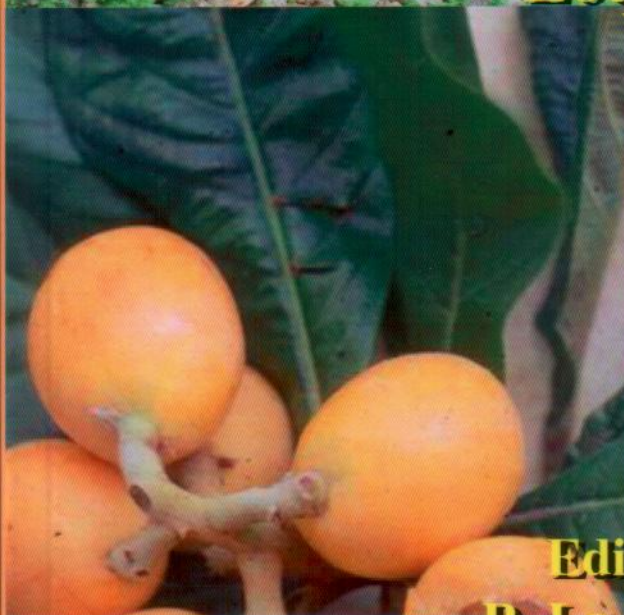
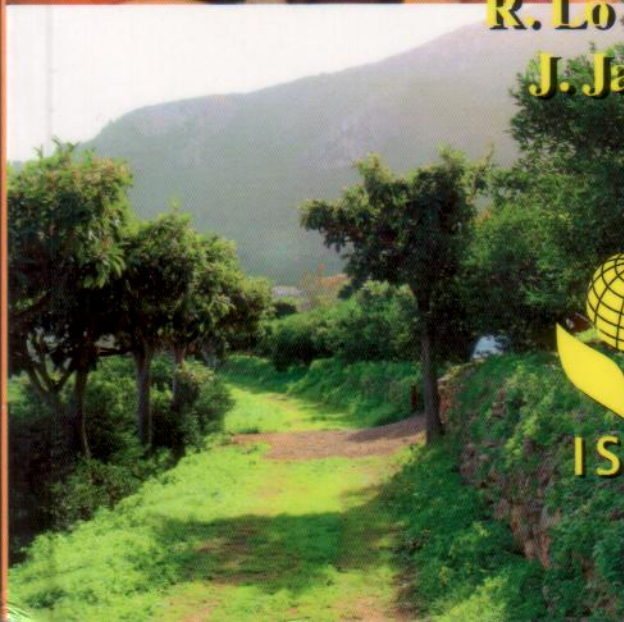


Acta Horticulturae
Number 1092

**Proceedings of the
Fourth International Symposium
on
Loquat**



Editors
R. Lo Bianco
J. Janick



The Role of the Loquat in Maintaining Entomological Diversity in the Conca d'Oro Orchards of Sicily

M. Bellavista¹, T. La Mantia² and I. Sparacio³

¹ Via Carlo De Grossis 7, 90135 Palermo, Italy

² Department of Agricultural and Forest Sciences, Viale delle Scienze, Ed 4, 90128 Palermo, Italy

³ Via E. Notarbartolo 54 int. 13, 90145 Palermo, Italy

Keywords: biodiversity, *Eryobotria japonica*, longhorn beetles, wood decomposer

Abstract

The loquat [*Eriobotrya japonica* (Thumb.) Lindl.] is an allochthonous species long cultivated in Sicily. In some parts of Sicily such as the Siracusa province, the loquat is cultivated in mono-specific orchards. In other sites, like Conca d'Oro and other places near the town of Palermo, loquat is intercropped with other tree species such as citrus, apricot, peach, mulberry, walnut, Mediterranean hackberry. The loquat plays an important role in order to increase biodiversity within these orchards. The old or dead loquat trees host a variety of xylophagous insects and more in particular *Coleoptera*: *Cerambycidae* beetles *Dynastidae*, and *Cetoniidae*. Longhorn beetles, rhinoceros beetles and flower beetles are usually considered excellent indicators for woodland biodiversity and, particularly, for the wood decomposer community. However, they have never been associated to fruit orchards. Instead, in old or abandoned orchards, it is common to find live trees with dead parts or dead trees which host a rich community of decomposer insects. Today, farming changes or collapses in the urban surroundings have partly contributed to erasing this diversity. Research carried out in the past years has pinpointed that the loquat plays an important role in the preservation of different species, particularly *Cerambycidae*, such as: *Aegosoma scabricorne*, *Cerambyx scopoli*, *Penichroa fasciata* and *Niphona picticornis*. These species have been recorded as stable populations in many loquat orchards of the agricultural surroundings of the town of Palermo, where the presence of suitable natural environments for these beetles is rare. Some of these species are included in the red list of the sapro-xylophagous insects.

INTRODUCTION

Dead wood plays an important role in the conservation of forest biodiversity. In recent years, the ecological role of dead wood was highly valued. Sustainable management of forests must go hand in hand with the evaluation of the quantity and quality of this dead wood in forests (Stokland et al., 2012). Indeed, dead wood is associated with certain functions including the preservation of insect species that live in them and that, in turn, serve as nourishment to some bird species such as pecks that use, in addition, the dead trees to build their nests. In modern orchards, however, the role played by dead wood has never been evaluated due to pruning and elimination. In old orchards, however, dead trees are maintained as firewood "reserves" or used as supports for climbing plants. The aim of this study was to evaluate the role of dead loquat plants and the portions of dead wood that are often still present in older living plants in maintaining the diversity of insects population, particularly *Coleoptera* of the *Cerambycidae* family.

MATERIALS AND METHODS

Study Area

The survey was conducted in the Conca d'Oro, the plain surrounding Palermo. As a result of urban speculation, mixed citrus plantings have been greatly reduced in terms of surface (Rühl et al., 2009). The plain has always been characterized by a thriving

agriculture, in particular by orchards. The cultivated species include citrus fruits (lemon, mandarin, orange), loquat, walnut, Mediterranean hackberry (*Celtis australis* L.) and vegetable crops such as beans, eggplant, peas, broccoli, and tomato.

Sampling Methods

The *Cerambycidae* beetles were collected during the last 20 years, and more intensively during the years 2010-2014. Many *Cerambycidae* are crepuscular and nocturnal, coming out from galleries and remaining on the larval host plant in search of a female to mate before and after oviposition. Branches, portions of stumps and logs that evidenced signs of larval presence were collected. Part of the determinations were conducted by observing the entire insect life cycle from larval to adult stage. The samples were monitored regularly for a certain period, depending on the phenology of the flicker adult species. The data collected in the field were integrated with that obtained from literature and from public and private collections.

RESULTS AND DISCUSSION

Several beetle species associated with timber also included four *Cerambycidae* (Table 1). These species are quite common although the *Cerambyx scopoli sculus* (Rapuzzi and Sama, 2010) was recently exclusively ascribed to Sicily's territory. Other species of *Coleoptera saproxilofagi* have developed in dead loquat, especially in large trunks on the ground or in logs, such as the *Dynastidae* *Oryctes nasicornis* (Linnaeus, 1758) and *Phyllognathus excavatus* (Forster, 1771) and the *Cetoniidae* *Potosia hypocrita* (Ragusa, 1905) and *Cetonia aurata sicula* (Aliquò, 1983). In addition, subcortical and mycophagous species as the *Tenebrionide* *Diaperis boleti* (Linnaeus, 1758) were found, typical of natural and intact forest habitats, uncommon in Sicily (Aliquò and Soldati, 2010).

CONCLUSIONS

Dead wood is rare in modern orchards while in old orchards it is quite common and associated to a great biodiversity (La Mantia, 2007). In the Conca d'Oro orchards, the loquat plays a fundamental role in order to preserve biodiversity; many dead loquat trees are not cut down because they serve as a support for climbing plants and vegetables, in particular bottle gourd [*Lagenaria siceraria* (Molina) Standl.]. The presence of large hollow trees with parts of dead wood and standing dead trees, facilitates the conservation of the fauna associated to forest environments. Dead trees play an important role in orchards and are considered to be irreplaceable for many species; in addition to xylophagous and saproxyllophagous insects, it also hosts other insects such as mycetophagous and parasitoid ones.

Dead loquat trees are also the regular wintering sites for reptiles, such as *Podarcis sicula* (Rafinesque, 1810) that are hosted in the tunnels bore by *Cerambycidae* or under the bark together with *Tarentola mauritanica* (Linnaeus, 1758). Birds, as the wren (*Troglodytes troglodytes*, Linnaeus, 1758) build their nests under loquat bark (Massa and La Mantia, 2009). The *Cerambycidae* that live in dead loquat wood do not attack live plants, while the moths *Zeuzera pyrina* (Linnaeus, 1761) and *Cossus cossus* (Linnaeus, 1758) attack live trees. A risk for loquat, but also for citrus, could be represented by the *Cerambycidae* recently reported in Italy *Anoplophora chinensis* (Forster, 1771) and *Anoplophora malasiaca* (Thomson, 1865; Colombo and Limonta, 2001; Van Der Gaag et al., 2010), which attack living organs ultimately leading to plant death.

ACKNOWLEDGEMENTS

We would like to thank Francesca Quatrini for helping with language editing.

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Tables

Table 1. *Cerambycidae* fulfilling their life cycle in loquat tree in the Conca d'Oro, an area close to the Town of Palermo.

Species	Chorotype and distribution	Biology and host plants
<i>Aegosoma scabricorne</i> (Scopoli, 1763)	Turano-European; throughout Italy	Polyphagous, larval stage on spontaneous or cultivated broadleaves (<i>Quercus</i> , <i>Fagus</i> , <i>Juglans</i> , <i>Ulmus</i> , <i>Hedera</i> , <i>Celtis</i> , <i>Populus</i> , <i>Prunus</i> , <i>Alnus</i> , <i>Platanus</i> , etc.). Adult nocturnals can be found on the same host plants from June to August
<i>Penichroa fasciata</i> (Stephens, 1831)	Turano-Mediterranean; central and southern Italy, Sicily, Sardinia, sporadic in northern Italy	Larval development in dead woods and various broadleaves (<i>Ceratonia</i> and <i>Pistacia</i> in southern and insular Italy, Sama, 1988) but have also been reported on <i>Pinus halepensis</i> (Peyerimhoff, 1919; Sama, 1988) and <i>Thuya</i> (Sama, 2002). Adults can be found at night on host plants from May to August or can be attracted by artificial lights
<i>Cerambyx scopolii siculus</i> (Rapuzzi and Sama, 2010)	<i>C. scopolii scopolii</i> Fuesslins, 1775 Turano-European, throughout Italy; the ssp. <i>siculus</i> in Sicily (Rapuzzi and Sama, 2010; Bellavista et al., 2010).	Polyphagous, larval stage on spontaneous or cultivated broadleaves (<i>Quercus</i> , <i>Castanea</i> , <i>Pirus</i> , <i>Prunus</i> , <i>Carpinus</i> , <i>Ostrya</i> , <i>Juglans</i> , <i>Fagus</i>). Adults can be found on trees and flowers from May to August August; attracted by sugary substances
<i>Niphona picticornis</i> (Mulsant, 1839)	Mediterranean; Italy, Sicily and Sardinia	Larvae polyphagous on deciduous trees, in particular, <i>Ficus carica</i> , <i>Spartium junceum</i> , <i>Pistacia</i> , <i>Robinia</i> , <i>Castanea sativa</i> , <i>Quercus</i> , <i>Calycotome</i> and <i>Euphorbia dendroides</i> ; also reported on conifers (<i>Pinus</i>) (Sturani, 1981). Adult nocturnal can be found on the same host plants from June to August, or can be attracted by artificial lights

Figures *Characterization of Methyl-Thiophanate Resistance in Field Strains of Fusicladium rosaebrunneum, the Causal Agent of Loquat Scab*



Fig. 1. Dead trees left as firewood “reserves”, or used as supports for climbing plants or horticultural plants (top left and right); a *Aegosoma scabricorne* and a larvae (middle left and right); living loquat tree with a portions of dead wood. Dead wood hosts a *Podarcis sicula* or a subcorticicole and mycetophagous species as the Tenebrionide *Diaperis boleti* (bottom left, center, right).