

## A STUDY ON EFFICACY OF IVERMECTIN AGAINST *LINOGNATHUS STENOPSIS* (PHTHIRAPTERA: LINOGNATHIDAE) IN GOATS

**Nikola Nizamov, Petyo Prelezov**

*Trakia University, Faculty of Veterinary medicine, Stara Zagora, Bulgaria*

*E-mail: nikola\_nizamov@abv.bg*

### ABSTRACT

In this study were included 30 goats naturally infested by lice. The goats come from a herd of 300 animals of a local breed, belonging to a private owner from Mogila village, Yambol county. The visit to the farm was a response to a signal of distress from the owner who informed us that the goats were scratching themselves and were expressing strong discomfort. The study proved the presence of sucking lice belonging to the species *Linognathus stenopsis*, Burmeister (1838) from the family Linognathidae and order Phthiraptera. 28 of the 30 observed animals turned out to be infested (93.3 %). The treatment was carried out with ivermectin (Pandex™) in dosage 0.2 mg/kg of body weight. The results were observed on the 3<sup>rd</sup> and the 14<sup>th</sup> day after treatment. The whole body of all the goats included in the study was inspected. No viable lice were found during the first and the second control examination. The eggs of the parasite which were present on the third day were not discovered on the 14<sup>th</sup> day which proved the high efficacy of the macrocyclic lactone ivermectin against *Linognathus stenopsis* after a single treatment.

**Key words:** goats, lice, *Linognathus stenopsis*, ivermectin, efficacy.

### Introduction

Goat breeding is a branch of livestock breeding that is very important to the economics of our country. Goats are highly productive and not very fastidious small ruminants which explains their wide spread here. As animals that are bred on pastures and in goat-sheds during the different seasons of the year goats are an object of attack from different kinds of permanent and temporary ectoparasites. A very common entomosis in goats is phthirapterosis (lice infestation). Lice (order Phthiraptera) can be sucking (suborder Anoplura) and biting (suborders Ischnocera and Amblycera). Sucking lice are permanent ectoparasites with high specificity towards the host. By feeding with blood they cause serious economic losses by causing different kinds of pathological changes varying in severity in the organism of their hosts, such as: weight loss, anemia, hypoproteinemia, shortage of nutrients and decreased vitality (Otter et al., 2003; Paul et al., 2012). Their transmissive role is of great importance as well. As vectors they can transmit a variety of pathogens (viruses, bacteria, fungi and protozoa) to their hosts (Hornok et al., 2010).

Ivermectin (22,23-dihydroavermectin B<sub>1a</sub>+22,23-dihydroavermectin B<sub>1b</sub>) is an antiparasitic drug from the macrocyclic lactones group obtained from *Streptomyces avermitilis* in 1981 (Campbell and Benz, 1984). Its activity against nematodes and arthropods is a result of disconnecting the nerve impulses which causes paralysis in the parasite. According to Vercreysee and Rew (2002) its discovery raises parasitic control to a new level. In recent years the drugs from this group are used for treatment of infestations with more than 300 species of endo- and ectoparasites in a wide variety of hosts (Shoop and Soll, 2002).

The control of ectoparasitic invasions in domestic animals in Bulgaria is not widely organized and is mostly conducted incidentally in cases of rapid increase of the parasitic population or in case of worsening of the animals' condition. That is attributed mainly to the relatively low pathogenic ability of the ectoparasites and the relatively low mortality and lethality rates which are characteristic

for these parasitic invasions. The lack of prophylactic and therapeutic programs for control of the ectoparasitic invasions, the low competency and bad awareness from the owners of the animals have led to the wide spread of the ectoparasitic invasions in livestock in some regions. This statement is especially true for goat breeding because in our country it has mainly extensive nature.

The circumstances above provoked our interest into the current study.

## **Materials and methods**

### *Animals*

The study included 30 (10%) naturally infested goats from a herd of 300 animals of a local breed. It was conducted in a private farm in Mogila village, Yambol county during the period between 09. Feb. and 23. Feb. 2018. From the anamnesis it becomes clear that the animals have displayed strong discomfort and are scratching themselves in objects nearby and some are eating reluctantly. The goats haven't been treated for ectoparasites for one year. During pasture season the animals use common pastures with other livestock herds that are bred in the region.

### *Examination*

Before the parasitological examination the goats included in the study were inspected with a magnifying glass to determine any skin anomalies such as alopecia, squamas, crusts, knots as well as eggs and adult ectoparasites. The lice that were found (preimaginal and imaginal live stages) were collected individually with forceps and preserved in containers with 70% ethanol. The material was collected from 7 fields with square shape and measure of 10 cm<sup>2</sup>, measured with a pre-prepared paper template. The areas were selected in the following regions: (1) shoulder, (2) brisket, (3) neck, (4) flank, (5) thigh, (6) groin and (7) abdomen on one side of the body. When calculating the intensity of the invasion (I.I.) we multiplied the number of all parasites found on the seven locuses by 100 (Brown et al, 2005). The collected insects were transported to the lab where they were submerged in a vessel with xylene for 5 minutes with the purpose of lightning and dehydration after which they were fixed on slides with Canadian balm and covered with a coverslip in order to prepare permanent microscopic samples. The lice were classified by morphological characteristics given by Neveu Lemaire (1938). For microscopic observation and creating picture material we used a Leica<sup>®</sup> microscope equipped with a photo camera.

### *Treatment*

All goats from the herd with treated with ivermectin (Pandex<sup>™</sup>) applied subcutaneously in 0.2 mg/kg b.w. dosage. The results of the treatment were reported by examining the whole body of the 30 animals used in the study twice-on the 3<sup>rd</sup> and 14<sup>th</sup> day after the treatment.

## **Results**

From the 30 goats that were studied 28 (93.3%) turned out to be infested with lice. On three of the infested goats (10.7 %) we discovered skin and fur changes as: local alopecia on the head with squamas and crusts, disheveled and matt fur. All infested animals were expressing signs of discomfort and itching.

From all infested animals were collected and conserved in ethanol a total of 453 insects. Their morphological microscopic identification proved them to be all imago and nymph forms of the sucking lice species of goats *Linognathus stenopsis*, Burmeister (1838) that belongs to the family Linognathidae, suborder Anoplura of order Phthiraptera (Fig. 1 and 2). The number of collected insects on the 7 locusses on the body of the goats that were studied varied between 4 and 32, an average of 15.1, and the average I.I. was 1510 (Brown et al, 2005) (Table 1). During the examination on the third day after the treatment there were no living insects found but on the fur of the animals viable eggs were still found. The examination on the 14<sup>th</sup> day was negative for phthiraptera species as well as for viable eggs on all treated animals which demonstrated 100 % insecticide activity of ivermectin against *Linognathus stenopsis* in goats after a single treatment.

**Table 1: Results after subcutaneous treatment with ivermectin (Pandex™) of goats, naturally infected by *Linognathus stenopsis* Burmeister (1838).**

Total number animals	Number examined animals	Mean intensity of infection before treatment	Results after	on 3 <sup>rd</sup> treatment	Results after	on 14 <sup>th</sup> treatment
			number lice	eggs	number lice	eggs
300	30	1510	0	+	0	-



**Figure 1: *Linognathus stenopsis* Burmeister (1838), male, magn. 40X (dorsal view).**



**Figure 2: *Linognathus stenopsis* Burmeister (1838), female, magn. 40X (dorsal view).**

## Discussion

The current study was conducted in a private farm for extensive breeding of goats after a signal of distress from its owner. Our visit in the farm and the laboratory research that followed proved an invasion in the goats with sucking lice from the *Linognathus stenopsis* species, Burmeister (1838). After the treatment of the animals with the antiparasitic drug ivermectin (Pandex™) we did two examinations of the results. The first one was on the 3<sup>rd</sup> day because according to Alvinerie et al. (1993) ivermectin applied subcutaneously to goats reaches maximum concentration on the third and fourth day. The second examination of the effect of the treatment was conducted on the 14<sup>th</sup> day. According to Kaufman (2006) the eggs of the sucking lice of goats hatch in the interval between the seventh and fourteenth day which gives us reason to check the effect of the applied treatment at the end of the mentioned interval.

The results that we have gathered confirm the deductions of many scientists that the drugs from the macrocyclic lactones group demonstrate high efficacy in control of the invasions with lice in goats. Pal et al. (2001) follow the efficacy of doramectin 1% (Dectomax™) applied subcutaneously in 1ml/50 kg b.w. dosage against the same species of lice of goats and they report 100% efficacy of the drug on the 7<sup>th</sup> day after treatment. The authors examine the animals a month after the treatment and they do not discover a new invasion which they explain with the high persisting concentration of the drug in the blood plasma. Yadav et al. (2004) use a drug from the same group – moxidectin applied in pour-on form in 1ml/10 kg b.w dosage and report 100% efficacy on the 4<sup>th</sup> day. The same authors treat goats with ivermectin as well with the same dosage and applying method as in our study but on the 4<sup>th</sup> day they discover 96% efficacy. It reaches 100% on the 7<sup>th</sup> day after the treatment and it remains the same till the 30<sup>th</sup> day. The differences in the results could be accounted to the moderately low level of invasion of the animals used in the current study.

It is known that ivermectin can be used successfully for control of flea invasions in other animal species. Shastri (1991) treats cattle, buffalos, goats and dogs against sucking lice with ivermectin with the same dosage that we used and gets similar results. He reports 100% efficacy against nymphs and adults on the 5<sup>th</sup> day but then discovers viable eggs which disappear on the 10<sup>th</sup> and 15<sup>th</sup> day.

In our country Nedelchev et al. (1985) report 100% efficacy of Ivomec (ivermectin) against sucking species of lice in cattle 60 days after the treatment.

## Conclusion

Ivermectin is a highly efficient drug in the area of lice invasion control in goats during the dry period. Although it has been used for many years it shows 100 % efficacy against *Linognathus stenopsis* from which we can conclude that the parasitic population that was treated is not resistant to the drugs from the macrocyclic lactone group and they continue to be a reliable drug of great importance to the campaign against phthirapterids in small ruminants. It is necessary to create and follow adequate schemes for control and prevention of the ectoparasitic entomoses which guarantee successful breeding of these animals.

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