Bulgarian Journal of Veterinary Medicine, 2017, **20**, Suppl. 1, 383–388
ISSN 1311-1477 (print); ISSN 1313-3543 (online)

DERMANYSSUS GALLINAE – A GHOST ECTOPARASITE FOR THE GREEK LAYING HEN INDUSTRY: RESULTS OF A PILOT STUDY

K. ARSENOPOULOS, A. ANGELOU & E. PAPADOPOULOS

Laboratory of Parasitology and Parasitic Diseases, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, Thessaloniki, Greece

Summary

Arsenopoulos, K., A. Angelou & E. Papadopoulos, 2017. *Dermanyssus gallinae* – a ghost ectoparasite for the Greek laying hen industry: Results of a pilot study. *Bulg. J. Vet. Med.*, **20**, Suppl. 1, 383–388.

Dermanyssus gallinae, the poultry red mite (PRM), is a blood sucking ectoparasite, provoking a variety of clinical signs in avian population, amongst other mammals including humans. It consists a major threat to the laying hen industry and is responsible for significant economic losses to the global poultry industry. In our study, 12 Greek laying hen farms were visited in Central Macedonia in order to identify the prevalence of PRM infection within a pilot program. All farms were infected with this ectoparasite (100% prevalence). It is, therefore, obvious that PRM is a major problem for the Greek laying hen industry and coordinated action must be taken. An increase of *D. gallinae* prevalence rates may have an epidemiological impact on several animal and human diseases, as PRM can be a potential vector for several pathogens (One Health).

Key words: *Dermanyssus gallinae*, laying hens, poultry red mite, vector

INTRODUCTION

Dermanyssus gallinae, also known as the poultry red mite (PRM), is a blood sucking ectoparasite, widespread in many parts of the world including Europe, U.S.A., Japan and China (Sparagano *et al.*, 2009, Wang *et al.*, 2010). It is the most pathogenic ectoparasite of the poultry population, posing an increasing economic threat, especially for the laying hen industry (Chauve, 1998). Its pathogenicity is based on its haematophagous activity, which is responsible for the reduction of the egg production (quality and quantity), susceptibility of the poultry health status and danger for the public health (Brannstrom *et al.,* 2008).

According to its life cycle, PRM is an obligatory blood feeder (Chauve, 1998). In other words, it requires blood meals to develop into the last three stages of its life cycle and become an adult parasite, i.e. capable of oviposition (Pritchard *et al.*, 2015). Although PRM is considered avian specific and it can infest more than 30 avian species (e.g. canaries, pigeons etc.) (Roy & Chauve, 2007), nowadays many

reports support its capability to infest non-avian hosts (host expansion) (Pritchard *et al.*, 2015). More precisely, *D. gallinae* has been found to infest dogs and cats (Declerq & Nachtegaele, 1993), horses (Mignon & Losson, 2008), goats (Dorny *et al.*, 1994), rabbits (Sikes & Chamberlain, 1994) and even mice (Allymehr *et al.*, 2012) in the absence of birds, which are considered the primer hosts (Roy *et al.*, 2009).

The presence of *D. gallinae* has a negative impact for the poultry industry either through potential direct effects on birds themselves (Pritchard *et al.*, 2015) or indirect on humans (e.g. workers, veterinarians, visitors etc.) (Collgros *et al.*, 2013). In poultry level, the appearance of clinical signs varies depending on infestation rates. The first stages of PRM infestation are characterized by a susceptibility of the immune system and therefore, a reduction of the birds' health status due to restlessness and increased self-pecking (Kilpinen *et al.*, 2005, Pritchard *et al.*, 2015). In severe infestations, these ectoparasites cause mainly anemia in birds, enhance cannibalism and may lead to death (Kilpinen *et al.*, 2005). The major financial losses, due to *D. gallinae* infestation, include a significant reduction of the quantity and quality (e.g. increased shell thinning and spotting) of the laid eggs (Chauve, 1998, Cosoroaba, 2001). At a public health level, the increasing reports of PRM attacks on humans may be of great veterinary and medical importance as well (George *et al.*, 2015). They cause annoyance on the workers of the farm, while in cases of severe infestation, these ectoparasites adapt their blood sucking activity on humans (Williams, 1958), causing skin reactions such as dermatitis called gamasoidosis (George *et al.*, 2015) and allergic conditions.

Epidemiological studies, regarding the prevalence and key figures for the PRM infection in Greek laying hen farms, have not yet been conducted. Therefore, this preliminary study focused on the prevalence and importance of *D. gallinae* for Greek laying hen industry and attempted to elucidate the infection rate within a pilot programme.

MATERIAL AND METHODS

Twelve laying hen farms of Central Macedonia, Northern Greece were visited, within a pilot study. All the farms had the enriched cage system (approximately 15–25 hens per cage) with totally controlled climatic conditions. The breeding capacity ranged between 6.000 and 80.000 birds per farm, aged from 20 to 65 weeks old. The egg collection and feeding systems were automated.

Fig. 1. The cardboard traps (15×40 cm) used to collect the PRM.

In order to assess the PRM infestation/infection, 5 cardboard traps (15×40 cm) per farm were placed in a variety of sites, including beneath feed troughs, inside cage fittings and fastening clips, under egg conveyer belts and under manure belts (Fig. 1). After 24 hours, the traps were collected and transferred to the Laboratory of Parasitology and Parasitic Diseases, at the Faculty of Veterinary Medicine of Aristotle University of Thessaloniki.

The traps (60 in total) were examined for the presence (counting and identification) of *D. gallinae* (Fig. 2). Mites were killed and washed off the traps, using a certain volume of water, into a glass vial. Subsequently, aliquots were taken (post thorough mixing) and the mite numbers were recorded. Collected mites were placed in plastic tubes containing ethanol 99%, 48 h prior to identification with the use of a stereoscope. The identification was based on morphological criteria provided by Taylor *et al.* (2007).

Fig. 2. The poultry red mite *Dermanyssus gallinae*

RESULTS

Massive infestations of the PRM were found in all farms. More precisely, the prevalence of *D. gallinae* infection of the 12 farms visited was 100%. The number of mites per trap varied from 330 to 372 specimens. The average number (±SD) of mites (including 60 cardboard traps) was 356±26. In certain cases hens were anaemic (Fig. 3).

Fig. 3. Anaemic hen due to heavy PRM infestation.

DISCUSSION

The aim of this pilot study was to investigate the prevalence of *D. gallinae* infestation of the Greek laying hen industry and provide information on the importance of PRM control.

D. gallinae is a major epidemiological and economical threat for the poultry farm

systems, all over the world. PRM is a haematophagus ectoparasite and it is considered responsible for anaemia in birds and downgrading of the quality and quantity of the egg production. Many recent reports suggest that it could also have a vector role for several animal and human pathogens (Chauve, 1998).

According to the results from this small number of farms (n=12) visited, the prevalence of *D. gallinae,* in Greece, seems to be extremely high (100%). The prevalence of PRM infestation ranges between 80–90% of poultry population in the United Kingdom, Italy, Serbia, Morocco, Japan and Netherlands (Sparagano *et al.*, 2009). In less intensive management farms (e.g. barns, free range and organic farms) the prevalence rates are usually higher than intensive farms. In these farms, *D. gallinae* is favoured by the variety of hiding places (e.g. cracks and crevices) and the limitations regarding the use of chemical control methods. Anon (2003) reported 7.5, 32.5 and 60% PRM infection rate for cage systems, alternative systems and backyard flocks, respectively. Poultry husbandry advisers estimate a prevalence of 95%, in Netherlands (Sparagano *et al.*, 2009). The research community has to take into consideration the fact that in the near future, many countries will ban cages due to avian welfare issues. Therefore, *D. gallinae* prevalence will increase rapidly with even higher economic losses for the avian industry, if no effective control methods are employed against this pest immediately (Sparagano *et al.*, 2009).

An increase of *D. gallinae* prevalence rates may have an epidemiological impact on several animal and human diseases, as PRM can be a potential vector for several pathogens (Moro *et al.*, 2007; 2008). Due to its avian (host) preference, PRM has been incriminated for the transmission of many pathogens (bacteria, viruses) such as *Chlamydia psittaci, Salmonella gallinarum, Pasteurella multocida, Erysipelothrix rhusiopathiae, Listeria monocytogenes, Mycoplasma synoviae*, newcastle disease, fowlpox virus, St. Louis encephalitis, tick borne encephalitis, western equine encephalitis and Venezuelan equine encephalitis (George *et al.*, 2015).

As the transmission of pathogens among avian population has been demonstrated in several cases, the likelihood that diseases may pass from birds to humans is still under research (Moro *et al.*, 2009). Nevertheless, several reports concluded that this ectoparasite is involved in the transmission of spirochetes, rickettsiae, salmonellae, bartonellae, pasteurellae, sporozoa, hemogregarines, flagellates and filariae. More recent researches report that PRM is responsible for the infection with *Bartonella* spp., *Coxiella burnetii* causing Lyme disease and *Babesia* spp (George *et al.*, 2013). It is, therefore, obvious that *D. gallinae* can contribute to many pathological outcomes of great veterinary and medical importance (One health concept), stressing that efforts focused on the control of *D. gallinae* are absolutely necessary.

Control of PRM is primarily achieved by continuous applications of various synthetic acaricides, such as organophosphates and carbamates. Until recently, the number of commercial products available against PRM remained limited. For this reason, often poultry farmers used products not registered for use against *D. gallinae*. but for use in agriculture or on other animal species. Their repeated, as well as hypodosic extralabel use, threatens animal and human health because it favours the development of acaricide resistant *D. gallinae* populations (Tabari *et al.*, 2015) and

the accumulation of acaricide residues in chickens' organs and tissues. Moderm acaricides are available nowadays in the European market, including spinosad and fluralaner. Alternative control measures, such as dietary plant extracts and essential oils, have already been identified as being toxic to *D. gallinae* (Miresmailli *et al.*, 2006). Furthermore, there are available effective chemicals administered at the poultry environment, such as silicon compounds.

CONCLUSIONS

D. gallinae poses a major threat for the egg laying industry. Understanding PRM biology, prevalence rate and key figures of its infection is essential in order to develop appropriate strategies focused on its control. The results of this pilot study confirmed the widespread presence of PRM (100% prevalence) in poultry farms in Northern Greece and highlighted the urgent need of an effective control strategy.

REFERENCES

Allymehr, M., M. Tavassoli, M. H. Manoochehri & D. Ardavan, 2012. Ectoparasites and gastrointestinal helminths of house mice (*Mus musculus*) from poultry houses in northwest Iran. *Comparative Parasitology,* **79**, 283–287.

Anon, 2003. Red mite confirmed in 60% of units. *Poultry World*, July.

Brannstrom, S., D. A. Morrison, J. G. Mattsson & J. Chirico, 2008. Genetic differences in internal transcribed spacer 1 between *Dermanyssus gallinae* from wild birds and domestic chickens. *Medical and Veterinary Entomology*, **22**, 152–155.

Chauve, C., 1998. The poultry red mite *Dermanyssus gallinae* (De Geer, 1778): current situation and future prospects for control. *Veterinary Parasitology*, **79**, 239–245.

Collgros, H., M. Iglesias-Sancho, M. J. Aldunce, V. Expósito-Serrano, C. Fischer, N. Lamas & P. Umbert-Millet, 2013. *Dermanyssus gallinae* (chicken mite): an underdiagnosed environmental infestation. *Clinical and Experimental Dermatology*, **38**, 374–377.

Cosoroaba, I., 2001. Massive *Dermanyssus gallinae* invasion in battery-husbandry raised fowls. *Révue de Médecine Vétérinaire*, **152**, 89–96.

Declerq, J. & L. Nachtegaele, 1993. *Dermanyssus gallinae* infestation in a dog. *Canine Practice,* **18**, 34–36.

Dorny, P., T. Van Wyngaarden, J. Vercruysse, C. Symoens & A. Jalia, 1994. Survey on the importance of mange in the aetiology of skin lesions in goats in Peninsular Malaysia. *Tropical Animal Health and Production*, **26**, 81–86.

George, D., R. Finn, K. Graham, M. Mul & O. A. E. Sparagano, 2013. Of mites and men: preliminary evidence for increasing incidence of avian ectoparasitosis in humans and support of its potential threat to medical health. In: *XVIIIth World Congress of the World Veterinary Poultry Association* (Abstracts), Nantes, France, World Veterinary Poultry Association, Nantes, p. 635–636.

George, D. R., R. D. Finn, K. M. Graham, M. F. Mul, V. Maurer, C. V. Moro & O. A. E. Sparagano, 2015. Should the poultry red mite *Dermanyssus gallinae* be of wider concern for veterinary and medical science? *Parasites & Vectors,* **8**, 178.

Kilpinen, O., A. Roepstorff, A. Permin, G. Norgaard-Nielsen, L. G. Lawson & H. B. Simonsen, 2005. Influence of *Dermanyssus gallinae* and *Ascaridia galli* infections on behaviour and health of laying hens (*Gallus gallus domesticus*). *British Poultry Science*, **46**, 26–34.

Mignon, B. & B. Losson, 2008. Dermatitis in a horse associated with the poultry mite (*Dermanyssus gallinae*). *Veterinary Dermatology,* **19**, 38–43.

Miresmailli, S., R. Bradbury & M. B. Isman, 2006. Comparative toxicity of *Rosmarinus*

officinalis L. essential oil and blends of its major constituents against *Tetranychus urticae* Koch (Acari: Tetranychidae) on two different host plants. *Pest Management Science,* **62**, 366–371.

Moro, C., P. Fravalo, M. Amelot, C. Chauve, L. Zenner & G. Salvat, 2007. Colonization and organ invasion in chicks experimentally infected with Dermanyssus gallinae contaminated by Salmonella Enteritidis. *Avian Pathology*, **36**, 307–311.

Moro, C., C. De Luna, J. H. Guy, O. A. E. Sparagano & L. Zenner, 2008. The poultry red mite, *Dermanyssus gallinae*, a potential vector of pathogenic agents. *Experimental Applied Acarolory*, (submitted to the same EAA special issue).

Moro, C., C. J. De Luna, A. Tod, J. H. Guy, O. A. E. Sparagano & L. Zenner, 2009. The poultry red mite (*Dermanyssus gallinae*): A potential vector of pathogenic agents. *Experimental Applied Acarolory*, **48**, 93–104.

Pritchard, J., T. Kuster, O. Sparagano & F. Tomley, 2015. Understanding the biology and control of the poultry red mite *Dermanyssus gallinae*: a review. *Avian Pathology*, **44**, 143–153.

Roy, L. & C. M. Chauve, 2007. Historical review of the genus *Dermanyssus Duges*, 1834 (Acari: Mesostigmata: Dermanyssidae). *Parasite*, **14**, 87–100.

Roy, L., A. P. Dowling, C. M. Chauve, I. Lesna, M. W. Sabelis & T. Buronfosse, 2009. Molecular phylogenetic assessment of host range in five *Dermanyssus* species. *Experimental Applied Acarology,* **48**, 115–142.

Sikes, R. K. & R. W. Chamberlain, 1954. Laboratory observations on three species of bird mites. *Journal of Parasitology,* **40**, 691–697.

Sparagano, O., A. Pavlicevic, T. Murano, A. Camarda, H. Sahibi, O. Kilpinen, M. M. Rick van Emous, S. Bouquin, K. Hoel & M. A. Cafiero, 2009. Prevalence and key figures for the poultry red mite *Dermanyssus gallinae* infections in poultry farm systems. *Experimental & Applied Acaroloroly*, **48**, 3–10.

Tabari, M. A., M. R. Youssefi, A. Barimani & A. Araghi, 2015. Carvacrol as a potent natural acaricide against *Dermanyssus gallinae*. *Parasitology Research*, **114**, 3801–3806.

Taylor, M. A., R. L. Coop & R. L. Wall, 2007. Parasites of poultry and gamebirds. In: *Veterinary Parasitology,* 3rd edn, Blackwell Publishing Ltd, London, pp. 1264–1267.

Wang, F. F., M. Wang, F. R. Xu, D. M. Liang & B. L. Pan, 2010. Survey of prevalence and control of ectoparasites in caged poultry in China. *The Veterinary Record*, **167**, 934–937.

Williams, R. W., 1958. An infestation of a human habitation by *Dermanyssus gallinae* (DeGeer, 1778) (Acarina: Dermanyssidae) in New York City resulting in sanguisugent attacks upon the occupants. *American Journal of Tropical Medicine Hygiene*, **7**, 627–629.