# ECOLOGICAL NOTES ON *THANATOPHILUS AMERICANA* L.

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*Thanatophilus americana* L. is a carrion beetle of the family *Silphidae*, tribe *Silphini*, and subgenus *Oiceoptoma* Leach. This species is broadly oval and, like the rest of its tribe, strongly depressed. It is about five-eighths of an inch long. The prothorax is yellow with a central black area, and the rest of the body is black or brownish black. Blackburn (1936) describes the morphology of this beetle in detail, including the sexual dimorphism of the apices of the elytra. The campodeiform larvae are entirely black, very active, have an amazing capacity for food, are cannibalistic when food is scarce. The larvae of *T. americana* and related species have been described by Dorsey (1940).

*T. americana* has some advantages as the subject of field and laboratory studies. First, it is abundant in season and can be easily collected in baited traps. Second, the adults brought in from the field will live for long periods of time under suitable laboratory conditions. Third, the adults will lay eggs in the laboratory, the eggs can be hatched, and the young raised to the imago stage. Finally, Purina Lab Chow can be substituted for decaying meat as a diet for the beetle, thus eliminating offensive odors. The disadvantages are chiefly these: *T. americana* cannot be collected, at least in large numbers, except by rather smelly traps; it is available only during the warmer months; it is a large beetle and thus experiments with large numbers require much space.

In spite of these disadvantages, however, *T. americana* seems to be well adapted to certain types of laboratory work. This paper is intended to introduce *T. americana* to scientific society as a laboratory animal of sorts. Although the collecting of this beetle still involves malodorous bait, the odor is mitigated by fresh, outdoor air. And since the objectionable odors of decaying flesh have been eliminated from the process of maintaining this beetle in the laboratory, *T. americana's* debut may be moderately successful.

## Collecting Methods

Cans sunken into the ground and baited with meat have probably been used from time immemorial for traps. But open cans are subject to the depredations of local carnivores, bait lying loose in the can quickly becomes messy, and rainwater may drown the trapped beetles. Certain precautions will avoid these mishaps. Cans with tight-fitting covers should be selected, preferably gallon paint cans, since the covers can be pried off easily after the cans have been sunk into the ground. A cross-shaped slit should be cut into the lid and the free ends of the triangles thus formed bent slightly inward. The jagged edges thus formed effectively prevent any purloining of the bait but do not interfere with the entry of the beetles. The bait should

be wrapped in gauze, tied with a string, and suspended from a heavy wire bar fastened across the diameter of the can near the top. If the bait is suspended with a bent paper clip, it can be taken out of the trap easily while the catch is being removed. Finally, the can should be located so that rainwater will not drain into it and a sizable hole left under it into which water can drain from holes punched through the bottom of the can. When these precautions are observed, ground traps prove to be very successful. The disadvantages are chiefly the immobility of the traps and the inconvenience of removing the beetles with the hand or long forceps.

More elaborate hanging traps can be constructed which eliminate the necessity of digging holes in the ground, and which can easily be moved from place to place. This provides for easy renewal of the bait, and the beetles can be removed merely by screwing off a glass jar and dumping them into a container. A plan for such a trap has been published by the Chicago Museum of Natural History. A modification of this trap was constructed by a local sheet metal shop in Quincy. Widemouth, self-sealing fruit jars were used. The center of the cap is discarded, leaving a metal ring which will screw onto either a quart or pint jar. The metal rims were soldered to a galvanized metal funnel. Three baffles were soldered to the funnel and screwed to a conical metal roof. A wire cloth capsule for the bait can be inserted easily into the central area of the baffles. This trap has been quite successful. A study of the relative efficiency of the ground and hanging traps and the effect of height will be undertaken during the coming summer.

Decaying fish has been used very successfully in the past as a bait in both ground and hanging traps, but there is a tendency for the bait to dry instead of putrifying in the hanging traps. Plans for testing chemical attractants are being made, since a constant lure would be invaluable in field studies. Dethier (1947) mentions some attractants for the *Nicrophorini* but none for the *Silphini*, except those generally attracting this type of insect.

## Habitat

In the Quincy area, *T. americana* has been trapped in sparsely wooded, humid bottomland and along upland streams in wooded areas which remain moist during the summer. In this area, however, it is impossible to study habitats of flying insects accurately by trapping, since open fields, scantily wooded areas, and dense woods are interspersed and no type of habitat is very extensive.

During July 1947, eighteen days of trapping in the Chicago area yielded interesting results. Traps were placed in a parkland area near a stagnant pond, in oak forest, and in prairie. In the dunes area several traps were scattered through the black oak, cottonwoods, and foredunes. Each of these areas was very extensive, covering many square miles. Thus the catch gives some indication of the species present. The parkland traps yielded 460 *T. americana*, the prairie traps only one pair, and the traps in the oak forest one single specimen. *T. americana* was not found in the dunes area. These collections seem to indicate that *T. americana* is a parkland species, inhabiting open woods or semi-denuded areas where

vater is available. It is absent from ther environments, at least during he summer. At Quincy it has been ollected from similar areas.

*T. laponica* was the only species present on the prairie in numbers nd thus seems to be a prairie spe-ies, having been collected from no ther area. It has not been taken in he Quincy area, a fact in favor of ts being a native of the prairie. *T. naequalis* was abundant in the for-st of oak on upland areas and show-d up in the black oak forest in the lunes area. *T. noveboracensis* was ot notably abundant anywhere, but 27 specimens were taken in forest raps. Observations indicate that his species breeds early in spring. Recently, April 15, 1950, breeding ndividuals were observed on a car-ass in upland woods, and shortly fterwards hundreds of larvae ap-peared. In the spring of 1947 traps vere visited almost daily from April 3 to May 29. *T. americana* appeared ater than the other species and vas not taken at all or only in mall numbers when the night tem-perature fell below about 50°F. Seasonal studies might show an in-eresting avoidance of competition etween these species in terms of abitats and breeding seasons.

## Husbandry

Laboratory observations and ex-periments have indicated the needs of *T. americana* for survival under domestication. Adult beetles will ive for long periods of time in any ype of container if provided with ood and water. The bottom of the ontainer should be covered with ab-sorbent paper or soil. Water may e furnished in small glass dishes. Pieces of gauze or paper should be laced in the dishes so that the beetles can escape drowning by climbing out after falling or crawling into the dishes. Meat (cooked or raw), fish, and Purina Lab Chow have been used successfully for food. For life history studies, paired adults may be kept in wide-mouth fruit jars and covered with the original caps in which screen has been substituted for the removable center. Moist soil, water, and food must be provided. The lack of any of these items will stop egg production. The eggs are deposited in the moist soil in cavities excavated as the beetles burrow through the soil. The necessity of using moist soil usually excludes sifting for the eggs since most available soils do not sift well when moist. The eggs can be recovered by searching through the soil with brush and section lifter.

The eggs are large and cream-colored and enclosed in a pliable but tough outer cover. They will hatch successfully if placed in petri dishes on moist pieces of paper towel. The eggs quickly swell to about twice the size of a newly laid egg. If they are not kept moist they quickly dry and shrivel up. In this connection it is interesting to note that the adult beetles will not oviposit in dry soil, as shown by an experiment involving about four dozen pairs of *T. americana*. All of 409 eggs, laid over a period of two weeks, were laid in moist soil, although dry soil was equally available and convenient.

The larvae can also be maintained in petri dishes, but a wad of wet gauze to supply water and food must be added. During the third instar the larvae eat for the first few days and then become extremely restless unless placed in a container of moist soil where they hollow out a cell within which they pupate. The soil must be kept moist in order to insure suc-

cessful pupation and ecdysis. This latter point has the support of experimental evidence. Of a total of 56 third instar larvae which were ready to construct their earthen cell, 27 were placed in moist containers and 29 in dry containers. Of the 27 in moist containers, 24 pupated, 21 reached the adult stage. Of the 29 individuals placed in dry containers, 6 pupated and 2 reached the adult stage. Thus 77.8% pupated successfully in moist containers and only 6.9% in dry containers.

## Life Cycle

The eggs hatch in from one to four days, the mean time necessary being about three and a half days. The time spent in the first instar varies from less than one day to about three and a half days. The mean time is slightly less than two days. The second instar is very similar in length to the first. The third instar is the longest stage in the development of this beetle. It varies in length from about 8 days to 14 days, the mean being about 11 days. The third instar larvae are very active for a few days, feeding and then constructing their earthen cell. A few days after the cell is complete, they turn over on their backs and become immobile, except for twitching the abdomen. The pupal stage varies in length from 8 to 13 days, the mean time required being about 8 days. The pupae are extremely sensitive to light and mechanical stimulation of any kind. Towards the end of the pupal stage they are less sensitive but still react easily to slight jarring and strong light. Hence it is difficult to examine them closely while alive. The pupae are almost pure white at first but soon develop a light brown coloration on spines, appendages, and peripheral areas. The adult beetles are very light in color at first. The elytra are a semi-transparent white whereas the body is a light brown. Full coloration is developed after two or three days. The mean length of time from egg to adult is about 26 days and varies from 25 to 27. These studies of the life cycle were carried out at a constant temperature of 25°C. They will be described in greater detail in another paper.

## Discussion

The study of the complete ecology of *T. americana* and its relatives promises to reveal interesting interspecific adjustments. *T. americana* and probably also other species can be used in the laboratory for the study of the effect of temperature and food on the rate of development. Since this beetle will eat and do well on an artificial diet its nutritional requirements can be studied in detail. The adults are not overly sensitive to handling and thus make good subjects for behavior studies. Exploratory work along this latter line has been done. It must be said, however, that the usefulness of *T. americana* as a laboratory animal is still to be proved.

## REFERENCES

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