COLOR OF MALAISE TRAP AND THE COLLECTION OF TABANIDAE [1, 2]

R. H. ROBERTS
Entomology Research Division, Agr. Res. Serv., USDA, Stoneville, Mississippi 38776

ABSTRACT

Malaise traps constructed of gray colored plastic screen, natural colored Saran® screen, and a combination of green and natural colored Saran screen collected significantly different numbers and species of Tabanidae. The trap constructed entirely of natural colored Saran screen trapped the most; that constructed of gray screen trapped the least.

The Malaise trap (Townes, 1962) has been reported as an excellent tool for the collection of flying insects, especially hematophagous Diptera (Smith *et al.,* 1965; Breeland and Pickard, 1965; Easton *et al.,* 1968). Townes stressed that changes in design such as size, shape, baffle arrangement, and color would influence the quantity and relative proportions of the species collected with the trap. The present paper reports the effect of color on the collections of Tabanidae made with three traps, all constructed according to Townes' design.

MATERIALS AND METHODS. Figure 1 is a schematic diagram of the Malaise trap and includes the dimensions of the three traps used in the present test. Trap 3 was the smallest, trap 1 the largest, and trap 2 was just slightly smaller than trap 1. The trap opening on each wall was 2400 square inches in trap 1, 2300 square inches in trap 2, and 1540 square inches in trap 3. The height of the opening from the base was the same in traps 1 and 3 and two inches lower in trap 2.

Trap 1 was constructed locally with new natural colored Saran® screen, which is a pale golden yellow that tends to darken somewhat after several months of exposure to weather.

Trap 2 was loaned by the Reservoir Ecology Branch, TVA, Muscle Shoals, Alabama and is the type used by Breeland and Pickard (1965). The lower half of the internal baffle and the corner panels were made of green colored Saran screen and the roof and the upper half of the internal baffle were made of natural colored Saran screen.

Trap 3 was obtained from the Live-

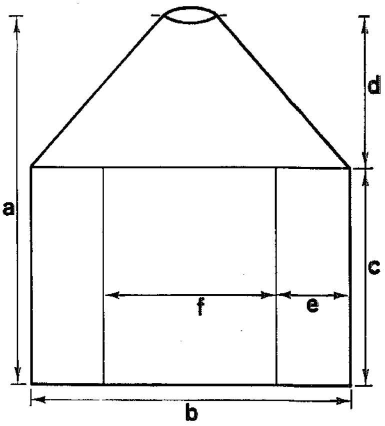

FIG. 1.—A schematic diagram of the Malaise trap and the dimensions (in inches) of the three types used in this study.

Dimension	Trap Type 1	2	3
a	86	83	72
b	76	76	48
c	48	46	48
d	36	32	24
e	13	13	8
f	50	49	32

[1] In cooperation with the Delta Branch of the Mississippi State University Agricultural Experiment Station, State College, Mississippi 39762.

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

stock Insects Laboratory, Kerrville, Texas and is the type used by Easton *et al.*, (1968). This trap was constructed of gray plastic screen (Figs. 2 and 3).

Collections were made for a 24-hour period beginning at 9:30 a.m. Therefore, since a collection period involved two dates, the date when this period ended is used in reference to all collection data.

The first comparison was made between trap types 1 and 3. Two of each type were set up on the banks of a drainage canal in the Delta Experimental Forest in a site design in the shape of a rectangle, 70 by 385 feet, with similar traps at the diagonal corners. The canal bisected the short sides of the rectangle. Collections were made from April 15 to 20.

The second comparison was made between trap types 1 and 2. One trap of each type was set up in a cleared strip about 30 feet wide and 0.1 mile long in the Delta Experimental Forest that separated red gum and cottonwood experimental plots from the forest. The traps were about 200 feet apart. Collections were made from June 27 to 30; then, the positions of the traps were reversed, and collections were made from July 1 to 3.

The third comparison was made between trap types 2 and 3. One trap of each type was set up in the same location used in the second comparison; however, the trap positions were not reversed. Collections were made from July 23 to August 4, except that none were made July 25–27 because of adverse weather.

Results and Discussion. The numbers of each species of Tabanidae collected are shown in Table 1. Trap 3 collected the fewest.

Trap 1 exceeded trap 3 in the numbers collected by a factor of about 100 to 1 and exceeded trap 2 by a factor of 12–15 to 1. Trap 2 exceeded trap 3 by a factor of about 2.5 to 1.

Four species, *L. annulatus, T. americanus, T. equalis,* and *T. mularis,* were

Fig. 2.—Appearance of traps 1 and 3 against background of trapping area. (Trap 1, left; trap 3, right.)

TABLE 1.—Numbers of each species of Tabanidae collected in Malaise traps of three colors (No. 1—natural Saran screen; No. 2—green and natural Saran screen; No. 3—gray plastic screen).

	Numbers collected during indicated period in indicated trap							
	4/15–20		6/27–30		7/1–3 [1]		7/23–8/4 [2]	
Species	1	3	1	2	1	2	2	3
Hybomitra								
lasiophthalma (Macquart)	738	4	..	..	..	..	..	..
Leucotabanus								
annulatus (Say)	..	..	2	0	4	0	7	4
Chlorotabanus								
crepuscularis (Bequaert)	..	..	8	2	9	7	..	..
Tabanus								
abdominalis F.	..	..	129	39	364	28	7	2
americanus Forster	..	..	1	0	..	..	..	..
equalis Hine	..	..	2	0	2	0	..	..
fusciostatus Hine	..	..	562	26	353	13	6	4
lineola F.	..	..	259	10	141	13	8	1
mularis Stone	..	..	2	0	1	0	..	..
proximus Walker	..	..	18	2	32	1	12	0
subsimilus Bellardi	15	3	135	9	130	6	20	8
sulcifrons Macquart	..	..	..	..	..	..	11	5
venustus Osten Sacken	..	..	1	1	1	0	..	..
wilsoni Pechuman	..	..	3	1	4	0	..	..
Chrysops								
flavidus Wiedemann	..	..	35	4	14	0	4	7
TOTAL	753	7	1157	94	1055	68	75	31
Average/trap/day	62.8	0.6	289.2	23.5	351.6	29.3	7.5	3.1

[1] Reversed trap positions.
[2] No collections 7/25, 7/26, and 7/27 due to weather factors.

collected in trap 1, but not in trap 2. These four species, though not rare in the area, are infrequent in collections from bait animals. Only one additional species, *T. proximus,* was obtained from trap 2 when this trap was used with trap 3. Traps 1 and 3 were compared early in the season when only two species of tabanids were collected, but the comparisons between traps 1 and 2 and between traps 2 and 3 indicate that trap 1 would be more efficient than trap 3 in detecting species present in low numbers.

Since the reversal of trap positions in the second comparison (traps 1 and 2) did not result in any distinct differences between locations in numbers collected, positions were not reversed in the third comparison made in the same location.

Each trap type indicates a different relative abundance of tabanid species. Trap location, changes in population levels with time, environmental conditions, variations in numbers collected, and differences in trap attractancy for each species appeared to be some of the factors responsible for the differences noted in relative abundance. Additional study is needed to determine which trap type collection most accurately represents the population parameters.

The Malaise trap operates on the assumption that flying insects blunder or wander into the structure, are stopped by the internal baffle, and work upward into the collection apparatus as they attempt to extricate themselves (Townes, 1962). Then if numbers collected are, in fact, the result of random wandering into the traps, they should correlate with the size of the trap opening. This correlation did not occur. Traps 1 and 2

FIG. 3.—Appearance of Traps 1 and 2 against background of trapping area. (Trap 1, right; trap 2, left.)

had openings of nearly equal size, and both had openings 1.5 times larger than those of trap 3.

The other primary difference between the traps (Fig. 2 and 3) was the degree of contrast between them and the background. When this factor is compared with the collections, the obvious conclusion is that the numbers collected increased with the degree of contrast. However, contrast involves two factors: the difference in color between traps and backgrounds and the difference in light reflectance between traps and backgrounds.

In studies with colored silhouettes, Bracken *et al.* (1962) found that objects must differ from the background in either color or reflectance to be perceived by horse flies. He found that the dark colors—black, blue, and red—were highly attractive and that grays that matched the reflectance of these colors were also attractive. However, attraction to gray decreased with increasing reflectance. Except for one species, those grays that exceeded the reflectance of the background did not attract horse flies.

Measurements of reflected light from the Malaise traps with a Gossen Tri-Lux® footcandle meter gave values of reflectance for the traps that were greater than, equal to, or less than the background readings, depending on the relationship of trap side measured to the angle of incidence of sunlight. Thus, a trap had one side that horse flies would enter regardless of which reflectant level they preferred. Then, entrance into the Malaise trap is governed by the visual perception of the trap color and light reflectance, not by chance. Presumably, other colors could increase the effectiveness of the Malaise trap as a sampling tool for Tabanidae.

References Cited

BRACKEN, G. K., W. HANEC and A. J. THORSTEINSON. 1962. The orientation of horse flies and deer flies (Tabanidae:Diptera). II. The role of some visual factors in the attractiveness of decoy silhouettes. Canadian Jour. of Zoology, 40: 685–695.

BREELAND, S. G. and E. PICKARD. 1965. The Malaise trap—an efficient and unbiased mosquito collected device. Mosq. News, 25(1):19–21.

EASTON, E. R., M. A. PRICE and O. H. GRAHAM. 1968. The collection of biting flies in West Texas with Malaise and animal-baited traps. Mosq. News, 28(3):465–469.

SMITH, G. E., S. G. BREELAND and E. PICKARD. 1965. The Malaise trap—a survey tool in medical entomology. Mosq. News, 25(4):398–400.

TOWNES, H. Design for a Malaise trap. 1962. Proc. Entomol. Soc. Wash., 64(4):253–262.

NON-CHEMICAL METHODS OF MOSQUITO CONTROL FOR PLAYA LAKES IN WEST TEXAS[1]

JOHN C. OWENS, CHARLES R. WARD, ELLIS W. HUDDLESTON AND DONALD ASHDOWN[2]

Entomology Section, Texas Tech University, Lubbock 79409

INTRODUCTION

The High Plains region of West Texas is an area of very gentle slopes with no well-defined watershed patterns. Small wet-weather lakes, known as playa or pluvial lakes, dot this extensive area of 35 thousand square miles at the remarkably uniform rate of 1 per square mile. Playa lakes show great variability in size and depth, ranging from a few yards to a mile in diameter, and from a few inches to 50 feet in depth. They are estimated to receive approximately 89 percent of the runoff water of the High Plains (Clyman and Lotspeich 1966) which, supplemented by excess irrigation "tail water," provides sufficient accumulations of water in the playas to produce more than 70 percent of the mosquito population in the area (Harmston, Schultz, Eads and Menzies 1956). Because of the nuisance and disease problems which arise from the several species of mosquitoes produced in the lakes, local mosquito control officials are forced to use some type of chemical control (Harmston, *et al.* 1956, Smith 1966, and Pigford 1957). Direct application of insecticides to these lakes in mosquito control efforts, coupled with the likely contamination of playa water through the accumulation of agricultural pesticides, has led to much concern about the use of recharge techniques in extending the life of the diminishing underground water supply in the Ogallala formation (Huddleston and Riggs 1965). This associated contamination problem, insecticide resistance possibilities, and the very real need for mosquito control due to the encephalitis problem has led to investigations into the potential use of non-chemical methods of mosquito control in playa lakes.

Various non-chemical methods of control have been proposed and a few have been investigated, including, especially, extensive modifications of the lake basins (Huddleston and Ward 1969). Further discussion of these and other modifications has been published by Hauser (1966). The use of cultural methods of mosquito control on these lakes had not been previously explored. Because of the well-known association of mosquito larvae

[1] Presented in part at the 1969 national meeting of the Entomological Society of America, Chicago, Illinois. Portions of this research were used by John C. Owens in partial fulfillment of the Master of Science degree requirements.

[2] Former Graduate Research Assistant; Assistant Professor; Associate Professor; and Professor, Entomology Section, Texas Tech University, Lubbock 79409.

The work upon which this report is based was supported in part by funds provided by the United States Department of the Interior, Office of Water Resources Research, as authorized under the Water Resources Research Act of 1964.