

## THE EFFECTS OF *SITONA HUMERALIS* LARVAE ON ALFALFA *MEDICAGO SATIVA* (L.) DEVELOPMENT

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Abstract: Adults of *Sitona humeralis* Steph. damage leaves of alfalfa, causing bay-shaped leaf holes characteristic for the *Sitona* spp. The larvae damage root nodules, taproots and open the infection paths for pathogenic fungi which occur in soil and on the root surface which results in the withering of plants.

Key words: alfalfa, *Sitona humeralis* Steph., root, fungi

### I. INTRODUCTION

The purpose of this study was to analyse the effect of larvae of *Sitona humeralis* Steph., the most numerous species in south-eastern Poland, on the development of alfalfa throughout its growing season.

### II. MATERIAL AND METHODS

The research on the harmfulness of *S. humeralis* larvae on alfalfa crops was conducted in laboratory conditions. In April, alfalfa was sown in five-litre containers filled with soil (taken from three-year-old alfalfa plantation) rich in *Rhizobium* strains. Part of the seeds was dressed with Funaben T in a quantity of 4 g per 1 kg of seeds. Ten best plants were left in each vase. When nodules with *Rhizobium* bacteria developed on roots, alfalfa plants were trimmed at the height of 5 cm above the ground and the procedure of applying freshly hatched larvae of *S. humeralis*, coming from an earlier established culture, according to the following pattern:

- |                                 |   |                       |
|---------------------------------|---|-----------------------|
| – object I: not dressed seeds   | } | + 20 larvae per plant |
| – object II: dressed seeds      |   |                       |
| – object III: not dressed seeds | } | + 40 larvae per plant |
| – object IV: dressed seeds      |   |                       |
| – object V: not dressed seeds   | } | no larvae             |
| – object VI: dressed seeds      |   |                       |

Objects V and VI formed a control. The experiment was repeated 6 times. The vases were kept outdoors in isolated cabin and watered systematically. After three months since larvae introduction into the soil, measurements were performed in order to evaluate the root sys-

tem. 20 plants were sampled from each object for mycological analysis. The fragments of roots, disinfected in 0.1% sublimate solution, were put onto Petri dishes with glucose and potato inoculation medium. Ten Petri dishes x 10 inoculums of the main root were prepared for each object. The obtained fungi colonies were determined by Dr. Eng. Janina Błażej on the basis of monographs (Gilman 1962; Domsch et al. 1970; Raiłło 1950).

### III. RESULTS AND DISCUSSION

The manners of the feeding of *S. humeralis* individuals adults and larvae varied. The adults were biting out more or less regular U-shaped holes in leaf blades while holding their edges between their limbs and moving backwards. Such a manner of feeding was defined as «lacunar» by Wnuk and Wiech (1996). According to Błażejewska and Wawrzyniak (1977), the quantity of damaged leaf blade was small and therefore had no economic significance. Exceptionally, during the plant sprouting period a risk may come from *Sitona* adults because at that time not only the edges of leaves but also the growth cones are damaged (Rotrekl 1979).

The *S. humeralis* larvae fed on the content of root nodules and damaged the root tissue.

The following types of damaged root nodules are distinguished: first, when the original shape of the excrescence remained; larvae fed only on the inside (bacteroidal tissue, *Rhizobium* bacteria) and second involving total destruction of root nodules and superficial damage of the root. Only a small part of the excrescence remained in the feeding spot.

The research by Błażejewska and Wawrzyniak (1977), Wysocki (1982), Wnuk and Wiech (1996), Śledź and Kordan (1994) indicated that the percentage of damaged root nodules on one-year-old papilionaceous plants was similar to that on alfalfa. It was 24.7-44.3% on lupine, 28.5-47.7% on field pea and 39.3-61.8% or 58.0-72.9% on pea, depending on the research region. On the other hand, Czerniakowski (1992) found that larvae of *S. sulcifrons* damaged only 10-25% of root nodules.

While devouring the root nodules the larvae of *Sitona* spp. destroy *Rhizobium* bacteria, which works as a detriment to the quantity of nitrogen assimilated by the plant from the air. Thus, the contribution of papilionaceous plants in the crop rotation is reduced and so is the yield of the subsequent crops.

Beside the damaged root nodules, the other symptoms of feeding of *S. humeralis* larvae were the bite cavities on roots which can be subdivided into two types:

- shallow; in a shape of dash or oval; groups of 2-3 bite cavities located close to each other
- deep; covering 2/3 of the root width; predominantly in a shape of a wheel; individual (5.5-13.3% of all injuries).

The results of the measurements of root system showed that the feeding of *S. humeralis* stimulated the alfalfa plants to more intensive growth. The main roots of plants in vases with larvae (objects: I – IV) were longer, by approximately of 2.4 cm. *S. humeralis* stimulated production of root nodules because their number increased from 7.6 do 11.3 (Tab. 1).

Table 1

Evaluation of the root system of alfalfa damaged by *Sitona humeralis*

More important characteristics of the root system	Objects*					
	I	II	III	IV	V	VI
Length of main root (cm)	16.5	17.1	16.5	17.6	14.0	15.0
Number (per plant):						
– total root nodules	11.3	11.1	11.3	10.3	7.6	8.8
– damaged root nodules	3.7	4.2	6.0	5.1	–	–
– bite cavities	0.6	1.0	1.9	1.9	–	–
Percentage of damaged main roots	9.4	58.8	78.4	74.5	–	–

\* explanations in Materials and methods

However, the larvae introduced into the soil caused serious damage. In total, 35% of root nodules were damaged in the initial occupation of 20 larvae per plant (objects I and II) and 51.3% in case of 40 larvae per plant (objects III and IV). In addition to the damage of root nodules, from 29.4 to 78.4 % plants showed root injuries. From 0.6 do 1.9 bite cavities per root were recorded (Tab. 1).

It was observed that *S. humeralis* fed mainly on the main root (74%), much less on side roots. Besides, the damages of root nodules or roots themselves were found only in the upper part of the root and not all along its length.

In Polish references Czerniakowski (1992) has also reported a potential of root damages of papilionaceous plants by *Sitona* spp. The author has stated that, during the feeding of larvae of *Sitona sulcifrons* (Thunb.), he observed a decay of red clover root system, with consequent inhibition of development, drying and loss of plants in the plantation. On the other hand, Nadolnik (1993) has reported on worsening of condition of the red clover in consequence of channel biting by *Apion virens* Herbst.

The evaluation of condition of alfalfa roots by the author of this paper has shown that pathological changes deviously result in the feeding of *S. humeralis* larvae. The damage

Table 2

## Fungi isolated from alfalfa roots

Species	Objects*					
	I	II	III	IV	V	VI
<i>Alternaria alternata</i> (Fr.) Keiss.	21	11	31	22	12	6
<i>Fusarium culmorum</i> (WGS) Sacc.	3	15	3	0	6	0
<i>Fusarium oxysporum</i> Schl.	71	25	63	22	54	6
<i>Fusarium sambucinum</i> Fuckel.	0	10	0	11	0	0
<i>Phoma</i> sp.	0	5	1	1	1	1
<i>Rhizoctonia solani</i> Kühn	9	8	5	0	7	5
<i>Stemphylium botryosum</i> Wallr.	0	0	0	0	0	2
<i>Penicillium</i> spp.	12	3	15	7	11	7
Non-sporulating colonies	3	1	3	7	12	4
Total	119	78	121	70	103	31

\* explanations in Materials and methods

caused by these insects made it easier for micro-organisms to penetrate the root system. The highest percentage of fungi was isolated from plant roots on objects (I and III) where seeds of alfalfa were not dressed and where larvae were implanted. It was 22.8 and 23.2% (Tab. 2), respectively. The dressing of seeds limited the occurrence of some fungi species. The smallest number of fungi colonies was isolated from roots on reference object (VI) where the seeds were dressed and insects were not feeding – 5.9%.

The number of fungi isolates obtained from fragments of alfalfa roots was 522. The most numerous among them were: *Fusarium oxysporum* Schl. (46.1% of all fungi colonies), *Alternaria alternata* (Fr.) Keiss. (19.7%) and species not specifically determined, such as *Penicillium* sp. (10.5%) (Tab. 2). Godfrey and Yeargan (1987 and 1989), as well as Leath and Hower (1993) claimed that fungi of the following species: *Fusarium* spp., *Rhizoctonia* spp. and *Pythium* spp. were dangerous to alfalfa. Those authors showed also that pathological processes, especially the browning and decay of tissues take place more rapidly in roots which were damaged by the larvae of *Sitona hispidulus* (Fabr.). It caused premature loss of plants and shortening of plantation use periods.

The numbers of larvae of *S. humeralis* per plant in author's research had no effect on the index of species. Similar results were obtained by Wiech et al. (1992) from their observation of *A. virens* damaging the root neck of red clover. This fact may be an indication that, through feeding on the root system of papilionaceous plants, *Curculionoidea* opened the infection paths for pathogens occurring in the soil and on the root surface.

#### IV. REFERENCES

1. Błażejewska A., Wawrzyniak M. 1977. Występowanie oprzędzików (*Sitona* sp.) na różnych uprawach roślin motylkowatych w okolicach Bydgoszczy. Zesz. Nauk. ATR Bydgoszcz 44 (3): 5-21.
2. Czerniakowski Z.W. 1992. Wpływ larw oprzędzika koniczynowego (*Sitona sulcifrons* Thunb.) na rozwój koniczyny czerwonej. Materiały 32. Sesji Nauk. Inst. Ochr. Roślin, cz. 2: 203-206.
3. Domsch K.H., Gams W. 1970. Pilze aus Agrarboden Gustar Fischer Verlag, Stuttgart. 288 ss.
4. Gilman J.C. 1962. A manual of soil fungi. Ames, Iowa. 449 ss.
5. Godfrey L.D., Yeargan K.V. 1987. Effects and interactions of early season pests on alfalfa yield in Kentucky. J. Econ. Entomol., 80 (1): 248-256.
6. Godfrey L.D., Yeargan K.V. 1989. Effects of clover root curculio, alfalfa weevil (*Coleoptera: Curculionidae*), and soil-borne fungi on alfalfa stand density and longevity in Kentucky. J. Econ. Entomol., 82 (6): 1749-1756.
7. Leath K.T., Hower A.A. 1993. Interaction of *Fusarium oxysporum* f.sp. *medicaginis* with feeding activity of clover root curculio larvae in alfalfa. Plant Disease 77 (8): 799-802.
8. Nadolnik M. 1993. Wpływ pestycydów na stan zdrowotny systemu korzeniowego koniczyny czerwonej. Roczn. AR Poznań CCXLVII: 23-28.
9. Raiho J.A. 1950. Griby roda *Fusarium* Gos. Izol. Selskochoz. Lit. Moskwa. 410 ss.
10. Rotrekl J. 1979. The destructive effect of weevils on emerging lucerne. Sbor. ÚVTIZ – Ochr. Rostl., 15 (2): 139-134.
11. Śledź D., Kordan B. 1994. Występowanie i szkodliwość oprzędzików (*Sitona* spp.) na różnych odmianach grochu siewnego (*Pisum sativum* L.). Materiały 34. Sesji Nauk. Inst. Ochr. Roślin, cz. 1: 194-201.
12. Wiech K., Nadolnik M., Wnuk A. 1992. Wpływ zwalczania pędrusia zieleniaka (*Apion virens* Herbst) na zdrowotność korzeni koniczyny czerwonej. Materiały 32. Sesji Nauk. Inst. Ochr. Roślin, cz. 2: 258-262.

13. Wnuk A., Wiech K. 1996. *Sitona* weevils (Coleoptera: Curculionidae) feeding on pea (*Pisum sativum* L.). Pol. Pismo Ent., 65: 73-81.
14. Wysocki W. 1982. Wyniki badań nad szkodliwością oprzędzika wielkiego (*Sitona grisea* F.) dla łubinu. Roczn. Nauk. Roln. – Seria E – Ochrona Roślin 12 (1/2): 75-83.

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## WPŁYW LARW *SITONA HUMERALIS* STEPH. NA ROZWÓJ LUCERNY SIEWNEJ

### STRESZCZENIE

Chrząszcze *S. humeralis* uszkadzają liście lucerny, powodując zatokowe wżery blaszki liściowej charakterystyczne dla *Sitona* spp. Larwy tego owada uszkadzają brodawki korzeniowe, korzeń palowy oraz otwierają drogi zakażenia dla znajdujących się w glebie i na powierzchni korzenia patogenicznych grzybów, co w konsekwencji powoduje zasychanie roślin.