James R. Hill, III

A common sight in most Purple Martin nests: a blood-engorged maggot of the blowfly, *Protocalliphora splendida*, attached to a growing wing feather of a nestling martin. It's not unusual for 100 to 500 of these parasitic fly larvae to be present in each martin nest. Adult female flies, which resemble shiny-green houseflies (see photo on page 3), enter a martin's nest and lay their eggs. After a few days, larvae hatch from the fly eggs, begin taking repeated blood meals from their martin hosts, and grow rapidly. After the nestling martins fledge from the nest, the maggots metamorphose into purple, football-shaped pupae (see photos on page 2) that hatch into adult flies within a few weeks.

What's Bugging Your Birds?

An Introduction to the Ectoparasites of Purple Martins

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This article is not meant to "gross out" anyone, nor scare potential landlords away from the immensely-rewarding hobby of martin attraction. Nor is it meant to give martins a bad image as "dirty" birds. Rather, it is an attempt to educate martin enthusiasts about the fascinating and complex web of life that intertwines with the martins nesting in their yards. People need to realize that nearly ALL life forms play host to a myriad of parasites. It's a natural and normal phenomenon.

Like most higher forms of life, birds and mammals are parasitized by a vast array of "bugs." These bugs belong to the taxonomic phylum Arthropoda. The Arthropods that parasitize birds are in the classes, Insecta and Arachnida. The insects that parasitize martins include the lice, fleas, bedbugs, blowflies, louseflies, blackflies, and mosquitoes. The parasitic arachnids are represented by the mites and ticks. Nearly all of these arthropods are known to parasitize the Purple Martin and can easily be found by the inquisitive martin landlord either *on* their martins or *in* their nests.

Actually, a close examination of the life within the martin's nest-cavity ecosystem is quite a fascinating experience. I encourage every martin landlord to do so. But, I caution you,

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Above: A handful of blowfly maggots, *Protocalliphora splendida*, removed from a single martin nest. Note the range of sizes. It's not uncommon to find 100-500 per nest. The dark ones are blood engorged, indicating a recent meal. Blowfly maggots are the most destructive martin parasite.

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Above: A series of blowfly pupal cases. The one on the right has successfully hatched an adult blowfly. It emerges from the end, leaving a large opening. The three pupal cases on the left failed to hatch a blowfly, but instead hatched 30-60 *Nasonia* wasps (as below). Note the multiple, tiny exit holes.

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you might be shocked at the sheer abundance and variety of organisms that you'll find feeding off the blood, feathers, and skin of nestling martins. Remember, though, parasitism is a natural phenomenon, and martins have coevolved with their parasites and the energy drain they inflict. To compensate, martins have evolved their own set of defensive strategies to combat their parasites. They have evolved a physiological immune system that responds to the presence of internal parasites; they have developed instinctive preening behavior to harvest the parasites that live in their plumage; they molt the feathers that are damaged by the chewing activities of their feather mites and lice; and finally, they line their nest bowls with fresh green leaves that, as they decay, release hydrocyanic acid (cyanide gas), a fumigant somewhat toxic to their nest-dwelling parasites.

It's clear, therefore, that parasites have played a highly-significant role in the evolution of many of the characteristics that make Purple Martins the birds we love and cherish today. Personally, I am fascinated by the complex web of interactions that take place inside a martin's nest. It is imperative for martin landlords to understand the ecology of these parasites if they are to fully understand the ecology of martins. I have included a list of terms and definitions (see page 7) that will help the reader better understand the language that is spoken by explorers who venture into the fascinating world of parasites. You should read these now, before proceeding.

The Effects Parasites Have on their Hosts

In their frequently-cited study, published in *Science* magazine back in 1970, Moss and Camin measured the effect that the martin bird-nest mite, *Dermanyssus prognephilus*, has on martin nesting success. They established two colonies side by side. One was kept as a control, the other was kept mite-free using a miticidal dust. The experiment was repeated for several years, although each year they alternated which house was the control and which was the test house.

Their results showed that although an equivalent number of martin eggs was laid in the nests of each colony, the average number of young fledged by the mite-free birds was 4.2 per nest compared to 3.6 per nest by mite-parasitized birds. During one particularly warm, wet nesting season during this long-term study, the mite population became so severe in the untreated control house that nearly all of the nests were abandoned, while there was no nest abandonment in the treated house 30 feet away. Compare these results with the 4-year test run by the *PMCA*, reported on pages 28-29, where we eliminated *all* parasites, not just mites.

Obviously, parasites do lower the reproductive success of their hosts, and during periods of

heavy infestation, may actually weaken and kill them. During fair weather, parent birds usually can gather enough food to offset most of the parasite-induced energy drain on their nestlings. But, during poor weather, when the parents can't deliver enough food to the nest, their young weaken, allowing parasites to multiply. It is during these heavy infestations that parasites cause extreme irritation to their hosts, may lower their resistance to disease, and may actually kill them.

Many disease-producing microorganisms (bacteria, viruses, and protozoans) are dependent on ectoparasites for their transmission. As a result of the blood-feeding habits of ticks, bird-nest mites, lice, fleas, hippoboscid flies, blackflies, mosquitoes, and blowfly larvae, many hosts suffer from anemia. And the skin lacerations left by these bloodsucking parasites can act as portals of entry for bacteria. With all of this in mind, it seems desirable for martin landlords to take proper steps toward controlling the parasites at their colony sites.

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An adult blowfly, *Protocalliphora splendida*, that has just emerged from it pupal case. They are about the size of a common housefly.

After 10-20 days of intermittent blood feeding, the larvae pupate in the nest. The pupal cases are purplish-brown in color, oblong in shape, and about 10 mm long (photos on page 2). Adult flies emerge from these pupal cases after about 11 days if the pupa was not parasitized by the tiny, 2 mm long, wasp parasite, *Nasonia vitripennis*. The female of this wasp pierces the wall of the blowfly puparium and lays her eggs on the metamorphosing fly. This kills the developing blowfly. Typically, the wasp is able to control the blowfly population by parasitizing about 95% of the pupal blowflies. Parasitized blowfly puparia hatch about 30 to 60 tiny wasps instead of a single blowfly adult. Because of these beneficial wasps developing inside the parasitized blowfly pupae, landlords should never burn the martin nests removed from their housing — this will only result in *more* blowflies in forthcoming seasons.

It's not unusual to find 100-500 blowfly larvae or pupae in a single nest of the Purple Martin (see photos on page 2). A common location to find larvae and pupae is under the subfloors of your Trio™ martin houses. Several authors feel that nestlings may be killed or greatly weakened by these fly larvae. Experimental tests run on the Eastern Bluebird, *Sialia sialis,* have shown that nestlings in food-deprived nests become more heavily parasitized by blowflies than nestlings in control nests. Large numbers of parasitic larvae impose a substantial energy drain on parent birds through the increased food needs of their young. If we were to view blowfly parasitism from a human perspective (which is improper to do), it would be like trying to sleep in your bed at night with dozens of pickle-sized, bloodsucking maggots intermittently feeding on you!

If you find blowfly larvae attached to the nestlings in your martin colony you might feel tempted to pull them off and squash them; unfortunately, this is totally ineffective since only about 1-2% of the larvae present in each nest are feeding at any given time during daylight hours. The most practical control method is complete nest replacement (see page 28).

Finally, many landlords observe what they describe as hundreds of small, white maggots feeding on the dead remains of some of their martin nestlings. These are not blowfly larvae; instead they are likely the larvae of non-parasitic, carrion-feeding flies, the beneficial cleanup crew of the insect world. They had nothing to do with causing the nestlings' deaths. It is advisable to remove all dead martin nestlings when they are encountered in a nest.

The Insect Parasites of Birds

BLOWFLIES — *Adult* blowflies resemble greenbottle or bluebottle flies, but they are not parasitic on birds; their bloodsucking larvae (maggots) are. The blowfly species that is a serious pest of the Purple Martin within parts of its breeding range is *Protocalliphora splendida*. It is also a parasite on the Tree Swallow and Eastern Bluebird — seeming to prefer hosts that are cavity nesters. These are the most harmful of all martin parasites.

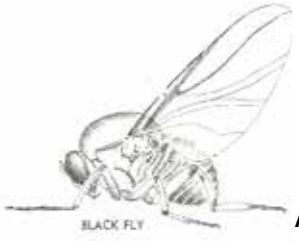
The adult female blowfly lays her eggs in the host's nest. When the parasitic larvae hatch, they intermittently attach themselves by means of a suction pad, to various parts of the nestlings' bodies and suck their blood. Typical attachment sites include the nestlings' feet, legs, toes, abdomen, beak, ear cavities, and the bases of growing wing and tail feathers (see photo on page 1). Blowfly larvae get up to 12 mm long and are a translucent, pearly white color. In contrast, freshly-fed larvae have an internal reddish tinge from the blood they have ingested. These larvae usually feed at night to avoid visual detection by the host's parents, but during heavy infestations a few may be seen attached to the nestlings during the day. Here in Pennsylvania, martin nests have so many blowfly maggots in them that the nests are little more than seething, writhing, beds of them.

LOUSEFLIES (Hippoboscid Flies) — These are the largest parasites you might observe crawling through a bird's plumage. Adult flies are slightly smaller than a housefly and are extremely flattened top to bottom. This flattening enables them to move quickly through the plumage of their hosts. Adult louseflies stay on their hosts for their entire life, sucking blood whenever they are hungry. The insects apparently overwinter as puparia in the host's nest. Young, feathered-out nestlings are generally more susceptible than adults to the attacks of louseflies. Feather lice commonly disperse to new host individuals by "hitching a ride" on the hairy bodies of these much larger insects; thus the name "lousefly."

Louse fly

The current scientific literature on hippoboscid flies fails to list the Purple Martin as a known host, but in 1982 in Pennsylvania, I observed an adult fly on a prematurely-fledged martin. Unfortunately, I was unable to collect it. Thus began a long quest for this elusive parasite. I didn't observe another hippoboscid on a martin until 1989. This time I was able to capture it. This specimen awaits identification by a hippoboscid authority. A few other martin researchers report having observed hippoboscids on the martins they study.

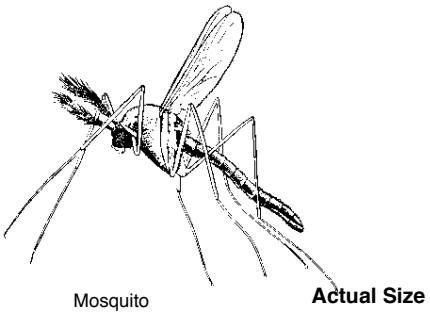
BLACKFLIES — Blackflies, also known as buffalo gnats, are tiny flies (2-3 mm long) whose adult females parasitize mammals and birds. Before a female blackfly can lay her eggs, she must engorge herself with a blood meal. Larval development takes place in aquatic environments. Adult females are famous for inflicting painful bites on humans, especially outdoorsmen in the north woods. Being winged, blood-feeders, they are capable of transmitting avian blood parasites.



In 1982, I collected three blood-engorged female blackflies in Griggsville, IL, attached to the unfeathered skin surrounding the eye of a 28-day-old nestling Purple Martin. They were later identified as *Simulium meridionale* by Dr. Peter Adler, entomologist at the *Pennsylvania State University*. The Purple Martin was a new host record for this species. Until my Illinois observation, it had been recorded only from turkeys, chickens, pheasants, doves, starlings, and humans. Heavy infestations of these flies have been shown to cause a drop in egg production in domestic chickens.

In 1984, heavy spring rains in the upper Midwest apparently caused ideal breeding habitat for blackflies, whose populations exploded in Iowa, Minnesota, Nebraska, and South Dakota. Dense clouds of them attacked nesting Purple Martins causing widespread die-offs and colony-site abandonments. In Edinboro, PA, in 1990, I collected several other specimens of blackflies that were taking blood meals from nestling martins.

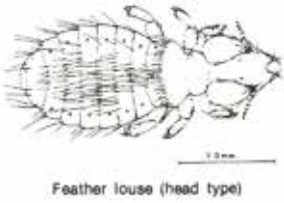
MOSQUITOES — Female mosquitoes of all species require a blood meal from a warmblooded animal before they can lay their eggs. Mosquitoes frequently attack birds and play an important role in transmission of blood-borne diseases, such as avian malaria, between birds.



For example, the mosquito, *Culex pipiens*, which was accidentally introduced by man 177 years ago into the Hawaiian Islands ecosystem is responsible for transmitting avian malaria from infected migratory shorebirds wintering there, to the uninfected native landbird fauna. This has caused the extinction of many endemic bird species because they were highly susceptible to this exotic, blood-borne pathogen.

Mosquitoes are known to parasitize nestling Purple Martins at night. The McEwen video, taken *inside* a martin house (see *Update* 3(4)), clearly shows mosquitoes tormenting the nestlings. Many others who have conducted research at night on martins report mosquitoes taking blood meals. Ironically, there's a lot more truth to the statement *"mosquitoes eat martins,"* than there is to the often heard statement *"martins can eat 2000 mosquitoes a day."*

BIRD LICE — These are the most common parasites likely to be found by martin landlords *on* their birds. There are over 800 North American species. They feed by biting off bits of their host's skin, or by eating the feathers themselves. A few species actually suck blood as part of their normal diet.

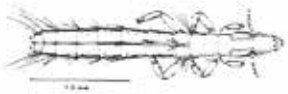


Feather louse (head type)

Bird lice are active, wingless insects, typically 2-3 mm in length. They are generally white, yellowish, or brownish in color, and are flattened top to bottom. They require the body heat of their hosts in order to survive and therefore spend their entire life cycle on their hosts. For this reason martin landlords will *never* find lice swarming through their martins' nests, or crawling on the outside of the housing. Lice are only found *on* the birds themselves. (The "lice" that many landlords report swarming over their martin nests and houses are actually bird-nest mites, described elsewhere in this report.)

Most bird hosts typically have 3-5 different louse species inhabiting the different regions of their plumage. Those that are habitat-specific to the head, neck, and throat regions of birds

are fat, rounded, and sluggish, with clasping mouth parts. These structural and behavioral features enable them to avoid being dislodged by the scratching actions of their hosts. In contrast, the lice species inhabiting the feathers of the breast, back, wing, and anal areas are generally slender, rapid-running forms able to dodge the host's scratching, picking, and preening actions.



Feather louse (wing type)

Bird lice are well adapted to their parasitic mode of life. They have claws perfectly designed for clinging to the feather barbs of the plumage regions they specialize in feeding on, and they are flattened for easy locomotion between these feathers. Everywhere the host flies, they fly as tightly-clinging passengers. Becoming dislodged from their host would mean certain death.

Bird lice lay their eggs, called nits, on the feathers of their hosts, but not during the periods of their host's feather molt. Any eggs laid during the molt period would be lost with the shed feathers. Lice nits are easily visible on the crown, forehead, and lore feathers of most older Purple Martin nestlings. The lice nits of martins are white, translucent capsules, about 1 mm long, and are usually attached in clumps (see photo to the right).

Four different species of lice are known to live on the Purple Martin. They are known by the scientific names: *Myrsidea dissimilis, Philopterus domesticus, Machaerilaemus americanus*, and *Bruellia brevipes*.

The breeding cycle of feather lice coincides with the reproductive cycle of their host, enabling the newly-hatched lice to disperse onto the newly-available nestlings without exposing themselves to unfavorable environmental conditions.

A normal louse population appears to have little impact on the host, since by preening its plumage a healthy bird is able to keep these parasites in check. A sick or injured bird, in contrast, often develops a heavy infestation of lice, particularly if it is too weak to properly preen itself. In cases of heavy louse infestation, there is considerable destruction of the host's feathers, but it is extremely rare for lice to kill their hosts, because to do so would be suicide for them.

Preening, besides being a feather combing and oiling behavior, is also mechanical delousing behavior. Since preening birds eat their lice, it is unwise to use pesticides on a bird's plumage. When you see a martin scratching its head with its foot, it is relieving the irritation caused by the lice running around on its head — martins frequently scratch their heads, even in flight. Lice commonly drink from the lacrimal fluid covering the eye of their hosts.

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Above: A nestling Purple Martin with six lice running around on its skin. Lice are relatively harmless to their hosts. They are mostly an irritant. When you see a martin scratching its head, it's likely to relieve the discomfort caused by the action of lice. Martins eat their lice while preening.

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Above: A cluster of white lice eggs (called nits) above the eye of a nestling martin. Below: A louse coming to the eye of an ASY (adult) male Purple Martin to get a drink of lacrymal fluid. Lice spend their entire lifecycle *on* their hosts, travelling to Brazil and back. They're never found *in* the nest.

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Continued from page 5

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A nestling Purple Martin with several blood-engorged bird-nest mites, *Dermanyssus prognephilus,* on its face and in its ear opening. Bird-nest mites live in martin nests and climb aboard their hosts when they want a blood meal.

FLEAS — Fleas are easily recognized; they are small (3-4 mm long), wingless, jumping insects, dark brown in color, with mouth parts adapted for piercing the skin and sucking the blood of their hosts. Their bodies are somewhat oval in profile, and they are greatly compressed laterally, an adaptation enabling them to slip easily and quickly through the narrow spaces between the feathers of their hosts.

Fleas are parasitic as adults only; the larvae of bird fleas feed on debris in the nest. There are only about 20 species of fleas parasitic on North American birds. The Purple Martin is parasitized by two species; the common martin flea, *Ceratophyllus idius*, in eastern U. S. and *Ceratophyllus niger* in nests west of the Rocky Mountains.

It is not unusual to find in excess of 100 adult fleas and a couple of thousand immature, wormlike larvae in a martin's nest during the summer. One martin nest that I collected during the summer of 1982 in Pennsylvania and held in a zip-lock bag over the winter at room temperature hatched out 1900 adult fleas. Fleas can and do overwinter outdoors in martin nests. They have an antifreeze-like substance in their bodies that enables them to survive extremely cold temperatures. Overwintering martin fleas must fast for 8-9 months between blood meals, while their hosts are in Brazil.

Most bird fleas crawl through the feathers of their host, but generally are not found there. They spend the majority of their time in the host's nest and climb aboard the host only to feed or disperse. Therefore, examination of the host's nest is the best way to determine the relative numbers infesting the host. Some species of flea may transmit blood-borne diseases to their hosts. The flea that parasitizes domestic poultry causes weight loss, reduction in egg production, and even death due to blood loss.

During a less enlightened era, experts recommended the use of the pesticide DDT, for treatment of fleas on birds and in their nests. But again, as with lice, preening birds eat what fleas they can catch and therefore might ingest any pesticide sprinkled or sprayed in their nests for flea control.

BEDBUGS — Bedbugs are bloodsucking insects, characterized by oval bodies that are flattened top to bottom; short, wide heads with compound eyes; conspicuous four-jointed antennae; and reduced, functionless wings. Bedbugs are not continuous feeders; instead they engorge themselves in about five minutes and then drop off their host.

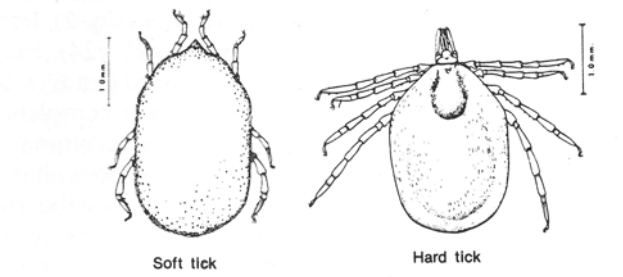
Bedbug

Actual Size

Five species of bedbug have been found in the nests of the Purple Martin: *Hesperocimex coloradensis* in the tree-cavity nests of martins in western North America; *H. sonorensis* in martin nests in the saguaro cacti of the Sonoran Desert of Mexico; *H. cochimiensis* in martin nests in the saguaro cacti of Baja California; *Cimexopsis nyctalus* in man-made nest-boxes in Florida; and *Ornithocoris pallidus* in man-made nest-boxes in Florida and Georgia. Little is known about the biology of these insects, nor what role they play in ecology of their avian hosts. Should you find a martin bedbug, please send it to us.

The Arachnid Parasites of Birds

TICKS — Ticks are frequently found attached to the bare skin areas of birds, including the underwings, feet, brood patches, bare throats, eyelids, or bare heads. It is at these locations that they feed by sucking blood.



Soft tick

Hard tick

The abdomen is distendible in soft ticks, and in female hard ticks, so that after engorging on a meal of blood, a tick may be quite large. Male hard ticks, however, are often overlooked because their abdomens do not become distended. Ticks are most often encountered in large seabird colonies, but may also be found in the nests of non-colonial breeders. Ticks use their host only as a food source and not for shelter, and therefore pass the majority of their life cycle nearby in the nest, or in the litter on the ground.

Ticks have never been reported on the Purple Martin, but should, nonetheless, be looked for. Another species of colonial-breeding swallow, the Cliff Swallow, *Hirundo pyrrhonota*, is an occasional host to ticks.

MITES — There are three general types of mites that are parasitic to birds. Each will be treated separately.

Nasal Mites: As incredible as it may sound, there are mites that live and feed *inside* the nostrils, trachea, lungs, and air sacs of birds. They feed on mucous, blood, or tissues and are considered *endoparasites*.

Feather Mites: These tiny arachnids are so extremely small that to the naked eye they appear to be tiny dirt particles on the bird's body, wing, and tail feathers. On the Purple Martin, "colonies" of them can be seen on the long wing and tail feathers between the feather barbs (see photo on page 27), but you'll have to have the bird in your hand to see them.

Definitions

ARACHNID — Any of a class (Arachnida) of small, wingless, air-breathing arthropods, having 8 legs. This group includes spiders, mites, ticks, scorpions, and pseudoscorpions.

ARTHROPOD — Any of a large phylum (Arthropoda) of invertebrate animals having jointed legs, chitinous exoskeletons, and segmented body parts. These include the spiders, mites, ticks, crabs, and insects.

COEVOLUTION — When ecologically intimate organisms (such as predators and their prey, or parasites and their hosts) influence each other's evolution. For example: martins are dragonfly specialists. To avoid being eaten by martins, dragonflies evolved faster and more erratic flight speeds. In turn, to avoid starving to death, martins evolved a faster, more agile flight to keep up with their favored prey. Over time, this coevolutionary race between predator and prey continues. Actually, martins have coevolutionary relationships with all of their *native* competitors, predators, prey, and parasites.

ECTOPARASITE — An organism that lives on the surface of the body of a host organism to the detriment of this host.

ENDOPARASITE — an organism that lives inside the body of a host organism to the detriment of this host.

HABITAT-SPECIFIC PARASITE — A parasite that can live in only one specific location on or in its host. For example, some species of feather lice are found only on the head feathers of their hosts.

HOST — The organism from which a parasite obtains nourishment and shelter.

HOST-SPECIFIC PARASITE — A parasite that can live and reproduce on only one species of host or group of closely related hosts.

INSECT — Any of a class (Insecta) of small, air-breathing arthropods, having 6 legs, a body divided into a head, thorax, and abdomen, and one, two, or no pairs of wings.

PARASITE — An organism that lives in or on another organism, the "host," at whose expense it obtains nourishment and shelter.

PARASITOLOGIST — A scientist who specializes in the study of parasites.

PARASITOLOGY — The scientific study of parasites and parasitism.

NEST FAUNA — The total assemblage of organisms that live in the nests of birds . Some of these organisms are ectoparasitic and therefore harmful to the nest owner, but others may actually be beneficial to their hosts by cleaning the nest of feces and other organic debris, and by eating or parasitizing the bird's parasites.

PARASITICIDE — A poisonous agent or product used to destroy parasites. These are typically, but not always, a chemical pesticide.

TOXICITY — A measure of the effectiveness of a poison at killing the target species.

Parasites: Continued from page 7

For nourishment, they chew on the feathers and a heavy infestation may severely damage a bird's plumage. Other species of feather mites, known as quill mites, pass their entire life cycle *within* the hollow confines of the wing feather quills. These types feed on host tissue fluids by piercing the quill wall with their sharp mouth parts.

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A landlord's hand covered by several hundred individual martin bird-nest mites, *Dermanyssus prognephilus*. After martin nestlings fledge, these nest mites will crawl onto anything that moves, in an attempt to disperse to a new host. They do not bite humans, but you'll itch like crazy once they're on you! I have counted as many as 5,147 in a single martin's nest. In huge numbers, they can cause colony-site abandonment and premature fledging of nestlings.

Like the bird lice, feather mites spend their entire life cycle on the host, laying their eggs on the feathers. They are very habitat specific on their hosts, different species preferring different types of feathers and even different parts of particular feathers.

Bird-nest mites: These tiny (1 mm long), bloodsucking, mites occur in the nests of cavity-nesting birds in spectacular numbers. They pass their entire life cycle in avian nest material, emerging only to feed. A large volume of blood is ingested at each feeding. After engorgement the females lay up to 20 eggs in the nest material. This is the parasite martin landlords most often see, since they are external, conspicuous, and very numerous. The species living in the nest of the Purple Martin is *Dermanyssus prognephilus*.

During heavy infestations, *Dermanyssus prognephilus* can be observed crawling all over the nests, cavity walls, entrance holes, and porches of martin houses. If you reach into a heavily-infested nest, especially after the martins have fledged, hundreds of them may leap onto your hand, seeking dispersal to a new host (see photo at left). I have counted as many as 5,147 in a single nest! Heavy infestations have been blamed for causing both colony-site abandonment and premature fledging in Purple Martins.

Bird-nest mites breed only during the period of nest occupancy by their hosts. In late summer when martins depart for Brazil, adult mites must survive a 36-week period of starvation until their hosts return. Immature stages of the martin bird-nest mite are eaten by a predatory cheyletid mite that is found in most nests. *D. prognephilus* has also been collected from the nests of the red squirrel, Eastern Bluebird, Northern Flicker, Redheaded and Downy Woodpeckers.

Conclusions

When present in sufficient numbers, blowflies, blackflies, louseflies, mosquitoes, fleas, bedbugs, and bird-nest mites suck so much blood from martins that they can cause some to die from anemia. These parasites can also weaken martins, making them more susceptible to secondary infections, such as pneumonia, tuberculosis, aspergillosis, and avian pox. Several are also vectors in the transmission of *endoparasitic* roundworms, flukes, bacteria, viruses, and protozoans. In general, cavity nesters are parasitized to a higher degree than open nesters, since cavity nesters tend to reuse cavities from year to year, despite the fact that fleas, nest mites, bedbugs, and louseflies overwinter in nest debris (as adults, larvae, nymphs, pupae, or eggs). As a result, cavity nesters tend to be a bit more tolerant of their parasites. In fact, research at the *PMCA* shows that returning martins would rather nest in a cavity with a flea-infested, preexisting nest, than in a cleaned-out cavity (see *Update* 4(4):28-29). Obviously, the energy drain caused to martins by their fleas isn't too severe.

Martin parasites are not known to feed on humans or transmit diseases to them. So there is no need to get upset when an occasional bird-nest mite, flea, or louse gets onto your hands or clothes while doing a nest check. This is normal; just brush them off. Despite this lack of threat, it is not wise to bring a martin house or gourd into your house for winter storage until the nests have been removed and the interiors scrubbed with soap, water, and a disinfectant. More than one martin landlord has unknowingly brought their martin housing into a heated garage in late fall, only to have thousands of martin fleas and bird-nest mites warm up and disperse into the rest

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Clusters of tiny (0.5 mm long) feather mites on the upper surface of a Purple Martin's tail feathers (rectrices). They get their nourishment by chewing on the feathers. Although these parasites are typically harmless to Purple Martins, they can severely damage an individual's plumage during heavy infestations.

of their house. This calamity can be no minor inconvenience. One woman nearly divorced her husband after some mites ended up in their bed. She thought they were Crab or Pubic Lice, a sexually-transmitted human ectoparasite, and accused the poor man of being unfaithful!

Recommendations

What should a landlord do about the parasites attacking their martins? There are two schools of thought on this. Many landlords do nothing — they just let nature take its course. They know that Purple Martins coevolved with their parasites, predators, and *native* nest-site competitors, so have a clutch size perfected adapted to compensate for these losses. Martins have survived with their parasites for millions of years without human intervention. Other landlords want to do everything they can to help, after all, research shows that during bad weather, parasite-free martin nests fledge nearly twice as many young as nests with normal parasite levels. It seems desirable, therefore, to control parasites. In the past, placing pesticides in martin nests was common. Now, however, we are very reluctant to recommend such practices. Pesticides in the nest are eventually ingested by martins when they eat their parasites, or consume their nestlings' fecal sacs after they've been deposited on the floor of the nest. The practice of *"nest replacement"* (see page 28) is far safer and is now the recommended technique.

In the debate over whether humans should intervene at all between martins and their parasites, consider one additional thought. The parasite load martins are exposed to in human-supplied, artificial housing *might* actually be higher than the levels they evolved with and, thus, are adapted to, even though humans typically remove nests between seasons, today. This is because artificial housing has far more cavities, at much closer proximity, than those found in tree cavities. The denser the living conditions, the faster that parasites multiply and disperse through host populations. The colony sites martins used before they underwent their tradition shift to human-supplied housing, and those they still use in the trees of western North America, had (and have) far fewer nest cavities.

Martin enthusiasts should decide whether to leave parasites alone, or take measures to safely control them. What ever your decision, please don't use pesticides in your nests.