

## Lung- and gastrointestinal helminths of goats (*Capra hircus*) in Iceland

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### SUMMARY

This is the first systematic study on parasites of goats in Iceland and its objective was to determine the helminth species in the lungs and gastrointestinal tract of goats, their prevalence and abundance.

During the traditional slaughter season in September–October 1998, the lungs and gastrointestinal tracts from a total of 15 kids, 4–6 months of age, from 8 farms in West- and North Iceland, were collected and examined for adult helminths. The faeces were examined for lungworm larvae.

The following species were found: *Teladorsagia circumcincta* (incl. *T. trifurcata* and *T. davtiani*) (prevalence 100%, range of parasite numbers 700–5250); *Trichostrongylus capricola* (40%, 0–250); *Nematodirus filicollis* (87%, 0–450); *N. spathiger* (60%, 0–500); *Chabertia ovina* (27%, 0–16); *Oesophagostomum venulosum* (7%, 0–2); *Trichuris ovis* (53%, 0–7); *Muellerius capillaris* (only searched for larvae in faeces) (46%, larvae pr g faeces 0–53) and *Moniezia expansa* (20%, total length of worms in each kid 0–625 cm).

The helminth species, their prevalence and abundance is similar to what would be expected in Icelandic lambs of the same age and at the same time of the year. Helminth species which have been found in the lungs and gastrointestinal tracts of sheep in Iceland, but were not found in this study are *Trichostrongylus axei*, *T. vitrinus*, *Cooperia oncophora*, *Bunostomum trigonocephalum*, *Dictyocaulus filaria* and *Protostrongylus rufescens*. These species are less common which is probably the main reason why they were not observed in this study.

Measurements on the length of the dorsal ray of the bursae of 65 of the *T. circumcincta* males in this study indicate that they all belonged to a “sheep line” (found both in sheep and goats) and not to the “goat line” (only found in goats). This could indicate that if the goat line has ever existed in Iceland, it has not been able to maintain itself in competition with the sheep line, because of the small number of goats compared to the much higher number of sheep ever since the settlement of the country.

Key words: *Capra hircus*, goats, helminths.

### YFIRLIT

*Ormar í geitum* (*Capra hircus*) á Íslandi

Geitur hafa sennilega verið fluttar til Íslands þegar á landnámsöld og ekki er vitað til síðari innflutnings. Elstu upplýsingar um fjölda vetrarfóðraðra geita eru frá 1703–1712 er þær voru um 800. Síðan hefur fjöldi geita sveiflast frá tæplega 100 og upp í næstum 3000. Fjöldi þeirra nú er rúmlega 400, á rúmlega 50 búum.

Þetta er fyrsta skipulega rannsóknin á sníkjudýrum í geitum á Íslandi og markmið hennar var að rannsaka hvaða ormategundir fyndust í geitum, tíðni þeirra og magn. Í sláturtíðinni, haustið 1998, var safnað lungum og meltingarvegi úr samtals 15 kiðum, 4–6 mánaða gömlum, frá 8 bæjum á Vestur- og Norðurlandi, og leitað í þeim að fullþroska ormum. Einnig var leitað að lungnaormalifum í saur.

Eftirfarandi tegundir fundust: Práðormarnir *Teladorsagia circumcincta* (innifaldir *T. trifurcata* og *T. davtiani*) (tíðni 100%, fjöldi 700–5250); *Trichostrongylus capricola* (40%, 0–250); *Nematodirus filicollis* (87%, 0–450); *N. spathiger* (60%, 0–500); *Chabertia ovina* (27%, 0–16); *Oesophagostomum venulosum* (7%, 0–2); *Trichuris ovis* (53%, 0–7) og *Muellerius capillaris* (46%, lirfur í g saurs 0–53). Bandormurinn *Moniezia expansa* (20%, heildarlengd orma í kiði 0–625 cm).

Ormategundirnar, tíðni þeirra og magn reyndist svipað því sem vænta mætti í lömbum á Íslandi á sama aldri og árstíma. Ormategundir, sem fundist hafa í sauðfé á Íslandi en fundust ekki í pessari rannsókn, eru *Trichostrongylus axei*, *T. vitrinus*, *Cooperia oncophora*, *Bunostomum trigonocephalum*, *Dictyocaulus filaria* og *Protostrongylus rufescens*. Pessar tegundir eru sjaldgæfari og er það líklega meginorsök þess að þeirra varð ekki vart í rannsókninni.

Mælingar á bakgeisla („dorsal ray“) sogblöðku („bursa“) karldýra af tegundinni *Teladorsagia circumcincta* bentu til þess að þau tilheyrðu „sauðfjárlínu“ (sem fer bæði í sauðfé og geitur) en ekki „geitalínu“ (sem finnst eingöngu í geitum). Þetta bendir til þess að hafi geitalínan einhverntíma fundist á Íslandi þá hefur henni ekki tekist að halda velli í samkeppninni við sauðfjárlínuna, vegna lítla fjölda geita, samanborið við margfalt meiri fjölda sauðfjár allt frá landnámi.

## INTRODUCTION

Goats were probably imported to Iceland during the settlement of the country in the 8th to 10th centuries and there is no information on the importation of goats ever since (Aðalsteinsson, 1981). Topographical names indicate that goats have been common during the first centuries after the settlement and goats are often mentioned in old scripts (Sigurjónsson, 1955; Sigvaldason, 1960).

The earliest information on the number of goats is from 1703–1712 when winterfed goats were approximately 800. Since then their numbers have fluctuated from less than 100 to almost 3000 (Sigurjónsson, 1955; Dýrmundsson, 1988; Sveinsdóttir and Dýrmundsson, 1994). The number of goats in 1998 was 425, divided on 51 farm. The number on each farm varied from 1–73. (Annual report of the Farmers Association of Iceland for 1998).

Goats have always been grazed with sheep, the most common livestock in Iceland. The number of winterfed sheep in Iceland now is approximately 490,000.

This is the first systematic study on parasites of goats in Iceland. Its objective was to determine the helminth species found in the lungs and gastrointestinal tract of goats, their prevalence and abundance.

## MATERIALS AND METHODS

During the traditional slaughter season in Sep-

tember-October 1998, the lungs and gastro-intestinal tracts from a total of 15 kids, 4–6 months of age, from 8 farms in West- and North Iceland, were collected. The locations of the farms are shown in Figure 1.

Adult helminths from the lungs, abomasum, small intestine and large intestine were collected, identified to species and counted.

The bronchi of the lungs were cut open and searched for adult lung nematodes.

The abomasum was cut open and the contents were washed into a bucket, under a strong stream of water. More water was added to give



**Figure 1.** The locations of the farms from where the lungs and gastrointestinal tracts of goats were collected.

1. mynd. Staðsetning þeirra þeirra þaðan sem lungum og meltingarvegi geita var safnað.

a total volume of 5 liters. While agitating the bucket, four aliquots of 50 ml (altogether 1/25 of the total material) were taken. The rest was washed through a screen with a grid aperture of 250  $\mu$ m and searched for large nematodes with the naked eye. The aliquots were then washed gently through a screen with a grid aperture of 100  $\mu$ m. What was left in the screen was poured into a petri dish and studied on a dark background in a binocular stereoscope. All adult male nematodes were transferred to a microscopic slide, identified to species and counted. The males were identified using as a reference the drawings from Skryabin (1949–54), Soulsby (1965) and Lapage (1968).

The same method was used on the small intestine with the exception that the intestine was not cut open, but its content was pressed out and the rest washed out with a water-current. Besides counting and identifying the nematodes, all *Moniezia*-cestodes were collected and their total length measured.

The large intestine was cut open, its contents washed through a screen with a grid aperture of 250  $\mu$ m. The contents of the sieve were put in small portions into a large tray, water poured on and then searched for large nematodes with the naked eye. The nematodes found were transferred to a microscopic slide and their species identified.

Three g of faeces were examined for lung-worm larvae, using a modified Baerman analysis (Henriksen, 1965).

Nematodes were photographed, using a Leitz microscope with an automatic camera and a black and white 100 iso Kodak Tmax film.

The length of the dorsal ray of the bursa of 5 *Teladorsagia circumcincta* males from each of 13 of the kids was measured (Figure 2).

A t-test (two tailed) was used in order to compare the difference in helminth numbers between different regions of the country.

Ecological terms are used according to Margolis *et al.* (1982).

## RESULTS

Altogether 9 species of helminths were found,

namely 8 species of nematodes and 1 cestode species.

No nematodes were found in the bronchi of the lungs.

In the abomasum the following nematode species were found: *Teladorsagia circumcincta* (incl. *T. trifurcata* and *T. davtiani*) (prevalence 100%, range of parasite numbers 700–5250) (Table 1).

In the small intestine the following helminth species were found: The nematodes *Trichostyngylus capricola* (prevalence 40%, range of parasite numbers 0–250); *Nematodirus filicollis* (87%, 0–450) and *N. spathiger* (60%, 0–500) and the cestode *Moniezia expansa* (prevalence 20%, total length of worms in each kid 0–625 cm) (Table 1).

In the large intestine the following nematode species were found: *Chabertia ovina* (prevalence 27%, range of parasite numbers 0–16); *Oesophagostomum venulosum* (7%, 0–2) and *Trichuris ovis* (53%, 0–7) (Table 1).



**Figure 2.** Bursa of *Teladorsagia circumcincta* showing where the length of the dorsal ray was measured.

2. mynd. Sogblaðka af *Teladorsagia circumcincta* þar sem sýnt er hvar lengd bakgeislans var mæld.

Table 1. The helminths found in the kids and their numbers in the kids. (In the abomasum and the small intestine, the numbers of the nematodes are the numbers of the males in 1/25 aliquots, multiplied with 25 for the total number and with 2 accounting for the females. In the large intestine the numbers are the total numbers of the nematodes found. The number of *Muellerius* larvae are the number found in 3 g faeces, divided by 3. For *Moniezia* the total length of the tape-worms was measured).

*I. tafla. Ormarnir sem fundust í kiðunum og fjöldi þeirra í kiðunum. (Í vinstur og miðgírni er fjöldi þráðormanna fjöldi karldýra í 1/25 hluta innihalds, margfaldadur með 25 til að fá heildarfjölda og með 2 m.t. kvendýra. Í digurgírni er ornafjöldinn heildarfjöldi fundinna þráðorma. *Fjöldi Muellerius* fyrir fjöldinn fundinn í 3 g saurs, deilt með 3. Hvað varðar Moniezia þá var samanlögð lengd bandormanna mæld.*

	Abomasum— <i>Vinstur</i> <i>Teladorsagia circumcincta davianii trifurcata</i>	Small intestine— <i>Mjóginri</i> <i>Trichostrongylus Nematodirus</i> <i>capricola filicollis spathiger expansa</i>	Large intestine— <i>Digurgirni</i> <i>Chabertia Oesoph. Trichuris</i> <i>ovina venulosum ovis</i>	Lungs— <i>Lungu Muellerius capillaris</i>	
				Total length in cm	Larvae pr g faeces
<b>N-Iceland</b>					
Farm 1— <i>Bær 1</i>					
Kid 1— <i>Kið 1</i>	1350	0	0	50	0
Kid 2— <i>Kið 2</i>	1950	200	250	450	0
Farm 2— <i>Bær 2</i>					
Kid 1	900	0	0	100	150
Kid 2	650	0	50	0	100
Farm 3— <i>Bær 3</i>					
Kid 1	1450	50	50	50	500
Kid 2	1900	0	0	100	450
Farm 4— <i>Bær 4</i>					
Kid 1	4800	50	400	200	250
Kid 2	3400	0	150	250	100
Farm 5— <i>Bær 5</i>					
Kid 1	1400	150	0	300	50
<b>W-Iceland</b>					
Farm 1— <i>Bær 1</i>					
Kid 1	1850	250	0	200	350
Kid 2	1100	300	300	150	200
Farm 2— <i>Bær 2</i>					
Kid 1	3050	0	0	50	250
Kid 2	2700	250	50	0	150
Farm 3— <i>Bær 3</i>					
Kid 1	-	-	-	0	0
Kid 2	-	-	-	0	0
$\bar{x}$ (=abundance)— <i>Medaltal</i>	2038,5	103,8	96,2	46,7	153,3
Prevalence, %— <i>Tíðni</i>	100	61	53	40	87

**Table 2.** The results from t-tests on the numbers of four nematode species between the Western- and Northern regions of Iceland.

2. *tafla. Niðurstöður t-prófana á fjöldafjögurra þráðormategunda milli Vestur- og Norðurlands.*

Nematode species <i>Práðormstegund</i>	P-value <i>P-gildi</i>
<i>Teladorsagia circumcincta</i>	0.68
<i>Nematodirus filicollis</i>	0.76
<i>Nematodirus spathiger</i>	0.09
<i>Muellerius larvae</i>	0.58

In the faecal samples the first stage larvae of the lung-nematode *Muellerius capillaris* were found (prevalence 46%, range of larval numbers pr g faeces 0–53) (Table 1).

**Table 3.** The measurements in  $\mu\text{m}$  of the dorsal ray of the bursa of *Teladorsagia circumcincta* males. 3. *tafla. Mælingar í  $\mu\text{m}$  á bakgeisla í sogblöðku Teladorsagia circumcincta karldýra.*

	Sample number— <i>Sýnistala</i>					Mean <i>Meðaltal</i>	SD <i>Staðalfrávik</i>
	1	2	3	4	5		
<b>N-Iceland</b>							
Farm 1							
Kid 1	89,9	86,8	105,4	89,9	86,8	91,8	7,0
Kid 2	89,9	93,0	89,9	77,5	93,0	88,7	5,7
Farm 2							
Kid 1	89,9	80,6	80,6	96,1	89,9	87,4	6,0
Kid 2	93,0	93,0	86,8	89,9	86,8	89,9	2,8
Farm 3							
Kid 1	93,0	89,9	96,4	93,0	89,9	92,4	2,4
Kid 2	74,4	86,8	93,0	93,0	83,7	86,2	6,9
Farm 4							
Kid 1	77,5	77,5	77,5	74,4	71,3	75,6	2,5
Kid 2	83,7	71,3	77,5	89,9	89,9	82,5	7,2
Farm 5							
Kid 1	89,9	86,8	93,0	96,4	89,9	91,2	3,3
<b>W-Iceland</b>							
Farm 1							
Kid 1	89,9	86,8	77,5	77,5	93,0	84,9	6,4
Kid 2	89,9	89,9	93,0	93,0	86,8	90,5	2,3
Farm 2							
Kid 1	80,6	83,7	86,8	77,5	74,4	80,6	4,4
Kid 2	74,4	74,4	77,5	77,5	77,5	76,3	1,5
Mean— <i>Meðaltal</i>						86,0	
SD— <i>Staðalfrávik</i>						5,7	

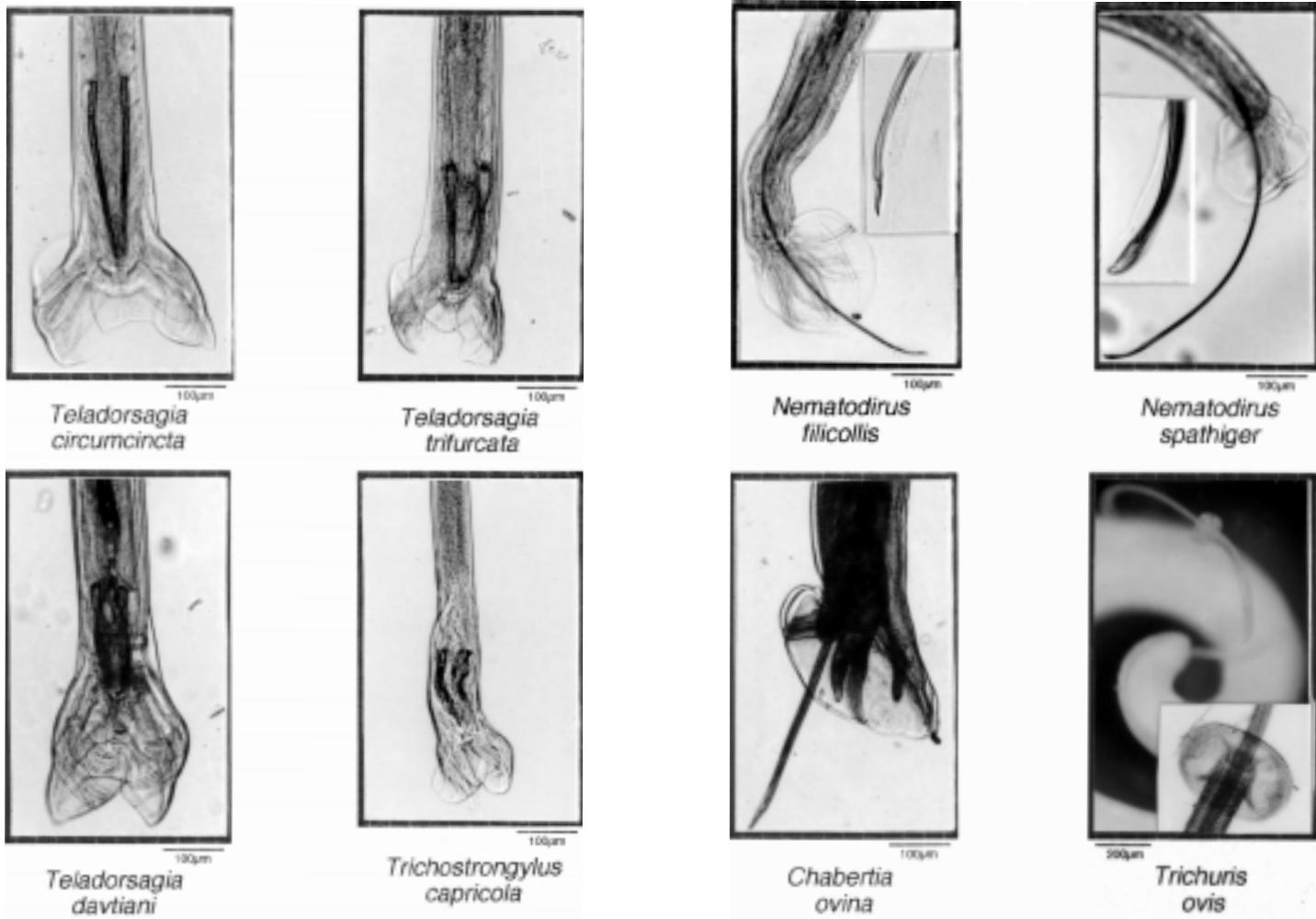
A t-test (two tailed) was used in order to compare the difference in numbers of four nematode species, between the Western- and Northern regions of the country. The results are shown in Table 2.

Photographs of the bursae and spicules of males of the gastrointestinal nematode species, found in the study, are shown in Figure 3.

The lengths of the measured dorsal ray of the bursa of *Teladorsagia circumcincta* males are shown in Table 3.

## DISCUSSION AND CONCLUSIONS

All the helminth species found in the goats have also been found in sheep in Iceland and their prevalence and abundance is similar to what would be expected in Icelandic lambs of



**Figure 3.** The bursae and spicules of the males of the gastrointestinal nematode species found in the study.  
3. mynd. Sogblöðkur og broddar karldýra þeirra práðormategunda í meltingarvegi sem fundust í rannsókninni

the same age and at the same time of the year (Gíslason, 1968; Sigurður H. Richter, unpublished data).

No statistically significant differences were observed between Northern and Western Iceland in the numbers of the four nematode species tested.

It has been proposed that the length of the dorsal ray of the bursa of *T. circumcincta* can be used to identify if the nematode belongs to a "goat line" (only found in goats) or "sheep line" (found both in sheep and goats) of this species (Gasnier *et al.*, 1997). The dorsal rays measured in this study were all found to be within the range of the sheep line. This could indicate that if the goat line ever existed in Iceland, it has not been able to maintain itself in competition with the sheep line, because of the small number of goats compared to the much higher number of sheep.

Nematode species, which have been found in sheep in Iceland but were not found in this study, are *Trichostrongylus axei*, *T. vitrinus*, *Cooperia oncophora*, *Bunostomum trigonoccephalum*, *Dictyocaulus filaria* and *Protostrongylus rufescens* (Gíslason, 1968; Sigurður H. Richter, unpublished data). All these species are less common in sheep than those found in this study, which is probably the main reason why they were not observed in the goats.

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