

Original Article**Scarab Beetle (Coleoptera: Scarabaeidae) Fauna in Ardabil Province, North West Iran**G Mowlavi¹, E Mikaeili,² I Mobedi¹, EB Kia¹, L Masoomi², *H Vatandoost³¹Department of Medical Parasitology and Mycology, School of Public Health and Institute of Public Health Research, Tehran University of Medical Sciences, Iran² Department of Biology, Faculty of Science, Mohaghegh Ardebil University, Ardebil, Iran³ Department of Medical Entomology and Vector Control, School of Public Health and Institute of Public Health Research, Tehran University of Medical Sciences, Iran

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Abstract**Background:** Dung beetles of Coleoptera associated to undisturbed cattle droppings in pastures present great diversity and abundance. Dung beetles also play an important role for transmission of some helminthes to human and cattle. This study was made to survey the biodiversity and abundance of these beetles in Ardebil Province, western Iran.**Methods:** According to the field study all beetles attracted to fresh cow dung in five areas of Ardebil Province including Namin, Ardabil, Meshkinshahr, Neer and Sarein were collected and identified. They were collected during summer 2007 from June to September, with general peaks appearing to be correlated with temperature mainly at 11 a.m to 15 p.m. The samples were identified using appropriate systematic key**Results:** A total of 231 specimens belonging to 9 beetle genera and at least 15 species were identified as *Euoniticellus fulvus*, *Sisyphus schaffaer*, *Euonthophagus taurus*, *Copris lunaris*, *Chironitis pamphilus*, *Gymnopleurus coriarus*, *Euonthophagus amyntas*, *Caccobius schreberi*, *Onthophagus speculifer*, *Onthophagus furcatus*, *Aphodius lugens*, *Aphodius fimetarius*, *A. scrutator*, *Geotrupes spiniger* and *G. stercorarius*

The most abundant and diverse subfamilies were Coprinae, Geotrupinae, and Aphodiinae.

Conclusion: We found 15 species of dung beetles occurred in the region. The prevalence of each species is varied depending on location. Some of them play an important role for helminths transmission of veterinary and public health importance. The finding will provide a clue for pasture management as well as public health monitoring and surveillance of the disease transmitted by dung beetles.**Keywords:** Cattle dung, Dung beetle, Diversity, Iran**Introduction**

Dung beetles have intense contact with animal and human feces. This biological behavior provides them a constant access to parasites' eggs in human and animal excretions. Due to this behavior they play an important role as an intermediate host for numbers of helminths such as *Gongylonema* sp., *Spirocerca* and Acanthocephalans (Eberhard and Busillo 1999, Mowlavi et al. 2006, Eslami

and Farokhzadegan 1972, Eslami and Nabavi 1976, Hall 1929).

Cattle dung pats naturally dropped in pastures are normally colonized by a diversified arthropod community which has been studied in detail in several places. The coprophagous fauna is composed mainly by Diptera and Coleoptera, The family Scarabaeidae, which are considered the most important agents promoting dung pat decay (Anderson et al. 1984).

*Corresponding author: H Vatandoost, Tel: +98 21 88951393, Fax: +98 21 88951393, E-mail: hvatandoost@yahoo.com

Several studies have been done to determine the role of dung beetles in recycling the dung and to assess the possibility of using them as decomposing agents in the dung decaying process and in the control of dung breeding arthropod pests, mainly Diptera (Ridsdill-Smith, 1981, Anderson et al. 1984, Roth et al. 1988).

This study aimed to determine dung beetle diversity, abundance, and species richness and presents data on diversity and abundance of cattle dung beetles collected during a four month period in five areas of Ardebil Province.

Material and Methods

Geographical information

Ardebil Province is located about 70 km from the Caspian Sea and 25 km from Republic of Azerbaijan's border. It has an average altitude of 1263 m and total area of 18,011 km². Its geographical coordinates are 38°15'N, 48°17'E. The province has a great diversity. The maximum temperature reaches to 35 °C during the hot summer months. The winters are bitter cold, with a temperature plummeting to -25 °C (provincial health center unpublished data) (Fig.1).

Dung beetle collection

A total of 231 dung beetles were collected manually from cattle pastures, mostly from fecal deposits and the adjacent surface soil, in rural areas of 5 different towns including Namin, Neer, Meshkinshahr, Sarein, and Ardebil City, during the summer 2005. The sample size was calculated according to the previous studies based on cluster sampling. The beetles were collected directly by forceps from fresh dung and then transferred into the small plastic container and subsequently into the laboratory for species identification as well as infectivity to the helminths.

The collection was carried during the warmer month (June-September) in 2005.

Species identification

All the collected specimens were pinned and transferred to the Plant Pathology Research Institute, Ministry of Jihad, Iran for species identification and comparing them with mounted specimens. Several morphological characteristics such as antennal segmentation, head shape, horn, ventral sclerites of the abdomen, elytra, claws of tarsi, body shape, middle and posterior tibiae, mesotibia, pygidium, were used for species identification (Barari 2001, Borror et al. 1989, Booth et al. 1990.).

Results

The collected dung beetle specimens, belonging to 9 genera and 15 species. They were collected from cow dung in different parts of the province. Out of 231 collected dung beetle, *Onthophagus taurus* (34.19%) were identified as most prevalent species while *O. amyntas* (0.86 %), *O. speculifer* (0.86%) and *O. furcatus* (0.86%) were the least prevalent (see Fig.2). Among all area, the Meshkinshahr and Sarein had the most and least ones, i.e. 45.02% and 3.89%, respectively. *Copris lunaris* were present in high numbers in Namin while *Aphodius lugens* were numerous in Neer. In Overall, Meshkinshahr and Sarein had the highest and lowest diversity, respectively. Eight species were collected in Meshkinshahr including: *Sisyphus schafaferi*, *O. taurus*, *C. lunaris*, *Chironitis pamphilus*, *O. amyntas*, *Caccobius schreberi*, *Aphodius lugens*, and *Geotrupes stercorarius* (see Fig.3).



Fig. 1. Map of study area located in Ardebil Province, North West of Iran

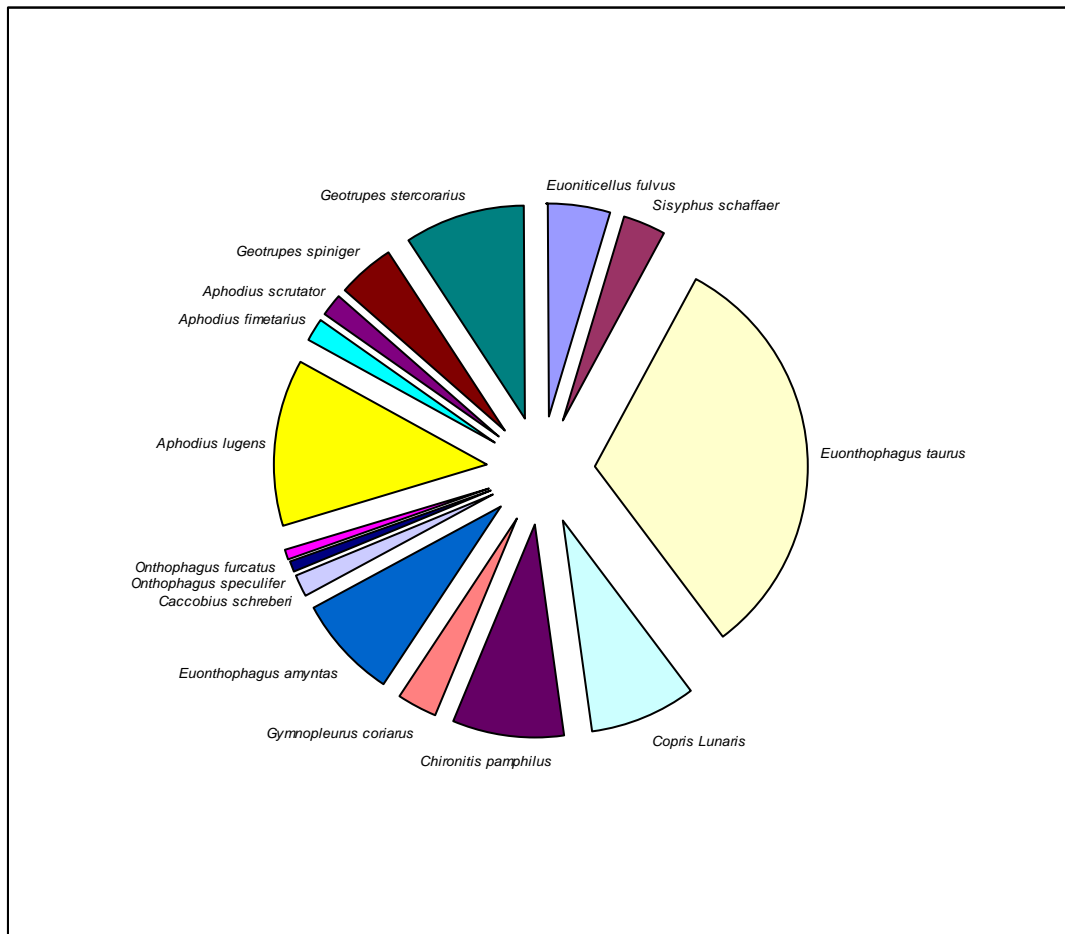


Fig. 2. Percentage of collected beetles in study area

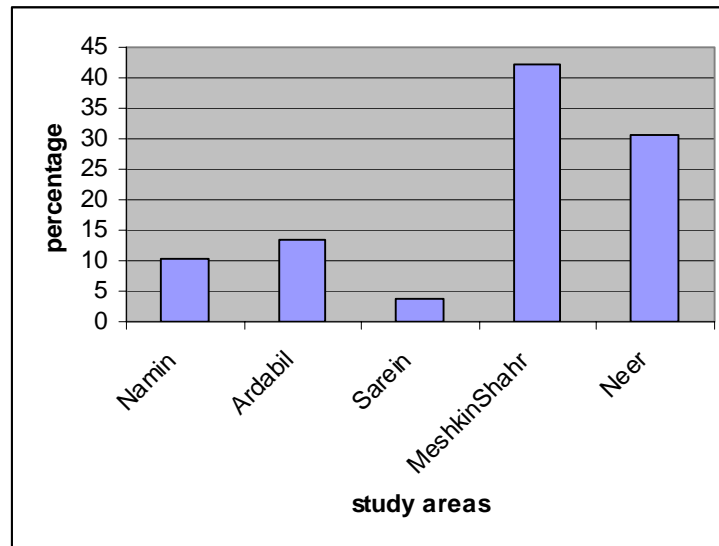


Fig. 3. Abundance of collected beetles in different parts of study areas

Discussion

Taxonomically, dung beetles group belongs to the order Coleoptera, family Scarabaeidae, and comprises about 5000 species worldwide including 12 tribes (González-Maya and Mata-Lorenzen 2008). However, there may be many more dung beetles because thousands of existing species have not yet been described or discovered. Dung beetles are of high ecological and economic importance due to the many ecosystem services that they provide. The burial or removal of animal waste reduces micro- and macro-invertebrate parasites, facilitates nutrient cycling, contributes to soil conditioning and aeration and aids seed dispersal (Spector 2006).

No studies have addressed the ecology, fauna, community structure and succession pattern of the dung beetles associated with the herbivorous mammals in Ardebil Province. The occurrence of suitable habitats and favorable climate conditions in Iran benefit the maintenance of Scarabaeoides dung beetles in nature. In a study carried out by Molavi et al. (2009), They were able to found larval stages of *Gongylonema* spp, and *Rhabditis* spp internally through the beetle dissections. In similar sur-

vey numbers of other free living nematodes such as *Rhabditis* spp. as well as *Pelodera* spp .have been observed externally on the body surface of the beetles

Overall, Meshkinshahr and Sarein had the highest and lowest diversity, respectively. Eight species were collected in Meshkinshahr (45.02%). One factor that might explain a higher overall diversity of dung beetles in Meshkinshahr and Neer is mammal diversity. Another contributing factor might be the more moderate climate conditions there. Two species were collected in Sarein. Low diversity and abundance in Sarein may be related with loose of enough mammals. Mammalian fauna in Ardebil Province includes a wide variety of wild and domestic species but the accurate data on mammal species is currently not available for each of the above mentioned sites. However, the main mammals in the study area are cows. Dung beetles are to a large extent adapted to man-made habitats. The practice of keeping large herbivores such as cows and horses in pastures has probably increased the abundance of several species substantially. The 'suitability' of dung is also crucial because different species can have varied preferences for dung that

are guided by their life cycle requirements. For example, the moisture content of dung is an important factor for some species (Gittings and Giller, 1997). Some species of dung beetles prefer specific habitats (grassland or forest) or certain soil types (sand or clay). Some species feed on dung of only one species of animal, while others are not so limited.

Some of beetles in current study were reported from other provinces in Iran including *Caccobius schreberi* (L.) (From Golestan and Tehran), *Onthophagus furcatus* Fab. (From Golestan, Kordestan, and Tehran), *Onthophagus speculifer* Sols (From Azarbayjane Gharbi and Fars), *Oniticellus fulvus* (Goez.) (From Fars, Gilan, Golestan, and Kordestan), *Chironitis pamphilus* (Men.) (From Azarbaijane Gharbi, Chaharmahal Bakhtiari, Kohkiluyeh Boyerahmad, Kordestan, Mazandaran, and Tehran) and *Geotrupes spiniger* Marsh (From Gilan) (Barari 2001).

The diversity of local dung-beetle communities is primarily influenced by vegetation cover, soil type and moisture, and resource (dung) availability (Doube 1987, Davis 2002). Since dung beetles have different preferences for dung of different mammals based on texture, the structure of dung-beetle communities is influenced by the local mammalian fauna. Many studies in tropical South America and Southeast Asia have demonstrated that deforestation caused by human activities (e.g. logging, pasture clearing, and plantation cutting) reduces the diversity of dung-beetle communities. Deforestation has sometimes decreased the numbers of mammals producing dung for beetles (Estrada & Coates-Estrada 2002). This suggests that although vegetation cover may be most important for determining the structure of dung-beetle communities. Mammalian fauna may substantially influence the diversity of dung-beetle communities.

There are several reports of biodiversity of dung beetles in the world (Kanda et al. 2005, Durães et al. 2005). In a study in In-

dia the abundance of small rollers (*Sisyphus*) and the low presence of large rollers (*Gymnopleurus*) in pitfall traps and succession studies indicated the dominance of smaller rollers in elephant dung of the region (Sabu et al 2006). In conclusion, dung beetles have an important function in farmland ecosystems. Their role in dung breakdown and as valuable prey for vertebrate predators should not be underestimated, because of their economic importance; their use as biodiversity indicators is the important ecological and conservation plant factor. Results of this study show the diversity of dung beetles in the Ardabil Province for the first time and this finding will help local authority for pasture management utilizing Integrated Pest Management (IPM) principles as well as veterinary importance of these insects. A complete round the year survey considering the differences in fauna of the beetles in relation to mammals' fauna may provide more information on the community ecology of the dung beetles. Additionally, further sampling effort is needed in the area to obtain a comprehensive pool and distribution of potential species. However this first list represents an important advance in the knowledge of this important group of indicator species in the region. Scientists believe that, while it is important to maintain the advantages of controlling livestock pests by using veterinary chemicals, the adverse side effects of these on dung fauna are of considerable concern.

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