

REARING THE BLACK HORNED TREE CRICKET, *OECANTHUS NIGRICORNIS* (ORTHOPTERA: GRYLLOIDAE)

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Abstract

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Black horned tree crickets, *Oecanthus nigricornis* (Walker), were continuously reared for the first time in the laboratory. Optimum rearing conditions per unit effort involved 2 months at -5°C to terminate egg diapause, and subsequent incubation of eggs from infested raspberry cane segments at 27°C and 45% relative humidity. Eggs began hatching in 2 weeks, and second generation eggs were obtained within 2.5 months. The best survival from egg to adult was 55%. The possibility that male tree crickets provide a nutritional investment in their progeny is discussed.

Introduction

The black horned tree cricket, *Oecanthus nigricornis* (Walker), can now be reared relatively simply through a complete life cycle in the laboratory. Previously, one was restricted to studying the adults for a few weeks at the end of the summer. Rearing methods have been described for other Orthoptera, e.g., *Chorthippus brunneus* (Thunberg) (Acrididae) (Moriarty 1969); *Acheta domesticus* (L.) (Gryllidae) (Burkhardt *et al.* 1970; Busvine 1955; Patton 1963); and *Gryllus pennsylvanicus* (Burmeister) (Gryllidae) (Harris and Svec 1964). However, no rearing methods published can be applied to tree crickets.

Fulton (1915) gave a detailed account of the life history of *O. nigricornis*. In the fall *O. nigricornis* lays its eggs in close packed rows in woody stems, such as raspberry canes (*Rubus* spp.). The eggs overwinter and first instar nymphs hatch in late June with the appearance of raspberry foliage and warm temperatures. The nymphs pass through five instars and by late summer, the adults eclose, court, mate, and oviposit.

A successful rearing method is described for *O. nigricornis*, a common pest that damages stems and new foliage of many fruits and berries such as apple and raspberry.

Materials and Methods

Raspberry canes with *O. nigricornis* oviposition scars were collected from December 1977 to March 1978 in Huttonville, Nassau Mills, and Credit Forks, Ontario for an initial egg stock.

Three egg hatching techniques were used. Thirty scarred cane segments, 10-20 cm long were equally distributed in 10 upright 100 ml glass jars each containing 50 ml of water. Three scarred cane segments, 2-5 cm long were laid on moistened filter paper in each of 20 glass covered petri dishes. All cane segments were exposed to 30°C , a minimum of 45% relative humidity and 13 h of light per day. Infested canes were dissected and the eggs carefully removed with a sable brush. This third technique involved placing 10 eggs on moistened filter paper in each glass covered petri dish. All filter paper was moistened daily with 0.5 ml of water. Ten eggs removed from canes and at least one replicate of 10 were incubated at each combination of 20° , 22° , 27° , 30° , 35° , and 40°C and 0:24, 13:11, 24:0 L:D photoperiods, all at a minimum 45% relative humidity.

When the eggs hatched, about 50 nymphs were placed in glass terraria ($30 \times 35 \times 50$ cm) and fed on young potted wheat shoots, sliced apple, raspberry foliage, and Tetra Growth Food[®]_{TM} (47% min. protein). The terraria contained a water supply and numerous twigs as moulting perches. Fifth instar nymphs were separated by sex and placed in fiberglass screen cages ($45 \times 50 \times 50$ cm). Ten adult pairs raised from

Huttonville eggs were arbitrarily chosen for mating. In each mating the total time the female fed on the secretions of the male metanotal gland was recorded. Externally the gland appeared as a moist triangular pit located between the male's hind wings. Half the females were allowed 10 min or more of feeding time; the remainder were stopped before 7 min had elapsed. Females that had copulated were placed in oviposition cages (Fig. 1). Ten days later, canes with oviposition scars were removed. The eggs were dissected out and kept at -5°C on filter paper in glass covered petri dishes for 2 months. Eggs were then incubated at 30°C , 45% relative humidity, and 13 h of light per day.

Results

An average of 0.554 eggs/mm of scar (range 0.071–1.133) was found in field collected canes. The average scar length was 19.8 mm (range 5–102) ($N = 120$). Laboratory ovipositions yielded on average 0.706 egg/mm (range 0.130–1.130) ($N = 31$).

Canes partly immersed in water, cane segments in petri dishes, and eggs in petri dishes yielded hatch rates of 20%, 67%, and 85% respectively at 30°C , 45% relative humidity, and 13 h of light per day.

There was no significant difference in hatch rates, between eggs taken from the field and hatched at 27°C in December 1977 (65%), January 1978 (67%), February 1978 (60%), March 1978 (70%).

All eggs and cane fragments developed severe fungal growth, and no eggs hatched at minimum relative humidities of approximately 70 and 90% at 30°C . Light cycle had little influence over egg hatching (Table I).

Egg incubation periods decreased and egg hatch increased as temperatures increased from 20° to 30°C . At temperatures over 30°C the converse was true (Fig. 2). The data suggest increasing temperature shortened the time taken for all the eggs to hatch (Table I).

Cannibalism reduced the 50 nymphs per glass terraria to five or fewer after 3 weeks. The eating of newly moulted individuals by larger crickets was virtually

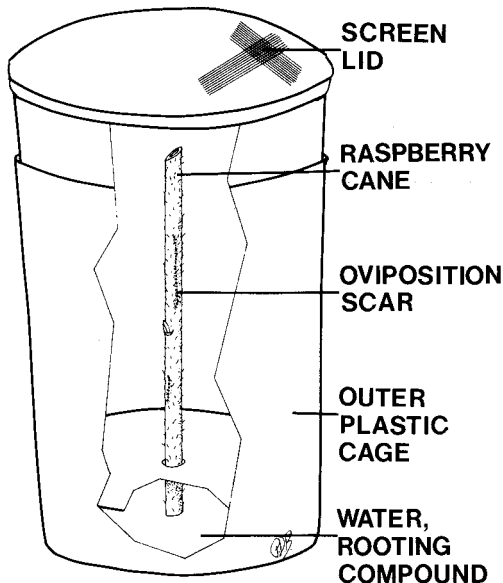


FIG. 1. Oviposition cages, made from 2, 1L plastic ice cream containers.

Table I. *O. nigricornis* egg hatch, after removal from field-collected canes in February 1978 and subsequent incubation at 20°, 22°, 27°, 30°, 35°, or 40°C and photoperiods of 0:24, 13:11, or 24:0 L:D at 45% R.H.

TEMP °C	● 0/24 HRS LIGHT			◐ 13/24 HRS LIGHT			○ 24/24 HRS LIGHT		
	DAYS HATCH TILL PERIOD		%	DAYS HATCH TILL PERIOD		%	DAYS HATCH TILL PERIOD		%
	HATCH	DAYS	HATCH	HATCH	DAYS	HATCH	HATCH	DAYS	HATCH
20	39	6	18	35	4	24	34	8	29
22	28	4	27	26	10	32	-	-	-
27	19	3	70	17	9	67	16	6	60
30	15	4	73	16	7	85	15	4	71
35	20	4	10	21	6	19	0	0	0
40	0	0	0	-	-	-	0	0	0

eliminated by introducing additional wheat shoot moulting perches. Populations of at least 20 per terrarium were thus maintained. The sex ratio was 1.27 in favour of males from 68 animals that reached adulthood from eggs collected at Huttonville.

Females oviposited on canes (Fig. 1) within 20 h after mating and laid no additional eggs for 10 days while in isolation. Females allowed to feed on the metanotal gland 10 min or longer after copulation laid on average 27.7 eggs ($N = 3$); females interrupted from feeding for more than 7 min averaged 13.5 eggs ($N = 5$).

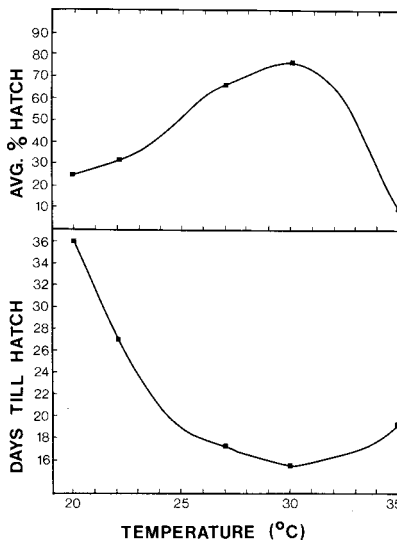


FIG. 2. Required incubation period and average % hatch in *O. nigricornis* eggs, field-collected in February 1978 when maintained at temperatures of 20°, 22°, 27°, 30°, and 35°C, 13:11 L:D photoperiod and 45% R.H.

Discussion

The most successful method for hatching *O. nigricornis* eggs per unit effort involved placing infested segments of cane, 40 mm of scar (about 22 eggs) on filter paper and moistened daily in glass petri dishes at 45% relative humidity and 27°C. Although these conditions did not result in the fastest hatch, fungus infection was lower than at 30°C and filter paper did not need changing as often. Dissecting out individual eggs for hatching did increase hatch success but was a difficult, time consuming technique. These methods could likely be improved by determining the minimum hibernation period required before diapause can be terminated. However, these methods can be used to ensure a supply of adult specimens for study throughout the year.

Many female insects require some proteinaceous food for egg production, and males of some species, e.g., *Panorpa* spp. (Mecoptera: Panorpidae), provide such a nutritional investment while mating (Thornhill 1976). During courtship female tree crickets mount the male and feed upon the metanotal gland secretions. After copulation the females continue this behavior, and in addition eventually pluck off and consume the spermatophore from their genitalia. On average twice as many eggs were oviposited by those females who were not interrupted from their post-copulatory gland feeding. The data indicate that the secretions of the metanotal gland may constitute paternal investment in *O. nigricornis*. The degree to which the metanotal gland and the spermatophore contribute to female reproduction is being investigated.

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