

ON THE BIOLOGY OF THE SUGAR CANE MEALY BUG,
Saccharicoccus sacchari (COCKERELL)
(HOMOPTERA : PSEUDOCOCCIDAE)

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ABSTRACT

Laboratory studies on the biology of *Saccharicoccus sacchari* (Cockerell) were carried out at $25 \pm 1^\circ\text{C}$ and $70 \pm 5\%$ R.H. At such conditions, this species proved to be oviviviparous. Three nymphal instars were recorded for the female and the apterous male form. The winged male form passes through four nymphal instars to attain the adult stage. The durations of the first, second and third instars of female nymphs lasted 6.3 ± 0.13 , 5.3 ± 0.17 and 6.1 ± 0.23 days respectively. The total duration of the female nymphs lasted 17.8 ± 0.32 (17-23) days, for the apterous and winged male nymphs, the total duration was 16.9 ± 0.13 (15-19) and 20.3 (18-22) days, respectively.

Adult longevity was 43.6 ± 0.80 days in females and few days in males. Preoviposition, oviposition and postoviposition periods lasted 18.1 ± 0.53 , 22.0 ± 0.41 and 3.5 ± 0.40 days, respectively.

Reproduction in this species occurs sexually. The total number of eggs deposited for female ranged from 79 to 357 with an average of 191.2 ± 39.70 .

The duration of life-cycle from hatch to death at the experimental condition lasted 63.4 ± 0.8 for female. The life-cycle of male was of greatly shorter duration.

INTRODUCTION

Saccharicoccus sacchari is one of the most important pests in the sugar cane cultivations of Egypt. According to Hafez and Salama (1969), this mealy bug is present in all biological regions of the world except the Nearctic and Australian regions.

An account on the biology of the sugar cane mealy bug, *S. sacchari* was given by Hafez and Salama (1969) It was found necessary to study and throw more light on the biology of the same species.

The present work deals with certain biological aspects of *S. sacchari* reared under controlled conditions.

MATERIAL AND METHODS

An incubator was used to study different biological aspects of *Saccharicoccus sachari* under controlled conditions of $25 \pm 1^{\circ}\text{C}$ and $70 \pm 5\%$ R.H. The different biological aspects of this pest were determined mainly according to methods adopted by Hafez and Salama (1969) During this study, egg packing cartons were used to fasten the artificially infested cane parts.

RESULTS AND DISCUSSION

The egg stage

The results obtained on the egg stage of *Saccharicoccea sacchari* (Cockerell) coincide with those of Hafez and Salama (1979) who indicated that the egg is oval in shape and straw yellow in

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colour at deposition, changing quickly to golden yellow just before hatching. At average conditions of 25°C and 70% R.H. , the incubation period lasted few minutes giving the impression that this species is viviparous, while it is in fact oviviviparous. As indicated by Hafez and Salama (1969), the incubation period of the egg is very short and this gives the impression that the insect gives birth to young crawlers, but actually eggs are laid.

The nymphal stage

The newly hatched crawler wanders around on the artificially infested cane part, spots a suitable site, mostly on the cane bud or in the area just above the cane to settle itself for feeding. After the first moult, differentiation of both sexes begins. The male nymph stops feeding near the end of the second instar and seeks for a more protected place, where it completes its development mostly in a waxy cocoon. Two types of male nymphs for this species were recorded. The first passed through three nymphal instars to be at the end an apterous adult male. The second type of male nymphs passed through four instars before reaching the winged adult male. On the other hand, three nymphal instars were recorded for the female to attain the adult stage. These results coincide with those obtained by Hafez and Salama (1969) who indicated that after hatching of the eggs, the crawlers seek for a feeding site round the cane nodes beneath the leaf sheaths where they settle themselves. Following the first moult, differentiation of both sexes begins. The male nymph stops feeding near the end of the second stage, where it shelters in a more protected crevic and secretes a waxy cocoon round its body inside which it completes its development. It moults to the third or fourth nymphal stages which gives rise to apterous or winged adult males, respectively.

The female, on the other hand, completes its development in its feeding site and passed through three nymphal stages before reaching the adult stage.

Data on the nymphal stage of the sugar can mealy bug *S. sacchari* at $25 \pm 1^\circ\text{C}$ and $70 \pm 5\%$ R.H. are shown in Table (1). The duration of the first female instar ranged from 6 to 9 days with an average of 6.3 ± 0.13 days. The first male instar lasted 6.6 ± 0.14 (6-9) and 6.5 ± 0.13 (6-10) days in the apterous and the winged male nymphs, respectively. In general, the first instar nymph passed through the longest duration among the nymphal instars. This finding agrees with that obtained by Sayed et al. (1962) on *Planococcus citri* (Risso) and *P. vitis* Nied., by Hafez and (1969) on *S. sacchari* Ckll. and by El-Minshawy et al. (1974) on *Pseudococcus longispinus* (Targ. and Tonneti) who stated the first instar usually passes through the longest duration in the total of the pre-adult period.

The duration of the second female instar ranged from 4 to 8 days with an average of 5.3 ± 0.17 days. The second male instar showed a relatively longer duration than that of the female. Duration of the second instar nymph lasted a range of 5-8 (5.8 ± 0.18) days for the apterous male and 4-9 (5.9 ± 0.23) days for the winged one.

The third female stage passed through a longer duration compared with that of male. The duration of the third instar nymph was 6.1 ± 0.23 (6-11) days for female and 4.5 ± 0.23 (4-7) and 3.6 ± 0.12 (3-6) days in the apterous and winged male nymphs, respectively.

Table (1): Durations of immature stages, dult longevity and total life-cycle of *S. accjaro* at 25 ± 1°C and 70 ± 5% R.H.

Stage	Duration in days									
	Female			Apterous male			Winged male			Mean
	Min.	Max	Mean	Min.	Max.	Mean	Min.	Max.	Mean	
<u>Nymphal instar:</u>										
First	6	9	6.3 ± 0.13	6	9	6.6 ± 0.14	6	10	6.5 ± 0.13	
Second	4	8	5.3 ± 0.17	5	8	5.8 ± 0.18	4	9	5.9 ± 0.23	
Third	6	11	6.1 ± 0.23	4	7	4.5 ± 0.23	3	6	3.6 ± 0.12	
Fourth							4	8	4.3 ± 0.21	
Whole period	17	23	17.8 ± 0.32	15	19	16.9 ± 0.31	18	22	20.3 ± 0.15	
Adult longevity	41	47	43.6 ± 0.80	2	7	3.9 ± 0.52	2	6	4.2 ± 0.43	
Total life-cycle	61	67	63.4 ± 0.81	20	26	22.8 ± 0.52	23	27	26.5 ± 0.45	

: Individuals pass through three nymphal instars before reaching the adult stage.

The fourth instar nymph was recorded to occur for the winged male only. It passed through a period ranged from 4 to 8 days with an average of 4.3 ± 0.21 days.

As show from Table (1), the whole nymphal periods for female; apterous and winged males were 17.8 ± 0.32 (17-23) , 16.9 ± 0.31 (15-19) and 20.3 ± 0.15 (18-22) days, successively. The total nymphal duration for female was longer than that in the apterous male nymphs and shorter than that in the winged male nymphs. This finding agrees with that obtained by Hafez and Salama (1969) who pointed out that nymphs of *S. sacchari* which gave apterous males passed through a shorter duration (three nymphal stages) than those of the female, while those giving winged males passed through longer duration (four nymphal stages).

The adult stage

Mating and sexual behaviour

After a short time of male emergence, the adult male seeks for the sexually mature virgin female. When the male finds the female a process of male courtship takes place. The male gets over the female and keeps moving around for some times. While, again and again the female bends its abdominal apex up and down. Towards the end of the courting process, the male moves backwards over the female to catch the end. There, it turns round and keeps tightly attached to the female by legs. The male then slides slowly backwards, bending its abdominal apex downwards around that of the female to secure a suitable position for copulation. Meanwhile, the female bends its abdomen upwards to direct the genital opening towards the male aedeagus allowing for copulation process to occur. When a mating attempt ended in failure, the male returns again to

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Continue courtship for a short time before another try.

It was observed in one case two males in courting process for a female and in another three males. In both cases, mating attempts were made by all males. Lastly, the mating process occurred only by the fittest male when the other competitors failed back. A female in copula often stand still. The copulatory act was found in three cases to last for an average of 33 ± 4.1 minutes in apterous males. As indicated by Hafez and Salama (1969) on the same species, copulation occurs after the last moult by which the nymphs reach the adult stage. Before copulation a process of male courting usually takes place. They added, the duration of the mating process averaged 30 and 42 minutes in the apterous and winged males, respectively. During which, the female usually remains motionless, although it raises its abdomen occasionally.

It was found that parthenogenesis does not in *S. sacchari* and males are necessary for reproduction. Hall (1922) and Willcocks (1925) mentioned that *Pseudococcus sacchari* reproduces parthenogenetically. But Hafez and Salama (1969) reported that parthenogenesis does not occur in *S. sacchari* and males are necessary to perform fertilization.

Adult longevity

The data obtained on the adult longevity of female , apterous and winged males are shown in Table(1). Under laboratory conditions of $25 \pm 1^{\circ}\text{C}$ and $70 \pm 5\%$ R.H. , the female longevity showed a range of 41 to 47 days with an average of 43.6 ± 0.80 days . The adult longevity of male was greatly shorter. The average longevity of the apterous and winged males was 3.9 ± 0.52 (2-7) and 4.2 ± 0.43 (2-6) days , respectively.

The oviposition periods

Data in Table (2) indicate that the preoviposition period of *S. sacchari* lasted an average of 18.1 ± 0.53 (16-21) days. The oviposition period ranged from 19 to 26 days with 22.0 ± 0.41 days, on the average. While, the postoviposition period lasted the shortest duration, being 3.5 ± 0.40 (2-6) days. Hafez and Salama (1969) found that the preoviposition and oviposition periods are affected by temperature changes. The results obtained at 24°C showed that both periods were 20.0 ± 0.25 (18-22) and 21.0 ± 0.26 (18-23) days, respectively.

Fecundity

During the reproductive period of female, the total number of eggs/female at $25 \pm 1^{\circ}\text{C}$ and $70 \pm 5\%$ R.H. varied between 79 and 357 with an average of 191.2 ± 39.70 eggs/female. As indicated by Hafez and Salama (1969) on the same species, the average number of eggs was 185.7 ± 6.1 /female at 20°C . Above or below this temperature, a marked significant reduction in the egg production occurs.

The total life-cycle¹³

The duration of the total life-cycle from hatch to death for the two sexes of *S. sacchari* was very different. In case of female, the total period lasted 63.4 ± 0.81 (61-67) days. As for the male, the total life-cycle was 22.8 ± 0.52 (20-26) days for the apterous males and 26.5 ± 0.45 (23-27) days for the winged ones. As indicated by Hafez and Salama (196) on the same species, the total lifecycle of the male was always shorter than the female.

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Table(2): Durations of the oviposition periods and fecundity of *S. sacchari* reared as nymphs at $25 \pm 1^\circ\text{C}$ and $70 \pm 5\%$ R.H. (means \pm S.E.).

Attribute	Duration in days		
	Min.	Max	Mean
Preoviposition period	16	21	18.1 ± 0.53
Dviposition period	19	26	22.0 ± 0.41
Postoviposition period	2	6	3.5 ± 0.40
No. of eggs/female	79	357	191.2 ± 39.70

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