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SCARABIDAE — INTERMEDIATE HOST FOR *MACRACANTHORHYNCHUS HIRUDINACEUS*

ABSTRACT: *Macracanthorhynchus hirudinaceus* infestation is parasitosis caused by *Macracanthorhynchus hirudinaceus* Adult forms parasite in small intestine of swine. Development of parasite is happening through intermediate hosts — coleopteras from *Scarabaeidae* family (*Melolontha vulgaris*, *Cetonia aurata*, *Polyphilla fullo*, *Anomalia vitis* etc). Infection begins when swines ingest infected coleopteras. *Macracanthorhynchus hirudinaceus* infestation is encountered in swines in extensive breeding, as well as in wild boars.

KEY WORDS: *Macracanthorhynchus hirudinaceus*, coleopteras, swine's, epysootiology

INTRODUCTION

Macracanthorhynchus hirudinaceus infestation is parasitosis induced by acanthocephales belonging to gender *Macracanthorhynchus* — *Macracanthorhynchus catulinus* (Kostylev, 1927), *M. ingens* (Linstow, 1879) and *Macracanthorhynchus hirudinaceus* (Pallas, 1781) (Crompton and Nikol, 1995, Pavlović et al., 2007b). Disease of swines is most frequently caused by *Macracanthorhynchus hirudinaceus* (Eršov et al., 1963; Vujić, 1976; Lindquist, 1978; Lončarević et al., 1997; Pavlović et al., 1997; Kulišić, 2001). *Macracanthorhynchus hirudinaceus* are cylinder parasites of big growth and explicit expression of sexual dimorphism (Crompton and Nikol, 1995). Male is 5—10 cm long, 3—5 mm wide and usually bended like comma, with bell shaped posterior end. Females are 10—17 cm long, (yet exemplars of 47—53 cm of length are registered, too), and 4—10 mm wide (Eršov et al., 1963; Soulsby, 1977; Crompton and Nikol, 1995). They have dull posterior end and usually are spirally twisted

(Šulc and Grozdov, 1972; Lindquist, 1978). At the anterior end, there is rounded proboscis-feeler 1 mm long, up to 500 microns wide, armed with backwards twisted hooks, placed by 6 in 5—6 transversal rows, or by 3 in 12 longitudinal rows. Body of parasite is painted white with shades of blue, cylindrical with bigger or lesser extensions in different parts, with grooved cuticle (Dunagan and Miller, 1987).

Macracanthorhynchus hirudinaceus parasitizes in domestic and wild swines, and rarely in dogs and monkeys (Corwin and Stewart, 1992; Crompton and Nickol, 1995; Mary Aquin, 2003). Human infections are registered in Asia and Australia (Pradatsundarasar and Pechranond, 1961; Prociw et al., 1990).

INTERMEDIATE HOSTS OF *Macracanthorhynchus hirudinaceus*

Macracanthorhynchus hirudinaceus females lay oval eggs 60—100 micrometers long and 50—56 microns wide, that come to environment excreted with feces. They contain embryo surrounded by 3 membranes, armed with several hooks (hooklets) (Crompton and Nickol, 1995). Their further development takes place in intermediate hosts-coleopteras belonging to Scarabaeidae family (Soulsby, 1977; Lindquist, 1978; Pavlović et al., 2007b). Those are most frequently insects *Melolontha melolontha* and *Melolontha vulgaris*, rose vermin — *Cetonia aurata*, marble insect — *Polyphylla fullo*, May's vermin — *Anomala vitis*, rolling insect — *Scarabeus (Ateuchus) sacer*, shaggy insect — *Tropinota (Epicometis) hirta* Poda, grain-vermin — *Anisoplia segetum*, *Amphimallon solsititialis*, *Phylophaga vehemens*, etc. (Olsen, 1986; Crompton and Nickol, 1995; Parshad and Crompton, 1997).

MORPHOLOGY OF Scarabidae

Hardalated insects from Scarabidae family belong to class *Insecta*, order Coleoptera and suborder Polyphaga. They are distributed worldwide, ranging in size from 0.4—11 cm. Anterior wings (elitere) are thickened, while posterior wings (alae) are of use for flying. Head and almost entire body has grown strong — is hardened. Facets of daily species are tiny, more flattened, while species active in twilight have convex and massive (Bei-Benko, 1968; Krunić, 1981). Antennas have phalanxes, up to 11 articles, all of different length.

Mouth apparatus of imago and larva's is adapted for crunching — mandible and maxilla are well developed and strong (Crompton and Nickol, 1995). It continues into esophagus that is broadening in craw, behind which is muscular stomach with cuticular thickening. Middle intestine is capacious and posterior intestine is twisted, while some species have caecum. Rectum is like broad chamber (Hickman, 1973; Krunić, 1981).

Blood system consists of heart with different number of chambers with ostia on it. Tracheal system is branching, a well developed, and 10 pair of

stigmatic apertures is arranged on thorax and abdomen. Brain, 3 pairs of thoracic, and 6 to 8 pairs of abdominal ganglia constitute nerve system (Hickman, 1973).

Out of three thoracic segments, prothorax is well developed and mobile. Meso- and metathorax are connected forming pterothorax, which is carrying eliteras (almost whole dorsal surface of pterothorax is covered with eliteras) and wings for flying. They fly with aid of posterior wings that are well developed, while eliteras do not have significant role in that. Posterior wings are longer from eliteras, and when insects are resting, they are wrinkled below eliteras (Krunić, 1981).

Extremities of Scarabidae are adapted for walking and running with 35-articles tarsus. They have pygidial glands developed for defense (Krunić, 1981).

DEVELOPMENT OF LARVAE

Macracanthorhynchus hirudinaceus AT Scarabidae

Members of Scarabidae family have complete metamorphosis. They lay eggs in different places, most often on leaves or in plant's tissue. Larva hatches from egg (Bei-Benko, 1968; Šulc and Grozdov, 1972; Krunić, 1981; Nichols et al., 2008). Scarabidae larvae have thoracic extremities without tarsus, but with little claws on them. They do not have abdominal prolongations (Hickman, 1973; Krunić, 1981). Stigmas are placed on thoracic and abdominal segments. They drag out into soil where live for 3—4 years and during that period undergo complete metamorphosis (larva — doll — adult form) (Šulc and Grozdov, 1972; Nichols et al., 2008).

Infection of Scarabaeidae happens in larval stage (Šulc and Grozdov, 1972). When larvae of Scarabidae eat macracanthorhynchus eggs excreted into ground with feces of swine, they release larvae (acantor) that hitch on intestinal wall soon, with their hooklets (Šulc and Grozdov, 1972; Parshad and Crompton, 1997). Acantor is completely developed in 5—20 days, becoming evolutive form well known as acanthela (Crompton and Nickol, 1995). In this shape, it becomes parasite of Scarabaeidae larva, feeding, growing, and developing until stage infectious for original — real hosts (Zhao and Wang, 1992, Parshad and Crompton, 1997; Mary Aquin, 2003). In this stage they stay during whole metamorphosis of Scarabaeidae (Moore, 1984; Crompton and Nickol, 1995; Nichols et al., 2008).

If infection begins before June, acantheles are created in 3—4 months, whilst with later beginning of infection larvae are created in 12—13 months (Dunagan and Miller, 1987; Mary Aquin, 2003; Nichols et al., 2008). Preparent period of parasite lasts 2—3 months. Larvae of Scarabaeidae live in soil 3—4 years crunching roots of plants (Bei-Benko, 1968; Hickman, 1973; Krunić, 1981). After finishing of development, they are going out from the soil and live on the trees like adult insects, feeding with buds and leaves (Krunić, 1981; Crompton and Nickol, 1995). *Macracanthorhynchus* larvae — acantheles stay vital during whole life cycle of coleopteras,

so we can find them in larval as well as in doll stage, and in adults of Scarabidae also (Šulc and Grozdov, 1972; Crompton and Nickol, 1995; Pavlović et al. 1997, 2007b).

Considering habitats where we can meet Scarabidae — fields and pasture grounds, it is real to expect that biggest grade of infection is on fields manure with swine feces, or in grassland with swineherd (Vujić, 1976; Lončarević et al., 1997). In some district areas (Posavina, Podrinje, upper parts of Backa to Danube) where swine herding is permanent and number of Scarabidae big, prevalence of infection with acanthelas amounts even 60% (Pavlović et al., 2007b).

In some larval and doll examples, especially May's coleopteras belonging to Melolontha, Cetonia and Polyphylla order, up to 130 acanthelas can be encountered (Olsen, 1986; Parshad and Crompton, 1997). High prevalence of infection of Scarabaeidae certainly correlates with large extension of swine infection, length of parasite life and great resistance of parasite eggs in external environment. Besides, long life of Scarabidae larvae in soil (3—4 years) maintains permanent degree of contamination in above-mentioned region (Nichols et al., 2008).

SWINE INFECTION

Swine infection originates most frequently through larval forms of Scarabidae. Larvae live in soil 12 — 5 cm deep, whilst swines searching for food during digging come to them (Šulc and Grozdov, 1972; Vujić, 1976; Pavlović et al. 1997). Swine could also become infected through adult Scarabaeidae forms that happen during their non-hygienic or pasturage way of feeding (Lindquist, 1978; Olsen, 1986; Nichols et al., 2008).

Adult parasites take rise from acanthelas in digestive system of swine during 2 months. They attach with proboscis to intestinal wall of host. Deep lesions are being formed at those places, sometimes reaching intestinal serosa (serous layer) (Lindquist, 1978; Lončarević et al., 1995; Pavlović et al., 1997; Ivetić et al., 2000). On the exterior side of intestine, convexes little knots at the attachment points could be seen.

Swine with heavy degree of infestation is agitated — (anxious, nervous), thin and skinny, has weaker appetite and sometimes even convulsions may be present (Corwin and Stewart, 1992; Lindquist, 1978). Young pigs may die most often because of peritonitis, caused by perforation of intestinal wall in consequence of parasite activity (Lindquist, 1978; Pavlović et al., 1997, 2007b).

PREVENTION OF INFECTION

In the aim of prevention, it is recommended to avoid contaminated grassland and pasture fields, in consideration of deepness of Scarabidae larva's burying (12—15 cm) and their long life (3—4 years) (Lončarević et al.,

1997). Pre-expulsion method PREGON for leave out (similar way like in sheep) has full justification. Preventive autumnal dehelminthisation is also recommended — being performed 3—4 weeks after dragging, drawing from pasture fields, and spring dehelminthisation before expulsion, exile to pasturage, when all animals are treated (Lončarević et al., 1997; Pavlović et al., 2007b). After the treatment, cleaning and mechanical removal of manure from building is necessary, as well as washing with hot water (above 60°C) and disinfection using 2% NaOH solution as most efficient (Pavlović et al., 2007a).

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SCARABIDAE — ПРЕЛАЗНИ ДОМАЋИНИ ЗА
MACRACANTHORHYNCHUS HIRUDINACEUS

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Резиме

Макраканторинхоза је паразитоза узрокована акантоцефалом *Macracanthorhynchus hirudinaceus*. Одрасли паразити паразитирају у танким цревима свиња. Развој паразита се одвија преко прелазних домаћина — колеоптера из фамилије Scarabidae (*Melolontha vulgaris*, *Cetonia aurata*, *Polyphilla fullo*, *Anomalina vitis* и др). Инфекција настаје када свиње поједу заражене колеоптере. Макраканторинхоза се среће код свиња у екстензивном држању, као и код дивљих свиња.