Effect of some mulches on carabids fauna in the strawberry field

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Abstract: Carabid species composition and their abundance were studied in strawberry plantation where plants of three different cultivars 'Jonsok', 'Bounty' and 'Senga Sengana' were differently mulched (black plastic, bed carpet, wood chips, straw, and without any mulching control). The abundance of carabid beetles was estimated with the pitfall trapping during one season in 1997 in all test variants. The chemical treatment of the plots was avoided. The carabids constituted 91,4% from fauna caught with pitfall traps. 18 different species from 11 genera were established. The species of genera *Harpalus, Pterostichus* were dominating. Large predators from genus *Carabus* (*C. cancellatus* and *C. nemoralis*) were also present. The abundance of carabids was significantly higher in the variants of black plastic, bed carpet and wooden chips than in control variant.

Key words: strawberry, mulches, Coleoptera, Carabidae.

Introduction

Carabids are abudant in agricultural fields all over the world. They form a predominant part of overground agrocoenisis (Tischler, 1980). Both larvae and adults are mostly predators. profoundly Agriculture influences composition, abundance, and spatial distribution of ground beetles through the use of agrochemicals, changes in habitat structure from cultivation methods and crop type, etc. Carabids can and have been used as indicator organisms for assessments of environmental pollution, habitat classification for nature protection, or characterization of soil-nutrient status in forestry.

Carabids are important for natural pest control and the effects of cultivation methods and landscape structural elements (Kromp, 1999). Field carabids are species rich and abundant in arable sites, but are affected by intensive agricultural cultivation. Carabids spermophagous feeding habits, species of *Harpalus* and *Amara* could have some potential for biological weed control. Carabids are

considered of bioindicative value for cultivation impacts.

Genera common in European agricultural fields are representatives of genera *Pterostichus*, *Harpalus* and *Agonum* (Lövei, 1996).

Samples collected from pitfall and light traps indicated *H. rufipes* is the dominant ground beetle species (up to 78,4% of the total Carabidae) in Main potato agroecosystems (Zhang et all., 1997).

Pterostichus family is the most numerous from carabids genera living in agricultural fields (Chiverton, 1986).

A rapid cash return is predicted to strawberry growers. Experience of investigators and local growers is the best guide in selecting profitable culture measures. The strawberry yield as well as fauna influencing it is dependent on cultivation technologies (Kikas, Luik, 2002). Phytophagous fauna is always regulated by entomophagous insects and spiders who are usually abundant in the fields where more nature friendly technologies are used (Luik et all., 2000)

We selected four mulch materials to investigate their effect carabids. The aim of the study was to establish carabid fauna in strawberry field.

Methods

The plantation was established in the middle of May 1995 on the farm of Oru-Nõlvaku near Abja-Paluoja in Southern Estonia (EL 25° 22' 09" and NL 58° 08' 34"). Runner plants of the first generation, after tissue culture, of the 'Jonsok' 'Senga Sengana', cultivars 'Bounty' were used for planting. Strawberries were planted in rows with 30 cm distances between plants and 100 cm distances between rows. Experiments were carried out in four replications. No fertilizers and chemical weed control were used. Four different mulches (black plastic film, bed carpet, wooden chips and straw) were used, plus a control of without mulch. In 1997, the pitfall traps were used to catch beneficial arthropods running on the soil surface. The plastic cups (250 cm³) with the diameter at 80 mm were placed for traps; for preservation 10% salt water solution was used. Traps were laid between strawberry plants in rows. During the vegetation period traps were checked and beetles collected at 10-day intervals. The collected material was identified in the laboratory. The analysis of variance was used for data processing.

Results and discussion

Carabids are common and the most important beneficial insects in agrocoenosis. Carabids formed 91.4 % of the caught specimens. 18 different species from 11 genera established (Tab. 1). 4195 carabids were established on 60 pitfall traps from the middle of May to the end of September. Most numerous were specimens from genera Harpalus and Pterostichus. Dominating species were Harpalus rufipes, Pterostichus cupreus, P. melanarius, P. versicolor, P. niger, Amara nitida, Synuchus nivalis. Large predators from genus Carabus (C. cancellatus and C. nemoralis) were also present.

The aim of the current experiment was to find out the relative abundance of carabids within genera during the period of catching and dependence of the number on mulches and cultivars of strawberry plants (Fig. 1). Significant differences (p<0.05) in carabids abundance, especially in *Pterostichus* spp. and *Harpalus* spp. depending on different mulching, appeared in all test treatments. Even though the specimens from genus Carabids were most frequent in the traps when mulch was not used, the difference was not statistically significant.

Pterostichus spp. was most frequent in the traps, forming 43% of the total number of specimens. In comparison with mulchless control variant, on strawberry beds of the cultivar 'Jonsok' the average number of Pterostichus spp. was bigger in the case of bed carpet and wooden chips mulch. In the case of beds with strawberry cultivar 'Bounty' the variants with black plastic and bed carpet mulches differed significantly from the control variant and in the case of cultivar 'Senga Sengana' the experimental variant with wooden chips mulch.

Table 1. Species composition of carabids in the strawberry field.

No	Species
1	Agonum dorsale
2	Amara bifrons
3	Amara fulva
4	Amara nitida
5	Bembidion lampros
6	Calathus melanocephalus
7	Carabus cancellatus
8	Carabus nemoralis
9	Harpalus affinis
10	Harpalus rufipes (= pubescens)
11	Loricera pilicornis
12	Pterostichus coerulescens
13	Pterostichus niger
14	Pterostichus versicolor
15	Pterostichus cupreus
16	Synuchus nivalis
17	Stomis pumicatus
18	Trechus secalis

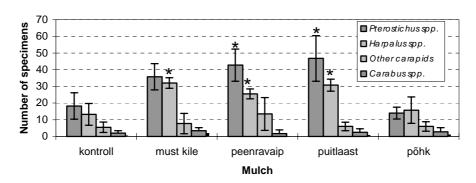
36,8% of the total number of specimens of

Carabids caught with surface traps were from genus Harpalus. Main species was Harpalus rufipes, whereas very few of the specimens from the species Harpalus affinis were found (less than 5%). In the plants of the cultivar 'Jonsok' 'Bounty' there appeared significant differences in the number of species of genus Harpalus on different mulches in comparison with mulches control variant. In both cases the number of species of genus Harpalus was the highest on the beds covered with black plastic mulch and bed carpets. In the case of cultivar 'Jonsok' the number was significantly higher than that of the control variant on the beds mulched with wooden chips. In the case of cultivar 'Senga Sengana' the tendency was similar to the cultivar 'Jonsok', but the differences were insignificant. The difference in abundance appears especially during harvest

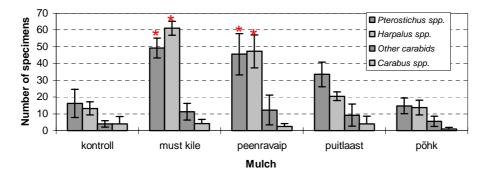
period when the specimens of *Harpalus* spp. actively gather on strawberry beds.

15% of the Arthropoda that were caught were the specimens of genera Amara, Bembidion, Calathus, Carabus, Synuchus and Trechus. In comparison to mulches control variant there were no significant differences found in the number of caught specimens on variants with different mulches. The influence of mulches can probably be explained with favourable and stable temperature and dampness conditions under mulches and the possibility for hiding, which, on one hand, can cause the insects living on the surface to gather under the mulch and on the other hand increase their activity. In general the number of carabids on strawberry beds was high because the field was surrounded with natural diverse plant coenosis and no pesticides treatments were used.

'Jonsok'



'Bounty'



'Senga Sengana'

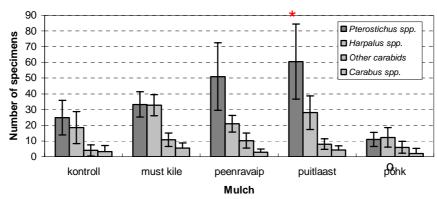


Figure 1. The number of caught carabids of different genera as a mean value of recurrence during catching period, depending on mulches (must kile –black plastic, peenravaip – bed carpet, puitlaast – wooden chips, põhk – straw) and cultivars of strawberry plants. (1997). *- p<0.05 (Tukey test).

It was established (Metspalu et all., 2000) that herbicide treatment between strawberry rows drastically decreased the occurrence of carabids. No serious pest problem occurred, obviously due to a high population of carabids.

Some species of carabids may be important predators of vine weevil, Otiorhynchus sulcatus (Easterbrook et all., 1997). Potential predators are being screened in laboratory arenas for feeding on different life stages of the weevil. strawberry weevils, root Otiorhynchus spp., are also difficult to control once established in the field (Tuovinen, 1997). The larvae of strawberry root weevil feed on strawberry roots and crowns. In Estonia the insect did not favour plastic mulch (Metspalu et all., 2000). Their results also showed that ground beetles preferred plastic mulch for hibernation and as a hiding-place in summer. This can be linked to the fact that as the number of carabids is higher in the variants with plastic mulch, they also regulate the number of Otiorhynchus sp.

It is possible to conclude that the black plastic, the bed carpet and the wooden chips may be recommended for mulching of strawberry beds because these materials enhance beneficial insects in the strawberry plantation.

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