Research Article

Incidence and Management of Major Arthropod Pests of Poultry and Livestock Sectors

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Abstract | Poultry and livestock sectors are the primary sources of animal protein for humans. However, the production of poultry birds and livestock animals is hindered by many factors, and the incidence of different insect and other arthropod pests is one of the major constraints to optimum production of farm animals worldwide, including Pakistan. This review paper consolidates the state-of-the-art information regarding the incidence and management of these invertebrate pests such as lice, fleas, bot flies, warble flies, stable flies, ticks, etc. Biology, ecology, mode of damage, and available control options that are being practically implicated in combating these pests have been gathered and discussed in this draft with a basic objective to improve the effective management of arthropod pests of economic importance in the poultry and livestock sectors.

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Introduction

Food security, in accompanying with economic advancement and employment opportunities, highly depends on poultry and livestock industries across the globe. Essential protein products, which include meat, together with eggs, milk, leather, and wool, are supplied by these sectors (Mottet and Tempio, 2017). According to FAO (2021), global meat production reached up to 337 million tons in 2020 because the poultry and livestock industries remained essential (FAO, 2021). The GDP of developing countries significantly depends on these industrial sectors. The poultry industry has become the industrial preference due to its rapid production process and low operational expenses, which have led to its market adoption across the world (Dikmen *et al*., 2012). As consumers' demand increases for animal food, continued success in this industry is mandatory, which requires effective pest control systems (Makkar and Ankers, 2014). The agricultural food products generated by livestock is supplying food to 1.3 billion people of the human population and amount to 40% of total outputs (FAO, 2019). Translation research combined with superior nutrition programs and disease control systems has led to productivity increases, according to FAO's (2019).

Similarly, the pharmaceutical and cosmetic industries, alongside textile manufacturing, get benefits from animal products and by-products (Fraser, 2008; Steinfeld *et al*., 2006). The production of fertilizer for agricultural purposes becomes possible through waste management of poultry and livestock, which enhances soil quality (Thornton and Herrero, 2010; Mottet *et al*., 2017; FAO, 2019). Rotational grazing systems, along with efficient feed management, present sustainable farming methods that decrease climate change impacts (Thornton and Herrero, 2010). When improved feeding methods along with genetic developments lead to decreased greenhouse gas emissions in agriculture (Fraser, 2008). Cattle grazing systems under passive management enable both carbon reduction and ecosystem preservation according to FAO (2019) and Steinfeld *et al.* (2006). Barnyard production shows that an increase in efficiency is because of modern agricultural techniques, which include sophisticated genetics and automated, precise farming approaches (Mottet and Tempio, 2017). Modern climate control features and veterinary services with updated feeding systems boost operational efficiency levels in the industry (FAO, 2021).

Objectives of the current review

The primary aim of this article is to study insect pests that affect poultry and livestock through detailed assessments of their biological characteristics and damage potential, along with relevant management methods. The review organizes the main insect pests that target both poultry (Table 1) and livestock (Table 4) by presenting their classification system, structural features, and an economic cost analysis (Tables 2 and 5). It evaluates both the short-term and long-term effects of these pests regarding their disease transmission capabilities, stress-related production reductions, and financial impacts on farmers. The analysis will investigate existing pest control strategies, examining their strengths and weaknesses, as well as the practical applications of chemical, biological, and cultural pest management solutions, including integrated pest management (IPM). The discussion highlights the necessity of environmentally friendly pest control strategies that mitigate the risks of pesticide resistance and reduce hazardous exposures to animals while protecting the environment. Additionally, the review acknowledges current research limitations in insect pest management and proposes new directions for advancing control strategies using emerging systems, novel biopesticides, and improved integrated pest management practices. This review consolidates existing information to provide critical knowledge that benefits researchers, veterinarians, and stakeholders in the poultry and livestock industries for effective pest management practices.

Major arthropod pests of the poultry sector

Ectoparasitic insects

Lice

Poultry lice, mainly the chicken body louse *Menacanthus stramineus* (Order: Psocodea; Suborder: Phthiraptera; Family: Menoponidae), are common ectoparasites of chickens and turkeys. Worldwide poultry populations suffer from infections from wingless parasitic insects within the insect order Phthiraptera (Gustafsson *et al*., 2025), and it has been demonstrated that body lice infestations occur by direct contact with breeding birds, in addition to contaminated equipment that harms feathers and creates skin irritation, resulting in production losses. The most harmful chicken louse, known as *M. stramineus*, feeds on blood, skin, and feathers among other species. The existence of the life stage lasts from 5 to 10 days, during which egg growth is established in 4 through 7 days (Bhawa, Morêki and Machete, 2023). Multiple parasites lead to such extensive damage that birds shed their feathers and their skin suffers from excruciating pain, making them more vulnerable to infections (https://poultry.extension.org/articles/poultry-health/external-parasites-of-poultry).

It is through flight feathers that *Lipeurus caponis* resides to consume the remaining feathers. The 14–21-day lifecycle of this parasite generates stress by negatively affecting the quality of feathers (https://www.veterinaryentomology.org/chicken-lice). *Cuclotogaster heterographus* attach to the comb areas, which leads to anemia development in addition to restlessness after 10–15 days (Gustafsson *et al*., 2025). Laboratory tests show that lice infections, specifically *Goniocotes gallinae* and *Menopon gallinae*, frequently infect chickens, resulting in 100% infestation rates in certain locations (Ikpeze *et al*., 2009). The lice require poultry as their lifecycle host, where they feed on feather particles. The life cycle of *G. gallinae* lasts for 36 days, yet the population can reproduce twice within a period of 11 to 14 days according to Saxena *et al.* (2007). *M. gallinae* became one of the earliest lineages of parasitic lice after its genome sequencing which allowed scientists to uncover information about louse evolutionary history and host transfer patterns (Xu *et al.*, 2024). The poultry industry experiences financial losses because of lower market value for infested chickens that sell for a reduced amount of up to10-20% (Ikpeze *et al.*, 2009).

Mites

The red poultry mite, *Dermanyssus gallinae* (Class: Arachnida; Subclass: Acari; Order: Mesostigmata; Family: Dermanyssidae), and the northern fowl mite, *Ornithonyssus sylviarum* (Order: Mesostigmata; Family: Macronyssidae), are the most important ectoparasites of poultry. The presence of mites causes two main issues in poultry farms, causing blood loss and pain, in addition to spreading diseases to other birds. Due to their quick reproduction procedure, poison spiders spread with exceptional severity according to Sparagano *et al.* (2014). *Dermanyssus gallinae* spends its total life span from 7 to 10 days as a feeding predator during nighttime ~~hours~~ while hiding during daylight. An infestation from this parasite results in anemia and stress, together with decreased egg production according to its well-known clinical presentation (Sparagano *et al.*, 2014). Laying hens frequently encounter the ectoparasite *Ornithonyssus sylviarum,* known as the Northern fowl mite, which produces noticeable welfare risks and economic expenses. The parasitic infestation of chickens causes a decrease of 2 to 15% in egg output, reduces the feed conversion ratio (Devaney, 1979), and lowers egg quality (Vezzoli *et al.*, 2016; Jarrett *et al.*, 2022). The physical and psychological health of hens deteriorates when infested by mites because they develop skin irritations, suffer from damaged feathers, alongside impaired immune function (Vezzoli *et al.*, 2016; Jarrett *et al.*, 2022). Infestation can be varied at different levels of severity due to factors such as hen age and housing system (Jarrett *et al.*, 2022). Research shows that MHC haplotypes impact mite resistance by creating differences between the B21 haplotype, which starts earlier but causes less skin inflammation than the B15 haplotype (Murillo *et al.*, 2016). The potential of breeding programs to introduce mite resistance requires enhanced studies of how mites affect both genetics and business parameters.

The *Megninia* species and similar feather mites frequently invade the skin of poultry birds as well as wild bird species. *M. ginglymura* exists at high frequencies within broiler breeder farms in India (D'souza *et al.*, 2001) and in laying hen systems in Brazil (Horn *et al.*, 2018). The mite infestation leads to depluming itch as a pathogenic effect on fowls according to D'Souza *et al.* (2001). Feather mite contamination results in weak plumage quality and shorter wings, together with lower muscle protein storage in birds (Harper 1999). Some feather mite species demonstrate commensalism and mutualistic relationships, which sustainability help sustainably extract detritus and detrimental microorganisms from bird feathers (Labrador *et al.*, 2021). Egg productivity decreases, and feed consumption and survival rates suffer alongside commercial losses when mites lead to higher infection rates of *E. coli* and *Salmonella* (Sparagano *et al.*, 2014).

Fleas

Blood-feeding fleas such as the sticktight flea *Echidnophaga gallinacea* (Class: Insecta; Order: Siphonaptera; Family: Pulicidae), the European chicken flea Ceratophyllus gallinae (Order: Siphonaptera; Family: Ceratophyllidae), and the cat flea Ctenocephalides felis (Order: Siphonaptera; Family: Pulicidae) are opportunistic ectoparasites of poultry. During their journeys through the feathers, the flat body of fleas combined with their powerful back legs enables young birds to move unaided (Bitam *et al.*, 2010; Mullen and Durden, 2019). Fleas belonging to the species *E. gallinacea* complete their life cycle within 14 to 30 days. During feeding, the female sticktight flea (*E. gallinacea*) stays on the eyes along with wattle and comb tissue before egg laying resulting in adults that develop within bedding materials according to Soulsby (1982).

The European chicken flea (*C. gallinae*) begins its feeding behavior before it enters secluded hiding areas after choosing its nesting materials. The lifecycle duration of this parasite ranges from 10–50 days, depending on temperature levels and environmental moisture (Rust, 2017). The presence of fleas leads to severe skin conditions that also cause microbial infections, beginning with the biting process. Continuous *E. gallinacea* infestation leads to anemic symptoms along with weight reduction and almost no egg production, in addition to anxiety and destructive habits in poultry (Mullen and Durden, 2019).

Pathogenic microorganisms travel through the fleas' digestive tract to chickens, and the worms Raillietina that reside inside fleas cause further deterioration in poultry health (Oliveira, Alves, and Sosa-Gómez, 2014).

Bed bugs

Bed bugs, including *Cimex lectularius* and *Cimex hemipterus* (Class: Insecta; Order: Hemiptera; Family: Cimicidae), are blood-feeding ectoparasites that infest poultry houses, causing economic damage and welfare issues. During the daytime, bed bugs hide in narrow spaces because their dorsoventrally compressed body shape allows them to fit into small openings between materials such as crevices and nest materials (Doggett *et al*., 2018; Axtell and Arends, 1990). The bed bug goes through 5 immature stages before achieving maturity but requires blood from host animals after discarding every skin layer in its developmental cycle of 35 to 50 days (Polanco *et al*., 2011; Potter, 2011). The parasites sense hosts during nighttime through their heat and carbon dioxide detection capabilities, along with specialized mouthparts that help them extract blood from birds (Doggett *et al*., 2018). Infestations by bed bugs cause distress and insomnia in animals, which reduces poultry eating behaviors and leads to weight decrease and damages feathers, and also causes secondary infection development (Axtell and Arends, 1990; Potter, 2011). The presence of bed bugs throughout poultry farms causes both stress and anemia and stimulates a reduction in overall egg production (González-Morales *et al*., 2022). The pests easily build hazardous populations that might result in substantial blood depletion in hosts during 3-8 months (Pereira *et al*., 2013). It remains unclear whether bed bugs transmit diseases, but their presence increased expenses and reduced profits to poultry farms (Doggett *et al*., 2018).

Endoparasitic insects

Lesser mealworm

The lesser mealworm, *Alphitobius diaperinus* (Order: Coleoptera; Family: Tenebrionidae), also known as the darkling beetle, is a common pest of poultry houses. The insect thrives most efficiently within areas that are both hot and humid by hiding inside multiple organic materials, which consist of manure and cracks, and any remains of feed. *A. diaperinus* mealworms can survive without moving through 4 developmental phases from their beginning as eggs until becoming adults. Female lesser mealworms place their eggs in organic material until the ectodermal stage larvae reach maturity for 4–7 days before they migrate to ceramic litter to feed on decayed matter mixed with poultry manure (Acharya *et al*., 2014). A lesser mealworm species needs 37.9 days at 30°C temperature to complete its life cycle, during which the larvae grow for 26.2 days while the pupae survive 5.5 days (Thornton and Herrero, 2010). The broiler house population of larvae reaches its highest number at point 26 days into the flock cycle, according to Lambkin *et al*. (2007). The lesser mealworm beetle (*A. diaperinus*) establishes itself as a major poultry facility pest because it damages building structures while

Table 1: *Major insect pests affecting poultry production.*

Pest	Scientific name	Region	Effects on poultry	References
Lice	*Menacanthus stramineus* (Chicken Body Louse)	Reported in Sindh, Pakistan; also, in Indian backyard flocks.	Causes feather loss, irritation, anemia, stress, and reduced egg production.	Pavlicevic *et al.*, 2021; Knežević *et al.*, 2018; Shaikh *et al.* (2022)
Mites	*Dermanyssus gallinae* (Poultry Red Mite)	Widespread in Pakistan and India poultry farms.	Causes anemia, stress, disease transmission, and a 20% drop in egg production.	Sparagano *et al.*, 2014; Flochlay *et al.*, 2017; Eladl *et al.*, 2018; Sparagano and Ho (2020)
Fleas	*Echidnophaga gallinacea* (Stick-tight Flea)	Documented in Indian poultry; present in Pakistan rural flocks.	Attaches to the skin, causing irritation, weight loss, and reduced egg production.	Knežević *et al.*, 2018; Sparagano *et al.*, 2009; Sharma *et al.*, 2020; Udhayavel *et al.*, 2019
Flies	*Musca domestica* (House fly)	Abundant in poultry houses in Punjab, Pakistan and India.	Spreads bacterial diseases, increasing infection risk and poultry stress.	Oliveira *et al.*, 2014; Acharya *et al.*, 2015; Khan *et al.*, 2018; Abbas *et al.* (2015)
Bed bugs	Cimex lectularius	Occasionally infest poultry houses in Indo-Pak rural setups.	Causes skin irritation, stress, weight loss, and egg reduction.	Weeks *et al.*, 2018; Singh *et al.*, 2017; Murillo, 2021
Lesser mealworm	Alphitobius diaperinus	Found in poultry litter in Pakistan and India.	Damages insulation, transmits bacteria, and competes for feed.	Smith *et al.*, 2021; Crippen *et al.*, 2009; Ahmed *et al.*, 2015; Sammarco *et al.* 2023

holding pathogens that threaten animals (Smith *et al*., 2021; Sammarco *et al*., 2023). Lesser mealworms can carry and spread bacterial pathogens, including *Salmonella spp.* and *Escherichia coli*, which endanger both poultry health and food safety (Smith *et al*., 2021; Polat *et al*., 2024). Crippen *et al*. (2009) established that these beetles speedily absorb Salmonella inside their alimentary canal and circulatory system to disseminate pathogens. These beetles display night-time behavior patterns that make birds feel agitated, leading to their physical unrest (Axtell and Arends, 1990).

Disease spread and economic impact

Role of pests in transmitting avian pathogens

Worldwide poultry production incurs losses because of the transmission of avian diseases by poultry pests, because of ectoparasites and endoparasites (Puvača *et al*., 2019). The health and production numbers of poultry suffer major threats due to pests and diseases that affect both egg-laying and meat-raised birds. The mechanism of disease transmission combines mechanical and biological elements, which deteriorate bird health and boost mortality numbers (Collett, 2013). The global trade of exotic birds facilitates disease spread, threatening livestock production as well as wildlife populations (Burgos and Burgos, 2007). The biological processes required for egg production become targets in laying flocks due to viral infections, which results in decline in both quantity and quality (Hassan and Abdul-Careem, 2020). The primary signs of illness consist of unkempt feathers together with anorexia along with depression, and diarrheal symptoms (Yitbarek *et al*., 2016).

The poultry red mite serves as a pathogen carrier for five major disease agents, including *E. coli* with *P. multocida*, and *M. gallisepticum* alongside AIV (Sparagano *et al*., 2014). In one research, *Dermanyssus gallinae* carrying Salmonella, a bacterial infection it functions as a transfer agent between birds, causing salmonellosis outbreaks (Chauve, 1998). The chicken pathogen *Staphylococcus aureus* causes a range of diseases that affect birds, such as septicemia, omphalitis, and arthritis, along with synovitis, osteomyelitis, and dermatitis (Bergmann *et al*., 1980; Tabar *et al*., 2024). The combined infections generate economic concerns due to lameness, weight loss, and reduced egg production levels (Tabar *et al*., 2024). Researchers in Pakistan established that septic arthritis developed because of *S. aureus* bacteria affecting both broiler and layer chickens primarily in their hock joints (Malhi *et al*., 2015). Among all isolated *S. aureus* strains causing infections in fowl, the site variety known as *gallinae* contained crystal-violet Type A strains, which showed specific lysis patterns, and this combination was detected in approximately 78.1% of cases (Bergmann *et al*., 1980).

The poultry disease Necrotic enteritis (NE), produced by *Clostridium perfringens*, causes total yearly losses above $6 billion. NE causes severe economic setbacks by killing broiler birds and reducing the productivity of laying hens. The disease progression starts when bacteria attach to tissues, followed by toxin release and subsequent mucosal tissue destruction (Flores-Dıaz *et al*., 2016; Alizadeh *et al*., 2021). The bacteria *Campylobacter jejuni* exist outside and inside these beetles because they can pass this pathogen to chickens through eating practices (Strother *et al*., 2005). Worldwide poultry facilities experience widespread infestation from the lesser mealworm beetle (*Alphitobius diaperinus*), which obstructs facility integrity and maintains many disease-causing pathogens (Smith *et al*., 2021; Sammarco *et al*., 2023). Scientific research has documented that beetles quickly take up bacteria, including Salmonella, in their alimentary canal and hemolymph (Crippen *et al*., 2009). Bacterial acquisition and transfer between beetles and poultry manure occur best when the concentrations of Salmonella is high, as per research conducted by Crippen *et al*. (2009). The beetle demonstrates its pathogen maintenance and transfer capabilities, which necessitate properly integrated pest management systems for controlling contamination risk in poultry farms (Smith *et al*., 2021; Crippen *et al*., 2009).

Economic losses from pest infestations

The parasitic disease coccidiosis inflicts significant financial losses on the poultry industry, mainly by harming the development of broiler chickens (Bera *et al*., 2010). The prevalence of coccidiosis in Indian poultry farms led to Rs 1.14 billion loss during the 2003-04 period, as it reduced body weight gain while increasing feed conversion ratio. The poultry red mite *Dermanyssus gallinae* creates expense burdens of up to 60 euros on annual farm production for farmers (Pavlicevic *et al*., 2021). Worldwide, poultry farms have a substantial pest control issue due to *D. gallinae* poultry red mite infestations, with rates exceeding 80-90% in particular European nations (Knežević *et* *al*., 2018). Cases of stress occur in chickens because of ectoparasites, leading to compromised animal welfare and mortality combined with economic losses in the poultry industry, according to Sparagano *et al*. (2009).

Poultry production suffers from heat stress due to environmental exposure and this factor causes detrimental effects on growth performance, along with both egg production and product quality standards (Lara and Rostagno, 2013). *D. gallinae* functions as a pathogen for transmission of Salmonella and Newcastle disease, together with various bacterial and viral diseases, which adversely affect poultry health (Knežević *et al*., 2018). Research by Eladl *et al*. (2018), together with Flochlay *et al*. (2017), indicates that severe mite infestations cause a decrease in egg yield by up to 20% while increasing their daily feed consumption by approximately 10-15%. The poultry industry maintains importance for both food security and economic progress, even it experiences health problems from Highly Pathogenic Avian Influenza (HPAI) disease (Acharya and Phuyal, 2024; Mottet and Tempio, 2017). The economic impact of diseases on poultry farming exceeds 20% of total net revenue (Zhou *et al*., 2020). Nepal depends primarily on imported vaccines to prevent diseases, even though it manufactures its local vaccines (Poudel *et al*., 2020).

In developing nations, the expansion of the poultry industry causes four main things in like poverty reduction alongside small farmer market entry, health risks to humans, and harm to the environment (Mottet and Tempio, 2017). The meat industry experiences substantial financial losses worldwide because poultry develop parasitic infections mainly from fasciolosis and cysticercosis. The infections cause detrimental effects on meat quality and lead to carcass grading reductions and organ rejection in abattoirs, according to Regasa and Seboka (2021) and Dahourou *et al*. (2019). Each year, in the case of livestock, the condition of fasciolosis results in US$3 billion of agricultural losses globally by decreasing both meat and milk yields (Regasa and Seboka, 2021). Northeastern Iran experienced 80.8% of organ and carcass condemnations, which were mainly caused by parasites, primarily including *E. granulosus* and *D. dendriticum* (Borji and Parandeh, 2010). The combination of unfavorable pre-slaughter handling methods with stress causes increased economic losses because it impacts both market value and meat quality properties (Faucitano, 2018).

The structural pest lesser mealworm (*A. diaperinus*) damages poultry house insulation materials to an extensive extent, according to Turner (1986). The pupating process of late-stage larvae tunneling into polystyrene and fiberglass insulation materials until adulthood, and they start enlarging the passages, resulting in loss of insulation and decreased R-value ratings (González-Morales *et al*., 2022). Moisture in manure, together with wall materials and insulation types, determines the extent of infestation (Turner 1986, Despins *et al*. 1987). The beetles transmit pathogens to animals while replacing their normal food diet, thus hindering broiler weight gain (Japp *et al*., 2010). The presence of diseases along with pests in poultry production facilities leads to major economic losses throughout the global industry. Viral threats in Nigeria include Newcastle disease avian influenza, and infectious bursal disease, which have been found to result in maximum losses (Sadiq and Mohammed., 2017). Coccidiosis, together with clostridiosis, frequently affects broiler chickens while layers primarily develop salpingoperitonitis (Jones *et al*., 2019).

Pathogens transmitted from arthropods and rodents result in an increased danger of foodborne infections to poultry, according to Yang *et al*. (2014). Small-scale farmers do not give priority to invest in biosecurity measures because poultry only contributes 10% of their household earnings (Otte *et al*., 2021). Research has focused mainly on epidemiology without adequate studies about the financial impacts. Logical and scientific evidence shows that uncontrolled diseases lead to unprofitable flocks, yet appropriate intervention measures reduce financial losses Jones *et al*., 2019). The evaluation of recurring outbreak costs through future research will strengthen disease prevention plans (Sadiq and Mohammed, 2017).

Management of poultry pests

The control and registration of poultry pests involves biological methods, together with chemical methods, as well as physical control through cultural practices (Table 3). The pest control sector protects bed bugs alongside lice, mites, fleas, and lesser mealworms using synthetic pyrethroids, which they combine with organophosphates and carbamates, but sustain insecticide protection by rotating between the use of spinosad, fluralaner, ivermectin, and insect growth regulators (Sparagano *et al*., 2014). The fungal strain *Beauveria bassiana* and *Metarhizium anisopliae* possess

Table 2: *Economic impact of poultry pests.*

Pest/Disease	Region	Economic losses	References
Coccidiosis	India	Rs 1.14 billion loss due to lower weight gain and poor feed efficiency.	(Bera *et al*., 2010)
Poultry red mite (*Dermanyssus gallinae*)	Europe	Prevalence up to 90%, causing stress, mortality, 20% egg loss, and 10-15% higher feed costs.	(Knežević *et al*., 2018)
Highly pathogenic avian influenza (HPAI)	Global	Losses exceed 20% of poultry income.	(Zhou *et al*., 2020)
Fasciolosis	Global	Over $3 billion loss due to reduced meat and milk yield.	(Regasa and Seboka, 2021)
Parasitic infections (e.g., *Echinococcus granulosus, Dicrocoelium dendriticum*)	Iran	80.8% of carcasses condemned.	(Borji and Parandeh, 2010)
Preslaughter stress factors	Global	Reduced carcass value and meat quality.	(Faucitano, 2018)
Lesser mealworm (*Alphitobius diaperinus*)	Global	Damages poultry house insulation, increasing costs.	(Turner, 1986; Vaughan *et al*., 1984; Despins *et al*., 1987)
Newcastle disease, Avian Influenza, and Infectious bursal disease	Nigeria	Major economic losses, Newcastle Disease is the most severe.	(Sadiq and Mohammed, 2017)
Coccidiosis and clostridiosis in broilers	Global	Significant losses: Salpingoperitonitis impacts the layers.	(Jones *et al*., 2019)
Arthropods and rodents	Global	Spread pathogens, increasing foodborne risks and losses.	(Yang *et al*., 2014)
Uncontrolled poultry diseases	Global	Can render flocks unprofitable without intervention.	(Jones *et al*., 2019)

efficient biological pest control traits for poultry pests, which provide a substitute for chemical insecticides (Oliveira *et al*., 2014; Weeks *et al*., 2018). Studies have shown that these fungi destroy multiple arthropods in addition to eliminating house flies as well as lesser mealworms and feather mites (Oliveira *et al*., 2014). The fungal bio-pesticides reduce 3 important factors of the adult fly multiplication while lowering their chance to reproduce and produce eggs (Acharya and Phuyal, 2024). Large-scale field deployment of these pathogens faces ongoing challenges because scientists need to develop effective isolates and suitable formulas for deployment, as well as strains that tolerate diverse environmental conditions (Weeks *et al*., 2018).

Scientific investigations focus on enhancing the practical utility of these biopesticides for commercial use within poultry industries. Multiple proven strategies make up an effective approach to managing pests in poultry farms. Temperature levels above 45°C within litter spaces lead to the complete death of *Alphitobius diaperinus* population members at different life stages (Wolf *et al*., 2014). Academic research has shown that litter rotation alongside appropriate ventilation can help decrease moisture levels and speed up drying, yet more studies need to confirm the impact on litter condition and animal comfort (Pepper and Dunlop, 2021). High moisture content (37.4-51.1%) in litter performs a unique function to inhibit ammonia emission (Miles *et al*., 2011). Releasing heat causes negative impacts on poultry by lowering their feed–intake and growth rates while decreasing operational output. The prevention of heat stress in animals can be reduced by procedures such as nutritional modifications along with electrolyte and vitamin supplementation, feed formulation methods, and controlled fasting and water distribution management (Bhawa *et al*., 2023). The integration of various methods produces more suitable growing conditions, which leads to enhanced production while resolving pests and environmental problems in poultry systems.

The essential oils from plants could provide safe, natural methods for controlling poultry pests. Multiple essential plant oils such as tea tree oil, eucalyptus oil, and neem oil have proved effective in killing poultry red mites (Quilicot *et al*., 2020; Puvača *et al*., 2019). The antimicrobial along with antioxidant, and acaricidal effects of tea tree oil surpass almost 80% mortality rates against poultry red mites (Puvača *et al*., 2019). The joint application of neem products together with diatomaceous earth leads to better results against stored product pests than separate treatments alone (Ulrichs and Mewis, 2000). The use of essential oils as feed additives produces multiple health benefits, such as by improving poultry productivity along with strengthening appetite and

Table 3: *Poultry pest control methods.*

Control method	Target pests	Examples/Details	References
Chemical control	Bed bugs, lice, mites, fleas, lesser mealworms	Synthetic pyrethroids, organophosphates, carbamates, spinosad, fluralaner, ivermectin, insect growth regulators	(Sparagano *et al.,* 2014)
Biological control	House flies, lesser mealworms, feather mites	Entomopathogenic fungi (*Beauveria bassiana, Metarhizium anisopliae*)	(Oliveira *et al.,* 2014; Weeks *et al.,* 2018)
Fungal biopesticides	House flies	Reduce adult fly populations, egg viability, and fecundity	(Acharya *et al.,* 2015)
Heat treatment	*Alphitobius diaperinus* (Lesser mealworm)	High temperatures (45°C) cause total mortality of adults and larvae	(Wolf *et al.,* 2014)
Litter management	Various poultry pests	Litter turning, proper ventilation, moisture reduction	(Pepper and dunlop, 2021)
Essential oils and plant products	Poultry red mites, stored product pests	Tea tree, *eucalyptus*, neem oils, diatomaceous earth, improved poultry productivity	(Quilicot *et al.,* 2020; Puvača *et al.,* 2019; Ulrichs and Mewis, 2000)
Nutrient and feed management	General poultry health and pest resistance	Electrolyte and vitamin supplementation, controlled feeding, water management	(Bhawa *et al.,* 2023)
Antibiotic alternatives	Poultry red mites, bacterial infections	Essential oils used as feed additives (improve appetite, and immune response)	(Krishan and Narang, 2014; Puvača *et al.,* 2019)

stimulating immune response, according to Krishan and Narang (2014) and Puvača *et al.* (2019). The research community needs to explore better ways to use these natural approaches as antibiotic growth promoter substitutes, while investigating how they work in poultry farms (Quilicot *et al.,* 2020).

Major insect pests of livestock sector

Hematophagous arthropod pests

Ticks

Ticks are classified into three families: Argasidae (soft ticks), Ixodidae (hard ticks), and Nuttalliellidae (represented by *Nuttalliella namaqua*). Important livestock pests include *Hyalomma anatolicum* and *Rhipicephalus microplus* (Family: Ixodidae), and the fowl tick Argas persicus (Family: Argasidae. (Guglielmone *et al.* (2010) and Nava *et al.* (2009)). According to Guglielmone *et al.* (2010), globally there exist 896 tick species, divided between 193 of the Argasidae family and 702 of the Ixodidae family. The cattle pests *H. anatolicum,* along with *R. microplus,* affect ruminants in tropical and subtropical zones as principal hard ticks. Farm practices that increase tick prevalence in livestock herds include the nonexistence of rural poultry combined with non-use of acaricides and traditional housing methods and extensive grazing patterns (Rehman *et al.,* 2017).

The life cycle of ticks includes four transformational stages from egg through larva into nymph and finally ending with adulthood (Awerbuch and Sandberg, 1995; Due *et al.,* 2013). The life span of hard ticks spans from 2 to 3 years, yet each developmental stage requires a single blood meal, while soft ticks undergo repeated feeding following multiple juvenile stages (Due *et al.,* 2013). The deer tick (*Ixodes dammini*) requires between 2 to 4 years to finish its cycle, depending on the suitable hosts it encounters (Xu *et al.,* 2024). The lifecycle development *of Ixodes ricinus* proceeds through three years from egg to adult. The temperatures above 7°C activate ticks, and their activity reaches its peak during spring months. Eggs from a single female tick number between one thousand and to two thousand (Reid, 1987), which enhances their population development.

Environmental variations influence the natural cycle of tick populations (Xu *et al.,* 2024). The species depend on host transportation since they do not perform lateral movements but ascend plants to find potential hosts (Reid, 1987). The presence of ticks in domestic animals creates weight loss in live bodies while causing anemia and reducing the quality levels of hides and skin (Rajput *et al.,* 2006; Eskezia, 2016). Protozoan, rickettsial, and viral diseases transmitted by ticks create widespread economic damage throughout the world (Jongejan and Uilenberg, 1994; Rajput *et al.,* 2006). The economic effect of ticks generates financial losses through three major categories, which include reduced body weight, diminished milk output, and the expense of treatments (Eskezia, 2016). Production of meat, milk, eggs, and leather becomes affected when ticks infest cattle, small ruminants, swine, and poultry (Hurtado and Giraldo-Ríos 2018).

Mosquitoes

Mosquitoes of the genera Anopheles, Aedes, and Culex (Class: Insecta; Order: Diptera; Family: Culicidae) are important hematophagous ectoparasites. Several arboviruses, notably Rift Valley fever virus (RVFV), West Nile virus (WNV), and Japanese encephalitis virus (JEV), transmitted by mosquito genera such as Anopheles, Aedes, and Culex, pose significant health threats to livestock and, by extension, humans (Pagès and Cohnstaedt, 2018), (Bird and Nichol, 2012; Tariku and Rebuma, 2024). RVFV is particularly notorious for its outbreaks in Africa and the Middle East, leading to severe economic consequences for the livestock industry, especially affecting domestic ruminants like sheep and cattle, which suffer high mortality and abortion rates (Linthicum *et al*., 2016; Tariku and Rebuma, 2024). Environmental factors such as heavy rainfall and flooding contribute to the proliferation of mosquito vectors responsible for RVFV transmission (Masters *et al*., 2020), (Masters *et al*., 2020).

Mosquitoes undergo a four-stage life cycle from eggs to adults, which takes about 7 to 10 days depending on species and environmental conditions; *Aedes aegypti*, for instance, can withstand prolonged periods of desiccation. Temperature influences the growth and mortality rates of mosquito populations—higher temperatures may curtail development (Arévalo-Cortés *et al*., 2022). The virulence of RVFV transmitted by Aedes and Culex mosquitoes result in high mortality rates and reproductive failures in livestock, notably with 100% abortion rates in affected species. Additionally, JEV and WNV infections pose reproductive risks for pigs, indicating a broader risk to the livestock sector (Bird and Nichol, 2012; Linthicum *et al*., 2016). Climate change and human-induced environmental changes further exacerbate these viral transmissions (Pagès and Cohnstaedt, 2018; Singh *et al*., 2015). The presence of blood-feeding dipteran insects leads to notable productivity losses in dairy and beef cattle, significantly impacting milk and meat yield, with financial losses estimated at $160 per cow over five months, thereby enhancing risks to livestock during nighttime hours (Pagès and Cohnstaedt, 2018).

Stable flies

The stable fly, *Stomoxys calcitrans* (Order: Diptera; Family: Muscidae) damages livestock operations throughout the world by causing economic harm to cattle production (Taylor, 2020). Ball-feeding behavior of these insects leads to troubles that lower productivity levels in addition to reduced animal welfare. The U.S. cattle industry loses approximately $2.211 billion yearly due to stable flies, yet the economic impact is divided into four sections: dairy experiences $360 million in losses the cow-calf sector sustains $358 million in damages and pastured cattle endure $1.27 billion in expenses while feedlot cattle experience $226 million losses (Taylor *et al*., 2012). Decreased milk production in dairy cows, along with weight loss problems in beef cattle, creates the main economic issues in this situation. The clustering of cattle due to stable fly results in increased heat stress that causes 71.5% of observed weight reduction (Xu *et al*., 2024).

Stable flies need blood for natural survival and reproduction activities since both genders show persistent blood-feeding behavior (Taylor, 2020). The infestation of stable flies results in decreased cattle production potential because they cause dairy cows to produce 139 kg less milk annually and attain 6-26 kg less weight across different cattle types (Taylor *et al*., 2012). Researchers have discovered that dipteran pests, stable flies as one group of them, can decrease cattle live body weight gain by 10-11% over 5 months, which may lead a 100-cattle feedlot to lose $16,000 (Boonsaen *et al*., 2024). Research confirms the necessity of powerful strategies that control flies in cattle farms. Female stinging insects spend their life cycle by laying between 100 and 1,000 eggs in rotting organic materials, according to Foil and Hogsette (1994). Adult flies extract required blood meals from livestock animals for successful reproduction (Foil and Hogsette, 1994; Taylor, 2020). The conditions caused by their painful bites lower livestock productivity and also cause disturbances to human activities (Taylor, 2020). Practical studies demonstrate that cattle productivity suffers major declines because of stable fly infestations, which reduce milk output and weight growth (Taylor *et al*., 2012). Challenges to both physiological functioning and natural behaviors are observed in cattle that encounter stable flies, and these manifestations result in worsened heat stress effects while simultaneously diminishing productivity (Byford *et al*., 1992; Wieman *et al*., 1992).

Horn flies

The horn fly, *Haematobia irritans* (Order: Diptera;

Family: Muscidae) remains a small, dark-grey biting insects that mainly attack cattle, whereas they may also impact horses and various other livestock populations (Votýpka and Mihalca, 2020; Boxler, n.d.). These blood-feeding ectoparasites depend on host contact for life survival so they live most on the host's back and shoulders and underbelly region (Votýpka and Mihalca, 2020). Adult flies from both sexes need blood for survival, and they need to eat multiple blood meals each day, according to Kuramochi (2000). Research has thoroughly examined numerous fly species that live in cattle dung. The female *SanSimonicus* lay large numbers of eggs in fresh dung, where each egg reaches maturity in less than a day. The maturation of larvae at three stages stretches from 2.5 to 7 days based on conditions of the environmental. Following several days to 7.5 days of development, the flies emerge from the poo mass during the pupal stage (Vezzoli, King, and Mench, 2016). Multiple generations per year are possible because egg-to-adult development takes place within 7-24 days according to Parr (1962) and the other research authors Melo *et al*. (2020), Sammarco, Hinkle and Crossley, (2023).

The development along with oviposition of *H. irritans* depends on temperature, moisture content, dung composition, and feeding behavior (Parr, 1962; Melo *et al*., 2020; Campbell and Kettle, 1976; Wang, 1964). Knowledge of pest flies lifecycles in cattle farming remains essential for creating successful control measures (Melo *et al*., 2020). The bloodsucking horn flies (*H. irritans*) result in substantial economic damage to cattle, which results in annual United States losses surpassing $2.3 billion according to Brewer *et al*. (2021). Adult horn flies require a powerful host because they spend nearly all their time on cattle while performing blood feeds between 38 times each day (Brewer *et al*., 2021). Successful host location by these flies depends on temperature, wind velocity, and humidity, and occurs within a temperature range of 18.3°C (Faucitano, 2018).

Acute infestation in beef steers causes physical stress and elevates their heart rates, respiration rates, and body temperatures according to Schwinghammer *et al*. (1986). Throughout their blood diet, these pests generate pain, which makes cattle off feed and causes restlessness in them (Kaufman and Weeks, 2012). A heavy horn fly population exceeding 200 per animal results in a weight loss of 15-50 pounds in calves experiencing at weaning. According to Tomberlin (2023), the presence of horn flies decreases milk productivity in dairy cows by up to 20% and reduces both the quantity and quality of milk in cows (Mays *et al*., 2014). The impact on milk production differs among sire breeds and in lactating animals, but certain breeds appear less affected by flies (Mays *et al*., 2014). Horn flies create yearly economic losses that amount to between $700 million to $1 billion throughout the USA, as per Kaufman and Weeks (2012).

Internal pests and parasitic larvae

Bot flies

Bot flies of the family Oestridae (Class: Insecta; Order: Diptera), including *Oestrus ovis*, *Hypoderma spp.*, and *Gasterophilus intestinalis*, parasitize mammals exclusively after they complete their life cycle inside various hosts, including cattle, horses, and sheep, as well as numerous other animals (Catts 1982; Angulo-Valadez *et al*. 2010). Throughout their life cycle, eggs are laid onto animal hair or body opening areas before larvae penetrate tissues to migrate until larval emergence starts the pupation process (Colwell *et al*., 2006). *Oestrus ovis*, commonly known as the sheep nasal bot fly, attacks nasal cavities along with sinuses, creating irritation that results in fluid discharge, according to Angulo-Valadez *et al*. (2010). Studied bighorn sheep reveal that this species might transmit between different animal species (Wolf *et al*., 2014). Adult bot flies exist for only a brief duration before death while skipping the feeding stage because they dedicate themselves to reproductive activities (Dahourou *et al*., 2019). The developmental stage of larvae occurs within multiple host tissues because different species use subcutaneous areas to create warbles and gastric mucosa to complete maturity (Colwell *et al*., 2006).

The worldwide spread of bot flies leads to substantial financial damage among livestock populations. Warble flies (*Hypoderma spp.*) together with nasal bots (*Oestrus ovis*) cause damage to animal hides and lower productivity levels, and also lead to respiratory problems throughout cattle and sheep populations (Chhabra and Pathak, 2009). Horses suffer from gastric problems due to *Gasterophilus* larvae infestation, and *Chrysomya bezziana* creates traumatic myiasis in multiple animal species (Regasa and Seboka, 2021). The parasites cause three major problems in animals, which include decreased feed consumption and problems in nutrient absorption, resulting in a compromise in performance (Polat *et al*., 2024). Billions of dollars in economic expenses develop annually throughout the world due to parasitic infestation. In Australia alone, parasitic diseases in sheep and cattle result in losses of one billion dollars annually (Pal and Chakravarty, 2020). Myiasis, together with associated diseases, causes economic losses amounting to 20% of turnover in developed countries and up to 35-50% in the developing world, according to Pal and Chakravarty (2020). These economic losses can be mitigated through antiparasitic treatments and constant veterinary services practice (Touré, 1994).

Warble flies

Warble flies *(Hypoderma bovis* and *Hypoderma lineatum*) (Class: Insecta; Order: Diptera; Family: Oestridae) function as major ectoparasites that damage livestock as well as wild ruminants throughout the Mediterranean area, the Indian subcontinent, and China (Yadav *et al*., 2017; Otranto *et al*., 2004). Adult flies survive up to one week before which they lay eggs on their host's coat (Yadav *et al*., 2017). After skin penetration, the larvae move through body tissues for multiple months until they develop beneath the skin surface (Reina *et al*., 2000). The *Hypoderma spp* life cycle follows different yearly patterns because *H. lineatum* develops before *H. bovis* (Reina *et al*., 2000; Khan *et al*., 2007). In Pakistan egg-laying season begins in June, before larval migration, which starts in July, and warbles reach their peak appearance in mid-December (Khan *et al*., 2007). *Hypoderma lineatum* damages both milk production and leather worth, hence loss to the economy of India (Jaiswal *et al*., 2016). Warble fly infestations originating from *Hypoderma bovis* and *H. lineatum* larvae inflict major harm to both cattle health and animal productivity. The path of migrating larvae results in tissue necrosis and inflammatory tissue damage according to Wolfe (1959). The parasites create skin warbles that result in breathing holes. The immune response pattern also changes because plasma cells dominate the area surrounding healthy larvae while macrophages become more prominent during the death of larvae (Cabanelas *et al*., 2015). Milk production, together with the leather manufacturing industry, experienced significant financial damage from infestations (Jaiswal *et al*., 2016). The programs of anti-parasitism create long-lasting advantages for livestock producers, as well as maintaining environmental quality and benefiting consumers (Boulard, 2002). The stress caused by infestations results in low fertility along with delayed puberty because of hormonal imbalances (Crowe and Williams, 2012; Wrzecińska *et al*., 2021). Uterine infections prevail more frequently in high-yielding cows, which deteriorates their fertility level (Crowe and Williams, 2012). Under heavy insect infestation, milk production decreases by 15-25%, and the connection between insect counts and milk output is negatively correlated (Renčínová *et al*., 2021; Taylor *et al*., 2012). The combination of stress from insects along with udder irritation leads to an increased chance of mastitis. The continuous stress of flies causes cows to develop huddling behaviors and increases their kicking motions during the milking process (Renčínová *et al*., 2021).

Table 4: *Major insect pests of livestock sector.*

Pest	Scientific Name	Effects on Livestock	References
Ticks	Hyalomma anatolicum, Rhipicephalus microplus, Ixodes ricinus, Ixodes dammini	Blood loss, anemia, reduced weight gain, decreased milk production, transmission of protozoan, rickettsial, and viral diseases	(Jongejan and Uilenberg, 1994; Rajput *et al.,* 2006; Eskezia, 2016)
Mosquitoes	Anopheles spp., Aedes spp., Culex spp.	Vector of arboviruses (Rift Valley fever virus, West Nile virus, Japanese encephalitis virus), decreased milk production, weight loss	(Bird and Nichol, 2012; Linthicum *et al.,* 2016; Kaufman *et al.,* 2006)
Stable flies	Stomoxys calcitrans	Painful bites, stress, reduced feed intake, decreased weight gain, lower milk yield.	(Taylor, 2020; Taylor *et al.,* 2012; Wieman *et al.,* 1992)
Horn flies	Haematobia irritans	Blood loss, reduced weight gain, decreased milk production, irritation, increased heart rate	(Votýpka and Mihalca, 2020; Kaufman and Weeks, 2012; Tomberlin, 2023)
Bot flies	Oestrus ovis, Hypoderma spp., Gasterophilus spp., Chrysomya bezziana	Tissue damage, respiratory distress, reduced feed intake, impaired nutrient absorption, and hide damage	(Colwell *et al.,* 2006; Angulo-Valadez *et al.,* 2010; Touré, 1994)
Warble flies	Hypoderma spp.	Subcutaneous warbles, hide damage, reduced meat quality, weight loss	(Chhabra and Pathak, 2009; Sykes, 1994)

Effects on animal health and productivity

Impact of insect pests on meat, milk, and hide production

Biting flies among livestock pests create major economic damage in cattle business operations. Stable flies lead to annual milk output up to 139 kg in dairy cows, as well as body weight gain between 6-26 kg in beef cattle. The U.S. cattle industries face yearly economic losses of almost $2.21 billion due to stable fly population (Taylor *et al*., 2012). The combined yearly economic impact of six major cattle parasites, consisting of flies in Mexico, amounts to $1.41 billion, which equals $43.57 for each head of cattle (Rodríguez-Vivas *et al*., 2017). The evaluation revealed that hematophagous flies cause feeder cattle to lose 8.0 ± 1.5 kilograms of weight per month, resulting in a complete body weight gain reduction of 40.0 ± 5.5 kilograms over five months. A feedlot containing 100 calves can face a total economic loss of $16,000 throughout five months because of pests, according to Boonsaen *et al*. (2024).

Disease transmission risks

Rift Valley fever virus (RVFV) depicts a mosquito-carried viral pathogen that produces extensive outbreaks among livestock populations, as well as victimizes humans throughout the African continent and Arabian countries (Linthicum *et al*., 2016). The transmission of RVFV to cattle results in abortion rates exceeding 90-100% and causes 70% death ~~of~~ newborns, which leads to total loss in expenses up to $500 million (Bird and Nichol, 2012). Rift Valley fever virus affects livestock more than any other group since these species, including cattle, sheep, goats, and camels, act as amplifying hosts (Linthicum *et al*., 2016). The mortality rate in humans after infections remains between 10-20%, while the disease typically leads to brief illness or serious complications (Bird and Nichol, 2012). The World Health Organization classifies RVFV as a possible weapon for bioterrorism while it presents major health issues to worldwide populations, together with agricultural concerns (Linthicum *et al*., 2016). New habitats for RVFV infection emerge gradually because of climate change, along with the increasing globalization effects (Pagès and Cohnstaedt, 2018).

Economic consequences of infestations

Sadie and Mike operate Cattle Fly Traps that adversely impact livestock production globally. Stable flies result in $2.211 billion worth of losses every year throughout dairy and cow-calf operations in pastured and feeder cattle farms within the United States, according to Taylor *et al*. (2012). Stable flies lead to economic losses because they decrease milk outputs from dairy cows, combined with performance reductions in beef cattle. The economic impact of stable fly infestation on dairy cows results in a seasonal milk loss of 139 kg per year, whereas pastured stockers suffer a body weight reduction of 26 kg in a single season (Taylor *et al*., 2012). The United States livestock industry suffers more than $3 billion in yearly expenses due to attacks by stable flies, together with horn flies. The pests result in direct economic losses for livestock operations and spread multiple infectious diseases in animals and people, which shows the necessity of implementing practical pest management methods (Zhu and Wang, 2024).

Control of livestock pests

Customers who want to manage pests now initiate integrated pest control that uses biological and chemical methods alongside cultural control strategies (Table 6). Stable fly control includes various insecticides, arthropod predators, and biopesticides, as well as cultural practices such as farm hygiene and physical barriers (Cook, 2020). The complete management of sheep flystrike incorporates efforts that combine insecticide resistance control strategies

Table 5: *Economic impact of livestock arthropod pests.*

Pest	Region	Economic losses	References
Ticks	USA and mexico	$3 billion (USA), $573 million (Mexico)	(Zhu and Wang, 2024; Rodríguez-Vivas *et al*., 2017)
Mosquitoes	Africa	Losses due to Rift Valley fever outbreaks up to $500 million	(Bird and Nichol, 2012
Stable flies	USA and mexico	$2.21 billion (USA), $1.41 billion (Mexico)	Taylor *et al*., 2012; Rodríguez-Vivas *et al*., 2017)
Horn flies	USA	$1 billion annually	(Zhu and Wang, 2024
Bot flies	Global	Significant losses in cattle production	Various sources)
Warble flies	Europe	Losses in hide and meat production	(Various sources)

Table 6: *Control strategies for livestock pests.*

Pest	Control strategies	References
Stable flies	Insecticides, Arthropod predators, Biopesticides, Farm hygiene, Physical barriers	(Cook, 2020)
Sheep flystrike	Insecticide resistance management, Therapeutic delivery methods, Breeding for flystrike resistance	(Kotze and James, 2021)
Various livestock pests	Entomopathogenic fungi (*Beauveria bassiana*), Combination with reduced insecticides or botanical products (neem)	(Borges and Vila Nova, 2011; Islam and Omar, 2012; Weeks *et al.*, 2018; Shaurub, 2022)

with innovative therapeutic methods and selective sheep breeding for natural flystrike resistance (Kotze and James 2021). The implementation success of such pest management strategies relies on the partnerships between researchers and both extension personnel and growers alongside industry stakeholders to manage pests effectively and minimize the usage of traditional insecticides. Recent scientific research demonstrates that *B. bassiana* entomopathogenic fungi present a suitable biological control mechanism against different livestock and agricultural pests. Tests have confirmed that these fungal species succeed in controlling fly populations, providing a viable option for synthetic insecticide products (Weeks *et al.*, 2018). Laboratory experiments show that *B. bassiana* controls pests through minimized feeding performance while restricting their mobility (Weeks *et al.*, 2018). When entomopathogenic fungi are used in conjunction with lower quantities of insecticides or botanical products such as neem, they become more potent and less harmful to the environment (Islam and Omar, 2012; Borges and Vila Nova, 2011). Success rates for implementation depend on the formulation accuracy, together with the identified susceptibility of hosts and ideal environmental conditions. Biological and chemical pest management approaches in combination with agricultural strategies result in lower insecticide usage which is helpful to protect environment, and increase biodiversity (Borges and Vila Nova, 2011).

Conclusions and Recommendations

The future of worldwide food security, together with economic stability, can be linked to the poultry and livestock sectors because insect pests threaten both sectors with financial loss as well as health threats. The chosen review investigates all leading insect pests affecting these industries by studying their life cycle behaviors together with their destruction potential, followed by a systematic analysis of existing pest control techniques. Research results make it clear that sustainable pest control approaches founded in science must gain priority status because they ensure the continued success of these agricultural sectors. The widespread use of chemical pesticides as controls results in two main issues: insects developing pesticide resistance, besides creating environmental contaminations that endanger human and animal wellbeing. The present age depends on integrated pest management (IPM) for sustainable pest control. Gradual improvements from biotechnology applied to pest control have led to higher management accuracy, but scientists must continue research on biological control methods and pest-host relationship comprehension for better detection and management techniques. Policies for practical field adoption of scientific innovations require improved cooperation among entomologists with livestock producers, their veterinarians, and government officials. Sustainable pest management strategies that utilize technological developments allow both poultry and livestock sectors to guard against long-term arthropod pest threats and to optimize productivity as well as animal health, and stabilize agricultural structures with improvement in the economy in this sector.

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Novelty Statement

This review paper consolidates the scientific literature regarding different ectoparasitic insect and arthropod pests of poultry and livestock animals with an emphasis on the prevailing incidence and control practices being practically implicated combating these veterinary pests.

Author's Contribution

Muhammad Zeeshan Majeed: Conceived the idea and supervised the work.
Asghar Ali: Performed the research work and prepared the initial draft.

Laiba Idrees: Helped in technical revision of the draft, and financially supports the manuscript.
Muhammad Usman: Technically revised the draft.
Muhammad Tayyab Raza: Helped in literature-based data collection and curation.
Adeela Manzoor: Assisted in data analysis and financially supports the manuscript.

Generative AI or AI assisted technology statement
The authors declare that no generative AI was used to conceive, analyze, or interpret the research data.

Conflict of interest
The authors have no conflict of interest.

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