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THE EFFECT OF AGE ON THE FERTILITY OF MALES OF CULEX MOLESTUS (DIPTERA, CULICIDAE)

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Abstract. Older males of *C. molestus* have a markedly lowered fertility (even by 50 %) and the imago productivity of their progeny is much lower than that of freshly hatched males (more than 6×). This fact may hinder the population explosion particularly in those species whose individual generations coincide in the course of a year or are much diffused.

Since long ago it has been known that the fertility of animal males decreases with their increasing age. However, factual data concerning the mosquitoes are still lacking. The majority of mosquitoes copulate several times during their life. Nevertheless, in some species, like *Culex molestus* Forskal, 1775, all eggs layed by a female during its whole life are successfully fertilized by the first male with which it copulated (Kitzmiller and Laven 1958), while in other species, as *Aedes aegypti* (Linnaeus, 1762), eggs from one clutch of eggs may be the progeny of several males (Van de Hey and Craig 1958). The life span of mosquito females in general is usually longer than that of males, which usually hatch somewhat earlier (Clements 1963). At the present time, several populations of *C. molestus* are being bred in the Institute of Parasitology, Czecholsovak Academy of Sciences. The mean life span of males ranges from 3 to 20 days. The aim of the present study was to obtain some data about the fertility of older males.

MATERIALS AND METHODS

A laboratory line of *C. molestus* Forsk. mosquitoes bred in the Institute of Parasitology, Czechoslovak Academy of Sciences, was used in our experiments. They were kept in plexiglass 5-liter boxes in which plexiglass dishes with 200 ml of water were placed. The mosquitoes were divided into two groups including 20 pairs each. One box contained 20 pairs of virgin imagoes of the same generation at the age of at most 24 h, the other contained virgin females of the same generation and age and 20 males of the same laboratory line but from the previous generation, at the age of at least 10 days. It could be supposed that each of these males had copulated at least once.

The egg laying was checked and counted daily and the eggs were transferred from the box to dishes containing 1 250 ml and 500 ml of water, respectively. The water surface measured 200 cm^2. The egg rafts from individual days were kept separately and not more than 300 eggs were put in each dish. The larvae were fed with a suspension prepared from IKU 1^R and IKU ^{II} aquarium food in a volume ratio of 3:1 with 5 volume portions of hot water which was then cooled. Every dish contained an excess of food. The numbers of hatched adults were counted. The experiment was performed for 29 days, i.e. up to the time when all parental specimens died.

RESULTS AND DISCUSSION

The numbers of egg rafts, their volumes and numbers of adults in both daughter generations are given in Table 1. The males of the older generation (of the second group) died within 3 days after the beginning of the experiment, whereas the last male of the first group, where both males and females were of the same age, died on day 12 after beginning of the experiment. The females of the second group lived

somewhat longer. On day 23, there were no living parental specimens in the first group (of equal age), whereas 10 females of the second group still survived and the last of them died only on day 29.

Table 1. Egg production and numbers of adults which successfully terminated their development in both groups under study

day of experiment	
1st group: 20♂ 20♀ of the same generation	
1.	initiated
6.	12 rafts — 50, 46, 36, 70, 60, 44, 46, 78, 92, 64, 100, 101 Σ = 787, ⌀ 65.6
8.	6 rafts — 78, 81, 82, 62, 68, 86 Σ = 457, ⌀ 76,2
	altogether 18 rafts from 20♀ (= 90%♀ layed) Σ eggs = 1244, ⌀ 69.1
	eggs from 6th day → 132♂ 44♀
	8th → 170♂ 102♀
	Σ adults = 448 → 36% eggs finished development
2nd group: 20♂ of the older generation, 20♀ of the younger generation	
1.	initiated
6.	8 rafts — 30, 51, 48, 17, 26, 23, 33, 63 Σ = 291, ⌀ 36.4
8.	2 rafts — 23, 42 Σ = 65, ⌀ 32.5
	altogether 10 rafts from 20♀ (= 50%♀ layed) Σ eggs = 356, ⌀ 35.6
	eggs from 6th day → 6♂
	8th → 4♂ 10♀
	Σ adults = 20 → 5.6% eggs finished development

The average egg rafts were 69.1 and 35.6 eggs layed by 90 % and 50 % of female in the first and second groups, respectively. The development was successfully terminated in 448 (i.e. 36 % of layed eggs) and 20 (5.6 %) adults, respectively. These data show that the number of eggs and percentage of females laying eggs were by one half lower and the number of adult specimens which terminated their development was 6.5 times lower in the second group. It is interesting that the egg-laying took place only on days 6 and 8 of the experiment in both groups. No eggs were layed on day 7. In both cases the second egg-layings (on day 8) were more productive because they produced distinctly more adults than those from day 6. We did not study the reason of this phenomenon, but it is possible that this did not happen by chance and it would be suitable to repeat the whole experiment.

As it was said above, the decrease in fertility with increasing age of the animal is a generally known phenomenon which has not previously been studied in mosquitoes. The males of most mosquito species copulate several times during their life if they have an opportunity. The female of *C. molestus* becomes fertilized only by the first male with which it copulates (Kitzmiller and Laven 1958) and this provision of spermatozoa is sufficient for all further clutches of eggs. Consequently, the presence of older males in the mosquito population may hinder the population explosion of the species. If a sudden mass occurrence of a certain species occurs in nature, then it is often preceded by a great decrease in the number of adults of the previous generation (e.g., due to the climatic conditions, after application of an insecticide, or as a result of another event with similar effect), particularly in those

species, in which individual generation coincide during the year. Although many other factors are involved, one of the most important is the decrease in predators, which usually takes place simultaneously with the decrease in the prey number (Odum 1977). This factor is one of the causes of mass occurrence.

Although relatively small numbers of specimens were used in our experiment, the differences between the two groups were very marked. In spite of this, these results should be regarded as preliminary and the whole experiment will be repeated with higher numbers of specimens of different mosquito species before the conclusions can be generalized.

ВЛИЯНИЕ ВОЗРАСТА НА ФЕРТИЛЬНОСТЬ САМЦОВ КОМАРА *CULEX MOLESTUS* (DIPTERA, CULICIDAE)

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Резюме. У старших самцов *C. molestus* фертильность значительно понижена (до 50 %) и продуктивность их потомства гораздо ниже, чем у молодых самцов (более чем 6×). Этот факт может тормозить популяционный взрыв особенно у тех видов, отдельные генерации которых встречаются одновременно в течение года или они широко распространены.

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