DISCUSSION

THE COURTING FLIGHTS OF TABANIDS

MOST species of insects are represented by both males and females, and normally mating occurs the same as in the higher animals. The males may use any one of several approaches to the act of copulation. Some use the primitive cave man method of manhandling the female without preliminary courtship. Others may stimulate the mating desire in the female by furnishing glandular secretions, probably containing sex hormones, which she eats. Still others lull the female into submission by offering her titbits, with odors, bright colors or with monotonous hypnotic music. The males of the common horseflies or tabanids, seemingly, resort to the use of the musical hum of their wings and their peculiar dizzy courting or hovering flights for attracting the females. Few workers in this country have observed and described these courting flights and the mating of tabanids. Mosier and Snyder[1] observed the early morning courting flights of *Tabanus americanus* in the Florida Everglades in 1917 and 1918. J. S. Hines,[2] in Ohio, observed *Tabanus sulcifrons* in the act of mating between 8 and 9 o'clock in the morning during mid-August. However, he apparently did not observe the courting flights which occur earlier just at daybreak.

During the past summer and early fall, the writer made rather extensive observations on the courting flights of the males of the two species of tabanids, *T. sulcifrons*[3] and *T. giganteus*[3] at Columbia, Missouri. The first species is the medium-sized, brown horsefly so common during the summer and early fall in Missouri. It was first heard and seen hovering in great numbers above elm, walnut and hickory trees in the writer's lawn at 5:30 in the morning of July 27, though it probably began these courting flights prior to that date. Its hum resembled that of drone honeybees or large blowflies, and its flights observed in previous summers were mistaken for those of blowflies. These flights continued until September 2. The flights always began just at daybreak when the light intensity was still only a fraction of one foot-candle and they continued for 20 to 25 minutes and ceased by the time the light intensity reached three to five foot-candles. At no time did the flies hover nearer the ground than 30 feet. Most of them continued to hover at tree-top level, except as they began to disperse, when they would often rise and hover high above the trees for a few minutes. The courting flights included only the males, though the females were always on wing about the lawn and low shrubs. Two males in the act of hovering were taken with a net from the roof of the house. As the summer advanced and the days grew shorter, the flights began later so that by September 1 they did not begin until a few minutes after 6 o'clock. The courting flights of this fly did not occur when the temperature was below 60° F. and they seemed to be confined to scattered rather restricted areas. A number of others here around Columbia reported seeing them during the summer. Just why the males of this species perform these 20-minute courting flights at daybreak when, according to Hines' observations, mating occurs at 8 o'clock in the morning, or the equivalent of 9 o'clock central war time, is difficult to understand. On the other hand, cocks do much of their crowing at this same twilight period. During the courting flight period, females were found to have well-developed eggs, but in no case was copulation observed.

In the fall, as this brown species became less abundant, the larger, dark species, *T. giganteus,* became more abundant. On September 9, several males of this species were seen hovering three to five feet above the writer's lawn and driveway not at daybreak but just at dusk. The courting flights of this species continued for only about a week and the last males were observed on September 15. Three specimens taken with a net on September 9 were males with fully developed testes, and during the courting flight period females were taken repeatedly, but in no case was mating observed. For their courting flights, this species seemed to require more light, as they began soon after 7 o'clock in the evening with a light intensity of about 30 foot-candles and continued for some thirty minutes, ceasing when the light had dropped to an average of about 3 foot-candles. This species would often hover, seemingly without fear, only a few feet from the observer, which made it possible to note their fully distended body, alertness to moving objects, and their tendency to reverse their direction after hovering almost motionless in one spot for several seconds. The pitch of the hum of this species was considerably lower than that of the smaller brown species.

That these peculiar hovering flights of male horseflies have some connection with mating seems certain,

[1] Mosier and Snyder, *Proc. Ent. Soc. Wash.*, 20, 115, 1918.

[2] J. S. Hines, *USDA Bur. Ent. Tech. Ser.*, No. 12, Part III, p. 24, 1906.

[3] Determinations made by Dr. Alan Stone, USDA Bur. Ent. and Plant Quarantine.

but these observations throw little light on just what that connection really is.

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MALARIAL CRYPTOZOITES

THE recent attention which has been directed at the initial stages in the early schizogonic or asexual cycles of malarial parasites has revealed an inadequacy in terminology which it seems desirable now to correct. The stage which initiates this cycle is, of course, the sporozoite which is the end product of the sporogonous cycle in the mosquito. If the theory of Schaudinn were correct that sporozoites enter directly into erythrocytes and transform into trophozoites and schizonts the present terminology would be adequate. However, there is both direct and indirect evidence that this direct entry does not occur, but that development occurs elsewhere in the body before the erythrocytes are invaded. There is the choice of expanding our conceptions of the terms, trophozoite and schizont, to include any such stages in the life-cycle or of proposing a new term for the stages in question. We believe that the latter course is preferable, since the terms, trophozoite and schizont, have become so definitely associated with stages of the malarial parasites which live in erythrocytes.

For the first generation, exoerythrocytic stages of the parasite which develop from sporozoites we propose the name "cryptozoite." This term is chosen because (1) historically these stages remained hidden for a long time and (2) they are even now difficult to demonstrate. The zoological term "cryptozoic," referring to animals which inhabit dark, hidden places is already in use. We suggest that in the use of the new word care should be taken not to apply it specifically to any particular type of parasite falling within the above definition. Different types of cryptozoites might be described as uninucleate cryptozoites, multinucleate cryptozoites, cryptozoic schizonts, etc. Since, by definition, a cryptozoite is an exoerythrocytic stage of the parasite it should be emphasized that the converse is not necessarily true. In fact, it is definitely known that some exoerythrocytic stages arise from erythrocytic parasites. If further investigation should reveal that in some species of malarial parasites there is direct entry of the sporozoite into the erythrocyte it would suffice in describing the schizogonous cycle of such species to indicate that they lacked any cryptozoic stages. Moreover, if the cryptozoites of various species should prove to fall into various types, the procedure followed by Porter[1] in reference to exoerythrocytic stages might be adopted. He indicated that there are at least two types of exoerythrocytic stages, *elongatum*-type and *gallinaceum*-type, according to whether they resembled the predominating exoerythrocytic stages of these two species of *Plasmodium*. We realize that research will need to be done on each species of malarial parasite to determine in each case the length of life, the synchronism, the tissue affinities and the fate of cryptozoites.

[1] R. J. Porter, *Jour. Inf. Dis.*, 71: 14, 1942.

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THE NEPHELINIZED PARAGNEISSES OF THE BANCROFT REGION, ONTARIO

A TOTAL of more than seven months was spent in the field in the Bancroft-Haliburton region of Ontario in 1941. A detailed geological and topographical map was prepared of the important area of nepheline-bearing rock to the immediate east of Bancroft village; the map is somewhat different from all previous maps of that area. Other areas were examined in varying detail. A great deal of thin section examination was carried out, and many analyses were made.

All the evidence gathered points to a parasedimentary origin for the nepheline-bearing rocks. They are interbanded conformably with a series of Grenville-type micaceous paragneisses and crystalline carbonate rocks. Delineation of the belt of rocks to the east of Bancroft indicates a fold, probably a syncline plunging east, and crossfolded north and south. The central and outer bands, enclosing the nepheline-rich gneisses, are composed dominantly of nepheline-poor and nepheline-free gneisses of great variety. Gradations in nepheline content both along and across the strike were noted. There is crystalline limestone of several degrees of purity around the limbs of the fold, and a good deal of it is to be classed as "flow marble."[1]

Several points indicate that the nepheline came into existence through a process analogous to granitization, differing only in the chemistry of the reactions. Osborne[2] believed that some nepheline rocks were replacements. Also, it is believed that the nephelinization is post-folding, since the flow marble contains fragments of all rocks except those containing nepheline,[1] and the zones richest in nepheline are in the shape of drag folds along the limbs of the major structure which suggest that structural openings localized intense nephelinization.

No evidence of the existence of a nepheline syenite magma was noted except in the case of certain of the nepheline pegmatites, many of which appear to be the result of regeneration of the nepheline of the paragneisses, and others of which may have been sec-

[1] F. Chayes, *Bull. Geol. Soc. Amer.*, LIII, 1942.
[2] F. F. Osborne, *Amer. Jour. Sci.*, XX, 1933.