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CONTRIBUTION TO THE KNOWLEDGE OF THE GROUND BEETLE FAUNA FROM SERBIA (COLEOPTERA: CARABIDAE)

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Abstract

During a two-year period of research on the ground beetle fauna in agroecosystems in northern Serbia 19,003 carabid specimens were collected. A total of 67 species from 29 genera were identified. *Harpalus distinguendus* (Duftschmid, 1812), *Amara aenea* (De Geer, 1774), *Poecilus cupreus* (Linnaeus, 1758), and *Amara similata* (Goeze, 1777) were the dominant species in the winter oilseed rape and winter wheat. The ground beetle genera richest in species were *Harpalus*, *Amara*, *Calathus*, *Poecilus* and *Brachinus*. Seven species were new for the ground beetle fauna of Serbia: *Calathus cinctus* Motschulsky, 1850, *Laemostenus complanatus* (Dejean, 1828), *Brachinus nigricornis* Gebler, 1829, *Cychrus attenuatus* (Fabricius, 1792), *Patrobus septentrionis* Dejean, 1828, *Anchomenus cyaneus* Dejean, 1828 and *Pterostichus leonisi* Apfelbeck, 1904. Three species were recorded for the first time for Vojvodina Province in Serbia: *Harpalus signaticornis* (Duftschmid, 1812), *Harpalus taciturnus* Dejean, 1829 and *Patrobus atrorufus* (Ström, 1768). Newly recorded species were collected in epigeic pitfall traps. Six of them were found in oilseed rape while one was found in winter wheat.

KEY WORDS: Coleoptera, Carabidae, Serbia, oilseed rape, winter wheat, new records

Introduction

A total of 608 carabid species from 111 genera have so far been recorded from Serbia (ĆURČIĆ *et al.*, 2007, 2013; GUÉORGUIEV, 2008; ĆURČIĆ & STANKOVIĆ, 2011; ĆURČIĆ & STOJANOVIĆ, 2011; STANČIĆ, 2013; VRBICA *et al.*, 2013). ĆURČIĆ *et al.* (2007) noted northern and southeastern regions of Serbia as insufficiently studied. More detailed studies on the diversity of ground beetles from northern Serbia exist from the mountainous area of Fruška Gora National Park, but comprehensive systematic studies are lacking (TALLÓSI, 1984a; 1984b; TOŠEVSKI, 1990; RADOVIĆ *et al.*, 1995; PAVIĆEVIĆ *et al.*, 1997; DROVENIK & PEKS, 1999; ĆURČIĆ, 2000, 2003, 2008; ĆURČIĆ & STOJANOVIĆ, 2008, 2011; GUÉORGUIEV, 2008). Previous studies concerning the ground beetles from agrocenoses in the northern part of the country were conducted by SEKULIĆ (1977) and SEKULIĆ *et al.*, (1987). In this paper we present a brief report on the ground beetle fauna from oilseed rape and winter wheat fields in northern Serbia.

Material and Methods

Ground beetles were sampled in three winter oilseed rape fields of approximately 1.5 ha each between September 2010 and June 2012, then during fallow which lasted up to October 2011, and lastly in the succeeding crop of winter wheat up to June 2012. Fields were located at the Stari Žednik, near the city of Subotica, Vojvodina Province, northern Serbia (UTM coordinate CR 79, GPS coordinates 45°57′280′′N, 19°37′554′′E) (Fig. 1). Within each sampled field a grid of eight sampling points were installed on 15th September 2010. Each sampling point consisted of three trap types (epigaeic pitfall trap, funnel traps and emergence traps) which were positioned along the central line of each field with the first sampling point placed 50 meters within the crop and the distance between sampling points of 50 meters. During fallow four sampling points were installed within each field along the central line with the first sampling point placed 50 meters within the field and a distance of 70 meters between sampling points.

Epigaeic pitfall traps were used to measure activity density of epigaeic active ground beetles. Each pitfall trap consisted of a plastic cup (9 cm diameter and 11 cm depth) filled up with a 5% benzoic acid solution. The plastic cup was positioned in the soil so that the upper edge was in line with the soil surface. Emergence traps with photoeclectors on top (www.ecotech-bonn.de) and with the addition of a pitfall trap inside were used in order to collect beetles which hatched from the covered soil. Due to high temperatures and fast evaporation during summer, ethylene glycol was used in photoeclectors and pitfall traps, instead of 5% solution sodium benzoate.

The funnel trap consisted of a funnel (17 cm in diameter) which was connected to a plastic cup which was inserted into the soil. Originally funnel traps were used to assess the area-related abundance of oilseed rape pests dropping from the crop plant canopy to the soil for pupation but some ground beetles also dropped from the crop plant canopy.

Pitfall trap sampling in oilseed rape started on 1 October 2010 and continued in two weeks intervals until 30 November 2010 when the temperature dropped below +5°C. In 2011 sampling continued from 12 February 2011 with monthly controls, and onward from 23 March 2011, as soon as the snow disappeared, traps were controlled in weekly intervals until harvest. In oilseed rape emergence traps were installed on 19th May 2011 at each sampling point. Traps were controlled in weekly intervals until harvest. Funnel traps were installed on 14th April 2011 at each sampling point on each system and were controlled in weekly intervals until harvest.

Funnel traps were installed only in oilseed rape crop. Emergence traps were installed on 19th May 2011 at each sampling point on each system. Traps were controlled in weekly intervals until harvest.

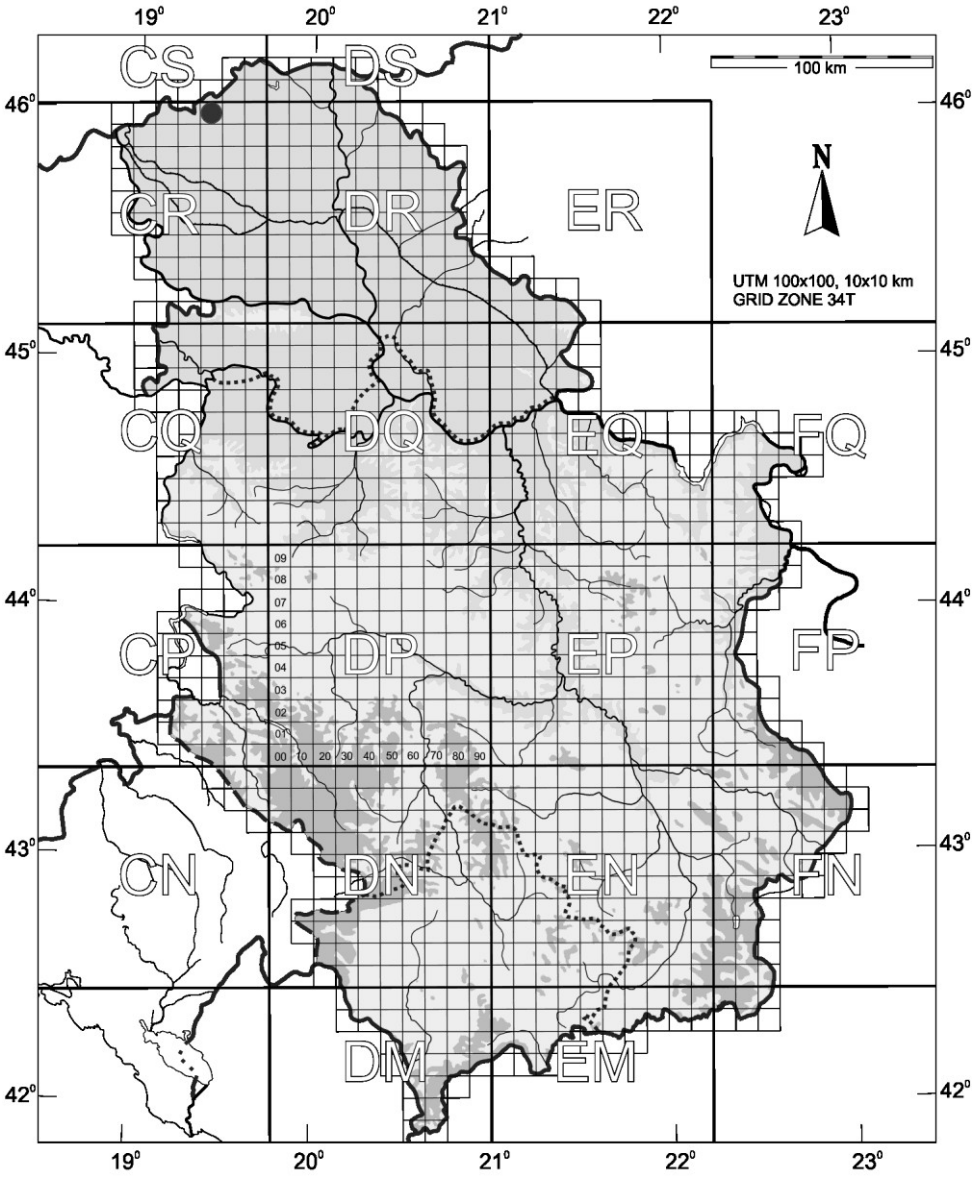

Figure 1. UTM map of Serbia with the marked point that designates the area of the Stari Žednik, Vojvodina, northern Serbia, as the locality at which the ground beetle species were recorded.

Sampling of epigaeic pitfall traps and emergence traps during the fallow period started on 2 July 2011 and continued in four week intervals until the sowing of winter wheat (20 October 2011). Pitfall and emergence trap sampling in the winter wheat period started 25 October 2011 and continued in two weeks intervals until 28 November 2011. In 2012 sampling continued from 10 January and ended on 19 June 2012 and traps were controlled in two weeks intervals.

The beetles were then prepared, labeled and determined. The specimens were identified to species level according to TRAUTNER & GEIGENMÜLLER (1987), HŮRKA (1996), and FREUDE *et al.* (2004). The material is stored at the Institute for Plant Protection and Environment, Belgrade, Serbia as well as at the Julius Kühn-Institut, Institute for Crop and Soil Science, Braunschweig, Germany. The newest systematics and nomenclature were used (LÖBL & SMETANA, 2003). The landscape of the studied area consists of farmland on calcareous chernozem soil with a loamy texture type.

Results and Discussion

A total of 19,003 ground beetle specimens belonging to 67 species, 29 genera, and 18 tribes were collected and identified (Appendix 1). The tribe Harpalini was the most numerous in taxa (with 24 species and six genera), followed by the tribes Pterostichini (with eight species and two genera), Sphodrini (with seven species and three genera), and Zabrini (with seven species and two genera). *Harpalus distinguendus* (Duftschmid, 1812), *Amara aenea* (De Geer, 1774), *Poecilus cupreus* (Linnaeus, 1758), and *Amara similata* (Gyllenhal, 1810) were dominant species in the fields studied. *Harpalus distinguendus* represented 14.6% of all carabid specimens found. The second most dominant species was *Amara aenea*, which covered 13.6% of the total number of carabid specimens, followed by *Poecilus cupreus* (11.7%) and *Amara similata* (11.4%). The dominance level of as much as 52 (77.6%) species was lower than 1% each. The catch of ground beetles differed according to the type of traps. Most of the ground beetles were caught in the epigaeic pitfall traps (17450 individuals), then in the funnel traps (928 individuals), and in the emergence traps (625 individuals). Regarding the crop, in the oilseed rape 14985 individuals were collected; in the fallow, 2561 individuals; and in the winter wheat, 1457 individuals only. Six newly recorded species for Serbia were found in the oilseed rape [*Laemostenus complanatus* (Dejean, 1828), *Brachinus nigricornis* Gebler, 1829, *Cychrus attenuatus* (Fabricius, 1792), *Patrobus septentrionis* Dejean, 1828, *Anchomenus cyaneus* Dejean, 1828, and *Pterostichus leonisi* Apfelbeck, 1904], while only one (*Calathus cinctus* Motschulsky, 1850) was found in the winter wheat fields.

The two most abundant species were the *Calathus cinctus* and *Laemostenus complanatus* (96 and 45 specimens, respectively), while the abundance of five other species was very low (three to one specimens per species). According to FREUDE *et al.* (2004), *Calathus cinctus* and *Laemostenus complanatus* are West Palaearctic species, indicating that the northern part of Serbia has been insufficiently studied so far.

The findings of *Harpalus signaticornis* (Duftschmid, 1812), *Harpalus taciturnus* Dejean, 1829 and *Patrobus atrorufus* (Ström, 1768) are the first records in Vojvodina Province (Northern Serbia). The findings of *Broscus cephalotes* (Linnaeus, 1758), *Harpalus dimidiatus* (Rossi, 1790), *Licinus depressus* (Paykull, 1790), *Poecilus versicolor* (Sturm, 1824) and *Amara communis* (Panzer, 1796) are the first precise ones from the territory of Vojvodina Province, i.e. these species were already noted for Vojvodina, but without precise localities (ĆURČIĆ *et al.*, 2007).

Ground beetle genera richest in specimens were *Amara* Bonelli, 1810 (25.7%), *Calathus* Bonelli, 1810 (19.8%), *Poecilus* Bonelli, 1810 (19.2%), *Harpalus* Latreille, 1802 (18.7%), and *Brachinus* Weber, 1801 (9.7%). In terms of the species composition, the genus *Harpalus* with 17 species was the most diverse, followed by *Amara* with six species. A survey of literature, reports and unpublished data demonstrates that *Amara similata* is the only species here with an extraordinarily high abundance in oilseed rape fields (WARNER *et al.* 2000; BÜCHS *et al.*, 2006; FELSMANN & BÜCHS, 2006). It is also the most abundant carabid species in European oilseed rape fields (BÜCHS *et al.*, 2006, 2007a). According to the further analysis of literature and databases, amongst the other dominant species, *Amara aenea* and *Poecilus cupreus* have a dominance level >5% each in European oilseed rape crops (BÜCHS *et al.*, 2007a). BÜCHS *et al.* (2006, 2007b) also reported that *Poecilus cupreus* plays a major role in European oilseed rape fields as predator of key insect pests – first instar larvae of brassica pod midge [*Dasineura brassicae* (Winnertz, 1853), Diptera: Cecidomyidae] and pollen beetle larvae [*Meligethes aeneus* (Fabricius, 1775), Coleoptera: Nitidulidae].

Conclusions

The final list of carabids of Serbia is not yet complete. We may expect findings of new taxa for the country in the future as well, especially after thorough studies performed in the border areas such as the investigated site. The recording of seven species new for Serbia at only three arable fields, average in size, indicates that faunistic surveys obviously focus more on extraordinary locations (e.g. caves, national parks etc.) neglecting "common" habitats (e.g. arable fields, orchards etc.). It also indicates that epigaeic predators (ground beetles, spiders, rove beetles) as natural enemies of pests are neglected in agricultural research and therefore systematic assessments of these taxa in rural landscapes are needed. Thus, much more remains to be studied and assessed before we can say that the carabids of Serbia are sufficiently known.

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Appendix 1

List of the ground beetle species in oilseed rape fields during fallow and in winter wheat fields at the Stari Žednik locality (northern Serbia), recorded between September 2010 and June 2012. Species marked with the symbol "*" are new to the carabid fauna of Serbia.

Tribe Bembidiini

Asaphidion flavipes (Linnaeus, 1761)
Metallina (*Metallina*) *properans* (Stephens, 1828)

Tribe Brachinini

Brachinus (*Brachinus*) *elegans* Chaudoir, 1842
Brachinus (*Brachynidius*) *explodens* Duftschmid, 1812
Brachinus (*Brachynidius*) *nigricornis* Gebler, 1829 *
Brachinus (*Brachinus*) *psophia* Audinet-Serville, 1821

Tribe Broscini

Broscus cephalotes (Linnaeus, 1758)

Tribe Carabini

Calosoma (*Campalita*) *auropunctatum* (Herbst, 1784)

Tribe Chlaeniini

Chlaenius (*Chlaenius*) *festivus* (Panzer, 1796)

Tribe Clivinini

Clivina (*Clivina*) *fossor* (Linnaeus, 1758)

Tribe Cychrini

Cychrus attenuatus (Fabricius, 1792) *

Tribe Harpalini

Acupalpus (*Acupalpus*) *meridianus* (Linnaeus, 1761)
Diachromus germanus (Linnaeus, 1758)
Harpalus (*Harpalus*) *affinis* (Schrank, 1781)
Harpalus (*Harpalus*) *albanicus* Reitter, 1900
Harpalus (*Harpalus*) *anxius* (Duftschmid, 1812)
Harpalus (*Pseudophonus*) *calceatus* (Duftschmid, 1812)
Harpalus (*Harpalus*) *dimidiatus* (Rossi, 1790)
Harpalus (*Harpalus*) *distinguendus* (Duftschmid, 1812)
Harpalus (*Harpalus*) *fuscicornis* Ménétriés, 1832
Harpalus (*Harpalus*) *hirtipes* (Panzer, 1796)

Harpalus (*Harpalus*) *latus* (Linnaeus, 1758)
Harpalus (*Harpalus*) *pumilus* Sturm, 1818
Harpalus (*Harpalus*) *pygmaeus* Dejean, 1829
Harpalus (*Harpalus*) *rubripes* (Duftschmid, 1812)
Harpalus (*Pseudophonus*) *rufipes* (De Geer, 1774)
Harpalus (*Harpalus*) *serripes* (Quensel in Schönherr, 1806)
Harpalus (*Semiophonus*) *signaticornis* (Duftschmid, 1812)
Harpalus (*Harpalus*) *taciturnus* Dejean, 1829
Harpalus (*Harpalus*) *zabroides* Dejean, 1829
Ophonus (*Hesperophonus*) *azureus* (Fabricius, 1775)
Parophonus (*Parophonus*) *maculicornis* (Duftschmid, 1812)
Stenolophus (*Stenolophus*) *mixtus* (Herbst, 1784)
Stenolophus (*Stenolophus*) *teutonus* (Schrank, 1781)

Tribe Lebiini

Syntomus pallipes (Dejean, 1825)

Tribe Licinini

Licinus (*Licinus*) *depressus* (Paykull, 1790)

Tribe Nebriini

Nebria (*Nebria*) *brevicollis* (Fabricius, 1792)

Tribe Panagaeini

Panagaeus (*Panagaeus*) *bipustulatus* (Fabricius, 1775)

Tribe Patrobini

Patrobus atrorufus (Ström, 1768)
Patrobus septentrionis Dejean, 1828 *

Tribe Platynini

Agonum (*Olisares*) *viridicupreum* (Goeze, 1777)
Anchomenus (*Anchodemus*) *cyaneus* Dejean, 1828 *
Anchomenus (*Anchomenus*) *dorsalis* (Pontoppidan, 1763)

Tribe Pterostichini

Poecilus (*Poecilus*) *cupreus* (Linnaeus, 1758)
Poecilus (*Sogines*) *punctulatus* (Schaller, 1783)
Poecilus (*Macropoecilus*) *sericeus* Fischer von Waldheim, 1824
Poecilus (*Poecilus*) *versicolor* (Sturm, 1824)
Pterostichus (*Argutor*) *leonisi* Apfelbeck, 1904 *
Pterostichus (*Morphnosoma*) *melanarius* (Illiger, 1798)
Pterostichus (*Feronidius*) *melas* (Creutzer, 1799)
Pterostichus (*Phonias*) *strenuus* (Panzer, 1796)

Tribe Sphodrini

Calathus (*Neocalathus*) *ambiguus* (Paykull, 1790)
Calathus (*Neocalathus*) *cinctus* Motschulsky, 1850 *
Calathus (*Neocalathus*) *erratus* (Sahlberg, 1827)
Calathus (*Calathus*) *fuscipes* (Goeze, 1777)
Calathus (*Neocalathus*) *melanocephalus* (Linnaeus, 1758)
Dolichus halensis (Schaller, 1783)
Laemostenus (*Laemostenus*) *complanatus* (Dejean, 1828) *

Tribe Trechini

Trechus (*Trechus*) *quadristriatus* (Schrank, 1781)

Tribe Zabrini

Amara (*Amara*) *aenea* (De Geer, 1774)
Amara (*Amara*) *anthobia* A. Villa & G. Villa, 1833
Amara (*Amara*) *communis* (Panzer, 1797)
Amara (*Bradytus*) *consularis* (Duftschmid, 1812)
Amara (*Amara*) *familiaris* (Duftschmid, 1812)
Amara (*Amara*) *similata* (Gyllenhal, 1810)
Zabrus (*Zabrus*) *tenebrioides* (Goeze, 1777)

ПРИЛОГ ПОЗНАВАЊУ ФАУНЕ ТРЧУЉАКА СРБИЈЕ (COLEOPTERA: CARABIDAE)

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Извод

Током двогодишњих истраживања фауне трчуљака у агроекосистемима у северној Србији укупно је уловљено 19.003 јединки. Регистровано је 67 врста, класификованих у 29 родова. Доминантне врсте у усеву уљане репице и у усеву озиме пшенице су *Harpalus distinguendus* (Duftschmid, 1812), *Amara aenea* (De Geer, 1774), *Poecilus cupreus* (Linnaeus, 1758) и *Amara similata* (Goeze, 1777). Родови најбогатији врстама су *Harpalus*, *Amara*, *Calathus*, *Poecilus* и *Brachinus*. Седам врста је ново за фауну Србије: *Calathus cinctus* Motschulsky, 1850, *Laemostenus complanatus* (Dejean, 1828), *Brachinus nigricornis* Gebler, 1829, *Cychrus attenuatus* (Fabricius, 1792), *Patrobus septentrionis* Dejean, 1828, *Anchomenus cyaneus* Dejean, 1828 и *Pterostichus leonisi* Apfelbeck, 1904. Три врсте су први пут регистроване на територији Војводине: *Harpalus signaticornis* (Duftschmid, 1812), *Harpalus taciturnus* Dejean, 1829 and *Patrobus atrorufus* (Ström, 1768). Нове врсте су сакупљене у епигејским ловним посудама. Шест врста је уловљено у усеву уљане репице, док је једна врста уловљена у усеву озиме пшенице.

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