UF IFAS Extension UNIVERSITY of FLORIDA

EENY480
doi.org/10.32473/EDIS-in866-2010

Black Larder Beetle, Incinerator Beetle, *Dermestes ater* DeGeer (Insecta: Coleoptera: Dermestidae)[1]

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The Featured Creatures collection provides in-depth profiles of insects, nematodes, arachnids, and other organisms relevant to Florida. These profiles are intended for the use of interested laypersons with some knowledge of biology as well as academic audiences.

Introduction

The black larder beetle, *Dermestes ater* DeGeer, is a cosmopolitan species that feeds on various plant and animal products, although it scavenges more on dead insects and carrion. It is a common pest of cheese, dried fish, leather (Illingworth 1916), copra (Aitken 1975), silk (Ansari and Basalingappa 1987, Kumar et al. 1988), wool (Bennett et al. 1988), milk powder (Champ 2003) and has been associated with incinerator-burnt waste materials (Byrd and Castner 2009).

Dermestes ater also serves as an intermediate host for tapeworms in poultry (Avancini and Ueta 1990, Ueta and Avancini 1994). *Dermestes ater* larvae are very important in helping estimate the postmortem interval of corpses (Voss et al. 2008). According to Byrd and Castner (2009), *D. ater* frass (feces) can be used as an alternative DNA and toxicology sample, as well as an indicator to help support the postmortem interval estimation. Other important dermestid species that are of similar importance are the hide beetle, *Dermestes maculatus* DeGeer and the larder beetle, *Dermestes lardarius* Linnaeus.

Synonymy

Dermestes ater DeGeer, 1774

Dermestes cadaverinus Fabricius, 1775

Dermestes piceus Thunberg, 1781

Dermestes felinus Fabricius, 1787

Dermestes domesticus Germar, 1824

Dermestes cadaverinus ab. *domesticus*: Erichson, 1846

Dermestes hispidulus Montrouzier, 1860

Dermestes chinensis Motschulsky, 1866

Dermestes subcostatus Murray, 1867

Dermestes noxius Mulsant and Rey, 1868

Dermestes favarcqui Godard, 1883

Dermestes ater var. *domestica* Blackwelder, 1945

Dermestes ruficapicalis Pic, 1951

(Herrmann 2010)

Distribution

Dermestes ater is native to North America and Hawaii (ITIS 2010) but is distributed in all zoogeographical regions of the world.

In Florida, it has been reported in Alachua, Broward, Clay, Miami-Dade, Duval, Gilchrist, Jackson, Manatee, Monroe, Orange, Seminole, and Volusia counties (Peck and Thomas 1998).

Description

Adult

The adult is about 7 to 9 mm (~1/4–1/3 in) in length with black or brown un-serrated elytra (beetle forewings) (Robinson 2005). It lacks an ocellus (simple eye) (Gennard 2007) and the whole body is covered with yellowish-gray hair (Hedges and Lacey 1996). On both the third and fourth segment of the abdominal sternites, the adult male has a small stout bristle surrounded by golden-colored bristles, which the female lacks (Roth and Willis 1950). The adult is also cannibalistic on all instars and pupae.



Figure 1. Dorsal view of adult male black larder beetle, *Dermestes ater* DeGeer.
Credit: Andreas Herrmann, http://www.dermestidae.com/. Used with permission.

The underside of the abdomen is light brown with dark brown patches in the middle and on the sides (Mound 1989). This characteristic distinguishes *D. ater* from *D. lardarius* (larder beetle), which has an underside lighter in color (Hedges and Lacey 1996).



Figure 2. Ventral view of abdomen of an adult black larder beetle, *Dermestes ater* DeGeer. Notice dark brown patches in the middle and on the sides. Also note that on both the third and fourth segment of the abdominal sternites (counting from the top), the adult male has a small stout bristle surrounded by golden-colored bristles, which the female lacks.
Credit: Andreas Herrmann, http://www.dermestidae.com/. Used with permission

Egg

The egg is elongate and measures around 1.9 mm (~1/16 in) long x 0.48 mm (~ 1/64 in) wide (Kumar et al. 1988). It has fine processes on both ends and is pearly white in color when first laid, but the egg will appear pebbled as the embryo matures (Roth and Willis 1950).

Larva

The newly hatched larva is white with rows of dark bristles but the body gradually darkens after each molt (Roth and Willis 1950). As the larva matures, the color ranges from reddish-brown to black (Hedges and Lacey 1996). It has a discontinuous yellow stripe that runs along the middle of the back (Hedges and Lacey 1996) and is about 10 to 14 mm (~1/3–1/2 in) long (Robinson 2005). It also has a pair of broadly based urogomphi that point vertically (Robinson 2005) and are not strongly curved (Byrd & Castner 2009). An urogomphus is a process or spine on the last segment of certain insect larvae. This distinguishing character of the urogomphi differentiates *D. ater* from *D. lardarius* (larder beetle), whose urogomphi point upwards and backwards away from the body, and *D. maculatus* (hide beetle), whose urogomphi point upwards and inwards towards the body (Hedges and Lacey 1996). The larva is cannibalistic on all instars and eggs (Roth and Willis 1950).



Figure 3. Dorsal view of a larva of the black larder beetle, *Dermestes ater* DeGeer.
Credit: Dave Hodges, http://www.thewcg.org.uk/. Used with permission

Pupa

The pupa is oval-shaped, and at this stage the sex of *D. ater* can be determined. The pair of side projections on the underside of the last abdominal segment is fleshier in the female than in the male (Roth and Willis 1950).



Figure 4. Pupa (left) of the black larder beetle, *Dermestes ater* DeGeer, recently emerged from the last larval stage (right).
Credit: Scott Nacko. Used with permission.

Life Cycle

The egg hatches in about two days at 35°C (95°F) and six days at 21°C (69.8°F) (Robinson 2005). Larval development is about 19 days for six to seven instars at 35°C (95°F) and 50 days for seven to nine instars at 21°C (69.8°F) (Robinson 2005). The variable numbers of instars is dependent on factors such as sex and the availability of food and water. Humidity is also an important factor in larval development. At 25°C (77°F), larval development is 50 days at 80% and 60 to 70 days at 40% relative humidity (Coombs 1981).

Pupal development takes about five days at 35°C (95°F) and 12 days at 21°C (69.8°F) (Robinson 2005).

For adults, the pre-oviposition period is four days at 30°C (86°F) and 33 days at 25°C (77°F), followed by a two month oviposition period (Coombs 1981). A female lays either a single egg or batches of 17 to 25 eggs, while the number of eggs laid by a female in her lifetime ranges from 200 to 800 eggs (Robinson 2005). At 21°C (69.8°F), adult *D. ater* males and females can live up to 169 and 173 days, respectively (Robinson 2005).

Economic Importance

Dermestes ater is a pest of various food and non-food items worldwide (Rajendran and Hajira Parveen 2005). It is an important pest of museum collections (Gonsalves 2003) and fishmeal-processing factories (Haines and Rees 1989). Together with *D. maculatus* (hide beetle), black larder beetles are major pests of dried fish in Zambia (Proctor 1970) and the salted fish industry in Indonesia (Heruwati 2002). *Dermestes ater* poses a serious threat in silk production because it preys upon adult silkworm moths (Kumar et al. 1988) and damages the silkworm cocoon to feed on the silkworm pupa within (Ayuzawa et al. 1972). According to Veer et al. (1996), silk production in Mysore, India, suffered a 20% loss due to *D. ater.*

Veterinary Importance

Dermestes ater was the principal intermediate host of the parasitic tapeworm *Raillietina laticanalis* (Skrjabin) in a poultry facility in southeastern Brazil (Ueta and Avancini 1994). The beetle was also found hosting the tapeworm *Choanotaenia infundibulum* (Bloch), which parasitizes poultry, resulting in lower egg production and reduced growth and weight in birds (Avancini and Ueta 1990).

Forensic Importance

According to Byrd and Castner (2009), *D. ater* is very important in forensic science. An infestation on a human corpse in Malaysia suggested that *D. ater* adults arrived at an early stage of decomposition (Kumara 2009). In a study of decomposition and insect succession on pig carcasses under different conditions in the summer, *D. ater* adults were found on carcasses as early as two days (bloat stage) while the larvae were present from the dry stage (15 to 36 days) until the skeletal stage (>34 days) (Voss et al. 2008). In the fall, larvae were collected as early as the wet stage (5 to 17 days) until the skeletal stage (>41 days) (Voss et al. 2008). Adult dermestids have been reported to skeletonize a body in 24 days (Byrd and Castner 2009). However, only the larval stages are used to estimate the postmortem interval, which is based on the understanding of the history of larval development at a given condition.

The presence of frass suggests a long postmortem interval, and it can be used as an alternative DNA or toxicology sample (Byrd and Castner 2009). In the study of mummies, the presence of *D. ater* was used as a non-destructive tool to indicate the cadaver's exposure time prior to mummification (Figueiredo 2004).

Management

Inspection

Homeowners and pest control operators investigating an infestation should inspect the kitchen, pantry, garage and basement where cheese, meats, fish, dried pet food, insect collections and mounted animals are stored. The attic and crawlspace are also good places to find the

source of infestation because they may conceal dead insects, rodents, birds and reptiles, which are all food sources for *D. ater*. Another good indicator is the presence of frass on the attacked material. Dermestid frass is very distinct in appearance. It is dark brown, dry and stringy because the feces wrapped by the remnants of the peritrophic membrane, which is a secretion in insects that occurs in the digestive tract (Byrd and Castner 2009).

Cultural Control

Prevention and control are best achieved through good sanitation practices.

Physical Control

Installing screens and sealing cracks and crevices can serve as exclusion methods from outside. Other physical methods include pheromone traps and cold and heat treatment.

Chemical Control

While residual insecticide sprays have been used, if an infestation is severe the best method for control may be fumigation.

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[1] This document is EENY480, one of a series of the UF/IFAS Department of Entomology and Nematology. Original publication date August 2010. Revised July 2022 and December 2025. Visit the Ask IFAS website at https://ask.ifas.ufl.edu/ for the currently supported version of this publication.

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