P O L I S H J O U R N A L O F E N T O M O L O G Y
P O L S K I E P I S M O E N T O M O L O G I C Z N E

VOL. **79**: 81-90 Bydgoszcz 30 March 2010

Contribution to the knowledge of darkling beetles (Coleoptera: Tenebrionidae) from Iranian rice fields and surrounding grasslands

HASSAN GHAHARI*, MAREK BUNALSKI**, MEHRDAD TABARI***
HADI OSTOVAN****

* Department of Agriculture, Islamic Azad University; Shahre Rey Branch, Tehran, Iran; email: hghahari@yahoo.com
** Department of Entomology, University of Life Sciences, Dabrowskiego 159, 60-594 Poznan, Poland; email: bunalski@au.poznan.pl
*** Amol Rice Research Institute, Mazandaran, Iran; email: ma_tabari@yahoo.com
**** Department of Entomology, Islamic Azad University, Fars Science & Research Branch, Marvdasht, Iran; email: ostovan2001@yahoo.com

ABSTRACT. Darkling beetles (Coleoptera: Tenebrionidae) are one of the most numerous and diverse family of beetles, present in almost all agroecosystems. The fauna of these beneficial insects in chain foods of ecosystems was studied in Iranian rice fields and surrounding grasslands. The results show a total of 21 tenebrionid species of 16 genera including, *Zophosis* LATREILLE, *Dailognatha* ESCHSCHOLTZ, *Tentyria* LATREILLE, *Eutagenia* REITTER, *Phymatiotris* SOLIER, *Pachyscelis* SOLIER, *Pimelia* FABRICIUS, *Dendarus* DEJEAN, *Colpotus* MULSANT et REY, *Gonocephalum* SOLIER, *Opatroides* BRULLÉ, *Blaps* FABRICIUS, *Cephalostenus* SOLIER, *Probaticus* SEIDLITZ, *Euboeus* BOIELDIEU and *Tribolium* MACLEAY. Altogether, members of 3 subfamilies (*Pimeliinae, Opatrinae, Tenebrioninae*) were collected from Iranian rice fields and surrounding grasslands. Four genera and 14 species are new records for Iran.

KEY WORDS: Tenebrionidae, rice field, fauna, new records, Iran.

INTRODUCTION

Tenebrionids are mostly rather large, flightless beetles, although a few species living in rotten wood and in stored products are small. With more than 15,000 known species, darkling beetles are one of the most common members of the beetle, or coleopteran, community (SOLDATI & SOLDATI 2003). Darking beetles can be found in desert or semidesert regions all over the world. They burrow under stones, bark and leaf litter. Some species

even move through sand, "swimming" with their legs. The darkling beetles that inhabit the most torrid deserts can withstand temperatures of 50 °C. They have long legs that keep their bodies at a safe distance from the burning sand and enable them to move at high speed. Many are excellent burrowers and can bury themselves in sand very quickly in order to avoid the scorching sun (SCHAWALLER 1996, BOUCHARD et al., 2005).

They live mainly in the soil, under logs, or in leaf litter, and feed on dead organic matter. Certain species infesting stored foodstuff are called 'flour beetles', and the larvae of others are called 'mealworms'. Because mealworms are easily reared in large numbers they are a popular and nutritious form of food for insect-eating animals kept in captivity. Tenebrionids have a sophisticated system for retaining water in the body which enables them to live in drier habitats than most other beetles (KULZER 1954, MATTHEWS & BOUCHARD 2008).

Most species of darkling beetles are active above ground from spring to late fall. Also, most of them are nocturnal, with the exception of some species that inhabit sandy beaches. In contrast, many overseas tenebrionids are active during the daytime. With the onset of winter weather, some species seek shelter below ground in burrows of other animals and remain there until warmer weather returns in the spring. Other species of darkling beetles do not live through the winter as adults. They lay eggs in the soil during warm weather and die with the onset of freezing. Their eggs hatch into larvae when warm weather returns. These larvae live in the soil for up to two years before the adults emerge to eat and reproduce (DOYEN & LAWRENCE 1979, WATT 1992). Darkling beetles are probably useful as indicators of environmental quality, in that their presence signifies that the place is relatively undisturbed. The great majority of these insects are scavengers. In nature, they are quite content to feed on dried or rotting plant residue. Man has made many a darkling beetle's day by storing vast quantities of grain products (WATT 1974, SCHAWALLER 1996).

MATERIALS AND METHODS

The specimens were collected through recent years (2000-2005) under stones by hand, sweeping of vegetation and pitfall trap methods from the different rice and cotton fields of Iran. In addition to collecting the materials, several specimens of different insect collections of Iranian universities were checked and their data have also been included in this paper. Subfamilies and tribes were given in phylogenetic order and species were listed alphabetically within each tribe. The information concerning specific name, describer and description date, locality, altitude (in brackets) and date of collection, place/ plant on which the species were collected, determinant and number of species (in brackets) was given. Classification and nomenclature of darkling beetles suggested by LAWRENCE & NEWTON (1995), IWAN (2001), SOLDATI & SOLDATI (2003) have been followed.

RESULTS

In this study, 21 species in 16 genera belonging to 3 subfamilies of Tenebrionidae were collected from Iranian rice fields and surrounding grasslands. Of these, four genera and fourteen species are newly recorded from Iran. The list of species with their synonymies, distributional data and plants on which the specimens were collected from them are given below.

Family Tenebrionidae LATREILLE 1802

Subfamily Pimeliinae LATREILLE 1802

Tribe Zophosini SOLIER 1834

Genus *Zophosis* LATREILLE 1807

Zophosis (Oculosis) dilatata DEYROLLE 1867

Distribution: Greece, Turkey, Syria, Lebanon.

Material: Mazandaran province, Amol, *Amaranthus graecizans* (Amaranthacea) (1), August 2002. **New record for Iran.**

Zophosis (Oculosis) punctata punctata BRULLÉ 1832

Synonyms: *algeriana* SOLIER 1834, *barbara* SOLIER 1834, *curta* SOLIER 1834, *deflexa* REITTER 1916, *faldermanni* DEYROLLE 1867, *gibbicollis* SOLIER 1834, *kollari* DEYROLLE 1867, *maillei* SOLIER 1834, *mediocris* DEYROLLE 1867, *nitida* GEBLER 1844, *nitidula* MOTSCHULSKY 1860, *orientalis* DEYROLLE 1867, *osmanlis* DEYROLLE 1867, *ovata* BRULLÉ 1832, *polita* LUCAS 1854, *steppensis* GEMMINGER 1870, *subinflata* BRULLÉ 1832, *truquii* DEYROLLE 1867, *variepunctata* DEYROLLE 1867, *vescoi* DEYROLLE 1867.

Distribution: South Europe, North Africa, Middle East, Asia Minor, Iraq, Iran, Pakistan, Central Asia, West China.

Material: Isfahan province, Lenjan, around the rice field (1), Najaf-Abad, on the ground (2), July 2000.

Tribe Tentyriini ESCHSCHOLTZ 1831

Genus *Dailognatha* ESCHSCHOLTZ 1829

Dailognatha caraboides (ESCHSCHOLTZ 1831)

Synonyms: *audiuini* SOLIER 1835, *caucasica* (DESBROCHERS 1881).

Distribution: Bulgaria, Greece, Turkey, Syria, Armenia, Georgia, Azerbaijan, Iran, Iraq.

Material: Mazandaran province, Ghaemshahr, pitfall trap (2), October 2001.

Dailognatha pumila (BAUDI 1874)

Synonym: *humeralis* (DESBROCHERS 1881).

Distribution: Armenia, Turkey.

Material: Mazandaran province, Savadkooh, on the ground (1), September 2001. **New record for Iran.**

Genus *Tentyria* LATREILLE 1802

Tentyria (Tentyria) rotundata BRULLÉ 1832

Synonyms: *grossa* SOLIER 1835, *kindermanni* FISCHER-WALDHEIM 1844, *subdepressa* SOLIER 1835, *subsulcata* KOCH 1948.

Distribution: Balkans, Turkey, Iran.

Material: Mazandaran province, Behshahr, *Polygonum convolvulus* (Polygonaceae) (1), July 2001.

Tribe Stenosini LACORDAIRE 1859

Genus *Eutagenia* REITTER 1886

Eutagenia smyrnensis (SOLIER 1838)

Synonyms: *hellenica* REITTER 1889, *longicollis* (REY 1892).

Distribution: Bulgaria, Greece, Turkey, Syria, Jordan.

Material: Chaharmahal & Bakhtiari province, Shahrekord, *Eragrostis poaeoides* (Gramineae) (1), July 2005. **New record for Iran.**

Tribe Pimeliini LATREILLE 1802

Genus *Phymatiotris* SOLIER 1836 (=*Graecopachys* SKOPIN 1968)

Phymatiotris quadricollis (BRULLÉ 1832)

Synonyms: *cycladica* (REITTER 1893), *porphyrea* (SOLIER 1836).

Distribution: Greece, Turkey.

Material: Mazandaran province, Savadkooh, on the ground (2), Summer 2000. Mazandaran province, Behshahr, rice field (3), May 2004. **The genus is new record for Iran.**

Genus *Pachyscelis* SOLIER 1836

Pachyscelis (Parapachyscelis) villosa (DRAPIEZ 1820)

Synonyms: *crinita* SOLIER 1836, *granulosa* SOLIER 1836, *hirtella* SOLIER 1836, *tenebrosa* SOLIER 1836, *wettsteini* SCHUSTER 1936.

Distribution: Greece, Turkey, Iraq, Syria, Israel, Egypt.

Material: Guilan province, Roodsar, on the ground (1), June 2004. **New record for Iran.**

Genus *Pimelia* FABRICIUS 1775

Pimelia (Camphonota) akbesiana FAIRMAIRE 1884

Distribution: Turkey, Syria.

Material: Mazandaran province, Amol, pitfall trap (3), September 2004. **New record for Iran.**

Pimelia (Pimelia) bajula KLUG 1830

Synonyms: *cylindrica* SOLIER 1836, *mulsanti* REICHE 1861.

Distribution: Turkey, Cyprus, Iran.

Material: Isfahan province, Lenjan, around the rice field (1), Isfahan (Borkhar), on the ground (2), July 2000.

Subfamily Opatrinae BRULLÉ 1832

Tribe Dendarini ESPAÑOL 1945

Genus *Dendarus* DEJEAN 1821

Dendarus (Pandarinus) foveolatus SEIDLITZ 1893

Distribution: Turkey, Armenia.

Material: Mazandaran province, Ghaemshahr, *Helianthus anuus* (Compositeae) (1), September 2005. Mazandaran province, Joibar, dung (1), October 2005. **New record for Iran.**

***Dendarus (Pandarinus) tenellus* (MULSANT et REY 1854)**

Distribution: Greece, Turkey, Iraq.

Material: East Azarbayjan province, Kaleibar, on the snow, (2), November 2001. **New record for Iran.**

Tribe Pedinini ESCHSCHOLTZ 1829

Genus *Colpotus* MULSANT et REY 1853

***Colpotus vogti* KOCH 1948**

Distribution: Greece, Turkey.

Material: Guilan province, Rasht, on the ground (1), August 2003. **The genus and species are new recorded for Iran.**

Genus *Pedinus* LATREILLE 1796

Pedinus (Pedinus) strabonis SEIDLITZ 1893

Distribution: Turkey, Azerbaijan, Armenia, Iran.

Material: Guilan province, Rasht, Olea europea (Oleaceae) (1), August 2003.

Tribe Opatrini BRULLÉ 1832

Genus *Gonocephalum* SOLIER 1834

***Gonocephalum (Gonocephalum) rusticum* (OLIVIER 1811)**

Synonyms: *errans* (WOLLASTON 1854), *femalicum* (KÜSTER 1849), *fuscum* (HERBST 1793), *modestum* (KÜSTER 1849), *obductum* (GEBLER 1860), *pulverulentum* (OLIVIER 1811), *rusticum* (BRULLÉ 1832), *setulosum* KÜSTER 1849, *substriatum* (BESSER 1832), *terrosum* (KÜSTER 1845), *trichopterum* (GEMMINGER 1870), *tricostatum* (FISCHER-WALDHEIM 1844), *vestitum* (KÜSTER 1849), *vicinum* (GEMMINGER 1870), *villosum* (STEVEN 1829).

Distribution: S. Europe, N. Africa, Middle East, Turkey, Iran, Iraq, Central Asia, Mongolia, China.

Material: Khuzestan province, Ahwaz, on the ground (2), October 2000.

Genus *Opatroides* BRULLE 1832

Opatroides punctulatus BRULLE 1832

Distribution: S. Europe, N. Africa, Arabia, Middle East, Transcaucasus, Afghanistan, Central Asia.

Material: Chaharmahal & Bakhtiari province, Shahrekord, *Cucumis sativus* (Cucurbitaceae) (1), July 2005. Isfahan province, Najaf-Abad, under stone (1), July 2000.

Subfamily Tenebrioninae LATREILLE 1802

Tribe Blaptini LEACH 1815

Genus *Blaps* FABRICIUS 1775

Blaps (Blaps) ocreata ALLARD 1880

Distribution: Greece, Turkey.

Material: Zanjan province, Zanjan, on the ground (1), August 2002. **New record for Iran.**

Tribe Scaurini BILLBERG 1820

Genus *Cephalostenus* SOLIER 1836

Cephalostenus elegans (BRULLE 1832)

Synonym: *dejeanii* SOLIER 1838.

Distribution: Greece, Turkey.

Material: Mazandaran province: Behshahr, rice field (2), July 2001. **The genus and species are new recorded for Iran.**

Tribe Helopini LATREILLE 1802

Genus *Probaticus* SEIDLITZ 1896

Probaticus (Pelorinus) tenebricosus (BRULLÉ 1832)

Distribution: Balkans, Turkey.

Material: Guilan province, Lahijan, *Quercus* sp. (1), May 2004. **New record for Iran.**

Tribe *Cylindronotini* ESPAÑOL 1956

Genus *Euboeus* BOIELDIEU 1865

***Euboeus mimonti* BOIELDIEU 1865**

Distribution: Bulgaria, Greece, Turkey.

Material: Mazandaran province: Kiakola, rice field (1), April 2002. **The genus and species are new recorded for Iran.**

Tribe Triboliini GISTEL 1848

Genus *Tribolium* MACLEAY 1825

***Tribolium castaneum* (HERBST 1797)**

Synonyms: *bifoveolatum* (DUFTSCHMID 1812), *ferrugineum* (FABRICIUS 1787), *testaceum* (FABRICIUS 1798).

Distribution: Cosmopolitan.

Material: Mazandaran province, Babol, light trap (1), Amol, dung (1), July 2003. **New record for Iran.**

DISCUSSION

The fauna of Iranian Tenebrionidae was poorly studied so far. Since Iran is a large country incorporating various geographical regions and climates and we expect that a large number of species remain to be discovered. To find new species and distributional records, more studies should be conducted on this important insect group in Iran.

Rice fields are very important because they are environmental buffers. They are a dynamic ecosystem that helps balance temperature and wind. They provide a moderating effect on the surroundings. One can feel the refreshing coolness of rice fields as opposed to the oppressive heat in the concrete jungle of the city. Rice plants produce oxygen during the day, and air moving in rice fields helps circulate the oxygen produced and hastens carbon dioxide exchange. Places with or near rice fields have cooler, fresher air compared with crowded and polluted locations where the air is hot and dirty (BAMBARADENIYA et al. 1998, BAMBARADENIYA & AMERASINGHE 2003). Arthropods are the main terrestrial invertebrates of rice fields. The arthropod community in rice fields consists mainly of insects and spiders that largely inhabit the vegetation (rice plants and weeds) and soil surface. With respect to rice cultivation and based on the inter relationships between populations, the terrestrial arthropod communities can be further divided into rice pests, their natural enemies (predators and parasitoids) and neutral forms. In rice fields the composition of the terrestrial ar-

thropod communities are known to change with the growth of the rice crop (BARRION & LITSINGER 1994, GHAHARI et al. 2008).

Acknowledgment

The authors are indebted to Dr. B. KESKIN of Turkey and Dr. V. TICHY of Czech Republic for invaluable helps in progress of the project. Also we are thanks to Dr. H. SAKENIN (Ghaemshahr Islamic Azad University) and Eng. M. HAVASKARY (Tehran Islamic Azad University) for loaning several specimens. The research was supported by Shahre Rey Islamic Azad University, University of Life Sciences, Poland and Mazandaran Rice Research Institute.

REFERENCES

BAMBARADENIYA C.N.B., FONSEKA K.T., AMBAGAHAWATTE C.L. 1998. A preliminary study of fauna and flora of a rice field in Kandy, Sri Lanka. Ceylon Journal of Science, Biological Sciences, **25**: 1-22.

BAMBARADENIYA C.N.B., AMERASINGHE F.P. 2003. Biodiversity associated with the rice field agroecosystem in Asian countries: a brief review. International Water Management Institute Working Paper, **63**: 1-29.

BARRION A.T., LITSINGER J.A. 1994. Taxonomy of rice insect pests and their arthropod parasites and predators. [in:] E.A. HEINRICHS (ed.): Biology and management of rice insects, Wiley Eastern Ltd., India & IRRI, Manila, Philippines, pp. 13-362.

BOUCHARD P., LAWRENCE J.F., DAVIES A.E., NEWTON A.F. 2005: Synoptic classification of the world Tenebrionidae (Insecta: Coleoptera) with a review of family-group names. Annales Zoologici, **55**: 499-530.

DOYEN J.T., LAWRENCE J.F. 1979. Relationships and higher classification of some Tenebrionidae and Zopheridae (Coleoptera). Systematic Entomology, **4**: 333-377.

GHAHARI H., HAYAT R., TABARI M. OSTOVAN H., IMANI S. 2008. A contribution to the predator and parasitoid fauna of rice pests in Iran, and a discussion on the biodiversity and IPM in rice fields. Linzer Biologisches Beitrag, **40**(1): 735-764.

IWAN D. 2001. A comparative study of male genitalia in Opatrinae sensu MEDVEDEV (1968) (Coleoptera, Tenebrionidae) with notes on the tribal classification. Part I. Annales Zoologici, **51**(3): 351-390.

KULZER H. 1954. Achter Beitrag zur Kenntnis der Tenebrionidae: Zwei neue *Ceropria* LAP. et BRULL. (Opatrini), Entomologische Arbeiten aus dem Museum G. Frey, **5**(1): 20-73.

LAWRENCE J.F., NEWTON A.F. 1995. Families and subfamilies of Coleoptera with selected genera, notes, references and data on family-group names. (pp. 779-1006). [in:] J. PAKALUK, S.A. ŚLIPIŃSKI (eds.): Biology, phylogeny and classification of Coleoptera. Papers celebrating the 80th birthday of Prof. Roy A. CROWSON. Museum and Institute of Zoology PAS, Warszawa, 1092 pp.

MATTHEWS E.G., BOUCHARD P. 2008. Tenebrionidae of Australia. Descriptions of tribes. Keys to genera. Catalogue of species. Australian Biological Resources Study, Canberra.

SCHAWALLER W. 1996. Tenebrionidae (Coleoptera) aus Nord-Griechenland: Habitate, Artengesellschaften und Verbreitung. Entomologische Blätter, **92**: 3-18.

SOLDATI F., SOLDATI L. 2003. Réactualisation de la liste systématique des Coléopteres Tenebrionidae (Alleculinae exclus) de France continentale et de Corse. Bulletin Mensuel de la Société Linnéenne de Lyon, **72**(10): 331-349.

WATT J.C. 1974. A revised subfamily classification of Tenebrionidae (Coleoptera). New Zealand Journal of Zoology, **1**: 381-452.

WATT J.C. 1992. Tenebrionidae (Insecta: Coleoptera): Catalogue of types and keys to taxa. Fauna of New Zealand, **26**: 1-70.

Received: November 26, 2009
Accepted: January 29, 2010