

**Short scientific note**Submitted: December 6<sup>th</sup>, 2017 - Accepted: December 18<sup>th</sup>, 2017 - Published: December 29<sup>th</sup>, 2017**Severe alterations caused by the indigenous pyralid *Denticera divisella* (Dup.) on the cultivated *Euphorbia x lomi* Rauh (Euphorbiaceae) in Sicily, with notes on some agronomic aspects (Lepidoptera: Pyralidae)**Salvatore BELLA<sup>1,\*</sup>, Alfio SPINA<sup>2</sup>, Adele SALAMONE<sup>3</sup>, Giancarlo FASCELLA<sup>3</sup><sup>1</sup> (CREA-OFA) Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria. Centro di ricerca olivicoltura, frutticoltura e agrumicoltura - Corso Savoia 190, 95024 Acireale (Catania), Italy - salvatore.bella@crea.gov.it<sup>2</sup> (CREA-CI) Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria. Centro di ricerca Cerealicoltura e Colture Industriali, Laboratorio di Acireale - Corso Savoia 190, 95024 Acireale (Catania), Italy - alfio.spina@crea.gov.it<sup>3</sup> (CREA-DC) Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria. Centro di ricerca Difesa e Certificazione - S.S. 113, km 245.500, 90011 Bagheria (Palermo), Italy - giancarlo.fascella@crea.gov.it

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**Abstract**

In this contribution, we report information on the severe alterations caused by the stem boring moth *Denticera divisella* (Duponchel, 1842) (Lepidoptera, Pyralidae) on the cultivated *Euphorbia x lomi* Rauh (Euphorbiaceae). This plant is an ornamental hybrid of recent origin, much appreciated for the attractive inflorescences, used both as an apartment plant and, especially in Sicily, as an outdoor plant. In this region, this species is an important source of income for many nursing businesses that have replaced it with some species whose market was in crisis. The pyralid is an indigenous species with an European distribution, while *Euphorbia x lomi* is a hybrid from Thailandia native to Madagascar, with many varieties currently cultivated in the world. The observations were conducted in Sicily in 2014 and 2015.

**Key words:** Euphorbiaceae, *Euphorbia x lomi*, stem borer moth, ornamental plant.**Introduction**

*Euphorbia x lomi* Rauh (Euphorbiaceae) was recently introduced to Mediterranean countries as a new ornamental species according to the increased demand for new low-maintenance ornamental plants. Its many hybrids are much appreciated for its abundant and vivid blossoms, and it is used both as an apartment plant and as an outdoor plant environments, and above all, in Sicily, this euphorbia represents an important source of income for many nursing businesses that have replaced other ornamental species whose market was saturated and, therefore, in crisis. Agronomic value is one of the most important traits when evaluating a species for its ornamental attitude, along with resistance to biotic and abiotic stresses, growth rate, and time to flowering.

These hybrids can be grown year-round in dry areas with high temperatures and solar radiation as potted or garden plants (Jankalski 2000). Although much is still to be known, several studies have already been carried out in the last decade in Italy that have made known the requirements of this euphorbia in outdoor cultivation and in a protected environment (Fascella et al. 2006, 2011, 2015; Fascella & Roupheal 2017; Giovino et al. 2014).

In areas with favorable climatic conditions, such as Florida or Thailand, its use as an outdoor species for urban greening is possible, with satisfactory results in growth and flowering (Cunsolo 2006).

Its use in outdoor environments can still be constrained by high summer and low winter temperatures. In Sicily, extreme temperatures can cause leaf and flower abscission and plant death, especially at a juvenile stage (personal observations); it still also known that these hybrids are tolerant to drought and water deficit (Fascella et al. 2011). However, very little information is available on the tolerance of this plant to the extreme Mediterranean seasonal temperatures that can damage or compromise growth and flowering (Giovino et al. 2014).

In recent years, severe attacks have been produced on this ornamental plant in some Sicilian nursery farms and even on specimens grown outdoors by private citizens. Here we report information on the severe alterations caused by the pyralid *Denticera divisella* (Duponchel, 1842) (Lepidoptera, Pyralidae) on the cultivated *Euphorbia x lomi*. This moth is an indigenous species associated to several woody southern European *Euphorbia* spp., while *Euphorbia x lomi* is a horticultural hybrid from Thailandia native from Madagascar.

## Materials and methods

### Sampling methods

Field observations were carried out especially in the years 2015–2016, in the spring–autumn. In the sites with the suffering *Euphorbia x lomi*, direct observations were made dissecting plant samples to record eggs or larvae of the pyralid. Plant samples, including portions of green or woody organs, were placed in containers and carried to the laboratory. They were isolated in cages with standard temperature and relative humidity (25°C and 65 % RH), and regularly inspected for the collection of emerged adults. The specimens were identified based on the morphology of adults and confirmed by the examination of the genital structures. The studied specimens are stored in S. Bella's collection. For the association plant and moth species, records on the catching date, bibliographic sources for general and Italian distribution, distribution in Sicily, emergence period of the adult, and some biological notes are provided. Nomenclature and systematic order follow Leraut (2014).

### The study sites

Samplings were carried out in Sicily, in Catania and Palermo provinces.

Catania province: Acicastello, 15 m a.s.l., Jul–Aug 2016 (Spina A. leg., Bella S. coll.); Acireale, locality 'San Salvatore', 80 m a.s.l., Jun–Aug 2015 (Bella S. leg. et coll.); Girre, locality 'San Leonardello', 40 m a.s.l. Aug–Sep 2015

(Spina A. leg., Bella S. coll.); Palermo province: Bagheria, 98 m a.s.l., Jul–Sep 2006 (Salamone A. leg., Bella S. coll.).

### The plants

*Euphorbia x lomi* Rauh 1979 is an interspecific hybrid of the crown of thorns, *E. milii* Des Moulins x *E. lophogona* Lamarck, both endemic to Madagascar (Rauh 1979).

*Euphorbia milii x lophogona* hybrids are succulent, spiny shrubs usually cultivated as potted flowering plants. This species is very common in China and Thailand, where it is called and marketed under the name of 'Poysean'. They are normally propagated by cuttings developing from the shoots produced by the stem. They are succulent shrubs characterised by an erect, thick, fleshy, branched, spiny stem up to 1–1.5 m long with long, lanceolate leaves and brightly coloured bracts (Rauh 1979). As an ornamental plant, this species is popular for its cyathia. Cyathia are flower-like structures consisting of a true female flower (at most 5 mm wide), surmounting 2 cup-like bracts (usually wider than 3 cm), also termed cyathophylls. Female flowers and cyathophylls can show a wide gradation of colours from all shades of cream, to pale yellow, pink, and even dark red. Frequently, the tone of the cyathophylls is a blend of different colours, which give the cyathia special nuances (Giovino et al. 2014). The cultivation as an indoor ornamental plant is mainly due to its demand for a high temperature, which is needed to produce clusters of cyathia. In fact, under optimal conditions, the 'Poysean' is able to almost continually produce cyathia and maintain



**Fig. 1** – Stem and vegetative apex of *Euphorbia x lomi* attacked by mature larvae of *Denticera divisella* (Duponchel).

leaves even in adverse seasons. Information on the vegetative propagation of *Euphorbia x lomi* hybrids is given by Fascella & Zizzo (2009), Fascella et al. (2008), and Spina et al. (2009, 2010, 2017), information on the agronomic cultivation is given by Fascella et al. (2006, 2009, 2011, 2015), Dispenza et al. (2016), and De Lucia et al. (2008), and information on the climatic requirements is given by Giovino et al. (2014).

*The Moth*

Family Pyralidae Latreille, 1809

Subfamily Phycitinae Zeller, 1839

***Denticera divisella*** (Duponchel, 1842)

Wingspan 16-25 mm; female with filiform antennae, male with raised scales at base of flagellum; forewing light grey-brown, with a broad white line under costa, which displays a distinct black streak; hindwing white (Leraut 2014).

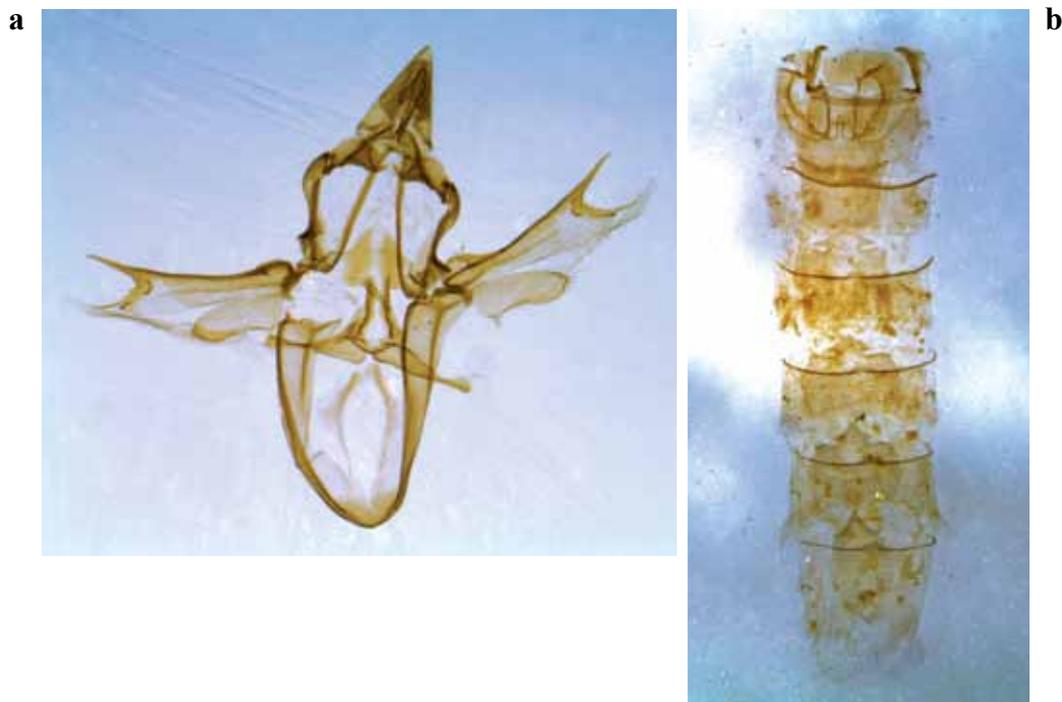
*Denticera divisella* larvae in nature attack different species of spontaneous *Euphorbia*, including *E. ceratocarpa* Ten., *E. characias* L., *E. cyparissias* L., and *E. myrsinites* L. (Longo 2012; Leraut 2014). Females lay 70-100 eggs in clusters (10-50 per cluster), mostly on stems but also on the upper and lower surfaces of leaves. The incubation period is 10-12 days. Neonate larvae live gregarious in groups of 30-50 feeding on the meristematic tissue at the top of stems of the host plant, causing extensive

damage. The last instars are solitary feeders or in groups of 2 or 3 individuals. They spin a silken web, including dry leaves and faeces, in which they rest until they penetrate the stem, where they continue feeding. In southern Europe, larvae of *D. divisella* live from September to May. They reach the pupal stage in 35-50 days. Mature larvae pupate in silken cocoons spun amongst the stems or in the silken web. The pupa is brownish-red, and the pupal stage lasts 12-16 days (Cristofaro et al. 1998).

The species is homodynamic and in optimal conditions has a generation time of about two months; however, in Sicily, it can have up to 4 generations annually. The larvae are of variable colour, from green to hazelnut light, with two longitudinal brown strips and a black cephalic capsule (Longo 2012; Leraut 2014). Adults fly May-September, preferring open Mediterranean biotopes. It is present in southern Europe, northern Africa, including Malta and the Canary Islands, the Middle East, and Sub-Saharan Africa (Leraut 2014).

**Phytosanitary aspects**

*Denticera divisella* attacks on *Euphorbia x lomi* can be severe, and represent a significant economic loss. In fact, even if localised, the alterations produced by mature larvae can lead to the desiccation of the apical parts of the plants, making them unsaleable. The cause lies in the attack mode, since the larvae, after a short period of feeding



**Fig. 2** – *Denticera divisella* (Duponchel). Male, a) genitalia, aedeagus removed (prep. gen. 209 SB), b) tympanal organ and abdominal segments; Sicily, Bagheria, 28 Aug 2006.

on the younger leaves, penetrate the vegetative nodules, initially stopping growth and flowering, and subsequently the death of stems. Although the symptoms of the attack are quite visible, the fight against the moth, especially against its larvae, is not easy and, above all, can be expensive. Defense strategies from pyralid attacks can easily be carried out in the greenhouse habitat, simply using physical means to prevent the entry of the moths into the nursery. Methods are already well known and implemented in the nursery districts of southeastern Sicily to defend agricultural production from some very damaging lepidopterans, such as *Tuta absoluta* (Meyrick), *Heliotis* spp., and *Spodoptera littoralis* (Boisduval).

### Concluding remarks

The relationships between insects and their host plants are very interesting, especially if the plants are not native to the territory where the relationship is established (Bella 2008, 2013a; Suma et al. 2014). In recent years, numerous species of alien moths have been recorded for the first time in Sicily, such as *Cydalima perspectalis* (Walker) (Lepidoptera, Crambidae) on *Buxus sempervirens* L., *Lantanophaga pusillidactylus* (Walker) on *Lantana* spp., *Megalorhipida leucodactyla* (F.) (Lepidoptera, Pterophoridae) on *Borhavia repens* L., *Anatrachyntis badia* (Hodges) (Lepidoptera, Cosmopterigidae) on *Cycas revoluta* Thunb., and *Paysandisia archon* (Burmeister) (Lepidoptera, Castniidae) on *Chamaerops humilis* L. (Bella & Ferrauto 2005; Colazza et al. 2005; Bella & Mazzeo 2006; Bella & Marchese 2007; Bella 2013b). These species have often caused serious damage to the cultivated plants in parks and gardens in urban and sub-urban environments.

*Denticera divisella* has been considered as a possible agent for the biological control of the weed *Euphorbia esula* L. that, accidentally introduced in the 1800s in North America, spread widely and has been reported among the ‘invasive alien weed species’ by the United States Department of Agriculture. Preliminary laboratory tests have shown, however, that the moth larvae also feed on some ornamental euphorbia, and therefore *D. divisella* has not been included in the biological control program for this target species (Cristofaro et al. 1998).

*Euphorbia x lomi* is a valid alternative to traditional flowering potted plants, due to the high ornamental value and general interest in drought-tolerant and easily maintained species. Additional studies are therefore necessary in order to increase the knowledge of insect pests and pathogens, of allochthonous or indigenous origin, able to attack *Euphorbia x lomi* in the Mediterranean area, both in the nursery and in the urban environment, looking for techniques and strategies to protect this plant species from this biotic factors.

In Sicily, on spontaneous euphorbia species, larvae of *D. divisella* are parasitised by the Hymenoptera Ichneumo-

nidae *Sinophorus* sp., and *Habrobracon* sp. (Longo 2012). Treatments with *Bacillus thuringiensis* Berliner formulations carried out in the early stages of life can be an effective defense against larvae, especially in nursing centers.

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