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STUDIES ON PARASITE INFECTION AMONG RUMINANTS IN HYOGO PREFECTURE

Shige KIMURA

During a period from 1956 to 1964, an extensive survey was made of endoparasites harbored by the ruminants species in the southern and northern regions of Hyogo Prefecture[1~7].

This paper deals with the results of fecal tests on parasite eggs and rates of infection among cattle, sheep, and goats kept in Taki, Hikami, Mikata, and Tsuna Counties of the prefecture.

Materials and Methods

In this experiment, 467 cattle, 178 sheep, and 172 goats were used.

Fecal specimens were examined immediately or within 1 day after collected by the water-smear of WATANABE. Dilutions of materials were made by the antiformin-ether of YAOITA in most of the specimens of formed feces.

Results and Discussion

Rate of parasite infection among cattle in Taki County.

Fecal egg tests and determination of infection rate were carried out on specimens collected from 271 Japanese native oxen and 29 Holstein-Friesian cattl in Taki County during a five-month period from March to July, 1960.

The number of species which appeared in the fecal specimens examined was rather limited, being only nine (Table 1). The rate of apperance of *Paramphistomum sp.* was the highest, amounting to 89.7 per cent, on the average, of the total eggs in a specimen. It was followed by that of *Oesophagostoma radiatum*, averaging 40.3 per cent. The other species are listed in the decreasing order of this rate as follows: *Haemonchus contortus*, 29.3 per cent; *Bunostomum phlebotomum*, 20.7 per cent; *Fasciola hepatica*, 18.0 per cent; *Cooperia sp.*, 9.7 per cent; *Trichuris ovis*, 3.3 per cent; *Eimeria sp.*, 3.3 per cent; *Strongyloides papillosus*, 1.3 per cent; and *Ascaris vitulorum* 1.0 per cent.

The relation ship between age and parasite infection in cattle is summarized in Table 2. *Fasciola hepatica* or *Paramphistomum sp.* revealed a high infection rate among adult cattle, but *Cooperia sp.* or *Eimeria sp.* did among young ones. *Oesophagostoma radiatum*, *Haemonchus contortus*, *Bunostomum phlebotomum*, *Trichuris ovis*, *Strongyloides papillosus*, and *Ascaris vitulorum* showed a wide range of distribution of infection from young to adult.

Rate of parasite infection among cattle in Tsuna County.

Fecal egg tests and determination of infection rate were performed on specimens collected from 62 Japa-

Table 1. Infection rate of each species of Parasite among cattle in Taki County

Locality	No. Exam.	*Paramphistomum sp.*	*Oesophagostoma radiatum*	*Haemonchus contortus*	*Bunostomum phlebotomum*	*Fasciola hepatica*	*Cooperia sp.*	*Trichuris ovis*	*Eimeria sp.*	*Strongyloides papillosus*	*Ascaris vitulorum*
Okano	100	86 (86.0)	31 (31.0)	35 (35.0)	6 (6.0)	19 (19.0)	9 (9.0)	2 (2.0)	4 (4.0)	3 (3.0)	1 (1.0)
Johoku	100	90 (90.0)	54 (54.0)	32 (32.0)	18 (18.0)	15 (15.0)	16 (16.0)	3 (3.0)	5 (5.0)	1 (1.0)	1 (1.0)
Jonan	100	93 (93.0)	36 (36.0)	21 (21.0)	38 (38.0)	20 (20.0)	4 (4.0)	5 (5.0)	1 (1.0)		1 (1.0)
Total	300	269 (89.7)	121 (40.3)	88 (29.3)	62 (20.7)	54 (18.0)	29 (9.7)	10 (3.3)	10 (3.3)	4 (1.3)	3 (1.0)

Table 2. Infection rate in age of cattle in Taki County

Age	1	2	3	4	5	6	7	8
No. Exam.	35	39	40	109	36	33	5	3
Paramphistomum sp.	23 (65.7)	37 (94.9)	35 (87.5)	98 (88.9)	36 (100)	32 (97.0)	5 (100)	3 (100)
Oesophagostoma radiatum	16 (45.7)	19 (48.7)	11 (27.5)	46 (42.2)	13 (36.1)	13 (39.4)	2 (40.0)	1 (33.3)
Haemonchus contortus	10 (28.6)	10 (25.6)	12 (30.0)	32 (29.4)	9 (25.0)	13 (39.4)	1 (20.0)	1 (33.3)
Bunostomum phlebotomum	9 (25.7)	6 (15.4)	3 (7.5)	27 (24.7)	12 (33.3)	3 (9.1)	2 (40.0)	
Fasciola hepatica	3 (8.6)	9 (23.1)	3 (7.5)	19 (17.4)	7 (19.4)	11 (33.3)	2 (40.0)	
Cooperia sp.	4 (11.4)	6 (15.4)	5 (12.5)	9 (8.3)	3 (8.3)	2 (6.1)		
Trichuris ovis		2 (5.1)			1 (2.8)	1 (3.0)		
Eimeria sp.	1 (2.9)	3 (7.7)	1 (2.6)	2 (1.9)		3 (9.1)		
Strongyloides papillosus		2 (6.1)			1 (2.8)	1 (3.0)		
Ascaris vitulorum	1 (2.9)			1 (0.9)		1 (3.0)		

Table 3. Infection rate of each species of parasite among cattle in Tsuna County

Locality	No. Exam.	*Fasciola hepatica*	*Paramphistomum sp.*	*Oesophagostoma radiatum*	*Haemonchus contortus*	*Bunostomum phlebotomum*	*Eimeria sp.*
Tani	35	14 (40.0)	16 (45.7)	6 (17.1)	5 (14.3)		1 (2.9)
Kusumoto	36	12 (33.3)	16 (44.4)	5 (13.9)	1 (2.8)	2 (5.6)	
Total	71	26 (36.6)	32 (45.1)	11 (15.5)	6 (8.5)	2 (2.8)	1 (1.4)

Table 4. Infection rate of each species of parasite among cattle in Mikata County

Locality	No. Exam.	*Paramphistomum sp.*	*Fasciola hepatica*	*Oesophagostoma radiatum*	*Cooperia sp.*	*Haemonchus contortus*	*Dictyocaulus viviparus*	*Bunostomum phlebotomum*	*Ascaris vitulorum*	*Trichostrongylus colubriformis*
Nakatsuchi	96	63 (65.6)	37 (38.5)	9 (9.4)	4 (4.2)	3 (3.1)	2 (2.1)	1 (1.0)	1 (1.0)	1 (1.0)

Table 5. Infection rate of each species of parasite among sheep in Taki County

Locality	No. Exam.	*Haemonchus contortus*	*Paramphistomum sp.*	*Oesophagostoma columbianum*	*Bunostomum trigonocephalum*	*Cooperia sp.*	*Trichuris ovis*	*Fasciola hepatica*	*Strongyloides papillosus*	*Ostertagia circumcincta*
Fukusumi	23	19 (82.9)	10 (43.5)	8 (34.8)	4 (17.4)	1 (4.3)	2 (8.1)	1 (4.3)		
Hioki	1	1 (100)	1 (100)					1 (100)		
Kumobe	4	1 (25.0)							1 (25.0)	
Jonan	8	7 (87.5)	4 (50.0)	1 (12.5)			1 (12.5)			
Johoku	8	7 (87.5)	1 (12.5)	6 (75.0)	2 (25.0)	3 (35.8)	2 (25.0)		1 (12.5)	
Okano	13	5 (37.5)	4 (30.8)	7 (53.9)	3 (23.1)	4 (30.0)	1 (7.7)	2 (15.4)	2 (15.4)	1 (7.7)
Kitakoti	3	2 (66.7)	1 (33.3)	1 (33.3)						
Ajima	1							1 (100)		
Oyama	19	12 (63.2)	7 (36.8)	4 (21.1)			1 (5.3)	1 (5.3)	1 (5.3)	
Total	80	54 (67.5)	28 (35.0)	27 (33.8)	9 (11.3)	8 (10.0)	7 (8.8)	6 (7.5)	5 (6.3)	1 (1.3)

nese native oxen and 9 Holstein-Friesian cattle in Tsuna County during one-month period extending from January to February, 1963.

The eggs detected from the fecal specimens examined were found to represent six species (Table 3). Of them, the most frequently occurring was *Paramphistomum sp.*, which accounted for 45.1 per cent of the egg contained in a specimen. It was followed by *Fasciola hepatica*, which accounted for 36.6 per cent, *Oesophagostoma, radiatum*, 15.5 per cent; *Haemonchus contortus*, 8.5 per cent; *Bunostoma phlebotomum*, 2.8 per cent; and *Eimeria sp.*, 1.4 per cent.

No clear correlation was generally observed between the infection rate and such factors as animal species and age. In this county, however, the most important species was *Fasciola hepatica* which showed a high rate of infection of 33.3 to 40.0 per cent. Those infected with *Fasciola hepatica* were relatively old.

Rate of parasite infection among cattle in Mikata County.

Fecal egg tests and determination of infection rate were conducted on specimens collected from 96 Japanese native oxen in Mikata County during a one-month period extending from March to April, 1964.

The number and species of parasite recovered from the cattle examined are presented in Table 4. These species are given below in the decreasing order of infection rate: *Paramphistomum sp.*, 65.6 per cent; *Fasciola hepatica*, 38.5 per cent; *Oesophagostoma radiatum*, 9.4 per cent; *Cooperia sp.*, 4.2 per cent; *Haemonchus contortus*, 3.1 per cent; *Dictyocaulus vitiparus*, 2.1 per cent; *Bunostomum phlebotomum*, 1.0 per cent; *Ascaris vitulorum*, 1.0 per cent; and *Tricostrongylus colubriformis*, 1.0 per cent.

Cattle infected with *Fasciola hepatica* were examined for age distribution. It was remarkable that the infection rate increased with the advance in age up to the adult stage, and that it was more than 40 per cent in any group of more than 6 years of age.

Rate of parasite infection among sheep and goats in Taki County.

Fecal egg tests and determination of infection rate were carried out on specimens collected from 80 sheep and 120 goats in Taki County during a seven-month period from March to September, 1956.

Table 5 shows the parasite infection rate among the sheep. Parasites were detected with the infection rates following: *Haemonchus contortus*, 67.5 per cent; *Paramphistomum sp.*, 35.0 per cent; *Oesophagostoma colubianum*, 33.8 per cent; *Bunostomum trigonocephalum*, 11.3 per cent; *Cooperia sp.*, 10.0 per cent; *Trichuris ovis*, 8.8 per cent; *Fasciola hepatica*, 7.5

Table 6. Infection rate of each species of parasite among goats in Taki County

Locality	No. Exam.	*Haemonchus contortus*	*Oesophagostoma columbianum*	*Bunostomum trigonocephalum*	*Oesophagostoma venulosum*	*Paramphistomum sp.*	*Cooperia sp.*	*Strongyloides papillosus*	*Fasciola hepatica*	*Trichuris ovis*	*Ostertagia circumcincta*	*Eimeria sp.*
Fukusumi	16	16 (100)	3 (18.7)	4 (25.0)	6 (37.5)	10 (62.5)		2 (12.5)	2 (12.5)			
Murakumo	1	1 (100)			1 (100)		1 (100)					1 (100)
Hioki	22	21 (95.5)	13 (59.1)	11 (60.0)	4 (18.2)	15 (68.2)	3 (13.6)	4 (18.2)	8 (36.4)	1 (4.4)	2 (9.1)	1 (4.6)
Kumobe	2	2 (100)	2 (100)	1 (50.0)								
Yakami	5	4 (80.0)	3 (60.0)	3 (60.0)	2 (40.0)		1 (20.0)	2 (40.0)				
Jonan	3	3 (100)			1 (33.3)		1 (33.3)	1 (33.3)				
Johoku	12	12 (100)	9 (75.0)	8 (66.7)	4 (33.3)	3 (25.0)	9 (75.0)	5 (41.6)	2 (16.7)	1 (8.3)		
Okono	10	8 (80.0)	1 (10.0)	4 (40.0)	8 (80.0)		8 (80.0)					2 (20.0)
Minamikoti	11	11 (100)	7 (63.6)	7 (63.6)	8 (72.7)	1 (9.1)	5 (45.5)	3 (27.3)	2 (18.2)	1 (9.1)	2 (18.2)	
Kitakoti	8	8 (100)	5 (62.5)	4 (50.0)	2 (25.0)	1 (12.5)		1 (12.5)	1 (12.5)	2 (25.2)		
Ajima	14	11 (78.6)	6 (42.9)	3 (21.4)	5 (35.7)	5 (35.7)	2 (14.3)	3 (21.4)	4 (28.6)			
Oyama	16	16 (100)	8 (50.0)	4 (25.0)	6 (37.5)	7 (43.8)	3 (18.8)	1 (6.3)		1 (6.3)	1 (6.3)	
Total	120	113 (94.2)	57 (47.5)	49 (40.8)	47 (39.2)	43 (35.8)	30 (27.5)	22 (18.3)	19 (15.8)	6 (5.0)	5 (4.2)	4 (3.3)

Table 7. Infection rate in age of sheep in Taki County

Age	2	3	4	5	6	7	8
No. Exam.	18	12	13	23	5	6	3
Haemonchus contortus	14 (77.7)	9 (75.0)	10 (76.9)	17 (79.3)	3 (60.0)	1 (33.3)	
Paramphistomum sp.	4 (22.2)	4 (33.3)	3 (23.1)	11 (47.8)	3 (60.0)	2 (33.3)	1 (33.3)
Oesophagostoma columbianum	7 (38.9)	6 (50.0)	3 (15.4)	8 (34.8)	3 (60.0)		1 (33.3)
Bunostomum trigonocephalum	2 (11.1)	1 (8.3)	1 (7.7)	1 (4.4)	4 (80.0)		
Cooperia sp.	3 (16.7)	2 (16.7)	1 (7.7)		1 (20.0)		1 (33.3)
Trichuris ovis	1 (5.6)		1 (7.7)	5 (21.7)			
Fasciola hepatica	2 (11.1)	1 (7.7)	1 (7.7)			2 (33.3)	
Strongyloides papillosus	1 (5.6)	3 (25.0)			1 (20.0)		
Ostertagia circumcincta		1 (8.3)					

Table 8. Infection rate in age of goats in Taki County

Age	2	3	4	5	6
No. Exam.	40	32	25	18	5
Haemonchus contortus	39 (97.5)	29 (90.6)	22 (88.0)	18 (100)	5 (100)
Oesophagostoma columbianum	22 (55.0)	15 (46.9)	9 (36.0)	3 (60.0)	
Bunostomum trigonocephalum	11 (27.5)	16 (50.0)	8 (32.0)	12 (66.7)	2 (40.0)
Oesophagostoma venulosus	17 (42.5)	13 (40.6)	10 (40.0)	5 (27.8)	2 (40.0)
Paramphistomum sp.	12 (30.0)	11 (34.4)	10 (40.0)	8 (44.4)	2 (40.0)
Cooperia sp.	9 (22.5)	11 (34.4)	8 (32.0)	5 (27.8)	
Strongyloides papillosus	10 (25.0)	4 (12.5)	6 (24.0)	2 (11.1)	
Fasciola hepatica	2 (5.0)	1 (3.1)	9 (36.0)	6 (33.3)	1 (20.0)
Trichuris ovis	1 (2.5)		3 (12.0)	2 (11.1)	
Ostertagia circumcincta	1 (2.5)	2 (6.3)	2 (8.0)		
Eimeria sp.	1 (2.5)	1 (3.1)	1 (4.0)	1 (5.6)	

per cent; *Strongyloides papillosus*, 6.3 per cent; and *Ostertagia circumcincta*, 1.3 per cent.

The infection rates of parasites found in the goats are summarized in Table 6. The following are the species and infection rate determined among these parasites: *Haemonchus contortus*, 94.2 per cent; *Oesophagostoma columbianum*, 47.5 per cent; *Bunostomum trigonocephalum*, 40.0 per cent; *Oesophagostoma venulosum*, 39.2 per cent; *Paramphistomum sp.*, 35.8 per cent; *Cooperia sp.*, 27.5 per cent; *Fasciola hepatica*, 15.8 per cent; *Trichuris ovis*, 5.0 per cent; *Ostertagia circumcincta*, 4.2 per cent; and *Eimeria sp.*, 3.3 per cent.

Patterns of the age distribution of infection rate for each species were demonstrated (Tables 7 and 8). The rate of *Fasciola hepatica* was relatively high in the adult groups, with a peak at 4 to 7 years; the peak of that of *Paramphistomum sp.* was seen at 6 years. The rate of *Oesophagostoma columbianum* increased with the advance in age, exhibiting a peak at 5 to 6 years. The cases of infection with any other species were distributed extensively from young to adult.

Rate of parasite infection among sheep and goats in Hikami County.

Fecal egg tests and determination of infection rate were performed on specimens collected

Table 9. Infection rate of each species of parasite among sheep in Hikami County

Locality	No. Exam.	*Haemonchus contortus*	*Paramphistomum sp.*	*Oesophagostma sp.*	*Fasciola hepatica*	*Trichuris ovis*	*Eimeria sp.*	*Capillaria ovis*	*Muellerius capillaris*	*Strongyloide papillosus*	*Cooperia sp.*	*Bunostomum trigonocephalum*
Ichijima	98	78 (79.6)	77 (78.6)	37 (37.8)	25 (25.5)	10 (10.2)	10 (10.2)	6 (6.1)	6 (6.1)	5 (5.1)	4 (4.1)	3 (3.1)

Table 10. Infection rate of each species of parasite among goats in Hikami County

Locality	No. Exam.	*Haemonchus contortus*	*Oesophagostoma sp.*	*Paramphistomum sp.*	*Fasciola hepatica*	*Eimeria sp.*	*Muellerius capillaris*	*Strongyloides papillosus*	*Cooperia sp.*	*Trichuris ovis*	*Bunostomum trigonocephalum*	*Capillaria ovis*	*Moniezia sp.*
Ichijima	52	47 (90.4)	39 (73.1)	30 (57.7)	12 (23.1)	8 (15.4)	7 (13(5)	6 (11.5)	4 (7.7)	3 (5.7)	2 (3.9)	1 (1.9)	1 (1.9)

from 98 sheep and 52 goats in Hikami County during a four-month period from June to September, 1960.

The parasites detected from sheep in each village of Hikami County are shown in Table 9, with their species and infection rates. They are listed below in the decreasing order of this rate: *Haemonchus contortus*, 79,6 per cent; *Paramphistomum sp.*, 78.6 per cent; *Oesophagostoma columbianum*, 37.8 per cent; *Fasciola hepatica*, 25.5 per cent; *Trichuris ovis*, 10.2 per cent; *Eimeria sp.*, 10.2 per cent; *Capillaria ovis*, 6.1 per cent; *Muellerius capillaris*, 6.1 per cent; *Strongyloides papillosus*, 5.1 per cent; *Cooperia sp.*, 4.1 per cent; and *Bunostomum trigonocephalum*, 3.1 per cent.

The infection rates of parasites found among the goats are summarized in Table 10. The infection rate of each species is as follows: *Haemonchus contortus*, 90.4 per cent; *Oesophagostoma sp.*, 73.1 per cent; *Paramphistomum sp.*, 57.7 per cent; *Muellerius capillaris*, 13.5 per cent; *Strongyloides paillosvs*, 11.5 per cent; *Cooperia sp.*, 7.7 per cent; *Trichuris ovis*, 5.7 per cent; *Bunostomum trigonocephalum*, 3.9 per cent; *Capillaria ovis*, 1.9 per cent; and *Moniezia sp.*, 1.9 per cent.

Infection with these parasites in Hikami County showed almost the same age incidence as that among the sheep and goats in Taki County, The highest incidence of *Fasciola hepatica* infection was observed in the groups of 4 to 5 years and that of infection with *Oesophagostomum sp.* in those of 2 to 4 years. The infection rates of *Eimeria sp.* and *Strongyloides papillosus* were low among adult animals and relatively high among young ones.

Summary

A survey was carried out to clarify the actual state of parasite infection among ruminants in Hyogo Prefecture.

Paramphistomum sp., *Fasciola hepatica*, and *Oesophagostoma radiatum* were the most frequently detected species among cattle, while *Haemonchus contortus*, *Oesophagostoma sp.*, and *Fasciola hepatica* were the most prevalent among sheep and goats.

In addition, the following species were observed among the ruminants examined with considerable rates of infection: *Aacaris vitulorum*, *Bunostomum sp.*, *Capillaria ovis*, *Cooperia sp.*, *Dictyocaulus viviparus*, *Eimeria sp.*, *Moniezia sp.*, *Muellerius capillaris*, *Ostertagia cirumcincta*, *Strongyloides papillosus*, *Trichostrongylus colubriformis*, and *Trichuris ovis*

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