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Opening session

No abstract

Session 1: Fundamental research in olive pathogens and pests

Abstract only

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Abstract: The olive fruit fly, *Bactrocera oleae,* is a major pest of olive crops and its expansion is restricted to the geographic areas where olive trees are grown. The knowledge of the within and between populations genetic variability can help to understand the history of a species and monitoring the origin and spread of invading populations. Such information could be crucial to define appropriate strategies for eradication or control.In the present work, PCR amplification of inter-simple sequence repeats (ISSR technique) was applied to the analysis of the genetic variability of four Iberian populations of *B. oleae*. Flies from four different geographical areas, representing the Iberian distribution range of the species, were collected by harvesting infested fruit and allowing the larvae to pupate in the laboratory. Four random primers (817, 820, 820, 847, UBC primer set no. 9) were used to assess their genetic variation. The results show considerable levels of genetic polymorphism in the analysed samples, ranging from 78.5% to 82.1%. Regarding the distribution of this variability, most of the genetic variation was found within populations (92.6%). Likewise, a substantial level of gene flow (5.36) was deduced. Thus, ISSR are highly sensitive markers for variability detection in *B. oleae* and could help to answer fundamental questions related to the population structure and dynamics of the fly and, hence, to improve management control.

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Effect of the plant protection systems on soil arthropods in olive groves from Alentejo region (southeastern Portugal)

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Abstract: Changes in arthropod abundance and biodiversity can be associated with the changes in land use and agricultural practices. The aims of this work were: *i*) to study the abundance and diversity of edaphic arthropods in olive groves following different plant protection systems (organic growing, intensive, super-intensive and conventional), *ii*) to analyse the seasonal variation of the most abundant groups and *iii*) to evaluate the differences among groves. The field work was carried out in Alentejo region (southeastern Portugal) and occurred monthly from April to October 2010. In each grove, 25 pitfall traps with 7cm height and 6cm diameter were randomly placed at the soil level and collected after 24h. Traps were placed in the south side of the canopy at 50cm from each tree trunk. All trapped individuals were preserved in 70% ethanol, sorted and identified to class, order or family taxa. Principal Response Curves (PRC) method was used to analyse the effect of management regime at the community level. Significantly higher abundances of arthropods were registered in the organic grove when compared with the other three systems. Formicidae was the most abundant group in all the sampled groves reaching higher abundances in August in the super-intensive system while the other three systems obtained higher abundance of Formicidae in May. Considering Araneae, this group was more abundant in June in the organic and super-intensive systems and in October in the conventional and intensive systems. Coleoptera were more abundant in October in the organic and intensive systems, in May in the super-intensive and in April in the conventional system. According the PRC method, Formicidae and Diptera were the most affected groups by the plant protection system. Moreover, in the sampling period, the super-intensive system showed the highest negative impact over arthropod abundance which can be explained by the application of herbicides for the control of *Conyza canadensis*.

Key words: high density systems, biodiversity, epigeic arthropods, management regime

Introduction

In the last few years, new olive planting systems based on an increase in the density of the trees/ha have been introduced in South Alentejo region. These systems are linked to improvements in harvesting and pruning machinery and irrigation systems and involve a reduction in the number of olive varieties used.

Among these modern planting systems are: (i) the high input intensive system with densities varying between 200 and 400 trees/ha and (ii) the super-intensive or high-density hedgerows system with 1500-1900 trees/ha allowing for mechanical harvesting (Tous *et al.*, 2011). This system has utilized a limited number of cultivars, primarily ‘Arbequina’, ‘Arbosana’ and ‘Koroneiki’, which possess suitable features such as a semi-dwarf habit, early production (first production at the second-to-third year after planting) and fruit that is impact-resistant and has good oil quality (Godini & Bellomo, 2002).

Both high input intensive systems and high-density systems are primarily managed through the application of several pesticides, fertilizers or frequent tillages for weed control. For this, it is essential to understand if changes in arthropod abundance and biodiversity can be associated with the changes in land use and agricultural practices. Therefore, the objective of this research was to study the abundance of edaphic arthropods in olive groves following different management systems (organic growing, intensive, super-intensive and conventional).

Material and methods

The study areas were located in four olive groves near Serpa in South-Alentejo (South-Portugal). The characterization of each olive grove is described in Table 1. With the exception of the organic grove, in all other groves insecticide sprays were done in the beginning of October 2010 against *Bactrocera oleae* (Rossi).

Table 1. Characterization of the study areas.

Olive grove	Area	Cultivar	Irrigation	Tree spacing (m × m)	Soil managment	Soil coverage	GPS	Nº trees/ha
Organic	92	Cordovil	Yes	7 x 6	Tillage on the row Weeds removed between rows Bone meal fertilizer in February	Natural vegetation Sown clover	37º53´59.1''N 7º32'24.3''W	238
Conventional	73	Verdeal, Cordovil	No	15 x 15	Herbicide Tillage	No	37º57´4.8''N 7º32'51.8''W	70
High input intensive	250	Arbequina	Yes	7 x 5	Herbicide on the row Weeds removed between rows Ferti-irrigation	Natural vegetation	37º57´26.1''N 7º31'2.5''W	285
Super-high-density	270	Arbequina	Yes	3.75 x 1.35	Herbicide Tillage Ferti-irrigation with binary or ternary fertilizer in March	No	37º56´29.9''N 7º31'21.4''W	1976

The epigeic communities were sampled on a monthly basis between April and October 2010 by using pitfall traps half filled with a mixture of 70% ethanol, 29% water and 1% detergent. In each grove, 25 pitfall traps with 16cm height and 9cm diameter were randomly laid at the soil level and collected after 24 h. Traps were placed facing the south side of the canopy at 50cm from each tree trunk. All trapped individuals were preserved in 70% ethanol, sorted and identified to class, order or family taxa.

The abundance of individuals of each taxon was compared by one-way ANOVA (Zar, 1998). Principal response curves (PRC) were applied to analyze the response of the whole community (Van den Brink & Ter Braak, 1999; Van den Brink *et al.*, 2003). The resulting PRC diagram displays a curve for the treatment that can be interpreted as the principal response of the community. By definition, the reference is zero in every date and, at each sampling period t, the deviation (given by a basic response pattern or Cdt) of the treatment curve d compared to reference is proportional to the effect of the plant protection system. The species weight (bk) indicates how close the response of species k matches the overall community response as displayed in the PRC diagram. Taxa with a positive weight are expected to decrease in abundance, relative to reference while taxa with negative weight are expected to increase. Taxa with species weights between 0.5 and -0.5 show a weak response.

Results and discussion

Arthropods collected in pitfall traps were classified into 11 taxa. The overall taxa abundance varied between olive groves and was significantly higher in the organic groves than in the other three groves. The epigeic community in all groves was numerically dominated by Formicidae (Table 2). Formicidae and Araneae were more abundant in the organic grove followed by the intensive, conventional and super-high-density that registered the smallest number of captures.

Table 2. Total abundance (N) of taxa captured in total samples in organic, conventional, intensive and super-high-density olive groves, in South Alentejo 2010(n = 175).

Taxa	Organic	Conventional	Intensive	Super-high density
Formicidae	3561	1114	1662	666
Araneae	131	58	96	58
Coleoptera	67	62	26	124
Hemiptera	18	10	23	1
Diptera	114	41	58	19
Collembola	78	77	57	30
Crustacea	47	17	6	38
Chilopoda	16	6	9	11
Orthoptera	4	29	1	21
Lepidoptera	8	11	12	23
Acari	10	6	17	1
Total	4054	1431	1967	992

Formicidae reached higher abundances in August in the super-intensive system while the other three systems obtained higher abundance of Formicidae in May. Araneae were more abundant in June in the organic and super-intensive systems and in October in the conventional and intensive systems. Coleoptera were more abundant in October in the organic, in May in the intensive and super-high-density and in April in the conventional system (Fig. 1).

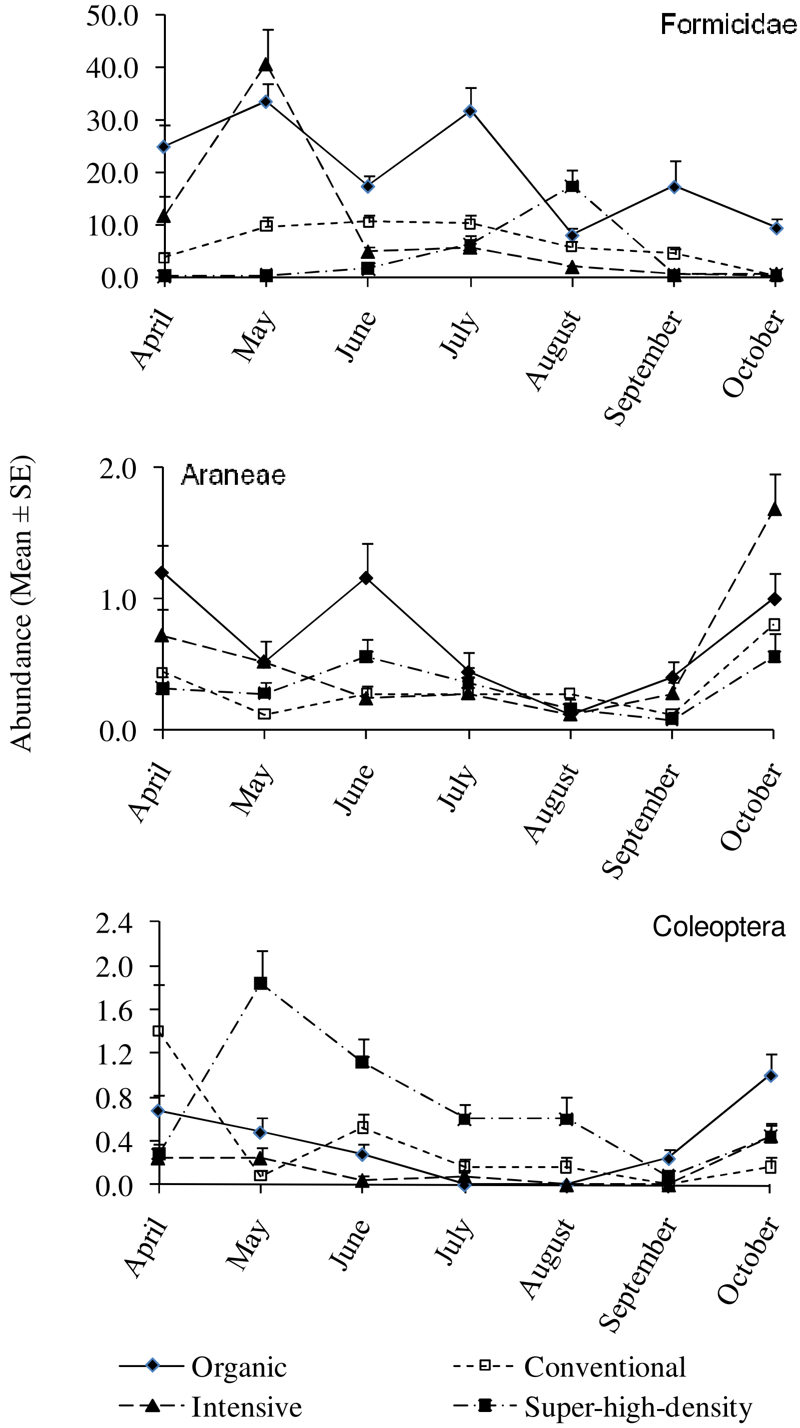

Figure 1. Abundance (mean ± SE) of the different taxa in each sampling date during 2010 (n = 25).

PRC diagram concisely shows changes in the variability of soil arthropod community composition (Fig. 2). Of the total variance, 15.3% is explained by sampling date and 33.6% by management regime. The Monte Carlo permutation test showed a significant difference between groves and 89.6% of that difference is displayed by the first PRC axis.

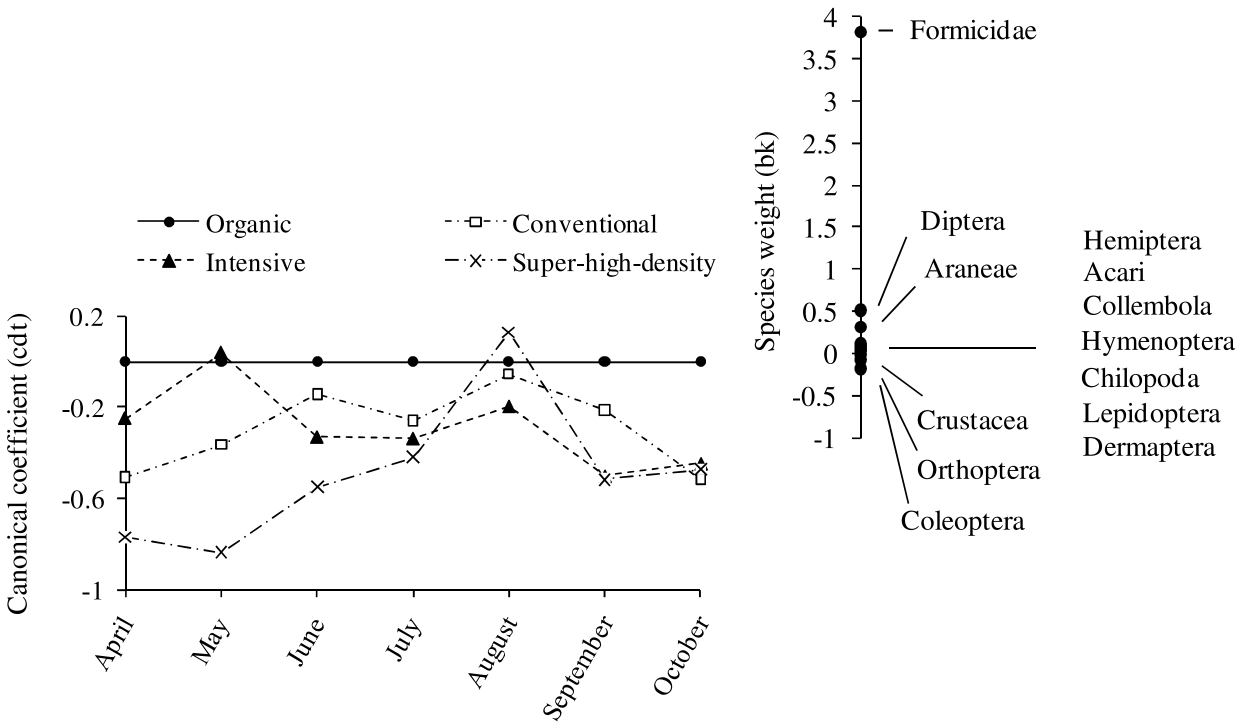

Figure 2. PRC diagram and taxa weights for sampled arthropods, showing variation in taxa abundance.

According the PRC method, Formicidae family was the most affected group by the plant protection system. Moreover, in the sampling period, the super-intensive system showed the highest negative impact over arthropod abundance, given by the lower negative values observed in the management system. This could be explained by the application of herbicides for the control of *Conyza canadensis*.

As far as we know, this was the first study concerning the effects of modern management systems on soil arthropods.

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