

***Hypoderma* sp. – rare, atypical parasites of horses**

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Many species of flies (*Diptera*) are parasites. Among them three groups can be distinguished as the most common and the most important pathogens in livestock and wild animals. These are flies belonging to the family *Oestridae*, of the subfamilies *Gasterophilinae*, *Hypodermatinae* and *Oestrinae*. This paper describes a case of invasion of flies of the genus *Hypoderma* sp. among horses kept at a riding club near Krakow (southern Poland), situated close to a farm where beef cattle are raised. The horses in the club are dewormed every year in autumn (October) with macrocyclic lactones (ivermectin). In two horses we found skin lesions taking the form of abscesses with openings closed by mucopurulent secretions. The lesions were located on the withers and the hindquarters. The larvae were identified as stage 2 larvae of *Hypoderma bovis*. The presence of larvae of these parasites in horses may reduce their use in horse riding.

KEY WORDS: *Hypoderma bovis* / horses

Many species of flies (*Diptera*) are parasites. Three groups among them can be distinguished as the most common and the most important pathogens in livestock and wild animals. These are flies belonging to the family *Oestridae* and the subfamilies *Gasterophilinae*, *Hypodermatinae* and *Oestrinae* [2]. Species of the subfamily *Gasterophilinae* (genus *Gasterophilus*) are specific for equids, and their larvae colonize various segments of the digestive tract of these animals. The most important genus of the *Hypodermatinae* is *Hypoderma*, whose larvae live as parasites under the skin of domesticated and wild even-toed ungulates (*Artiodactyla*). The subfamily *Oestrinae* includes several genera, of which the most important are considered to be *Oestrus*, *Cephenemyia*, *Pharyngomyia* and *Rhinoestrus*. The larvae of these flies live as parasites in the frontal sinuses of ungulates (*Ungulata*) and can migrate to the central nervous system.

In Poland the most commonly observed species are *Gasterophilus intestinalis* in horses, *Hypoderma bovis* and *H. lineatum* in cattle, and *Oestrus ovis* in sheep.

The purpose of the study was to describe a rare case of infestation of warble flies of the genus *Hypoderma* in domestic horses. The work describes cutaneous myiasis in a non-specific host.



Photograph 1. Location of *Hypoderma bovis* larvae on the skin of a horse

Material and methods

An equestrian club located in the vicinity of Krakow keeps nine horses that are used for recreation. In the close vicinity (about 200 m) there is a farm where feedlot cattle are raised. Horses on the farm are dewormed once a year in the autumn (October) with a medication containing macrocyclic lactones (ivermectin). Tests were undertaken at the club after the owner of the facility reported skin lesions in the horses. In previous years the horses had not been tested for other parasites, including internal parasites.

Case description. Two yearling horses (one female and one male), in good condition, were found to have lumps on the withers and hindquarters, with openings closed by a mucopurulent secretion (Photo 1). During treatment of the skin lesions, fly larvae were removed from the lumps and then fixed in 75% alcohol and transported to a parasitological laboratory for identification. The larvae were obtained in January 2014 after the autumn deworming of the horses. The larvae were identified using keys by Zumpt [31] and Draber-Mońko [4].

Results and discussion

Based on the morphology of the larvae, they were identified as second-stage larvae of the northern cattle grub *Hypoderma bovis* (Photos 2 and 3). The lumps on the horses, about 1 cm in diameter and containing larvae, were found near the spine (thoracic part) and on side of the hindquarters. Two lumps were found on each animal. No other skin changes, such as hair loss, were observed at the site of the larvae. The presence of larvae caused pain in the horses when the affected areas were touched.

Typical horse parasites among the Diptera are warble flies of the genus *Gasterophilus*. In our own previous research, the presence of larvae of these parasites was noted in about 10% of horses, and the predominant species was *Gasterophilus intestinalis* [14, 15]. Similar results have been obtained by other authors in Poland [6, 8, 21, 28], and the species *G. nasalis* has been recorded as well [21, 28]. The presence of larvae in various parts of the gastrointestinal tract (stomach, duodenum and rectum) leads to impairment of glandular activity in the stomach, damage to the gastric mucosa and other part of the gastrointestinal tract, colic, anaemia, and progressive emaciation. In extreme cases it may lead to death due to gastric perforation or cachexia [7, 13, 27].



Photograph 2. Isolated stage 2 larvae of *Hypoderma bovis* (x20 magnification)



Photograph 3. *Hypoderma bovis* – posterior spiracles of a larva (x100 magnification)

The occurrence in horses of warble fly larvae of the genus *Hypoderma* is rare. Of several hundred available abstracts in the PubMed base, only a few concern the occurrence of these parasites in horses. Sources of infestation in horses may be *H. bovis* (northern cattle grub) and *H. lineatum* (common cattle grub), which parasitize cattle, or other species of this genus – *H. acetabon*, *H. capreola*, *H. diana*, *H. moschiferi* or *H. tarandii*, occurring in deer (*Cervidae*). In Poland, warble flies of the genus *Hypoderma* are often noted in cattle [1, 24, 30]. Studies on deer (*Cervidae*) have also confirmed the presence of *H. diana* in this country [20]. The myiasis in horses described in this study may be linked to the close proximity of the equestrian club and the farm raising feedlot cattle.

The development cycle of warble flies of the genus *Hypoderma* in horses is unknown. In specific hosts, i.e. even-toed ungulates, the female flies are fertilized immediately after completing the pupal stage. The adult forms of these insects do not feed, having reduced mouthparts, and during flight they use energy stored in the fat body, which shortens their lifespan. Males die after fertilizing females. The females lay eggs, attaching them to hairs on the front and rear limbs, chest, sides, and tail of the host, and then they too die. The larvae developing from the eggs enter the body of the host through small cuts or actively penetrate the skin. The migration path of the first-stage larvae in ungulates runs through

the subcutaneous tissue, along the intercostal nerves to the vertebral canal, or through the abdominal and chest cavity to the oesophageal wall. Further migration of the larvae ends in the subcutaneous tissue of the back muscles, where they moult to reach the third stage [7, 27].

The presence of larvae on the back induces a defence reaction in the host, consisting in the formation of a connective tissue capsule surrounding the larvae. This results in the formation of lumps that increase in size as the larvae grow. The larvae penetrate the skin of the host after the first or second moulting, due to oxygen deficiency. The larvae remain in the host for a long time, about 9-10 months, from early spring to spring or summer of the following year. After this period the larvae fall out of the body of the host into the external environment, and pupa formation and metamorphosis take place in the soil within about one month. The activity of the adult form of *Hypoderma* that attacks cattle is greatest in the summer. Infestation of horses by this non-specific parasite also occurs during the pasture season.

Despite the complex migration of warble fly larvae in the host organism, the course of infestation is most often subclinical. The external manifestation is the appearance of lumps on the back of the animal after larval migration is complete. The infestation may result in petechiae or abscesses at the site where the larvae are present, as observed in the horses in this study, and sporadically paresis and paralysis of the limbs due to the presence of larvae in the vertebral canal. Insects can cause anxiety in herds of grazing animals, which can lead to fractures and limb injuries [7, 27].

As mentioned above, infestation with warble flies of the genus *Hypoderma* is rare in horses. The presence of *H. diana*, acquired from deer (*Cervidae*), has been reported in the Netherlands [10], the Czech Republic [11, 16, 18], Scotland [12] and southern and western Siberia [23, 26]. Schumann et al. [25] also described a case of *H. diana* infestation in donkeys. The larvae in these cases were located under the skin of the back, forming the lumps characteristic for this species. Most second- and third-stage larvae found have been dead, however, which may indicate that the developmental cycle cannot be completed in this atypical host. On the other hand, the presence of Hypodermatinae in horses can be very dangerous, due to the non-specific location of the larvae of *Hypoderma bovis* [9] or *Hypoderma lineatum* [19], which have been found in the central nervous system, resulting in paresis and impaired movement in the host.

The presence of *Hypoderma bovis* larvae in the horses described in the present study caused severe pain in the area of the withers, where the lumps were located. Infestation with this parasite can therefore lead to a reduction in their usefulness as mounts or draught horses, especially in the case of adult animals. The presence of *Hypoderma bovis* larvae in horses is linked to the close proximity of land where cattle are kept.

The potential widespread transmission of the larvae of flies of the genus *Hypoderma* (*H. sinense* and *H. tarandii*) to non-specific hosts is also evidenced by cases of their occurrence in humans [3, 5, 17, 22].

Preventing warble infestation in livestock is difficult. The most common means of inhibiting larval development is the use of antiparasitic preparations, in the form of subcu-

taneous and intramuscular injection or pour-on products, as well as preventive measures. Medications containing ivermectin have good properties for combating these parasites if used at least twice a year, i.e. before and after the start of the pasture season and after its completion [29]. Preventive measures include leaving the animals in the stable on sunny days in the afternoon, when warble flies are especially active on the pasture, and building shelters in pastures to provide the animals with a refuge from insect attacks.

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