Carabid beetles of the Russian steppe

Stephen Venn[1] & Andrey Matalin[2]

[1] Dept. of Geography, University of Helsinki, Finland, E-mail: stephen.venn@helsinki.fi

[2] Zoology & Ecology Department, Moscow State Pedagogical University, Moscow, Russia.

Bulletin of the European Grassland Group 23 (2014): 21-23

Abstract: *Carabid beetles were collected or observed from three areas in the Russian steppe region during the post-conference excursion of the European Dry Grasslands Meeting XII. Some records of beetles from other families were also made. This paper presents a list of specimens recorded and information on their habitat requirements. We call for the instigation of research into intertrophic reactions between invertebrate taxa and vascular plants in grassland ecosystems.*

Keywords: grassland, habitat requirements, invertebrates

Introduction

The steppe region is an extensive region of temperate grassland which extends through much of Russia to China and Tibet in the east, through Ukraine and Hungary into Germany in the west. The steppe grasslands include diverse range of species rich grasslands characterized by such grass species as *Stipa* spp. and *Bromus* spp. There are also a number of notable arthropod species associated with steppes, including such Orthoptera as the praying mantis *Mantis religiosa* and spiders such as the orb-web spider *Argiopa bruennichi* and the pigmy spider *Linyphia triangularis*. The carabid assemblage of steppe grasslands is also speciose.

The steppe region was a particular focus of the European Dry Grassland Meeting this year in Tula Russia. The programme of the meeting was supplemented by excursions to selected steppe sites. The purpose of this study was to obtain a sample of the carabid fauna of some of the steppe sites visited during that excursion and for the first author (Venn) to become familiar with species that are uncommon or absent from northern Europe.

Materials and Methods

The sites visited during this study were: Kulikovo Pole, Tula; Streletsky Reserve, Kursk and Rostov. A number of sites in each region were visited once during the period 9th-12th July 2014. Beetle samples were obtained exclusively by hand-searching and now trapping protocol was employed. The sampling was conducted by Venn at each site. The sampling intensity was not standardized and the efficiency of sampling was subject to the abundance of stones and other subjects which could be turned over to look for arthropods. Therefore the results cannot be considered comparable but merely indicative of some of the species that occur in them during this part of the season.

Specimens were sought by lifting stones, leaves, pieces of wood and other such debris. Also tiger beetles (Cicindela spp.) were stalked. At sites where collecting was prohibited (Streletsky), specimens were observed, identified if possible and then released. At the other sites, captured specimens were placed into collecting pots, fixed in ethanol and labelled with information of the site and date collected. The carabid species were identified by A. Matalin using a dissection microscope and with reference to taxanomical keys, and to specimens from the reference collection of the Moscow State Pedagogical University.

Results

A total of 37 individuals of 25 species was collected from the studied sites. The species recorded for each site are listed in Table 1.

Discussion

The number of species recorded at the different sites varied considerably due to the variation in sampling effort and the scarcity or abundance of stones and other artefacts beneath which to search. The largest catches were obtained from the Rostov sites, which were sparsely vegetated, and also had loose rocks and stones. The Kulikovo Pole sites were more densely vegetated apart from an escarpment that had loose stones, though this was completely exposed and rather parched and generated only few specimens. The Streletsky reserve at Kursk had particularly dense vegetation, though a small number of carabids were active on sandy paths and areas with less dense vegetation. The number of observations from both Kulikovo and Streletsky Reserve were minimal, primarily due to the relatively dense vegetation. Also the latter site was a strict reserve and I did not obtain permission to collect at this site, so records are based on observations rather than collected specimens. In addition to carabids, a number of longhorn beetles (Cerambycidae) were also recorded, including Dorcadion equestre, which was abundant at Streletsky, Kursk. Tenebrionid beetles were also relatively abundant in all of the steppe sites, some of which superficially resemble carabid beetles.

The genera Amara and Harpalus are amongst the most speciose grassland genera (Venn et al. 2013). They are primarily xerophilous (favour dry conditions), heliophilic (favour bright sunny conditions) and spermatophagous (seed-eating) species (Hurst & Doberski 2003, Klimeš & Saska 2010), and only very few species in these genera favour more shady habitats. Such species are most easily observed on sandy roads or patches of bare soil, in bright sunlight (Thiele 1977). Cafeteria experiments (Honek et al. 2006), in which test subjects are offered seeds of a

Table 1. List of species recorded at the studied sites

Species	Region	Habitat	Observations
Cicindela (s. str.) *sahlbergii sahlbergii* F.-W.	Rostov-on-Don	Steppes, Semideserts, Sandy roads	2
Notiophilus laticollis Chaud.	Rostov-on-Don	Meadows	1
Dyschiriodes sp.	Rostov-on-Don	River banks	1
Bembidion (*Emphanes*) sp.	Rostov-on-Don	River banks, Salines	1
Bembidion (*Notaphus*) *varium* (Ol.)	Rostov-on-Don	River banks	1
Agonum (*Olisares*) *impressum* (Panz.)	Rostov-on-Don	River banks, Wet meadows	1
Calathus (Neocalathus) *ambiguus ambiguus* (Payk.)	Rostov-on-Don	Steppes, Dry meadows	1
Amara (*Bradytus*) *apricaria* (Payk.)	Rostov-on-Don	Steppes, Dry meadows	5
Harpalus (s. str.) *amplicollis* Mén.	Rostov-on-Don	Steppes, Dry meadows	1
Harpalus (s. str.) *anxius* (Duft.)	Rostov-on-Don	Steppes, Dry meadows	1
Harpalus (s. str.) *fuscicornis* Mén.	Rostov-on-Don	Steppes, Semideserts	1
Harpalus (s. str.) *hirtipes* (Panz.)	Rostov-on-Don	Steppes, Semideserts	1
Harpalus (s. str.) *pumilus* (Sturm)	Rostov-on-Don	Steppes, Dry meadows	1
Harpalus (s. str.) *rubripes* (Duft.)	Rostov-on-Don	Steppes, Meadows	1
Harpalus (s. str.) *subcylindriucus* Dej.	Rostov-on-Don	Steppes, Dry meadows	1
Harpalus (s. str.) *serripes serripes* (Quenz.)	Rostov-on-Don	Steppes, Semideserts	1
Harpalus (s. str.) *servus* (Duft.)	Rostov-on-Don	Steppes, Semideserts	1
Harpalus (s. str.) *smaragdinus* (Duft.)	Rostov-on-Don	Steppes, Meadows	5
Harpalus (s. str.) *tardus* (Panz.)	Rostov-on-Don	Steppes, Meadows	1
Chlaenius (*Chlaeniellus*) *vestitus* (Payk.)	Rostov-on-Don	Muddy riverbanks	2
Carabus (*Morphocarabus*) *excellens* (F.)	Streletsky, Kursk	Steppes	2
Amara (s. str.) *aenea* (De Geer)	Streletsky, Kursk	Different grasslands (ruderal)	2
Harpalus (s. str.) *subcylindricus* Dej.	Streletsky, Kursk	Steppes, Dry meadows	1
Carabus (*Trachycarabus*) *sibiricus haeres* F.-W.	Kulikovo, Tula	Steppes	1
Ophonus (*Hesperophonus*) *azureus* (F.)	Kulikovo, Tula	Steppes, Dry meadows	1
Total			**37**

variety of different species have revealed that spermatophagous species vary considerably in their food preferences, with some being restricted to a narrow range and others feeding on a broad range of grassland seeds (Klimeš & Saska 2010). The anatomy of the mandibles of such species also influences the potential range of seeds that can be exploited, depending on the size of the seeds and the hardness of the seed coat (Zetto Brandmayr et al. 1998; Paarmann et al. 2006). In general, Harpalus spp. have larger, stronger mandibles and therefore are capable of processing larger and harder seeds compared to Amara spp. (Klimeš &Saska 2010).

Harpalus spp. were the best represented genera in this study. The Harpalus species were all known to be typical of the steppe region and comprised a group of species that are typical of steppe and meadow vegetation, steppe and dry meadow vegetation and steppe and semi-deserts, so habitat moisture level is a major factor determining the Harpalus assemblage of a particular site. Some of these species, such as the harpalinids *Harpalus rubripes*, *H. smaragdinus* and *Ophonus azureus*, as well as *Calathus ambiguus*, also occur in dry grassland habitats in the north of Europe, even as far north as Finland, though they are not common there. Species such as *Harpalus tardus* and *Amara aenea* and *A. apricaria*, are common in grassland habitats throughout Europe.

The genus Carabus spp. includes a small number of rather ubiquitous species and a considerable number of species and sub-species with rather restricted ranges. Two such species were observed in this study, *Carabus excellens*, of which two individuals were observed on the Streletsky steppe and *C. sibiricus* haeres, of which one specimen was taken from Kulikovo Pole.

The tiger beetles (Cicindela spp.) are a sub-family of Carabid beetles that generally favour sandy conditions. They are weak flyers though fly actively. Typically they fly short distances of 1-2 m when disturbed. Thus they are relatively easy to catch with a sufficiently long-handled net, though frustratingly difficult to catch without such equipment (Fig. 1). These beetles were very active on the sandy roads of sandy sites in the Rostov region. The two individuals that I captured proved to belong to the southern species *Cicindela sahlbergii sahlbergii*.

Finally a group of riparian species were collected from the muddy banks of the River Don in Rostov. These included two specimens of the colourful green Chlaenius vestitus, which was abundant in a disturbed muddy area where cattle had been drinking, and two small Bembidion species. Bembidion are a speciose genera of carabid beetles that are mostly adapted to riparian habitats and are often highly substrate specific, some favouring gravel, others sand and others clay and rock, for instance.

Conclusions

Steppe grasslands have speciose carabid assemblages, and include some species with restricted ranges. It is highly likely that the occurrences of some of these species are correlated with particular vegetation types, soil types or plant species. Many of these carabid species are predominantly seed-eating spermatophagous, and therefore they are likely to be closely linked with the

Fig. 1 The first author (Steve Venn), accompanied and assisted by Dieter Frank, stalking specimens of Cicindela sahlbergii sahlbergii along a sandy road in Rostov-on-Don. Photo: Thomas Rohde

occurrences of favoured plant species. As yet little information is available on the trophic interactions between carabid beetles and vascular plants, though spermatophagous carabids clearly have the potential to affect vegetation structure. On the basis of their abundance, it can be assumed that tenebrionid beetles also clearly have an important role in steppe ecosystems. Longhorn beetles are also prevalent in steppe ecosystems, though they are dependent on woodlands with suitable resources of decaying wood, in addition to the nectar-plants on which the adults feed in steppe grasslands.

Acknowledgement

The authors wish to acknowledge the financial grant of the Chancellor of the University of Helsinki, which made it possible for Venn to participate in the conference, excursions and collecting trip.

References

Honek A., Saska P., & Martinkova Z. (2006): Seasonal variation in seed predation by adult carabid beetles. Entomologia Experimentalis et Applicata 118: 157-162.

Hurst C. & Doberski J. (2003): Wild flower seed predation by *Pterostichus madidus* (Carabidae: Coleoptera). Annals of Applied Biology142: 251-254.

Klimeš P. & Saska P. (2010): Larval and adult seed consumption affected by the degree of food specialization in Amara (Coleoptera: Carabidae). Journal of Applied Entomology 134: 659-666.

Paarmann W., Faust N., Arndt E., Lüchtrath I. & Rohe W. (2006): Constant seed size and mandible growth - a fundamental problem for granivorous ground beetle larvae (Coleoptera: Carabidae). Entomologica Fennica 17: 334-339.

Thiele H-U. (1977): Carabid beetles in their environment: a study on habitat selection by adaptations in physiology and behaviour. Springer, Berlin, 369 pp.

Venn S. J., Kotze D. J., Lassila T. & Niemelä J. K. (2013): Urban dry meadows provide valuable habitat for granivorous and xerophilic carabid beetles. Journal of Insect Conservation, DOI 10.1007/s10841-013-9558-8.

Zetto Brandmayr T., Giglio A., Marano I., Brandmayr P. (1998): Morphofunctional and ecological features in carabid (Coleoptera) larvae. In: Ball G.E., Casale A., Vigna Taglianti A. (Eds.) Phylogeny and Classification of Caraboidea. Museo Regionale di Scienze Naturali, Torino, pp. 449-489.