Topical Application of Garlic Reduces Northern Fowl Mite Infestation in Laying Hens

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ABSTRACT
Northern fowl mites (NFM) are external parasites that can lower egg production and cause anemia and even death in laying hens. An experiment was conducted with New Hampshire Red and Single Comb White Leghorn laying hens. Hens were individually caged and provided a complete laying diet and water ad libitum. Hens were assigned to groups in a way that assured that treatments, within each breed, would be applied to comparable numbers of birds with light and heavy mite infestations. Each hen was sprayed around the vent with either water or 10% garlic juice in water. Spraying continued each week for 3 wk. During the fourth week, each bird was scored for the presence of NFM on its skin and feathers. A small snippet of feathers was removed from below the vent of each hen and placed in a labeled petri dish with a round, white filter paper insert. The NFM content of each dish was scored by two individuals approximately 1 h after sampling. There was no significant difference in the NFM scores for hens based on breed or future treatment. After the birds were treated for 3 wk, there was no significant difference in external NFM scores based on breed. There were significantly fewer NFM on the birds treated with garlic juice compared with controls, based on external and petri dish scoring ($P < 0.002$ and $P < 0.04$, respectively). The reduction in external NFM score was also significant ($P < 0.004$), with controls declining approximately 0.2 units, whereas garlic-treated hens had a 1.8-unit decrease in external NFM score. Topical application of garlic juice may be an effective way to decrease NFM in laying hens.

(Key words: Northern Fowl Mites, garlic, ectoparasites, laying hens)

INTRODUCTION
The northern fowl mite (NFM; Ornithonyssus sylviarum) is an economically damaging ectoparasite of poultry. Commercial losses in states like Georgia easily exceed one million dollars per year (Nolan and Sheppard, 1997), primarily in egg laying hens. Pullets are initially less susceptible to mite infestation, but this resistance decreases as they begin producing eggs (Hall et al., 1978a). Hens with heavy infestations of NFM may produce 10 to 15% fewer eggs than control hens (DeVaney, 1978, 1979). Infested birds may be anemic and restless, especially nesting birds. Humans, do not serve as a host for NFM, but can be bitten by these mites and suffer irritation and allergic reactions. Egg handlers are particularly susceptible, and may refuse to work with flocks or eggs from flocks with NFM infestations.

Standard industry practices for suppression of NFM include high-pressure pesticide sprays directed at the abdomen and vent of the birds. Typically, an insecticide such as carbaryl (Sevin) (Crystal and DeMilo, 1988; Fletcher and Axtell, 1991; Levott, 1992) is applied at a rate of 1 gallon per 100 hens. Care must be taken not to contaminate eggs, feed, or water (Ivey et al., 1984). Novel approaches to NFM control include genetic selection for NFM resistance (Hall, 1978b; DeVaney et al., 1980, 1982), immunization with purified mite proteins (Burg et al., 1988; Minnifield et al., 1993), and high temperature (DeVaney, 1985). Recent interest in homeopathic remedies and concerns about cost, residues, and resistance of NFM to traditional pesticides led us to examine the effect of a topical garlic spray on NFM in laying hens.

MATERIALS & METHODS
A flock of 30 laying hens, 17 New Hampshire Red and 13 Single Comb White Leghorn, were housed at the Clemson University Morgan Poultry Center. These birds, used for a previous nutrition study, were known to have NFM. The birds were individually caged in a curtain-sided house. Cage dimensions were $55 \times 30 \times 45$ cm (length, width, and height, respectively). All hens were

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Abbreviation Key: NFM = northern fowl mites.
fed a standard laying mash diet formulated to meet NRC requirements. This diet was available ad libitum, along with water. The lighting schedule throughout the experiment was 16.8 h light:dark.

All birds were scored (0 to 4 in 0.5 increments) based on the presence and concentration of NFM around the vent and abdomen. Each bird was individually handled, and the physical presence of live NFM was evaluated around the vent and under the wings and abdomen. The presence of mite debris and feces adhering to feathers was not automatically considered evidence of an NFM infestation. Scores were based on live, active NFM. Hens were scored by the same two individuals, and the scores for each bird were averaged. Within each breed, all birds that were initially scored between 0.5 and 2 were randomly assigned to either the control or garlic treatment. The same process was used for birds that scored between 3 and 4. This procedure allowed treatments to be applied to comparable numbers of birds with light and heavy mite infestations within each breed. There were 15 garlic-treated hens and 15 controls.

Treatment consisted of spraying the vent and abdomen of each hen with either tap water (control) or a 10% garlic solution (Garlic Barrier). Treatments were applied once every 7 d for 3 wk. At 4 and 8 wk after the first application, each bird was scored by the same individuals that performed the initial scoring. In addition, a snippet of feathers near the vent was clipped and placed on a white filter paper disk covering the bottom of a 100 × 15-mm petri dish. The insert helped to visualize the mites. Each plate was identified by hen number and returned to the lab. The NFM content of each dish was scored by two individuals approximately 1 h after sampling. Data were analyzed by ANOVA, with breed and treatment as main effects (Harvey, 1982). This project was approved by the Clemson University Animal Research Committee (protocol 98-011). Animals were housed in facilities that were maintained and inspected as part of Clemson University’s American Association of Animal Laboratory Accreditation Council certification program.

**RESULTS**

There was no significant breed difference in the level of infestation of NFM at any of the three times tested (Figure 1). Because there was no effect of breed, all hens were used in subsequent ANOVA to test the effect of treatment. There were significantly fewer NFM on the laying hens treated with 10% garlic juice compared with controls, based on external and petri dish scoring at 4 and 8 wk (Figure 2). At 4 and 8 wk, hens treated with the garlic spray had an external NFM score that was 1.8 units lower than pretreatment. Contemporary control birds had a 0.2-unit reduction in external NFM score. These differences were significant ($P < 0.01, SE = 0.4$).

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**DISCUSSION**

Both methods used to evaluate and score NFM infestation, external examination and petri dish, gave comparable results at 4 and 8 wk. The petri dish method allows for a delayed examination and is, in our opinion, more reliable. External examination and scoring of hens can lead to overestimation of NFM infestation if the individuals are not trained to ignore the mite debris and residue on feathers that may persist long after mites have been eliminated from the bird.

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The conditions of this study were designed to maximize infestation with NFM. Hens were near the end of their laying cycle, selected on the basis of having NFM, and housed in individual cages. Decreasing the number of birds per cage is known to increase the incidence of NFM (Arthur and Axtell, 1983). The hypothesis is that social stress associated with multiple-bird cages is responsible for this phenomenon. Not all breeds, varieties, and strains of chickens are equally susceptible to NFM (Hall, 1978b; DeVaney et al., 1980, 1982). In this study, both breeds of commercial laying hens had comparable numbers of NFM before the application of garlic or control treatments. There was no difference in the NFM response to garlic treatment between the brown- and white-shell egg layers.

Spraying laying hens each week for 3 wk with a 10% garlic juice solution significantly decreased the incidence of NFM at 4 and 8 wk following start of treatment. Garlic is known to be an effective insecticide, acting on adult (Dhar et al., 1996) and larval stages (Amonkar and Reeves, 1970; Amonkar and Banerji, 1971; George et al., 1973). In this study, garlic seemed to act as a repellent (Bhuyan et al., 1974) and against other life stages (George et al., 1973; Dhar et al., 1996) to prevent NFM reinestation for at least 5 wk after the last application. The spray application of garlic juice could be done in conjunction with systems now used to treat laying hens with organic-based pesticides. Diluted garlic juice would not cause the residue and health concerns for birds and workers associated with traditional pesticides (Ivey et al., 1984). Topical application of garlic juice would be an effective method to control NFM for producers who market their eggs as organic or pesticide-free. Future studies are needed to determine the NFM response to single garlic spray treatments and the lowest effective dose for NFM suppression. Such studies could demonstrate whether garlic juice suppression of NFM would be feasible in large-scale commercial laying hen operations.

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REFERENCES


