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ATTRACTANCY OF TWO BLACK DECOYS AND CO_2 TO TABANIDS (DIPTERA: TABANIDAE)[1 2]

R. H. ROBERTS[3]

Bioenvironmental Insect Control Laboratory, Agric. Res. Serv., Stoneville, Mississippi 38776

ABSTRACT. In comparative studies, a spherical black decoy and a doughnut-shaped black decoy were generally equally attractive to tabanids when used as baits in Malaise traps. Three of ten species did not respond to either decoy. The combination of CO_2 and a black decoy did not increase collection numbers over those collected with CO_2 alone. This would indicate that the two types of attractants, the black object and the CO_2, are sampling the same population.

The attractancy of CO_2 or a black object for tabanids has been recorded by a number of investigators (Wilson et al. 1966; Defoliart and Morris 1967; Knudsen and Rees 1968; Olkowski et al. 1967; Blume et al. 1972; Roberts 1970, 1971; Bracken et al. 1962; Thorsteinson et al. 1966; Hansens et al. 1971). The study reported here was made to compare the relative attractancy of 2 decoy shapes and to determine the effect of combining a decoy with CO_2.

MATERIALS AND METHODS. The decoys used in the study were a 9-inch-diameter plastic ball and a doughnut-shaped decoy made from four 6-inch diameter stove pipe elbows. Both decoys were painted with a shiny black enamel. The CO_2 was used at the rate of 100 ml/min.

Malaise traps (Townes 1962) located on the shoulders of roads in the Delta Experimental Forest, Stoneville, MS, were used to study the relative effectiveness of these attractants. Statistical analysis was based on a randomized latin square design so that over an equivalent number of days each treatment was tested at each trap site. Each collection day was started between 1:00–2:00 p.m. (Central Daylight Time) and terminated the following day between 9:00–10:00 a.m.

Three series of tests were conducted. The 1st series and the 2nd series were both made during the period of seasonally low populations, that is, in August 1970 and 1971, respectively. The 3rd series was made in June 1972 when population levels of the different species were at their peak or were increasing.

The decoys were hung from the trap frame in the opening facing the road about 1 ft below the top of the trap opening. The CO_2 was released on the center pole of the trap about 3 ft above ground level. In the 1st study, the 3 attractants were compared separately. In the 2nd study the comparison was made between the ball decoy, CO_2, and the decoy plus CO_2. In the 3rd study, CO_2 and both decoys with and without CO_2 were compared. In all studies, an unbaited trap was used to determine whether attractancy was present.

All statistical analyses were made on the transformation of the data to log $(X+1)$.

RESULTS AND DISCUSSION. Six of the 11 species collected in the 1st study, 5 of the 12 species collected in the 2nd study, and 9 of the 18 species collected in the 3rd study were present in sufficient numbers for statistical analysis. In addition, total tabanids collected without regard to spe-

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[1] In cooperation with the Delta Branch of the Mississippi Agricultural and Forestry Experiment Station, Stoneville, MS 38776.

[2] Mention of a proprietary product in this paper does not constitute an endorsement of this product by the USDA.

[3] Present address: Insects Affecting Man Research Laboratory, Agric. Res. Serv., USDA, Gainesville, Florida 32604

cies were also analyzed (Tables 1, 2, & 3).

In the 1st study, the 3 attractants significantly increased the total numbers of tabanids collected compared with the unbaited trap. However, there was no significant difference between collections with the 3 attractants. One species, *T. fuscicostatus*, did not respond to any of the attractants. Another species, *C. flavidus*, was attracted only by the CO_2. Collections of *T. subsimilis* were significantly increased by the decoys, but CO_2 was a more effective attractant than either decoy. The analyses of the collections of the other 3 species, *T. lineola, T. proximus,* and *T. sulcifrons*, showed that although the attractants increased these collections compared with the unbaited trap, there was no significant difference between the 3 attractants in numbers collected.

In the 2nd study no additive effect was found when the 2 attractants were combined, i.e., the numbers collected with CO_2 and with CO_2 plus the decoy did not differ statistically, though significantly more tabanids were collected with CO_2 than with the decoy. However, among the 5 species that were analyzed, there was no difference in the collections made with the decoy and with CO_2 except for *T. abdominalis* and *C. flavidus.* In this study as in the 1st, the decoy showed no attractancy for *C. flavidus.*

In the 3rd study as in the 2nd study, there was no significant difference in the numbers of total tabanids or, except for 1 species, in the numbers of each species collected with CO_2 alone or in combination with either decoy. Except for one species, *T. wilsoni,* there was no significant difference between the 2 decoys in the numbers of each species collected. The ball decoy was significantly more effective in attracting *T. wilsoni* than the doughnut decoy. Also, the total tabanids collected with the ball decoy was significantly greater than the total collected with the doughnut decoy. The ball decoy was as effective as the CO_2 bait for all species except *T. abdominalis* and *T. cymatophorus.* Neither decoy significantly increased collections of *T. abdominalis, T. cymatophorus* or *C. flavidus* above the collections in the unbaited traps.

In the first two studies, *T. fuscicostatus* did not respond to either the CO_2 or black object, which is in contrast to a previous study in which CO_2 at 100 ml/min and a black ball both increased collections 3-fold over unbaited traps (Roberts 1975). The one explanation that can be offered at this time is that this species was being sampled at the end of its adult cycle, and the population numbers present in the field were not sufficient for the trap method of sampling to detect a response. In the 3rd study, when field populations were high,

Table 1. Total number of tabanids of each species collected in Malaise traps baited with decoys or CO_2 (females only).

Species	Unbaited	Decoy: Doughnut	Decoy: Ball	CO_2 (100 ml/min)
Tabanus				
fuscicostatus Hine	70a[a]	79a	132a	75a
lineola F.	38a	88b	81b	84b
proximus Walker	17a	71b	85b	103b
subsimilis Bellardi	73a	144b	176b	299c
sulcifrons Macquart	116a	637b	937b	552b
Chrysops				
flavidus Wiedemann	26a	36a	39a	104b
Total tabanids	345a	1088b	1457b	1194b

[a] For each species, numbers followed by the same letter are not significantly different at the .05 level.

Table 2. Total numbers of tabanids of each species collected in Malaise traps baited with indicated attractant (females only).

Species	Unbaited	Ball decoy	CO_2 (100 ml/min)	CO_2 decoy
Tabanus				
abdominalis F.	28a[a]	39a	154b	107b
fuscicostatus Hine	15a	29a	25a	33a
proximus Walker	24a	37ab	68b	70b
sulcifrons Macquart	290a	512ab	689b	1055b
Chrysops				
flavidus Widemann	25a	31a	66b	42ab
Total tabanids	438a	722b	1099c	1406c

[a] For each species, numbers followed by the same letter are not significantly different at the .05 level.

T. fuscicostatus did respond to the black object and to the CO_2.

Bracken et al. (1972), in comparing the attractiveness of decoy silhouettes, found that a horizontal cylinder was almost as effective as a sphere. They concluded that the difference in numbers collected was caused by the fact that reflection from the cylinder was only visible to those flies present in the area perpendicular to the cylinder; all approaches were covered by reflection from a sphere. The present study was conducted to determine whether a cylinder bent into the shape of a doughnut, which in this case was not a true torus but was flexed only at 4 points with straight sections between, would be as effective as a sphere. From the data, those species that were attracted by the ball decoy were equally attracted to the doughnut decoy except for *T. wilsoni* and for all tabanids which were collected in significantly greater numbers with the ball decoy. Three species were not attracted by either decoy. This would indicate that there are probably other species that are not attracted by a black decoy.

The failure of the two types of attrac-

Table 3. Total numbers of tabanids of each species collected in Malaise traps baited with indicated attractant (females only).

Species	Unbaited	Decoy: Ball	Decoy: Doughnut	CO_2 (100 ml/min)	CO_2 +: Ball	CO_2 +: Doughnut
Tabanus						
abdominalis F.	140a[a]	150a	62a	506b	627b	154b
americanus Forster	2a	11ab	24bc	22bc	91c	45c
cymatophorus Osten Sacken	1a	2a	2a	14bc	15c	17b
fuscicostatus Hine	303a	781bc	803ab	1139bc	1394c	1263c
lineola F.	79a	248bc	213b	318bc	356c	356c
proximus Walker	14a	51b	38b	56b	87b	72b
subsimilis Bellardi	123a	411bc	236b	610c	554c	495c
wilsoni Pechuman	49a	143cd	100b	121bc	167d	165cd
Chrysops						
flavidus Wiedemann	41ab	55abc	55a	96c	96c	70bc
Total tabanids	761a	1865c	1592b	2900c	3410c	2667c

[a] For each species, numbers followed by the same letter are not significantly different at the .05 level.

tant, black decoy and CO_2, to show an additive effect may simply indicate a lack of sensitivity in the sampling techniques. However, another valid assumption is that the sphere of influence of the 2 types of attractants is the same. Thus, all the flies in an area would respond, and there would not be 2 separate populations, one reacting only to the visual attractant and the other only to the chemical attractant. The host-seeking female thus seems to be responding to both types of attractant at the same time.

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COMPARATIVE TOLERANCE LEVELS OF BLACK FLY (*SIMULIUM*) LARVAE TO PERMETHRIN (NRDC 143) AND TEMEPHOS

R. C. MUIRHEAD-THOMSON

Zoology Dept., Reading University, and (postal address) Jealotts Hill Research Station, Bracknell, Berkshire, UK

INTRODUCTION. The screening and evaluation of new and more selective larvicides as replacements of DDT are playing an increasingly important part in black fly (*Simulium*) control programs (Chance 1970, Jamnback 1973, Le Berre et al. 1976, WHO, unpublished, Wallace et al. 1973). Despite a wide selection of candidate insecticides available, evaluation of their effect on *Simulium* larvae, as well as on associated non-target invertebrates, has been hampered by the paucity of base-line data of the type which can be provided only by strictly controlled and reproducible laboratory experiments. The great value of a logically phased evaluation scheme, progressing from laboratory through semi-natural to natural field trial, which has characterized the classic studies on fish toxicants (Lennon et al. 1971, Lennon 1973) is very far from being realized in the field of *Simulium* control. Some of the long recognized difficulties in the way of establishing *Simulium* lar-