A SIMPLE REARING METHOD FOR FUNGUS GNATS *CORYNOPTERA* SP. (DIPTERA:SCIARIDAE) WITH NOTES ON LIFE HISTORY[1]

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ABSTRACT

A method of rearing fungus gnats of *Corynoptera* sp. (Diptera:Sciaridae) is described, based on a diet of bean seed and horticultural peat. The gnats completed development from egg to adult in 13-15 days at 24 ± 2° C. Oviposition and longevity were increased by a honey supplement to the adults.

INTRODUCTION

Various species of fungus gnats (Diptera:Sciaridae) are common pests in greenhouse crops (Lindquist, Faber and Casey 1985; Wilkinson and Daugherty 1970a, b). Larvae reportedly damage the roots of seedlings and mature plants (Wilkinson and Daugherty 1970a; Dennis 1978), and adults are a source of annoyance and irritation to workers and consumers. The species most commonly reported causing damage in greenhouses is *Bradysia coprophilia* (Lintner) (Lindquist, Faber and Casey 1985). Wilkinson and Daugherty (1970a) reported *B. impatiens* (Johannsen) feeding on roots of soybean plants in a greenhouse.

In the fall of 1982 larvae of a species of Sciaridae were noted feeding on and around the roots of *Gerbera jamesonii* in a greenhouse. These were collected, reared and subsequently identified as *Corynoptera* sp. This species was successfully placed in continuous rearing. The following reports rearing techniques for this species which may be adaptable to other species of Sciaridae. The life history of *Corynoptera* sp. is described.

MATERIALS AND METHODS

Rearing

The rearing mixture was prepared by first soaking 100 g of dried pinto or small red beans in water for 24 h. These were rinsed under cold running water and ground with 500 ml of water in a blender. The ground beans were then added to 2 ℓ of sieved (16 mesh) horticultural peat and sufficient water was added to produce a moist mixture. This was stored in the refrigerator at 2°C until needed.

Cylindrical plastic 1 ℓ refrigerator containers coated on the outside with black paint were used as rearing containers. A hole of 2.5 cm diam. in the lid was covered with 80 mesh screen to provide ventilation. Approximately 100 ml of the rearing mix was added to these containers and packed firmly into the bottom. A small quantity of honey was then smeared on the lid. Twenty-five to 50 1- to 2-day-old gravid female fungus gnats and an equal quantity of males were briefly anesthetized with CO_2 and placed in the container. Colonies were renewed by anesthetizing freshly emerged adults in the original container and then placing the appropriate number into a new container.

Life History

Eggs for life history studies were collected by placing large numbers of female and male *Corynoptera* sp. in sealed containers with moist paper towelling. Eggs were rinsed from the towelling after 24 h and collected on a 200 mesh screen. Approximately 2000 freshly laid eggs were put into each of five containers as described above, with 200 ml of rearing mix. These were held at 24 ± 5°C. On the following day and each day thereafter a 10 ml sample of mix was taken from each container. Samples were teased apart with dissecting needles. Fungus gnats at all stages were extracted from the medium by gentle agitation in a 40% sucrose solution as suggested by Fordyce and Cantelo (1981). They were removed from the solution as they floated to the surface. This activity was maintained until no further individuals could be extracted. All fungus gnats extracted from each sample were counted and identified by stage, i.e. egg, larva, pupa or empty pupal case (= adult).

Adult Fecundity and Longevity

The effects of carbohydrate supplement on fecundity and adult longevity were tested. One freshly-emerged unmated female and one male were placed in each of 30 inverted, vented petri dishes. Blotting paper discs on the bottom of the dishes were kept moist throughout. A small portion of rearing mixture was provided to focus egg laying. In 15 of the dishes a drop of honey (approximately 0.1 ml) was placed on the blotting paper as a carbohydrate supplement. Oviposition was assessed daily. Data were analysed by t-test (= 0.05).

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RESULTS

Rearing

The method described was effective for rearing *Corynoptera* sp. Cultures have been maintained continuously for three years with occasional supplementing from wild stocks collected in greenhouses. Yield of individual culture vessels ranged from 500 to 1000 insects. A culture normally took 16 to 18 days to cycle at lab temperatures 18 to 24°C). The rearing mixture developed a luxuriant covering of mold that rapidly disappeared when the larvae hatched and began feeding. After the visible fungus had been consumerd, the larvae turned to the larger bean pieces left in the mixture as well as the mixture itself. By the time larval development was complete, the mixture had been reduced to a rich compost.

Life History

Overall development required slightly less than 13 days to 50% emergence of adults (Fig 1). The egg stage lasted between 1 and 2 days. Larval development required 7 days and the pupal stage lasted about 4 days. Emergence of adults was essentially complete by day 15. Males began emerging 1 day before the females (Table I). The male:female ratio was 1:1.3.

Adult Fecundity and Longevity

Females lived for 7.3 ± 1.72 days and laid 149.6 ± 42.39 eggs when provided with a honey supplement. In contrast, females lived only 3.8 ± 0.68 days and laid 111.1 ± 47.18 days without the honey supplement. Males lived 10.6 ± 2.12 days with honey supplement and 4.5 ± 0.53 days without honey supplement. All differences are significant (t-test, $p<0.01$).

In a separate experiment, all females without mates laid eggs on the day of death and these eggs were infertile. Eggs from the mated females in the previous experiment were generally fertile although the level of fertility was not checked.

Most of the eggs were laid on day 3 of the experiment in both honey and no honey treatments (Table II). Without honey, all oviposition took place in a 3-day span whereas with honey, oviposition occurred during an 8-day span.

DISCUSSION

The rearing system described above is similar to that of Wilkinson and Daugherty (1970a). In their studies, *Bradysia impatiens* was reared on finely ground soybeans mixed in distilled water. A mixture of ground beans and distilled water proved too odoriferous for use in a laboratory environment, particularly when large numbers were being reared in vented containers. Other rearing methods for *B. coprophilia* used ingredients ranging from a sterilized manure/straw mixture inoculated with mushroom spawn (Thomas 1929) to sterilized, blended grass cuttings on agar slants (Kennedy 1973). Horticultural peat was chosen because it closely simulates the substrate used by fungus gnats in greenhouses. In addition, it and the beans are more readily available than the exotic ingredients.

Fig. 1 Development of *Corynoptera* sp. over time in a rearing mixture of peat and ground beans.

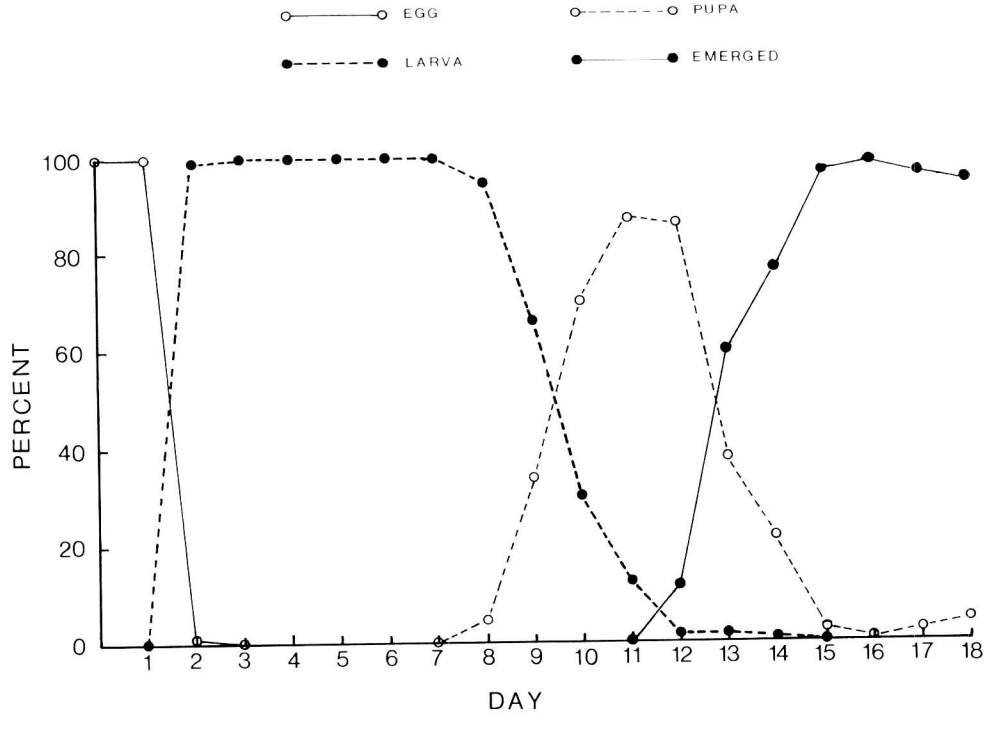

TABLE I. Cumulative percent emergence of *Corynoptera* sp. adult males and females from a rearing mixture of peat and ground beans.

Day	Males	Females
11	0	0
12	33.2	.2
13	71.0	55.5
14	93.7	92.5
15	97.9	95.8
16	98.9	98.4
17	99.8	99.4
18	100.0	100.0

TABLE II. Mean daily egg production (S.D.) of *Corynoptera* sp. females with and without honey supplement.

Day	With Honey N=14	Without Honey N=15
1	0	0
2	1.1 (4.01)	2.4 (6.51)
3	74.1 (63.18)	83.4 (57.28)
4	19.4 (28.10)	25.2 (46.36)
5	33.8 (57.65)	0
6	8.4 (19.08)	0
7	3.9 (8.70)	0
8	5.6 (7.88)	0
9	3.6 (13.63)	0
10	0	0
Grand X	149.6 (42.39)	111.1 (47.18)

The life cycle of *Corynoptera* sp. is considerably shorter under our conditions than that of *B. coprophilia* as described by Wilkinson and Daugherty (1970b). They found the optimum for that species to be approximately 20 days at 18.9-30.0°C as opposed to 13 days for *Corynoptera* sp. at 24 ± 2°C. The apparent increase in numbers of pupae after day 16 (Fig. 1) was probably spurious and due perhaps to waterlogging or disintegration of empty pupal cases.

Kennedy (1973) observed adults of *B. impatiens* apparently feeding on "ooze" from rearing cultures, although Wilkinson and Daugherty (1970a) did not observe feeding by adults of this species. I have many times observed fungus gnat females of undetermined species apparently feeding on honeydew deposits from *Trialeurodes vaporariorum* (Homoptera:Aleyrodidae). It appears from the feeding experiment that this behavior could increase the oviposition and lifespan of females, perhaps to the degree that in cases of whitefly outbreak, fungus gnat populations should be monitored carefully.

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