8

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Aviculture Medicine and Flock Health Management

Passage of the Wild Bird Conservation Act of 1992 has transformed American aviculture, shifting the supply of birds for pet and avicultural consumers from reliance on wild-caught imported birds to aviculture. Economics of the pet bird industry are also changing with the changing political and social climate. Predictions of price increases after passage of the act have not materialized. As aviculture matures as a cottage industry, maintaining the health and increasing the productivity of avicultural flocks will be vital to success. Veterinarians can play a major role in enhancing avicultural profitability and production.

Aviculture medicine differs from companion avian practice in several very important ways. Flock health and management is the primary concern. Establishing an etiologic diagnosis or preventing the introduction of infectious disease is of primary importance. The aviculturist usually is knowledgeable in providing home care; hospitalization is not cost-effective. Attention to the maintenance of appropriate biosecurity must also be considered to avoid the veterinarian's becoming the vector for disease between clients' facilities.

Confidentiality is of utmost importance, because rumors concerning disease problems in an aviculture facility can permanently and irreparably damage a facility's reputation. Staff must be counseled on strict professional behavior and in maintaining client-doctor confidentiality.

Economics must always be considered, especially when dealing with a commercial flock. Increased production usually coincides with decreasing sale prices for individual birds. The commercial aviculturist, like any livestock producer, often operates on a relatively slim margin of profit, which can be profoundly affected by disease or management problems. Understanding the economics of the pet bird industry is vital for a successful aviculture practice.

THE VETERINARIAN'S ROLE IN AVICULTURE MANAGEMENT

An understanding of the principles of aviculture management as well as avian medicine and disease is needed for a veterinarian to work with an aviculturist as a management team. A veterinarian who provides routine preventive care and has an understanding of the facilities and collection of the aviculturist can be invaluable in making quick management decisions in the face of a disease outbreak. In this section the veterinary services that can most benefit aviculture are outlined.

New Bird Examination

The addition of new birds to an established aviary always carries with it the risk of introduction of disease. New birds that are misrepresented (not accurately sexed or sold as a result of previous reproductive failure) constitute a potential loss to the aviculturist by occupying space that could be used for productive pairs. A new bird examination should include confirmation of sex and diagnostic testing as indicated by the client's needs, the bird's

species, source of the birds, and physical examination results.

Aviary Visits

Annual flock examination can assist in detection of flock problems, establishing identification systems, confirmation of identification and sex, clarification of records, assessment of physical condition as an indicator of suitability of diet and husbandry, correction of health and management problems, and elimination of nonproductive individuals. A review of the health problems of previous years and selective testing of suspect animals can assist in epidemiologic tracing of problems. An assessment of age may be helpful in understanding reproductive failure.

Biosecurity must be paramount to avoid being a mechanical vector of disease. The veterinarian should visit only one facility a day, preferably in the morning prior to hospital cases, or plan for cleanup or wearing of protective clothing between aviaries.

Providing Emergency Care

An experienced aviculturist is the first person involved in providing emergency care. The client should be well schooled in provision of first aid and recognizing signs of illness that require veterinary intervention. The veterinarian assists the aviculturist in preparing a first aid kit, in preparation for nursing and transporting an ill bird, and in providing the proper environment for nursing care after an ill or injured bird is stable. The experienced aviculturist should also know how to collect appropriate samples and provide supportive care in the event that the veterinarian cannot immediately attend to an ill bird. Helping aviculturists deal with those problems within their capabilities encourages them to involve a veterinarian in management of the collection.

Advisor on Husbandry

Husbandry advice should be directed to the level of experience of the aviculturist. Successful aviculturists have vast experience in animal husbandry and have studied the behavior of their birds. They often understand intuitively that problems exist but require veterinary assistance in identification of problems and implementing control programs. To gain compliance with therapeutic programs, the veterinarian must be aware of the daily problems faced by the breeder, and the demands that some procedures (such as treatment protocols that may be very time-consuming or disruptive) may place on available time, labor, and resources.

Assist with Incubation and Pediatric Problems

Veterinarians can play a role in evaluation of incubation failures and nursery management. The art of successful incubation entails extensive experience. Subtle problems in egg handling, especially prior to incubation or in early incubation, can result in developmental abnormalities that may not be expressed until the time of hatching. A definitive cause of embryonic mortality is often elusive. Ideally, all fertile eggs that fail to hatch should be examined in an attempt to detect patterns of mortality, which may be helpful in detecting problems associated with incubation. A veterinarian who is experienced in nursery management can provide valuable consultation to prevent the development of clinical disease related to husbandry or nutritional problems.

Establish a Preventive Medicine Program

Quarantine procedures, infectious disease (viral, bacterial, and fungal) testing or prophylaxis plans, parasite control techniques, pest control, identification systems, and first aid procedures should be discussed (Table 8–1). The aviculturist should establish a relationship with the veterinarian in advance of problems so that fast action can be taken in case of disease outbreaks. An isolation area for new and sick birds should be available and protocols established for management of these areas. Storage for medical supplies and equipment should be discussed.

Table 8–1

FIRST AID SUPPLIES TO BE KEPT ON HAND BY AN AVICULTURIST

Isolated area with cage and provision for supplemental heat and humidity
Balanced electrolyte solutions
Feeding tubes and syringes
Selection of emergency medications and dosage recommendations, as prescribed by attending veterinarian
For wound care, bandage materials including nonsticking elastic bandage material, adhesive tape, nonstick wound pads, antibiotic ointments, hydrogen peroxide, or iodine solutions
Scissors and forceps
Coagulants for bleeding nails
Clean container for transporting sick or injured bird

Evaluate Reproductive Failure

Veterinarians can help aviculturists introduce or adopt a reproduction record system. Reproductive failure may be multifactoral and the causes elusive. The veterinarian working in unison with the aviculturist may be able to determine physical, hormonal, nutritional, behavioral, and psychological causes of reproductive failure and institute remedial measures (Table 8–2).

Table 8–2

EVALUATION OF REPRODUCTION FAILURE IN PSITTACINES

1. Review health and production records and take detailed history
2. Perform physical examination and appropriate diagnostic tests as indicated by results
3. Re-evaluate sex determination techniques for monomorphic birds. If in doubt, laparoscopy should be used to verify sex and visually evaluate the reproductive system and other organ systems
4. Evaluate suitability of husbandry practices
   a. Is diet appropriate, balanced, and accepted?
   b. Is caging appropriate?
   c. Is nest box secure, dry, clean, free of pests, and placed appropriately in the cage?
   d. Are secure perches available for copulation?
   e. Is shelter or protection from elements appropriate for the climate and location?
   f. Is the cage or aviary protected from disturbance by visitors, pests, pets, etc?
5. Evaluate behavior
   a. Is one bird of a pair, or in a colony, exhibiting excessive aggression?
   b. Does the pair exhibit a strong pair bond?
   c. Has the pair been observed in copulation?
   d. Does the pair show an interest in or inspection of the next box?
   e. Do the birds exhibit signs of stress, fear, or unrest in the present location?
   f. Do birds quarrel with or display to birds in adjacent cages?

AN INTRODUCTION TO AVICULTURE

To serve as part of the aviary management team, a veterinarian must understand some of the principles of aviculture. The needs of aviculturists vary widely depending on their level of experience, the species being bred, and the aviculturists' status as hobbyists or commercial producers.

The primary goal of a commercial breeder is profitable production of companion birds. The breeder must select species that are productive in captivity, adapt well to the environment in which they are kept, are popular in the trade, and are suitable companion animals. Rare or endangered species, species that inherently make poor pets, species that are difficult avicultural subjects, or species that have extraordinary housing requirements are not suitable for the commercial breeder. Increases in housing density that may contribute to economy also contribute to the incidence and potential severity of disease outbreaks; therefore, there is the necessity of closer monitoring of a facility for potential health hazards.

Hobbyists usually specialize in a species or group of species, producing birds for exhibition, for the pure pleasure of aviculture, or for the more altruistic goals of establishing or preserving a species in captivity. Hobbyists typically sell offspring to offset the costs of maintenance of their collection. Profit is not typically the primary motive. Many aviculturists may start as hobbyists and turn that hobby into a profitable business as they gain expertise with the proper species and individual birds for their aviaries.

BIRD ACQUISITION

Selection of appropriate species increases breeding success and provides better satisfaction and economic rewards for the aviculturist. Inexperienced aviculturists have little concept of which species they will ultimately be breeding and often acquire and sell many birds, prior to settling upon species that are right for their aviaries.

Choosing species that are adaptive to the region and climatic conditions increases success. For example, species that inhabit dry, high altitude environments may be unduly stressed and more susceptible to disease when housed in outdoor aviaries in

a warm humid climate, such as when attempting to breed the plum-headed pionus in South Florida.

Sources of birds for captive breeding include imported wild-caught birds; captive-bred juvenile birds; surplus birds, either wild-caught or captive-bred, that are being eliminated from another aviculturist's aviaries; or unwanted pets. Until recently, aviculturists have depended upon wild-caught birds for the majority of their breeding stock. Future imports (into the US) of species listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are restricted. Wild-caught birds for captive breeding are limited to those aviculturists who are willing to participate in cooperative breeding programs.

Because recent imports are no longer available in large quantities, the aviculturist must rely on long-term captives or captive-bred birds for breeding stock. These birds cannot be considered disease-free and may introduce diseases such as polyoma, proventricular dilatation, or psittacine beak and feather disease (PBFD). Wild-caught birds that have been nonproductive are often offered. Often, re-pairing or changing the environment for these birds results in breeding success. Some individuals or pairs, however, are refractory to adaptation to captivity.

The purchase of captive-bred birds for breeding stock is a logical alternative for many species. It is common for gallinaceous and columbiform birds. Some psittacine and passerine species have adapted well to captivity, and the success of breeding captive-bred birds has been demonstrated. For the larger psittacine species, however, the productivity of many species, especially of hand-raised individuals, has not been well demonstrated. For captive-bred birds, inbreeding is often a problem.

As in the purchase of birds for resale or as pets, care must be taken to avoid the purchase of smuggled birds, which pose an unacceptable disease risk as well as a legal risk. Bargain-priced birds should be looked upon with suspicion. The buyer should attempt to gain as much information as possible prior to buying a bird for breeding. The first question to ask the potential seller would be "why is this bird/pair being sold?". Other questions include the source of the bird. If it is wild-caught, does the seller know the country of origin and who the importer was? Has the bird been sold numerous times, and if so why? If captive-bred, who bred the bird, was it parent-raised or hand-raised, and when was it hatched? If the bird is represented as captive-bred but is not closed-banded, why? Can the parents be identified for genealogic purposes? What is the health history of this bird, its parents, and the flock of origin? Has the bird exhibited aggressive behavior to people or other birds? (For example, male cockatoos are often sold after they have killed their mate.) How and when was sex determined? If a proven pair is being sold are the birds identified and can breeders' records be produced? This type of information often is withheld because of fear that disclosure will lose the sale.

CULLING

Culling is a vital tool for management of breeding stock. The subject of culling has emotional repercussions, especially when dealing with birds considered pets, and with birds that represent endangered species. In reality, maintaining birds for breeding stock that are not vigorous, that fail to adapt to captivity, or that are not of the best genetic stock is a detriment to the future of aviculture and to the species. Birds should not be considered disposable, but we must also consider the importance of selective breeding in aviculture success.

Purchasing culled breeding stock, especially birds represented as proven breeders, carries with it a degree of risk. Birds are often culled because they failed to breed. Laparoscopic examination of these birds is important. Birds sold as part of an entire collection that is being sold are less likely to be misrepresented.

Dealing with culled birds can strain veterinary ethics. Euthanasia of valuable birds because of a poor reproductive record or a poorly understood medical problem (such as cloacal papillomatosis) is not acceptable to many people. Resale of these birds without disclosure is equally unacceptable and can strain the client/veterinarian relationship. It is inadvisable for the veterinarian to represent both the buyer and seller in a bird transaction unless both parties are present at the time of examination. Although the purchase of culled breeding stock should be looked upon with suspicion, movement of healthy pairs to a new environment often results in breeding.

Culled breeding birds can often be placed or

sold as pets. Older birds that have exceeded their reproductive potential can make excellent companions. They are content to be more sedate and quiet than young or sexually active birds, therefore adapting to life in the home.

QUARANTINE AND ACCLIMATION

Quarantine facilities vary tremendously. In many aviaries, there is no space for strict segregation of new arrivals. Birds in quarantine should be housed separately in an enclosed or, if outdoor, screened facility for a minimum of 30 days, and often longer. Birds in quarantine should be cared for by a person who either has no contact with the established collection, or who takes care of established birds prior to servicing the quarantine facility, or who showers and changes clothes after servicing the birds in quarantine. Off-premises quarantine, such as holding new birds in the home of a neighbor, is a practical means of quarantine.

Household options for quarantine should be in a room that does not contain existing birds and that can be serviced after other birds are attended, without traffic flow directly into existing housing. Absolute minimal segregation is a separate cage, physically separated as much as possible, with separate handling of bowls. A bird in the same airspace with established birds is not in quarantine. The aviculturist must understand that quarantine does not ensure that new birds are not asymptomatic carriers of parasitic, bacterial, or viral pathogens.

Veterinarians should standardize the new bird examination and quarantine testing program to the needs and resources of the aviculturist and the species. Minimal screening includes a thorough physical examination, cloacal culture, and evaluation of a blood smear. Complete blood count, *Chlamydia* testing, and blood chemistry profile are useful to detect birds that require more extensive evaluation. Specific diagnostic screens may be employed, including enzyme-linked immunosorbent assay (ELISA) tests or deoxyribonucleic acid (DNA) probes for *Chlamydia*, polyomavirus, and PBFD virus. Direct or flotation examination for internal parasites is essential if birds will be placed in flights or colonies where establishment of parasitism will be difficult to control. In species other than psittacines, a direct and flotation fecal examination and crop swab for trichomoniasis is recommended. Routine worming of new birds, (for nematodes and cestodes, depending upon the species) should be considered. Thin birds, especially those species susceptible to proventricular dilatation syndrome, should be examined radiographically. Some diseases that are characterized by an asymptomatic carrier state are easily missed, even with routine testing, including Pacheco's parrot disease, giardiasis, fluke infestation, and proventricular dilatation syndrome.

Acclimation

Acclimation begins when the bird arrives in the facility. Small birds often refuse food for several days, and large birds may refuse to eat for up to 1 week, especially those that previously were pets. New birds should be weighed upon arrival and watched for weight loss. Initiating gavage feeding hastily should be avoided if weight loss is not dramatic to avoid unnecessary stress, especially in frightened birds. The bird should initially be given the previous diet and slowly changed to the diet offered by the aviculturist. Change in water may also cause temporary intestinal upset. Note that small birds such as canaries die within 48 hours if they do not eat.

If the bird is to be housed outdoors, it should be acclimated to environmental temperatures. Tropical birds should be placed in outdoor facilities in northern temperate climates during the summer to allow acclimation before being exposed to winter temperatures. Bare skin areas may be sunburned when birds are placed in outdoor facilities and exposed to direct sunlight. Birds on chlortetracycline therapy may suffer photosensitization. Exposed areas such as eye rings, facial patches in macaws and exposed skin in feather-plucked birds eventually "tan" and show color changes indicative of melaninization or deposition of other protective pigmentation. Biting insects may also cause dermatologic reactions that can become quite severe in the new arrival. Housing of affected birds indoors until the severity of such reactions subsides may be helpful. Antigens for desensitization are not available. Sensitization to pollens or resins of plants may also occur.

Identification

Records should be established at the time the bird enters the aviary. As much medical history as possible should be obtained from the seller. Many aviculturists are becoming involved in establishment of stud books and cooperative breeding programs. Identification of individuals while recording all existing information when it is most available could be invaluable in the future.

Each new bird should be permanently identified at the time of entrance into the aviary. Electronic identification using implantable transponders is ideal, allowing permanent unalterable identification with minimal risk to the bird.* Incorporation of the transponder number into medical, genealogic, and breeding records allows accurate records to follow a bird throughout its lifetime. Closed bands should be used as an adjunct to, or replacement for, transponders. Properly fitting closed bands are an indication (not proof) that a bird was bred in captivity, and bands allow immediate visual identification as well as an indication of the source of the birds.

Permanent identification using closed bands or implantable transponders is required for export of captive-bred birds (from the US) of CITES-listed species. Unfortunately, the numbers often wear off closed bands; large birds may collapse them, resulting in foot injury; or bands may become caught on loose cages wires. These disadvantages should not preclude the serious aviculturist from closed banding, nor should they encourage the veterinarian to remove those bands.

Open bands are the least desirable means of identification but are preferable to no identification. Rolled steel bands used for imported birds have sufficient tensile strength to preclude complete closure. These bands always have a slight gap between the ends, making the risk of entanglement higher than for closed bands. An alternative to removal of open bands is to close them as tightly as possible, thereby reducing the risk of the gap slipping over cage wire. The numbers are more durable on steel open bands than on breeders' closed bands, which are usually made of aluminum.

The importance of individual identification was graphically presented in the aftermath of Hurricane Andrew's assault on South Florida in August, 1992. Many birds escaped from damaged aviaries and could not be identified for recovery by their owners.

*Companies marketing electronic identification systems in the US are Infopet Identification Systems, Inc., distributing Trovan equipment, 517 West Travelers Trail, Burnsville, MN 55337 Telephone 612–890–2080; and American Veterinary Identification Systems (AVID), 3179 Hamner, Suite 5, Norco, CA 91760 Telephone 714–371–7505; and Destron IDI, 2545 Central Avenue, Boulder, CO 80301 Telephone 303–444–5306.

FACILITY DESIGN AND HOUSING

The aviary must be designed for safety, security, sanitation, ease of maintenance, and meeting the psychological needs of the bird. No single formula exists for successful aviculture other than housing healthy pairs in a way that they feel secure and remain healthy. Happy, healthy birds are more likely to breed.

Outdoor aviaries are commonly used in southern regions, whereas breeders in northern climates and city dwellers usually house their birds indoors.

Indoor Aviaries

Indoor aviaries have the advantages of easier pest control; ability to manipulate lighting, temperature, and humidity factors; and protection from the elements and theft. Routine care is not affected by seasonal changes, rainfall, and weather conditions. Disturbance by nocturnal predators or other wildlife and introduction of disease by wild birds is eliminated.

Indoor facilities are usually less spacious than outdoor aviaries. High population density increases the potential for the spread of disease. The lack of seasonal cycling of light and other climatic factors may affect breeding success. Cost per unit of housing as well as maintenance costs are typically higher for indoor facilities. Indoor areas require more cleaning to prevent accumulation of feces, food wastes, and dust as well as preventing stagnation of the air. The potential hazard that dust poses for human health should also be considered.

When planning an indoor avicultural facility, ease of cleaning must be paramount. Drainage to allow hosing or pressure washing must be considered. If floor drains are installed, they must be of adequate size to prevent blockage by feed (especially seed, which sprouts in drains) or debris. Floor drains may

be used by pests, especially rats, to enter a facility. Design to reduce excessive movement around or under birds during cleaning may be important to reduce disturbance.

Good air quality reduces stress and the spread of disease. The use of ventilation fans, air filters, and ozone generators should be considered for improvement of air quality. Provision of full spectrum light should be used to enhance activation of vitamin D_3 and to enhance well-being. In dry climates or during northern winters, supplemental humidity, by air humidifiers or misters, may be required for the comfort of tropical species.

Outdoor Aviaries

Outdoor aviaries are more common in southern states and provide a more natural setting for birds. Outdoor aviaries are usually more spacious because of decreased per unit construction and maintenance costs. Natural seasonal weather variations may stimulate reproduction. The beneficial effects of fresh air and sunshine to health and productivity may play a role in aviculture success.

Disadvantages include the inability to control climatic factors when the weather is inclement, difficulty in pest control, the potential for bird noise to irritate neighbors, and increased risk of theft. Some birds may exhibit sensitivity to biting insects or other allergens. Predation and the potential for introduction of disease by wild animals pose some risk. Protection of food bowls and nest boxes from heavy rains poses some problems.

Some of the disadvantages of both approaches can be corrected by using combination indoor/outdoor facilities, in which birds can be allowed outside in good weather.

Aviary Design and Planning

Site selection and preparation is the first step in outdoor aviary planning and construction. Location of aviaries and support buildings; flow of traffic through the aviaries; source of water and electric power; the effects of noise on neighbors; and the potential for disturbance of the birds by people, animals, and traffic must be considered. Aviculturists must evaluate drainage, weather protection, and windbreaks for protection from the elements. Roofs should maximize protection of nest boxes and food bowls from rain.

Privacy is provided by the use of vegetation or fences, or by placement of birds as far as possible from roads or houses. Shade should be used appropriately. Desert species may prefer a more sunny, open aviary whereas forest species may feel more secure in wooded or secluded aviaries.

Security from predators that prey upon the birds or spread disease must be provided. Raccoons, opossum, foxes, cats, dogs, and rats may injure birds, frighten them into self-inflicted injuries, or introduce disease. Electric fences help to exclude wild predators from aviaries. Dogs are often used to exclude predators. Poorly trained, noisy, or excitable dogs may reduce production by killing, disturbing, or frightening birds. A fenced kill zone, where dogs are housed surrounding bird holding areas, may reduce some pest control and predator problems.

When outdoor housing is chosen, the effects of climatic factors are more critical. Species that evolved in a vastly different climate may be unsuitable for inclusion in the breeding collection. Birds that are housed outdoors and exposed to natural sunlight should not require supplemental vitamin D_3. Macaws are especially susceptible to vitamin D toxicity, which can be potentiated by supplementation of the vitamin to birds that receive natural sunlight.

Caging

Breeding birds can be housed in either suspended cages or flights. A suspended cage is elevated on poles or suspended from the ceiling and is not entered by the caretaker. Suspended cages have the advantages of being simple to construct, easy to clean, inexpensive, and easy to modify or move if necessary. Birds have less exposure to their feces and accumulated food, and thus disease and parasite control is simplified. Larger cages and perches placed above eye level of the caretaker contribute to security and contentment of the birds housed within (Table 8–3).

Flight cages extend to the floor or ground. They are aesthetically pleasing to people. They provide more space for large, shy or aggressive species,

Table 8-3

SUGGESTED SIZES* FOR SUSPENDED CAGES AND NEST BOXES FOR BREEDING PSITTACINE BIRDS

	Cage (feet)	Nest Box (inches)
Large macaws	6 × 6 × 12 5 × 5 × 10	16 × 48 × 16
Large cockatoos, medium macaws, obese Amazons	4 × 4 × 8 6 × 6 × 8	36 × 12 × 12
Amazons, African grey parrots	2 × 2 × 6 4 × 4 × 4	24 × 12 × 12
Pionus, mini-macaws	2 × 3 × 8	18 × 12 × 12
Conures, caciques	2 × 2 × 6 2 × 2 × 4	18 × 12 × 12
Small conures, cockatiels	2 × 2 × 3 2 × 2 × 4	16 × 10 × 10
Lovebirds, parrotlets, budgies	2 × 2 × 3 2 × 2 × 2	8 × 6 × 6

*Cage and box dimensions are height × width × depth.

and provide more space for exercise. Disadvantages include difficulty in sanitation and pest and parasite control. Caretakers walking from flight to flight can track disease organisms or parasites.

Furnishing Cages and Flights

Furnishings should be placed so enclosures can be serviced with minimal disturbance and labor. Efficiently designed feeders reduce contamination, reduce dumping by the birds, prevent or reduce perching on bowls, and protect food from rain. Alcove feeders or basket feeders can be used.

Adequate cage doors allow capture of birds with minimal chasing. Enclosures can be made escape-proof with safety aisles or suspended safety netting. A portable catching cage or drape can be suspended over the door surrounding the catcher to reduce the chance of escape in cases of outside suspended cages that lack safety doors or aisles. Adequate space or double wiring between cages or flights prevents fighting between neighboring pairs.

Nest boxes should be mounted in or on the cage in such a way to facilitate easy and frequent examination. Placement on the same end as the feeding/watering station allows simultaneous feeding and nest box examination. Very shy birds may be more comfortable if the nest box is away from high traffic areas.

Some aviculturists believe that species such as Amazons require visual isolation around the ne box, whereas other species, such as cockatoos, a less affected by visual contact with conspecific These differences may arise from flocking behavi and the existence or lack of communal nesting the species.

Nest boxes must be constructed so that wat does not soak through. They must be shielded fro rain or direct sunlight, which may cause overhe ing. Nest boxes may be constructed of many mate als, plywood being the most common. Pressur treated plywood should not be used because of t potential of ingestion of toxins. Wire lining reduc nest box chewing; however, chewed wires can pr duce dangerous projections that could damage eg or injure chicks or adults. Plastic or metal barr have the advantages of being more permanent a they can be disinfected; however, they are mo susceptible to environmental temperature var tions. Nesting materials can contribute to disea problems. The use of potting soil, corn cob be ding, or hay may contribute to fungal growth. Pi shavings are recommended for nesting material.

Perches must be secure for successful copulatio Natural wood perches with variable diameter a surface textures provide optimal exercise for fe However, unless very hard woods such as man nita or Australian pine are used, wood perches rapidly destroyed by many psittacines. Very la or flat perches, used to avoid frequent replaceme may cause pressure lesions on the ventral surfa of the hocks. More permanent perches may made from polyvinylchloride (PVC) or steel pi concrete, rolled wire, and some synthetic materi Some foot and leg problems may be associated w long-term perching on hard perches, especially cold climates where chilling of the feet may oc Alternative perching must be provided. A concr perch helps keep nails trimmed.

AVICULTURE MANAGEMENT

Managing Intraspecific Aggression

Unpredictable aggression of a bird toward its m is a common cause of mortality for species s as cockatoos. It most frequently involves a m cockatoo, which with or without previous sign aggression attacks or kills its mate. Aggression

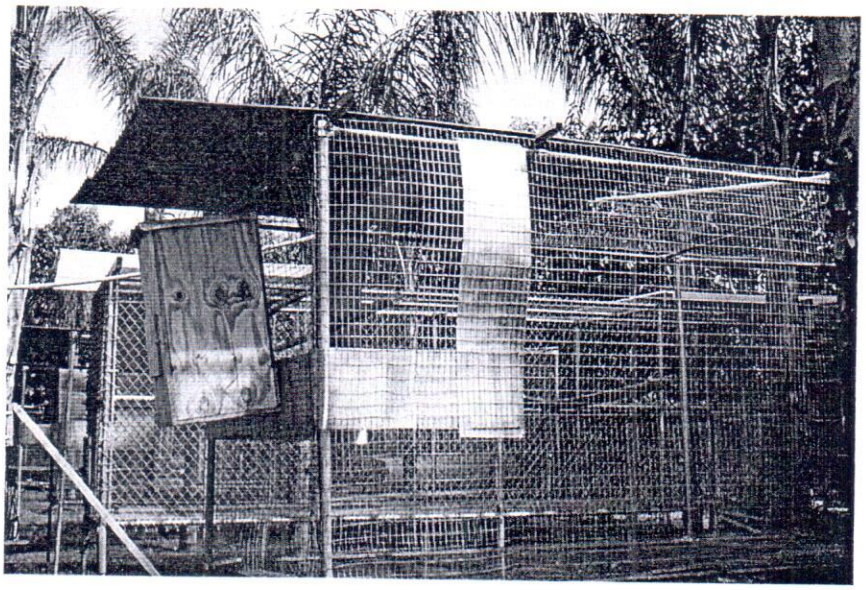

Figure 8–1

Sheetmetal barriers can be used to provide a safe haven surrounding the nest box for a hen that is paired with an aggressive male. When his wings are clipped he cannot climb up to the perch and nest box. The hen can fly to his perch to be bred.

occur at any time of year but is more common early in the breeding season. In species or pairs that exhibit this behavior, preventive management may reduce the chance of losing a bird.

Many breeders routinely clip the wings of male cockatoos prior to the breeding season so that they are less able to catch the female. Special boxes with two entrances and baffled interiors may help reduce the chance of the male trapping the hen in the box. A promising cage alteration has been designed in which a sheetmetal strip is placed as a barrier around the box and a perch in front of the box. This keeps the wing-clipped male from climbing up to the box (Figs. 8–1, 8–2). The hen can fly down to the male for breeding.

In males that have a history of biting the hen, an acrylic or rubber bumper can be attached to the tip of the maxilla to reduce the chance that he can inflict a fatal injury. These tips are only temporarily effective, because they loosen and fall off with beak

Figure 8–2

Sheetmetal barriers.

growth. Bumpers typically last 2 to 8 weeks, but this time period may be adequate to prevent aggression in the early breeding season.

Diets and Nutrition

Proper nutrition is vital to aviculture success. Diets should be complete and balanced for optimal health and reproduction. Establishing a species in captivity often requires an understanding of the feeding habits of the species in the wild and preferences of captive birds to meet nutritional requirements and provide psychological stimulation to enhance breeding success. Several goals should be met when formulating diets for captive breeding birds, including meeting the known or perceived nutritional requirements; maintaining good food hygiene; providing psychological enrichment by offering variety; affording ease of preparation; and minimizing labor, waste, and expense.

A wild parrot must forage for its food. In its quest for food a bird may ingest a varied diet, which may include fruits, flowers, buds, pollen, seeds, grains, roots, and some live foods. Many of these foods are seasonally available. In tropical or subtropical zones, seasonality of food and breeding seasons may be associated with wet and dry seasons. The seasonal provision of extra soft foods prior to the onset of the breeding season may stimulate reproduction. This practice is often referred to as "flushing."

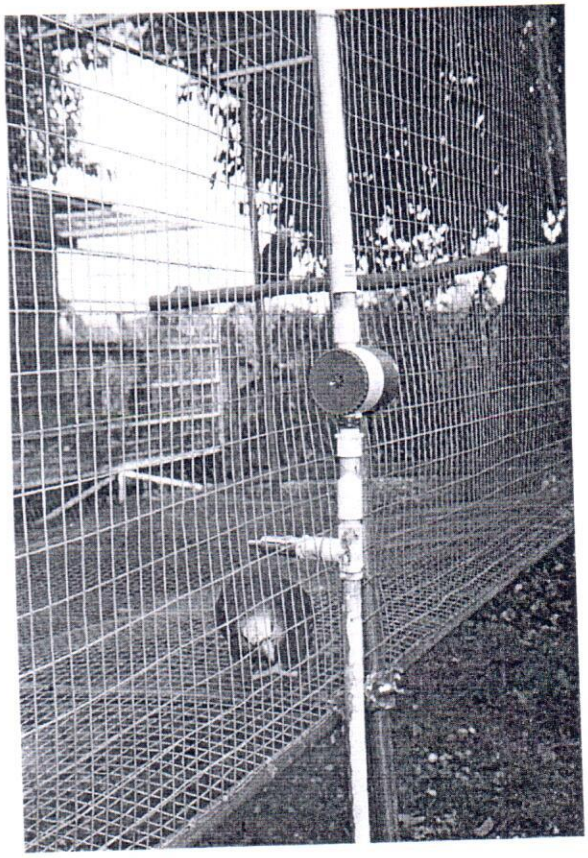

Figure 8–3

A nipple drinker (Lixit) can be used to provide fresh water at all times without using bowls. The gray sprinkler timer above the drinker provides periodic showers from overhead sprinklers.

Planning a Health Maintenance Program

A health maintenance program is necessary for each aviary, while considering problems that are common in the aviary and endemic problems in the locality. For example, birds housed in outdoor aviaries in southern coastal states must be provided with protection against the introduction of opossum (if Old World psittacine species are housed in the aviary) to prevent the inevitable introduction of sarcocystosis. Controlling biting insects is important to prevent or limit introduction of pox viruses as well as reduce insect bite hypersensitivity.

Annual examinations should be done in the nonbreeding season, typically in the fall. The veterinarian should limit the numbers of assistants and visitors when visiting an aviary so that disturbance is minimized.

Sanitation is vital to good health; however, the level of hygiene must be balanced against the disturbance associated with it. Designing cages so that cleaning and maintenance are minimized saves labor and limits disturbances that can reduce the chances of successful reproduction in shy birds. Frequent disinfection of cages is not necessary if healthy birds are permanently housed within and organic debris is not allowed to build up in the cage.

Good food hygiene practices prevent the spread of food-borne pathogens. Storage of feed in closed garbage cans prevents infestation by insects or rodents. Hygiene is especially important when dealing

with soft or fresh foods with high water content in which spoilage is rapid. Sprouts are considered highly beneficial and stimulating by many aviculturists, but routine cultures usually reveal gram-negative bacteria and fungi. Rinsing sprouts in dilute hypochlorite or chlorhexidine solutions prior to feeding can reduce bacterial and fungal contamination. Likewise, fruits and vegetables support microbial growth if left too long in a cage, especially in a warm, humid climate. Feeding programs should be designed so that removal of food from a cage is easy. For example, use of a commercial coleslaw machine to grind and blend vegetables allows for easy removal of uneaten food by simply hosing the remains out of the cage.

Water offered to birds must be potable and provided fresh daily. Water bowls should be washed as necessary and as indicated by algae growth and food or fecal deposition in the bowl. Vitamins should not be added to drinking water because they oxidize rapidly and promote bacterial growth.

Automatic waterers reduce labor and ensure that birds have a clean, fresh supply of water at all times (Figs. 8–3, 8–4). Contamination from food or fecal deposition in water is eliminated. Contamination of water lines can occur, and frequent flushing of water lines is important to maintain good water quality (Fig. 8–5). Water should be flushed through lines daily as part of the maintenance routine. Periodic flushing of water lines with hypochlorite or iodophors may be necessary. Reliance on automatic waterers without a visual check to assure they are working every day can result in mortality from system failures. Water bottles are less susceptible to contamination than bowls; however, bottles can be a reservoir for bacteria if not cleaned frequently or appropriately.

The use of foot baths is often considered an important aspect of a disease control program. They are probably of minimal value as long as people are not entering flight cages; more attention should be focused on the cleanliness of objects that directly contact birds, such as clothing, nets, and hands. Nonetheless, the veterinarian must take precautions when going from one premises to another to avoid transmission of pathogens on contaminated footwear. Washing shoes or boots after leaving an aviary, or the use of disposable plastic shoe covers, is a good preventive measure. The proper disinfection of equipment is especially important because items such as nets, restraint devices, and instruments come into direct contact with birds and can serve as fomites.

Air conditioners and ventilation systems may be foci for bacterial and fungal growth in an indoor facility. In a California finch breeding facility, the source of recurrent bacterial infections was traced to an air conditioner filter that supported the growth

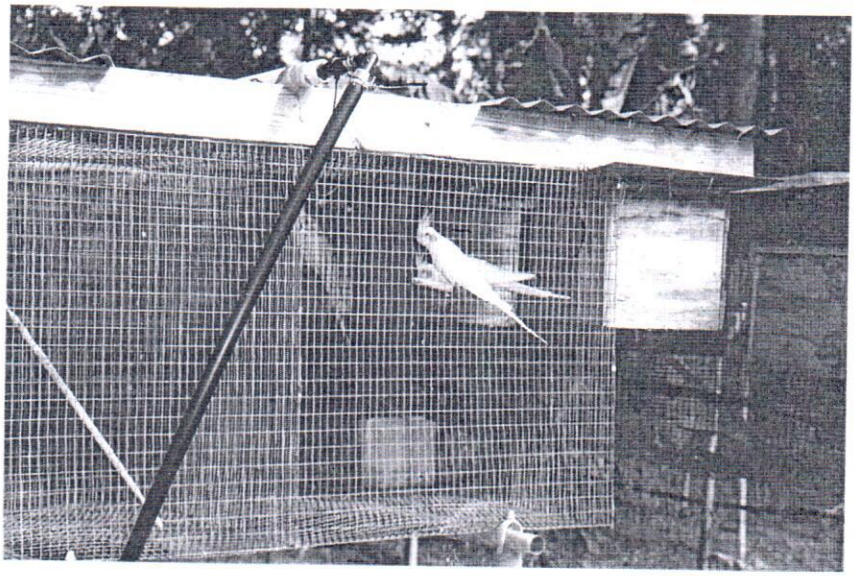

Figure 8–4

The water system pictured here consists of a polyvinyl chloride (PVC) pipe running over the cage. The pipe is drilled with holes so water drips into the cage. A sprinkler timer system allows the water to flow for 3- to 20-minute periods each day. This system allows birds to drink without bowls and without contacting the water line, which could result in contamination.

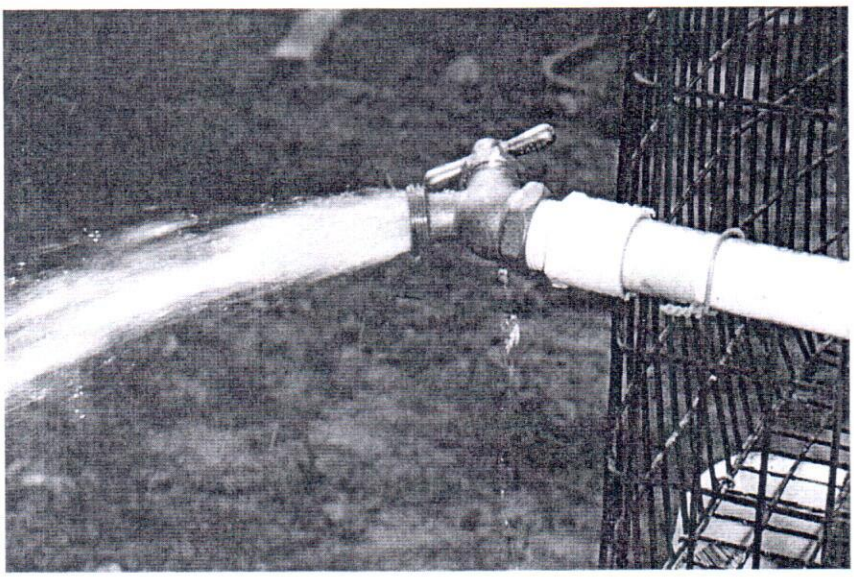

Figure 8–5

It is vital that water lines for automatic watering system can be easily flushed to dislodge bacterial plaques. The flushing system is best fitted on a timer for frequent flushing.

of *Pseudomonas*. In another facility, *Aspergillus* was disseminated through an air conditioner filter that was not changed with necessary frequency.

Daily washing of food bowls is not practical in many avicultural facilities. Soiled bowls, however, are a source of contamination, and a system must be established to wash bowls as frequently as necessary to maintain a reasonable level of sanitation (Fig. 8–6). Bowls should either be washed with soap and water and returned to the same cage, or, if washed in a group, they should be washed then disinfected. For ease of washing, a series of tubs can be set up, the first with detergent and hot water, followed by a rinse, followed by immersion for the recommended period of time in a properly diluted disinfectant solution, followed by a second rinse and air drying on a rack. A commercial dishwasher is a viable alternative if organic debris can be adequately removed.

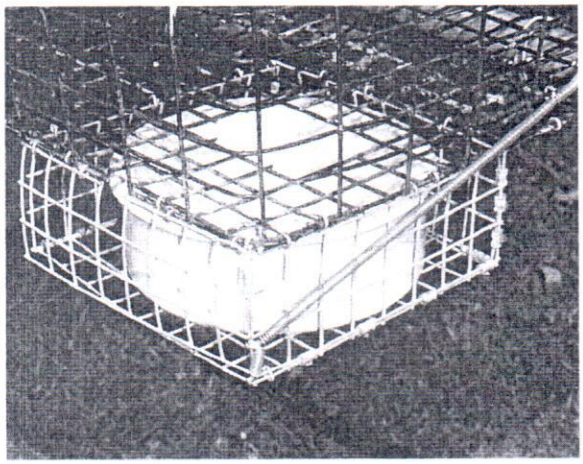

Figure 8–6

Basket feeders allow changing bowls without opening cage doors. The basket is mounted under a hole in the cage floor. If it is mounted above the floor, it has a hole in the top. The opening is large enough for the bird to insert its head but is too small to allow escape.

Nest boxes, at a minimum, should be thoroughly cleaned annually, and nest material should be changed after each clutch if chicks were allowed to hatch in the nest (Fig. 8–7). The dark, damp interior of a nest box can provide an ideal environment for the proliferation or dissemination of pathogens. Wood nest boxes should be destroyed if the inhabitants develop viral or serious bacterial diseases, such as psittacine pox, polyoma, or salmonellosis. Problems such as dead-in-shell embryos, contaminated eggs, and chicks hatching with infections may be directly traced to a moist nest box and transport of bacterial agents through eggshell pores.

Wire floor cages allow feces and food debris to fall through or to be hosed out of the cage, limiting unnecessary disturbance associated with overzealous cleaning. Excessive organic debris should not be allowed to build up in a cage.

Facilities should be maintained in a clean, sanitary condition. All surfaces should be cleaned of

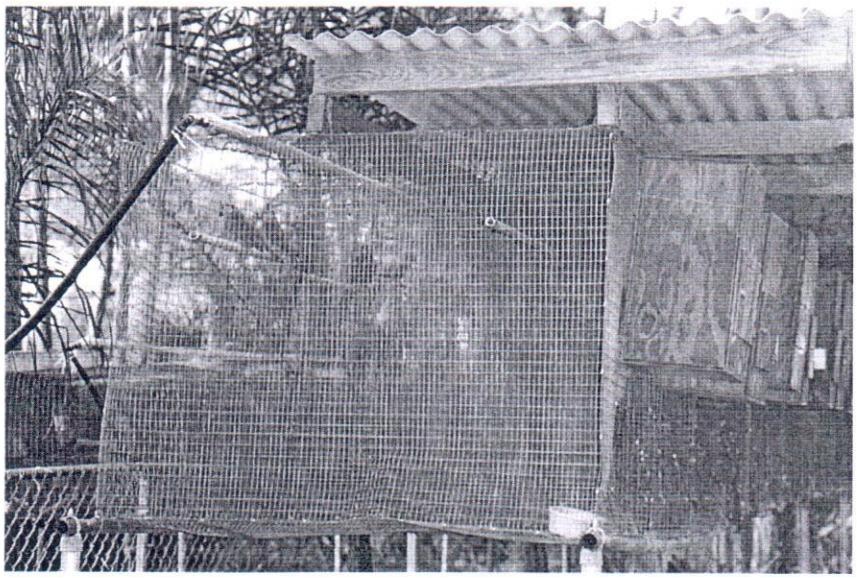

Figure 8–7

Roofs suspended above nest boxes and food bowls protect them from rain. Corrugated PVC roofing does not absorb heat in the summer. Note the drip/timer water system as in Figure 8–4.

organic debris prior to disinfection. Disinfectants should be used according to label instruction; stronger solutions are not more effective. The constant use of powerful disinfectants in the absence of a disease threat may not be beneficial and can be potentially harmful. Chlorine bleach should only be used in well-ventilated areas, and a 5% solution is effective for most uses.

PEST CONTROL

Insect and rodent pests are vectors for disease and parasites and are a source of irritation and disturbance for breeding birds. Cockroaches transmit *Sarcocystis falcatula* from opossum feces and can contaminate a bird's food and nest or can be eaten by a bird, resulting in fatal illness. Control of roaches, especially in outdoor facilities in southern coastal climates, is challenging if not impossible. The use of insecticides alone is not likely to be effective; the potential exists that they may cause toxicity in birds. Biologic control methods are preferable, such as attempting to limit or eliminate breeding sites, or keeping insectivorous animals, such as chickens or geckos, in a bird compound to consume insects (Fig. 8–8). The use of flightless chicken breeds, such as silky chickens, is recommended so that the chickens are not able to roost on the cages of parrots.

Ants can transmit some parasites such as the proventricular worm *Dispharynx*. Ants can also reduce food consumption by swarming food bowls or build nests in nest boxes. Control procedures should include baiting of nests and trails, keeping facilities clean, and avoiding foods that attract ants into cages. The incidence of mites and lice is low in captive psittacines, but they may be introduced into an aviary by wild birds. The red mite (*Dermanysis gallinae*), however, can be troublesome in aviculture. The mite is nocturnal and hides during the day in crevices in aviaries and nest boxes, and thus control cannot be achieved without treating the environment. Red mites can kill chicks by weakening from exsanguination. Carbaryl powder 5% has been used successfully for the control of mites inhabiting nest boxes without apparent harm to chicks or adults. Mosquitos can also be a problem for chicks in nest boxes.

Rodents and Predators

Rats entering an aviary at night can not only spread disease, but also can disturb nesting birds and on occasion kill birds. In a survey on one breeding farm in South Florida, 50% of resident rats were found to be carrying *Salmonella* species.

In Southern US coastal areas, rats are particularly a problem in the fall when populations seem to

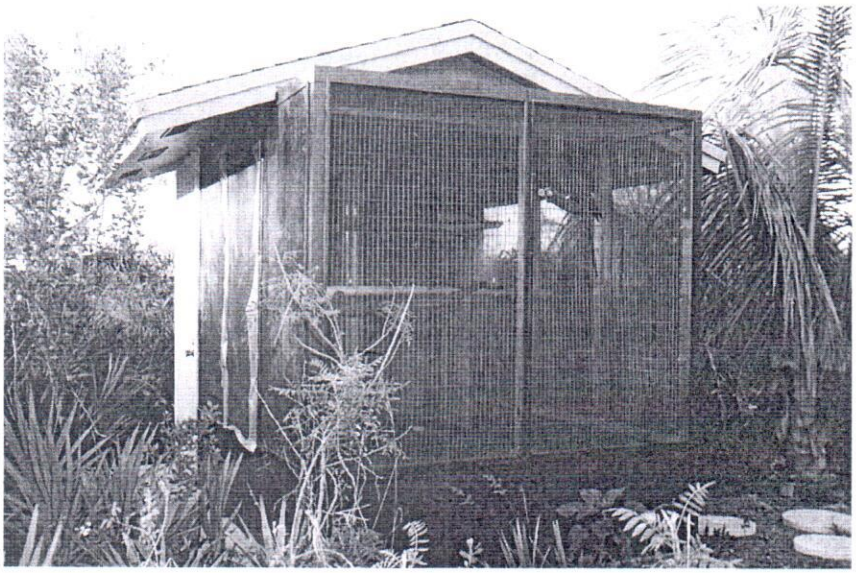

Figure 8–8

This isolated aviary, constructed for a pai of hyacinth macaws, is screened tc prevent entry of biting insects and is equipped with a burglar alarm. Feedinç and nesting areas are sheltered, but the open end of the flight allows exposure tc sun and rain.

rise. Biologic control methods appear to be most effective. Attempts should be made to build in such a way as to discourage nesting in or around the aviary. For example, the use of concrete slabs under aviaries appears to provide additional cleanliness under suspended cages, but rats almost invariably tunnel and nest under these slabs. Cages suspended on poles can be fitted with rat guards, or the poles can be greased to prevent climbing. Sheetmetal guards can be wrapped around trees to prevent nesting in trees by rats or use of trees by predators to cross fences. Bait boxes should be used as needed and with caution.

Snakes occasionally enter cages and eat small birds, but they rarely attack larger species. If an aviculturist is breeding small birds outdoors, such as finches, the cage should be constructed with small wire or screened to prevent entry of snakes.

Large predators such as opossum, raccoons, cats, and dogs should be carefully excluded from the aviary (Fig. 8–9). Electric wires running along the top or bottom of a perimeter fence that is buried at the bottom is a very effective means of control. Aviculturists must observe the perimeter of the enclosure to ensure that overhanging trees do not provide access to aviary roofs from points outside the perimeter.

Wild birds may also be problematic in an outdoor aviary, especially pigeons and doves, which may transmit *Chlamydia* to psittacines.

Preventive Medicine

Routine preventive medicine programs can be designed around a detailed health history of the collection. Many parasites can be excluded from an aviary by screening of new birds, and annual deworming of all birds may yield some benefit, especially if food- or water-borne medications can be used, which do not result in stress. Testing of all or a portion of the birds may help to reveal the need for deworming and the choice of medication. If birds are handled for annual examinations, the opportunity exists for deworming.

Annual prophylactic treatment for chlamydiosis is often advocated, even in the absence of a diagnosis of chlamydiosis. If the birds are housed outdoors and exposed to wild birds, especially pigeons, this may be necessary and quite beneficial. Treatment should be delayed until the nonbreeding season, usually the fall for most species. Egg production typically is reduced or stopped, and chicks that hatch from eggs laid during treatment may exhibit abnormalities.

Commercially available oil emulsion adjuvant vaccines for Pacheco's parrot disease and *Salmonella* infection can be very beneficial in populations at risk. These vaccines were developed for use in wild-caught imported birds to prevent catastrophic disease outbreaks. In an aviculture collection, the benefits of vaccination must be weighed against the

Figure 8–9

Live trapping of predators can be useful in controlling raccoons and opossum. Raccoons must be relocated many miles away (at least 10 miles) and may still return to the farm. Sardines, cat food, and eggs make good baits.

potential for granulomatous reactions to oil emulsion adjuvants.

Disinfectants should be used judiciously in aviaries. All disinfectants are potentially toxic. All are ineffective if organic debris is present, and thus cleaning with detergents and water prior to disinfection is necessary. The least toxic disinfectant for the need should be chosen. Bleach diluted at the rate of one part bleach to 20 parts water is very effective; however, bleach should never be mixed with other chemicals because toxic chlorine gas may be liberated. Increasing the water temperature increases the efficacy of chlorine. Chemical burns result if birds come into contact with bleach, and some birds attempt to ingest bleach if allowed to.

An appropriate response taken in the face of a disease outbreak can dramatically alter the outcome. When dealing with an individual bird, isolation and the provision of specific therapy is indicated. In an aviculture setting, the flock must take priority. Containment of spread, or demonstrating the source and implementing control procedures, is the primary consideration. Ideally, management changes or biologic control measures can be instituted in preference to drug therapy.

Selling Birds

Offering a liberal warranty may be used as a sales tool. However, as a perishable product, long-term guarantees given on the health or life of birds, especially unweaned birds, can be difficult to provide. Presale testing for selected infectious diseases such as polyoma virus, PBFD, or chlamydiosis may help assure the buyer of good health. However, for birds entering commercial trade, the cost of such testing is often declined because an initial negative test does not rule out exposure after testing, testing during incubation periods, or false negative test results. The best guarantee of good health logically stems from a stable flock of known health history and good husbandry practices.

Pet shops and breeders often require veterinary examination within a certain period of time to activate a guarantee. A suggested guarantee may be 14 to 30 days with a postpurchase examination within the first 7 days to activate the guarantee. A no-question return policy should be in place for birds found unsuitable for purchase by the buyers' veterinarian. The veterinarian must practice good judgment in recommending return and not reject birds for frivolous or unsubstantiated reasons.

Suggested Reading

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