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MATING FREQUENCY OF THE MALE CACTUS MOTH, *CACTOBLASTIS CACTORUM* (LEPIDOPTERA: PYRALIDAE), UNDER LABORATORY CONDITIONS

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The cactus moth, *Cactoblastis cactorum* (Berg) (Lepidoptera: Pyralidae), belongs to the economically important subfamily Phycitinae, which includes such species as the Indian meal moth, *Plodia interpunctella* (Hübner), and the Mediterranean flour moth, *Ephestia kuehniella* (Zeller) (Borror et al. 1992). The cactus moth is a native of Uruguay and the northern portions of Argentina (Sweetman 1958). The larvae of *C. cactorum* feed gregariously inside prickly pear cactus (*Opuntia* spp.) pads and have been used successfully as a biological control agent to destroy dense stands of weedy cacti in Australia, South Africa, and elsewhere around the world (Zimmermann et al. 2004). However, it is now considered an invasive pest since its arrival into the United States in 1989 (Habeck & Bennett 1990). The insect has spread westward along the Gulf Coast and poses a serious threat to the *Opuntia*-rich desert ecosystems in the southwestern United States and Mexico (Mahr 2001). Currently, an area-wide integrated pest management approach based on the sterile insect technique (SIT) is being investigated as a tool to slow or stop the spread of the cactus moth beyond the Florida/Alabama state line (Hight et al. 2003; Hight et al. 2005).

In the application of the SIT, insects are mass reared, treated with radiation to render them sterile, and released in an effort to ensure that a significant proportion of wild females mate with sterile males (Carpenter et al. 2001). As such, it is critical that the laboratory reared males are as competitive as wild males in successfully mating with wild females. The degree to which mating interactions result in copulation is dependent on a number of factors, including male and female choice, male courtship behavior, female response to courtship, female reproductive or motivational status, and mating competition (Halliday 1983; Sauter & Brown 2001). Detailed information on cactus moth mating behavior could prove useful to develop laboratory quality control tests and to help determine the optimal overflooding ratio needed to achieve suppression when using the SIT. Hight et al. (2003) conducted mating table studies with *C. cactorum* and determined that mating takes place briefly during the morning twilight, within the hour before sunrise. However, no information exists on the mating frequency of male or female *C. cactorum*. Therefore, the objective of this study was to determine the number of times *C. cactorum* males mate under laboratory conditions.

Cactus moth pupae previously sorted by gender were obtained from a colony maintained at the USDA-ARS Crop Protection Management Research Unit in Tifton, Georgia. Male and female pupae were placed in separate screen cages (30.5 × 30.5 × 30.5 cm) prior to eclosion and allowed to emerge separately at room temperature (23 ± 1°C). Newly emerged (<24 h-old) virgin adult males were placed individually in rectangular plastic containers (30 × 20 × 10 cm) containing a clean uninfested cactus pad of *Opuntia stricta* (Haworth) Haworth. Virgin females (<24 h-old) were provided to each male at 24 h intervals until male death. Females removed from the containers were killed by freezing (0°C) and stored for dissection to ascertain their mating status. Females were dissected under a dissecting microscope to verify the presence of a spermatophore in the bursa copulatrix (Ferro & Akre 1975). The study consisted of 19 males each constituting a single replicate and were held at a laboratory temperature of (23 ± 1°C), 40-60% RH and a photoperiod of approximately 14:10 (L:D) for the duration of the study.

A total of 19 *C. cactorum* males were paired with virgin females every 24 h until male death. Of these males, 4 (or 21%) did not mate under our experimental set-up. All females provided to these 4 males were dissected and found to be virgin—no spermatophore present in the bursa copulatrix. These 4 males were not included in further analysis so that information presented below is only based on males that successfully mated. The remaining 15 males mated a total of 32 times under our laboratory conditions resulting in a mean mating frequency of 2.2 mating events per male. The number of matings ranged from a low of 1 to a high of 5 in a male's lifetime. Three males mated 1 time, 9 males mated twice, 2 males mated 3

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times, and 1 male mated 5 times. Two of the males (10.5%) mated on consecutive days, but there was a mean refractory period (the period of time elapsing between successive matings) of 2.75 d required for the 12 males (63%) that had multiple matings. Eight matings, representing 25% of the total mating events, occurred on the first day that the male was provided with a virgin female. The next peak in mating activity occurred on d 4, with a total of 4 mating events occurring on this day (representing 12.5% of the total mating events). A third peak in mating activity occurred on d 7, with a total of 4 mating events occurring on this day. In general, after the seventh day, mating activity declined drastically. Two mating events occurred at d 8 and 9, respectively, and 1 mating occurred on d 13 (Fig. 1). The 15 successfully mating males lived an average of 11 d with a range of 7-16 d.

SUMMARY

Our results show that male cactus moths will successfully mate several times when provided daily with virgin females. The mean number of mating events recorded in the laboratory was 2.2 per male with a range of 1-5 events in their lifetime. Furthermore, males took an average of 2.75 d to mate again. This study did not address the mating frequency of female moths, or whether males were able to mate with multiple females in a 24 h period, important questions that must be answered if a comprehensive understanding of *C. cactorum* mating biology is to be understood.

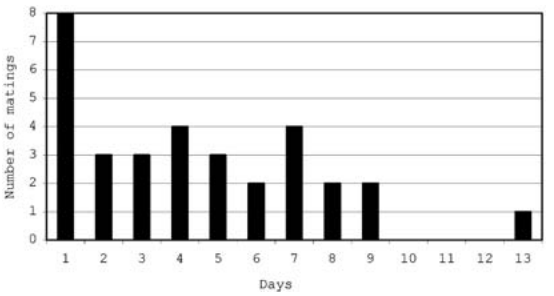


Fig. 1. Total number of mating occurrences per day by 15 *Cactoblastis cactorum* males under laboratory conditions when provided with a new virgin female every 24 h.

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