# THE EFFECTIVE MONITORING OF STORED PRODUCT MOTHS USING A FUNNEL PHEROMONE TRAP

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The use of the female sex pheromone (Z,E)-9,12,tetradecadienyl acetate (TDDA) to detect or monitor pyralid stored product moths has been reported by several workers [ Reichmuth et al (1978) Hoppe and Levinson (1979) and Sifner and Zdarek (1982) ]. In each instance the pheromone lure was placed on or near a sticky surface which held the lured moths. In recent years the first specifically designed non-sticky trap for use in storage and food manufacturing areas has been introduced in the UK by International Pheromones Ltd (IPL). This 'funnel' trap has been successfully used for detecting and monitoring stored product moths in many storage and food industry environments in the UK. This paper presents results from the use of the funnel trap together with a general comparison of sticky and non-sticky trap types currently available in the UK.

The trap consists of a plastic funnel protected by a lid from the centre of which hangs the polyethylene lure (Fig. 1a). Moths attracted to the lure fall into the funnel then into the detachable bucket below, where they are killed by dichlorvos emitted from a small impregnated strip. The overall dimensions of the trap are; diameter 11 cm, height 25 cm.

Recently the Unitrap (Fig. 1b) based on the original funnel trap design has been introduced and has proved successful in flour mills. Results referred to throughout this paper relate to the first design of IPL trap.

In a laboratory trial to compare moth trap efficiacy, for each trap tested, 25 male Ephestia kuehniella were released into a room 9 x 3.6 x 2.5 m high with light at 0.1 lux. The results are presented in table 1 with individual traps grouped under trap type. The funnel proved as effective as the delta traps possessing the sticky pad within the trap but less effective than those with exposed sticky surface.

In the UK, opposition to the use of sticky traps occurs in the food processing and manufacturing industries especially in sensitive food preparation areas. The presence of dead glue-covered moths has led to traps being hidden from view and therefore not in the best position for catching moths. As the funnel trap is not sticky and has a more aesthetic appearance it overcomes this difficulty.

When pheromone traps are used either for detection or monitoring stored product moths several other factors may be considered. A

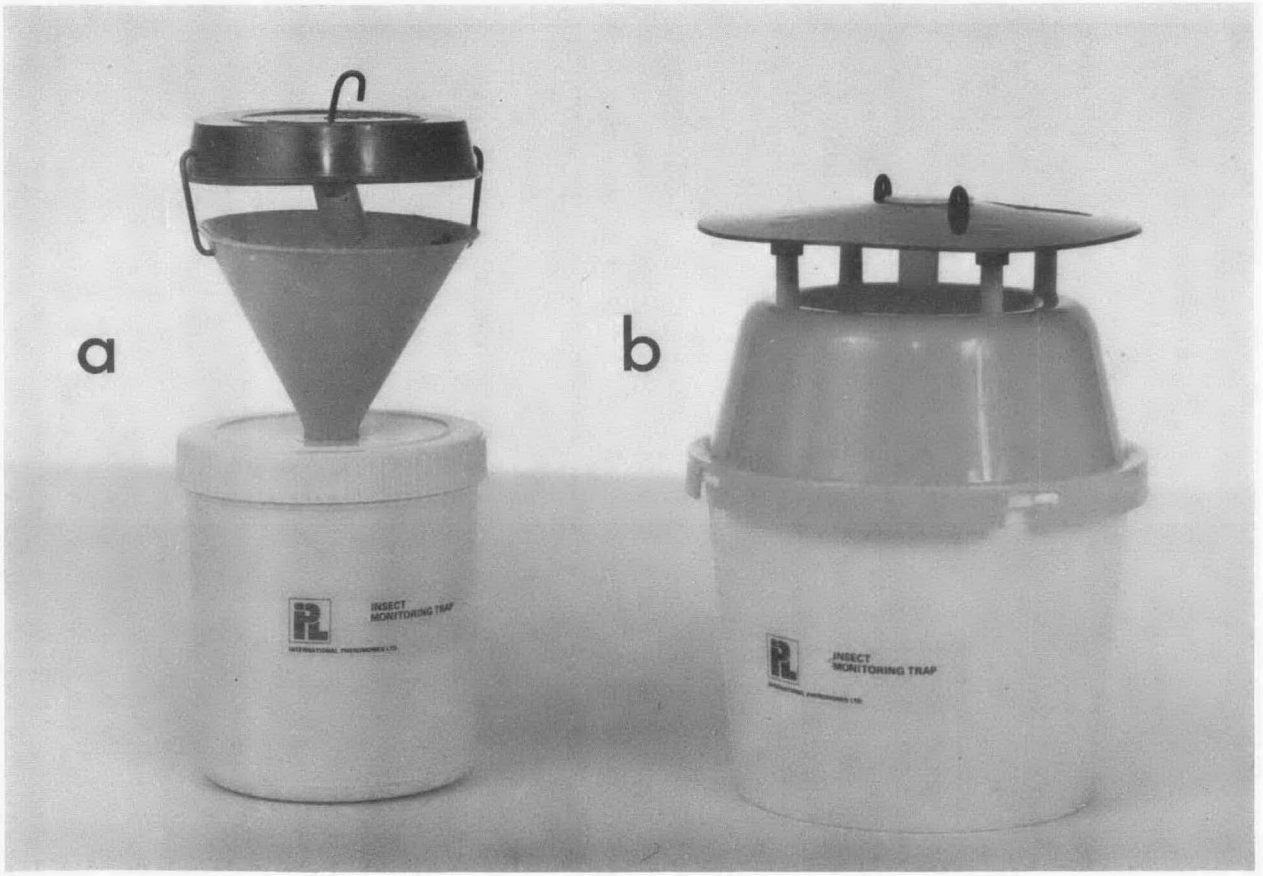


Fig. 1. Funnel pheromone traps a) Original design b) 'Unitrap' design.

Table 1. A laboratory comparison of pheromone trap types

| TRAP TYPE | AVERAGE MOTH CAPTURE * ( % AFTER 7 DAYS ) |
|---|---|
| LARGE DELTA FRAME (STICKY SURFACE OUTSIDE) | 96 |
| STICKY FLY PAPERS | 80 |
| SMALL DELTA FRAME (STICKY SURFACE OUTSIDE) | 73 |
| DELTA TRAPS (STICKY PAD INSIDE ) | 66 |
| FUNNEL TRAP | 67 |

*25 male ***E.kuehniella*** released per trap tested .

comparison of the two trap techniques is made in table 2. The funnel trap compares favourably with sticky traps except in its high initial cost and where it is used in atmospheres that coat the funnel with an oil or sticky dust deposit.

The IPL funnel trap was introduced in 1979 and was first used to monitor an infestation of E. cautella, E. elutella and E. kuehniella in groundnuts in a warehouse room (COGAN and LUND IN PREP). The traps were found to be specific to males of the target species and demonstrated population peaks for each species. Identification of each species was possible without the need for genitalial examination which is often required when using sticky traps. The traps also detected the moths both before visual inspection revealed them and for a period of one month after visual inspections failed to detect them.

The funnel traps have also been used to monitor E. kuehniella in a flour mill where the disinfestation regimes of cleaning and spraying were periodically altered. When the use of insecticides was initially plotted against pheromone trap catch (Fig. 2) apparently little effect of treatment was observed but when the treatments were discontinued (x) the numbers of moths trapped greatly increased even through the winter period. When the spraying regime restarted (Y) the numbers of moths caught in the traps fell. Thus it was observed that insecticide treatments in the mill kept numbers down rather than eliminated the infestation. By examining the pheromone trap catch results for 3 different insecticide spraying and cleaning regimes it was found that a regular cleaning and spraying contract by a servicing company together with spraying and cleaning machinery nearest to the highest trap catch carried out by mill personnel was most effective.

A further successful use of the IPL funnel trap has been in UK long-term flour storage warehouses. Since 1979 traps have been used as an aid to visual inspection for detection of E. kuehniella. The flour warehouses are considered to be nil tolerance areas for moths and when an infestation is detected the infested flour is rapidly fumigated. Results for the period 1978 until 1982 for one area of the UK are presented in Table 3. As can be seen the numbers of warehouses monitored by traps increased from 33% in 1979 to 100% in 1982 and this led initially to an increase in E. kuehniella infestations detected. Detection by the traps rather than visually was most dramatic during this period. In 1982 the percentage of warehouses infested with E. kuehniella fell to just above the 1978 level even though one-third more warehouses were monitored by traps than in 1981. In the UK since 1979 all infestations of adult moths have been detected by the traps where these have been present.

The successful use of the IPL funnel pheromone trap has led to the development of two strategies to combat stored product moths. Firstly, as occurred in the flour mill, traps are installed in all areas of the premises at approximately 10 m intervals. Traps are checked at 7 or 14 day intervals and records kept. After 1 year the traps records are examined and those traps with the highest or most consistent trap catch are retained for year 2. Using the

previous years results a base line for each trap can be established. Special attention (ie. cleaning and spraying, should be paid to any areas where the moth catch rises above this base line. This base line figure is then gradually reduced. Using this system a flour mill with 35 tonne/hr grain intake was effectively monitored in the second year using just 9 traps compared with 20 in the first year.

A second regime which has proved effective is to place traps in all sensitive areas of the premises and then clean and spray machinery nearest to the highest trap catch. This regime should continue until numbers are reduced to an economically satisfactory figure. This regime is more suitable to food factories wherein the aim is to reduce a low general infestation down to a level where there is zero catch in the traps. Both these strategies are suitable for attacking established infestations and where infestations are continually re-introduced for example in flour mills.

The funnel trap is not as efficient in capturing moths as some sticky traps available but has proved more adaptable and effective in a wide variety of storage and processing areas. Current usage in the UK as indicated by table 4 shows an even distribution of these traps in storage environments in the UK where they are becoming an indispensible tool in the fight against storage losses by moths.

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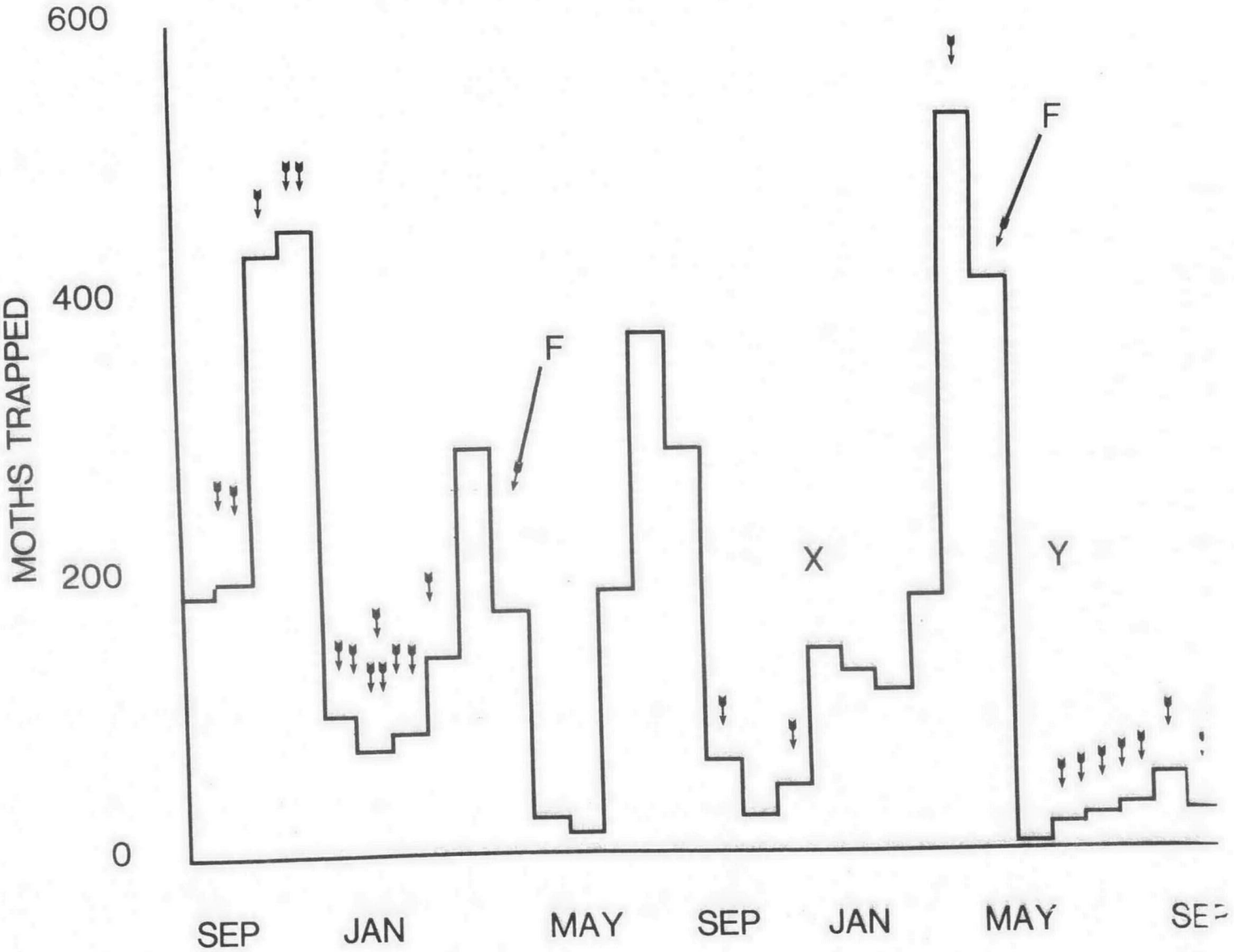


Fig. 2. *E. kuehniella* funnel trap data for the roller mill floor of a flour mill indicating insecticide treatments (arrowed) and fumigation (F). For explanation of X and Y see text.

Table 2. Comparison of features of sticky and funnel traps

| STICKY TRAPS | FEATURE | FUNNEL TRAP |
|---|---|---|
| DIFFICULT (STICKY) | HANDLING | EASY ( CLEAN ) |
| UNSIGHTLY IN FOOD AREAS | APPEARANCE | GOOD |
| DIFFICULT, USUALLY ON GENITALIA | IDENTIFICATION OF TRAPPED MOTHS | EASY,USUALLY ON WING PATTERN |
| MAY CLOG WITH DUST OR INSECTS | ENVIRONMENT | NO CLOGGING ,DUST ASSISTS CATCH. STICKY ENVIRONMENTS DETRIMENTAL |
| USUALLY LOW TARGET SPECIFICITY. FEMALES ALSO CAUGHT | SPECIFICITY | HIGH SPECIFICITY FOR TARGET SPECIES. FEW FEMALES CAUGHT ( AS LOW AS 0.1% ). MONITORING EASY |
| LOW BUT CONSTANT DUE TO REPLACEMENT OF STICKY SURFACE | COST | HIGH INITIALLY BUT VERY LOW RUNNING COSTS |

Table 3. The use of funnel pheromone traps in long term flour storage warehouses, in one area of the UK, 1978–1982

| YEAR | FLOUR WAREHOUSES | | |
|---|---|---|---|
| | % WITH MOTH INFESTATIONS | % WITH TRAPS | % INFESTATIONS DETECTED BY TRAPS |
| 1978 | 33 | 0 | 0 |
| 1979 | 50 | 33 | 50 |
| 1980 | 50 | 58 | 100 |
| 1981 | 58 | 67 | 86 |
| 1982 | 36 | 100 | 100 |

Table 4. IPL funnel pheromone trap use in the UK as represented by sales.

| | % SALES |
|---|---|
| FOOD PROCESSING COMPANIES | 29 |
| PEST CONTROL COMPANIES | 27 |
| FOOD STORAGE (WAREHOUSES ) | 24 |
| FLOUR MILLS AND BAKERIES | 19 |