008 – 2010

№	Genotype	Number of plants					
		spring 2008	autumn 2008	spring 2009	autumn 2009	spring 2010	autumn 2010
1	5A107 - KP98	81	79	71	46	15	5
2	Dunavka 3 - S2	81	74	71	57	10	1
3	(BH 330)x(KS 153) - F1	81	78	75	59	14	3
4	Banat - S1	81	64	53	37	16	4
5	(Klaudia)x(Ax 93) - F1	81	77	73	66	23	5
6	L - 108	81	73	71	54	28	6
7	L - 109	81	74	74	65	27	12
8	L - 112	81	79	77	65	14	3
9	L - 113	81	77	75	57	11	2

eight live larvae were found out in a plant with diameter of root neck 42 mm and the number of green stems was 13 (Table 6). This fact is unique about biology of the pest, unlike all, although few studies in Bulgaria, reported only one larva in a root (Makarov, 1968). The highest number of moves was registered in L – 109 hybrid (average 2.54 pcs. per a plant).

Table 6
Attack of Lucerne longhorn beetle (*Plagionotus floralis* Pall.) on eight alfalfa genotypes

№	Genotype	Number of plants, pcs.m^{-2}	Moves, num.m^{-2}	Moves, num. per a plant	Larvae, pcs.m^{-2}	Larvae, pcs. per a plant
1	Prista 2	43	37	0.9	0	0.00
2	Pleven 6	40	61	1.5	5	0.13
3	A + B	43	56	1.3	9	0.21
4	Dunavka	52	48	0.9	11	0.21
5	Europe	52	73	1.4	29	0.56
6	L - 108	75	71	0.9	2	0.03
7	L - 111	66	59	0.9	1	0.02
8	L - 114	80	32	0.4	5	0.07

Conclusions

Alfalfa hybrids with the highest forage and seed productivity were the least attacked by Lucerne longhorn beetle. Infestation of Lucerne longhorn beetle was less in alfalfa stands with merged surface, compared with individual plants, located according to the scheme of PF (70 x 70 cm). For the first time eight live larvae were found in an alfalfa plant.

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Received January, 12, 2012; accepted for printing June, 2, 2012.