

Two Cases of Myiases Caused by Blowflies (Diptera: Calliphoridae) on Noctule Bats (*Nyctalus noctula* Schreber, 1774) (Chiroptera) in Bulgaria

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Abstract: Two cases of fatal myiases on bats are reported, with the first record of myiasis caused by *Calliphora vicina* on noctule bats in Bulgaria. Myiasis as a factor for increasing mortality of bats are discussed.

Keywords: Myiasis, blowfly, body of mammal

Myiases are parasitic diseases caused by fly larvae, which feed on the tissues of carrions or living animals, usually of small size (ZUMPT 1965). Myiasis-causing flies are widely observed in the tropical countries whereas in Bulgaria, a country with a temperate climate, the epidemiology and clinical presentation of these diseases are poorly known, especially in small mammals.

Although cases of myiasis on juveniles of bats that form large colonies are known (KULZER 2002), such records with regard to forest species and adult individuals are extremely rare (KOCK, ALTMANN 1991, KULZER 2002). The present article reports two cases of myiases on adult bats, which caused their death in both direct and indirect way.

Material and Methods

The specimens were stored at the National Museum of Natural History, Sofia, Bulgaria (NMNHS). The staff of the NMNHS and the Bat Research and Conservation Centre (BRCC) team was trained according to all ethical requirements for work with bats and provided with permissions required by the Bulgarian Biodiversity Act (Permission 554/20.1.2014). The keys by LAVCHIEV (1980), SZPILA (2010, 2012) and SZPILA *et al.* (2014) were used for identification of the larvae and imago of Calliphoridae.

Results

On 18 May 2014, children found a noctule bat, *Nyctalus noctula* Schreber, 1774, in debilitated condition in Sofia City centre (Knyazhevska Gradina Park) and carried it to the BRCC at NMNHS on the evening of the same day. The bat was kept in a well-closed cardboard box with good air permeability but with no access of insects. The same night the bat was examined by some volunteers, fed with meal worms and water was offered. At first sight, it looked vital according to the examiners. On the next day, after a careful examination, the bat was determined as a male, with a wound in the scrotal area. Then, the presence of fly larvae in the wound was noticed (Figs. 1-2). The bat appeared extremely exhausted and was losing its vitality quickly. On attempting to remove larvae and clean and decontaminate the wound, some larvae were found in the abdominal cavity. This was the reason for the decision to euthanize the animal. The larvae remained on the bat carcass. In 10 days, they pupated and in the next 10-12 days the adult flies appeared: totally 74 specimens (38 males and 36 females) of the species *Calliphora vicina* Robineau-Desvoidy, 1830 (Fig. 3).

The second case concerns a female noctule bat received by the counterparts of the BRCC on 5 June 2014. It was found in a debilitated condition in Borisova Gradina Park, Sofia. The examination



Fig. 1. First of studied individuals of noctule bats, *Nyctalus noctula* with a wound in the scrotal area



Fig. 2. Fly larvae in the wound in the scrotal area of *Nyctalus noctula*

showed that the bat was old, exhausted and infested with lots of maggots in the left axillar area, where there was no fur and an open wound existed. The larvae were manually removed and the wound was cleaned with peroxide and povidone-iodine by a vet-

erinary doctor. The bat was fed with meal worms and water was offered. On the next day, four larvae were found in the wound, which were then removed by hand and the wound was cleaned again with peroxide and povidone-iodine. The bat appeared in better

condition and ate with an increased appetite. Over the following five days, the wound was cleaned by peroxide followed by povidone-iodine on daily basis. The condition appeared to be improved, with some signs of an increased vitality and mobility in the box. The wound seemed well, with no signs of infection and no larvae observed subcutaneously or in the tissues. On the fifth day, the bat was found dead in the evening, although it had some food and water after the wound cleaning in the morning. The cause for its death was not clear. The last four larvae were placed on snail carrion (*Helix lucorum* Linnaeus, 1758) for further development. However, the larvae failed to develop on that substrate.

Discussion

This is the first record of myiasis caused by *Calliphora vicina* on the noctule bat *Nyctalus noctula*, and the first record of bat myiasis in Bulgaria. *C. vicina* has been recorded in cases of myiasis in various small animals (ZUMPT 1965, KNOTEK *et al.* 2005), and in juvenile *Myotis myotis* (Borkhausen, 1797) in Germany (KULZER 2002). The cases of myiasis caused by *C. vicina* in living humans are extremely rare (DEHLAES *et al.* 2001, SALVETTI *et al.* 2012, ZAMMARCHI *et al.* 2014, ZUMPT 1965).

In our cases, we can only speculate about the causes of infestation. In the first case, most probably the fly eggs were hatched in a previously existing wound of the bat while it was out of its roost, helpless on the ground (most probably caused by the wound). This assumption is supported by the small size of the larvae observed at first in the wound, as well as the lack of any possibility of contamination after the bat delivery to the NMNHS.

The wet surface and the presence of urine in the genitalia area may attract the flies to lay their eggs in this area. The axillar area, which is permanently wetted, also cannot dry fast. The reason is the lower body temperature in the torpid bats. The presence of moisture under the wing surfaces and the following strong smell of the bat may also attract the blowflies.

Similar blowfly “strike”, but without infestation and development of larvae, was observed in the dormant noctule bats (CRANBROOK 1964). The low body temperature was discussed as a possible reason for the absence of larvae, since it prevents the quick hatching and further development of the larvae. Moreover, when the bat is active, it is able to clean its fur from the larvae (CRANBROOK 1964). When the bat activity is deteriorated by exhaustion or by an incident most likely the bats become sus-



Fig. 3. Lateral view of head and thorax of reared flies *Calliphora vicina*

ceptible to infestation, which is illustrated by the two cases reported here as well as by other cases reported without determination of the fly species (KOCK, ALTMANN 1991).

The end of spring, the summer and autumn of 2014 (including the period of finding the bats) were very rainy and humid, which could considerably favor the development of flies connected with rotting waste. In wet and rainy seasons bats get wet while hunting and are unable to dry up during the day, or they develop wounds, which remain wet for a long period of time. Under these conditions, myiases caused by various fly species may become a serious threat, leading to an increase in the mortality not only in juveniles but also in adults. The flies are attracted by the debilitated condition of the bats that are out of the roost, accompanied by suitable body temperature and specific body odour. The body odour in bats is produced by the glandular secretion (sebaceous and gular glands in *Nyctalus* species) or volatile components of the urine and feces (BROWN 1979, HAFFNER 1995, BLOSS 1999). The wet fur may increase the scent effect and this may serve as additional olfactory stimuli to the blowflies (LE BLANC, LOGAN 2010). The myiasis infestation may be extremely dangerous for the long-distance migrants such as noctule bats, which migrate actively in May and are considerably endangered by exhaustion or exposure to unfavorable weather changes for relatively long period of time (STRELKOV 2000, HUTTERER *et al.* 2005).

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