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Katoch R

Professor and Head, Division of
Veterinary Parasitology,
SKUAST-Jammu, India.

Adarsh

Clinical Research &
Development Dept., Ayurved
Limited, Baddi, H.P., India.

Maini S

Clinical Research &
Development Dept., Ayurved
Limited, Baddi, H.P., India.

Kotagiri K

Clinical Research &
Development Dept., Ayurved
Limited, Baddi, H.P., India.

Correspondence**Adarsh**

Clinical Research &
Development Dept., Ayurved
Limited, Baddi, H.P., India.

An alternate to insecticides: Chemical residues free natural Ectoparasitocidal formulation assessment in poultry houses

Katoch R, Adarsh, Maini S, Kotagiri R

Abstract

A study was conducted to evaluate the efficacy of herbal ectoparasitocidal- Keetguard liquid (*M/s Ayurved Limited*) against louse infestation and to control the population of *Musca domestica* in poultry houses. Keetguard liquid efficacy compared with Deltamethrin. Keetguard liquid application was significantly ($p < 0.05$) effective to decrease the lice count (*Lipeurus caponis*) by day 7th, 14th, 21st and 28th and results were in comparison with Deltamethrin. Fly repellent efficacy of Keetguard liquid was also in well comparison with Deltamethrin. 7th day, on post Keetguard liquid and Deltamethrin treatment birds showed increase in body weight. At the end of the study on 28th day body weight gain varied non significantly among Keetguard liquid and Deltamethrin treated birds but varied significantly ($p < 0.05$) from untreated control group birds. Feed consumption was improved in ectoparasitocidal treated birds. Based on the results, it can be concluded that the Keetguard liquid showed very good efficacy against louse infestation (*Lipeurus caponis*) in birds and as a fly (*Musca domestica*) repellent in poultry houses. No toxicity/ adverse effects of Keetguard liquid in birds were noticed during the study.

Keywords: Bioinsecticides, herbal ectoparasitocidal, *Lipeurus caponis*, weight gain.

1. Introduction

Ectoparasites cause losses in poultry due to secondary infections at the site of attachment and stress related to irritation. Although they do not cause death directly, they affect the hatching and growth rates of the birds [1, 2]. Lice cause intense pain, irritation, slow weight gain, decreased egg production, inferior laying capacity and skin lesions that may become sites of secondary infection [3, 4, 5]. To control parasites infestation ectoparasitocides are used. Conventional synthetic ectoparasitocide proved to be deterrent for causing environmental contamination, potential harmful residues in food, toxicity to workers and consumers [6]. Chemical control, however, is increasingly difficult because of the very limited arsenal of registered pesticides and the development of resistance [7, 8]. A study by Marangi *et al.* [9] confirmed the presence of pesticides banned by the EU (carbaryl) or not licensed for use (permethrin) in the organs and tissues of laying hens, which have been treated against red mites, and then slaughtered for human consumption at the end of their life cycle. Because of hazardous effect of synthetic ectoparasitocides various research studies were performed to find the alternate for synthetic ectoparasitocides [10, 11]. Presently, bioinsecticides, especially those derived from plant origin, have been increasingly gaining interest in controlling insects. Many herbs such as *Andrographis paniculata*, *Curcuma longa*, *Stemona tuberosa*, *Tinospora crispa*, *Cymbopogon citratus*, *Nicotiana tabacum*, *Ocimum tenuiflorum*, *Psidium guajava* and *Areca catechu* are very popular among farmers to keep their birds healthy [12]. A novel natural alternate to chemicals- Keetguard liquid (herbal ectoparasitocidal) is developed by Ayurved limited and this study was designed to study its efficacy as ectoparasitocidal and fly repellent in a commercial poultry broiler houses.

Material and methods

The study was carried out at SKUAST- Jammu during April, 2014. Total 300 birds were divided into 3 groups of 100 birds each and kept in three different buildings. Building A birds were kept as untreated control group. Building B birds were treated with Keetguard liquid in 1:20 dilution, 2 applications per week for 4 consecutive weeks (against louse infestation) and Building C birds were treated with Deltamethrin (Butox) at the concentration of 25 ppm, 2 applications per week for 4 consecutive weeks (against louse infestation). The second spray of Keetguard liquid and Deltamethrin were made on day 3 in each week. Parameters viz. weekly body weight, feed

efficiency and lice count were studied on day 0, day 7, day 14, day 21 and day 28 post-treatment. To study the fly repellent activity, keetguard spray was used in 1:40 dilution, 2 applications per week and Deltamethrin spray was used in same concentration (25 ppm), 2 applications per week. In present study, the treatments were made with manually operated hand sprayer with an attached spray nozzle hose into the building at the front and back entrances (2 liters). Assessment of house fly populations was made by using white cards (6x6 inches) sheets. Two sheets were kept per building. New cards were placed after every counting. Fly population was studied on 1 hour, 6 hour, 24 hour, 3 day and 5 day and 1 week post-treatments. All the results were analyzed statistically by analysis of variance to determine the means and standard error.

Results and Discussion

Louse infestation

In louse infestation, *Lipeurus caponis* (wing louse) was recorded as the predominant species. Feather louse may pierce the pulp of the feather or the skin by their biting mandibles and lick the excreted blood which is extremely dangerous for young birds [13]. To check the ectoparasitocidal efficacy randomly ten birds were selected for lice count from each group. Lice were counted per square inch area (total 2 areas from each bird). On day zero lice count (per square inch area) varied non significantly among the all groups. Day 7 post treatment lice count was significantly (p<0.05) decreased in Keetguard liquid (herbal ectoparasitocidal) and Deltamethrin treated birds i.e. 1.5 and 0.5 respectively (table 1) in comparison to untreated control group birds (lice count, 4.5). On 14th, 21st and 28th day after Keetguard liquid (herbal ectoparasitocidal) and Deltamethrin treatment the lice count was found to be 0 in comparison to untreated control building A birds (table 1). Keetguard liquid a poly herbal formulation contains extracts and essential oils from herbs viz. *Cedrus deodara*, *Pongamia glabra* which possess both insecticidal and larvicidal properties [14, 15, 16]. Sulphur as an ingredient of Keetguard liquid, studies shows its anti-lice and anti-mange activity [17].

Table 1: Effect of Keetguard liquid and Deltamethrin against louse infestation

Group	Lice count days post-treatment (mean±SEM)				
	0	7	14	21	28
Untreated control (A)	3.5 ±1.5	4.5 ±0.5 ^a	6.5 ±0.5 ^a	6.0 ±2.0 ^a	7.0 ±1.0 ^a
Keetguard Treated (B)	4.0 ±2.0	1.5 ±0.5 ^b	0.0 ±0.0 ^b	0.0 ±0.0 ^b	0.0 ±0.0 ^b
Deltamethrin Treated (C)	3.5 ±0.5	0.5 ±0.5 ^b	0.0 ±0.0 ^b	0.0 ±0.0 ^b	0.0 ±0.0 ^b

Mean with different superscripts (a, b) in the same column differ significantly at the level of 5%.

Table 3: Mean body weight gain (g) (±SEM) in the respective groups of birds

Group	Body weight gain (g) days post-treatment				
	0	7	14	21	28
Untreated control (A)	46.4±0.51	143.7±1.1 ^a	328.3±4.3	567.9±6.4 ^a	1117.0±10.8 ^a
Keetguard Treated (B)	46.7±0.48	147.1±0.9 ^b	329.9±3.9	587.3±7.4 ^{ab}	1156.2±10.9 ^b
Deltamethrin Treated (C)	46.9±0.49	148.1±0.9 ^b	340.1±4.1	590.6±7.7 ^b	1176.6±10.8 ^b

The mean with different superscripts (a, b) in the same column differ significantly at the level of 5%.

Fly repellent efficacy

House fly is vector for several pathogenic organisms such as enterovirus, protozoa cysts, helminth parasites and bacteria [18, 19, 20, 21]. Resistance to chemical insecticides have developed in house fly [22] and these chemicals have hazardous effect on environment and health [23]. Bioinsecticides, especially those derived from plant origin are recently considered eco-friendly alternatives to conventional synthetic pesticides [24, 25]. At day 0 fly counts were higher in all buildings. One hour after Keetguard liquid (herbal ectoparasitocidal) and Deltamethrin treatment the fly count was significantly (p<0.05) reduced to 0.5 in comparison to 3 in untreated building A (table 2). This fly count decreasing trend was continued till day 3rd after 1st spray application. After 2nd (day 3rd) spray application of both Keetguard liquid (herbal ectoparasitocidal) and Deltamethrin, the fly counts on day 5th were 0 in both Buildings B and C, varied significantly (p<0.05) in comparison to untreated building A i.e. 29 (table 2). One week after Keetguard liquid and Deltamethrin application the count was reduced to 7 and 5 respectively, significantly (p<0.05) less in comparison to untreated building A (32) (table 2). Previously reported studies on essential oils and natural terpenes, claimed them potential alternatives and environmental friendly insecticides [26, 27, 28, 29].

Table 2: Fly repellent activity of Keetguard liquid and Deltamethrin

Group	Time post-treatment (1 st spray)					2 nd spray	
	0d	1h	6h	24h	3d	5d	1wk
Untreated control (A)	24.5 ±3.5	3.0 ±1.0 ^a	20.5 ±1.5 ^a	39.0 ±3.0 ^a	47.0 ±3.0 ^a	29.0 ±1.0 ^a	32.0 ±2.0 ^a
Keetguard Treated (B)	21.5 ±1.5	0.5 ±0.5 ^b	4.5 ±1.5 ^b	7.0 ±1.0 ^b	13.0 ±4.0 ^b	0.0 ±0.0 ^b	7.0 ±2.0 ^b
Deltamethrin Treated (C)	23.0 ±2.0	0.5 ±0.5 ^b	3.5 ±0.5 ^b	6.0 ±1.0 ^b	11.0 ±1.0 ^b	0.0 ±0.0 ^b	5.0 ±1.0 ^b

Mean with different superscripts (a, b) in the same column differ significantly at the level of 5%.

Eucalyptus globules, *Pinus longifolia* as Keetguard liquid ingredient herbs possess repellent, acaricidal and larvicidal activities [30, 31, 32, 33] this may be the reason for the fly repellent activity of Keetguard liquid.

Body weight gain

Heavy loads of parasites can pose health implications for the hens such as impaired weight gain and growth, decreased egg production, increased mortality, and possibly anaemia [34, 35, 36]. So using herbal ectoparasitocidal can have beneficial effect on poultry health. In this study, the body weight gain was significantly (p<0.05) more on 7th day in both Keetguard liquid (herbal ectoparasitocidal) (147.1) and Deltamethrin (148.1) treated birds in comparison of untreated birds (143.7). At the end of the study, on 28th day body weight gain was significantly (p<0.05) more in Deltamethrin treated birds i.e. 1176.6 varied non-significantly from Keetguard liquid (herbal ectoparasitocidal) treated bird i.e. 1156.2. The body weight gain in treated group birds varied significantly (p<0.05) from untreated control group birds (1117) (table 3).

Feed efficiency

Ectoparasites may cause indirect harm including behavioural disturbances, such as increased frequency of rubbing or scratching, leading to reduced time in feeding and retarded development [37, 38, 39]. Feed efficacy was higher in Keetguard (1.75) and Deltamethrin (1.76) treated birds in comparison to untreated birds (1.72) (table 4)., this may be because of improvement in feeding habits as ectoparasites load decreased in treated birds.

Table 4: Feed efficiency in the respective groups

Group	Feed efficiency
Untreated control (A)	1.72
Keetguard Treated (B)	1.75
Deltamethrin Treated (C)	1.76

Conclusion

The Keetguard liquid (herbal ectoparasitocidal) showed very high efficacy against louse infestation in birds and as a fly (*Musca domestica*) repellent in poultry houses. The results of Keetguard liquid were in well comparison with results of Deltamethrin, and in future chemical insecticides can be replaced by Keetguard liquid. No toxicity or adverse effect of Keetguard liquid on the birds was observed during the study.

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