

Research article

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Diptera communities from Ria de Aveiro saltmarshes, with new records for Portugal

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Abstract

Ria de Aveiro coastal lagoon is a socio-ecological system comprising a rich landscape mosaic of beaches, dunes, sandflats, mudflats, sea-grasses, and small water channels. The lagoon is one of the largest saltmarsh areas in Portugal and Europe, supporting coastal food webs and serving as a nursery area for several species. Because of these features, Ria de Aveiro is a Long-Term Socio-Ecological Research platform (LTSER) site and integrates the Natura 2000 network. Despite this, only recently has research been conducted regarding its entomofauna. In this study, field collections were carried out in seven locations along Ria de Aveiro saltmarshes areas by sweep-netting the dominant halophyte vegetation in September 2020. A total of 222 Diptera specimens from 13 families (Asteiidae, Canacidae, Chamaemyiidae, Chyromyidae, Hybotidae, Lauxaniidae, Milichiidae, Scathophagidae, Sciomyzidae, Sepsidae, Sphaeroceridae, Therevidae and Ulidiidae), belonging to 19 genera and 23 species, are presented in this paper. From these, 1 genus and 4 species are new records for Portuguese territory. Sphaeroceridae was the most species-rich family, with *Rachispoda fuscipennis* being the most abundant species recorded. This study provides a snapshot into coastal insect communities in Portuguese coastal lagoons and highlights the need to continue to access insect biodiversity in these coastal areas, which are threatened mostly by sea-level rise, coastal squeeze, and saline intrusion.

Key words: Coastal insects, Diptera, Brachycera, coastal biodiversity, saltmarshes, wetlands, faunistics.

Introduction

Ria de Aveiro is a coastal lagoon located on the north-west coast of Portugal. The lagoon is connected to the Atlantic Ocean through a single inlet and is approximately 45 km long by 10 km wide, covering an area of up to 83 km² of wetlands during high tide (Lillebø et al. 2015). Ria de Aveiro provides a heterogeneous network of habitats with high biological diversity, encompassing one of the largest contiguous saltmarsh areas in Portugal and Europe. Ria de Aveiro is a Long-Term Socio-Ecological Research platform (LTSER) and part of the Natura 2000 Network with two Special Protection Areas (the lagoon area and the adjacent marine area). However, the research regarding entomofauna in Ria de Aveiro ecotones is very recent, starting in 2016 (Olga Ameixa unpublished data). Over this period, 12 new faunistic records were disclosed for Portugal (Lourenço et al. 2020, 2023; Prado e Castro et al. 2022; Santos et al. 2023) and 3 for the Iberian Peninsula (Prado e Castro et al. 2022). Over these field campaigns, it

was possible to observe that Diptera was one of the most conspicuous taxonomic groups in Ria de Aveiro, but this area also provides habitat for more cryptic species, such as the mirid bug *Teratocoris antennatus* (Boheman, 1852) (Santos et al. 2023).

The aim of this work was to add new records for this area, contributing to the overall biodiversity knowledge of coastal entomofauna communities in Portugal.

Material and Methods

Field insect collections were carried out on the 7th and 10th of September 2020 in 7 selected sites along the Ria de Aveiro, Portugal (40°37'59.99" N, -8°38'59.99" W, see Fig. 1). Since most of these sites are under a tidal regime, the collections were carried out during low tide.

Insects were collected by sweep-netting the dominant halophyte vegetation: *Halimione portulacoides* L., *Juncus maritimus* L., *Limonium vulgare* Mill., *Spartina*

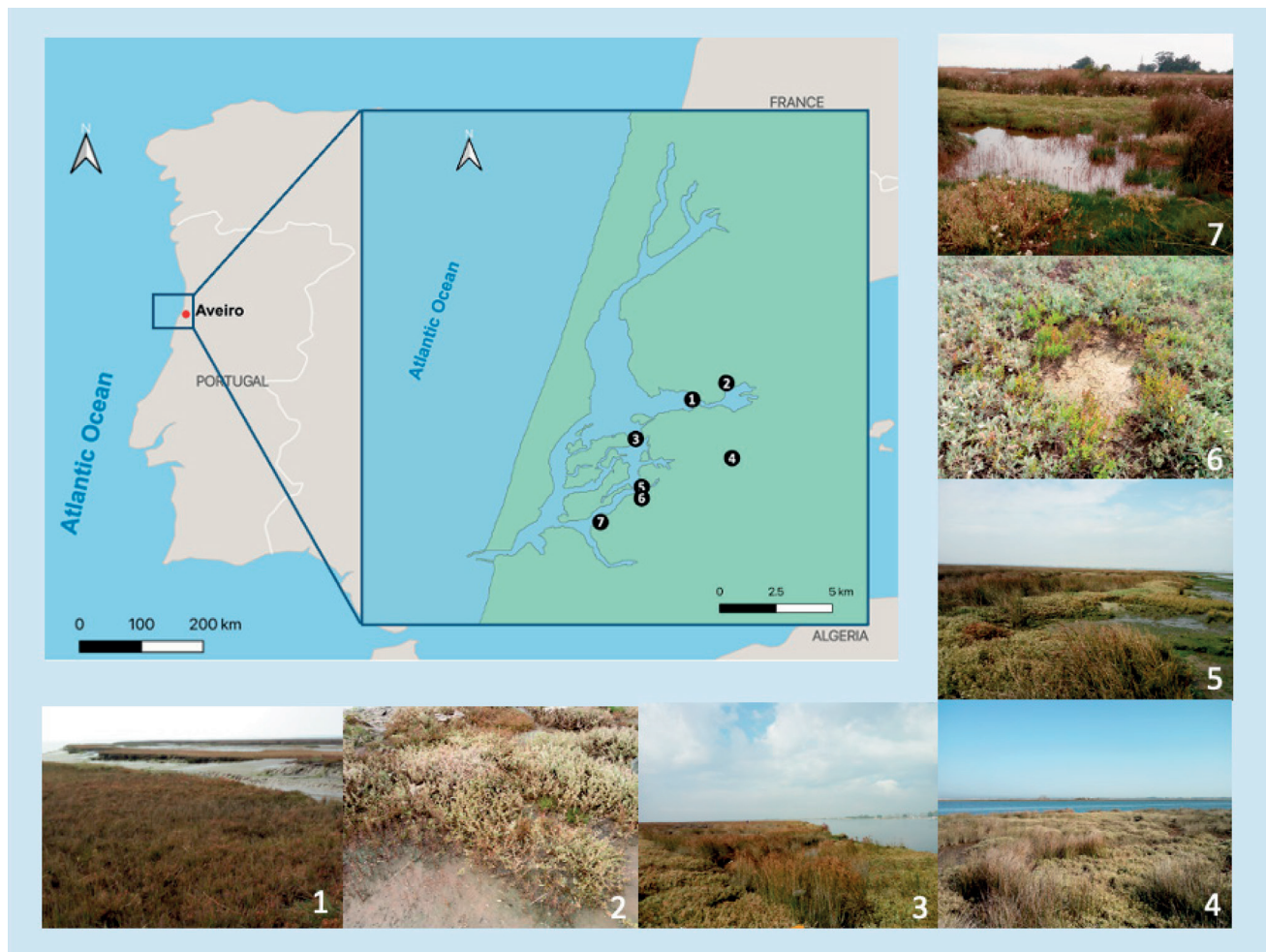


Fig. 1 – Sampling area location; sampled sites: **1**, Foz do Rio Novo, dominated by *Spartina maritima*; **2**, Salinas, dominated by *Halimione portulacoides*, *Juncus maritimus*, *Sarcocornia perennis* and *Phragmites australis*; **3**, Bico, dominated by *H. portulacoides* and *J. maritimus*; **4**, Reboxo, dominated by *H. portulacoides*, *S. perennis*, *S. maritima* and *Limonium vulgare*; **5**, Monte Farinha, dominated by *J. maritimus* and *H. portulacoides*; **6**, Cambeia, dominated by *H. portulacoides*, *Salicornia ramosissima* and *Tamarix africana*; **7**, Cacia, dominated by *J. maritimus*, *H. portulacoides* and *Aster tripolium* subsp. *pannonicus*.

maritima (Curtis) Fernald., *Spartina patens* (Aiton) Muhl, *Aster tripolium* subsp. *pannonicus* (Jacq.) Soó and *Tamarix africana* Poir. For each dominating plant, we collected three replicates of 100 sweeps each (300 sweeps/plant). The content of the sweep-net was collected with the help of an insect aspirator and placed into plastic flasks. The flasks were labelled with the location, name of the host plant, date, and number of replicate. Since this sampling was carried out by boat, in order to preserve the insects, the samples were placed in a thermal container at -4°C and transported to the laboratory, where the collected specimens were preserved in a fridge at -20°C until identification. The dipteran specimens were later sorted and sent to M. Carles-Tolrà for species identification. They are currently preserved in ethanol (70%) and deposited in the entomological collection of the Departamento de Biologia da Universidade de Aveiro (Aveiro, Portugal) and in the private collection of MC-T.

Results

A total of 222 Diptera specimens from 19 genera and 23 species are presented in this study. Below, we provide a list of families and recorded species with information regarding the site of collection, host plant, number of individuals, and sex.

ASTEIIDAE

Asteia amoena Meigen, 1830

Cacia, *Juncus maritimus* 1♂.

Previous Portuguese records: Évora. New species for the Aveiro district.

Asteia inanis Lyneborg, 1969

Bico, *Spartina maritima* 2♂ 4♀. Monte Farinha, *Limonium vulgare* 2♂ 1♀. Salinas, *Halimione portulacoides* 1♂.

New species for Portugal.

CANACIDAE

Xanthocanace ranula (Loew, 1874)

Reboxo, *Limonium vulgare* 1♀, *Spartina maritima* 3♀.

Previous Portuguese records: Leiria. New species for the Aveiro district.

CHAMAEMYIIDAE

Chamaemyia juncorum (Fallén, 1823)

Reboxo, *Halimione portucaloides* 1♀, *Limonium vulgare* 1♀.

Previous Portuguese records: Guarda. New species for the Aveiro district.

CHYROMYIDAE

Aphaniosoma melitensis Ebejer, 1993

Cacia, *Juncus maritimus* 1♂ 2♀. Cambeia, *Juncus maritimus* 1♂ 1♀. Salinas, *Juncus maritimus* 1♂.

Previous Portuguese records: Porto. New species for the Aveiro district.

HYBOTIDAE

Crossopalpus aeneus (Walker, 1871)

Cambeia, *Halimione portucaloides* 1♂.

New genus and species for mainland Portugal.

Platypalpus sp.

Cambeia, *Spartina patens* 1♀.

LAUXANIIDAE

Minettia fasciata (Fallén, 1826)

Cambeia, *Juncus maritimus* 1♀, *Tamarix africana* 2♂.

Salinas, *Spartina patens* 1♀.

MILICHIIDAE

Desmometopa m-nigrum (Zetterstedt, 1848)

Cambeia, *Tamarix africana* 1♂.

New species for the Aveiro district.

SCATHOPHAGIDAE

Ceratinostoma ostiorum (Haliday in Curtis, 1832)

Foz do Rio Novo, *Juncus maritimus* 1♀. Reboxo, *Spartina maritima* 2♂ 4♀.

Previous Portuguese records: Viana do Castelo. New species for the Aveiro district.

Scathophaga litorea (Fallén, 1819)

Bico, *Halimione portucaloides* 2♀. Foz do Rio Novo, *Halimione portucaloides* 2♀. Reboxo, *Halimione portucaloides* 1♂ 2♀, *Limonium vulgare* 1♂, *Spartina maritima* 6♂ 3♀. Monte Farinha, *Halimione portucaloides* 4♀, *Juncus maritimus* 1♂ 2♀. Salinas, *Juncus maritimus* 1♂.

SCIOMYZIDAE

Pherbina mediterranea Mayer, 1953

Cambeia, *Juncus maritimus* 1♂ 4♀.

SEPSIDAE

Sepsis fulgens Meigen, 1826

Cambeia, *Tamarix africana* 1♂ 1♀.

New species for the Aveiro district.

Sepsis thoracica (Robineau-Desvoidy, 1830)

Cambeia, *Tamarix africana* 2♂.

New species for the Aveiro district.

SPHAEROCERIDAE

Coproica ferruginata (Stenhammar, 1854)

Cambeia, *Halimione portucaloides* 2♂ 1♀, *Juncus maritimus* 2♀, *Spartina patens* 1♀, *Tamarix africana* 4♂ 2♀.

New species for the Aveiro district.

Coproica vagans (Haliday, 1833)

Cambeia, *Halimione portucaloides* 1♀.

New species for the Aveiro district.

Leptocera nigra Olivier, 1813

Cacia, *Halimione portucaloides* 1♂.

New species for the Aveiro district.

Pullimosina heteroneura (Haliday, 1836)

Cacia, *Halimione portucaloides* 1♀.

New species for the Aveiro district.

Rachispoda fuscipennis (Haliday, 1833)

Bico, *Halimione portucaloides* 3♀. Cacia, *Halimione portucaloides* 1♂, *Juncus maritimus* 1♂. Foz do Rio Novo, *Halimione portucaloides* 1♂ 2♀. Monte Farinha, *Halimione portucaloides* 4♂ 7♀. Reboxo, *Halimione portucaloides* 6♂ 5♀, *Limonium vulgare* 17♂ 23♀, *Spartina maritima* 5♂ 8♀. Salinas, *Halimione portucaloides* 3♂.

New species for the Aveiro district.

Rachispoda longior Roháček, 1991

Bico, *Halimione portucaloides* 1♀, *Spartina maritima* 1♂.

Cacia, *Aster tripolium* 1♂ 2♀, *Halimione portucaloides* 6♂ 4♀, *Juncus maritimus* 5♂ 3♀. Cambeia, *Juncus maritimus* 3♂ 5♀.

New species for Portugal.

THEREVIDAE

Thereva spilopectera Wiedemann, 1824

Cambeia, *Tamarix africana* 1♂.

New species for the Aveiro district.

ULIDIIDAE

Ceroxys urticae (Linnaeus, 1758)

Bico, *Juncus maritimus* 1♂. Cacia, *Aster tripolium* 2♂ 2♀, *Halimione portucaloides* 4♂ 4♀, *Juncus maritimus* 2♂ 1♀. Cambeia, *Tamarix africana* 1♀.

New species for Portugal.

Physiphora alceae (Preysslner, 1791)
Cambeia, *Tamarix africana* 1♀.
New species for the Aveiro district.

Discussion

Coastal areas are under threat mostly due to sea level rise, increased soil salinization, pollution, but also due to coastal squeeze (Ameixa & Sousa 2020). In Ria de Aveiro, loss of habitats, mostly due to saline intrusion and an increase in submergence periods, can lead to changes in plant communities and the associated organisms, including insects.

In this work, we report a new genus (*Crossopalpus* Bigot, 1857) and four new species (*Asteia inanis*, *Ceroxys urticae*, *Crossopalpus aeneus* and *Rachispoda longior*) for Portuguese territory.

Sphaeroceridae was the most species-rich family, with *Rachispoda fuscipennis* being the most abundant species recorded, and one which was recorded in six of the seven sampled sites. From all the 23 species identified, only two species, *Scathophaga litorea* (collected in five sites) and *Xanthocanace ranula* (collected in one site), are strictly associated with coastal areas.

From all the seven sampled sites, Monte Farinha and Foz do Rio Novo were the least prolific regarding the number of species captured, with only three species being collected at each. On the contrary, seven species were found in Cacia and fourteen in Cambeia. This is most likely because Cacia and Cambeia are less exposed to tidal regimes with more terrestrial features in comparison with Monte Farinha and Foz do Rio Novo which are completely covered during spring tides.

Plant zonation, a typical saltmarsh feature, determines plant cover and is responsible for different plant species dominating different sites, for instance, *Aster tripolium* was present in just one site, while *Juncus maritimus* could be found in all sampled sites. It is noteworthy the presence of the invasive plant species *Spartina patens* in Cambeia, where only two fly species were recorded. The species *Aphaniosoma meltensis* is worth mentioning, as it has been collected only on *Juncus maritimus* in three different habitats (Cacia, Cambeia and Salinas).

In December 2022, governments from around the world came together at the United Nations Biodiversity Conference (COP15) to agree on a new set of goals to guide global action through 2030 to halt and reverse nature loss.

However, less attention was given to the fact that there are still several knowledge gaps regarding extant species and their current distribution.

Due to their diversity and abundance, insects perform essential ecological functions in ecosystems and even have potential biotechnological uses (Duarte et al. 2021; Ameixa et al. 2022). Further, they can be

employed as bioindicators of ecological changes since they are sensitive to habitat disturbances (Ameixa et al. 2018), which helps to track ongoing environmental changes in coastal areas.

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References

- Ameixa O.M.C.C., Soares A.M.V.M., Soares A.O., Lillebø A.I. 2018. Ecosystem services provided by the little things that run the world. In: Selected Studies in Biodiversity. Bülent Şen and Oscar Grillo [Eds]. InTech Open. ISBN 978-953-51-5442-6.
- Ameixa O.M.C.C., Sousa A.I. 2020. Saltmarshes: Ecology, Opportunities, and Challenges”. In Encyclopedia of the UN Sustainable Development Goals, edited by Walter Leal Filho; Anabela Marisa Azul; Luciana Brandli; Amanda Lange Salvia; Tony Wall, 1–15. Springer International Publishing. Doi: https://doi.org/10.1007/978-3-319-71064-8_79-1
- Ameixa O.M.C.C., Rebelo J., Silva H., Pinto D. 2022. Gall midge *Baldratia salicorniae* Kieffer (Diptera: Cecidomyiidae) infestation on *Salicornia europaea* L. induces the production of specialized metabolites with biotechnological potential. Phytochemistry, 113207. Doi: <https://doi.org/10.1016/j.phytochem.2022.113207>.
- Duarte P., Maciel E., Pinho M., Domingues R., Calado R., Lillebø A.I., Ameixa O.M.C.C. 2021. Omega-3 on the fly: long-legged fly *Machaerium maritimae* as a potential source of eicosapentaenoic acid for aquafeeds. Journal of Insects as Food and Feed, Doi: <https://doi.org/10.3920/JIFF2020.0112>.
- Lillebø A.I., Ameixa O.M.C.C., Sousa L.P., Sousa A.I., Soares J.A., Dolbeth M., Alves F.L. 2015. The physio-geographical background and the ecology of Ria de Aveiro (chapter 3), pp. 21–29. In: Lillebø A.I., Stålnacke P., Gooch G.D. (eds), Coastal Lagoons in Europe: Integrated Water Resource Strategies. IWA Publishing, London. Doi: <https://doi.org/10.2166/9781780406299>
- Lourenço F., Prado e Castro C., Ameixa O.M.C.C. 2020. First record of *Fucellia maritima* (Haliday, 1838) (Diptera, Anthomyiidae) populations in Portugal. Norwegian Journal of Entomology, 67: 246–248. Doi: <http://www.entomologi.no/journals/nje/2020-2/pdf/nje-vol67-no2-2020-246-248-lourenco.pdf>.
- Lourenço F., Prado e Castro C., Ameixa O.M.C.C. 2023. First record of *Malacomyia sciomyzina* (Haliday, 1833) (Diptera,

Coelopidae) in continental Portugal, with notes on its life cycle. *Graellsia*, 79 (1): e192. Doi: <https://doi.org/10.3989/graellsia.2023.v79.366>

Prado e Castro C., Santos V., Ameixa O.M.C.C. 2022. Shore fly communities from Ria de Aveiro, with new records for Portugal (Diptera: Ephydriidae). *Fragmenta entomologica*, 54(1), 95–100. Doi: <https://doi.org/10.13133/2284-4880/715>.

Santos V., Dioli P., Prado e Castro C., Ameixa O.M.C.C. 2023. The rare saltmarsh bug *Teratocoris antennatus* (Boheman, 1852) (Hemiptera, Miridae), new species for Portugal. *Graellsia*, 79(1): e185. Doi: <https://doi.org/10.3989/graellsia.2023.v79.369>.

