TROPICAL LEPIDOPTERA, 6(1): 5-9

PORTABLE BAIT TRAPS FOR THE STUDY OF BUTTERFLIES

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ABSTRACT.– The construction of two types of bait traps for butterflies is outlined. Suggestions are made for effective baits and trap placement.

KEY WORDS: baits, butterflies, collecting techniques, inventory, tropical.

In the tropics of the world, much more so than in temperate regions, many butterflies derive nutrients from decomposing matter. Because of this, species can readily be attracted to rotting fruit and flesh in bait traps. Bait traps are designed to lure butterflies with aromatic bait into the trap. The trap itself is designed to exploit the escape response of most butterflies to fly upwards. On several trips to the Neotropics, we have noted the general ignorance among lepidopterists of the value and effectiveness of traps for the study of butterflies. This exists despite a number of publications dealing with the construction of traps and their use in collecting and studying numerous taxa which are otherwise difficult to observe or capture (Sevastopulo, 1954; Rydon, 1964; Platt, 1969; Winter, 1980; de la Maza, 1987; DeVries, 1987, 1988; Koehn, 1988; MacDonald and MacDonald, 1988).

We will herein give instructions for the construction of two inexpensive and simple-to-build traps, suggest effective baits, and comment on trap placement.

MATERIALS AND CONSTRUCTION

TRAP DESIGN #1

Materials:

1) two embroidery hoops: 23-30cm (9 or 12 inch size) diameter (obtained from most craft or sewing supply stores).
2) netting: almost any relatively sturdy and durable material will do, such as mosquito netting or even some types of interfacing (obtained from cloth store); some cloth materials will eventually rot or be chewed by insects (roaches, etc.); for long term use (more than 1 year), we suggest a pliable screening (obtained from hardware store).
3) floor: thin wood or plastic, square or circular of the size of the embroidery hoops used (or larger) with four evenly-spaced holes near its edge; scrap plywood, etc. is readily obtainable but may warp in time; plastic is more durable but is subject to cracking with transport and handling.
4) 8 small eye screws: for attachment of cord for floor and hanging (obtained from hardware store).

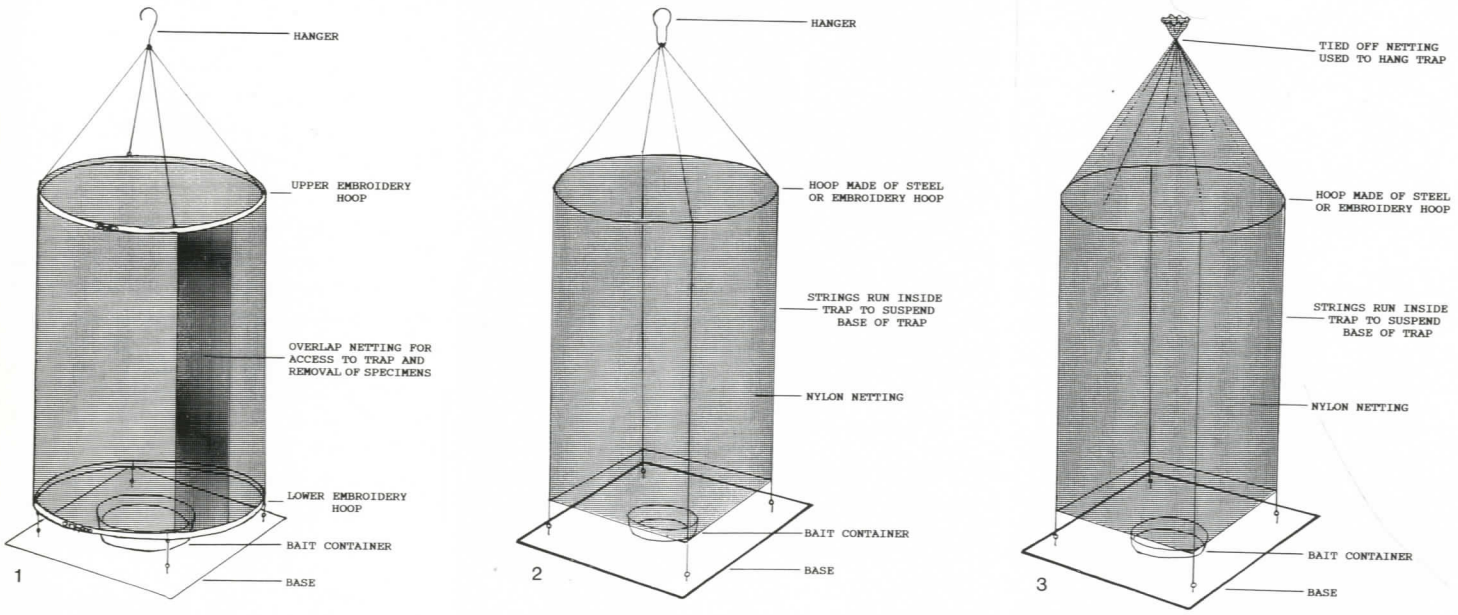

Fig. 1-3. Trap designs: 1) Trap design #1 utilizing two embroidery hoops. 2) Trap design #2 with flat top. 3) Trap design #2 with tied off netting formed into cone-shaped top.

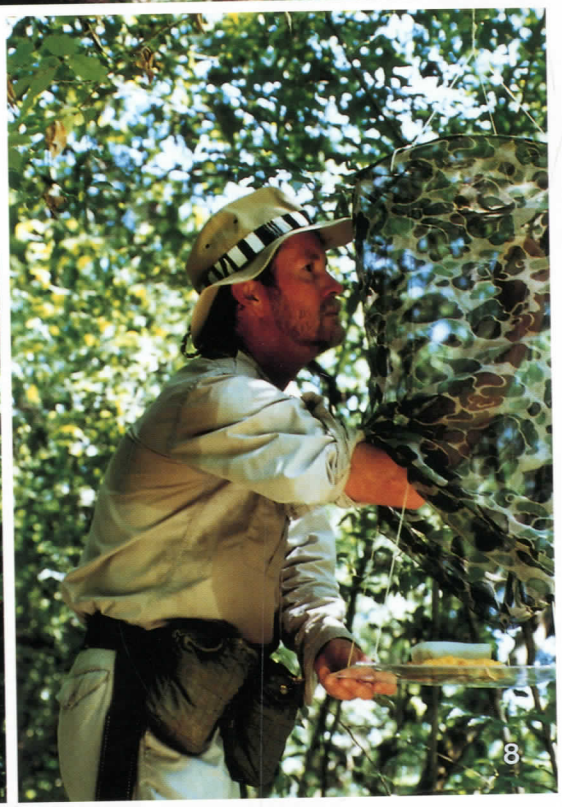

Fig. 4-9. Traps in use: 4) Trap design #1. 5) Trap design #1. 6) Trap design #2. 7) Trap design #2 in black, making it less visible against the forest. 8) Removing specimens from trap design #2. 9) Trap design #2 in camouflage material.

5) cord: nylon or equivalent for attachment of floor, hanger, and for hanging (obtained from hardware store).
6) glue (insoluble in water): for affixing the netting to the embroidery hoops.
7) small (10-15cm diameter) aluminum pie pan: for bait (obtained at grocery store).

Assembly:

1) cut one piece of netting (for side of trap) 60-80cm wide and 15cm longer than circumference of embroidery hoops used.
2) cut second piece of netting (for top of trap) about 5cm larger than hoop.
3) separate the two parts of the hoops.
4) with help, place netting for top of trap over the inner piece of one hoop and the trap side around the outside of the same hoop allowing the ends to overlap.
5) place a string of glue on inner side of the outer piece of the hoop.
6) place the outer piece of the hoop over the inner piece plus the netting for the trap top and side, adjust these as needed and tighten outer piece of the hoop (two people are necessary for this operation also).
7) similarly (but without a top), attach the other hoop to the lower portion of the side.
8) attach four evenly-spaced eye screws each to the upper and lower hoops.
9) tie a piece of cord from one eye screw on the upper hoop to the one on the other side; similarly, tie an equal length piece of cord to the remaining two eye screws.
10) attach a piece of string to each eye screw on the lower hoop and tie these through the holes in the floor leaving a gap of about 5cm between the lower hoop and the floor.
11) when in the field, tie cord for hanging traps to the crossing cords at the top of the trap; the crossing cords may be adjusted individually so that the trap hangs straight.
12) place a pie tin with bait in the center of the trap and hang trap in suitable location (the use of Velcro was suggested to attach the bait tin to the trap floor to prevent its sliding; in use, we found this to be cumbersome as it was difficult to remove the bait cup within the confines of the trap whenever it was necessary to change or add bait).
13) when traps are checked, the trap may be lowered to the ground sufficiently to push the floor up to the lower hoop; specimens are removed between the overlapping ends of trap sides.

This trap design is simple to assemble (15 min. or less) and the components are readily obtainable (at least in the United States). No appreciable escape has been noted which would justify the time and added expense to include an internal cone (e.g., Platt, 1969). The majority of butterflies fly to the top of the trap when they have finished feeding; most losses occur by butterflies flying from the bait directly out of the bottom of the trap, before a cone would be serviceable. By lowering the trap to the ground, there is nowhere for specimens to escape. The overlapping sides allows ease of access without the more "fancy" closures (zippers, Velcro) of other trap designs.

TRAP DESIGN #2

Materials:

1) stiff wire from a coat hanger or similar gauge, wire approximately 90cm long.
2) nylon net material, black or dark green in color.
3) floor: thin wood or plastic. Thin plastic (3 mm) is available in most home supply stores and is easily cut with a hand or power saw. Floor should have sufficient weight to keep trap from swaying severely during storms. Lighter material such as corrugated plastic (like that used in real estate signs) allows trap to swing excessively and cause liquid baits to spill.
4) nylon or rot resistant string.
5) 4 small screw eyes to attach string to base of trap.
6) bait container: any small dish or pan-like container will do. Straight sides spill less than slope-sided containers.
7) metal shower curtain hanger with tension closure to hang trap.

Assembly:

1) bend wire into circle and connect ends. This is easily accomplished by bending ends into a loop and hooking them together. Clamp the loop shut with pliers and wrap with tape. If the wire used will rust, a coat of rust-preventing paint will prolong trap life.
2) for body of trap, cut piece of netting 60-80cm wide and approximately 2.5cm longer than circumference of wire hoop used to shape and suspend trap. Sew lengthwise to produce a "tube" of netting.
3) for the top of the trap, cut a circular piece of netting approximately 2.5cm larger in diameter than the wire hoop you just made. Sew this to one end of the tube of the netting using the extra 2.5cm of diameter to overlap and sew.
4) place wire hoop so it lies at the junction of the top and the trap body. Hand sew in place. Netting across top of trap should be flat. An embroidery hoop may be substituted for the wire ring at the top, eliminating the need to hand sew the wire ring into the trap netting.
5) tie 4 pieces of nylon string to wire hoop and run down the **inside** of the trap body.
6) tie 2 pieces of string in an "x" pattern across top of hoop. Tie together in the center and attach to shower curtain hanger or other similar device to hang trap. The shower curtain hanger allows trap to quickly be attached to a low branch; trap may also be hung as trap design #1.
7) cut material for trap base. Base may be round or square but allow 5-8cm to extend beyond diameter of trap.
8) attach screw eyes to base and attach nylon strings. Leave approximately 4cm of space between the base and bottom edge of trap netting.
9) place bait container in center of trap base. Use a rolled piece of duct tape to attach container to base.

This design is similar to the "hanging trap" described by Rydon (1965) and uses the suspension strings to the base to keep the trap body open. It allows easy access to specimens by reaching in through the bottom of the netting. Unwanted specimens, flies, wasps, etc. may easily be removed by turning the trap inside-out when lifting the netting up over the top of the trap.

The flat top of the trap design is very important to prevent butterflies from damaging themselves when there are many individuals in the trap. Butterflies tend to disperse over the flat surface of the trap and are not likely to damage one another.

A similar and simpler method of constructing trap #2 is to sew

a "net tube" approximately 45-50cm longer than the intended trap body and tie off one end. This forms a conical top above the metal hoop and can even be used to hang the trap (Fig. 3). This modification, however, causes trapped butterflies to concentrate at the peak of the cone. In cases where many butterflies are trapped in a short time or traps are checked infrequently, specimens may become damaged in the tight confines at the top of the trap. In any trap design, specimens should be removed at least once per day (preferably more often) to minimize wing damage.

Escapes from trap design #2 are most likely to occur when reaching inside the trap to remove specimens, causing the net material to be raised as the arm is extended into the trap. Trap netting and suspension strings may be closed around the arm by your free hand to prevent any escape. This, however, may tilt the base of the trap and spill liquid baits.

Trap demensions also influences the chance of escapes and ease of specimen retrieval. Experience suggests that small diameter (30cm or less) and tall (60cm or more) traps reduce escape. Short traps allow easy escape when excited butterflies fly up and down inside the trap. Larger diameter traps allow trapped butterflies more room to outmaneuver the hand or bottle of the collector resulting in more time needed to remove specimens and greater chances of escape or damage.

Care should also be exercised when reaching into traps containing stinging Hymenoptera. Wasps become trapped in the folds of netting and will sting if contacted. Large ants pose similar hazards. Depending upon one's reaction to stings and the species involved, experience has shown that traps can be damaged, bait spilled, and specimens lost in a violent reaction to being stung.

BAITS

Many decomposing materials may be used as bait. These include fruits, meat, fish, feces, and urine. Liquified baits are conveniently carried in plastic bottled-water containers available in many tropical areas; otherwise, plastic bottles may be brought from home. Our impression is that various baits have different effectivenesses at different times and at different locations. Thus various baits should be tried from time to time and at each visit to a new location.

Good baits may be produced rapidly in a warm climate. Fruits (bananas, mangos, etc.) placed in plastic bags in the sun are sufficiently ripe (semi-liquid) in 2-3 days. Similarly, meat (table scraps, dead animals) and fish pieces placed in a closed container (can, plastic bag) with water produce bait in 2-3 days. The fetid water is decanted off into a bottle and used as the bait. Additional water is added to the "starter" for future use. Feces may be placed as is in the trap or, better, putrefied as is meat and fish. For a short trip, bait may be started before leaving home, sealed tightly, and packed in the luggage.

Fruits attract both sexes (Sevastopulo, 1954; Rydon, 1964; DeVries, 1988). Stink bait (putrid meat, fish, feces) appears to attract only males (Sevastopulo, 1954; Rydon, 1964; Mielke, pers. comm.) but in larger numbers and diversity than fruits alone. Use of both in the same trap appears to maximize capture rate. When fruit is placed in a trap along with stink bait, we place the latter in a pie tin and the fruit directly on the trap floor. In Rondônia (Brazil), our observations suggest that rotten fish is immediately attractive and draws an abundance of butterflies and other insects (Orthoptera, Hemiptera as well as Diptera and Hymenoptera) in a relatively short time compared with fruit baits alone. The ideal is to stir or replace bait several times per day to maximize the distribution of volatiles, but replacement once or twice per day gives excellent results and frees the trapper to do other things. Heavy tropical storms can quickly dilute liquid baits and submerge solid baits held in a deep container, greatly diminishing effectiveness. Depending on how frequently the trap is visited and bait is replenished, it may be helpful to fashion a rain shelter to protect the bait. This can easily be done by taping clear plastic (an old plastic bag will do) over the top of the trap. This may or may not affect the vertical dispersal of aromatics.

Rydon (1964), Platt (1969), and Koehn (1988) discussed additional baits which include beer, sugars, and molasses. These and other baits have worked well in other locations but we have not tried them, partially because of our success with rotten fruit and/or flesh. Care should be taken to avoid spilling rotten baits on skin or clothing; the odor of putrid fish can remain for days.

TRAP PLACEMENT

For most work, traps probably do not need to be placed at a great height; 5-10m or less seems sufficient. Traps are hung directly on a branch or by a cord usually over a vine or tree limb where they can be lowered to the ground without interference from other vegetation. The free end of the cord is weighted (fallen pieces of branches are readily available and work well), thrown over the branch, and then tied off to a nearby trunk. We have found it useful to tie off the trap at ground level before raising it to its final height and tying it off a second time. This facilitates the later lowering of the trap with specimens inside. With excess handling of the trap, an occasional trapped butterfly will fly to the bottom and escape before the trap is closed. For traps needed in the canopy, more elaborate methods of stringing lines and hanging traps are necessary. The procedures suggested by Munn (1991) for canopy netting of birds can be modified to suit the needs of the butterfly trapper. The use of petroleum jelly on the line above the trap will repel ants and other crawling nuisances. A length of fishing line between the trap and cord also serves this purpose. Care should be taken to insure that the trap itself does not touch leaves or branches which also serve as avenues of access.

Traps may be placed anywhere in the habitat, usually with good results. If results are poor, a change in bait and/or location are in order. Stink baits may well attract from a broader radius than fruit baits but this needs to be demonstrated. DeVries (1988), using fruit baits in Costa Rica, found differences between traps placed in the understory and those in the canopy. In Brazil, we have taken many species not (or rarely) seen at ground level in traps less than 5m above the ground, including nearly all the genera (and several of the species) that DeVries (1988) found in the canopy, suggesting that strong baits may lure some species out of the canopy. We have the impression that traps lowered to about 1m above the ground in the late afternoon are more likely to trap crepuscular and nocturnal (and often ground-loving) butterflies than those left at higher levels; this needs to be tested with paired traps (see DeVries, 1988).

Different microhabitats and different trap locations have different trappable taxa. Traps placed at the edge of a moderate-

ly-sized light gap in the forest interior appear to attract the greatest diversity, although traps at the forest edge and dark interior often trap additional species.

Consideration should also be given to attracting human attention when placing traps. Black or green netting aids in concealing traps from curious passers-by. The dark material causes the trap to virtually disappear into a dense forest. This, combined with a careful, inconspicuous placement, will prevent disturbance of the trap and its contents. This is more-or-less important depending on where you collect and the nature of the local inhabitants. Experience, however, has shown that in some locations, traps can and will attract attention. Traps have been hacked by machete, blasted by shotguns, chopped down for the string and plastic base, as well as just disappearing. Net material printed in camouflage colors and patterns may also help conceal traps, but unless these colors closely match the background, they may not work as well as all black or dark green.

DISCUSSION

Both traps are designed for use in remote locations where collectors often must carry a day's supply of equipment. Therefore, both designs emphasize light weight, economy, and simplicity of construction and maintenance. Design #2 collapses to about 1-1.5cm thickness when a 3mm plastic base is used. A dozen or more can easily be packed in a suitcase for air travel and their light weight facilitates packing and carrying to and from the field.

The authors have used these two trap designs in many locations where air travel necessitated light-weight, compact equipment. Compared with more complex designs using internal cones or other escape-preventing devices, we feel that any sacrifice in efficiency due to simplicity of design is more than offset by the ability to quickly construct, carry, and deploy a large number of traps. Also, the investment in time and money is minimal so they do not need to be carried home. However, they will endure over a year of use with little damage.

We have captured a wide variety of taxa in Rondônia, Brazil using the above traps and baits. These include not only the "commonly trappable" nymphalid genera (*Prepona, Archaeoprepona, Agrias, Memphis, Catonephele, Panacea, Hamadryas, Doxocopa, Nessaea, Adelpha, Colobura, Caligo, Opsiphanes*) but also some *Morpho*, some satyrines (especially *Taygetis, "Euptychia" antonoe*), occasional dananines (*Lycorea*), and heliconiines (especially *Heliconius doris*), We also trapped certain riodinines (especially *Rhetus*, some *Euselasia*, and others) and numerous, mainly large pyrgine, hesperiids (*Epargyreus, Aguna, Typhedanus, Heronia, Urbanus, Astraptes, Bungalotis, Dyscophyllus, Nascus, Marela, Aethilla, Achlyodes*).

Aside from the use of traps for species inventories, which results in a more complete understanding of the diversity of an area, traps may be used for a variety of other studies. Patterns of vertical stratification were studied by DeVries (1988). Further investigations need to be done using his methods. Traps also have the potential to be used for studies of habitat partitioning, daily and seasonal patterns of activity, longevity and population age structure, dispersal, and possibly population densities using traps set in a grid pattern (e.g., see O'Farrell *et al.*, 1977, and O'Farrell and Austin, 1978, for trap placement configurations used to study rodent populations) and mark-recapture techniques (see Ehrlich and Davidson, 1960, for methods of marking butterflies).

ACKNOWLEDGEMENTS

We wish to thank the many people who have trapped in the Neotropics and have shared their experiences with us and our non-trapping field companions who have, usually quietly, tolerated our often nauseating bait aromas. We especially thank the following: David Ahrenholz who introduced the senior author to stink baits, Olaf Mielke for information on trapping generally, J. D. Turner for his advice, Jim Brock for his enthusiam and assistance in many ways, and Mike Quinn for the photograph in Fig. 8. Ron Gatrelle supplied pertinent literature. Acknowledgement is also given to the late Gordon B. Small, Jr. who introduced the junior author to trapping in the tropics. Finally, we are grateful to the Harald Schmitz family (Cacaulandia, Rondônia, Brazil) for their hospitality, trap storage, and supplying many of the raw materials for our baits.

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