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PARASITES IN POULTRY FAECES: SHOULD WE BE CONCERNED?

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ABSTRACT
Poultry faeces may contain many harmful parasites, which may pose significant health risks to the consumer. These parasites may then be transmitted to man by contaminated soil, drinking water supply or by mechanical vectors like flies and rodents. This is a neglected area of public health and deserves more scientific attention. Scientific literature was explored and our findings were also assessed. In our experience, coccidian oocysts, *Entamoeba* oocysts and rarely some *Giardia* oocysts and larvae of *Strongyloides* spp. larvae and trematode eggs were found. Hence keeping in view the public health importance of parasites in poultry faeces, open poultry shops should be cleaned and properly sanitized to mitigate health risks to humans and also the environment.

KEYWORDS: Poultry, faeces, parasites, one health.

INTRODUCTION
Poultry is one of the most important and fastest growing sectors of agriculture in India. Poultry sector plays a crucial role in meeting the protein and nutritional requirements of the population.

India, today is one of the largest manufacturers of eggs and broiler meat. Over the past two decades, the poultry sector in India has undergone a remarkable transformation, evolving from a modest and backward farming practice into a thriving mega-industry with a substantial workforce.

Various domesticated bird species, including chickens, ducks, geese, guinea fowl, and turkeys, fall under the purview of the poultry sector. Among these, chickens (*Gallus gallus domesticus*) hold particular prominence due to their pivotal role in providing both eggs and meat, contributing significantly to protein-rich diets. Diverse breeds of chickens, such as Rhode Island Red, Leghorn, Plymouth Rock, Wyandotte, and Orpington, are integral components of the poultry industry. Chicken, in particular, stands out as an excellent dietary option. It serves as a low-calorie and low-fat source of high-quality protein, making it a favourable choice for health-conscious consumers. Beyond its macronutrient composition, chicken renders a nutritional profile rich in essential nutrients, playing a vital role across various stages of life. Additionally, chicken contains tryptophan, an amino acid known for its role in elevating serotonin levels in the brain, thereby contributing to overall well-being. Dark and white meat chickens contain vitamin B1 and choline which promote brain development in children.

In summary, the poultry industry in India has not only become a key player in meeting the protein needs of the population but has also undergone a transformative journey, emerging as a significant contributor to the country's agricultural and economic landscape.

Chicken faeces also known as droppings contain 0.5%-0.9% nitrogen, 0.4% - 0.5% phosphorus and 1.2-1.7% potassium. Single chicken produced approximately 8-11 pounds of chicken faeces monthly. Chicken faeces serve as a potent natural fertilizer, enriching the soil with nutrients vital for plant development.

Poultry are also infested with numerous kinds of parasites. Parasitic diseases in poultry chickens are common due to several reasons such as mismanagement, malnutrition, diseases and predation. Haemoparasites are often transmitted by bloodsucking arthropods like mosquitoes, biting midges or flies[1] Protozoan parasites can infect the human intestinal tract causing serious diseases. Most prominent intestinal protozoan pathogens found here are, namely, *Entamoeba histolytica*, *Coccidia (Cystoisospora)* and *Entamoeba coli.* Others are *Giardia*

lamblia and *Cryptosporidium, Strongyloides stercoralis (Rabditiform larvae), Blastocystis hominis and Fasciola.* We regard these organisms as obligate pathogens because they may cause symptoms in otherwise completely healthy individuals and disappear after clearance by the immune system and/or successful chemotherapy. Conversely, opportunistic pathogens are found in healthy individuals as a part of the normal microbiome and cause symptoms in challenged individuals only. A (controversial) example is *Blastocystis hominis*, one of the most frequent eukaryotes isolated from feces and pathogenic in immunocompromised and irritable bowel syndrome (IBS) patients.

There are no intermediate hosts. Cystoisospora (*Cryptosporidium*) are excreted in feces and (auto) infection occurs via ingestion of these permanent stages. As a consequence, due to the poor hygienic conditions, the prevalence of these intestinal protozoans is, however, much higher in underdeveloped countries thereby constituting a major problem for global health.

Poultry coccidiosis stands as one of the most significant protozoan diseases affecting poultry worldwide, causing substantial economic losses to the industry. The disease, predominantly caused by intracellular parasites of the genus *Eimeria*, is endemic in many tropical and subtropical regions, primarily transmitted through the feco-oral route. Its impact is particularly notable among young chickens and those managed intensively.

Clinically, poultry coccidiosis manifests through symptoms such as bloody diarrhea, ruffled feathers, dehydration, and paleness of the comb. Postmortem examinations often reveal thickening of the intestine, hemorrhage, and necrotic enteritis at specific sites, varying with the species of *Eimeria* involved.

Diagnosis of coccidiosis relies on clinical observation, coprological analysis, and postmortem examinations, though biochemical and molecular methods have become increasingly common in recent years. Despite available treatment options such as anticoccidial and sulfa drugs, the emergence of drug resistance poses a significant challenge to effective management.

The economic impact of coccidiosis is substantial, stemming from both production losses and the costs associated with treatment and prevention. Thus, it remains imperative for the poultry industry to prioritize the implementation of stringent management practices, including robust hygiene and biosecurity measures, to effectively control and prevent the spread of this debilitating disease.

Entamoeba histolytica colonizes the colon and, unlike the former pathogens, may invade the colon wall and disseminate to other organs, mainly the liver, thereby causing life-threatening amebiasis. Here, we present condensed information concerning the pathobiology of these diseases.

Giardiasis is caused by fecal contaminations of drinking water, food, or direct contact with feces, waterborne transmission being regarded as a major source(2). Pathogenesis and virulence depend on the genotype of the *Giardia* strain and the immune and nutritional status of the host. *Giardia* exists in two morphologic forms: the multi-flagellated trophozoite (four pairs of flagella) and the cyst. The trophozoite is dinucleated, pear-shaped, multi-flagellated, 9 to 15 µm long, 5 to 15 µm wide, and 2 to 4 µm thick, with an adhesive disk on the ventral surface.

Poultry birds are sometimes not covered by the prophylactic program against parasitic diseases. We conducted this cross-sectional study to determine the prevalences of gastro-intestinal helminths, protozoans and haemoparasites in poultry chickens.

The common gut parasites which can infect poultry include, cestodes, nematodes, trematode and protozoans with mixed infections being widespread. The poultry birds become infected by picking up worm eggs from litter, soil or droppings. Once in the gut, the eggs hatch and mature.[3] The eggs of the worms are then excreted in the birds' droppings and the cycle gets repeated. These parasites may spread to humans when they consume contaminated or uncooked meat and may cause severe diseases. Parasitosis should not be neglected, as they have an adverse effect on the health of the animals as well as humans around them and can be detrimental.[4]

Many concentration methods are available to detect parasites from stool but some of them are very expensive and non-specific hence, there is a need of simple and effective method for concentrating stool samples and viewing parasites. Hence, we tried to find the different parasites causing human infection from poultry faeces. This comprehensive research study aims to provide an in-depth understanding of the public health implications of important parasitic poultry diseases and how these diseases can be managed to reduce human health impact. As the focus is on smallholder systems, including scavenging extensive systems and small-scale semi-intensified or intensified systems, most of the literature is from Kolkata, West Bengal, where smallholder systems predominate, despite the rapid growth of intensive systems. We consider broad public health implications that are not limited to zoonoses but include antimicrobial resistance and food and nutrition security.

This review hence comprehensively tries to address the context of smallholder poultry systems, emphasizing the significance of poultry diseases and their public health impacts, including nutrition. It underscores the common diseases prevalent in smallholder poultry and their impacts on income, food security, and public health. Moreover, it discusses preventive and control measures

to alleviate the burden of poultry diseases. The review initiates by examining the prevalence of commonly observed diseases, progresses to general health management strategies, and further explores specific diseases and their impacts, particularly those with public health implications. It also acknowledges the role of ethnoveterinary medicine in poultry health. A brief conclusion summarises the key findings. The information presented here aims to assist policymakers, animal health practitioners, livestock officers, and extension agents in improving the health and productivity of smallholder poultry production across the area of inspection.

MATERIALS AND METHODS

Scientific literature search was done using MeSH (Medical subject headings) terms. Additionally, our own experience was also depicted.

RESULTS

Poultry faeces and microbes

The total Poultry population in the country is 851.8 million as of 2019, that has increased by 16.8% over previous census. The total backyard Poultry in the country is 317.07 Million in 2019, increased by 45.8% over previous Census. The commercial poultry has increased by 4.5% and the total commercial poultry is 534.74 million.[5]

Humans can be exposed to pathogens from poorly managed animal faeces, particularly in communities where animals live in close proximity to humans. Nearly two-thirds of human pathogens and three-quarters of emerging pathogens are zoonotic in origin.[6,7] While research has focused on zoonotic transmission of respiratory and vector-borne pathogens, such as Ebola and West Nile Virus, less attention has been given to pathogens found in animal faeces that are transmitted via water, sanitation, and/or hygiene related pathways.

The isolation of different parasites from poultry birds involves various techniques and methods to identify and study these organisms. Parasites that commonly affect poultry include helminths (worms), protozoa, mites, lice, and ticks. Faecal samples are commonly examined for the presence of helminth eggs (nematodes, cestodes) and protozoan cysts. Techniques such as floatation, sedimentation, and faecal cultures may be used.

The concentration method of ova and parasite examination was the commonest method of isolation of *Coccidia* and other protozoan parasites identified in the current study. In conclusion, *Coccidia* infection is high in food obtained from poultry birds. Therefore, to tackle the disease, there is a need for a concerted effort in the identification, diagnosis and general prevention and control of the disease.

Poultry coccidiosis

Coccidiosis is a protozoan disease caused by parasites of the genus. It is a major disease in commercial poultry production in many countries. The infectious process is rapid (4-7 days) and is characterized by parasite replication in host cells with extensive damage to the intestinal mucosa. Each species has a specific site of development in the small intestine (upper, middle, lower, rectum, and caeca). Poultry coccidia have a high capacity to reproduce within the host; this leads to a rapid increase to the high level of the parasite within the susceptible host and subsequently a high level of contamination of the environment.[8]

Occurrence and distribution (epidemiology) of chicken coccidiosis

Poultry coccidiosis is distributed worldwide, where ever poultry are kept. Intensive methods used for the production of poultry farm and other laboratory animals favours the production of Emeria and the usual well balance host-parasite relationship; which commonly occurs in animals kept under natural conditions. Low level infections occur in animals in the wild; because the intake of sporulated infective oocyst is small.[9]

Epidemiology of coccidiosis in hen is dependent on 3 factors, which include environmental and management-related risk factors, the virulence of the agent and the host-related risk factors. These factors are influenced by environmental changes which can substantially affect the dynamics and as a result, influence the transmission patterns of the disease. Poultry birds reared on litter are always vulnerable to these types of infections.[10] The occurrence of poultry coccidiosis is dependent on both the species of *Eimeria* and the size of the infecting dose of oocysts. Poultry coccidia have a high propensity to reproduce within the host. This leads to a rapid increase to the high level of the parasite within the susceptible host and subsequently a high degree of contamination of the environment. Oocystss may remain in buildings in soil and water, from a previous batch of birds, and moreover they may be carried mechanically, by equipment, clothing, insects and also animals. Birds introduced to an infected building will quickly become infected. Poor hygiene related to personnel, feeding, and drinking is important for the presence of *Eimeria* species and other diseases in the poultry farm.

Life cycle and transmission of chicken coccidiosis

The life cycle of *Eimeria* consist of two stages:

1. An exogenous stage: Sporogony in the external environment and
2. An endogenous stage: In the digestive tract of the chicken.[11]

Exogenous stage: Infected birds excrete oocysts with their droppings in the external environment. The oocysts which are excreted in this way have to sporulate to become infectious. Sporulation or sporogony is therefore an important stage in parasitic cycle. It takes place outside the host in the external environments. About 48 hours at 25-28°C, or longer if the temperature is lower are needed for the sporont inside the oocyst to transform

itself in to four sporocyts each containing two sporozoites.[12]

Endogenous stage/ Ingesting sporulated oocysts and subsequent excystation: The bird becomes infected by ingestion of sporulated oocysts that are found in the environment, like litter, feed and water contaminated by faeces of oocyst-excreting poultry birds. Coccidian populations take time to reach dangerous levels. Therefore, outbreaks usually take place when poultry birds are between 3 and 8 weeks of age.[13] Young birds (under six months of age) are most vulnerable to the disease since they have not had the time to develop natural immunity against parasites. However, adult birds can also be infected, and pass the infection to other members of their flock via droppings. Maximum prevalence of coccidiosis in chicken has been reported during 41-50 days of their age.[14] Infection is via the fecal-oral route. Under the right environmental conditions, the oocysts can contaminate all areas of the poultry's environment, including feed, litter, soil, and be viable for months.[14] Consequently, controlling substrate and litter moisture levels become essential. Oocysts can be transmitted by mechanical carriers (e.g, equipment, clothing, insects, farmworkers, and other animals. Wet litter may have a strong ammonia smell which can cause coccidial overgrowth and other flock management problems.[15]

Clinical signs of chicken coccidiosis

Sign of coccidiosis in poultry include diarrhea, fever, inappetence, weight loss, emaciation, and in extreme cases, death. The birds become gloomy, have ruffled feathers, drooped wings, have loose bowels, and inclined to huddle. Food and water consumption usually decreases and may become emaciated and dehydrated. Egg production rate tends to reduce in laying hens. fecal coccidiosis may produce bloody droppings and clinical signs are associated with tissue destruction from the release of the merozoites and mature oocysts from the mucosal surface during the last generations of merogony and throughout gametogony.[16]

Coprological examination

One of the most prominent parasitological examination approach for diagnosing chicken coccidiosis is the coprological examination. It is a qualitative technique for detecting the oocyst by precisely conducting the procedure.[17] The first step includes collection of 3-5 g of faeces from the upper surface of the litter immediately after birds have dropped, followed by dissolve the faeces in 20-30 ml of flotation solution (NaCl), then shifting the faecal suspension through a tea strainer into a beaker. The sample should next be centrifuged for 3-5 minutes at 1500 rpm. Finally, observed under a microscope with low power objectives.[17]

Poultry faeces can harbour various parasites, and the examination of faecal samples is a common method for diagnosing certain infections. Here are some parasites that can be detected in the faeces of poultry:

Nematode Eggs

- *Type:* Nematodes (Roundworms)
- *Conditions:* Capillariasis, Ascaridiasis, Heterakiasis
- *Description:* Fecal samples may contain eggs of various nematodes, such as *Capillaria*, Ascaridia, and Heterakis, indicating the presence of these intestinal parasites.

Cestode Eggs

- *Type:* Cestodes (Tapeworms)
- *Condition:* Tapeworm infestation
- *Description:* Fecal examination can reveal the presence of tapeworm eggs, such as those from the genus *Raillietina*, indicating a tapeworm infection.

***Giardia* spp.**

- **Type: Protozoa**
- *Condition:* Giardiasis
- *Description: Giardia* cysts, the infective stage of the parasite, may be detected in the feces during a giardiasis infection.

***Entamoeba* histolytica**

- **Type:** Protozoa
- **Condition:** amoebiasis
- **Description:** Trophozoites can cause tissue invasion, leading to amoebic colitis and, in severe cases, extra-intestinal amoebiasis by spreading to other organs such as the liver.

***Capillaria* spp.**

- *Type:* Nematodes (Roundworms)
- *Condition:* Capillariasis
- *Description:* These nematodes infect the intestinal tract, specifically the ceca, causing capillariasis. Infected birds may exhibit weight loss, weakness, and pale combs.

Trichuris trichiura (human whipworm)

- Type: Nematodes (whipworms)
- Condition: diarrhea, rectal prolapse
- Description: Adult worms have a distinctive whip-like shape with a long, thin anterior end and a thicker posterior end. Microscopic examination of stool samples is used to identify the characteristic barrel-shaped eggs of Trichuris trichiura.

In our experience, coccidian oocysts were commonest in hen's faeces (18.47%), followed by *Entamoeba* oocysts (15.21%), and rarely some *Giardia* oocysts and larvae of *Strongyloides* spp. Larvae (1.08 %) and trematode eggs were found. Some less pathogenic parasites, like *Entamoeba coli* (3.26%) and *Blastocystis hominis* were also found.

Fig. 1: Oocysts of Coccidia/Toxoplasma spp.

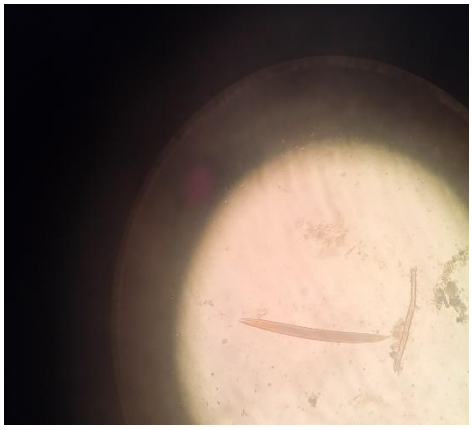

Fig. 2: larvae of Strongyloides in poultry faeces.

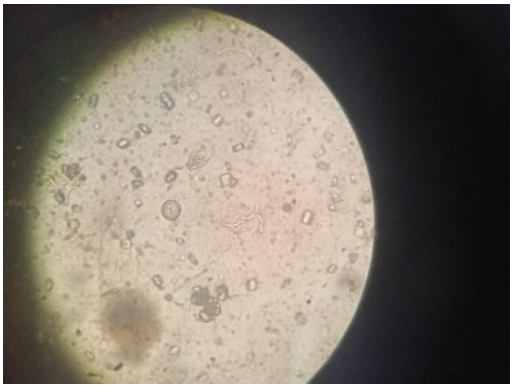

Fig. 3: Oocyst of *Entamoeba histolytica* /*E. dispar.*

DISCUSSION

Once the parasites are identified in poultry stool, appropriate treatment and control measures can be implemented. These may include the use of anthelmintic drugs, ascaricides, or other specific treatments depending on the type of parasite. Implementing preventive measures such as proper hygiene, sanitation, and vaccination can help reduce the risk of parasitic infections in poultry flocks. Regular monitoring and a proactive approach to parasite control contribute to the overall health and productivity of poultry birds. In our experience, coccidian oocysts, *Entamoeba* oocysts and rarely some Giardia oocysts and larvae of *Strongyloides* spp. Larvae and trematode eggs were found.

Effective management of gut parasites in poultry needs proper sanitation, implementing biosecurity measures, and also routine deworming activities. It is crucial for poultry farmers to work in tandem and liaison with veterinarians in order to develop a comprehensive parasite control strategy tailored to the specific needs of their flock. Regular monitoring and prompt treatment are essential for maintaining the health and productivity of poultry birds. So, keeping in view of public health security, more studies should be done in this regard. Poultry can harbour various parasites that are harmful to both the birds and humans. Identifying and isolating these parasites allow for effective disease control measures to be implemented, preventing outbreaks and minimizing economic losses in the poultry industry.

Some poultry parasites are zoonotic, meaning they can be transmitted from animals to humans. By isolating these parasites, public health authorities can take appropriate measures to prevent human infections, such as implementing proper hygiene practices and treatment protocols.

Knowledge of the types and prevalence of parasites in poultry populations helps veterinarians develop targeted treatment and prevention strategies. This includes selecting appropriate dewormers and vaccines, as well as implementing biosecurity measures to minimize parasite transmission.

Over time, parasites can develop resistance to commonly used dewormers and other control measures. Isolating parasites allows researchers to monitor for resistance development and adapt control strategies accordingly, such as rotating dewormers or developing alternative treatment methods. Parasites present in poultry faeces can contaminate the environment and potentially contaminate poultry products if proper hygiene practices are not followed. By isolating parasites, measures can be taken to reduce the risk of contamination and ensure the safety of poultry products for human consumption. These parasites present in poultry faeces, can also contaminate the soil and water and thus enter the human food chain, thus posing grave health risks and is thus s public health problem. In a study from Uttar Pradesh and Uttarakhand, out of 58 poultry farms that were tested for gastrointestinal parasites, 81.03% were positive for *Eimeria* spp., 15.52 % for *Ascaridia galli*, 3.45 % for *Hetarakis gallinarum*, 1.72 % for *Syngamus trachea*, 5.17 % for *Capillaria* spp, 1.72 % for *Raillietina* spp., 1.72 % for *Trichostrongylus tenuis*, 1.72 % for *Choanotaenia infundibulum* and 1.72 % for *Strongyloides avium*.[18] The last percentage roughly matches our study. More such studies are needed in this context, with more advanced tools also, to assess the true

burden of protozoa and STH (Soil transmitted helminths) that can be carried via poultry faeces.

CONCLUSION

In conclusion, detection of parasites from poultry faeces is important for disease control, effective veterinary management, monitoring parasite resistance, public health protection, and also maintaining food safety standards. It enables targeted interventions to minimize the impact of parasites on both poultry and human health, as well as ensuring the sustainability and profitability of the poultry industry. These are significant from a one health viewpoint.

REFERENCES

1. https://www.sciencedirect.com/science/article/abs/pii/S0167587700001252 Last accessed 02/03/24
2. Prasites-Giardia. https://www.cdc.gov/parasites/giardia/index.html#:~:text=Giardia%20is%20found%20on%20surfaces,food%2C%20surfaces%2C%20or%20objects. Last acceseed 19/02/24.
3. Worm parasites in poultry. https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/animals/diseases/guide/worm-parasites#:~:text=Birds%20become%20infected%20by%20picking,and%20the%20cycle%20starts%20again. Last accessed 19/02/24.
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7126848/ Last accessed 02/03/24
5. https://dahd.nic.in/sites/default/filess/Key%20Results%2BAnnexure%2018.10.2019.pdf
6. Jones K. E.; Patel N. G.; Levy M. A.; Storeygard A.; Balk D.; Gittleman J. L.; Daszak P. Global trends in emerging infectious diseases. *Nature.*, 2008; 451(7181): 990–993. 10.1038/nature06536. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
7. World Health Organization. *The Control of Neglected Zoonotic Diseases: A Route to Poverty Alleviation: Report of a Joint WHO/DFID-AHP Meeting*; WHO: Geneva, Switzerland, 2006. [Google Scholar]
8. Nahed A, Abd El-Hack ME, Albaqami NM, Khafaga AF, Taha AE, Swelum AA, et al. Phytochemical control of poultry coccidiosis: A review. Poult Sci., 2022; 101(1): 101542.
9. Berto BP, Lopes CW. Coccidia of wild birds as ecological biomarkers: Some approaches on parasite-host-environment interaction. J Parasit, 2020; 106(5): 707-713.
10. Fatoba AJ, Adeleke MA. Diagnosis and control of chicken coccidiosis: A recent update. J Parasit Dis., 2018; 42: 483-493.
11. López-Osorio S, Chaparro-Gutiérrez JJ, Gómez-Osorio LM. Overview of poultry Eimeria life cycle and host-parasite interactions. Front Vet Sci., 2020; 7: 384.
12. Biard C, Monceau K, Teixeira M, Motreuil S, Bettencourt-Amarante S, Develay L, et al. Coccidial oocyst release: once a day or all day long? Tropical bird hosts shed new light on the adaptive significance of diurnal periodicity in parasite output. Parasit, 2022; 149(4): 469-481.
13. Abdisa T, Hasen R, Tagesu T, Regea G, Tadese G. Poultry coccidiosis and its prevention, control. J Adv Vet Anim Res., 2019; 1(1): 1.
14. Asfaw Y, Ameni G, Medhin G, Alemayehu G, Wieland B. Infectious and parasitic diseases of poultry in Ethiopia: A systematic review and meta-analysis. Poult Sci., 2019; 98(12): 6452-6462.
15. Abebe E, Gugsa G. A review on poultry coccidiosis. Abyssinia J Sci Technol, 2018; 3(1): 1-2.
16. .Nahed A, Abd El-Hack ME, Albaqami NM, Khafaga AF, Taha AE, Swelum AA, et al. Phytochemical control of poultry coccidiosis: A review. Poult Sci., 2022; 101(1): 101542.
17. Jatau ID, Sulaiman NH, Musa IW, Lawal AI, Okubanjo OO, Magaji Y, et al. Prevalence of coccidia infection and preponderance Eimeria species in free range indigenous and intensively managed exotic chickens during hot-wet season, in Zaria, Nigeria. Asian J Poult Sci., 2012; 6(3): 79-88.
18. Kumar S, Garg R, Ram H, Maurya PS, Banerjee PS. Gastrointestinal parasitic infections in chickens of upper gangetic plains of India with special reference to poultry coccidiosis. J Parasit Dis., Mar., 2015; 39(1): 22-6. doi: 10.1007/s12639-013-0273-x. Epub 2013 Mar 9. PMID: 25698854; PMCID: PMC4328009.