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Ground beetles (Coleoptera: Carabidae) from some regions of Iran

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A b s t r a c t : The fauna of Carabidae as one of the efficient biological control agents in almost ecosystems was studied in some regions of Iran. In a total of 22 species from 17 genera and 12 tribes belonged to seven subfamilies (including, Bembidiinae, Carabinae, Chlaeniinae, Cicindelinae, Harpalinae, Pterostichinae and Scaritinae) were collected.

K e y w o r d s : Coleoptera, Ground beetle, Carabidae, fauna, Iran.

Introduction

The carabidae is a huge, worldwide distributed beetle family which is an exceptionally interesting object of various biological observations. There are more than 40.000 named species known in the world and arose in the early Tertiary (DESENDER et al. 1994). Primary importance of the family lies in the variety and the location of the food they consume. They are usually predators but some species are omnivorous, and some phytophage (LARSEN et al. 2003; LÖBL & SMETANA 2003). Also, some species (ex.: *Ophonus calceatus* (DUFTSCHMID 1812), some *Bembidion* spp.) feed as omnivorous also phytophage (LODOS 1989).

Most ground beetles are found in the tropics. More than 30% of species are arboreal, though in general temperate species are terrestrial, most are also flightless and predatory (LÖVEI & SUNDERLAND 1996). They are commonly found under stones, logs, leaves, bark, debris, or foraging on the ground. They run rapidly, but seldom fly. Many species are equipped for digging and burrowing in the soil. Most species are nocturnal and a few are attracted to lights especially at night. They are predaceous on insects, worms, slugs, snails, caterpillars, grubs and maggots (THIELE 1977; STORK 1990; LUFF et al. 1992). Carabid habitat and microdistribution (the precise distribution of one or more kinds of organisms in a microenvironment or in part of an ecosystem) are governed by abiotic and biotic factors such as light, temperature, and humidity extremes, food supply, predator presence and distribution, and life history strategies (THIELE 1979; LÖVEI & SUNDERLAND 1996).

An extensive literature documents the breadth of carabid beetle larval and adult diets. Investigations of feeding habits, especially in agricultural systems, have categorized carabid food preferences as beneficial, pestiferous, or neutral, with respect to crop plants.

Through observation in the laboratory and field, investigators found that most carabids are facultatively predaceous insects (LÖVEI & SUNDERLAND 1996) that also scavenge dying and dead arthropods (BALL & BOUSQUET 2001). This family is common in Iran as in the world but these insects were studied very poorly (MODARRES AWAL 1997; GHAHARI et al. 2009a, b). The aim of this study is to record the carabid species collected from different regions of Iran for increasing the knowledge on Iranian Carabidae.

Materials and Methods

The material of this investigation was collected from some regions of 9 provinces including, Ardabil, Chaharmahal & Bakhtiari, East Azarbayjan, Fars, Golestan, Isfahan, Khuzestan, Mazandaran and Zanjan. The specimens were obtained by pitfall traps (GREENSLADE, 1964), 8.5×10 cm (diameter × depth), from under of stone with hands through 2004-2008. The pitfall traps consisted of plastic cups filled with 25-30% ethylene or propylene glycol and detergent and covered with 10 × 10 cm plexi roofs to protect them from litter and rain. The traps were emptied monthly (ARMSTRONG & MCKINLAY 1997; MAGURA et al. 2000). In addition to the pit fall traps, sweeping nets were used randomly in different regions and the collected specimens were put in alcohol ethanol 75 %. Also, a few specimens of insect collections of some universities were used for this paper, too.

Results

Totally 22 carabid species of 17 genera and 12 tribes belonged to seven subfamilies were collected from some regions of Iran as the below list.

Subfamily *Bembidiinae*

Tribe *Bembidiini*

Genus *Asaphidion* DES GOZIS 1886

Asaphidion (s. str.) *flavicornis* SOLSKY 1874

M a t e r i a l : Isfahan province: Najaf-Abad, 2 specimens, June 2006.

Genus *Bembidion* LATREILLE 1802

Bembidion quadrimaculatum (LINNAEUS 1761)

M a t e r i a l : East Azarbaijan province: Arasbaran, 3 specimens, August 2007.

Subfamily *Carabinae*

Tribe *Carabini*

Genus *Calosoma* WEBER 1801

***Calosoma (Campalita) olivieri* (DEJEAN 1831)**

M a t e r i a l : Zanjan province: Zanjan, 3 specimens, September 2006.

Genus *Carabus* LINNAEUS 1758

***Carabus (Oreocarabus) cribratus porrectangulus* GEHIN 1885**

M a t e r i a l : Fars province: Abadeh, 1 specimen, April 2004.

Subfamily *Chlaeniinae*

Tribe *Chlaeniini*

Genus *Chlaenius* BONELLI 1810

***Chlaenius* (s. str.) *festivus* (PANZER 1796)**

M a t e r i a l : Zanjan province: Zanjan, 2 specimens, September 2006.

***Chlaenius* (s. str.) *lederi* REITTER 1888**

M a t e r i a l : Golestan province: Kordkoy, 1 specimen, July 2006.

Subfamily *Cicindelinae*

Tribe *Cicindelini*

Genus *Cicindela* LINNAEUS 1758

***Cicindela (Cephalota) deserticola* FALDERMANN 1836**

M a t e r i a l : Golestan province: Gorgan: 2 specimens, October 2004.

Subfamily *Harpalinae*

Tribe *Harpalini*

Genus *Acinopus* LATREILLE 1829

***Acinopus (Osimus) ammophilus* (DEJEAN 1829)**

M a t e r i a l : East Azarbayjan province: Arasbaran, 1 specimen, July 2007.

***Acinopus (Oedematicus) megacephalus* (ROSSI 1794)**

M a t e r i a l : Mazandaran province: Ramsar, 2 specimens, September 2008.

Tribe D i t o m i n i

Genus *D i t o m u s* BONELLI 1810

***Ditomus calydonius* (ROSSI 1790)**

M a t e r i a l : East Azarbaijan province: Arasbaran, 2 specimens, August 2006.

Genus *H a r p a l u s* LATREILLE 1802

***Harpalus* (s. str.) *caspius* STEVEN 1806**

M a t e r i a l : Ardabil province: Pars-Abad, 1 specimen, September 2007. Gilan province: Lahijan, 3 specimens, June 2008.

***Harpalus* (*Harpalophonus*) *hospes* (STURM 1818)**

M a t e r i a l : Khuzestan province: Ahwaz, 2 specimens, Summer 2007.

Tribe Z u p h i i n i

Genus *P o l i s t i c h u s* BONELLI 1816

***Polistichus* (s. str.) *connexus* (FOURCROY 1785)**

M a t e r i a l : Golestan province: Kordkoy, 4 specimens, July 2006.

Subfamily P t e r o s t i c h i n a e

Tribe A m a r i n i

Genus *A m a r a* BONELLI 1810

***Amara* (s. str.) *familiaris* (DUFTSCHMID 1812)**

M a t e r i a l : Isfahan province: Lenjan, 1 specimen, Summer 2006.

***Amara* (*Curtonotus*) *propinquus* MENETRIEES 1832**

M a t e r i a l : Zanjan province: Zanjan, 1 specimen, September 2006.

Genus *Z a b r u s* CLAIRVILLE 1806

***Zabrus* (*Pelor*) *trinii* (FISCHER von WALDHEIM 1817)**

M a t e r i a l : Mazandaran province: Sari, 1 specimen, October 2005.

Tribe P l a t y n i n i

Genus *C a l a t h u s* BONELLI 1810

***Calathus* (s. str.) *fuscipes* (GOEZE 1777)**

M a t e r i a l : Isfahan province: Shahreza, 4 specimens, August 2006.

***Calathus* (s. str.) *syriacus* CHAUDOIR 1863**

M a t e r i a l : Chaharmahal & Bakhtiari province: Shahrekord, 1 specimen, September 2005.

Genus *Laemostenus* BONELLI 1810

***Laemostenus* (*Sphodroides*) *cordicollis* (CHAUDOIR 1854)**

M a t e r i a l : Mazandaran province: Behshahr, 3 specimens, June 2005.

Tribe *Pterostichini*

Genus *Poecilus* BONELLI 1810

***Poecilus* (s. str.) *cupreus* (LINNAEUS 1758)**

M a t e r i a l : Chaharmahal & Bakhtiari province: Shahrekord, 2 specimens, September 2005.

Subfamily *Scaritinae*

Tribe *Dyschirini*

Genus *Dyschirius* BONELLI 1810

***Dyschirius* (s. str.) *nitidus nitidus* DEJEAN 1825**

M a t e r i a l : Isfahan province: Shahreza, 1 specimen, August 2006.

Tribe *Scaritini*

Genus *Scarites* FABRICIUS 1775

***Scarites* (*Parallelomorphus*) *terricola pacificus* BATES 1873**

M a t e r i a l : Golestan province: Bandar-Torkman, 2 specimens, June 2006. East Azarbaijan province: Arasbaran, 1 specimen, August 2007.

Discussion

The results of this research indicate that there is a diverse fauna of Carabidae in Iran. Among the seven studied subfamilies in this paper, Pterostichinae and Harpalinae included the highest number of species (6 and 5, respectively). The subfamily Harpalinae is the largest group of carabid beetles and includes about 19,000 species (LORENZ 1998), the bulk of the family's species-level diversity. Iran is a large country with a various geographical regions and climates; consequently it would be expected that a large number of additional species remain to be discovered.

Carabid beetles are increasingly used as taxonomic study group in biodiversity and as bio-indicators in monitoring or site assessment studies for nature conservation purposes (e.g. LOREAU 1994; HEIJERMAN & TURIN 1994). One problem related to the study of carabid diversity is to assess which part of the species caught at a certain site actually

belongs to the local fauna and has reproducing populations. Related to this problem is the question of observed turnover in species richness from year to year on a given site. A short review of the literature shows that most authors either deny the problem (i.e. assume that all species caught on a site belong to the local fauna and/or that species caught in low numbers have a small local population) or use a more or less arbitrary limit between so-called local species and accidentally caught species. Surprisingly, there have only been few attempts to discriminate between the two by means of long term population studies or by investigating additional aspects of the biology (dispersal power and reproductive characteristics) and ecology (occurrence in surrounding or nearby other habitats). A comparable problem is also encountered on a larger geographical scale, where one recently has started to distinguish between core and satellite species (NIEMELA & SPENCE 1994; DESENDER 1996).

An important additional advantage is that carabids can be fairly reliably and (almost) quantitatively collected by pitfall traps. Although the question of the relative merits of this collecting method as compared to others is continuously and often hotly debated, it still remains the method in many kinds of studies involving collecting carabids in the field (SPENCE & NIEMELA 1994; DIGWEED et al. 1995). It is remarkable to note that this debate has been going on for quite some time. Already in 1963, at a Dutch carabidologists' gathering, a progenitor of present day carabidologists' symposia, pitfall trapping was in the forefront. Despite the difficulties of pitfall trapping the use of the method has contributed to making carabids popular 'model organisms' in conservation and land use evaluation (DESENDER et al. 1994). For instance, most of the studies presented at the 3rd International Symposium of Carabidology were based on pitfall trapping, and about 75 % of them dealt with questions related to the effects of human activities on carabids or to the use of carabids in conservation studies. The increase of these studies is very encouraging as invertebrates have been rarely used in conservation studies, although their potential utility is immense (FRANKLIN 1993; KIM 1993; KREMAN et al. 1993).

Carabid occurrence appears to be determined by a multitude of biotic and abiotic factors acting together. Furthermore, the relative importance of these factors may vary from species to species as suggested by LOREAU (1992). Numerically dominant species may be affected by interspecific competition, whereas less abundant species may be primarily influenced by abiotic conditions. Moreover, the relative importance of these effects may from year to year (NIEMELA 1996).

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Zusammenfassung

Die Carabiden-Fauna, als eine der effizientesten biologischen Bekämpfungsmethoden, wurde in einigen Regionen des Irans untersucht. Insgesamt konnten 22 Arten aus 17 Gattungen, 12 Triben und sieben Unterfamilien (Bembidiinae, Carabinae, Chlaeniinae, Cicindelinae, Harpalinae, Perostichinae und Scaritinae) nachgewiesen werden.

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