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Case report

A mammary myiasis caused by *Psychoda albipennis* (Diptera: Psychodidae) in a dairy cow: first record

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ABSTRACT. Myiasis is one of the most prevalent ectoparasitic infestation worldwide. In this study, we present a rare case of mammary myiasis caused by the larvae of the *Psychoda albipennis* species. The larvae emerging from the cows' udder were cleared with lactophenol and 30% KOH. Morphological characteristics and literature reviews indicated that the larvae belonged to the species *P. albipennis*. As a result of mechanical damage caused by the larvae and the use of medications leading to the atrophy of the udder, the cow was sent for slaughter. Myiasis cases occurring in animals housed under inadequate hygiene conditions have been observed to cause economic losses and even lead to death.

Keywords: dairy cow, mammary, myiasis, Psychodidae, *Psychoda albipennis*

Introduction

Myiasis, defined as the infestation of various organs and tissues of humans and other vertebrates by the larvae and eggs of more than 50 fly species from the class Insecta and the order Diptera, can occur in three different forms: obligate, facultative, and accidental. „Myia" is derived from the Greek word for fly [1]. While some flies rarely cause myiasis, others may require a host to continue their life cycle [2]. Cases of myiasis are rarely observed in humans, typically occurring in tropical and subtropical regions during warm summer months and in situations where hygiene conditions are inadequate or not adhered to [3]. This condition, one of the most common arthropod diseases in both the world and Türkiye, especially in animals, is observed during the active periods of flies in summer and autumn [3].

In cases of myiasis, eggs (oviparous) or larvae (larviparous) of certain flies belonging to the order Diptera may be deposited by the flies in open wounds or body cavities such as the nasal cavity, oral cavity, ear canal, and genital tract. The feeding activity of the larvae in wounds and body cavities can result in severe tissue loss, loss of productivity, reproductive issues, blindness, lameness, and even cases of death [3]. The flies responsible for causing myiasis are mainly from the families Calliphoridae, Sarcophagidae, Hypodermatidae, Oestridae, and Gasterophilidae. However, certain species from other families, such as Muscidae and Psychodidae, may occasionally cause myiasis. Flies from the Hypodermatidae, Oestridae, and Gasterophilidae families cause obligate myiasis in animals such as cattle, sheep, and goats [3].

The Psychodidae family is divided into six subfamilies, with only two being medically significant. The subfamily Phlebotominae, also known as sand flies, includes blood-feeding insects that live in organic-rich environments such as animal burrows, termite nests, and tree cavities. The subfamily Psychodinae, also known as moth flies or drain flies, includes small flies (2–5 mm) with a distinctive resting posture, hairy bodies, and mouthparts that are relatively shorter than those of sand flies, making them unsuitable for blood-feeding. The larvae of these flies are aquatic and breed in damp environments, often found around drainpipes. They are, therefore, also known as „sewer flies" or „drain flies". These species are oviparous and lay their eggs together with a jelly-like structure [4].

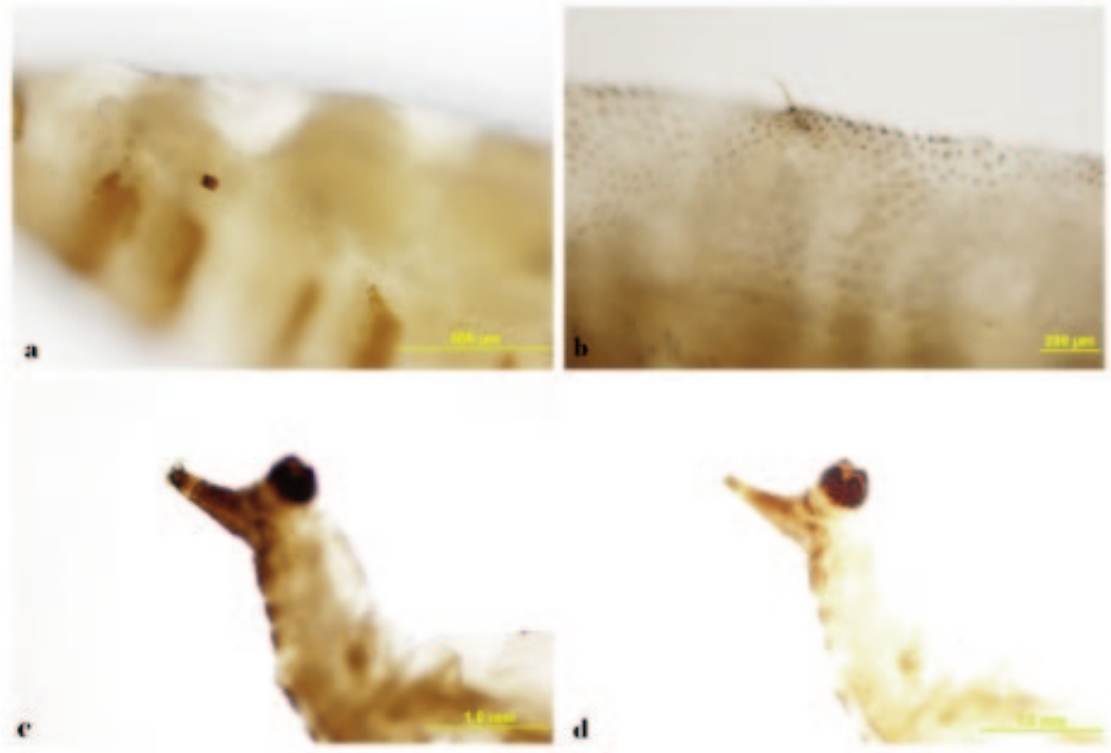

Figure 1. a. anterior spiracle; b. appearance of short hairs and spines on the larva's body surface; c, d. structure of the siphon and posterior stigmata

In particular, three species *P. albipennis* (Zetterstedt, 1850) [1,5–12]; *Psychoda alternata* (Say, 1824) [13]; *Clogmia albipunctata* (Williston, 1893) [14–20] within the family Psychodidae have been reported as cases of myiasis in humans. A review of previous studies shows that Psychodidae species have not been reported as causes of myiasis in animals other than humans.

Literature reviews show that the species *P. albipennis*, *P. alternata*, and *C. albipunctata* have been reported in cases of urogenital myiasis [1,5–12, 15,17–23], ocular myiasis [13] and intestinal myiasis [16] in humans. The predominance of urogenital system cases among the reported instances may be related to the abundance of these species in bathrooms and toilets.

This study presents a case of myiasis associated with larvae of the species *P. albipennis* detected during milking from the udder of a 5-year-old lactating Holstein dairy cow. Based on a comprehensive literature review, this case report is believed to be the first of its kind worldwide, even though species of the family Psychodidae are not commonly reported as causes of myiasis in animals.

Case

In April 2023, the owner of a 5-year-old native Holstein dairy cow kept on a family farm in Aydın province brought a sample of milk collected after milking to the Department of Parasitology at the Veterinary Faculty of Aydın Adnan Menderes University. The owner reported observing tiny, mobile, worm-like organisms in the milk. Preliminary examination revealed that the larvae brought to the laboratory belonged to the Psychodidae family, but a definitive association with myiasis could not be established. During this preliminary examination, the owner was asked comprehensive anamnesis questions, including the cleanliness of the milking machine, the cleanliness of the milk collection containers, the presence of larvae in tools and equipment used in the barn, and the presence of larvae in other cows. Approximately ten days after the arrival of the first sample, the owner brought another ten larvae from the same cow's udder to our laboratory. The owner reported that he sterilized all equipment used in the barn, including the milking machine, down to the smallest part and that he ensured hygiene conditions and checked for the presence of larvae before milking the cow. Despite these measures, the owner

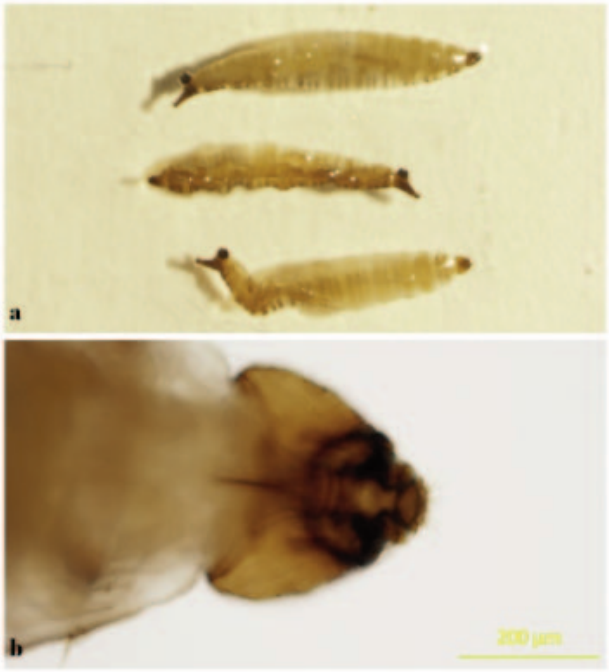

Figure 2. a. habitus view of the larvae of *P. albipennis* under a stereomicroscope; b. head region and mouthparts of the larva

observed larvae in the milk containers again after milking. Additionally, he reported that after observing larvae in the milk collected by milking machine, he milked by hand the same udder and confirmed that the larvae emerged directly from the udder. Because of their delicate structure and small size, the larvae were placed in 25% ethyl alcohol. For microscopic examination, two larvae were soaked in lactophenol and one in 30% KOH [6] for 24 hours to achieve transparency. The larvae were examined by light microscopy. Different parts, such as the head, the anterior spiracle, the posterior siphon, and the spines on the body, were photographed (Fig. 1) using a photographic application. The presence of hairs on the posterior siphon organ, covering the body with spine-like structures, varying lengths of hairs on the body, and measuring an average length of 4–10 mm in fourth instar larvae were identified as distinctive features for diagnosis [24,25]. In addition, larvae that were not transparently examined under a stereomicroscope and habitus photographs (Fig, 2a) were taken using a photographic application. Larvae with an average body length of approximately 7–8 mm were identified as larvae of *P. albipennis* (Zetterstedt, 1850) (Diptera: Psychodidae) based on these criteria, together with macroscopic and microscopic examinations and literature review.

Discussion

P. albipennis, a species within the Psychodidae family, is commonly called the moth fly or drain fly during its adult stage [22]. The larvae of this species are aquatic, leading them to deposit their eggs in clusters of 30–40 in various locations, including homes, especially bathrooms, toilets, and drains, as well as in the natural environment, around sources of wastewater and accumulated waste [21]. The larvae progress through four stages of development and display a cylindrical, grey hue with body lengths ranging from 2–3 mm to 15–20 mm. They possess a short, hairy, and spiny morphology [3,7,21]. In addition, molecular analyses such as PCR and sequencing can be used to identify this species. These methods were used in another case of myiasis in Egypt caused by *C. albipunctata*, a species of the same family [18]. Our reasons for not using molecular tests include the large number of specimens we have, the numerous human myiasis cases caused by *P. albipennis* reported in the literature, and the clear morphological and morphometric data available for this species in the literature [3,7,21].

P. albipennis has frequently been reported in myiasis of the human urogenital system, globally and in Türkiye [1,12]. However, no previous studies regarding myiasis cases in animals have been found. There needs to be more literature on udder myiasis in cows. Rahman et al. [26] and Munif et al. [27] found, through separate studies conducted in Bangladesh, that cases of udder myiasis can be detected in cows. Moreover, Sayın and Şaki [28], in a study conducted in Diyarbakır, reported cases of udder myiasis in other ruminant species, such as sheep and goats. However, in these cases, *Wohlfahrtia magnifica* (Schiner, 1862) has been identified as the etiological agent causing udder myiasis.

Although there are limited accounts of human breast myiasis in the literature, they are commonly linked with illness or inadequate hygiene conditions. In a study by Garbeloto et al. [29], it was noted that a 60-year-old woman with a malignant neoplasm in her right breast, which had ulcerated during chemotherapy, developed a case of myiasis caused by the *Sarcophaga* sp. genus. The study particularly highlighted that the patient neglected personal hygiene practices. In a separate instance, Sprenger et al. [30] documented a case of myiasis affecting the right breast of an 84-year-old female

caused by *Dermatobia hominis* (Linnaeus, 1781). In a recent study conducted by Boff et al. [31], a case of myiasis was observed in a 56-year-old woman with stage IV breast cancer and a disadvantaged socioeconomic background.

Literature documenting cases of mammary myiasis typically features species that lay eggs or larvae in a wound on the breast or directly in the subcutaneous tissue. The larvae of the *P. albipennis* species are found in aquatic habitats. This species is not viewed as an obligatory myiasis-causing agent, and instances where it has been found to lay eggs in a wound or body cavity are sparse in literature reviews [8]. Eggs or larvae in contaminated water or personal use products typically cause infestation. Inadequate environmental conditions may allow *P. albipennis* eggs or larvae to enter a cow's teat through surfaces that accumulate urine and faecal fluids. A wound in the udder can also enable larvae and eggs to enter the teat's interior. The larvae's ability to tolerate low oxygen levels and adapt to cold and warm environments enables their participation as agents in myiasis [24].

In this case report, the owner of the cow applied medical treatment. At first, doramectin was intramammarily administered, though the extent of dilution is unknown. Given that this method proved ineffective, eprinomectin was intramuscularly injected at an unknown dosage by the patient owner. Subsequently, when larvae reappeared in the same area, an unknown dosage of diluted ivermectin was intramammarily administered. After administering ivermectin, the udder size reduced, and the cow ceased to produce milk. The owner chose to slaughter the cow due to the notable decline in milk yield.

Due to the warm climate in our country and the wide distribution of several fly species, numerous myiasis cases affect both humans and animals. Accidental and facultative myiasis cases often arise from poor hygiene. In rare cases, flies with larvae living in aquatic environments, including *P. albipennis*, may cause myiasis, where liquids such as urine, faeces, and rainwater accumulate in the animals' living areas. Synanthropic flies commonly exist among humans and domestic animals within similar environments. Mammary myiasis is an infrequent occurrence with limited literature, yet it presents a potential hazard leading to life-threatening situations. Determining the mechanism by which aquatic fly larvae gain entry into the mammary gland is crucial. It is also necessary to consider whether these larvae could mechanically transfer saprophytic or opportunistic micro-organisms in environments contaminated with organic waste, such as water, faeces, and urine. As demonstrated in the cited case, myiasis risks public health and may also result in economic losses. With the termination of larval expulsion during the existing egg period in living animals, cases of myiasis may pass unnoticed or recover spontaneously without medical intervention, highlighting the need to bring them to the community's attention. Consequently, raising awareness campaigns is necessary, and there should be an effort to enhance environmental and personal hygiene conditions. For prevention and control in livestock farming, it is necessary to regularly clean the ground of the environment where the cows are kept, from accumulated urine and faecal liquids. It will also be beneficial to apply teat dipping before and after milking. Regular cleaning of public restrooms and household bathroom drains with various chemicals or insecticides can reduce the incidence of these flies causing myiasis in humans. Similarly, in livestock farming, implementing insecticide treatments at times suitable for the flies' biology is crucial to prevent both accidental and obligate myiasis cases. This is important for livestock productivity as well as for the triangle of animal health, human health, and environmental health. This case report constitutes the first documented incident of udder myiasis attributable to *P. albipennis* in cattle globally.

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