Occurrence of Manure-Inhabiting Mites in Different Animal Sheds in Ismailia Governorate, Egypt

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ABSTRACT

The present study was conducted for one year (from February 2012 to January 2013) to survey mites inhabiting organic manures of some domestic animals (Buffalos, Cows, Sheep, Goats, Rabbits and Poultry) in Experimental Farm of the Faculty of Agriculture, Suez Canal University, Ismailia governorate. The study revealed the presence of 21 mite species, belonging to 16 families and 4 suborders (Acaridida, Actinedida, Gamasida and Oribatida). Dominance of the relative abundance and Shannon-Wiener index were calculated for mite communities. *Tyrophagus putrescentiae* (Shrank) was the dominant species within all manures examined. The poultry manure harbored the highest numbers of mite species (S = 13), while the rabbit manure harbored the lowest (S = 4). On the other hand, *Macrocheles mascadomesticae* (Scopoli), and *Cheyltus malaccensis* Oudemans, were the widespread species inhabiting most of the examined animal manurs.

Key Words: Organic manure, Mite fauna, Animal sheds, Ismailia, Egypt.

INTRODUCTION

Accumulated animal manure is a heterogeneous substrate, with numerous microhabitats available to the arthropods therein (Lindquist *et al.*, 2009 and Arjomandi *et al.*, 2013).

Some studies on mites occurrence in animal manures were undertaken by Axtell (1991), De Jesus and Rueda (1988), Rueda and Axtell (1997) , Cobanoglu (2001), Masan and Halliday (2009) , Bahrami *et al.* (2011) , and Arjomandi (2013). On the other hand, little information about manure-inhabiting mites and their role in biological control of manure pests was known in Egypt. Sherref *et al.* (1980) recorded the mites of different organic manures collected from various regions of Egypt. Studying population density of mites in three types of organic manures, Zaher *et al.*, (1980) found that mesostigmatid mites were the most abundant; while other mite suborders differed according to manure types. According to their population densities the suborders were arranged descendingly as Cryptostigmata, Prostigmata and Astigmata in cattle manures; Prostigmata, Astigmata and Cryptostigmata in sheep manures; Cryptostigmata, and Astigmata in horse manures.

The main objective of this work was a faunistic study on the manure-inhabiting mites and their communities within buffalos, cows, sheep, goats, rabbits and poultry in Ismailia governorate, Egypt, in order to determine its important role as a biological control agent.

MATERIALS AND METHODS

The present study was carried out in the Experimental Farm of the Faculty of Agriculture, Suez Canal University, Ismailia governorate, Egypt. Samples were collected twice monthly from animal manure of buffalos, cows, sheep, goats, rabbits and poultry. Samples were taken from surface layer (about 500 gm), then placed in plastic bags and transferred to the laboratory. Mites were extracted by using Tullgren funnels for 48 hours and collected in Petri dishes containing 70% ethanol. Collected mites were kept in Nesbit's solution few hours for clearing, then mounted in Hoyer's medium, examined and identified using keys of Hughes, 1976, Krantz, 1978 and Zaher 1986.

Dominance (D) is a measure of the relative abundance of a species in the collected samples, i.e., eudominant (D5) > 30.0%, dominant (D4) 15.1-30.0%, subdominant (D3) 7.1-15.0%, recedent (D2)3.0-7.0, subrecedent (D1) < 3.0%. For the community structure of mites the following measures were calculated: total number of individuals, total number of species (species richness) and Shannon-Wiener index (*H'*) (Equation 1) (Magurran, 1988), and the evenness (J) (Equation 2) (Pielou, 1984).

$$H' = -\sum_{i-1}^{s} pi \; ln(pi)$$

$$J = \frac{H'}{\ln(S)}$$

Where, *pi* is the proportion of *i*th species in the all collected samples, and *s* is the total number of species in the community.

RESULTS AND DISCUSSION

The total numbers, relative frequencies and dominance of mites collected from organic manures of buffalos, cows, sheep, goats, rabbits and poultry are shown in tables 1 and 2. From 144 examined samples, the total extracted mites were 7996 individuals including 21 species of 19 genera and 16 families. Of these; three species of the family

Table 1: Total number and relative frequency of the manure-inhabiting mesostigmatid mites collected from different animal manures from February 2013 to January 2014 in Ismailia governorate

Family & species	Buffalo			Cow			Sheep			Goat			Rabbit			Poultry		
	No	%	D	No	%	D	No	%	D	No	%	D	No	%	D	No	%	D
Ameroseiidae																		
Kleemannia plumosus (Oudemans)	29	3.91	D2	5	0.26	D1	7	3.08	D 2	-	-		-	-		40	2.00	D 1
Ascidae																		
Protogamasellus sp.	-	-		9	0.47	D 1	15	6.61	D 2	13	3.34	D 2	-	-		15	0.75	D 1
Lasioseius aegyptiacus Afifi	-	-		4	0.21	D1	6	2.64	D 2	12	3.13	D 2	-	-		-	-	
Deramanyssidae																		
Dremanyssus gallina De Geer	-	-		-	-		-	-		-	-		-	-		25	1.25	D 1
Laelapidae																		
Androlaelaps casalis (Berlese)	-	-		3	0.16	D 1	-	-										
Hypoaspis sp.	-	-		8	0.42	D 1	3	1.32	D 1	-	-		-	-		5	0.25	D 1
Macrochelidae																		
Macrocheles merdarius (Berlese)	-	-		-	-	-	3	1.32	D1	-	-		-	-	-	5	0.25	D 1
M. muscadomesticae (Scopoli)	-	-		50	2.63	D1	125	55.06	D 5	5	1.32	D1	1363	49.58	D5	17	0.85	D 1
Ologamasidae																		
Gamasiphis sp.	-	-		5	0.26	D 1	-	-		2	0.53	D 1	-	-		-	-	
Parasitidae																		
Parasitus badrii Hafez and Nasr	-	-		60	3.16	D 2	-	-		-	-		200	7.27	D 3	6	0.30	D 1
Phytoseiidae																		
Typhlodromus zaheri El-Badry	-	-		55	2.89	D 1	50	22.03	D 4	-	-		-	-		-	-	
Uropodidae																		
Uropovella sp.	10	1.35	D1	-	-		-	-		-	-		-	-		7	0.35	D 1

No= number/500 gm litter D = Dominance

Table 2: Total number and relative frequency of the manure-inhabiting acarid, prostigmatid and oribatid mites collected from different animal manures from February 2013 to January 2014 in Ismailia governorate

Family & species	Buffalo			Cow			Sheep			Goat			Rabbit			Poultry		
	No	%	D	No	%	D	No	%	D	No	%	D	No	%	D	No	%	D
Acaridae *Tyrophagus putrescentiae* (Shrank)	551	74.36	D5	1637	86.25	D5	-	-		127	33.42	D5	1100	40.01	D5	1061	53.13	D5
Bdellidae																		
Cyta laterostris (Herman)	-	-		-	-		3	1.32	D1	-	-		-	-		-	-	
Cheyletidae																		
Cheyletus malaccensis Oudemans	133	17.95	D4	60	3.16	D2	-	-		217	57.11	D5	-	-		490	24.54	D4
Cheyletus eruditus (Shrank)	4	0.54	D1	-	-		-	-		-	-		-	-		4	0.20	D1
Hemicheyletia bakeri (Ehara)	12	1.62	D1	-	-		-	-		-	-		-	-		70	3.51	D1
Cunaxidae																		
Neocunaxoides sp.	-	-		-	-		15	6.61	D2	8	2.11	D1	-	-		-	-	
Glycyphagidae																		
Glycyphagus sp.	-	-		-	-		-	-		-	-		86	3.13	D2	252	12.62	D3
Oppiidae																		
Oppia sticta Popp	2	0.23	D1	-	-		-	-		-	-		-	-		-	-	
Stigmaeidae																		
Apostigmaeus sp.	-	-		2	0.11	D1	-	-		-	-		-	-		-	-	
Total mites	741			1898			227			384			2749			1997		

No = number/500 gm litter D = Dominance

Table 3: Total number of individuals, species number (S), Shannon-Wiener index (*H'*), and the evenness (J) of mites inhabiting organic manures

Habitat	Total number of individuals	Number of species (*S*)	*H'*	*J*
Buffalo	741	7	1.18	0.61
Cow	1898	12	2.13	0.86
Sheep	227	9	1.86	0.85
Goat	384	7	1.08	0.55
Rabbit	2749	4	0.99	0.71
Poultry	1997	13	2.35	0.92

Cheyletidae, two species of each of the families Macrochelidae, Laelapidae and Ascidae. Ameroseiidae, Deramnysidae, Ologamasidae, Parasitidae, Phytoseiidae, Uropodidae, Acaridae, Bdellidae, Cunaxidae, Glycyphagidae, Oppiidae and Stigmaeidae each was represented by only one species. Suborder Gamasida included the greatest number of families (9 families) and species (12 species) followed by Actinedida (4 families and 6 species), while suborder Acaridida and Oribatida included the lowest families and species (two and one family for each, respectively) (Tables 1 & 2). The family Cheyletidae included the greatest number of species (3 species). This was parallel with those reported by Mohamed and Rakha (1980).

Family Acaridae comprised 55.98% of the total mite individuals, and based on mite frequency, *Tyrophagus putrescentiae* (Shrank) was the dominant species within all manure habitats (Table2). The highest species richness (*S* = 13 species) were recorded for poultry manure; while the lowest species richness (*S* = 4 species) was recorded for rabbit manure. Members of the family Acaridae were widely distributed and free-living, some of them were associated with insects or found in nests of small animals and living on all kinds of organic substrate (Mahgoob, *et al.*, 2006). *Cheyletus malacensis* Oudemans, was the most dominant species in buffalo and poultry manures (D = 17.95 and D = 24.54 %, respectively), and no individuals were recorded from sheep manure. Species of the family Cheyletidae are mainly free-living predators on phytophagous mites, scale insects, housefly eggs and larvae of small soil arthropods (Summers & Price, 1970).

The mesostigmatic fauna was dominated by species of the genus *Macrocheles* within sheep and rabbit manures (Table2). The most numerous species *Macrocheles muscaedomesticae* (Scopoli), comprised 19.51% of all mite individuals (D = 55.06 and 49.58 % within sheep and rabbit manures, respectively) and was presented in all examined samples except buffalo manure. Kazemi and Rajaei (2013) reported that 57 manure-inhabiting Mesostigmata from Iran were collected from cow, sheep, chickens, poultry and camel manure. Axtell (1991) reported that macrochelids were collected from all types of manure, (i.e. dairy cattle, horse, sheep, chicken, and duck), and mentioned that Parasitids were observed in the laboratory feeding on house fly eggs. Members of the family Macrochelidae, especially *M. muscaedomesticae*, found in poultry manures, are common predators of eggs and young larvae of the house fly, *Musca domestica* and significantly decreasing the pest flies population and the stable flies, *Stomoxys* sp., are also attacked by a number of *Macrocheles* species (Krantz 1983; Gerson *et al*. 2003). *Dremanyssus gallina* De Geer, was collected only from poultry manure with relative frequency 1.25%. On the other hand, *Androlaelaps casalis* (Berlese) was recorded in cow manure with very low richness. Arjomandi *et al.*, (2013) reported that low numbers of poultry red mite could be related to presence of its predator's *A. casalis* in the substrate. In cow manures the activity of these predatory mites may explain the low density of the poultry red mite within the examined cow manures. The predaceous mites considered a big group attacked phytophagous and acarid mites, while the fungiforous mites may feed on harmful and pathogenic fungus in manures. Family Ameroseiidae was represented by *Kleemannia plumosus* that feed on fungi spores and hyphal fragments, and the dermanyssid species being often ectoparasits of birds and small mammals (Lindquist *et al*. 2009), but the majority of the mesostigmatic mites found in this study comprised predatory species fed on none adult stages of small arthropods in addition to nematodes (Lindquist *et al*. 2009).

Manure type can have differences of mites diversity (Table3), the highest species richness of diversity index were dominant for poultry manure (*S* = 13, *H′* = 2.35 and *J* = 0.92), followed by cow manure (*S* = 12, *H′* = 2.13 and *J* = 0.86) but there were no differences between diversity mite communites within buffalo and goat manures (*S* = 7, *H′* = 1.18 and *J* = 0.61 and *S* = 7, *H′* = 1.08 and *J* = 0.55), respectively. Augustin and Rahman (2010) revealed that humidity in manure might has effects on diversity of mites, therefore, moisture when decreases in manure, mites transferee from an habitat to another with more appropriate moisture content by phoresy phenomenon. *Oppia sticta* (Popp) was also collected in very low relative frequency (0.23%) in buffalo manure. This mite may feed on fungi spores (Lindquist *et al*. 2009).

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