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Research Article

Prevalence of poltry dermanyssosis in Albania

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Abstract **–** Dermanyssosis, caused by *Dermanyssus gallinae* (De Geer, 1778) (Acari: Dermanyssidae), commonly known as the red mite of poultry, represents one of the most significant ectoparasitic threats in avian species, exerting both direct and indirect pathogenic effects. *D. gallinae* is an obligate, yet temporary, hematophagous ectoparasite that primarily affects domestic chickens but can also infest turkeys, ducks, and various wild birds. Additionally, infestations have been documented in mammals such as dogs and rodents. Human cases have been reported globally, typically presenting with pruritus and allergic dermatitis. In this study, 24 samples were collected from various regions across the country, of which 13 (54.17%) tested positive for dermanyssosis. The ectoparasite load per sample ranged from 30 to over 1,000 parasites. Infestations were classified as light, moderate, or severe based on parasite density. All samples were stored at -20 °C for further molecular analysis via PCR. This review consolidates critical information on the biology, epidemiology, and host spectrum of *D. gallinae*, along with its implications for animal welfare, current control strategies, and ongoing challenges in management. It aims to provide a comprehensive resource for poultry producers, veterinarians, and researchers, while outlining priority areas for future scientific investigation.

Keywords – Dermanyssosis, Prevalence, Birds, Infestation Level, Albania.

I. INTRODUCTION

The environment, animals, and plants are highly susceptible to parasitic infestations [6, 17]. In domestic poultry, ectoparasitic infestations are predominantly associated with the poultry red mite, *Dermanyssus gallinae*, which is a widespread pest in both commercial and backyard poultry farming systems worldwide [4, 5, 9, 11]. Although *D. gallinae* is primarily considered a parasite of domestic and commercially farmed birds raised for meat and egg production, more than 30 species of wild birds have been identified as susceptible to infestation in various studies [19, 21, 26]. The red mite is also increasingly recognized as one of the most economically damaging ectoparasites in poultry and, in some cases, mammals across the globe [5, 6, 10, 15, 16]. The rapid life cycle of *D. gallinae* significantly contributes to its presence. The complete development from egg to adult typically occurs within two weeks and may take even less time under optimal

conditions (original photo) [3, 4, 19]. Parasite density is a critical factor in determining the prognosis and severity of infestation, with high parasite loads leading to more severe outcomes [12, 22, 23]. However, even at low numbers, *D. gallinae* can have significant effects on bird health, as it is capable of acting as a vector for several infectious diseases [6, 14, 21, 23, 29]. In addition to its impact on various bird species and other domestic animals, increasing numbers of *D. gallinae*-related dermatitis cases have been reported in humans [1, 8, 22, 29]. These are typically caused by mite bites and subsequent allergic reactions, particularly in people living near poultry facilities [8]. The parasite also poses a potential occupational hazard to poultry workers and those in close proximity to infested environments [22, 24]. Efforts to control *D. gallinae* have often been unsuccessful due to its behavioral and biological adaptations. The mite completes its life cycle off the host and is primarily active at night, which reduces the efficacy of many conventional treatment approaches [2, 4, 9, 17]. These characteristics contribute to the failure of antiparasitic treatments, increased production costs, and the development of resistance to control measures [2, 20, 26, 27]. In 2017, *D. gallinae* infestations led to a major food safety incident involving residues of antiparasitic substances in poultry products, particularly eggs [2, 28]. This prompted risk communication challenges with consumers and drew the attention of European and global food safety authorities [2, 26]. Currently, there are very few antiparasitic compounds authorized for use in the presence of animals to control *D. gallinae* [10, 20, 28]. The situation is further complicated by the emergence of resistance in mite populations due to frequent and empirical use of such substances, especially under conditions of heavy infestation [20]. It has become clear that reliance solely on synthetic or semi-synthetic veterinary products is not a sustainable solution. Moreover, this approach has contributed to contamination of animal products, as illustrated by the Fipronil incident [2].

II. MATERIALS AND METHOD

Identification (typing) of *Dermanyssus gallinae* was performed, accompanied by a risk assessment based on the distribution of samples and the observed prevalence [3, 11]. The evaluation considered the potential impact of geographic factors, poultry species, hygienic and sanitary conditions, environmental temperatures, infestation periodicity, and other contributing elements [4, 9, 24]. A total of 24 samples were collected from 12 regions (two flocks per region) across the country. For each poultry farm, data were collected and processed through a structured questionnaire. A “flock” was defined as any group of more than 150 hens, regardless of production purpose. Samples were collected directly from the birds, from areas frequented by them, as well as from wooden surfaces and walls. On the birds’ bodies, feathers were sampled-especially those visibly infested with red mites. From each flock, 10 samples were taken. The presence of *D. gallinae*-including their eggs and larvaeon birds or in the surrounding environment was used as the diagnostic criterion. Additionally, traps specifically designed to collect *D. gallinae* were deployed in the poultry facilities. These consisted of corrugated cardboard boxes placed in strategic areas where mites are known to move frequently. Red mites were also consistently found in large numbers on recently deceased birds, sometimes even within the oral cavity, trachea, crop, and esophagus. Traps were constructed from ordinary paper coated with an oily substance and were positioned on the outer surfaces of poultry housing structures, particularly along known mite pathways. Traps were collected after 3-5 days, transported to the laboratory, and frozen at -20 °C for at least 24 hours to kill the mites. The contents of each trap were transferred into Petri dishes. Using a counting grid and stereomicroscope, mites (including eggs, larvae, nymphs, and adults) were identified following the keys provided by Bizhga [2013] and quantified [3, 6, 7, 14, 18, 19,]. For larger samples, a representative subsample was weighed and total counts were estimated through cross-multiplication. The degree of infestation was classified as high**,** moderate**, or** low**.** Based on these levels, pooled samples were prepared as follows:

- **High infestations**: >10 pools, each containing 20-50 parasites per sample
- **Moderate infestations**: 3-5 pools, each with 2-20 parasites per sample
- **Low infestations**: 1-3 pools with a small number of parasites per sample

Species differentiation was performed following the protocol by Bizhga [2013]. *D. gallinae* belongs to the genus *Dermanyssus* (Arachnida: Mesostigmata: Dermanyssidae), which also includes related genera such as *Acanthonyssus* Yunker & Radovsky in Wenzel & Tipton (1966), *Draconyssus* Yunker & Radovsky, *Laelaspisella* Marais & Loots (1969), and *Liponyssoides* Hirst (1913). Of the 24 known species under *Dermanyssus* Dugès, 1834, many taxonomic challenges remain, such as the existence of cryptic species and significant geographic variation, necessitating further research to improve classification and systematic [3, 6, 7, 14, 18, 19,]. *D. gallinae* feeds on poultry primarily during the dark period. Females lay oval eggs measuring approximately 0.4 mm × 0.25 mm. Under warm conditions, eggs hatch within 2-3 days; the process is slower at lower temperatures. The larvae, characterized by three pairs of legs, emerge and within 24 hours molt into protonymphs, which possess four pairs of legs and begin feeding on the host. At temperatures ranging from 18°C to 30°C (common during transport), larval hatching occurs within 2 days [3, 6, 18]. All developmental stages of the mite's life cycle were identified in a single sample.

Statistical evaluation and maps database.

BiostatisticsMCW, was used to determine if there are statistically significant differences between farms and regions of an independent variable on a continuous variable and tells that at least two groups were different. Since we have more groups in the study for determining which of these groups differ from each other we have done this using a post hoc test. BiostatisticsMCW ranks all the data from all groups together. Since average mite counts in each farm, Geographical distribution maps were constructed using QGIS software.

III. RESULTS

Sample collection from 24 farms (10 samples per farm).

Table No. 1. Data on flocks and samples collected in the study.

Farm 1	2	3	4	5	6	7	8	9	10	11	12
001	011	021	031	041	051	061	071	081	091	101	111
002	012	022	032	042	052	062	072	082	092	102	112
003	013	023	033	043	053	063	073	083	093	103	113
004	014	024	034	044	054	064	074	084	094	104	114
005	015	025	035	045	055	065	075	085	095	105	115
006	016	026	036	046	056	066	076	086	096	106	116
007	017	027	037	047	057	067	077	087	097	107	117
008	018	028	038	048	058	068	078	088	098	108	118
009	019	029	039	049	059	069	079	089	099	109	119
010	020	030	040	050	060	070	080	090	100	110	120
Farm 13	14	15	16	17	18	19	20	21	22	23	24
121	131	141	151	161	171	181	191	201	211	221	231
122	132	142	152	162	172	182	192	202	212	222	232
123	133	143	153	163	173	183	193	203	213	223	233
124	134	144	154	164	174	184	194	204	214	224	234
125	135	145	155	165	175	185	195	205	215	225	235
126	136	146	156	166	176	186	196	206	216	226	236
127	137	147	157	167	177	187	197	207	217	227	237
128	138	148	158	168	178	188	198	208	218	228	238
129	139	149	159	169	179	189	199	209	219	229	239
130	140	150	160	170	180	190	200	210	220	230	240

Table No. 2. Prevalence of *D. gallinae*.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
+	-	-	+	+	-	-	-	+	+	+	+	-	+	-	+	-	+	+	-	+	-	-	+

From the inspected farms, 13 were found positive, representing 54.17%. The number of ectoparasites per sample ranged from 30 to over 1,000. The positive cases were distributed across almost the entire territory of the country.
The data were not influenced by the number of birds in the flock.
Flocks in extensive farming systems were more affected compared to those in intensive systems. There were no differences based on the production purpose, with a similar distribution observed in both types of poultry production.

IV. DISCUSSION

The diagnosis in poultry flocks was based on a history of decreased egg production, anemia, mortality in young or sick birds, and the direct observation of the red poultry mite either on the birds or in their surrounding environment, as well as the data from the questionnaire specifically developed for this study. Signs on the feathers, blood on the birds' bodies, parasite bite marks, and allergic reactions at the site prompted further investigation of the environment to identify the cause. The presence of mites or their eggs and larvae in the environment and on the birds' bodies was technically used to diagnose *Dermanyssus gallinae*. In the poultry housing areas, traps made of corrugated cardboard boxes were prepared and placed specifically to collect *D. gallinae*. In freshly dead birds, mites were always found in large numbers, and they could even be found inside the oral cavity, trachea, crop, and esophagus. The only identified species was *Dermanyssus gallinae*. Morphologically, *Dermanyssus* species are divided into the *hirsutus* group (with distinct traits and clear host associations) and the *gallinae* group (with more variable and less distinguishable traits) [5, 7, 8]. *D. gallinae* measured 1-1.5 mm, with a chitinous exoskeleton that provides durability and allows for blood engorgement. Sensory setae located on the legs, dorsal shield, genitoventral shield, and anal shield help in locating the host through sensitivity to heat, vibrations, and CO_2 [3, 18]. Its specialized legs enable movement on slippery surfaces and olfactory detection, making the mite highly efficient at finding its host [3,14,18]. The mite's life cycle lasts 5-12 days and begins after a female becomes engorged with blood and then moves away from the host (into the shelter/stable) to lay 1-10 eggs, which hatch into larvae after 1-3 days (as confirmed by our photos). The larvae then develop into mobile protonymphs and, after feeding, into deutonymphs before reaching adulthood. Females can lay eggs 3–20 times throughout their lifespan [3, 13]. Optimal development occurs at 30 °C, while heat stress at 35 °C reduces reproduction and development speed, suggesting the potential use of this condition as a control strategy [25]. All affected farms experienced economic losses [25]. The poultry showed signs of anemia, stress, cannibalism, decreased egg production, poor egg quality, and mortality. In the analysis of the questionnaire data, an increase in mortality was observed in the studied farms, ranging from 1 to 4% of the birds, a decrease in egg production of up to 10%, and a reduction in meat production of up to 20% [21, 30].

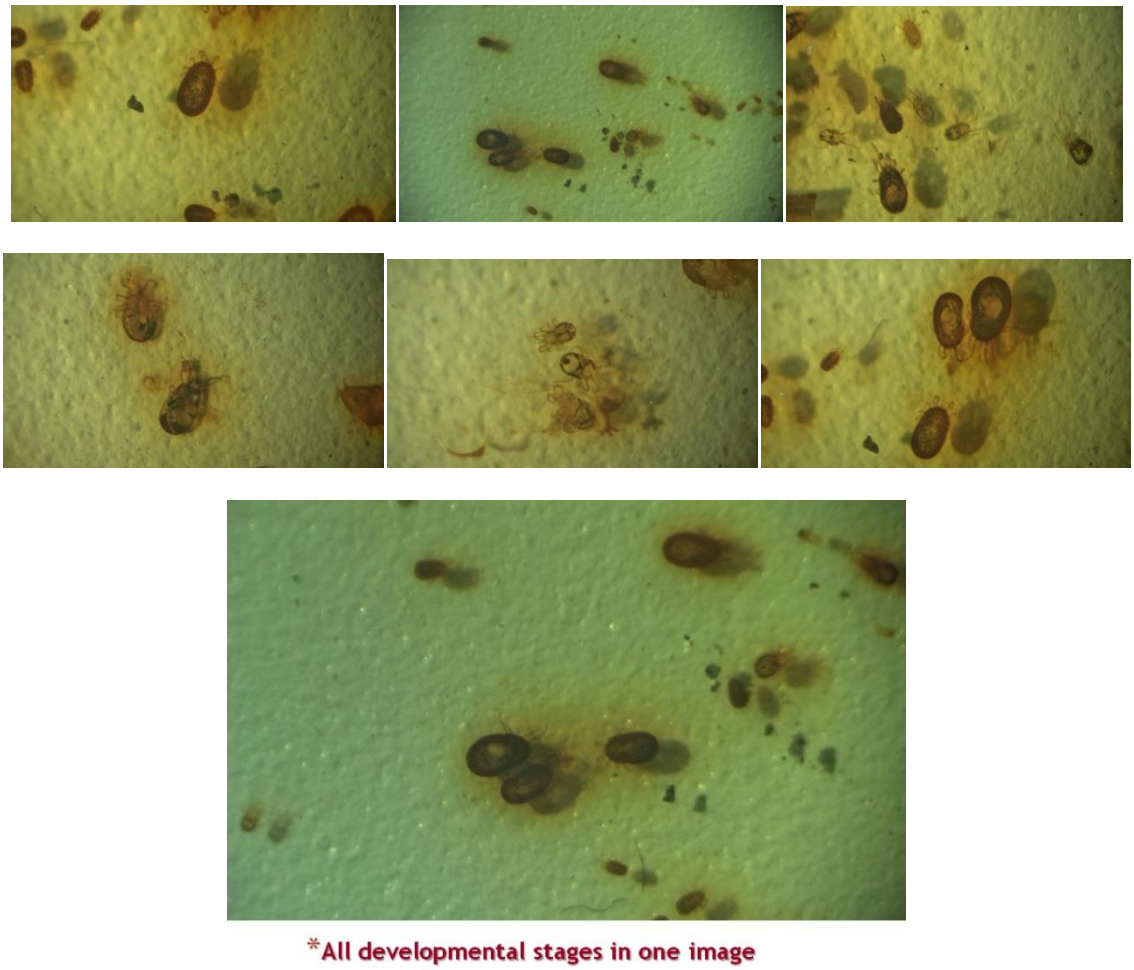

Figure 1. Original photos.

V. CONCLUSION

To determine the prevalence of the red mite in poultry in Albania, samples were collected from layer hen farms across the entire territory of the country. The identification of the causative agent was performed based on morphological characteristics. In 13 out of 24 farms studied, *Dermanyssus gallinae* was detected, resulting in a national prevalence of 54.17%. This is a high value, which was associated with health deterioration and reduced productivity in the affected poultry. Further work will be carried out to identify the pathogens carried by the collected samples. The questionnaire confirmed that even after cleaning the stables and applying disinfection, disinfestation, and deratization (DDD) procedures, parasites were still found in the poultry environments. We observed that elimination of *D. gallinae* from the stables was not achieved, due to treatment schemes that were poorly adapted to the parasite's biology, and in some cases due to complete lack of efficacy or the development of resistance to acaricides. There is a very high risk of the parasite spreading from one farm to another through equipment or other materials (related to farm biosecurity), as well as through many other birds that come into contact with poultry flocks.

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