

Spittle Insects as Food of Prairie Warblers.—A not uncommon feeding habit of the Northern Prairie Warbler near Bloomington, Indiana,—the rather systematic taking of immature spittle insects of the family Cercopidae—is interesting for several reasons.

In the first place, W. L. McAtee, reporting on the contents of the stomachs of some 80,000 Nearctic birds examined by the United States Biological Survey since 1885, states: "Our records do not show whether any immature Cercopidae . . . are eaten by birds." (McAtee, *Smithsonian Misc. Coll.* 85 [7]: 1-201, 1932.) Although not all suggestive titles listed in *The Zoological Record* since 1932 are available and some papers describing the food of particular species have therefore not been read, no subsequent references to young cercopids eaten by birds have been found.

Of broader interest is the relevance of the feeding habit under discussion to the question of the efficacy of the "spittle" as a protective mechanism. Most people are indirectly familiar with frog-hoppers or spittle bugs as a result of the masses of white froth, inhabited by nymphs and scattered conspicuously over the herbaceous plants on which the insects feed. The function of this exudation is evidently not a matter of agreement. Lutz quotes Kellogg as saying any advantage "is hard even to conjecture." (Lutz, *Field Book of Insects*, p. 78, 1935.) Imms believes the spittle "appears to protect the soft bodies of the nymphs from desiccation while it may also guard them to some extent against predators." (Imms, *Insect Natural History*, p. 206, 1947.) Comstock, on the other hand, says without hesitation: "It is evident that the covering of froth protects the spittle insects from parasites and other enemies." (Comstock, *An Introduction to Entomology*, p. 403, 9th ed., 1949.) As will appear, Comstock's proposition is emphatically not applicable to predation by Prairie Warblers, which rely on the froth to detect the insects' presence and on occasion search for it with considerable persistence.

According to Professor Frank N. Young, the commonest cercopid near Bloomington is the Meadow Spittle Bug, *Philaenus leucophthalmus* (Linn.), and it is probably this species which I have observed being eaten. From May to July spittle bugs abound on the soft plants of the open fields which in greater or lesser degree form part of all Prairie Warbler territories in the area. Where their concentrations are heaviest as many as 100 nymphs may occur within two or three square yards, and one plant may be dotted with several of the characteristic masses of spume.

While my study of the warbler has not yet included prolonged systematic observation of adult feeding habits and food, I would estimate that 15 per cent of the feeding time of the male, somewhat more in the case of the female, is spent foraging among herbaceous plants within three feet of the ground. In some seven or eight instances over a period of four summers I have watched adult warblers of both sexes flying from plant to plant, probing immediately into a mass of spittle, quite obviously eating the insect within, and then moving directly to another mass. The procedure has never extended to more than five or six plants in succession, but there can be no doubt from the behavior of the birds that they were searching for the spittle and, for the moment, specializing in cercopids as food.

This experience suggests either that Comstock is in error insofar as his category "other enemies" includes birds, or that if the production of the froth was originally an adaptation for concealment its value has been to some extent lost through the conditioning of the Prairie Warbler. Perhaps Dr. McAtee would go farther and find in the foregoing facts evidence to support the principle of "predation in proportion to population," which he advances in denial of the effectiveness of protective adaptations (McAtee, *op. cit.*, p. 136).—VAL NOLAN JR., *R. R. 10, N. Fee Lane, Bloomington, Indiana.*