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Full Length Research Paper

Comparison of the developmental and survival rates, adult longevity and oviposition of *Helopeltis schoutedeni* Reuter (Hemiptera: Miridae) on cashew

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Cashew (*Anacardium occidentale* Linn.) has become a very important tree crop in Ghana. It is, however, attacked by several sap sucking insects, including the mosquito bug, *Helopeltis schoutedeni* Reuter. Both the nymph and adult of *H. schoutedeni* feeding on cashew by sucking the sap from flushing shoots, panicles and immature fruits. The present study investigated the comparative effects of these food sources on the development, survival and oviposition of the species. All the nymphal stages experienced faster rates of development and survival when fed on fruits compared with feeding on flushing shoots or panicles. The adults survived longer and produced higher numbers of viable eggs when fed on fruits or flushing shoots than when fed on panicles.

Key words: Comparison, developmental rate, survival rate, longevity, *Helopeltis schoutedeni,* cashew.

INTRODUCTION

Helopeltis schoutedeni Reuter is one of the important insect species of cashew in Ghana (Forsyth, 1966; Boakye, 1995; Yidana et. al., 2004). Unlike other species of mirids which may feed on hardened stems and woody tissues (Gibbs et al*.,* 1968; Collingwood, 1971), *H. schoutedeni* feeds on tender flushing shoots (Figure 1), developing panicles (Figure 2) and immature fruits (Figure 3) of cashew. On flushing shoots, feeding occurs on the midribs and petiole on the adaxial surface of the laminae. On the panicles, feeding is usually restricted to the main axis around the nodes and also on the second-dary floral branches. Since there are alternative feeding sites, it is assumed that food is not a limiting factor, but the quality of nutrients obtainable from each part of the plant may differ significantly and affect the population dynamics of the species.

We, therefore, investigated the influence of flushing shoots, panicles and fruits on the rate of development, survival, adult longevity, and oviposition of *H. schoutedeni* under natural conditions in the field.

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MATERIALS AND METHODS

Laboratory raising of *H. schoutedeni*

Fifty nymphs of 4th and 5th instar of *H. schoutedeni* were collected, using camel hair brush, from cashew plantations at the Cocoa Research Institute of Ghana (CRIG), sub-station Bole (2^{o}30'NW; 9^{o}2'N) in the Northern region and reared on tender shoots of cashew in the laboratory to adulthood under ambient conditions. Twelve hours after emergence, each five individuals of both sexes were transferred into each of 10 nylon mesh cages with wooden frame, measuring 60 x 45 x 45 cm. Each cage was provided with a 3-month-old potted cashew seedling as food source and oviposition substrate. A fresh seedling was provided daily with replacing the old seedling in the cage. Each seedling was labelled with oviposition date and number of eggs deposited on it and kept until hatching. Temperature and humidity in the laboratory were monitored throughout the duration of the experiment.

Developmental rates of *H. schoutedeni* nymphs

The study was carried out on fresh (3 - 5 days old) flushing shoots, 5 - 7 days old developing panicles, and 7 - 14 days old developing fruits. Using camel hair brush, 40 hatched nymphs (0 - 12 h old) were transferred individually onto 40 each of flushing shoots, panicles and fruits (serving as the food sources), each enclosed in a nylon net sleeve cage. The nymphs were observed at 24 intervals to determine whether moulting had occurred, which was indicated by the presence of cast skins. The duration of each of the five nym-

Figure 1. Damaged flushing shoot

Figure 2. Damaged panicle.

Figure 3. Damaged immature fruit.

phal instars was recorded and the rate (duration) of development calculated. The experiment was repeated ones.

Survival rate of *H. schoutedeni* nymphs on different parts of cashew

One hundred newly emerged nymphs (0 - 12 h old) were transferred in groups of five onto 20 each of flushing shoots, panicles and fruits enclosed in a nylon mesh sleeve cage in the field. The numbers of nymphs that survived to the 2nd and subsequent instars were recorded. Each sleeve represented one replicate. The experiment was repeated ones.

Longevity and oviposition of *H. schoutedeni* reared on different parts of cashew.

One to 24 h after moulting into adults in the laboratory, 20 males and 20 females were paired in a sleeve cage on flushing shoots, panicle or fruits in the field, and observed for their longevity. The number of viable eggs was determined by the number of 1st instar nymphs that emerged in each sleeve (Awang et al., 1988). The number of days taken to moult into a bigger nymph, percentage survival of the various nymphal stages, adult longevity and number of viable eggs laid were the parameters measured. Monthly rainfall, temperature and relative humidity in the cashew plantation at Bole were monitored throughout the duration of the experiment. The design for each experiment was completely randomized and the data were statistically analyzed using GENSTAT (1995) software.

Results

Temperature and humidity in the laboratory ranged from 26^{o} to 31^{o}C and 40 to 83%, respectively, while those in the field ranged from 25.2 to 31.5^{o}C and 36.0 to 82.5%, respectively. Monthly rainfall figures ranged from 1.4 to 268.4 mm during the same period.

The rates of development of first to fifth instar nymph on the three cashew parts are presented in Table 1. All the nymphal stages developed significantly (P = 0.05) faster when fed on fruits than on flushing shoots or panicles. The duration from first to second instars on fruits was 60.0 h days, whilst that on flushing shoots and panicles was 64.8 and 67.2 h, respectively. The duration of development from 2nd to 3rd instars was 57.6 h on fruits and 86.4 h on flushing shoots. Similarly, from 5th instars to adulthood, duration of development was 57.6 h on fruits and 76.8 h on flushing shoots. The duration from first to second instar was, therefore, 4.8 h longer on the flushing shoot than on the fruit and, still 2.4 h more on the panicle. The largest difference in the developmental rate occurred during the change from 2nd to 3rd instars, where it took 28.8 and 31.4 h. more on flushing shoot and panicles respectively, than on the fruit (Table 1).

The survival rate from first to fifth instar nymph on the three cashew parts is shown in Table 2. The numbers surviving in all the nymphal stages were significantly (P = 0.05) larger when fed on fruits than on flushing shoots (P = 0.05), which also supported significantly (P = 0.05) larger numbers than on panicles (Table 2).

As shown in Table 3, there was a distinct difference in the longevity of both sexes and also in viability of eggs laid on fruits than on flushing shoots or panicles. In both sexes, those fed on fruits or flushing shoots lived twice as long as those fed on panicles even though differences in the longevity on flushing shoots and fruits were also highly significant (P = 0.05). The females generally lived longer than the males on all the cashew plant parts tested. Both females and males lived longest on fruits and shortest on panicles (Table 3).

Table 1. Mean development rate of *H. schoutedeni* instar nymphs reared on different parts of cashew.

Cashew plant part	Mean developmental rate (hours)				
	1st instars	2nd instars	3rd instars	4th instars	5th instars
Flushing shoot	64.8	86.4	64.8	79.2	76.8
Panicle	67.2	88.8	81.6	64.8	74.4
Fruit	60.0	57.6	62.4	60.0	57.6
LSD (*P = 0.05*)	4.8	4.8	5.0	4.8	4.5

Table 2. Mean percentage survival of *H. schoutedeni* instars nymph reared on different parts of cashew.

Cashew plant part	Mean per cent survival				
	1st instars	2nd instars	3rd instars	4th instars	5th instars
Flushing shoot	64	60	58	60	64
Panicle	40	36	43	52	46
Fruit	86	82	82	90	94
LSD (*P = 0.05*)	13.2	14.6	13.8	11.6	12.2

Table 3. Mean longevity and number of viable eggs laid by adults reared on different parts of cashew.

Cashew plant part	Mean longevity (days)		Mean number of viable eggs
	Male	Female	
Panicle	7.3	9.3	7.9
Flushing shoot	13.5	19.4	23.4
Fruit	15.9	21.3	25.8
LSD (*P = 0.05*)	1.0	1.7	5.9

The number of viable egg laid was presumed to be equal to the number of 1st instar nymphs that emerged. The mean number of viable eggs produced by the females of *H. schoutedeni* caged on flushing shoots and fruits were about three times or more greater than for those reared on cashew panicles (Table 3).

DISCUSSION

The rate of nymphal development is affected by quality of the food source (Betrem, 1953; Awang et al., 1988). In the present investigation, all the nymphal stages of *H. schoutedeni* developed significantly (*P* = 0.05) faster on fruits than on flushing shoots or panicles. This finding agrees with most reports on *Helopeltis theobromae* on cocoa, in which the nymphal instars fed on pods experienced faster rates of development than those fed on shoots (Awang et al., 1988). The ability of *H. schoutedeni* to develop faster on fruits could probably be due to the quality of food nutrients found in the fruit, which is more juicy and succulent compared to the flushing shoots and panicles.

The survival rates were significantly (*P* = 0.05) higher on fruits than on flushing shoots (*P* = 0.05), which also registered significantly (*P* = 0.05) higher rates than on panicles. The results suggest that, although the flushing shoot is not as good food as fruits, it is sufficient to sustain the nymphs when fruits are scarce. However, the fruits are very important to adult bugs for optimum survival.

Adult longevity has been reported to also vary with the food source (Betrem, 1953; Stonedahl, 1991). Both females (21.3 days) and males (15.9 days) of *H. schoutedeni* recorded their longest life spans on fruits whilst their shortest life spans were also recorded on panicles. Similarly, Tan (1974) recorded a mean adult longevity of 30 days for *Helopeltis theivora* on cocoa pods in Malaysia. The same species was reported by Awang et al. (1988) to have a mean longevity of only six days when raised on cocoa shoots. The results clearly show that longevity of *H. schoutedeni* greatly depend on availability of fruits in the field and this may explains the large populations of the pest experienced during the fruiting season of the cashew.

The mean number of *H. schoutedeni* nymphs (viable eggs) produced by females on fruits was 25.8 compared to 23.4 on flushing shoots and 7.9 on panicles. The results indicate that the development and hatching of eggs of *H. schoutedeni* were more favoured on fruits or flushing shoots than the panicles. This difference observed in viability of eggs might, therefore, be attributed to nutritional differences in the plant parts (Tan, 1974).

Conclusion

The present study has shown that, among the plant parts tested, the fruit was the most preferred choice by *H. schoutedeni* for food and oviposition. The nymphs of *H. schoutedeni* also developed faster when fed on fruits than on flushing shoots or panicles. The adults survived longer and produced greater numbers of offspring when fed on fruits or flushing shoots than on panicles. It was observed that in absence of fruits, the insect largely depended on flushing shoots for sustenance and propagation.

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