



Biology and mating behaviour of *Coranus spiniscutis* Reuter (Hemiptera: Reduviidae), a key predator of rice gandhi bug *Leptocoris varicornis* Fabricius

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ABSTRACT

The reduviid predator, *Coranus spiniscutis* was reared in the laboratory on rice moth *Corcyra cephalonica* larvae for studying its biology and mating behaviour. Female laid eggs in single and the incubation period was 4.66 ± 0.77 days. The stadial period was maximum for fifth and minimum for third instars. The sex ratio was 1:0.8 for male and female. The preoviposition and, oviposition periods were 6.20 ± 0.93 , 60.32 ± 2.52 days, respectively. The sequential acts of mating behaviour were: arousal, approach, riding over, genitalia extension, connection achievement and post copulatory acts. This study helps to integrate this reduviid in IPM programme either directly or indirectly.

Key words: Biology, behaviour, predatory insects, crop pest

INTRODUCTION

Predatory bugs (Insecta: Hemiptera) are the main natural enemies of economically important pests in agriculture. Reduviids constitute an important group of predatory insects and the genus *Coranus* is a very good predators with biological control efficiency (Wallace, 1958; Ambrose, 1988; Claver *et al.* 2004). *Coranus spiniscutis* Reuter is distributed in India (Ambrose, 1999), Japan (Tadashi, 2005) and commonly found in agroecosystem and predating on insect pests (Bose, 1949; Ambrose, 2009). In addition, we recorded that it also feeds on *Earias vitella*, *Leptocoris varicornis*, *Riptortus clavatus*, and *Dysdercus cingulatus* under laboratory condition. The detailed study about the life cycle and mating behaviour is essential for utilizing any biological control agent in the Integrated Pest Management programme. But no such information is available for *C. spiniscutis* except the preliminary report available on its biology (Bose, 1949). Hence, the authors urged to study its biology and mating behaviour under laboratory condition.

MATERIALS AND METHODS

Adults of *Coranus spiniscutis* were collected at different agriculture field of Gorakhpur district, Uttar Pradesh. They were brought to the laboratory and reared during July to September [temperature 33-36°C; relative humidity 85 - 90%; photoperiod 13:11 L: D] in separate plastic containers (1250 ml) on larvae of *Corcyra cephalonica* Stainton. The adult male and female *C. spiniscutis* were kept together for mating and oviposition in (700 ml)

containers. Laid eggs were collected in tissue paper and allowed to hatch in small plastic containers (130 ml) with moistened cotton swabs for maintaining optimum humidity. The cotton swabs were changed periodically to prevent fungal attack. These were used for biology studies. The adults of freshly collected and first generation of laboratory reared *C. spiniscutis* were used for mating behaviour experiments.

Biology

There were 25 newly emerged first instar nymphs randomly selected and reared individually in plastic containers (130 ml) to study their biology. These containers were monitored every 12 hours to record biological attributes such as stadial, nymphal mortality, sex ratio of emerging adults, adult longevity, preoviposition and oviposition periods. They were offered different sizes of *C. cephalonica* larvae as food.

Mating behaviour

The mating behaviour of sex starved *C. spiniscutis* were studied under two categories, ie, freshly collected ones and laboratory reared first generation ones. The time taken for the sequential acts of mating behaviour *viz.*, arousal, approach, nuptial clasp including riding over, copula, ejection of spermatophore capsule (ESC) and post copulatory behaviour were observed in the laboratory reared and freshly collected *C. spiniscutis*. The differences between these two categories were compared statistically (Zar, 1987).

RESULTS AND DISCUSSION**Microhabitat**

Coranus spiniscutis was found on shrubs, grasses and agroecosystem like egg plant, pigeonpea, lady's finger, mustard, cowpea, green gram, black gram. Nymphs were found on the ground surface while adults were on tender shoot and foliages. Species of predatory pentatomid bugs and carabid beetles were also seen in the microhabitat of *C. spiniscutis*. *Rhynocoris fuscipes* Fabr was found in the fields where *C. spiniscutis* collected, but there was no association of habitat sharing.

Biology

Oviposition pattern: The eggs are dark brown, elongate with distinct rounded operculum and are generally laid in single or sometimes in small clusters on plant foliages. In laboratory, eggs were found on the tissue paper, bottom and sides of the culture container, or on the cotton swabs as reported in *Edocla slateri* Distant (Vennison and Ambrose, 1986); *Acanthespis philomanmariae* Vennison and Ambrose and *Coranus soosaii* (Vennison, 1989). A female laid an average of 16.92 ± 1.60 eggs after each mate. The total number of eggs laid by a female over its life time is varied (150-220 eggs) (mean 173.72 ± 11.67). The Preoviposition period in *C. spiniscutis* was 6.20 ± 0.93 days and the index of oviposition days were 60.32 ± 2.52 days.

Incubation and hatching: During June to September under laboratory conditions the incubation period lasts about 3 to 5 days (mean 4.66 ± 0.77) (table 1) and 5 to 6 days between October to November. Nymphs took very less time (1hr) to start feeding after eclosion than *Coranus vitellinus* Distant (2hr) (Ambrose and Livingstone, 1985). Nymphs were found to be very active and they preferred

relatively small sized prey. Egg incubation period and the total nymphal developmental duration were the shortest and adult longevity of both sexes was maximal than those of *Coranus nodulosus* Ambrose and Sahayaraj (Sahayaraj and Ambrose, 1993) and *C. vitellinus* (Ambrose and Livingstone, 1985).

Post-embryonic development: The stadiation period of I, II, III, IV, V instars lasted for 3.9 ± 0.58 ; 4.15 ± 0.60 ; 3.89 ± 0.75 ; 4.34 ± 0.70 and 6.36 ± 0.70 days, respectively and the total stadiation period from I to V instar lasted for 22.06 ± 9.41 days (Table 1). The longest stadium was observed in fifth instars and the shortest was in third instars.

Adult longevity and sex ratio: The females lived longer than the males. The life span of adult female was 83.72 ± 2.45 days and that of male was 74.52 ± 4.38 days. The sex ratio was male biased (1:0.8).

Nymphal mortality: The highest rate of nymphal mortality was recorded in the first instar (20%) as reported in *C. vitellinus* (Ambrose and Livingstone, 1985) followed by second instar (4%). There was no mortality in later stages (III, IV and V instars).

Mating behaviour

Coranus spiniscutis was polygamous and polyandrous. The following sequence of mating act was observed in both categories of *C. spiniscutis* (Table 2).

Arousal: The freshly collected *C. spiniscutis* were aroused immediately by the sight of opposite sex in 51.88 ± 10.76 sec (laboratory reared 1.44 ± 0.57 min) as reported in other reduviids such as *Ectomocoris tibialis* and *Acanthespis pedestris* (Ambrose and Livingstone, 1978), *Rhynocoris kumarii* (Ambrose and Livingstone, 1987a) *C. vitellinus* (Ambrose and Livingstone, 1987b).

Approach: The aroused males has approached by chasing the females in 8.24 ± 3.62 min and 14.44 ± 6.79 min in the case of freshly collected and laboratory reared *C. spiniscutis*, respectively with extended antennae was also reported in *Sphedanolestes sp.* and *Coranus sp.* (Kumar, 1993). The motionless female showed willingness with antennal extension. Sometimes the females were escaped from the approaching male. The male placed his legs on the female after the antennal fencing as reported in several other harpactorine reduviids (Ambrose, 1999).

Nuptial clasp including riding over: The males rode over the females with extended rostrum and pressed her head region for few seconds and then pressed pterothorax region with its rostral tip. Then the male slowly moved either one side of the female prior to copulation, while rostral pinning. The duration of riding over were 17.12 ± 3.88 min and 27.52 ± 9.61 min in the case of freshly

Table 1. Biological parameters of *C. spiniscutis* reared on *C. cephalonica* under lab condition (no = \pm SD)

Parameter (in days)	Ist Generation
Incubation period	4.66 ± 0.77
I instar	3.9 ± 0.58
II instar	4.15 ± 0.60
III instar	3.89 ± 0.75
IV instar	4.34 ± 0.70
V instar	6.36 ± 0.70
Total developmental period	22.06 ± 9.41
Adult longevity	
Male	74.52 ± 4.38
Female	83.72 ± 2.45
Pre-oviposition period	6.20 ± 0.93
Oviposition period	60.32 ± 2.52
Total number of egg laid	173.72 ± 11.67

Table 2. Mating behaviour of *C. spiniscutis* (no \pm SD); Significance* P = 0.01, **P = 0.001)

Categories of reduviid	Copulatory behaviour (in min)					copulatory acts (min)	Post ESC (min)
	Arousal	Approach	Riding over	Genitalia extension and connection	Copulation		
Freshly collected	0.51 \pm 0.10	8.24 \pm 3.62	17.12 \pm 3.88	*0.52 \pm 0.24	88.45 \pm 0.44	5.04 \pm 0.77	14.24 \pm 3.75
Labreared	1.44 \pm 0.57**	14.44 \pm 6.79*	27.52 \pm 9.61	1.56 \pm 0.94 **	106.64 \pm 0.35	6.08 \pm 1.89	12.48 \pm 4.18

collected and laboratory reared *C. spiniscutis*, respectively.

Genitalia extension and connection achievement: The male extended genitalia and tried several times to achieve connection and finally achieved connection. The duration of this act were 0.52 \pm 0.24 sec and 1.56 \pm 0.94 min in the case of freshly collected and laboratory reared *C. spiniscutis*, respectively. It is noted that the male relaxed the characteristic pterothorax rostral pinning after the achievement of connection. *C. spiniscutis* mated in dorsoventral position as reported in *Sphedanolestes reclinator* and *C. soosai* (Vennison, 1988) and in several other harpactorine reduviids (Ambrose, 1999).

Copulation: *Coranus spiniscutis* remained motionless during copulation and if there is any disturbance, the male again exhibited pterothorax rostral pinning. It is observed that tibial brushing each other or against substratum, male were grooming the female genitalia with its hind legs during copula and then become down just prior to termination of copulation (Ambrose, 1999). The durations of copulation were 88 \pm 0.44 min and 106 \pm 0.35 min in the case of freshly collected and laboratory reared *C. spiniscutis*, respectively. Drooping down of antennae by both the sex was observed at the termination of copulation and thereafter separation of mating partners. After separation both male and female moved away from the place of copulation

Post copulatory acts: The post copulatory acts such as genitalia brushing, antennal grooming, cleaning the legs, wing beating were observed in both the sex partners. Post copulatory acts lasted for 5.04 \pm 0.77 and 6.08 \pm 1.89 min in the case of freshly collected and laboratory reared *C. spiniscutis*, respectively. Post copulatory cannibalism of female over male as reported for certain Harpactorinae and Peiratinae reduviids (Ambrose, 1999), was not found in *C. spiniscutis*. The successful completion of copulation was evidenced by the ejection of spermatophore capsule by female after termination of copulation (Ambrose, 1999) was 14.24 \pm 3.75 min in freshly collected *C. spiniscutis*, whereas laboratory reared ejected the spermatophore capsule in 12.48 \pm 4.18 min.

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