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INFLUENCE OF TEMPERATURE ON EGG PRODUCTION IN SUNFLOWER STEM WEEVIL *CYLINDROCOPTURUS ADSPERSUS* (COLEOPTERA: CUCURLIONIDAE)

John F. Barker[1]

ABSTRACT

Controlled laboratory experiments were conducted to study the influence of temperature on production of eggs by a sunflower stem weevil *Cylindrocopturus adspersus*. Maximum egg production occurred when the temperature was 30±1°C. At 27°C the rate of egg production was lower than at 30°C but significant only at the $P < 0.1$ level. At 20, 23, and 35°C egg production was significantly lower than at 30°C ($P < 0.05$) indicating that temperature can be an important factor in regulating the fecundity of this species.

The known range of *Cylindrocopturus adspersus* (LeConte), a sunflower stem weevil, is from southern Canada throughout the Great Plains (Oseto 1977, Rogers and Jones 1979) into the Texas high plains (Rogers and Serda 1982). In the northern Great Plains, *C. adspersus* is reproductively active during late June, July, and August. Populations of this species are sporadic and cyclic which strongly suggests that various environmental factors influence their abundance. The influence of temperature on egg production was investigated to determine the influence of temperature on fecundity of this species.

MATERIALS AND METHODS

Larvae of *C. adspersus* were field collected from sunflower stalks and stored at 4°C. After chilling for at least five weeks the larvae were brought out to 27°C to pupate. Pupae were sexed as described by Reinecke (1981) and separated shortly after eclosion. Five to 7 days after emergence as adults, the males were marked with a small spot of quick drying enamel paint and six males and six females were added to each of five hat boxes measuring 17 × 26 × 34 mm (n = 30 females for each temperature tested). The box covers had ventilation holes cut into them, and the holes were covered with a screen to keep the weevils confined. Each cage contained a short section of sunflower stalk and a cut sunflower leaf. To maintain freshness the leaf and stem were inserted into a small bottle of water. The leaf and stem were changed every 48 h. All experiments were conducted in a controlled environment chamber. Temperature was held constant ±1°C with relative humidity maintained at 55%. Temperature effects were tested at 20, 23, 27, 30, and 35°C. Each test was made with five replicates. The photophase was held at 15:9 light:dark cycle. Fluorescent light intensity at the level of the holding shelf was 350 lux.

The eggs oviposited during each 48-h period were used to quantify the rate and total egg production. *C. adspersus* females oviposited on the cut stalk and leaf stem of the

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Table 1. Effect of temperature on egg production in *C. adspersus*.

Temperature	Eggs/female/day	Total egg production[a]
35±1°C	3.2±0.3[b] A	1483
30±1°C	4.7±0.4 B	5842
27±1°C	3.6±0.3 AB	4826
23±1°C	1.4±0.1 C	1945
20±1°C	0.4±0.0 D	711

[a]Up to 75 days.
[b]Different letters indicate the means are significantly different at the $P < 0.05$ level.

sunflower plant placed in the hat box. Eggs were removed from the section of stalk and cut leaf and counted. The mean numbers of eggs in different temperature groups were compared by a one-way analysis of variance and an F test (Guenther 1964).

RESULTS

The effect of temperature on total egg production and the number of eggs per female per day are summarized in Table I. The total number of eggs oviposited and the number of eggs per female per day increased up to 30°C, while longevity decreased with increasing temperature. Each experiment at each temperature began with 30 females. The majority of females (22 of 30) held at 27 and 30°C lived at least 45 days while the majority (19 and 23 respectively of 30) held at 23 and 20°C were still alive at 75 days. In contrast, those held at 35°C were all dead by 30 days. The greatest number of eggs were produced when the temperature was 30 ± 1°C. Oviposition at 35, 23, and 20°C was significantly lower than at 30°C. At 27°C egg production was lower than at 30°C but significant only at the $P < 0.1$ level.

DISCUSSION

The above results suggest temperature is important in the regulation of egg production in *C. adspersus*. Reproduction is inhibited at fairly warm temperatures of 20–23°C and is lower even at 27°C than at 30°C. It is probable that extended summertime temperatures below 27°C can contribute to down-cycles of wild populations of this species in the northern Great Plains. At 35°C the mortality was high with a subsequent reduction in total egg production. Temperatures above 30°C could reduce fecundity through increased stress and mortality. At temperatures of 20–23°C, the insects produce about 12–33% as many eggs, respectively, as at 30°C. Longevity increased almost two fold at these temperatures but the insects would have to live three times as long or longer to produce the equivalent number of eggs as at 30°C. It is unlikely that under natural conditions in the northern Great Plains, egg production at 20 or 23°C could catch up to production at 30°C due to the onset of fall conditions and the maturation and drying of the host plant occurring at the end of August.

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