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INFORMATION LEAFLET

The Multi-Pher® insect trap

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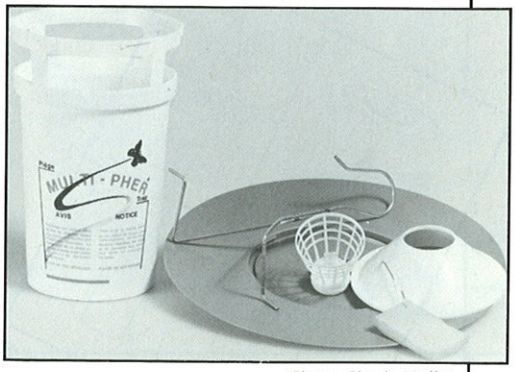
The production of synthetic sex pheromones for several forest and agricultural insect pests and the encapsulation of these pheromones have initiated the development of sex attractant traps. These traps have either a holding container or a sticky material to catch the insects. The container-type, or non-saturating traps, can collect large numbers of specimens of the target species. They are used for detecting, monitoring and, in some cases, mass-trapping of insect pests. The saturating traps contain an adhesive that generally catches only a small number of specimens and are mainly used for detecting the presence of a pest and determining its distribution area.

After the synthesis of the sex pheromone of the spruce budworm (Choristoneura fumiferana [*Clem.*])*, by Weatherston et al. (1971) and Sanders and Weatherston (1976), studies were undertaken to determine which commercially available saturating and non-saturating trap was most effective for detecting and measuring population trends of this major defoliator. Sanders (1978 and 1981), Houseweart et al. (1981), Kendall et al. (1982), Ramaswamy and Cardé (1982) and Allen et al. (1986a) tested a number of sex attractant traps for Lepidoptera, but none was found to be entirely satisfactory.*

Work to develop a multipurpose sex attractant trap began in 1982 in spruce budworm-infested stands. This research led to the commercial production in 1984 of a trap with the trade name Multi-Pher® (Jobin 1986). Tests conducted from 1984 and 1986 in gypsy moth (Lymantria dispar [*L.*])* populations confirmed the Multi-Pher® trap's multipurpose capability as a tool for detecting, monitoring and, in some cases, mass-trapping insect pests. It is also effective as a pitfall trap.*

Description of the Multi-Pher® trap

The Multi-Pher® trap structural components (Figure 1) were designed to permit commercial production of a non-saturating, effective, multipurpose trap (i.e., one that can capture different insect species, is easy to use, and has a low manufacturing cost). Its components are made of UV-resistant plastic.



(Photo: Claude Moffet)

Figure 1. The components of the model-1 Multi-Pher® trap.

The trap is made up of the following five parts:

1. Cover: Measuring 26.5 cm in diameter, the cover (Figure 2.1) has a slightly downward-sloped edge to prevent rainwater from entering the container. It is made of plastic that resists warping under intense heat. The top has two anchor points in which a metal hook or wire can be inserted for hanging the trap on a tree branch. The underside is cupped and ribbed so that it can be screwed onto the container. In the center of the cover are circular serrations to secure a lure holder (Figure 2.1).

2. Lure holder: The lure holder is latticed (Figure 2.2), opened at the base, and ressembles a shuttlecock. The synthetic sex attractant capsule is mounted on an entomological pin (Figure 2.3), which is pinned to its base. It is attached to the cover by means of the above-described serrations. In addition, it facilitates handling and installation of the pheromone lure in the trap and minimizes contact between the insect and the pheromone lure.

3. Funnel: The funnel is a truncated cone (Figure 2.4) with a wall angle of 90°. The upper section has a 10.5 cm opening and another of 4.0 cm near its base. The funnel is removable. It rests on a ledge inside the container and is held in place by small knolls projecting from the container wall. A 2.0 mm diameter hole in the funnel wall (Figure 2.5) is used to insert a hook from which a small strip impregnated with dichlorvos insecticide is suspended in the container. The funnel keeps the insects in the container and the insecticide quickly kills the insects, providing good conservation of the specimens thus making accurate identification possible.

4. Container: Slightly conical in shape, the container (Figure 2.6) is 20.5 cm in height with a diameter of 10.0 cm at its base and 13.0 cm at its rim. There are three water-drainage holes in the bottom. The outer rim is ribbed so that it can be screwed to the cover. Inside the container, 4.0 cm from its mouth, is the ledge on which the funnel rests. Around the upper portion of the container, between the ledge and the rim, are ingress holes whose number and configuration vary according to the insect species being surveyed (Figure 2a, b, and c). These are punctured after the container has

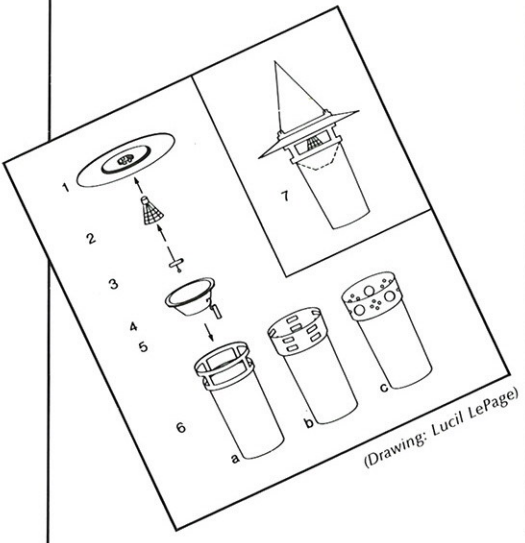
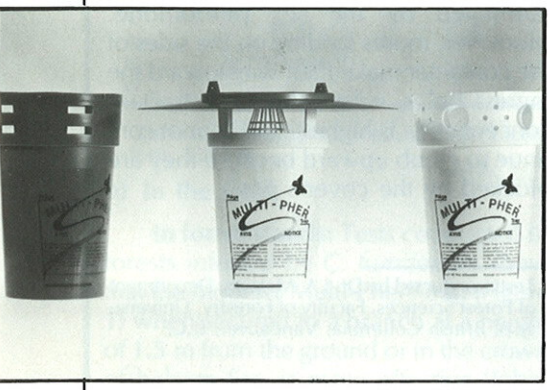


Figure 2. Sketches showing Multi-Pher® trap components, assembly method, and three available models (a, b, and c): 1. Cover 2. Lure holder; 3. Lure mounted on entomological pin; 4. Funnel; 5. Insecticide; 6. Container; 7. Assembled trap.

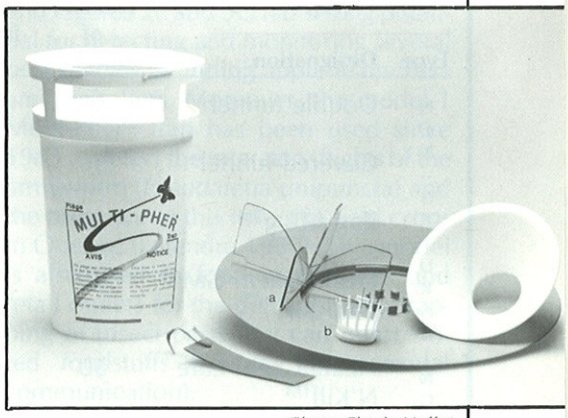
been manufactured. At present, three models of the Multi-Pher® traps (Figure 2a, b, and c, and Figure 3) are being produced[a] and marketed[b].

5. Baffle: To improve the trap catch of the Multi-Pher® trap model-I, a baffle was developed and tested in spruce budworm-infested stands. The baffle is removable (Figure 4), manufactured from 1.5 mm thick plastic (Lexan), and made up of two winglets overlapping at the base. The edges of the outer winglet rest against the sides of the ingress holes, while the lower distal edges rest on the funnel. Its purpose is to deflect the moth's flight as it enters the trap and thus increase trap effectiveness. To use the baffle, it is necessary to remove nearly all of the curved, latticework side of the lure holder (Figure 4).



(Photo: Claude Moffet)

Figure 3. Three models of the Multi-Pher® trap used for detecting and monitoring forest and agricultural crop insect pests.



(Photo: Claude Moffet)

Figure 4. Baffle (a) and modified lure holder (b) used in model-1 Multi-Pher® trap.

[a] Plastiques Gagnon Inc. Saint-Jean-Port-Joli, Québec, G0R 3G0

[b] Les Services Bio-Contrôle, 2600 Dalton, Parc Colbert, Sainte-Foy, Québec, G1P 3S4

Observations on the effectiveness of the Multi-Pher® trap

a) In the laboratory

Tests conducted in the laboratory (Sanders, C.J., personal communication) using a wind tunnel, compared the effectiveness of various home-made and commercially available traps for catching male *C. fumiferana* moths attracted by a lure containing a 0.3 percent concentration of Fulure pheromone. Table 1 shows that the performance of the Multi-Pher® trap (model-1) matched or exceeded that of the other traps tested.

The three models of the Multi-Pher® trap (Figure 2a, b, and c) were also subjected to wind tunnel tests using titanium tetrachloride smoke. According to Dr. J.A. McLean[c] (personal communication), the design of the cover on the Multi-Pher® trap performs two functions which augment the trap's effectiveness. Air passing through the top portion of the trap is deflected in such a way that the upper surface of the cover is not contaminated by the sex pheromone. Moreover, moths landing on the sides of the container make their way toward the ingress holes, where the sex attractant concentration is highest, and cannot continue to climb upward because they are blocked by the cover's rim.

[c] Tests conducted by Dr. J.A. McLean, Department of Forest Sciences, Faculty of Forestry, University of British Columbia, Vancouver, B.C.

Table 1
Effectiveness of various pheromone traps used to catch male *C. fumiferana* moths under wind tunnel test conditions

Trap		Number of moths	Entry frequency (%)	Time of first entry (min)	Number of entries/ moth	Catch rate (%)
Type	Designation					
NON-SATURATING	Double funnel	50	50	0.43	1.2	38
	Covered funnel	50	86	0.24	1.4	44
	Bag-a-Bug™	50	16	0.33	1.0	10
	HealthChem-GM Canister™	50	44	0.67	1.5	10
	HealthChem-Lure N'Kill™	50	68	0.50	2.1	20
	International Pheromones Ltd. S.P.I. Moth Trap™	50	88	0.44	1.1	82

Table 1 (cont'd)

Trap		Number of moths	Entry frequency (%)	Time of first entry (min)	Number of entries/ moth	Catch rate (%)
Type	Designation					
	Multi-Pher®	50	90	0.31	1.4	82
SATURATING	Pherocon 1C	23	83	0.11	1.4	83
	1CP	24	62	0.64	1.1	58
	1CP (crosswind)	24	75	0.52	1.4	62

[1] Tests conducted by C.J. Sanders, Great Lakes Forestry Centre, Forestry Canada, Sault St. Marie, Ontario, Canada.

b) In the field

In forest stands: Tests conducted in forests infested by *C. fumiferana* show that the model-1 Multi-Pher® trap (Figure 1) when secured to a branch at a height of 1.5 m from the ground or in the crown of balsam firs, is more effective (Jobin 1986) than the CFT (Covered Funnel Type) trap developed by Ramaswamy and Cardé (1982) and the S.P.I. (Store-Products Invert Moth Trap). The Multi-Pher® trap was recommended for the establishment of *C. fumiferana* detection and monitoring systems (Allen et al. 1986b) and has been used for this purpose in Quebec since 1984 by the Quebec Department of Energy and Resources. Established annually, this detection and monitoring system will make it possible to detect the presence of an insect, monitor annual population trends, and predict outbreaks. A summary of network results have been published annually since 1984 in a document entitled "***Insectes et maladies des arbres — Québec***", published as a supplement of the magazine **Forêt Conservation**. Since 1985, an international (Canada/US) spruce budworm detection system has been set up each year over the insect's entire range and primarily in the areas most susceptible to budworm outbreaks. In 1986, the Quebec Department of Energy and Resources used the model-1 Multi-Pher® trap to establish a detection system for the spruce budmoth (*Zeiraphera canadensis*) and the jack pine budworm (*Choristoneura pinus pinus*) (Table 2).

In agricultural crops: The results of tests conducted in apple orchards in Canada and the United States (Vincent et al. 1986) as well as in Italy (Mori, P. personal communication) indicate that the model-3 Multi-Pher® trap (Figure 1c and Figures 2c and 3c) has strong potential for detecting and monitoring several pest species including apple leafminers and leafrollers. Moreover, the model-1 Multi-Pher® trap has been used since 1985 to detect the migratory flights of the armyworm (*Pseudaletia unipuncta*) and the presence of this insect in field crops in Quebec (Letendre 1985). This model is also used in food warehouses and retail outlets for the detection and trapping of insect pests that can infest stored foodstuffs (Sévigny, S. personal communication).

In urban areas: In 1985, we tested the model-2 Multi-Pher® trap (Figure 2b and Figure 3a) in woodlots infested by *Lymantria dispar* and compared it with two non-saturating traps — the Gypsy

Table 2
Preliminary list of insect pests affecting forests, agriculture, or stored foodstuffs for which the Multi-Pher® trap is used in detection, monitoring, or control applications[1]

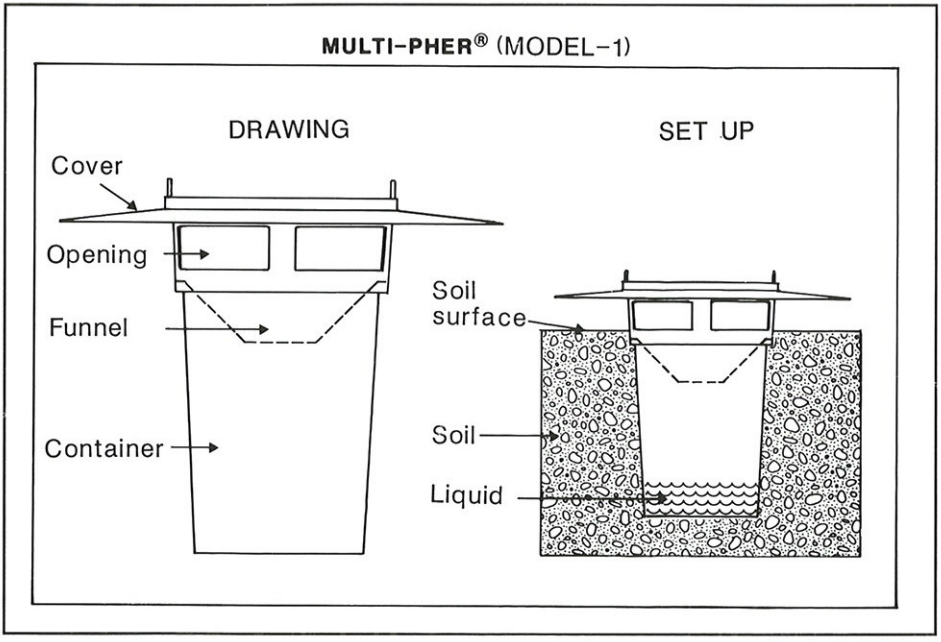
	Target insects	Model		
		1	2	3
Forest insects				
Gypsy moth	*Lymantria dispar*		X	
Spruce budmoth	*Zeiraphera canadensis*	X		
Spruce budworm	*Choristoneura fumiferana*	X		
Jack pine budworm	*Choristoneura pinus pinus*	X		
Orchard insects				
Codling moth	*Cydia pomonella*			X
Spotted tentiform leafminer	*Phyllondrycter blancardella*			X
Speckled green fruitworm	*Orthosia hibisci*			X
Lesser appleworm	*Grapholita prunivora*			X
Oriental fruit moth	*Grapholita molesta*	X		
Redbanded leafroller	*Argyrotaenia velutinana*			X
Crop insects				
Armyworm	*Pseudaletia unipuncta*	X		
Food insects				
House fly	*Musca domestica*			X
Indian meal moth	*Plodia interpunctella*	X		
Meditaerranean meal moth	*Anagasta kuehniella*	X		

[1] Source: Les Services Bio-Contrôle, Sainte-Foy, Québec.

moth Canister Trap™ and Gypsy Moth Lure N'Kill Trap™ sold by Healthchem Corporation of New York. Of the 25 332 *L. dispar* males caught, 40.6 percent were taken in the Multi-Pher® trap as compared to 31.5 and 27.9 percent respectively in the Lure N'Kill™ and GM Canister™ traps. These three traps have a volume of 1 L. The maximum average number of male moths per cubic centimetre was 1.9 for the Multi-Pher® trap and 1.4 for the other two traps.

From 1984 to 1986 inclusive, a detection system of model-2 Multi-Pher® traps (Figure 2b and Figure 3a) was tested over a vast area covering some twenty municipalities in the Quebec City region as a means of detecting and delineating new *Lymantria dispar* infestation areas. The test results (Sévigny 1984, 1985, and 1986) clearly show the potential and effectiveness of this trap for detecting and delineating the infestation foci of the gypsy moth in an urban environment. Moreover, large-scale trapping of adult males in the infestation areas, coupled with other insect control techniques, helped to keep the populations of this major defoliator below the damage threshold.

Other uses for the Multi-Pher® trap: Trials are being conducted with the model-1 Multi-Pher® trap in forest environments (maple stands and softwood plantations) and, also in various agricultural crops for the study of insects that are active on the soil surface. In this application, it is used as a pitfall trap and it is buried in the ground to the level of the ingress holes. The container is made watertight by plugging the three holes in its bottom with silicone and it is filled with 200 cm^3 of antifreeze liquid. The funnel and the liquid keep the specimens in the container and the cover prevents rainwater from entering the trap (Figure 5). The results of these trials have not yet been published. A brief description of the Multi-Pher® trap and some of its applications appeared in **Forêt Conservation** in 1985.



(Drawing: Lucil LePage)

Figure 5. Drawing of the Multi-Pher® trap used as a pitfall trap.

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