Aquatic macrofauna of Vila Nova de Milfontes temporary ponds, with the first record of *Cyphon hilaris* Nyholm, 1944 (Coleoptera: Scirtidae) from Portugal

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Abstract: The aquatic community of 12 temporary ponds located in Vila Nova de Milfontes (south-western Portugal) was sampled in April 2013. We identified a total of 78 taxa, of which insects were the best represented group (59 taxa), with 29 coleopterous taxa, 11 heteropterous taxa and 5 odonate taxa, among others. Worthy of note is the first record of *Cyphon hilaris* Nyholm, 1944 from Portugal.
Key words: Coleoptera, Scirtidae, macroinvertebrates, amphibians, checklist, Mediterranean wetlands, Portugal.

Biodiversidad de la macrofauna acuática de las lagunas temporales de Vila Nova de Milfontes, con la primera cita de *Cyphon hilaris* Nyholm, 1944 (Coleoptera: Scirtidae) para Portugal
Resumen: Se ha estudiado la comunidad acuática de 12 lagunas temporales localizadas en Vila Nova de Milfontes (suroeste de Portugal), muestreadas en abril de 2013. Se identificaron un total de 78 taxones, siendo el grupo de los insectos (59 taxones) el que tuvo mayor representación, incluyendo 29 taxones de coleópteros, 11 de heterópteros, y 5 de odonatos, entre otros. Cabe destacar la primera cita de *Cyphon hilaris* Nyholm, 1944 de Portugal.
Palabras clave: Coleoptera, Scirtidae, macroinvertebrados, anfibios, lista faunística, humedales mediterráneos, Portugal.

Temporary ponds are, in general, small and shallow water bodies, easily overlooked in the landscape, and vulnerable to various human activities (Cancela da Fonseca *et al*., 2008). They are a biologically important habitat type, renowned both for their specialised assemblages and the considerable numbers of rare and endemic species they support (Giudicelli & Thiéry, 1998; Quézel, 1998; Williams *et al*., 2001; Zacharias & Zamparas, 2010). Mediterranean temporary ponds are protected under the Habitats Directive 92/43/CEE, although management plans concerning these special and fragile habitats are still rare, particularly because the state of knowledge is still insufficient to establish management procedures (Grillas & Roché, 1997; Cancela da Fonseca *et al*., 2008). Nevertheless, some LIFE projects have already been carried out in some Mediterranean regions like Provence and Corsica in France, or Minorca and Valencia in Spain (Grillas *et al*., 2004; Fraga *et al*., 2010; Sancho & Lacomba, 2010).

The SW of Portugal is a key area for temporary ponds, with a high density of these habitats (Machado *et al*., 1999; Beja & Alcazar, 2003; Canha & Pinto-Cruz, 2010; Caramujo & Boavida, 2010). The importance of these ponds derives from the presence of some vulnerable species of flora and fauna, for example, *Juncus emmanuelis* A. Fern. & J.G. García, *Hyacinthoides vicentina* (Hoffmanns & Link) Rothm., *Dussartius baeticus* (Dussart, 1967), *Acilius duvergeri* Dettner, 1982 (Bergsten & Miller, 2006; Canha & Pinto-Cruz, 2010). For this reason, these ponds are considered to have a high conservation value for aquatic assemblages such as plants, coleopterans or amphibians (Ribera, 2000; Beja & Alcazar, 2003; Pinto-Cruz *et al*., 2009). In addition, the amphibian species are included in conservation international agreements, such as the Convention on the Conservation of European Wildlife and Natural Habitats (known as Berne Convention, 19-IX-1979). Although a large number of these temporary ponds are included in the Southwest Alentejo and Vicentine Coast Natural Park (PNSACV), the degradation and loss of these habitats is a matter of great concern (Canha & Pinto-Cruz, 2010). It is important to note that some of these habitats have been included in a conservation European project that will be developed during the next years: "LIFE Charcos. Conservation of Temporary Ponds in the Southwest Coast of Portugal" (LIFE12 NAT/PT/000997). Due to its high conservation value, many studies on flora (Pinto-Cruz *et al*., 2009; 2011) and fauna have already been conducted in this area. Regarding the fauna, different groups of the aquatic community of the ponds have previously been studied. These works were mainly focused on amphibians (Beja & Alcazar, 2003), aquatic insects (Chaves, 1999), copepods and cladocerans (Caramujo & Boavida, 2010), large branchiopods (Machado *et al*., 1999) and ostracods (Martins *et al*., 2010). Nevertheless, we have not found a comprehensive study of all the aquatic macrofauna community of this site. Thus, this work aims to present the first description of the aquatic macrofauna communities of these Mediterranean temporary ponds.

The survey was carried out between 22nd and 23rd April 2013 in twelve temporary ponds located near the village of Vila Nova de Milfontes (37°45' N 8°48' W), within the Southwest Alentejo and Vicentine Coast Natural Park in Portugal. They are situated on a coastal sandy plateau protected by consolidated dunes on the west, and by a wooded area to the east (Caramujo & Boavida, 2010). This is a set of ponds of different sizes, shapes and depths which in turn, show variations of these features individually throughout the year (Chaves, 1999). The climate is Mediterranean with oceanic influence. The soil is highly permeable and ponds fill mainly with rain water (Caramujo & Boavida, 2010). Each pond was sampled only once. Macrofauna samples were taken using a dip net with a diameter of 22 cm and a mesh size of 250 µm. The sampling procedure was based on 20 dip-net sweeps in rapid sequence spanning all of the different mesohabitats. Samples were preserved *in situ* in ethanol 70°. Individuals were identified to species level whenever possible, except in the case of chironomids, which were identified to subfamily.

The macrofauna found in the studied area included 78 taxa, 59 of which were insects. Within the insects, Coleoptera, Diptera and Heteroptera were the best represented orders with 29, 12 and 11 taxa, respectively. Nevertheless, we should assume that Diptera richness was underestimated, because Chironomidae which is one of the richest families in temporary Mediterranean ponds (Bazzanti *et al*., 1997; Boix *et al*., 2001) were identified to a low taxonomic resolution. Odonata (five taxa) and Ephemeroptera (two taxa) were the insect orders less represented (Table I). It should also be highlighted the presence of six different species of amphibians despite the global population decline of this group (Houlahan *et al*., 2000). Each pond had a minimum of three amphibian species.

The aquatic insects of these ponds were previously studied by Chaves (1999) in a study during a nine month period when a large number of samples were collected. That study was focused on Coleoptera, reporting the presence of 9 families and 30 genera while in the present study we recorded 12 families and 28 genera. Taking into account only adult coleopterans, which can usually be identified to the species level, Chaves (1999) found 39 species while we only found 17. Although the ponds were sampled only in one occasion, it is interesting to note that some taxa were not recorded before, such as *Gyrinus caspius* Ménétries, 1832, *Gyrinus dejeani* Brullé, 1832, *Ilybius* sp., *Porhydrus* sp., *Liopterus atriceps* (Sharp, 1882), *Cybister tripunctatus africanus* Laporte, 1834, *Helophorus* cf. *lapponicus* Thomson, 1853,

Hydraena (Hydraena) sp., *Cyphon hilaris* Nyholm, 1944 and *Stenopelmus rufinasus* Gyllenhal, 1835. In addition, we found some soil indeterminate coleopterans of the subfamily Alleculinae that have also been found in other temporary ponds in northeastern Iberian Peninsula such as Espolla pond (Boix *et al*., 2000) and Albera temporary ponds (unpublished data).

The most significant finding of this study was the presence of the coleopteran species *Cyphon hilaris* Nyholm, 1944 (Family Scirtidae), for the first time recorded in Portugal. *C. hilaris* is mainly distributed along the Baltic and Atlantic coasts of Europe, from Finland to Spain (Hannappel & Paulus, 1997; Cuppen & Foster, 2005; Klausnitzer, 2009). The species has been previously found in the Iberian Peninsula in only two areas: Galicia and Doñana (Millán *et al*., 2005; Klausnitzer, 2009). It is common to find this species in acidic and mesotrophic environments, although it is not rare in reedbeds (Cuppen & Foster, 2005; Klausnitzer, 2009). The Scirtidae is one of the least known families of aquatic coleopterans in the Iberian Peninsula, and therefore the citations of this family in the region are particularly interesting (Ribera *et al*., 2009-10). In the Iberian Peninsula, the genus *Cyphon* Paykull, 1799 includes 13 species, with two of them, *C. padi* (Linnaeus, 1758) and *C. coarctatus* Paykull 1799, with unconfirmed presence (they are not recorded by Klausnitzer [2009], although they appear in the checklist by Ribera *et al*. [1998]).

It is also interesting to note the presence of several exotic species in these ponds. As it is already well-known, invasive non-indigenous species are one of the main threats to biodiversity (Mack *et al*., 2000; Clavero and García-Berthou, 2005) and temporary ponds are not exempt from this pressure (e.g., Gutiérrez-Yurrita *et al*., 1998; Margaritora *et al*., 2001), although in some cases the abiotic factors can attenuate the effects of the invasive species in these environments (Adams, 2000; Gerhardt & Collinge, 2007). In the present study, we found 4 non-indigenous species: *Physella acuta* Draparnaud, 1805, *Ferrissia* sp., *Trichocorixa verticalis verticalis* (Fieber, 1851) and *Stenopelmus rufinasus* Gyllenhal, 1835. Both *P. acuta* and *Ferrissia* sp. are gastropods from North America that have long been regarded as indigenous to continental Europe (García-Berthou *et al*., 2007; Marrone *et al*., 2011). In the case of the heteropteran *T. v. verticalis*, native to Atlantic coast of America (Sailer, 1948; Jansson, 2002), recent studies seem to confirm its establishment in Europe (Günther, 2004; Sala & Boix, 2005) and its continuing expansion (Rodríguez-Pérez *et al*., 2009; L'Mohdi *et al*., 2010; Carbonell *et al*., 2012; Guareschi *et al*., 2013). This citation from Vila Nova de Milfontes represents a geographically intermediate population between the known localities from the south (Doñana, Algarve; Millán et al., 2005; Sala & Boix, 2005) and the northern locality of Santarém (Kment, 2006). Regarding the coleopteran *S. rufinasus*, which has recently been cited from Portugal for the first time (Carrapiço *et al*., 2011), it has probably been introduced in Europe with the aquatic fern *Azolla filiculoides* Lamarck, from which it feeds. Janson (1921) suggested that immature stages of the beetle could be carried with its host plant attached to waterfowl, which can act as a dispersal vector. However, the association of the aquatic fern with the rice fields, together with its use as a green manure suggests that humans probably also play a role in its dispersal (Lumpkin & Plucknett, 1985; García-Murillo *et al*., 2007). Despite *S. rufinasus* has been found in the Iberian Peninsula associated with *A. filiculoides* (Fernández *et al*., 2005; Mor *et al*., 2010), in our study site *A. filiculoides* has not been detected. However, *A. filiculoides* has been cited in the nearby region of Odemira (Canha & Pinto-Cruz, 2010), even though some authors have collected *S. rufinasus* also from *Lemna* sp. (Carrapiço *et al*., 2011).

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Table I. Checklist of the aquatic macrofauna found in this study from Vila Nova de Milfontes (Portugal) with the pond codes and geographical coordinates. **B16** (37°45'34.8''N 8°47'39.1''W), **B23** (37°44'54.0''N 8°47''47.1''W), **B18** (37°45'14.6''N 8°47'33.8''W), **B9** (37°45'15.6''N 8°47'25.3''W), **B22** (37°44'53.5''N 8°47'53.3''W), **B14** (37°45'31.5''N 8°47'32.0''W), **B27** (37°45'21.0''N 8°47'54.5''W), **B26** (37°45'01.1''N 8°47'49.5''W), **B20** (37°45'02.6''N 8°47'40.8''W), **B12** (37°45'28.2''N 8°47'27.5''W), **B20bis** (37°44'54.0''N 8°47'34.7''W), **B17** (37°45'21.5''N 8°47'32.1''W).

	B16	B23	B18	B9	B22	B14	B27	B26	B20	B12	B20b	B17
Ph. Cnidaria												
Cl. Hydrozoa												
O. Anthomedusae												
F. Hydridae												
Hydra sp.	-	-	-	-	-	-	-	-	+	-	-	-
Ph. Platyhelminthes												
Cl. Turbellaria												
O. Neorhabdocoela												
Neorhabdocoela indet.	-	-	+	-	-	-	+	+	+	+	+	+
O. Tricladida												
F. Dugesiidae												
Dugesiidae indet.	-	-	-	+	-	-	+	-	+	+	-	+
Ph. Annelida												
Cl. Hirudinea												
O. Arhynchobdellida												
F. Erpobdellidae												
Dina lineata (OF Müller, 1774)	-	-	-	-	-	-	+	-	-	-	-	-
Cl. Oligochaeta												
O. Opisthopora												
F. Lumbricidae												
Eiseniella tetraedra (Savigny, 1826)	-	-	-	-	+	-	-	-	-	-	-	-
O. Tubificida												
F. Enchytraeidae												
Enchytraeidae indet.	+	+	-	+	-	+	+	+	+	+	+	+
F. Tubificidae												
Tubificidae indet.	-	-	+	-	-	-	-	-	-	-	-	-
Ph. Arthropoda												
Cl. Arachnida												
O. Prostigmata												
F. Pionidae												
Piona sp.	-	-	-	+	+	-	+	-	+	-	-	+
Tiphyinae indet.	+	-	-	+	-	+	+	-	-	+	-	+

Table I (cont.)

	B16	B23	B18	B9	B22	B14	B27	B26	B20	B12	B20b	B17
Cl. Insecta												
O. Odonata												
F. Aeshnidae												
Aeshna mixta Latreille, 1805	-	-	-	-	+	-	+	-	+	-	-	-
F. Coenagrionidae												
Coenagrionidae indet.	+	-	-	-	-	-	-	-	-	-	-	-
F. Lestidae												
Lestes sp.	-	-	-	+	-	-	-	-	-	-	-	-
F. Libellulidae												
Sympetrum fonscolombii (Sélys, 1840)	-	+	+	+	+	-	+	+	+	+	+	+
Sympetrum striolatum (Charpentier, 1840)	+	-	-	+	-	-	+	-	-	+	+	+
O. Ephemeroptera												
F. Baetidae												
Cloeon gr. *dipterum*	+	-	-	+	+	+	+	+	+	+	-	+
Cloeon schoenemundi Bengtsson, 1936	-	+	-	-	-	-	-	-	-	-	-	-
O. Heteroptera												
F. Corixidae												
Corixa afinis Leach, 1817	-	-	-	+	-	+	+	+	-	-	-	-
Hesperocorixa linnaei (Fieber, 1848)	-	-	-	-	-	-	-	-	+	-	-	-
Sigara lateralis (Leach, 1817)	-	-	-	-	-	-	-	-	-	-	-	+
Sigara nigrolineata (Fieber, 1848)	-	+	-	-	-	-	-	-	-	-	-	-
Sigara cf. *scotti* (Douglas & Scott, 1868)	-	-	-	-	-	-	-	-	-	+	-	-
Trichocorixa verticalis verticalis (Fieber, 1851)	-	-	-	-	-	+	-	-	-	-	-	-
F. Gerridae												
Gerris thoracicus Schummel, 1832	+	+	-	+	+	+	+	+	-	+	+	+
F. Notonectidae												
Anisops sardeus Herrich-Schäffer, 1849	+	-	+	+	+	+	+	-	-	+	-	+
Notonecta glauca Linnaeus, 1758	-	+	-	-	-	+	-	-	-	-	-	-
Notonecta meridionalis Poisson, 1926	+	+	+	+	+	+	-	+	+	-	+	-
F. Pleidae												
Plea minutissima Leach, 1817	-	-	-	+	-	+	+	-	-	-	-	-
O. Coleoptera												
F. Dryopidae												
Dryops doderoi Bollow, 1936	-	-	-	-	-	-	+	-	-	-	-	-
F. Dytiscidae												
Agabus sp. (larva)	+	-	+	-	-	+	-	-	-	-	+	+
Bidessus goudoti (Laporte, 1834)	-	+	-	+	-	-	-	+	-	+	+	+
Cybister tripunctatus africanus Laporte, 1834	-	-	-	-	-	-	+	-	-	-	-	-
Graptodytes flavipes (Olivier, 1795)	+	-	+	+	-	+	-	-	-	+	-	-
Hydroporus tessellatus (Drapiez, 1819)	+	-	+	+	-	-	-	+	+	+	-	-
Hydrovatus cuspidatus Kunze, 1818	-	-	-	+	+	-	+	-	+	+	+	-
Hygrotus inaequalis (Fabricius, 1776)	+	-	-	-	-	-	-	-	-	-	-	-
Hyphydrus sp. (larva)	+	+	-	+	+	-	+	-	+	-	+	+
Ilybius sp. (larva)	-	+	+	-	-	-	-	-	-	-	-	-
Laccophilus sp. (larva)	+	+	+	+	+	+	+	+	+	-	+	+
Liopterus atriceps (Sharp, 1882)	+	-	+	+	+	-	-	+	+	+	+	+
Porhydrus sp. (larva)	+	-	-	+	+	-	+	-	+	+	+	+
Rhantus sp. (larva)	+	-	+	-	-	+	-	-	-	-	+	-
F. Erirhinidae												
Stenopelmus rufinasus Gyllenhal, 1835	+	-	-	-	-	-	-	-	-	+	-	-
F. Gyrinidae												
Gyrinus caspius Ménétries, 1832	-	-	-	-	+	-	+	-	+	-	-	-
Gyrinus dejeani Brullé, 1832	-	-	-	-	+	-	+	-	+	-	-	-
F. Haliplidae												
Haliplus sp. (larva)	-	-	-	-	-	-	-	-	-	+	-	-
F. Helophoridae												
Helophorus cf. *lapponicus* Thomson, 1853	-	+	-	-	-	-	-	-	-	-	+	-
F. Hydraenidae												
Hydraena (*Hydraena*) sp.	-	-	-	+	+	-	-	-	-	-	-	-
F. Hydrophilidae												
Anacaena lutescens (Stephens, 1829)	-	-	-	-	-	+	-	-	-	-	-	-
Berosus sp. (larva)	+	+	-	+	+	-	+	-	+	+	+	+
Enochrus sp. (larva)	+	+	-	-	+	-	-	+	-	-	-	-
Helochares sp. (larva)	-	-	-	+	-	-	-	-	-	-	-	-
Hydrobius sp. (larva)	+	+	+	+	+	+	+	+	+	-	+	-
F. Hygrobiidae												
Hygrobia hermanni (Fabricius, 1775)	-	+	-	-	-	-	+	+	-	+	-	+
F. Noteridae												
Noterus laevis Sturm, 1834	-	-	-	+	-	-	+	-	-	-	+	-
F. Scirtidae												
Cyphon hilaris Nyholm, 1944	-	+	-	-	-	-	-	-	-	-	-	-
F. Tenebrionidae												
Alleculinae indet. (larva)	+	-	-	-	+	-	-	-	-	-	+	-

Table I (cont.)

	B16	B23	B18	B9	B22	B14	B27	B26	B20	B12	B20b	B17
O. Diptera												
F. Ceratopogonidae												
Ceratopogonidae indet.	+	-	-	-	-	-	-	-	-	-	-	-
F. Chaoboridae												
Chaoborus flavicans (Meigen, 1830)	+	-	+	+	+	+	+	+	+	+	+	+
F. Chironomidae												
Chironominae indet.	+	+	+	+	+	+	+	+	+	+	+	+
Orthocladiinae indet.	+	+	+	+	+	+	+	+	+	+	+	+
Tanypodinae indet.	+	+	+	+	+	+	+	+	+	+	+	+
F. Culicidae												
Culex pipiens Linnaeus, 1758	+	-	+	+	-	+	+	+	-	+	+	-
Culex theileri Theobald, 1903	+	-	+	+	-	+	-	+	-	+	+	-
Culiseta subochrea/annulata	+	+	-	-	+	+	-	-	-	-	+	+
F. Dixidae												
Dixella attica (Pandazis, 1933)	-	-	-	-	+	-	+	-	-	-	-	-
F. Ephydridae												
Ephydridae indet.	-	+	-	-	-	-	-	-	-	-	-	-
F. Limoniidae												
Dicranomyia/Atypophthalmus/Neolimonia	-	+	-	-	+	-	-	-	-	-	-	-
F. Tabanidae												
Tabanus sp.	-	-	-	-	-	-	-	-	-	+	-	-
Ph. Mollusca												
Cl. Bivalvia												
O. Veneroida												
F. Sphaeriidae												
Musculium lacustre (O. F. Muller, 1774)	-	-	-	-	-	-	-	-	+	-	-	-
Cl. Gastropoda												
O. Basommatophora												
F. Ancylidae												
Ferrissia sp.	-	-	-	-	-	-	+	+	-	-	+	-
F. Physidae												
Physella acuta Draparnaud, 1805	-	-	-	-	-	-	+	-	-	-	-	-
F. Planorbidae												
Gyraulus laevis (Alder, 1838)	+	+	-	+	+	-	+	+	+	-	+	+
Ph. Chordata												
Cl. Amphibia												
O. Anura												
F. Hylidae												
Hyla meridionalis/arborea	+	-	+	+	+	+	-	-	+	+	+	+
F. Pelobatidae												
Pelobates cultripes (Cuvier, 1829)	+	+	+	+	+	+	+	+	-	+	+	+
F. Ranidae												
Pelophylax perezi (López Seoane, 1885)	-	-	-	-	-	-	-	+	-	-	-	-
O. Urodela												
F. Salamandridae												
Lissotriton boscai (Lataste, 1879)	+	+	+	+	+	-	+	+	+	+	+	+
Pleurodeles waltl Michahelles, 1830	-	-	-	-	-	+	-	-	+	-	-	-
Triturus pygmaeus (Wolterstorff, 1905)	+	+	+	+	+	+	+	+	+	+	+	+
Taxa richness	**35**	**27**	**23**	**37**	**32**	**27**	**38**	**26**	**30**	**31**	**32**	**29**