HISTORY AND USE OF THE McPHAIL TRAP

GEORGE C. STEYSKAL
Systematic Entomology Laboratory, IIIBIII, Agr. Res. Serv., USDA

ABSTRACT

The so-called McPhail trap was developed as a household fly trap in Europe before the turn of the century, but it is used in the United States for survey work with fruit flies. An experiment conducted in the Washington, D.C. area shows it to be a promising collector of many kinds of Diptera.

In a book that I purchased in a secondhand store, I noted what I knew as a McPheat trap. The book (Balogh 1968) showed a drawing (Fig. III, p. 482) of a glass trap set on the ground over a class tumbler set into the ground and provided with bait and a rod leading upward into the trap. The trap stood on 3 small integral legs and contained a quantity of liquid. The figure was captioned in German as a "Dahl flytrap (after Koch, 1924)." In the extensive bibliography appended to the book, I found references that led eventually to a paper by Dahl (1896). Dahl claimed therein that his effort to determine quantitatively what kind of insects come to small carrion was the first attempt to combine experiment and statistics in an ethological investigation in nature. He also provided a drawing of his apparatus, here reproduced as Fig. 1, and described its operation as follows (in my translation from German):

"The experiment, which after much feeling around turned out to be especially well adapted to my purpose, is very simple: a dead sparrow was placed, at various times of the year and in various kinds of territory in a glass tumbler set into the ground and a bellshaped glass flytrap placed over it, then at certain defined intervals the capture was removed and determined. The flying insects were captured in the spirits (sp) and the non-flying carrion-feeders, which almost without exception are unable to climb up smooth glass walls, were found in the tumbler. In order to obtain regular and complete catches, it was found that some safety precautions had to be taken. One should write as clearly as possible with a diamond pencil on the bell glass one's name and the remark that a scientific experiment is being made.

The word 'science' (German "Wissenschaft") sounds so good to the German people that its effect never failed, even with youngsters who did not understand it. Instead of the glass stopper, one should place a cork in the top of the bell glass, because deer and cows will remove the glass stopper. Around the edges one should raise a dark wall (w) 2-3 cm high and place a stick extending from the bird carcass into the trap, in order that the flies may not crawl out, but instead as many of them as possible get into the alcohol. The trap should be brought in at least every eighth day, because otherwise the alcohol will become too much evaporated and captured insects decay."

Dr. Paul Arnaud, Jr. has an antique standing on his desk in the California Academy of Sciences, which is nothing more or less than a

fine example of this kind of flytrap. An article in a Washington, D.C. newspaper (Wash. Post, 2 July 1973) showed a photograph of a flytrap of this type and stated that a dealer in the area had imported some of them from Sweden. Thus the trap known in America as the McPhail trap has a long history of domestic use in Europe. As a piece of entomological apparatus, however, its designation with M. McPhail's name seems proper enough.

A trap built on the same principal, but with a screw-top, was used in Italy for work with the Mediterranean fruitfly, Ceratitis capitata Wiedemann. It was described by Costantino (1930), part of whose figure is copied here in Fig. 2.

![Fig. 1-3. 1. Experimental set-up used by Dahl. 1896; 2. trap used by Costantino, 1930; 3. copy of sketch from unpublished report by McPhail, 1934-1935.](image)

The summary of the work on the Mexican fruitfly, Anastrepha ludens (Loew), in Baker, Stone, Plummer, and McPhail (1944) is the only extended account of the early use of a trap of this type by entomologists in America. In that report (p. 84), under the heading "Trapping the Adults," it is stated that "(McPhail) . . . undertook work on traps . . . That which proved most effective is shown in figure 45 (p. 85) and this has been adopted as the standard trap. The first
samples were blown in Mexico, and varied somewhat in size. The standard, however, is now made from a mold. The use of these traps with suitable lure now permits an index of populations and a method of inspection for adults.” In this same work, there is reference to several unpublished USDA reports. In one of them by McPhail (No. 54, 1934-1935), is a sketch (Fig. 3) of the apparatus he used in his early study on attractants and a photograph of the investigator servicing the traps. Mr. McPhail has kindly permitted the use of the photograph here (Fig. 4).

![Fig. 4. M. McPhail servicing fruit fly traps in 1935 (from unpublished USDA report).](image)

In order to obtain some firsthand information on the origin of the traps used by McPhail, I obtained his address in Cuernavaca, Mexico, where he is now living in retirement. In a letter to me, dated 13 October 1972, Mr. McPhail writes “I was browsing around in a glassware shop in Mexico City and found hidden away there 6 of these traps. The owner said they had been imported from Japan. I took the lot and did my first experiment with them. They were made of very thin glass and had 3 short legs—obviously intended for table use. The fact that the trap is called the “McPhail trap” in some localities is due, presumably, to confused reporting after the trap had been distributed by the thousands to several fruitfly operations.”

The first reference to the trap by McPhail’s name is apparently by Newell (1936): “Up to June 1933, wire fruitfly traps, similar to those used during the Mediterranean fruitfly campaign, were used in Key West [Florida]. Although baited with many different materials, their use was negative. On July 1, 1933, about 25 glass McPhail traps were
received. Baited with a fermenting mixture of citrus juice and brown sugar, these traps immediately demonstrated their superiority over the old ones. In September 1933, some hundred additional traps were received at Key West, and subsequent shipments, the last in November 1934, have increased the total number of traps to 500 . . . Traps are not used as a control measure but merely as an indication of the progress of eradication.” Bait is now put in the trap.

The traps continue to be used in fruit fly survey work. For example, thousands have been used in Florida for survey and detection of *Anastrepha* species. During recent work with the Caribbean fruit fly, *Anastrepha suspensa* Loew, a bait of hydrolyzed torula yeast and borax in water was developed (Lopez, Steiner, and Holbrook 1971).

Because I received many very interesting flies captured during the recent work with the Caribbean fruit fly, I became interested in the possibilities of the trap for other than fruit fly surveys. The only purposes is that of Bennett (1972) in which he recounts very successful trapping of euglossine bees with special attractants in British Honduras. I therefore secured a few McPail traps and set them out in my backyard in Bethesda, Maryland, Where they were hung at a height of 6 ft in a flowering dogwood tree, *Cornus florida* L., after I had baited them with 4 pellets of the hydrolyzed torula yeast-borax in water. The results were most gratifying.

The first baiting lasted from 17 to 23 July 1972. The flies captured were skimmed off the liquid, washed in tap water, and preserved in 70% ethyl alcohol, from which they were later removed through cellosolve and xylene and mounted dry. The only records I kept of that run are the specimens of *Gaurax* species (Chloropidae) determined by C. W. Sabrosky:

<table>
<thead>
<tr>
<th>Species</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Gaurax maculicornis</em> Sabrosky</td>
<td>28 females</td>
</tr>
<tr>
<td><em>G. apicalis</em> Malloch</td>
<td>11 females</td>
</tr>
<tr>
<td><em>G. pilosulus</em> Becker</td>
<td>10 females</td>
</tr>
<tr>
<td><em>G. festivus</em> Loew</td>
<td>6 males</td>
</tr>
<tr>
<td><em>G. pallidipipes</em> Malloch</td>
<td>5 females</td>
</tr>
<tr>
<td><em>G. pseudostigma</em> Johnson</td>
<td>5 females</td>
</tr>
<tr>
<td><em>G. melanotum</em> Sabrosky</td>
<td>2 females</td>
</tr>
<tr>
<td><em>G. ocellaris</em> Sabrosky</td>
<td>2 females</td>
</tr>
<tr>
<td><em>G. dorsalis</em> Loew</td>
<td>1 female</td>
</tr>
<tr>
<td><em>G. n. sp. a</em></td>
<td>2 females</td>
</tr>
<tr>
<td><em>G. n. sp. b</em></td>
<td>1 female</td>
</tr>
<tr>
<td><em>G. n. sp. c</em></td>
<td>1 male</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>74 specimens</strong></td>
</tr>
</tbody>
</table>

Twelve species of a genus that I did not even know occurred in the locality, and 3 new species among them!

During 1973, I hung out the trap daily from 15 May to 30 June and from 25 July to 10 September. I brought the catch in every night at dark and reset the trap, using the same bait for an average of 4 days. The following insects were captured:
DIPTERA

Muscoidea

Anthomyiidae 60
Calliphoridae 764
Muscidae 315
Sarcophagidae 764
Acalyptratae
Aulacigastridae 5
Chloropidae 208
Clusiidae 6
Drosophilidae 1244
Lonchaeidae 367
Millyodidae 3
Odiniidae 2
Otitidae 197
Palpopteridae 14
Periscelididae 1
Piophilidae 352
Sphaeroceridae 1
Sepsidae 12
Aschiza
Syrphidae 3
Phoridae 233
Nematocera
Various families 42
HYMENOPTERA 38
OTHER ORDERS 28

The Otitidae included the following species; 173 Delphinia picta (F.), 14 Idana marginata (Say), 7 Pseudoseioptera colon (Loew), 2 Buxesta nitula (Wiedemann), and 1 Pseudoseioptera van (Say). I was not previously aware that Idana marginata and Pseudoseioptera colon were in the neighborhood.

I set out a trap again in 1974 from 4 to 13 June and kept only specimens of Gaurox. In these 10 days with only 1 trap I accumulated 652 specimens of at least a dozen species.

Thus, without experimenting at all with baits other than the pellets used for Anastrepha suspensa and in a suburban residential neighborhood developed several decades earlier from an Appalachian hardwoods containing many Liriodendron tulipfera and Cornus florida, I demonstrated that the McPhail trap can be a valuable collecting tool for certain kinds of Diptera.

LITERATURE CITED


BOOK REVIEW

FIELD PHOTOGRAPHY, BEGINNING AND ADVANCED TECHNIQUES. Alfred A. Blaker. 1976. W. H. Freeman and Co., San Francisco. 451 p. $19.95. This is the book naturalists and field scientists have been hoping for. It actually is 2 books: a hardback text, and a small “paperback” booklet (41 p.) with tables and formulas for field convenience. Blaker, an anthropologist by formal education, was a staff member and then head of the Scientific Photography Laboratory of the Univ. of California, Berkeley. Currently he is Lecturer in Photography for the Univ. of California Extension, at Berkeley. He has written another book dealing with scientific photography, Photography For Scientific Publication. No question of it, Blaker’s book is the single most important book on photography for field science and should be added to personal as well as experiment and field station libraries.

Content is broad, not merely aimed at taking pictures, and includes discussions on lab operation, training, facilities, and staffing; basic photography, scientific accuracy, and composition, as well as a broad treatment of filters (IR, UV, ND, and color balancing), and darkroom procedures; and exposure. Finally, 167 pages are devoted to field subjects and techniques, including the inevitable chapter on field manners (morals). Chapters: climatic problems (temperate zone and extreme conditions); high resolution 35 mm techniques (camera, film processing, and printing); closeup and photomacrography (standard, macro, reversed, retro-focus, and add-on lenses; extension and reversal technique); focal-length variation (telephoto and wideangle), stereo photography, and balanced-ratio flash applications. There are 3 appendices, including one on copying color slides to black-and-white. A number of formulas are included and discussed (e.g. base separation for stereo effects, effective aperture of camera-binocular combinations, calculation of extension for closeup, and 16 more). There are 37 tables, 83 figures, 55 B&W photos, 12 color plates, a bibliography, and index.

When studying this book one knows he is learning from a master. (I noted only one seeming error—on page 123, line 2, if “the product of” is deleted, the verbal expression will agree with the formula on the next page.)

J. E. Lloyd