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Some studies on the egg laying behaviour, fecundity and fertility of Aiolopus thalassinus Fab. (Orth. ; Acrididae)

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Summary

Laboratory studies were conducted on the egg laying behaviour, fecundity, fertility of **Aiolopus thalassinus**. Females lay their egg pods in the soil. The hole for the egg pod is dug by the upper and lower pairs of valves of the ovipositor. The abdomen of the female is extended about three times the normal one which is mainly due to the extension of the membranes between 3rd to 8th segments. No. egg pods were laid in dry sand as well as in moist sand covered with 3 inch or above with dry sand, while a reduced number resulted when the sand was sodden.

The females rejected the soil containing below 2 and above 20 per cent soil moisture for laying. However most egg pods were laid in sand containing between 12 to 17 per cent moisture. The pre-copulation and pre-oviposition period was averagely 9.5 ± 0.06 and 15.1 ± 0.32 days respectively. Inter-oviposition period was about 3 - 6 days. A female laid averagely 2.1 ± 0.15 egg pods in her life time, containing 14.6 eggs in each pod. About 36.4 ± 0.42 per cent with a range of 50.0 - 80.3 eggs were viable in those pods.

The females were able to reproduce parthenogenetically. All the hatchlings were females.

Fertilized females laid 45 eggs in 3 egg pods, while unfertilized female 13 eggs in 1 egg pod. About 7.53 percent of the unfertilized eggs hatched, but give female progeny only.

Introduction

In Pakistan certain species of grasshoppers have attained pest status and cause damage to both cultivated and pasture crops. Among injurious species of grasshoppers of Pakistan, *Aiolopus thalassinus* tops the list. The pest has been recorded from every part of the country throughout the year.

Although *A. thalassinus* has been collected from different cultivated crop fields, but it has been most frequently observed to be present in Lucerne *(Medicago sativa* L.), Wheat, *(Triticum aestivum* L.), Maize, *(Zea mays* L.), Jowar, *(Sorghum vulgare* Pers.) crops and grasslands; occasionally on cucurbits (particularly as a pest of Watermelon, *Citrullus vulgaris* S.).

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In literature there are some descriptions of the oviposition in some Acridoidea - in *Locusta migratoria* (Nikolsky, 1925), *Schistocerca gregaria* (Kunckel, 1905, quoted by Fedorov, 1927), but still in many grasshoppers particularly in *A. thalassinus* the true sequence of events during those movements of the process which occur in the ground, to determine the function of various parts of the genital apparatus involved in the act, fecundity and fertility remain to be studied. These considerations led us to a study of these aspects of the *A. thalassinus* by more exact laboratory methods and form the main them of present studies.

Material and methods

The basic material used in the present studies were the field collected nymphs which were collected by sweeping, from lucerne, grasses and vegetables cultivated fields weekly, then they were held under laboratory conditions. The cages used and the methods of rearing employed were that of Baloch and Soomro (1976). As soon as these nymphs became adults, they were identified and used for different experiments. Lucerne and maize plants were provided daily as food to the insects during the course of studies.

In order to see the laying behaviour of the grasshopper 50 pairs of newly emerged adults were kept in a single cage. Daily observations were made to note the first mating and laying behaviour. Vacume sterilized sharp builders sand was provided for egg laying. Sand conditioned to 15 per cent moisture was filled and packed in the aluminum oviposition tubes measuring 1 inch diameter and 6 inch in lenght. A set of such four tubes was longitudinally placed on the false floor of the cage. Oviposition tubes were removed every day from the cage and inspected for egg pods if any. The effect of 0, 2, 4, 5, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 per cent soil moisture on egg laying was also studied.

For determining the pre-oviposition, pre-copulation periods, fecundity and fertility, 50 pairs of freshly emerged adults were caged separately. Same food and other conditions were provided to them, and the dead specimens were replaced by a new ones of the same age. In the cages, the soil with 15 per cent moisture was provided. Observations on copulation and egg laying were recorded daily. The duration of the adult life to the first observed copulation, and first oviposition were considered as pre-copulation and pre-oviposition periods respectively.

In order to investigate the fecundity and fertility of *A. thalassinus* a set of experiment in which 50 cages each containing a pair of freshly emerged adults were kept under laboratory conditions. The total number of egg pods

recovered from each cage, total number of eggs and survival percentage of offsprings per female were also recorded. The eggs were incubated in an incubator set at 32±1°C.

The difference between two ovipositions was termed as inter-oviposition period and the same was also recorded.

To find out the parthenogenesis if any, 50 freshly emerged females were kept alone singly in jars under room temperature and were provided fresh food daily. The moist sand was provided to them only on the ninth day of their adult life and was daily changed and replaced with fresh one. The egg pods were noted if any. The eggs laid parthenogenetically were incubated at the same moisture and temperature conditions. Later, the freshly hatched hoppers were anasthesised with benzene vapours and sexed under microscope.

Results and discussion

Laying behaviour : Females ready for oviposition may be recognised by the volume of the abdomen. The females ready to oviposit change their place in the cage, they usually kept themselves in the upper parts on the twigs of the food plant and climb down every now and then on the bottom of the cage in search of laying bed. Just before the act of oviposition, the ovipositor begins to make movements as if attempting to dig.

Mature females usually probed the soil with her ovipositor many times to make preliminary bores. The earth during digging is not thrown out, but merely compressed, which is particularly noticeable in cages. When she found a suitable place, she successfully dug a hole usually 2-4 cm deep into it and settle down for laying. This period varied from one to two and a half (1-2½) hours, depending upon the conditions provided to her for laying.

After selecting a suitable place, she starts laying. The hole in the earth is made by the opening and closing mechanism of the ovipositor. During this process the abdomen of the female is extended, which is due to the expansion of 3rd to 8th abdominal segments. The remaining ones became more contracted to each other. The abdomen extends about 3 times more than the original one.

These findings are in partial agreement with those of Fedorov (1927) who reported that in *Anacridium aegytium* the abdomen of the female is extended upon 9 - 10 cm, while its normal length being about to 3 cm. This extension of the abdomen is due to the expension of membranes between the 4th and 5th, also between the 5th and 6th, and 6th and 7th; partly between 3rd and 4th and 7th and 8th segments.

Towards the end of the digging operation the intersegmental membranes became strongly extended and transparent, due to that the calyces of the ovaria full of eggs and the abdominal air-sacs became visible. The function of the terminal muscles of the abdomen is to move parts of the ovipositor. The whole work digging consists the following simple movements (a) putting valves of the ovipositor together, (b) a jerk downwards, (c) opening of the valves and the left and right movements of the ovipositor is also controlled by the muscles.

While laying, the female retracted her abdomen slightly and frothy secretion of the accessary glands was emitted. This was partly absorbed by the soil and partly adhered to the walls of egg pod. The eggs were propelled out by pulsating movements of the abdominal sternites. When an egg approached the exit, the ovipositor valves opened widly and the egg came out. The egg appeared with the micropylar end first, the other end being held between the dorsal valves. On pulsating movements, the egg slipped out the ovipositor. The embryo of the egg was at its micropylar region. Further, it developed in such a way that the head of the embryo pointed out to other end. Later, this process was resumed, more froth was emitted and the second egg was laid. As this process continued, the abdomen gradually contracted. After deposition of an entire «clutch» of eggs the unoccupied space of the hole was filled with frothy secretion. This upper portion of the hole filled with froth has been referred to as «plug» of the egg pod. The duration of egg laying varies from 0.5 to 1.5 hours, depending upon the number of eggs laid. Similarly Kennedy (1949) reported that in *Locusta migratoria migratorioides* the whole process from the initiation of digging to the complition of trampling lasts about 2 hours.

Effect of soil conditions on the oviposition : Like other acridids, *A. thalassinus* also lay their eggs in the moist sand. In order too see the probing, digging and oviposition behaviour, an experiment was conducted in which different conditions of the soil was used. About 50 pairs of the grasshopper were tested. Oviposition tubes were marked according to the soil conditions and were alternated daily. Holes made in loose dry sand were immediatly filled up again when the abdomen was removed. The results are presented in Tablo 1.

Table : 1

Probing, digging and oviposition behaviour of **A. thalassinus**

Female behaviour	Moist sand of 15 % soil moist-ture	Moist sand covered with top dry sand upto a level of: (in inchies)				completly dry sand	total
		1	2	3	4		
1. Empty holes not of full length.	0	30	26	23	20	10	109
2. Empty holes of full length	10	24	22	15	10	0	81
3. Egg pods deposited	40	15	3	0	0	0	58
4. Total full length diggings	50	39	25	15	10	0	139
Total diggings	100	108	76	53	40	10	387
Percente of egg pods	40	13.9	3.9	0	0	0	14.9

As the egg pod deposition is concerned, the females laid about 40 pods in moist sand and only 15 and 3 in sand which was covered with 1 and 2 inch dry sand respectively. Above level no any egg pod was recorded, that means the females have rejected the dry sand (Table 1). It was also observed that some females laid their eggs on the surface of the cage, which may be due to unavailability of normal conditions.

Similarly Maxwell Darling (1934) stated that in *Schistocerca gregaria* the actural oviposition requires rain fall which moistens the sand. He observed two females of *S. gregaria* digging in dry sand but not laying until the sand was moistened. Johnston and Maxwell Darling (1931) described *Locusta migratoria migratorioides* as digging repeatedly in dry sand, but the locusts finally laid on the floor of the cage, when rain moistened the sand more deeply, laying took place in the sand. Faure (1932) also found in cage experiments on *L. m. migratorioides* that egg laying occured in wet sand and not in dry sand.

The present findings also supports to Kennedy (1949) who reported that in *L. m. migratorioides* the oviposion was prevented altogether in dry sand and reduced in frequency in dry-topped moist sand.

From Table 1 it could also be seen that the females made many false bores in the oviposition tubes, but dit not oviposit. This behaviour may be due to unsatisfactory conditions of the egg bed. These findings are in confor-

mity with those of Zakharov and Boldyrev (quoted by Kennedy, 1949) who found numerous empty pits dug by *Locusta* which were due to unsatifactory soil conditions.

The present studies show that this is true, but it is striking that about 20 per cent of the pits were dug by females in standared soil moisture were left empty, which may be due to disturbance of the females by other grass-hoppers etc.

Oviposition under the influence of soil moisture : The mature females were offered soil containing 0, 2, 4, 5, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 per cent soil moisture and 20 pairs of adults were kept in each cage. The experiment was replicated twice and the results obtained are presented in Fig. 1.

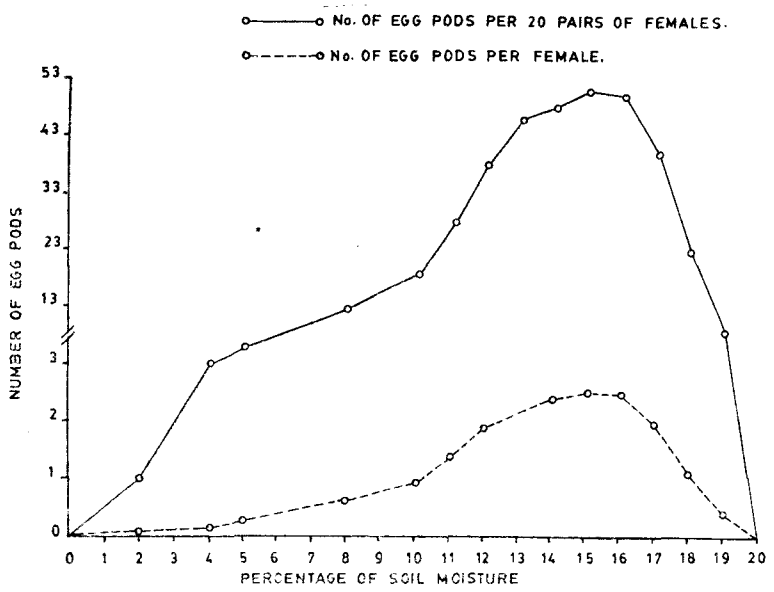

Fig. : 1. Egg pod recovery from **A. thalassinus** under the influence of different soil moisture.

Fig. 1 shows that the female refrained from laying either in soil which was completely dry or containing 20 per cent soil moisture and dropped their pods in either cases on the surface of the cage. However, a maximum number of pods were recorded between 12 and 17 per cent soil moisture. The egg pod deposition is seriously influenced by soil moisture. As the percentage of soil moisture increased or decreased beyond the normal level, the egg pod deposition is decreased.

The experiment described above indicates that under laboratory conditions female selects an oviposition site with care. Before oviposition the female probed the surface of the soil with their ovipositor. Once digging had began it generally continued until the abdomen was fully extended, but if the abdomen was quickly withdrawn and hole was left uncovered. The females would then move to an other point where probing and digging would begin again. Eventually a female would find a cell in which the subsurface soil was moist enough and when this happened the abdomen was withdrawn very slowly while the eggs were deposited and the pod formed.

Females rejected the soil containing 0,2 and 20 per cent water moisture. This may be due to then reason that at 0 and 2 per cent moisture level the eggs may not develop and on the other hand water logged soils seemed to cause drowning or asphaxiation of the embryo.

These findings agree with our earlier findings (Baloch, 1978) when the females of *Anacridium aegyptium* rejected the soil containing 4 and 30 per cent soil moisture. Similarly Chesler (1938) also noticed oviposition of *A. thalassinus* on the soil surface and even on the sides of the cage but did not gave any specific reason for such a behaviour.

Fecundity and fertility : Observations on pre-copulation, pre-oviposition, fecundity and fertility were recorded and the results are presented in Tables 2 and 3.

Table. : 2

Duration of pre-copulation and pre-oviposition of adult female.

Cage No.	Pre-copulation period (days)	Pre-oviposition period (days)	Inter-oviposition period (days)
C - 1	7	14	5 , 3 , 3
C - 2	7	14	—
C - 3	7	13	3
C - 4	9	13	4 , 3
C - 5	8	13	4 , 5 , 3
C - 6	8	13	5 , 3
C - 7	8	20	—
C - 8	8	20	4
C - 9	11	18	6 , 3 , 3
C - 10	11	18	—
C - 11	10	14	3 , 3
C - 12	10	14	—
C - 13	10	14	4
C - 14	10	17	—
C - 15	7	16	3 , 5
C - 16	7	20	—

Table : 2 Continued

No. Cage	Pre-copulation period (days)	Pre-oviposition period (days)	Inter-oviposition period (days)
C - 17	9	18	3
C - 18	9	18	—
C - 19	9	16	5 , 3 , 3
C - 20	17	18	—
C - 21	17	18	4 , 3
C - 22	13	12	—
C - 23	13	13	3 , 4
C - 24	13	13	—
C - 25	13	13	6 , 3
C - 26	13	14	—
C - 27	14	14	4 , 3
C - 28	14	14	—
C - 29	11	15	—
C - 30	7	15	3
C - 31	7	15	—
C - 32	7	14	3 , 3 , 4
C - 33	7	14	—
C - 34	7	13	4
C - 35	7	14	—
C - 36	12	17	6 , 4
C - 37	12	17	—
C - 38	8	19	4
C - 39	8	20	—
C - 40	8	13	3 , 4
C - 41	8	13	3
C - 42	8	13	—
C - 43	8	14	3 , 3
C - 44	8	14	—
C - 45	8	13	5 , 3
C - 46	7	13	4
C - 47	7	15	—
C - 48	7	13	3 , 3 , 4
C - 49	7	13	5
C - 50	13	14	4 , 4
Average	9.5 ± 0.06	15.1 ± 0.32	3.8 ± 0.12
Range :			
Minimum	7	13	3
Maximum	17	20	6

Table. : 3

Fecundity and fertility of **A. thalassinus**

Cage No.	Fecundity					Total No. of eggs per female	Fertility		Percentage of hatching
	No. of egg pods/female	No. of eggs in pods					Number of eggs		
		I	II	III	IV		Hatched	Unhatched	
C- 1	4	17	16	15	15	63	50	13	80.3
C- 2	1	12	—	—	—	12	9	3	75.0
C- 3	2	18	17	—	—	35	24	11	68.0
C- 4	3	15	13	11	—	39	26	13	66.7
C- 5	4	20	17	16	13	66	45	21	68.2
C- 6	3	18	15	14	—	47	30	17	63.8
C- 7	1	11	—	—	—	11	7	4	63.6
C- 8	2	14	13	—	—	27	17	10	63.0
C- 9	4	18	16	13	11	58	40	18	69.0
C-10	1	20	—	—	—	20	14	6	70.0
C-11	3	13	12	11	—	36	25	11	69.4
C-12	1	12	—	—	—	12	8	4	66.7
C-13	2	13	10	—	—	23	16	7	69.6
C-14	1	17	—	—	—	17	10	7	58.8
C-15	3	17	15	14	—	46	35	11	76.1
C-16	1	16	—	—	—	16	11	5	68.7
C-17	2	15	12	—	—	27	19	8	70.4
C-18	1	18	—	—	—	18	13	5	72.2
C-19	4	18	17	15	11	61	46	15	75.4
C-20	1	16	—	—	—	16	12	4	75.0
C-21	3	16	13	11	—	40	24	16	60.0
C-22	1	15	—	—	—	15	9	6	60.0
C-23	3	20	16	12	—	48	33	15	68.7
C-24	1	13	—	—	—	13	7	6	53.8
C-25	3	17	16	11	—	44	31	13	70.4
C-26	1	19	—	—	—	19	14	5	73.7
C-27	3	20	14	12	—	46	30	16	65.2
C-28	1	12	—	—	—	12	7	5	58.3

Table : 3 Continued

Cage No.	Fecundity					Total No. of eggs per female	Fertility		Percentage of hatching
	No. of egg pods/female	No. of eggs in pods					Number of eggs		
		I	II	III	IV		Hatched	Unhatched	
C-29	1	13	—	—	—	13	7	6	53.8
C-30	2	13	11	—	—	24	14	10	58.3
C-31	1	14	—	—	—	14	10	4	71.4
C-32	4	16	13	12	11	52	38	14	73.1
C-33	1	15	—	—	—	15	8	7	53.3
C-34	2	15	13	—	—	28	20	8	71.4
C-35	1	16	—	—	—	16	10	6	62.5
C-36	3	17	13	11	—	41	30	11	73.2
C-37	1	18	—	—	—	18	12	6	66.7
C-38	2	17	14	—	—	31	20	11	64.5
C-39	1	14	—	—	—	14	9	5	64.3
C-40	3	16	13	12	—	41	32	9	78.0
C-41	2	17	12	—	—	29	17	12	58.6
C-42	1	16	—	—	—	16	8	8	50.0
C-43	3	16	13	11	—	40	25	15	62.5
C-44	1	18	—	—	—	18	11	7	61.1
C-45	3	19	14	12	—	45	31	14	68.9
C-46	2	19	13	—	—	32	23	9	71.9
C-47	1	14	—	—	—	14	8	6	57.1
C-48	4	17	15	14	12	58	41	17	70.7
C-49	2	16	13	—	—	29	19	10	65.5
C-50	3	17	13	11	—	41	26	15	63.4
Average	2.1	16.1	13.9	12.5	12.2	30.3	20.6	9.7	66.4
	±0.15	±0.33	±0.34	±0.38	±0.65	±1.13	±1.07	±0.64	±0.42
Range									
Minimum	1	11	11	11	11	11	7	3	50.0
Maximum	4	20	17	16	15	66	50	21	80.3

From Table 2 it could be seen that the mating of the grasshoppers occured as early as 7 days after acquiring wings, and some times they (the pair) took 17 days to meet. However, the pre-copulation period averages 9.5 ± 0.06 days. The pairs were found usually mating for more than one time and remained in the state of copulation about 1 to 2 hours. But it was quite often that males stayed mounted for some time on the females before and after copulation.

The minimum and maximum pre-oviposition period was almost 13 and 20 days respectively, the average was about 15.1 ± 0.32 days. The female often oviposited thrice with an intervening period of 3 - 6 days.

The maximum number of pods laid by a single female was 4, normally a single female laid 1 - 3 pods during her life time. The average number of pods per female was 2.1 ± 0.15. The minumum and maximum number of eggs produced by single female in her life was 11 and 66 eggs respectively. The average number of eggs per female was found to be 30.3 ± 1.13 (Table 3), which may be an effect of low population density as in grasshoppers the number of eggs per female increases with reduction in population density and vice versa.

From the same Table, it could also be seen that usually there was a reduction in the number of eggs per pod as the females grow old. The average number of eggs in the first, second, third and fourth pod was 16.1 ± 0.33, 13.9 ± 0.34, 12.5 ± 0.38 and 12.2 ± 0.65 respectively.

The present results supported to Drake et al. (1945) who found that the number of eggs per pod decreased as the age of female increased. Norris (1950) reported that it depended upon the number of pods the female had laid. While Barness (1955) said that it depends on the food of the parent female. In *A. aegyptium* the number of eggs per pod is affected both by the food and the number of pods laid by the female, i. e., the number of eggs were more in first pod and then it decreased successively (Baloch, 1978).

The fertility ef eggs was found to be averagely 66.4 ± 0.42 per cent. Generally majority of the pods contained some number of nonviable eggs which though developed to some extent but encountered death at different developmental stages. There was no difference in fertility between eggs laid earlier and later of the same females.

Parthenogenesis : About 50 fledglings were selected and reared singly in plastic jars of 2 liter capacity. Daily observations were made and the results are presented in Table 4.

Table : 4

Egg pod deposition by unfertilized females of **A. thalassinus.**

Cage No.	Date of		Pre-oviposion period (days)	No. of pods laid by a female	Total No of eggs per female	Number of egg		Percentage of hatching	Sex	
	Acquiring wings	Ist laying				Hatched	Unhatched		Male	Female
C- 4	5.5.78	16.5.78	11	1	13	1	12	7.69	—	1
C- 8	-do-	16.5.78	11	1	14	1	13	7.14	—	1
C-12	-do-	16.5.78	11	1	12	1	11	8.33	—	1
C-17	27.5.78	12.6.78	17	2	27	3	24	11.11	—	3
C-20	-do-	12.6.78	17	1	13	1	12	7.69	—	1
C-23	-do-	12.6.78	17	1	13	2	11	15.38	—	2
C-26	-do-	15.6.78	20	1	17	2	15	11.76	—	2
C-29	-do-	12.6.78	17	2	25	3	22	12.00	—	3
C-32	-do-	15.6.78	20	1	16	1	15	6.25	—	1
C-33	-do-	17.6.78	22	1	15	0	15	0.00	—	—
C-35	-do-	12.6.78	17	1	14	0	14	0.00	—	—
C-38	6.6.78	26.6.78	20	1	13	0	13	0.00	—	—
C-39	-do-	26.6.78	20	1	17	2	15	11.76	—	2
C-40	-do-	28.6.78	22	2	22	0	22	0.00	—	—
C-42	-do-	23.6.78	17	1	11	1	10	9.09	—	1
C-43	-do-	23.6.78	17	1	11	1	10	9.09	—	1
C-45	-do-	28.6.78	22	1	14	2	12	14.28	—	2
C-47	-do-	26.6.78	20	1	13	1	12	7.69	—	1
C-48	-do-	28.6.78	22	1	12	0	12	0.00	—	—
				22	292	22	270	7.53	—	22
Control	6.6.78	16.6.78	10	3	45	36	9	80.00	13	23

It can be seen from Table 4 that out of 50 females only 19 females laid egg pods parthenogenetically. All the females had laid a single egg pod except 3 females which laid 2 egg pods each. Three females deposited their pods in 11 days after acquiring wings, while 7,5 and 4 females deposited their egg pods in 17,20 and 22 days respectively. When these pods were incubated at 32 ± 1°C, the eggs were found developing normally in most of the cases up to the hatching stage, but embryoes failed to crack the chorion and emerge. However, about 7.53 per cent of all the eggs hatched successfully. But in control group where 10 pairs of the adults were reared under same conditions, laid 3 egg pods averagely. The pre-oviposition period was also less i. e.,10 days, than the treated females where the same was 11 to 22 days. As the percentage of hatching is concerned, in control group about 80 per cent eggs hatched in which the sex ratio was about 1 : 3 (male : female). Whereas parthenogenetically laid eggs produced all the females, and percentage of hatching is about 7.53. Therefore, it could be concluded that the *A. thalassinus* can also reproduce parthenogenetically as it is a case with almost all the grasshoppers (Uvarov, 1966), and all such offsprings are female.

Similarly the parthenogenesis has been also reported in other acridids such as by Nabours and Foster (1929) in *Melanoplus differentialis, Arphid sulphurea, Hippiscus apiculatus* and *Trimenotropis citrina* (all females); Slifer and King (1932) in *M. differentialis, Romelea microptera, A. sulphurea, H. apiculatus* and *Dissosteira carolina,* sex not stated but believed to be females (quoted by Hamilton, 1955); by Hamilton (1953 and 1955) who reared four successive generations of *S. gregaria* (all females); by Norris (1954) in *S. gregaria* who discontinued her experiments after some progeny (all female) had been produced. But Husain and Mathur (1945) claim to have obtained one generation of this species parthenogenetically with equal numbers of male and female. Any way in present studies only females were recorded. But still it needs some detailed investigations on the subject.

Özet

Aiolopus thalassinus Fab. (Orth.: Acrididae)'un yumurta bırakma davranışları, bırakılan yumurta sayıları ve yumurtaların açılımı üzerinde bazı çalışmalar

Bu çalışmada **Aiolopus thalassinus**'un yumurta bırakma davranışları, bırakılan yumurta sayıları ve yumurtaların açılımı üzerinde yapılan bazı laboratuvar çalışmaları ele alınmaktadır. Dişiler yumurta yüksüklerini toprağa bırakırlar. Yüksüklerin içine konduğu oyuklar ovipozitörün üst ve altındaki birer çift olan valfler yardımıyla kazılır. Yumurtlama sırasında dişinin abdomeni, 3-8 segmentler arasındaki membranın uzaması sayesinde normal boyunun aşağı yukarı 3 katı kadar artar. Yumurta yüksüklerinin çoğu kuru topraklara ve 7.6 cm kadar ve üst kısmı kuru kumla kaplanmış nemli topraklara bırakılmış, çok ıslak çamur haline gelmiş topraklarda ise bırakılan yüksük sayısı azalmıştır.

Dişiler toprak ıslaklığı % 2'den az ve % 20'den fazla olan topraklara yumurta bırakmamışlardır. Bununla beraber yumurta yüksüklerinin çoğu, toprak ıslaklığı % 12-17 arasında olan topraklara bırakılmıştır. Prekopülasyon dönemi 9.5 ± 0.06 gün, preovipozisyon dönemi 15 ± 0.32 gün ve interovipozisyon dönemi ise 3-6 gün arasında bulunmuştur. Bir dişi ömrü boyunca her biri 14.6 yumurta içeren ortalama 2.1 ± 0.15 yumurta yüksüğü bırakmıştır. Bu yüksükler içindeki yumurtaların % 66.4 ± 0.42'si (50.0-80.3) canlılıklarını korumaktadır.

Dişiler partenogenetik olarak çoğalma özelliğine sahipttir. Bu şekilde meydana gelen bütün nimflerin dişi olduğu saptanmıştır.

Döllenmiş dişiler 3 yüksük halinde 45 yumurta bırakırken döllenmemiş dişiler işe sadece 1 yüksük halinde 13 yumurta bırakmışlardır. Döllenmemiş yumurtaların ancak % 75.3'ü açılmış, fakat bunlardan sadece dişiler meydana gelmiştir.

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