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Development of an Unconventional Method to Control the Ectoparasites in Backyard Poultry

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Abstract. Dust of *Nicotiana tabacum*, *Azadirachta indica* and *Polygonum hydropiper* when applied in the poultry sheds as bedding for control of six species of lice, one species of fly and two species of mites, highest efficacy (96.67%) was shown by tobacco at 15% concentration followed by neem at the same concentration (efficacy, 77.52%) and tobacco at 10% concentration. Tobacco at 15% concentration significantly ($p<0.05$) reduced the ectoparasitic burden within 12 days with maximum mean body weight gain by poultry, being 232.30 g.

Keywords: *Nicotiana tabacum*, *Azadirachta indica*, *Polygonum hydropiper*, ectoparasites, poultry parasites

Introduction

In rural areas, of Bangladesh, poultry are commonly reared in semi-scavenging system. This backyard poultry is generally infested with various type of ectoparasites including different species of lice, mites etc. having various adverse effects specially on body weight gain and egg production (Islam *et al*.,1999; DeVaney, 1979; 1976) and acting as vectors of many microbial pathogens including *Erysipelothrix rhusiopathiae* and *Borrelia anserina* (Chirico *et al.*, 2003; Urquhart *et al*., 1996; Kettle, 1995).

Ectoparasitic infestation of poultry is the most common problem worldwide and utmost attempts have been made to control them by using several chemical compounds. Although some of the chemicals are efficient enough to kill ectoparasites but most of them are unsuitable in terms of food safety and environmental problems as they have residual and cumulative effects (Lee *et al.*, 2002). Moreover, some of them are toxic to mammals including humans. These are also not readily available especially in rural areas. Besides, resistance frequently develops in ectoparasites against chemical insecticides (Szczypel *et al*., 2003). Various species of plants and herbs of medicinal value are available in Bangladesh which are commonly used by the village people to treat many diseases. These herbal products are usually safe, easily available, cost effective and environment friendly. Nahar *et al*. (2005) found acaricidal efficacy of ata, durba, neem, bishkatali and sharifa. Acaricidal and insecticidal activities have been widely evaluated in different countries of the world, such as in India (Rahman *et al*., 2005), South Korea (Kim *et al*., 2004), Pakistan (Khan *et al.*, 2003) etc. The present research work was undertaken to determine the efficacy of three different plants *viz*. *Nicotiana tabacum* (tobacco), *Azadirachta indica* (neem) and *Polygonum hydropiper* (bishkatali) against ectoparasites of poultry so as to develop an unconventional control method which would be easy to use, cost effective and applicable everywhere.

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Materials and Methods

Dust prepared from leaves and/or stems of tobacco, neem and bishkatali were applied in backyard poultry, naturally infested with lice, mites and flies, during July 2005 to May 2006 in Patuakhali district in Bangladesh, covered by the smallholder livestock development project- 2 (SLDP-2). Identification of the parasites, preparation of plant products and other relevant work were done in the Department of Parasitology, Faculty of Veterinary Science (FVS), Bangladesh Agricultural University (BAU), Mymensingh.

Three common plants namely neem (*Azadirachta indica*) bishkatali (*Polygonum hydropiper*) and tobacco (*Nicotiana tabacum*) were selected based on their ethno-veterinary use among the rural people of Bangladesh. Neem and bishkatali were collected from the surrounding area of BAU campus, and tobacco leaves were collected from the local markets. For neem and tobacco only leaves were used, whereas for bishkatali both the stems and leaves were used.

After collection, plants were brought to the laboratory. All the fresh leaves and stems were washed in running tap water and cut into small pieces. The plant materials were dried in

sunlight, and then in the oven at 55-60 °C to constant weight. Dusts of different plants were prepared primarily by manual crushing of dried leaves and then by pulverizing the crushed leaves and stems with the help of pulverizer and preserved in airtight plastic contaners, till their use.

For the study of ectoparasiticidal efficacy, birds were selected from the farmers households in the research area which were regularly vaccinated and dewormed. Thirty families were selected from the said areas, each having at least five birds and all infested with ectoparasites. These families were divided into ten groups containing three families in each. In all the families, almost similar type of management practices such as housing, feeding, cleaning of shed etc. were confirmed by regular monitoring. Birds were identified by leg bands.

Pretreatment observations. One square inch of the body surface area of poultry in which the ectoparasites were densely populated were selected and counted. Body weight of each bird was taken by digital balance and recorded before treatment.

Treatment. Treated groups were marked as GT5, GT10, GT15, GN5, GN10, GN15, GB5, GB10 and GB15. Powdered form of tobacco leaves were given admixture with ashes as litter at 5%, 10% and 15% concentration in GT5, GT10 and GT15 groups, respectively. Another three groups viz. GN5, GN10 and GN15 were treated with neem leaves at 5%, 10% and 15% concentration, respectively. Last groups, GB5, GB10 and GB15 were treated with bishkatali leaves in the same concentrtions. Bedding with only ash (500 g for each poultry shed) was given to the control group. The treatment was given 5 times, at 4 days intervals, to each group (21 days).

Posttreatment observations. Regular monitoring of each poultry house, with counting and recording of ectoparasites was carried out at 4 days intervals in the selected birds to detect the efficacy of the sample substances, up to the end of the experiment. Efficacy was determined in terms of reduction of load of ectoparasites. At the end of the experiment, body weight of each bird was taken and recorded.

Statistical analysis. Odds ratio with its confidence interval was computed for comparing different concentrations (Schlesselman, 1982). Repeated analysis of variance was performed for testing the effectiveness of tobacco, neem and bishkatali using the software Systat 6.0 for Windows (SPSS, 1996). Analysis of Covariance (ANCOVA) was conducted to compute the mean body weight gain per bird as there existed a heterogeneity in age and sex of the experimental birds (Gomez and Gomez, 1984). The benefit cost ratio (BCR), a simple calculation that depicts the total financial return for each taka (Tk, local currency) invested in the programme was computed by the following formula:

$$\text{BCR} = \frac{\text{total benefit}}{\text{total cost}} \text{ (in Tk)}$$

Results and Discussion

In the present study, birds were found to be infested with the following lice species: *Menacanthus stramineus* (74%), *Menopon gallinae* (63%), *Lipeurus caponis* (48%), *Cuclotogaster heterographus* (25%), *Goniodes gigas* (18%) and *Goniocotes gallinae* (14%), one species of fly, namely *Simulium* sp. (3.7%), and two species of mites namely *Dermanyssus gallinae* (57%) and *Knemidocoptes mutans* (43%). The study revealed that regular use of tobacco, neem and bishkatali plant's pulv gradually reduced the mean ectoparasitic load in backyard poultry (Table 1). The highest ectoparasiticidal efficacy was exerted by tobacco at 15% concentration (96.91%) followed by neem at the same concentration (77.52%) and tobacco at 10% concentration (76.92%). Odds ratio of the plants at different concentrations showing highest efficacy was also calculated. Tobacco at 15% concentration was 9.09 and 9.40 times more effective against ectoparasites than neem at 15% concentration and tobacco at 10% concentration, respectively. On the other hand, odds ratio between neem at 15% concentration and tobacco at 10% was 1.03, which indicated that they were almost equally effective for removing ectoparasites (Table 2). Tobacco at 15% concentration drastically reduced the parasitic burden in GT15 group. The changes in the number of ectoparasites were significant up to 3rd observation in that group but tobacco at 10% concentration rapidly reduced ectoparasites on the 1st treatment, then it acted slowly up to the 5th observation. On the other hand, neem at 15% concentration reduced ectoparasitic load slowly throughout the five observations (Table 1).

Efficacy of tobacco was studied by other workers against different types of ectoparasites. Vasanthi *et al.* (2004) treated *Sarcoptes scabiei*-infested rabbit with tobacco decoction and found that it was highly effective with no side effect and re-infestation was not observed even after one and a half month of the treatment. Burkhart and Burkhart (2000) reported that nicotine (active ingredient in tobacco) facilitated removal of adult lice by inducing muscle twitching that may affect the insects' normal grip on hair follicles. Potenza *et al.* (1999) reported more than 80% efficacy of aqueous extract of tobacco against spider mite. Though there are some variations between the present and previous results, it can undoubtedly be concluded that these plant products are effective in removing ectoparasites. However, there can be differences in

Table 1. Effectiveness of tobacco, neem and bishkatali in terms of reduction of mean ectoparasitic load per bird in each square inch of highly affected body region

Groups	Pretreatment observation	Post treatment observation (96 h interval)				
		1	2	3	4	5
Control	7.33^{a1} ±1.46	7.47^{a} ± 1.53	7.73^{a} ± 1.65	8.33^{a} ± 1.64	8.73^{a} ± 1.68	8.87^{a} ± 1.74
GT-5	4.60^{a} ± 1.02	4.13^{b} ± 1.03	3.40^{c} ± 0.82	3.13^{cd} ± 0.82	2.67^{d} ± 0.72	2.40^{e} ± 0.77
GT-10	6.07^{a} ± 1.58	3.33^{b} ± 0.67	2.53^{c} ± 0.49	1.87^{d} ± 0.48	1.60^{ed} ± 0.51	1.33^{e} ± 0.44
GT-15	6.47^{a} ±1.63	2.13^{b} ± 0.39	0.73^{c} ± 0.15	0.27^{d} ± 0.12	0.20^{d} ± 0.11	0.20^{d} ± 0.11
GN-5	6.67^{a} ± 2.00	6.60^{a} ± 2.00	5.80^{b} ± 1.77	5.47^{bc} ± 1.77	5.13^{c} ± 1.68	4.80^{d} ± 1.67
GN-10	3.93^{a} ± 0.57	3.47^{b} ± 0.52	3.00^{c} ± 0.48	2.27^{d} ± 0.36	1.73^{e} ± 0.35	1.60^{e} ± 0.29
GN-15	8.60^{a} ± 1.89	6.73^{b} ± 1.28	5.33^{c} ± 1.06	3.87^{d} ± 0.80	2.80^{e} ± 0.56	1.93^{f} ± 0.33
GB-5	4.67^{a} ± 0.62	4.33^{ab} ± 0.62	4.13^{b} ± 0.60	4.00^{bc} ± 0.64	4.00^{bc} ± 0.64	3.73^{c} ± 0.61
GB-10	6.20^{a} ± 0.95	5.47^{b} ± 0.84	5.27^{b} ± 0.83	5.07^{c} ± 0.77	5.00^{c} ± 0.77	4.40^{c} ± 0.74
GB-15	9.13^{a} ± 1.78	7.93^{b} ±1.58	7.60^{c} ± 1.48	7.40^{c} ± 1.42	7.33^{c} ± 1.41	5.33^{d} ± 1.30

values of different superscripts were statistically significant (P< 0. 5)

Table 2. Efficacy of tobacco, neem and bishkatali against ectoparasites of poultry

Plants	Concentration (%)	Efficacy (%)	Odds ratio		95% CI
Neem	5	28	GT15 vs GN15	9.09*	2.68-30.84
	10	59.32			
	15	77.52			
Tobacco	5	47.83	GN15 vs GT10	1.03	2.68-30.84
	10	76.92			
	15	96.91	GT15 vs GT10	9.40*	0.54-1.95
Bishkatali	5	20	-	-	-
	10	29.03	-	-	-
	15	41.61	-	-	-
Control	-	-	-	-	-

* = indicates significant (p<0.05); GT15 = tobacco 15%; GT10 = tobacco 10%; GN15 = neem 15%

the rate of efficacy depending on the method of application and the type of parasites.

In tobacco, active ingredient is alkaloid which is known as nicotine (Burrows and Tyrl, 2001). Nicotine is a contact poison which is highly toxic and is absorbed through spiracles and integument of ectoparasites. It acts directly on the ganglia of the insects' central nervous system and produces excitation at low concentration but paralysis at high concentration due to a direct action on the synopses (Gillott, 1995). Perhaps, in this manner, they cause paralysis of ectoparasites rapidly. Besides, nicotine sulphate has a fumigant action against *Dermanyssus gallinae* when it is painted on the perches (Soulsby, 1982). Lapage (1962) reported killing of lice without disturbing poultry by painting the perches with strong tobacco extract containing 40% nicotine and keeping the birds in that house for two nights; the warmth of the bird bodies causes the nicotine to evaporate and kill the lice and eggs. He also suggested repeating the treatment after 10 days. In this experiment, tobacco leaves were applied as pulv mixed with ashes as bedding. So, pulv of tobacco leaves came in contact with ectoparasites throughout the night. Furthermore, the said evaporating effect might be also exerted on the ectoparasites. No toxic effect was observed in poultry with tobacco dose used in the study.

Neem at 15% concentration was also effective (77.52%), but it took a little longer time for exerting its effect on the parasites. Efficacy of bishkatali was insignificant in all the three concentrations applied. Pathak *et al.* (2004) recorded that methanol extract of neem was highly effective against tick. Kumar *et al.* (2002) found that neem leaves caused 80% mortality to adult lice. Nahar *et al.* (2005) carried out an *in vitro* trial with neem, bishkatali, durba, ata and sharifa against cattle tick *Boophilus microplus* and observed 100% efficacy of ethanol extract of bishkatali at 2% concentration. But the efficacy of neem was 86.67% when applied as aqueous extract. Probably active ingredients of neem plants, having ectoparasiticidal efficacy, are water soluble. It could be said that contents of neem leaves have some ectoparasitcidal effect in dry preparations but required high concentration. On the other hand, the ingredients present in bishkatali may not be effective against ectoparasites prevalent in poultry or those ingredients are not active in dry preparation. Pulv is a crude product which possibly contains active ingredients in

relatively lower concentration than the soluble form and do not get proper contact with the ectoparasites.

In study of the effect of ectoparasites in terms of body weight gain, among the treated groups, the highest mean body weight (232.3 g) had been achieved by poultry in GT15 group (treated with 15%) followed by that in GT10 (178.26 g) and GN15 (159.76 g) groups that were treated by 10% tobacco and 15% neem leaves, respectively (Table 3).

Table 3. Mean body weight gain per bird (adjusted for heterogeneity in age and sex) at different concentrations of plants after applying them five times during 4 days

Treatment group	Body weight in (gm) (Mean ± SE)		Mean body weight gain (gm)
	Pre-treatment	Post-treatment	
GT-5	810.00±124.62	965.24±111.05	155.24
GT-10	1070.00±115.76	1248.26±111.91	178.26
GT-15	1113.57±102.43	1345.87±67.36	232.30
GN-5	996.67±76.92	1077.51±63.89	80.84
GN-10	1115.00±76.39	1251.21±77.94	136.21
GN-15	1165.33±106.20	1325.09±64.06	159.76
GB-5	1066.25±119.81	924.08±87.23	-142.17
GB-10	1017.33±92.98	981.70±63.85	-35.63
GB-15	956.33±50.17	978.58±63.81	22.25
Control	1215.56±119.29	919.17±94.80	-296.39

It is evident that the birds of each treatment group (except GB15 and GB10) had the advantage of gaining body weight due to the removal of ectoparasites. This finding directly conforms with the result of Devaney (1979) who evaluated the effect of *Ornythonyssus sylviarum* (northern fowl mite) on poultry. He observed that the mean body weight of White Leghorn roosters was approximately 100 g less than that of the uninfested roosters. Devaney (1976) also studied such an effect on lice, (*Menacanthus stramineus*) in White Leghorn hens and found that average body weight of hens decreased (85, 300, and 450 grams in 23, 35, and 49 weeks old birds) in comparison with the uninfested control group. Due to treatment, parasitic load of birds gradually decreased, and simultaneously restlessness was also reduced. So, their feed consumption and utilization increased resulting in improvement of health.

Tobacco is cost effective in the treatment of ectoparasites in backyard poultry. Although, some chemical agents (malathion, dichlorvos, permethrin, pyrethrin etc.) are effective in very low concentration and very small amount of insecticide is required but these may be suitable in the treatment of large poultry farm birds. In small farms or in backyard poultry farms, these may not be equally suitable since farmers need some extra care in applying these chemical insecticides. Besides, tobacco is available in local markets of rural areas all the year round and requires less care and attention. Moreover the effective doses (15% and 10%) are not toxic for the poultry. On the contrary, chemical agents are toxic to the poultry and are not environmentally friendly. In the present experiment, the benefit cost ratio (BCR) per bird was found to be Tk.7.5 (Takka or Tk is local currency of Bangladesh) depicts the investment of Tk. 1 would make return of Tk. 7.5 (taking Tk 130/kg poultry meat and Tk. 50/kg tobacco, mean body weight gain in best treatment group was 232.30 g). Therefore, use of tobacco is recommended at 15% concentration, mixed with ashes as bedding, for 12 days for the control of ectoparasitic infestation in backyard poultry.

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References

Burkhart, C.G., Burkhart, C.N. 2000. Use of topical nicotine for treatment of *Pediculus humanus capitis* (Anoplura: Pediculidae). *J. Medical Entomol.* **37:** 170-171.

Burrows, G.E., Tyrl, R.J. 2001. *Toxic Palnt of North America*, 1124 p, 1st edition, Iowa State University Press, Iowa, USA.

Chirico, J., Eriksson, H., Fossum, O., Jansson, D. 2003. The poultry red mite, *Dermanyssus gallinae* a potential vector of *Erysipelothrix rhusiopathiae* causing erysipelas in hens. *Med. Vet. Entomol.* **17:** 232-234.

DeVaney, J.A. 1979. The effects of the northern fowl mite, *Ornithonyssus sylivarium* on egg production and body weight of caged White Leghorn hens. *Poul. Sci.* **58:** 191-194.

DeVaney, J.A. 1976. Effects of the chicken body louse, *Menacanthus stramineus*, on caged layers. *Poul. Sci.* **55:** 430-435.

Gillott, C. 1995. *Entomology*, pp. 691-744, 2nd edition, Plenum Press. New York, USA.

Gomez, K.A., Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research*, pp. 424-437, 2nd edition, John Wiley and Sons, New York, USA.

Islam, M.K., Mondal, M.M.H., Rahman, M.M., Haque, A.K.M.F., Chowdhury, M.A.A. 1999. Effects of *Lipeurus caponis*, Linnaeus, 1758, (*Mallophaga : Philopteridae*) on laying hens. *Vet. Rev.* **14:** 32-33.

Kettle, D.S. 1995. *Medical and Veterinary Entomology*, pp.

3-6, 2nd edition, CAB International, Cambridge, UK.

Khan, M.N., Nadeem, M., Iqbal, Z., Sajid, M.S., Abbas, R.Z. 2003. Lice infestation in poultry. *Int. J. Agric. Biol.* **5:** 213-216.

Kim, S.I., Yi, J.H., Tak, J., Ahn, Y.J. 2004. Acaricidal activity of plant essential oils against *Dermanyssus gallinae* (Acari: Dermanyssidae). *Vet. Parasitol.* **120:** 297-304.

Kumar, S., Sijngh, S.K., Baslas, R.K., Glildiyal, J.C., Saxena, A.K. 2002. Lousicidal properties of few aqueous plant extracts. *Indian Vet. J.* **79:** 1136-1140.

Lapage, G. 1962. *Monning's Veterinary Helminthology and Entomology,* pp. 446-813, 5th edition, Baillière Tindall and Cox, London, UK.

Lee, S.S., Kim, J.W., Jee, C.H. 2002. Immune effects on the somatic antigens against *Dermanyssus gallinae* and *Dermatophagoides pteronyssinus* in chicken. *Korean J. Vet. Res.* **42:** 253-266.

Nahar, L., Anisuzzaman, Alim, M.A., Karim, M.J., Islam, K.I., Mondal, M.M.H. 2005. *In vitro* acaricidal effects of some indigenous plants against *Boophilus microplus* (Arachnida : Ixodidae). *Bangladesh J. Vet. Med.* **3:** 118-123.

Pathak, D., Mathur, V.C., Latha, B.R., John, L. 2004. *In vitro* effect of indigenous plant extracts on ixodid ticks of small ruminants. *Indian J. Animal Sci.* **74:** 616-617.

Potenza, M.R., Takematsu, A.P., Sivieri, A.P., Sato, M.E., Passerotti, C.M. 1999. Acaricide effect of some plant extracts on *Tetranychus urticae* (Koch, 1836) (Acari: Tetranychidae) in the laboratory. *Arquivos Institute Biologico* **66:** 31-37.

Rahman, I., Gogoi, I, Dolui, A.K., Handique, R. 2005. Toxicological study of plant extracts on termite and laboratory animals. *J. Environ. Biol.* **26:** 239-241.

Schlesselman, J.J. 1982. *Case-Control Studies Design, Conduct, Analysis,* pp. 174-177, Oxford University Press, New York, USA.

Soulsby, E.J.L. 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*, pp.359-504, 7th edition, Baillière Tindall and Cox, London, UK.

SPSS. 1996. Systat G.O. for Windows: Command Reference, SPSS Inc. Publ., Chicago, USA.

Szczypel, B., Larramendy, R., Hernandez, M. 2003. Evaluation of different insecticides against external parasites of hens. *Rev. Cubana de Ciencia Avicola* **27:** 121-124 (Abstract in English).

Urquhart, G.M., Armour, J., Duncan, J.L., Dunn, A.M., Jennings, F.W. 1996. *Veterinary Parasitology,* 2nd edition, Blackwell Science Inc., London, UK.

Vasanthi, C., Choudhary, R.K., Latha, B.R., John, L. 2004. Effect of *Nicotiana tabacum* decoction on sarcoptic mange infestation in rabbits. *Indian J. Animal Sci.* **74:** 732-733.