

CASES OF INTERSPECIFIC "PARASITISM" IN SCARABAEIDAE (COLEOPTERA)¹

HENRY F. HOWDEN

Department of Zoology and Entomology, University of Tennessee

A large number of beetles in the family Scarabaeidae have been classified biologically as dung feeders. In most cases the larvae of these beetles develop on dung provided by the adults. Although the adults of many species may utilize the same dung mass, the methods used to assure the larval food supply are amazingly varied. It is the purpose of this paper to mention some of the parasitic habits of *Aphodius*, one of many genera included in the dung-feeding Scarabaeidae.

Usually the species in *Aphodius* do not "provision" the larvae. In many cases the eggs are deposited deep in the dung mass and the larvae mature, through rapid development, before the mass becomes uninhabitable through desiccation. (See Mohr 1943, p. 283) This is probably the most common method of development in *Aphodius*.

Some digression from the supposed norm evidently occurs in *Aphodius*. In 1869, T. A. Chapman published a paper entitled "*Aphodius porcus*, a cuckoo parasite on *G. stercorarius*," and followed this with a supplementary note in 1870. The title of these papers is intriguing and their content no less so. While observing the activities of several pairs of *Geotrupes stercorarius* (*G. spiniger* according to Main 1917, p. 19) as they constructed their larval cells, Chapman noted an adult specimen of *Aphodius porcus* (Fabr.) entering the egg cavity of the *Geotrupes* cell. After having entered the cell the *Aphodius* destroyed the egg, whether by eating it or not was not definitely ascertained. The *Aphodius* then laid its own eggs, using the food supply furnished by the *Geotrupes* to nourish its own larva.

Subsequent investigators have not added to or confirmed these observations. However, J. Henri Fabre, in his writings on the "Sacred Beetle" (*Scarabaeus sacer* L.) noted that the adults or eggs of other dung beetles were often included in the mass buried by the sacred beetle for its larvae. Fabre states (1918, p. 92, Mattos translation) that while other species damaged this mass, "The evil is worse still with *Aphodius* [*pusillus* Hbst.], whose family hatch, develop and undergo their transformation in the very heart of the provisions. My notes contain descriptions of pears [of the sacred beetle] perforated in every direction, riddled with a multitude of holes that serve for the escape of the tiny dung-worker, a parasite in spite of himself." He mentions that the larva of *S. sacer* may die if the *Aphodius* are numerous,

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but there is no mention of the larvae being killed by the "parasites."

This type of "parasitism" while not commonly noted, seems to occur in some of the North American *Aphodius*. While collecting Scarabaeidae near Interlachen, Florida, on November 17, 1951, the writer found what appeared to be the larval food mass of *Phanaeus* (probably *igneus floridanus* Dols.). *Phanaeus* were common in the area and the dung mass, which was buried 31 inches deep, was the size and shape of the cells usually made by some of the *Phanaeus*, i. e., slightly pear-shaped and 1¼ inches in diameter. When the mass was examined it was found to contain only *Aphodius* larvae. These were placed, along with the dung, in a metal salve box and kept until February 25, 1952, when adults emerged. They proved to be *Aphodius rubeolus* Beauv. It seems highly unlikely that *Aphodius* buried the dung mass, but the method of disposal of the original occupant could not be ascertained. Neither Fabre's observation on *A. pusillus* nor the writer's on *A. rubeolus* indicated deliberate parasitism. Subsequent findings, however, seem to indicate its possibility.

On a recent trip to Texas the writer collected and brought back to Knoxville a number of living *Onthophagus*. Among them there were some *O. medorensis* Brown, which were placed with cow dung in a dirt-filled, 12-inch flower pot, provided with a glass cover. On June 26, the contents of the flower pot were examined and a single dung mass of the *Onthophagus* was found. The mass, which measured 16 mm. long by 10 mm. wide, contained a single egg in a cavity 5 mm. in diameter. The mass with the egg was placed in a metal salve box and examined daily. On June 28, there was no trace of the egg, but an *Aphodius* larva was in the dung mass.

Again on July 5, the flower pot was examined and at that time yielded 4 cells of *O. medorensis*, several adults of *Ataenius* and one of *Aphodius lividus* (Oliv.). All of the cells contained eggs. Each cell was placed in a separate salve box, two of the tins being kept at room temperature and two at a constant temperature of 72°. On July 6 one of the *O. medorensis* eggs held at room temperature hatched. The next day neither the freshly emerged larva nor the other egg kept at room temperature could be found. The dung masses were no longer compact and when examined closely each mass was found to contain a single *Aphodius* larva. These larvae were reared and when they emerged as adults on July 14, proved to be *Aphodius lividus* (Oliv.).

No indication of *Aphodius* larvae or eggs could be found on the surface of two remaining cells. However, on July 8, one of the *Onthophagus* eggs was destroyed by an *Aphodius* larva.

which had been concealed in the center of the dung mass. In the other cell the first stage larva, which had emerged July 9, was killed and almost entirely consumed by an *Aphodius* larva on July 15. In each case the reared adults proved to be *Aphodius lividus*.

Additional information was not obtained, since the *Onthophagus medorensis* adults died without having constructed other cells.

A few conclusions can be reached from the information at hand. *Aphodius* occasionally will develop in dung cells buried by other Scarabaeidae. The *Aphodius* larvae destroy and may consume the eggs or larvae of the host. In the five cases observed, the immature stages of the *Onthophagus* were "parasitized" by single *Aphodius* larvae. Chance inclusion of a single *Aphodius* egg in each of the masses formed by the *Onthophagus* seems unlikely. However, it cannot be said definitely that *Aphodius lividus* (Oliv.) is deliberately "parasitic."

LITERATURE CITED

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STATUS OF THE WHITE-TAILED DEER IN TENNESSEE

VINCENT SCHULTZ

Department of Biostatistics
Johns Hopkins University

The southern white-tailed deer (*Odocoileus v. virginianus* Boddaert) was formerly an abundant game animal in Tennessee. Early writers of the history of Tennessee made frequent reference to the abundance of this animal and its utilization by early settlers and explorers in the state. However, such brief reports are of little value to biologists interested in population densities and histories of extirpation in various regions of Tennessee. Apparently complete information on the past status and history of extirpation of this important game animal is lost forever. The purpose of this paper is to present data on the current status of the white-tailed deer in Tennessee and to attempt to piece together a picture of its history. In recent years a number of northern white-tailed deer (*Odocoileus v. borealis* Miller) have been introduced, thus complicating the classification of present individuals as to subspecies. The location and extent of these introductions will be discussed later in this paper.