

Fig. 1. Distribution of *Cyphoderris strepitans* in the Yellowstone and Grand Tetons area. Dots indicate locations where singing males were heard. Major roads and lakes are indicated.

CYPHODERRIS STREPITANS (ORTHOPTERA: HAGLIDAE):
REPRODUCTIVE BIOLOGY AND GEOGRAPHICAL DISTRIBUTION

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Introduction

Cyphoderris strepitans Morris and Gwynne is a common species of nocturnal insect in many sagebrush areas within Grand Tetons and Yellowstone National Parks. It is a primitive orthopteran group, a relict of the ancient family Haglidae. Only five species in three genera are currently known (Morris and Gwynne 1978, Storozhenko 1980). Males produce a calling song by rubbing their forewings together. Females are attracted to male song; during mating the female feeds on the tissues of the male's fleshy underwings. Virgin and non-virgin males can, therefore, be distinguished by examining their underwings. At the end of mating the male transfers a large proteinaceous spermatophore which the female also consumes.

The main objective of this study has been to investigate the role and consequences of the male investment in his underwings and spermatophore (see Morris and Gwynne 1979). Female katydids use spermatophore proteins for egg production (Gwynne and Toolson unpublished) so these nutrients can be regarded as an important male investment likely to influence patterns of sexual selection within this group. Trivers (1972) outlined the theory of parental investment and its influence on sexual selection. Females, because they produce fewer larger gametes (eggs) are usually the limiting sex for the males which have a relatively large number of small gametes (sperm). As a result, males are predicted to maximize reproductive success by competing with each other to inseminate as many females as possible. Females, because they are limited by their fewer gametes will not gain by competing for copulations. Instead they should enhance reproductive success by being selective about which males fertilize their eggs. Sexual selection should, therefore, be stronger on males since competition for mates should produce a greater variance in the reproductive success of this sex (i.e., some males obtain few or no mates while others mate frequently).

Males can offset the initial disparity of investment in gametes by investing parentally via paternal care of eggs or offspring or, as in many insects, by feeding the female with prey items or glandular products (Thornhill 1976). These sorts of male investments should decrease the variance in reproductive success of these males because

the males are more "female like" in their reproductive strategy i.e., competing less because they reduce the number of potential copulations engaged in due to the large nutrient investment in each copulation.

In orthopterans such as *Cyphoderris* where females feed on male-produced nutrients the following predictions emerge: (1) females should select a mate who is likely to provide more of the nutrient; (2) as mentioned above, the variance in male reproductive success should be low; few males should go unmated.

Previous work in Grand Teton National Park has indicated that females may prefer *Cyphoderris* males who can supply more nutrients. Significantly more virgin males are mated than non-virgins (Morris and Gwynne 1979). Virgins are likely to be a better mate choice for females since they have not only more wing material but also would have large reproductive accessory glands capable of producing a full sized spermatophore. The main purpose of this season's work was to investigate the variance in reproductive success of males.

An effort was also made to further collect information on the distribution of *C. strepitans* in and around Grand Teton and Yellowstone national parks. This information is presented first.

Methods

Data on the distribution of the species was collected by driving the park roads at night and listening for the calling songs of males.

Mating by males was detected by individually marking 80 males at the Pacific Creek site (see Morris and Gwynne 1979). Most males were marked as virgins in mid-May during the first week of male singing but before any mating was noted. The incidence of mating by virgin males was easily detected by the appearance of scars on the fleshy underwings. Second matings were detected by recording the shape of the chewed wings and examining non-virgins each night to check for either loss of wing material or a change in the shape of the scar.

Results and Discussion

Geographic distribution. *C. strepitans* is restricted to the Rocky Mountains being found in high altitude sagebrush-forest areas from southern Colorado to northwestern Wyoming (Morris and Gwynne 1978). During May and June 1979 and 1980 the habitats and geographical distribution were determined for the species within Grand Teton and Yellowstone Park. Figure 1 shows its range which was extended during 1980 to two localities in Montana just north of West Yellowstone. The species is found in both open sagebrush areas and in conifer forest. At the west entrance to Yellowstone Park, for example, it is very common in the pine forest.

Reproductive biology. Figure 2 shows the decrease in the percentage of virgin males from the end of May to the end of June 1980. Four samples

Cyphoderris strepitans 1980

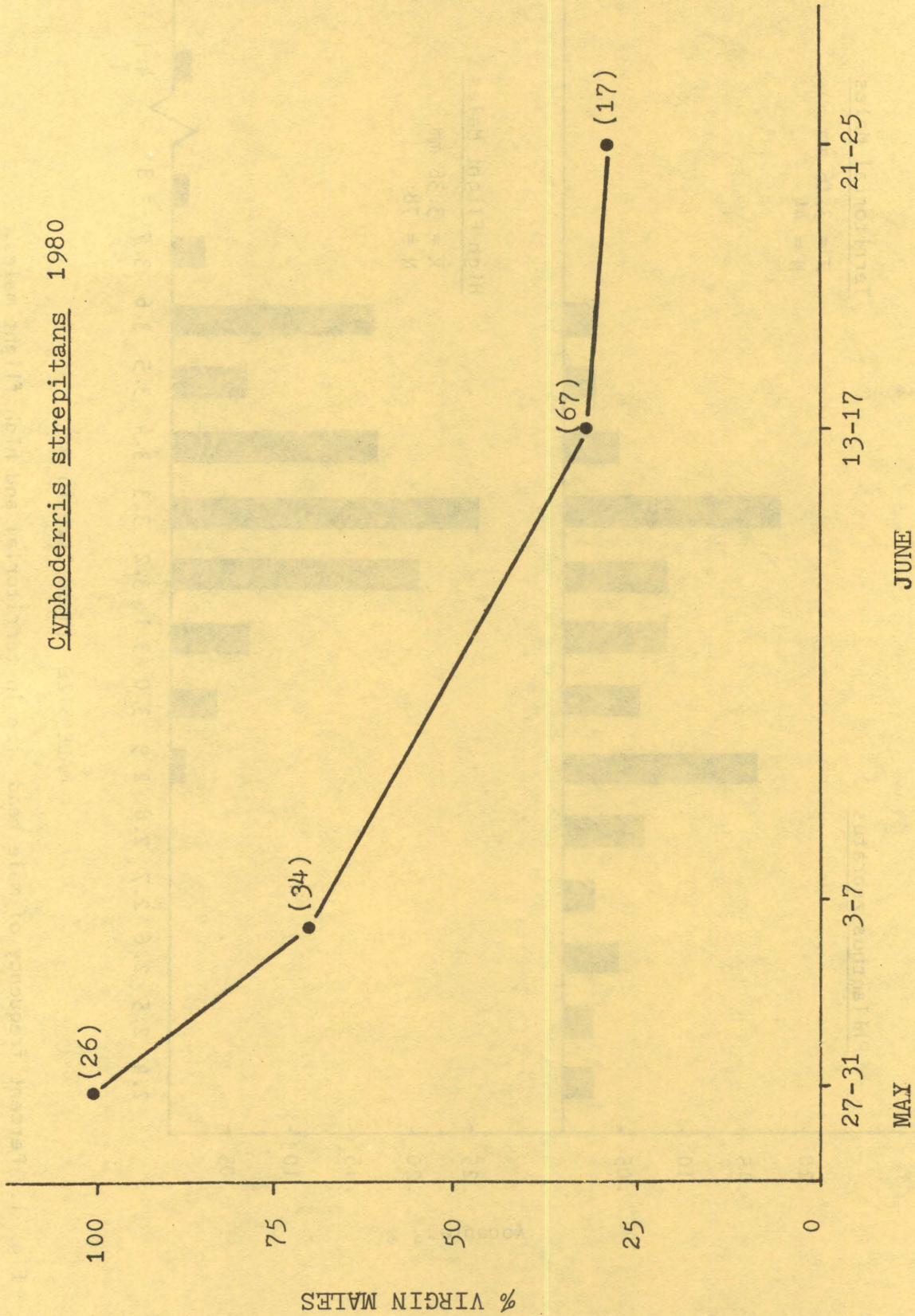


Fig. 2. Decline in the number of virgin males during 1980

of four days each are included in fig. 2. Each point in the figure represents a sample of different males. There were 100% virgin males at the beginning of the study and this decreased to about 25% by the time the study was terminated. Most of the mating occurred during the first 10 days of June. It is likely that very few virgins would remain after the beginning of July. The rapid decrease in the number of virgins in the population is no doubt a result of the fact that virgins mate more frequently than non-virgins (Gwynne and Morris 1979).

Figure 2 indicates that, as predicted, there is a low variance in male reproductive success; most males do obtain copulations. Usually males mate only once. Most of the original 80 males marked were not located again. This is likely to be a result of the long distances males can move in 24 hrs (Morris and Gwynne unpublished). During 1980 records were obtained for matings of 35 males. In the one month of study 31 were noted to have mated once and 4 twice. There was no evidence of triple matings.

Literature Cited

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