

Ground dwelling Coleoptera fauna of commercial apple orchards

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Abstract: First results are reported of a wide faunistic study of epigeic Coleoptera assemblages occurring in apple orchards in different fruit-growing regions of Hungary. The investigation took place in eleven apple orchards in Hungary. Pitfall traps were used to collect beetles from April until October. During the study 13 583 Coleoptera individuals were collected. On the basis of the cumulated samples we can state, that the dominant family was Carabidae (37%), followed by Silphidae (26%), and Staphylinidae (18%). The families Curculionidae (5%), Dermestidae (2.5%), Histeridae (2%) and Coccinellidae (1.5%) also occurred with a relatively high abundance. Within the family Carabidae the most common species were *Pseudoophonus rufipes* De Geer, *Harpalus tardus* Panzer, *Harpalus distinguendus* Duft., *Harpalus serripes* Quensel, *Calathus erratus* Sahlberg and *Anisodactylus binotatus* Fabricius. Within the family Staphylinidae the species of the subfamilies Omaliinae, Aleocharinae and Xantholininae were abundant. The dominant species were *Omaliium caesum*, *Aleochara bipustulata* and *Tachyporus hypnorum*.

Key words: Apple, orchard, epigeic, Coleoptera, Carabidae, Staphylinidae

Introduction

The reduction of the impact of pesticides on the environment of orchards, as well as the possible conservation of beneficial and other non target organisms, are among the basis aims of IPM. Among these non-target organisms epigeic Arthropods are the most abundant, indifferent or often useful group in the in orchards. The species richness and composition of Arthropods in the canopy level were studied widely in Hungary (Mészáros 1984, Markó et al. 1995, Bogyai et al 1999, Jenser et al 1999). However, the structure of ground dwelling beetles, their family diversity and abundance in apple orchards are still little known (Kádár & Szél 1989, Kádár & Lövei 1992). During the development of different environmentally friendly and integrated plant protection methods the apple orchards were placed in the main focus. Our aims were to investigate the composition of ground dwelling Coleoptera assemblages in these orchards in Hungary. In the present paper we focused our attention on two predator groups, on Carabidae (Holliday & Hagley 1978, Gilgenbegr 1990, Fazekas & Kádár & Lövei 1992, Heyer 1994, Riddick & Mills 1995), and Staphylinidae families (Gilgenberg 1990, Andersen 1995), as their role in apple orchards are still little know.

Material and methods

The investigations were carried out in nine apple orchards in different geographical regions of Hungary. Samples were collected in the following localities: Bakonygyirót, Györgyarló, Szebtlőrinc, Újfehértó, Szigetcsép, Tura, Vámosmikola and Kecskemét (Table 1). The pest management of the orchards based on wide spectrum, mainly organophosphorus insecticides. However, three orchards were investigated in Újfehértó: a conventional, treated with wide

spectrum insecticides, another, where integrated pest management (I.P.M) was applied and an abandoned orchard. The orchard situated in Kecskemét was also abandoned (Table 1). Covered pitfall traps (300 cm³ in size, 8 cm in diameter, half-filled with ethilene glycol in water) were used to collect beetles from April until October in 1998 - 1999. Ten pitfall traps were used per orchards, except the ones in Újfehértó and Vámosmikola where only six traps were placed. Five traps were placed in the centre of the orchards, and five near the inner edges. Samples were collected only for one year in Újfehértó and Vámosmikola, spring and autumn samples were studied in Szentlőrinc and Szigetcsép.

Table 1. The characteristics of the investigated orchards and samples

| | | | | | | | | |
|--------------------|------------|------|------------|---------|-------|-------|-------|---------|
| Apple orchards | 1 | 2 | 3 | 4 | 5.1 | 5.2 | 5.3 | 6 |
| Sampling years | 1998-99 | 1999 | 1998-99 | 1998-99 | 1999 | 1999 | 1999 | 1998-99 |
| Trap number used | 10 | 6 | 10 | 10 | 6 | 6 | 6 | 10 |
| Treatments | CT | CT | CT | CT | A | CT | IPM | A |
| Age of plantation | 40 | 13 | 36 | 50 | 15 | 15 | 15 | 37 |
| Size of plantation | 10 ha | 10ha | 118 ha | 20 ha | 1 ha | 5 ha | 7 ha | 20 ha |
| Soil | sandy-loam | clay | sandy-loam | clay | sandy | sandy | sandy | sandy |

Code of plantations: 1. Bakonygyirót, 2. Vámosmikola, 3. Tura, 4. Györgyarló, 5. Újfehértó, 6. Kecskemét, A - abandoned, IPM - integrated pest management, CT - conventionally treated.

Results and discussions

During the study 13,103 Coleoptera individuals were collected. On the basis of the cumulated samples we can state, that the dominant family was Carabidae (39.4%), which was followed by Silphidae (26.5%), and Staphylinidae (17.3%). The families Curculionidae (5.3%), Dermestidae (2.6%), Histeridae (2.3%), Coccinelidae (1.5%) and Leiodidae (1.5%) also occurred with relatively high abundance. The members of additional 26 Coleoptera families occurred in the samples only occasionally. The dominance levels mentioned above show significant differences if we separate the samples by orchards.

The dominant families were Carabidae (85%) in Vámosmikola, Staphylinidae (48%) in Tura and Silphidae (62%) and Dermestidae (5%) in Kecskemét. The family Histeridae (9%) was relatively abundant in Bakonygyirót and Curculionidae (32%) in Györgyarló.

The dominance of the family Carabidae takes values between 22.2% and 85.1%. A highest abundance was found in the conventionally treated orchard in Vámosmikola, and the lowest abundance in Tura and Györgyarló. Altogether 109 species of Carabidae were identified from the investigated 11 plantations. The species richness of Carabidae was between 14 and 53 in the investigated orchards. The most abundant ground beetle species and their abundance are given in table 2.

Within the family *Carabidae* the most common species was *Pseudoophonus rufipes*, found in all orchards with abundance of at least 5%, and was the dominant species in 5 orchards.

The other dominant species was *Harpalus tardus*, found to be dominant in one orchards and subdominant in 5 orchards. The species of *Calathus erratus* was found with abundance of

46% and 60% in two plantations. Other common species were *Calathus fuscipes*, *Harpalus serripes*, *Amara aulica* and *Amara bifrons* found with greater than 5% abundance only in abandoned orchards. In conventionally treated plots the dominant species were *Anisodactylus binotatus*, *Amara aulica* and *Amara aenea*. However, in the I.P.M. plot the *Bembidion propeans*, *Agonum dorsale*, and *Nebria brevicollis* were found as dominant species.

Table 2. List of the most common Carabidae species and their dominance (%) in apple orchards in Hungary. (Pitfall trapping, 1998 – 1999). Data are shown only in case of the dominance higher than 5%.

| | 1 | 2 | | 3 | 4 | 5.1 | 5.2 | 5.3 | 6 |
|--------------------------------|-------------|------------|------------|------------|------------|------------|------------|-----------|-------------|
| <i>Pseudoophonus rufipes</i> | 6 | 50 | 52 | 27 | 9 | | 32 | 15 | 28 |
| <i>Harpalus tardus</i> | | 30 | 24 | 17 | 54 | | 13 | | |
| <i>Calathus erratus</i> | 46 | | | | | 60 | 6 | | |
| <i>Harpalus distinguendus</i> | | | | | | | 27 | 61 | |
| <i>Anisodactylus binotatus</i> | | | | 14 | 5 | | | | |
| <i>Amara aenea</i> | 5 | | | 7 | | | | | |
| <i>Harpalus serripes</i> | | | | | | | | | 20 |
| <i>Amara bifrons</i> | | | | | | 13 | | | |
| <i>Amara familiaris</i> | 11 | | | | | | | | |
| <i>Calathus fuscipes</i> | | | | | | | | | 10 |
| <i>Amara aulica</i> | | | | | | | | | 9 |
| <i>Bembidion properans</i> | | | | | | | 6 | | |
| <i>Nebria brevicollis</i> | | | 5 | | | | | | |
| <i>Agonum dorsale</i> | | | | | | | 5 | | |
| specimens | 1559 | 758 | 553 | 207 | 141 | 162 | 106 | 97 | 1637 |
| species | 53 | 36 | 31 | 27 | 26 | 16 | 14 | 14 | 47 |

Code of plantations: 1. Bakonygyirót, 2. Vámosmikola, 3. Tura, 4. Györgyarló, 5. Újfehértó, (5.1: abandoned, 5.2: IPM, 5.3: conventionally treated) 6. Kecskemét

The other important predatory group is the family Staphylinidae. Their abundance in orchards varied between the 6 and 49 %. The higher abundance was found in Újfehértó in abandoned plot, the lesser abundance in Vámosmikola in conventionally treated plot.

Altogether 107 species were captured in the investigated 11 plantations, the species richness varied between the 11 and 50. The most dominant Staphylinid species and their abundance are given in table 3.

Within the family Staphylinidae the species of the subfamilies Omaliinae, Xantholyninae, Staphylininae, Tachyporinae and Aleocharinae were abundant. The most widespread species was *Omalius caesum* Gravenhorst, found in five plots with abundance of 7% and 27%. The most abundant species was *Platydracus stercorarius* (Olivier) found in two orchards with 54% and 67%. The dominant species in the studied orchards were as follows: *Omalius caesum* in Györgyarló, *Paraphalus linearis* (Olivier) in Tura, *Platydracus stercorarius* in Vámosmikola, *Tachyporus hypnorum* (Fabricius) in Újfehértó, and *Aleochara bipustulata* (Linnaeus) in Bakonygyirót. We can also conclude on the basis of this study, that the role of the Staphylinidae in some apple orchards may be important.

We can conclude that the species of the families Carabidae and Staphylinidae are the most abundant in conventionally treated apple orchards. The most abundant ground beetle

species, we found in the orchards, are typical for disturbed ecosystems. However, in case of Staphylinid assemblages there were great differences in species composition and especially in dominance order. We found nearly 110 species from both families and only 14 species were more abundant than 5%. The most dominant species were the carabid *Pseudoophonus rufipes* and the row beetle *Omalium caesum*. Both families could play a certain role in biological control in Hungarian apple orchards.

Table 3. List of the most common Staphylinidae species and their dominance (%) in apple orchards in Hungary. (Pitfall trapping, 1998 - 1999). Data are shown only in case of the dominance higher than 5%.

| | 1 | 2 | 3 | 4 | 5.1 | 5.2 | 5.3 |
|---------------------------------|------------|-----------|-----------|------------|------------|------------|-----------|
| <i>Omalium caesum</i> | | | 7 | 27 | 7 | 9 | 8 |
| <i>Aleochara bipustulata</i> | 26 | | | | 9 | 9 | 7 |
| <i>Tachyporus hypnorum</i> | | | 6 | | 10 | 15 | 11 |
| <i>Platydracus stercorarius</i> | | 54 | 67 | | | | |
| <i>Sphenoma abdominale</i> | 20 | | 11 | | | | |
| <i>Pseudocypus mus</i> | | 11 | 13 | | | | |
| <i>Mocyta orbata</i> | 5 | | 7 | | | | |
| <i>Paraphalus linearis</i> | | | 45 | | | | |
| <i>Purrolinus laeiceps</i> | | | | 10 | | | |
| <i>Styloxys rugifrons</i> | | | | 8 | | | |
| <i>Hyponigrus angustatus</i> | 6 | | | | | | |
| <i>Hemitropia sordida</i> | 6 | | | | | | |
| <i>Philonthus debilis</i> | 5 | | | | | | |
| <i>Meneidopalpus roubali</i> | | | | 5 | | | |
| specimens | 330 | 37 | 15 | 310 | 226 | 103 | 34 |
| species | 50 | 11 | 11 | 28 | 42 | 19 | 19 |

Code of plantations: 1. Bakonygyirót, 2. Vámosmikola, 3. Tura, 4. Györgytarló, 5. Újfehértó, (5.1: abandoned, 5.2: IPM, 5.3: conventionally treated) 6. Kecskemét

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