Contribution to the study of the beneficial fauna of olive orchards in Porto Martins, Terceira island, Azores

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Introduction

The Porto Martins olive production area is situated in the southeast area of Terceira island, is characterized by its rural landscape, where one can observe vineyards in the traditional way and known for being the place where traditionally exists the culture of the olive tree.
The olive tree is a culture that presents some key-pests with economic importance and that cause great production losses, decreasing the quality of the olives and increasing the production costs, namely due to the phytosanitary treatments. Among the pests that attack this culture, the most important pests are olive fly *Bactrocera oleae* (Gmelin) and also the olive moth, *Prays oleae* (Bernard).
Other pests, such as scales, *Saissetia oleae* (Olivier), olive thrips, *Liothrips oleae* (Costa) and olive cottonworm, *Euphyllura olivina* (Costa), can also be harmful to the crop, but can be controlled and kept at levels that do not affect this crop due to the presence of beneficial fauna and implementation of cultural practices (pruning and correct fertilizations). There are other problems that affect the olive tree with minor importance such as *Capnodium elaeophilum* Prill. (common named as fumagina), *Pseudomonas savastanoi* (Erw. Smith) Stevens (Tuberculosis), *Cercospora cladosporioides* Sacc. (Cercospora), *Margaronia unionalis* Hübn. (Jasmine butterfly) and *Phloeotribus scarabaeoides* Bern. (Olive tree beetle) (Figueiredo, 2003; Horta Lopes et al., 2009; Meneses, 2012).

Main Goal – Evaluate and identify the beneficial fauna of the olive orchards

Material and methods

The olive orchards were chosen according to the number of phytosanitary treatments during an crop cycle:
- 1 organic olive orchard – without treatments application;
- 3 semi-intensive regime olive orchards – less than 10 treatments;
- 3 intensive regime olive orchards – more than 10 treatments.

In each plot, 15 trees were selected in the month of April and May and in each were made 5 beatments.

All samples were collected and tagged and in laboratory screening and identification was performed to separate each family and specie of arthropods present in each olive orchard sampled.

Regarding species diversity the Hill series indices were used to measure it (Magurran, 2004; Lopes & Gelisch, 2020)
- Hill nº 1 - species richness (S);
- Hill nº 2 - exp (H'), being H' the Shannon - Wiener index;
- and Ratio H'/S

Results

The field work lasted for 3 months and 525 samples were collected. In the studied olive orchards were collected and identified 1470 arthropods belonging to the orders Araneae, Coleoptera, Hemiptera, Hymenoptera, Psocoptera and Thysanoptera (as is shown in Table 1).

Table 1- Distribution among order and families of the sampled arthropods in Porto Martim olive groves.

Order	Family	Specie
Araneae	Araneidae	*Mangora acalypha* (Walckenaer, 1802)
	Linyphiidae	*Erigone autumnalis* Emerton, 1882
	Linyphiidae	*Erigone dentipalpis* (Wider, 1834)
	Clubionidae	*Porrhoclubiona decora* (Blackwall, 1859)
	Dictynidae	*Emblyna acoreensis* Wunderlich, 1992
	Dictynidae	*Nigma puella* (Simon, 1870)
	Salticidae	*Pseudeuophrys vafra* (Blackwall, 1867)
	Clubionidae	*Porrhoclubiona genevensis* (L. Koch, 1866)
	Linyphiidae	*Entelecara schmitzi* (Kulczynski, 1905)
	Salticidae	*Macaroeris diligens* (Blackwall, 1867)
Coleoptera	Staphylinidae	*Atheta fungi* (Gravenhorst, 1806)
	Staphylinidae	*Tachyporus chrysomelinus* (Linnaeus, 1758)
	Phalacridae	*Stilbus testaceus* (Panzer, 1797)
	Scraptiidae	*Anaspis proteus* (Wollaston, 1854)
	Nitidulidae	*Brassicogethes aeneus* (Fabricius, 1775)
	Curculionidae	*Mecinus pascuorum* (Gyllenhal, 1813)
	Curculionidae	*Otiorhynchus cribricollis* (Gyllenhal, 1834)
	Brentidae	*Kalcapion semivittatum semivittatum* (Gyllenhal, 1833)
	Cetoniidae	*Oxythyrea funesta* (Poda, 1761)
	Cryptophagidae	*Gen. Sp. PROJ Teresa*
Hemiptera	Cixiidae	*Cixius azoterceirae* (Remane & Asche, 1979)
	Lygaeidae	*Kleidocerys ericae* (Horváth, 1908)
	Psyllidae	*Euphyllura olivina* (Costa, 1839)
	Cicadellidae	Gen. (sp.4)
	Cicadellidae	Gen. (sp.)
	Anthocoridae	Gen. (sp.2).
Hymenoptera	Formicidae	*Lasius grandis* (Forel, 1909)
Psocoptera	Ectopsocidae	*Ectopsocus briggsi* (McLachlan, 1899)
	Trogiidae	*Cerobasis* cf sp.1
	Caeciliusidae	*Valenzuela flavidus* (Stephens, 1836)
	Psocidae	*Atlantopsocus adustus* (Hagen, 1865)
	Trichopsocidae	*Trichopsocus clarus* (Banks, 1908)
Thysanoptera	Aeolothripidae	*Aeolothrips gloriosus* (Bagnall, 1914).

Results

- In olive orchards with intensive regime the order thar dominated was Hemiptera with 57% (as can be see in Fig. 1).
- In olive orchards with semi-intensive regime the distribution of insects was more balanced (as shown in Fig.2). The obtained data show that in orchards with intensive and semi-intensive regime a greater diversity of predators was lost.
- In the organic olive orchard, the order Psocoptera with 53% was the one with the highest percentage followed by Hemiptera (25%) (as shown in Fig. 3). This organic orchard was where the highest abundance of predatory insects and the lowest abundance of herbivorous insets were observeed, showing that this type of orchard is in natural balance.

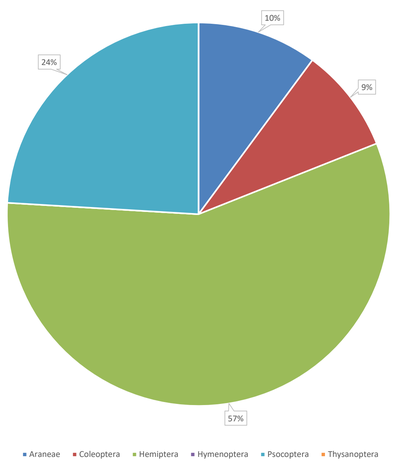

Figure1. Distribution of insect orders captured in the orchards with intensive phytosanitary treatments..

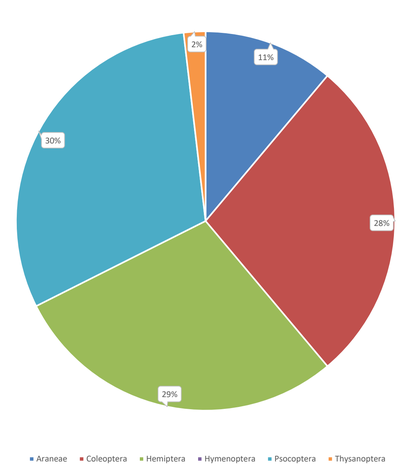

Figure 2. Distribution of insect orders captured in the orchards with less intensive phytosanitary treatments.

Regarding the Hill indices obtained for the predators and herbivores present in the sampled olive groves in the case of predatory insects, as sown in Table 1 and 2. The plots with lower intensity of phytosanitary treatments and the organic orchard had a higher average abundance of species compared to the orchard with much intensity and frequency of chemical treatments.
Through the H'/S ratio results shown in Table 1 for predatory insects it was found that in the intensive and less intensive orchards where greater diversity of predator species was lost, 73% and 82% and in the organic orchard where there is greater diversity of predators (49%).

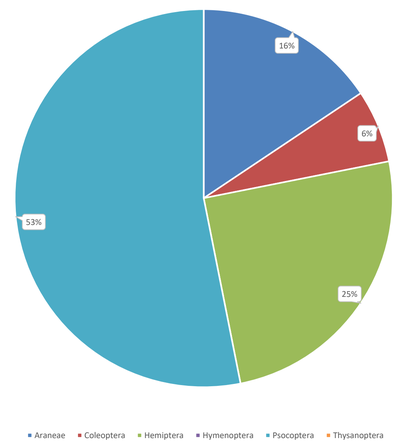

Figure 3. Distribution of insect orders captured in the organic orchard.

Table 1. Hill index calculated for predatory insects present in Porto Martim olive groves.

Predatory insects			
	Intensive	Less intensive	Organic
Hill 1 (S)	8	10	6
S Mean	4,3	5,7	6
Hill 2 (exp H')	2,14	1,81	2,96
Ratio (H'/S)	0,27	0,18	0,49

Table 2. Hill index calculated for herbivorous insects present in Porto Martim olive groves.

Herbivorus insects			
	Intensive	Less intensive	Organic
Hill 1 (S)	5	7	3
S Mean	2,7	4,7	3
Hill 2 (exp H')	1,07	1,62	1,3
Ratio (H'/S)	0,21	0,23	0,43

Conclusions

From the results obtained, we can affirm that there is always a great loss of diversity in the orchards that are treated in relation to that which does not have chemical applications. In the orchards where there are applications of phytopharmaceutical products, whether in an intensive or semi-intensive regime, there is an imbalance of the species present and there is a great presence of olive cotton (*E. olivina*).
In the organic orchard, there is olive cotton, but it is controlled, probably by the presence of insects which naturally combat this pest. It was also noted that in the organic orchard there is a greater diversity of predators and a lower abundance of herbivorous insects.
Therefore, producers will be able to increase the yield extracted from the crop mainly by taking the biological option in exploring their olive groves.

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