University of West Hungary
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Thesis of the doctoral (Ph.D.) dissertation

COMPARATIVE STUDY OF HEALTH STATUS AND PARASITIC INFECTION OF WILD BOARS IN ENCLOSURES AND IN OPEN AREAS

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1 The significance and scientific antecedents of the subject

The importance of animal health in wildlife management is increasing, for whether we examine the problem from the ecological angle or from the economical angle, it is the elementary interest of the wildlife manager to have a healthy stock of game because he can accomplish a high quality wildlife management with solid yield only with a „stable" stock. It is especially true of the enclosure stock because in enclosure breeding we intervene in the natural conditions so it is the task and responsibility of the wildlife manager to create and preserve the normal conditions. An integral part of this is the permanent observation and continuous veterinary supervision of the animals in the wild since the health status of health of the animals is the indicator of the general state of health and state of balance of our stock.

The continuous metabolism and circulation of energy is a primary condition of the normal functioning of natural systems and also that of the health of the individual organism. Its condition, the amount of accumulated reserves is indicated by the nutritional state, the *physical condition* of the animal. In addition to the observation of the perishing and determining the nutritional state, the *parasitic examination* of the animals is also possible. Although it is not a veterinary problem of great importance but it works very well as an indicator of the general health status of our stock. Parasites are also inseparable from human health, for instance man is one of the secondary intermediate host of the tapeworm (*Echinococcus granulosus*) of dogs.

2 Aims

The author's aim in the thesis was:

- to examine the endoparasitic infection of wild boar stock living in different conditions, i.e. in enclosures and in open areas,
- to determine the significance of the examined parasitic infections
- to explore the practical benefits and results of the parasitic, hygienic examinations in terms of game management
- to find correlation between the infection, the age of the animals and the time of the examinations
- to show the connection between the physical condition of the animals and the measured level of infection
- to demonstrate the effect of the different technologies (breeding, feeding, preventive methods) used in enclosures and in open areas on the health and conditional status of the animals, and finally
- to determine the difference between the health status of wild boar stock kept in enclosures and in open areas

3 Methods

The wild boars were examined between 1996 and 2004. During this period samples from a total of 764 wild boars were collected and examined. The *parasitic examinations* covered the examination of the lungworms and the tapeworm larvae from the endoparasites of wild boars. The other significant part of the research were the examinations aimed *to determine the physical condition* of the animals which was deduced from the evaluation of the weight data and the calculation of the kidney fat indices.

3.1 Study area

The examinations were executed in Middle Somogy, in three wild boar enclosures in the Zselic hunting area of SEFAG Plc. and on the surrounding open areas.

1/ Ropoly enclosure: 393,4 ha extensive enclosure with separate breeding and hunting enclosures, inhabited by 240 wild boars prior to the hunting season. At the end of May after the capturing, the complete stock is treated with *ivermectin* (*100 μg ivermectin/kg b.w.*) added to the feed.

2/ Sásostó enclosure: 299,2 ha intensive enclosure. The progeny is looked after in pigsties with runway, forming groups of ten; besides this there are separate breeding- and hunting enclosures, while tuskers are kept separately by age groups in order to reach the decent trophy size. Stock size is 220 wild boars prior to hunting season. After the capturing only piglets are treated with *ivermectin* (*0,1 ml/33 kg b.w., subcutan inj.*).

3/ Tótfalu enclosure: 213,4 ha extensive enclosure. In addition to the hunting enclosure there is also a 23,9 ha quarantine enclosure. The total stock is about 170 wild boars. As medication *albendazol* (*10 mg albendazol/kg b.w.)* is used in the supplementary feed.

4/ Open hunting area: includes about 6,000 ha with 67% afforestation. The wild boar population is estimated to be around 250-300 individuals.

3.2 Methods of datasurvey

The collection of samples and data took place during common huntings in winter season (November-January) except for some animals.

The following data were collected during the examination:

- carcass weight
- number of lungworms
- number and positioning of tapeworm larvae
- weight of kidney and that of the fat around the kidney
- sex- and age group
- date of examination
- site of examination
- big game identification serial number

Measure of *carcass weight* was executed at the carcass collecting site, with 1 kg precision in accordance with the regulations of the game processing plants.

Respiratory organs were exposed from the trachea to the final ramification of the main bronchial tubes. The lungs were usually examined in full, or sometimes palm-sized pieces of the lobe. The collected lungworms were counted in the laboratory using a stereomicroscope.

The examination of the *liver and the intestinal tract* helped to reveal the mould of the tapeworm larvae (echinococcus, cysticercus) which usually catch the eye right at the evisceration.

To calculate the *kidney fat index* the weight of the kidney and that of the fat around the kidney was measured with 1 g precision. The following formula was used to calculate the index:

$$kidney\ fat\text{-}index = \frac{weight\ of\ \ kidney + weight\ of\ \ fat\ around\ the\ kidney\ (g)}{weight\ of\ \ kidney\ (g)}$$

(SUGÁR, 2000)

The age of the animals was identified on the basis of their dentition. The author distinguished three age groups (*age group 1*: wild boars less than one year old – piglets, *age group 2*: wild boars aged one and a half years – yearlings, *age group 3*: wild boars more than two years of age).

Wild boars that perished during the the examination period and those that were shot because of disease diagnostic higienic reasons were examined in the *Kaposvár Veterinary Higienic Institution*.

3.3 Methods of data processing

The evaluation of data was executed with the help of mathematical-statistical (biometrical) methods. The samples and the results of examination were systematized on the basis of place of origin, age group, sex and also of time of examination.

3.3.1 Calculation of parasitic infection

The author calculated the *prevalence* data of lungworm and tapeworm larva infection (infected wild boars/all examined wild boars, %) and the mean *intensity* (number of worms/number of infected wild boars) and *abundance* (number of worms/number of examined wild boars) of lungworm infection on the basis of the datasurvey during sample collection. *Quantitive parasitology 2.0* program was applied for the statistical analysis. For the statistical comparison of the prevalences in different age groups Chi-square test and Fisher-test were applied, and for the analysis of the mean intensity and abundance data Bootstrap 2-sample t-test was applied. To evaluate the correlation between lungworm burden and physical condition regression analysis was applied.

3.3.2 Determination of physical condition

Basic statistical indicators (mean, dispersion, coefficient of variation) were applied to describe the data sets. SPSS 11.0 statistic program was applied for the processing of *weight and kidney fat index data*. Single-factor variance analysis was applied for the statistical verification of the differences between age groups, dates, places; the significance of the differences between groups was examined by LSD test.

4 Summary of scientific findings

4.1 Endoparasitic infections

74,2 % of the wild boar stock of Zselic were infected regarding the examined parasites. The results of the parasitological examinations are detailed in the followings.

4.1.1 Lungworm infection

73.4 % of the examined wild boar stock was infected with lungworms. Lungworm occurence in wild boars shot in Tótfalu and Ropoly enclosure showed the lowest prevalence and mean abundance, whereas the highest prevalence and mean abundance was shown in Sásostó enclosure. The author could also statistically verify the differences between the *examined areas*. The differences between the technology in Tótfalu and Sásostó were revealed in the results too since *anthelmintic treatments* in Sásostó enclosure were used less often and only for piglets wich caused higher prevalance and abundance.
The *age group* of piglets was less infected with lungworms than the elder age groups. Considering the mean intensity and abundance data piglets were more infected only in open areas. This points to the fact that piglets in good condition and in good health status are not more susceptible than the elder boars in the period following the development of acquired immunity of appropriate level. However the statistical analysis of the worm burden per on unit body weight in each age groups showed a significantly higher worm burden in piglets.
Considering the lungworm infection of the two *sexes* significant difference could be found in adult boars only. The level of value is low in both sexes in spite of the existing differences.

The author could not find correlation between the lungworm burden and physical condition in any age group.
As wild boars spent less than a year in each of the examined enclosures, the *time-series analysis* performed in the examined areas showed significant difference in a few instances only.

4.1.2 Tapeworm larvae infection

Cysticercosis and *echinococcosis* are present only in a low level in the examined stock. Echinococcosis needs to be dealt with due to its being inseparable from human health (zoonosis). *Cysticercosis* was present in each examined areas, the highest prevalence was shown in Ropoly enclosure whereas the lowest prevalence was shown in Tótfalu enclosure. Tapeworm larvae infection occured only in wild boars more than one year old (yearling and adult age groups), though the author couldn't find statistically verifiable difference between the prevalence in the two sexes.

4.2 Diagnostic investigations

4.2.1 Tuberculosis

Wild boars infected with the pathogen of tuberculosis were found both in enclosures and in the open area during the period of the examination which draws the attention to the dangers of the prevalence of the disease. The wildlife manager has to take good care of the prevention in the case of wild boar stock in enclosures. By the proper treatment of the viscera and by controlling the motor- and passenger traffic of the enclosure not only the prevalence of tuberculosis but also the chain of development of many parasites can be interrupted.

4.2.2 Other diseases

The author could find ailments of other diseases (enzootic pneumonia, oedema of piglets, coli enterotoxemia, etc.) only in enclosures. The occurence of these diseases arise from the change of the environmental conditions and the failure of adaptability to these changed conditions. About half of the cases (46,6%) occured in intensively feeded pigsties, considerable part of the animals perished through feeding problems or the stress due to the rough weaning.

4.3 Examinations of physical condition

4.3.1 Body weight data

The intensive technology and more balanced feeding in Sásostó enclosure resulted in better condition (body weight) of the wild boars living there, since the largest average weight in each age groups came from the Sásostó data. The less average body weight

of piglets in enclosures compared to those in open areas indicates that piglets are the most sensitive to the changed environmental conditions concomitant of being kept in enclosures. Comparing the three age groups the decrease of the average body weight could be observed in each of them by the end of the hunting season, but significant difference decrease could be observed only in the case of adult animals. The influence of the weather factors cannot be shown in the condition of the animals because the intensive feeding, which is entirely different from that of the natural condition, compensates the negative effects of periods of adverse weather.

4.3.2 Kidney fat index data

From the examined groups sows were in the best while piglets were in the poorest condition. Considering the entirety of the exampled samples the author could find individuals in very poor condition in each age groups due to the wide dispersion of kidney fat index values, in spite of the average good condition (3,65) of the animals. The author finds that collecting samples cannot be without considerable amount of errors even if it executed with the utmost attention and care, therefore applying kidney fat index is unsuitable because of the anatomical and species specific characteristics, or it can be applied to show only the extreme differences in condition. The author suggests that individuals with kidney fat index above 2,5 should be generally considered to be in good condition.

5 Scientific achievements (thesis)

1. Prevalence of lungworm infection can be considered similar in the examined areas. The author found that lungworm occurence in wild boars in Sásostó enclosure showed the highest prevalence. The abundance of Sásostó enclosure also significantly differed from that of the other examined areas. It is very likely that the difference comes from the fact that anthelmintic treatments were used less often and only for piglets in this enclosure. On the basis of it the author suggests that anthelmintic treatment should be applied on the occasion of every important technological interference in intensive enclosures.

2. In regard of the worm burden in wild boar low values were found by the author. According to the statistical analysis there aren't correlation between the number of lungworms (mean intensity and abundance) and the animals physical condition or their age.

3. Considering age groups, the lower prevalence in piglets mentioned in literatures on the subject couldn't be demonstrated. To determine the worm burden of the different age groups an evaluation on the basis of the number of worms/body weight ratio is suggested.

4. The author proved that there was higher lungworm infection occurence (mean intensity and abundance) in male boars caused by their reduced immunity which is a consequence of the stress and higher testosterone level in the breeding period. The fact that difference between the two sexes could only be found in adult age groups also confirms this conclusion.

5. Hydatidosis is present in a low level in the wild boar stock, the infection can be further reduced by the proper treatment of the viscera. The results of the research indicate that tapeworm larvae occur only in elder animals; sex is of no importance in this respect.

6. The thesis proves that stock kept under intensive conditions – mostly the age group of piglets – is sensitive to the keeping and feeding conditions to a greater extent. According to the author the proper keeping and feeding of this age group is more important and more efficient than the repeated use of anthelmintics.

7. The author states that kidney fat index is difficult to use in the case of wild boars because of the species specific characteristics. When applying kidney fat index difference couldn't be shown therefore it is suggested that animals with kidney fat index above 2,5 should be generally classified as to be in good condition.

List of publications in connection with the matter

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