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Simple Traps for Invertebrates

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1 **Abstract**—Four simple traps for dendrobiontic invertebrates and two light traps that attract nonflying (wingless and larval) forms of invertebrates are described. Along with data on phenology, population dynamics, and other aspects of invertebrate biology and ecology, the new traps provide the possibility of revealing migrations of entomophages and economically dangerous species in a timely manner, thereby improving the efficiency of pest population monitoring.

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1 A number of traps for both flying and nonflying invertebrates inhabiting different layers of plant communities have been described to date. In order to protect crops from harmful dendrobiontic insects, catching and sticky bands as well as protective belts made of rags and straw have long been in wide use (Bramson, 1896; Chuvakhin, 1957; Fasulati, 1971; etc.). Other well-known devices include a scraper for removing gypsy
2 moth egg layings (Savkovskii, 1976), a photoeclector for dendrobionts (Vidlicka, 1989), and a number of special traps (Younau and Hain, 1982; Starney and Raff, 1988; etc.). Methods for studying the entomofauna of tree crowns are usually based on visual observations through binoculars, sweeping with a long-handle entomological net, and shaking the insects down on a length of cloth (Plavil'shchikov and Kuznetsov, 1952; Fasulati, 1971; Koch, 1984). In addition, there are descriptions of different mechanical traps for taking samples from three crowns (Menzies and Hagley, 1977; Tsurikov and Tsurikov, 2001), as well as of suction traps for insects (Kennard and Spenser, 1955; Wairhouse, 1980; Holtkamp and Thompson, 1985).

Several types and modifications of traps for dendrobiontic insects were invented in the Galich'ya Gora Nature Reserve (Lipetsk oblast). Four of them are described below. In addition to offering new possibilities in research on phenology, population dynamics, and other aspects of the biology and ecology of dendrobionts, the new traps may be used in agriculture and forestry for promptly revealing migrations of entomophages and harmful species, thereby improving the efficiency of pest population monitoring.

As light traps won popularity among entomologists, a large number of devices of this type were developed. A comprehensive reference list on light traps was compiled by Gornostaev (1984). Since then, several more types and modifications of the traps for luciphilous insects have been invented (Fernander-Ribio, 1985; Löbel, 1987; Holmes, O'Connor, 1988; Barlow, 1989; Tsurikov and Tsurikov, 2001; etc.). However, although the designs of light traps are numerous, most of them are intended for collecting flying insects, while many wingless and larval forms of invertebrates are also attracted by these traps. It is especially for the latter two groups that two light traps described below were
invented and successfully tested. Among nonflying 1
invertebrates found in the traps tested by the author, attention should be paid to predators (Aranei and larval Coleoptera) that were attracted by abundant prey gathering around the light source. However, soil Acari and Collembola accounted for a much greater proportion of
nonflying invertebrates in catches. Evidence that light 1
indeed attracted mites and springtails was obtained in an experiment with several pitfall traps installed 3 m away from the light traps: the abundance of these invertebrates in the former was 4–7.5 times lower. Such a picture was also observed in periods of very high night air temperatures (up to 27°C), when animals usually tend to hide in cooler places. This fact shows that temperature in this case was not the main factor attracting invertebrates.

Trap for Invertebrates Migrating over Tree Branches

The trap is installed on a lateral tree branch, horizontal or sloping (Figs. 1a, 1b). A segment of the branch is wrapped in thin metal foil 30 cm wide (*1*), and the edges of the foil on both sides are affixed to the bark with plasticine (*2*) to make migrating dendrobionts move over its outer surface. Using pieces of wire (3), a funnel (*4*) with a removable plastic container for insects (*5*) is installed under the branch. This trap was initially designed to collect beetles migrating along tree branches: most of them slip from the smooth foil surface and fall into the trap. For example, 22 Coleoptera

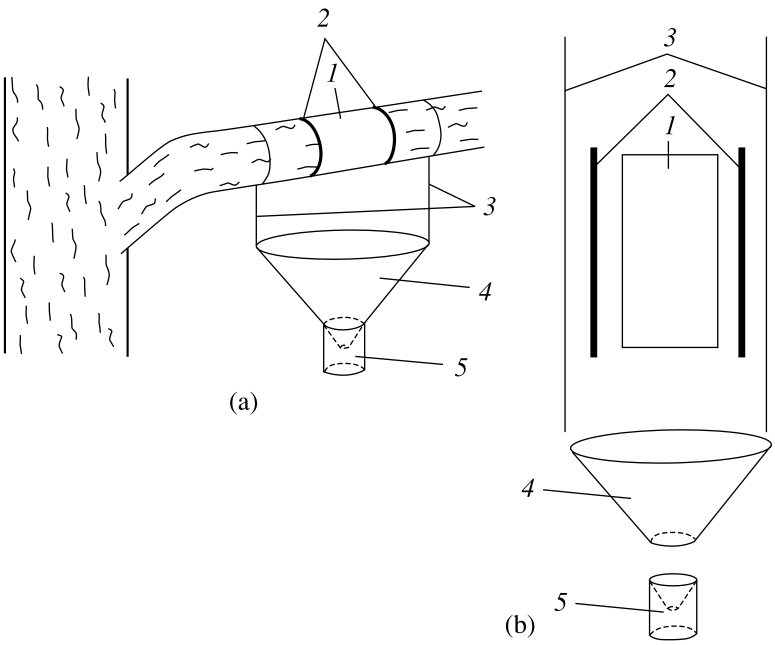

Fig. 1. Trap for invertebrates migrating over tree branches: (a) installed trap, general view, and (b) its components: (*1*) metal foil, (*2*) plasticine, (*3*) wire, (*4*) funnel, and (*5*) plastic container.

species of 12 genera were collected with one such trap set in an oak stand in the Morozova Gora area (Galich'ya Gora Nature Reserve) from April 19 to October 20, 1999. Despite a low catching rate (no more than 19 individuals per day), this trap helped us to collect interesting data on the migrations of several species, including *Calosoma inquisitor* L. (Carabidae) and *Otiorrhynchus scopularis* Hochh. (Curculionidae). In addition, representatives of 11 more orders of invertebrates were collected: Acari, Aranei, Collembola, Psocoptera, Homoptera, Heteroptera, Neuroptera, Raphidioptera, Lepidoptera, Hymenoptera, and Diptera.

Trap for Xylobionts

The trap for xylobionts is intended for studying the species composition of invertebrates living under the bark of trees (Fig. 2a). It is made from a piece of polyethylene film (170 × 200 mm) by folding it in two and welding the resulting layers together as shown in Fig. 2b (dotted lines) with a special appliance or by heating through a transparent infusible lining. The excess of polyethylene film is cut off, the narrow end of the resulting bag is inserted inside it and straightened to form an inverted funnel, and a frame made of thin wire (*2*) is placed in the bag in order to keep its volume constant. The top of the bag is folded and fixed with a paper clip (Fig. 2b). Traps made in this way are installed on the openings of holes drilled in the bark of a dead tree and fixed in place with common pins. Two to four pins driven through the rim of the funnel firmly hold the trap in place even in strong wind, and the material collected is preserved. Insects living under the bark fall into the trap while trying to fly out through the artificial opening. Using several such traps, it is possible to perform comparative studies on xylobiont communities of different tree species. Thus, 12 traps were installed on oak, birch, and willow trees in the Morozova Gora area from May 7 to June 20, 2003, and the catch consisted of 287 individuals representing ten orders of invertebrates: Acari, Aranei, Collembola, Homoptera, Heteroptera, Coleoptera, Neuroptera, Lepidoptera, Hymenoptera, and Diptera.

Sweep Net for Phyllobionts

The net (Figs. 3a, 3b) consists of a ring 1 m in diameter (*1*) fitted with a socket for a handle; a sack (*2*) made of durable fabric (e.g., nylon gauze), 1.5–2 m long; a wooden handle (*3*) 3–5 m long, depending on the height of the tree crown area of interest; and a metal hook (*4*). The sack is sewn to the ring, the handle is placed in the socket so that its end protrudes 150 mm toward the center of the ring and then fastened with a screw, and the hook is attached to the end of the handle (see Figs 3a, 3b).

The net is used as follows. The sack is drawn over a branch, which is then caught with the hook and vigorously shaken several times (thus, as the net is attached to the branch, holding it in place requires no effort). Thereafter, the sack is carefully removed from the branch and spread on the ground to sort out its content.

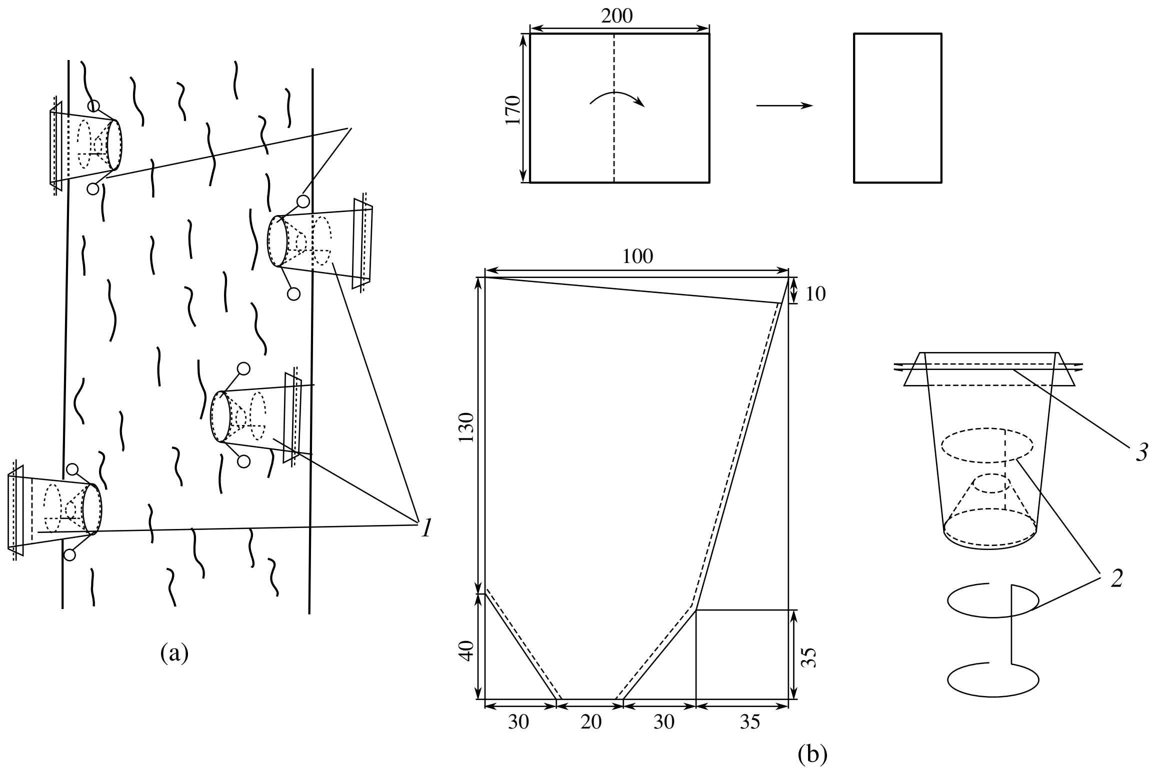

Fig. 2. Trap for xylobionts: (a) installed traps, general view; (b) stages of making the trap: (*1*) trap, (*2*) frame, (*3*) paper clip, and (*4*) pins. Sizes are shown in millimeters.

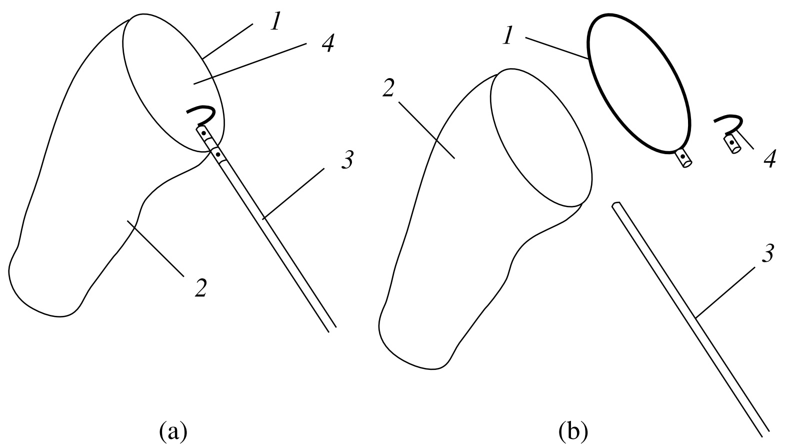

Fig. 3. Sweep net for phyllobionts: (a) general view and (b) components: (*1*) ring, (*2*) sack, (*3*) handle, and (*4*) hook.

Trap for Studying Vertical Distribution of Phyllobionts

The trap (Figs. 4a, 4b) consists of a pole (*1*), three square pieces of glass (*2*), a hook (*3*), and six a-shaped bent nails (*4*). The length of the pole and the size of the glass squares may vary depending on the purposes of the study. In the experimental variant, the pole was 2 m long, and the size of the glass squares was 200 × 200 mm. The hook (the diameter of curvature around 100 mm) is attached to the end of the pole as shown in Fig. 4a. The glass squares are arranged along the pole at equal distances from each other and fixed in place with nails.

The trap is used as follows. Entomological glue or some other glue characterized by low fluidity, slow drying, and good solubility (to allow the removal of insects without damage) is smeared over both sides of the glass squares, and the trap is suspended in the tree crown by the hook. To prevent the trap from falling during gusts of wind, it should be attached to a sufficiently strong

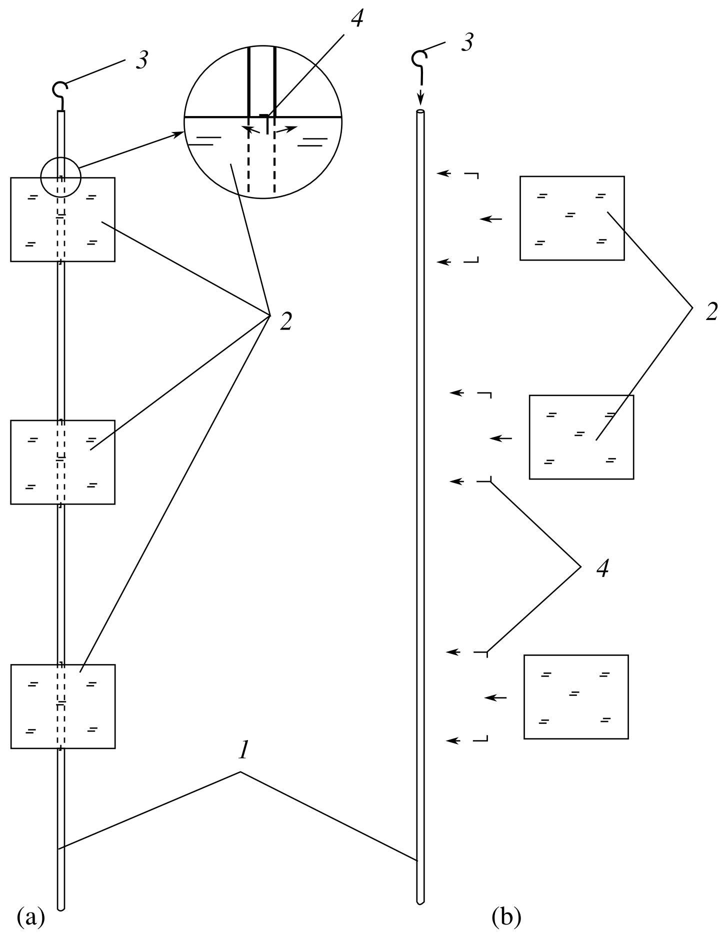

Fig. 4. Trap for studying vertical distribution of phyllobionts: (a) general view and (b) components: (*1*) pole, (*2*) glass squares, (*3*) hook, and (*4*) nails.

and thick branch. At certain intervals, the trap is removed from the tree, and the glass squares are unfastened from the pole (by turning aside the bent parts of the nails) and transferred to the laboratory to study the insects stuck to the glue. It is expedient to have several sets of glass squares in order to perform the study continuously. When phyllobionts inhabiting birch crowns in the Galich'ya Gora Reserve were studied using such traps, noticeable differences in the abundance and species composition of insects collected from the upper and lower glass squares were revealed.

Soil Light Trap

The trap (Figs. 5a, 5b) consists of a shallow but broad glass container (*1*), a reflector (*2*), and a light source (*3*). The container tested by the author was 350 mm in diameter, its height was 100 mm, and its walls were 8 mm thick. The reflector is a sheet-aluminum funnel with the rim of the same diameter as the container and the apex having a socket for a light bulb.

The light trap is installed as follows. A round hole 350 mm in diameter and 400 mm deep is dug into the soil, the reflector with the light bulb directed upward is fixed on the bottom, and the container is placed on it as shown in Fig. 5b. The container should be one-quarter full of water with a few drops of detergent added. The trap is very effective in catching epigeic invertebrates. One of the possible reasons why they move toward the light trap placed below the soil surface is that bright specks of light reflected from the wings of flying insects may attract them. Light scattering by water may be another factor making this trap more attractive to luciphilous insects.

Light Trap for Herpetobionts

The light trap for herpetobionts is designed mainly to catch luciphilous insects that are incapable of flying and do not fall into conventional light traps. The trap (Figs. 6a, 6b) consists of a truncated cone (*1*) made of either sheet metal or plastic, a container (*2*) 90 mm in diameter and 70 mm high for collecting invertebrates, a light bulb (*3)* (100 W in the variant tested), and a socket for the bulb (*4*) with an electrical cord (*5*) and a plug (*6*). The cone should have a broad base (500 mm

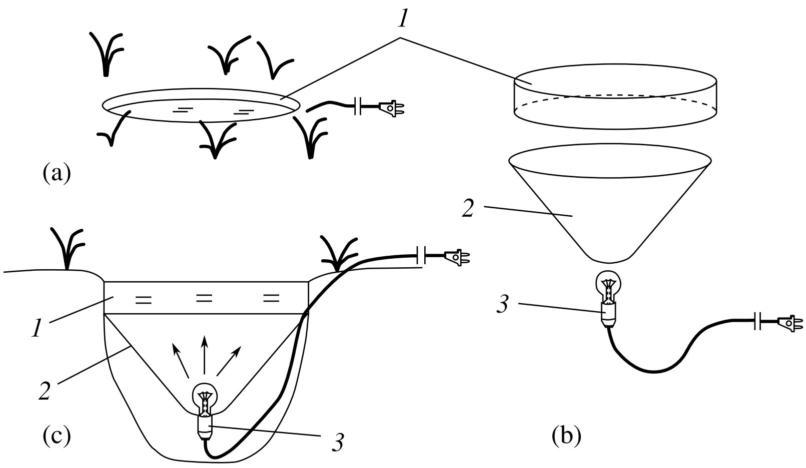

Fig. 5. Soil light trap: (a) installed trap, general view; (b) components; and (c) cross section: (*1*) glass container, (*2*) reflector, and (*3*) light bulb.

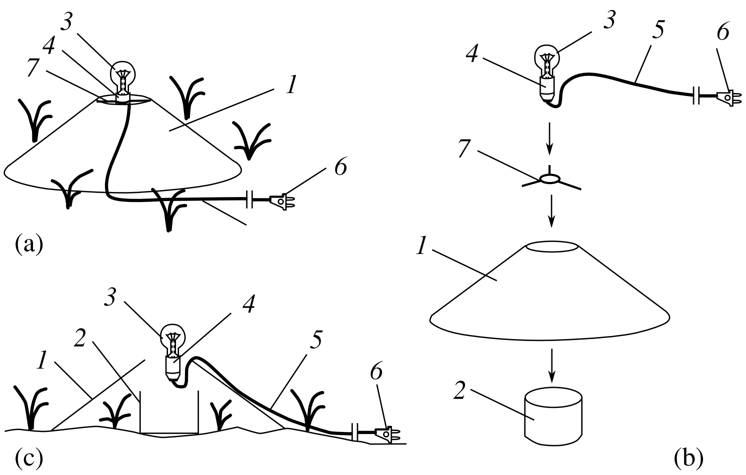

Fig. 6. Light trap for herpetobionts: (a) installed trap, general view; (b) components; and (c) cross section: (*1*) cone, (*2*) container, (*3*) light bulb, (*4*) socket, (*5*) electrical cord, (*6*) plug, and (*7*) holder.

in diameter), small height (100 mm), and an opening 80 mm in diameter on the apex. It should also be fitted with a device (Fig. 6b, *7*) holding the socket vertically so that the bulb extends above the cone. Such a holder can be easily made of wire.

The container is placed on the ground and covered with the cone. The socket is placed in the holder so as to prevent the cord from hanging down to the bottom of the container (Fig. 6b). When the light is turned on, invertebrates move toward the light bulb and fall down in the container through the gap between the edge of the cone and the socket. A major advantage of this design is that the trap can be easily installed on any horizontal surface, including paved and stony areas where a hole for a pitfall trap is very difficult to dig.

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SPELL: 1. nonflying, 2. layings