AGROCIENCIA URUGUAY

Agrociencia Uruguay 2019 23(2):1-7
ISSN electrónico 2301-1548

First Record of *Palpita persimilis* (Lepidoptera, Crambidae) and *Oxycenus maxwelli* (Acari, Eriophyidae) in south-eastern Uruguay

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Recibido: 2017/12/26 - Aceptado: 2018/09/18

Summary

Olive production has increased in recent years in Uruguay. In the south-eastern region, where oceanic influence leads to humid climatic conditions, some pests associated with foliar and fruit damage are not well known. Blacklight traps, a portable vacuum aspirator and observation of olive shoots were employed for a survey of adults and larvae of Lepidoptera and mites in an olive orchard from November 2016 to April 2017, in Rocha, Uruguay. Lepidopterous larvae increased from December to March, while adults reached a maximum in February. Larvae abundance was higher on cv Arbequina than on cv Coratina and cv Picual. Eriophyid mites were more abundant in December and their population decreased through the sampling period. This is the first report for *Palpita persimilis* (Lepidoptera, Crambidae) and *Oxycenus maxwelli* (Acari, Eriophyidae) in olive trees in Uruguay.

Keywords: *Olea europaea*, Eriophyoidea, *Palpita* spp., olive bud mite

Primer registro de *Palpita persimilis* (Lepidoptera, Crambidae) y *Oxycenus maxwelli* (Acari, Eriophyidae) en el sureste de Uruguay

Resumen

La producción de olivos ha aumentado en los últimos años en Uruguay. En la región sureste, donde la influencia oceánica determina condiciones climáticas húmedas, algunas plagas asociadas a los daños foliares y de frutos son poco conocidas. Trampas de luz UV, un aspirador motorizado portátil y la observación directa de brotes fueron empleados para realizar una prospección de adultos y larvas de lepidópteros y ácaros en un monte de olivos entre noviembre 2016 y abril 2017, en Rocha, Uruguay. La población de larvas de Lepidoptera se incrementó de diciembre a marzo, mientras que los adultos alcanzaron un máximo en febrero. La abundancia de las larvas fue mayor en el cv Arbequina que en los cvs Coratina y Picual. Los ácaros eriófidos fueron más abundantes en diciembre y su población decreció a lo largo del período de muestreo. Este es el primer registro de *Palpita persimilis* (Lepidoptera, Crambidae) y *Oxycenus maxwelli* (Acari, Eriophyidae) en olivos en Uruguay.

Palabras clave: *Olea europaea*, Eriophyoidea, *Palpita* spp., ácaro de las yemas del olivo

Introduction

Olive production in Uruguay has increased recently, reaching nowadays around 10,000 ha. Olive cropping has been well adapted in several countries in South America, both for olive and oil production. In these countries, pest damage could be of significant expression if control measures are not provided[1].

The most important olive pests for olive production, *Bactrocera oleae* and *Prays oleae,* are not present in South America, where the scale *Saissetia oleae*, the olive moth *Palpita* spp., and the eriophyid mite *Oxycenus maxwelli* are cited as the main olive pests[2]. In southern Brazil, the moth *Palpita forficifera* and the scales *S. oleae* and *Saissetia coffea* were reported as the main pests, in addition to some hemipteran and two thrips species[3].

In Uruguay, the moth *P. forficifera*, the H scale, *S. oleae* and *Hylesinus oleiperda* (Coleoptera: Curculionidae) are reported[4]. The presence of the white scale *Aspidiotus nerii*, the Australian red scale *Aonidiella aurantii*, and the curculionid *Phloeotribus scarabaeoides* are also cited[5]. *P. forficifera* was registered in 2003 surveys conducted in the north-western region of Uruguay. Nowadays, it is a common pest all over the country[6]. First moths appear in early spring and the flights are common during summer and fall. Larvae are present since late spring to mid-autumn[5]. For moth surveys in olives, non-traditional black light traps have been developed[7], or sexual pheromones[8] or a combination of both methods is used[9]. Sex pheromones have been successfully employed as a sexual confusion method to control *P. oleae*[10].

The eriophyid mites *Oxycenus maxwelli*, *Ditrymacus athiasellus* and *Aceria oleae* are present in Argentina, Brazil and Chile[11]. Their main damage is fruit deformation in adult trees and blooms and leaves deformation in seedling trees. The importance of these mites has been associated with some cultural practices, such as irrigation, nitrogen fertilization, higher planting density and broad spectrum insecticides.

Black scale, or H scale, is the most extended hemipterous pest in olives, always associated with fumagine (*Capnodium leaophilum*), which grows over this insect honeydew. In southern Uruguay, two generations of this scale were registered, one in spring and the other in fall[12]. Thus, this study was aimed at surveying the species of olive moths and mites present in an olive orchard in eastern Uruguay.

Materials and Methods

A survey was conducted in an olive 50 x 100 m plot, in Rocha, Uruguay, in the reproductive period of olives, between November 2016 and April 2017. Between November 2016 and February 22nd, 2017, no pesticide applications were made in the area, when one application of insecticide was needed for the control of lepidopterous larvae.

For collecting adult lepidopterans, three adapted black (UV) light traps[7] were installed in between the olive trees in one of the rows, with a distance of 30 m between one trap and the following. The cultivars present in the survey plot were Arbequina, Coratina, and Picual. Traps were energy-supplied by a battery connected to a pair of solar panels, controlled by a timer device programmed to work every two nights, previous to samples collecting. The samples from these traps were collected also on a weekly basis, from December 2016 to March 2017.

For the mites and lepidopteran larvae survey, every weekly sampling date, four new sprouts in three replicates were randomly detached from each cultivar. These were maintained and examined at the Laboratory of Animal Biology of Centro Universitario Regional del Este, under a binocular stereomicroscope (40x) for searching mites. In these samples the number of sprouts with presence of eriophyid mites and their damages were registered. Also randomly obtained larvae of *Palpita* sp. were collected and reared in laboratory conditions, to obtain the adult stage for their identification. For monitoring the presence of larvae in the foliage, weekly samples were taken with a portable vacuum aspirator, during one minute in each olive tree, around their canopy, in three replicates per cultivar. Labeled samples were placed in plastic bags (aspirator) or in hermetic plastic vials containing ethyl alcohol 70 % (light traps) and maintained in a refrigerator until being analyzed.

The eriophyid mites were identified at the Laboratory of Plant Quarantine, Embrapa Genetic Resources and Biotechnology, Brasilia, Brazil. They were mounted in permanent microscope preparations using Berlese modified medium[13] and then identified using a phase contrast microscope[14]. Specimens of mites collected in this survey were deposited at the Reference Mite Collection of the Laborator of Plant Quarantine.

Adult specimens of *Palpita* sp. collected with the blacklight traps and those emerged at the laboratory from a stock mass larvae rearing from the field were identified by Dr. Vítor O. Becker, at Instituto Uiraçu, in Camacan, Bahia, Brazil, where the genitalia remained.

To assess if there were differences on the abundance of *Palpita* adults among cultivars, we ran GLM models with negative binomial error distribution and logit link function. Similarly, GLM with binomial error distribution and log link function were used for assessing if there were differences among the olive cultivars in the probability of occurrence of eriophyid mites. Contrasts method was applied for assessing which cultivar (i.e. levels of the factor variable) had a significant effect on *Palpita* abundance, as well as on the occurrence of the eriophyid mites[15]. We ran models with R 3.3.1[16] to run the GLMs.

Results and Discussion

A total of 164 adults of *Palpita* sp. were captured in blacklight traps from January 2017 until April 2017, reaching a maximum by the end of February and beginnings of March. With the portable vacuum aspirator, we collected, in total, 178 larvae of the olive moth. That sudden increase in the number of adults collected led the responsible of the crop management to make an insecticide application (Figure 1). It is assumed that such intervention might have been responsible for the later decrease of adults captured.

All specimens sent to Dr. Vítor O. Becker were identified as *Palpita persimilis* Munroe, 1959 (Lepidoptera: Crambidae, Spilomelinae). This is the first report for this species in olives in Uruguay. This species has been cited for Chile[17][18] and Brazil[19]. *Palpita persimilis* is sympatric with *Palpita forficifera* in southern Brazil (Becker, V. pers. comm.), which is probably the same status these two species have in Uruguay, as the latter has been already cited[4][5][6].

It must be pointed out that *P. persimilis* and *P. forficifera* are morphologically identical, the moths having almost entirely white wings, with a wingspan from 19 to 27 mm. The labial palpi of *P. persimilis* are mostly reddish brown with distinct dark-brown to black scales bordering the reddish area dorsally and ventrally; the same dark scales are also prominent on the maxillary palpi and lateral margin of the frons. Their identification must be always confirmed by the study of their genitalia. Males of *P. persimilis* have elongate processes on the valvae that curve around to parallel the distal margin of the valva. Each process has two parts. The inner parts are symmetrical and have

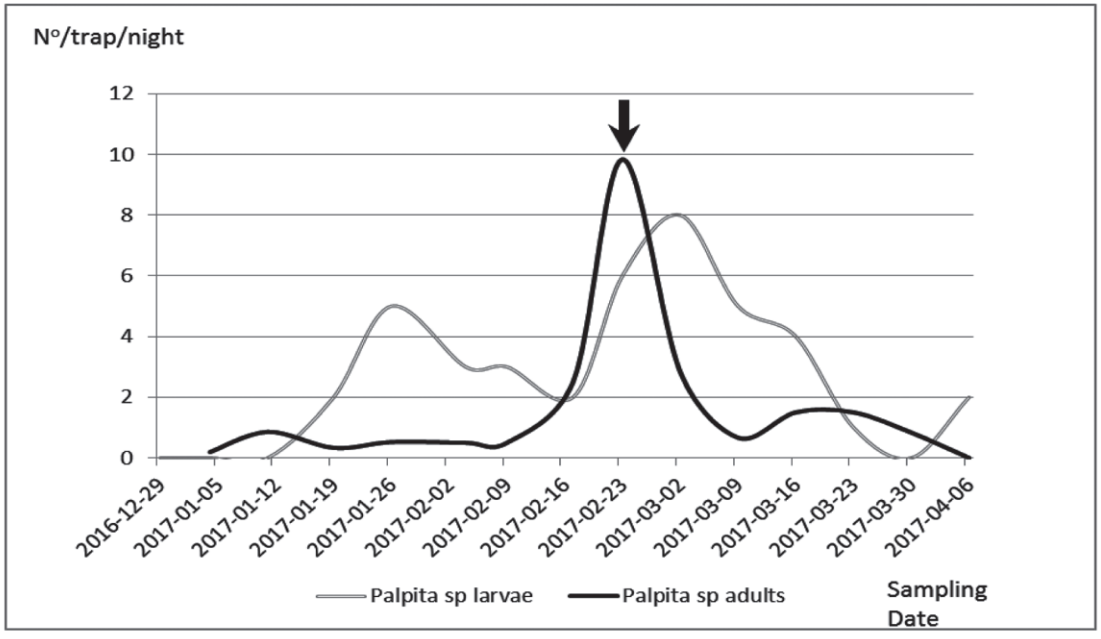

Figure 1. Mean number of *Palpita* sp. adults (by night, collected in blacklight traps) and larvae (by sample, collected with a portable vacuum aspirator), from December 2016 to April 2017. The arrow indicates an insecticide application.

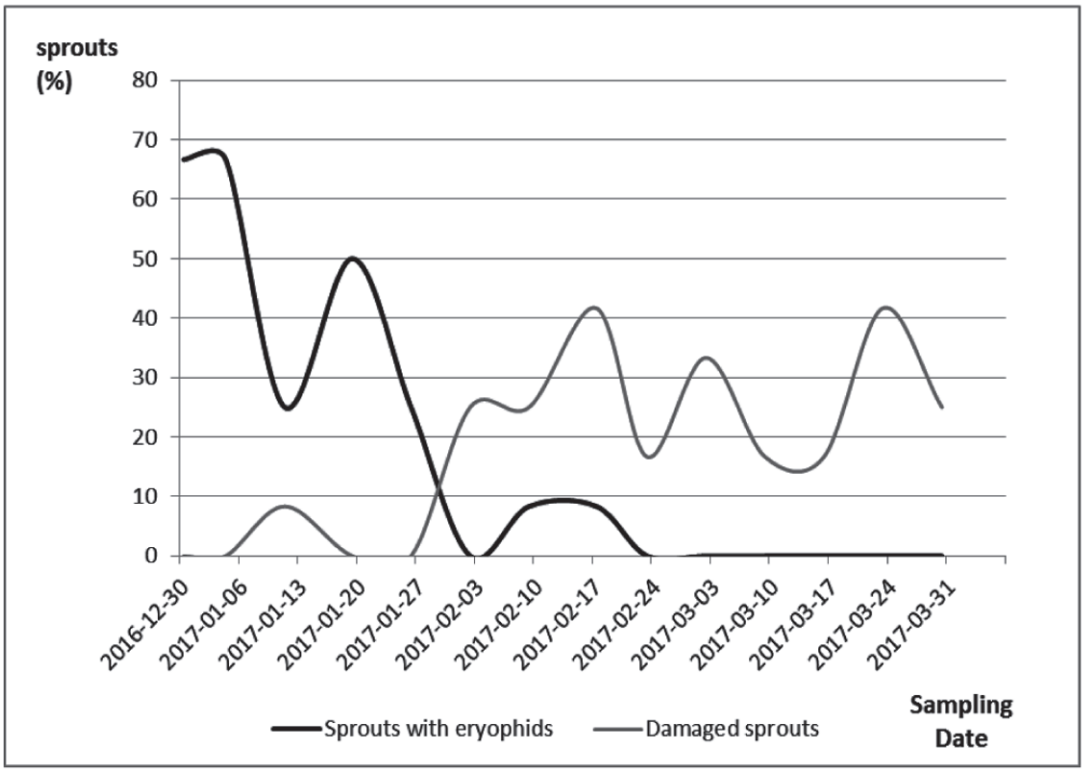

Figure 2. Percentage of new sprouts with a presence of Eriophyidae mites or with mite damage.

swollen grooved apices. The outer parts are narrow and asymmetrical, with the right-hand one nearly as long as its inner part and slightly bifurcate, and the left-hand one half as long as its inner counterpart. Females have lamella postvaginalis asymmetrical, tapered like a spout[20].

Direct examination of new olive sprouts showed an eriophyid species as the predominant mite, and its presence on the sprouts declined from December to February, since when were almost not found (Figure 2).

In the conditions of this survey, the presence of eriophyid mites was detected in most of the new sprouts examined in the earlier sampling dates, in summer, and the incidence decreased as the sampling period went forward. In this case, the number of mites had already decreased significantly before the insecticide application (February 22nd). Mite damage is produced to the buds and it is expressed and easily verified when the leaves of the sprout expand. Then, the damage stays in the sprout even when the mites are not there, so the damage level did not decrease towards the final sampling dates.

The Eriophyid mite species was identified as *Oxycenus maxwelli (Keifer)* [21] (Acari: Eriophyidae), also representing the first report for this species in olives in Uruguay. These mites are exclusively phytophagous and cause leaf silvering and deformations in most plant tissues, except for roots. *Oxycenus maxwelli* had been cited in Argentina[22], Chile and Brazil[23][24]. This species was described from California, USA, as a mite with a fusiform body, orange in color, females measuring 140-160 ìm[21]. Opistosoma (dorsal region) has a serrate median elevation, arrows of dorsal shield near the posterior margin and some dorsal rings have lateral projections, frontal lobe acuminate, rounded above[24]. The female genital shield has 18-20 longitudinal ridges[21].

According to GLM model, *Palpita persimilis* larvae abundance was significantly higher on cv Arbequina than on Coratina and Picual (Z = 2.389, p = 0.01), while no differences were found between these latter (Z = -0.935, p = 0.349) (Figure 3).

No differences were found for the occurrence probability of the mite *O. maxwelli* between cultivars (Figure 4). GLM on probability of occurrence of *O. maxwelli* showed no significant differences either between Arbequina and Coratina and Picual cultivars (Z = 0,105, p = 0,916) and Coratina and Picual (Z = 1,450, p = 147; Figure 4).

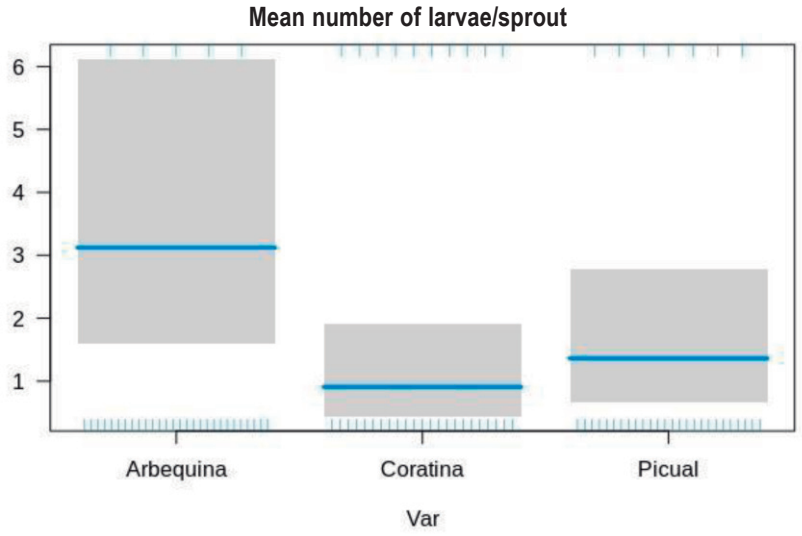

Figure 3. Adjusted GLM for *Palpita persimilis* larvae abundance in three cultivars. The blue line indicates the mean, while 95 % confidence intervals are shown in grey.

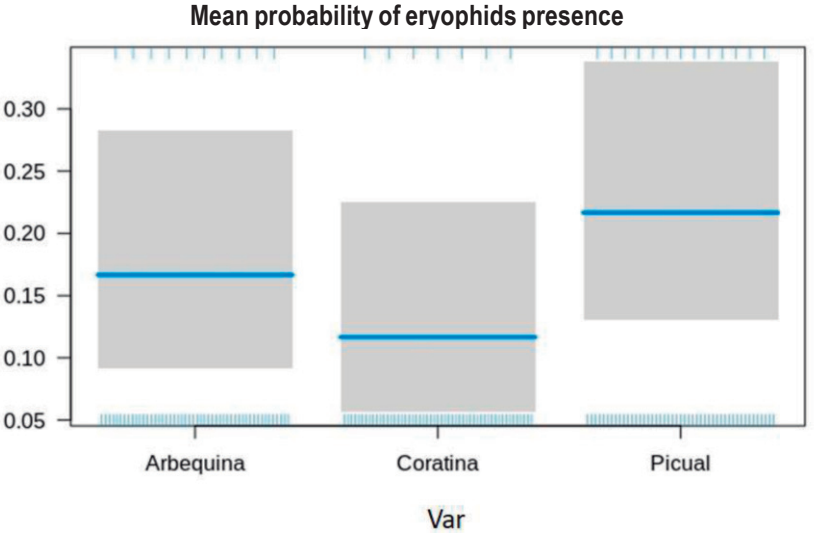

Figure 4. Adjusted GLM for the probability of the presence of eriophyid mite *Oxycenus maxwelli* on new olive sprouts of cultivars Arbequina, Coratina and Picual. The blue line indicates the mean, while 95 % confidence intervals are shown in grey.

The portable vacuum aspirator provides an active useful sampling method for a general capture of canopy inhabitant organisms. However, this sampling method misses those arthropods that have nocturnal habits. This fact was, to some extent, complemented by the samples taken with the light traps. However, in the present study, light traps were used only for monitoring the lepidopteran adults defined as one of the target organisms.

Final Considerations

Palpita persimilis Munroe (Lepidoptera: Crambidae) and *Oxycenus maxwelli* Keifer (Acari: Eriophyidae), are reported for the first time in an olive crop in Uruguay, and appear to be key pests of this production in the south-eastern region of this country.

However, the incidence of these species in terms of damage or economic impact was not studied as it depends

on the interaction of different factors that affect their presence/abundance (climatic conditions, natural control, use of agrochemical products, among others).

The sampling methods showed to be adequate for the general characterization of the arthropods present in the area and could be useful for monitoring main target species.

Acknowledgments

To Diego Martínez, CEO of Nuevo Manantial, for the financial support of this survey, and Dr. Vítor O. Becker, the entomologist from the Instituto Uiraçu, Camacan, Bahia, Brazil, for the identification of *Palpita persimilis*.

Author's contribution

BJ: Article's conception, survey layout, field sampling and laboratory processing.

CE: Article's conception, survey layout, field sampling.

ND: Performed mites' recognition and carried out the work of specimens' curatorship.

AJ: Defined and performed statistical analysis of the biological information.

All authors participated in the interpretation of the results and were part of the writing of the manuscript's final version

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