Caged young pigeons mortality by Coleoptera larvae

Adele Magliano[1], Jiri Hava[2], Andrea Di Giulio[3], Antonino Barone[1] and Claudio De Liberato[1*]

[1] *Istituto Zooprofilattico Sperimentale del Lazio e della Toscana 'M. Aleandri', Roma, Italy.*
[2] *Department of Forest Protection and Entomology, Faculty of Forestry and Wood Sciences, Czech University of Life Sciences, Prague, Czech Republic.*
[3] *Dipartimento di Scienze, Università degli Studi Roma Tre, Roma, Italy.*

** Corresponding author at: Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "M. Aleandri", Via Appia Nuova 1411, 00178 Roma, Italy.*
Tel.: +39 06 79099336, Fax: +39 06 79099331, e-mail: claudio.deliberato@izslt.it.

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Summary
Dermestidae and Tenebrionidae are well known inhabitants of bird's nests and poultry farms, under favourable conditions they can be very abundant under favourable conditions. At times, their larvae shift from a scavenging behaviour to a parasitic/predatory one, entering nestling's plumage and feeding on skin and feathers, and finally provoking skin damages and blood losses. These episodes mainly involve species of the genus Dermestes, but the tenebrionid *Alphitobius diaperinus* h also been reported to be responsible of similar cases. In June 2014, a mortality of caged young pigeons occurred in a family farm in Central Italy. Post-mortem examination of 1 of the dead nestlings revealed the presence, near the cloacal orifice, of a triangular shaped hole of about 1 cm side, with rounded edges facing inward and with bleeding from the cavity. Five coleoptera larvae 0.5-2 cm long were collected from the edges of the hole. Bacteriological examination of liver, intestine, and lungs revealed the presence of *Escherichia coli* in the lung samples. The 5 larvae were morphologically identified as *Dermestes bicolor* (4) and *Alphitobius diaperinus* (1). This is the first reported case of pigeon nestling's mortality caused by Dermestidae and Tenebrionidae larvae acting as parasites/predators in Italy.

Mortalità in nidiacei di piccioni causata da larve di coleottero

Parole chiave
Alphitobius diaperinus,
Coleoptera,
Dermestes bicolor,
Italia,
Parassiti,
Piccione.

Riassunto
I coleotteri delle famiglie Dermestidae e Tenebrionidae sono comuni infestanti di nidi di uccello e di aziende avicole dove, date condizioni particolarmente favorevoli, possono divenire numerosissimi. In alcuni casi le larve di questi coleotteri, normalmente detritivore, possono comportarsi da predatori/parassiti, nutrendosi di piume e cute degli uccelli, fino a provocare danni ai tessuti e perdite di sangue. In letteratura sono riportati danni simili provocati da specie del genere *Dermestes* (Dermestidae) e dal tenebrionide *Alphitobius diaperinus*. Nel mese di giugno 2014 si è verificata una mortalità di nidiacei di piccione in un'azienda agricola del Centro Italia. La necroscopia di uno degli uccelli coinvolti ha evidenziato la presenza di un foro triangolare di 1 cm di lato in prossimità della cloaca e la presenza, ai margini della ferita, di 5 larve di coleottero. L'esame batteriologico dei polmoni è risultato positivo per *Escherichia coli*. Le 5 larve sono state identificate morfologicamente come *Dermestes bicolor* (4) e *Alphitobius diaperinus* (1). Questa è la prima segnalazione in Italia di una mortalità di uccelli provocata da larve di coleottero.

Coleoptera of the families Dermestidae and Tenebrionidae are well known inhabitants of bird's nests and poultry farms, where their larvae feed on manure, broken eggs, other insects, dead birds, and stored food. Under favourable conditions they can become very abundant. In poultry houses, *Dermestes* spp. larvae are also known to cause structural damages, due to their attitude to bore into wood structures to pupate (Jefferies 1979, Wildey and Wayman 1979, Cloud and Collison 1986). Similarly, in nests of wild birds larvae dig into the twigs constituting the nest. Thus, these larvae can be considered opportunistic scavengers, feeding on almost every kind of organic matter present in the nest/cage. However, in some rare circumstance, these larvae shift their behaviour from a scavenging one to a parasitic/predatory one, entering nestling's plumage, mainly in the abdominal region in contact with nest material, and starting to feed on skin and feathers provoking at times skin damages and blood losses (Walldorf *et al.* 2012). Sometimes blood loss and/or disease agents entering bird's body via the wound can cause nestling's death; herpes viruses, infectious bursal disease (Gumboro) virus, *Salmonella* spp. and *Escherichia coli* have been reported (Walldorf *et al.* 2012). New borne or very young nestlings are more frequently affected by super-infections at the biting site of the larvae. Snyder and colleagues (Snyder *et al.* 1984) hypothesize that dermestid larvae start feeding on living birds only in case of a pre-existing lesion, accentuating wound caused by other processes, such as abrasions against twigs in nest bottoms (Snyder *et al.* 1984). Other studies (Samish *et al.* 1991) also claim that the parasitic/predatory behaviour of beetle larvae would be triggered by the concomitance of high populations of larvae and scarcity of alternative food sources in nests and poultry houses. These episodes, mainly involving Dermestidae of the genus *Dermestes*, are described both in wild and domestic birds. Snyder and colleagues reported *Dermestes nidum* provoking abdominal lesions in *Rostrhamus sociabilis, Mycteria americana*, and *Ardea herodias* in the USA (Snyder *et al.* 1984). In 1993, the same species was found affecting again *Mycteria americana* nestlings in Florida (Rodgers *et al.* 1993). Regarding domestic birds, *Dermestes maculatus* has been reported feeding on live turkeys in Israel (Samish *et al.* 1991) and *Dermestes* sp., *Dermestes bicolor*, and *Dermestes lardarius* have been considered responsible of similar cases in poultry farms (Jefferies 1979, Armitage 1986, Walldorf *et al.* 2012). The latter study also describes *Alphitobius diaperinus* (Tenebrionidae) as responsible of similar damages to poultry. Some (Háva and Reiter 2006) consider this behaviour as a true predatory one (Háva and Reiter 2006) according to this analysis, larval *D. bicolor* would provoke the death of young fowls, ducks, and pigeons gnawing out the wound and then would feed on their dead bodies. Attacks on living chicks due to both Dermestidae and Tenebrionidae larvae have also been reported (Harding and Bissel 1958). When acting as predators or "true parasites" or "hemi-parasites" (according to the definition of Pearsons *et al.* 2009), due to their chewing mouthparts these larvae provoke open, crater-shaped wounds, about 1-3 mm deep and 7 mm in diameter usually localised in the abdominal region (Snyder *et al.* 1984, Rodgers *et al.* 1993).

In particular regarding pigeons, *D. bicolor* has been found inhabiting nests and parasitizing young specimens both in rearing facilities and in feral nesting sites (Háva and Reiter 2006), while *D. lardarius* and *D. nidum* have been reported digging into the underside of wings and bodies of squabs, provoking their death (Snyder *et al.* 1984). According to some studies, the economic relevance for poultry farms of losses due to these "part-time parasites" is such to make desirable the development of specific treatments or control strategies (Walldorf *et al.* 2012). At the same time, other studies questioned whether these beetle larvae acting as predators/parasites could constitute a threat for wild birds, especially in case of endangered species (Snyder *et al.* 1984, Rodgers *et al.* 1993).

In June 2014, a 25-day old pigeon was brought to the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana 'M. Aleandri' for post-mortem examination. The owner referred that the nestling was the seventh of the brood to die with the same symptoms in the span of a few days. Pigeons were bred in a family farm in a village in Viterbo Province (Central Italy), together with poultry and quails. Animals were kept in small shelters made with metal coverings and enclosures and wooden frameworks. Adjacent to pigeon shelter there was a big woodshed, and plenty of firewood was stocked there. In the pigeon shelter there were 8 wooden nesting boxes, filled with straw during the laying period. In the pigeon shelter, food seed was stocked in a metallic can. Dead pigeons, all around 25-day old, originated from 4 nesting boxes.

Post-mortem examination revealed the presence, near the cloacal orifice, of a triangular shaped hole about 1 cm side, with rounded edges facing inward and with bleeding from the cavity. The owner referred that similar crater-shaped wounds, as well as blood loss soaking nest material, were present on all the nestlings found dead in the brood. Five coleoptera larvae 0.5-2 cm long were collected from the edges of the hole. Bacteriological examination of liver, intestine, and lungs revealed the presence of *Escherichia coli* in lung samples.

The 5 larvae were identified as belonging to the families Dermestidae (4 larvae) and Tenebrionidae

(one larva). Dermestidae were sent to the Department of Forest Protection and Entomology of the University of Prague, where they were morphologically identified as *Dermestes bicolor*. The Tenebrionidae was identified at the Department of Science of the University of Roma Tre (Italy) as *Alphitobius diaperinus* (Vergara and Gazani 1996, Chernaki and Almeida 2001); measurements of head capsule at the scanning electron microscope (SEM) (Francisco and Prado 2001) allowed for identifying this larva as a 7th instar one, close to pupation.

To the best of our knowledge, this is the first report of pigeon nestling's mortality caused by Dermestidae and Tenebrionidae larvae acting as parasites/predators in Italy. Although already reported in literature, these cases are quite rare, especially in rearing facilities, hence the relevance of describing it. Given the biology of Dermestidae and Tenebrionidae larvae, which is known as opportunistic and polyphagic feeders, it would be very interesting to understand whic factor triggers the parasitic/predatory behaviour. In the described case, the presence of pigeon seed in the shelter and of abundant organic matter (broken eggs, dry manure, feathers, etc.) in the nest boxes make difficult to believe that this behaviour would have been elicited by lack or scarcity of other food sources, as hypothesized by previous studies (Snyder *et al.* 1984). It worth mentioning, that the proximity of the woodshed could have provided abundance of pupation sites at least for *D. bicolor* larvae. Furthermore, farmers excluded the presence of pre-existing lesions on the nestlings. It is noteworthy that the 'attack' occurred at the same time in 4 nesting boxes, so that it cannot be considered a casual, unique event. Surely, the environmental situation in the farm was such to facilitate the development of huge populations of these Coleoptera, a factor considered relevant in the relevant literature (Snyder *et al.* 1984).

Anatomopathological findings fit well with the date reported in the relevant literature concerning both the description of the lesion (Snyder *et al.*, 1984, Samish *et al.* 1991, Rodgers *et al.* 1993) and the number of larvae found feeding on the lesion margins. Similarly, also the report of *E. coli* as secondary invader trough the open lesion, finally provoking the bird death, has also been reported in other studies (Walldorf *et al.* 2012).

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