

## Helminth parasitism of domestic fowl (*Gallus domesticus* L.) in a sub-tropical high-rainfall area of India

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An investigation into the helminth parasitic infections of domestic fowl in a subtropical area of India, based on an autopsy of 532 chickens, revealed a 90.9% prevalence of infection. 10 species of helminths were encountered, of which *Capillaria contorta* was recorded for the first time from fowls in India. *Ascaridia galli* was the most prevalent species, followed by *Raillietina* spp. and *Heterakis gallinae*. The infection by trematodes appeared to be very rare. The helminth fauna of fowls in this climatic area was compared with that of fowls in other areas of the world and found to differ in respect of prevalence and incidence of various parasitic species. The role of the climate in the distribution and in regulating populations of parasitic species is discussed.

### 1. Introduction

Climatic conditions, particularly temperature and rainfall, are important factors which regulate the species composition and population pattern of helminth parasites (THOMAS 1981). The agroclimatic conditions of Meghalaya, a northeastern state of India, are characterized by heavy rainfall almost throughout the year except for a short period of dry season during winter (November to February). Helminth parasites infecting domestic fowls have been studied in various climatic regions of India (GOGOI 1974, SAXENA and NAMA 1976, MALHOTRA and CAPOOR 1984, FOTEDAR and KHATEEB 1986) and of the world (SSENYONGA 1982, VATTANODORN and SINGH 1984), but information seems to be lacking on the nature of helminth parasitism of fowls in a subtropical and high-rainfall climatic environment like the one in the northeastern region of India. Our studies on nematode infections in pigs and goats of Meghalaya revealed a significantly high rate of parasitic infections in the area (YADAV and TANDON 1989 a, b). Associated with this an investigation was undertaken on the spectrum of parasitic helminths and seasonal variations in the prevalence and intensity of major helminth infections in domestic fowls of Meghalaya.

## 2. Material and methods

The investigation between March 1986 and February 1987 included 532 domestic fowls, *Gallus domesticus* L. (a mixed lot of leghorn and Rhode Island Red breeds) of both sexes and various ages (6–13 months) from local markets of the East and West Khasi Hills districts of Meghalaya (fig. 1). These districts cover an altitude range of 400–1600 m ASL and experience a monsoonic climate. The average annual rainfall is 400 cm, while in southern parts it is up to 1040 cm (as 2460 cm in an exceptional year such as 1974) recorded at Cherrapunjee and Mawsynram, the wettest spots of the world (RAM and RAMAKRISHNAN 1989). The range of temperature is low, varying between a mean minimum of 8°C in January and a mean maximum of 24°C in June. The following weather conditions tend to produce a high humidity in the environment, particularly during summer (May–July), when it varies between 80 and 85%. Poultry is extensively practised among native tribes on a free range system and receives very little attention from the owners.

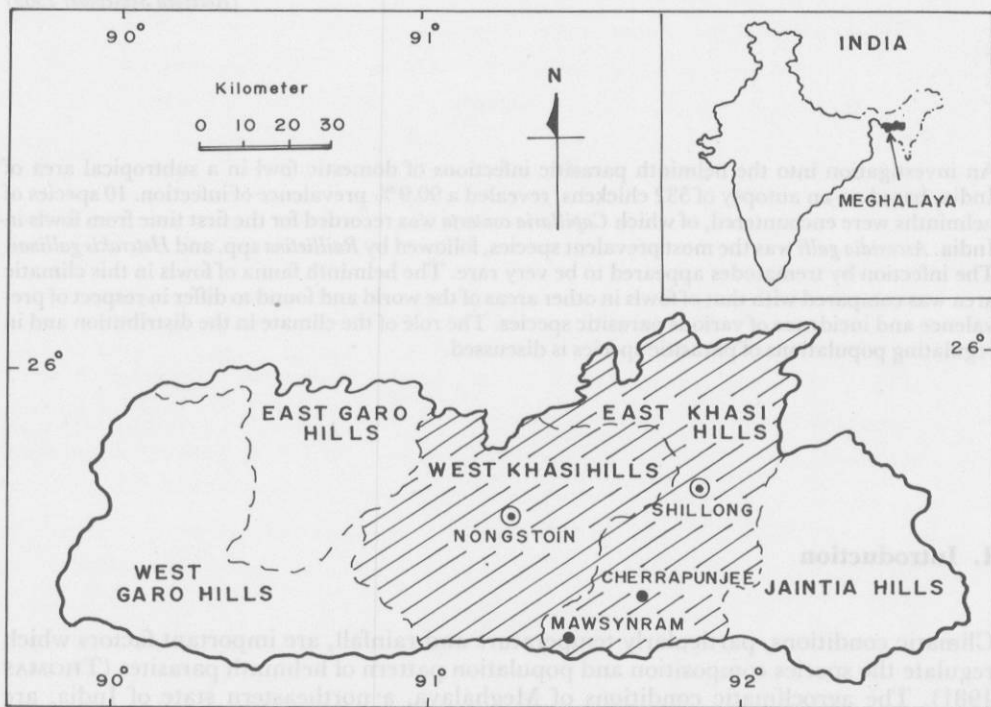


Fig. 1: Collection area shown as hatched in Meghalaya (India)

The alimentary canals along with the associated body organs after collection were brought to the laboratory and examined for parasites by standard techniques. The specimens thus collected were counted and identified according to „CIH keys to the nematode parasites of vertebrates“ No. 1–10 (1974–1983) and SOULSBY (1982).

The meteorological data for the study area pertaining to the survey period were obtained through the meteorological station of the India Meteorological Department, situated in Shillong. They are shown in fig. 2.

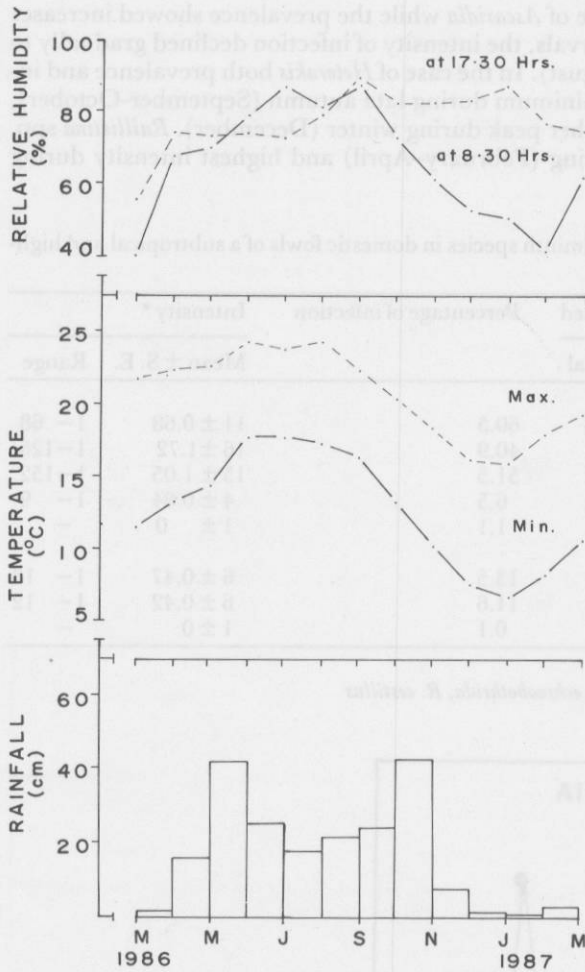


Fig. 2: Average relative humidities at 8.30 and 17.30 hrs., mean monthly maximum and minimum temperatures, and total rainfall at Shillong during the study period

### 3. Results

Of the 532 domestic fowls examined, 484 (90.9%) were found infected with one or more species of helminth parasites. Single, double, and multiple species infections were encountered in 106 (21.9%), 178 (36.8%), and 200 (41.3%) fowls, respectively. The prevalence and intensity of the parasitising species are presented in table 1. A total of 10 helminth species were recorded. Infections with *Ascaridia galli*, *Raillietina* spp. (a complex of three species, namely *R. tetragona*, *R. echinobothrida* and *R. cesticillus*, and considered collectively) and *Heterakis gallinae* were the most common, followed by *Capillaria contorta*, *C. annulata* and *Echinolepis carioca* which occurred in < 13.5% of the hosts examined; *Echinostoma* sp. and *Strongyloides* sp. had a very low prevalence rate. With regard to the mean worm load per infected host, *H. gallinae* showed the highest burden in the hosts, followed by *Raillietina* spp. and *A. galli* (table 1).

To study the impact of various seasons on the helminth infections, observations were made monthwise on the prevalence and mean intensity of infection for three major components of the spectrum (*A. galli*, *Raillietina* spp., and *H. gallinae*) during one annual cycle (figs. 3-5). *Ascaridia* and *Heterakis* exhibited highest peaks in their prevalence and intensity

during summer. However, in the case of *Ascaridia* while the prevalence showed increases and declining trends at monthly intervals, the intensity of infection declined gradually to a low level during early autumn (August). In the case of *Heterakis* both prevalence and intensity declined slowly, reaching a minimum during late autumn (September-October), after which a rise occurred with another peak during winter (December). *Raillietina* spp. showed maximum prevalence in spring (February-April) and highest intensity during early autumn.

Table 1: Prevalence and intensity of helminth species in domestic fowls of a subtropical and high-rainfall area of India (n = 532)

Location/ specieswise prevalence	No. of birds infected			Percentage of infection	Intensity*	
	Pure	Mixed	Total		Mean $\pm$ S. E.	Range
<b>Intestine</b>						
<i>Ascaridia galli</i>	69	253	322	60.5	11 $\pm$ 0.68	1- 68
<i>Heterakis gallinae</i>	21	197	218	40.9	16 $\pm$ 1.72	1-126
<i>Raillietina</i> spp.**	56	218	274	51.5	15 $\pm$ 1.05	1-152
<i>Echinolepis carioca</i>	-	35	35	6.5	4 $\pm$ 0.84	1- 9
<i>Echinostoma</i> sp.	1	5	6	1.1	1 $\pm$ 0	-
<b>Caecum</b>						
<i>Capillaria contorta</i>	5	67	72	13.5	6 $\pm$ 0.47	1- 18
<i>C. annulata</i>	3	59	62	11.6	6 $\pm$ 0.42	1- 12
<i>Strongyloides</i> sp.	-	1	1	0.1	1 $\pm$ 0	-

\* Number of worms per infected bird

\*\* A complex of 3 species, *R. tetragona*, *R. echinobothrida*, *R. cestillus*

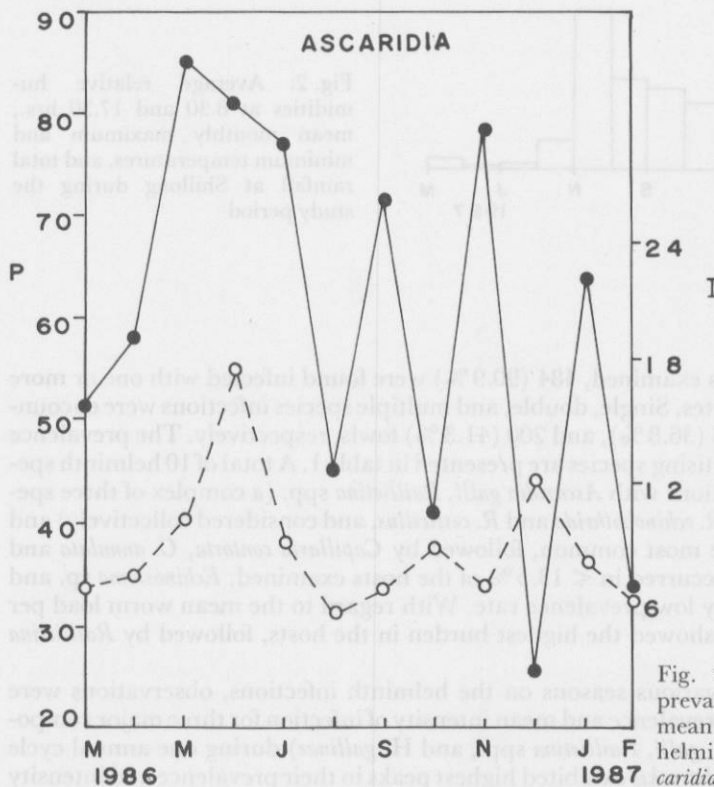


Fig. 3: Seasonal variations in prevalence (P, solid line) and mean intensity (I, broken line) of helminth infections in fowls: *Ascaridia galli*

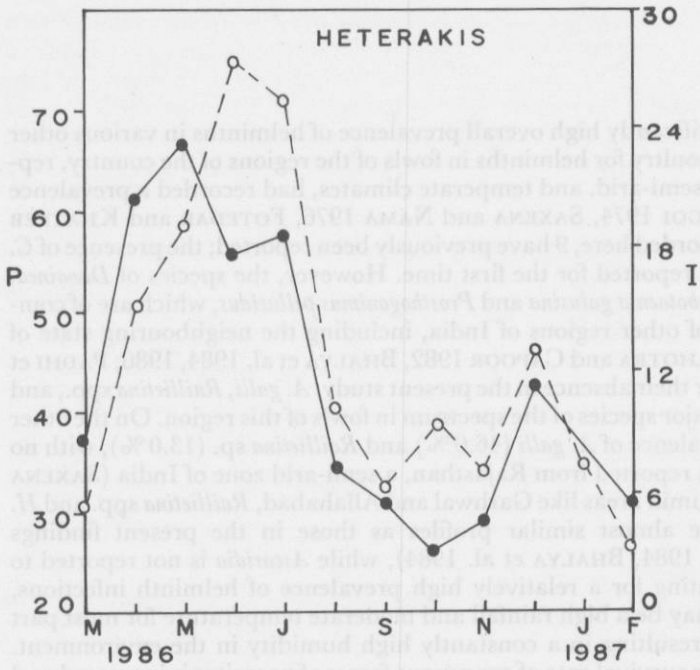


Fig. 4: Seasonal variations in prevalence (P, solid line) and mean intensity (I, broken line) of helminth infections in fowls: *Heterakis gallinae*

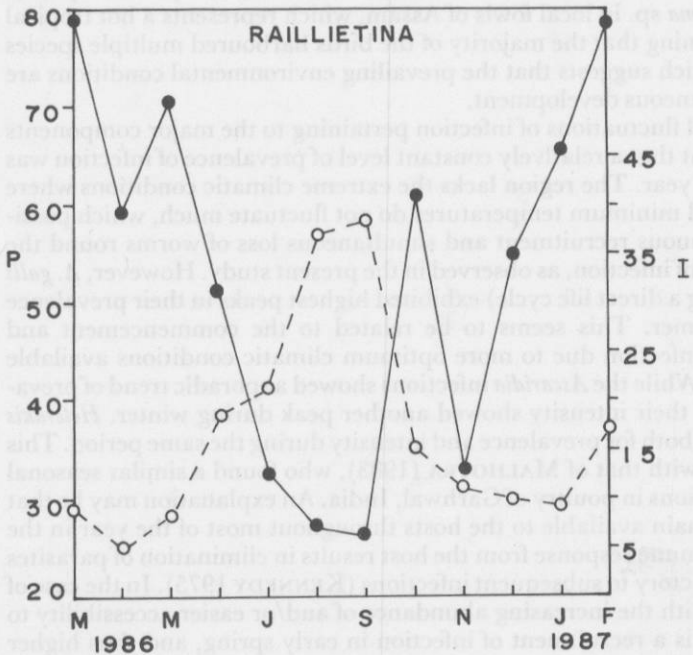


Fig. 5: Seasonal variations in prevalence (P, solid line) and mean intensity (I, broken line) of helminth infections in fowls: *Raillietina* spp.

#### 4. Discussion

The survey revealed a significantly high overall prevalence of helminths in various other region. Earlier surveys of poultry for helminths in fowls of the regions of the country, representing the hot tropical, semi-arid, and temperate climates, had recorded a prevalence between 50.5–74.3% (GOGOI 1974, SAXENA and NAMA 1976, FOTEDAR and KHATEEB 1986). Of the 10 species recorded here, 9 have previously been reported; the presence of *C. contorta* in fowls of India is reported for the first time. However, the species of *Davainea*, *Acuaria*, *Tetramers* and *Amoebotaenia galusina* and *Prosthogonimus pellucidus*, which are of common occurrence in fowls of other regions of India, including the neighbouring state of Assam, (GOGOI 1974, MALHOTRA and CAPOOR 1982, BHALYA et al. 1984, 1986; PADHI et al. 1987) are noteworthy for their absence in the present study. *A. galli*, *Raillietina* spp., and *H. gallinae* emerge as the major species of the spectrum in fowls of this region. On the other hand, a relatively low prevalence of *A. galli* (46.0%) and *Raillietina* sp. (13.0%), with no occurrence of *H. gallinae*, is reported from Rajasthan, a semi-arid zone of India (SAXENA and NAMA 1976). In sub-humid areas like Garhwal and Allahabad, *Raillietina* spp. and *H. gallinae* are found to have almost similar profiles as those in the present findings (MALHOTRA and CAPOOR 1984, BHALYA et al. 1984), while *Ascaridia* is not reported to occur. The factors accounting for a relatively high prevalence of helminth infections, nematodes in particular, may be a high rainfall and moderate temperature for most part of the year in the region, resulting in a constantly high humidity in the environment. Under these conditions, the survival rate of exogenous forms of parasites is increased and dense populations of the infective stages rapidly build up on the ground. This enhances the possibility of host infections. The same argument may be extended to the occurrence of *Raillietina* spp., which suggests that in the existing climatic conditions the intermediate host fauna of these cestodes (e. g. beetles, ants, slugs, etc.) is better favoured and thus is more accessible to poultry. A poor registering of trematodes in the survey may be related to the topography (hilly terrain) of the region which perhaps accounts for the absence or less occurrence of snail habitats in the area. GOGOI (1974), however, reported a prevalence of 12.3% of *Echinostoma* sp. in local fowls of Assam, which represents a hot tropical climate. It is worth mentioning that the majority of the birds harboured multiple species infections of helminths, which suggests that the prevailing environmental conditions are favourable for their simultaneous development.

With regard to the seasonal fluctuations of infection pertaining to the major components of the spectrum, it is evident that a relatively constant level of prevalence of infection was maintained for most of the year. The region lacks the extreme climatic conditions where the monthly maximum and minimum temperatures do not fluctuate much, which possibly accounts for the continuous recruitment and simultaneous loss of worms round the year and thus a steady rate of infection, as observed in the present study. However, *A. galli* and *H. gallinae* (both having a direct life cycle) exhibited highest peaks in their prevalence and intensity during summer. This seems to be related to the commencement and maximum recruitment of infection due to more optimum climatic conditions available during that period (fig. 2). While the *Ascaridia* infections showed a sporadic trend of prevalence throughout the year, their intensity showed another peak during winter. *Heterakis* also exhibited a sharp peak both for prevalence and intensity during the same period. This observation agrees closely with that of MALHOTRA (1983), who found a similar seasonal trend for *Heterakis* sp. infections in poultry of Garhwal, India. An explanation may be that though infective stages remain available to the hosts throughout most of the year in the prevailing situation, an immune response from the host results in elimination of parasites and/or makes the host refractory to subsequent infections (KENNEDY 1975). In the case of *Raillietina* spp. – perhaps with the increasing abundance of and/or easier accessibility to intermediate hosts – there is a recruitment of infection in early spring, and thus higher

peaks of worm burden appear in the following autumn. The level of infection in the intermediate hosts population may vary seasonally in a manner related to the breeding cycle, growth, and mortality of those hosts (KENNEDY 1975) and thus can influence the recruitment of infection in the final host. The rising trend in the prevalence of *Raillietina* spp. without a marked increase in intensity during winter probably reflects new recruitment but also failure to retain stably numbers due to immune response of the host. In conclusion it is apparent that in the humid subtropical environment of India *A. galli*, *Raillietina* spp., and *H. gallinae* are the major worm infections which could be the main constraints to poultry production in the humid areas. The presence of these species in a moderate number apparently is not harmful, but in large numbers they may be detrimental to the host (ISLAM 1985). Long-term studies should be conducted on the development and survival of pre-parasitic stages of these worms under the environmental conditions of the region to fulfil epizootiological requirements needed to aid their effective control.

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A. K. YADAV und V. TANDON: Helminthenbefall beim Haushuhn (*Gallus domesticus* L.) in einem subtropischen Gebiet mit hohen Niederschlägen in Indien

90,9% von 532 seziierten Hühnern aus einem subtropischen Gebiet Indiens mit hohen Niederschlägen waren mit Helminthen infiziert. Es konnten insgesamt 10 Helminthenarten festgestellt werden, dabei wurde *Capillaria contorta* zum ersten Male beim Geflügel in Indien nachgewiesen. Dominierende Art war *Ascaridia galli*, gefolgt von *Raillietina* spp. und *Heterakis gallinarum*. Trematodeninfektionen scheinen sehr selten zu sein. Die Helminthenfauna beim Geflügel in dieser klimatischen Region wurde mit der in anderen Gebieten der Welt verglichen. Unterschiede zeigten sich hinsichtlich Vorkommen und Verbreitung. Die Rolle des Klimas wird diskutiert.

A. K. YADAV и V. TANDON: Поражение домашней курицы (*Gallus domesticus* L.) гельминтами в субтропическом районе Индии с высоким количеством осадков

90,9% из 532 вскрытых кур из субтропического района Индии с высоким количеством осадков были инфицированы гельминтами. Всего было установлено 10 видов гельминтов. При этом *Capillaria contorta* был обнаружен у домашних птиц в Индии впервые. Доминирующим видом был *Ascaridia galli*, последующими *Raillietina* spp. и *Heterakis gallinarum*. Трематодные инфекции были редкими. Гельминтная фауна домашней птицы этого климатического района сравнивалась с фауной других районов мира. Обнаружены различия в отношении наличия и распространения. Обсуждается роль климата.

A. K. YADAV et V. TANDON: L'helminthiase chez le *Gallus domesticus* L. dans une région subtropicale avec des chutes élevées de l'Inde

90,9% de 532 poules disséquées provenant d'une région subtropicale de l'Inde avec des chutes élevées étaient infectés d'helminthes. On a constaté en tout 10 espèces d'helminthes, parmi eux pour la première fois, chez la volaille en Inde, la *Capillaria contorta*. L'espèce prédominant était l'*Ascaridia galli*, suivie de *Raillietina* spp. et de *Heterakis gallinarum*. Les infections de trématodes semblent être très rares. La faune helminthique de la volaille de cette région climatique a été comparée avec celle dans d'autres régions du monde. Il s'est montré des différences quant à la présence et à la propagation. Est discuté le rôle du climat.

A. K. YADAV y V. TANDON: Infestado por helmintos en la gallina doméstica (*Gallus domesticus* L.) en una región subtropical con muchas precipitaciones de India

90,9% de 532 gallinas disecadas provenientes de una región indiana subtropical con elevadas precipitaciones se mostraron infectadas por helmintos. Se verificaron, en total, 10 especies de helmintos, entre los cuales se constató, por la primera vez en India, *Capillaria contorta* como helminto entre aves. La especie predominante era *Ascaridia galli* seguida por *Raillietina* spp. y *Heterakis gallinarum*. Infecciones con trematodos parecen ser muy raras. La fauna de helmintos de esta región climática fue comparada con otras regiones del mundo. Hubo diferencias relativo a la existencia y diseminación. Se está discutiendo el papel que desempeña el clima.