Efficacy of Indispron® D110 in the treatment of red mites (*Dermanyssus gallinae*) infestation in Specific Pathogens Free Poultry Flock in Vom, Nigeria

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Abstract

The main objective of this study was to evaluate the efficacy of Indispron® D110 against the red mite (*Dermanyssus gallinae*) infestation in specific pathogen free birds reared for vaccine research and production in National Veterinary Research Institute (NVRI), Vom. A total 250 birds comprising of 150 harcowhite growers and 100 cockerels all at 16 weeks old were considered in this study. The Harcowhite were treated with Indispron® D110 according to manufacturer instructions for a period of 14 days while the cockerels were left as untreated control. The initial results showed a significant reduction of mites (85%) in mite's population after three days of spraying in the first week. Thereafter, a drastic decline in the mite's population as no clusters were seen in the environment and on the shanks three days after application on week two (2) indicative of 100% efficacious when compared with the control birds which still have clusters of red mites and scaly shanks. This is the first report on Indispron® D100 being used for treating red mites in Nigerian poultry farm and is therefore recommended for routine use in controlling ectoparasites in Poultry houses and to promote quality research in the country.

Keywords: Efficacy, Indispron® D110, *Dermanyssus gallinae,* specific pathogen free birds, Nigeria.

Introduction

In domesticated birds, ectoparasitic mites are a particular issue with *Dermanyssus gallinae* being ubiquitous as a poultry pest throughout much of the globe [1] . Though *D. gallinae* are reported to be avian-specific, albeit infesting more than 30 species of wild birds [2.] Increasing reports of attacks on non-avian hosts may be indicative of host expansion. Such events are not uncommon among invertebrates, being most often recorded in phytophagous insects. *D. gallinae* the red mite of poultry is a cosmopolitan species which attacks the fowl, pigeon, canary and other caged and wild birds and may also feed on man as it invades human dwellings [3]). Increasing densities of humans and associated livestock/companion animals may make medical and veterinary systems particularly susceptible to host expansion events, where increased host occurrence logically

favours rising encounter rates with novel parasites [4]. Interestingly, *D. gallinae* has already been found to 'switch' more readily between avian hosts of different species than several other related species within the same genus [5]. When removed from hens and offered canaries as a host, *D. gallinae* readily switched between the two, whereas *Dermanyssus longipes* could not. *Dermanyssus carpathicus* was able to switch between hosts, but only after suffering high initial losses not seen with *D. gallinae* [5]. This apparent tendency for higher switching success may reflect the generally broader host range of *D. gallinae* as compared to other species in the genus *Dermanyssus*[2]. Increasing reports of bird-mite attacks on humans and mammalian companion animals may be of increasing medical and veterinary concern. Though several species of bird mite from multiple genera may be responsible for gamasoidosis, *D. gallinae* is most commonly implemented as the causal agent. *D. gallinae* is called red mites only when it has recently fed on its host blood otherwise it is whitish or black in colour [6] and the dorsal shield does not quite reach the posterior end of the body and its posterior margin is truncated. The setae are smaller than those on the skin around the dorsal plate, and chelicerae are long whiplike [6] compared to *Cheyletiella*, and *Ornithonyssus* [7] . *Dermanyssus gallinae* is a blood feeding ectoparasite that lives in cracks and crevices in poultry pens, coming out at night to hop in birds for least. They cannot fly but are a very serious problem for poultry keepers and large infestation can kill birds by sucking their blood making them anaemic. They are not species specific and can feed from any type of birds, and can be carried into the flock from wild birds and transfer from bird to bird [8]. The rapid life cycle of *D. gallinae* undoubtedly contributes to its status as a pest. Complete development from egg to adult typically occurs over two weeks, though may take place in less than half this time [9, 10]. Temperatures of 10-35°C and high relative humidity (>70%) facilitate *D. gallinae* reproduction and development[10,11] and weekly doubling of populations is possible in egg-laying facilities where these conditions are often met[10,12] Resulting *D. gallinae* densities typically reach 50,000 mites per bird in caged systems though can escalate to 500,000 mites per bird in severe cases[13] The life cycles are divided into larvae, two nymphal stages and adult which lay the eggs[6] *D. gallinae* is a vector of *Borrelia anserine* in Australia, and a vector of viruses of St. Louis encephalitis and Western encephalitis because it has been found naturally infected with the viruses. Also it transmits fowl pox and Newcastle Disease Viruses [6, 14, 15]. As an avian mite recorded from numerous bird hosts it is of little surprise that *D. gallinae* may pose a threat to domestic fowl other than poultry [2]. Companion birds, such as hobby pigeons and budgerigars are also at risk and in canaries *D. gallinae* has even been linked to infection with the bacteria *Chlamydia psittaci*[16]. *D. gallinae* have also been reported as posing a risk to poultry workers, so much so that this work proposes their presence as an 'occupational hazard'[17]. For *D. gallinae* at least, this body of literature, though currently small, confirms ingestion of human blood[18], propensity for persistent infestation when feeding on human blood alone[19] and geographically wide-spread occurrence on a global scale. That *D. gallinae* is assigned responsibility for the majority of gamasoidosis cases is perhaps unsurprising, with laboratory study demonstrating that these mites can be induced to feed upon humans, albeit at low levels, whereas other avian-ectoparasitic mites (*Ornithonyssus* (syn. *Bdellonyssus* spp) cannot [20, 21]. The aim of this study

was to evaluate the efficacy of Indispron® D110 against the red mite (*D. gallinae*) infestation in specific pathogen free birds reared in deep litters for research and vaccine production purposes in the National Veterinary Research Institute (NVRI), Vom, Nigeria.

Materials and Methods

Study area

This study was conducted in Jos Plateau State which is located in Nigeria's middle belt, with an area of 26,899 square kilometers and an estimated population of about three million people. It is located between Latitude 9^o 0' to 9^o 40' North and longitude 8^o 30' to 10^o 30' East of the equator. The altitude ranges from around 1,200 metres (about 4000 feet) to a peak of 1,829 metres above sea level in the Shere Hills range near Jos. Years of tin mining have also left the area strewn with deep gorges and lakes. Though situated in the tropical zone, a higher altitude means that Plateau State has a near temperature climate with an average temperature of between 18 and 22^{o}C. Harmattan winds cause the coldest weather between December and February. The warmest temperatures usually occur in the dry season months of March and April. The mean annual rainfall varies from 131,75cm (52 in) in the southern part to 146cm (57 in) on the Plateau. The highest rainfall is recorded during the wet season months of July and August [22] .

History

Following several complaints from the specific pathogens free poultry unit of N.V.R.I Vom of tiny moving organisms on the bodies of the poultry attendants and on the walls of the pen, investigations were carried out on the flock to identify the causative agents. These birds were raised in low pens on deep litter that had 150 Harco white growers (Group1) and 100 cockerels (Group 2) all at 16 weeks old. The birds were fed rations produced at Dagwom Farm of NVRI, Vom. Vaccines administered were in accordance with the institute vaccination programme, and routine deworming with albendazole according to the manufacturers recommendation. There were decreases in egg production in layers, and increased feed consumption in all the pens based on existing records.

Physical Examination

Examination of the two groups (1 and 2) revealed tiny reddish, whitish and black dots organism clustered in cracks, crevices, loose clods of manure, under the slate, in the laying boxes and nests. Also some of the organisms were found on the shanks. From the farm records, there were decreased egg production and increased feed consumption. On physical examination, the combs were pale and whitish; there were scales on the shanks and weightlessness of the birds. Some of the organisms were collected in 70% alcohol in pyrex test tube for laboratory examination at Parasitology laboratory of NVRI Vom. In addition, 2 ml each of blood were collected from 10 birds in each pen for heamoparasitic investigation.

Laboratory Examination

The tiny clustered organism were placed in Petri dishes and examined under a stereomicroscope

for examination based on morphological and morphometric characteristics as described by [6]. Thin smears and packed cell volumes (PCV) were analyzed as described by [23]

Treatment

Birds and there pen were treated based on the life cycle of *Dermanyssus gallinae* using Indispron® D110 a synthetic amorphous silica produced by Evonik Industries, Germany according to the manufacture instructions [24,]

Result

The laboratory result revealed that the tiny clustered organism were *Dermanyssus gallinae* based on the morphometric and morphological characteristics as described by [6]. The PCV were within normal ranges for poultry. Blood smears showed no parasites. In group 1, Indispron® D100 was applied and after three days of spraying there were significant reduction in mite's population as shown in Table 1. At the second spraying a week after there was dramatic reduction in the mite's population as no clusters were seen and even the shanks were free from the mites. However in Pen B where Decis® was used, there was a high significant reductions (90%) seen after the second spray. Few clusters of the red mite's were still seen in cracks and cravices until five days post treatment thereafter, no mites seen indicative a 100% effectiveness Table 1. Also with Indispron® D100 three days after the second spray no mites were seen but the third spraying was done according to the manufacturer's recommendation.

Table1: Efficacy evaluation of Indispron® **D100 against *D. gallinae* infestation on birds and the environment for 14 days**

Group	Number of birds	Breed	Parasiticides used for treatment	Treatment day (s)	Efficacy (%)
1	150	Harcowhite	Indispron® D100	1, 8	95, 100
2*	100	Cockerels	None	NA	0

2*: Pen B used as control showing 0% efficacy since there was no treatment applied.

Discussion

In this study, we present the first report of the efficacy of Indispron® D110 against the red mite (*Dermanyssus gallinae*) in Vom Jos, Nigeria. Despite its potential significance, little research had been conducted on the threat of gamasoidosis to non-avian animal and human health, with the bulk of work being formed of case studies documenting occurrence only 25. Where medical significance is concerned, this is in stark contrast to work undertaken with other (primarily) veterinary ectoparasites of medical concern (e.g. biting flies and ticks); this probably reflects the historically low prevalence of gamasoidosis in comparison. Several literature reports indicated that red mite's infestation is a difficult problem in poultry raised on deep litters ([3, 6, 8,14]). Chemicals used for the treatment of mite's infestation in Nigeria include Benzone Hexa diluride,

Gamatore® and Decis® [3]. Indispron® D110 is used in boosting the productivity 0f egg – laying hens by wiping out the notorious red mites parasite [24]. Red mites are a particular problem for non-caged birds and can significantly reduce both the number and quality of the eggs produced [24]. In severe cases they can also result in early deaths of the birds and the usual treatment is to use powder-based paraticides to destroy the mites chemically, but these may leave behind organic residence and in some cases the mites have also been found to develop resistance to the treatments. Indispron® Dll0 exerts its effects physically, killing the mites by drying them out so there are no problems with resistance nor toxicity or residences in eggs or poultry products [24]. It has been proved that problems with chemical based insecticides range from toxicity, resistance to irritations of the mucosal lining [3, 14, 15,] .Indispron® D110 from the results seen was not toxic and caused no problem to the birds. *D. gallinae* infestation is commonly associated with excessive decrease in egg production and increased feed intake which was in agreement in this study [24.] The product exhibited a better and faster response on mites and was found to be environmentally friendly with no side effects recorded. It is therefore recommended for routine application in the control of mites and other related ectoparasites of poultry in Nigeria.

Competing interests

The authors declare that they have no competing interests.

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