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Short Communication

Sampling, Distribution, Dispersal

Diversity of Arthropods in Municipal Solid Waste Landfill of Urmia, Iran

Ebrahim Abbasi,[1] Javad Rafinejad,[2] Saeed Hosseinpoor,[3] Fatollah Gholami-Borujeni,[4] and Saber Gholizadeh[1,5]

[1]Social Determinants of Health Research Center, Urmia University of Medical Sciences, Urmia, Iran, [2]Medical Entomology Department, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran, [3]Department of Environmental Health Engineering, School of Public Health, Urmia University of Medical Sciences, Urmia, Iran, [4]Department of Environmental Health Engineering, Health Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran, and [5]Corresponding author, e-mail: saber@umsu.ac.ir

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Abstract

The present study was designed for identification of arthropods species in Urmia city municipal solid waste (MSW) landfill in 2014. The specimens were collected by hand and with sweep net. After the initial classification at the order level, genus and species identification were done using morphological identification keys. In total, 1,913 arthropod samples were collected. The samples were classified into four different classes. The most abundant species of arachnids was *Steatoda paykulliana* Walckenaer (Araneae: Theridiidae) and *Agelenopsis* spp. Giebel (Araneae: Agelenidae). Out of nine insect orders, Coleoptera, Diptera, and Hymenoptera were the most prevalent, all of which include medically important species. Sixteen families and 25 genera of insects were collected, including the muscid genera, *Musca*, *Muscinia*, *Phannia*, and *Stomoxys*. *Musca*, *Psyllabora*, and *Phania* were the most prevalent insect genera. In total, 33 species of arthropods were collected from MSW landfill in Urmia. Five insect species were heterometabolic including medically important species, *Periplaneta americana* Linnaeus (Blattodea: Blattidae) and *Shelfordella lateralis* Walker (Blattodea: Ectobiidae). Determination of the fauna in MSW landfill will be helpful in the control of possible vector borne disease epidemics.

Key words: Diptera, Blattaria, Muscidae, Calliphoridae, Blattidae

Almost half of the world population currently resides in urban areas (Haub et al. 2012). The urban population is expected to increase to 4 billion by the year 2020 (Pauchard et al. 2006, Zimmerer 2011). One of the major consequences of rapid urbanization is the generation of waste products, chiefly, in the form of solid and liquid waste (Lole 2005). Municipal solid waste is defined as wastes consisting of everyday items (Sharholy et al. 2008). These wastes come from homes, institutions, and commercial sources, such as restaurants and small businesses (Qdais et al. 1997). Some estimates suggest that each household waste production is approximately 800 g/d (Hassanvand et al. 2008, Fathi et al. 2014, Rezaee et al. 2014).

Open dumping and uncontrolled landfills, and even managed landfills, attract scavenging animals, insects, and other pests. The accumulation of municipal solid waste (MSW) creates an environment that is conducive to habitation and proliferation by various arthropods species. These arthropods could endanger human health through mechanical and biological transmission of pathogens (Genchi 1992, Rodiek 1995). Therefore, waste disposal by municipalities must be at regular intervals and through efficient and scientific methods to minimize the risks (Howard 2001). Our objective, for the first time, was to document and quantify arthropods composition and prevalence in Urmia MSW landfill, a typical and exemplary of landfills across Iran.

Materials and Methods

The study was conducted in Nazloo-Landfill (37° 40′ N, 44° 58′ E), located about 15 km from Urmia, West-Azerbaijan Province, Iran. The landfill covers about 80 ha and has been in operation since 1997.

Arthropods were collected every 15 d in April–October 2014 by hand picking, sweep nets, sticky traps, and pitfall traps (Grootaert et al. 2010). Sweep netting was used for catching flying insects, whereas hand picking was employed in collecting larger arthropods and crawling insects. Tibrats sticky traps (12 traps) were used for collecting specimens (Mazón and Bordera 2008). Eight pitfall traps (beaker bottles containing detergent and alcohol) used for 3 h based on the description by Azalia et al. (2015). The specimens were preserved in 70% ethanol and transported to the Department of Medical

Entomology and Vector Control Laboratory (MEL) of Urmia University of Medical Sciences for identification to species level using keys (Farzanpay 1990, Triplehorn et al. 2005, Service 2008, Nihei and De Carvalho 2009). Voucher specimens were deposited in MEL.

Results

In total, 1,931 insect (*n* = 1,895) and other arthropod (*n* = 36) specimens were collected, consisting of members of Insecta (99.05%), Arachnida (0.67%), Chilopoda (0.23%), and Crustacea (0.05%). Three arachnid species, *Haplodrassus silvestris* Blackwall (Araneae: Gnaphosidae) (15.38% of all arachnid specimens), *Steatoda paykulliana* Walckenaer (Araneae: Theridiidae) (30.76%), *Drassodes neglectus* Keyserling (Araneae: Gnaphosidae) (7.69%), and one major group of species, *Plattbauchspinnen* (Gnaphosidae) (15.38%), and *Agelenopsis* spp. Giebel (Araneae: Agelenidae) (30.76%), were collected. The only chilopodan collected was *Scolopendra canidens* Newport (Scolopendromorpha: Scolopendridae) and the only crustacean was *Mesobuthus caucasicus* Nordmann (Scorpiones: Buthidae).

Insects collected from Nazloo-Landfill belonged to 9 orders, 16 families, and 25 genera (Table 1). Diptera, Coleoptera, and Hymenoptera were the most abundant orders. The medically significant arthropod families were Muscidae (86.27%), Calliphoridae (1.76%), Sarcophagidae (1.76%), Blattidae (0.5%), and Scorpionidae (7.14% of all Arachnid specimens). *Musca domestica* Linnaeus (Diptera: Muscidae) (83.32% of all insect specimens) was the most abundant vector species, whereas *Periplaneta americana* Linnaeus (Blattodea: Blattidae) (0.21%) and *Shelfordella lateralis* Walker (Blattodea: Ectobiidae) (0.10%) were two other mechanical vector species.

Discussion

The role of insects in landfills is a relatively forgotten subject, and very limited number of studies have been conducted in this domain. Houseflies (48.1%), cockroaches (29.5%), mature mosquitoes (20.2%), rodents (1.6%), and scorpions (0.8%) were the most abundant specie at a landfill in Nigeria (Onyido et al. 2009). In Indonesia, Acrididae, Carabidae, Culicidae, Formicidae, Myrmicidae, Gryllidae, and Sphecidae were reported from a landfill (Azalia et al. 2015). In a study conducted in New Zealand, the most prevalent family was Formicidae with a frequency of 48.6%, whereas in two other districts, Acrididae was the most prevalent family with 53.5 and 67.2% frequencies, respectively (Azalia et al. 2015). Banjo et al. (2012), in a zone in 60 km of Northwest of Lagos, in dumpsites around the city, reported that arthropods belonged to the families of Muscidae, Culicidae, Blattidae, Scolopendridae, Diplopoda, Gryllidae, and Sparassidae from all the areas under the study (Banjo et al. 2012). In the present study that was conducted in Urmia landfill, in addition to the medically important families, Libellulidae, Acrididae, Labiduridae, Myrmeleontidae, Coccinellidae, Tenebrionidae, Scarabaeidae, Cerambycidae, Syrphidae, Noctuidae, Braconidae, and Sphecidae were collected (Table 1). Some of these insects play an important role in the food chain, especially as the parsers of organic material. Furthermore, some other families play a role as the preys in keeping the balance of arthropods. The difference between the arthropods of different habitats in Urmia, New Zealand, and Northwest of Lagos might be due to the different accessible food sources (Sukri et al. 2003).

The occurrence of medically important species in Nazloo-Landfill can affect human health in direct (mechanical transmission) or indirect (myiasis) ways. A good public health education to proper disposal of dumps and informing the residents on the role of vectors in disease transmission is necessary. Application of good and perfect sanitary municipal solid waste land fill, such as daily cover (10–15 cm cover soil) and good final cover (20–30 cm; White et al. 2012), perfect leachate collection and treatment system in landfill site, and other management methods, can be used to control of vectors breeding in Nazloo-Landfill.

Table 1. Arthropod taxonomic status and their relative abundance in Nazloo-Landfill

Order	Family	Species	Number of specimens	Percent of species
Odonata	Libellulidae	*Libellula needhami* Westfall	3	0.158
Orthoptera	Acrididae	*Oedipala aurea* Uvarov	8	0.422
Dermaptera	Labiduridae	*Labidura riparia* Pallas	5	0.263
Blattodea	Blattidae	*Periplaneta americana* Linnaeus	4	0.211
		Shelfordella lateralis Walker	2	0.105
Neuroptera	Myrmeleontidae	*Myrmeleon* spp. Linnaeus	3	0.158
Coleoptera	Coccinellidae	*Psyllobora vigintimaculata* Say	119	6.279
		Coccinella septempunctata Linnaeus	7	0.369
	Tenebrionidae	*Alobates pennsylvanica* DeGeer	2	0.105
	Scarabaeidae	*Eleodes hispilabris* Say	5	0.263
	Cerambycidae	*Euphoria sepulcralis* Fabricius	2	0.105
		Ergates spiculatus LeConte	7	0.369
Diptera	Syrphidae	*Syrphus vitripennis* Meigen	12	0.633
	Sarcophagidae	*Sarcophaga* spp. Meigen	10	0.527
	Muscidae	*Musca domestica* Linnaeus	1,580	83.377
		Muscina stabulans Fallén	23	1.213
		Fannia canicularis Meigen	39	2.058
		Stomoxys calcitrans Linnaeus	4	0.211
	Calliphoridae	*Calliphora vicina* Robineau-Desvoidy		1.002
		Lucilia sericata Meigen	19	0.633
		Lucilia silvarum Meigen	15	0.158
Lepidoptera	Noctuidae	*Orthosia hibisci* Guenée	2	0.105
Hymenoptera	Braconidae	*Apanteles* spp. Foerster	3	0.158
	Sphecidae	*Prionyx atratus* Lepeletier	16	0.844
		Sphex pensylvanicus Linnaeus	4	0.211
		Ammophila nigricans Dahlbom	1	0.052

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