Al-Qadisiyah J. Vet. Med. Sci. 2025; 24 (3): 10.29079/qjvms.2025.165355.1122
The 1st National and International Scientific Conference November 26 / 2025
ISSN P: 1818-5746
E: 2313-4429
qjvms@qu.edu.iq

Mycoplasma gallisepticum and Chronic Respiratory Disease in Poultry: A Comprehensive Review

Saeed Mohammad Hasan Mudhafar[1], Alaa Abdulaziz Abed[2]
[1]Dept. of Veterinary Microbiology, College of Veterinary Medicine, University of Al-Qadisiyah
[2]Dept.of Pathology and Poultry diseases, College of Veterinary Medicine, University of Al-Qadisiyah

Submitted: October 06, 2025
Revised: November 10, 2025
Accepted: November 11, 2025

Correspondence:
Saeed M. H. Mudhafar[1]
saeedhanan2005@gmail.com

Abstract *Mycoplasma gallisepticum* (MG) is one of the most significant pathogens in poultry medicine, responsible for chronic respiratory disease (CRD) in chickens and infectious sinusitis in turkeys. As a member of the class Mollicutes, MG is distinguished by its lack of a cell wall, small genome, and parasitic lifestyle. Infections cause substantial economic losses in the global poultry industry through reduced productivity, increased mortality, and costs of treatment and prevention. This review summarizes current knowledge on MG, including its history, taxonomy, morphological and molecular characteristics, pathogenic mechanisms, epidemiology, clinical manifestations, immune responses, diagnostic strategies, antibiotic resistance, control measures, and vaccination. Future perspectives are also outlined, emphasizing genomic insights, host–pathogen interactions, and novel therapeutics.

Introduction Mycoplasmas are unique prokaryotes, representing the smallest free-living organisms. They lack a rigid cell wall, possess reduced genomes, and depend heavily on host-derived nutrients (1). Among avian mycoplasmas, MG is of particular importance, causing CRD in chickens and sinusitis in turkeys, both of which impair flock performance and increase susceptibility to secondary infections such as Escherichia coli (2). Despite decades of research, MG remains globally prevalent, and avian mycoplasmosis is listed by the World Organisation for Animal Health (WOAH) as a notifiable disease due to its transboundary and economic impact (3).

Historical Background

The study of mycoplasmas dates back to Pasteur's observations in 1843 of organisms linked to bovine pleuropneumonia. Subsequent isolation of these agents by Nocard and Roux in 1898 and their filterability led to initial misclassification as viruses (4). The term mycoplasma derives from Greek—mykes (fungus) and plasma (formed)—reflecting their fungal-like growth. Molecular studies in the 1960s clarified their identity as wall-less prokaryotes distinct from bacterial L-forms (5). Avian mycoplasmas, including MG, were later recognized as major causes of poultry respiratory disease (6).

Taxonomy and Evolutionary Perspectives

MG belongs to the class Mollicutes ("soft skin"), characterized by wall-less, pleomorphic organisms. Mollicutes evolved from low-GC Gram-positive ancestors (Firmicutes) via reductive evolution, losing genes for biosynthetic pathways and increasing host dependence. While 16S rRNA analyses suggest monophyly, whole-genome sequencing has provided higher resolution, confirming their close relationship to Gram-positive bacteria (6).

Morphology and Cultural Characteristics

MG cells are extremely small (300–800 nm), pleomorphic, and bounded by a cholesterol-rich plasma membrane that stabilizes osmotic pressure and mediates host interactions (7). On culture media, MG forms "fried-egg" colonies, but growth is slow (3–10 days) and requires serum and complex nutrients. MG is facultatively anaerobic and forms biofilms, enhancing persistence and antimicrobial tolerance (8).

Genome Organization and Molecular Biology

The MG genome (~1.0–1.1 Mb, ~31% GC content) encodes ~700–800 proteins. A hallmark is surface antigenic variation: the pMGA multigene family encodes variable immunodominant proteins. Key adhesins GapA and CrmA are essential for attachment to host epithelium. MG also exhibits gliding motility, aiding colonization of respiratory mucosa. Recently, CRISPR-Cas9 has been

Al-Qadisiyah J. Vet. Med. Sci. 2025; 24 (3): 10.29079/qjvms.2025.165355.1122
The 1st National and International Scientific Conference November 26 / 2025
ISSN P: 1818-5746
E: 2313-4429
qjvms@qu.edu.iq

explored for functional genomic studies to identify virulence-related genes (9).

Pathogenesis and Virulence Factors

Adhesins such as GapA and CrmA mediate tight adherence to ciliated epithelial cells, initiating colonization. Frequent phase variation of surface lipoproteins allows MG to evade host immunity. TLR2-mediated recognition of MG lipoproteins triggers cytokine release, inflammation, and lesions. Coinfections with *E. coli* or respiratory viruses exacerbate disease severity (10).

Clinical Manifestations

Chickens: Chronic respiratory disease with coughing, nasal discharge, airsacculitis, reduced feed conversion, egg drop, and poor hatchability (11). Turkeys: Infectious sinusitis with sinus swelling, ocular/nasal discharge, and growth retardation. Economic impact: Subclinical infections reduce productivity even without overt mortality (12).

Immune Responses

Innate immunity: MG lipoproteins activate TLR2, inducing pro-inflammatory cytokines. Adaptive immunity: Both humoral and cellular immunity develop but are insufficient for clearance due to antigenic variation. Immune evasion: Antigenic variation, biofilm formation, and immune modulation enable persistence (13).

Epidemiology

MG is distributed worldwide in commercial and backyard poultry; >50 wild bird species serve as reservoirs. Transmission occurs vertically (transovarian) and horizontally (aerosol, fomites, direct contact) (14). Latent carriers perpetuate flock infections and complicate eradication.

Diagnostic Methods

Culture: Gold standard but slow and technically demanding. Serology: ELISA (sensitive), HI and RSA (rapid but less specific). Molecular: PCR/qPCR for rapid detection; MLST and WGS for epidemiology and vaccine differentiation. Recently, LAMP assays have been highlighted as rapid and cost-effective diagnostic alternatives (15).

Antibiotic Resistance

Macrolides, tetracyclines, and fluoroquinolones remain widely used. Mutations in 23S rRNA (macrolides) and gyrA/parC (fluoroquinolones) drive resistance. Resistance prevalence varies regionally, with increasing fluoroquinolone resistance reported (16).

Vaccination Strategies

Live Attenuated Vaccines: F strain (effective but transmissible); ts-11 and 6/85 (safer but less immunogenic). Inactivated Vaccines: Safe but confer shorter protection. Recombinant/Subunit Vaccines: Promising approaches under development (17). Challenges: Antigenic variation, limited cross-protection, and surveillance complications.

Economic Impact

MG causes direct losses via reduced egg production, hatchability, and growth, plus indirect costs of medication, vaccination, and culling. Global annual losses are estimated at >$780 million (18). Trade restrictions further amplify economic burdens.

Prevention and Control

Strict biosecurity, including all-in/all-out management, sanitation, and wild bird exclusion, remains critical. Monitoring programs such as NPIP in the U.S. enforce regular testing and control (19). Antimicrobial stewardship and vaccination are essential components of integrated management.

Emerging Research & Future Perspectives

Genomic Insights: WGS identifies virulence determinants and resistance markers. Host–Pathogen Interaction Models: Omics-driven studies reveal mechanisms of persistence and immunity (20).

Novel Therapeutics: Nanoparticles, immunomodulators, and recombinant vaccines hold promise for future sustainable control. CRISPR-Cas9 applications are emerging as tools for studying gene function and vaccine development (21-29). A One Health perspective integrating wild bird reservoirs and farm management is essential.

Conclusions

MG remains a globally significant pathogen in poultry, with major economic and trade implications. Effective control requires integration of biosecurity, vaccination, prudent antimicrobial use, and advanced molecular diagnostics. Future research should focus on next-generation vaccines, omics-based host–pathogen studies, and One Health approaches addressing wild reservoirs.

Conflict of interest

Authors declare no conflict of interest.

Funding source

This research had no specific fund; however, it was

Al-Qadisiyah J. Vet. Med. Sci. 2025; 24 (3): 10.29079/qjvms.2025.165355.1122
The 1st National and International Scientific Conference November 26 / 2025
ISSN P: 1818-5746
E: 2313-4429
qjvms@qu.edu.iq

References

1. Feberwee A, de Wit S, Dijkman R. Clinical expression, epidemiology, and monitoring of Mycoplasma gallisepticum and Mycoplasma synoviae: an update. Avian Pathol. 2022 Feb;51(1):2–18. doi:10.1080/03079457.2021.1944605.
2. Feberwee A, Ferguson-Noel N, Catania S, Bottinelli M, Wawagema N, Gyuranecz M, Gautier-Bouchardon AV, Lysnyansky I, Wiegel J, Möller Palau-Ribes F, Ramirez AS. Mycoplasma gallisepticum and Mycoplasma synoviae in commercial poultry: current control strategies and future challenges. Avian Pathol. 2025 Apr;54(2):168–174. doi:10.1080/03079457.2024.2419037.
3. Liu Y, Wang Y, Zheng SJ. Immune evasion of Mycoplasma gallisepticum: an overview. Int J Mol Sci. 2024 Feb 29;25(5):2824. doi:10.3390/ijms25052824.
4. Yadav JP, Tomar P, Singh Y, Khurana SK. Insights on Mycoplasma gallisepticum and Mycoplasma synoviae infection in poultry: a systematic review. Anim Biotechnol. 2022 Dec;33(7):1711–1720. doi:10.1080/10495398.2021.1908316. PMID:33840372.
5. Mugunthan SP, Kannan G, Chandra HM, Paital B. Infection, transmission, pathogenesis and vaccine development against Mycoplasma gallisepticum. Vaccines (Basel). 2023 Feb 17;11(2):469. doi:10.3390/vaccines11020469.
6. Sawicka A, Durkalec M, Tomczyk G, Kursa O. Occurrence of Mycoplasma gallisepticum in wild birds: a systematic review and meta-analysis. PLoS One. 2020 Apr 16;15(4):e0231545. doi:10.1371/journal.pone.0231545.
7. Levisohn S, Kleven SH. Avian mycoplasmosis (Mycoplasma gallisepticum). Rev Sci Tech. 2000 Aug;19(2):425–442.
8. Gautier-Bouchardon AV. Antimicrobial resistance in Mycoplasma spp. Microbiol Spectr. 2018 Jul;6(4):10.1128/microbiolspec.arba-0030-2018. doi:10.1128/microbiolspec.ARBA-0030-2018.
9. Chaidez-Ibarra MA, Velazquez DZ, Enriquez-Verdugo I, Castro Del Campo N, Rodriguez-Gaxiola MA, Montero-Pardo A, Diaz D, Gaxiola SM. Pooled molecular occurrence of Mycoplasma gallisepticum and Mycoplasma synoviae in poultry: a systematic review and meta-analysis. Transbound Emerg Dis. 2022 Sep;69(5):2499–2511. doi:10.1111/tbed.14302.
10. Yehia N, Salem HM, Mahmmod Y, Said D, Samir M, Mawgod SA, Sorour HK, AbdelRahman MAA, Selim S, Saad AM, El-Saadony MT, El-Meihy RM, Abd El-Hack ME, El-Tarabily KA, Zanaty AM. Common viral and bacterial avian respiratory infections: an updated review. Poult Sci. 2023 May;102(5):102553. doi:10.1016/j.psj.2023.102553.
11. Ishfaq M, Hu W, Khan MZ, Ahmad I, Guo W, Li J. Current status of vaccine research, development, and challenges of vaccines for Mycoplasma gallisepticum. Poult Sci. 2020 Sep;99(9):4195–4202. doi:10.1016/j.psj.2020.06.014.
12. Balfour MJ. The Ring-Necked Pheasant (Phasianus colchicus) industry within the United Kingdom and the threat posed by Mycoplasma gallisepticum: a review. Vet Sci. 2022 Jul 29;9(8):391. doi:10.3390/vetsci9080391.
13. Zhao Y, Wang Z, Hou Y, Zhang K, Peng X. gga-miR-99a targets SMARCA5 to regulate Mycoplasma gallisepticum (HS strain) infection by depressing cell proliferation in chicken. Gene. 2017 Sep 5;627:239–247. doi:10.1016/j.gene.2017.06.039.
14. Lu Z, Liu X, Zhang Y, Han Y, Ishfaq M, Lu B, Lu X. Oral immunization with recombinant Saccharomyces cerevisiae expressing TM1 of Mycoplasma gallisepticum induces unique specific antibodies and protective immunity. Microb Pathog. 2025 Nov;208:108012. doi:10.1016/j.micpath.2025.108012.
15. Rosales RS, Puleio R, Loria GR, Catania S, Nicholas RAJ. Mycoplasmas: brain invaders? Res Vet Sci. 2017 Aug;113:56–61. doi:10.1016/j.rvsc.2017.09.006.
16. Hein R, Koopman R, García M, Armour N, Dunn JR, Barbosa T, Martinez A. Review of poultry recombinant vector vaccines. Avian Dis. 2021 Sep;65(3):438–452. doi:10.1637/0005-2086-65.3.438.
17. Wang Y, Zou M, Zhao Y, Kabir MA, Peng X. Exosomal microRNA/miRNA dysregulation in respiratory diseases: from Mycoplasma-induced respiratory disease to COVID-19 and beyond. Cells. 2023 Oct 9;12(19):2421. doi:10.3390/cells12192421.
18. Bencina D. Haemagglutinins of pathogenic avian mycoplasmas. Avian Pathol. 2002 Dec;31(6):535–547. doi:10.1080/0307945021000024526.
19. Kleven SH. Control of avian mycoplasma infections in commercial poultry. Avian Dis. 2008 Sep;52(3):367–374. doi:10.1637/8323-041808-Review.1.
20. Macklin DN, Ruggero NA, Covert MW. The future of whole-cell modeling. Curr Opin Biotechnol. 2014 Aug;28:111–115. doi:10.1016/j.copbio.2014.01.012.
21. Liu H, Pan S, Wang C, Yang W, Wei X, He Y, Xu T, Shi K, Si H. Review of respiratory syndromes in poultry: pathogens, prevention, and control measures.

Al-Qadisiyah J. Vet. Med. Sci. 2025; 24 (3): 10.29079/qjvms.2025.165355.1122
The 1st National and International Scientific Conference November 26 / 2025
ISSN P: 1818-5746
E: 2313-4429
qjvms@qu.edu.iq

Vet Res. 2025 May 17;56(1):101. doi:10.1186/s13567-025-01506-y.
22. Barbosa EV, Cardoso CV, Silva RCF, Cerqueira AMF, Liberal MHT, Castro HC. Ornithobacterium rhinotracheale: an update review about an emerging poultry pathogen. Vet Sci. 2019 Dec 27;7(1):3. doi:10.3390/vetsci7010003.
23. Williams ES, Yuill T, Artois M, Fischer J, Haigh SA. Emerging infectious diseases in wildlife. Rev Sci Tech. 2002 Apr;21(1):139–157. doi:10.20506/rst.21.1.1327.
24. Staley M, Bonneaud C. Immune responses of wild birds to emerging infectious diseases. Parasite Immunol. 2015 May;37(5):242–254. doi:10.1111/pim.12191.
25. Bradbury JM. Gordon Memorial Lecture. Poultry mycoplasmas: sophisticated pathogens in simple guise. Br Poult Sci. 2005 Apr;46(2):125–136. doi:10.1080/00071660500066282.
26. Sorci G. Immunity, resistance and tolerance in bird–parasite interactions. Parasite Immunol. 2013 Nov;35(11):350–361. doi:10.1111/pim.12047.
27. Hannan PC. Guidelines and recommendations for antimicrobial minimum inhibitory concentration (MIC) testing against veterinary mycoplasma species: International Research Programme on Comparative Mycoplasmology. Vet Res. 2000 Jul–Aug;31(4):373–395. doi:10.1051/vetres:2000100.
28. Noormohammadi AH. Role of phenotypic diversity in pathogenesis of avian mycoplasmosis. Avian Pathol. 2007 Dec;36(6):439–444. doi:10.1080/03079450701687078.
29. Cobb SP. The spread of pathogens through trade in poultry hatching eggs: overview and recent developments. Rev Sci Tech. 2011 Apr;30(1):165–175. doi:10.20506/rst.30.1.2025.