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Metabolic and enzymatic profile of sheep fed on forage treated with the synthetic pyrethroid Supersect 10 EC

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Abstract. Most of the small ruminant flocks on the Balkan Peninsula are bred on pasture. Thus the animals are endangered to graze treated alfalfa, without observing quarantine. The instability of the pyrethroid insecticides in rumen alkaline pH of the sheep is the reason for its absorption as early as in the upper part of the digestive tract and hence a better-expressed subtoxicosis appeared. Following the technological instruction given by the producer of the insecticide, the alfalfa field plots were treated with Supersect 10 EC. After seven days quarantine, the alfalfa was mowed, dried and added to the ration of the tested animals. After 20 days feeding of the animals, a decrease in the amount of the total lipids was established, without any changes of the blood glucose and total protein values. As regards the enzymatic profile of sheep fed on alfalfa treated with Supersect 10 EC, a significant increase of the activities of ASAT, LDH, MAO and ChE was reported. Based on the data obtained, we could conclude that when sheep was fed on alfalfa treated with Supersect 10 EC, a strong change in the enzymatic profile was observed. There were not significant changes in hepatocyte according to De Rites but the metabolic strain in the organism was suppressed as compared to that of the control animals.

Keywords: synthetic pyrethroids, Supersect, forage, sheep, metabolic and enzymatic profile.

Abbreviations: ASAT – aspartataminotranspherase, ALAT – alaninaminotranspherase, LDH – lactatedhydrogenase, MAO – monoaminoxidase, ChE – cholinesterase

Introduction

Pyrethroid insecticides have been used for more than 40 years and account for 25% of the worldwide insecticide market (Shafer et al., 2005). Most of the small ruminant flocks on the Balkan Peninsula are bred on pasture (Sakata et al., 1986). Thus the animals are endangered to graze treated alfalfa, without observing quarantine (Cassidi, 1978). The instability of the pyrethroid insecticides in rumen alkaline pH of the sheep is the reason for its absorption as early as in upper parts of the digestive tract and hence a better-expressed subtoxicosis appeared (Crawford and Hutson, 1972; Orinak, 1993; Martinez-Haro et al., 2008). Acute poisoning with synthetic pyrethroids is uncommon unlike the chronic diseases that are commonly seen in relation to their wide use in the treatment of insecticides and their use as antiparasitic agents (Bateman, 2000).

Studies on the kinetics and metabolic transformations regarding homeostasis in the body of ruminants are numerous and affect individual characteristics (Jousef et al., 1998; Bradberry et al., 2005). Pyrethroid excretion is slower compared to other animals. That obviously explains their stronger toxic effect in sheep (Danielson et al., 1996; Neuschl et al., 1995).

The aim of the present study was to establish the effect of feeding on forages treated with Supersect 10 EC, following the technological scheme, on the metabolic and enzymatic profile of sheep.

Material and methods

Three-year old alfalfa plots in the village of Brestovitsa were treated with the synthetic pyrethroid Supersect 10 EC by spraying with a back pack sprayer with nozzle number one, producing droplets of 200 250 μm. According to the adopted rate, the amount of the working solution was 25 l per unit of area (0.1 hectare), the chemical concentration being 0.08%. Spraying was conducted at the beginning of buttoning stage. After a 7-day quarantine period, the alfalfa was cut, dried and after 14 days added to the ration of the tested group of animals comprising 8 healthy sheep, equal in age, mean weight (53.3 ± 3.6 kg) and physiological status, selected from a flock of 67 animals. Another group of animals (8 in number) from the same flock was used as a control, their ration including alfalfa untreated with pesticides. Besides, 1.300 kg of dried alfalfa, the ration of each of the two groups, was supplemented with 300.0 g of concentrated forage (wheat), providing 1.08 feed units, 191.0 g digestible protein, 19.24 g Ca, 4.6 g P and 46 mg carotene. After a two-week period of feeding, a blood test was taken from both groups of sheep to check the levels of blood glucose, total protein, total lipids and the enzymes aspartataminotranspherase (ASAT), alaninaminotranspherase (ALAT), lactatedhydrogenase (LDH), cholinesterase (ChE), monoaminoxidase (MAO) and the ratios between them.

Results and discussion

The influence of feeding sheep on alfalfa treated with Supersect 10 EC, following the suggested technological scheme was studied. The results are presented in Tables 1 and 2. After a 20-day period of feeding the animals, a decrease in the total lipid values was established and no changes observed in the levels of blood glucose and total protein.

Concerning the enzymatic profile of sheep, a significant increase in the activities of ASAT (p<0.01), LDH (p<0.05), MAO...
relevant stress indicator radicals generated from the biodegradation of piretroids. Moreover, to the injury to hepatocytes, which could have resulted from free applied at the rate of 25 l per unit of area and a concentration of

On the basis of the data obtained, we reached the conclusion that either the quarantine period was short or there was an influence of the final pyrethroid products on the sheep homeostasis because most probably the proper quarantine period after treatment of alfalfa with Supersect 10 EC should be different.

### Table 1. Blood sugar, total proteins and total lipids changes in sheep fed with forage treated with Supersect 10 EC

<table>
<thead>
<tr>
<th>Blood test</th>
<th>Control (n=8) Mean ± SEM</th>
<th>Treated (n=8) Mean ± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood sugar mmol/L</td>
<td>2.385 ± 0.10</td>
<td>2.527 ± 0.11</td>
</tr>
<tr>
<td>Total proteins g/L</td>
<td>68.20 ± 0.32</td>
<td>70.20 ± 2.22</td>
</tr>
<tr>
<td>Total lipids g/L</td>
<td>1.65 ± 0.07</td>
<td>1.22 ± 0.05*</td>
</tr>
</tbody>
</table>

* p<0.05

### Table 2. Enzyme activity in sheep fed with forage treated with Supersect 10 EC

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Control (n=8) Mean ± SEM</th>
<th>Treated (n=8) Mean ± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACAT nmol/s/L</td>
<td>266.8 ± 9.5</td>
<td>471.8 ± 0.3*</td>
</tr>
<tr>
<td>ALAT nmol/s/L</td>
<td>200.04 ± 1.5</td>
<td>238.3 ± 15.3</td>
</tr>
<tr>
<td>LDH μmol/s/L</td>
<td>0.190 ± 0.001</td>
<td>0.254 ± 0.007**</td>
</tr>
<tr>
<td>MAO U/L</td>
<td>24.8 ± 1.00</td>
<td>84.5 ± 1.13***</td>
</tr>
<tr>
<td>ChE nmol /s/L</td>
<td>0.31 ± 0.005</td>
<td>0.43 ± 0.009*</td>
</tr>
</tbody>
</table>

* p<0.01, ** p<0.05, *** p<0.001

References


Crawford MJ and Hutson DH, 1977. The elimination and retention of WL 43467 when administered dermaly or orally to sheep. Sittingbourne, Shell Research (TLGR.0098.77).


Conclusion

Feeding sheep on alfalfa treated with the synthetic pyrethroid applied at the rate of 25 l per unit of area and a concentration of 0.08% of the working spray solution induced changes in the animals, most strongly expressed in their enzymatic profile. De Ritis index showed that there were no significant changes in hepatocytes.
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