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ENTOMOFAUNA ASSOCIATED TO DIFFERENT PHENOLOGICAL STAGES ON BLUEBERRY CROP[1]

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ABSTRACT - The blueberry (*Vaccinium ashei* Reade, Ericaceae) is a small fruit with great growth potential in Brazil. This research was developed in order to identify the insects found on associated to the different phenological stages of blueberry in order to implement the integrated pest management for this crop. Insect samples were collected from three orchards, in the region of Pelotas, RS, from January 2010 to June 2012. The data were analyzed based on the composition and abundance of the collected insects. In all three sites, 2,354 insects were studied and the majority belonged to Hymenoptera (72%), Coleoptera (16%), Hemiptera (6%) and Diptera (4%). Forty-one families were identified with 59% of the listed insects belonging to the Apidae family, followed by 11% for Chrysomelidae and Formicidae. Overall, 50 species of insects were identified and *Trigona spinipes* (Fabr.) and *Apis mellifera* L. were the most abundant. Of the species found, 78% were herbivores, while 22% was beneficial insects (pollinators, predators and parasitoids) belonging to the orders Hymenoptera, Coleoptera and Dermaptera. The analysis of variance with the randomization test showed that the insect fauna does not differ between locations and phenological stages. The interaction of site with phenological stages was not significant for the three grade levels (order, family and species). The knowledge of the entomofauna associated with blueberry, along with the similarity in composition with the phenological stages and evaluated sites, contributes to the development of integrated pest management and establishment of production system for this new culture in southern Rio Grande do Sul, Brazil.
Index terms: *Vaccinium ashei*, insect pest, pollinators.

ENTOMOFAUNA ASSOCIADA A DIFERENTES ESTÁDIOS FENOLÓGICOS DA CULTURA DO MIRTILEIRO

RESUMO - O mirtilo (*Vaccinium ashei* Reade, Ericaceae) é uma das pequenas frutas com grande potencial de crescimento no Brasil. Este trabalho foi desenvolvido com o objetivo de conhecer a entomofauna associada aos diferentes estádios fenológicos do mirtileiro, com vistas à implementação do manejo integrado de pragas nesta cultura. Foram realizadas coletas de insetos em três pomares da região de Pelotas-RS, de janeiro de 2010 a junho de 2012. Os dados foram analisados com base na composição e abundância dos insetos coletados. Nos três locais, foram observados 2.354 insetos, sendo a maioria pertencente às ordens Hymenóptera (72%), Coleoptera (16%), Hemíptera (6%) e Díptera (4%). Foram identificadas 41 famílias, sendo 59% do total de insetos coletados pertencentes à família Apidae, seguida por 11% das famílias Chrysomelidae e Formicidae. Ao todo, 50 espécies de insetos foram identificadas, sendo *Trigona spinipes* (Fabr.) e *Apis mellifera* L. as mais abundantes. Do total de espécies encontradas, 78% foram consideradas herbívoras, enquanto o restante 2% esteve representado por insetos benéficos (polinizadores, predadores e parasitoides) pertencentes às ordens Hymenóptera, Coleóptera e Dermáptera. Com base em análises de variância com teste de aleatorização, foi determinado que a entomofauna não diferiu quanto à localização dos pomares e quanto aos estádios do cultivo. Os resultados indicaram que não houve diferenças significativas para a interação dos fatores local de coleta e estádio para os três níveis de classificação (ordem, família e espécie). O conhecimento da entomofauna ,associada ao mirtileiro, aliado à semelhança na sua composição, tanto nos estádios fenológicos como nos pomares avaliados, contribuirão para o desenvolvimento do manejo integrado de pragas e para o estabelecimento do sistema de produção, para esta nova cultura, na região sul do Rio Grande do Sul.
Termos para indexação: *Vaccinium ashei*, insetos praga, polinizadores.

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INTRODUCTION

The blueberry is a shrubby plant, widely grown in countries of the northern hemisphere, especially Europe and the United States (RASEIRA, 2006). In South America, the major producers are Chile, Argentina and Uruguay, which grow and export the fruits during the off season in Europe and North America (FACHINELLO, 2008).

In Brazil, the blueberry was introduced in the 1980s, from plants obtained at the University of Florida, United States (MADAIL AND SANTOS, 2004). Currently, it is estimated that roughly 200 ha on this species are located mainly in the states of Rio Grande do Sul, Santa Catarina, São Paulo, and Minas Gerais.

Although the culture is considered rustic in phytosanitary terms, it is feared that with the increase of cultivation areas, some pests may cause significant losses. It is estimated that about 300 species of arthropods prey on blueberry worldwide, however, only a few have economic importance and represent chronic problems that require periodic control (LARRAÍN et al., 2007).

In most South American countries, where the blueberry was introduced after the 1980s, there is good knowledge about the arthropod-pest associated to culture and measures to be adopted for its control. In Chile, 17 species of insects and mites are known, namely *Otiorhynchus rugosostriatus* (Goeze), *Coccus hesperidum* L., *Pseudococcus calceolariae* (Maskell) and *Orgia antiqua* (L.) (PRADO, 1991). In southern Argentina, the most important arthropods associated with blueberry crops are *Tetranychus urticae* Koch, *Myzus persicae* (Sulzer), *Otiorhynchus* sp., *Naupactus* sp. and *Sericoides* sp. (RECALDE, 2008), while in the region on the west bank of the Uruguay River, the fruit flies *Anastrepha fraterculus* (Wiedemann) and *Ceratitis capitata* (Wiedemann) were recorded (GORDÓ, 2008). In Brazil, the existing information on insect pests associated with blueberry is scarce with studies on *Naupactus tremolesari* L., *Tolype innocens* (Burmeister), *Trigona spinnipes* (Fabricius) and *Eurhizococcus brasiliensis* (Wille) (GONÇALVES et al., 2009; LOUZADA et al., 2011; SILVEIRA et al., 2011; EFROM et al., 2012). Thus, the objective of this study was to know the insect fauna associated with the different phenological stages of the blueberry crop in Pelotas area, Rio Grande do Sul State, in order to obtain support for implementing integrated pest management to this culture.

MATERIALS AND METHODS

An insect population survey was carried out in three orchards, of approximately 0.5 ha each, with soil of the type Argissolo Bruno-Acizentado Eutrófico, and Argissolo Acizentado Eutrófico, located in the county of Pelotas, Rio Grande do Sul, Brazil, between January 2010 and June 2012. The plants were approximately 5 years old, being cultivated in spacing of 1 m in the row x 4 m between the lines. In Site 1 (L_1) (31°40’47”S and 52°26’24”W; 60 m ASL), the orchard was composed of several blueberry selections. Site 2 (L_2) (31°54’21”S and 52°57’41” W, 250 m ASL) comprised the cultivars Climax, Bluegem and Powder Blue and Site 3 (L_3) (31°39’51”S and 52°32’7”W, 135 m ASL) was planted with cultivars Misty and O´Neal. The orchards were conducted under the organic production system without application of agricultural inputs. Samplings were accomplished, biweekly, through the observation of insects in about 3% of the plants of each orchard. The plants were randomly selected and evaluated in the morning. If the insects had not yet been identified, the collection was carried out in an entomological net and portable vacuum cleaner. Afterward, the samples were individually placed in plastic pots (100 mL) and taken to the Entomology Laboratory of Embrapa Clima Temperado, where they were conditioned for further identification.

Based on the composition and abundance of species by location and time of sampling, data analyses were performed to detect composition patterns of the insects, according to the phenological development stages of the blueberry crop, defined as: vegetative stage (E_1), flowering stage (E_2), and fruiting stage (E_3). The sampling sites were called: Site 1 (L_1), Site 2 (L_2) and Site 3 (L_3). For L_1 and L_2, the duration of the vegetative stage (E_1) was considered between the months of February and July, flowering (E_2) between August and October, and fruiting (E_3) between November and January (ANTUNES et al., 2008). For L_3, the stages began with approximately one month in advance, compared to L_1 and L_2.

The data set consisting of lists of species, families or orders, by sampling time in each orchard, was organized into arrays submitted to the Analysis of Principal Coordinates (PCoA), and the data were previously processed according to the methodological requirements of the type of analysis applied in accordance to Legendre and Legendre (1998). For the calculation of Euclidean distance matrices, aimed at the comparison between the communities of insects of each sampling unit in absolute terms, the data were previously transformed (log (| x + 1|)) or standardized by total marginal within the sampling units. The calculation of the Sorense index, related to the evaluation of the Beta (ß) diversity, species data were previously transformed for presence and absence.

This index was used to assess the differential diversity or replacement between species from one sampling unit and time to another, since the greater the difference in species composition between sites and times, the greater the diversity. All the exploratory data analyses and randomization tests to assess the significance of hypotheses were conducted in software MULTIV v242 (PILLAR, 2001). In order to test the stability of ordination axes and the sharpness of the groups generated, auto-resampling (bootstrap) tests were performed (PILLAR, 1998, 1999a, 1999b).

RESULTS AND DISCUSSION

In all three locations evaluated, 2,354 insects were observed, belonging to the orders Hymenoptera (72%), Coleoptera (16%), Hemiptera (6%) and Diptera (4%). Insects of the orders Lepidoptera, Odonata, Mantodea, Orthoptera, Psocoptera, Dermaptera and Neuroptera represented the remaining 2%. Fourty one families were identified, being 59% of the insect total corresponding to Apidae family, followed by 11% in Chrysomelidae and Formicidae (Table 1). Rocca and Greco (2011) carried out works in Argentina and observed that the orders with highest abundance in three regions were Hemiptera (52%) and Lepidoptera (19%), followed by Coleoptera (17%), Orthoptera (7%), Thysanoptera (3%) and Hymenoptera (3%), showing difference in composition of the insect fauna associated with blueberry, in the studied areas in that country. The number of families found by these authors was lower (31) than that observed in the region of Pelotas, RS, with emphasis to Apidae.

Overall, 50 species of insects were identified, with the \`irapuá´ bee [*Trigona spinipes* (Fabr.)] accounting for 52% of the total, followed by *Apis mellifera* L. with 19%, *Colaspis* sp. with 12% and *Camponotus* sp. with 6% (Table 1) that had higher abundance in blueberry orchards in the municipality of Pelotas. The bee *T. spinipes*, unlike *A. mellifera*, is considered harmful to the blueberry culture due to the damage it inflicts to the flower corolla, causing low fruiting, small-size fruit and a small number of seeds. Furthermore, the damage also hinders pollination by other insects that use the damaged spot to reach the nectar, instead of natural openings of the blueberry flowers (SILVEIRA et al., 2010).

In Argentina, Rocca and Greco (2011) reported 39 species of insects collected on blueberry orchards in the provinces of Buenos Aires and Entre Ríos. In the region of Coquimbo, in Chile, Larraín et al. (2007) reported 19 insect species on blueberry, of which only *Pseudococcus viburni* (Signor) and *Hylamorpha elegans* (Burm.) have economic importance. Therefore, a greater species diversity of insects is observed in Pelotas when compared to the provinces or regions studied in the cited countries. On the other hand, insects belonging to orders Thysanoptera and Hemiptera (Suborder Sternorryncha), not observed in this work, are important in orchards of Argentina and Chile. Coleopterans of the genera *Naupactus*, *Colaspis* and *Diabrotica* and Hemipterans of genera *Leptoglossus*, *Largus*, *Dichelops*, *Edessa* and *Piezodorus* also appear in collections in both countries, and the genus *Pantomorus* only in Chile. Thus, the insect fauna associated with the blueberry culture in the municipality of Pelotas shows greater similarity to that of Argentina than the one of Chile. Probably, the insect fauna associated with the blueberry culture in these countries is related with the climate (temperature, precipitation, relative humidity, etc.), favoring certain groups of insects to the detriment of others.

Of the total number of species found, 78% was considered herbivorous, while 22% was represented by beneficial insects (pollinators, predators and parasitic) belonging to the orders Hymenoptera, Coleoptera and Dermaptera. In the order Hymenoptera, the pollinators species *A. mellifera*, *Bombus* sp. and *Xylocopa* sp., belonging to the family Apidae were observed as well as the predatory species *Brachygastra lecheguana* (Latr.), *Polybia* sp. and *Polistes* sp. of the family Vespidae (Table 1; Figure 1). Parasitoids of families Ichneumonidae and Braconidae were also collected, however, their hosts were not identified. According to Silveira et al. (2011), bumblebees of the genus *Bombus* are the most efficient pollinators of blueberry under southern Brazil conditions while bees play a complementary role.

Regarding the order Coleoptera, the following predatory species *Harmonia axyridis* (Pallas), *Cycloneda sanguinea* (L.), *Eriopis conexa* (Ger.) and *Olla v-nigrum* (Muls.), belonging to the family Coccinelidae, were registered (Table 1; Figure 1). A study conducted in Chile verified the presence of three Coccinellidae species, in blueberry orchards namely *E. connexa chilensis* (Hoffmann), *E.*

eschscholtzii (Muls.) and *Hyperaspis sphaeridioides* (Muls.) (VERA et al., 2010). In the order Dermaptera, we observed predatory species *Doru linear* (Eschs.) (Table 1; Figure 1).

The greater abundance of beneficial insects was observed during blueberry flowering ($P \leq 0.05$) (Figures 2A, 3A and 4A), represented primarily by pollinators. The test of contrasts, which detects differences between the phenological stages, showed that there were significant differences between E_2 and E_1 and between E_2 and E_3, for the insect abundance ($P \leq 0.05$).

The ordering analysis synthesized the composition and structure variation on two main axes, containing about 70% of the total variance for order, 55% for family, and 66% for species after the Euclidean distance or 29% after the Sorense index (Figures 2, 3 and 4). The axes were not stable according to the bootstrap results to any of the orderings, because all probabilities generated by the tests reached values above the threshold (P = 0.1), and therefore the null hypothesis (H_0) was not rejected. H_0 establishes that the patterns indicated by ordering axes do not differ from those obtained on unstructured data, being null the expected correlations between variables (PILLAR, 1999a). Thus, the results obtained under the orderings hinder to secure interpretations regarding the variation patterns.

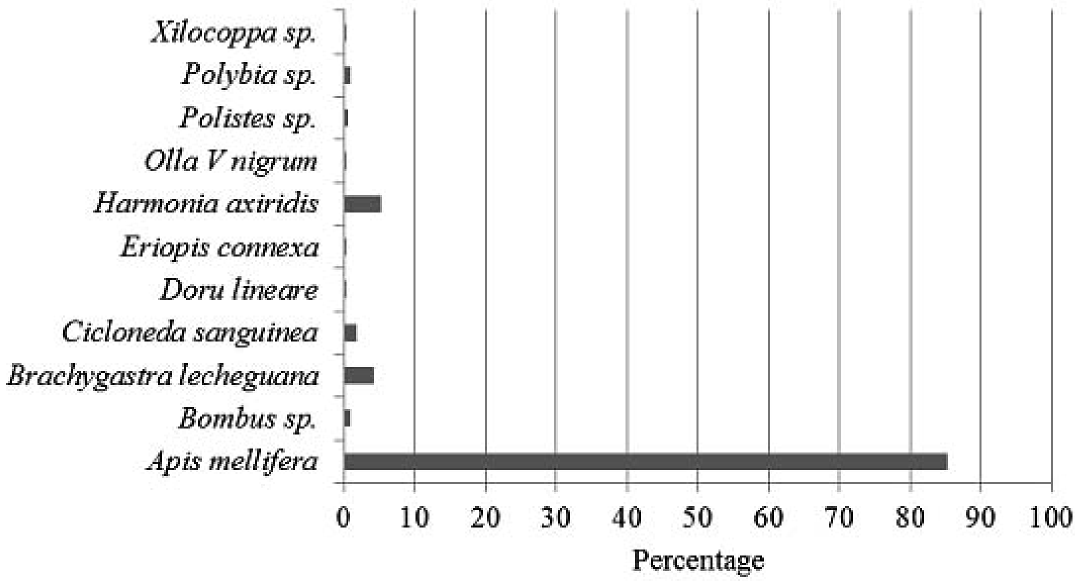

FIGURE 1-Percentage of beneficial insects found in blueberry orchards in the region of Pelotas, RS, in the period from Jan/2010 to June/2012.

TABLE 1- Insects collected in blueberry orchards in the region of Pelotas, RS, within the period Jan/2010 to June/2012.

Order	Family*	Species	Feeding habit**	Blueberry stage***
Coleoptera	Chrysomelidae	*Chelymorpha nigricolis* Boheman	Fi	E_1
		Colaspis sp.	Fi	$E_{1,3}$
		Diabrotica speciosa (Germar)	Fi	$E_{1,2,3}$
		Omophoita sp.	Fi	E_1
		Stolas chalybaea (Germar)	Fi	E_1
	Coccinellidae	*Cycloneda sanguinea* (L.)	Pre	$E_{1,2}$
		Eriopis conexa Germar	Pre	$E_{2,3}$
		Harmonia axyridis (Pallas)	Pre	$E_{1,2,3}$
		Olla V- nigrum (Mulsant)	Pre	E_3
	Curculionidae	*Naupactus* sp.	Fi	E_1
		Pantomorus sp.	Fi	E_1
		Sithopilus sp.	Fi	E_1
	Scarabaeidae	*Pelidnota aeruginosa* L.	Fi	E_1
		Rutela lineola L.	Fi	E_3
	Melyridae	*Astylus variegatus* (Germar)	Fi	E_1
	Tenebrionidae	*Lagria villosa* Fabricius	Fi	E_1
	Meloidae	*Epicauta atomaria* (Germar)	Fi	E_1
	Cantharidae	*Chauliognathus fallax* (Germar)	Fi	E_1
	Cerambycidae	*Paromoeocerus barbicornis* (Fab)	Fi	E_1
	Elateridae	*Conoderus* sp.	Fi	E_1
	Cleridae*	---	---	---
	Lampiridae*	---	---	---
Hemiptera	Coreidae	*Hypselonotus fulvus* (DeGeer)	Fi	E_3
		Hypselonotus interruptus (Hahn)	Fi	$E_{1,2}$
		Hypselonotus sp.	Fi	E_1
		Leptoglossus sp.	Fi	$E_{2,3}$
		Phthiapicta (Drury)	Fi	E_1
		Zicca annulata (Burmeister)	Fi	E_1
	Pentatomidae	*Chinavia longicorialis* (Breddin)	Fi	E_3
		Chinavia obstinate (Stål)	Fi	E_3
		Dichelops furcatus (Fabricius)	Fi	$E_{1,3}$
		Edessa meditabunda (Fabricius)	Fi	E_1
		Piezodorus guildini (Westw.)	Fi	E_2
	Scutelleridae	*Pachycoris torridus* (Scopoli)	Fi	E_1
	Alydidae	*Hyalymenus* sp.	Fi	E_1
	Largidae	*Largus rufipennis* (Laporte)	Fi	$E_{1,2}$
	Cercopidae	*Deois flexuosa* (Walk.)	Fi	$E_{1,3}$
	Cicadellidae*	---	---	---
	Membracidae*	---	---	---
	Miridae*	---	---	---
	Reduviidae*	---	---	---
	Outras			

Hymenoptera	Apidae	*Apis melífera* (L.)	Po	$E_{2,3}$
		Bombus sp.	Po	$E_{2,3}$
		Trigona spinipes (Fabricius)	Fi/Po	$E_{1,2,3}$
		Xilocopa sp.	Po	E_{3}
	Formicidae	*Acromyrmex* sp.	Fi	E_{2}
		Camponotus sp.1	Fi	$E_{1,2,3}$
		Camponotus sp.2	Fi	$E_{1,2,3}$
		Crematogaster sp.	Fi	$E_{1,2}$
	Vespidae	*Brachygastra lecheguana* (Latr.)	Pre	$E_{1,2}$
		Polistes sp.1	Pre	$E_{1,2}$
		Polybia sp.	Pre	E_{2}
	Halictidae*	---	---	$E_{2,3}$
	Ichneumonidae*	---	---	$E_{1,3}$
	Braconidae*	---	---	E_{2}
	Outras			
Lepidoptera	Arctiidae	*Dycladia lucetius* (Stoll)	Fi	E_{1}
	Hesperiidae	*Hylephila phyleusphyleus* (Drury)	Fi	E_{1}
		Polites vibexcatilina (Plötz)	Fi	E_{1}
	Noctuidae*	---	---	E_{1}
	Tortricidae*	---	---	$E_{1,2}$
	Outras			
Orthoptera	Acrididae	*Opshomala* sp.	Fi	E_{2}
	Proscopiidae*	---	---	E_{1}
Dermaptera	Forficulidae	*Doru lineare* (Eschs.)	Pre	E_{1}
Diptera	Muscidae*	---	---	E_{2}
	Biblionidae*	---	---	$E_{1,2}$
	Tabanidae*	---	---	$E_{1,3}$
	Asilidae*	---	---	E_{1}
	Sarcophagidae*	---	---	E_{2}
	Sirphidae*	---	---	E_{2}
	Others			
Mantodea				$E_{1,2}$
Psocoptera				$E_{1,3}$
Odonata				$E_{1,2}$
Neuroptera				E_{1}

All insects were collected in the adult phase, except for those belonging to order Orthoptera
*Identification up to family level
**Fi (phytophagous), Pre (predator), Po (pollinator), Pa (parasitoid).
***E_1 (vegetative), E_2 (flowering), E_3 (fruiting)

The ordering diagrams of the sampling units (local and cultivation stage) suggest the formation of groups of developmental stages in flowering, characterized basically by differentiated compositions of Hymenoptera *A. mellifera* and *T. spinipes* (Apidae) and *B. lecheguana* (Vespidae) (Figures 2A - 5A). This indicates a great fauna similarity between the culture stages, observed throughout the study, regardless of site. However, the blueberry orchards individually present a peculiarity related to compositional character of communities. This feature can be observed on the two ordering axes labeled with the name of the orchards sites. The vertical positioning of the orchards (two axes) allows identifyingthat L_3 is preferably below the horizontal axis and characterized by the orders Coleoptera, Hemiptera and Diptera. L_1 and L_2 sites remained above the axis and are characterized by greater abundance of the order Lepidoptera and Odonata (Figure 2B).

In other organizational levels, family and species, the trends observed in the multivariate exploratory analyses above were repeated (Figures 3AB – 4AB); however, the trends were little less clear and more diffuse than the order level. Therefore, the diagrams showed greater abundance of families Apidae, Vespidae and Formicidae (Hymenoptera) at the flowering stage. Besides, the families Chrysomelidae (Coleoptera), and Cercopidae and other Hemipterans (Hemiptera) stand out as representatives of the L_3 site (Figures 3AB).

Detailing the species, *A. mellifera*, *T. spinipes* and *B. lecheguana* stand out. On the other hand, it was also observed that the species *Camponotus* sp., *Pelidnota aeruginosa* (L.) and *Colaspis* sp. are related with the second axis, which indicates an increased presence of these species in the composition of communities in the vegetative stage of L_3 site (Figures 4 and 5 AB).

Therefore, based on the analysis of variance, the three sites evaluated did not differ regarding the location (L_1, L_2 and L_3). The cultivation stages (E_1, E_2 and E_3) did not differ in terms of time. Rocca and Greco (2011) observed that the location of the orchards and the phenological stages, in the province of Buenos Aires influenced the richness of families found, which was higher for the vegetative and fruiting stages. However, no differences were observed in orchards, in the province of Entre Rios. According to the authors, this would be related to the predominant vegetation around the blueberry orchards. In this way, in the Pelotas area, the proximity of the orchards evaluated and consequently the similarity in vegetation, consisting of native fields and perennial crops [peach trees (*Prunus persica* (L.) Batsch.), vines (*Vitis* sp.), etc.], may have contributed to the absence of differences between sites, on the same phenological stages of the blueberry culture.

The results also indicated that there were no significant differences regarding the interaction of local and stage factors for the three classification levels (order, family and species). There was little influence of the classification level (order, family or species) on the results, except for species, in which the differences between L_3 and L_1 locations, as well as between E_1 and E_3, stages were not significant, thus the equality of species composition was accepted. The randomization did not indicate significant differences between stages E_1 and E_3 for both compositions based on classification or family. The other comparisons between sites and culture stage showed significant differences regarding the insect fauna composition.

Therefore, the knowledge of insects associated with the blueberry culture in the region of Pelotas, RS, as well as the absence of differences between sites on the same phenological stages and orchards, will contribute to the development of integrated pest management strategies in this culture.

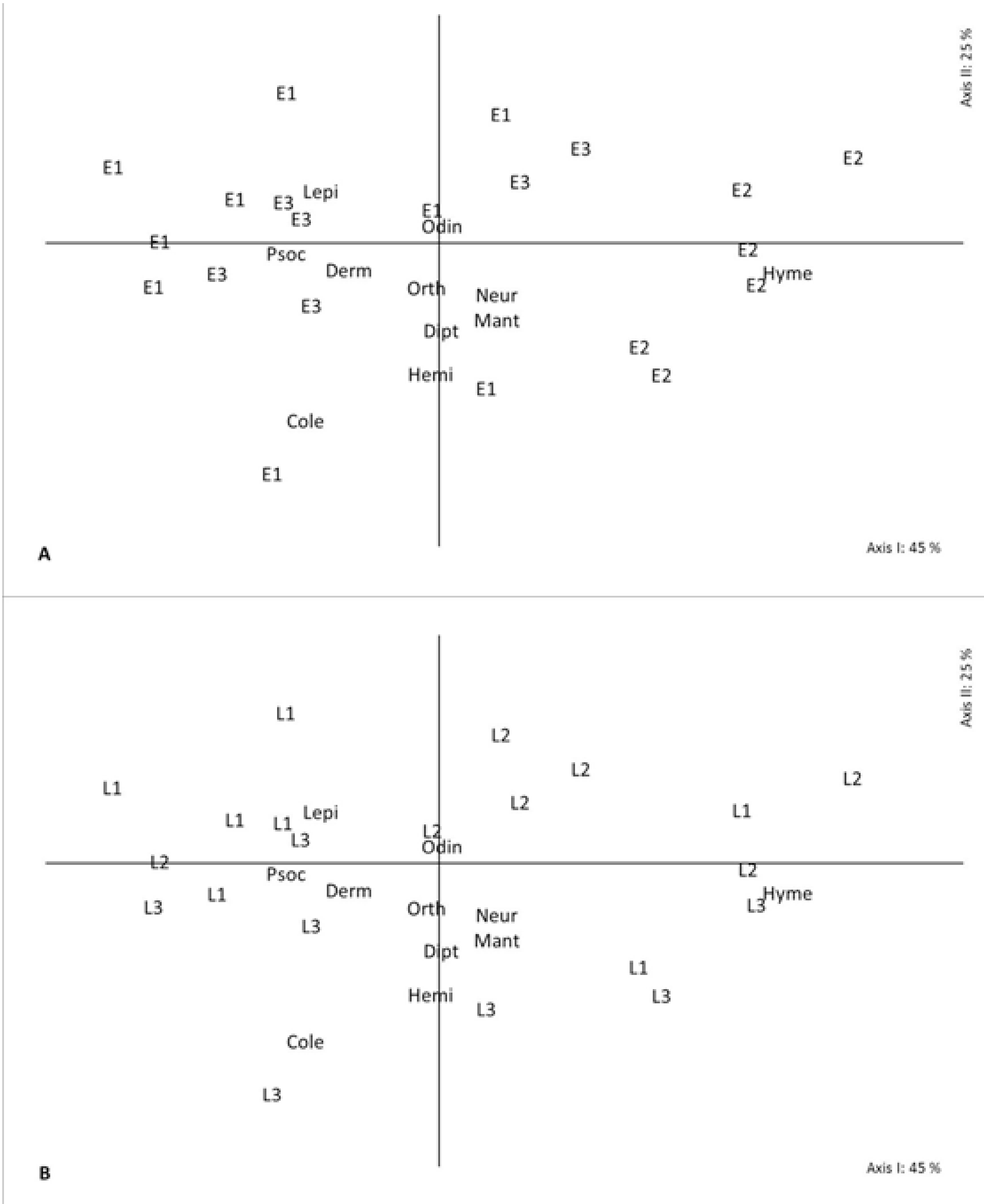

FIGURE 2- Scatter diagram of 21 sampling units on axes I and II, obtained by the analysis of principal coordinates. The letters and numbers identify the phenological stages (E_1: vegetative; E_2: flowering; E_3: fruiting) (A) and the location (L_1: site 1; L_2: site 2; L_3: site 3) (B) of blueberry orchards. The orchards were described by the composition of 11 orders identified by the abbreviation of the name initial.

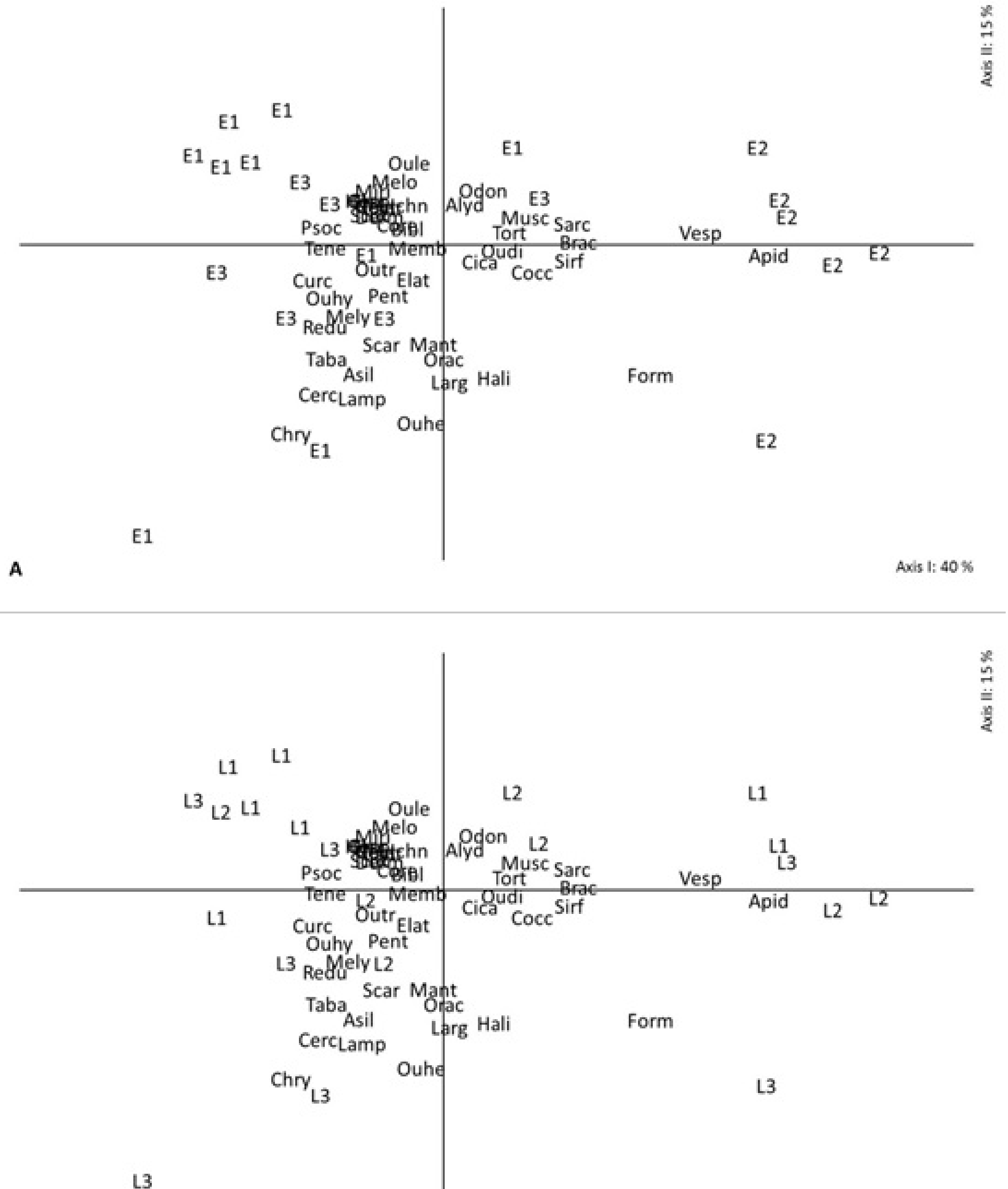

FIGURE 3-Scatter diagram of sampling units in 21 axes I and II obtained by analysis of principal coordinates. The letters and numbers identify the phenological stages (E_1: vegetative; E_2: flowering; E_3: fruiting) (A) and the location (L_1: site 1; L_2: site 2; L_3: site 3) (B) of blueberry orchards. The orchards were described by the composition of 49 families identified by the abbreviation of the name initial.

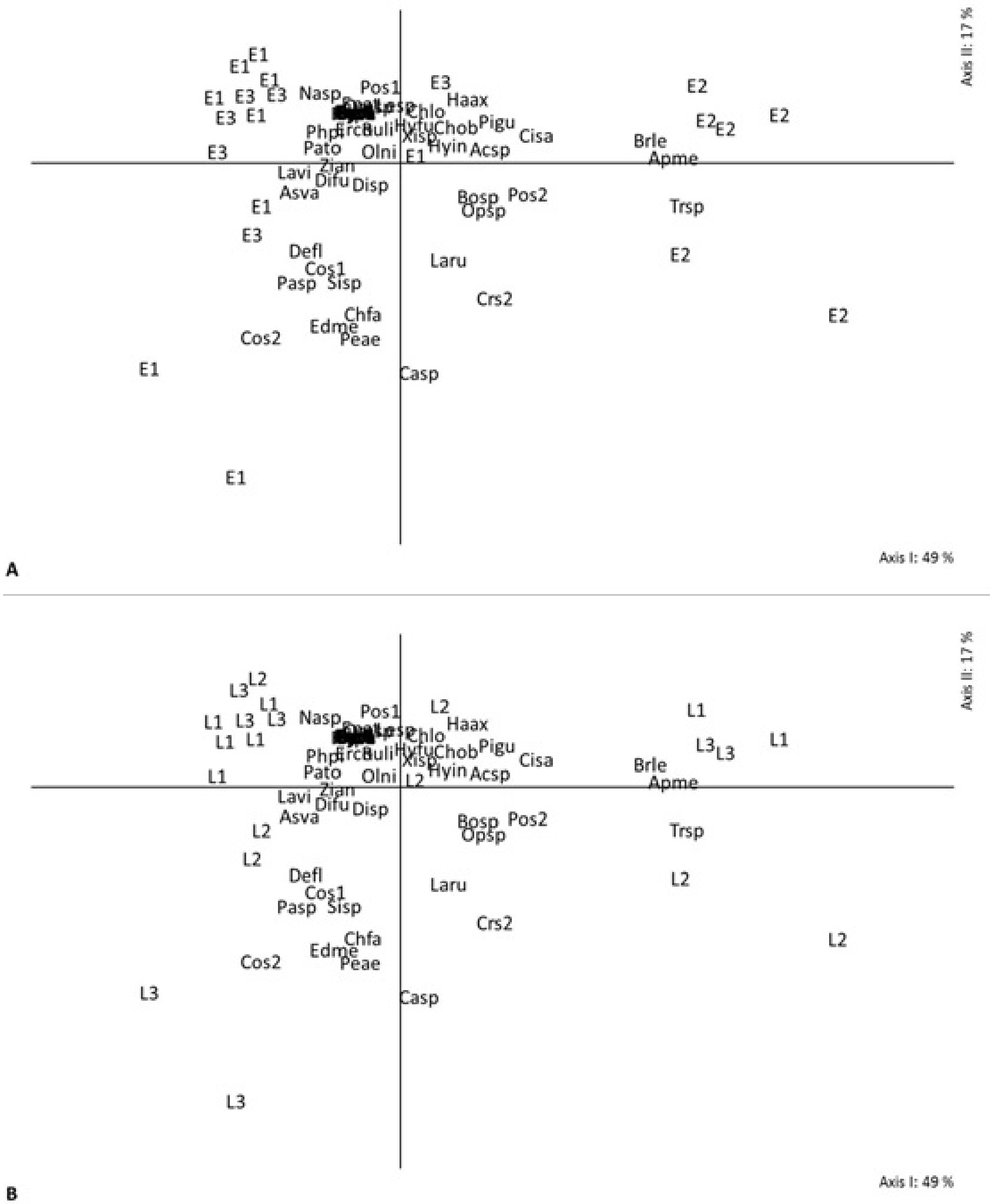

FIGURE 4- Scatter diagram of sampling 21 units on axes I and II, obtained by the analysis of principal coordinates. The letters and numbers identify the phenological stages (E_1: vegetative; E_2: flowering; E_3: fruiting) (A) and the location (L_1: site 1; L_2: site 2; L_3: site 3) (B) of blueberry orchards. The orchards were described by the composition of 51 species identified by the abbreviation of the genus and species initials.

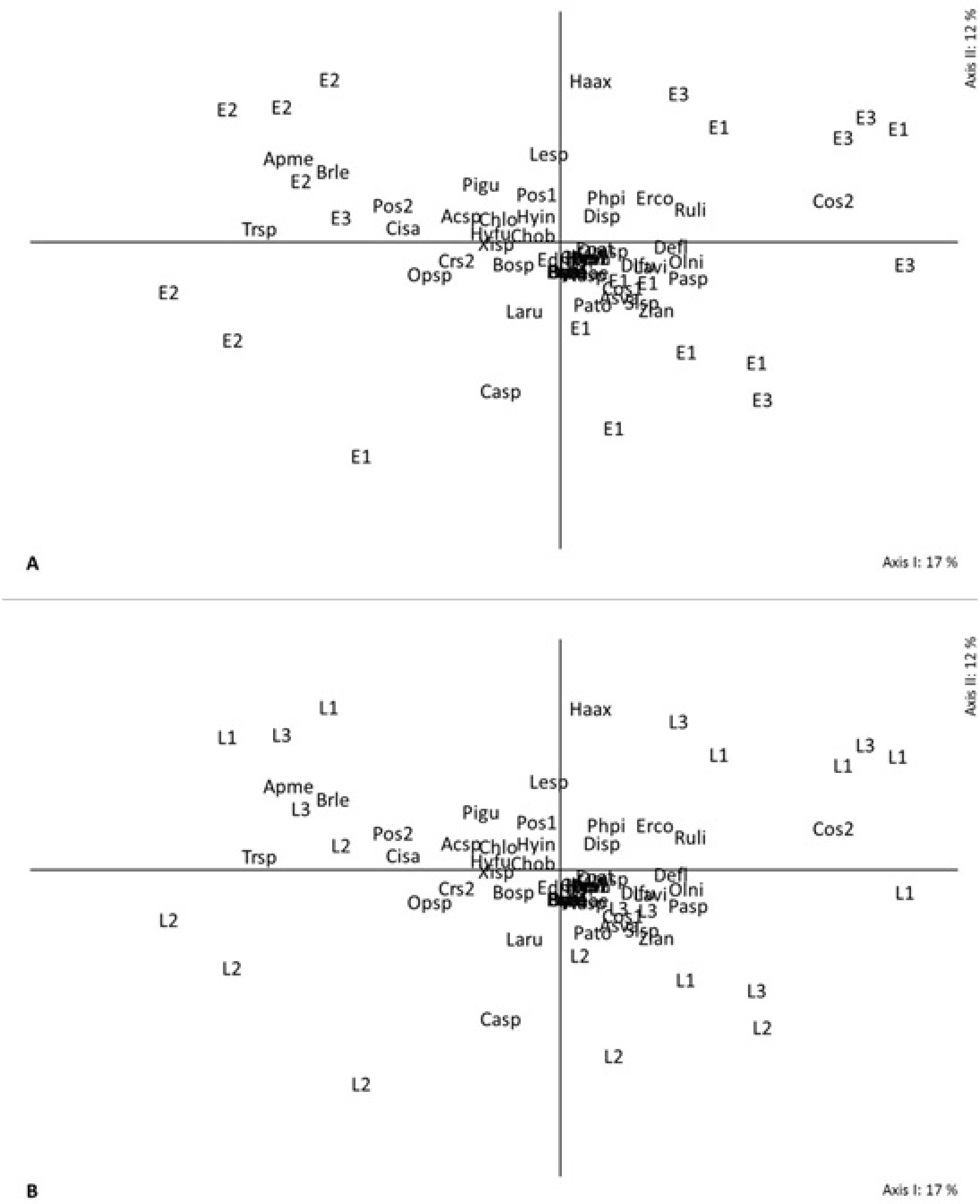

FIGURE 5- Scatter diagram of 21 sampling units on axes I and II, obtained by the analysis of main coordinates after processing the data for the presence and absence of species and comparison of units by measuring similarity of Sorense. The letters and numbers identify the phenological stages (E_1: vegetative; E_2: flowering; E_3: fruiting) (A) and the location (L_1: site 1; L_2: site 2; L_3: site 3) (B) of blueberry orchards. The orchards were described by the composition of 51 species identified by the abbreviation of the genus and species initials.

Annex: Abbreviations used in Figures 2, 3, 4 and 5.

Order: Coleoptera (Cole), Dermaptera (Derm), Diptera (Dipt), Hemiptera (Hemi), Hymenoptera (Hyme), Lepidoptera (Lepi), Mantodea (Mant), Neuroptera (Neur), Odonata (Odon), Orthoptera (Orth), Psocoptera (Psoc)

Family: Alydidae (Alyd), Apidae (Apid), Asilidae (Asil), Biblionidae (Bibl), Braconidae (Brac), Cantharidae (Cant), Cerambycidae (Cera), Cercopidae (Cerc), Chrysomelidae (Chry), Cicadeliidae (Cica), Cleridae (Cler), Coccinelidae (Cocc), Coreidae (Core), Curculionidae (Curc), Forficulidae (Derm), Elateridae (Elat), Formicidae (Form), Halictidae (Hali), Hesperiidae (Hesp), Ichneumonidae (Ichn), Lampiridae (Lamp), Largidae (Larg), Mantodea (Mant), Meloidae (Melo), Melyridae (Mely), Membracidae (Memb), Miridae (Miri), Muscidae (Musc), Noctuidae (Noct), Odonata (Odon), Acrididae (Orac), Proscopiidae (Orpr), Others Coleopteros (Outr), Outros Dipteros (Oudi), Outros Hemipteros (Ouhe), Outros Hymenopteros (Ouhy), Outros Lepidopteros (Oule), Pentatomidae (Pent), Psocoptera (Psoc), Reduviidae (Redu), Sarcophagidae (Sarc), Scarabeidae (Scar), Scollidae (Scol), Scutelleridae (Scut), Sirfidae (Sirf), Tabanidae (Taba), Tenebrionidae (Tene), Tortricidae (Tort), Vespidae (Vesp)

Species: *Acromyrmex* sp. (Acsp), *Apis mellifera* (Apme), *Astylus variegatus* (Asva), *Bombus* sp. (Bosp), *Brachygastra lecheguana* (Brle), *Camponotus* sp. (Casp), *Chauliognatus fallax* (Chfa), *Chelymorfa nigricolis* (Chni), *Chinavia longicorialis* (Chlo), *Chinavia obstinata* (Chob), *Cicloneda sanguinea* (Cisa), *Colaspis* sp. (Cos2), *Conoderus* sp. (Cos1), *Crematogaster* (Crs2), *Deois flexuosa* (Defl), *Diabrotica speciosa* (Disp), *Dichelops furcatus* (Difu), *Doru lineare* (Doli), *Dycladia lucetttius* (Dylu), *Edessa meditabunda* (Edme), *Epicauta atomaria* (Epat), *Eriopis conexa* (Erco), *Harmonia axiridis* (Haax), *Hyalimenus* sp. (Hys1), *Hylephila phylaeusphylaeus* (Hyph), *Hypselonotus fulvus* (Hyfu), *Hypselonotus interruptus* (Hyin), *Hypselonotus* sp. (Hys2), *Lagria villosa* (Lavi), *Largus rufippenis* (Laru), *Leptoglossus* sp. (Lesp), *Naupactus* sp. (Nasp), *Olla-v nigrum* (Olni), *Omophoita* sp. (Omsp), *Opshomalas* sp. (Opsp), *Pachycoris torridus* (Pato), *Pantomorus* sp. (Pasp), *Paramoeocerus barbicornis* (Paba), *Peliodnota aeruginosa* (Peae), *Phitia picta* (Phpi), *Piezodorus guildini* (Pigu), *Polistes* sp. (Pos1), *Polites vibexcatilina* (Povi), *Polybia* sp. (Pos2), *Rutella lineola* (Ruli), *Sitophillus* sp. (Sisp), *Stolas chalybaea* (Stch), *Trigona spinipes* (Trsp), *Xilocoppa* sp.(Xisp), *Zicca annulata* (Zian)

CONCLUSIONS

- The largest number of species belong to the family Apidae (Hymenoptera), being *Trigona spinipes* and *Apis mellifera* the most abundant.
- The composition of the entomofauna does not differ in the location of the orchards and also in relation to the phenological stages.

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