Biota from the coastal wetlands of Praia da Vitória (Terceira, Azores, Portugal): Part 1 - Arthropods

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Abstract

Background

During a LIFE research project aiming at the implementation of the conservation of the habitats and restoration of coastal wetland areas of Praia da Vitória (Terceira, Azores, Portugal), there was the opportunity undertake a systematic record of several groups of arthropods in three wetland areas: Paul da Praia da Vitória (PPV), Paul do Belo Jardim (PBJ) and Paul da Pedreira do Cabo da Praia (PPCP). The objective of the study was to perform a rapid biodiversity assessment, comparing the three sites in two different years,
before and after the implementation of several conservation measures. This project also contributed to improve the knowledge of Azorean arthropod diversity at both local and regional scales, including new taxa for Terceira island and new records for Azores. Taking into consideration those aims, a set of standardised sampling methods were performed, inspired by the COBRA protocol originally developed for spiders.

**New information**

A total of 15,810 specimens belonging to 216 arthropod species and subspecies were collected. Beetles (Insecta, Coleoptera) and spiders (Araneae) dominated, with 81 and 51 taxa, respectively. Two beetle families dominated, Staphylinidae and Curculionidae with, respectively, 22 and 17 species and subspecies. Exotic species were also dominant (132 species and subspecies), the Azorean endemics being restricted to only eight taxa. The remaining 76 species and subspecies are native non-endemic. Two rare endemic species were found with relatively sustainable populations, the Azores Cone-head *Conocephalus chavesi* (Orthoptera, Tettigoniidae) and the true weevil *Drouetius oceanicus oceanicus* (Coleoptera, Curculionidae). A total of six species are novel for the Azores, five exotic (*Bledius unicornis*, *Carpelimus zealandicus*, *Oenopia doublieri*, *Sitona hispidulus*, *Trichiusa immigrata*) and one possibly native (*Pyrrhocoris apterus*). An additional 15 taxa are novel for Terceira island, ten exotic (*Cheiracanthium mildei*, *Cylindroiulus latestriatus*, *Eumodicoryllus bordigalensis*, *Nemobius sylvestris*, *Pissodes castaneus*, *Psyllipsocus ramburi*, *Trachyzelotes lyonneti*, *Trigonidium cicindeloides*, *Tychius cuprifer*, *Zelotes tenuis*) and five native (*Aegialia arenaria*, *Oxypoda lurida*, *Platycleis sabulosa*, *Plinthisus brevipennis*, *Tachyura diabrachys*).

**Keywords**

Arthropoda, Azores, Terceira Island, coastal area, standardised sampling

**Introduction**

The terrestrial coastal lines of the Azores include important wetland areas, namely salty lakes. These habitats were subject to intense human disturbance and, after almost 600 years of human occupancy, only very few coastal wetland habitats still persist in these Atlantic islands. Despite these impacts, three small areas are still available in Terceira Island: i) a native but highly modified coastal saltmarsh habitat, Paul Praia da Vitória (PPV); ii) a new coastal saltmarsh that was created by rehabilitation of the quarry at Cabo da Praia, Paul da Pedreira do Cabo da Praia (PPCP) (Morton et al. 1997); iii) a wetland included in a dune area, the Paul do Belo Jardim (PBJ). The knowledge of the arthropod fauna of these habitats was until recently very incipient, but more recently, the LIFE project "Ecological Restoration and Conservation of Praia da Vitória Coastal Wet Green Infrastructure" (2013-2018) implemented a two-year inventory and monitoring of the biota.
in these wetland areas. As a consequence, a first survey was conducted in 2016 in order to compare the diversity of arthropods in ground and aerial habitats (herbaceous, shrubs and trees) in the referred wetland areas (Borges et al. 2017). A second survey was performed in 2017, repeating the same sampling protocols with some additional sampling.

General description

Purpose: In this contribution, we present detailed data on the distribution and abundance of species belonging to several groups of arthropods in three Terceira Island (Azores) wetlands during two years (2016-2017). In addition, we list the new taxonomic records for the Azores or Terceira Island. In doing this, we are contributing to address two key biodiversity shortfalls (see Cardoso et al. 2011): i) the need for improving current information on the local and regional distribution of Azorean arthropods (the Wallacean shortfall); and ii) the need for collecting abundance data for future monitoring purposes (the Prestonian shortfall).

Project description

Title: The inventory of selected groups of terrestrial arthropods in three coastal wetlands from Terceira Island (Azores)

Personnel: The inventory was conducted during two years (2016-2017) under the responsibility of Paulo A. V. Borges with constant participation of César Pimentel. For the night sampling, additional help in the field was provided by Rosalina Gabriel and Mariana Brito. A large group of taxonomists contributed for the species identification: Luís Crespo (Araneae); Artur Serrano (Insecta, Coleoptera); Volker Assing and Michael Schülke (Coleoptera, Staphylinidae); António O. Soares (Coleoptera, Coccinellidae); Simone Fattorini (Coleoptera, Tenebrionidae); Peter Stüben (Coleoptera, Curculionidae). Finally, in the lab, we had the support of Alejandra Ros-Prieto in vouchers management for the University of Azores Insect Collection "Dalberto Teixeira Pombo" and Enésima Mendonça for the database management.

Study area description: Terceira Island (area: 400.6 km²; elevation: 1,021.14 m) is one of the nine islands from the Azores archipelago, located in the North Atlantic, roughly at 38°43′49″N 27°19′10″W. The climate in the Azores is temperate oceanic, with regular and abundant rainfall, with high levels of relative humidity and persistent winds, mainly during the winter and autumn seasons.

Terceira Island is known for the presence of some very important pristine areas at high elevation (Gaspar et al. 2011). However, few natural areas still remain at lower elevations, notably in Praia da Vitória county. Three wetland areas, Paul da Praia da Vitória (PPV), Paul do Belo Jardim (PBJ) and Paul da Pedreira do Cabo da Praia (PPCP) (Figs 1, 2) were studied in this project. Coastal vegetation dominates, namely Juncus acutus and still
includes some arboreal cover by the native shrub *Morella faya*. The *Erica-Morella* coastal woodlands as described in Elias et al. (2016) are not present and the exotic invasive species *Arundo donax* is very common.

The PPV (Fig. 1) was a large coastal salty marshland with associated dunes, which was largely transformed and reduced for urban development and underwent several dynamic changes in the last 500 years of human occupation. After some major work performed between 2006 and 2010, PPV is currently characterised by a large waterbody with islands...
of *Juncus acutus* isolated by channels (Fig. 2). PBJ was originally one of the largest dune areas from the Azores (Fig. 3), but after the construction of the Praia da Vitória harbour, it was reduced to a very small wetland area, with a dune covered partially by *J. acutus* (Fig. 4). Of particular relevance is the presence of a small stream adding some diversity of vegetation and arthropods (Borges et al. 2017). The case of PPCP is completely different, since this is a recently created wetland (Fig. 5), resulting from the removal of large amounts of stones for the construction of the Praia da Vitória harbour, around 1980 (Fig. 6). As a consequence a new ecosystem was created, the quarry of Cabo da Praia (Morton et al. 1997).
Design description: In each of the three wetland areas, transects were setup to allow the sampling of epigean arthropods in the main habitats.

In PPV, three main transects were setup: i) PPV-T200 (Paul da Praia Vitória - Margins) that covers the main margins of the water bodies; ii) PPV-T201 (Paul da Praia Vitória - Island) that covers some of the isolated islands; iii) PPV-T205 (Paul da Praia Vitória - Cerrado São Lazaro) to sample an historical locality with a high diversity of ground-beetle species (Borges 1995; Borges et al. 2017).
In PBJ, two transects were setup: i) PBJ-T203 (Paul do Belo Jardim - Margins), which was located within the *Juncus acutus* plants; ii) PBJ-T204 (Paul do Belo Jardim - Stream), which was setup in a small stream.

In PPCP, only one transect was setup, PPCP-T202 (Paul da Pedreira do Cabo da Praia - Margins), which covers the main margins of the water.

The beating and sweeping samples were conducted both during the day and night and were undertaken by walking randomly within the sites.

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**Sampling methods**

**Study extent:** This study covers a small coastal area with 3.58 km extension between PPV and PPCP.

**Sampling description:** In each site, arthropods were sampled during the summers of 2016 and 2017 using a combination of standardised methods inspired by the COBRA protocol (Cardoso 2009):

- **Nocturnal active aerial searching (AAS):** Four samples were obtained by four trained collectors (Paulo Borges, Mariana Brito, Rosalina Gabriel, César Pimentel) targeting active arthropods found above knee-level by hand, forceps, pooter or brush and immediately transferring them into vials containing alcohol. All the time spent in searching (one hour per researcher) was accounted for.
- **Foliage Beating (FB):** During daytime, ten samples from each dominant tree or bush were taken. A 110 cm × 80 cm sheet with a frame was used as a drop-cloth (beating tray) and a wooden pole of at least 1.5 m was used to beat tree branches, as high as possible. The plants selected were: *A. donax* and *M. faya* in PPV and PPCP and *A. donax* and *J. acutus* in PBJ. In 2017, in addition, two samples during the night (FSN) were obtained (one hour each sample covering several plants).
- **Foliage sweeping (FS):** A round sweep net with an opening diameter of 46 cm was used to sweep bushes and tall herbs. All time spent sweeping or searching for dislodged arthropods was accounted for. Two samples during daytime (FSD) were obtained (one hour each sample). In 2017, in addition, two samples during the night (FSN) were obtained (one hour each sample).
- **Pitfall (PIT):** Pitfall traps (4.2 cm wide at the top and approximately 7.2 cm deep) were placed immediately outside the perimeter of each lake, spaced 10 metres apart. Traps were filled with 3–4 cm of 100% propylene glycol and left in the field for seven days. Traps were protected from predation, inundation with rainwater and unwanted vertebrate capture by using plates sitting on stilts 2 cm above the ground surface. In PBJ, two transects were performed with 30 traps in the main transect
and 15 traps in a secondary transect covering a small stream. In PPV and PPCP, single transects of 30 traps each were setup in the margins of water bodies. In PPV, half of the traps were in the margins of the largest “island”. In 2017, additional traps were setup in Cerrado São Lazaro (PPV-T205 Paul da Praia Vitória).

For each site, a total of four samples of AAS, 20 samples of FB, two samples of FS and 30 main samples of PIT were obtained, totalling 56 samples per site and an overall 168 samples in 2017. Further, in 2017, additional pitfall traps in the PBJ small stream added 15 more samples totalling 183 samples. The main 56 samples per site included the sampling of two main sub-habitats, the aerial vegetation with 26 samples (20 beatings during the day, two sweeps during the day and four night aerial searches) and the ground habitat with 30 pitfall samples.

In 2017, the additional samples made during the night added four samples for each site, totalling 60 samples per site. Accumulation curves were performed and completeness was high for all sites (see Borges et al. 2017).

Quality control: The correct identification of the sampled taxa is crucial. We followed a three-step process to identify arthropod species: (1) for arthropod orders for which there was taxonomic expertise, one of us (CP) performed morphospecies sorting using a parataxonomy approach (see Oliver and Beattie 1993) with a reference collection; (2) a trained taxonomist (PAVB) corrected all the splitting and lumping errors and identified most of the species; and 3) the morphospecies for which a correct identification was not possible were sent to experts for identification. Taxonomic nomenclature followed the arthropod checklist in Borges et al. (2010) and for the new six taxa the following taxonomic references were used: Lohse 1984, Quinn and Hower 1986, Smaili et al. 2009, Schülke and Smetana 2015.

Geographic coverage

Description: Terceira Island (Azores), Macaronesia, Portugal

Coordinates: and 38°42’47.95’ Latitude; 27°03’40.93’ and Longitude.

Taxonomic coverage

Description: Arthropods including Diplopoda, Chilopoda, Arachnida (Opiliones; Pseudoscorpiones; Araneae) and Hexapoda (Microcoryphia; Zygoptera; Odonata; Orthoptera; Phasmatodea; Dermaptera; Psocoptera; Hemiptera; Thysanoptera; Neuroptera; Coleoptera; Lepidoptera; Hymenoptera - Formicidae)
Temporal coverage

Notes: The sampling was performed on two occasions: summer 2016 and summer 2017.

Collection data

Collection name: Dalberto Teixeira Pombo insect collection at the University of Azores.
Collection identifier: DTP
Specimen preservation method: All specimens were preserved in 96% ethanol
Curatorial unit: Dalberto Teixeira Pombo insect collection at the University of Azores.

Usage rights

Use license: Open Data Commons Attribution License
IP rights notes: Additional information on this study may also be requested to the first author

Data resources

Data package title: LIFE_CWR_TER_Arthropods
Resource link: http://ipt.gbif.pt/ipt/resource?r=arthrop_pv_ter_az
Alternative identifiers: http://islandlab.uac.pt/software/ver.php?id=30
Number of data sets: 1

Data set name: Arthropods from Praia da Vitória
Download URL: http://ipt.gbif.pt/ipt/resource?r=arthrop_pv_ter_az
Data format: Darwin Core Archive
Data format version: version 1
Description: In this data table, we include all the records for which a taxonomic identification of the species was possible. The dataset submitted to GBIF is structured as a sample event dataset, with two tables: event (as core) and occurrences. The data in this sampling event resource has been published as a Darwin Core Archive (DwC-A), which is a standardised format for sharing biodiversity data as a set of one or more data tables. The core data table contains 343 records. One extension data table also
exists. An extension record supplies extra information about a core record. The number of records in each extension data table is illustrated in the IPT link.

This IPT archives the data and thus serves as the data repository. The data and resource metadata are available for downloading in the downloads section. The versions table lists other versions of the resource that have been made publicly available and allows tracking changes made to the resource over time.

In Suppl. material 1, we provide a simpler dataset with few columns in a single table.

| Column label            | Column description                                                                 |
|-------------------------|------------------------------------------------------------------------------------|
| Table Event             | The sub-table with events                                                          |
| eventID                 | Identifier of the events, unique for the dataset                                    |
| eventDate               | Date or date range the record was collected                                         |
| eventTime               | Time of the day the record was collected                                            |
| samplingProtocol        | The sampling protocol used to capture the species                                   |
| samplingEffort          | The amount of time of each sampling                                                |
| sampleSizeValue         | The numeric amount of time spent in each sampling                                   |
| sampleSizeUnit          | The unit of the sample size value                                                   |
| locationID              | Identifier of the location                                                          |
| fieldNumber             | Number given to each sample                                                         |
| decimalLatitude         | Approximate centre point decimal latitude of the field site in GPS coordinates      |
| decimalLongitude        | Approximate centre point decimal longitude of the field site in GPS coordinates     |
| geodeticDatum           | The reference point for the various coordinate systems used in mapping the earth    |
| coordinatePrecision     | Precision of the coordinates                                                       |
| coordinateUncertaintyInMeters | Uncertainty of the coordinates                                               |
| georeferenceSources     | Method used to obtain coordinates                                                  |
| minimumElevationInMetres| Minimum elevation in metres                                                         |
| maximumElevationInMetres| Maximum elevation in metres                                                         |
| country                 | Country of the sampling site                                                        |
| countryCode             | ISO code of the country of the sampling site                                        |
| stateProvince           | Name of the region of the sampling site                                             |
| islandGroup             | Name of archipelago                                                                |
| island                  | Name of the island                                                                  |
| municipality            | Name of the municipality                                                            |
| Field                        | Description                                                                 |
|------------------------------|-----------------------------------------------------------------------------|
| locality                     | Name of the locality                                                        |
| locationRemarks              | Details on the locality site                                                |
| verbatimCoordinates          | Original coordinates recorded                                               |
| Table Occurrences            | The sub-table with occurrence data                                          |
| type                         | Type of the record, as defined by the Public Core standard                  |
| modified                     | Date of the last modification of the record                                 |
| eventID                      | Identifier of the events, unique for the dataset                            |
| licence                      | Reference to the licence under which the record is published                |
| occurrenceID                 | Identifier of the record, coded as a global unique identifier               |
| basisOfRecord                | The nature of the data record                                               |
| InstitutionID                | The identity of the institution publishing the data                          |
| InstitutionCode              | The code of the institution publishing the data                              |
| collectionCode               | The code of the collection where the specimens are conserved                |
| datasetName                  | Name of the dataset                                                         |
| catalogNumber                | Record number of the specimen in the collection                             |
| recordedBy                   | Name of the person who performed the sampling of the specimens              |
| identifiedBy                 | Name of the person who made the identification                              |
| dateIdentified               | Date on which the record was identified                                     |
| scientificName               | Complete scientific name including author and year                           |
| taxonRank                    | Lowest taxonomic rank of the record                                         |
| kingdom                      | Kingdom name                                                                |
| phylum                       | Phylum name                                                                  |
| class                        | Class name                                                                   |
| order                        | Order name                                                                   |
| family                       | Family name                                                                  |
| genus                        | Genus name                                                                   |
| specificEpithet              | Specific epithet                                                             |
| infraspecificEpithet         | Infraspecific epithet, when available                                        |
| individualCount              | Total number of individuals captured                                         |
| organismQuantity             | Total number of individuals captured, as numeric                             |
| organismQuantityType         | The unit of the identification of the organisms                             |
sex | The sex and quantity of the individuals captured
---|---
lifeStage | The life stage of the organisms captured
scientificNameAuthorship | Name of the author of the lowest taxon rank included in the record
establishmentMeans | The process of establishment of the species in the location, using a controlled vocabulary: 'native non-endemic', 'introduced', 'endemic'
ocurrenceRemarks | Remarks on the occurrence with the plant species from where the specimens where captured

**Additional information**

We collected and identified 15,810 specimens representing 216 species or subspecies and 197 genera during this study (Table 1). Beetles (Insecta, Coleoptera) and spiders (Araneae) were the most diverse taxa, with 81 and 51 taxa, respectively. Two beetle families were also diverse, Staphylinidae and Curculionidae with, respectively, 22 and 17 species and subspecies. Exotic species dominated with 132 species and subspecies, the Azorean endemics being restricted to only eight taxa. The remaining 76 species and subspecies are native non-endemic.

| Class | Order | Taxon | Colonization | PPV | PBJ | PPCP |
|---|---|---|---|---|---|---|
| Arachnida | Araneae | Altella lucida | INTR | 1 |
| Arachnida | Araneae | Arctosa perita | INTR | 1 | 84 | 1 |
| Arachnida | Araneae | Argiope bruennichi | NAT | 23 | 154 | 6 |
| Arachnida | Araneae | Cheiracanthium mildei | INTR | 76 | 18 | 1 |
| Arachnida | Araneae | Clubiona decora | NAT | 191 | 57 | 86 |
| Arachnida | Araneae | Clubiona terrestris | INTR | 30 |
| Arachnida | Araneae | Cryptachaea blattea | INTR | 6 |
| Arachnida | Araneae | Dysdera crocata | INTR | 12 | 47 | 12 |
| Arachnida | Araneae | Eidmannella pallida | INTR | 1 |
| Arachnida | Araneae | Emblyna acoreensis | END | 144 | 47 | 191 |
| Arachnida | Araneae | Entelecara schmitzi | INTR | 1 | 9 | 7 |
| Arachnida | Araneae | Erigone autumnalis | INTR | 5 | 9 |

Table 1.
Species abundance per site. PPV – Paul da Praia da Vitória; PBJ – Paul Belo Jardim; PPCP – Paul da Pedreira do Cabo da Praia. END - endemic species from Azores; NAT - native non-endemic species; INTR - exotic species.
| Arachnida | Araneae       | Species                | Category | Intr. | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   |
|-----------|---------------|------------------------|----------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Arachnida | Araneae       | Erigone dentipalpis    | INTR     | 3     | 6   | 9   |
| Arachnida | Araneae       | Ero aphaena            | INTR     | 1     |
| Arachnida | Araneae       | Ero furcata            | INTR     | 1     | 6   |
| Arachnida | Araneae       | Heliopterus kochii     | INTR     | 3     | 6   |
| Arachnida | Araneae       | Macaroeris cata        | NAT      | 4     | 4   |
| Arachnida | Araneae       | Macaroeris diligens    | NAT      | 127   | 45  | 120 |
| Arachnida | Araneae       | Malthonica pagana      | INTR     | 1     |
| Arachnida | Araneae       | Mangora acalypha       | INTR     | 1     |
| Arachnida | Araneae       | Memessus bryantae      | INTR     | 1     |
| Arachnida | Araneae       | Memessus tradeorum     | INTR     | 2     | 1   | 1   |
| Arachnida | Araneae       | Metellina merianaene   | INTR     | 6     | 8   |
| Arachnida | Araneae       | Neoscona crucifera     | INTR     | 26    | 12  | 25  |
| Arachnida | Araneae       | Neottiura bimaculata   | INTR     | 1     |
| Arachnida | Araneae       | Nigma puella           | INTR     | 3     | 88  |
| Arachnida | Araneae       | Oecobius navus         | INTR     | 1     |
| Arachnida | Araneae       | Oedothorax fuscus      | INTR     | 91    | 115 | 205 |
| Arachnida | Araneae       | Ostearius melanopygillus| INTR    | 4     | 3   |
| Arachnida | Araneae       | Pachygnatha degeeri    | INTR     | 6     | 9   | 2   |
| Arachnida | Araneae       | Parasteatoda tepidariorum| INTR | 4     | 1   |
| Arachnida | Araneae       | Pardosa acorensis      | END      | 9     | 50  |
| Arachnida | Araneae       | Pelecopis parallela    | INTR     | 4     |
| Arachnida | Araneae       | Phidippus audax        | INTR     | 47    | 104 | 3   |
| Arachnida | Araneae       | Prinerigone vagans     | INTR     | 1     |
| Arachnida | Araneae       | Pseudeuophrys vafra    | INTR     | 3     |
| Arachnida | Araneae       | Salticus mutabilis     | INTR     | 3     | 4   | 10  |
| Arachnida | Araneae       | Segestria florentina   | INTR     | 4     |
| Arachnida | Araneae       | Steatoda grossa        | INTR     | 7     | 3   |
| Arachnida | Araneae       | Steatoda nobilis       | INTR     | 4     | 4   | 4   |
| Arachnida | Araneae       | Synageles venator      | INTR     | 22    | 11  | 14  |
| Arachnida | Araneae       | Tegenaria domestica    | INTR     | 2     | 3   | 6   |
| Arachnida | Araneae       | Tenuiphantes tenuis    | INTR     | 43    | 34  | 2   |
| Kingdom         | Phylum          | Class              | Order       | Family               | Genus          | Species                | Area1 | Area2 | Area3 | Area4 | Area5 |
|----------------|-----------------|--------------------|-------------|----------------------|----------------|------------------------|-------|-------|-------|-------|-------|
| Arachnida      | Araneae         | Tetragatha extensa | INTR        | 39                   | 3              | 6                      |
| Arachnida      | Araneae         | Theridion hannoniae| INTR        | 4                    | 1              |                        |
| Arachnida      | Araneae         | Theridion melanostictum | INTR  | 4                    | 7              | 6                      |
| Arachnida      | Araneae         | Theridion musivivum | NAT        | 2                    |                |                        |
| Arachnida      | Araneae         | Trachyzelotes lyonneti | INTR  | 1                    | 1              |                        |
| Arachnida      | Araneae         | Xysticus nubilus   | INTR        | 24                   | 218            | 164                    |
| Arachnida      | Araneae         | Zelotes aeneus     | INTR        | 17                   | 11             | 16                     |
| Arachnida      | Araneae         | Zelotes tenuis     | INTR        | 6                    |                |                        |
| Arachnida      | Araneae         | Zodarion atlanticum| INTR       | 1                    |                |                        |
| Arachnida      | Araneae         | Zoropsis spinimana | INTR       | 5                    |                |                        |
| Arachnida      | Araneae         | Zygiella x-notata  | INTR        | 6                    | 6              | 14                     |
| Arachnida      | Opiliones       | Homalenothes corieae | NAT      | 47                   | 149            | 1                      |
| Arachnida      | Opiliones       | Leobunum blackwali | NAT        | 157                  | 923            | 10                     |
| Arachnida      | Pseudoscorpiones| Chthonius tetrachelatus | INTR  | 2                    |                |                        |
| Chilopoda      | Lithobiomorpha  | Lithobius pilicornis pilicornis | NAT  | 13                   |                |                        |
| Chilopoda      | Scutigeromorpha | Scutigera coleoptrata | INTR  | 1                    | 6              | 14                     |
| Diplopoda      | Julida          | Choneiulus palmatus | INTR       | 2                    |                |                        |
| Diplopoda      | Julida          | Cylindroiulus latestriatus | INTR  | 2                    |                |                        |
| Diplopoda      | Julida          | Ommatoiulus moreletti | INTR  | 147                  | 510            | 35                     |
| Diplopoda      | Julida          | Proteroiulus fuscus | INTR       | 1                    | 2              |                        |
| Diplopoda      | Polydesmida     | Oxidus gracilis    | INTR        | 2                    | 3              |                        |
| Diplopoda      | Polydesmida     | Polydesmus corieae  | INTR        | 63                   | 7              |                        |
| Insecta        | Coleoptera      | Acupalpus flavicolis | NAT     | 1                    |                |                        |
| Insecta        | Coleoptera      | Aegialia arenaria  | NAT        | 1                    |                |                        |
| Insecta        | Coleoptera      | Aeolus melliculus moreleti | INTR  | 4                    |                |                        |
| Insecta        | Coleoptera      | Ahasverus advena   | INTR        | 2                    |                |                        |
| Insecta        | Coleoptera      | Aleochara bipustulata | INTR  | 1                    |                |                        |
| Insecta        | Coleoptera      | Amischa analis     | INTR        | 1                    |                |                        |
| Insecta        | Coleoptera      | Amischa forcipata  | INTR        | 1                    | 1              |                        |
| Insecta        | Coleoptera      | Anisodactylus binotatus | INTR  | 2                    | 13             |                        |
| Insecta        | Coleoptera      | Anotylus nitidifrons | INTR  | 76                   | 2              |                        |
| Insecta | Coleoptera | Species | Class | Type | ID1 | ID2 | ID3 | ID4 | ID5 |
|---------|------------|---------|-------|------|-----|-----|-----|-----|-----|
| Insecta | Coleoptera | Aspidapion radiolius | NAT | 3 | 14 | 104 |     |     |     |
| Insecta | Coleoptera | Astenus lyonessius | NAT | 2 |     |     |     |     |     |
| Insecta | Coleoptera | Atheta fungi | INTR | 4 | 6 | 3 |     |     |     |
| Insecta | Coleoptera | Bembidion semipunctatum | NAT | 27 | 2 |     |     |     |     |
| Insecta | Coleoptera | Bledius unicornis | INTR | 13 |     |     |     |     |     |
| Insecta | Coleoptera | Bradycellus distinctus | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Calymmaederus solidus | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Carcelimus corticinus | NAT | 2 |     |     |     |     |     |
| Insecta | Coleoptera | Carcelimus zealandicus | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Cartodere bifasciata | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Cercyon haemorrhoidalis | INTR | 1 | 3 |     |     |     |     |
| Insecta | Coleoptera | Chrysolina bankii | NAT | 11 | 1 |     |     |     |     |
| Insecta | Coleoptera | Coccinella undecimpunctata undecimpunctata | INTR | 11 |     |     |     |     |     |
| Insecta | Coleoptera | Coccotrypes carpophagus | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Coelositona puberulus | INTR | 3 |     |     |     |     |     |
| Insecta | Coleoptera | Cordalia obscura | INTR | 15 | 38 | 5 |     |     |     |
| Insecta | Coleoptera | Cryptamorpha desjardinsii | INTR | 21 | 8 | 7 |     |     |     |
| Insecta | Coleoptera | Drouetius oceanicus oceanicus | END | 5 |     |     |     |     |     |
| Insecta | Coleoptera | Enochrus bicolor | INTR | 5 | 1 |     |     |     |     |
| Insecta | Coleoptera | Epitrix hirtipennis | INTR | 2 |     |     |     |     |     |
| Insecta | Coleoptera | Gonipterus scutellatus | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Gymnetron pascuorum | INTR | 1 | 3 | 2 |     |     |     |
| Insecta | Coleoptera | Heteroderes azoricus | END | 13 | 12 | 10 |     |     |     |
| Insecta | Coleoptera | Heteroderes vagus | INTR | 20 | 219 | 11 |     |     |     |
| Insecta | Coleoptera | Hirticollis quadriguttatus | NAT | 32 | 92 |     |     |     |     |
| Insecta | Coleoptera | Hybera postica | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Hypocaccus brasiliensis | INTR | 21 |     |     |     |     |     |
| Insecta | Coleoptera | Kalcapion semivittatum semivittatum | NAT | 3 |     |     |     |     |     |
| Insecta | Coleoptera | Laemostenes complanatus | INTR | 2 |     |     |     |     |     |
| Insecta | Coleoptera | Lixus pulverulentus | INTR | 1 |     |     |     |     |     |
| Insecta | Coleoptera | Name | Status | COUNT1 | COUNT2 | COUNT3 |
|---------|------------|------|--------|--------|--------|--------|
| Insecta | Coleoptera | Meligethes aeneus | INTR | 3 | 6 |
| Insecta | Coleoptera | Naupactus leucoloma | INTR | 22 | 30 | 53 |
| Insecta | Coleoptera | Ocyopus olens | NAT | 1 |
| Insecta | Coleoptera | Oenopia doublieri | INTR | 2 | 3 | 1 |
| Insecta | Coleoptera | Orthochaetes insignis | NAT | 1 |
| Insecta | Coleoptera | Otiorhynchucribicollis | INTR | 24 | 19 | 68 |
| Insecta | Coleoptera | Oxypoda lurida | NAT | 1 |
| Insecta | Coleoptera | Pantomorus cervinus | INTR | 59 | 70 | 3 |
| Insecta | Coleoptera | Phaleria bimaculata | INTR | 677 |
| Insecta | Coleoptera | Phloeonomus punctipennis | NAT | 6 |
| Insecta | Coleoptera | Phloeostiba azorica | END | 1 |
| Insecta | Coleoptera | Pissodes castaneus | INTR | 7 |
| Insecta | Coleoptera | Platystethus nitens | NAT | 2 | 1 |
| Insecta | Coleoptera | Pseudoophonus rufipes | INTR | 5 |
| Insecta | Coleoptera | Psylliodes marcidus | NAT | 1 |
| Insecta | Coleoptera | Ptenidium pusillum | INTR | 1 | 6 | 1 |
| Insecta | Coleoptera | Pterostichus vernalis | INTR | 1 |
| Insecta | Coleoptera | Rhyzobius litura | NAT | 1 |
| Insecta | Coleoptera | Rodolia cardinalis | INTR | 4 | 4 |
| Insecta | Coleoptera | Rugilus orbiculatus orbiculatus | NAT | 1 | 0 | 1 |
| Insecta | Coleoptera | Scymnus interruptus | NAT | 14 | 14 | 37 |
| Insecta | Coleoptera | Scymnus nubilus | NAT | 14 | 14 | 37 |
| Insecta | Coleoptera | Sepedophilus lusitanicus | NAT | 1 |
| Insecta | Coleoptera | Sericoderus lateralis | INTR | 11 | 9 | 1 |
| Insecta | Coleoptera | Sitona disoideus | INTR | 3 | 7 |
| Insecta | Coleoptera | Sitona hispidulus | INTR | 2 |
| Insecta | Coleoptera | Sitona lineatus | INTR | 2 |
| Insecta | Coleoptera | Sphenophorus abbreviatus | INTR | 1 |
| Insecta | Coleoptera | Stegobium paniceum | INTR | 1 |
| Insecta | Coleoptera | Stenolophus teutonus | NAT | 1 | 2 |
| Insecta | Coleoptera | Stethorus pusillus | NAT | 1 |
| Insecta | Coleoptera | Stilbus testaceus | NAT | 124 | 175 | 657 |
|---------|------------|-----------------|-----|-----|-----|-----|
| Insecta | Coleoptera | Tachyporus chrysomelinus | INTR | 1 |
| Insecta | Coleoptera | Tachyporus nitidulus | INTR | 1 | 1 |
| Insecta | Coleoptera | Tachyra diabracys | NAT | 1 |
| Insecta | Coleoptera | Tribolium castaneum | INTR | 1 |
| Insecta | Coleoptera | Trichiusa immigrata | INTR | 1 |
| Insecta | Coleoptera | Tychius cuprifer | INTR | 10 | 7 |
| Insecta | Coleoptera | Tychius picrostris | INTR | 8 |
| Insecta | Coleoptera | Typhaea stercorea | INTR | 2 | 2 | 1 |
| Insecta | Coleoptera | Xantholinus longiventris | INTR | 1 |
| Insecta | Dermaptera | Euborellia annulipes | INTR | 307 | 96 | 120 |
| Insecta | Dermaptera | Forficula auricularia | INTR | 1 | 16 | 14 |
| Insecta | Dermaptera | Labidura riparia | NAT | 46 | 38 |
| Insecta | Hemiptera | Anoscopus albifrons | NAT | 3 | 3 | 2 |
| Insecta | Hemiptera | Beosus maritimus | NAT | 1 |
| Insecta | Hemiptera | Buchananiella continua | INTR | 2 | 18 |
| Insecta | Hemiptera | Closterotomus norwegicus | NAT | 1 |
| Insecta | Hemiptera | Cyphopterum ascendens | NAT | 1 |
| Insecta | Hemiptera | Emblethis denticollis | NAT | 1 |
| Insecta | Hemiptera | Empicoris rubromaculatus | INTR | 3 | 3 | 1 |
| Insecta | Hemiptera | Euscelidius variegatus | NAT | 8 |
| Insecta | Hemiptera | Geotomus punctulatus | NAT | 12 | 28 | 1 |
| Insecta | Hemiptera | Kelisia ribauti | NAT | 1 | 3 |
| Insecta | Hemiptera | Kleidocerys ericae | NAT | 11 | 2 |
| Insecta | Hemiptera | Megamelodes quadrimaculatus | NAT | 2 |
| Insecta | Hemiptera | Monalocoris filicis | NAT | 1 |
| Insecta | Hemiptera | Nabis pseudoferus ibericus | NAT | 6 | 3 | 22 |
| Insecta | Hemiptera | Nezara viridula | INTR | 7 | 5 | 46 |
| Insecta | Hemiptera | Nysius atlanticum | END | 2 | 116 |
| Insecta | Hemiptera | Orius laevigatus laevigatus | NAT | 6 | 8 | 210 |
| Insecta | Hemiptera | Oxycarenus lavaterae | INTR | 4 | 244 |
| Insecta     | Hymenoptera | Lasius grandis | NAT | 1587 | 672 | 881 |
|------------|-------------|----------------|-----|------|-----|-----|
| Insecta    | Hymenoptera | Monomorium carbonarium | NAT | 224 | 237 | 315 |
| Insecta    | Hymenoptera | Temnothorax unifasciatus | NAT | 13 | 4 |  |
| Insecta    | Hymenoptera | Tetramorium caespitum | NAT | 99 | 33 | 17 |
| Insecta    | Lepidoptera | Agrotis ipsilon | NAT | 1 | 2 |  |
| Insecta    | Lepidoptera | Aproaerema anthyllidella | INTR | 4 | 2 |  |
| Insecta    | Lepidoptera | Autographa gamma | NAT | 5 |  |  |
| Insecta    | Lepidoptera | Blastobasis marrocanella | NAT | 1 | 6 | 3 |
| Insecta    | Lepidoptera | Colias croceus | NAT | 10 | 13 | 2 |
| Insecta    | Lepidoptera | Lampides boeticus | NAT | 3 |  |  |
| Insecta    | Lepidoptera | Mythimna unipuncta | NAT | 5 | 5 | 2 |
| Insecta    | Lepidoptera | Oinophila v-flava | INTR | 11 | 33 | 1 |
| Insecta    | Lepidoptera | Opogona sacchari | INTR | 1 | 3 |  |
| Insecta    | Lepidoptera | Rhopobota naevana | INTR | 1 |  |  |
| Insecta    | Lepidoptera | Udea ferruginalis | NAT | 1 |  |  |
| Insecta    | Microcoryphia | Dilta saxicola | NAT | 2 | 2 |  |
| Insecta    | Neuroptera | Hemerobius azoricus | END | 1 |  |  |
| Insecta    | Odonata | Sympretum funscolombii | NAT | 1 |  |  |
| Insecta    | Orthoptera | Conocephalus chavesi | END | 34 | 340 | 18 |
| Insecta    | Orthoptera | Eumodicogyllus bordigalensis | INTR | 10 | 148 | 37 |
| Insecta    | Orthoptera | Gryllus bimaculatus | INTR | 1 | 8 | 4 |
The most abundant species, belonging to the first quartile when ranking species abundances, accounted for 14,680 specimens, i.e. 93% of all adult sampled specimens belong to 25% of the species (54 species). From these 54 species, four are endemic, 22 are native and 28 are exotic. Thirty one species had more than 100 specimens and four of them were particularly abundant: the native ant *Lasius grandis* with 3140 specimens, the native harvestman *Leiobunum blackwalli* (Opiliones) with 1090 individuals, the native beetle *Stilbus testaceus* with 956 specimens and the native ant *Monomorium carbonarium* with 776 individuals.

Only one of the three most abundant ground-beetles recorded for PPV in 1991-1993 (Borges 1995) was found in the current sample, but with low abundance: *Bembidion semipunctatum*. The species was found in PPV (with 27 specimens), but also in PPCP with only two specimens.

Paul Belo Jardim (PBJ) was the richest site with 148 species and subspecies, the other two sites having equal diversity (Table 1). Particularly relevant was the finding of two rare
endemic species in PBJ, the Azores Cone-head *Conocephalus chavesi* (Orthoptera, Tettigoniidae) (Fig. 7), that was recently listed as Endangered by IUCN (Hochkirch and Borges 2016) and the true weevil *Drouetius oceanicus oceanicus* (Coleoptera, Curculionidae) (Fig. 8), that was recently listed as Endangered by IUCN (see Borges and Lamelas-López 2018). The Azores Cone-head *Conocephalus chavesi* was also found in the two other sites but with lower abundance.

Figure 7. doi
A juvenile of Azores Cone-head *Conocephalus chavesi* (Orthoptera, Tettigoniidae) (Photo by Paulo A.V. Borges).

Figure 8. doi
The Azores endemic true weevil *Drouetius oceanicus oceanicus* (Coleoptera, Curculionidae) (Photo by Paulo A.V. Borges).
Known ranges and ecology of newly reported species

Twenty-one species, which represent 10% of the total species collected, are new records for either the Azores and Terceira island (six species) or only Terceira Island (15 species). The new species for the Azores include five exotic and one possibly native species. The 15 new records for Terceira island include ten exotic and five native species (see also Table 1).

Diplopoda - Julida

- *Cylindroiulus latestriatus* (Curtis, 1845) (new for Terceira island). Previously recorded on five islands (Corvo, Flores, Faial, S. Miguel and S. Maria). Exotic species common in Western Europe. This species is usually associated with coastal and dune systems (Klime 2004). Captured with pitfall traps.

Araneae

- *Cheiracanthium mildei* L. Koch, 1864 (new for Terceira island). Previously recorded on two islands (Flores and S. Miguel). This is an exotic spider native from Europe, North Africa, Turkey and the Near East. Introduced to North America, Argentina and Azores. (see World Spider Catalog 2018). The species was found mostly in the canopy of *Morella faya*.

  - *Trachyzelotes lyonneti* (Audouin, 1926) (new for Terceira island). Previously recorded on four islands (Faial, Graciosa, S. Miguel and S. Maria). This is an exotic spider native from the Mediterranean to Central Asia. The species has been introduced into the United States, Mexico, Peru and Brazil (see World Spider Catalog 2018). Captured with pitfall traps.

  - *Zelotes tenuis* (L. Koch, 1866) (new for Terceira island). Previously recorded on a single island (S. Miguel). This is an exotic spider, native from the Mediterranean to Russia (Caucasus). Introduced to Galapagos Is., Azores and USA (see World Spider Catalog 2018). Captured with pitfall traps.

Insecta - Orthoptera

- *Eumodicogryllus bordigalensis* (Latreille, 1804) (new for Terceira island). Previously recorded on two islands (S. Miguel and S. Maria). This is an exotic species native from N-Africa, S-Europe and warmer parts of Asia. It is spreading northwards due to climate change. It has already reached southern parts of West Germany (see Anonymous 2018a). Captured with pitfall traps.

  - *Nemobius sylvestris* (Bosc D’Antic, 1792) (new for Terceira island). Previously recorded on a single island (S. Miguel). This is an exotic species, native from North Africa across the Iberian Peninsula, France, north-westernmost Italy and parts of Central Europe to southern England, south-western Poland and the Czech Republic (see Anonymous 2018c). Captured with pitfall traps.
- *Platycleis sabulosa* Azam, 1901 (new for Terceira island). This is a possible native species with origin in Northern Africa and South-western Europe (Iberian Peninsula, Southern France) (see Anonymous 2018b). Captured with pitfall traps.

- *Trigonnidium cicindeloides* Rambur, 1839 (new for Terceira island). First recorded for Azores (S. Miguel) by Borges et al. (2013) and now also found in Terceira. This is a southern Europe (Mediterranean area) native species, but occurs also on the Canary Islands, Africa, Madagascar, China, Japan and Korea. This species if frequently found associated with ponds. Captured with pitfall traps.

**Insecta - Hemiptera**

- *Plinthus brevipennis* (Latreille, 1807) (new for Terceira island). Previously recorded on five islands (Faial, Pico, Graciosa, S. Miguel and S. Maria). This is a native species usually associated with grassy environments. Captured with pitfall traps.

- *Pyrrhocoris apterus* (Linnaeus, 1758) (new for the Azores). This is a very common and widespread Palaearctic species. This is possibly a native species from Azores. Captured with pitfall traps, but also associated with *Arundo donax*.

**Insecta - Psocoptera**

- *Psyllipsocus ramburi* Sélys-Longchamps, 1872 (new for Terceira island). Previously recorded on two islands (S. Miguel and S. Maria). This is an exotic species in Azores and native from West Palaearctic. Captured with pitfall traps, this species is usually associated with damp sites (Robinson 2005).

**Insecta - Coleoptera**

- *Aegialia arenaria* (Fabricius, 1787) (new for Terceira island). Previously recorded on a single island (S. Miguel). This is a native dune scarab beetle species in Azores and native from West Palaearctic. Captured with pitfall traps, this species is commonly associated with coastal dune areas.

- *Bledius unicornis* (Germar, 1825) (new for the Azores). This is a common rove-beetle species distributed from the Atlantic Islands across Europe and the Mediterranean eastwards to Middle Asia (Schülke and Smetana 2015). Captured with pitfall traps, this species is adapted to damp areas, particularly salt-marsh areas (Zanella and Scarton 2017).

- *Carpelimus zealandicus* (Sharp, 1900) (new for the Azores). Originally most likely from the Australian Region, this species is adventive in Europe, with confirmed records from Central Europe, the British Isles and Scandinavia (Schülke and Smetana 2015). Captured with pitfall traps.

- *Oenopia doublieri* (Mulsant, 1846) (new for the Azores). This exotic species is native from the Mediterranean region. The species was recently recorded also in Morocco and
associated with citrus orchards (Smaili et al. 2009). This is, possibly, a recent introduction in the Azores. The species was found associated with the invasive *Arundo donax*.

- *Oxypoda lurida* Wollaston, 1857 (new for Terceira island). Previously recorded on a single island (S. Maria). *Oxypoda lurida* is a widespread and mostly parthenogenetic species distributed from the Atlantic Islands across Europe and the Mediterranean eastwards to Turkey and Cyprus (Schülke and Smetana 2015). Captured with pitfall traps.

- *Pissodes castaneus* (De Geer, 1775) (new for Terceira island). Previously recorded on four islands (Faial, Pico, S. Miguel and S. Maria). The small banded pine weevil is a cosmopolitan species commonly associated with pines, the larval stage having some impact on adult trees. This species is considered invasive (Pestaña and Santolamazza-Carbone 2010) and is widespread on all Macaronesian islands (Stüben 2018) where pines from Europe (e.g. *Pinus sylvestris*) were introduced. Captured with pitfall traps.

- *Sitona hispidulus* (Fabricius, 1777) (new for the Azores). Known as Clover Root Curculio, this species is native to and widespread throughout Eurasia, but also introduced in North America (Quinn and Hower 1986). Captured with pitfall traps. This species has a short-winged and a long-winged form and prefers stands of *Trifolium* (especially *T. repens*) on damp and relatively dry localities and with a minor preference also for *Medicago* and *Vicia*. It seems to have just arrived into the Azores, otherwise this *Sitona* species could/should have been found even before.

- *Tachyura diabrachys* (Kolenati, 1845) (new for Terceira island). Previously recorded on a single island (S. Maria). This is a west European species. Captured with pitfall traps, this is a species usually associated with damp areas.

- *Trichiusa immigrata* Lohse, 1984 (new for the Azores; Note: there is a mention of this species in the latest edition of the Palaeartic Catalogue, but we have no idea who published the primary record). Originally from North America, this adventive rove-beetle species was first recorded from Central Europe by Lohse (1984) and is now widespread and common in the West Palaeartic region from the Atlantic Islands eastwards to Russia and Ukraine. It is usually found in decomposing plant material and in the leaf litter (Moore 2004). The material from the Azores was found in grassland.

- *Tychius cuprifer* (Panzer, 1799) (new for Terceira island). Previously recorded on a single island (S. Miguel). It is also reported from Madeira in 2015 for the first time, collected in multifunnel traps (Stüben 2018). It is most probably introduced with Fabaceae (forage). *T. cuprifer* is a xerothermophilous species from South Europe and North Africa (uninterruptedly until Turkmenistan) and develops mainly on *Trifolium arvense* (it is also called *T. pratense* and *T. stellatum* (CURCULIO_Team 2010).
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Author contributions

PB and EN conceived the project. PB conceived and drafted the manuscript. PB, RG, CMMP and MRB collected the data. PB, ARMS, LCFC, VA, PS, SF and AOS identified the species. EM and PB organised the final database. All the authors revised the final text.

References

• Anonymous (2018a) Eumodicogryllus bordigalensis (Latreille, 1804). http://www.pyrgus.de/Eumodicogryllus_bordigalensis_en.html. Accessed on: 2018-5-19.
• Anonymous (2018b) Platycleis sabulosa Azam, 1901. http://www.pyrgus.de/Platycleis_sabulosa_en.html. Accessed on: 2018-5-19.
• Anonymous (2018c) Nemobius sylvestris (Bosc, 1792). http://www.pyrgus.de/Nemobius_sylvestris_en.htm. Accessed on: 2018-5-19.
• Borges PAV (1995) Seasonal activity of a ground-beetle (Coleoptera: Carabidae) assemblage in a remnant of a salty-lake from Terceira (Azores). Elytron 9: 65-75. URL: https://repositorio.uac.pt/bitstream/10400.3/1856/1/4_Borges_Elytron_1995.pdf
• Borges PAV, Costa A, Cunha R, Gabriel R, Gonçalves V, Martins AF, Melo I, Parente M, Raposeiro P, Rodrigues P, Santos RS, Silva L, Vieira P, Vieira V (Eds) (2010) A list of the terrestrial and marine biota from the Azores. 1st. Príncípio, Cascais, 432 pp. URL: http://www.azoresbioportal.angra.uac.pt/ [ISBN 978-989-8131-75-1]
• Borges PAV, Reut M, Ponte NB, Quartau JA, Fletcher M, Sousa AB, Pollet M, Soares AQ, Marcelino J, Rego C, Cardoso P (2013) New records of exotic spiders and insects to the Azores, and new data on recently introduced species. Arquipelago - Life and Marine Sciences 30: 57-70. URL: http://www.cerambyx.uochb.cz/assets/pdf/borges_et_al_2013_introduced_azores.pdf
• Borges PAV, Pimentel C, Brito MR, Borda-de-Água L, Gabriel R (2017) Arthropod diversity patterns in three coastal marshes in Terceira Island (Azores). Arquipelago - Life and Marine Sciences 34: 61-84. URL: http://ce3c.ciencias.ulisboa.pt/fotos/publicacoes/1509647205.pdf
• Borges PAV, Lamelas-López L (2018) Drouetius oceanicus Machado, 2009. http://www.maisg.com/specie/Drouetius_oceanicus. Accessed on: 2018-5-19.
• Cardoso P (2009) Standardization and optimization of arthropod inventories—the case of Iberian spiders. Biodiversity and Conservation 18 (14): 3949-3962. https://doi.org/10.1007/s10531-009-9690-7

• Cardoso P, Erwin TL, Borges P, New T (2011) The seven impediments in invertebrate conservation and how to overcome them. Biological Conservation 144 (11): 2647-2655. https://doi.org/10.1016/j.biocon.2011.07.024

• CURCULIO_Team (2010) Digital-Weevil-Determination for Curculionoidea of West Palaearctic. Transalpina: Tychius (Curculioninae: Tychiini). SNUDEBILLER, Studies on taxonomy, biology and ecology of Curculionoidea 11 (149): 27-39. URL: www.curci.de

• Elias RB, Gil A, Silva L, Fernández-Palacios JM, Azevedo EB, Reis F (2016) Natural zonal vegetation of the Azores Islands: characterization and potential distribution. Phytocoenologia 46 (2): 107-123. https://doi.org/10.1127/phyto/2016/0132

• Gaspar C, Gaston KJ, Borges PAV, Cardoso P (2011) Selection of priority areas for arthropod conservation in the Azores archipelago. Journal of Insect Conservation 15 (5): 671-684. https://doi.org/10.1007/s10841-010-9365-4

• Hochkirch A, Borges PAV (2016) Conocephalus chavesi. IUCN Red List of Threatened Species https://doi.org/10.2305/iucn.uk.2016-3.rlts.t68279966a72323178.en

• Kime RD (2004) The Belgian millipede fauna (Diplopoda). Bulletin de l’Institut Royal des Sciences Naturelles de Belgique, Entomologie 74: 35-68. URL: bibliov.naturalsciences.be/rbins-publications/bulletins-de-l'institut-royal-des-sciences-naturelles-de-belgique-entomologie/bulletin-of-the-royal-belgian-institute-of-natural-sciences-entomology/74-2004/entomo-74-2004_35-68.pdf

• Lohse G (1984) Tichiusa immigrata n. sp., eine neue Adventivart aus Mitteleuropa. Entomologische Blätter 80 (2-3): 163-165.

• Moore R (2004) Trichiura immigrata Lohse (Staphylinidae) new to Scotland. The Coleopterist 13 (1): 34-34.

• Morton B, Britton JC, Frias Martins AMd (1997) The former marsh at Paul, Praia da Vitória, and the case for the development of a new wetland by rehabilitation of the quarry at Cabo da Praia. Açoreana 8 (3): 285-307. URL: www.cmpv.pt/minisites/life/ficheiros/Morton+Britton+Martins%201997.pdf

• Oliver I, Beattie AJ (1993) A possible method for the rapid assessment of biodiversity. Conservation Biology 7 (3): 562-568. https://doi.org/10.1046/j.1523-1739.1993.07030562.x

• Pestaña M, Santolamazza-Carbone S (2010) Mutual benefit interactions between banded pine weevil Pissodes castaneus and blue-stain fungus Leptographium serpens in maritime pine. Agricultural and Forest Entomology 12 (4): 371-379. https://doi.org/10.1111/j.1365-2311.1986.tb00318.x

• Quinn MA, Hower AA (1986) Effects of root nodules and taproots on survival and abundance of Sitona hispidulus (Coleoptera: Curculionidae) on Medicago sativa. Ecological Entomology 11 (4): 391-400. https://doi.org/10.1111/j.1365-2311.1986.tb00318.x

• Robinson W (2005) Urban insects and arachnids: a handbook of urban entomology. Cambridge University Press, Cambridge, 472 pp. [ISBN 0-521-81253-4]

• Schülke M, Smetana A (2015) Staphylinidae. In: Löbl I, Löbl D (Eds) Catalogue of Palaearctic Coleoptera. New, updated Edition. 2. 2. Brill, Leiden, 304–1134 pp.

• Small MC, Blenzar A, Fursch H (2009) First record of new species and phenotypes of ladybird (Coleoptera: Coccinellidae) in citrus orchards in Morocco. Entomologie
Supplementary material

Suppl. material 1: LIFE_CWR_TER_Arthropods doi

Authors: Borges, PAV et al.
Data type: Occurrences and abundances
Brief description: In this contribution, we present detailed data on the distribution and abundance of species belonging to several groups of arthropods in three Terceira Island (Azores) wetlands during two years (2016-2017).
Filename: LIFE_CWR_TER_Arthropods.XLSX - Download file (527.32 kb)