ABSTRACT
It has already been proven that estode *Anoplocephala perfoliata* is liable for causing fatal colic in horses. The epidemiology of the cestode has never been thoroughly evaluated in Albania. The main purpose of the study was to probe and fully account for the prevalence *Anoplocephala perfoliata* in horses in the southern part of Albania, where there is still a substantial number of working horses. The estimated prevalence of adult *A. perfoliata*, based upon the presence of eggs in a total of 240 faecal samples was 10%. Out of the total number of equines examined, 4 (4.7%) equines from the planes, 9 (11.4%) from the hills and 11 (14.7%) from the mountains were infected with *A. perfoliata*. Prevalence of *A. perfoliata* was significantly higher in samples collected from mountains and hills and the lowest in those collected from plains in the course of the study, very likely depicting their higher rates of exposure to mite intermediate hosts. The purpose of this study was to determine *A. perfoliata* prevalence in horses from selected regions in southern Albania and to evaluate whether factors such as season, management regime and habitat could prove explanations on variations in prevalence within the selected regions.

KEYWORDS: Prevalence, Epidemiology, Equine Cestodes, Season, Management Regime

INTRODUCTION
The cestode *Anoplocephala perfoliata* is a well-documented parasite residing in the gastrointestinal tract of equines. It is cosmopolitan in its distribution, apparently taking up residence wherever soil and moisture conditions are right for the survival of its mite intermediate host (Meana et al., 2005; Tsiafouli et al., 2005). Since the reporting of the presence of tapeworms as a weighted risk factor in certain equine colic syndromes (Proudman et al., 1998), there has been quite a remarkable interest in devoting the right amount of attention to them. *A. perfoliata* is the most common type of the equine tapeworms, with prevalence varying in various geographical regions (Owen et al., 1988; Borgsteede and
van Beek, 1996; Beelitz and Gothe, 2001; Chapman et al., 2002). There is still no correct data on the extent to which the incidence of fatal colic can be attributed to complications from *A. perfoliata* infection, but concern within the veterinary parasitology and equine health community has increased considerably over the past decades (Proudman and Edwards, 1993; Proudman and Trees, 1999; Rodriguez-Bertos et al., 1999; Meana et al., 2005). The concern over potential *A. perfoliata* induced pathology in horses has resulted in huge efforts already under way which are intended to characterize the basic epidemiological characteristics. Its life-cycle is indirect and involves oribatid mites as intermediate hosts. This helps us realize that horses are most likely to pick up the infection orally at pasture during the grazing season. As is the case with many parasites of veterinary importance, a poor or incomplete understanding of epidemiological characteristics always leads to poor, inefficient, and expensive treatment (Meana et al., 1998). The huge variation patterns in infection traits and characteristics of *A. perfoliata* in horses sampled throughout the world is almost certainly tied up to the regional and local variations in environmental characteristics (Hoglund et al., 1998; Meana et al., 2005). Imprecise and faulty diagnosis contributes to the magnitude of variations observed in the studies. The transmission rates of eggs to mites, the development of cysticercoids, and the rates they are swallowed by horses, have been shown to be pretty much influenced by soil moisture conditions (Tsiafouli *et al.*, 2005) and climate patterns (Hoglund *et al.*, 1998; Meana *et al.*, 2005). The distribution of this tapeworm in Albania is not yet known and no information is available concerning the seasonal and spatial variation in prevalence. The purpose of this study was to determine *A. perfoliata* prevalence in horses from selected regions in southern Albania.

**MATERIAL AND METHODS**

**Faecal samples**

The study area comprised a total of 26 different regions in south-eastern areas of Albania. 240 animals in southern Albania were enlisted in the study, and a varying number of 48, 42, 71 and 79 individuals were sampled during each season in these regions. Information regarding usage, type of management, history of anthelmintic treatment, and environment was asked for and recorded wherever possible. Animal faecal samples from the plains (approximately 0-200 m above the sea level), hills (> 200-700 m altitude) and mountains (> 700 m altitude) were collected in this study. Faecal samples were gathered from privately-owned horses in southern Albanian regions. Fresh faecal samples were collected during the
period from March 2012 through to February 2013, which in turn were examined for cestode eggs by using a double centrifugation/combined sedimentation–floatation technique. For those horses that were reared in individual stables, the freshest faecal sample was collected. Horses were further categorized according to their history of pasture use. Pasture horses (134 individuals) were characterized as those that had access to pasture within the previous year. Non-pasture horses (106 individuals) were those that were kept mainly in stable conditions prior to sampling. Horse owners indicated the management regime of the animal when the description of the horse was provided.

**Assay procedure**

Fifteen grams of each faecal sample were weighed. Each sample was mixed with about 40 ml of tap water. The faecal slurry then was sifted through a tea sieve and pushed against with a teaspoon. The resulting suspension was poured immediately into two conical-bottom 30-ml centrifuge tubes and centrifuged at 400 g for 10 min in a swinging-bucket centrifuge. The supernatant was removed with a water aspirator pump and the sediment re-suspended in a small amount of floatation solution using a vortexer. Re-suspended samples were moved to 15-ml conical-bottom centrifuge tubes. Extra floatation solution was poured into the tubes until a slight convex meniscus formed, and a cover slip was set on top of each tube to allow for contact with the floatation solution. Tubes were placed in a swinging-bucket centrifuge and rotated for 10 min at 200 g. After the centrifuge came to a complete halt, the cover slips, with the attached suspension, were taken away and set on a microscope slide. The preparation was examined for cestode eggs by using a light microscope at a magnification of X40 or X100. For floatation, the following solution was used: concentrated sugar solution, sp. g. 1.26 (prepared by dissolving 450 g sugar in 350 ml water).

**RESULTS**

The calculated prevalence of adult *A. perfoliata*, relying upon the presence of eggs in a total of 240 faecal samples was 10 % (Table 1, p < 0.05).

**Table 1**: Total prevalence of infection by *Anoplocephala* spp. eggs (N=240) in equids in southern Albania from March 2012 to February 2013

<table>
<thead>
<tr>
<th>Infection</th>
<th>Seasons</th>
<th>n/N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Anoplocephala</em> spp.</td>
<td>Spring*</td>
<td>2/48 (4.2)</td>
</tr>
<tr>
<td></td>
<td>Summer†</td>
<td>3/42 (7.14)</td>
</tr>
<tr>
<td></td>
<td>Autumn*</td>
<td>8/71 (11.3)</td>
</tr>
<tr>
<td></td>
<td>Winter*</td>
<td>11/79 (13.9)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>24/240 (10.0)</td>
</tr>
</tbody>
</table>

*† Values with different symbols were significantly different, *P* < 0.05
Out of the total number of equines probed, 4 (4.7%) equines from the plains, 9 (11.4%) from the hills and 11 (14.7%) from the mountains were infected with *A. perfoliata*. Prevalence of *A. perfoliata* was significantly higher in samples collected from mountains and hilly geographical areas and the lowest in those collected from plains during the study (Table 2, \( p < 0.05 \)), most likely pointing to their higher rates of exposure to mite intermediate hosts.

**Table 2. Geographical areas prevalence of *A. perfoliata* based on faecal analysis of horses in southern Albania from March 2012 to February 2013**

<table>
<thead>
<tr>
<th>Infection</th>
<th>Geographical areas</th>
<th>n/N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Anoplocephala</em></td>
<td>Plane ‡</td>
<td>4/86 (4.7)</td>
</tr>
<tr>
<td></td>
<td>Hill *</td>
<td>9/79 (11.4)</td>
</tr>
<tr>
<td></td>
<td>Mountain *</td>
<td>11/75 (14.7)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>24/240 (10.0)</strong></td>
</tr>
</tbody>
</table>

*‡ Values with different symbols were significantly different, \( P < 0.05 \)*

In the overall data set, prevalence of infection was significantly higher in pastured vs. non-pastured horses (\( p < 0.05 \)). Only 4 out of the 106 fecal samples collected from non-pasture horses were found to be positive for *A. perfoliata* (3.8%). One of the non-pasture positive horses was from the hills, and the other from the mountainous geographical areas.

**DISCUSSION**

This survey on the prevalence of equine cestodes in southern Albania regions was carried out from March 2012 through to February 2013, and comprised some 240 animals. The calculated prevalence of adult *A. perfoliata*, in light of the presence of eggs in a total of 240 faecal samples hovered over the 10%. This study has enabled us to examine fully the occurrence of *Anoplocephala* spp infection in horses in southern Albania. The purpose of this study is to characterize the prevalence of *A. perfoliata* in privately-owned horses sampled across southern Albania. This was the first study undertaken to observe horses maintained for pleasure or working purposes in concrete management settings in Albania. The present findings point to a significant lower infection rate when contrasted with previous surveys when the infection rate varied from roughly 18-82% in various geographical regions (Owen et al., 1988; Borgsteede and van Beek, 1996; Beelitz and Gothe, 2001; Chapman et al., 2002). The highest prevalence recorded in Europe came from wet, northern countries such as Sweden (Nilsson et al., 1995, a whole year study), the United Kingdom (Owen et al., 1988, in winter), France (Collobert et al., 1997, in autumn and winter) or Germany (Beelitz and
Gothe, 2001). In Mediterranean Basin countries lower prevalence are reported (Italy 14% by Scala et al., 1994; Greece 0.4% by Sotiraki et al., 1997). One obvious explanation on the prevalence of equine cestodes in southern Albania regions is their lower rates of exposure to mite intermediate hosts. Generally speaking, regions already known for the year-round moist humid conditions have a tendency of having high prevalence (Bain and Kelly, 1977), whereas areas with more marked seasonality are inclined to have lower prevalence (Slocombe, 1979). The principal constraint for oribatid population dynamics in Mediterranean environments is draught (Meana et al., 2005). Anyway, the true infection rate is believed to be much higher than, as fecal diagnostic methods are regarded to have very low sensitivity for detecting *Anoplocephala* spp infection, especially where only a few tapeworms are present (Proudman and Edwards, 1992). The percentage of animals found with tapeworm eggs should be considered to be a minimum prevalence.

The survey results of the 1-year long study indicate that between 5-15% of horses in different geographical areas in southern Albania were infected with gravid cestodes. This result is lower than most other studies carried out elsewhere (as mentioned above). This result is in compliance with those of Mediterranean Basin countries which have reported lower prevalences. However, there are no comparable studies that have been completed in northern Albania as yet, making it difficult to draw generalizations about these results. The epidemiology of *A. perfoliata* in southern Albania appears to be strongly tied to local moisture conditions and to horse management patterns. In spite of the relatively low prevalence of cestodes in horses from south-eastern part of Albania, the findings of this study show significant variations between regions, with a general decrease in prevalence from mountains to plains and other geographical areas. This result is not surprising. The mountainous and hilly regions of south-eastern Albania are higher in elevation, have a lower average temperature and get more rainfalls (Adams et al., 2007). Transmission rates of *A. perfoliata* between eggs and mites and between mites and horses have been established to be linked to soil moisture conditions (Meana et al., 2005). For example, Tsiafouli et al. (2005) found that oribatid soil mites were significantly more common in irrigated plots than in dry plots. The positive association between moisture conditions and transmission success is typical of many other helminth and nematode parasites of grazing animals (Stromberg, 1997; Baudena et al., 2000; Roepstorff et al., 2001). Hence the detection of moderate prevalence of *A. perfoliata* in mountainous and hilly regions of south-eastern Albania is probably characteristic of other regions which undergo broadly similar precipitation patterns.
Similarly, the abnormally low prevalence that was observed in plain-dwelling horses of south-eastern Albania is best accounted for by reduced rates of transmission within the semi-arid habitat that is typical of plain regions of south-eastern Albania.

The observation that prevalence was significantly higher in pastured horses 20 (15%) is not surprising. Transmission rates for indirectly transmitted helminths and nematodes are often tied up with intermediate host densities (Otranto and Traversa, 2002). In the case of A. perfoliata, mite densities are likely to be much lower within stables compared to nearby pasture (Proudman et al., 1998; Trotz-Williams et al., 2008). Grazing horses would therefore have a much greater probability of encountering infected mites.

REFERENCES