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## An improved beating tray and aspirator for collecting small arthropods.

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A method for collecting insects from trees and shrubs is described which consists of an improved design of an umbrella held upside down, a beating stick and an aspirator containing ethanol. Some advantages to existing designs are discussed.

### INTRODUCTION

A large number and variety of arthropods live on plants. Particularly the ones on trees and shrubs are easily collected by beating. Several methods have been described and illustrated in literature (BALOGH, 1958; FREEMAN, 1974; JANETSCHKE, 1982; NATON, 1980; PETERSON, 1964; PIECHOCKI, 1966; SOUTHWOOD, 1971; WINKLER & WAGNER, 1913). The classic method is to place an umbrella upside down under a branch, which is then sharply hit by a stick so that the specimens drop off the plant. The animals are collected from the umbrella by an aspirator or «pooter». A variant of the umbrella is the beating tray which is available from several suppliers of entomological equipment. The beating tray consists of a square sheet of cloth or nylon in which triangular pockets, open towards the centre of the square, are sewn on the four corners. Two sticks are inserted into the pockets providing both a handle and a more or less rigid frame. Beating trays in which a removable jar is attached to a central hole are in use for quantitative studies.

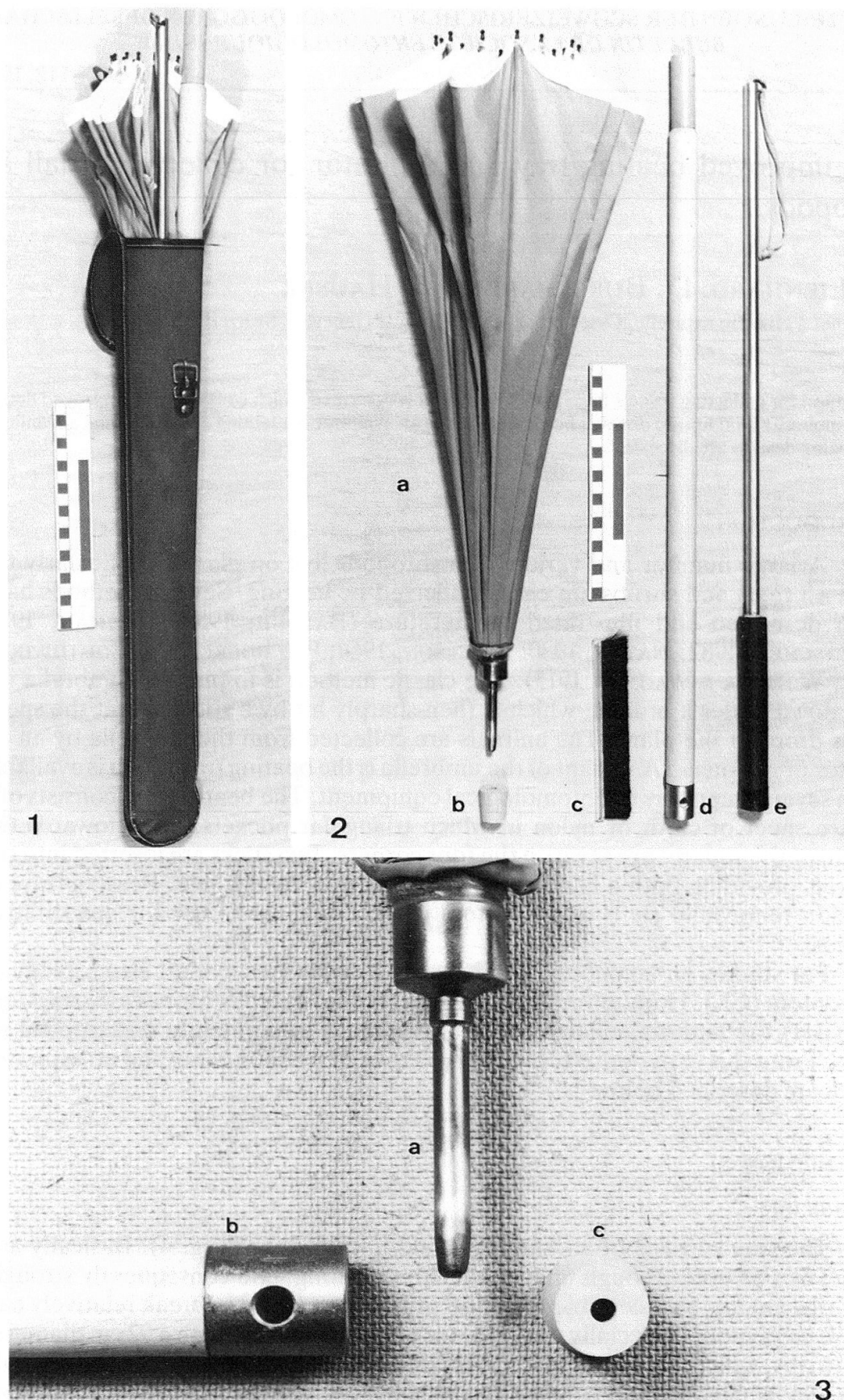
For studies on taxonomy, faunistics and, to a lesser extent, also ecology of Psocoptera (CL), Homoptera: Psylloidea (DB) and microarthropods in caves and soil (BH) the authors collected arthropods, both in temperate and tropical regions. From this experience resulted the design of a beating tray and an aspirator which are described below.

### DESCRIPTION

#### *Beating tray*

The tray consists of an umbrella held upside down (Fig. 4). Basically any model can be used, though umbrellas with very long, and consequently strongly bent ribs are more susceptible to lateral pressure and tend to break relatively easily. We use a model, specially designed for mountaineering, with a 92 cm diameter and 16 ribs, which is covered with a synthetic material of grey colour. It is available from «Sporthaus Witting, Maria-Theresien-Str. 39, A-6020 Innsbruck, Austria».

The original handle of the umbrella is sawn off at a distance of 10 cm from the hook which keeps the umbrella open (Fig. 5). The inner surface is lined with



Figs 1–3: 1. Beating tray, handle and beating stick in case. 2. a. beating tray, b. rubber cone, c. flat brush, d. handle, e. beating stick. 3. a. point of beating tray, b. handle, c. rubber cone. Scale = 20 cm.

a white cotton poplin of a relatively fine texture (Fig. 5). The borders are sewn over the margin of the umbrella to give it more stability (Fig. 4), the centre is reinforced but not fixed to the ribs. The lining is attached to the middle of every second rib, loosely enough to allow an easy closing of the umbrella, but tightly enough to hold it down when open. An iron point of 6 cm is fixed to the tip of the umbrella (Fig. 3a). This point is put into a corresponding hole in a wooden stick of 66 cm length (Figs 2d, 6). This stick, in the following referred to as handle, has its tip reinforced with an iron ring (Fig. 3b). The hole should be just big enough to allow a smooth turning of the umbrella. To prevent the umbrella from becoming detached from the handle a rubber cone with a central hole is stuck over the point (Figs 2b, 3c, 6).

### *Beating stick*

As beating stick (Fig. 2e) we use a 66 cm long stainless steel pipe with an outer and an inner diameter of 1.2 and 0.8 cm respectively. To protect the plant surface while beating, a piece of rubber pipe is put over the apical 18 cm of the stick. A metal ring at the base of the stick bears a lash for holding the stick while collecting specimens from the umbrella.

### *Aspirator*

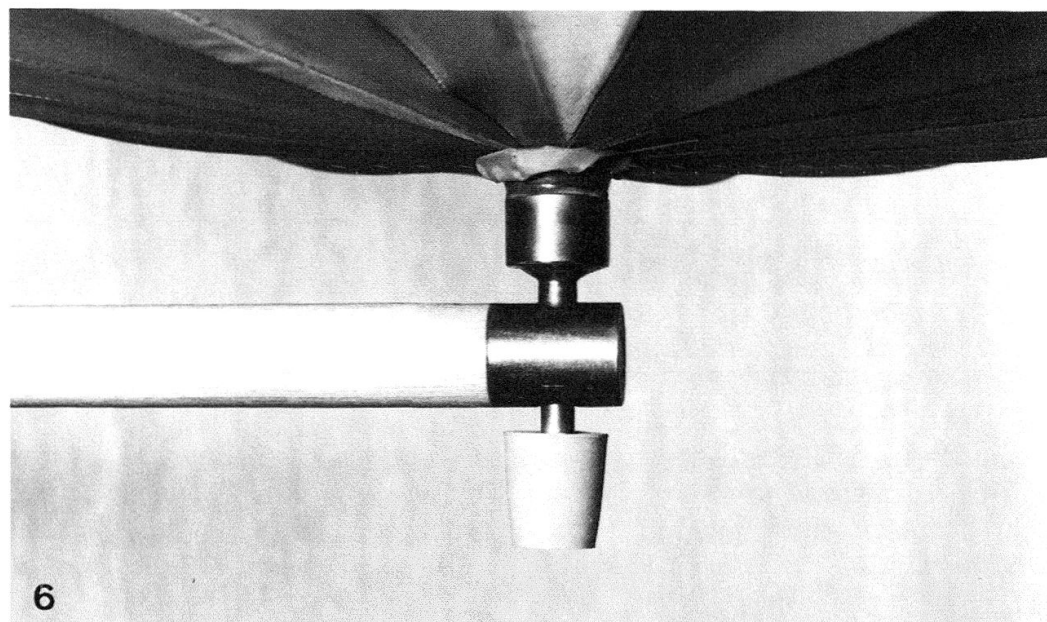
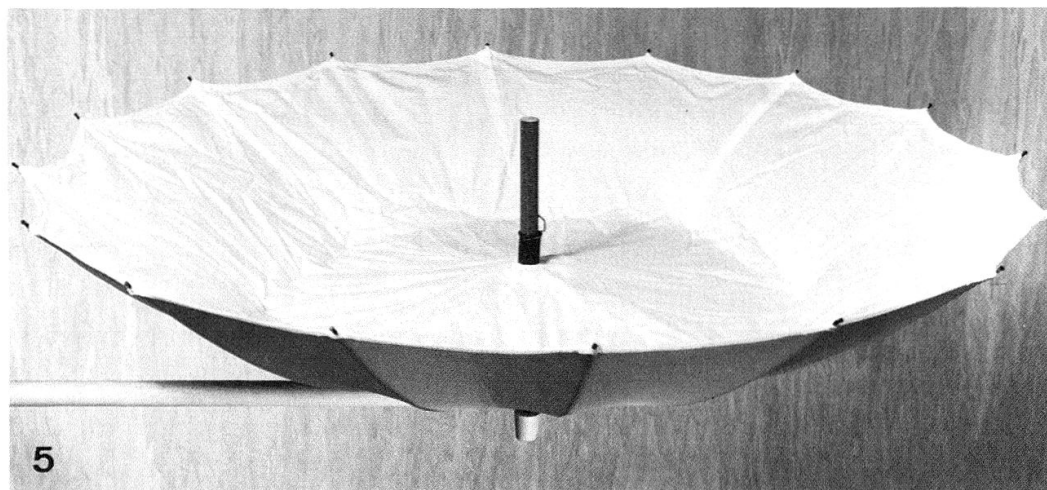
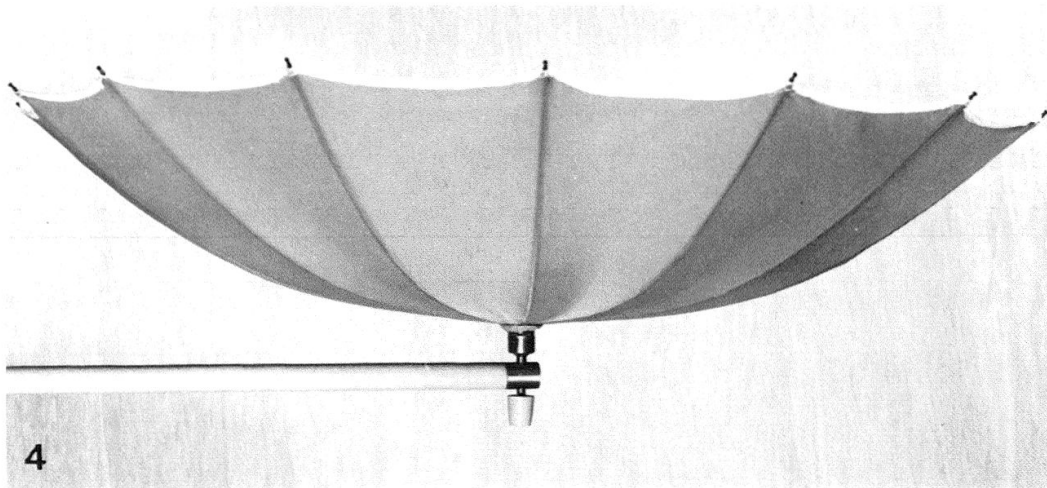
Different types of aspirators are described in literature (cf. introduction). We use the one of SOUTHWOOD (1971) with following modifications (Fig. 7). A 2 cm diameter rubber bung, bears 2 short glass pipes of 0.5 and 0.7 cm outer diameter (Fig. 7b). The thicker pipe is about 6.5 cm long and placed in the rubber bung so that 1 cm sticks out into the glass tube. A flexible, transparent PVC pipe of 20 cm length is attached to the outer end of the wider pipe (Fig. 7c). As specimens may be damaged by the sharp edges of this outer end, the edges should be ground or fired. The narrower glass pipe is 5 cm long and pushed into the rubber bung that the piece in the glass tube ends on level with the bung. This piece is sealed with a plancton gauze, allowing air to pass while small specimens and particles remain in the tube. A rubber or better silicon pipe of 60 cm length is attached to the outer end of the pipe (Fig. 7d). This pipe can be equipped with a mouth piece.

The glass tubes have a diameter of 2 cm and are 10 cm long (Fig. 7a). When collecting the tube contains some 70 % ethanol. Immediate killing of specimens has the advantage of fragile specimens not being damaged by more robust ones. Two points should be respected otherwise collected specimens and ethanol will block the pipes of the aspirator. Not more than about 1 cm of ethanol should be filled in the glass tube. While collecting the aspirator should be held in a more or less vertical position.

While working with the beating tray, it is convenient to wear the aspirator with a ribbon around the neck (Fig. 7e). For collecting in soil and caves only a short pipe without ribbon yielded the best results.

## DISCUSSION

The equipment is particularly designed for qualitative studies where often biotopes, which are inaccessible by car, have to be prospected and where light and handy equipment is vital. When not in use, umbrella, beating stick and handle are put away in a case (Fig. 1) which can be carried in a rucksack.



Figs 4–6: 4. Beating tray, lateral view. 5. Inner surface of beating tray. 6. Detail of point, handle and rubber cone.



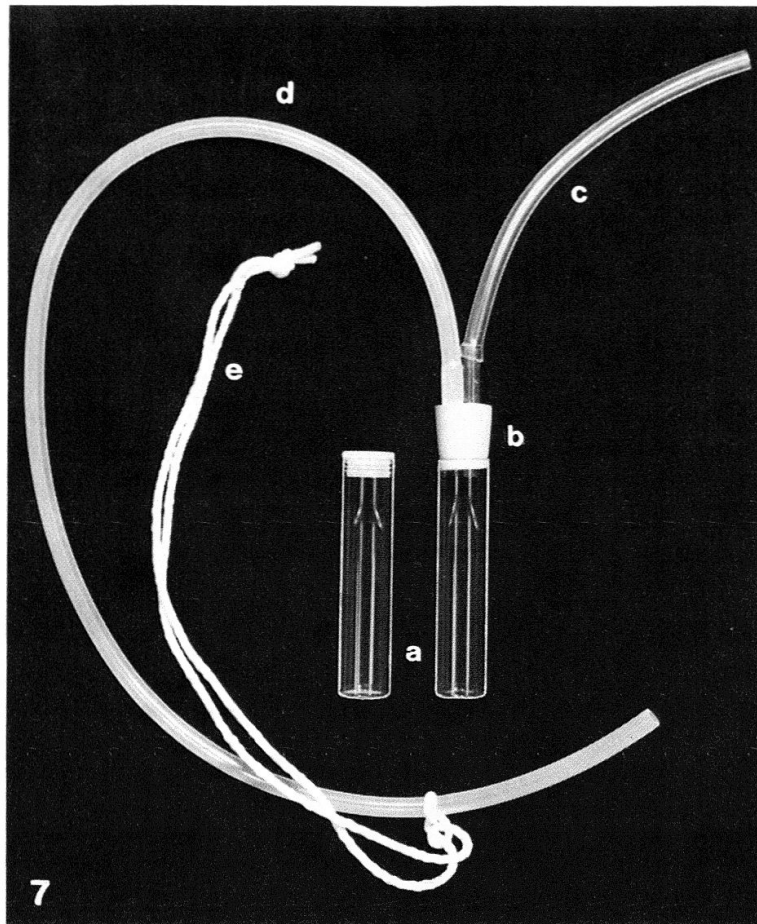


Fig. 7: Aspirator, a. glass tubes, b. rubber bung, c. PVC pipe for aspirating specimens, d. silicon pipe, e. ribbon. (Photographs by G. Dajoz).

Compared to other beating trays the new design has following advantages:

- Even in relatively strong wind collecting can be done thanks to the rigidity of the umbrella and the tight fit of the lining.
- The possibility of rotating the umbrella makes it very easy to collect specimens from any point on the umbrella.
- The long handle under the umbrella allows to reach branches which are relatively inaccessible, e. g. overhanging water.
- Easy and quick opening and closing of the umbrella is convenient in dense woods.
- The beating tray can be used also in its original function as umbrella, when it is stuck (lining downwards) into the PVC collar at the base of the handle. In this position the lining is prevented from getting wet, and it can be used efficiently again as beating tray as soon as it ceases to rain.
- The lining of the beating tray can be easily cleaned with a brush after each sample (e. g. different plants). We use a flat brush of 15 cm length (Fig. 2c). This is particularly important when collecting host plant specific animals.

The beating stick should not be too light and has to be very robust. An aluminium pipe we tried turned out to be unsatisfactory. After using the beating

stick it is hung with its lash to a finger of the hand holding the handle of the beating tray.

Most efficient is the use of two aspirators. One with ethanol for immediate conservation of specimens, and a second one to get live material for breeding. Small pieces of bark, twigs and leaves should be placed in the tube for the live material. The tubes can be easily exchanged for separating samples.

The use of a flexible, not too short pipe to aspirate the insects, and a relatively long pipe leading to the mouth, which is fixed with a ribbon around the neck, help to keep the aspirator at any stage of the manipulations in a more or less vertical position.

A significant application of the aspirator is in collecting microarthropods in caves and soil (e. g. Palpigradida, Pauropoda, small Collembola and mites). Traditional aspirators without ethanol are not satisfactory as preservation of specimens is not guaranteed.

It is very important to use a transparent pipe to aspirate the insects in order to check that no specimens remain in the pipe, and come out only later in another sample. For a good functioning the pipe should be clean and dry. A simple method for drying or cleaning the pipe is to aspirate the free end of a thread to which a small piece of tissue is fixed, and which is then pulled through the pipe.

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