ORIENTATION OF CARRION BEETLES TO CARRION BURIED UNDER SHALLOW LAYERS OF SAND (COLEOPTERA: SILPHIDAE)[1]

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ABSTRACT: Experiments were conducted to determine if *Oiceoptoma noveboracense* and other carrion beetles were able to orient to carrion under shallow layers of sand. Six baited traps were set with carrion buried as follows: 2 under 1 cm, 2 under 3 cm, and 2 under 5 cm of sand. Eighty-seven % of 68 *O. noveboracense* was taken in the 1 cm traps, 13% in the 3 cm traps, but no individuals were taken in the 5 cm traps. Fourteen other silphids also were taken in the 1 cm traps. The ability of carrion beetles to orient to carrion under shallow layers of sand was limited to depths of 1 cm and 3 cm. The possible forensic value of using carrion beetles to locate hastily-buried carcasses, including human cadavers, seems to be quite limited.

In a recent paper Shubeck & Blank (1982) reported on carrion beetles attracted to buried fetal pig carrion in Maryland. They found that pig carrion under 1 cm of sand was not more difficult for *Necrophila americana* (L.) and other silphids, to locate than was exposed carrion. Carrion under 2 and 3 cm of sand was more difficult for them to locate, and carrion under 4 cm of sand was virtually impossible for *N. americana* and other silphids to locate. Payne (1968) had earlier reported that pig carrion buried in boxes at depths from 50 cm to 100 cm, in clay soil, had not attracted carrion beetles.

Because of the surprising results in the Maryland study (limited ability by carrion beetles to locate carrion under shallow layers of sand) it was decided that additional experiments should be conducted at considerable distance from the original site with other populations of Silphidae to confirm (or minimize) the earlier findings. The present study was conducted in the Great Swamp National Wildlife Refuge (GSNWR), Basking Ridge, NJ. The collecting station was located in a red oak forest about 2 km northeast of the original refuge headquarters building.

The purpose of both studies (Maryland and Great Swamp) was to explore the possibility that there might be forensic value in using carrion beetles to locate hastily buried carcasses, including human cadavers.

MATERIALS AND METHODS

The beetles were trapped in six No. 10 food cans (3.78 liter), each of which was suspended from a crosspiece between 2 stakes. These traps have been described elsewhere by Shubeck (1984). They were situated along a north to south line at intervals of 5 meters. Carrion bait in each trap

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consisted of one chicken leg weighing about 90 gms. Chicken legs were used for carrion bait because they are so readily available and because the kind of carrion used seems to be of minor significance to carrion beetles. In a previous study Shubeck (1976) found that only 1 of 5 carrion beetle species studied, *Nicrophorus orbicollis* Say, manifested a significant difference in preference when cold-blooded carrion (fish) and warm-blooded carrion (chicken) was available in respective traps. It is probable, if fact, that the preference for fish (much stronger odor) was related to the nocturnal behavior of *N. orbicollis* when olfactory clues would be more important than visual clues. The other species were diurnal.

Two traps containing chicken legs were buried under 1 cm of sand, two containing chicken legs under 3 cm of sand, and two containing chicken legs under 5 cm of sand. They were arranged so that the first trap, at the north end of the base line, had bait under 1 cm of sand, the second under 3 cm of sand, the third under 5 cm of sand, the fourth under 1 cm, etc. A circular piece of ¼" (0.63 cm) mesh hardware cloth, cut to fit the inner diameter of the trapping can, was placed upon the sand in each can to discourage the beetles from getting under the sand to reach the carrion. By doing this I did not have to disturb the sand in search for trapped beetles when collections were made.

Three tests were run between 25 June and 29 July 1983 to determine if *Oiceoptoma noveboracense* (Forster), and other carrion beetles, were able to orient to carrion under shallow layers of sand. Collections were always initiated 3 days after fresh bait was set and continued until the 11th day. Although collecting was done daily during the first experiment, it was done every second day (because of the small numbers of carrion beetles) during the second and third trials.

RESULTS AND DISCUSSION

The results of field work in GSNWR during the summer of 1983 are shown in Table 1. In order to obtain a graphic view of these results the numbers were converted to percentages, for each trial, and plotted in Figure 1. It is clear from the figure and table that the ability of the carrion beetle *Oiceoptoma noveboracense* to locate carrion under shallow layers of sand is limited. Eighty-seven % of 68 individuals of this species was taken in the 1 cm traps, 13% of the specimens were taken in the 3 cm traps, but not one individual was taken in the 5 cm traps. Fourteen other silphids, representing 5 species - *Oiceoptoma inaequale* (F.) *Necrophila americana* (L.), *Nicrophorus tomentosus* Weber, *Nicrophorus orbicollis* Say, *Nicrophorus pustulatus* Herschel - were also taken (all in the 1 cm traps). The ability of carrion beetles to orient to carrion under shallow layers of sand was limited to depths of 1 and 3 cm.

A gradual decline in numbers of *O. noveboracense* from the end of June

through July was noted. This seasonal decline had previously been observed in GSNWR by Shubeck, Downie, Wenzel, and Peck (1981) and it appears to be a normal seasonal occurrence.

Although the Maryland paper (Shubeck & Blank, 1982) dealt primarily

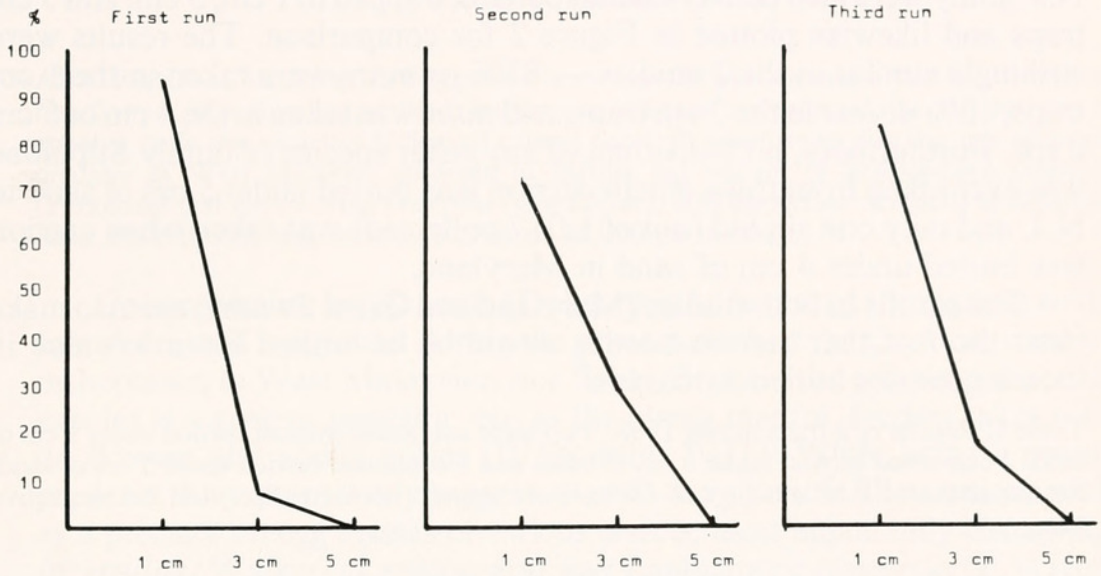

Fig. 1. Results of 3 experiments in 1983. The numbers of *Oiceoptoma noveboracense* are converted to % trapped in 1 cm, 3 cm, and 5 cm traps for each trial.

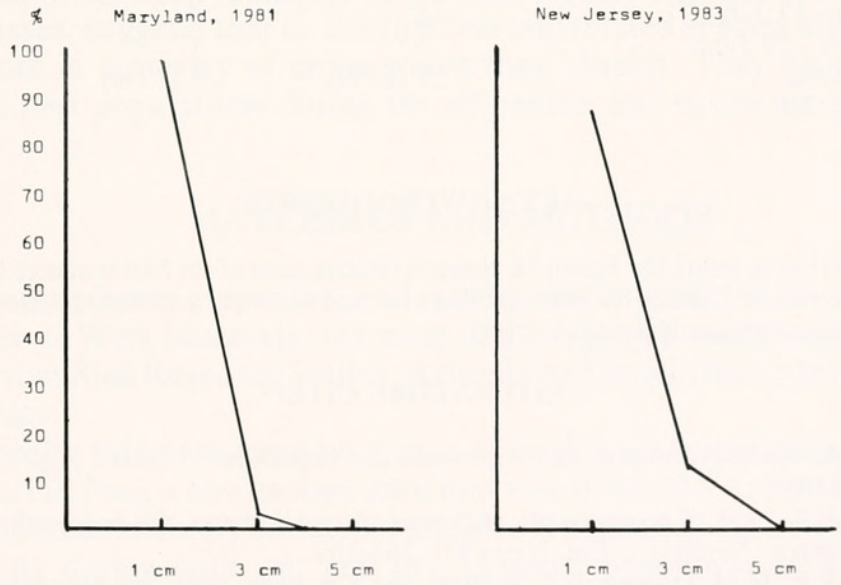

Fig. 2. Total results of experiments conducted in Maryland (1981) and New Jersey (1983). The numbers of *Oiceoptoma noveboracense* are converted to % trapped in 1 cm, 3 cm, and 4 cm traps in Maryland and 1 cm, 3 cm, and 5 cm traps in N.J. throughout entire study periods.

with *N. americana,* data on "other silphids" were also included. By examining the original data sheets I was able to obtain the numbers of *O. noveboracense* that were trapped in 1 cm, 3 cm, and 4 cm traps. A total of 39 individuals (none under 4 cm of sand) was taken and these numbers were converted into percent and plotted in Figure 2. The total numbers from the N.J. study were also converted into percent trapped in 1 cm, 3 cm, and 5 cm traps and likewise plotted in Figure 2 for comparison. The results were strikingly similar in the 2 studies — 87% or *more* were taken in the 1 cm traps, 13% or *less* in the 3 cm traps, and *none* was taken in the 4 cm or 5 cm traps. Furthermore, no individual of any other species of family Silphidae was ever taken from traps where carrion was buried under 5 cm of sand in N.J. and only one silphid (out of 1,017 collected) was taken when carrion was buried under 4 cm of sand in Maryland.

The results in both studies (Maryland and Great Swamp) seem to make clear the fact that carrion beetles would be of limited forensic value in locating hastily buried carcasses.

Table 1. Results of 3 trials during 1983. Two traps contained chicken carrion under 1 cm of sand, 2 contained carrion under 3 cm of sand, and 2 contained carrion under 5 cm of sand. Results show the total numbers of *Oiceoptoma noveboracense* collected in the respective traps.

	Number of *Oiceoptoma noveboracense* collected		
	Sand level		
	1 cm	3 cm	5 cm
25 June - 6 July	41	3	0
6 July - 17 July	13	5	0
18 July - 29 July	5	1	0
Total	59 (87%)	9 (13%)	0

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