

Avian Mycoplasmosis

(*Mycoplasma gallisepticum*)

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Importance

Mycoplasma gallisepticum

Is the most economically significant mycoplasmal pathogen of poultry. *M. gallisepticum* infections can cause significant economic losses on poultry farms from chronic respiratory disease, reduced feed efficiency, decreased growth and decreased egg production. The carcasses of birds sent to slaughter may also be downgraded. *M. gallisepticum* infections are notifiable to the World Organization for Animal Health (OIE). This organism has been eradicated from most commercial chicken and turkey breeding flocks in the United States; however, it remains endemic in many other poultry operations. Since 1994, *M. gallisepticum* conjunctivitis has become an emerging disease in finches. This disease has been responsible for major declines in house finch populations in the eastern U.S., and was recently reported in western house finch populations. *M. gallisepticum* can also affect other finch species, although its impact has not been as severe.

Etiology

Avian mycoplasmosis can be caused by several species of *Mycoplasma* (class Mollicutes, order Mycoplasmatales, family Mycoplasmataceae) including *Mycoplasma gallisepticum*, *M. synoviae*, *M. meleagridis* and *M. iowae*. *M. gallisepticum* is the most important pathogen in poultry. It also causes disease in other avian species. *M. gallisepticum* infections are also known as chronic respiratory disease (CRD) of chickens, infectious sinusitis of turkeys and house finch conjunctivitis.

Several strains of *M. gallisepticum* have been reported, including the R (poultry), P (psittacine) and house finch strains. Strains may vary greatly in their pathogenicity for different species of birds. In one study, budgerigars developed severe disease after experimental infection with the R strain of *M. gallisepticum* but not the house finch strain.

Species Affected

Mycoplasma gallisepticum causes disease in chickens, turkeys, and game birds including pheasants, chukar partridges, bobwhite quail, Japanese quail and peafowl. The organism has also been isolated from ducks and geese, as well as yellow-naped Amazon parrots, pigeons and greater flamingos. It has been found in wild peregrine falcons in Spain

Since 1994, *M. gallisepticum* epidemics have been reported in house finches (*Carpodacus mexicanus*) in the U.S. This organism has also been confirmed by culture or polymerase chain reaction (PCR) in American goldfinches (*Carduelis tristis*), purple finches (*Carpodacus purpureus*), eastern tufted titmice (*Baeolophus bicolor*), pine grosbeaks (*Pinicola enucleator*), evening grosbeaks (*Coccothraustes vespertinus*) and a captive blue jay (*Cyanocitta cristata*). PCR-positive mourning doves (order Columbiformes) have also been reported, but these birds remained seronegative and culture negative, and may have been infected by a related species of *Mycoplasma*. Other passerine species have tested positive by serology. House sparrows (*Passer domesticus*) and budgerigars (*Melopsittacus undulatus*) have been infected experimentally with some strains.

Geographic Distribution

M. gallisepticum can be found worldwide. In the United States, this organism has been eradicated from most commercial chicken and turkey breeding flocks, but remains present in other poultry operations. Beginning in 1994, *M. gallisepticum* epidemics associated with conjunctivitis were

reported in house finches throughout the eastern U.S. Infected birds have recently been reported in house finch populations in the western U.S.

Transmission

M. gallisepticum is transmitted during close contact between birds as well as on fomites. Aerosol spread occurs over short distances and can be responsible for transmission within a flock. *M. gallisepticum* is also transmitted vertically in eggs. Shedding in the egg can vary; egg transmission is more frequent in birds infected during laying than in birds infected before they mature. Infected birds carry *M. gallisepticum* for life, and can remain asymptomatic until they are stressed.

Incubation Period

Experimentally infected poultry develop symptoms after 6 to 21 days. In natural infections, the incubation period is variable; infected birds may be asymptomatic for days or months until stressed. In finches, incubation periods from 4 to 14 days have been reported.

Clinical Signs

M. gallisepticum infections vary from asymptomatic to severe, depending on the infecting strain and other factors. More severe infections are seen when the birds are infected concurrently with Newcastle disease virus, infectious bronchitis virus, *Escherichia coli* or other pathogens.

Infected chickens usually develop respiratory symptoms that may include rales, coughing, sneezing, nasal discharges and dyspnea. Turkeys typically experience more severe disease, often accompanied by swelling of the paranasal (infraorbital) sinus. Conjunctivitis with a frothy ocular exudate is common in turkeys and occurs occasionally in chickens. Production is lower in infected flocks, with decreased weight gain, feed efficiency and egg production. The symptoms of avian mycoplasmosis are typically slow

to develop, and the course of the disease can be prolonged. However, acute respiratory disease sometimes occurs in young birds, particularly turkeys.

Avian mycoplasmosis has also been reported from other species of birds. In game birds, avian mycoplasmosis is characterized by upper respiratory disease, conjunctivitis lethargy, weight loss, decreased egg production and deaths. Conjunctivitis, sometimes accompanied by infraorbital sinus swelling, rhinitis, and ocular and nasal discharges, occurs frequently in house finches infected with *M. gallisepticum*. Conjunctivitis has also been reported in experimentally infected American goldfinches, pine siskins, purple finches and tufted titmice. In one study, the clinical signs were severe in house finches and American goldfinches, and milder in pine siskins and purple finches. In experimentally infected house finches and other passerine species, *M. gallisepticum* infections may take weeks or months to resolve; in one study, conjunctivitis persisted for an average of seven weeks. Clinical disease has also been reported in psittacine birds including experimentally infected budgerigars. *M. gallisepticum*, together with *M. iowae* and an unidentified mycoplasma, was isolated from a flock of yellow-naped Amazon parrots with upper respiratory disease. The condition appeared to be caused by concomitant infections with mycoplasmas and bacteria, and the precise role of *M. gallisepticum* was not established

M. gallisepticum infections seem to be subclinical in some species of birds. House sparrows infected with the R (poultry) strain shed the organism transiently, but remained asymptomatic. In another study, budgerigars developed severe disease after experimental infection with the R strain of *M. gallisepticum* but not the house finch strain.

Post Mortem Lesions

In uncomplicated cases in chickens, the lesions typically include mild sinusitis, tracheitis and airsacculitis. If the chicken is infected concurrently with *E. coli*, thickening and turbidity of the air sacs, exudative accumulations, fibrinopurulent pericarditis and perihepatitis may be seen. In

turkeys, severe mucopurulent sinusitis may be found, with variably severe tracheitis and airsacculitis. Lesions reported in naturally infected chukar partridges and pheasants include conjunctivitis and sinusitis of one or both infraorbital sinuses. Finches typically exhibit mild to severe inflammation in one or both eyes and the periorbital region. The eyelids may be swollen and inflamed, and a clear to cloudy, thickened ocular discharge may be noted. There may also be drainage from the nares.

Morbidity and Mortality

In the U.S., *M. gallisepticum* has been eradicated from most primary and multiplier poultry breeding flocks, but this organism can be endemic in large, multiple-age commercial egg laying flocks. Outbreaks also occur in meat flocks. Clinical cases tend to occur in large commercial operations during the winter. Stressors such as viral infections, vaccination with live viruses, cold weather or crowding can trigger disease outbreaks in infected flocks. In chickens with uncomplicated infections, the morbidity rate is high and the mortality rate low; however, more severe disease occurs if the birds are concurrently infected with other viruses or bacteria. Mortality rates can be high in turkeys.

In wild songbirds, the impact of the disease is complicated by other factors. Under controlled experimental conditions, house finches exhibited morbidity rates approaching 100%, but low mortality rates of approximately 5% or less. However, the mortality rate can be high in wild house finches, probably due to environmental factors such as cold, predation and difficulty locating food and water. American goldfinches are also highly susceptible to experimental infection; however, in the wild, the morbidity rate is reported to be 2-3% in this species, compared to a 20-27% morbidity rate in free-living house finches. The cause of this discrepancy is unknown.

Diagnosis

Clinical

M. gallisepticum infections should be considered in poultry or game birds with upper respiratory disease and wild house finches with conjunctivitis. Avian mycoplasmosis may also be a possibility in other species of passerine and psittacine birds, as well as blue jays.

Differential diagnosis

In poultry, the differential diagnosis includes respiratory diseases such as infectious bronchitis, mild Newcastle disease and avian influenza. *Hemophilus paragallinarum*, *Pasteurella multocida* and *Mycoplasma synoviae* infections should also be ruled out. In turkeys, other pathogens to consider include avian pneumovirus, *Pasteurella multocida*, *Chlamydia* and *M. synoviae*. Mixed infections with *M. gallisepticum* and other organisms can occur.

Laboratory tests

M. gallisepticum infections can be diagnosed by culturing the organism on mycoplasma media. The colonies are tiny, circular, smooth and translucent, and sometimes have a “fried egg” appearance with a central dense mass. Biochemical tests can be useful in preliminary identification, but definitive identification is by indirect immunofluorescence, immunoperoxidase staining, a growth inhibition test, metabolism inhibition or PCR. Polymerase chain reaction/ restriction fragment length polymorphism (PCR-RFLP) may be necessary to distinguish *M. gallisepticum* from *M. imitans*. These two species can also be differentiated by immunofluorescence using serial dilutions of antisera to *M. gallisepticum* and *M. imitans* in parallel.

M. gallisepticum can be difficult to grow directly from clinical samples, and PCR-based assays are commonly used for diagnosis. Animal inoculation, using mycoplasma-free chicken embryos or chickens, is

occasionally necessary to isolate the organism if these results of other tests are not conclusive; however, animal inoculation has largely been superceded by PCR. Immunological tests to detect antigens are generally not used directly on clinical samples, due to the very small size of the organisms and the absence of suitable negative and positive controls in many cases.

Serology can also be used for diagnosis, and is particularly helpful in screening poultry flocks. Serology is less useful in individual birds, as nonspecific reactions are common. Commonly used assays include a rapid serum agglutination (RSA) test, enzyme-linked immunosorbent assays (ELISAs) and hemagglutination inhibition. Other tests including radioimmunoassay, microimmunofluorescence and indirect immuno-precipitation assays may be available.

Samples to collect

Swabs should be collected from affected organs, tissues and exudates for mycoplasma culture. In poultry, the samples can be taken from live birds, recently dead animals or carcasses frozen soon after death. There has been only limited success isolating *M. gallisepticum* from the frozen carcasses of house finches. In live poultry and other birds, swabs can be taken from the choanal cleft, oropharynx, esophagus, trachea, cloaca and phallus. At necropsy, samples can be collected from the air sacs, trachea, nasal cavity and infraorbital sinus. Aspirates can also be taken from the infra-orbital sinuses or joint cavities. In addition, *M. gallisepticum* can be cultured from dead in-shell embryos, chickens or poults that have broken the shell but failed to hatch, and embryonated eggs. Tissues or swab samples can be transported in mycoplasma broth. Samples should be sent to the laboratory as soon as possible and kept chilled with an ice pack.

Similar samples can also be used for PCR. One commercial test kit uses the material directly extracted from swabs. Serum samples should be collected from the flock for serology.

Recommendation

Recommended actions if *Mycoplasma gallisepticum* infection is suspected

Notification of authorities

Control

M. gallisepticum can be introduced into a flock by live birds or hatching eggs, as well as the movement of people and fomites. Subclinically infected small backyard flocks can be a source of infection for commercial poultry. In the U.S., lateral transmission is the most common means of introduction, as the disease has been eradicated from most primary and multiplier breeding flocks. *M. gallisepticum*-negative breeding stock can be identified and maintained by serologic testing. Heat treatment or tylosin can eliminate egg transmission from valuable breeding animals. Biosecurity measures are important in preventing transmission on fomites. Wild or pet birds can also carry *M. gallisepticum*, and should be excluded from poultry operations.

Infections can be eliminated from a farm by depopulation of the flock, followed by thorough cleaning and disinfection of the premises. Most commonly used disinfectants are thought to be effective for *M. gallisepticum*. Recommended disinfectants for buildings and equipment include phenolic or cresylic acid disinfectants, hypochlorite, and 0.1% glutaraldehyde. Mycoplasmas are typically fragile and only survive in the environment for a few days; birds can be re-introduced after two weeks.

Eradication from large, multiple-age commercial egg laying flocks is complicated by persistent infections and periodic shedding under stress. In these flocks, *M. gallisepticum* infections may be treated with antibiotics, which decrease the clinical signs but do not eliminate the infection. Other concurrent infections must also be treated. Several live *M. gallisepticum* vaccines are available for chickens in the U.S.; permission from the state

veterinarian may be required for their use. An inactivated bacterin is also available in most countries. Vaccines are generally used to prevent egg-production losses and reduce the impact of respiratory disease in commercial layers, but they can also aid eradication, or reduce egg transmission in breeding stocks. Vaccination of turkeys with live vaccines is usually not recommended; however, newer live vaccines are less pathogenic for this species than the older (F strain) vaccine. One vaccine strain (6/85) has been tested in commercial turkeys in the U.S

Routine cleaning of bird feeders and disinfection with a 10% solution of household bleach can reduce transmission in wild finches. Transmission at wild bird rehabilitation facilities should be minimized by good sanitation and disinfection; in one case, a blue jay contracted the infection from a house finch that had previously occupied the same cage. Consideration should be given to the possibility that *M. gallisepticum* may be present in poultry carcasses fed to raptors.

Public Health

Mycoplasma gallisepticum does not appear to be zoonotic.

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