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Case Report

Infestation of Research Zebra Finch Colony with 2 Novel Mite Species

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A zebra finch (*Taeniopygia guttata*) housed in a neuroscience laboratory was observed to have numerous feather mites. Subsequently, similar mites were found on other birds in the animal facility and research space. The most abundant mite was a novel, undescribed species in the genus *Neocheyletiella*. Whereas known *Neocheyletiella* mites have previously been characterized as skin parasites of various birds worldwide, the species on the zebra finches is unique because it lives and builds nests in the feathers. Infrequent specimens of a 'true' feather mite, a new species of *Megninialges*, were present also. Although multiple treatments using a pyrethrin spray were effective in eradicating the mites, topical ivermectin later was found to be more efficacious, better tolerated by the birds, and less labor intensive. This case highlights the general dearth of information regarding ectoparasites in zebra finches, even though these are the most frequently used songbirds in biomedical research. The mite epizootic also underscores the diverse pathogens possible in zebra finches that arrive from outside sources and why ongoing health monitoring of finch colonies is warranted.

Zebra finches (*Taeniopygia guttata*) are increasingly popular as animal models in biomedical research, especially in the fields of neurobiology and behavior.[2,7] Many investigators using these birds maintain inhouse, closed breeding colonies. When birds need to be imported, they are provided by colleagues or are obtained from a limited number of pet-bird dealers that often buy zebra finches from 'backyard' breeders. A primary concern about any outside supplier, as has been noted by other authors,[1] is that little (if any) health monitoring of the birds might be done prior to shipment. Birds can arrive at research institutions infected with various parasites and potentially pathogenic bacteria, among other agents. Depending on many factors, such as parasite burden, infections can cause immediate morbidity and mortality or can be clinically silent. This report describes an epizootic of feather mites that presumably went undetected for some time. The 2 mite species observed in the finches had not previously been described by entomologists, and the most prevalent mite was sufficiently novel to justify the assignment of a scientific name. The infestation reinforces why vigilant diagnostic testing, and perhaps prophylactic treatment, of newly arrived zebra finches should occur before their release into the regular colony and why continued health surveillance of an established group of zebra finches is invaluable.

Case Report

At the Massachusetts Institute of Technology (Cambridge, MA), a colony of approximately 350 zebra finches is used for research involving the neurologic mechanisms of song development. The birds are maintained under a 12:12-h light:dark cycle, with temperatures between 70 to 80 °F (21.1 to 26.7 °C) and an ambient relative humidity set at 30% to 70%. A millet–oat–canary seed mix fortified with amino acids, vitamins, and other additives (Canary–Finch Diet, LM Farms, Hartz Mountain Corporation, Secaucus, NJ) is provided ad libitum. In addition, a high-protein supplement (High Potency Mash, Harrison Bird Foods, HBD International, Brentwood, TN) combined with minced hard-boiled eggs and water is fed several times each week. Fresh drinking water and cuttlebones are always available. In the AAALAC-accredited animal facility, the finches are housed as breeding pairs plus offspring or in large flight cages containing as many as 20 birds; singly housed, experimental birds can be held in the laboratory for as long as 1 mo, with IACUC approval. When new zebra finches are purchased from outside vendors or received from other academic institutions, quarantine testing over 6 wk includes fecal exams and cultures to screen for intestinal pathogens, along with a complete necropsy of at least one clinically healthy bird when the shipment is large. Additional necropsies are performed on sick birds and any that die in quarantine. Such testing has revealed subclinical coccidia and *Campylobacter jejuni* infections, as well as occasional helminths. Routine colony surveillance is performed semiannually. For more than 10 y, the colony has been considered healthy overall.

A research associate noted 'moving dandruff' on one bird in the laboratory (Figure 1), and the veterinary staff was contacted. When plucked feather samples were placed on slides with mineral oil and examined using a light microscope, potentially 2 different types of mites were in evidence. A survey of birds in the animal housing facility and research space revealed similar mites in both locations. Most affected finches appeared normal, with good body and feather condition, but a few birds (less than

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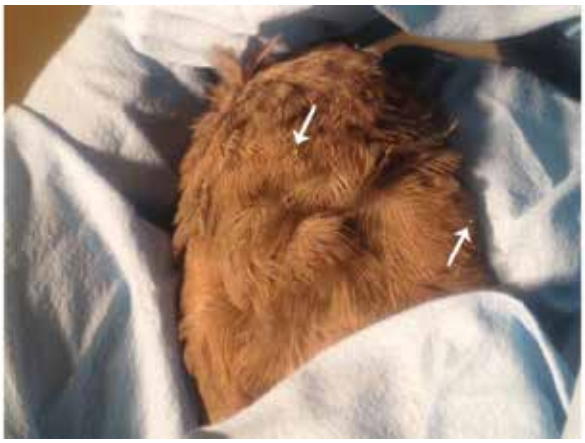

Figure 1. Index zebra finch with visible mites (arrows).

Figure 2. Novel *Megningales* sp., adult female.

1% of the colony) had ruffled feathers and partially closed eyes. Mites were more numerous on the birds that exhibited signs of ill health; these birds subsequently were monitored, given supportive care (for example, extra mash), and isolated as needed.

An external entomologist confirmed that 2 mite species were living on the zebra finches; in addition, both mites were novel and previously undescribed. One species, which was found on the birds infrequently, is a 'true' feather mite of the subclass Acari, superorder Acariformes, cohort Astigmatina, family Analgidae, genus *Megninialges* (Figure 2); only one species has been named in the genus to date. Feather mites normally feed on glandular secretions and dander from the host and are considered to be commensal symbionts.[5,8] The second, much more prolific, mite species (Figures 3 and 4) belongs to the acariform suborder Prostigmata, family Cheyletidae, genus *Neocheyletiella*; these are not true feather mites. *Neocheyletiella* mites principally are found as parasites on the skin of passerine birds;[4] in the present case, however, the mites are living gregariously in the feathers themselves, where they construct silken nests (Figure 5)—that is, not in association with the skin. Because of its unique biology, the neocheyletid mite has been characterized and named (*Neocheyletiella parvisetosa*).[6]

Once mite identification was complete, all zebra finches in the animal facility and the laboratory were treated twice, with a 2-wk interval between treatments, using a pyrethrin-based spray (0.16 mg/100 mL water; Permectrin II, KMG-Bermuth, Houston, TX); during these 2 applications, birds were sprayed in situ. However feather examinations carried out a few weeks later demonstrated incomplete mite eradication, and 4 additional treatments at biweekly intervals were performed by individually spraying each bird that lived outside a nest box; hatchlings were sprayed within the nest. The pyrethrin spray method was well tolerated in general but was stressful for postoperative birds and some with low body condition scores. The deaths of 2 birds were attributed to the spraying. Nevertheless, a sample of feathers was checked several times after the final spraying, and no live mites were found.

Because of welfare and labor concerns, topical ivermectin (200 µg/kg in propylene glycol applied to the skin under a wing) was selected for use as a routine parasiticide in the future. Also, when subsequent shipments from 2 finch suppliers revealed feather debris suggestive of ectoparasites, the quarantine protocol was revised to include 2 biweekly applications of topical ivermectin; this regimen is undertaken after checking new birds for mites and

Figure 3. *Neocheyletiella parvisetosa*, adult female.

Figure 4. *Neocheyletiella parvisetosa*, adult male.

irrespective of test results. Compared with the pyrethrin spray, ivermectin has been more efficacious (no live mites found on sampled feathers after only 2 applications), and less labor intensive; importantly, there has been no evidence of ivermectin toxicity, even when it has been administered to hatchlings and transgenic zebra finches. Furthermore, feather and skin examinations have been added to the semiannual surveillance testing of resident colony and laboratory zebra finches.

Figure 5. Feather containing silken nests and various life stages of *Neocheyletiella parvisetosa*.

Discussion

The source of the mites on the zebra finches is not definitively known, but conceivably they were present in low numbers on birds that had been received in preceding months. It is likewise unclear how the mites became so abundant; for example, there were no dramatic temperature or humidity extremes recorded in either housing space that might have affected mite density. Nevertheless, some environmental perturbation that influenced mite colonization cannot be ruled out. Within the animal facility, moving birds between cages for breeding purposes could facilitate the transfer of mites to naive birds. In the laboratory, open-sided bird cages are juxtaposed closely; this arrangement could allow mite movement from infested finches to birds in adjacent cages. In addition, research personnel transport birds between the housing facility and the laboratory, and surgical procedures on the laboratory-housed birds, with potentially concomitant immunosuppression, might enhance the proliferation and survival of ectoparasites. Although zebra finches in the housing facility are checked daily by veterinary staff, and the laboratory birds are monitored by a research technician on weekdays in conjunction with monthly site visits from the veterinary staff, the mites were not discovered until several birds were heavily infested.

Even though theories regarding the development of the mite epizootic remain inconclusive, increased attention to feather and skin examinations and prophylactic ivermectin treatment during quarantine will minimize the likelihood of a recurrence. Indeed, an informal, limited survey by one author (MP) revealed that many U.S. academic institutions using zebra finches routinely administer parasiticides to new arrivals, and preemptive drug treatment against potential ectoparasites was cited in a recent article about laboratory finches.[9] Given the insidious nature of the outbreak at our institution, we recommend that birds from resident colonies be tested for external parasites on a regular schedule (for example, semiannually or annually).

Several ectoparasites, including chewing and biting lice, blood-sucking mites (*Dermanyssus gallinae* and *Ornithonyssus sylviarum*), skin mites (*Backericheyla* spp. and *Neocheyletiella media*), and feather mites, can affect passerine birds.[3] In addition, various quill mites have been described in passerines, and air sac mites (*Sternostoma tracheacolum*) are reported to be common in estrildid finches, the group to which zebra finches belong.[3] *Knemidocoptes pilae*, the scaly mite, causes hyperkeratotic lesions on the beak base and feet of finches, and there are anecdotal reports that laboratory zebra finches have occasionally been colonized with a *Knemidocoptes* mite. Despite these examples, specific and novel mites had not been ascribed to zebra finches previously. Within the genus *Neocheyletiella*, 16 species had been described as of 2012. All of these neocheyletid mites are considered to be skin parasites of various bird species, but little is known about their biology or feeding habits because they are rarely studied in vivo. Regardless, the novel neocheyletid mite identified on zebra finches (*Neocheyletiella parvisetosa*) at our facility is very unlike any of its congeners. As time allows and until SPF zebra finches are available, laboratory animal personnel in charge of these birds should monitor for pathogens that can influence their health; this knowledge will contribute to our understanding of their ecology in captivity.

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