

**First report of the lesser wax moth *Achroia grisella* F. (Lepidoptera: Pyralidae)
consuming polyethylene (silo-bag) in northwestern Argentina**

Adriana Chalup^{a,b}, María Marta Ayup^{a,e}, A. Carolina Monmany Garzia^c, Agustina Malizia^c,
Eduardo Martín^{a,b}, Ricardo De Cristóbal^d, Alberto Galindo-Cardona^{a,e*}

^a *Fundación Miguel Lillo (FML), Miguel Lillo 251 T4000JFE, San Miguel de Tucumán,
Tucumán, Argentina.*

^b *Facultad de Ciencias Naturales e Instituto Miguel Lillo, Universidad Nacional de Tucumán,
Miguel Lillo 251 T4000JFE, San Miguel de Tucumán, Argentina.*

^c *Instituto de Ecología Regional (IER), Consejo Nacional de Investigaciones Científicas y
Técnicas (CONICET) - Universidad Nacional de Tucumán (UNT), Casilla de Correo 34, CP
4107, Yerba Buena, Argentina*

^d *Instituto Superior de Investigaciones Biológicas (INSIBIO), CONICET-UNT and Instituto
de Química Biológica "Dr. Bernabé Bloj", Facultad de Bioquímica, Química y Farmacia,
UNT. Chacabuco 461, CP 4000, San Miguel de Tucumán, Tucumán, Argentina.*

^e *Centro Científico Tecnológico (CCT) CONICET, Crisóstomo Álvarez 722, CP 4000, San
Miguel de Tucumán, Tucumán, Argentina.*

*coleopterino@gmail.com

First report of the lesser wax moth *Achroia grisella* F. (Lepidoptera: Pyralidae) consuming polyethylene (silo-bag) in northwestern Argentina

In this note we report *Achroia grisella* F. (Lepidoptera: Pyralidae), a beehive pest, for the first time in Argentina. In addition, we report observations of the larvae of this pest species consuming silo-bags, a material commonly used in the country for hive management. Silo-bags are composed of three layers of polyethylene and one anti-UV layer and no records of insects consuming this material are found in the literature. Our report represents a warning for apiculture in Argentina, especially when honey production has been observed to decrease recently. This decrease may be a result of a combination of factors, including the poor monitoring of hive's health, and inappropriate management of pests, like *A. grisella*. In addition, our observations on silo-bag consumption represent a call for attention to beekeepers that use this material to conserve heat in the hives and open questions about the mechanisms involved in silo-bags consumption by the larvae.

wax moth; sentinel hives; health; pest; plastic

The total number of Lepidoptera species' descriptions in the world exceeds 150,000, of which about 18,000 are butterflies (Heppner 2002; Kristensen et al., 2007) and more than 130,000 are moths (Kristensen et al., 2007). Most Lepidopteran larvae are phytophagous, but some larvae are considered pests of different items such as household goods -clothing, paper, stored food -flour, grain, fodder- and even plastics (e.g., Yang et al., 2014). In addition, various species within the Lepidoptera, like *Achroia grisella* (F.), the lesser wax moth (LWM) and *Galleria mellonella* (L.), the greater wax moth (GWM) (both belonging to Pyralidae) parasitize beehives causing damage to the colonies. Moth pests in beehives may have a great economic impact as honey production is an important productive activity in many countries. Research about wax moth control has recently dropped, though, because of the perception of these species as secondary pests (Ellis et al., 2013). But, given the effects

of global change on bees and insects in general, it is important to monitor these pests as climatic or other changes could trigger their population levels. In the world, Argentina is the second producer (Institute of Productive Development of Tucumán, pers. comm.) and the first exporter of honey (95% is exported). In the last decade, however, honey production was reduced by more than 20% (from 84.000 to 68.000 tons) (Haberle, 2014; SENASA 2014). This reduction may be a result of a combination of factors, including climate change, invasive species including beehive pests, and others.

Among beehives' enemies wax moths are considered the most damaging enemies within the Lepidoptera given their negative impact for beehives and beekeeping industry in different parts of the world (Ritter & Akwatanakul, 2006, Egelie et al., 2015). In Brazil, Cepeda et al. (2000) reported both the LWM and the GWM as pests of *Apis mellifera* since 1938 and reported these pests for the first time in stingless bees, Meliponinae, colonies. It is probable that the LWM and the GWM have been present in beehives in Argentina for a long time, considering the reports for Brazil, but no record of any has been officially registered (National System of Biological Data, <http://datos.sndb.mincyt.gob.ar>). In this study, we describe *Achroia grisella* for the first time in Argentina based in adult coloration.

The adults of the LWM are characterized by their small size from 8 to 13 mm, being the females larger. This species has long, filiform antennae, with the distal segments markedly thinner than the basal segment. The front is covered by orange scales like hairs. The body is lightly brown with golden highlights and sprinkled with black scales. The prothorax is covered with black scales. The rounded-contour wings show similar coloration than the body, with a conspicuous fringe of brown scales (Figure 1).



Figure 1. Adult of male *Achroia grisella*

The LWM is distributed in high altitudes and high latitudes (Egelie et al., 2015) and it is more abundant and widespread than the GWM. The feeding behavior of larvae is associated with the construction of silk galleries, which are later covered by fecal particles. When in the pre-pupal stage, LWM moths are found in depressions in the wooden walls of the hives and in the combs, weave the cocoons and pupate usually side by side. Adult males and fertilized females seek to enter the hives at night (Singh, 1962, Zacarin et al. 2004). Their food consists in pollen, wax, and litter accumulated in the hive, usually on the floor; they can infest frames hosting different bee developmental stages, and honey cells but their populations increase faster within abandoned hives. Rainy seasons favor this species hive colonization and damages are increased during these periods; in one season, they can reach 3–4 generations (Singh, 1962).

We found LWM larvae on July 4th, 2017, in a sentinel hive located within a Chaco (dry forest) curtain or remnant, surrounded by soybean and corn crops. For the species determination, we examined ~180 specimens (~60 males and ~120 females) (collector, M. M. Ayup). The hive was located in a field 8 km north from Pozo Bertbeder locality, Santiago del Estero province, northwestern Argentina (26°20'41.59"S, 64°20'29.49"W, 336 m.a.s.l). It was one of the 18 sentinel hives that we placed in northwestern Argentina from September to

November 2016, aiming to monitor the bees' population dynamics and diseases in the region. Sentinel hives are those that have been isolated from the apiary and are left unmanaged. They are monitored to evaluate different environmental effects on the bees, such as climatic effects, effects of pesticides and land use changes. In addition, they are useful to study behavior and natural vulnerability or resistance of bees to diseases, without the influence of the high density observed in apiaries. Sentinel hives are also used to detect pest geographical expansion within countries or regions. The infested hive had only three frames with bees (much less than its nearest neighbor hive) and the queen was absent. We took the whole hive to the lab, including the larvae and pupae of this species and larvae and pupae of the GWM.

Due to the cold winters in the Chaco region, beekeepers usually place pieces of silo-bags below the cover of the hives. Silo-bags are composed of three layers of polyethylene and one ultraviolet filter and they are a costly material designed for the storage of grains (cereals and oilseeds) where farmers keep the crop for months until it is commercialized. Using this material below the hive cover, beekeepers protect bees from the cold helping them to conserve heat. The hive infested by the LWM had a silo-bag under its cover and it was consumed. We isolated pieces of silo-bags in 36 petri dishes and offered each of them to one LWM larva; after 12 days, we observed consumption in more than 90% of the cases (Figure 2). GWM has recently been reported consuming single-layered polyethylene bags and microbiota was suggested to be involved in the plastic digestion (Bombelli et al. 2017). Thus, we are currently conducting an experiment to compare the ability of both LWM and GWM to degrade silo-bags and their microbiota will be examined. According to Hammer et al. (2017), it is likely that the microbiota degrading polyethylene in individuals of the same species may vary according to geographical location. Then we expect that the species found in the guts of LWM and GWM will be different from those reported for other locations. If we

corroborate that the gut microbiota of LWM and GWM is responsible for silo-bag degradation new research questions emerge aiming to understand this mechanism.



Figure 2. *Achroia grisella* caterpillar consuming silo-bag.

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