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DISTRIBUTION AND SEASONAL ABUNDANCE OF SOME ARTHROPODS INHABITING DUNG OF FARM ANIMALS

By

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ABSTRACT

A survey of three insect orders (Diptera , Coleoptera and Collembola) and four soil mite suborders (Actinedida, Gamasida, Acaridida and Oribatida) associated with buffalo and sheep dung and rabbit litter , was carried out from September of 1989 to August of 1990 in Menoufia region.

Obtained results revealed that the populations of three insect orders vary considerably from month to another. It appeared that dipterous fly species have two or three periods of high population in the three kinds of farm animal dung. The occurrence of coleoptran species was higher in buffalo dung than that in rabbit litter, while sheep dung contains a few number. The population density of collembolan insects was high in buffalo dung,having obvious population fluctuations from season to another. Relatively, low populations of collembolans were observed in sheep dung,but not recorded in rabbit litter.

Actinedid, gamasid and acarided mites have one or two periods of high population in the three animal manures under consideration, while oribatid mites were scarce. The highest total numbers of actinedid mites were found in rabbit litter,as well as of gamasid and acaridid mites in buffalo manure.

INTRODUCTION

One of the first ecological studies of insects associated with domestic animal dung dropped on pasture in Egypt was by Hafez (1939 a and b). Additional survey of dung-inhabiting insects and mites in various parts of the country was reported by Hafez (1947), Badr and Salit (1976), Tawfik et al.(1976 a and b), Ammer et al.(1977), Shereef and Afifi (1980), Shereef et al.(1980), Zaher et al.(1980), Salem et al.(1985), Zaher (1986), Zaki et al.(1986), Darwish et al.(1990), Mahunka and Zaki (1990 and 1992).

In central Texas, U.S.A., 103 species of insects have been found associated with cattle dung dropped on pasture. Many of these are coprophilus insects which influence populations of dung-breeding flies. Inverse relationship between the number of horn flies emergance and the number of other insects found in cattle dung has been reported (Blume 1970 and Blume et al. 1970).

Richards (1961) had previously estimated that if the sexes of dipterous flies are produced in equal numbers, and a species lays 100 eggs, population stability results if 98% mortality occurs. A deviation of 0.5% in the mortality will result in a 25% increase or decrease in the population in the next generation.

Predatory insect and mite complement one another in regulating populations of house flies and other pest species. Macrocheles muscaedomesticae (Scop.) invade fresh manure when fly oviposition pressure is greatest in the habitat. Mite populations increase rapidly in the early weeks of manure accumulation. In contrast, the beetles, Carcinops pumilio (Erichson) are slow to colonize fresh manure accumulations, but build low to high population densities if proper manure conditions are maintained. The mites kill fewer fly immatures per capita than do the beetles, but they

are often more numerous. The two predators prefer somewhat different microhabitats, and both show broad ecological overlap with pest species (Geden 1990).

However, few detailed studies on the impact of predators have been conducted on flies associated with confined beef and dairy cattle (Petersen et al. 1990). For most complete work to date, Smith et al.(1987) recovered forty-five species of arthropods from twelve families of Coleoptera, five of Diptera, two of Hemiptera, one of Dermaptera and one mesostigmatid mite. Macrochelids and staphylinids were the predacious arthropods most frequently collected.

It is therefore, attempt was carried out to study the distribution and seasonal abundance of dipterous, coleopteran and collembolan insects as well as the four suborders of soil mites associated with buffalo and sheep dung and rabbit litter.

MATERIALS AND METHODS

Survey was conducted in two animal farms located in El-Rahib and Shebin El-Kom, Faculty of Agriculture, Menoufia University, during the period from September 1989 to August 1990.

Dung samples of buffalo, sheep and rabbit farm animals were collected by the aid of a sampler. Each sample was replicated three times and about 1000 gm of manure was gathered and placed in a plastic bag, and bags were transported immediatly to the laboratory. The dung samples were placed in Tullgren funnels, using a 40 watt bulb on top of each funnel to drive the arthropods downward into a 200 ml glass jar containing 70% ethyl alcohol. Manure samples were left in the funnels for about seventy-two hours. After that, the contents of the glass jars were transferred to screw-cap jars. From these collected arthropods, the species of the three insect orders Di-

Table 1: Records of temperature, relative humidity, soil temperature and moisture at 0 - 20 cm depth, obtained from the Meteorological Station in Menoufia, from September, 1989 to August, 1990.

Month	Average No. of					
	Air				Soil	
	Temperature °C		R.H. %		Temperature °C	Moisture %
	Max.	Min.	Max.	Min.		
September 1989	32.7	17.7	89.4	44.8	29.7	24.7
October	28.6	14.4	94.0	47.6	26.2	34.3
November	23.1	12.3	94.2	53.3	22.1	35.2
December	18.9	8.7	88.6	49.8	16.9	36.5
January 1990	18.2	7.6	82.1	40.1	15.8	36.6
February	21.3	7.8	85.7	42.9	16.4	35.3
March	21.1	7.6	82.2	44.3	19.0	34.9
April	24.9	10.3	71.4	34.7	22.1	34.1
May	31.2	14.2	64.9	30.3	25.4	31.3
June	33.4	18.6	72.9	35.2	28.7	31.7
July	33.1	20.2	75.3	40.9	29.9	33.6
August	35.4	21.3	79.2	43.9	30.8	35.8

ptera, Coleoptera and Collembola and the four mite suborders Actinedida, Gamasida, Acaridida and Oribatida were separated and counted.

Data were subjected to the analysis of variance test (ANOVA) with mean separation at 5% level of significance according to the method of Snedecor and Cochran (1967).

Data of weather conditions of temperature and relative humidity as well as soil temperature and soil moisture (20 cm depth) were recorded in Table 1, and obtained from the Meteorological Station at Shebin El-Kom, Menoufia province.

RESULTS AND DISCUSSION

In Egypt, as well as in many other countries, over half of the annual farm income is derived from livestock and/or livestock products. The numbers of buffaloes, cows and sheeps in the Menoufia Governorate were estimated to be 239,422 ; 131,247 and 60,301, respectively, as recorded by the Department of Animal Production of Administration of Agriculture at Shebin El-Kom, during 1988 - 1989.

On the other hand, these animals produced approximately equal numbers of cowpats per day falling on the surface of pastures and/or stables. Many insect and mite species breed in these cowpats, including economical important pests of man and animals. These pests severely affect the animals, making them very susceptible to other stress factors such as adverse climate, inadequate food, and pathogens or parasites. Beneficial insect and mite species may also be found in such habitats.

1. Seasonal abundance of some arthropods inhabiting buffalo dung:

It is obvious from Table 2, that the popu-

lation of the three insect orders under investigation vary considerably from one month to another. It appears that the dipterous fly larvae have two periods of high population in early autumn (September) and late summer (August).A moderate peak was noticed during spring (April). A very low population of these insects was observed during winter, January and February.

Also, data obtained in Table 2, revealed that buffalo manure had two periods of high population of coleopteran beetles. The first was recorded during autumn season in September and October and the second was at late summer in August. A moderate peak was found during spring in May, while a low population was recorded throughout winter season.

The population fluctuation of collembolan insects was highly noticed in buffalo dung. With the regard to results in Table 2, it is obvious that collembolan species highly fluctuated from season to another. It appeared that these insects had three peaks of seasonal abundance throughout autumn (October), spring (May) and summer (July).

It could be concluded that collembolan insects were the most common species inhabiting buffalo dung followed by dipterous flies and coleopterus insects. The total numbers of the three insect orders were presented in three peaks during October, May (the highest one) and July, where the maximum temperatures and relative humidity percentages were 28.6 ^{o}C, 94%R.H.; 31.2 ^{o}C, 64.9% R.H. and 33.1 ^{o}C, 75.3% R.H., respectively.

Concerning the mite suborders, obtained data in Table 2, show that the population density of actinedid mites associated with buffalo manure occurred all year round and have two periods of high numbers in autumn (September) and

summer (August). A low population was observed during winter and spring seasons.

Gamasid predacious soil mites were found in two peaks the first in early autumn (September) and the second in mid summer (July). The later maintained the highest population numbers.

Data concerning the population density of acaridid mites and their monthly variations were given in Table 2. Acaridid mites were found all year round with two periods, the first during autumn throughout September, and the second in summer during July and August. A moderate population occurred in winter season during February.

Refering to oribatid mites, data summarized in the same table revealed that this suborder was scarce in buffalo dung and not observed from April to August.

However, acaridid mite species were the most dominant in buffalo manure followed by actinedid and gamasid mites. In addition, the total numbers of the four mite suborders showed two peaks the first during September and the second during August (the highest one) at the maximum temperature and relative humidity proportions of 32.7°C, 89.4% R.H. and 35.4°C, 79.2% R.H., respectively.

Statistical analysis of the data in Table 2, showed that there were insignificant differences neither between insect orders nor between mite suborders and also between months of investigation in buffalo manure at the level of 5% .

2. Seasonal abundance of some arthropods inhabiting sheep dung:

With regard to the results in Table 3, it is obvious that dipterous fly species inhabiting sheep dung have a high fluctuation from season

Table 2: Average No. of three insect orders and four mite suborders inhabiting dung of buffalo from September 1989 to August 1990.

Month	Average No. of insect orders				Average No. of mite suborders				
	Diptera	Coleoptera	Collembola	Total	Actinedida	Gamasida	Acaridida	Oribatida	Total
Sep. 1989	89.67	74.67	17.33	181.67	148.00	117.67	607.33	1.33	874.33
Oct.	19.33	76.33	545.33	640.99	7.33	7.00	77.33	4.33	95.99
Nov.	28.67	37.67	11.33	77.67	5.67	0.33	36.00	0.00	42.00
Dec.	8.33	9.00	0.00	17.33	16.00	1.33	9.33	0.00	26.66
Jan. 1990	0.33	3.00	0.00	3.33	2.00	0.00	0.33	0.00	2.33
Feb.	0.00	0.33	0.00	0.33	31.67	0.67	32.33	0.33	65.00
Mar.	1.00	3.33	1.67	6.00	2.33	9.67	4.67	0.33	17.00
Apr.	41.00	18.67	184.33	244.00	2.67	1.00	3.67	0.00	7.34
May	7.00	42.67	1572.33	1622.00	1.67	0.00	0.67	0.00	2.34
June	20.00	8.33	19.00	47.33	10.00	0.00	2.67	0.00	12.67
July	27.33	32.00	237.67	297.00	160.33	206.33	187.00	0.00	553.66
Aug.	142.33	60.33	13.00	215.66	398.33	57.33	498.67	0.00	954.33

F values: Between insect orders = 0.32 Between mite suborders = 0.32
Between months = 0.16 Between months = 0.34

Table 3: Average No. of three insect orders and four mite suborders inhabiting dung of sheep from September 1989 to August 1990.

Month	Average No. of insect orders				Average No. of mite suborders				
	Diptera	Coleoptera	Collembola	Total	Actinedida	Gamasida	Acaridida	Oribatida	Total
Sep. 1989	17.00	0.33	0.67	18.00	292.67	109.00	136.00	2.00	539.67
Oct.	18.67	1.33	3.00	23.00	11.67	35.00	3.33	0.00	50.00
Nov.	13.67	0.33	0.00	14.00	0.00	16.00	1.00	0.00	17.00
Dec.	7.00	0.00	0.00	7.00	1.33	15.00	0.33	0.00	16.66
Jan. 1990	1.00	2.33	0.00	3.33	27.67	13.00	5.67	0.00	46.34
Feb.	0.33	0.00	0.00	0.33	5.67	0.33	2.00	0.00	8.00
Mar.	17.33	1.00	25.33	43.66	0.67	7.67	4.67	0.00	13.01
Apr.	26.33	0.33	3.33	29.99	2.33	19.67	2.00	0.00	24.00
May	5.00	0.00	4.00	10.00	2.67	6.00	3.33	0.00	12.00
June	61.00	0.00	0.00	61.00	1.33	5.33	18.67	0.00	25.33
July	29.00	0.00	100.00	129.00	175.00	141.00	1.33	0.33	317.66
Aug.	20.67	1.00	0.00	21.67	27.00	28.00	115.33	0.67	171.00

F values: Between insect orders = 5.5* Between mite suborders = 3.15*
Between months = 4.57 Between months = 6.91**

Table 4: Average No. of three insect orders and four mite suborders inhabiting litter of rabbit from September 1989 to August 1990

Month	Average No. of insect orders				Average No. of mite suborders				
	Diptera	Coleoptera	Collembola	Total	Actinedida	Gamasida	Acaridida	Oribatida	Total
Sep. 1989	1.00	21.33	0.00	22.33	181.00	22.33	146.67	0.33	558.33
Oct.	3.67	28.67	0.00	29.34	189.00	19.67	52.00	0.67	271.34
Nov.	13.00	0.33	0.00	13.33	20.33	16.33	0.67	0.67	38.00
Dec.	34.00	0.33	0.00	34.33	4.33	4.33	4.67	0.00	10.33
Jan. 1990	29.67	5.00	0.00	55.67	8.00	7.00	1.67	0.33	18.00
Feb.	12.00	8.33	0.00	20.33	1805.33	212.67	5.00	1.33	2029.33
Mar.	22.33	5.33	0.00	27.66	17.00	11.00	4.67	0.33	33.00
Apr.	129.33	29.00	0.00	157.33	4.30	5.67	4.33	0.00	15.00
May	27.33	45.67	0.33	67.33	22.33	28.33	25.67	0.33	76.66
June	107.67	7.67	0.00	115.34	45.00	21.00	27.67	0.00	93.67
July	1.00	1.67	0.00	2.67	27.00	5.00	21.67	0.00	56.67
Aug.	0.00	0.33	0.00	0.33	19.00	3.67	16.67	0.33	39.67

F values: Between insect orders = 17.6** Between mite suborders = 6.29**
Between months = 4.56** Between months = 4.74**

to another. Relatively it appeared that the fly species have three peaks of abundance during autumn (October), spring (April) and the third which was the highest in summer (June). A low population of those insects was found throughout winter months.

Coleopterus insects represented only few numbers throughout the period of investigation in sheep manure.

The present study indicated that collembolan insects were observed during two periods in early spring (March) and mid summer (July). No population was found from November to February, June and August.

However, dipterous flies were found in large numbers than the collembolan insects. The total numbers of insects inhabiting sheep dung indicated that two peaks occurred in March and July at the maximum temperature and relative humidity of 21.1 ^{o}C, 82.2% R.H. and 33.1 ^{o}C, 75.3% R.H., respectively.

The present investigation also indicated that (Table 3) suborder Actinedida have two periods of high population in sheep dung. The first was the highest one during autumn in September, and the second was during summer in July.

Similar trend of Actinedida population level took place for suborder Gamasida in sheep manure. The highest peak was during summer in July.

Also, the obtained data indicated that suborder Acaridida had two peaks the first during autumn and the second in summer during September and August, respectively (Table 3).

As a matter of fact, the suborder Oribatida was found in few numbers in sheep dung during this study.

On the other hand, the actinedid mites were the most dominant species in sheep dung followed by gamasid mites and acaridid mites. Furthermore, the total numbers of the four mite suborders were found in two peaks in large numbers, the first during September and the second during July at the maximum temperature and relative humidity of 32.7°C, 89.4% and 33.1°C, 75.3% R.H., respectively.

Statistical analysis of the data (Table 3) showed that there were significant differences between the three insect orders but with no significant differences between months. Also, there were significant differences between the four suborders as well as high significant differences between months.

3. Seasonal abundance of som arthropods inhabiting rabbit litter:

As shown in Table 4, three peaks of the dipterous larvae occurred in the samples of rabbit litter. The highest number of larvae were found during spring and summer in April and June, respectively. The third one was in moderate numbers during early winter in December.

The population density of coleopterus insects had relatively two peaks with few numbers, the first during autumn in October and the second in spring in May (Table 4).

According to collembolans the result obtained in Table 4, showed that litter of rabbit was free from this insect all year round.

In fact, the dipterous insect larvae were the most common species in rabbit litter followed by a moderate numbers of coleopterus insects. Moreover, the total numbers of the three insect orders occurred in two peaks the first during

April and the second during June, at the temperature and relative humidity of 24.9°C, 71.4% R. H. and 33.4°C, 72.9% R.H., respectively.

Results of the mites inhabiting rabbit litter samples are presented in Table 4. It appears that actinedid mites occurred in two periods with high population. The first during autumn in September and the second occurred in high numbers during winter in February.

Population fluctuation of gamasid mites occurred in high numbers during winter season in February. Furthermore, few numbers were found during other months.

As tabulated in Table 4, the individuals of mite groups were found only in one peak during autumn in September. Few numbers of mite groups were recorded throughout the whole year round. Regarding the data in Table 4, the oribatid mites in rabbit litter occurred in few numbers all year round.

Statistical analysis of the data in Table 4, showed that there were highly significant diferences between the three insect orders, and between the four mite suborders as well as between months in rabbit litter at level of 5%.

In conclusion it could be mentioned that data obtained revealed that the populations of dipterous flies were more dominant in buffalo manure than in rabbit litter or sheep dung. The populations of coleoptrans were more frequent in buffalo manure than that in rabbit litter and sheep manure. The populations of collembolans were the most dominant in buffalo dung followed by in sheep dung, while in rabbit litter no individuals of these insect species were recorded.

The obtained data agree with the findings of Hafez (1939 a and b) who found that muscid

flies and coleopterus beetles are among the earliest members of the insect fauna of dung at early summer. Covarrubias et al. (1984) mentioned that the dominant arthropods associated with cattle dung were mites and collembola.Collembola were significantly more frequent in dung than in soil of either type. Salem et al. (1985) found that the largest number of the predacious staphylinid species were collected from cow dung followed by buffalo dung. The larvae and adults of Staphylinidae prey on eggs and larvae of dipterous flies. The Philanthus species are the most effective predator insects (Fincher 1990).

Also, population densities of actinedid mites were more dominant in rabbit litter than in buffalo and sheep dung. Moreover, gamasid mites were higher in numbers in buffalo dung than in sheep dung and rabbit litter. Furthermore, acaridid mites were numerous in buffalo dung than in rabbit litter and sheep dung.

Krantz (1983), Shehata et al. (1989) and Darwish et al. (1990) mentioned that some of mite species encountered in dung are predators on arthropods. Parasitic mites attack immature flies in very fresh manure where predatory beetles are lacking. Minor coleopterus predator species such as some staphylinids can play important role in managing flies, especialy in older manure that is less attractive to macrochelid mites. The manure arthropod community is complex and efforts to mainpulate predators in integrated pest management programs must take this complexity into account (Geden 1990).

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الانتشار والتوزيع الموسمى لبعض مفصليات الارجل المصاحبة لروث حيوانات المزارع

تم عمل حصر لثلاث رتب حشرية هى رتبة ذات الجناحين ورتبة غمدية الاجنحة ورتبة ذات الذنب القافز (الكولمبولا) وكذلك أربعة تحت رتب من حلم التربة هى الاكتينوديدا والجامسيدا والاكاريدا والاوريباتيدا وذلك على روث كل من الجاموس والاغنام والارانب كحيوانات المزرعة الشتية الكبيرة وكذا متوسطة الحجم والصغيرة على الترتيب فى منطقة المنوفية .

ولقد دلت النتائج على ما يلى :

١- أن تعداد الثلاث رتب الحشرية يختلف فيما بينها وبين أشهر السنة المختلفة .

٢- كان لحشرات الذباب من ٢ - ٣ فترات عالية التواجد وذلك فى أنواع الروث الثلاثة .

٣- كان تواجد حشرات غمدية الاجنحة عاليا فى روث الجاموس يليه روث الارانب بينما كان التعداد بسيطا جدا فى روث الاغنام على مدار السنة .

٤- أن التوزيع الموسمى وتعداد حشرات الكولمبولا كان عاليا جدا فى روث الجاموس وبتعداد منخفض فى روث الاغنام بينما خلى روث الارانب من هذه الحشرات .

٥- أما بالنسبة لحلم التربة فإن الثلاث تحت رتب أكتينوديدا وجاماسيدا وأكاريدا فكانت ذو تواجد عالى ملحوظ مرة أو مرتين فى السنة فى أنواع الروث المختلفة .

٦- فى نفس الوقت كان الحلم الاوريباتى يتواجد بأعداد نادرة فى أنواع الروث المختلفة .

٧- كان أعلى تواجد للحلم الاكتينوديدى فى روث الارانب بينما كان الحلم المفترس الجاماسيدى بأعلى تواجد له فى روث الجاموس .