

## INFLUENCE OF LARVAE SOLIDITY OF CEREAL LEAF BEETLE (Coleoptera, Chrysomelidae: *Lema melanopus* L.) ON YIELD DECREASING OF SMALL GRAINS

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ABSTRACT. Flag leaf area in eight winter wheat cultivars (Dicna, NS rana 5, Proteinka, Jugoslavija, Studenica, KG 56-S, Levčanka and Ravanica) and one winter barley cultivar (Partizan) was investigated. The value of flag leaf varied from 10.16 cm<sup>2</sup> in barley cultivar Partizan to 29.24 cm<sup>2</sup> in Dicna wheat cultivar. Estimation of density of larvae on flag leaf showed differences among analyzed cultivars. The highest average number (1.27) of larvae was in Studenica cultivar and the lowest one (0.46) in Ravanica wheat cultivars and (0.42) in barley cultivar Partizan. Also difference was registered considering damages of flag leaf area which cereal leaf beetle (Coleoptera, Chrysomelidae: *Lema melanopus* L.) as well as differences in yield decreasing. In average the highest level of damages by larvae of beetle was established in barley cultivar Partizan (75.86%) and Studenica wheat cultivar (72.40%).

### INTRODUCTION

Cereal leaf beetle (CLB) is pest of leaf in small grains. Leaves of small grains plants are attractive source for nutrition of cereal leaf beetle. During intensive attack whole leaves become dry. In this case assimilative area are decreased what cause inhibition of normal growth and development and consequently influenced on incredible decreasing of yield. Sometimes in winter oat occurred decreasing of yield per year for 20% or 48 respectively (WILSON et al., 1969; MERRITT and APPLE, 1969), and during extreme yield decreasing can reach 80% of planned production (TEOFILOVIC, 1969). In spring oat loses of yield varied between 82 and 147 kg/ha (WEBSTER et al., 1980). Investigation indicating that on larvae per plant on oat have consume in average 20% of leaf area what cause loses of plant vigor (WILSON et al., 1969). In winter wheat yield loss amount 25% (WEBSTER, 1977), 28-49% in spring wheat, respectively (KOLAROV, 1988; WEBSTER et al., 1972), and in barley 19-52% (WEBSTER and SMITH, 1979). VITVITZKY and KOVAL (1984) were established loses of yield in wheat per year that amount 10-20%. If flag leaf was damaged 90%,

the loss of yield amount about 23% (GALLUN *et al.*, 1967). WEBSTER *et al.* (1982) reported that by solidity of 4,3-10,4 larvae per plant caused differences of yield between resistant and susceptible winter wheat. Yield of resistant winter wheat was higher for 17.6-25,6% than in susceptible wheat cultivar. WEBSTER and SMITH (1979) reported that by solidity of 1,6 larvae per plant of spring barley have influence on yield decreasing for 38%. Investigation of spring barley cultivars for degree of resistance to cereal leaf beetle showed that majority cultivars (77,4%) was attractive for nutrition (CIRIC, 1988), while low number of investigated cultivars expressed satisfied degree of resistance and yield of those cultivars have not decreased significantly.

The aim of this work was to establish flag leaf area in wheat and barley cultivars and density of larvae CLB on leaves of investigated plants and influence on yield decreasing caused by damages.

## MATERIAL AND METHODS

Eight genetically divergent winter wheat cultivars (Dicna, Novosadska rana 5, Proteinka, Jugoslavija, Studenica, KG 56-S, Levcanika and Ravanica) and one winter barley cultivar (Partizan) were included for investigation.

Experiment carried out on the experimental field of Center for small grains in Kragujevac during 1996/97 and 1997/98.

The experiment carried out under controlled field collection (plant in cages) and native field conditions (controls plant). On plot 1 m<sup>2</sup> in spring were placed cages (size 1 x 1 x 1 m). After that in each cages were take in 90 imago of CLB collected after hibernation from neighbour experimental plants.

After copulation, oviposition and larvae occlusion, the number of larvae per plants were established and registered as well larvae density on flag leaf, second and third leaf.

Also, flag leaf area was measured by apparatus for measurement of leaf area (leaf area meter-LAM; Portable area Meter, LI-COR, Model LI-3000 A).

Plants were harvested by hand in full maturity stage. Quantitative traits (number of kernels per spike, mass of grain per spike and thousand grain mass) of wheat, barley were analyzed.

Statistical analysis was done by using program package M-stat Meny Manager 4.0 (C) 1987, Michigan State University, Version 4.0/EM. Data processed by analysis of variance method for three factorial trial designed by randomized block system. Differences were tested by using LSD test (less significant differences). Coefficient of correlation among analyzed parameters and significance of correlation were computed too.

## RESULTS AND DISCUSSION

Flag leaf area in investigated cultivars at flowering phase varied from 10.16 cm<sup>2</sup> in barley Partizan cultivar to 29.24 cm<sup>2</sup> in wheat cultivar Dicna (Fig. 1). The highest values of flag leaf area were found wheat cultivars NS rana 5 (25.97 cm<sup>2</sup>), KG 56-S (24.49 cm<sup>2</sup>), Studenica (23.87 cm<sup>2</sup>), Jugoslavija (22.55 cm<sup>2</sup>) and Levcanka (21.63 cm<sup>2</sup>), and the lowest in wheat cultivars Proteinka (19.77 cm<sup>2</sup>) and Ravanica (17.06 cm<sup>2</sup>).

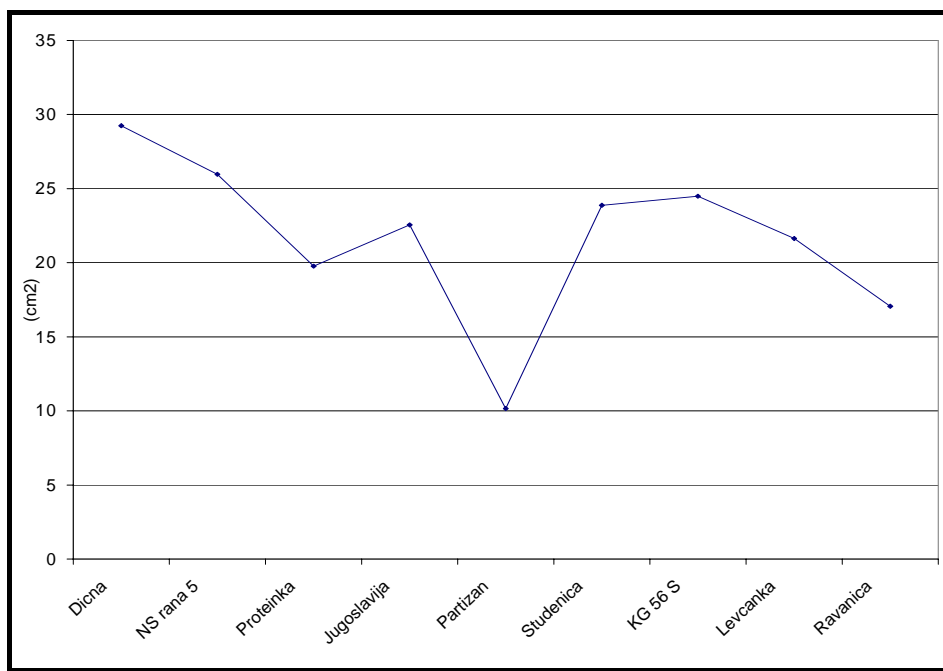


Fig. 1. Average value of leaf area of analyzed cultivars for two years

Flag leaf play important role for grain filling in wheat (DJOKIC and PANTIC, 1975; DJOKIC and STOJANOVIC, 1980). Yield increasing was followed by increasing of flag leaf area. The same investigators were found negative correlation of yield with lower positioned leaves and positive correlation with upper leaves. Flag leaf area duration have important role for grain filling. Very important is to note that flag leaf represent important source of nitrogen for grain (DJOKIC and STOJANOVIC, 1980; DJOKIC *et al.*, 1999). It is organ with the highest concentration of nitrogen in plant during reproductive period. Quantity of nitrogen in flag leaf, mainly depends from their size (mass).

Flag leaf area, as morpho-physiological trait, besides of its important role for grain filling, can contribute to higher adaptability on stress conditions i. e. by reinforcement pest attack.

Flag leaf play important role during photosynthesis process as well in realization of high grain yield. Activity of photosynthesis green area can directly influence on yield increasing through number of spikelets per spike, number of fertile flowers or indirectly through increasing of root mass. Leaf area duration and leaf area index have positive connection with synthesis of dray matter and with stress tolerance to insects.

Considering that, the highest density of larvae of beetle on flag leaf was established, the coefficient of correlation between leaf area and number of larvae of beetle was analyzed. Positive correlation ( $r=0.631$ ) between flag leaf area and number of larvae of beetle was established what practically mean that on leaves with measured higher area was registered higher density of population of leaf beetle.

Also, coefficient of correlation between degree of damage of plant and leaf area was computed ( $r=-0.483$ ). That is average negative correlation, which indicated that leaves with low area was more damaged at the moment of estimation of degree of damage than leaves with bigger area.

Number of larvae of beetle was registered on first (flag leaf), second and third leaf. The highest number of larvae was established on flag leaf (0.80), than on second (0.45) and the lowest number on third leaf (0.16). On remain lower leaves, larvae of beetle was not registered likely because upper leaves are younger and more attractive for nutrition of cereal beetle. Also, because of morpho-physiological traits and leaf position which are giving possibility for higher sensibility of larvae of beetle.

Density of larvae of beetle on flag leaf was higher for 0.37 in first experimental year than in second year.

The highest average number of larvae on flag leaf was registered in wheat Studenica cultivar (1.27) which had the highest degree of damage (72.40%) among analyzed wheat cultivars. Differences among other analyzed cultivars were not significant. The lowest number of larvae was established in wheat Ravanica cultivar (0.46) and barley Partizan cultivar (0.42). The winter barley Partizan had the highest degree of damage (75.86%) in comparison with all analyzed cultivars. The lowest number of larvae at the moment of estimation can explain by fact that leaf green area which cereal beetle use for nutrition already was used (exploited). Because of that larvae are migrated on neighbor plant of wheat for source of nutrition.

In first experimental year, number of larvae on flag leaf varied from 1.65 in wheat Studenica cultivar to 0.48 in Ravanica cultivar. In second year, the highest number (0.88) of larvae of beetle was established in wheat Studenica cultivar and the lowest (0.36) in barley cultivar Partizan (Fig.2).

The analysis of interaction year x cultivar showed similar value of number of larvae of beetle, degree of damage and its effect on yield decreasing in main cultivars except in wheat Studenica cultivar in which was higher value for 0.77 in first experimental year.

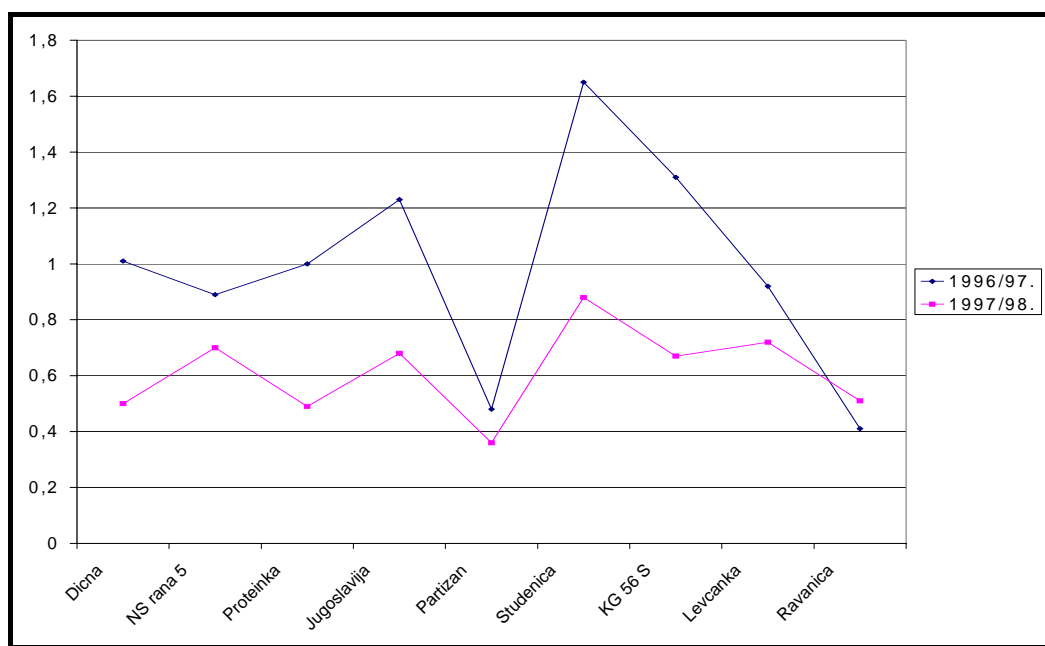


Fig. 2. Number of larvae on flag leaf in two experimental years

Correlation between yield components and number of larvae on flag leaf was negative (Tab.1). Increasing of density of larvae on flag leaf caused decreasing of value of yield components of wheat and barley and therefore decreasing of grain yield. Coefficient of correlation varied from  $-0.374$  for number of kernels per spike to  $-0.444$  for thousand grain mass.

Tab. 1. Correlation between larvae of cereal beetle on flag leaf and some yield components in wheat and barley.

Indicators of correlation	Coefficient of correlation	Intensity of correlation
AVERAGE NUMBER OF LARVAE ON FLAG LEAF FOR BOTH TESTED YEARS		
Number of kernels per spike	-0.374	Low
Grain mass per spike (g)	-0.427	Medium
Thousand grain mass (g)	-0.444	Medium

## CONCLUSIONS

Analysis of flag leaf area, density of larvae of beetle, damages of green area and effect on yield showed differences among analyzed cultivars. The highest density of larvae beetle on flag leaf was established in wheat cultivar Studenica and the lowest in Ravanica wheat cultivar and barley Partizan cultivar. The highest number of larvae was registered on flag leaf and than on second and on third leaf.

Degree of damages of flag leaf caused by larvae of beetle was different in analyzed cultivars. The highest level of damages was established in barley Partizan cultivar. Density of larvae of beetle had influence on decreasing of yield components and finally on decreasing of yield.

Correlation between yield components and number of larvae on flag leaf was negative. Increasing of density of larvae on flag leaf are in correlation decreasing of value of yield components of wheat and barley and therefore decreasing of grain yield.

Coefficient of correlation varied from  $-0.374$  for number of kernels per spike to  $-0.444$  for thousand grain mass.

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