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Echidnophaga gallinacea on country chicken (Aseel) in different agro climatic zones of Tamil Nadu and its control by using herbal preparation

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Abstract

Poultry fleas are known to cause severe irritation, anemia, blindness and death in chicken. A total of 2580 country chicken (Aseel) from 12 villages of six districts and three agro-climatic zones in Tamil Nadu, India were examined for flea infestation from April 2019 to March 2020. The collected fleas were identified as *Echidnophaga gallinacea*. The overall prevalence of flea infestation in country chicken was 25.54% with western zone alone having 40.80% which was significantly ($P < 0.01$) higher than the north eastern and hill zones. The infestation was comparatively more in adult birds than chicks. Three different preparations were used to control the fleas in country chicken: a 1% Deltamethrin solution, ground *Acorus calamus* (Vasambu) powder made into a paste with coconut oil and *Psidium guajava* (common guava) leaf extracts. The preparations deltamethrin, vasambu paste and guava leaf extracts controlled flea infestation in the chicken after 2nd, 4th and 5th day of application, respectively.

Keywords: *Echidnophaga gallinacea*, country chicken, agro climatic zones, ethnoveterinary

Introduction

Fleas are blood sucking arthropods that affect mammals, poultry, reptiles and humans [1, 2, 3]. *Echidnophaga gallinacea* also known as the sticktight flea is a permanent burrowing ectoparasites on poultry and occurs mostly on desi birds [4]. It also occurs in quails, turkeys, pigeon [5], dogs [6, 7, 8], cats [9] and African pygmy hedgehogs [10]. Severe flea infestation in chicken leads to severe irritation, anemia, blindness and even death [11]. Ivermectin and synthetic pyrethroids like deltamethrin are commonly used to control flea infestation in ruminants and poultry [12] but the repeated use of chemical compounds may give rise to acaricidal resistance. Hence, herbal preparations are preferred for controlling such infestation. *Acorus calamus* (Vasambu) is a volatile oil-containing bushy herb possessing insecticidal properties [13]. Its rhizome contains active ingredients such as isoshyobunone (15.56%), β -asarone (10.03%), shyobunone (9.60%) and methylisoeugenol (6.69%) [14]. Leaves of *Psidium guajava* (common guava) contain high amounts of limonene (42.1%), caryophyllene (21.3%), α -pinene, β -pinene, isopropyl alcohol, menthol, terpenyl acetate, caryophyllene, longicyclene, β -bisabolene and oleanolic acid [15, 16]. The essential oils of these plants are known to possess insecticidal and acaricidal properties. Hence, the present study reports the prevalence and control of flea infestation in country chicken (Aseel) belonging to different agro-climatic zones of Tamil Nadu, India.

Materials and Methods

The study was undertaken from April 2019 to March 2020 to find out the prevalence of flea infestation in country chicken under different agro-climatic zones of Tamil Nadu, India. A total of 2580 country chicken (Aseel and its strains like Siruvidai and Peruvidai) from three agro-climatic zones viz., western zone (Erode, Coimbatore, Tiruppur), north eastern zone (Kancheepuram, Tiruvallur) and hill zone (Nilgiris) of Tamil Nadu, India (Plate 1) were examined for flea infestation. A total of 12 villages (Kothampalayam, Poonthirai, Vadavalli, Veerakeralam, Kallipalayam, Chencherimalai, Kilkadirpur, Walajabad, Muthukoor, Mappedu, Pallipadi and Gudalur) were selected from six districts of these three different agro-climatic zones (Table 1). All the birds were reared under backyard system as free range and were fed with concentrates at 60 gm and 120 gm per day for chicks and adults, respectively.

During the study period, the birds were vaccinated against Ranikhet disease and Infectious bursal disease. Deworming and dipping were not followed to control endo- and ectoparasites. All the birds in the study were thoroughly examined for the presence of fleas. Fleas collected from the eyelids, comb and wattles were preserved in 70% alcohol and processed for further identification [17].

Three preparations were used to control fleas in the country chicken which were naturally infested with the *E. gallinacea*. Deltamethrin (Intas polivet) was prepared as 1% solution. *Acorus calamus* (Vasambu) powder was made into a paste with coconut oil. Approximately 250g of *Psidium guajava* (common guava) leaves were chopped in a blender and macerated with 20mL of water until a homogenous semisolid mixture was obtained. The mixture was filtered through a strainer and the filtrate collected in a glass beaker was used as a dip solution. Birds heavily infested with fleas were grouped into four, each containing 20 birds. Groups I, II and III were treated with 1% deltamethrin dip, *Acorus calamus* paste and *Psidium guajava* leaf extract dip, respectively while Group IV remained as control. The data were analyzed by Chi Square Test using statistical software IBM SPSS version 20.0 for windows.

Results

The overall prevalence of flea infestation in the birds was found to be 25.54% (Table 1). Among the three agro-climatic zones, flea infestation was observed only in country chicken

of western zone with an overall prevalence of 40.80%, which was significantly ($P < 0.01$) higher than the north eastern and hill zones; in the infested areas of western zone, the infestation was significantly ($P < 0.01$) higher in adult birds (44.97%) than chicks (39.08%) (Table 2). Among the three agro-climatic zones, flea infestation was observed only in country chicken of western zone (Coimbatore, Erode, Tiruppur) with an overall prevalence of 40.80%; the infestation was observed more in adult birds than chicks. Fleas were not observed in the country chicken of north-eastern (Kancheepuram, Tiruvallur) and hill zones (Nilgiris). Among the districts, highest infestation was observed in Coimbatore (44.62%) followed by Erode (41.58%) and Tiruppur (39.79%) with the infestation significantly ($P < 0.01$) higher in chicks than adult birds (Table 3).

The parasites embedded mostly around the eyelids, comb and wattles (Plate 2) of the country chicken were collected and identified as *Echidnophaga gallinacea* fleas based on their morphological characteristics such as angular frons, serrated mandible, reduced thorax and lack of both the genal and pronotal combs (ctenidia). In this study, the flea-infested birds showed restlessness, irritation, anemia, weakness, anorexia, ulceration on eye lids, corneal opacity and blindness due to fleas present in these regions (Plate 3).

Flea infestation was controlled in treatment groups I (1% Deltamethrin dip), II (*Acorus calamus* paste) and III (*Psidium guajava* leaf extracts as dip) after 2nd, 4th and 5th days of application, respectively.

Table 1: Flea infestation in country chicken of Tamil Nadu

District	Village	Total No. of birds		Total No. of birds infested		Infestation %		
		Adult	Chicks	Adult	Chicks	Adult	Chicks	Total
Coimbatore	Vadavalli	50	0	28	0	56.0	0	56.00
	Veerakeralam	32	48	14	16	43.75	33.33	37.50
Erode	Kothampalayam	100	426	48	158	48.00	37.10	39.16
	Poonthirai	60	128	32	56	53.33	43.75	40.81
Tiruppur	Kallipalayam	60	386	46	186	76.67	48.19	52.02
	Chencherimalai	165	148	42	28	25.45	18.92	22.36
Kancheepuram	Kilkadirpur	40	122	0	0	0	0	0
	Walajabath	72	56	0	0	0	0	0
Tiruvallur	Muthukoor	86	140	0	0	0	0	0
	Mappedu	150	120	0	0	0	0	0
Nilagiri	Pallipadi	26	71	0	0	0	0	0
	Gudalur	38	56	0	0	0	0	0
Total		879	1701	210	444	23.89	26.10	25.54

Comparison Between Adult and Chick Chi-square value = 1.50 NS ($p > 0.05$)

Table 2: Agro climatic zone wise prevalence of flea infestation in country chicken of Tamil Nadu

Agro climatic zone	Total No. of birds			Total No. of birds infested			Infestation %		
	Adult	Chicks	Total	Adult	Chicks	Total	Adult	Chicks	Total
Western zone	467	1136	1603	210	444	654	44.97	39.08	40.80
Northeastern zone	348	438	786	0	0	0	0	0	0
Hill zone	64	127	191	0	0	0	0	0	0
Total	879	1701	2580	210	444	654	12.07	20.44	17.17

Comparison Between Zones:

Among Adult: Chi-square value = 243.42 ** ($p < 0.01$)

Among Chick: Chi-square value = 298.83 ** ($p < 0.01$)

Among Total: Chi-square value = 533.95 ** ($p < 0.01$)

Table 3: District wise prevalence of flea infestation in country chicken of Tamil Nadu

Agro climatic zone	District	Total No. of birds		Total No. of birds infested		Infestation %		
		Adult	Chicks	Adult	Chicks	Adult	Chicks	Total
Western zone	Erode	160	554	80	214	50.00	38.63	41.58
	Coimbatore	82	48	42	16	51.22	33.33	44.62
	Thiruppur	225	534	88	214	39.11	40.07	39.79
Northeastern zone	Kancheepuram	112	178	0	0	0	0	0
	Thiruvallur	236	260	0	0	0	0	0
Hill zone	Nilagiri	64	127	0	0	0	0	0
Total		879	1701	210	444	23.89	26.10	25.54

Comparison between Districts:

Among Adult: Chi-square value = 251.56 ** ($p < 0.01$)

Among Chick: Chi-square value = 299.98 ** ($p < 0.01$)

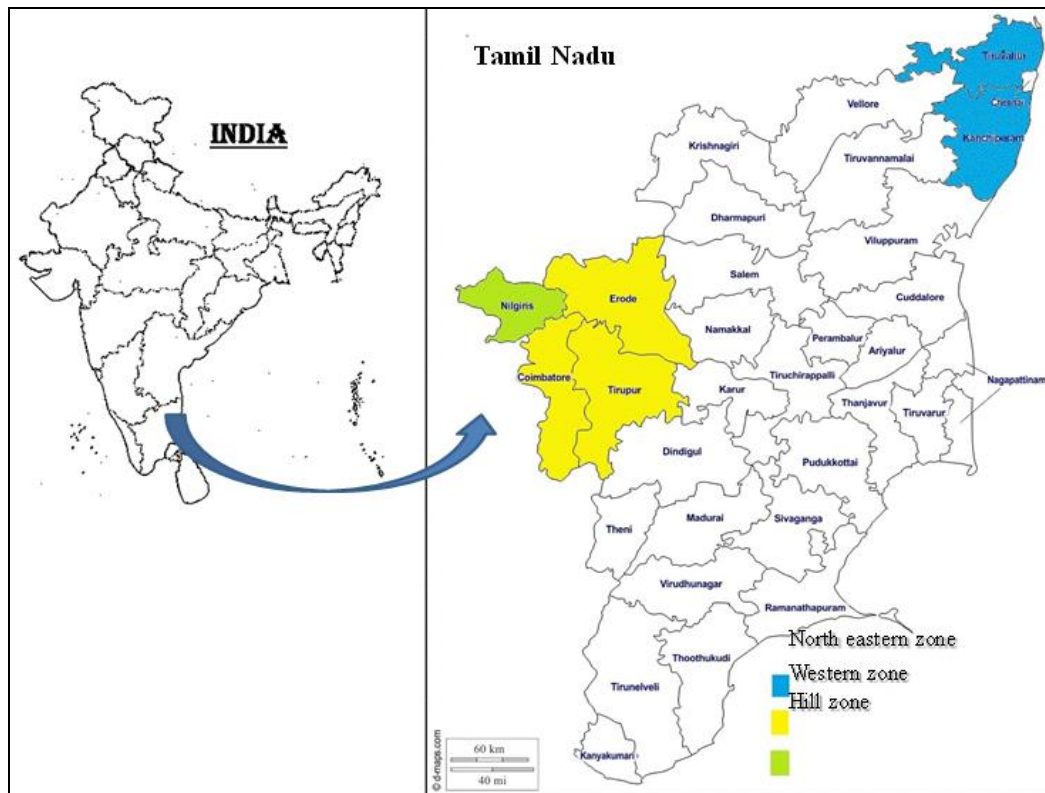
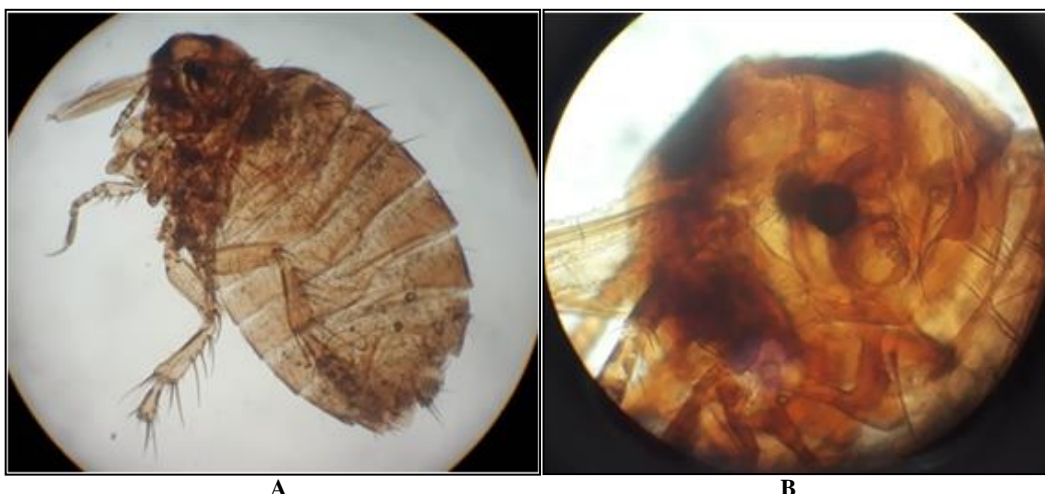


Plate 1: India and Tamil Nadu map. Study area indicated in colour



A

B

Plate 2: a. *Echidnophaga gallinacea* and b. *E. gallinacea* Head end



Plate 3: Flea infestation on country chicken. a. Fleas on eye lids, comb and nose, b. Corneal opacity and blindness, c. Fleas on comb and eyelids and d. Comb, eyelids and wattles.

Discussion

The overall prevalence of flea infestation in the birds was found to be 25.54% which is in accordance with ^[18] who have reported 35.71% of flea infestation in village chicken at Nigeria. In contrast to our study ^[19], observed 6.7% of *E. gallinacea* infestation in free range desi birds in Tirunelveli district of Tamil Nadu (India) ^[20]. also recorded *E. gallinacea* in free range chicken in Zimbabwe.

In this study, highest flea infestation was observed on young birds (26.10%) than the adult birds (23.89%). Among the age groups, there was no significant difference ($P > 0.05$) in young birds and adult birds.

The higher incidence of flea infestation in the Coimbatore, Erode, Tiruppur districts of western zone could be due to medium relative humidity (50-60%), moderate to high temperature (21-36 °C) and low rainfall (600-800 mm) in these areas compared to the other two zones.

The prevalence of *E. gallinacea* infestation in desi chicken is also reported by ^[4, 19, 21] in districts of Kanyakumari, Tirunelveli, and Namakkal which have an optimum temperature (27-35 °C) and relative humidity (50-55%) ideal for flea thriving.

Fleas were not observed in the country chicken of north-eastern (Kancheepuram, Tiruvallur) and hill zones (Nilgiris). This could be attributed to the relatively high temperature (18-38 °C), high relative humidity (69-75%) and high rainfall (1200mm) prevailing in the north-eastern zone. Likewise, very low temperature (5-20 °C), high relative humidity (75%) and high rainfall (1238mm) prevailing in hill zone may not provide a conducive environment for the existence of fleas in country chicken.

Flea-infested birds showed restlessness, irritation, anemia, weakness, anorexia, ulceration on eye lids, corneal opacity

and blindness due to fleas present in these regions. This is in accordance with earlier reports of ^[11, 4] observed ulceration around the eyes and blindness in young desi birds whereas ^[21] have observed partially closed eyes in adult desi chicken. ^[22] also reported *E. gallinacea* infestation in young birds. The flea-infestation associated mortality observed in this study was 11.39%. This is similar to ^[17, 23] who had also reported mortality in young birds due to *E. gallinacea*.

Out of the three preparations that were used to control fleas in the country chicken, Deltamethrin (1%) dip controlled flea infestation after 2nd day of its application. The immediate response of flea control to deltamethrin was achieved because of its usage on both the birds and also its surroundings which could have killed the larvae and pupae of the fleas. Deltamethrin solution when sprayed on the floor and walls of the shed controls the larval and pupal stages of the fleas ^[12]. ^[24] have reported that Deltamethrin controls *Ctenocephalides orientis* and *C. felis* fleas within a day of application on goats. Although deltamethrin is a powerful acaricidal agent, its long term use to control fleas can result in the development of resistance against it, hence the use of herbal or ethnoveterinary preparations are preferred. In this study, the use of *Acorus calamus* paste and *Psidium guajava* leaf extracts as dip, controlled the flea infestation in country chicken after 4th and 5th days of application, respectively. The essential oils of *Acorus calamus* rhizome and *Psidium guajava* leaves are found to possess repellent and acaricidal properties, which may be attributed to the active principles present in their essential oils ^[25, 26].

Conclusion

Echidnophaga gallinacea infestation in country chicken (Aseel) is more prevalent in the western agro-climatic zone of Tamil Nadu, India. This is mostly due to the relative humidity

along with high temperature and medium rainfall in this zone. With regards to the control of fleas in country chicken, herbal preparations using *Acorus calamus* and *Psidium guajava* can be used as an alternative to conventional acaricidal drugs (Deltamethrin) as they are easily available, cost effective, safe on birds, easy to use and do not develop any resistance.

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Conflict of Interest: There is no conflict of interest among authors for this study.

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