

Helminth Infections in Dairy Sheep Found in an Extensive Countrywide Study in Greece and Potential Predictors for Their Presence in Faecal Samples

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Table S1. Presence of helminths in faecal samples from individual animals in sheep flocks, in which such parasites had been found in pooled faecal samples, in Greece.

Helminths	No. of farms in which helminths were found in pooled faecal samples and in which faecal samples from individual animals were also examined	No. of animals present in these farms	No. of animals sampled in these farms	No. of animals in the faecal samples of which helminths were found	Overall prevalence of recovery of helminths in samples from individual animals	Among farms median prevalence of recovery of helminths in samples from individual animals
<i>Dicrocoelium dendriticum</i>	13 (24.1% ¹)	2,957	350	150	42.9%	40.0%
<i>Fasciola hepatica</i>	0 (0.0%)	0	0	0	0.0%	n/a
<i>Paramphistomum cervi</i>	2 (28.6%)	410	50	7	14.0%	21.8%
<i>Moniezia</i> spp.	20 (32.8%)	5,809	560	265	47.3%	48.3%
Trichostrongylidae	77 (27.7%)	19,842	2,210	1,813	82.0%	93.5%
<i>Nematodirus</i> spp.	13 (21.3%)	4,573	390	183	46.9%	45.0%
<i>Stronguloides papillosus</i>	8 (34.8%)	3,789	250	79	31.6%	33.8%
<i>Trichuris</i> spp.	20 (30.8%)	6,027	570	173	30.4%	30.0%
Lungworms	18 (31.0%)	3,859	470	230	48.9%	49.0%

¹ figures in brackets indicate the proportion of these flocks among all those from which respective helminths had been found in pooled faecal samples.

Table S2. Presence of helminths in faecal samples from individual animals in sheep flocks, in which such parasites had not been found in pooled faecal samples, in Greece.

Helminths	No. of farms in which helminths were not found in pooled faecal samples and in which faecal sam- ples from individual ani- mals were also examined	No. of animals present in these farms	No. of animals sampled in these farms	No. of animals in the faecal samples of which hel- minths were found	Overall prevalence of recovery of helminths in samples from in- dividual animals	Among farms median prevalence of recovery of helminths in sam- ples from indivi- dual animals
<i>Dicrocoelium dendriticum</i>	78 (28.8% ¹)	21,210	2,250	0	0.0%	0.0%
<i>Fasciola hepatica</i>	0 (0.0%)	24,167	2,600	0	0.0%	0.0%
<i>Paramphistomum cervi</i>	89 (28.0%)	23,757	2,550	0	0.0%	0.0%
<i>Moniezia</i> spp.	71 (26.9%)	18,358	2,040	0	0.0%	0.0%
Trichostrongylidae	14 (29.8%)	4,325	390	0	0.0%	0.0%
<i>Nematodirus</i> spp.	78 (29.5%)	19,594	2,210	0	0.0%	0.0%
<i>Stronguloides papillosus</i>	83 (27.5%)	20,378	2,350	0	0.0%	0.0%
<i>Trichuris</i> spp.	71 (27.3%)	18,140	2,030	0	0.0%	0.0%
Lungworms	73 (29.2%)	20,308	2,130	0	0.0%	0.0%

¹ figures in brackets indicate the proportion of these flocks among all those from which respective helminths had not been found in pooled faecal samples.

Table S3. Geographical areas of Greece ($n = 4$), in which administrative regions and regional units of the country were clustered, for characterizing location of 325 sheep flocks from which faecal samples were collected.

Central
Region of Central Greece
Region of Thessaly
From the region of Epirus: regional unit of Arta and regional unit of Preveza
From the region of Western Greece: regional unit of Aetolia-Acarnania
Islands
Region of Crete
Region of Ionian islands
Region of North Aegean
Region of South Aegean
North
Region of Central Macedonia
Region of Eastern Macedonia and Thrace
Region of Western Macedonia
From the region of Epirus: regional unit of Ioannina and regional unit of Thesprotia
South
Region of Attica
Region of Peloponnese
Region of Western Macedonia
From the region of Western Greece: regional unit of Achaia and regional unit of Elis

Figure S1. Map of Greece indicating the geographic areas of the country ($n = 4$), in which administrative regions and regional units of the country were clustered, for characterizing location of 325 sheep flocks from which faecal samples were collected (blue: Central, green: Islands, yellow: North, red: South).

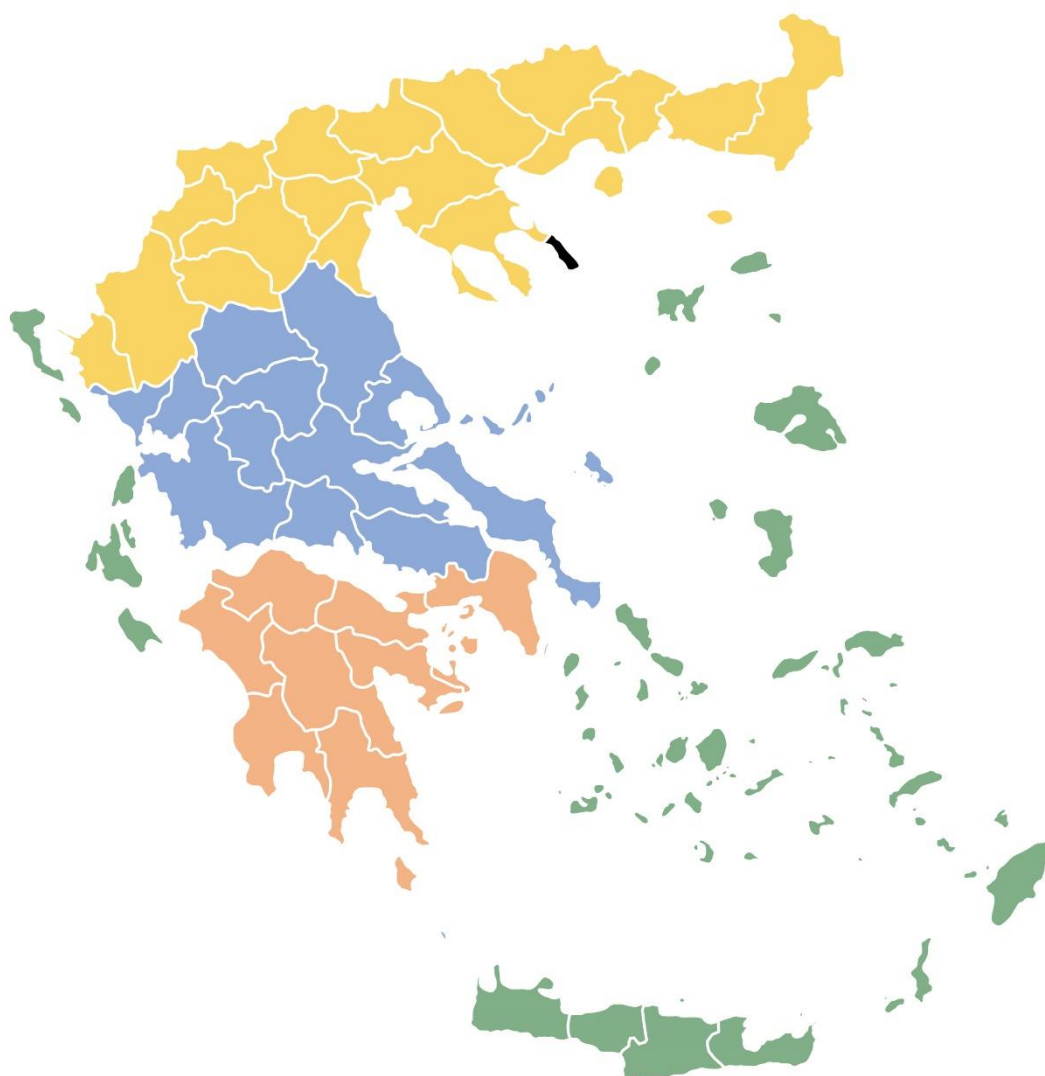


Table S4. Variables ($n = 27$) evaluated for potential association with presence of helminths in faecal samples from 279 sheep flocks in Greece.

Management system applied in the farm (description according to EFSA classification)
Years at the location (no. of years)
Month into the lactation period at sampling (month)
Availability of a main building for animals (yes / no)
Material of the floor of the barn (soil / other)
Availability of straw bedding (yes / no)
Annual frequency of removal / clean-up of the straw bedding (no. of occasions)
Grazing practiced (yes / no)
Grazing land available to animals (acres per animal)
No. of female animals in the farm (no.)
Breed of ewes (description)
Month of the start of the lambing season (description)
Collaboration with a veterinarian (yes / no)
Use of laboratory diagnostic examinations in faecal samples preventively (yes / no)
Total visits made annually by veterinarians to the farm during the preceding season (no.)
Application of reproductive control practices in the farm (yes / no)
Nutritional modifications before the lambing period (yes / no)
Age of lamb removal from their dams (days)
Seasonal transfer of animals to other site (yes / no)
Annual frequency of systemic disinfections in the farm (no.)
Shearing of animals (yes / no)
Provision of finished feed (concentrate) to animals throughout the year (yes / no)
Age of the farmer (years)
Length of animal farming experience of the farmer (years)
Education of the farmer (description)
Farmer by profession (yes / no)
Presence of working staff in the flock (yes / no)

Table S5. Details of multivariable models employed for the evaluation of the presence of helminths in faecal samples from 279 sheep flocks in Greece.

Outcome	Variables offered to the multivariable models (<i>n</i>)	Variables required in the final models
Presence of <i>Dicrocoelium dendriticum</i> in faecal samples	4	(a) Availability of a main building for animals, (b) Material of the floor of the barn, (c) Seasonal transfer of animals to other site
High (> 300) epg counts in faecal samples	7	(a) Month into the lactation period at sampling, (b) No. of female animals in the farm, (c) Collaboration with a veterinarian, (d) Application of reproductive control practices in the farm, (e) Farmer by profession
High proportion (> 63%) of <i>Teladorsagia</i> spp. among Trichostrongylidae helminths in faecal samples	7	(a) Availability of straw bedding, (b) Grazing practiced, (c) Breed of ewes, (d) Nutritional modifications before the lambing period, (e) Shearing of animals, (f) Age of the farmer
High proportion (> 29%) of <i>Haemonchus contortus</i> among Trichostrongylidae helminths in faecal samples'	9	(a) Month into the lactation period at sampling, (b) Availability of a main building for animals, (c) Availability of straw bedding, (d) Grazing land available to animals, (e) Breed of animals, (f) Seasonal transfer of animals to other site, (g) Age of the farmer
Presence of <i>Trichuris</i> spp. in faecal samples	7	(a) Month of the start of the lambing season, (b) Total visits made annually by veterinarians to the farm during the preceding season, (c) Provision of finished feed (concentrate) to animals throughout the year, (d) Age of the farmer
Presence of lungworms in faecal samples	4	(a) Availability of a main building for animals, (b) Shearing of animals, (c) Provision of finished feed (concentrate) to animals throughout the year, (d) Farmer by profession

Table S6. Results of parasitological examinations in pooled faecal samples from 325 sheep flocks in a countrywide investigation in Greece, in accord with the geographical area of the country and the administration of anthelmintic treatment during the two months prior to sampling.

Untreated flocks ¹																		
Frequency (proportion) of flocks in which presence of parasitic elements of the following helminths was detected																		
	Dd ²	Fh	Pc	Mon	Trich fam	Tel	Hc	Trich spp.	Chab	Coop	Bun	Nem	Sp	Trichur	Lung	epg ³ > 300		
North ⁴ (n = 84)	12 (14.3%)	0 (0.0%)	0 (0.0%)	13 (15.5%)	84 (100.0%)	84 (100.0%)	84 (100.0%)	79 (94.0%)	61 (72.6%)	43 (51.2%)	22 (26.2%)	28 (33.3%)	6 (7.1%)	19 (22.6%)	20 (23.8%)	32 (38.1%)		
Central (n = 105)	22 (21.0%)	1 (1.0%)	2 (1.9%)	22 (21.0%)	98 (93.3%)	98 (93.3%)	98 (93.3%)	91 (86.7%)	74 (70.5%)	48 (45.7%)	24 (22.9%)	18 (17.1%)	9 (8.6%)	22 (21.0%)	18 (17.1%)	15 (14.3%)		
South (n = 47)	6 (12.8%)	0 (0.0%)	2 (4.3%)	11 (23.4%)	37 (78.5%)	37 (78.5%)	37 (78.5%)	35 (74.4%)	29 (61.7%)	19 (40.4%)	7 (14.9%)	8 (17.0%)	3 (6.4%)	12 (25.5%)	8 (17.0%)	16 (34.0%)		
Islands (n = 43)	9 (20.9%)	0 (0.0%)	1 (2.3%)	7 (16.3%)	42 (97.7%)	42 (97.7%)	42 (97.7%)	38 (88.3%)	30 (69.8%)	18 (41.9%)	11 (25.6%)	1 (2.3%)	1 (2.3%)	8 (18.6%)	8 (18.6%)	3 (7.0%)		
p-value ⁵	0.47	0.65	0.36	0.63	< 0.0001	< 0.0001	< 0.0001	0.016	0.62	0.62	0.49	0.0003	0.59	0.87	0.66	< 0.0001		
Mean ± standard error of the mean of parametre in faecal samples																		
	epg	Proportion (%) Tela			Proportion (%) Haem			Proportion (%) Tricho			Proportion (%) Chab			Proportion (%) Coop			Proportion (%) Buno	
North (n = 87)	301 ± 23	63.3 ± 0.9			31.9 ± 0.9			3.0 ± 0.2			1.0 ± 0.1			0.6 ± 0.1			0.1 ± 0.1	
Central (n = 127)	190 ± 16	59.2 ± 1.6			30.0 ± 1.1			2.4 ± 0.2			0.9 ± 0.1			0.6 ± 0.1			0.2 ± 0.0	
South (n = 68)	311 ± 47	51.2 ± 3.4			24.0 ± 1.8			2.1 ± 0.3			0.8 ± 0.1			0.5 ± 0.1			0.1 ± 0.1	
Islands (n = 43)	177 ± 18	61.8 ± 1.9			31.6 ± 1.4			2.6 ± 0.4			0.9 ± 0.1			0.6 ± 0.1			0.3 ± 0.1	
p-value	0.0007	0.02			0.001			0.13			0.67			0.81			0.83	
Treated flocks																		
Frequency (proportion) of flocks in which presence of parasitic elements of the following helminths was detected																		
	Dicr	Fasc	Para	Moni	Tr/idae	Tela	Haem	Tricho	Chab	Coop	Buno	Nema	Stro	Trichu	Lung	epg ² > 300		
North (n = 3)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	3 (100.0%)	3 (100.0%)	3 (100.0%)	3 (100.0%)	3 (100.0%)	3 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	0 (0.0%)		
Central ³ (n = 22)	2 (9.1%)	0 (0.0%)	0 (0.0%)	5 (22.7%)	6 (27.3%)	6 (27.3%)	6 (27.3%)	4 (18.2%)	3 (13.6%)	4 (18.2%)	0 (0.0%)	4 (18.2%)	2 (9.1%)	2 (9.1%)	2 (9.1%)	0 (0.0%)		
South (n = 21)	3 (14.3%)	1 (4.8%)	2 (9.5%)	2 (9.5%)	8 (38.1%)	8 (38.1%)	8 (38.1%)	7 (33.3%)	6 (28.6%)	2 (9.5%)	1 (4.8%)	2 (9.5%)	2 (9.5%)	2 (9.5%)	1 (4.8%)	0 (0.0%)		

Islands (<i>n</i> = 0)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<i>p</i> -value	0.71	0.54	0.29	0.39	0.049	0.049	0.049	0.014	0.006	0.001	0.54	0.55	0.86	0.86	0.26	n/a
Mean ± standard error of the mean of parametre in faecal samples																
	epg	Proportion (%) Tela	Proportion (%) Haem	Proportion (%) Tricho	Proportion (%) Chab	Proportion (%) Coop	Proportion (%) Buno									
North (<i>n</i> = 3)	163 ± 15	54.7 ± 0.8	39.3 ± 0.6	3.3 ± 0.2	1.3 ± 0.1	1.3 ± 0.1	0.0 ± 0.0									
Central (<i>n</i> = 22)	38 ± 6	16.0 ± 2.4	10.5 ± 1.6	0.5 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.0 ± 0.0									
South (<i>n</i> = 21)	30 ± 7	24.6 ± 3.9	12.1 ± 2.0	0.8 ± 0.2	0.3 ± 0.1	0.1 ± 0.1	0.1 ± 0.0									
Islands (<i>n</i> = 0)	n/a	n/a	n/a	n/a	n/a	n/a	n/a									
<i>p</i> -value	0.013	0.10	0.026	0.002	0.005	0.002	0.56									

1 Untreated / Treated flocks = Flocks that had not / had received anthelmintics during the two months prior to sampling.

2 Dd = *Dicrocoelium dendriticum*, Fh = *Fasciola hepatica*, Pc = *Paramphistomum cervi*, Mon = *Moniezia* spp., Tric fam = Trichostrongylidae, Tel = *Teladorsagia* spp., Hc = *Haemonchus contortus*, Trich spp. = *Trichostrongylus* spp., Chab = *Chabertia* spp., Coop = *Cooperia* spp., Bun = *Bunostomum* spp., Nem = *Nematodirus* spp., Sp = *Strongyloides papillosus*, Trichur = *Trichuris* spp., Lung = lungworms.

3 Trichostrongylidae eggs per gram.

4 Details of the geographical areas in Table S3 and Figure S1.

5 *p*-value = for comparison between flocks in the four geographical areas.

Table S7. Associations of presence of *Dicrocoelium dendriticum* in faecal samples from 279 sheep flocks in Greece, as found in univariable analysis.

Number of farms								<i>p</i>
Farms with presence of <i>Dicrocoelium dendriticum</i> in faecal samples (<i>n</i> = 49)				Farms with no presence of <i>Dicrocoelium dendriticum</i> in faecal samples (<i>n</i> = 230)				
Management system applied in the farm								
Intensive	Semi-intensive	Semi-extensive	Extensive	Intensive	Semi-intensive	Semi-extensive	Extensive	
7	22	16	4	29	106	76	19	0.99
Years at the present location								
0 – 2		3 – 5	> 5	0 – 2		3 – 5	> 5	
2		5	42	3		25	202	0.41
Month into the lactation period at sampling								
0–1st	2nd–5th	6th–9th	After 9th	0–1st	2nd–5th	6th–9th	After 9th	
2	21	22	4	3	96	119	12	0.43
Availability of a main building for animals								
Yes			No	Yes			No	
46			3	226			4	0.07
Material of the floor of the barn								
Soil			Other	Soil			Other	
47			2	205			25	0.14
Availability of straw bedding								
Yes			No	Yes			No	
39			10	188			42	0.73
Annual frequency of removal / clean-up of the straw bedding								
1 – 2			> 2	1 – 2			> 2	
24			15	123			65	0.64
Grazing practiced								
Yes			No	Yes			No	
42			7	200			30	0.82
Grazing land available to animals								
0 – 0.5 acre per animal		> 0.5 acre per animal		0 – 0.5 acre per animal		> 0.5 acre per animal		
16		33		35		195		0.004
No. of female animals in the farm								
0 – 165	166 – 330	331 – 500	> 500	0 – 165	166 – 330	331 – 500	> 500	
10	16	13	10	65	80	47	38	0.57
Breed of ewes								
Cross-breeds	Greek breeds	Imported breeds		Cross-breeds	Greek breeds	Imported breeds		
8	22	19		31	100	99		0.81

Month of the start of the lambing season							
All year 1	Autumn 37	Winter 11	Spring-Summer 0	All year 14	Autumn 173	Winter 38	Spring-Summer 5
0.38							
Collaboration with a veterinarian							
Yes 44			No 5	Yes 190			No 40
0.21							
Use of laboratory diagnostic examinations in faecal samples preventively							
Yes 2			No 47	Yes 20			No 210
0.28							
Total visits made annually by veterinarians to the farm during the preceding season							
0 – 4 22	5 – 7 13	> 7 14	0 – 4 101	5 – 7 59	> 7 70		
0.97							
Application of reproductive control practices in the farm							
Yes 14			No 35	Yes 62			No 168
0.82							
Nutritional modifications before the lambing period							
Yes 31			No 18	Yes 162			No 68
0.32							
Age of lamb removal from their dams							
≤ 40 days 18	41 – 60 days 24	> 60 days 7	≤ 40 days 81	41 – 60 days 124	> 60 days 25		
0.73							
Seasonal transfer of animals to other site							
Yes 13			No 36	Yes 34			No 196
0.046							
Annual frequency of systemic disinfections in the farm							
0 – 9 42			> 9 7	0 – 9 209	> 9 21		
0.28							
Shearing of animals							
Yes 48			No 1	Yes 227			No 3
0.69							
Provision of finished feed (concentrate) to animals throughout the year							
Yes 46			No 3	Yes 214			No 16
0.83							
Age of farmers							
Up to 50 years 32	Over 50 years 17		Up to 50 years 134	Over 50 years 96			
0.36							

Length of previous animal farming experience of the farmer					
≤ 5 years	> 5 years	≤ 5 years	> 5 years		
7	42	49	181		0.27
Education of the farmer					
Primary education	Secondary or post-secondary education	Tertiary education	Primary education	Secondary or post-secondary education	Tertiary education
6	39	4	40	156	34
Professional involvement in farming					
Full-time	Part-time	Full-time	Part-time		
45	4	204	26		0.52
Presence of working staff in the flock					
Yes	No	Yes	No		
16	33	86	144		0.53

Table S8. Associations of high (> 300) epg counts in faecal samples from 279 sheep flocks in Greece, as found in univariable analysis.

Number of farms								<i>p</i>
Farms with high (> 300) epg counts in faecal samples (<i>n</i> = 66)				Farms with low (≤ 300) epg counts in faecal samples (<i>n</i> = 213)				
Management system applied in the farm								
Intensive	Semi-intensive	Semi-extensive	Extensive	Intensive	Semi-intensive	Semi-extensive	Extensive	
10	27	23	6	26	101	69	17	0.81
Years at the present location								
0 – 2	3 – 5		> 5	0 – 2	3 – 5		> 5	
0	9		57	5	20		188	0.29
Month into the lactation period at sampling								
0–1st	2nd–5th	6th–9th	After 9th	0–1st	2nd–5th	6th–9th	After 9th	
0	19	39	8	5	98	102	8	0.006
Availability of a main building for animals								
Yes			No	Yes			No	
65			1	207			6	0.55
Material of the floor of the barn								
Soil			Other	Soil			Other	
57			9	195			18	0.21
Availability of straw bedding								
Yes			No	Yes			No	
50			16	177			36	0.18
Annual frequency of removal / clean-up of the straw bedding								
1 – 2			> 2	1 – 2			> 2	
30			20	117			60	0.43
Grazing practiced								
Yes			No	Yes			No	
55			11	187			26	0.35
Grazing land available to animals								
0 – 0.5 acre per animal		> 0.5 acre per animal		0 – 0.5 acre per animal		> 0.5 acre per animal		
22		44		76		137		0.73
No. of female animals in the farm								
0 – 165	166 – 330	331 – 500	> 500	0 – 165	166 – 330	331 – 500	> 500	
25	19	11	11	50	77	49	37	0.13
Breed of ewes								
Cross-breeds	Greek breeds	Imported breeds		Cross-breeds	Greek breeds	Imported breeds		
10	27	29		29	95	89		0.86

Length of previous animal farming experience of the farmer					
≤ 5 years		> 5 years	≤ 5 years	> 5 years	
14		52	42	171	0.79
Education of the farmer					
Primary education	Secondary or post-secondary education	Tertiary education	Primary education	Secondary or post-secondary education	Tertiary education
16	42	8	30	153	30
Professional involvement in farming					
Full-time		Part-time	Full-time	Part-time	
62		4	187	26	0.16
Presence of working staff in the flock					
Yes		No	Yes	No	
24		42	78	135	0.97

Table S9. Associations of high proportion (> 63%) of *Teladorsagia* spp. among Trichostrongylidae helminths in faecal samples from 279 sheep flocks in Greece, as found in univariable analysis.

Number of farms								<i>p</i>
Farms with high proportion (> 63%) of <i>Teladorsagia</i> spp. among Trichostrongylidae helminths in faecal samples (<i>n</i> = 94)				Farms with low proportion (≤ 63%) of <i>Teladorsagia</i> spp. among Trichostrongylidae helminths in faecal samples (<i>n</i> = 185)				
Management system applied in the farm								
Intensive 8	Semi-intensive 42	Semi-extensive 34	Extensive 10	Intensive 28	Semi-intensive 86	Semi-extensive 58	Extensive 13	0.31
Years at the present location								
0 – 2 2		3 – 5 8	> 5 84	0 – 2 3		3 – 5 22	> 5 160	0.67
Month into the lactation period at sampling								
0–1st 1	2nd–5th 43	6th–9th 45	After 9th 5	0–1st 4	2nd–5th 74	6th–9th 96	After 9th 11	0.76
Availability of a main building for animals								
	Yes 93		No 1		Yes 179		No 6	0.27
Material of the floor of the barn								
	Soil 82		Other 12		Soil 170		Other 15	0.21
Availability of straw bedding								
	Yes 70		No 24		Yes 157		No 28	0.035
Annual frequency of removal / clean-up of the straw bedding								
	1 – 2 46		> 2 24		1 – 2 101		> 2 56	0.84
Grazing practiced								
	Yes 86		No 8		Yes 156		No 29	0.10
Grazing land available to animals								
	0 – 0.5 acre per animal 29		> 0.5 acre per animal 65		0 – 0.5 acre per animal 69		> 0.5 acre per animal 116	0.29
No. of female animals in the farm								
0 – 165 24	166 – 330 35	331 – 500 21	> 500 14	0 – 165 51	166 – 330 61	331 – 500 39	> 500 34	0.82
Breed of ewes								
Cross-breeds 18	Greek breeds 41	Imported breeds 35		Cross-breeds 21	Greek breeds 81	Imported breeds 83		0.17

Month of the start of the lambing season								
All year	Autumn	Winter	Spring-Summer	All year	Autumn	Winter	Spring-Summer	
5	70	17	2	10	140	32	3	0.99
Collaboration with a veterinarian								
Yes			No	Yes			No	
76			18	158			27	0.33
Use of laboratory diagnostic examinations in faecal samples preventively								
Yes			No	Yes			No	
6			88	16			169	0.51
Total visits made annually by veterinarians to the farm during the preceding season								
0 – 4	5 – 7		> 7	0 – 4	5 – 7		> 7	
42	29		23	81	43		61	0.23
Application of reproductive control practices in the farm								
Yes			No	Yes			No	
28			67	49			136	0.60
Nutritional modifications before the lambing period								
Yes			No	Yes			No	
59			35	134			51	0.10
Age of lamb removal from their dams								
≤ 40 days	41 – 60 days		> 60 days	≤ 40 days	41 – 60 days		> 60 days	
27	56		11	72	92		21	0.23
Seasonal transfer of animals to other site								
Yes			No	Yes			No	
19			94	28			157	0.70
Annual frequency of systemic disinfections in the farm								
0 – 9			> 9	0 – 9			> 9	
86			8	165			20	0.55
Shearing of animals								
Yes			No	Yes			No	
94			0	181			4	0.15
Provision of finished feed (concentrate) to animals throughout the year								
Yes			No	Yes			No	
85			9	175			10	0.19
Age of farmers								
Up to 50 years		Over 50 years		Up to 50 years		Over 50 years		
65		29		102		83		0.024

Length of previous animal farming experience of the farmer					
≤ 5 years		> 5 years	≤ 5 years	> 5 years	
17		77	39	146	0.55
Education of the farmer					
Primary education	Secondary or post-secondary education	Tertiary education	Primary education	Secondary or post-secondary education	Tertiary education
18	65	11	28	130	27
					0.61
Professional involvement in farming					
Full-time		Part-time	Full-time	Part-time	
83		11	166	19	0.72
Presence of working staff in the flock					
Yes		No	Yes	No	
30		64	72	113	0.25

Table S10. Associations of high proportion (> 29%) of *Haemonchus contortus* among Trichostrongylidae helminths in faecal samples from 279 sheep flocks in Greece, as found in univariable analysis.

Number of farms								<i>p</i>
Farms with high propotion (> 29%) of <i>H. contortus</i> among Trichostrongylidae helminths in faecal samples (<i>n</i> = 160)				Farms with low propotion (≤ 29%) of <i>H. contortus</i> among Trichostrongylidae helminths in faecal samples (<i>n</i> = 119)				
Management system applied in the farm								
Intensive 24	Semi-intensive 78	Semi-extensive 47	Extensive 11	Intensive 12	Semi-intensive 50	Semi-extensive 45	Extensive 12	0.23
Years at the present location								
0 – 2 3		3 – 5 18	> 5 139	0 – 2 2		3 – 5 12	> 5 105	0.94
Month into the lactation period at sampling								
0–1st 4	2nd–5th 58	6th–9th 89	After 9th 9	0–1st 1	2nd–5th 59	6th–9th 52	After 9th 7	0.12
Availability of a main building for animals								
	Yes 154		No 6		Yes 118		No 1	0.12
Material of the floor of the barn								
	Soil 145		Other 15		Soil 107		Other 12	0.84
Availability of straw bedding								
	Yes 136		No 24		Yes 91		No 28	0.070
Annual frequency of removal / clean-up of the straw bedding								
	1 – 2 86		> 2 50		1 – 2 61		> 2 30	0.56
Grazing practiced								
	Yes 134		No 26		Yes 108		No 11	0.09
Grazing land available to animals								
	0 – 0.5 acre per animal 62		> 0.5 acre per animal 98		0 – 0.5 acre per animal 36		> 0.5 acre per animal 83	0.14
No. of female animals in the farm								
0 – 165 47	166 – 330 47	331 – 500 36	> 500 30	0 – 165 28	166 – 330 49	331 – 500 24	> 500 18	0.23
Breed of ewes								
Cross-breeds 17	Greek breeds 76	Imported breeds 67		Cross-breeds 22	Greek breeds 46	Imported breeds 51		0.12

Month of the start of the lambing season								0.64
All year 9	Autumn 116	Winter 32	Spring-Summer 3	All year 6	Autumn 94	Winter 17	Spring-Summer 2	
Collaboration with a veterinarian								0.36
Yes 137	No 23	Yes 97	No 22					
Use of laboratory diagnostic examinations in faecal samples preventively								0.24
Yes 10	No 150	Yes 12	No 107					
Total visits made annually by veterinarians to the farm during the preceding season								0.33
0 – 4 70	5 – 7 37	> 7 53	0 – 4 53	5 – 7 35	> 7 31			
Application of reproductive control practices in the farm								0.62
Yes 46	No 114	Yes 31	No 88					
Nutritional modifications before the lambing period								0.16
Yes 116	No 44	Yes 77	No 42					
Age of lamb removal from their dams								0.64
≤ 40 days 60	41 – 60 days 81	> 60 days 19	≤ 40 days 39	41 – 60 days 67	> 60 days 13			
Seasonal transfer of animals to other site								0.05
Yes 21	No 139	Yes 26	No 93					
Annual frequency of systemic disinfections in the farm								0.24
0 – 9 141	> 9 19	0 – 9 110	> 9 9					
Shearing of animals								0.47
Yes 157	No 3	Yes 118	No 1					
Provision of finished feed (concentrate) to animals throughout the year								0.96
Yes 149	No 11	Yes 111	No 8					
Age of farmers								0.08
Up to 50 years 88	Over 50 years 72	Up to 50 years 78	Over 50 years 41					

Length of previous animal farming experience of the farmer					
≤ 5 years		> 5 years	≤ 5 years	> 5 years	
35		125	21	98	0.38
Education of the farmer					
Primary education	Secondary or post-secondary education	Tertiary education	Primary education	Secondary or post-secondary education	Tertiary education
27	114	19	19	81	19
Professional involvement in farming					
Full-time		Part-time	Full-time	Part-time	
146		14	103	16	0.21
Presence of working staff in the flock					
Yes		No	Yes	No	
63		97	39	80	0.26

Table S11. Associations of presence of *Trichuris* spp. in faecal samples from 279 sheep flocks in Greece, as found in univariable analysis.

Number of farms								<i>p</i>
Farms with presence of <i>Trichuris</i> spp. in faecal samples (<i>n</i> = 61)				Farms with no presence of <i>Trichuris</i> spp. in faecal samples (<i>n</i> = 218)				
Management system applied in the farm								
Intensive	Semi-intensive	Semi-extensive	Extensive	Intensive	Semi-intensive	Semi-extensive	Extensive	
7	27	19	8	29	102	72	15	0.48
Years at the present location								
0 – 2	3 – 5		> 5	0 – 2	3 – 5		> 5	
1	9		51	3	21		193	0.52
Month into the lactation period at sampling								
0–1st	2nd–5th	6th–9th	After 9th	0–1st	2nd–5th	6th–9th	After 9th	
2	25	31	3	3	92	110	13	0.78
Availability of a main building for animals								
Yes			No	Yes			No	
60			1	212			6	0.62
Material of the floor of the barn								
Soil			Other	Soil			Other	
53			8	199			19	0.30
Availability of straw bedding								
Yes			No	Yes			No	
48			13	179			39	0.54
Annual frequency of removal / clean-up of the straw bedding								
1 – 2			> 2	1 – 2			> 2	
32			16	115			64	0.76
Grazing practiced								
Yes			No	Yes			No	
54			7	188			30	0.64
Grazing land available to animals								
0 – 0.5 acre per animal		> 0.5 acre per animal		0 – 0.5 acre per animal		> 0.5 acre per animal		
25		36		73		145		0.28
No. of female animals in the farm								
0 – 165	166 – 330	331 – 500	> 500	0 – 165	166 – 330	331 – 500	> 500	
24	10	15	12	50	87	45	36	0.005
Breed of ewes								
Cross-breeds	Greek breeds	Imported breeds		Cross-breeds	Greek breeds	Imported breeds		
11	27	23		28	95	95		0.52

Month of the start of the lambing season								
All year 8	Autumn 42	Winter 11	Spring-Summer 0	All year 7	Autumn 168	Winter 38	Spring-Summer 5	0.015
Collaboration with a veterinarian								
Yes 54			No 7	Yes 180			No 38	0.26
Use of laboratory diagnostic examinations in faecal samples preventively								
Yes 4			No 57	Yes 18			No 200	0.66
Total visits made annually by veterinarians to the farm during the preceding season								
0 – 4 20	5 – 7 19	> 7 22		0 – 4 103	5 – 7 53	> 7 62		0.13
Application of reproductive control practices in the farm								
Yes 19			No 42	Yes 58			No 160	0.48
Nutritional modifications before the lambing period								
Yes 42			No 19	Yes 151			No 67	0.95
Age of lamb removal from their dams								
≤ 40 days 19	41 – 60 days 35	> 60 days 7		≤ 40 days 80	41 – 60 days 113	> 60 days 25		0.71
Seasonal transfer of animals to other site								
Yes 11			No 50	Yes 36			No 182	0.78
Annual frequency of systemic disinfections in the farm								
0 – 9 52			> 9 9	0 – 9 199			> 9 19	0.17
Shearing of animals								
Yes 61			No 0	Yes 214			No 4	0.29
Provision of finished feed (concentrate) to animals throughout the year								
Yes 54			No 7	Yes 206			No 12	0.10
Age of farmers								
Up to 50 years 43	Over 50 years 18		Up to 50 years 123		Over 50 years 95		0.048	

Length of previous animal farming experience of the farmer					
≤ 5 years		> 5 years	≤ 5 years	> 5 years	
14		47	42	176	0.53
Education of the farmer					
Primary education	Secondary or post-secondary education	Tertiary education	Primary education	Secondary or post-secondary education	Tertiary education
15	38	8	31	157	30
					0.15
Professional involvement in farming					
Full-time		Part-time	Full-time	Part-time	
54		7	195	23	0.84
Presence of working staff in the flock					
Yes		No	Yes	No	
26		35	76	142	0.27

Table S12. Associations of presence of lungworms in faecal samples from 279 sheep flocks in Greece, as found in univariable analysis.

Number of farms								<i>p</i>
Farms with presence of lungworms in faecal samples (<i>n</i> = 54)				Farms with no presence of lungworms in faecal samples (<i>n</i> = 225)				
Management system applied in the farm								
Intensive	Semi-intensive	Semi-extensive	Extensive	Intensive	Semi-intensive	Semi-extensive	Extensive	
6	26	16	6	30	102	76	17	0.77
Years at the present location								
0 – 2		3 – 5	> 5	0 – 2		3 – 5	> 5	
1		6	47	4		24	197	0.99
Month into the lactation period at sampling								
0–1st	2nd–5th	6th–9th	After 9th	0–1st	2nd–5th	6th–9th	After 9th	
1	24	25	4	4	93	116	12	0.88
Availability of a main building for animals								
Yes			No	Yes			No	
54			0	218			7	0.19
Material of the floor of the barn								
Soil			Other	Soil			Other	
50			4	203			22	0.59
Availability of straw bedding								
Yes			No	Yes			No	
44			10	183			42	0.98
Annual frequency of removal / clean-up of the straw bedding								
1 – 2			> 2	1 – 2			> 2	
32			12	115			68	0.22
Grazing practiced								
Yes			No	Yes			No	
48			6	194			31	0.60
Grazing land available to animals								
0 – 0.5 acre per animal		> 0.5 acre per animal		0 – 0.5 acre per animal		> 0.5 acre per animal		
21		33		77		148		0.52
No. of female animals in the farm								
0 – 165	166 – 330	331 – 500	> 500	0 – 165	166 – 330	331 – 500	> 500	
16	22	11	5	59	74	49	43	0.33
Breed of ewes								
Cross-breeds	Greek breeds	Imported breeds		Cross-breeds	Greek breeds	Imported breeds		
7	25	22		32	97	96		0.91

Length of previous animal farming experience of the farmer					
≤ 5 years		> 5 years	≤ 5 years	> 5 years	
12		42	44	181	0.66
Education of the farmer					
Primary education	Secondary or post-secondary education	Tertiary education	Primary education	Secondary or post-secondary education	Tertiary education
9	39	6	37	156	32
Professional involvement in farming					
Full-time		Part-time	Full-time	Part-time	
51		3	198	27	0.17
Presence of working staff in the flock					
Yes		No	Yes	No	
19		35	83	142	0.82