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tence of an ancient lineage of Taxus baccata L. in Macaronesia and call for immediate conservation actions

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Morphological and molecular data from Madeira support the persistence of an ancient lineage of Taxus baccata L. in Macaronesia and call for immediate conservation actions

Federico Vessella [a], Marco Cosimo Simeone [a], Francisco Manuel Fernandes [b], Avra Schirone [a], Martinho Pires Gomes [c] & Bartolomeo Schirone [a]
[a] Department of Agriculture, Forests, Nature and Energy (DAFNE), Università degli Studi della Tuscia, Via S. Camillo de Lellis, 01100, Viterbo, Italy
[b] Jardim Botânico da Madeira, Quinta do Bom Sucesso, Caminho do Meio, 9064-251, Funchal, Portugal
[c] Serviço do Parque Natural da Madeira, Quinta do Bom Sucesso, Caminho do Meio, 9064-512, Funchal, Portugal
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2006-2012

of extinct fossil scops owl (Aves: Strigiformes) from the Archipelago of Madeira (North Atlantic Ocean)

Rando *et al* .

2012

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Article

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A new species of extinct fossil scops owl (Aves: Strigiformes: Strigidae: *Otus*) from the Archipelago of Madeira (North Atlantic Ocean)

JUAN CARLOS RANDO[1], HARALD PIEPER[2], JOSEP ANTONI ALCOVER[3,4] & STORRS L. OLSON[5]

[1]*Departamento de Biología Animal (UDI Zoología), Universidad de La Laguna E-38206; Island Ecology and Evolution Research Group (IPNA-CSIC), La Laguna, Tenerife - Canary Islands (Spain). E-mail: canarionesx@yahoo.es; jcrmalo@ull.es*
[2]*Ulmenstr. 21, 24223 Schwentinental (Germany). E-mail: : neuzelpieper@conalmservices.com*
[3]*Departament de Biodiversitat i Conservació, Institut Mediterrani d'Estudis Avançats, C/ Miquel Marquès 21, 07190 Esporles, Mallorca, Balearic Islands (Spain). E-mail: jantcover@imedea.uib-csic.es*
[4]*Division of Birds, National Museum of Natural History, P. O. Box 37012, Smithsonian Institution, Washington DC 20013-7012. E-mail: olsons@si.edu*
[5]*Corresponding author*

Abstract

The extinct Madeiran Scops Owl *Otus mauli* **n. sp.** is described from fossil bones found in Quaternary sites on Madeira Island (Madeira Archipelago, North Atlantic Ocean). It is the first extinct bird to be described from this archipelago and the first extinct species of Strigiformes known from anywhere in Macaronesia. The forelimb bones of the new taxon are similar in size to those of the Eurasian Scops Owl (*Otus scops* Linnaeus) but the hindlimb bones are longer, especially the tarsometatarsus, which is much longer and more slender than in *O. scops*. The estimated body weight and wing loading, together with the proportions of hindlimb bones (femur, tibiotarsus and tarsometatarsus) in relation to total length of leg bones (femur+tibiotarsus+tarsometatarsus), seem to indicate a ground-dwelling life-style. Human arrival and subsequent habitat alterations (introduction of alien taxa, burning, etc.) are the most probable causes of its extinction. The same species or a close relative is documented from dunes on the island of Porto Santo, but the quality of preservation of its bones precludes more certain identification.

Key words: Extinction, evolution of island biotas, Madeiran Scops Owl, *Otus mauli* **n. sp.**, Macaronesia, Quaternary.

Introduction

Existing vertebrate faunas of islands have usually been modified by two recent global events: (1) numerous extinctions and (2) introduction of alien taxa, both mainly caused by human arrival and subsequent alteration of insular ecosystems (Olson & James 1982a; Worthy & Holdaway 2002; Steadman 2006). Consequently, current autochthonous biotas are essentially human-influenced subsets of those originally present. Knowing the former diversity and species' distributions of pristine island faunas is critical for understanding the evolutionary history, biogeography, and conservation status of remaining species and ecosystems.

The oceanic Macaronesian archipelagos (Azores, Madeira, Selvagens, Canary Islands and Cape Verde) are located in the North Atlantic Ocean (15°N–39°N and 10°W–30°W), and between ~100 km (Canary Islands) and ~1350 km (Azores) from the Old World mainland (Fig. 1). The original Quaternary faunas of these islands have been poorly studied in the Azores, Madeira, Selvagens, and Cape Verde, whereas those from the Canary Islands are better known. The Canary Islands differ from other Macaronesian islands by: (i) the prehistoric presence of endemic non-flying land mammals (three extinct species of Rodentia and one of Soricomorpha), which are absent from the other archipelagos; and (ii) by their different history of human colonization. In the Canary Islands, two well differentiated waves of human arrival took place; the "aboriginal", from north-west Africa, some time between 756 cal BC–313 cal AD (Alcover *et al.* 2009), and a second wave of colonization from Europe starting in the 14th century (Aznar *et al.* 2006). The other Macaronesian archipelagos were first populated from Portugal during the 15th century (Crosby 1988).

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ius species from Macaronesia (Coleoptera, Zopheridae)

Machado *et al* .

2012

Journal of Natural History
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Two new Tarphius species from Macaronesia (Coleoptera, Zopheridae)

Antonio Machado [a]
[a] c/ Chopin 1, 38208 La Laguna, Tenerife, Canary Islands, Spain

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The diet of Atlantic Yellow-legged Gulls (*Larus michahellis atlantis*) at an oceanic seabird colony: estimating predatory impact upon breeding petrels

Eur J Wildl Res
DOI 10.1007/s10344-010-0384-y

ORIGINAL PAPER

The diet of Atlantic Yellow-legged Gulls (*Larus michahellis atlantis*) at an oceanic seabird colony: estimating predatory impact upon breeding petrels

Rafael Matias · Paulo Catry

Received: 21 September 2009 / Revised: 7 March 2010 / Accepted: 19 March 2010

Abstract The diet and breeding ecology of Yellow-legged Gulls (*Larus michahellis atlantis*) were studied on Selvagem Grande, North Atlantic in the nesting season of 2007. We collected and analyzed 715 pellets from adults. The most frequent prey were White-faced Storm-petrels (*Pelagodroma marina*; present on 40.8% of all pellets) and the endemic land snails (*Theba macandrewiana*; present on 36.5% of all pellets). Other birds, namely Cory's Shearwaters (*Calonectris diomedea*), Macaronesian Shearwaters (*Puffinus assimilis*), Bulwer's Petrels (*Bulweria bulwerii*), and Band-rumped Storm-petrels (*Oceanodroma castro*) were relatively less frequent, but overall, seabirds were present in ca. 50% of all pellets, representing an estimated 60.4% of all mass consumed by gulls. We estimate that the contribution of seabirds to the overall calorie balance accounted for 82.5% of all energy consumed. The number of gull pairs breeding on Selvagem Grande was 12 on 2005 and 2007. Breeding success was low (0.92 and 0.25 juveniles per breeding pair, respectively). Using a simple bioenergetics model, we estimate the breeding gull population to have the potential to consume approximately 4,847 adult/sub-adult seabirds in 3.5 months in order to meet its energetic requirements. The importance of the estimated predation levels is discussed and some management actions are suggested.

Keywords Predation · Selvagens · Pelagodroma · Calonectris · Bioenergetics

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R. Matias · P. Catry (✉)
Eco-Ethology Research Unit & Centro de Biociências, ISPA,
Rua Jardim do Tabaco 34,
1149-041 Lisboa, Portugal
e-mail: paulo.catry@gmail.com

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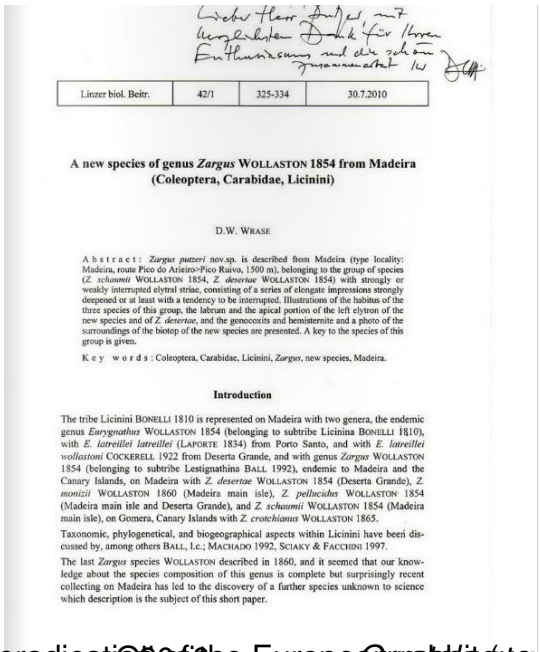
Introduction

Large gulls (*Larus* spp.) are widespread seabird predators. They may play an important role in the population regulation of several prey species, namely auks (Alcidae) and petrels (Procellariformes). Typically, on islands, the seabird prey includes species of small body size, particularly storm-petrels (Hydrobatidae; e.g., Vidal et al. 1998; Stenhouse and Montevecchi 1999; Oro et al. 2005).

During the last century, there were marked population increases of several large gull species throughout the world; among other factors, the organic waste available at refuse tips and landfills and, especially, fish offal and discards originating on an ever-growing fishing industry have been implicated as important causes for rapid population increase in large gulls (e.g., Spaans 1971; Furness et al. 1992; Oro et al. 1995; Duhem et al. 2008; but see Harris 1970 and Belant et al. 1993). Such changes led to overpopulation in many areas, which in turn resulted in disproportionate predation rates where gulls coexisted with small petrels and other seabird prey (e.g., Stenhouse and Montevecchi 1999; Oro et al. 2005 and references therein). The impact of predation levels on prey populations can be very severe, particularly when anthropogenic or alternative natural prey resources become scarce; and in some cases, management measures have been applied, albeit with variable success (Oro et al. 2005 and references therein; Oro and Martínez-Abraín 2007).

The Selvagens archipelago (consisting of the islands Selvagem Grande, Selvagem Pequena and Ilhéu de Fora) is classified as an important bird area (Costa et al. 2003) and holds internationally important populations of several seabirds: Cory's Shearwaters (*Calonectris diomedea*), Macaronesian Shearwaters (*Puffinus assimilis*), Bulwer's Petrels (*Bulweria bulwerii*), White-faced Storm-petrels

A new species of the genus Dytiscus LINNAEUS 1758 from Madeira (Coleoptera, Carabidae, Licinini)



Linzer biol. Beitr. | 42/1 | 325-334 | 30.7.2010

A new species of genus *Zargus* WOLLASTON 1854 from Madeira (Coleoptera, Carabidae, Licinini)

D.W. WRASE

A b s t r a c t : *Zargus putzeri* nov.sp. is described from Madeira (type locality: Madeira, route Pico do Arieiro>Pico Ruivo, 1500 m), belonging to the group of species (*Z. schaumii* WOLLASTON 1854, *Z. desertae* WOLLASTON 1854) with strongly or weakly interrupted elytral striae, consisting of a series of elongate impressions strongly deepened or at least with a tendency to be interrupted. Illustrations of the habitus of the three species of this group, the labrum and the apical portion of the left elytron of the new species and of *Z. desertae*, and the genocoxits and hemisternite and a photo of the surroundings of the biotop of the new species are presented. A key to the species of this group is given.

K e y w o r d s : Coleoptera, Carabidae, Licinini, *Zargus*, new species, Madeira.

Introduction

The tribe Licinini BONELLI 1810 is represented on Madeira with two genera, the endemic genus *Eurygnathus* WOLLASTON 1854 (belonging to subtribe Licinina BONELLI 1810), with *E. latreillei latreillei* (LAPORTE 1834) from Porto Santo, and with *E. latreillei wollastoni* COCKERELL 1922 from Deserta Grande, and with genus *Zargus* WOLLASTON 1854 (belonging to subtribe Lestignathina BALL 1992), endemic to Madeira and the Canary Islands, on Madeira with *Z. desertae* WOLLASTON 1854 (Deserta Grande), *Z. monizii* WOLLASTON 1860 (Madeira main isle), *Z. pellucidus* WOLLASTON 1854 (Madeira main isle and Deserta Grande), and *Z. schaumii* WOLLASTON 1854 (Madeira main isle), on Gomera, Canary Islands with *Z. crotchianus* WOLLASTON 1865.

Taxonomic, phylogenetical, and biogeographical aspects within Licinini have been discussed by, among others BALL, l.c.; MACHADO 1992, SCIAKY & FACCHINI 1997.

The last *Zargus* species WOLLASTON described in 1860, and it seemed that our knowledge about the species composition of this genus is complete but surprisingly recent collecting on Madeira has led to the discovery of a further species unknown to science which description is the subject of this short paper.

cessful eradication of the European rabbit (*Oryctolagus cuniculus*) and the house mouse (*Mus musculus*) from the island of Selvagem Grande (M

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ORIGINAL ARTICLE

Successful eradication of the European rabbit (*Oryctolagus cuniculus*) and house mouse (*Mus musculus*) from the island of Selvagem Grande (Macaronesian archipelago), in the Eastern Atlantic

Paulo OLIVERA,[1] Dilia MENEZES,[1] Roger TROUT,[2] Alan BUCKLE,[3] Pedro GERALDES[1] and José JESUS[1]

[1]Parque Natural da Madeira, Quinta do Bom Sucesso, Caminho do Meio, Madeira, [2]Forest Research, Alice Holt Lodge, Farnham, Surrey, [3]School of Biological Sciences, The University of Reading, Reading, UK and [4]University of Madeira, Department of Biology, Campus of Penteada, Portugal

Abstract

The Portuguese island of Selvagem Grande (Great Salvage) in Macaronesia is an important seabird breeding station in the eastern Atlantic. Significant populations of Cory's shearwater *Calonectris diomedea* (Scopoli, 1769), Bulwer's petrel *Bulweria bulwerii* (Jardine & Selby, 1828) and little shearwater *Puffinus assimilis baroli* (Bonaparte, 1857) are present, and white-faced storm-petrel *Pelagodroma marina* (Latham, 1790) and Madeiran storm-petrel *Oceanodroma castro* (Harcourt, 1851) populations are of global significance. Selvagem Grande also provides diverse habitats for an extensive flora, including 11 endemic species. The 270-ha island was also inhabited by two alien invasive mammals: the European rabbit *Oryctolagus cuniculus* (Linnaeus, 1758) and the house mouse *Mus musculus* (Linnaeus, 1758). Both are known to have had adverse impacts on breeding seabirds and island vegetation. In 2002, the Natural Park of Madeira conducted a program using brodifacoum bait formulations aimed at rabbit and mouse eradication. Approximately 17 000 individual baiting points were established on a 12.5 × 12.5 m grid. Baits were also applied by hand "seeding" on steep slopes and cliffs where bait stations could not be placed. Rabbits were removed after a month. However, mice persisted for considerably longer and strategic bait applications against them continued for a further six months. Subsequent assessments by trapping, bait takes and systematic observation of signs over three years, has confirmed the removal of both alien invasive species. This paper presents information on these operations, on measures adopted to mitigate adverse impacts of the eradication program on important vertebrate non-target species, including Berthelot's pipit *Anthus berthelotii* Bolle, 1862 and a species of gecko *Tarentola bischoffi* Joger, 1984 and on the initial response of the island's ecosystem to the eradication of rabbits and mice.

Key words: alien invasive, island restoration, *Mus musculus*, non-target mitigation, *Oryctolagus cuniculus*.

Correspondence: Paulo Oliveira, Parque Natural da Madeira, Quinta do Bom Sucesso, Caminho do Meio, 9050–251, Funchal, Madeira, Portugal.
Email: paulooliveira.sra@gov-madeira.pt

INTRODUCTION

The Ilhas Selvagens consist of a sub-archipelago of the three Portuguese Salvage Islands (Selvagem Grande,

earwaters shift winter destinations between hemispheres and across ocean basins

PROCEEDINGS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Breaking the routine: individual Cory's shearwaters shift winter destinations between hemispheres and across ocean basins

Maria P. Dias, José P. Granadeiro, Richard A. Phillips, Hany Alonso and Paulo Catry

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eria to prioritize resource allocation for oceanic island species conservation

Biodivers Conserv
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ORIGINAL PAPER

Using taxonomically unbiased criteria to prioritize resource allocation for oceanic island species conservation

José L. Martín · Pedro Cardoso · Manuel Arechavaleta · Paulo A. V. Borges · Bernardo F. Faria · Cristina Abreu · António F. Aguiar · José A. Carvalho · Ana C. Costa · Regina T. Cunha · Francisco M. Fernandes · Rosalina Gabriel · Roberto Jardim · Carlos Lobo · António M. F. Martins · Paulo Oliveira · Pedro Rodrigues · Luís Silva · Dinarte Teixeira · Isabel R. Amorim · Nídia Homem · Berta Martins · Mónica Martins · Enésima Mendonça

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Abstract Oceanic islands have been the grand stage of documented extinctions. In view of limited resources, efficient prioritization is crucial to avoid the extinction of taxa. This work lists the top 100 management priority species for the European archipelagos of the Macaronesian region (Azores, Madeira and the Canary Islands), taking into account both their protection priority and their management feasibility. Bryophytes, vascular plants, molluscs, arthropods and vertebrates were scored by species experts following two sets of criteria: (i) protection priority, including ecological value, singularity, public institutions' management responsibilities and social value; (ii) management feasibility, including

J. L. Martín · M. Arechavaleta
Servicio de Biodiversidad, Consejería de Medio Ambiente y Ordenación Territorial, Gobierno de Canarias, Centro de Planificación Ambiental, La Laguna, Santa Cruz de Tenerife, España

P. Cardoso · P. A. V. Borges · R. Gabriel · I. R. Amorim · N. Homem · B. Martins · E. Mendonça
Departamento de Ciências Agrárias, Azorean Biodiversity Group-CITAA, Universidade dos Açores, Terra-Chã, 9701-851 Angra do Heroísmo, Portugal

B. F. Faria · D. Teixeira
Secretaria Regional do Ambiente e dos Recursos Naturais-Direção Regional do Ambiente, Rua Dr. Pestana Júnior, 6, 3° Dto, 9064-506 Funchal, Portugal

C. Abreu
Department of Biologia/CEM, Universidade da Madeira, Campus da Penteada, 9000-390 Funchal, Portugal

A. F. Aguiar
Laboratório Agrícola da Madeira, Núcleo de Entomologia, Caminho dos Caboucos 61, 9135-372 Camacha, Portugal

J. A. Carvalho · F. M. Fernandes · R. Jardim · C. Lobo
Jardim Botânico da Madeira, Caminho do Meio, 9064-512 Funchal, Portugal

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nd its relation with the Islands of the Madeira and Canary Islands Archipelagos

Nova Hedwigia, Beiheft 138, 187–199 Article
Stuttgart, November 2010

The Selvagens Islands bryoflora and its relation with islands of the Madeira and Canary Islands Archipelagos

Manuela Sim-Sim[1, 2], Susana Fontinha[3], Leena Luís[1, 2], Carlos Lobo[4] and Michael Stech[5]

[1] Universidade de Lisboa, Faculdade de Ciências de Lisboa, DBV, Centro de Biologia Ambiental, C2, Campo Grande, 1749-016 Lisboa, Portugal (corresponding author: msimsim@fc.ul.pt)
[2] Museu Nacional de História Natural, Jardim Botânico/CBA, Rua da Escola Politécnica, nº 58, 1250-102 Lisboa, Portugal
[3] Centro de Estudos da Macaronésia (CEM), Universidade da Madeira, Campus da Penteada, 9000-390 Funchal, Madeira, Portugal
[4] Jardim Botânico da Madeira-Eng° Rui Vieira/CEM, Quinta do Bom Sucesso, 9064-512 Funchal, Madeira, Portugal;
[5] Netherlands Centre for Biodiversity Naturalis, section Nationaal Herbarium Nederland, Leiden University, P. O. Box 9514, 2300 RA Leiden, The Netherlands

With 4 figures and 2 tables

Abstract: The bryoflora of the Selvagens Archipelago is characterised and updated based on results from recent fieldwork, and compared with those of Madeira and Canary Islands. The bryoflora of Selvagens Islands includes 16 taxa, four of which are reported for the first time for these islands. As a result of its small area and strong saline influence, low habitat diversity is present on Selvagens Archipelago determining most of its bryophyte diversity, which is dominated by acrocarpous mosses and mainly by species adapted to stressful conditions. Due to its topography, the Selvagens bryoflora is quite distinct from the other islands of Madeira Archipelago. Cluster analysis revealed closest relationships with the driest islands of Madeira Archipelago (Desertas Islands and Porto Santo), and with the Canary Islands of Fuerteventura and Lanzarote. Recent revisions in the course of this comparison also revealed new taxa for the bryoflora of Desertas and Porto Santo, namely one and eight species, respectively.

Key words: Bryoflora, Canary Islands, dry areas, Madeira Archipelago, Selvagens Islands

Introduction

The uninhabited Selvagens Archipelago is situated in the North Atlantic at approximately 300 km south of Madeira Island and 180 km north of the Canary Archipelago (Fig. 1). It consists of a group of small islands of volcanic origin, Selvagem Grande, Selvagem Pequena and Ilhéu de Fora, which originated from the same volcanic hotspot as the Canary Islands and have an estimated age of 27 Myr (e.g., Geldmacher et al. 2005). This archipelago constitutes the southernmost part of the Portuguese territory and is administrated by the Madeira Autonomous Region.

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mountain shrublands of the Macaronesian islands (NW Africa, Atlantic Ocean)

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PL ISSN 0001-7051 doi: 10.4098/j.at.0001-7051.065.2009

Trophic habits of feral cats in the high mountain shrublands of the Macaronesian islands (NW Africa, Atlantic Ocean)

Félix M. MEDINA, Paulo OLIVEIRA, Dilia MENEZES, Sérgio TEIXEIRA, Rafael GARCÍA and Manuel NOGALES

Medina F. M., Oliveira P., Menezes D., Teixeira S., García R. and Nogales M. 2010. Trophic habits of feral cats in the high mountain shrublands of the Macaronesian islands (NW Africa, Atlantic Ocean). Acta Theriologica 55: 241–250.

Feral cats *Felis catus* Linnaeus, 1758 have contributed to the extinction of numerous native species on islands, which are clearly sources of global biodiversity. We studied the diet of this introduced predator in the Madeira and Cape Verde archipelagos, which harbour important colonies of endangered seabirds in the high mountain habitats, and compared the results with those obtained in the same habitat in the Canary Islands, Macaronesian archipelago. On Madeira, 461 prey were identified from 143 scat groups. Mammals, overall mice, constituted the basic diet appearing in 95% of cat scats. On Fogo (Cape Verde), 657 prey items were obtained from 145 scats, and mammals were also the most important prey, reaching a frequency of occurrence of 88%. Although introduced mammals were the main prey category on all Macaronesian islands, we observed variation in feral cat diet among these islands. Birds were more frequently consumed on Madeira, lizards on Tenerife (Canaries) and invertebrates on Fogo. No specific differences were observed in relation to La Palma. We suggest that the diet composition on these islands varies according to the respective availability of the different prey types.

Consejería de Medio Ambiente, Cabildo Insular de La Palma, Santa Cruz de La Palma, Canary Islands, Spain, e-mail: felix.medina@cabalpalma.es (FMM); Serviço do Parque Natural da Madeira, Funchal, Madeira, Portugal (PO and DM); Avenida Luiz de Camões, Bloco 5, 4° Dto. Funchal, Madeira, Portugal (ST); C/ San Miguel 9, Santa Cruz de La Palma, Canary Islands, Spain (RG); Island Ecology and Evolution Research Group (IPNA-CSIC), Tenerife, Canary Islands, Spain (MN and FMM)

Key words: non-native cats, Macaronesia, Madeira, Canaries, Cape Verde, diet, mountain environments

Introduction

Feral cats *Felis catus* Linnaeus, 1758 have become a top predator in the food chains on islands where they were introduced (Nogales *et al.* 1992), contributing to the decline and extinction of numerous native species worldwide (Lever 1994, Tershy *et al.* 2002). From continents (Dickman 1996) to islands of continental origin

[241]

hylogeny of the North Atlantic Ocean petrels *Pterodroma* evidence for specific status of Bugio and Cape Verde petrels and

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Phylogenetic relationships of gadfly petrels *Pterodroma* spp. from the Northeastern Atlantic Ocean: molecular evidence for specific status of Bugio and Cape Verde petrels and implications for conservation

JOSÉ JESUS, DÍLIA MENEZES, SARA GOMES, PAULO OLIVEIRA, MANUEL NOGALES and ANTÓNIO BREHM

Summary

It is widely accepted that the gadfly petrels of the Macaronesian islands comprise three closely related and morphologically similar taxa, *Petrodroma madeira* from Madeira island, *P. deserta* (also treated as *P. feae deserta*) from Bugio and *P. feae* (also treated as *P. feae feae*) from Cape Verde Islands. However, the taxonomic rank of each taxon is not well defined, and has been subject to a long debate. Partial sequences of cytochrome *b* (893 bp) from 39 individuals (five from Madeira, 18 from nearby Bugio, and 16 from Fogo) and morphometric data from five characters from 102 individuals (74 from Bugio and 28 from Fogo in Cape Verde), were used to compare and estimate phylogenetic relationships and the taxonomic status of these petrels. In the phylogenetic analysis and sequence divergence estimation, we also include 23 sequences of 19 *Pterodroma* species available from GenBank. Our results show that Macaronesian gadfly petrels form a monophyletic clade. Birds from Bugio and Cape Verde are the most closely related taxa followed by those from Madeira. The group formed by the three taxa studied is closely related to Bermuda Petrel *P. cahow* and Black-capped Petrel *P. hasitata*. A hypothesis for the colonization of the islands is presented. The level of sequence divergence is sufficient to consider the populations of Bugio and Cape Verde as separate species. Reproductive isolation is supported by exclusive haplotypes and fixed changes. Despite the presence of some significant differences in bill and tarsus measurements, the two species seem to be morphologically similar because the great overlap of variation intervals in the measurements hinders identification. It therefore appears suitable for consideration as a cryptic species. An important conservation implication is that the world population of both species is very small; if treated as a full species, *deserta* on Bugio may qualify for uplisting to 'Vulnerable' on the IUCN Red List.

Introduction

Petrels of the genus *Pterodroma* form the largest group of tube-nosed birds, consisting of 29 species with a geographical distribution range covering the Atlantic, Indian and Pacific Oceans (Imber 1985). Gadfly petrels of the genus *Pterodroma* are represented in the Northeast Atlantic by three breeding colonies, located on Madeira Island itself, Bugio (one of the nearby Desertas islets) and the Cape Verde Islands. The taxonomy of these petrels has been controversial and subject to discussion (see for example Mathews 1934*a*, *b*; Imber 1985; Zino and Zino 1986; Zino *et al.* 2008), mainly due to their morphological similarities.

om the Selvagens Islands (Portugal): additions to the current knowledge

Boletín Sociedad Entomológica Aragonesa, nº **45** (2009) : 343–348.

SPIDERS (ARACHNIDA: ARANEAE) FROM THE SELVAGENS ISLANDS (PORTUGAL): ADDITIONS TO THE CURRENT KNOWLEDGE

Luís Crespo[1], Pedro Cardoso[2,3], Isamberto Silva[4] & Dília Menezes[5]

[1] IMAR – Coimbra Interdisciplinary Center, Department of Zoology, University of Coimbra, Largo Marquês de Pombal, 3004-517 Coimbra, Portugal. – luiscarlacrespo@gmail.com
[2] Azorean Biodiversity Group – CITA-A, University of Azores, Terra-Chã, 9701-851 Angra do Heroísmo, Portugal; – pcardoso@uma.pt
[3] Smithsonian Institution, National Museum of Natural History, 10th & Constitution NW, MRC 105, Room E-509, Washington, DC 20560-0105, USA
[4] Division of Nature Conservation, Service of the Madeira Natural Park, Funchal, Portugal. – diliamenezes.sra@gov-madeira.pt

Abstract: A large collection of spiders from Selvagem Grande (Selvagens Islands, Portugal) was gathered to analyze the community response to a vegetation recovery experiment. The presence of several species in this small archipelago is confirmed and nine additions to its spider fauna are reported: *Filistata insidiatrix* (Forskål, 1775), *Lepidomexxx hyteloscorchi* Barland, 1934, *Urozelotes rusticus* (L. Koch, 1872), *Zimirina isparia* (Blackwall, 1859), *Mioxenia* cf. *canariensis* (Wunderlich, 1987), *Synaphris* cf. *zaphrynis* Lopardo, Hormiga & Melic, 2007, *Steatoda nobilis* (Thorell, 1875), *Thomisus onustus* Walckenaer, 1805 and *Xysticus tanzerotensis* (Wunderlich, 1992). The archipelago currently comprises 43 species.
Key words: Araneae, faunistics, Selvagens Islands, Portugal.

Spiders (Arachnida: Araneae) de las islas Selvagens (Portugal): aportaciones al conocimiento actual
Resumen: Se colectó un gran número de arañas en Selvagem Grande (islas Selvagens, Portugal) con el fin de analizar la respuesta de la comunidad a un experimento de regeneración de la vegetación. Se confirma la presencia de varias especies en este pequeño archipiélago, y se aportan nueve novedades a su fauna de arañas: *Filistata insidiatrix* (Forskal, 1775), *Lepidomexxx hyteloscorchi* Barland, 1934, *Urozelotes rusticus* (L. Koch, 1872), *Zimirina isparia* (Blackwall, 1859), *Mioxenia* cf. *canariensis* (Wunderlich, 1987), *Synaphris* cf. *zaphrynis* Lopardo, Hormiga & Melic, 2007, *Steatoda nobilis* (Thorell, 1875), *Thomisus onustus* Walckenaer, 1805 y *Xysticus tanzerotensis* (Wunderlich, 1992). Actualmente se conocen 43 especies del archipiélago.
Palabras clave: Araneae, faunística, islas Selvagens, Portugal.

Introduction

The Selvagens Islands comprise a small group of islands and islets situated about 300 km south of Madeira Island and 180 km north of the Canary Islands. They began emerging 27 m.y. BP. However, at least Selvagem Grande had three eruptive cycles, at 24-26 m.y., 8-12 m.y. and 3-4 m.y. (Geldmacher *et al.*, 2001) and its current fauna may have originated after this last eruption, being the previous faunas extirpated by submergence of the island. The Selvagem Grande is also the largest island of the archipelago with about 245 ha and a maximum altitude of 153 m; it is mostly dominated by a semi-desertic habitat. All collected specimens come from this island. The remainder islets are the Selvagem Pequena, Ilhéu de Fora, Ilhéu Comprido and Ilhéus do Norte.

The spider community of the Selvagens Islands is far from being well known. Previous works are reduced to early expeditions that provided material for Blackwall (1864), Kulczynski (1899) and Simon (1912), however much of the material from these expeditions is supposed to be lost and some species were identified using juveniles, which provides doubtful records. A more thorough approach was followed by Denis (1963). A preliminary checklist of 33 species was compiled by Wunderlich (1992) who, additionally to listing the citations by the previous authors, analyzed some specimens collected by Rambla in 1978. Wunderlich (1992) erroneously cited 4 endemic species to the Selvagens but we know now that two were synonyms of other species (*Dysdera wollastoni* sensu Kulczynski, 1899 is now known as *Dysdera nesiotes* Simon, 1907, and *Scotognapha beieki* Denis, 1963, is now known as *Scotognapha patrui* (Blackwall, 1864)); a third endemic species was added when this same author described *Oecobius selvagensis* Wunderlich, 1995. More recently, a compilation of all previously published literature was made by Cardoso & Crespo (2008), in which material from the work now presented was included.

Material

The invasive plant *Nicotiana glauca* was removed from the Selvagem Grande during the three years (2000 – 2002). In order to perceive the community changes with this removal, spiders were captured using pitfall traps, hand collecting (along transects and inside 1 m^2 delimited squares) and vegetation beating from 2002 to 2005. Different collectors at different seasons have done all methods in a non-standardized way. Although such collection did not allow understanding compositional differences before and after the experiment, it provided the material now presented.

Half of the obtained material and the taxonomic and most faunistic additions are deposited in the National Museum of Natural History of Denmark, Zoological Museum (ZMUC) while the other half of the material is deposited at the Municipal Museum of Funchal (MMF).

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phylogenetics, islands, ecological shifts and interisland colonizations

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Molecular phylogenetics of the Macaronesian-endemic genus *Bystropogon* (Lamiaceae): palaeo-islands, ecological shifts and interisland colonizations

JENNIFER L. TRUSTY,*¶ RICHARD G. OLMSTEAD,† ARNOLDO SANTOS-GUERRA,‡ SUSANA SÁ-FONTINHA,§ and JAVIER FRANCISCO-ORTEGA*

Department of Biological Sciences, Florida International University, University Park Campus, Miami, FL 33199, USA, †Department of Biology, University of Washington, PO Box 355325, Seattle, WA 98195, USA, ‡Jardín de Aclimatación de La Orotava, Calle Retama Num. 2, Puerto de La Cruz, E-38400, Tenerife, Canary Islands, Spain, §Parque Natural da Madeira/CEM, Caminho do Meio, Bom Sucesso, PT-9050-251, Funchal, Madeira, Portugal, ¶Fairchild Tropical Botanic Garden, 11935 Old Cutler Road, Coral Gables, FL 33156, USA

Abstract

A molecular phylogenetic study of *Bystropogon* L'Hér. (Lamiaceae) is presented. We performed a cladistic analysis of nucleotide sequences of the internal transcribed spacers (ITS), of the nuclear ribosomal DNA, and of the *trnL* gene and *trnL-trnF* intergenic spacer of the chloroplast DNA. *Bystropogon odoratissimus* is the only species endemic to the Canary Islands that occurs in the three palaeo-islands of Tenerife. This species is not part of an early diverging lineage of *Bystropogon* and we suggest that it has a recent origin. This phylogenetic pattern is followed by most of the species endemic to the palaeo-islands of Tenerife. The two sections currently recognized in *Bystropogon* form two monophyletic groups. Taxa belonging to the section *Bystropogon* clade show interisland colonization limited to the Canary Islands with ecological shifts among three ecological zones. Taxa from the section *Canariense* clade show interisland colonization both within the Canary Islands and between the Canary Islands and Madeira. Speciation events within this clade are mostly limited to the laurel forest. The genus has followed a colonization route from the Canaries towards Madeira. This route has also been followed by at least five other plant genera with species endemic to Macaronesia. Major incongruences were found between the current infrasectional classification and the molecular phylogeny, because the varieties of *Bystropogon origanifolius* and *Bystropogon canariensis* do not form two monophyletic groups. The widespread *B. origanifolius* appears as progenitor of the other species in section *Bystropogon* with a more restricted distribution.

Keywords: adaptive radiation, biogeography, evolution, molecular phylogenetics, oceanic islands, quantum speciation

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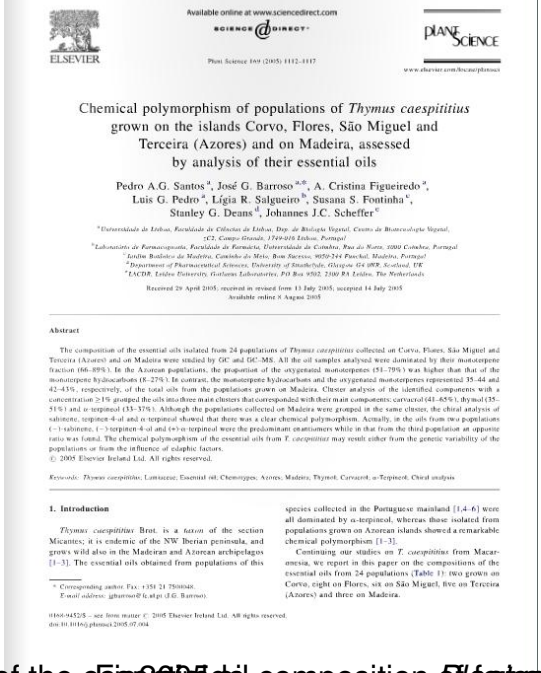
Introduction

The Macaronesian Islands comprise the Atlantic archipelagos of the Azores, Madeira, Selvagens, Canaries, and Cape Verde. In the last 10 years, many evolutionary biology studies have focused on this region, and these island systems have played an important role in the understanding of plant speciation processes in archipelagos worldwide (Baldwin *et al.* 1998; Juan *et al.* 2000; Emerson 2002; Silvertown 2004; Vallejo *et al.* 2004). Research into the interisland relationships of Macaronesian endemics gives insight into the relative roles of dispersal and ecological adaptation as evolutionary avenues (Francisco-Ortega *et al.* 1996, 2002; Panero *et al.* 1999). However, none of these studies have focused on interpreting phylogenetic patterns in the framework of the geological history of Macaronesia. The island of Tenerife (Canary Islands) has a complex geological history

Correspondence: Javier Francisco-Ortega, Fax: 1305 348 1986; E-mail: ortegaj@fiu.edu

Chemical polymorphism of populations of *Thymus caespititius* grown on the islands Corvo, Flores, São Miguel and Terceira (Azores) and on Madeira, assessed by analysis



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Chemical polymorphism of populations of *Thymus caespititius* grown on the islands Corvo, Flores, São Miguel and Terceira (Azores) and on Madeira, assessed by analysis of their essential oils

Pedro A.G. Santos [a], José G. Barroso [a,*], A. Cristina Figueiredo [a], Luis G. Pedro [a], Lígia R. Salgueiro [b], Susana S. Fontinha [c], Stanley G. Deans [d], Johannes J.C. Scheffer [e]

[a] *Universidade de Lisboa, Faculdade de Ciências de Lisboa, Dep. de Biologia Vegetal, Centro de Biotecnologia Vegetal, C2, Campo Grande, 1749-016 Lisboa, Portugal*

[b] *Laboratório de Farmacognosia, Faculdade de Farmácia, Universidade de Coimbra, Pao do Norte, 3000 Coimbra, Portugal*

[c] *Jardim Botânico da Madeira, Caminho do Meio, Bom Sucesso, 9050-244 Funchal, Madeira, Portugal*

[d] *Department of Pharmaceutical Sciences, University of Strathclyde, Glasgow G4 0NR, Scotland, UK*

[e] *IACDB, Leiden University, Gorlaeus Laboratories, PO Box 9502, 2300 RA Leiden, The Netherlands*

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Abstract

The composition of the essential oils isolated from 24 populations of *Thymus caespititius* collected on Corvo, Flores, São Miguel and Terceira (Azores) and on Madeira were studied by GC and GC–MS. All the oil samples analysed were dominated by their monoterpene fraction (66–89%). In the Azorean populations, the proportion of the oxygenated monoterpenes (51–79%) was higher than that of the monoterpene hydrocarbons (8–27%). In contrast, the monoterpene hydrocarbons and the oxygenated monoterpenes represented 35–44 and 42–45%, respectively, of the total oils from the populations grown on Madeira. Cluster analysis of the identified components with a concentration ≥1% grouped the oils into three main clusters that corresponded with their main components: carvacrol (41–65%); thymol (35–51%) and α-terpineol (33–37%). Although the populations collected on Madeira were grouped in the same cluster, the chiral analysis of sabinene, terpinen-4-ol and α-terpineol showed that there was a clear chemical polymorphism. Actually, in the oils from two populations (−)-sabinene, (−)-terpinen-4-ol and (+)-α-terpineol were the predominant enantiomers while in that from the third population an opposite ratio was found. The chemical polymorphism of the essential oils from *T. caespititius* may result either from the genetic variability of the populations or from the influence of edaphic factors.

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Keywords: *Thymus caespititius*; Lamiaceae; Essential oil; Chemotypes; Azores; Madeira; Thymol; Carvacrol; α-Terpineol; Chiral analysis

1. Introduction

Thymus caespititius Brot. is a *taxon* of the section Micantes; it is endemic of the NW Iberian peninsula, and grows wild also in the Madeiran and Azorean archipelagos [1–3]. The essential oils obtained from populations of this species collected in the Portuguese mainland [1,4–6] were all dominated by α-terpineol, whereas those isolated from populations grown on Azorean islands showed a remarkable chemical polymorphism [1–3].

Continuing our studies on *T. caespititius* from Macaronesia, we report in this paper on the compositions of the essential oils from 24 populations (Table 1): two grown on Corvo, eight on Flores, six on São Miguel, five on Terceira (Azores) and three on Madeira.

* Corresponding author. Fax: +351 21 7500048.
E-mail address: jgbarroso@fc.ul.pt (J.G. Barroso).

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parison of the essential oil composition of *Plagiochila* species: *P. bifaria*

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Comparison of the essential oil composition of four *Plagiochila* species: *P. bifaria*, *P. maderensis*, *P. retrorsa* and *P. stricta*

A. Cristina Figueiredo,[1]* Manuela Sim-Sim,[2] Monya M. Costa,[1] José G. Barroso,[1] Luis G. Pedro,[1] M. Glória Esquível,[3] Francisco Gutierres,[2] Carlos Lobo[4] and Susana Fontinha[4]

[1] Universidade de Lisboa, Faculdade de Ciências de Lisboa, DBV, Centro de Biotecnologia Vegetal, C2, Campo Grande, 1749-016 Lisbon, Portugal
[2] Universidade de Lisboa, Faculdade de Ciências de Lisboa, DBV, Centro de Ecologia e Biologia Vegetal, C2, Campo Grande, 1749-016 Lisbon, Portugal
[3] Centro de Botânica Aplicada à Agricultura, Dep. Botânica e Engenharia Biológica, ISA, UTL, 1399 Lisboa, Codex, Portugal
[4] Serviço do Parque Natural da Madeira, Caminho do Meio, Quinta do Bom Sucesso, 9050-251 Funchal, Madeira, Portugal

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ABSTRACT: **Essential oils isolated by distillation–extraction from *P. bifaria*, *P. maderensis*, *P. retrorsa* and *P. stricta*, collected on Madeira, were analysed by GC and GC–MS. Methyl everninate (1–35%), peculiaroxide (13–16%) and *ent*-cadalen-4(15)-ene-6-one (9–19%) were the main components in all *P. bifaria* specimens analysed. Terpinolene (34–60%) dominated the oils isolated from *P. maderensis* specimens, β-Phellandrene (16–46%) was the main component of two of the three specimens of *P. retrorsa*, *allo*-ocimene (15%), terpinolene (13%), peculiaroxide (12%) and *neo-allo*-ocimene (10%) being the main components of the third specimen. *P. stricta* oils were dominated by peculiaroxide (11–21%), *allo*-ocimene (7–19%), bicyclogermacrene (4–17%), *neo-allo*-ocimene (4–11%) and spathulenol (2–14%). Essential oil cluster analysis showed a high degree of similarity between three of the four species studied, the least correlated being *P. maderensis* oils.**

KEY WORDS: *Plagiochila bifaria* (Sw.) Lindenb.; *Plagiochila maderensis* Gottsche ex Steph.; *Plagiochila retrorsa* Gottsche; *Plagiochila stricta* Lindenb.; Plagiochilaceae; liverworts; essential oil; GC; GC–MS

Introduction

The genus *Plagiochilla* comprises over 1600 species, being one of the largest of the liverwort genera.[1] Madeiran *Plagiochila* species constitute more than 50% of the total species referred to Europe. According to Schumacker and Váňa,[2] Söderström *et al.*,[3] Rycroft *et al.*[4] and Sim-Sim *et al.*[5] (2004), nine *Plagiochila* spp. are presently referred to Madeira: *P. bifaria* (Sw.) Lindenb., *P. exigua* (Taylor) Taylor, *P. maderensis* Gottsche ex Steph., *P. porelloides* (Torrey ex Nees) Lindenb., *P. punctata* (Taylor) Taylor, *P. retrorsa* Gottsche, *P. spinulosa* (Dicks.) Dumort., *P. stricta* Lindenb. and *P. virginica* A. Evans.

P. bifaria is the most frequently found of the *Plagiochila* spp. in Madeira's native laurel forest ('laurissilva'). It can be found in sheltered or exposed habitats along water courses, forming loose to dense patches on rocks, boulders and stone walls.[5] Morphological evidence of the conspecificity between this Neotropical species and the European *P. killarniensis* Pearson, was presented by Heinrichs *et al.*,[6] and recent molecular, morphological and phytochemical evidence support a broad species concept of *P. bifaria*.[7] *P. maderensis* is a Madeiran endemic species that was formerly synonymized with *P. spinulosa* (Dicks.) Dumort.[4] It grows on the north side of the Madeiran 'laurissilva'.[5] *P. retrorsa* occurs in Central America and in the Southern Appalachian Mountains of the eastern USA. It is also known from the Azores and Madeira archipelagos in Macaronesia.[4] On the island of Madeira *P. retrorsa* is a common species, especially in the less humid parts of the 'laurissilva', where it can be found on rocks and slopes.[5] *P. stricta* is a Neotropical and Macaronesian liverwort widespread on the Madeiran 'laurissilva', where it grows forming scattered or pure mats in shaded slopes located along water rivulets.[5,8]

With the exception of a recent study on the volatiles of *P. bifaria*,[10] previous phytochemical studies have examined only the solvent extracts of the four species.[4,5,8,11,12] As part of our studies on the essential oil-bearing plants of Portugal and with the aim of determining the potential of essential oils as chemical markers, we report on the comparison of the essential oil composition of four *Plagiochila* spp. collected on Madeira.

* Correspondence to: A. C. Figueiredo, Universidade de Lisboa, Faculdade de Ciências de Lisboa, DBV, Centro de Biotecnologia Vegetal, C2, Campo Grande, 1749-016 Lisbon, Portugal.
E-mail: acs@fc.ul.pt
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ira. Uma das Aves Marinhas mais ameaçadas do Mundo

Referência: Publicado na Revista Islenha, nº 37 (Julho – Dezembro 2005), pág. 143-149.

FREIRA da MADEIRA

A Freira da Madeira. Uma das aves marinhas mais ameaçadas do Mundo

Dília Menezes
Bióloga do Serviço do Parque Natural da Madeira

Uma das aves marinhas mais ameaçadas do Mundo que ocorre unicamente na Madeira, tendo sido considerada extinta até finais da década de 60. Desde então, tem apresentado uma evolução francamente positiva pelos esforços desenvolvidos em prol da sua conservação.

INTRODUÇÃO

A Freira da Madeira *Pterodroma madeira* é uma ave marinha, endémica da Ilha da Madeira, classificada como *Em Perigo* no Livro Vermelho dos vertebrados de Portugal (www.icn.pt 2004) e está incluída no Anexo I da Directiva Aves e no Anexo II da Convenção de Berna (Oliveira e Menezes 2004). Actualmente apresenta uma população mundial de apenas 65 a 80 casais, com uma área de nidificação restrita ao Maciço Montanhoso Oriental, mais precisamente em pequenos patamares acima dos 1600 metros de altitude, localizados entre o Pico do Areeiro e o Pico Ruivo. A presença desta ave, dado o seu estatuto de conservação, é suficiente para conferir à área a designação de Zona de Protecção Especial (ZPE), sendo também um Sitio de Interesse Comunitário (SIC), por apresentar uma elevada biodiversidade, nomeadamente ao nível da vegetação onde são conhecidos vários endemismos.

Reprodução

As aves marinhas pertencentes à ordem dos Procelariformes, onde se inclui a Freira da Madeira, vivem exclusivamente no mar, apenas vindo a terra durante a época de reprodução. No caso deste endemismo madeirense, que passa o ano em paragens

Dumort.) Dumort. Bergius chilaceae, Hepaticae) in Madeira Archipelago - Molecular relationships, ecology a

Nova Hedwigia 81 3—4 449—461 Stuttgart, November 2005

The genus *Plagiochila* (Dumort.) Dumort. (Plagiochilaceae, Hepaticophytina) in Madeira Archipelago - Molecular relationships, ecology, and biogeographic affinities

by

Manuela Sim-Sim[1], Maria da Glória Esquível[2], Susana Fontinha[3] and Michael Stech[4]

[1]Universidade de Lisboa, Faculdade de Ciências de Lisboa, DBV, Centro de Ecologia e Biologia Vegetal, C2, Campo Grande, 1749-016 Lisboa, Portugal, msimsim@fc.ul.pt

[2]Centro de Botânica Aplicada à Agricultura, Instituto Superior de Agronomia, Universidade Técnica de Lisboa, 1349-017 Lisboa, Portugal

[3]Centro de Estudos da Macaronésia. Serviço do Parque Natural da Madeira, Quinta do Bom Sucesso, 9050-251 Funchal, Madeira, Portugal

[4]Institut für Biologie - Systematische Botanik und Pflanzengeographie -, Freie Universität Berlin, Altensteinstr. 6, D-14195 Berlin, Germany

With 3 figures

Sim-Sim, M., M.G. Esquível, S. Fontinha & M. Stech (2005): The genus *Plagiochila* (Dumort.) Dumort. (Plagiochilaceae, Hepaticophytina) in Madeira Archipelago - Molecular relationships, ecology, and biogeographic affinities. - Nova Hedwigia 81: 449-461.

Abstract: *Plagiochila* is one of the most frequent bryophyte genera in Madeira, inhabiting almost all habitats of the Madeiran laurel forest (Laurisilva). Results on the biodiversity, ecology and molecular relationships based on nuclear ribosomal ITS1 and ITS2 sequences of all *Plagiochila* species referred to Madeira Archipelago are summarized with the aims to provide (i) a first molecular confirmation of a species inventory of a bryophyte genus in a specific geographic region and (ii) a bryophyte example for displaying biogeographic affinities of the Madeiran laurel forest. The molecular analyses confirm the presence of nine species in Madeira, which belong to four sections: *Plagiochila* sect. *Arrectae*, sect. *Ruilanies*, sect. *Vagae* and sect. *Plagiochila*. Section *Arrectae* is represented in Madeira by five species, *P. bifaria*, *P. punctata*, *P. retrorsa*, *P. spinulosa*, and *P. stricta*. Section *Ruilanies* is represented by *P. exigua* and the Macaronesian endemic *P. maderensis*, which is reported for the first time to Canary Is. The sections *Vagae* and *Plagiochila* are represented by a single species each, *P. virginica* and *P. porelloides*, respectively. The molecular data indicate strong biogeographic affinities of the Madeiran *Plagiochila* flora with Central and northern South America, and to a lesser extent with Africa and Continental Europe. The environmental conditions found in Madeira Island, especially

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upping habit[illegible] Critically E[illegible] in the archipelago of Madeira

Oryx Vol 38 No 2 April 2004

The availability of resting and pupping habitat for the Critically Endangered Mediterranean monk seal *Monachus monachus* in the archipelago of Madeira

Alexandros A. Karamanlidis, Rosa Pires, Nadia Carina Silva and Henrique Costa Neves

Abstract In order to describe the resting and pupping habitat of the Critically Endangered Mediterranean monk seal *Monachus monachus* and facilitate the identification of preferences by the species for suitable habitat for resting and pupping, 94 sea caves in the archipelago of Madeira were located, charted, and categorized using six characteristics. A cluster analysis indicated that there are eight different types of cave, in three groups. Observations of cave usage indicate that monk seals in the archipelago do not appear to exhibit a preference for certain cave types for resting. When taking care of young, however, the species appears to prefer sea caves that have beaches above sea level during high tide and long entrance corridors. Based on these preferences we believe that although there is a large number of caves in the area that are suitable for resting, only 16 (17%) of the caves are suitable for pupping. The survival of the Critically Endangered Mediterranean monk seal will depend on the allocation of sufficient suitable habitat for reproduction.

Keywords Caves, Madeira, marine protected areas, Mediterranean monk seal, *Monachus monachus*, habitat, pupping.

Introduction

The Mediterranean monk seal *Monachus monachus*, is categorized as Critically Endangered on the IUCN Red List, with an estimated 500 individuals surviving in the wild (Johnson, 2000; IUCN, 2003). Habitat loss, direct killing by fishermen, accidental entanglement in fishing gear (Johnson & Lavigne, 1998) and a mass mortality in 1997 caused by dinoflagellate poisoning and/or a virus epidemic (Costas & Lopez-Rodas 1998; Harwood 1998), have caused monk seal populations to decline steeply and confined the species to four isolated subpopulations. These are located at the Cabo Blanco peninsula of Mauritania, on the archipelago of Madeira in the Atlantic Ocean, the western and eastern Mediterranean, and the Black Sea (Aguilar, 1999).

When on land Mediterranean monk seals frequent sea caves, a behaviour that is believed to be a result of relentless persecution by humans (Pires & Neves, 2000). Suitable seal shelters usually have one or multiple entrances (underwater or not) leading to a dry surface or beach, of various substrates (sand, pebbles, stones or rock), which is used for resting and rearing of pups (Neves & Pires, 1999; Dendrinos & Dimitropoulos, 2000). Because of the species' elusive nature and the inaccessibility of its habitat, knowledge of the preferences and minimum requirements for resting and pupping has remained limited. Circumstantial evidence indicates that for resting monk seals use caves that protect them from wind and wave action (Neves & Pires, 1999; Karamanlidis, 2000), and human disturbance (Pareu *et al.*, 1995). The species has, however, often been observed to rest in water Kouroutes, 1987; López-Jurado *et al.*, 1995; Neves & Pires, 1999) near heavily populated areas and in marginal habitat (Pareu *et al.*, 1995; Johnson & Lavigne, 1999; Güçlüsoy *et al.*, 2002). Pupping in contrast has been recorded mainly in well-protected, isolated caves (Mursaloglu, 1986; Neves & Pires, 1999; MOm, 2001).

Following a steep decline in the last century, the Mediterranean monk seal in the archipelago of Madeira is now found mainly in the Desertas Islands, a group of three uninhabited islands (Deserta Grande, Bugio and Ilhéu Chão) lying c. 20 km south-east of Madeira (Fig. 1). In order to protect this species, the Parque Natural da Madeira Service initiated a Monk Seal Conservation and Monitoring Programme in 1988, and in 1990 the Desertas Islands were declared a Nature Reserve. Due to this protection the monk seal colony, which was estimated to number 6–8 individuals in 1984 (Reiner & dos Santos, 1984), has experienced a remarkable recovery and is now believed to number 23 individuals (Pires & Neves, 2001). In addition, the species is now occasionally sighted on

Alexandros A. Karamanlidis Department of Genetics, School of Biology, Aristotle University of Thessaloniki, 54006 Thessaloniki, Greece.

Rosa Pires (Corresponding author), **Nadia Carina Silva and Henrique Costa Neves** Parque Natural da Madeira (PNM), 9060 Funchal, Madeira, Portugal. E-mail: rosapires@netmadeira.com

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t of the endan[illegible] Mediterranean monk seal (*Monachus*) at São Lourenço - Madeira

Aquatic Mammals 2003, **29.3**, 400–403

Habitat of the endangered Mediterranean monk seal (*Monachus monachus*) at São Lourenço-Madeira

Alexandros A. Karamanlidis, Rosa Pires, Henrique C. Neves and Carlos Santos

Parque Natural da Madeira, Quinta do Bom Sucesso, Caminho do Meio, 9050 Funchal, Madeira, Portugal

Abstract

The Mediterranean monk seal (*Monachus monachus*) survives in small isolated subpopulations, some of which currently are facing extinction. In the Archipelago of Madeira, the species is found only at the Desertas Islands, where it is legally protected. The last place on the main island of Madeira where monk seals were sighted was the São Lourenço Peninsula, where a protected area was recently created. A habitat survey carried out in the area, and recent sporadic sightings, indicated the existence of suitable resting and pupping habitat. The enforcement of protection measures in the area is intended to promote the establishment of a resident colony and enhance the species' recovery chances.

Key words: *Monachus monachus*, pinniped, Madeira, habitat, wildlife management.

Introduction

The Mediterranean monk seal (*Monachus monachus*) experienced a dramatic population decline in the past century and is considered to be critically endangered (Hilton-Taylor, 2000). The species is found only in isolated subpopulations in the Black Sea, the northeastern and western Mediterranean Sea, and in the Cabo Blanco Peninsula and the Archipelago of Madeira in the Atlantic Ocean (Aguilar, 1999).

Mediterranean monk seals seek refuge in isolated coastal caves to rest and reproduce (Sergeant *et al.*, 1978). Suitable seal shelters generally have one entrance leading to a chamber with a surface above water level (Marsalioglu, 1986). To prevent habitat loss, which is considered to be one of the main threats to the species (Johnson & Lavigne, 1999), conservationists have suggested the creation of Marine Protected Areas (MPAs) that will allocate enough suitable habitat for the continued survival of the species (Johnson & Lavigne, 1998).

In the Archipelago of Madeira commercial exploitation, deliberate killings by fishermen and accidental deaths in fishing gear led the species to the brink of extinction in the 1960s (Neves & Pires, 1999). Mediterranean monk seals now are found only around the Desertas islands, 11 nautical miles southeast of Madeira (Neves & Pires, 1998). To protect the species, the Parque Natural da Madeira Service (PNMS) initiated a Monk Seal Conservation and Monitoring Project (MSCMP) in 1988. The Desertas islands were declared a Nature Reserve in 1990. Due to the protection measures implemented in the area, the monk seal population of the Desertas, which is currently estimated at 24 individuals (Pires & Neves, 2001), has experienced a remarkable recovery and monk seal sightings on open beaches at the Desertas Islands and around the main island of Madeira have been steadily increasing (Pires & Neves, 2000; Pires, 2001).

Suitable habitat for the species in the Desertas area is limited. In order to enhance the chances of recovery of the monk seal colony, the Parque Natural da Madeira Service promoted the creation of additional protected areas on the main island of Madeira. One of the most promising candidate areas is the São Lourenço Peninsula, which is located at the easternmost tip of Madeira and is the nearest point to the Desertas islands. It is the last place on Madeira where Mediterranean monk seals were regularly sighted (Machado, 1979). The entire Peninsula and the adjacent marine area up to a depth of 50 m have been included in the Natura 2000 Network as a Site of Community Importance (SIC).

In 2001, the Parque Natural da Madeira Service carried out a habitat survey in the protected area of São Lourenço to assess and confirm the location of potential monk seal shelters, which were previously identified during a preliminary survey in 1993 (Neves, 1994). The 2001 survey aimed also at verifying the presence of monk seal individuals in the area. This information will be used in evaluating the suitability of the Peninsula for the future survival of the species.