Slovak Academy of Sciences
Institute of Animal Physiology

COST Short-Term Scientific Mission (STSM) Report

STSM Applicant: Jana Pisarcikova

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COST Action FA1302: "Methagene – Large-scale methane measurements on individual ruminants for genetic evaluations".

STSM period: 08/06/2015 to 31/07/2015 (8 weeks)

Host: Prof. Dr. Michael Kreuzer, Institute of Agricultural Sciences (IAS) – Animal Nutrition, ETH Zurich, Switzerland

1. Background and purpose of STSM

My interest in the METHAGENE project is focusing on methane determining factors associated with the variation in methane production and methane emission in relation to animal nutrition and digestion. Manipulation of the rumen environment by phytogenic additives is part of my dissertation thesis.
The purpose of my STSM with the working group of Prof. Michael Kreuzer at the Institute of Agricultural Sciences, ETH in Zurich was the screening of post-mortem rumen fluid obtained from dairy cows and beef cattle of different breeds for detectability of differences in methane emission potential within and between breeds. The topic of my experiment contributes to the goal 2 of COST Action FA1302 "Easy to record and inexpensive proxies for methane emissions to be used for genetic evaluations." The methane emission from the rumen fluid samples collected post-mortem from different breeds of dairy cows and beef cattle at slaughter was assessed in order to quantify the inter-individual variability within and between breeds. The results of this preliminary study gained by this STSM will help to clarify whether future collection of such data may be useful as a proxy and thus may foster national breeding strategies. The inclusions of linseed in the diet, performed to challenge the microbes in the rumen fluid samples, was found by others to improve milk and meat quality, and at the same time to reduce methane production, i.e. the environmental footprint of animal production.

2. Description of the work carried out during the STSM

Rumen fluid samples of this experiment were collected directly at the slaughter house in Zurich from random animals slaughtered. The rumen fluid samples were transported immediately to the ETH laboratory. Samples from 8 animals two times per week were collected, in total 103 samples. The breed of each animal was recorded. The Hohenheim gas

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test (HGT) apparatus to estimate ruminal nutrient degradation from gas production was operated as described by Menke et al. (1979), Menke and Steingass (1988) and Soliva and Hess (2007). A basal diet consisting of forage (hay) and concentrate in a ratio of 0.8:0.2 was used as control. Extruded linseed in a dosage that provided 3.5% lipids in dry matter was supplemented in order to determine the methane mitigation potential. Analyses were performed in duplicate measurements. The gas production was quantified 24 h after starting the incubation of the basal diet supplemented with or without linseed in 30 ml of a 1:2 mixture of rumen fluid and buffer. pH, ammonia and methane concentration before and after 24-h incubation were measured. Samples of rumen content were transported to my home institute for the analysis of neutral detergent fiber (NDF) content.

3. Description of the main results obtained

Rumen fluid randomly sampled from 103 animals were grouped according to genotype as purebred and crossbred. In total three pure breed, Brown Swiss, Black Holstein and Swiss Fleckvieh, and four crossbred types, Brown Swiss × Limousin, Holstein × Limousin, Swiss Fleckvieh × Limousin and Holstein × Swiss Fleckvieh were sampled in a significant number to allow data analysis. In the three pure breeds the proportions of methane per total gas production were 175 ± 11, 179 ± 13, and 177 ± 10 mL L^{-1}, respectively. In crossbred types the methane per total gas produced ranged from 166 to 211 mL L^{-1}. These preliminary results indicate that the methane emission potential and its variability are similar between breeds using post-mortem rumen fluid samples. The within-breed variability in methane emission seems to be relatively low in the pure breeds. The analysis of other influencing factors, such as neutral detergent fibre in rumen content is still in progress. Unexpectedly, the preliminary evaluation showed that there were no effects of extruded linseed in the concentration of 3.5% lipids in dry matter on ruminal methanogenesis. But for more clear and detailed interpretation of results a thorough analysis is needed to conclude.
In future, I will stay in contact with Dr. Angela Schwarm and Prof. Dr. Michael Kreuzer to consult and summarize results of this experiment and after conclusions we are planning to publish the results in a scientific journal.

4. Benefits of the STSM

During the STSM at the ETH Zurich I learned to perform the Hohenheim gas test and various experimental and analytical techniques concerning ruminal methanogenesis.
The results from this experiment will give us information about differences in methane emission potential within and between genotypes. This experience provided me the opportunity to work in a research group under leading of Prof. Dr. Michael Kreuzer, to discuss issues and improve my knowledge in field of rumen physiology. I am confident that my experience at ETH Zurich was valuable for my PhD studies and overall general development.

I would like to acknowledge the financial support by the STSM Grant from the COST Action FA1302.

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5. Confirmation by the host institution of the successful execution of the STSM

Confirmation of the successful STSM execution is submitted as an e-mail attachment.

6. Photos

Fig. 1: Hohenheim Gas Test: Buffer with rumen fluid

Fig. 2: Incubator with rotor (24h incubation)

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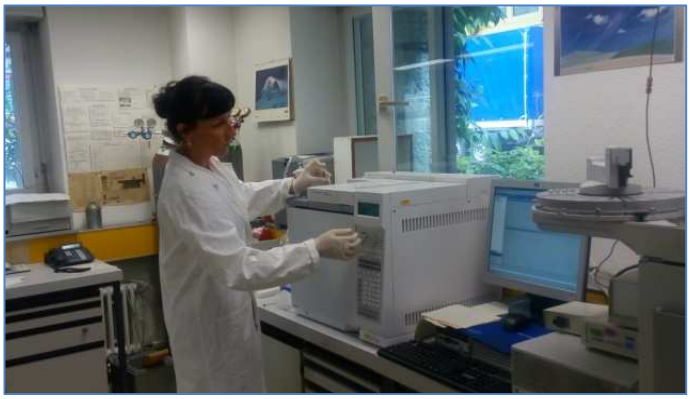
Fig. 3: HGT Glass syringes after 24 h incubation / gas production

Fig. 4: pH, ammonia and methane analyses



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