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Synergistic fly control efficacy of neem products with methoprene against the house fly in poultry farm

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Abstract
The synergistic fly control efficiency of neem seed powder and neem seed oil with methoprene against house fly was evaluated in broiler shed. One hundred and ninety two, day old broiler chicks were randomly divided into eight groups of twelve each with two replicates and the study was conducted for a period of five weeks. Methoprene and neem seed powder were given through the feed @ of 10 gm and 1 Kg per tonne of feed, respectively and neem oil (5% v/v) was sprayed on broiler litter material twice a week until the completion of the study. Fly density was measured on 14th and 28th day in all the treatments. The rate of emergence of adults flies, both for treated and control groups on 14th and 28th day. All the feed incorporated treatments possessed significant reduction in fly density on 14th and 28th days. Inhibition of fly emergence was higher when neem products were combined with methoprene in both 14th and 28th day. The results of the present study indicate that these neem product with methoprene can find a place in eco-friendly strategy for housefly control programme in poultry industry.

Keywords: Synergistic fly control, methoprene, neem seed powder, neem oil, poultry

Introduction
The common housefly, *Musca domestica*, is an important veterinary insect that causes considerable effects on the poultry industry and acts as a vector for more than 100 species of pathogens, thereby causing serious threat to human health and livestock (Rovida *et al*., 2015) [8]. The control of this insect largely relies on synthetic insecticides which have led to many serious issues like resistance development, bioaccumulation and harm to non-target organisms, environmental contamination and incorporation in to food chains (Jyoti *et al*., 2018) [4]. Therefore, more attention has been recently paid to the use of natural or organic insecticides such as insect growth regulators (IGRs) and natural plant based products for controlling housefly in different parts of the world (Begum *et al*., 2013) [1]. Methoprene is one of the existing IGRs which affects exclusively the flies without any significant toxic damage upon their natural enemies. Methoprene products have been developed which act especially upon their first instar, hindering their aptitude to moult to the next stage and disabling pupae to reach the adult stage. Neem formulations can be standardized and used as best insecticides for fly control in poultry farming operations, because of the absence of resistance development, lack of residues, environmental safety, ready availability and cost effectiveness (Ilavarasan *et al*., 2016) [3]. Therefore, the study was designed with an aim of assessing the effect of neem products i.e, neem seed powder and neem seed oil in the control of house flies with methorprene in broiler chicken.

Material and Methods
One hundred and ninety two, day-old commercial broiler chicks of straight run obtained from commercial hatchery. The birds were reared in table-top cages under standard management practices and the experiment was conducted from one day to thirty five days. The birds were fed with standard broiler ration without antibiotics and toxins from feed manufacturing technology unit of Veterinary College and Research Institute, Namakkal. The birds had access to *ad libitum* feed and water throughout the study period. The experiment was approved by the Institutional Animal Ethical Committee of Veterinary College and Research Institute, Namakkal (Approval no: IAEC/11/VCRI-NKL/2019). The details of experimental design was presented in Table 1.

Table 1: Experimental design of the study

Group	Treatment	No. of chicks (2x24)	Route of administration
T1	Control	24	Only basal diet
T2	Methoprene (10 gm per tonne of feed)	24	Through feed, throughout the study period
T3	Neem seed powder (1 kg per tonne of feed)	24	Through feed, throughout the study period
T4	Neem oil spray (5% v/v)	24	As spray on litter material (twice a week)
T5	Methoprene (10 gm per tonne of feed) + Neem seed (1 kg per tonne of feed)	24	Through feed, throughout the study period
T6	Methoprene (10 gm per tonne of feed) + Neem oil spray (5% v/v)	24	Methoprene – through feed; Neem oil spray on litter material
T7	Neem seed powder (1 kg per tonne of feed) + Neem oil Spray (5% v/v)	24	Neem seed powder – through feed; Neem oil–spray on litter material
T8	Methoprene (10 gm per tonne of feed) + Neem seed powder (1 kg per tonne of feed) + Neem oil Spray (5% v/v)	24	Methoprene and Neem seed powder– through feed; Neem oil – spray on litter material
Total		192	

Fly density

Fly density was measured using spot card method and it was fixed at six different areas in each group on 14th and 28th day as per Ponnudurai *et al.* (2011) [7] with small modifications. The card board fixed with white paper of 210x217 mm size. Six spot cards were placed below every group in the shed at different locations for 24 hours. After 24 hours all the cards were collected and the spots made by the flies were counted.

Inhibition of fly emergence

For the evaluation of rate of inhibition of fly emergence, the dung samples were collected in the plastic containers and kept at room temperature for 15 days with proper air circulation. After this time the emerged flies in each group were collected and counted. The inhibition of fly emergence rates were evaluated by means of the formula described by Mulla *et al.* (1975) [6];

EI = 100 – T/C (100), where

T = number of emerged flies in the treated group.

C = number of emerged flies in the control group

Statistical analysis

Data were analyzed by ANOVA and Student's t-test and means were compared with Tukey's post-hoc test using SPSS16 software. Data were expressed as mean ± SE. A value of $p < 0.05$ was considered statistically significant.

Results and Discussions

The house fly density of all groups were counted by spot card method on 14th, and 28th day and presented in Table 2. The mean values of fly density for the groups T1 to T8 on 14th day were 448.67 ± 19.18, 197.67± 9.84, 192.33 ± 7.57, 219.33 ±7.58, 145.17± 3.67, 167.83±13.61, 178.17±3.84 and 100.39±9.62 respectively. Fly density was reduced significantly in the treatment of neem oil spray on poultry litter alone (T4), methoprene (T2) or neem seed powder (T3) supplemented diets of broilers as compared to control groups. Among these treatment groups (T2, T3 and T4), there was no significant difference.

Table 2: Effect of dietary inclusion of methoprene, neem seed powder and neem oil spray on poultry litter on fly density (Mean ± S. E.) in broiler house

Treatment	14th day	21th day
T1	448.67 ± 19.18^{e}	475.67 ± 24.92^{d}
T2	197.67 ± 9.84^{cd}	214.50 ± 26.17^{c}
T3	192.33 ± 7.57^{bcd}	207.33 ± 11.73^{c}
T4	219.33 ± 7.58^{cd}	221.17 ± 12.08^{c}
T5	145.17 ± 3.67^{ab}	148.33 ± 5.40^{abc}
T6	167.83 ± 13.61^{bc}	104.50 ± 29.39^{ab}
T7	178.17 ± 3.84^{bcd}	182.67 ± 6.50^{bc}
T8	100.33 ± 9.62^{a}	89.83 ± 8.96^{a}

Values (Mean ± S.E.M., n = 6) in the same column bearing no superscript common vary significantly ($P < 0.05$) in Tukey's multiple comparison post hoc test.

Combined effect of neem seed powder and methoprene inclusion in feed (T5) showed reduction in fly density than neem seed and methoprene alone treatments. Moreover, there was synergism observed when neem products were combined with methoprene (T8) though it is not significant with the T5. Kocisova *et al.* (2004) [5] reported that methoprene affected most of the 3rd instar larvae ensuring 100% mortality in the susceptible strain and 99.5% mortality in the wild population of housefly. The mean values of fly density for the groups T1 to T8 on 28th day were 475.67 ±24.92, 214.50±26.17, 207.33± 11.73, 221.17±12.08, 148.33±5.40, 104.50±29.39, 182.67±6.50 and 89.83 ± 8.67 respectively. As compared to control (T1), all the treatment groups significantly reduced the fly density. Combined effect of neem seed powder and methoprene inclusion in feed (T5) showed reduction in fly density than neem seed and methoprene alone treatments. Both the feed incorporated and mere spray of neem oil treatments had reduced the fly density. This is in accordance with the study of Detheir (1982) [2] who stated that azadirachtin was a common example of a natural plant defence chemical affecting feeding, through chemoreception (primary antifeedancy), that result of the blockage of the input from the receptors that normally respond to phagostimulants or from stimulation of specific deterrent cells or both and through a reduction in food intake due to toxic effects if consumed (secondary antifeedancy). Moreover, there was

synergism observed when neem products were combined with methoprene (T8) though it is not significant with the T5 and T6. Inhibition of fly emergence for the groups T2 to T8 on 14th and 28th day were measured and presented in Table 3.

Table 3: Effect of dietary inclusion of neem seed powder, methoprene and spraying of neem oil on litter material on (Mean ± S. E.) inhibition of fly emergence (EI)

Treatment	14th day	28th day
T1	-	-
T2	13.7	14.28
T3	20.6	21.4
T4	17.24	17.85
T5	27.58	28.5
T6	20.6	25
T7	27.58	28.5
T8	41.37	39.8

EI was higher when neem products were combined with methoprene (T8) in both 14th and 28th day. It may be concluded that dietary inclusion of neem seed and neem oil spray in litter material showed good fly control effect and it was very economical to the poultry farmers.

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