

## Biology of the Planthopper *Sogatella furcifera* HORV. in Egypt

(Hom., Delphacidae)

By

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With 1 figure and 5 tables in the text

### Abstract

The planthopper *Sogatella furcifera* (HORV.) was reared on wheat seedlings, inside large wire cages placed in the open, at Kafr-el-Sheikh, Egypt (about 130 Km north of Cairo). Egg incubation period averaged 7.1 days at 23—34 °C, 9.3 days at 17—28 °C and up to 21 days at 13—22 °C. Egg hatchability averaged 64.3—88.9%. Total nymphal durations were 13.8—15.4 days at 21—33 °C and 50.8—52.1 days at 14—23 °C. Adult longevity of males and females, respectively, averaged 12.8 and 18.7 days at 18—30 °C, and 34.5 and 41.9 days at 12—21 °C. Fecundity, under the above two conditions respectively, averaged 75.6 and 64.2 eggs/female/life. Oviposition sites, egg aggregation in the host plant and durations, mortality and moulting sites of the five nymphal instars are indicated.

Eight successive generations of *S. furcifera* were reared in the wire cages from 14th October 1974 till 4th October 1975. The shortest generation (30 days) occurred in August at 23.9—32.8 °C, whereas the longest one (78 days) occurred in Dec.—Feb. at 12.8—22 °C.

### Introduction

The planthopper *Sogatella furcifera* (HORVATH) (Homoptera, Delphacidae) is one of the important pests of rice throughout Asia, Brazil and Tropicopolitan Caribbean (PATHAK, 1977). It is also vector of stunting disease in Pangola grass at Gyana (BISESSAR, 1966). In Egypt, *S. furcifera* was reported as the second abundant delphacid species on rice (AMMAR, LAMIE & KHODEIR, 1978), with peak numbers occurring in the autumn (Oct. and Nov.).

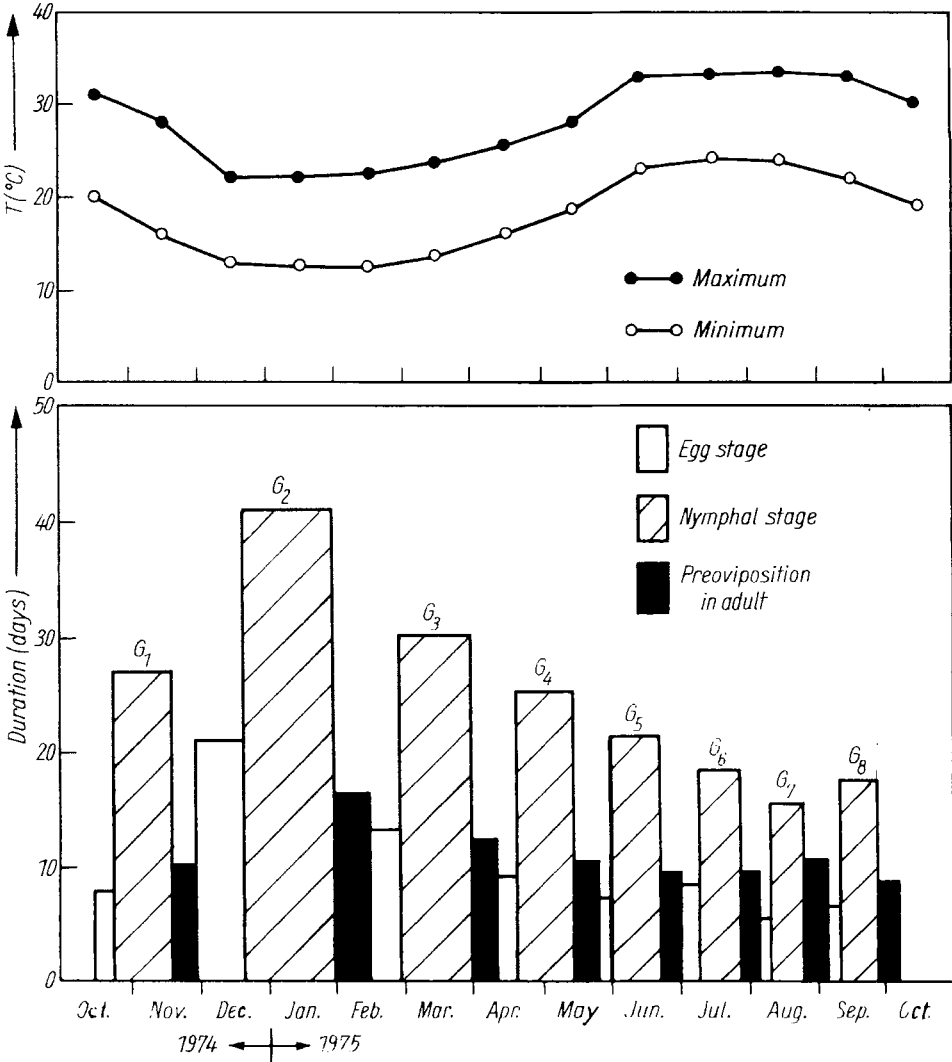
Most of the previous investigations on the biology of *S. furcifera* were reported from Asia. In the present work, biology of this species was studied, under semi-natural conditions, in one of the major rice-growing regions in Egypt (Kafr-el-Sheikh). Field population studies on this and other planthopper and leafhopper species on rice, in the above region, are reported elsewhere (AMMAR, LAMIE & KHODEIR, in press; LAMIE, AMMAR & KHODEIR, in press).

### Materials and Methods

Adults of *Sogatella furcifera* used to start cultures for the present work, were obtained by a sweeping net in 1974 from rice fields at Kafr-el-Sheikh (Egypt, about 130 Km north of Cairo). The planthoppers were reared exclusively on wheat seedlings in the 3rd—4th leaf stage, inside large wire cages (50 × 50 × 60 cm) placed in the open, in a shaded area in

the Faculty of Agric. at Kafr-el-Sheikh. Daily minimum and maximum temperature inside these cages were recorded (Figure).

For studying adult longevity, oviposition period and fecundity of planthoppers, tubular PVC cages, with meshcovered holes for ventilation, were used for confining pairs of the opposite sex (1 pair/seedling/cage). For studying nymphal duration and mortality, nymphs were maintained singly on wheat seedlings transplanted in glass specimen tubes (15 cm long, 2.5 cm diam.) as described by AMMAR (1977). For routine rearing of planthoppers, and for studying number of generations per year, chimney glass cages were used for confining groups of nymphs and/or adults on wheat seedlings growing in pots. In all cases,



Durations of eggs, nymphs and pre-oviposition in adults, in eight successive generations (G<sub>1</sub>—G<sub>8</sub>) of *Sogatella furcifera* reared on wheat seedlings in large wire cages, placed in the open, at Kafr-el-Shekh (Egypt), from 14 October 1974 till 4 October 1975.

however, nymphs and adults were transferred weekly to fresh wheat seedlings. Other details of the experimental procedure were essentially the same as described earlier (AMMAR, 1975).

## Results

### Oviposition sites and egg aggregation in host plants

Females of *Sogatella furcifera*, maintained on wheat seedlings, laid their eggs in the leaf sheaths or in the leaf blades, in various proportions according to generation time (Table 1). In the autumn generation (Oct.—Nov. 75, at 18.3—29.9 °C) more eggs were laid in blades than in sheaths, but the opposite was true in winter (Dec. 74—Feb. 75, at 11.9—21.3 °C). In both generations, however, more eggs were laid in the upper half than in the basal half of the leaf sheath; but in the leaf blades more eggs were laid in the basal part, followed descendingly by the middle and terminal parts, respectively.

Aggregation of oviposited eggs in the host plant was not affected by generation time (Table 1). In both autumn and winter generations, the majority of eggs were laid in small rows (twos, threes and fours), about 15% were laid in larger rows, whereas 9—11% were laid singly.

Table 1

Oviposition sites and egg groups in the host plant, in *Sogatella furcifera* reared on wheat seedlings in the autumn and winter, 1974—75. (Eggs were obtained within one week from 5 females/generation; Total no. of eggs in autumn and winter generations, respectively, were 276 and 241 eggs)

Egg position in the leaf:		Egg groups										
Sheath	Blade	1 <sup>s</sup>	2 <sup>s</sup>	3 <sup>s</sup>	4 <sup>s</sup>	> 4						
basal upper total	basal mid. upper total											
Autumn generation (Oct.—Nov.):												
%	11	26	37	46	15	2	63	9	27	23	26	15
Winter generation (Dec.—Feb.):												
%	27	42	69	21	8	2	31	11	22	34	18	15

### Duration and hatchability of eggs

Eggs of *S. furcifera* laid in wheat seedlings, hatched after  $7.1 \pm 0.03$  days at 22.6—33.9 °C (Sept. 75), and after  $9.3 \pm 0.1$  days at 17.1—27.2 (Nov. 74). However, eggs incubation period reached 21 days at 12.8—22 °C (Dec. 74, Table 5).

Hatchability in large batches of eggs laid weekly by 13—20 females of *S. furcifera*, averaged 88.9% at 18.3—29.9 °C (Oct.—Nov.), and 64.3% at 11.9—21.3 °C (Dec.—Feb.). (Total number of eggs examined for hatchability were 1350 and 834 eggs in the above two conditions, respectively.) Under both conditions, however, no appreciable decline in egg hatchability was observed throughout most of the oviposition period of females, that were caged with males throughout this period. Thus, hatchability of eggs laid in 5—6 weeks

by these females fluctuated between 86–91% and from 51–74% under the above two conditions, respectively.

### Duration, mortality and moulting sites of nymphs

In the autumn generation (Sept.—Oct. 75), at 21.4–33.1 °C, the five nymphal instars of *S. furcifera* were completed in 2.6, 3.5, 3.2, 2.7 and 4.2 days, respectively. Total nymphal durations in males and females averaged 13.8 and 15.4 days, respectively. In the winter generation (Nov.—Jan. 75) at 13.6–23.1 °C, durations of nymphal instars were considerably longer (Table 2), with total nymphal durations in males and females averaging 50.8–52.1 days, respectively. In both generations, however, the differences in total nymphal durations between the two sexes were not significant ( $F = 3.3$  and  $1.9$  in autumn and winter, respectively).

Table 2

Durations and mortality of the five nymphal instars of *S. furcifera*, during autumn and winter generations, at the indicated averages of min. and max. temperature

Nymphal instars	Autumn (Sept.—Oct., 75) at 21.4–33.1 °C				Winter (Nov.—Jan., 74/75) at 13.6–23.1 °C			
	Duration (days)		% mortality	No. of observations	Duration (days)		% mortality	No. of observations
	Mean	S.E.			Mean	S.E.		
I	2.6	0.07	7.4	108	6.7	0.17	12.9	70
II	3.5	0.07	4.0	100	8.1	0.25	3.3	61
III	3.2	0.10	12.5	96	8.9	0.20	3.4	59
IV	2.7	0.14	17.9	84	13.8	0.65	31.6	57
V	4.2	0.27	49.3	69	21.5	0.88	41.0	39
Total duration:								
Male	13.8	0.63	—	17	50.8	0.30	—	13
Female	15.4	0.56	—	18	52.1	1.60	—	10

Table 3

Percentages of *S. furcifera* nymphs, of various instars, moulting on various sites, when reared on glass-tube caged wheat seedlings (1 nymph/seedling tube)

Moulting site	Nymphal instars:				
	I	II	III	IV	V
Leaf blade	49.0	31.6	25.7	23.5	29.4
Leaf sheath	29.7	41.8	42.0	31.7	45.5
Tube wall	15.6	21.0	17.1	24.6	17.7
Sand	5.8	5.5	15.3	20.3	7.5
No. of observations	(161)	(156)	(141)	(108)	(68)

The total mortality observed throughout the nymphal stage was close in the above two generations (67.1–67.6%). Mortality was highest during the first instar, followed descendingly by the fourth, first, third and second instars, respectively (Table 2). Differences in mortality between nymphal instars were highly significant in both autumn and winter generations ( $X^2 = 62.8$  and  $24.1$ , respectively).

Generally, nymphs of *S. furcifera* reared on glasstube caged seedlings preferred moulting on the leaf sheath, followed descendingly by the leaf blade, the tube wall and the sand layer in the bottom of the tube. Only first instar nymphs preferred moulting on leaf blades than on leaf sheaths (Table 3).

### Adult longevity, oviposition period and fecundity

Longevity of adult *S. furcifera*, reared on wheat seedlings in the autumn (Oct.—Nov. 75) at 18.3–29.9 °C, averaged 12.8 and 18.7 days for males and females, respectively, ( $F = 5$ ,  $P < 0.05$ ). However, in winter (Dec.—Feb. 75) at 11.9–21.3 °C, longevity of males and females averaged 34.5 and 41.9 days, respectively. The difference in adult longevity between the above two generations was highly significant in females ( $P < 0.001$ ), but not significant in males. The pre-oviposition and oviposition periods of females were also significantly longer in the winter than in the autumn generation (Table 4).

The fecundity of females (no. of eggs/female/life) did not differ significantly between autumn and winter generations (75.6 and 64.2 eggs, respectively). However, owing to the longer oviposition period in the winter than in the autumn generation, average number of eggs/♀/day was significantly lower in the former one (Table 4).

Table 4

Longevity, preoviposition and oviposition periods and fecundity of adult *S. furcifera* reared on wheat seedlings for two generations: Autumn (Oct.—Nov. 75) at 18.3–29.9 °C, and Winter (Dec. 74–Feb. 75) at 11.9–21.3 °C

Attribute	Mean at:		S.E.	Variance ratio (F)	P <
	Autumn	Winter			
Adult longevity (days): male	12.8	34.5	2.8	2.88	NS
Female	18.7	41.9	4.3	21.13	0.001
Preoviposition period (days)	8.8	11.7	1.4	4.11	0.05
Oviposition period (days)	15.1	39.5	4.3	33.0	0.001
Fecundity (eggs/♀/life)	75.6	64.2	20.6	0.31	NS
No. eggs/♀/day	5.7	2.3	0.9	13.19	0.001
No. of adults observed	20–25	13–19	—	—	—

NS = not significant.

### Brachypterous females

In *S. furcifera*, reared singly throughout the nymphal stage, the proportion of brachypterous (short winged) females was 33–35% in the autumn and winter generations. Brachypterous females of this species were also encountered in rice fields at Kafr-el-Sheikh. However, no brachypterous males of *S. furcifera* were observed in the present work.

### Generations per year

In the wire cages places in the open at Kafr-el-Sheikh (Egypt), eight successive generations of *S. furcifera* were reared on wheat seedlings from 14th October 1974 till 4th October 1975 (Table 5). The shortest generation (30 days) occurred in August at 23.9–32.8 °C, whereas the longest one (78 days) occurred in December–February at 12.8–22 °C.

Table 5

Durations of eight successive generations of *S. furcifera* reared on wheat seedlings, in large wire cages, from 14 October 1974 till 4 October 1975

Generation No.	Date of 1st emergence of:			Min. duration (days) of:			Total duration (days)	Average temp. (°C)	
	eggs	nymphs	adults	egg	nymph	preoviposition in adult		min.	max.
1	14. 10. 74	22. 10. 74	18. 11. 74	8	27	10	45	20.2	31.1
2	28. 11. 74	19. 12. 74	29. 1. 75	21	41	16	78	12.8	22.0
3	14. 2. 75	27. 2. 75	29. 3. 75	13	30	12	55	12.8	23.7
4	10. 4.	19. 4.	14. 5.	9	25	10	44	17.1	27.9
5	24. 5.	31. 5.	21. 6.	7	21	9	37	22.7	33.1
6	30. 6.	8. 7.	26. 7.	8	18	9	35	24.1	33.3
7	4. 8.	9. 8.	24. 8.	5	15	10	30	23.9	32.8
8	3. 9.	9. 9.	26. 9.	6	17	8	31	22.4	33.9
9	4. 10. 75	—	—	—	—	—	—	—	—

## Discussion

Some aspects of the biology of *Sogatella furcifera* in Egypt, as indicated in the present work, are fairly similar to those of the related species *Sogatella vibix* studied earlier at Giza, Egypt (AMMAR, 1977). Among these aspects are the pattern of egg aggregation in the host (wheat) plant and the number of generations per year. In both species, under Egyptian conditions, there seems to be no particular stage during which overwintering occurs; only development slows down during winter months in the egg, nymph or pre-oviposition period of adults. Adults of both species were caught by the sweeping net from wheat and barley fields at Kafr-el-Sheikh (Egypt) during Dec. till May in 1973—1976 (LAMIE et al. 0000). In Japan, winter diapause in the eggs of *S. furcifera* was reported (Miyake & Fujiwara, 1961), but nymphs of this species remained active between 11 and 36 °C (Pathak, 1977).

Field studies in Egypt indicated that *Sogatella vibix* is far more abundant than *S. furcifera* on rice plants at Kafr-el-Sheikh (AMMAR et al. 1978) and on other graminous hosts at Giza (AMMAR, EL-NAHAL & EL-BOLOK, 0000). Comparing biological attributes of both species, under fairly similar conditions, three features are detectable in *S. furcifera* (in the present work) compared to *S. vibix* (AMMAR, 1977). In the former species: a. adult longevity and oviposition periods were much shorter, b. fecundity (no. eggs/♀/life) was much lower, and c. nymphal mortality was much higher. These differences may account, at least partially, for the striking differences in abundance between these two species on various hosts in Egypt.

## References

- AMMAR, E. D. (1975): Biology of the leafhopper *Cicadulina chinai* GHOURI (Homoptera, Cicadellidae) in Giza, Egypt. — *Z. ang. Entom.*, **79**, 337—345.
- AMMAR, E. D. (1977): Biology of the planthopper *Sogatella vibix* (HAUPT) in Giza, Egypt (Hom., Delphacidae). — *Dtsch. Ent. Z.*, **24**, 151—158.
- AMMAR, E. D., EL-NAHAL, A. K. M. & EL-BOLOK, M. M. (in press): Population studies on ten planthopper species (Hom.: Delphacidae, Meenoplidae and Cixiidae) at Giza, using light trap and sweeping net. — *Bull. Soc. Ent. Egypte*.

- AMMAR, E. D., LAMIE, O. & KHODEIR, I. A. (1978): Populations of leafhoppers and planthoppers in Egypt from 1973 to 1975, as indicated by sweeping net samples. — International Rice Research Newsletter, **3**, no. 2, 12—13.
- AMMAR, E. D., LAMIE, O. & KHODEIR, I. A. (in press): Population studies of leafhoppers and planthoppers (Hom., Auchenorrhyncha) on rice plants at Kafr-el-Sheikh. — Bull. Soc. Ent. Egypte.
- BISSESSAR, S. (1966): The stunting disease of Pangola grass and the reaction of *Digitaria* species to the virus in British Guiana. — Pl. Prot. Bull. FAO, **14**, 60—62.
- LAMIE, O., AMMAR, E. D. & KHODEIR, I. A. (in press): Population studies of leafhoppers and planthoppers (Hom., Auchenorrhyncha) on maize, broom corn, wheat and barley plants at Kafr-el-Sheikh. — Bull. Fac. Agric. Tanta Univ. (Egypt).
- MIYAKE, T. and FUJIWARA, A. (1961): Studies on the diapause and host plant preference in the white back planthopper *Sogatella furcifera* HORVATH. — Jap. J. appl. Ent. Zool., **5**, 174—179.
- PATHAK, M. D. (1977): Insect pests of rice, (4th ed.). I.R.R.I. Philippines.

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