

## INSECT DIVERSITY IN AN EXPERIMENTAL VINEYARD IN THE STATE OF RIO GRANDE DO NORTE, BRAZIL<sup>1</sup>

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**ABSTRACT** - The objective of this work was to survey the entomofauna in an experimental vineyard (*Vitis* spp.) in the semiarid of the State of Rio Grande do Norte (RN), Brazil. The survey was conducted from November 2012 to January 2013 at the Rafael Fernandes experimental farm of the Universidade Federal Rural do Semi-Árido (UFERSA), Mossoró, RN, in an area of 2,500 m<sup>2</sup>, cultivated with the *Italia*, *Niagara Rosada* and *Isabel* grapevine varieties. The insect collection was performed weekly during the grapevine flowering and fruiting periods, through a passive method, using four Pitfall traps, and an active method, collecting insects from the tree canopies (branches, leaves, flowers and fruits) using entomological net, tweezers and brushes. In the passive collection, 1,598 insects from five orders and 25 families were collected, especially from the Formicidae (83%), Dolichopodidae (5.9%) and Cicadellidae (1.9%) families, which were the most abundant. In the active collection, 288 insects from five orders and 14 families were collected, especially from the Vespidae (160 specimens) and Apidae (78 specimens) families, which were the most abundant, representing 82.7% of the total collected insects. The greater diversity (13 families) and greater number of insects collected (186 specimens) were observed in the grapevine variety *Isabel*.

**Keywords:** Semiarid. Natural enemies. *Vitis* spp.

## DIVERSIDADE DE INSETOS EM UM VINHEDO EXPERIMENTAL NO ESTADO DO RIO GRANDE DO NORTE, BRASIL

**RESUMO** - O objetivo deste trabalho foi realizar o levantamento da entomofauna em um vinhedo experimental (*Vitis* spp.) no semiárido do Estado do Rio Grande do Norte (RN), Brasil. O levantamento foi conduzido de novembro de 2012 a janeiro de 2013 na fazenda experimental Rafael Fernandes, da Universidade Federal Rural do Semi-Árido (UFERSA), Mossoró, RN, em uma área de 2500 m<sup>2</sup>, cultivada com videiras das variedades *Itália*, *Niagara Rosada* e *Isabel*. A amostragem dos insetos foi realizada semanalmente durante os períodos de florescimento e frutificação das videiras, através de um método passivo, usando quatro armadilhas Pitfall, e um método ativo, coletando insetos das copas das árvores (ramos, folhas, flores e frutos), usando rede entomológica, pinças e pincéis. Na amostragem passiva foram coletados 1.598 insetos de cinco ordens e 25 famílias, especialmente das famílias Formicidae (83%), Dolichopodidae (5,9%) e Cicadellidae (1,9%), as quais foram as mais abundantes. Na amostragem ativa foram coletados 288 insetos de cinco ordens e 14 famílias, especialmente das famílias Vespidae (160 espécimes) e Apidae (78 espécimes), as quais foram as mais abundantes, representando 82,7% do total de insetos coletados. A maior diversidade (13 famílias) e o maior número de insetos coletados (186 espécimes) foram observados nas videiras da variedade *Isabel*.

**Palavras-Chave:** Semiárido. Inimigos naturais. *Vitis* spp.

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## INTRODUCTION

Grape (*Vitis* spp.) is one of the most appreciated and produced fruit in the world. More than 1,4 million tons of grape were produced in Brazil in 2014, especially in the South (960,772 Mg) and Northeast (314,796 Mg), the country's main producing regions (IBGE, 2015). The vitiviniculture has been highlighted in some semiarid regions of Brazil due their high yields and grape quality (SILVA et al., 2009).

Despite economic importance of this fruit, information regarding insect diversity in grapevines in the Northeast region, especially in Rio Grande do Norte, are scarce. The entomofaunistic studies in cultivated areas with grapevine in Brazil are concentrated in the states of Minas Gerais and Rio Grande do Sul (FADINI et al., 2001; BISOTTO-DE-OLIVEIRA et al., 2007; RINGENBERG et al., 2010). Studies on insect diversity in grapevines are fundamental, since insect population surveys are essential for ecological studies and development of Integrated Pest Management (IPM) programs (SILVA; CARVALHO, 2000).

Therefore, the objective of this work was to survey the entomofauna in an experimental vineyard (*Vitis* spp.), in the semiarid of the State of Rio Grande do Norte (RN), Brazil, in order to generate the first information on the topic in the region and support future IPM programs in this culture.

## MATERIAL AND METHODS

The survey was conducted from November 2012 to January 2013 at the Rafael Fernandes experimental farm of the Universidade Federal Rural do Semi-árido (UFERSA) (05°03'37"S; 37°23'50"W and altitude of 72 m), Mossoro, RN, in an area of 2,500 m<sup>2</sup>, cultivated with the *Italia*, *Niagara Rosada*, and *Isabel* grapevine varieties, planted spaced 3m x 2m. The plants were distributed in the area in blocks (72 blocks), each block consisting of three plants of each variety. The sampled area was surrounded by preserved native vegetation (Caatinga) and a wood of *Sabia* (*Mimosa caesalpiniaefolia* Benth).

The insect collection was performed weekly during the grapevine flowering and fruiting periods, through active and passive methods, totaling nine collections for the survey. The passive method consisted of four Pitfall traps, made of plastic (15 cm diameter and 10 cm high), buried at ground level and filled with water (500 ml) and neutral detergent (2%). The traps were distributed in parallel in the two central planting rows, distant 30m from one another and 20m from the edge of the area. The substance inside the traps was renewed at every collecting. The active collection method was performed in the mornings with entomological net,

tweezers and brushes, sampling three plants of each variety per planting row. Collections were performed in the tree canopies (branches, leaves, flowers and fruits) in each set of three plants for 10 minutes.

The collected insects were stored in plastic containers containing alcohol (70%), labeled (date, collection site, geographical coordinates and collector), and then transported to the Applied Entomology Laboratory of the UFERSA for screening and identification. Subsequently, the bees were identified at genus-species level and the other insects at family level, using a stereoscopic microscope and the taxonomic key proposed by Triplehorn and Johnson (2011). All identified specimens were deposited in the entomological collection of the UFERSA, Mossoro, RN.

The relative abundance (RA) was calculated for each identified family by formula  $RA (\%) = n/N \times 100$ , in which: RA = Abundance percentage; n = number of specimens of the family; and N = Total number of captured specimens.

## RESULTS AND DISCUSSION

### Passive collection

A total of 1,598 insects were collected, belonging from five orders (Coleoptera, Diptera, Hemiptera, Hymenoptera and Orthoptera) and 25 families. The Formicidae (83%), Dolichopodidae (5.9%) and Cicadellidae (1.9%) families were the most abundant. The Tachinidae, Pompilidae, Eulophidae, Braconidae, Platygastriidae and Mutillidae families were noted for presenting many parasitoid species. The Formicidae and Dolichopodidae, and also the Carabidae, Reduviidae, Vespidae and Sphecidae families was noted for cover specimens that are predators of other arthropods (Table 1).

The highest abundance of Formicidae is probably associated with the capture form with Pitfall traps, which collect usually insects with edaphic habits, so it is one of the most used to survey the myrmecofauna (VARGAS et al., 2007; CERDA et al., 2009). In addition, Formicidae species has dominance in most terrestrial ecosystems and are present in almost all regions of the world, except the Arctic and Antarctic (WILSON, 1987).

The Formicidae presence in the studied area is an important fact, once it has various ecological functions, such as the organic matter decomposition and incorporation in the soil and seed dispersal; act as predators of pest arthropods; and are considered potential bioindicators of environmental quality (WILSON, 1987; PETERNELLI et al., 2004; LUTINSKI; GARCIA, 2005). Fadini et al. (2001) reported that the Formicidae was among the most abundant arthropods in a cultivated area with grapevine in southern Minas Gerais, and emphasized the importance of these insects as predators.

**Table 1.** Quantity (No.) and relative abundance (RA%) of insects captured through passive collections in the *Italia*, *Niagara Rosada* and *Isabel* grapevine varieties, from

Order	Family	No.	RA(%)
Hymenoptera	Formicidae	1326	83,0
	Vespidae	23	1,4
	Platygastridae	12	0,8
	Sphecidae	10	0,6
	Pompilidae	4	0,3
	Eulophidae	4	0,3
	Apidae ( <i>Apis mellifera</i> )	4	0,3
	Braconidae	3	0,2
	Mutillidae	1	0,1
Diptera	Dolichopodidae	94	5,9
	Phoridae	14	0,9
	Muscidae	11	0,7
	Tachinidae	10	0,6
	Scaptopsidae	8	0,5
	Stratiomyidae	1	0,1
	Sarcophagidae	1	0,1
Hemiptera	Cicadellidae	31	1,9
	Lygaeidae	6	0,4
	Reduviidae	1	0,1
Orthoptera	Romaleidae	10	0,6
	Gryllotalpidae	9	0,6
Coleoptera	Carabidae	10	0,6
	Scarabaeidae	3	0,2
	Tenebrionidae	1	0,1
	Elateridae	1	0,1
Total		1.598	-

Dolichopodidae was the second most abundant family, but information on the presence of this family in vineyards in Brazil are scarce. This family consists of important predator species of pest insects (ULRICH, 2005; SUJII et al., 2007), with potential for biological control agents to be used in future IPM programs on vineyards in the Rio Grande do Norte semi-arid. Regarding the Cicadellidae, Ringenberg et al. (2010), in a study conducted in Rio Grande do Sul, emphasized the importance of surveying this family on grape production areas, since Cicadellidae species may be vectors of the bacteria *Xylella fastidiosa* (REDAK et al., 2004), responsible for the Pierce's disease on grapevines.

The Tachinidae, Pompilidae, Eulophidae, Braconidae, Platygastridae and Mutillidae families are commonly observed in parasitoid fauna surveys in agricultural areas, which together have a wide host range, and act in regulating populations of other arthropods, especially pests (HANSON, 2006; CANTOR et al., 2006). There is little information related to the diversity of natural enemies in vineyards in Brazil, however, Bisotto-de-Oliveira et al. (2007) reported the presence of parasitoids of the Braconidae family associated with the honeydew

moth (*Cryptoblabes gnidiella*) (Lepidoptera:Pyralidae) in vineyards in Rio Grande do Sul and emphasized the importance of knowing the natural enemy fauna for pest management in the culture.

The presence of Carabidae, Reduviidae, Vespidae and Sphecidae specimens among the collected insects in this work should also be noted, since they have species of voracious predators of pest insects (MOURA et al., 2000; CIVIDANES; CIVIDANES, 2008; TRIPLEHORN; JOHNSON, 2011), and together with the other parasitoid families mentioned, are probably assisting in regulating populations of other arthropods in the studied area, generating perspectives for further studies that aim to promote the biological control of pests on vineyards in Rio Grande do Norte.

The other families found (Tenebrionidae, Elateridae, Scarabaeidae, Phoridae, Muscidae, Stratiomyidae, Sarcophagidae, Scaptopsidae, Lygaeidae, Apidae, Romaleidae and Gryllotalpidae) also include species that play important roles in nature, such as pollination, organic matter decomposition in the soil and seed dispersal.

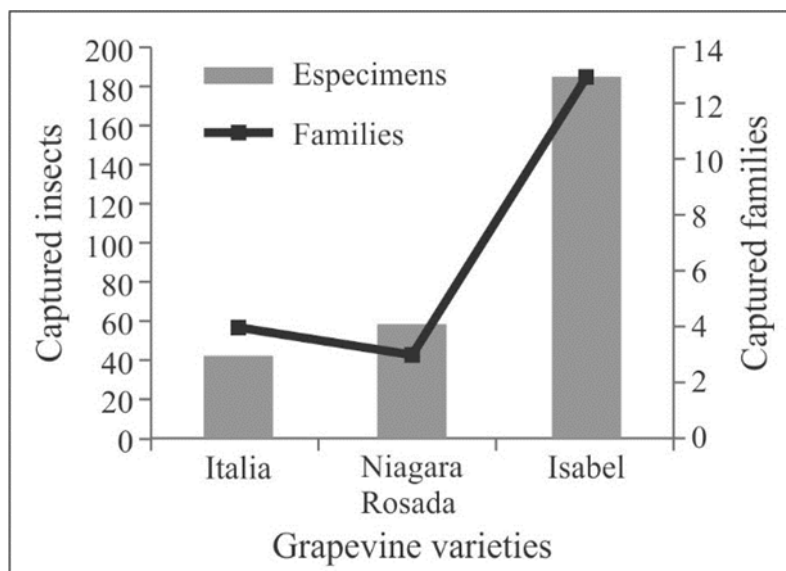
**Active collection**

A total of 288 insects were collected, belonging from five orders (Coleoptera, Diptera, Hemiptera, Hymenoptera and Neuroptera) and 14 families. The Vespidae (160 specimens) and Apidae (78 specimens) were the most abundant families in

the active collection, representing 82.7% of the collected insects. Regarding the diversity of insects in each variety, three families were captured on *Niagara Rosada*, four on *Italia* and thirteen in *Isabel* plants (Table 2 and Figure 1).

**Table 2.** Quantity (No.) and relative abundance (RA%) of insects captured through active collections in the *Italia*, *Niagara Rosada* and *Isabel* grapevine varieties, from November 2012 to January 2013 in Mossoro, RN, Brazil.

Order	Family	Italia		Niagara Rosada		Isabel		Total	
		N°	AR(%)	N°	AR(%)	N°	AR(%)	N°	AR(%)
Coleoptera	Coccinellidae	1	2,3	0	0,0	1	0,5	2	0,7
	Cerambycidae	0	0,0	0	0,0	1	0,5	1	0,3
	Nitidulidae	0	0,0	0	0,0	15	8,1	15	5,2
	Tenebrionidae	0	0,0	0	0,0	1	0,5	1	0,3
Diptera	Drosophilidae	0	0,0	0	0,0	4	2,2	4	1,4
	Sarcophagidae	0	0,0	0	0,0	1	0,5	1	0,3
Hemiptera	Lygaeidae	0	0,0	0	0,0	2	1,1	2	0,7
	Pentatomidae	1	2,3	0	0,0	1	0,5	2	0,7
	Reduviidae	0	0,0	0	0,0	2	1,1	2	0,7
Hymenoptera	Apidae1 ( <i>Apis mellifera</i> )	34	79,1	4	6,8	4	2,2	42	14,6
	Apidae2 ( <i>Trigona spinipes</i> )	6	14,0	6	10,2	22	11,8	34	11,8
	Apidae3 ( <i>Trigonisca</i> sp.)	0	0,0	0	0,0	2	1,1	2	0,7
	Vespidae	1	2,3	48	81,4	111	59,7	160	55,6
	Formicidae	0	0,0	0	0,0	18	9,7	18	6,3
	Ichneumonidae	0	0,0	0	0,0	1	0,5	1	0,3
Neuroptera	Chrysopidae	0	0,0	1	1,7	0	0,0	1	0,3
Total		43	-	59	-	186	-	288	



**Figure 1.** Number of specimens and families captured in the canopies of the *Italia*, *Niagara Rosada* and *Isabel* grapevine varieties, from November 2012 to January 2013 in Mossoro, RN, Brazil.

The highest abundance of Vespidae in the grapevine canopies, especially in the *Isabel* variety (Table 2), can be explained by their habit of building their nests in the branches of this variety. The

Vespidae presence in grapevines is important for the biological control in the area, since Vespidae species are known as predators of pest insects (MOURA et al., 2000; TRIPLEHORN; JOHNSON, 2011) and

can be used in future IPM programs in vineyards in the Rio Grande do Norte semiarid.

The Vespidae had the greatest potential for biological control of pests in vineyards among the families found by Fadini et al. (2001), in a study conducted in Minas Gerais. However, due to food shortages during certain times of the year, some Vespidae species can use the grape clusters at ripening for food and consequently cause injury to fruits and losses to producers (BUTTON et al., 2005).

Apidae was the second most abundant family in the grapevine canopies, represented by two species, *Apis mellifera* (14.6%) and *Trigona spinipes* (11.8%), and the *Trigonisca* (0.7%) genus. Apidae, especially *A. mellifera*, have an important role in pollination of many economically exploited plant species, however, Botton et al. (2005) reported that in the absence of food (nectar) due to the lack of native forests at flowering near the production areas, *A. mellifera* and *T. spinipes* species can cause damage to grape clusters at ripening.

In the present work, the studied area was surrounded by native forest (Caatinga), and bees attacking grape clusters were not observed. Regarding *Trigonisca*, there is no information about this genus association with the grapevine culture. The *Trigonisca* genus, widely distributed in the Neotropics, and in Brazil, are found mainly in the northern region (Silveira et al., 2002). Little information about *Trigonisca* species in Rio Grande do Norte is found, there are only reports of bees from this genus nesting in tree trunks (Leguminosae and Burseraceae) in a Caatinga fragment (DIAS et al., 2007). Therefore, this is the first record of a representative of the *Trigonisca* genus in grapevines in Brazil.

The presence of the Formicidae, Nitidulidae, Coccinellidae, Reduviidae and Chrysopidae families was also noted for cover species with predatory habits, and also the Ichneumonidae, a family consisting of important parasitoid species (BEZERRA et al., 2009; AZEVEDO; NASCIMENTO, 2009; TRIPLEHORN; JOHNSON 2011; DE BORTOLI et al., 2014). Among these families, only Formicidae and Ichneumonidae were already been reported in cultivated areas with grapevine in Brazil, the later associated with honeydew moth (*C. gnidiella*), an important grapevine pest in Rio Grande do Sul (FADINI et al., 2001; BISOTTO- DE-OLIVEIRA et al., 2007).

The greater diversity and quantity of insects found in the *Isabel* variety in this study is probably associated with better development of this variety compared to the others in the area evaluated and the nesting of Vespidae in the branches of this variety. The most vigorous development (vegetative and productive) probably provided greater availability of food and shelter for the insects. According to Assis et al. (2011), the *Isabel* variety is rustic and highly

fertile, which explains the best development in the semi-arid conditions of Rio Grande do Norte.

Regardless the collection method (passive or active), this is the first record of insect diversity in a cultivated area with grapevine in the Caatinga biome, in the Rio Grande do Norte semiarid. The presence of families with parasites and predatory habits is important for pest management in vineyards, indicating possible natural biological control of other arthropods in the studied area and, consequently, the maintenance of ecological balance.

## CONCLUSION

Six orders (Hymenoptera, Diptera, Hemiptera, Orthoptera, Coleoptera e Neuroptera) and 32 families (Tenebrionidae, Elateridae, Carabidae, Scarabaeidae, Coccinellidae, Cerambycidae, Nitidulidae, Drosophilidae, Dolichopodidae, Phoridae, Muscidae, Tachinidae, Stratiomyidae, Sarcophagidae, Scaptopsidae, Pentatomidae, Reduviidae, Cicadellidae, Lygaeidae, Formicidae, Vespidae, Pompilidae, Eulophidae, Apidae, Braconidae, Sphecidae, Platygasteridae, Mutillidae, Ichneumonidae, Romaleidae, Gryllotalpidae e Chrysopidae) of insects were identified in the cultivated area with grapevine in the Rio Grande do Norte semi-arid.

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