

Survey of the Hymenoptera Fauna in a “Caatinga” Area in the State of Rio Grande do Norte, Northeastern Brazil

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Abstract. The aim of this study was to carry out a survey of the fauna of the Hymenoptera families in an area of Caatinga in Mossoró, state of Rio Grande do Norte, Brazil. The samplings were carried out with Malaise traps, active between 6th of February and 6th of March, 2007 and between 13th March and 14th April, 2008. A total of 5,057 Hymenoptera, belonging to 12 superfamilies and 36 families, were collected. The most abundant superfamilies were: Chalcidoidea (1,206 specimens/23.85% of the total), Vespoidea (886/17.52%), Ichneumonoidea (837/16.55%) and Platygastroidea (801/15.84%) and the most abundant families were: Platygastriidae (801/15.84%), Braconidae (616/12.18%), Pteromalidae (583/11.53%), Figitidae (454/8.98%), Pompilidae (444/8.78%) and Formicidae (268/5.30%). The data obtained allow us to affirm that the Caatinga encompasses substantial family richness of Hymenoptera and that renewed effort is necessary to sample its fauna in a more extensive way.

Keywords: Biodiversity; Faunistic inventory; Semi-arid.

Levantamento da Fauna de Hymenoptera em uma Área de Caatinga do Estado do Rio Grande do Norte, Nordeste do Brasil

Resumo. O objetivo deste estudo foi realizar levantamento das famílias de himenópteros presentes em área de Caatinga em Mossoró, Estado do Rio Grande do Norte, Brasil. As amostragens foram realizadas com armadilhas Malaise, entre 6 de fevereiro e 6 de março de 2007 e 13 de março e 14 de abril de 2008. Foram coletados 5.057 himenópteros pertencentes a 12 superfamílias e 36 famílias. As superfamílias mais abundantes foram: Chalcidoidea (1.206 exemplares/23,85% do total), Vespoidea (886/17,52%), Ichneumonoidea (837/16,55%) e Platygastroidea (801/15,84%) e as famílias mais abundantes foram: Platygastriidae (801/15,84%), Braconidae (616/12,18%), Pteromalidae (583/11,53%), Figitidae (454/8,98%), Pompilidae (444/8,78%) e Formicidae (268/5,30%). Os dados obtidos demonstram grande riqueza de famílias de himenópteros na Caatinga e que estudos adicionais são necessários para estabelecer a riqueza desta fauna de forma mais extensiva.

Palavras-chave: Biodiversidade; Inventário faunístico; Semi-árido.

Hymenoptera is one of the largest and most diverse orders of insects. HANSON & GAULD (2006a) affirmed that there existed nearly 115 thousand species of Hymenoptera and estimated that such a number might reach 250 thousand; according to those authors, parasitic hymenopterans are very important for the maintenance of terrestrial biodiversity by regulating the populations of other arthropods. In the Neotropical region it is possible to find 21 superfamilies and 76 families of Hymenoptera (FERNÁNDEZ 2006); for the Brazilian territory has been reported the occurrence of 18 superfamilies and 63 families (FERNÁNDEZ & SHARKEY 2006; HANSON & GAULD 2006b).

The little that is known about Hymenoptera from Rio Grande do Norte is due to the occurrence reports in Eulophidae, Eurytomidae and Ichneumonidae (ONODY & PENTEADO-DIAS 2002; FERNANDES *et al.* 2012, 2014a), of braconids and eulophids associated with fruit flies (ARAUJO & ZUCCHI 2002; COSTA *et al.* 2005), of parasitic braconids of the leafminer fly (ARAUJO *et al.* 2007) and of aphids (MACEDO *et al.* 2010). Some authors have made checklists, such as the species of Apidae (ZANELLA 2000; SILVA 2014), Chrysididae (ZANELLA & LUCENA 2014), Ichneumonoidea (SHIMBORI *et al.* 2014), Ophioninae (Ichneumonidae) (FERNANDES *et al.* 2014b) and Vespinae (Vespidae) (ANDENA & CARPENTER 2014). PENTEADO-DIAS & SCATOLINI (2003), PENTEADO-DIAS *et al.* (2007) and FERNANDES *et al.* (2012) described new species from material collected in that state.

The Caatinga biome covers 10% of the Brazilian territory; with an area of nearly 844 thousand km² it is mainly located in the Northeast region of Brazil. It is the only biome that is exclusively Brazilian and only nearly 2% of its territory is protected as preservation areas (LEAL *et al.* 2005; IBGE 2014). The state of Rio Grande do Norte has nearly 95% of its area covered with Caatinga vegetation. Development of studies in the Caatinga biomes is scarce. Thus, little is known about the entomofauna associated with that type of vegetation.

The aim of this study was to carry out a survey of the fauna of Hymenoptera families present in an area of Caatinga at Mossoró, state of Rio Grande do Norte, Brazil.

MATERIAL AND METHODS

The samplings were carried out in the Santa Júlia's Farm (5°01'25"S and 37°22'57"W), located in Mossoró, state of Rio Grande do Norte, Brazil, in a Caatinga native vegetation fragment adjacent to a melon crop *Cucumis melo* L. (Cucurbitaceae). In the Caatinga fragment were set up two Malaise traps, approximately 100 m apart and 100 m of the board (melon crop). The traps were active between 6th of February and 6th March, 2007 (sample 1)

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and between 13th March and 14th April, 2008 (sample 2), both periods during the rainy season.

Hymenoptera were identified according to FERNÁNDEZ & SHARKEY (2006). For Apoidea the nomenclature follows MELO & GONÇALVES (2005), with Apidae (*sensu lato*). Posteriorly, the status of superfamilies and families follow SHARKEY (2007), except Apidae (*sensu lato*).

The studied material was deposited in the Coleção Entomológica do Laboratório de Sistemática e Bioecologia de Parasitoides e

Predadores (LRRP) of the APTA Ribeirão Preto, Ribeirão Preto, São Paulo State, Brazil (N.W. Perioto, curator).

RESULTS AND DISCUSSION

A total of 5,057 Hymenoptera were collected, belonging to 12 superfamilies and 36 families (Table 1). Six of those families do not present parasitic habits: Apidae (some are kleptoparasitic bees), Crabronidae (predators, with some species kleptoparasites), Formicidae (predators, micetophagous etc), Vespidae (predators), Argidae and Pergidae (phytophagous).

Table 1. Number and percentage of relative abundance of Hymenoptera collected with a Malaise trap in an area of Caatinga, in Mossoró, RN, Brazil, between 6th February and 6th March, 2007 (sample 1) and between 13th March and 14th April, 2008 (sample 2).

| Superfamily/Family | Sample 1 | Sample 2 | Total | RAHt | RAHs |
|------------------------------|------------|------------|--------------|--------------|--------|
| Apoidea | 127 | 60 | 187 | 3.70 | - |
| Apidae (<i>sensu lato</i>) | 37 | 10 | 47 | 0.93 | 25.13 |
| Crabronidae | 90 | 50 | 140 | 2.77 | 74.87 |
| Ceraphronoidea | 3 | 32 | 35 | 0.69 | - |
| Ceraphronidae | 3 | 32 | 35 | 0.69 | 100.00 |
| Chalcidoidea | 385 | 821 | 1,206 | 23.85 | - |
| Aphelinidae | 1 | 13 | 14 | 0.28 | 1.16 |
| Chalcididae | 96 | 151 | 247 | 4.88 | 20.48 |
| Encyrtidae | 11 | 46 | 57 | 1.13 | 4.73 |
| Eucharitidae | 2 | 0 | 2 | 0.04 | 0.17 |
| Eulophidae | 43 | 71 | 114 | 2.25 | 9.45 |
| Eupelmidae | 16 | 16 | 32 | 0.63 | 2.65 |
| Eurytomidae | 26 | 15 | 41 | 0.81 | 3.40 |
| Leucospidae | 4 | 0 | 4 | 0.08 | 0.33 |
| Mymaridae | 18 | 53 | 71 | 1.40 | 5.89 |
| Perilampidae | 8 | 2 | 10 | 0.20 | 0.83 |
| Pteromalidae | 150 | 433 | 583 | 11.53 | 48.34 |
| Signiphoridae | 1 | 2 | 3 | 0.06 | 0.25 |
| Torymidae | 9 | 8 | 17 | 0.34 | 1.41 |
| Trichogrammatidae | 0 | 11 | 11 | 0.22 | 0.91 |
| Cynipoidea | 167 | 287 | 454 | 8.98 | - |
| Figitidae | 167 | 287 | 454 | 8.98 | 100.00 |
| Chrysidoidea | 264 | 237 | 501 | 9.91 | - |
| Bethylidae | 71 | 99 | 170 | 3.36 | 33.93 |
| Chrysididae | 33 | 37 | 70 | 1.38 | 13.97 |
| Dryinidae | 152 | 91 | 243 | 4.81 | 48.50 |
| Sclerogibbidae | 8 | 10 | 18 | 0.36 | 3.59 |
| Diaprioidea | 0 | 2 | 2 | 0.04 | - |
| Diapriidae | 0 | 2 | 2 | 0.04 | 66.67 |
| Evanoidea | 8 | 105 | 113 | 2.23 | - |
| Evaniidae | 8 | 105 | 113 | 2.23 | 100.00 |
| Ichneumonoidea | 361 | 476 | 837 | 16.55 | - |
| Braconidae | 301 | 315 | 616 | 12.18 | 73.60 |
| Ichneumonidae | 60 | 161 | 221 | 4.37 | 26.40 |
| Platygastridae | 39 | 762 | 801 | 15.84 | - |
| Platygastridae | 39 | 762 | 801 | 15.84 | 100.00 |
| Proctotrupoidea | 0 | 1 | 1 | 0.02 | - |
| Proctotrupidae | 0 | 1 | 1 | 0.02 | 100.00 |
| Vespoidea | 597 | 289 | 886 | 17.52 | - |
| Formicidae | 117 | 151 | 268 | 5.29 | 30.25 |
| Mutillidae | 100 | 8 | 108 | 2.14 | 12.19 |
| Pompilidae | 367 | 77 | 444 | 8.78 | 50.11 |

To be continued...

Table 1. Continued...

| Superfamily/Family | Sample 1 | Sample 2 | Total | RAHt | RAHs |
|------------------------|--------------|--------------|--------------|-------------|-------|
| Rhopalosomatidae | 1 | 45 | 46 | 0.91 | 5.20 |
| Tiphiidae | 1 | 0 | 1 | 0.02 | 0.11 |
| Vespidae | 11 | 8 | 19 | 0.38 | 2.14 |
| Tenthredinoidea | 23 | 11 | 34 | 0.67 | - |
| Argidae | 19 | 7 | 26 | 0.51 | 76.47 |
| Pergidae | 4 | 4 | 8 | 0.16 | 23.53 |
| Total | 1,974 | 3,083 | 5,057 | | |

RAHt = percentage of relative abundance of the family or superfamily in relation to the total of Hymenoptera.

RAHs = percentage of relative abundance of the Hymenoptera families in relation to those collected in the superfamily to which it belongs.

In the Neotropical region are recorded 21 superfamilies and 72 families of Hymenoptera. The number reaches 76 if considered Andrenidae, Colletidae, Halictidae and Megachilidae (Apidae *sensu lato*) (FERNÁNDEZ 2006). For Brazil are reported 18 superfamilies and 63 families (FERNÁNDEZ & SHARKEY 2006; HANSON & GAULD 2006b). Thus, even from brief surveys of fauna, like the one here reported, it was possible to establish that 57.1% of the superfamilies and 50% of the families known for the Neotropics, 66.7% of the superfamilies and 57.1% of the families are already known for Brazil (Table 2).

Of the 5,057 Hymenoptera specimens collected in this study, 1,206 (23.85% of the total) are Chalcidoidea, a group in which Pteromalidae (583 specimens/11.53% of the total), Chalcididae (247/4.88%) and Eulophidae (114/2.25%) stand out, and which, together, represented more than 75% of the collected Chalcidoidea (Table 1). NOYES (2003) reported the existence of nearly 22,000 species of Chalcidoidea in the world. Such insects are relatively little studied. Nearly 12,000 species of insects are recorded as their hosts, which demonstrate their great capacity for parasitism and their importance as a factor of biotic mortality in the environment. GRISSELL & SCHAUFF (1997) asserted that Chalcidoidea have great diversity of biological habits: the group has, at least, 14 life strategies which include mainly solitary, gregarious, hyperparasitism and polyembryony.

A total of 886 specimens of Vespoidea (17.52%) were obtained, among which Pompilidae were the most collected (444/8.78%), followed by Formicidae (268/5.30%) and Mutillidae (108/2.14%). These three families together represent more than 90% of the collected Vespoidea (Table 1). Vespidae was poorly represented in the current survey (19/0.38%) and the reason for the small number of social wasps collected is unknown.

Ichneumonoidea was the third most collected superfamily, with 837 specimens (16.55%), among which 616 Braconidae (12.18%)

and 221 Ichneumonidae (4.37%), followed by Platygastroidea, with 801 specimens (15.84%) of Platygastriidae.

The other sampled families presented relative frequencies lower than 10% (Table 1). Noteworthy is the identification of 18 specimens of Sclerogibbidae (Chrysidoidea), a group rarely found in samplings of parasitic Hymenoptera and, consequently, rare in entomological collections (AZEVEDO & SANTOS 2000). Other families considered rare in collections were also obtained: Rhopalosomatidae (46 specimens), Leucospidae (four) and Proctotrupidae (one).

The number of 30 families of parasitic Hymenoptera recorded to Caatinga in the state of Rio Grande do Norte is considerably close to that which occurs in other Brazilian biomes, like in the Atlantic Rainforest, in the state of Espírito Santo, where AZEVEDO & SANTOS (2000) and AZEVEDO *et al.* (2002, 2003) found 30, 28 and 35 families of Hymenoptera parasitoids, respectively. PERIOTO *et al.* (2003, 2005) recorded 23 and 26 parasitic wasp families in the Atlantic Rainforest in Ubatuba and Iguape, in the state of São Paulo, respectively. FEITOSA *et al.* (2007) recorded 25 parasitic Hymenoptera families in the Amazonian tropical rain forest at Manaus, in the state of Amazonas, and PERIOTO *et al.* (2008) found 27 parasitic Hymenoptera families in the Brazilian Savannah (Cerrado) in Luis Antonio, in the state of São Paulo. PÁDUA & ZAMPIEON (2012) found 20 parasitic Hymenoptera families in the Brazilian Savannah (Cerrado) in Delfinópolis, in the state of Minas Gerais.

It is important to pointed out that most of the surveys of Hymenoptera fauna carried out in Brazil have not taken into consideration the Vespoidea, Apoidea and the Symphyta, perhaps due to the complexity of their identification. The data obtained confirm that the Caatinga biome embodies substantial Hymenoptera biodiversity but that further studies to show its fauna in a more extensive way, are still necessary.

Table 2. Superfamilies and families of Hymenoptera recorded for the Neotropical region, for Brazil and for Rio Grande do Norte (RN) (present study).

| Superfamily | Family | Brazil | RN | Superfamily | Family | Brazil | RN |
|----------------|------------------------------|--------|----|-----------------|----------------|--------|----|
| Apoidea | Apidae (<i>sensu lato</i>) | X | X | Diaprioidea | Diapriidae | X | X |
| | Crabronidae | X | X | | Monomachidae | X | |
| | Sphecidae | X | | Evanoidea | Aulacidae | X | |
| Cephoidea | Cephidae | | | | Evaniidae | X | X |
| Ceraphronoidea | Ceraphronidae | X | X | | Gasteruptiidae | X | |
| | Megaspilidae | X | | Ichneumonoidea | Braconidae | X | X |
| Chalcidoidea | Agaonidae | X | | | Ichneumonidae | X | X |
| | Aphelinidae | X | X | Megalyroidea | Megalyridae | X | |
| | Chalcididae | X | X | Mymarommatoidea | Mymarommatidae | X | |
| | Encyrtidae | X | X | Orussoidea | Orussidae | X | |
| | Eucharitidae | X | X | Pamphilioidea | Pamphiliidae | | |

To be continued...

Table 2. Continued...

| Superfamily | Family | Brazil | RN | Superfamily | Family | Brazil | RN |
|-------------|-------------------|--------|----|------------------|------------------|--------|----|
| | Eulophidae | X | X | Platygastridae | Platygastridae | X | X |
| | Eupelmidae | X | X | Proctotrupeoidea | Heloridae | X | |
| | Eurytomidae | X | X | | Pelecniidae | X | |
| | Leucospidae | X | X | | Proctotrupidae | X | X |
| | Mymaridae | X | X | Siricoidea | Siricidae | X | |
| | Ormyridae | X | | Stephanoidea | Stephanidae | X | |
| | Perilampidae | X | X | Tenthredinoidea | Argidae | X | X |
| | Pteromalidae | X | X | | Cimbicidae | X | |
| | Rotoitidae | | | | Diprionidae | | |
| | Signiphoridae | X | X | | Pergidae | X | X |
| | Tanaostigmatidae | X | | | Tenthredinidae | X | |
| | Tetracampidae | | | Trigonaloidea | Trigonalidae | X | |
| | Torymidae | X | X | Vespoidea | Bradynobaenidae | | |
| | Trichogrammatidae | X | X | | Formicidae | X | X |
| Chrysoidea | Bethylidae | X | X | | Mutillidae | X | X |
| | Chrysididae | X | X | | Pompilidae | X | X |
| | Dryinidae | X | X | | Rhopalosomatidae | X | X |
| | Embolemidae | X | | | Sapygidae | X | |
| | Plumariidae | X | | | Scoliidae | X | |
| | Sclerogibbidae | X | X | | Sierolomorphidae | | |
| | Scolecbythidae | X | | | Tiphiidae | X | X |
| Cynipoidea | Cynipidae | X | | | Vespidae | X | X |
| | Figitidae | X | X | Xiphidriidea | Xiphidriidae | X | |
| | Ibaliidae | X | | Xyeloidea | Xyelidae | | |
| | Liopteridae | X | | | | | |

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