

The Effect of Various Manure Suspensions (camel, cow and sheep) on the Life Cycle of *Culex pipiens*

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Abstract: The oviposition, larval period, and survival rate of *Culex pipiens* were studied in three animal manure suspensions (camel, cow, and sheep). Gravid *Cx. pipiens* females have significantly laid more egg masses and more eggs/mass in camel manure suspension than in the suspension of cow or sheep. The adult survival rate was higher in cow and sheep manure suspensions than in that of the camel. *Culex pipiens* larvae pupated significantly faster in cow manure suspension than in that of either camel or sheep. The possible reasons behind those variations were discussed.

Key Words: camel, cow, *culex pipiens*, life cycle, manure, sheep..

Introduction

The selection of an oviposition site is an essential part of the life history of all mosquito species. This involves visual, olfactory and tactile responses. Females of the genus *Culex* use contact factors prior to oviposition (Bentley and Day, 1989). Pond with high organic material was observed to contain up to three times *Culex* egg masses than those with clear water (Smith and Jones, 1972). In Saudi Arabia, following rainfall, ponds are formed in shallow places. Camels and sheep are attracted to those ponds to obtain water and grasses. The manure of animals is usually deposited

in those ponds and *Culex* females were observed to lay egg-masses there. The dominant mosquito species in Saudi Arabia is *Culex pipiens* (Buttker, 1981). In this study an attempt was made to evaluate the effect of three kinds of animal manure (camel, cow and sheep) suspensions on attraction of gravid *Cx. pipiens* females to oviposit and on the subsequent larval development and survival rate.

Materials and Methods

The mosquitoes used in this experiment, *Cx. Pipiens*, were originally obtained from the Department of Plant

Protection Laboratory, College of Agriculture and Veterinary Medicine, King Saud University, Al-Qassim Branch, Buraidah, Al-Qassim Region. The colony has already completed seven generations in our laboratory at the commencement of this experiment. Adults were maintained in mosquito cages (45x45x45 cm) and offered 5% sucrose solution diet and a blood meal (pigeon) before oviposition. Camel and sheep manures were collected from an open area near Al-Deriah. Cow manure was collected from a dairy farm near Al-Kharj. The manure was dried at 60 °C in an oven for 24 h and was then ground up in a mortar and pestle. Ten grams of each manure were suspended in one liter of distilled water to form each manure suspension that was kept for seven days before used to encourage growth of microorganisms. The manure suspensions were analyzed for some important elements, using the method of Champman and Pratt (1961). The experiments were carried out under the prevailing laboratory conditions of 25 °C ±2, 70% relative humidity and 12:12 h photoperiod.

Experiment 1

This experiment was conducted to determine the attraction of gravid females to manure suspensions for

oviposition. Two mosquito cages, each containing 500 adult *Cx. pipiens* (sex ratio 1:1) were fed on sucrose continuously and on pigeon blood (females) for 12 h. Three days later, six replicate cups (50 ml) each containing 30 ml of each manure suspension (camel, cow and sheep) or tap water (control) were put inside the cages. The cups were examined daily and the mosquito egg masses were collected from each cup and counted, till end of oviposition.

Experiment 2

A second experiment was conducted to determine the time of larval development and survival rate of adults on each manure suspension. Six replicates of 350 ml of each manure suspension, and 350 ml of tap water (control), were each put in 400 ml cup. To each cup, 0.05 bread crumbs were added to encourage microorganism growth. All cups were left to stand for three days before larvae were added at the rate of 30 (1-day old) to each cup. The cups were covered with nylon mesh screen and a plastic petri dish to prevent excessive evaporation. The cups were then checked daily, and any ensuing pupae were removed and placed in an emergence cup containing tap water. Emerging adults were removed, counted

and sexed daily. ANOVA (SAS, 1982) was used for statistical analysis.

Results and Discussion

In the first experiment, camel suspension contained significantly ($P=0.0001$) more eggs and egg masses than that of cow, sheep or tap water (Table 1). However, the selection of oviposition sites by the gravid *Cx. pipiens* females is not well understood. Maire (1983) has suggested several biophysical parameters, as well as biological ones such as microorganisms and decomposing organic matter of various types, as possible attractants for gravid female mosquitoes for oviposition. Moreover, Lee *et al.* (1991) have also observed many factors affecting

oviposition of gravid female mosquitoes such as visual stimuli; including light intensity, size and colour of the container; together with the properties of water including; depth, turbidity, temperature, pH, dissolved oxygen, and organic components.

In the second experiment, *Cx. pipiens* adults that have emerged from cow and sheep manure suspensions had significantly ($P=0.0001$) more than those emerging from camel manure suspension or from water (Table 2). This could be due to the higher copper contents of camel manure (Table 3), which is known to be highly toxic to mosquito larvae (Sharma, 1993). On the other hand, the time of larval

Table 1. Effect of different manure suspensions (camel, cow and sheep) on the oviposition of *Culex pipiens* gravid females.

Manure suspension	No. of egg masses / cup	No. of eggs/ mass
Camel	23.3 a	230.5 a
Cow	7.5 b	171.7 b
Sheep	7.17 b	204.3 ab
Water (Control)	1.67 b	56.7 c

Values are means of six replicates. Means followed by the same letter, within a column, are not significantly ($P \leq 0.05$) different.

Table 2. Number of pupae and adults emerging from 30 (1-day old) *Culex pipiens* larvae in various types of animal manure.

Type of manure	No. of emerging pupae	No. of emerging adults		Emergence (%)
		Male	Female	
Camel	22.3 b	10.8 b	8.2 b	64.0 b
Cow	29.7 a	15.0 a	12.5 a	92.5 a
Sheep	29.7 a	15.7 a	12.8 a	96.0 a

Values are means of six replicates. Means followed by the same letter, with a column, are not significantly ($P \leq 0.05$) different.

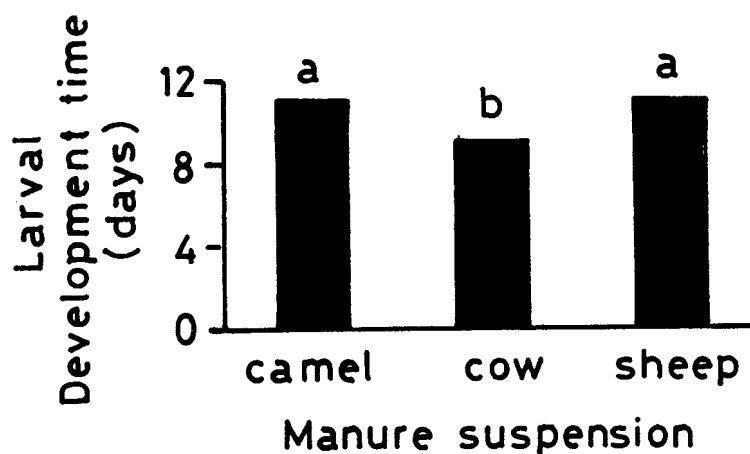


Fig. 1. Period of larval development of *Culex pipiens* in various means suspensions.

Table 3. Concentration (ppm) of some elements in the three manure suspensions (camel, cow and sheep) used in the study.

Manure suspension	N	P	K	Ca	Na	Cu
Camel	3.2	3.5	36.5	110	97	0.14
Cow	8.4	11.7	86	56.6	73	0.07
Sheep	1.4	5.15	42	42	61	0.09

development time was significantly shorter in cow manure suspension than either that of camel or sheep (Fig. 1). This could be due to higher nitrogen content of cow manure (Table 3), since nitrogen is known to enhance the growth of microorganisms and to accelerate larval development as well (Maire, 1983; Lee *et al.* 1991; Thiery *et al.* 1993; Wootton *et al.* 1997).

More work is needed to elucidate the attraction of gravid *Cx. pipiens* females

to camel manure for oviposition.

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تأثير معلقات مختلفة من الروث (الإبل والأبقار والأغنام) على دورة حياة البعوض
Culex pipiens

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الملخص : عملت دراسة لدورة حياة البعوض *Culex pipiens* تحت الظروف المعملية لمعرفة تأثير معلق مكون من ١% من روث كل من الإبل أو الأبقار أو الأغنام مع ٩٩% ماء على عدد كتل البيض ، وعدد البيض ، ومدة العمر اليرقي ، ومعدل خروج الحشرات الكاملة . ووجد أن إناث البعوض قد وضعت كتل بيض أكثر وعدد بيض أكبر في كل كتلة بصورة معنوية في معلق روث الإبل مقارنة بمعلق روث الأبقار أو الأغنام . وقد كان معدل خروج الحشرات الكاملة من معلق روث كل من الأبقار والأغنام أعلى وبفرق معنوي مقارنة بمعلق روث الإبل . لقد احتاجت اليرقات المرباة في معلق روث الأبقار إلى مدة أقصر وبفرق معنوي عن اليرقات المرباة في معلق كل من روث الإبل أو روث الأغنام للتحويل إلى خادرات ومن ثم إلى حشرات كاملة . وقد تمت مناقشة الأسباب المحتملة لهذه النتائج .