MATE FINDING AND MATING BEHAVIOR OF MICROPLITIS CROCEIPES 1/2/

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ABSTRACT

The courtship and mating behavior of Microplitis croceipes (Cresson) is reviewed and the pheromonal basis of mate finding is examined. Males find potential mates by positive anemotaxis to a volatile sex pheromone. Mating interactions should be examined under natural conditions to determine correlates between virgin female trapping of males and male patrolling.

INTRODUCTION

Parasitoid Mating Behavior. Mating behavior and, to a lesser degree, mate finding have been described for many parasitoids (Vinson 1972, Matthews 1975, van den Assem 1976, Barrass 1976, Askari and Coppel 1978, Gordh and DeBach 1978, Collins and Grafius 1986), as well as for other braconids (Grosch 1947, 1948, Sekhar 1957, Schlinger and Hall 1960, Obara and Kitano 1975, Weseloh 1976, Vinson 1978). Males may find females by responding to a pheromone (Grosch 1948, Vinson 1972, 1978, Weseloh 1976), and males have been successfully trapped in the field in traps baited with virgin females (Lewis and Snow 1971, Eller et al. 1984, Powell and King 1984). In one of the previous cases (Eller et al. 1984) the pheromone involved was identified.

Microplitis Mating. Evidence published by Powell and King (1984) showed that male M. croceipes were attracted to females placed in cages inside sticky traps in a cotton field. Cages containing virgin females, mated females, or mated males were placed inside Zoecon Pherocon II traps and located at random in cotton. Only male M. croceipes were captured, and all were caught in traps baited with virgin females. Traps baited with one virgin female each captured an average of 0.5 males per trap. Traps containing three virgin females each captured an average of 2.0 males per trap. This report was the first demonstration that M. croceipes males were attracted to females in the field, and these data strongly indicated the existence of a female-produced sex pheromone.

Powell and King (1984) observed male M. croceipes flying most often close to the ground between cotton rows from 0630 to 1100 CDST h, but parasitoids frequently hovered and apparently searched for females when flying in the upper foliage. The temporal sequence of flight activity for females began 1 h later than for males. Since males were more active than females in the morning, and females were often seen resting on a

1/ Hymenoptera: Braconidae.

2/ Mention of a trade name, proprietary product, or specific equipment does not constitute a guarantee or warranty by the U.S. Department of Agriculture and does not imply its approval to the exclusion of other products.

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cotton leaf at this time, it was suggested that the females were waiting to mate with males. One pair was observed in copula on a leaf.

Lewis (1970) gave an account of the mating behavior of M. croceipes. He reported that mating occurred soon after emergence and that males exhibited wing flutter when near females. Males mounted the dorsum of the female and extended the tip of the abdomen downward. As copulation occurred the female moved about dragging the male along. Lewis (1970) reported that copulation lasted about 20 seconds.

Lewis and Snow (1971) demonstrated that M. croceipes was arrhenotokous, (i.e. virgin females produced all male progeny). Mated females produced both male and female offspring. Females could mate effectively at any time during their first week of life and begin producing female offspring.

DISCUSSION AND CONCLUSION

Evidence shows that M. croceipes males are attracted to females in the field and probably males find potential mates by pheromone directed anemotaxis. It is highly probable that a female-produced sex pheromone is released by virgin and mated M. croceipes females, and as discussed in this monograph, (R. L. Jones, pers. comm.) this material has been isolated and partially purified.

The complexities of behavior of M. croceipes mating pairs are understood but still somewhat perplexing. For example, wing fanning (flutter) has been seen in many other parasitoids, such as Opius alloeus Muesebeck (Bousch and Baerwald 1967), Nasonia vitripennis Walker (Miller and Tsao 1974), Cardiochiles nigriceps Viereck (Vinson 1978), Anaphes sordidatus (Girault) (Collins and Grafius 1986), Pseudocoila bochei (Weld) (van den Assem 1969), and Campoletis sonorensis (Cameron) (Vinson 1972). Different authors have ascribed various functions to male wing fanning including tactile stimulus to induce female receptivity (Bousch and Baerwald 1967), courtship song (Miller and Tsao 1974), courtship song amplification (Leonard and Ringo 1978), and orientation to chemical stimuli (Vinson 1972). We can speculate concerning the function of wing fanning by M. croceipes. Wing flutter could be a display, a mechanism of orientation by pulling volatiles over the plane of the male, or some other little understood behavior.

Most studies have shown some degree of receptiveness by parasitoid females to courtship displays and wing fanning (van den Assem 1969, Bryan 1980, Simser and Coppel 1980, Kainoh 1986, Collins and Grafius 1986). As previously noted, female M. croceipes must mate in order to produce female offspring. Individuals which "waste time" in the mating process (Parker 1974) may be at a selective disadvantage. They may be exposed to predators and may also experience a lower fertilization rate. Courtship and mating shortly after emergence may favor sib-matings. Delay of mating could perhaps increase the chances of postdispersal mating and therefore increase mating with non-siblings, and increase gene flow to maintain a higher degree of genetic variation and fitness. Since nothing is known regarding male patrolling behavior by M. croceipes, a particular female may have an equal probability of mating with a vigorous non-sibling male if males from temporally displaced populations encounter newly emerged females. This is an area which would benefit from field studies using marked male and female parasitoids.

Microplitis croceipes is a parasitoid which may exert a strong influence on populations of damaging herbivores. This parasitoid is also relatively tolerant to applications of certain insecticides commonly used in cotton (Elzen et al. 1987). A thorough understanding of the biology of this parasitoid is warranted so that we may fully utilize its potential for biological control.

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