SEX AND THE ALTITUDE OF FLIGHT IN CYCLOCEPHALA

(Coleoptera: Scarabaeidae)[1]

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Several years ago (1941) I published in these *Transactions* a short discussion of the two beetles, *Cyclocephala immaculata* (Oliv.)[2] and *C. borealis* Arrow, as they occurred one year at Urbana. I had found that these insects were attracted to light traps in the ratio of 10.3 females to 1 male. This was just the reverse of the situation reported by Neiswander (1938) in Ohio, who had worked with *borealis* and found that, over the season, 7 males appeared in his traps to 1 female. Unfortunately, neither paper gave the height of the light traps from the ground.

My traps were suspended from telephone poles over the tops of apple trees at a height of 10 to 12 feet. In correspondence Neiswander informed me that his traps had been operated at a height of about 5 feet, and although his traps were rather low, on occasion he did get more females than males in a single night's collection, but that the sex ratio in recent years would probably run even higher than 7 males to 1 female. It may be that the occasional preponderance of females at the lower levels is due to a weather factor, somewhat similar to that observed by Wellington (1944) in the case of *Culex*.

Also in 1941 there appeared the study by Johnson of his work in Connecticut with *C. borealis*. Johnson, who stated that his traps were placed directly on the ground, found that the ratio of the sexes was 272.6 males to 1 female. He gave a description of the mating habits of the beetles, pointing out that mating takes place at dusk or at night, on or near the ground shortly after emergence from the soil. Hayes (1918) in describing the mating of *immaculata* said that it "takes place in the daytime [dusk?], and in life-history cages was several times observed on the surface of the soil." Ritcher (1944) has stated that the life cycle and biology of the two species are similar.

M. W. Sanderson made light trap collections at Fayetteville, Arkansas, in 1940, 1941 and 1942. His trap was hung between 7 and 8 feet high. He kept a record of all *Cyclocephala*, males and females separately, that were taken each night. The species of *Cyclocephala* collected was *immaculata* (with a very few *robusta* Lec.). In 1940 he operated the trap from June 19 to August 29 and took *Cyclocephala* between June 19 and August 17. In 1941, the only complete season Dr. Sanderson operated the trap, the operating dates were from April 11 to October 31 inclusive and *Cyclocephala* appeared from June 6 to October 1. During 1942 the trap was on from April 4 to August 28, and the beetles were taken between June 8 and August 19. In 1940 the sex ratio was 4.96

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[2] It appears that it may be necessary to call this species *C. tenuicutis* (Casey), as the true *immaculata* is said to be confined to the West Indies (see Arrow, 1947).

males to 1 female, in 1941 it was 3.01 males to 1 female, and in 1942 the ratio was 2.37 males to 1 female. Only the ratio for the complete season of 1941 is shown in the tabulation below.

When considered in relation to the elevation of the traps from the ground, these apparently divergent observations on the sex ratio of *Cyclocephala* in four localities indicate that there is a flight stratification of the sexes.

Thus we have a nice correlation between the height of the light trap and the ratio of males to females taken:

Place	Trap above ground (in feet)	Ratio of sexes		
		Males		Females
Conn....	1	272	to	1
Ohio.....	5	7	to	1
Ark.....	7-8	3	to	1
Ill.....	10-12	1	to	10

It seems from what we know of the habits of these insects that the males begin emerging from the soil in advance of the females. Mating takes place as soon as the females appear near, at, or just above the surface of the ground. It may be that the males ordinarily restrict their flight to within a few feet of the ground in their search for the females, as Johnson (*op. cit.*) has reported that the males "usually fly from 1 to 2 feet above the ground," and also that the males seem more active in the mating behavior. After mating it may be that the females become more active and fly higher in a sort of dispersal flight. As the adults are believed not to feed, it could hardly be a flight to find food. I have checked many of the females taken at the 10-12 foot level, and all were found to be carrying eggs.

It is quite apparent that there is the likelihood of misleading results in the use of light traps for checking on the difference between sexes in altitude of flight where the species is strongly attracted to artificial light. We do not know that the two sexes are attracted equally. Hayes (1925) has noted that, in a related subfamily, the males of *Phyllophaga* are commonly considered to be more abundant at lights than the females. In his study this was found to be true in 19 species, while in 3 species the females were more common at lights than the males. Further, if the sexes were equally attracted to lights, and if there was a stratification in the flight of the sexes, the influence of light traps would upset the stratification to a greater or lesser extent. On the other hand we cannot ignore the distinct differences between these four *Cyclocephala* studies which were based on hundreds of specimens trapped.

We know little about how far these beetles can be attracted by a light. It may be only a short distance, and they may come into the effective range of the light in a hit or miss manner during a somewhat aimless flight.

To summarize, on the basis of four studies involving the use of light traps, there is evidence that (1) male *Cyclocephala* beetles tend to remain near the ground, while (2) the females tend to fly at a higher level, and (3) are probably not attracted to artificial light until some time after mating.

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