Mite Fauna of the Family Syringophilidae (Acariformes: Prostigmata) Parasitizing Darwin’s Finches in Galápagos Archipelago

Maciej Skoracki 1,*, Bozena Sikora 1, Markus Unsoeld 2 and Martin Hromada 3,4,*

1 Department of Animal Morphology, Faculty of Biology, Adam Mickiewicz University, 61-614 Poznań, Poland; boszka@amu.edu.pl
2 Zoologische Staatssammlung München, Sektion Ornithologie, 81247 München, Germany; unsoeld@snsb.de
3 Laboratory and Museum of Evolutionary Ecology, Department of Ecology, Faculty of Humanities and Natural Sciences, University of Presov, 080 01 Prešov, Slovakia
4 Faculty of Biological Sciences, University of Zielona Góra, 65-516 Zielona Góra, Poland
* Correspondence: skoracki@amu.edu.pl (M.S.); hromada.martin@gmail.com (M.H.)

Abstract: Due to the biological uniqueness of the Galápagos Islands, ectoparasites of their avian fauna are relatively well-studied compared with other oceanic islands. However, in this study, quill mites (Acariformes: Prostigmata: Syringophilidae) were investigated for the first time in this archipelago. We investigated 7 species (out of 9) and 133 specimens of Darwin’s Finches of the genus Geospiza. Quill mite parasites were confirmed in two host species, Vampire Ground-Finch G. septentrionalis (Prevalence Index = 5%) and Small Ground-Finch G. fuliginosa (PI = 4%). Both hosts were infested by a new mite species, Aulonastus darwini sp. n., inhabiting the quills of their contour feathers. The host–parasite relationship is discussed.

Keywords: Acari; ectoparasites; Galápagos Archipelago; Geospiza; quill mites

1. Introduction

The geographical patterns of biodiversity on isolated islands are an intensively studied subject of evolutionary ecology [1,2]. However, despite this extensive research, island biogeography of parasites has received relatively little attention [3,4].

Oceanic Galápagos Islands, due to their isolation from the mainland, low probability of multiple colonization events, and restricted surface area, represent a unique natural laboratory and provide a suitable model to study co-phylogenetic patterns in hosts and parasites [5]. The archipelago is separated by ~1000 km of the ocean from the nearest mainland. It has low species diversity compared with other islands or close continental landmasses, representing a simpler community with fewer potential numbers of species and interactions among them [6]. Galápagos harbors 31 species of native resident land birds [7]. The archipelago’s isolation and harsh environment delayed its colonization by humans until the 1800s, and its biodiversity remains mostly intact; only ~5% of animal species have been lost. In addition, 26 breeding land bird species are endemic there, and no bird species extinctions occurred [8].

The bird symbionts (parasites and others) recorded on the Galápagos Islands can be divided into three groups according to their origin: (i) those that came to the islands with the ancestors of their host species; (ii) those acquired following colonization from other host species in the native bird community; and (iii) those introduced to the islands by humans [6].

Among the ectoparasites found on Galápagos land birds, the most studied group is probably Phthiraptera [6,9]. Relatively well-studied are also Diptera, particularly Hippoboscidae [6,10], and accidentally introduced parasitic vampire nest fly, Philornis downsi (Muscidae), which causes significant mortality and threatens the survival of some endangered species [11].
Regarding mites, although no parasitic prostigmatan mites (Prostigmata) were detected to date, representatives of several astigmatan families (Astigmata) were recorded from Galápagos birds, e.g., Psoroptoididae, Xolalgidae, Trouessartiidae, Proctophyllodidae, Analgidae, and Dermoglyphidae [6,10,12–16].

Darwin’s Finches are a monophyletic clade of 5 genera and 18 species of passerine birds native to the Galápagos Islands; they are members of the species-rich Neotropical family Thraupidae (tanagers and allies) [17–19]. Their biogeography, diet ranging from seeds to insects and even blood, and specialized beak morphology make them a classic example of adaptive radiation [17,20]. The most speciose Darwin’s Finch genus is Geospiza, with nine species (this number can differ according to taxonomy) [18].

Quill mites of the family Syringophilidae (Acariformes: Prostigmata) represent a cosmopolitan and taxonomically the most diverse group of obligatory and permanent parasites. They live and reproduce inside hollow quills (calamus) of the wing, tail, and contour feathers [21,22]. All stages of these mites (larvae, protonymphs, tritonymphs, and adults) are able to feed on fluids of the soft tissue of their hosts by piercing the quill wall with their needle-like, movable cheliceral digits [21,22]. Despite this family comprising more than 400 species described from all zoogeographical regions and continents (except Antarctica) [23], syringophilids associated with birds of the Galápagos Archipelago have never been studied. In this paper, we present the results of our study on the quill mites associated with Darwin’s Finches of the genus Geospiza.

2. Materials and Methods

During our research in the Bavarian State Collection of Zoology, Munich, Germany (SNSB-ZSM), we examined 133 bird specimens collected between 1891 and 1901 belonging to 7 (out of 9 currently recognized) species of Darwin’s Finches of the genus Geospiza from different Galápagos islands:

1. Large Cactus-Finch Geospiza conirostris Ridgway, (N = 6), from Espanola (=Hood) Island;
2. Genovesa Cactus-Finch Geospiza propinqua Ridgway, (N = 8), from Genovesa (=Tower) Island;
3. Common Cactus-Finch Geospiza scandens (Gould), (N = 20)—subsp. scandens (N = 4), from Santiago (=James) and Rabida (=Jervis) Islands, and subsp. intermedia (N = 16), from Santa Fe (=Barrington), Floreana (=Charles), Isabela (=Albemarle), and Pinzon (=Duncan) Islands;
4. Genovesa Ground-Finch Geospiza acutirostris Ridgway, (N = 8), from Genovesa (=Tower) Island;
5. Vampire Ground-Finch Geospiza septentrionalis Rothschild and Hartert, (N = 19), from Wolf (=Wenman, N = 17) and Darwin (=Culpepper N = 2) Islands;
6. Small Ground-Finch Geospiza fuliginosa Gould, (N = 48), from Isabela (=Albemarle), Santa Fe (=Barrington), Floreana (=Charles), San Cristobal (=Chatham), Pinzon (=Duncan), Gardner, Espanola (=Hood), Santiago (=James) and Rabida (=Jervis), Pinta (=Abingdon), and Marchena (=Bindloe) Islands;
7. Medium Ground-Finch Geospiza fortis Gould, (N = 24), from Santiago (=James) Island.

Although there are specimens labeled “Geospiza difficilis” in SNSB-ZSM, specifically, G. difficilis septentrionalis and G. difficilis nigrescens, these subspecies from Darwin/Wolf Islands are considered today to be full species, i.e., G. septentrionalis [18]. Similarly, subspecies G. difficilis acutirostris from Genovesa Island was erected to full species. Therefore, we considered monotypic G. difficilis sensu stricto, occurring on Pinta, Fernandina, and Santiago Islands (in the past, also Santa Cruz, Floreana, and San Cristobal Islands) [24], as not investigated in our study.

From each specimen, we examined about ten contour feathers (near the cloaca region), about five under tail coverts, and one small wing covert. Before mounting, mites were softened and cleared in Nesbitt’s solution at room temperature for three days, according to the protocol introduced by Walter and Krantz [25] and Skoracki [22]. Then, mites were mounted on slides in Hoyer’s medium and investigated using a light microscope.
(ZEISS Axioscope, Oberkochen, Germany) with differential interference contrast (DIC) illumination. Drawings were made using a camera lucida drawing attachment.

In the description, all measurements are in micrometers, and the dimension ranges of the paratypes are given in parentheses following the data from the holotype. The idiosomal setation follows Grandjean [26] as adapted for Prostigmata by Kethley [27]. The leg chaetotaxy follows that proposed by Grandjean [28]. Finally, the morphological terminology follows Skoracki [22].

Descriptive statistics were computed using Quantitative Parasitology on the Web [29], with 95% confidence intervals (the Sterne method).

Specimen depositories are cited using the following abbreviations: AMU—A. Mickiewicz University, Department of Animal Morphology, Poznan, Poland; SNSB-ZSM—Zoologische Staatssammlung München, München, Germany.

3. Results
3.1. Species Composition
Among the examined birds, three individuals were parasitized by quill mites, i.e., Geospiza septentrionalis (N = 19; infested = 1; prevalence index = 5%; CI = 0.3–25.7%), and Geospiza fuliginosa (N = 48; infested = 2; PI = 4%; CI = 0.7–14.3%). All three infested birds were parasitized by the same quill mite species described below as a new species for science.

3.2. Systematics

Family Syringophilidae Lavoipierre
Subfamily Syringophilinae Lavoipierre
Genus Aulonastus Kethley

3.2.1. Description

Aulonastus darwini sp. n. (Figure 1A–D).

Female, holotype. The total body length is 450 (455–520 in six paratypes). Gnathosoma:

Infracapitulum apunctate. Stylophore is 130 (130–135) long, and the exposed portion of the stylophore apunctate is 100 (100–110) long. Each medial branch of the peritremes has two chambers, and each lateral branch has four or five chambers.

Idiosoma:
Propodonotal shield is rounded anteriorly and apunctate, bearing bases of setae ve, si, se, and c1. Setae c1 and se are situated at the same transverse level. The length ratio of setae vesi is 1:1. Setae c1 are 1.2–1.4 times longer than se. The length ratio of setae d2:c1 is 1:1.3–1.5. Hysteronotal shield is fused to pygidial shield and apunctate, with bases of setae d1 and e2 situated out of this shield, anterior margin of this shield reaching level of d1 setal bases. Setae f2 are about 2.3–3 times longer than f1. Setae h2 are about 6.4–6.8 times longer than f2. The length ratio of setae agTag2ag3 is 1.1–1.4:1:1.5–1.9. The genital plate is absent. Both pairs of genital setae are subequal in length. All coxal fields are apunctate. Setae 3c are 2.4–2.8 times longer than 3b. Legs. Fan-like setae p′ and p″ of legs III and IV have six or seven tines. Setae tc″ of legs III and IV are 1.7 times longer than tc′III–IV. Lengths of setae: ve 20 (18–20), si 20 (18–20), se 150 (135–155), c1 195 (160–210), c2 130 (120–150), d1 15 (15–20), d2 130 (125–160), e2 15 (15–20), f1 20 (15–20), f2 45 (40–45), h1 20 (15–20), h2 290 (305), ps1 20 (15–20), g1 and g2 25 (20–25), ag1 100 (90–100), ag2 70 (75–80), ag3 130 (120–145), tc″III–IV 30 (30), tc′′III–IV 50 (45–50), 3b 25 (25), 3c 60 (60–70), l′III 45 (35–45), and l′ IV 35 (35).

Male. Not found.

Type Material
Female holotype and six female paratypes from the quill of contour feathers of Vampire Ground-Finch Geospiza septentrionalis Rothschild and Hartert (Passeriformes: Thraupidae) (host reg. no. SNSB-ZSM 03.2959); ECUADOR: Galápagos Islands, Wolf (=Wenman) Island, 1 February 1901, coll. R.H. Beck.


Figure 1. *Aulonastus darwini* sp. n., female: A—dorsal view; B—ventral view; C—peritremes; D—fan-like seta p’III.

Type Material Deposition

Holotype and four paratypes are deposited in the AMU (AMU MS-22-0202-067), and two female paratypes in the SNSB (SNSB-ZSM A20112130).

Additional Material

Ex quill of contour feathers of Small Ground-Finch *Geospiza fuliginosa* Gould (host reg. no. SNSB 03.1026); ECUADOR: Galápagos Islands, Isabela (=Albemarle) Island, 27 July 1891, coll. Unknown—two females deposited in the AMU (AMU MS-22-0202-069) and two females in the SNSB (SNSB-ZSM A20112132). Ex same host species and habitat (host reg. no. SNSB-ZSM 03.1048); ECUADOR: Galápagos Islands, San Cristobal (=Chatham) Island, 25 August 1891, coll. unknown—one female deposited in the SNSB (SNSB-ZSM A20112131).

Differential Diagnosis

*Aulonastus darwini* sp. n. is morphologically the most similar to *A. fringillus* Skoracki, 2011 described from *Fringilla coelebs* (Fringillidae) from Poland [22]. In females of both
species, each medial branch of the peritremes has two chambers, and each lateral branch has four or five chambers; the propodonotal shield is rectangular and bears bases of setae se, si, se, and c1; setae c1 are longer than se; setae e2 and d1 are subequal in length; setae h2 are longer than f2, and agenital setae ag2 are longer than 60 µm.

This new species differs from A. fringillus by the following features: in females of A. darwini, the infracapitulum is apunctate; the propodonotal shield is rounded anteriorly and apunctate; setae c1 are 1.3–1.5 times longer than d2, and lengths of setae d2 are 125–160 µm. In females of A. fringillus, the infracapitulum is sparsely punctate; the propodonotal shield is with a concave anterior margin and punctate on the whole surface; setae c1 are 1.9–2 times longer than d2, and lengths of setae d2 are 80–90 µm.

Etymology
The species is named after Charles Darwin and the common English name of the whole host lineage (Darwin Finches, Geospizini), which played an important role when Darwin formulated his theory of evolution by natural selection [30,31].

4. Discussion
4.1. Quill Mites of the Higher-Level Host Group—Birds of the Family Thraupidae

The Neotropic Tanagers and allies (Thraupidae) are poorly researched for the presence of the mite fauna of the family Syringophilidae, despite being the second-largest family of birds (it represents ~4% of all avian species and 12% of the Neotropical birds) [32]. Currently, only four mite species are recorded from six tanager hosts, i.e., (1) Neopicobia herbicola Glowska, Laniecka and Milensky, 2015, collected from Wedge-tailed Grass-Finch Emberizoides herbicola (Vieillot) (Emberizoidinae) from Guyana; (2) Syringophiloidus stavarczycki Skoracki, 2004, recorded on Blue Dacnis Dacnis cayana (Linnaeus) (Dacninae) and White-lined Tanager Tachyphonus rufus (Boddaert) (Tachyphoninae), both from Brazil; (3) Syringophiloidus sporophila Skoracki, 2017, collected from Cinnamon-rumped Seedeater Sporophila torqueola (Bonaparte) (Sporophilinae) from Mexico; and (4) above described Aulonastus darwini from Vampire Ground-Finch Geospiza septentrionalis and Small Ground-Finch G. fuliginosa (Coerebinae) [33–35]; present paper.

Considering that the family Thraupidae comprises more than 380 species [18], it shows how insufficient (less than 2%) is our knowledge of the syringophilid fauna associated with this host group. However, the above species overview shows that this taxon is infested by both large-sized mites such as Syringophiloidus (subfamily Syringophilinae), which occupy quills of large flight feathers with large calamus cavity and thick quill walls (secondaries) and small-sized syringophilids inhabiting small contour feathers such as representatives of the genera Aulonastus (Syringophilinae) and Neopicobia (Picobiinae). This set of genera (with many still undiscovered species) can be characteristic of birds belonging to the family Thraupidae.

4.2. Quill Mites of Darwin’s Finches

Darwin’s Finches form a group of approximately 18 species in 5 genera belonging to the subfamily Coerebinae [18], which exhibit the highest propensity for dispersal of all lineages in the tangarer radiation; most tanagers native to isolated islands are members of this subfamily [36]. Until now, we had no information on the presence of quill mites on other members of this subfamily, and currently, we present data about quill mite fauna associated with one genus of Darwin’s Finches (Geospiza), while the other genera of this group, i.e., Camarhynchus (five species), Certhidea (two species), Pinaroloxias (one species), Platyspiza (one species) still remain unexamined.

The overall diversity of Geospiza quill mites found in the Galápagos Archipelago seems to be low, in accordance with parasite island syndrome theory [3,37]. Out of 7 investigated species and 133 specimens of Darwin’s Finches of genus Geospiza, quill mite parasites were confirmed in only 2 species, G. septentrionalis and G. fuliginosa, whereas 5 Geospiza species examined in our study were not confirmed as hosts of quill mites, i.e., G. fortis, G. scandens,
Two species, namely *G. magnirostris* and *G. difficilis*, were not investigated in our study. At the moment, it is hard to say whether other species were not confirmed as quill mite hosts due to low sample size or any sorting event: parasites could either “miss the boat” during the colonization of individual Galápagos Islands (founding *Geospiza* population did not harbor the parasite on their arrival), or mites could be “lost overboard” (despite colonizing finches did harbor parasites, they lost them already when on the islands due to substantial host population fluctuations in harsh insular conditions) [17,38].

4.3. *Hosts of Aulonastus darwini sp. n.*

The Vampire Ground-Finch *Geospiza septentrionalis*, which is one of the hosts for *Aulonastus darwini*, is restricted only to Wolf and Darwin Islands, in the far northwestern corner of the archipelago, remote even by Galápagos standards. Due to the barrenness of both islands, the Vampire Ground-Finches undergo extreme dietary limitations during the dry season; they shift from seeds toward an insectivore diet but also significantly feed on blood and eggs of breeding seabirds and even partially digested fish regurgitate and guano. Blood-feeding likely evolved from the avian ectoparasite feeding (probably hippoboscid louse-flies), and then finches shifted from this mutualism to piercing the bird skin, allowing them to consume blood [20,39–41].

In our study, we investigated 19 bird individuals collected from both the Wolf and Darwin Islands, and we found only one infested host (originating from Wolf I.).

On the other hand, the second host of *A. darwini*, the Small Ground-Finch, is one of the most common, abundant, and highly adaptable, as well as widespread of Darwin’s Finches of the Galápagos Islands; it occurs on almost all the islands of the archipelago. In towns and villages, they act very much similar to a House Sparrow (*Passer domesticus*) in other parts of the world [42]. We examined birds (N = 48) collected from 11 islands (Isabela, Santa Fe, Floreana, San Cristobal, Pinzon, Gardner, Espanola, Santiago, Rabida, Pinta, and Marchena), and 2 of them were infested (originating from Isabela and San Cristobal Islands).

4.4. *Prevalence of Infestation and Habitat Preference*

The information about the proportion of infected hosts in the host population (index of prevalence (IP)) has recently appeared more in the literature on syringophilid mites and their hosts. Thus far, IP has been calculated for birds collected in the wild [43–55], kept in farm households [56,57], or zoological gardens [58], as well as on the birds housed in museum collections [59–64]. The historic bird skins in museums are as good material for studying quill mite ecology as living birds because these ectoparasites are not able to leave the calamus after the host’s death. All these studies show that the highest prevalence was noted among domestic birds kept in crowded conditions or birds closely associated with humans (such as House Sparrows), where IP can reach more than 80% (see [47,65]). Less but still high IP was noted for wild social birds, in which IP reaches 38% (see [62]). The lowest prevalence was recorded in wild and non-social birds, in which IP rarely exceeds 10% (see, e.g., [54]).

Examination of both Darwin’s Finches in our study shows a relatively low index of the prevalence of mite *A. darwini* (4–5%). However, their population parameters substantially differ. Vampire Darwin’s Finch has a global population estimated at fewer than 1000 mature individuals [38], while Small Ground-Finch lives on most Galápagos Islands, and its population is considered abundant. Due to highly insular conditions and permanently limited host population size (or, the island syndrome [3]) one would expect higher prevalence at least in Vampire Darwin’s Finch. Additionally, noteworthy is the fact that both prevalence and parasite presence/absence data are historic in our study, more than 120 years old.
In contrast to our findings, O'Connor et al. [14] and Villa et al. [13] noted that Geospiza species are commonly infested by feather mites (e.g., of the genera Mesalgoides, Proctophyllodes, Trouessartia, and Xolalgoides), in which the IP is higher than 25%.

Representatives of the genus Aulonastus are small-sized mites, and they are found mainly inside feather quills of wing coverts, contour feathers, and occasionally inside secondaries in small-sized passerines [21,22]. In our study, all mite specimens were collected from quills of contour feathers. Interestingly, besides the 133 examined specimens of 7 host species, we did not find any representative of the subfamily Picobiinae, which exclusively inhabit this type of habitat. One possible explanation for the absence of picobine mites on the Galápagos Archipelago could be again any kind of sorting event as for this subfamily—the founding flock of Darwin’s Finches that started to colonize the archipelago could be parasitized only by representatives of the syringophilinid genus Aulonastus. However, more detailed research is needed.

Author Contributions: Conceptualization, M.S. and M.H.; methodology, M.S. and B.S.; investigation, M.S., M.U., B.S. and M.H.; resources and material collection, M.S., M.U. and B.S.; writing—original draft preparation, M.S., M.H. and B.S.; writing—review and editing, M.S., M.H., B.S. and M.U.; supervision, M.S. and M.H. All authors have read and agreed to the published version of the manuscript.

Funding: The research was supported by the DAAD (Deutscher Akademischer Austauschdienst; 2021) to M.S.; the Slovak Research and Development Agency under the contract APVV-16-0411 and the Agency of the Ministry of Education, Research and Sport of the Slovak Republic and Slovak Academy of Sciences 1/0876/21 to M.H.

Institutional Review Board Statement: Ethical review and approval were waived for this study due to the use of only dead animals (specimens deposited in the ornithological collection).

Data Availability Statement: All necessary data (such as localities) are available in the text of this article.

Acknowledgments: We thank Roland Melzer and Stefan Friedrich (SNSB-ZSM—Arthropoda Varia) for their help during our (M.S. and B.S.) stay in the SNSB. We also thank anonymous reviewers for their critical review of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References
1. MacArthur, R.H.; Wilson, E.O. *The Theory of Island Biogeography*; Princeton University Press: Princeton, NJ, USA, 1967.
2. Losos, J.B.; Ricklefs, R.E. *The Theory of Island Biogeography Revisited*; Princeton University Press: Princeton, NJ, USA, 2009.
3. Nieberding, C.; Morand, S.; Libois, R.; Michaux, J.R. Parasites and the Island Syndrome: The Colonization of the Western Mediterranean Islands by *Helignosomoides polygyrus* (Dujardin, 1845). J. Biogeogr. 2006, 33, 1212–1222. [CrossRef]
4. Tomé, B.; Pereira, A.; Jorge, F.; Carretero, M.A.; Harris, D.J.; Perera, A. Along for the Ride or Missing It Altogether: Exploring the Host Specificity and Diversity of Haemogregarines in the Canary Islands. *Parasit. Vectors* 2018, 11, 190. [CrossRef] [PubMed]
5. Štefka, J.; Hoeck, P.E.A.; Keller, L.F.; Smith, V.S. A Hitchhikers Guide to the Galápagos: Co-Phylogeography of Galápagos Mockingbirds and Their Parasites. *BMC Evol. Biol.* 2011, 11, 284. [CrossRef] [PubMed]
6. Sari, E.H.R.; Klompen, H.; Parker, P.G. Tracking the Origins of Lice, Haemosporidian Parasites and Feather Mites of the Galápagos Flycatcher (*Myiarchus magnirostris*). *J. Biogeogr.* 2013, 40, 1082–1093. [CrossRef]
7. Jimenez-Uzcategui, G.; Wiedenfeld, D.; Vargas, F.; Snell, H. CDF Checklist of Galápagos Birds. In *Charles Darwin Foundation Galápagos Species Checklist*; Bungartz, F., Herrera, H., Jaramillo, P., Tirado, N., Jimenez-Uzcategui, G., Ruiz, D., Guezou, A., Ziemmek, F., Eds.; Charles Darwin Foundation: Puerto Ayora, Ecuador, 2014.
8. Parker, P.G.; Whiteman, N.K.; Miller, R.E. Conservation Medicine on the Galápagos Islands: Partnerships Among Behavioral, Population, and Veterinary Scientists. *Auk* 2006, 123, 625–638. [CrossRef] [PubMed]
9. Palma, R.L.; Peck, S.B. An Annotated Checklist of Parasitic Lice (Insecta: Phthiraptera) from the Galápagos Islands. *Zootaxa* 2013, 3627, 1–87. [CrossRef]
10. Whiteman, N.K.; Sánchez, P.; Merkel, J.; Klompen, H.; Parker, P.G. Cryptic Host Specificity of an Avian Skin Mite (Epidermoptidae) Vectored by Louseflies (Hippoboscidae) Associated with Two Endemic Galápagos Bird Species. *J. Parasitol.* 2006, 92, 1218–1228. [CrossRef]
11. O’Connor, J.A.; Sulloway, F.J.; Robertson, J.; Kleindorfer, S. *Philornis downsi* Parasitism Is the Primary Cause of Nestling Mortality in the Critically Endangered Darwin’s Medium Tree Finch (*Camarchynchus parter*). *Biodivers. Conserv.* 2010, 19, 853–866. [CrossRef]
12. Madden, D.; Harmon, W.M. First Record and Morphology of *Myialges caulotoon* (Acari: Epidermoptidae) from Galapagos Hosts. *J. Parasitol.* 1998, 84, 186–189.
13. Villa, S.M.; Le Bohec, C.; Koop, J.A.H.; Proctor, H.C.; Clayton, D.H. Diversity of Feather Mites (Acari: Astigmata) on Darwin’s Finches. *J. Parasitol.* 2013, 99, 756–762. [CrossRef]

14. O’Connor, B.M.; Foufopoulos, J.; Lipton, D.; Lindström, K. Mites Associated with the Small Ground Finch, *Geospiza fuliginosa* (Passeriformes: Emberizidae), from the Galapagos Islands. *J. Parasitol.* 2005, 91, 1304–1313. [CrossRef] [PubMed]

15. Mironov, S.V.; Perez, T.M. Two New Feather Mites (Astigmata, Analgoidea) from Ground Finches of the Genus Geospiza. *Acta Parasitol.* 2002, 47, 228–234.

16. Lindström, K.M.; Dolnik, O.; Yabsley, M.; Pärn, H.; Foufopoulos, J. Feather Mites and Internal Parasites in Small Ground Finches (*Geospiza fuliginosa*, Emberizidae) from the Galapagos Islands (Equador). *J. Parasitol.* 2009, 95, 39–45. [CrossRef] [PubMed]

17. Grant, P.R.; Rosemary Grant, B. *How and Why Species Multiply: The Radiation of Darwin’s Finches*; Princeton University Press: Princeton, NJ, USA, 2020.

18. Winkler, D.W.; Billerman, S.; Lovette, I.J. Tanagers and Allies (Thraupidae), Version 1.0. In *Birds of the World*; Billerman, S., Keeney, B.K., Rodewald, P.G., Schulenberg, T.S., Eds.; Cornell Lab of Ornithology: Ithaca, NY, USA, 2021.

19. Tebbich, S.; Fessl, B.; Blomqvist, D. Exploration and Ecology in Darwin’s Finches. *Evol. Ecol.* 2009, 23, 591–605. [CrossRef]

20. Michel, A.J.; Ward, L.M.; Goffredi, S.K.; Dawson, K.S.; Baldassarre, D.T.; Brenner, A.; Gotanda, K.M.; McCormack, J.E.; Mullin, S.W.; O’Neill, A.; et al. The Gut of the Finch: Uniqueness of the Gut Microbiome of the Galápagos Vampire Finch. *Microbiome* 2018, 6, 167. [CrossRef]

21. Kethley, J. A Revision of the Family Syringophilidae. *Contrib. Am. Entomol. Inst.* 1970, 5, 1–76.

22. Skoracki, M. Quill Mites (Acari: Syringophilidae) of the Palaearctic Region. *Zootaxa* 2011, 2840, 1–414. [CrossRef]

23. Zmudzinski, M.; Skoracki, M.; Sikora, B. An Updated Checklist of Quill Mites of the Family Syringophilidae (Acariformes: Prostigmata). 2021. Available online: https://github.com/articles/dataset/An_updated_checklist_of_quill_mites_of_the_family_Syringophilidae_Acariformes_Prostigmata_/16529574/1 (accessed on 15 July 2022).

24. Jaramillo, A.; Marks, J.S. Sharp-Beaked Ground-Finch (*Geospiza difficilis*), Version 1.0. In *Birds of the World*; del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A., de Juana, E., Eds.; Cornell Lab of Ornithology: Ithaca, NY, USA, 2020.

25. Krantz, G.W.; Walter, D.E. A Manual of Acarology; Texas Tech University Press: Lubbock, TX, USA, 2009.

26. Grandjean, F. Les Segments Post-Larvaires de L’hystérosoma Chez Les Oribates (Acariens). *Bull. Soc. Zool. Fr.* 1944, 55, 4282–4285.

27. Kethley, J.B. *Acarina: Prostigmata (Actinedida)*. In *Soil Biology Guide*, 2015, 488–493. [CrossRef]

28. Grandjean, F. Observations Sur Les Acariens de La Famille Des Stigmataeidae. *Arch. Sci. Phys. Nat.* 1944, 26, 103–131.

29. Reitzel, J.; Marozzi, M.; Fábián, I.; Rózsa, L. Biostatistics for Parasitologists—A Primer to Quantitative Parasitology. *Trends Parasitol.* 2019, 35, 277–281. [CrossRef]

30. Lack, D. *Darwin’s Finches*; Cambridge University Press: Cambridge, UK, 1947.

31. Sulloway, F.J. The Beagle Collections of Darwin’s Finches (Geospizinae). *Bull. Br. Mus. Nat. Hist. Zool. Ser.* 1982, 43, 49–94.

32. Burns, K.J.; Shulz, A.J.; Title, P.O.; Mason, N.A.; Barker, F.K.; Klicka, J.; Lanyon, S.M.; Lovette, I.J. Phylogenetics and Diversification of Tanagers (Passeriformes: Thraupidae), the Largest Radiation of Neotropical Songbirds. *Mol. Phylogenet. Evol.* 2014, 75, 41–77. [CrossRef] [PubMed]

33. Skoracki, M. A Review of Quill Mites of the Genus *Syringophiloides* Kethley, 1970 Parasitizing Quills of Passeriform Birds, with Descriptions of Four New Species. *Genus* 2004, 15, 281–300.

34. Skoracki, M. Quill Mites (Acariformes: Syringophilidae) Associated with Birds of Mexico. *Zootaxa* 2017, 4282, 179–191. [CrossRef]

35. Glowska, E.; Laniecka, I.; Milensky, C.M. Two New Picobiin Mite Species (Acari: Cheyletoidea: Syringophilidae) Parasitizing Passerine Birds in Guyana. *Acta Parasitol.* 2015, 60, 488–493. [CrossRef]

36. Funk, E.R.; Burns, K.J. Biogeographic Origins of Darwin’s Finches (Thraupidae: Coerebin). *Auk* 2018, 135, 561–571. [CrossRef]

37. Bliard, L.; Paquet, M.; Robert, A.; Dufour, P.; Renoult, J.P.; Grégoire, A.; Crochet, P.-A.; Covas, R.; Doutrelant, C. Examining the Link between Relaxed Predation and Bird Coloration on Islands. *Biol. Lett.* 2020, 16, 20200002. [CrossRef] [PubMed]

38. MacLeod, C.J.; Paterson, A.M.; Tompkins, D.M.; Duncan, R.P. Parasites lost—Do invaders miss the boat or drown on arrival? *Ecol. Lett.* 2010, 13, 516–527. [CrossRef]

39. del Hoyo, J.; Collar, N.; Sharpe, C.J. *Vampire Ground-Finch* (*Geospiza spectrunculalis*), Version 1.0. In *Birds of the World*; del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A., de Juana, E., Eds.; Cornell Lab of Ornithology: Ithaca, NY, USA, 2020.

40. Schluter, D.; Grant, P.R. Ecological Correlates of Morphological Evolution in a Darwin’s Finch, *Geospiza difficilis*. *Evolution* 1984, 38, 856–869. [CrossRef] [PubMed]

41. Bowman, R.L.; Billeb, S.I. Blood-Eating in a Galápagos Finch. *Living Bird* 1965, 4, 29–44.

42. Jaramillo, A.; Christie, D.A. Small Ground-Finch (*Geospiza fuliginosa*), Version 1.0. In *Birds of the World*; del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A., de Juana, E., Eds.; Cornell Lab of Ornithology: Ithaca, NY, USA, 2020.

43. Doster, G.L.; Wilson, N.; Kellogg, F.E. Ectoparasites Collected from Bobwhite Quail in the Southeastern United States. *J. Wildl. Dis.* 1980, 16, 515–520. [CrossRef] [PubMed]

44. Casto, S.D. Entry and Exit of Syringophilid Mites (Acari: Syringophilidae) from the Lumen of the Quill. *Wilson Bull.* 1974, 86, 272–278.

45. Casto, S.D. Quill Wall Thickness and Feeding of *Syringophiloides minor* (Berlese) (Acari: Syringophilidae). *Ann. Entomol. Soc. Am.* 1974, 67, 824. [CrossRef]
46. Casto, S.D. Mortality in the Quill Mite, *Syringophiloidus minor* (Acari: Syringophilidae). *Ann. Entomol. Soc. Am.* 1975, 68, 551–552. [CrossRef]

47. Casto, S.D. The Effect of the Postjuvenal Molt in the House Sparrow on Infestations of the Quill Mite, *Syringophiloidus minor* (Berlese) (Acari: Syringophilidae). *J. Med. Entomol.* 1975, 12, 23–27. [CrossRef] [PubMed]

48. Skoracki, M.; Møller, A.P.; Tryjanowski, P. A New Species of Parasitic Mites of the Genus *Syringophiloidus* Kethley 1970 (Acari: Syringophilidae) from the Barn Swallow *Hirundo rustica* Linnaeus, 1758. *Parasite* 2003, 10, 17–20. [CrossRef]

49. Skoracki, M.; Michalik, J.; Sikora, B. Prevalence and Habitat Preference of Quill Mites (Acari, Syringophilidae) Parasitizing Forest Passerine Birds in Poland. *Acta Parasitol.* 2010, 55, 188–193. [CrossRef]

50. Moraes, D.L.; Goulart, T.M.; Prado, A.P. Mites Associated with the Ruddy Ground Dove, *Columbina talpacoti* (Temminck, 1810), in São Paulo State, Brazil. *Zoosymposia* 2011, 6, 267–274. [CrossRef]

51. Goulart, T.M.; Moraes, D.L.; Prado, A.P. Mites Associated with the Eared Dove, *Zenaida auriculata* (Des Murs, 1847), in São Paulo State, Brazil. *Zoosymposia* 2011, 6, 275–281. [CrossRef]

52. Moraes, D.L.; Goulart, T.M.; Prado, A.P. Mites Associated with Sub-Saharan Sunbirds (Passeriformes: Nectariniidae). *J. Med. Entomol.* 2007, 44, 288–299. [CrossRef] [PubMed]

53. Kaszewska-Gilas, K.; Kosicki, J.Z.; Hromada, M.; Skoracki, M. Global Studies of the Host-Parasite Relationships between Ectoparasitic Mites of the Family Syringophilidae and Birds of the Order Columbiformes. *Animals* 2021, 11, 3392. [CrossRef] [PubMed]

54. Kaszewska, K.; Skoracki, M.; Hromada, M. A Review of the Quill Mites of the Genus *Gunabopicobia* Skoracki and Hromada (Acari: Syringophilidae) Associated with Birds of the Order Columbiformes. *Int. J. Acarol.* 2018, 44, 1464–1477. [CrossRef]

55. Kaszewska, K.; Skoracki, M.; Hromada, M. Parasitic Quill Mites of the Family Syringophilidae (Acariformes: Prostigmata) Associated with Birds of the Order Columbiformes. *Int. J. Acarol.* 2018, 44, 288–299. [CrossRef] [PubMed]