ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 11, pp.60293-60299, November, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EPIDEMIOLOGY OF CESTODE PARASITES IN DOMESTIC FOWL (*GALLUS GALLUS DOMESTICUS*) OF KASHMIR VALLEY WITH ANNUAL, SEASONAL, SEX BASED, AND WEIGHT BASED PREVALENCE

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ARTICLE INFO

Article History:
Received 22nd August, 2017
Received in revised form
29th September, 2017
Accepted 16th October, 2017
Published online 30th November, 2017

Key words:
Epidemology,
Intensity,
Prevalence.

ABSTRACT

For epidemiological studies of cestode parasites in domestic fowl hosts were collected from six sites from north and south zone of kashmir valley for the period of 24 months from March 2012 to Feb. 2014 for estimation of mean parasitic load, mean prevalence of Cestodes along with seasonal variation, variation with weight, and variation with sex. During the study 576 hosts were examined for cestode parasites and prevalence rate was found to be 61.63% (355/576) with mean intensity load of 43.46 per infected host. The species found were *R.tetragona* (38.27%), *R.cesticellus* (20.82%), *R.echinobothrida* (28.07%), *C.infundibulum* (15.12%), *A.cuneata* (9.27%), *D.proglottina* (10.4%). The highest prevalence was found to be in summer (74.30%) followed by autumn (70.13%) followed by spring (54.86%) followed by winter (47.22%). Prevalence rate was found to be higher in females (69.09%) than in males (53.81%). Infection was found more in growers (77.44%) then in adults (43.77%).

Citation: Suhail Rashid, Syed Tanveer and Shazia Ahad, 2017. "Epidemiology of cestode parasites in domestic fowl (*Gallus gallus domesticus*) of Kashmir valley with annual, seasonal, sex based, and weight based prevalence", *International Journal of Current Research*, 9, (11), 60293-60299.

INTRODUCTION

Gallus gallus is believed to have descended from the wild Indian and South East Asian red jungle fowl (Permin and Ranvig, 2001). In India poultry farming under backyard system is as old as its civilization. Large number of terracotta have been discovered from Mohenzo-daro and Harappa, which indicated that, the people domesticated number of birds and the domestic fowl (*Gallus gallus domesticus*) originated in India and its ancestor's, the red jungle fowl (*Gallus gallus*) is still found in Northern India from Kashmir to Assam and in Madhya Pradesh, West Bengal, Orissa, Visakhapatnam and parts of Godavari district of Andhra Pradesh. Indus valley people kept the fowl only for sports, and that its breeding for flesh occurred later (Randhawa, 1946). They were domesticated in India about 2000 BC and introduced to Japan via Korea about 300 BC-300AD. The Iron Age was the main period for dispersion of chickens throughout Europe, derived from China via Russia (West and Zhou, 1989). Both exotic or local breed of the domestic fowl, *Gallus gallus domesticus*, s is reared by rural and urban house holders who use their eggs and meat as source of animal protein, farm manure and income (Kekeocha, 1984; Frantovo, 2000). In most of the developing countries, indigenous poultry genotypes constitute between 80 to 99 percent of the total poultry populations that are kept in villages (Sonaiya and Swan, 2004). Backyard poultry farming is possible only due to hardy nature of the fowl as characterised by its marked physiological adaptability to wide and different agro-climatic environments (Goi, 1976). The domestic chicken (Gallus gallus domesticus) is widely reared traditionally in the tropics (Hodasi, 1979; Permin and Hansen, 1998). Backyard poultry contributes to nearly 30% of Indian egg production (Singh *et al*., 2009). At the same time, it provides excellent opportunity for gainful employment to idle or unemployed members of rural communities. Further, the meat and eggs of backyard poultry are more highly valued than that of industrially produced birds due of its comparatively superior taste and texture. It is considered equivalent to 'organic' chicken in Western Europe, as characterised by its low fat content than commercial bird meat. However, poultry reared under backyard system have poor productivity and have low economic returns due to inefficient local marketing and inappropriate health care practices (Singh and Pani, 1986; Saha, 2003). A lot of losses in poultry have been linked to disease causing agents such as viruses, bacteria and parasites. It has been estimated that more than 750 million chickens, guinea fowls and ducklings in Africa die each year as a result of various infections (Sonaiya, 1990). Infection with intestinal worms have been estimated to cause production losses in the range of 10 to 20% due to impaired feed conversion, reduced growth and egg production, and increased mortality (Seddiek *et al*., 2007). Gut of domestic fowl is a safe heaven for many cestode parasites, but the tapeworms belonging to the genus Raillietina are the most prevalent avian

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helminth parasites throughout the world. R. echinobothrida (Mégnin, 1880) is the most important species in terms of prevalence and pathogenicity, particularly in the domestic fowl, Gallus domesticus Linnaeus, 1758 (Permin and Hansen, 2003). The organic or traditional system of poultry rearing in Kashmir often suffers heavy production losses, impaired health and mortality due to infections, infestations and production losses, impaired health and mortality due to infections, infestations and predation (Hassouni and Belghyti, 2006).

MATERIALS AND METHODS

Methodology involves series of steps such as selection of sampling sites, collection of samples (fowl), dissection of samples collected, collection of parasites from infective hosts, processing of parasites collected for counting and identification. In present work total six collection sites were selected in Kashmir valley in which three sites were selected from north zone and three from south zone. The sites included district Kupwara, Bandipora and Baramulla from north Kashmir and district Budgam, Pulwama, and Ananthnag from south Kashmir. Every month four hosts (fowl), two male and two female, were collected from each of the above mentioned site. Weight of the host, temperature, humadity, and altitude of the site was recorded. The hosts were carried to parasitology lab, dept of Zoology were it was desected in a desection tray for further studies. The viscera was collected. Blood samples were also collected for haematological observations. The visceral organs were examined for parasites first by naked eye followed by microscopic examinations. The gastrointestinal tract was subjected to routine examination for collection of gastrointestinal parasites, according to the procedure as described by Fowler (1990). The parasites recovered were collected in a petrydish containing saline water. Cestodes, nematodes and trematodes were separated from each other counted recorded and processed for identification.

RESULTS

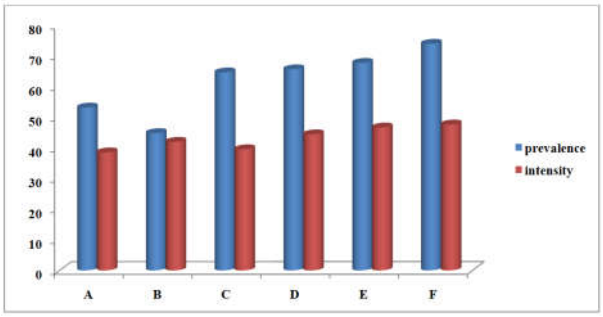
The results found during the study are presented in following tables. Species wise prevalence of cestode parasites of fowl for year 2012-2013 and 2013- 2014.

The species found were *R.tetragona* (38.27%), *R.cesticellus* (20.82%), *R.echinobothrida* (28.07%), *C.infundibulum* (15.12%), *A.cuneata* (9.27%), *D.proglottina* (10.4%).

Mean prevalence and intensity of cestode parasites of fowl for year 2012-2013 and 2013-2014

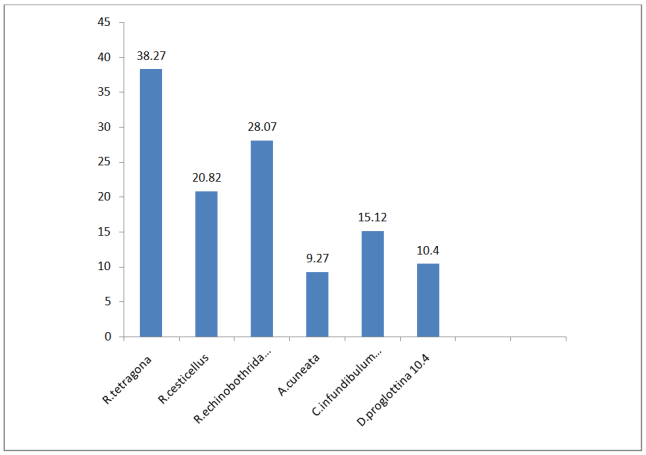
Name of the Site	No. of hosts examined	No. of infective hosts	Prevalence (%)	Total no. of Parasites recovered	Intensity
SiteA (Kupwara)	96	51	53.12	1968	38.50
Site B (Bandipora)	96	43	44.79	1804	41.95
Site C (Baramullah)	96	62	64.58	2450	39.51
Site D (Budgam)	96	63	65.62	2797	44.39
Site E (Pulwama)	96	65	67.70	3031	46.63
Site F (Ananathnag)	96	71	73.95	3381	47.61
Total	576	355	61.63	15431	43.46

The mean average prevalence for the above said period was found to be 61.63%. Site F (73.95%) shows highest infection rate followed by site E (67.70%) followed by site D (65.62%) followed by site C (64.58%) followed by site A (53.12%) followed by site B (44.79%). The mean intensity for the above said period was found to be 43.46. The site F (47.61) shows highest intensity followed by site E (46.63) followed by site D (44.39) followed by site B (41.95) followed by site C (39.51) followed by site A (38.50).



Graph showing mean prevalence and intensity of cestode parasites of fowl for years 2012-2013 and 2013-2014

Name of the species	Prevalence for year 2012-2013	Prevalence for year 2013-2014	Mean prevalence
R.tetragona	72/184=39.13	64/171=37.42	38.27
R.cesticellus	39/184=21.19	35/171=20.46	20.82
R.echinobothrida	55/184=29.89	48/171=28.07	28.07
A.cuneata	18/184=9.78	15/171=8.77	9.27
C.infundibulum	32/184=17.39	22/171=12.86	15.12
D.proglottina	20/184=10.86	17/171=9.94	10.4

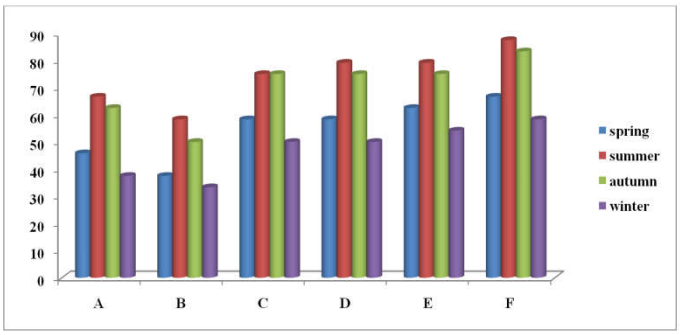


Graph showing prevalence of cestode species in fowl

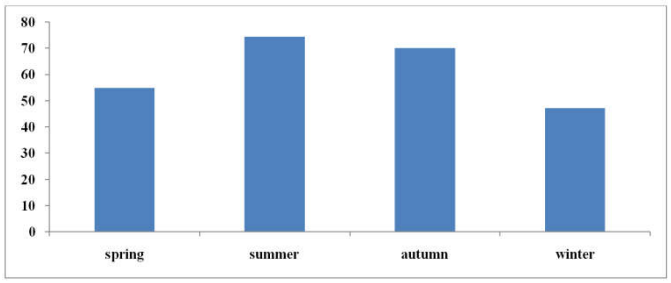
Mean seasonal prevalence of cestode parasites of fowl for year 2012-2013 and 2013-2014

Site	Spring			Summer			Autumn			Winter		
	Total Hosts	Inf.	Prev.	Total Hosts			Total Hosts	Inf.	Prev.	Total Hosts		
SiteA (Kupwara)	24	11	45.83	24	16	66.66	24	15	62.5	24	9	37.5
Site B (Bandipora)	24	9	37.5	24	14	58.33	24	12	50	24	8	33.33
Site C (Baramullah)	24	14	58.33	24	18	75	24	18	75	24	12	50
Site D (Budgam)	24	14	58.33	24	19	79.16	24	18	75	24	12	50
Site E (Pulwama)	24	15	62.5	24	19	79.16	24	18	75	24	13	54.16
Site F (Ananathnag)	24	16	66.66	24	21	87.5	24	20	83.33	24	14	58.33
Total	144	79	54.86	144	107	74.30	144	101	70.13	144	68	47.22

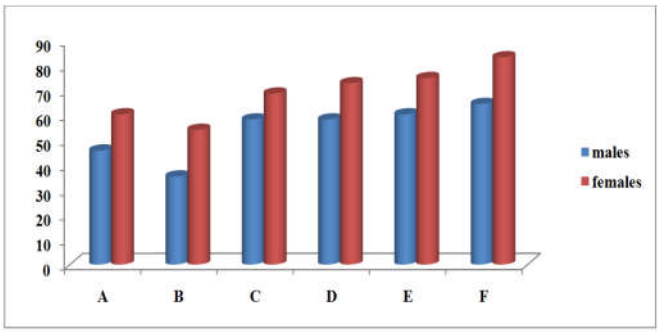
Highest prevalence was seen in summer (74.30%) followed by autumn (70.13%) followed by spring (54.86) followed by winter (47.22%).



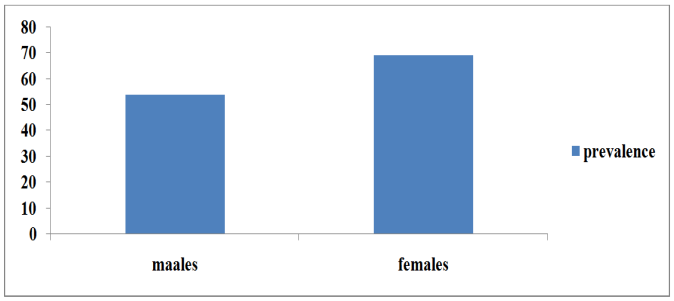
Graph showing mean seasonal prevalence of cestode parasites of fowl for all the above mentioned sites for year 2012-2013 and 2013-2014



Graph showing mean seasonal prevalence of cestode parasites of fowl for the year 2012-2013 and 2013-2014



Graph showing mean sex based prevalence of cestode parasites of fowl for all the above mentioned sites for year 2012-2013 and 2013-2014



Graph showing mean sex based prevalence of cestode parasites of fowl for year 2012-2013 and 2013-2014

Mean sex based prevalence of cestode parasites of fowl for year 2012-2013 and 2013-2014

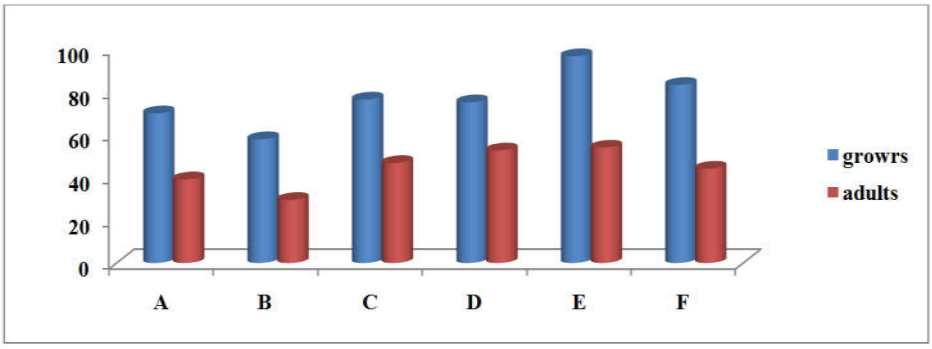
Site	Males			Females		
	Examined	Infected		Examined	Infected	
SiteA (Kupwara)	48	22	45.83	48	29	60.41
Site B (Bandipora)	48	17	35.41	48	26	54.16
Site C (Baramullah)	48	28	58.33	48	33	68.75
Site D (Budgam)	48	28	58.33	48	35	72.92
Site E (Pulwama)	48	29	60.41	48	36	75
Site F (Ananathnag)	48	31	64.58	48	40	83.33
Total	288	155	53.81	288	199	69.09

Males (53.81%) showed lower prevalence then females (69.09).

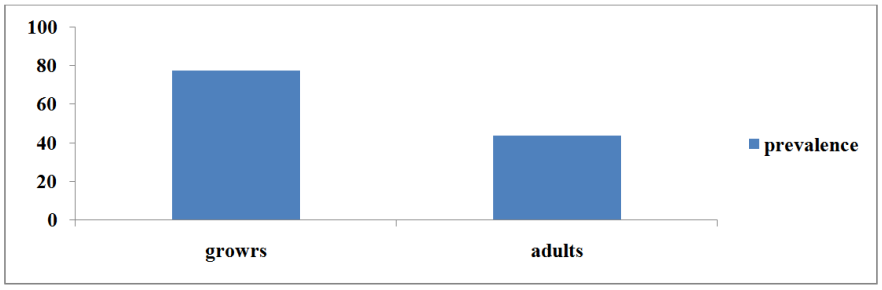
Prevalence in growers and adults (weight based prevalence) for the year 2012-2013 and 2013-2014

Site	Growers			Adults		
	Examined	Infected	Prevalence	Examined	Infected	Prevalence
SiteA (Kupwara)	49	34	69.38	41	16	39.02
Site B (Bandipora)	45	26	57.77	51	15	29.41
Site C (Baramullah)	59	45	76.27	37	18	46.64
Site D (Budgam)	56	42	75	40	21	52.5
Site E (Pulwama)	57	55	96.49	39	21	53.84
Site F (Ananathnag)	71	59	83.09	25	11	44
Total	337	261	77.44	233	102	43.77

Growers (77.44%) showed more prevalence than adults (43.77%).



Graph showing prevalence of cestode parasites in growers and adults for all the six sites for years 2012-2013 and 2013-2014



Graph showing prevalence of cestode parasites in growers and adults for years 2012-2013 and 2013-2014

DISCUSSION

The prevalence of poultry parasites in Kashmir have not been studied extensively. The few studies carried out have documented high prevalence rates for helminth parasites (Fotedar and Khateeb, 1986; Pandit *et al*., 1991; Ganaie *et al*., 2004). However Salam *et al.* (2010) have surveyed prevalence of R.cestcillus in Kashmir valley and found that 23.22% (111/478) of the chicken were infected with R. cesticillus either singly or in association with other parasites - Amoebotaenia sphenoides, Raillietina tetragona and Choanotaenia infundibulum. Bali and Katra (1975) have reported 28% of helminth infection rate in Kashmir. In The present study the mean average infection rate was found to be 61.63%. The difference from the previous studies which have documented either high or low infection rate then present study could have been due variations in sampling areas and different periods of study. However the decrease in the overall prevalence in present study may not be unconnected to the general improvement in sanitary habit, which makes the environment less conducive for the parasites and their intermediate hosts. The level of information now available to some farmers has also contributed to the proper management of the farms. The growing awareness of the essence of good sanitation habit in the farm and the environment has increased awareness on the need for regular deworming of the birds and this may also have contributed to the low level of infections observed in this study. The mean average infection rate was found low as compared to tropical areas which might be due to cold climate and different geography of the valley as compared to tropical areas which are characterised by dry and hot average weather. Many authors have reported prevalence of Cestodes from tropical parts with report of 89.9% in Morocco (Hassouni and Pandy, 1989) and 91.01% in Ethiopia (Eshetu *et al*., 2001) and (86.32%) of Cestodes and (75.79%) of nematodes in Ethiopia (Ashenafi and Eshetu, 2004) 100% in Zimbabwe (Phiri *et al*., 2007), 83% in Ethopia (Hussen *et al* 2012),72% jammu, N.W. India (Kotach *et al*., 2012), 90% recorded by Fabiyi (1972) in Nigeria, 92% by Gadzama and Strivastava (1986) from Borono, 100% by Okon and Enyenihi (1980) Nigeria and 95.2% by Fatihu *et al*. (1991) from Zaria

76.1% by Ogbaje *et al.* (2012) from Makurdi, 90.2% by Shukla and Mishra2013 from tribal areas OF MP India.

The cestodes use intermediate hosts such as beetles, ants, snails etc to complete their life cycle. The contamination of host by parasite depends on the encounter of intermediate host with that of definitive host. Thus the chances of transmission of cestode infection to definitive host depends on the availability and abundance of intermediate host. As in case of cestode parasites the intermediate hosts are insects and molluscs which are invertebrates and characterized by cold-bloodedness which restricts their distribution to warm areas and warm seasons of the cold areas. Kashmir being a temperate zone is characterized by long and cold winter. The other seasons of the valley are also not too hot to favour abundance of intermediate host populations. The other reason for low infection rate may be the scavenging type of model adopted by the fowl breeders in Kashmir valley which is quite different from tropics. In Kashmir valley the chicken are reared mostly in villages which are characterized by agro economy. The staple crop includes rice and maize. The cultivation is done only in worm months. During winter there is almost no agriculture. The chicken usually feed on left over grains after the harvest during the wormer months. During the winter the chicken are usually kept indoors in cages and fed with stored grains. This results less chances of chicken being fed on organic food which included small insects and other micro organisms. Also there is not that much of free land in valley in the form of pastures as there is in tropics. The use of pestsides and insectsides by formers also eliminates vast populations of insects including ants and beetles. Yoriyo *et al*. (2008) further support the observation that parasites are most predominant in tropical countries due to the climatic and environmental conditions prevailing there which favour helminth growth. However survey of cestodiasis reported from some temperate parts document more are less similar prevalence rates to present study. Jataoi *et al*. 2013 have reported 60.77% prevalence rate of Cestodes in domestic fowl from taluka Dokri Pakistan. Simillar results had met by Anwar *et al*., (1989) who reported 66.8% and Bano *et al*. (1989) who reported that poultry birds are heavily infested with cestodes ranging 75 percent.

There was evident seasonal variation in parasitic load and prevalence. The summer being worm was characterised by highest prevalence followed by autumn then spring. The lowest prevalence was observed in winter during which whole valley remains snow clad. During summer the fields are grown with crops and chicken are not allowed to feed in fields. This led chicken to depend on organic food as a result there are more encounters between the definitive and intermediate host which led to increased rate of infection rate during summer months. During autumn the crop is harvested and chicken are freed in fields to feed on left over grains after the harvest which may be the cause for decreased rate of infection during autumn months. In winter the valey remains snow clad and the chicken are fed indoors which may be the cause for lowest infecton rate during winter. In spring the chicken are again freed in fields which feed on mixed diet of grains and organic food. This may be the cause for increased rate of infection rate during spring over winter. Thus the parasite was found to be prevalent throughout the year with higher prevalence, as well as parasitic load, during late summer to mid autumn, when temperature and humidity were comparatively higher. Similar findings have been reported by other workers from this area (Fotedar and Khateeb, 1986; Pandit *et al*., and from other area (Hassouni and Belghyti, 2006; Abdelqader *et al*., 2008). High ambient temperature and high relative humidity may favor infection by lowering the birds' ambient temperature and high relative humidity may favor infection by lowering the birds' resistance, whereas lower temperatures during the winter causes arrested development of parasites in hosts and the environment. The increased availability of intermediate hosts parasites in hosts and the environment. The increased availability of intermediate hosts in the rainy season for the completion of the life cycles of parasites may also be one in the rainy season for the completion of the life cycles of parasites may also be one important factor responsible for the high rate of infection during the summer months. The most heavily infected segment of the intestine was the lower small intestine followed by the duodenum. The least populated segment was the rectum. Our results are compared with those of Onyirioha (2011) and Yousfi *et al*. (2013), who had carried out a similar study in India and Medjouel and Benakhla (2013) who had carried similar work in NW Algeria. The reason for higher load of parasites in lower small intestine may be the availability of semi digested and digested food in rich quantity, availability of amino acids, mono saccharides, vitamins, minerals. The parasite absorbs food through osmotrophy which could be best accomplished in small lower part of intestine as the latter provides favourable environment with increased concentration of monomers of food which are easily absorbed by Cestodes through their selectively permeable general body surface. The Ph in lower part of intestine is nearly neutral or slightly alkaline which favours the survival of the parasite. Earlier report (Smyth, 1976) suggests that the preference for the small intestine by these parasites is to complement their physiological osmotic feeding nature where nutrients exist in dissolved form. The female hosts were more infected then male hosts .This might be due to increased immunity of males for cestode infection then that of females in and influence of male and female sex hormones on the parasite. The above finding is similar to that of Shukla and Mishra (2013), Uhuo *et al* (2013) who have found preference in respect to sex as females harbored more parasites than males. Female birds are known to be more voracious in their feeding habits especially during egg production than the males which remain largely selective (Sonaiya, 1990, Matur *et al*., 2010).

The number of parasites recovered from individual birds varied from zero to 200. Yazwinski (2013) have also reported Helminth counts for individual birds ranged from zero to a maximum of 3,240, 1,280, 940, and 445 for H. gallinarum, C. obsignata, A. galli, and R. cesticillus, respectively. The adult hosts with larger weight and healthier built had less infection rate then growers with less weight and weak built. This might be again due to increased immunity offered by healthier hosts against cestode infection. The results are in agreement with Magwisha *et al* (2002) who conducted a research work on the prevalence of cestode infection in growers and adult rural free-range chickens in Morogoro, Tanzania and found higher infection rate in growers then adults. Most of the infective hosts were infected by only one cestode species. This may be due immunity provided by one species against other species. The most dominant species of Cestodes encountered was R. tetragona. This is in agreement with T.Salam (2015) who studied prevalence of cestode parasites in semi scavenging domestic fowl in Kashmir and found R.tetragona the most dominant species in infected hosts. Ghebremariam (2011) have reported R.tetragona as dominant species of fowl with 82.35%

prevalence rate North-East Africa. The high prevalence of Raillietina spp. could be attributed to the wide spread and accessibility of intermediate hosts (dung beetles, ants) to the free-range back yard chickens. Dung beetles and ants were very commonly observed in study area (Hossein *et al*., 2012).

The north zone of Kashmir showed less infection rate as compared to south zone of Kashmir. This again may be due to marked variation in temperature and humidity along with geography between the two zones of Kashmir. The south zone shows increased temperature and humidity then that of north zone. Also winter is more lengthy in northzone as compared to south zone. This is in agreement with Sheikh *et al*. (2015) who conducted a survey of helminths in domestic fowl of Gurez valley of north kashmir and found infection rate to be 40.2 %.

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