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The Biology of the Mango Leafhopper, *Idioscopus nitidulus* in Malaysia

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ABSTRAK

Eksperimen di ladang telah dijalankan untuk mengkaji biologi Idioscopus nitidulus *Walk. selepas letusan di utara Semenanjung Malaysia pada tahun 1986 dan 1987. Pada tangkai bunga jangkamasa perkembangan jantan ialah 13.77±0.25 hari dan betina 13.50±0.60 hari; tempoh inkubasi telur adalah 3.85±2.00 hari. Lelompat daun yang dibiak di atas tangkai bunga menghasilkan 277±110 biji telur dengan kadar penetasan telur 90.2±8.4%; manakala lelompat daun yang dibiak pada pucuk daun menghasilkan 149±57 biji telur dan kadar penetasan sebanyak 54.8±22.0%. Betina yang mengawan hanya sekali menghasilkan 176±72 biji telur, manakala betina yang mengawan beberapa kali menghasilkan 149±57 biji telur. Longeviti betina (69.8±9.8 hari) tidak berbeza dengan bererti daripada jantan (60.5±8.5 hari) pada pucuk daun mangga di ladang.*

ABSTRACT

Field experiments were conducted to study the biology of the mango leafhopper, Idioscopus nitidulus *Walk., following outbreaks in north Peninsular Malaysia in 1986 and 1987. The developmental period on inflorescense was 13.77±0.25 days for males and 13.50±0.60 days for females, and mean incubation period of eggs was 3.85±2.00 days. Hoppers reared on the inflorescence produced 277±110 eggs with a hatchability rate of 90.2±8.4%; those on shoots produced 149±57 eggs and had a hatchability rate of 54.8±22.0%. A female mating only once laid 176±72 eggs, whereas multiple mated females produced 149±57 eggs. On shoots in the field, the longevity of females (69.8±9.8 days) was not significantly different from that of males (60.5±8.5 days).*

INTRODUCTION

Mango, *Mangifera indica* L., in particular the variety Harumanis (MA 128) is grown extensively in north Peninsular Malaysia. Several important insect pests are associated with mango production in Malaysia (Khoo *et al.* 1991). The mango leafhopper, *Idioscopus nitidulus* Walk. (Homoptera: Cicadellidae) is an important pest of mangoes in Malaysia and Indonesia (Reddy 1975; Tandon and Varghese 1985). Although species of *Idioscopus* were recorded in Malaysia as early as 1924 (Gater 1924) little investigation has been carried out. These hoppers can pose a serious threat to the mango industry since their feeding activity can result in loss of flowers and reduce fruit set.

Little information is available on mango leafhoppers, particularly the species *I. nitidulus;* an exception is the species *I. clypealis* (Bato 1978; Corey 1986). Following outbreaks of *I. nitidulus* in 1986 and 1987, a study on the biology of this species was conducted.

MATERIALS AND METHODS

The study was conducted in a mango orchard growing the variety Harumanis in Perlis.

Twenty pairs of adult leafhoppers were collected at random from the mango orchard and

released into a cage which enclosed a one-week-old mango inflorescence on a mango tree; the cage, of dimensions 15 cm length by 18 cm diameter, was made from fine nylon mesh. Twenty pairs of leafhoppers were introduced into a similar cage enclosing a single mango shoot. The leafhoppers were allowed to lay their eggs for 12 h, after which they were removed. The development of the leafhoppers was monitored daily.

Larvae for morphological examination were fixed overnight in KAAD and AAD solutions (Peterson 1943). The preserved specimens were measured for width of head capsule, length of mouth sheath and body length.

Fecundity and Longevity

A pair of newly emerged adult male and female hoppers were placed inside a cage enclosing either an inflorescence or a shoot. The pair were transferred to another inflorescence or shoot every 24 h. The fecundity and longevity of 20 pairs were determined.

Single vs Multiple Mating

The effect of mating incidence on egg production was studied. For single mating, a newly emerged female was caged with two males until mating occurred, after which the males were removed. For multiple mating, the female was kept in captivity with two males throughout her life time. The fecundity and adult longevity of both single-mated and multiple-mated females were compared. There were 20 replications.

RESULTS AND DISCUSSION

Egg Development

Eggs were deposited along the rachis of the inflorescence in clusters averaging 65 eggs/cluster; each cluster consisting of several rows. The eggs were partially embedded in the plant tissue with the anterior end protruding. The stalked aeropyle, which is a respiratory horn (Hinton 1981), was clearly visible.

The eggs measured 0.95±0.05 mm in length. The egg was translucent, smooth and shining. In the later stage of egg development, the eye spots of the embryo were visible. The incubation period on the inflorescence was 3.85±2.00 days. Hatching took place between 0500 and 0900 h.

Nymphal Development

Newly emerged nymph were stationary for 20±5.5 min, after which they began to look for feeding sites. The sex of the nymph could be differentiated by the shape and size of the sheath surrounding the stylet. In males, the tip of the stylet is broader. On inflorescence, rudimentary wing pads appeared in the 3rd instar and by the 4th and final instar it resembled the adult. The number of nymphal instars for both males and females was based on the width of head capsules (Table 1). There were five nymphal instars on shoots, compared with only four on inflorescence (Table 2). This phenomenon of variation in number of instars was also recorded for *I. clypealis* in the Philippines (Bato 1978).

TABLE 1

Mean width (mm ± SD) of head capsules for determining the nymphal instars of *I. nitidulus* caged on the inflorescence and shoots of mango var. Harumanis in the field (n=20)

Nymphal instar	Inflorescence		Shoots	
	Female	Male	Female	Male
1	0.47±0.02	0.47±0.02	0.46±0.02	0.46±0.02
2	0.72±0.09	0.70±0.07	0.65±0.03	0.68±0.10
3	1.14±0.25	1.07±0.21	1.00±0.15	0.92±0.14
4	1.59±0.23	1.45±0.18	1.38±0.23	1.43±0.26
5			1.64±0.20	1.65±0.17

TABLE 2
Mean duration (days ± SD) of eggs and nymphal instars of *I. nitidulus* reared on inflorescence and shoots of mango var. Harumanis in the field (n=20)

Stage	Inflorescence		Shoots	
	Female	Male	Female	Male
Egg	3.85±2.00	3.85±2.00	3.76±2.00	3.76±2.00
Nymphal instar				
1	2.06±0.25	2.05±0.24	2.00±0.63	1.77±0.44
2	2.20±0.56	2.29±0.58	2.00±0.73	2.54±2.31
3	2.06±0.59	2.29±1.15	1.63±0.62	2.31±1.03
4	3.60±0.63	2.80±0.56	2.50±0.89	3.15±1.46
5			3.18±1.17	3.57±2.49
Total (nymph)	9.90±0.25	9.65±0.60	10.07±1.63	11.92±2.92

Ecdysis between the last instar and the adult took 30±5 minutes. This process occurred between 0700 - 0800 h. The total developmental periods of nymphs on inflorescence and shoot were not significantly different (Table 2).

Adult Mango Leafhoppers

The colour of the newly emerged adult was pale cream with weak venation; 30 min after emergence the wings changed to testaceous brown with prominent black veins. The scutellum was brownish with elongated triangular patches. The body lengths of male and female hoppers on inflorescence were 4.72±0.59 mm and 5.07±0.26 mm respectively (Table 3). The adult is equipped with a mouth sheath made of lipoprotein substance (Backus *et al.* 1988). The mouth sheath of the female is tubular and rounded at the tip. Its broadest end measured 0.31±0.05 mm. The mouth sheath of the adult male is tubular but broad and flattened at the tip with the broadest end at the tip measuring 0.39±0.05 mm. However, both males and females have the same mouth sheath length of 0.88±0.55 mm.

Reproductive Capacity

Leafhoppers reared on shoots produced half the number of eggs of those reared on the inflorescence. The flower sap may contain as much as 36% protein (Corey 1986) and insects that feed on protein food either as nymphs, adults, or both produce more eggs (Engelmann 1984).

The leafhoppers begin to mate 4.75±1.67 days after adult emergence. Oviposition took

TABLE 3
Mean width (mm ± SE) and mean body length (mm ± SE) of adults of *I. nitidulus* caged on inflorescence and shoots of mango var. Harumanis in the field (n=20)

Food source	Head capsule		Body length	
	Male	Female	Male	Female
Inflorescence	1.89±0.09a	1.99±0.090a	4.72±0.59a	5.07±0.26a
Shoot	1.87±0.15a	1.88±0.15a	4.73±0.61a	4.88±0.26a

Means within a column followed by the same letters are not significantly different at P>0.05 according to LSD

TABLE 4
Fecundity, hatchability and longevity of female *I. nitidulus* reared on inflorescence and shoots of mango var. Harumanis in the field (n=20)

Food source	Fecundity	Hatchability (%)	Longevity (days)
Shoot (±SE)	149.0±57a	54.8±22.0a	59.6±21.8a
Inflorescence (±SE)	277.1±110b	90.2±8.4b	50.8±17.5a

Means within a column followed by the same letters are not significantly different (P>0.05) according to LSD.

place shortly after mating as is usual of females of many related species (Engelmann 1984).

The number of eggs produced by single- and multiple-mated females fed on mango shoots were 176±72 and 149±57 eggs respectively. However, this difference was not significant..

Adult Longevity

The longevity of males feeding on shoots in the field was 60.5±8.5 days and females 69.8±9.8 days; the difference was not significant. However, Miller and Delzer (1960) emphasised that females, especially if mated, live longer than males of the same age. The shorter life span of male hoppers has also been reported by other workers (Severin 1924; Harries and Douglas 1948).

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