Facultative myiasis caused by rat-tailed maggots in a dog in Belgium

Facultatieve myiasis veroorzaakt door rattenstaartlarven bij een hond in België

[1]H. De Bosschere, [1]A.-S. Platteeuw, [2]A. Verstraeten

[1]MedLab Bruyland – Diergeneeskunde, Beneluxpark 2, B-8500 Kortrijk, Belgium
[2]Dierenartsencentrum ANIMO, Damse Vaart-zuid 75, B-8310 Sint-Kruis, Belgium

hendrik.de.bosschere@bruyland.be

ABSTRACT

A two-year-old cavalier King Charles spaniel was presented with accidentally observed larvae in fresh feces, which were identified as rat-tailed larvae of the common drone fly *(Eristalis tenax)*. This common drone fly can cause facultative myiasis in both humans and animals. Although facultative myasis has already been described in humans, to the authors' knowledge, this is the first description of such a case in an animal in Belgium.

SAMENVATTING

Een twee jaar oude cavalier king charles werd aangeboden met larven in de feces die als rattenstaartlarven van de blinde bij *(Eristalis tenax)* werden geïdentificeerd. Het is bekend dat deze zweefvlieg facultatieve myiase kan veroorzaken bij mens en dier. Hoewel in België reeds enkele gevallen bij de mens werden beschreven is dit volgens de auteurs het eerste geval beschreven bij een dier in België.

INTRODUCTION

Myiasis is the term proposed by Hope (1840) to define the presence of fly larvae (Insecta: Diptera) in the body of humans and animals. This term was more precisely defined in 1965 by Zumpt as the parasitic infestation of organs or tissues of humans and live vertebrates by dipteran larvae, which feed on a host's tissue, liquid body substances, or ingested food.

Myiasis has a worldwide-spread incidence among domestic and wild animals with relatively high biological and economic importance, especially in tropical countries (Pérez-Bañón et al., 2020). Myiasis can be classified based on the behavior of the involved fly species and the nature of the parasitic relationship, i.e. obligatory and facultative myiasis.

Obligatory myiasis means that the involved fly species can only complete their development exclusively parasitizing live hosts. On the other hand, facultative myiasis means that the species does not necessarily need a host for its development.

A third type of myiasis, named accidental myiasis or pseudomyiasis (Zumpt 1963; Kenney et al., 1976; Dorland, 1994), has also been documented. Accidental myiasis occurs when the larvae of a normally free-living species are swallowed with contaminated food or water, passing through the gastro-intestinal tract (Zumpt 1965; Kenney et al., 1976; Dorland, 1994).

In the literature, many reports are available of drone flies, especially the common drone fly *(Eristalis tenax)*, as accidental myiasis agents in humans and livestock around the world (Pérez-Bañón et al., 2020). Most of these cases are considered as intestinal myiasis and are probably caused by the drinking of putrid water containing eggs or small larvae, or by ingestion of contaminated food (Rotheray and Gilbert, 2011). Other authors proposed an alternative hypothesis, called 'rectal myiasis' (Zumpt, 1963). In this hypothesis, the flies are attracted to feces and deposit their eggs or larvae near or into the anus, where the larvae further penetrate into the rectum.

In the present case, the accidental discovery of rat-tailed maggots in fresh feces of a dog and the available literature are described.

CASE REPORT

A two-year-old, female, castrated cavalier King Charles spaniel was presented with larvae in the feces

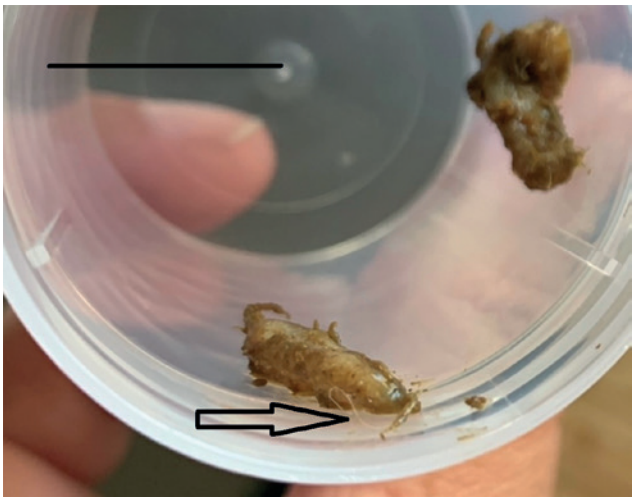

Figure 1. Drone fly larva or rat-tailed maggot in a feces container. These larvae have a characteristic elongated anal segment, pictured as a fine white thread (arrow), which allows them to breathe air while submerged in ponds and mud. Bar = 15 mm.

(Figure 1). The owner had observed several (2-3) larvae in fresh feces of the dog three times with more than one week in between. They were still alive after defecation.

Since a period of seven weeks before these larvae were found, the dog's feces had been dark (consistent with melena) and with a weak consistency. The dog showed signs of abdominal discomfort. During that period, the dog's feces had been examined three times for occult blood (FOB rapid test cassette, All Test), Giardia sp. (SnapGiardia, Idexx) and other intestinal parasites via the fecal sedimentation flotation method). All occult blood tests were positive while the dog tested negative for Giardia and other intestinal parasites. Nevertheless, the dog was treated for intestinal parasites with Milbemax® (Elanco - milbemycine oxime and praziquantel, Germany) and Panacur® (Intervet, fenbendazole, the Netherlands). One month after presentation, the dog's feces tested negative for occult blood; no more larvae were found during that period and clinical symptoms were absent. The owner had a fishpond in the garden, where the dog used to drink. The dog also had the habit of digging and chewing plants in the garden.

The larvae were 1.5 to 2 cm long, white-beige colored. They express as a fly maggot-like appearance with a telescopic extendable tube at their posterior end. This organ gives the larva its common name of rat-tailed larva/maggot (Chinery, 1986).

DISCUSSION

Flower flies, hover flies, drone flies or syrphids play an important role as potential pollinators of both natural and hand-managed ecosystems (Larson et al., 2001; Golding et al., 2001; Ratnieks and Carreck, 2010; Potts et al., 2010; Inouye et al., 2015) as they feed on pollen and nectar. The larvae of these flies present a large array of feeding modes, including phytophagy, saprophagy, mycophagy, predation (Rotheray and Gilbert, 2011), and also some more specialized trophic strategies (Pérez-Lachaud et al., 2014; Fleischmann et al., 2016). Rat-tailed maggots, as the larvae of hover flies are called, mostly live and feed in decaying liquid or semisolid matter (Rotheray and Gilbert, 2011). These larvae have a characteristic elongated anal segment with the posterior respiratory process at the tip, which allows them to breathe air while submerged in ponds and mud with accumulations of decaying vegetation or from farmyard manure or silage (Rotheray, 1993; Whish-Wilson, 2000). Some species of rat-tailed maggots are tolerant of pollution and water bodies with high organic content and low oxygen concentration.

The drone fly *(Eristalis tenax)* is quite large and resembles a honeybee (Figure 2). The female fly lays hundreds of eggs on decaying organic matter, including feces. The developing larvae feed on decomposing organic material. At the end of their larval stage, they search for a dry location where they pupate and become hover flies (Garcia-Zapata et al., 2005).

It has been suggested that humans acquire *E. tenax* intestinal myiasis by ingesting the fly eggs, or early-stage maggots, in contaminated food or water (Aguilera et al., 1999; Whish-Wilson, 2000). The larvae then develop in the intestine, feeding on luminal contents. However, it remains unclear whether they can survive the anaerobic environment of the intestine. Alternatively, it has been suggested that the female fly may deposit eggs in the perianal area, and the newly hatched maggots crawl into the rectum and develop there, extending their breathing tubes through the anus like a diver's snorkel (Zumpf, 1963). This has been described as the 'rectal myiasis hypothesis' (Zumpt, 1963). However, according to the authors of the present case, the latter mode of infection seems unlikely in Belgium, both for humans and animals due to the hygienic, vestimentary and housing habits in Belgium. This dog contaminated itself, probably via drinking from the fishpond or via chewing decomposing organic material in the garden where eggs or early-stage maggots of the hover fly were present.

Since the beginning of the twentieth century, there have been sporadic reports in humans excreting the larvae of *E. tenax* in feces. The drone fly larvae does not penetrate the epithelium of the digestive tract, and therefore does not infiltrate any body tissues. They are spontaneously expelled from the host organism after a period of partial maturation. Thereafter, the transformation of mature larvae into pupae occurs externally (Garcia-Zapata et al., 2005). This implies that no physical symptoms or limited anal discomfort and pruritus are experienced (Hall, 1918; Zumpf, 1963; Hira, 1977; Wish-Wilson, 2000). Rarely, dizziness,

nonspecific abdominal pain, vomiting and diarrhea have been described (Hira, 1977; Dorland, 1994; Aguilera et al., 1999; Derraik et al., 2010).

The dog of the present case showed melena and abdominal discomfort. To the authors' knowledge, the symptom of melaena hasn't been previously described in combination with a rat-tailed maggot infestation; however, the authors seriously question whether melena in the present case was attributed to the rat-tailed maggots, as they are believed to inhabit the rectum (Zumpt, 1963). In addition, fresh blood in the feces could have been expected in case the maggots had caused intestinal hemorrhage.

If it is assumed that myiases involving syrphid flies are due to the accidental ingestion of eggs or first instar larvae in contaminated food or drink (Aguilera et al., 1999; Garcia-Zapata et al., 2005), they should be classified as accidental myiasis. However, since expulsed maggots are 2.5 to 3 cm long and close to pupation, larval development must have been completed inside the digestive system of vertebrates. Therefore, drone fly larvae should be considered as true facultative myiasis agents instead of accidental agents or pseudomyiasis, as previously reported (Pérez-Bañón et al., 2020). In case of pseudomyiasis, the larvae are not able to continue their development (Pérez-Bañón et al., 2020). Nonetheless, as the parasitic stage is not obligatory and as the bowel constitutes an accidental site for their development, the infestation by *E. tenax* larvae should only be described as facultative myiasis (Aguilera et al., 1999).

In conclusion, discovery of living drone fly larvae in pet's feces may be frightening for the owner, but in most cases, facultative myiasis does not involve pathology.

Figure 2. Illustrative photograph of an adult female common hover fly *(Eristalis tenax)*. The common hover fly has about the same shape and color as the honeybee *(Apis mellifera)*. To reinforce the resemblance, this species also makes a buzzing sound while flying, but cannot sting. The difference can be seen mainly in flight: bees make a free-flowing movement, while the hover fly can shoot from position to position and regularly hovers still in the air. The body is brown with narrow yellow transverse stripes. The common hover fly has a fairly dense hairy head and chest piece and a lighter hairy abdomen. Just below the chest piece, yellow-orange, triangular spots are present. The eyes are typically fly-like. The blind bee is common in Belgium (Photo by H. De Bosschere).

ACKNOWLEDGEMENTS

The authors want to thank the dog owner for providing all necessary information to describe this case.

REFERENCES

Aguilera A., Cid A., Regueiro B. J., Prieto J. M., Noya M. (1999). Intestinal myiasis caused by Eristalis tenax. *Journal of Clinical Microbiology 37*, 3082.

Chinery M. (1986). Waterbewonende nymfen en larven. In: Chinery M. (editor). *Nieuwe Insektengids*, Tirion, Baarn, p. 296-297.

Dorland W.A.N. (1994). Pseudomyiasis – myiasis. In: Dorland W.A.N. (editor). *Dorland's Illustrated Medical Dictionary.* 28th Edition, WB Saunders Company, p. 1091-1379.

Derraik J. G. B., Heath A. C. G., Rademaker M. (2010). Human myiasis in New Zealand: imported and indigenously-acquired cases; the species of concern and clinical aspects. *New Zealand Medical Journal 123*, 21-38.

Fleischmann A., Rivadavia F., Gonella P. M., Pérez-Bañón C., Mengual X., Rojo S. (2016). Where is my food? Brazilian flower fly steals prey from carnivorous sundews in a newly discovered plant-animal interaction. *PLoS One 11*, e0153900. https://doi.org/10.1371/journal.pone.0153900

Garcia-Zapata M. T., de Souza Junior E. S., Fernandes F. F., Santos S. F. (2005). Human pseudomyiasis caused by Eristalis tenax (Linnaeus) (Diptera: Syrphidae) in Goia´s. *Revista da Sociedade Brasileira de Medicina Tropica 38 (2),* 185-187.

Golding Y. C., Ennos A. R., Edmunds M. (2001). Similarity in flight behaviour between the honeybee Apis mellifera (Hymenoptera: Apidae) and its presumed mimic, the dronefly Eristalis tenax (Diptera: Syrphidae). *Journal of Expimental Biololgy 204*, 139-145.

Hall M. C. (1918). A note regarding myiasis, especially that due to syrphid larvae. *Archives of Internal Medicine 21*, 309 -312.

Hira P. R. (1977). Rectal myiasis: First report on a case due to the rat-tailed larva of Eristalis tenax in Africa. *East African Medical Journal 54*, 224-226.

Hope F. W. (1840). On insects and their larvae occasionally found in the human body. *Transactions of the Entomological Society of London 2*, 256-271.

Inouye D. W., Larson B. M. H., Symank A., Kevan P. G. (2015). Flies and flowers III: ecology of foraging and pollination. *Journal of Pollination Ecology 16*, 115-133.

Kenney M., Eveland L.K., Yermakov V., Kassouny D.Y. (1976). Two cases of enteric myiasis in man. Pseudomyiasis and true intestinal myiasis. *American Journal of Clinical Pathology 66*, 786-791.

Larson B. M. H., Kevan P. G., Inouye D. W. (2001). Flies and flowers: taxonomic diversity of anthophiles and pollinators. *Canandia Entomology 133*, 439-465.

Pérez-Bañón C., Rojas C., Vargas M., Mengual X., Rojo S. (2020). A world review of reported myiases caused by flower flies (Diptera: Syrphidae), including the first case of human myiasis from Palpada scutellaris (Fabricius, 1805). *Parasitology Research 119 (3)*, 815-840.

Pérez-Lachaud G., Jervis M. A., Reemer M., Lachaud J. P. (2014). An unusual, but not unexpected, evolutionary step taken by syrphid flies: the first record of true primary parasitoidism of ants by Microdontinae. *Biological Journal of the Linnean Society of London 111*, 462-472.

Potts S. G., Biesmeijer J. C., Kremen C., Neumann P., Schweiger O., Kunin W. E. (2010). Global pollinator declines: trends, impacts and drivers. *Trends Ecology Evolution 25*, 345-353. https://doi.org/10.1016/j.tree.2010.01.007

Ratnieks F., Carreck N. (2010). Clarity on honey bee collapse? *Science 327*, 152-153. https://doi.org/10.1126/science.1185563

Rotheray G. E. (1993). Colour guide to hoverfly larvae (Diptera, Syrphidae) in Britain and Europe. *Dipterists Digestion 9*, 1-156.

Rotheray G. E., Gilbert F. (2011). The Natural History of hoverflies. *Forrest Text, Tresaith*, Wales, p. 333.

Whish-Wilson P. B. (2000). A possible case of intestinal myiasis due to Eristalis tenax. *Medical Journal of Australia 173*, 652.

Zumpt F. (1965). Myiasis in man and animals in the Old World. In: *A texts book for Physicians, Veterinarians and Zoologists*, Butterworths, London.

Zumpt F. (1963). The problem of intestinal myiasis in humans. *South African Medical Journal 37*, 305-307.

Oproep

Gevallen uit de praktijk in het Vlaams Diergeneeskundig Tijdschrift

Omdat het Vlaams Diergeneeskundig Tijdschrift in de eerste plaats een tijdschrift van en voor dierenartsen is, wil de redactieraad een oproep doen om bijzondere gevallen die u in uw praktijk ziet, kenbaar te maken in de vorm van een artikel dat in het tijdschrift na beoordeling gepubliceerd kan worden.

Geïnteresseerden worden voor de opmaak van hun case-report aangeraden de richtlijnen voor auteurs te volgen: https://openjournals.ugent.be/vdt/site/guidelines/ of kunnen terecht bij nadia.eeckhout@ugent.be

Als voorbeeld kunnen reeds eerder in het VDT gepubliceerde casuïstieken dienen.