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THE SPRING CEREALS FOOD PREFERENCES OF OULEMA SSP. IN PURE AND MIXED CROPS

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ABSTRACT

The oats were observed to be the species mostly damaged by *Oulema ssp.* phytophages which is represented by the highest damage indexes of the plant in all the objects researched. The two other species: barley and spring triticale are much less sensitive to feeding of the pest. The initial damage which was due to the complementary feeding was hidden due to the compensation capabilities of the cereals. Spring barley, which tillers most, compensated for the damage most considerably. The economic harmfulness of the *Oulema* feeding may be estimated only in shooting phase, when also the larvae start skeletoning of leaf blades. In barley and spring triticale

a considerably lower larvae feeding was observed when compared with leaf beetles. The co-ordinate cultivation of the researched species with fodder pea and in two-ingredient cereal mixtures enhances the damage reduction caused by *Oulema* feeding.

Key words: *Oulema* ssp., cereal mixtures

INTRODUCTION

The area of land under cereal cultivation in Poland covers about 70% of the total farm land. It means greater and greater simplification of crop rotation as well as reduction in bio-diversity on our farms. Cereal monocultures are much exposed to pest gradation with *Oulema* ssp. causing the greatest damage for the last few years. The loss of the assimilation surface weakens plant development and determines lower cropping. The size of damage is the same for all the cereals: the effect of *Oulema* ssp. complimentary feeding - clear-cut holes in leaf blades, however the larvae make a skeleton of the leaves leaving the lower peel. The size of damage differs depending on the form and the species of the cereal. In spring cereals a severe damage caused to young crops can have much more considerable effect than on winter cereals with a more advanced spring development. Different monoculture modifications (mixtures of varieties and species) influence the presence of the pest.

In Poland there are two species of *Oulema*, namely: *Oulema melanopus* and *Oulema gallaeciana* which belong to Coleopatra and Chrysomeliade. Far farming, the *Oulema melanopus* poses a greater threat. Its body is 5 mm long, of greenish and blue colour with red legs and pre-back. Pupation takes place in soil at the end of summer [1]. *Oulema gallaeciana* have greenish and blue body, however with black legs and pre-back. They are usually slightly smaller than *Oulema melanopus*, about 3-4 mm long. Pupation takes place in the corners of the leaf sheaths or between the ears [1]. The eggs are usually laid along the leaf veins or in the middle of the leaf blade. After the brood the larvae take up to feeding. It is characteristic for them to have a large head when compared to the whole body size. Soon they cover them with waste as their anus is present in the upper part of the abdomen. In winter the leaf beetles stay in litter and in the surface layer of the soil, in ditches, on the edge of fields and pastures. In spring, if they stayed in winter near cereal fields, a mass attack of the pests can be expected. When the air temperature reaches 15°C, the leaf beetles leave their winter habitat and look for food as well as habitats convenient for their development; it takes place at the beginning of April. In the first decade of May, the females lay eggs [3]. Usually at the beginning of June larvae emerge. After 2-3 days the larvae migrate to the upper leaves to continue their feeding there. In *Oulema* there is one generation a year. Leaf beetles of both species feed on the upper part of the leaf blade and larvae bite the upper peel of the leaf leaving the lower peel [4]. The size of leaves injures may differ considerably; it is higher when spring is warm [2,6,9]. The larva feeding causes damage of flag and under flag leaves [2,7,8]. Such injures immediately influences grain crop in the ears; the reduction may reach about 0,7 t/ha. Reducing the population of *Oulema*, pyretroidies have a great significance here, for example Fastac 10 EC [5]. Biological methods applied to reduce the pest population with its natural enemies seem important also [10]. The aim of the research conducted in the years 1997-1998 was defining the feeding preferences of *Oulema* from 3 species of spring cereals, namely: oats, barley, triticale as well as the relationship between the species of the cereal mixtures and cereals with fodder pea and the size of damage caused by this pest.

MATERIALS AND METHODS

The research was based on the field experiment conducted for two years in SDOO in Chrzastowo, in the Bydgoszcz province, in the set of randomized blocks repeated 4 times. The research material consisted of 3 species of spring cereals, as follows: oats, Komes variety spring barley, Lot variety spring triticale, Migo variety, cultivated in pure stand and in mixtures in the following combinations:

- a. pure barley crop - 320 plants per sq. m
- b. pure oats crop - 500 plants per sq. m.
- c. pure triticale crop - 500 plants per sq. m.
- d. barley + oats - 160/250 plants per sq. m.
- e. barley +triticale - 160/250 plants per sq. m.
- f. barley + fodder pea - 190/50 plants per sq. m.
- g. oats + triticale crop - 250/250 plants per sq. m.
- h. oats + fodder pea - 300/50 plants per sq. m.
- i. triticale + fodder pea - 300/50 plants per sq. m.

The observation of cereal damage caused by *Oulema* was conducted twice:

- a. in their tillering phase (Fekes scale - 35) - cockchafer feeding.
- b. in their shooting phase (Fekes scale - 35) - larvae feeding

Each time 30 plants of each species were sampled at random from the 18 sq m. experimental fields and they were evaluated according to the 0: 5 scale:

0 - no damage

5 - over 50% injures

The threshold of economic harmfulness was established at 25% injures. The soil valuation grades were transformed into indexes according to the Townsend - Heuberger formula:

$$\text{i.u.}[\%] = \frac{\sum_1^i (n_i \times v_i)}{N \times V}$$

i.u. damage index

v_i - damage class

n_i - number in one class

N - total number

V - the highest class

i - the number of classes

As the percentage results obtained did not violate the condition of homogeneity, such data underwent the analysis of variance and for the mean object comparisons the Tukey test was used.

RESULTS

Both in case of the first and the second year there was a visible tendency for the cereals researched irregular sensitivity to *Oulema* presence. The oats were most affected here

(Table 1). In all its crops the threshold of economic harmfulness was exceeded (over 25% injures). However a considerable reduction in oats injures was observed (about 16%) in oats mixtures with barley, triticale and pea. A smaller damage caused by *Oulema* was observed in spring barley (about 20%). Only pure crops of this species classified for the application of chemicals against the larvae. The barley cultivar cultivated with other cereals as well as with pea was observed to facilitate damage reduction. Here the *Oulema* feeding preferences were visible for oats in mixed crops.

Table 1. Percentage of damage due to *Oulema* ssp. larvae and leaf beetles feeding and the difference when compared with pure crop (mean results of two-year research)

a/ spring barley

Pure barley	Barley + oats	Difference	Barley + triticale	Difference	Barley + pea	Difference
\bar{x} from 97/98	\bar{x} from 97/98		\bar{x} from 97/98		\bar{x} from 97/98	
26.79	13.38	- 13.41	20.17	- 6.62	21.84	- 4.95

b/ oats

Pure oats	Oats + barley	Difference	Oats + triticale	Difference	Oats + pea	Difference
\bar{x} from 97/98	\bar{x} from 97/98		\bar{x} from 97/98		\bar{x} from 97/98	
46.42	27.79	- 18.63	30.54	- 15.88	31.42	- 15.0

c/ triticale

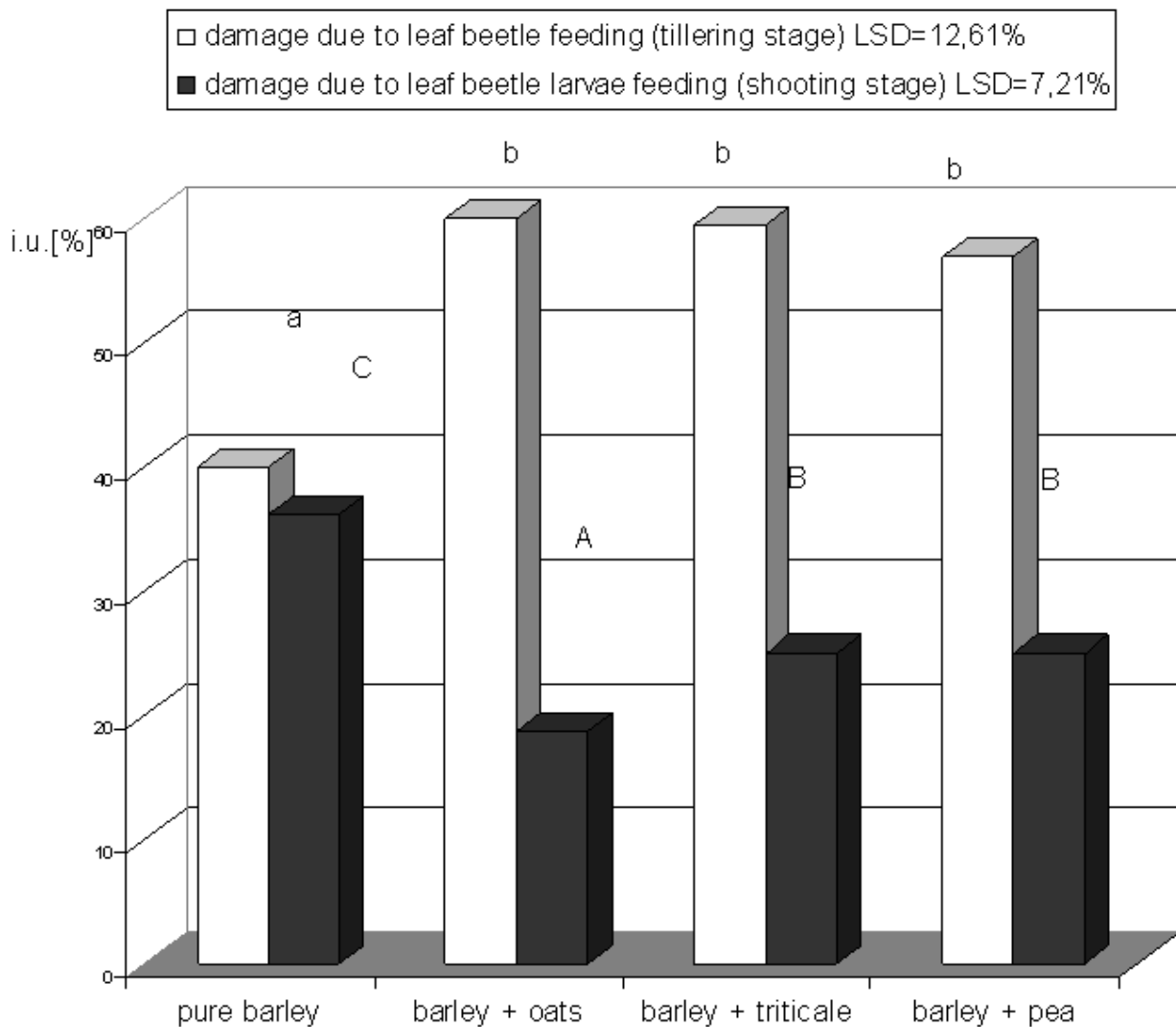
Pure triticale	Triticale + barley	Difference	Triticale + oats	Difference	Triticale + oats	Difference
\bar{x} from 97/98	\bar{x} from 97/98		\bar{x} from 97/98		\bar{x} from 97/98	
13.34	11.4	- 1.94	20.54	+ 7.2	12.96	- 0.38

Spring triticale was observed to be least attractive for *Oulema*; the percentage of leaf blade damage was slight when compared with the two other cereals. The 14.5% damage (mean value for the combination) do not constitute a threat for the crop development and it is compensated for very quickly. Its significant that in triticale and oats mixture there was a 7.2% increase in damage when compared with the pure triticale crop. Among all the mixed crops, it was the oats + triticale combination which had the most considerable total biomass damage (30.54% of oats and 20.54% of the triticale; 51.08% together).

The complimentary feeding of *Oulema* caused a considerable barley damage (Fig.1). In mixtures of this crop almost a 60% damage in leaf blades was observed, with a slightly smaller damage observed in pure barley crop - 38%. Although such considerable crop damage weakens their growth and condition (blades torn apart constitute a gate for fungi pathogens

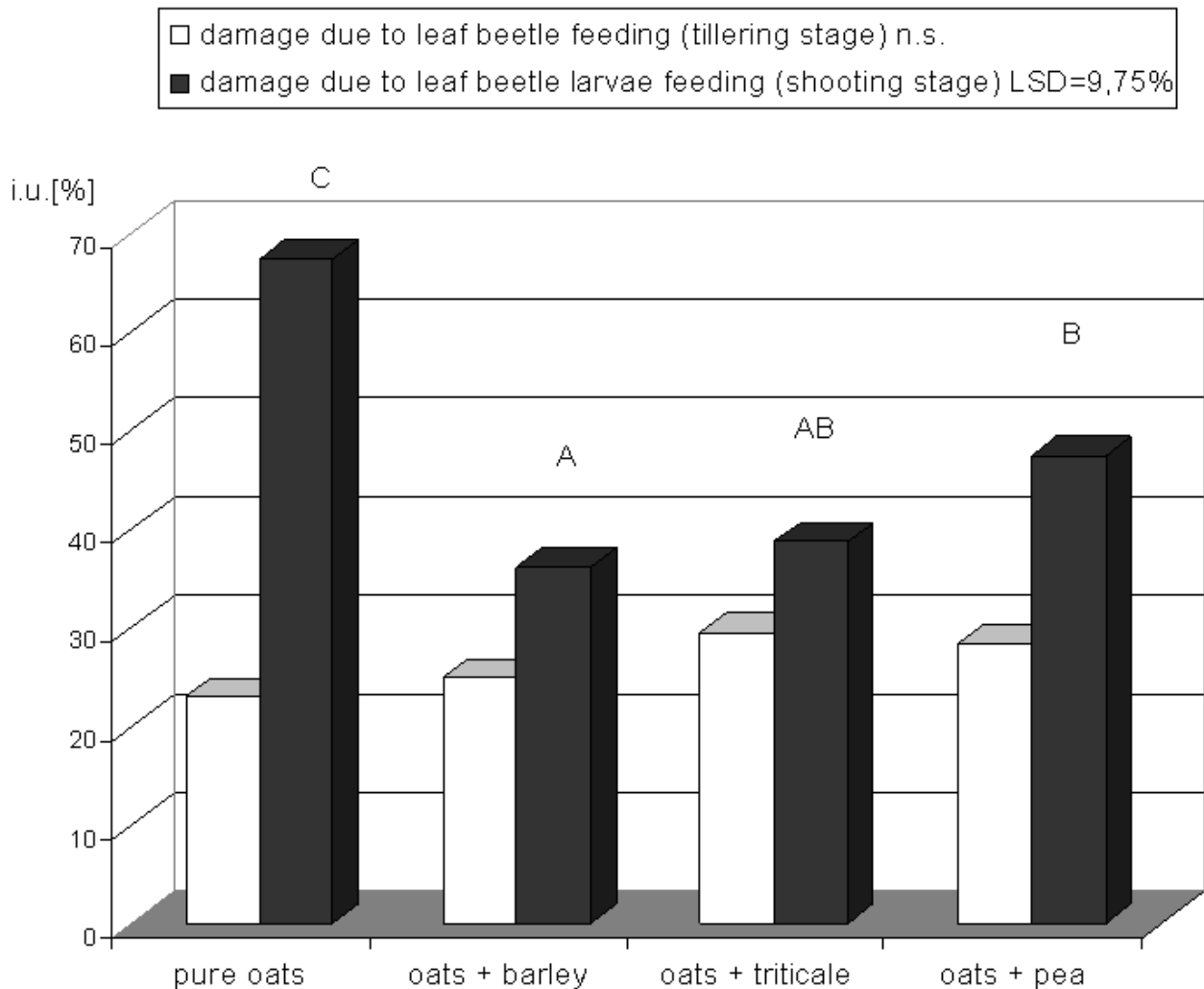
and viruses), it is mainly the larvae which are considered to cause the greatest damage as they feed on leaves which have the greatest contribution to substrate assimilation. Besides when the larvae appear on the crops, the damage caused by leaf beetles on older leaves has already been poorly visible.

Fig. 1. Barley leaf defoliation due to *Oulema* ssp. feeding on mixtures and pure crops



The number of larvae present depends mostly on where the eggs have been laid by female and not where complementary feeding took place. The *Oulema* larvae feeding on barley must have been inconsiderable as the percentage of leaf damage amounted to 18 - in the mixture with oats, 22% - with triticale and pea. Only in pure crop the damage was considerable - over 30% which signifies that leaf beetles laid most eggs. The considerable differences between the imago and *Oulema* feeding on barley in mixtures may have been due to the food source running low and searching for plants for larvae. In tillering phase, the oats damage ranged from 21 - 28 % and no significant differences were observed between pure crop and mixtures of this cereal (Fig.2).

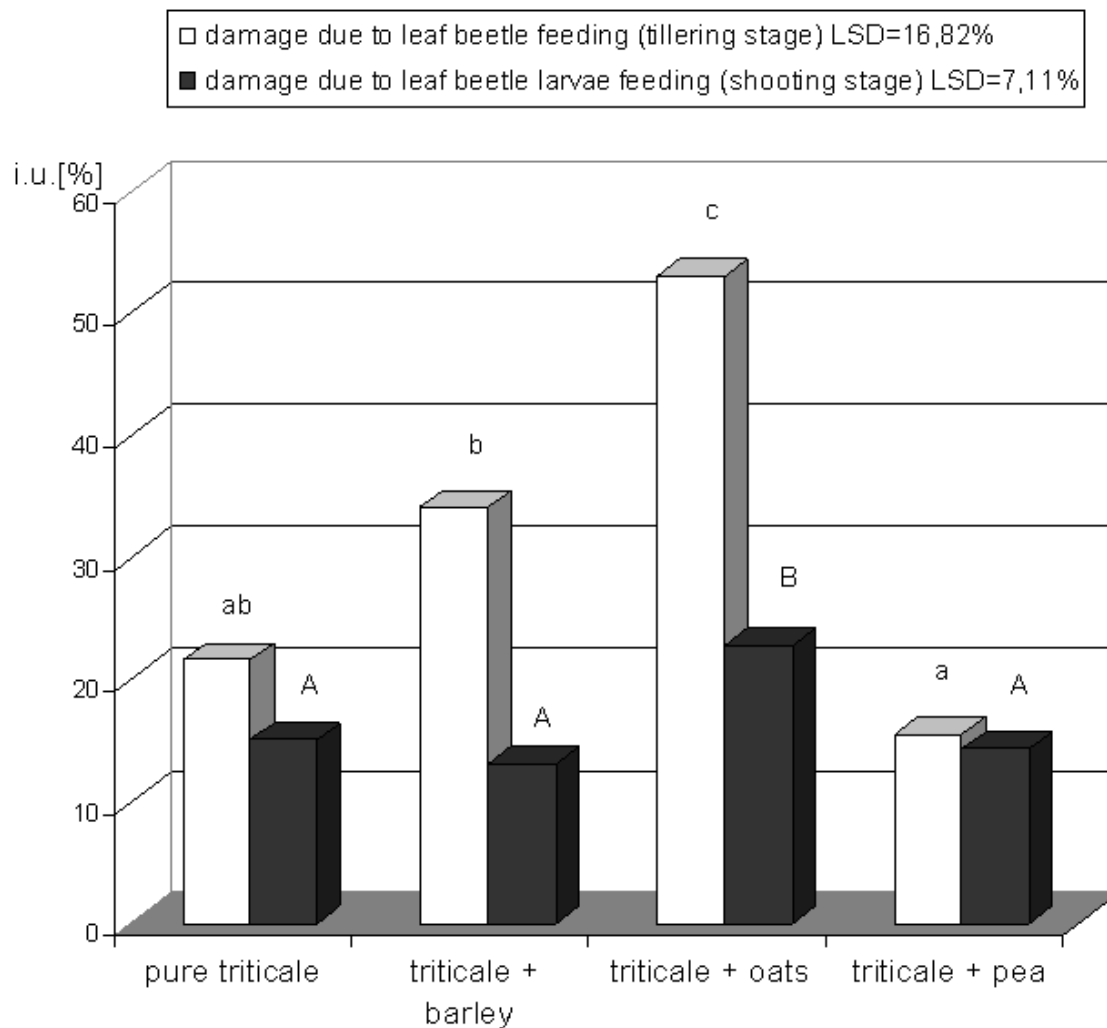
Fig. 2. Oats leaf defoliation due to *Oulema* ssp. feeding on mixtures and pure crops



Only in shooting phase a completely different damage was observed; the indexes increased considerably, which proves that the larvae prefer oats leaves. Besides there was a considerable discrepancy between the objects researched: the smallest damage in the oats, barley and triticale mixtures, medium with pea and a very significant damage caused to the leaf blades in pure crops. For agriculture, over 60% destruction of the assimilation apparatus is consequently tragic. The oats may be 'attractive' for *Oulema* larvae due to the morphological advantages of the plant: wide leaf blades and rough surface quality, which helps the snail-like larvae remain on the leaf surface.

The injuries caused by leaf beetles feeding on triticale + barley + oats combinations exceeded the threshold of the economic harmfulness (Fig. 3). However the imago complementary feeding of the *Oulema* is not dangerous enough to call for chemical protection.

Fig. 3. Triticale leaf defoliation due to *Oulema* ssp. feeding on mixtures and pure crops



Although the damage ranged from 30%-50%, however the crops compensated for the damage perfectly well later on. The plant biomass reconstruction was easier there as triticale is not an attractive feed for *Oulema* larvae. There was no mixture or pure crop where the damage exceeded 25 %, which means that similarly for larvae the application of chemicals is pointless.

DISCUSSION

In the present research, oats turned out to be the species most exposed to damage caused by *Oulema* ssp. phytophagies, which was evident from the highest plant damage index in all its objects. The two remaining species, spring barley and triticale were much less exposed to the feeding of *Oulema*, similarly to what was observed by other authors [1,2]. The primary size of damage, due to complementary feeding, was hidden as the result of cereal compensation capacity. Spring barley, tillering most, compensated for the leaf damage to the greatest extent. Economic harmfulness of *Oulema* feeding can be estimated as late as at cereal shooting stage when larvae start skeletonizing leaf blades [4,5]. In barley and triticale larval feeding was considerably lower than leaf beetles. Coordinate cultivation of the species researched with

fodder pea as well as in two-ingredient cereal mixtures facilitated damage reduction caused by *Oulema* feeding.

CONCLUSIONS

1. The greatest damage caused by *Oulema* was observed in oats when compared to the remaining species researched, namely spring barley and triticale.
2. *Oulema* showed a smaller preference for two-ingredient spring cereal crops as well as spring cereal mixtures with fodder pea than for pure cereal crops.

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