

VETERINARY SURGERIES, ZOOS AND PET STORES

Introduction

It may seem obvious that the one thing in common between veterinary clinics, zoos and pet stores is the presence of animals. However, these animals may differ greatly, not only in terms of their appearance, but in terms of their rarity, their monetary value and the uses to which they are put.

In zoos the animals themselves may have substantial market value. However, the value of rare species goes beyond monetary value, and increasingly zoos have become centres for preserving endangered species through breeding programs.

In common with other buildings, the buildings where various animals are housed are subject to infestation by many kinds of pests, including cockroaches, ants and rodents. Moreover, in supplying the needs of the animals, the pests may be given the means to flourish, and it is common to have severe pest problems in animal facilities.

Pests may have a severe impact on animals and their health. The value of these animals may make pest management essential, but before planning pest management measures it is important to understand the many factors favouring pests in these facilities, as

well as the factors which may make pest management difficult.

Factors Favouring Pests **Factors Favouring Pest Entry**

- Pests may crawl or fly in from outside through crevices and unprotected doors and windows. The open construction of zoos particularly favours invasion by outdoor pests.
- Pests may invade from neighbouring infested premises in the same complex. This is a particular problem with pet stores where neighbouring premises may include restaurants and other operations prone to infestation.
- Outside lighting and perimeter plantings may attract pests and increase the likelihood of building invasion.
- The arrival of new animals may introduce pests on cages.
- Food provisions can be a source of pests.
- Bedding may be a source of pests.

Factors Favouring Pest Survival

- Warm buildings, particularly where tropical conditions are reproduced for the comfort of some exotic species in zoos.
- Food sources of many kinds, including feed for animals and food facilities for staff or visitors.

- Food spills in animal areas.
- Organic waste of many kinds, including animal droppings and old bedding.
- Water sources of many kinds, including water containers for animals, aquariums, taps, drains, pools, outside irrigation, etc.
- Numerous harbourages, including cages, bedding, wall voids, ceiling voids, etc.

Factors Favouring Pest Dispersal

- Conduits for water, electricity and air provide lateral and vertical routes for pests.
- Lift shafts provide vertical access to each floor level.
- Corridors and wall or ceiling voids allow lateral pest movement.
- Cage washing rooms can act as distribution points for pests in veterinary surgeries.
- Pests may disembark from infested cages during transit from animal rooms to the cage washing area.
- Ground maintenance machinery can carry pests around zoos.

Factors Making Pest Management Difficult

- The choice of materials and methods is limited by the need to avoid harming the animals.
- It may be difficult or impossible to remove the animals during implementation of pest management measures.
- The susceptibility of most exotic animals to most pesticides is unknown, but some species are known to be highly sensitive to some pesticides.
- Cleaning measures can quickly remove surface deposits of

insecticides, particularly hosing down of animal rooms or zoo compounds.

- Animals may suffer from secondary poisoning by eating pests killed by pesticides.
- Hygiene levels often poor in animal facilities.
- Staff ignorance of the risks from pests can cause indifference to the pests and opposition to pest prevention programs.
- Some animals, particularly in zoos, can be intimidating and dangerous to pest management personnel who may need to work near them.

Planning a Pest Management Program

In many animal facilities there have been pest problems for many years, so it should be obvious that there are no fast, easy or cheap ways of achieving and maintaining pest-free conditions. Indeed, total freedom from pests in zoos may be an unreasonable objective, given the ease with which many pests can re-invade. Nonetheless, endangered species of animals may justify taking special measures to protect them from pests. In pet stores, the cost of maintaining pest-free conditions may not be justified by the cost of harm from a small number of pests.

The approach that is most likely to succeed against pests of animal housing and other animal facilities involves the integrated use of many non-control agent methods and selected control agent methods in ways which are suited to the particular situation. Successful programs are usually based on co-

operative efforts between on-site staff and pest management specialists.

The details of an integrated pest management (IPM) program will depend on such factors as the species of animal, the nature of activities at the facility, climatic factors, construction methods and materials, sanitation and maintenance standards, and the pest populations in or around the facility.

During the past decade great successes have been achieved in animal facilities using IPM programs which have included the use of insecticides. These programs are based on the following series of steps which together are known as the Pest Management System.

1. Obtaining management co-operation.
2. Inspecting the premises.
3. Developing recommendations for non-control agent measures.
4. Developing recommendations for control agent measures.
5. Obtaining co-operation of on-site staff.
6. Implementing the initial treatments.
7. implementing follow-up treatments.
8. Monitoring the results.

These steps are listed in the sequence they would occur in a new account. In most cases, because of the likelihood of re-infestation, the sequence would be repeated. In other words, if pest monitoring revealed a

new pest problem, a new inspection would be conducted, new

recommendations developed, and so on. The recommendations would vary on each occasion to match the changed situation. These steps are analyzed in more detail below.

1. Obtaining Management Co-operation

The level of co-operation and commitment of management will largely determine the effectiveness of any pest management program. Without co-operation at the highest level, it is unlikely that other on-site personnel will co-operate, whether they are vet nurses, animal handlers or cleaning staff.

The co-operation of directors of zoos, vets and pet store owners can be encouraged by pointing out the care that will be taken in dealing with pests and by stressing the harm that can result from pests if they are not eradicated or at least reduced in number.

In pet stores, pests may have less impact but they can cause losses by eating pet food. Moreover, visible pests will deter customers.

2. Inspecting the Premises

An initial inspection of the premises, inside and in adjoining areas, must be conducted to identify the type and extent of pest problems and factors contributing to these problems. Both night and day inspections may be necessary. In daytime, the inspector can note working procedures and ask staff about their work and about what pests they have seen.

At night, the inspection would reveal the activities of nocturnal pests. It

would also reveal some hygiene problems, such as what feed is exposed overnight and the standard of cleanup.

Key findings regarding pest invasion routes, factors favouring pests and actual pest locations should be recorded to form a baseline for future comparisons. In addition, notes should be made of site schedules, including feeding and cleaning schedules, and whether or not animals can be moved, to aid in planning pest management operations.

3-Developing Recommendations for Non- Control agentMeasures

Non-control agentpest management measures are important in all animal facilities. Depending on the situation, the following non-control agentmeasures may be used:

- Fitting tight, self-closing doors between areas housing animals and other areas.
- Fitting insect-proof screens on windows and vents.
- Sealing crevices around doors, windows and vents.
- Installing sealed (i.e. waterproof and pestproof) electrical outlets in animal areas.
- Removing false ceilings in animal rooms and adjacent corridors.
- Replacing hollow core doors with solid doors.
- Removing or sealing insulation on water pipes.
- Sealing crevices around plumbing fixtures, wall mounted equipment, etc.
- Repairing grouting in walls and floor tiles and repairing other cracks in walls.
- Removing unnecessary charts and notices from walls.
- Repairing plumbing leaks.
- Preventing water accumulations from condensation.
- Removing wooden tables, shelves, etc. and replacing them with stainless steel.
- Mounting sinks and other units away from walls to facilitate cleaning.
- Cleaning drains to reduce fly breeding.
- Trimming grass around building.
- Establishing a bare strip of gravel, crushed stone or concrete around building.
- Eliminating organic mulches around outdoor plantings close to animal facility.
- Cleaning gutters and outside drains and ensuring good site drainage.
- Keeping rubbish bins closed, and cleaning and emptying them regularly.
- Eliminating bird roosting sites on or close to animal areas.
- Checking incoming supplies of feed, laundry and bedding and rejecting infested items.
- Storing feed and bedding off the floor on steel racks in a room maintained in a pest-free condition.
- Keeping prepared feed in sealed containers prior to use and avoiding leaving feed exposed overnight, except where necessary in animal cages.
- Designating non-food areas for staff and enforcing compliance.
- Immediately discarding feed packaging material.
- Keeping garbage separate from animal areas,

- Disposing of animal waste so it does not become a source of fly breeding.
- Regularly removing dropped feed from floors of animal rooms.
- Ensuring that after cage washing, clean cages are stored in pest-free rooms or immediately returned to use.
- Using sticky traps for insect control, including double-sided sticky tape around the legs of animal cages.
- Using electrocuting light traps indoors for flying insect control when these will not disturb animals.

The non-control agentmeasures should be discussed with site management and staff and an action plan agreed upon which defines who does what. In general the more appropriate non-control agentmeasures that can be implemented, the less reliance there will be on control agentmeasures, and this might reduce risks and costs.

4. Developing Recommendations for Control agentTreatments

Clearly, methods of pesticide application should be chosen which avoid or at least minimize exposure of the animals. Moreover, pesticides should be chosen which have properties making them unlikely to cause problems. The following rules should be followed for choosing and using pesticides in veterinary surgeries, zoos and pet stores:

- Use pesticides labelled for use around animals.

- Use pesticides which are labelled and effective against the target pests, particularly cockroaches.
- Use products which are actively and expertly backed by their manufacturers for use in such situations.
- Use products with low volatility, and avoid treating hot surfaces near animals since these can vapourize any insecticide.
- Use products with low odour, especially if animals cannot be totally removed from the treated areas.
- Use non-irritant products.
- Use low repellency products to minimize scattering pests coated with pesticide into the vicinity of animals.
- Use products with a good safety record in such situations.
- Use products which are acceptable to the client.
- Ideally, apply pesticides after animals' feed and water have been removed.
- Use no-drift methods of application when feed, water, cages, bedding or animals are present. Liquid insecticides can be applied by paintbrush.
- Avoid treating surfaces which may later be contacted by animals, or from which washing down may transfer pesticide to the proximity of the animals. (For zoo or pet store animals it is normally sufficient to simply prevent animals from contacting surfaces wetted by insecticide until they are completely dry).
- When applying pesticides around aquariums, cover the surface of the water with an impervious sheet and turn off and cover the

air pump until any liquid insecticide deposits are dry.

- Take note of air flow patterns to avoid pesticide spray or vapour drift to sensitive areas.

For ants which attack zoo animals, the nest sites should be located and plans made for drenching each mound. Indoors, in sensitive areas, spot treatments can be applied using a paint brush to apply bands of insecticide around doors, windows, wall-ceiling junctions, wall-floor junctions and around the legs of cages to intercept ants and other crawling insects. The application by paint brush to structural surfaces and crevices in areas near occupied animal cages has particular advantages. Not only does it avoid spray drift, but it reduces the chance of gross mishaps, such as burst hose or exploding aerosol container.

For cockroaches and other pests which spend most of their time hiding, the emphasis will be on crack and crevice or void injection. Recommendations would normally include applications to cracks and crevices using a compressed air sprayer fitted with an injection tube. For wall voids it would be best to use a hand duster through existing openings or purposely drilled holes. False ceilings in animal laboratories or over aquariums would not be dusted because dust may subsequently sift down and cause contamination.

Where it is not possible to remove animals, treatment of wall voids can be planned from adjoining less-sensitive areas, by injection through

the back of the walls. Any possibility of insecticide dust emerging in sensitive areas should be anticipated and, where doubt exists, a pilot test should be conducted using non-toxic talc.

The final stage in developing recommendations for control agent treatments is to formalize these recommendations into a program which has been discussed and agreed upon by site management. This program would describe for each location the target pest, the specific product, the dose rate, the method and site of application, the timing and any necessary preparation or follow-up measures, including special precautions. In the case of zoos, the zoo veterinarian must be involved and must agree to the program. He can then familiarize himself with procedures for dealing with accidental poisonings and make sure he has appropriate antidotes on hand.

5. Obtaining Co-operation of On-Site Staff

Staff co-operation is essential for implementing many of the non-control agent recommendations and for preparing the various locations for insecticide applications. For instance, the contractor should not move the animals; this must be done by the staff. Other preparation might include removing feed and water, and cleaning and drying floors.

Once staff co-operation is approved in principle by the owner or director of the facility, co-operation is best achieved through staff training about pests. The staff should be told how to recognize key pests and about

their habits, routes of entry and conditions which encourage them.

6. Implementing the Initial Treatments

Ideally, what is needed for the initial treatment is a combination of non-control agentmeasures and control agentmeasures. Some of the non-control agentmeasures, such as eliminating harbourages, repairing leaks, replacing wooden fixtures and mounting sinks away from walls may take a long time, and where an acute problem exists it is not worth waiting till every non-control agentmeasure is implemented before implementing control agenttreatments. However, most non-control agentmeasures involve improvements in sanitation and these should be carried out as part of the initial treatment. These initial non-control agentmeasures include cleaning drains, gutters and floors, improving feed, water and waste handling, removing charts and other paperwork from walls in animal areas, and trimming or removing grass and shrubs growing near entry points.

These non-control agentmeasures are valuable for two reasons. First, they are visible measures which involve on-site staff and which help create changes in attitudes among staff who previously had been apathetic about pests. Secondly, these initial non-control agentmeasures, incomplete though they are, will put the pests under greater stress and make them more vulnerable to pesticides. For instance, German cockroaches need water every day and, if their normal

source has been removed (e.g. by drying sinks at night), they will wander further looking for it and will be more likely to contact an insecticide deposit. Likewise, a shortage of readily available food, such as open feed or waste bins or spilled feed, will force pests to explore new areas and they will be more likely to be killed by residual treatments.

For pests which live in distinct colonies, such as ants, the initial treatments can have the reasonable objective of obtaining total eradication of every colony that has been located. But for pests such as cockroaches, which are more dispersed and where individuals can occupy numerous different harbourages on different occasions, it is unlikely that a single treatment will achieve eradication. However, for the fast-breeding German cockroach, it is essential that the initial treatment achieve a substantial population reduction, say a 95% kill. Otherwise there may be sufficient survivors to breed and restore the population. Such a population crash can only be achieved if sufficient resources have been committed for the initial treatment and if every infested location is treated within a short period, say one week. This will help ensure that there are no untreated places for any cockroaches to hide and breed. If the initial treatment takes too long, the residual action in the first-treated areas will have worn off before the other areas are treated. This first-treated area could then become re-infested from the remaining untreated areas. Such re-infestation

is most likely to occur where cleaning measures quickly destroy insecticides.

Fortunately, many products have good residual action and, when applied in crevices and voids, they are not vulnerable to removal by cleaning and last many weeks, which is long enough to prevent re-infestation from areas not yet treated.

For the initial and subsequent control agent applications, the applications are best conducted when the premises are closed to the public in the case of zoos and pet stores, and during non-working hours in surgeries. This minimizes disruption of normal activities and allows easier access to areas usually occupied by people. Of course, essential staff will need to be present for moving animals, cages etc.

Any spills or contamination of non-target surfaces should be immediately cleaned up to prevent subsequent harm to animals. In addition, any risk of secondary poisoning will be reduced by picking up and removing dead insects so that the animals will not feed on them. In the case of nocturnal insects such as cockroaches, most insects will be killed after they become active at night and the largest number of dead insects are usually found early in the morning following treatment.

7. Implementing Follow-up Treatments

Following the initial treatments, any previously infested locations should

be re-inspected within about two weeks. Where the initial treatment was partly ineffective, the cause of failure should be identified and an appropriate new treatment made. With German cockroaches, the main cause of failure is overlooking key harbourages in crevices or voids, and follow-up treatments should focus on these missed harbourages rather than re-treating previously treated locations. The follow-up treatment should be no later than four weeks after the initial treatment in the case of German cockroaches, or else new breeding will occur.

In the case of ants in the grounds of zoos, an inspection about a week after the initial treatment will reveal if any survivors have re-started mound activity. If this is happening, the active mounds should be drenched again, using a greater volume in cases of large mounds with very deep gallery systems.

Where the facilities are subject to re-infestation from outside, follow-up will involve regularly scheduled treatments to prevent pests from becoming reestablished. In the case of invading flies, if the source cannot be eliminated or reduced (e.g. by relocating or improving drainage at a zoo manure heap), electric light traps may be useful indoors and these will need services to empty catch trays. Any outstanding non-control agent measures should be implemented as time, money and attitudes allow.

8. Monitoring the Results

A procedure should be established whereby any pests seen by on-site personnel are recorded and entered

into a central log which is accessible to pest - management specialists. Such logs are really helpful in dealing with new pest problems, and it is worthwhile periodically reminding staff to log their pest sightings. In veterinary surgeries, such co-operation allows localized infestations to be dealt with quickly and with minimal disruption, compared with the measures needed to handle a widespread infestation.

While the log is important, it is also essential to routinely inspect the premises, paying particular attention to areas vulnerable to invasion, such as food storage areas, and to the animal areas. Sticky traps can be used to reinforce visual inspection, but care should be taken not to place them within reach of the animals. In vet clinics it is useful to place sticky traps in the evening and retrieve them and inspect them the following morning, before work commences. If double- sided sticky tape has been used to trap insects climbing the legs of equipment, this can be routinely inspected and replaced every three months or sooner if necessary. Where sticky traps or tape reveal the presence of pests, or an upsurge in the pest population, then appropriate treatments can be made. Likewise, in the case of electric fly traps, if the catch becomes substantial, further steps can be taken to exclude flies or deal with the breeding source.