WORK STUDY › OPPORTUNITIES FOR PROFIT

INSECT MONITORING

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INTRODUCTION

A pest survey is any activity that collects data on the species, number and distribution of the pests. A survey relates to a given point in time.

When surveys are continued over a longer time they are strictly speaking surveillance or 'monitoring' operations. Surveillance operations tell us how pest populations change with time or they assess the performance of our control operations.

The ability to interpret survey data accurately is fundamental to the monitoring process and comes with experience and training.

LOOKING AND LISTENING

Obtain a plan and walk around the site to familiarise yourself with the layout of the premises. Note any signs of pests, such as cast skins of insects and any damage to property or products.

During the preliminary survey take care to inspect the whole site. Ask employees on the premises where pests have been seen and try to find out whether this is a new, occasional or continuous problem.

All pest infestations require food, moisture and safe harbourages to survive. Therefore during preliminary surveys, particular attention should paid to standards of hygiene and tidiness.

Removal of rubbish and the cleaning of the premises are an absolute prerequisite for successful pest control. Sometimes these measures alone can deal with the problem.

Good proofing is also essential and so the presence of cracks in outside walls, broken drain covers etc from where pests could invade and return should be noted.

Once the information has been collected, it is a good idea to go away and consider the facts. The first essential in pest control is accurate pest surveying, so time is needed to consider all the necessary factors and their implications.

PEST ACTIVITY

Experience and knowledge of pest biology should direct you to the most likely areas of infestation.

When considering pest activity, every attempt needs to be made to locate the source of an infestation. Pests can easily enter premises or they may be brought in on infested goods, furniture or office plants.

MONITORING DEVICES

Visits made out of hours and during peak production times can often be difficult to arrange at commercial premises and it is often better to leave monitoring monitorsdevices in place to assess possible pest activity.

As a general rule for all monitoring monitors, it is important to note that they are often designed for monitoring purposes only and they are not suitable as a method of control.

Sticky monitors are ideal for monitoring crawling insect pests, such as cockroaches, beetles and ants. They consist of an attractant placed upon an adhesive surface. Single large monitors may be used where infestations are heavy but where the infestation is expected to be light, a greater number of smaller monitors should be deployed. Some of these monitors utilise a variety of food attractants and pheromones. Flea monitors are available which use heat from a light bulb to attract fleas and hold them on a sticky board.

Sticky monitors for monitoring flying insects are available, which use coloured sticky boards as a visual attractant, combined with a reservoir for holding liquid baits. Various dome devices use liquid baits to attract and monitor flying insects. Traditional fly-papers are available for monitoring purposes. Spot cards, sampling squares and Scudder grids are all monitoring tools used to assess fly nuisances.

Pheromone monitors use synthetic chemicals to mimic the natural attractants given off by some insects. They are most commonly used to monitor the presence of specific pests, such as textile moths and beetles, stored product moths and beetles, since each attractant will be directed specifically at certain species. It is important to note that pheromone monitors are often species and sometimes sex – specific. For example, moth monitors are commonly based on female sex pheromones and these will only catch male moths.

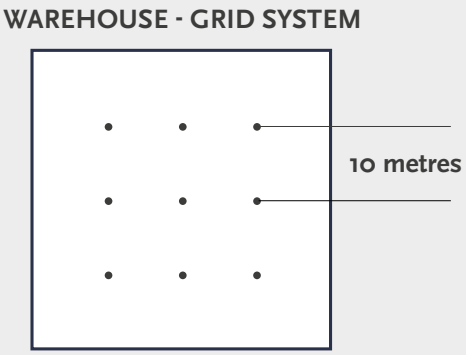
Bedbug monitors based on aggregation pheromones are also available. These attract nymphs, males and females whether fed on blood or unfed.

The presence of pests in a monitoring device gives a good indication as to the type, extent and age of the infestation. Determining the extent of a pest infestation will usually require setting several devices.

The number of pests depends on a number of factors. These include the initial size of the infestation, how long the monitors have been down and how efficient the devices are.

Monitoring devices should be set in the most appropriate position to give meaningful results. This will be determined from knowledge of pest biology and the layout of the site. The final position is usually a compromise between the best possible site, its accessibility and whether the monitor is likely to remain untouched.

Kairomone monitors
Kairomones are used for host tracking/locating/luring and are featured in some bedbug monitors as well as those for mosquitoes. Kairomones can be normal products of metabolism of one species that are now used by another to locate its host. They benefit the receiver (mosquito) rather than the emitter (human). Note the difference with pheromones which function between individuals of the same species. An overall term for pheromone, kairomone and others is 'semiochemical'.



Demi diamond *Ephestia/Plodia* pheromone monitor – suggested positioning.

Monitoring monitors should be set in the most appropriate position to give meaningful results. This will be determined from knowledge of pest biology and the layout of the site

INSECT MONITORING IN THE FOOD INDUSTRY:

Chartered Institute of Environmental Health (CIEH) recommendations

The CIEH recommend that insect monitoring procedures should be in place in the food industry.

Early detection of pest activity is essential if the impact of corrective control measures is to be optimised. A combination of thorough regular inspections and on-going monitoring using a variety of detectors will provide the information upon which to build control strategies.

The use of monitoring/detectors
The main benefit to be gained from the use of monitoring devices is that of time. Physical inspections are by nature time-consuming and rely on the skill of the inspector. Monitors such as electric fly killer (EFK) units, pheromone devices and adhesive detectors are able to collect information from a range of locations over a greater time scale.

Range of monitoring devices
Monitoring devices can be broken down into four main categories:

- Those using ultraviolet light to attract flying insects to be held on an adhesive film or electrocuted on a live grid.
- Those attracting insects by means of a sex pheromone
- Those attracting insects using a food attractant
- Pitfall monitors

Adhesive detectors may be used un-baited in order to pick up insects, which are moving in the vicinity. These are sometimes referred to as ‘blunder monitors’.

The use of the EFK (Electronic Fly Killer) as an effective pest monitoring tool
Catch tray or adhesive film analysis of fly killing units can provide information on:

- The species of insect present
- Numbers – particularly increases which should trigger a change in control strategy
- Seasonal fluctuations
- Likely foci of infestations
- Related hygiene or process shortcomings

Frequency of analysis will depend on the nature of the site, the potential risk of contamination and the contract specification. Monthly counts would be the norm but the period between counts may be extended during the winter months. In a high-risk operation weekly counts may be required during the peak insect activity season. Units should not be placed near open doors where they may attract insects into the premises.

The use of pheromone monitors
Pheromone monitors are available as funnel devices and as adhesive monitors. The pheromone lures consist of dispensers impregnated with a dose of the pheromone specific to the group of target insects. Monitors are placed in high-risk areas in order to intercept male insects.

The smaller adhesive detectors have the advantage over the larger suspended monitors in that they can be placed within machinery and can assist in pinpointing the source of the infestation. Lures must be replaced at intervals of 2, 6 or 12 weeks depending on the loading.

The use of monitors using food attractants
Apart from fly and wasp monitors, which use a liquid bait to attract and drown the insects, there are two types of detectors employing bait as an attractant.

- Adhesive devices using a food attractant pellet or flavouring. These do not have the range of attraction that pheromone monitors have and the insects in most cases must be in the reasonably close vicinity of the monitor to have anything other than a 'blunder' effect
- Bait bags used for detection of stored product insects (SPI) in grain storage areas. These would not be used in areas other than grain stores due to their ability to attract and harbour live insects.

Pitfall monitors
Pitfall monitors are used solely to detect SPI in stored grain. They can be placed just below the surface or deep in the grain. Crawling insects enter the devices through downward facing holes and are unable to return.

Pest activity
Experience and knowledge of pest biology should direct you to the most likely areas of infestation.

When considering pest activity, every attempt needs to be made to locate the source of an infestation. Pests can easily enter premises or they may be brought in on infested goods, furniture or office plants.

The use and limitations of adhesive detectors
Adhesive detectors are the most cost effective method of remote detection of insects throughout all areas of a site. If the full benefit of their deployment is to be achieved they must be checked regularly and replaced when rendered ineffective through dust or damp. They must be employed in sufficient number to give adequate cover as most insects have a relatively small range.

MONITORING COCKROACHES

Survey and monitor thoroughly, including adjoining rooms and / or premises, prior to a treatment. Night inspections (cockroaches are nocturnal) with red light torches may appropriate in rare cases. Use crawling insect monitors and flushing agents to aid inspection. It is a good idea to label crawling insect monitors with an arrow to indicate their orientation. If the monitors become dislodged during use, they can be placed back in the correct orientation. Labelling with arrows also helps to indicate the direction that the cockroaches are entering the monitor, giving further clues as to the characteristics of the infestation. Look for droppings, cast skins, eggs cases, faecal smears, live and dead cockroaches. Heavy cockroach infestations often have a characteristic smell.

Also advise that the client checks suppliers as a possible source of infestation e.g. via egg cases transported in. Seek identification from an Entomologist if you are unsure which species you are dealing with. It is crucial to get a correct identification because the biology of different cockroach species will affect their location in premises. For example, *Blatta orientalis* is a poor climber compared to *Blattella germanica*.

MONITORING STORED PRODUCT MOTHS

Pheromone monitors for stored product moth control should be correctly placed to maximise the accuracy of the monitoring program. Place the monitors at 10 – 20m spacing. Use a maximum of 1 monitor / 600 m^3 (equivalent to 1/100m^2, in a building of 6m height). In large, open buildings this can be reduced to 1/2500m^3 (equivalent to 1/400 m^2 in a building of 6m height). Place monitors where it is convenient for inspection, but where they do not obstruct normal operations.

Monitors should be positioned at the top end of the prevailing air movements to allow the plume or trail of attractant to disperse through the building. Do not locate monitors anywhere where air turbulence may create false or misleading trails or locate monitors next to open windows, doors or ventilation ducts where the air movement will take the plume directly out of the building, away from the area being monitored.

Record catches at least weekly and keep records safe. Use monitor data to help take remedial action such as spot cleaning, stock rotation or making chemical treatments.

MONITORING BEDBUGS

There are many monitoring options for detection of bedbugs. A thorough visual inspection by a trained and experienced pest control operator is imperative. There are also monitoring options based on aggregation pheromones, kairomones and a rapid detection swab kit.

Signs of bedbugs are cast nymphal 'skins', hatched or unhatched eggs, straw-yellow, dark brown or black marks (excrement spots, consisting mainly of excess water, with a little blood) and a sickly sweet / coriander-like smell, are all signs that are used to identify bedbug presence, along with customer complaints and evidence of bites.

A thorough visual inspection should be conducted. Use of a torch and hand lens may prove useful. A flushing agent is an essential part of a thorough inspection. The following key areas should be inspected:

- Mattress, including under buttons and along seams.
- Divan base – remove the material covering the base and also check hollow caster legs.
- Bed frame.
- Bed head.
- Bedside furniture, checking drawers in tables and cupboards.
- Other furniture, along seams, buttons and joins.
- Furniture should also be turned over and the underside examined.
- Electrical fittings and appliances, such as telephones, clock radios, televisions.
- Underneath carpet edges and along the straight edges.
- Floor-board joins.
- Under loose wallpaper.
- Architraves.
- Picture frames, wall mirrors, blinds, curtains and curtain rods, books, behind electrical conduit, cracks and joins in the ceiling and ceiling mouldings.
- Lounges in common rooms of Youth Hostel etc.
- Housekeeping rooms

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MONITORING TEXTILE MOTHS

Pheromone monitors for textile moths should be placed in storage areas or near items at risk throughout the year. The timing of pest appearance will vary with the external climate and other factors such as the use of central heating etc. The monitors should be placed on shelving or on the floor where the materials to be monitored are kept. Avoid hanging the monitors. If monitors must be hung then this should be as low as possible above the monitored items. One device should be sufficient to monitor a single confined space e.g. a wardrobe. Where larger areas need to be monitored a minimum of 1 monitor per 10m^2 should be used. Record catches at least weekly and keep records safe. Use monitor data to help take remedial action such as spot cleaning, stock rotation or making chemical treatments.

MONITORING NUISANCE FLIES ON LANDFILL SITES

Monitoring and control programmes should be able to minimize most insect nuisance cases that occur. Taking action against infestations in their early stages is crucial, to achieve early management of the insect nuisance.

Monitoring using fly grids (scudder grids) is important. Scudder grids consist of a wooden grid 60cm x 60cm (the recommended World Health Organisation tool for monitoring flies at Landfill sites).

Scudder grid fly monitoring technique for monitoring flies on waste handling and disposal sites
This method of counting flies is the recommended technique for landfill sites. Fly counting procedure – taken from ADAS and WHO recommendations

- If possible, the observer selects a group of flies within the monitoring area and the grid is dropped by hand into the cluster, which causes the flies to take off and then land again on the slats of the grid.
- A standard period (e.g. 5 seconds) after having placed the grid on the surface, the flies resting on the grid are quickly counted.
- The grid is then picked up, the observer moves on to the next group of flies, and repeats the operation until a specified number of counts have been done.
- Ideally the counts should be carried out at approximately the same time of day on each occasion.
- Counting very early or late in the day should be avoided as this may give misleading figures.
- Also it is advisable to avoid counting flies during weather which restricts the flies activity.

Sticky boards are also available for the monitoring of fly nuisances on landfill sites, following ADAS guidelines. It is recommended that each board is checked weekly and the catch recorded.

MONITORING NUISANCE FLIES ON FARMS

The main reasons for fly monitoring on farms are:

To help ensure effective control
Fly monitoring means that control can be more effective – insecticide treatments can be targeted towards areas where fly numbers are greatest. This targeted and careful use of insecticides reduces costs and helps reduce the likelihood of resistance developing. Monitoring also helps detect infestations early.

To show 'due diligence'
Farmers can protect themselves against complaints about fly levels by keeping accurate records of fly numbers. A typical method of monitoring fly populations indoors is to paint a monitoring square on the wall 1m x 1m and count the flies twice weekly in summer and less frequently at other times. Records should always be kept. Walk-by monitors may also be used for the purposes of fly monitoring and can be fixed to surfaces for outdoor monitoring.

Larval monitoring is just as important - areas containing moist organic matter should be examined to determine the distribution of larvae. As larvae are negatively phototropic (i.e they shun the light), they will tend to burrow into the manure. They may also seek out zones of higher temperature within the manure, so appropriate areas should be inspected thoroughly. In certain circumstances, electronic fly killers or other fly monitors may be appropriate, as an aid to adult monitoring and control.

Regular inspections of poultry houses should be made to identify any infestations of maggots or flies at an early stage so that they can be treated as quickly as possible. A monitoring and treatment process should be implemented and good records maintained to show what has been done. Research of ADAS approved schemes suggests that one way of monitoring the level of fly and larval activity is to use a grid system. The use of ADAS endorsed schemes may be used to demonstrate 'Best Practice'.

A number of monitoring squares, (six for large houses) are marked out along the inside walls and the undersides of walkways. They should be 1 metre by 1 metre and marked out with white paint to form a border. A count of flies on the wall and ceiling squares should be made on a regular basis at all times and twice weekly during the summer months from the beginning of May until the end of September.

There should also be six designated areas where maggot activity is monitored. These should be approximately 0.5 metre square areas which are intrusively investigated. A rough guide to larval assessment is 0 = 0 larvae, 1 = 5% of manure covered by larvae, 2 = 10% of manure covered by larvae, 3 = 20% covered by larvae, 4 = 30% of manure covered by larvae, 5 = 40% of manure covered by larvae. Treatment of the manure should be triggered at index 3 and no manure should be taken from the house if two or more larvae are counted.

The use of sticky monitors and indicator boards is also recommended and these should be monitored and changed regularly.

MONITORING MOSQUITOES:
CIEH recommendations

Routine monitoring, recording and mapping of mosquito presence and activity is an essential component of a mosquito management programme. It enables the control programme to progress in a timely, efficient and targeted fashion. Without frequently updated monitoring data, the programme is essentially operating blindfolded.

Priority areas for investigation will be where suitable mosquito breeding habitat adjoins human populated areas. Most mosquito breeding will take place not in obvious permanent water bodies, but in a variety of temporary pools such as in marshy areas, woodland pools, flooded cellars, storm drains etc.

Ovimonitors
Special small containers of water are used to monitor the density of container breeding mosquitoes. Monitors are positioned in areas in which mosquitoes may be present. Eggs deposited in the monitors are identified and indicate species and abundance in the area.

Larval Monitoring
Larval monitoring and sampling should normally be carried out using a mosquito dipper, typically comprising a pan with a handle. The pan is gently dipped into the water so the surface layer runs into the pan, and the water is then examined for mosquito larvae and pupae. Alternatively an aquatic sampling net may be used.

Water margins and vegetated areas are often more productive than open water. Very small sites can often be sampled using a large pipette.

Ten or twenty dips may be required to fully sample a particular water body. Areas sampled should include natural, semi-natural and artificial habitats.

Approximate numbers and stages of larvae found should be recorded.

Representative samples of larvae from each water body should be retained for subsequent identification.

Adult mosquito monitoring
Human landing rate:
People stand in the selected area for a short period; say 15 - 30 minutes, typically in the evening although daytime catches can be carried out in sheltered areas such as woodland. They catch the mosquitoes that land on them (before they are bitten), using an aspirator. The mosquitoes are counted, identified, and recorded.

A Risk Assessment for human landing rate catches will need to be carried out in the event of active disease transmission in the area.

Light/carbon dioxide/odour devices:
A number of different models are available commercially. Carbon dioxide baited CDC type miniature light-devices are widely used elsewhere in Europe and the USA. Light-devices consist of a light source (to attract mosquitoes) and an electric fan (to suck the mosquitoes into a collecting bag). In addition, a bag containing several kg of dry ice (solid carbon dioxide) is suspended close to the monitor, to improve the attraction of the monitor. Monitors are normally powered with a rechargeable battery.

In addition to conventional light-devices, there are also larger devices that use bottled gas, and synthetic odours. These are very effective at catching mosquitoes, but are considerably more expensive and cumbersome than conventional carbon dioxide baited light-devices. Mosquito monitors have been developed recently that utilize a fan, scent lure, programmable Carbon Dioxide release and UV light LED's.

Mosquito catches are often highest when the monitor is in a humid, sheltered area with long vegetation. They are best positioned away from bright light sources such as street lights etc. Monitors are typically placed in position at the end of the day, and collected the following morning. It is important to ensure that the monitors are located in secure environments e.g. concealed from public view on a collaborator's land, or theft may be an issue.

The number of monitors required and used will vary depending on the area and objectives. Routine use of say a dozen monitors, located in groups at different locations on different nights, would soon give much useful information. One operator can typically set up and collect a dozen or more monitors each day. The mosquito catch should be identified, counted and recorded.

WALK-BY MONITORING SYSTEMS:

The early detection of insects such as stored product moths and fruit flies is critical in maintaining a pest free environment in food manufacturing, storage and retail. Most monitoring devices are inspected by the pest controller during their routine visits, usually 4-6 weekly intervals. Problems can arise between these routine checks in that infestations may remain undetected.

Walk-by monitoring encourages regular checks and inspection of the monitoring monitors by both pest controllers and their customers, providing early detection of potential infestations. The open design allows walk-by monitoring systems to be placed in areas where they can easily be seen and inspected, at a glance, when just walking by.

The glue pads utilise slow-release pheromones within the glue ensuring long lasting attraction. It is recommended that the walk-by monitoring systems should be placed in a grid system, 10 metres apart to effectively monitor the whole space. Placing the monitors in this grid system allows infestations to be pinpointed more accurately.

WALK-BY MONITORING FOR FRUIT FLY AND PEST MOTHS

Walk-by monitors can be used where Fruit Fly (*Drosophila* sp) are a problem, such as restaurants, bars and cafes. The reservoir in the bottom of the monitor holds attractive substances that will increase the effectiveness and attraction to target insects. In the case of *Drosophila* sp these substances could include any fermenting liquid or solid e.g. wine, beer, fruit juice or pieces of fruit. Proprietary attractants are also available and the yellow glue boards provide optimum attractiveness for fruit fly.

These monitors can also be used to monitor Stored Product Moths *(Ephestia* sp and *Plodia* sp) and textile moths (*Tineola bisselliella*), when fitted with the appropriate pheromone glue boards.

Walk-by monitoring encourages regular checks and inspection of the monitoring monitors by both pest controllers and their customers, providing early detection of potential infestations

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KILLGERM OFFER A WIDE RANGE OF PRODUCTS FOR INSECT MONITORING

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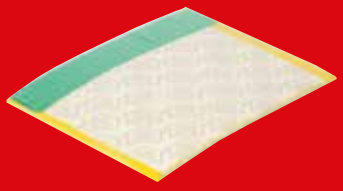

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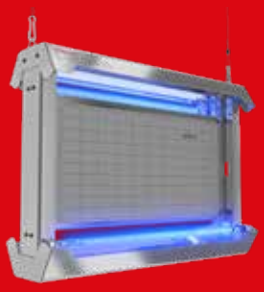

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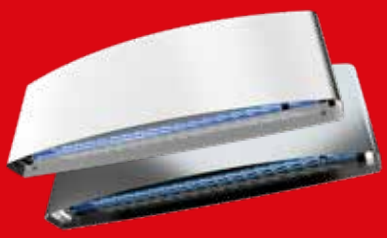

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