# THE MALAISE TRAP—AN EFFICIENT AND UNBIASED MOSQUITO COLLECTING DEVICE

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INTRODUCTION. The Tennessee Valley Authority is currently conducting an intensive survey of arthropods of medical importance in connection with the development of a national recreation area between the Cumberland and Tennessee Rivers in western Kentucky and Tennessee. This area, between Barkley and Kentucky Reservoirs, is known as the Land Between the Lakes. Its extensive size (170,000 acres) and remoteness require collecting devices not involving the use of electricity or great expenditure of time in any particular place. The Malaise trap as described by Townes (1962) has been the most useful device employed in this survey. The model being used by TVA was modified by Townes from the original design published by Dr. René Malaise (1937) of Stockholm from which the name "Malaise Trap" was derived.

The trap (Fig. 1), which was exhibited by Dr. Townes at the Seventh Annual Meeting of the Entomological Society of America at Detroit in 1959, is a tent-like structure of fine, weatherproof netting which traps flying insects. Their natural tendency to work upwards when trying to escape leads them into a collecting apparatus at the top of the trap. The trap operates 24 hours a day without attractants or baits and can be emptied at periodic intervals convenient to the collector. For a detailed account of the trap, including plans for its construction, collecting potential, modifications, limitations, etc., the reader is urged to consult Dr. Townes' previously cited paper. Although we conceived using this trap primarily for collecting tabanids, muscoids, and stinging wasps, it has been most surprising as an adult mosquito-collecting device. To our knowledge, it has not been reported as such before, and the purpose of this paper is to share with mosquito workers this unique and highly effective method of obtaining an unbiased sample of the natural mosquito population of an area.

FIG. 1.—Malaise trap in operating position.

MOSQUITO COLLECTION RESULTS. Table 1 shows the performance of six Malaise traps used by TVA during the summer of 1964 in collecting adult mosquitoes as compared to other well known and much used methods (light traps, diurnal resting shelters, and biting collections). To be noted from this table are such observations as: (1) of the 29 species collected by all methods between April 14 and September 15, 1964, 27 are represented in Malaise trap collections (*Aedes grossbecki* and *Psorophora cyanescens* excepted), (2) 6 species (*Ae. atlanticus, Ae. mitchellae, Anopheles barberi, Culex tarsalis, Mansonia perturbans, Toxorhynchites septentrionalis*) were collected in the Malaise trap and by no other methods, (3) 9 species (preceding 6 plus *Ae. trivittatus, A. crucians,* and *P. var-*

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*ipes*) not collected by light trap were collected in Malaise traps, and (4) if certain species highly attracted to light (*Ae. vexans, Uranotaenia sapphirina*) or to diurnal resting shelters (*A. quadrimaculatus, A. punctipennis, C. erraticus*) were evaluated in proper perspective, the Malaise collections would be even more impressive in measuring the overall natural mosquito population.

DISCUSSION. Certain advantages of the Malaise trap to mosquito workers are obvious. The trap will gather elusive species, e.g., in our survey, *Ae. mitchellae, C. tar-*

TABLE 1.—Adult mosquitoes taken in various types of collecting devices, Land Between the Lakes, April 14–September 15, 1964.

| Species | Type and number of collections | | | | | | |
|---|---|---|---|---|---|---|---|
| | Malaise (248) | | Light Trap (214) | | Resting (175) | | Biting (51) |
| | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ | ♀ |
| *Anopheles* | | | | | | | |
| *barberi* | .. | 2 | .. | .. | .. | .. | .. |
| *crucians* | 2 | .. | .. | .. | .. | 1 | .. |
| *punctipennis* | 25 | 89 | 5 | 65 | 250 | 403 | 5 |
| *quadrimaculatus* | 7 | 6 | 7 | 179 | 263 | 681 | 19 |
| *Aedes* | | | | | | | |
| *atlanticus* | 1 | .. | .. | .. | .. | .. | .. |
| *canadensis* | 1 | 22 | 2 | .. | .. | .. | 39 |
| *grossbecki* | .. | .. | .. | .. | .. | .. | 1 |
| *mitchellae* | .. | 2 | .. | .. | .. | .. | .. |
| *sollicitans* | 1 | 2 | 1 | 31 | .. | .. | .. |
| *sticticus* | .. | 3 | .. | 9 | .. | 10 | 11 |
| *triseriatus* | 34 | 39 | 5 | 23 | .. | 2 | 10 |
| *trivittatus* | .. | 1 | .. | .. | .. | .. | 1 |
| *vexans* | 177 | 642 | 282 | 1,653 | .. | 11 | 9 |
| *Culex* | | | | | | | |
| *erraticus* | 42 | 117 | 27 | 744 | 12 | 48 | 4 |
| *pipiens-quinquefasciatus* | 4 | 8 | 23 | 3 | 1 | .. | .. |
| *restuans* | 44 | 199 | 19 | 10 | 1 | 3 | 14 |
| *salinarius* | .. | 4 | .. | 5 | 1 | .. | .. |
| *tarsalis* | .. | 2 | .. | .. | .. | .. | .. |
| *territans* | 22 | 123 | 12 | 12 | 4 | 3 | .. |
| *Mansonia* | | | | | | | |
| *perturbans* | 1 | 2 | .. | .. | .. | .. | .. |
| *Orthopodomyia* | | | | | | | |
| *signifera* | 3 | 13 | .. | 1 | .. | .. | .. |
| *Psorophora* | | | | | | | |
| *ciliata* | 1 | 2 | 1 | 4 | .. | .. | 8 |
| *confinnis* | 10 | 31 | 31 | 127 | .. | 1 | 57 |
| *cyanescens* | .. | .. | .. | 7 | .. | 2 | 7 |
| *discolor* | .. | 1 | 1 | 24 | .. | .. | 4 |
| *ferox* | 5 | 21 | .. | 4 | .. | .. | 2 |
| *varipes* | .. | 2 | .. | .. | .. | .. | 1 |
| *Toxorhynchites* | | | | | | | |
| *septentrionalis* | 1 | 10 | .. | .. | .. | .. | .. |
| *Uranotaenia* | | | | | | | |
| *sapphirina* | 2 | 11 | 25 | 286 | .. | .. | .. |
| Total | 383 | 1,354 | 441 | 3,187 | 532 | 1,165 | 192 |
| No. of species by sex | 19 | 25 | 14 | 18 | 7 | 11 | 16 |
| No. of species, both sexes | 27 | | 19 | | 13 | | 16 |

*salis,* and *T. septentrionalis*. The trap can operate almost anywhere, including places not easily accessible, or where the briefness of favorable weather or the paucity of the fauna would discourage the ordinary collector. It collects efficiently both day and night under variable weather conditions. Only conditions that inhibit mosquito flight would reduce its effectiveness. The operator need not be present except at collecting time, and there is no fear of mechanical failure. Since the trap does not attract, it gives a completely unbiased sample of the mosquito activity. It can be compared to a spider's web into which insects wander as opposed to being attracted. With proper care the specimens collected are in "museum condition."

When one considers that light traps are specific only for those species which are positively phototactic, that diurnal resting stations are designed primarily for permanent pool species which rest during the day, and that biting collections are limited by the type of bait and to females only of those species active at the time of the collection, the potential of the Malaise can be more fully realized.

If we had purposely designed and placed Malaise traps to measure specific segments of the mosquito fauna, as is true of other collecting methods and devices, the results might have been even more astounding. Townes (*ibid.*) speculates on this point and advises against "freezing" the model in its present form and encourages modifications for specific purposes.

In using the Malaise trap, it should be noted that it will capture many insect species related to the interest of the average mosquito worker including a wide variety of nematocerous Diptera and other medically important groups. In fact, Townes (*ibid.*) reports that in southern Michigan more than half of a season's catch from a single trap (estimated at 120,000 specimens) was Diptera. This has been our experience in the present survey.

A word of caution—if you don't want to become a general collector of insects—don't use the Malaise!

SUMMARY. A novel insect collecting device, the Malaise trap, was employed by TVA in an arthropod survey being conducted in its Land Between the Lakes national recreation area under development in western Kentucky and Tennessee during the summer of 1964. Although the intention of using this device was for collecting other insects (tabanids, muscoids, and stinging wasps), it performed most effectively in collecting adult mosquitoes. Out of the 29 species collected in the 170,000-acre area between mid-April and mid-September, 27 were collected in Malaise traps as compared to 19, 13, and 16 species by the well established methods of light traps, resting shelters, and biting, respectively. A table is included which shows detailed results of Malaise trap collections of mosquitoes as compared to these other methods. The advantages of the trap to mosquito workers are discussed in light of the TVA results.

*Literature Cited*

MALAISE, RENÉ. 1937. A new insect trap. Entomologisk Tidskrift 58:148–160.

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