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Parasite island syndromes in the context of nidicolous ectoparasites: Fleas (Insecta: Siphonaptera) in wild passerine birds from Azores Archipelago

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Abstract

Island syndrome, previously established for isolation process of insular vertebrates' populations, have been adapted to insular parasites communities, termed parasite island syndromes. In this work, were studied for the first time the insular syndromes for nidicolous ectoparasites of the bird species, Turdus *merula*, *Sylvia atricapilla*, *Fringilla coelebs* and Erithacus rubecula from Azores and the mainland Portugal. Flea species were only recorded on Azorean birds, namely *Dasypsyllus gallinulae* and Ctenocephalides felis *felis*, known as not host-specific parasites. In the absence of shared flea species between mainland and islands birds, a comparison among our fleas prevalence to Azores Islands and mainland fleas prevalence, recorded to others European studies, showed that Azorean host populations undergo higher prevalence than the mainland one. This result was consistent with parasite island syndromes predictions recorded to ectoparasites, hippoboscid flies and chewing lice, that fleas have higher prevalence on the Azores Islands compared to mainland Portugal. However, our results provide a new perspective to parasite island syndromes assumptions, namely in the context of nidicolous ectoparasites that spend only brief periods on the hosts' body.

Introduction

Isolation processes of vertebrate populations on islands, and in some groups of insects and plants as well, frequently involve an ecological and life-history shifts (morphometric, behavioral, physiological and genetic), comparatively to related mainland forms. These patterns together are known as the island syndrome [[1], [2], [3]]. Over the last two decades, the biogeographical patters of insular parasite populations have also been studied to understand the fundamental ecological and evolutionary processes involved. In Macaronesia, for instance, these studies included patters for different avian parasites groups, including: i) haemoparasites – haemoparasite assemblages of blackcap *Sylvia atricapilla* (Linnaeus, 1758) in the Macaronesia was impoverished, with low prevalence, frequent host-switching and reduced host specialization [4]. Likewise, Barrientos et al. [5] described the loss of species richness and lower prevalence to *Bucanetes githagineus* (Lichtenstein, MHC, 1823) in the Canary Islands. In turn, Illera et al. [6] did not find an impoverishment of parasite diversity and lower parasite prevalence in the *Sylvia conspicillata* (Temminck, 1820) in Macaronesia; ii) chewing lice – Azorean blackcaps had fewer parasite richness, higher chewing lice prevalence and host specialization [7]; iii) hippoboscid flies – insular passerine birds had highest parasite diversity, prevalence and abundance [8]; iv) mites – lower species richness in Azorean birds than their continental relatives [9]. Additionally, Barrientos et al. [5] recorded higher prevalence of mites in *B. githagineus* (Lichtenstein, MHC, 1823) from islands; and v) coccidian parasite – higher linage diversity on the Macaronesian population of *S. conspicillata* than on the continental areas [6]. On others European Islands, particularly Danish Islands, insular nests of *Parus major* Linnaeus, 1758 showed a higher level of fleas infestation than mainland [10]. Even though not considered a parasite, avian poxvirus was more prevalent on the Canary Islands in *Calandrella rufescens* (Vieillot, 1819) in relation to their mainland counterparts [11]. These changes in the insular communities of parasites were termed parasite island syndromes [4].

Even though little is known about which mechanisms are important in colonizing success of parasites in new regions, it is known that during the hosts range expansion, parasites often are lost, by one of two independent events: i) "missing the boat" – individuals hosts of founder population may not be infected with the parasite [12,13]; and ii) "drowning on arrival" – parasites do arrive with the founder hosts, but "sinking with the boat" when infected hosts arrive but fail to establish, or "lost overboard" when parasite establishment fail for other reasons [14]. Several factors, associated with parasites – low vagility, high host-specificity and life cycle complexity [13,15,16]; and hosts – small founding populations, high mortality, low social interaction and small body size [12], have been suggested to explain parasites "lost overboard".

The elementary assumptions of Theory of Island Biogeography, that the area of the island and the distance of the island from the mainland source population are determinant factors to the insular vertebrates differentiation, have also been incorporated in parasite island syndromes analysis [1,17]. Pérez-Rodríguez et al. [4] described a negative correlation between haemoparasites species richness and the island distance from the mainland. Moreover, Wiggins et al. [10] described a positive correlation between level of ectoparasite infestation in nests and island isolation. Regarding the effect of the island size, Ishtiaq et al. [15] found a positive correlation between *Plasmodium* lineage richness and island area. In turn, Spurgin et al. [18] observed that *Anthus berthelotii* Bolle, 1862, an endemic Macaronesian avian species, harbored fewer bloodborne pathogens (avian malaria, poxvirus and trypanosomes) on smaller and more isolated islands than larger and less isolated islands. No significant correlation between species richness of parasites and island size and isolation degree have been recorded in other studies [4,7].

Fleas (Insecta: Siphonaptera) are highly specialized holometabolous insects, small, wingless, laterally flattened, heavily chitinized and with strongly developed hind legs, adapted for jumping. As obligate blood-sucking parasites of mammals and birds, immediately when adult fleas emerge from the cocoon, they seek a host to find a blood meal [19,20]. Of the over 2.500 species worldwide currently described, only 6% of the species are ornithophilic [21]. Throughout the world, flea-borne diseases with medical and veterinary importance such as plague (caused by *Yersinia pestis*), murine typhus (caused by *Rickettsia typhi*) and cat-scratch disease (being *Bartonella henselae* its etiological agent) cause significant morbidity and mortality [22].

The main goal of this study was characterize the flea populations on Eurasian blackbird *Turdus merula* Linnaeus, 1758, Eurasian blackcap *S. atricapilla*, common chaffinch *Fringilla coelebs* Linnaeus, 1758 and European robin *Erithacus rubecula* (Linnaeus, 1758), on the Azores Islands and the mainland Portugal, to test the three assumptions of the parasite island syndromes: i) the parasite diversity on the islands should be very similar to that observed on the mainland. Because parasites can “missing the boat” or “drowning on arrival” during colonization events, we expect parasite richness in island birds to be equal to or less than birds on the mainland [[12], [13], [14]]; ii) parasites prevalence should be different between island and mainland birds. Parasites are subject to different conditions in island environments, usually showing to be favorable to ectoparasites [7,8]. Therefore, we expect the fleas to be more prevalent in island regions; and iii) generalist parasites should be more likely to occur on the islands. Since generalist parasites can use diverse hosts to thrive on the islands, we predict these parasites to be more frequent on both islands and the mainland [14]. Furthermore, parasite diversity on the islands should not be positively correlated with their area and proximity to the mainland. Since ectoparasites depend on birds to thrive on the islands, and birds are well established on Azores Archipelago, we expect that fleas' populations should not be structured according to the assumptions of Theory of Island Biogeography.

Section snippets

Field sampling

Fieldwork took place in three islands of the Azores Archipelago, namely São Miguel (37°46′49.48”N; 25°29′49.369”W), Terceira (38°43′17.908”N; 27°13′14.077”W) and Flores Island (39°26′50.896”N; 31°11′38.202”W), and South mainland Portugal, specifically at Silves (37°11′20.393”N; 8°26′28.338”W) and Olhão (37°1′33.751”N; 7°50′32.464”W), during the post-breeding seasons (October–December) of 2018–2019 (Fig. 1). Live birds of the species *T. merula* (n_{total}=240; n=60 to each Azores Island (and…

Results and discussion

Two flea species were found in wild birds from Azores Islands, namely moorhen flea *Dasypsyllus gallinulae* (Dale, 1878) (Fig. 2A) and cat flea *Ctenocephalides felis felis* (Bouché, 1835) (Fig. 2B); no flea species were found in the mainland Portugal birds. Moorhen flea specimens were observed in blackbirds and chaffinches in three Azores Islands (Flores, Terceira and São Miguel), while only robins and blackcaps from Terceira Island showed this flea species. A single individual of cat flea was…

Conclusions

Even though we did not correlate the effect of insularity on ectoparasite richness, overall, Azorean birds showed higher flea infestation rates than their mainland European counterparts, supporting part of the predictions postulated to parasite island syndromes. However, further studies are needed, especially during or immediately to post-breeding bird, in order to have a more reliable sample of common ectoparasites, which will allow for a better understanding of the parasite island syndromes…

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References (57)

S. Baeckens *et al.*

The island syndrome

Curr. Biol. (2020)

R. Barrientos *et al.*

Biogeography of haemo- and ectoparasites of an arid-land bird, the trumpeter finch

J. Arid Environ. (2014)

A. Tomás *et al.*

Louse flies in Azorean and mainland populations of four Passeriformes species: a new perspective to parasite island syndromes

Int. J. Parasitol. Parasites Wildl. (2021)

L.A. Durden *et al.*

Fleas (Siphonaptera)

J. Reiczigel *et al.*

Biostatistics for Parasitologists – a primer to quantitative parasitology

Trends Parasitol. (2019)

G.H. Adler *et al.*

The island syndrome in rodent populations

Q. Rev. Biol. (1994)

K.C. Burns

Evolution in Isolation: The Search for an Island Syndrome in Plants

(2019)

A. Pérez-Rodríguez *et al.*

Evolution of parasite island syndromes without long-term host population isolation: parasite dynamics in Macaronesian blackcaps *Sylvia atricapilla*

Glob. Ecol. Biogeogr. (2013)

J.C. Illera *et al.*

Unforeseen biogeographical patterns in a multiple parasite system in Macaronesia

J. Biogeogr. (2015)

I. Literák *et al.*

Chewing lice in Azorean blackcaps (*Sylvia atricapilla*): a contribution to Parasite Island syndromes

J. Parasitol. (2015)

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