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MITES ASSOCIATED WITH THE SMALL GROUND FINCH, *GEOSPIZA FULIGINOSA* (PASSERIFORMES: EMBERIZIDAE), FROM THE GALÁPAGOS ISLANDS

Barry M. OConnor, Johannes Foufopoulos*, David Lipton†, and Karin Lindström‡

Museum of Zoology and Department of Ecology and Evolutionary Biology, The University of Michigan, Ann Arbor, Michigan 48109. *e-mail: bmoc@umich.edu*

ABSTRACT: In collections of ectoparasites from 368 small ground finches, *Geospiza fuliginosa*, in populations from the islands of Isabela, Santa Cruz, San Cristóbal, and Santa Fé, in the Galápagos Archipelago, Ecuador, we found 8 species of mites. Four mite species were common on all islands sampled, i.e., *Mesalgoides geospizae* Mironov and Pérez (Psoroptoididae), *Xolalges palmai* Mironov and Pérez (Xolalgidae), and 2 new species, *Trouessartia geospiza* n. sp. (Trouessartiidae) and *Proctophyllodes darwini* n. sp. (Proctophyllodidae). Four other species were represented by single collections from *G. fuliginosa*, i.e., *Pterodectes atyeoi* n. sp. (Proctophyllodidae), *Strelkoviacarus* sp. (Analgidae), *Dermoglyphus* sp. (Dermoglyphidae), and *Dermanyssus* sp. (Dermanyssidae). Authorship of new species names is attributed to the 3 authors who prepared the descriptions (B.M.O.C., J.F., D.L.). *Trouessartia geospiza* and *P. atyeoi* were also found on previously collected specimens of other *Geospiza* species in museum collections. For the 4 common species, we found no differences in prevalence among the 4 island populations, but infection prevalence differed among the 4 species. The mean infection prevalence was high for *T. geospizae* (89%), moderate for *M. geospizae* (58%) and *X. palmai* (44%), and low for *P. darwini* (26%) in all populations. The feather mite fauna of *G. fuliginosa* was similar to that of other *Geospiza* species, and generally related to communities found on other emberizid finches.

Although the Galápagos Islands have been the focus for many studies in evolutionary biology, very little is known about the parasite fauna of the vertebrates on the islands. Because island ecosystems like the Galápagos are facing a current threat of exposure to invading pathogens, baseline surveys of parasite faunas have now become urgent (Wikelski et al., 2004). On the Galápagos, studies on ectoparasitic Acari have been largely limited to ticks (Ixodoidea) and chiggers (Trombiculoidea). In his catalog of Galápagos Acari, Schatz (1991) recorded 17 species, of which 14 were endemic to the islands. The majority of these parasites were found on endemic iguanas and tortoises, with only 1 ixodid tick, *Ixodes galapagoensis* Clifford and Hoogstraal, 1980, restricted to the endemic rice rat, *Oryzomys galapagoensis* (Waterhouse, 1839) (= *O. bauri* of authors), and 1 argasid, *Alectorobius yunkeri* (Keirans, Clifford, and Hoogstraal, 1984), on seabirds. Studies on the astigmatid mites of birds on the islands have been very limited. Madden and Harmon (1998) reported female epidermoptid mites identified as *Myialges caulotoon* Speiser, 1907, as hyperparasites on 2 species of hippoboscid flies, *Olfersia sordida* Bigot, 1835, and *Lynchia* (= *Icosta*) *nigra* (Perty, 1833). The former lousefly was collected from brown pelicans, *Pelecanus occidentalis* L., 1766, and a single flightless cormorant, *Phalacrocorax harrisi* Rothchild, 1898, and the latter from Galápagos hawks, *Buteo galapagoensis* (Gould, 1837). These authors noted some morphological differences between the Galápagos specimens and the type material of *M. caulotoon* described from Tanzania. More recently, Mironov and Pérez (2002) described 2 new species of feather mites, *Mesalgoides geospizae* (Psoroptoididae) and *Xolalgoides palmai* (Xolalgidae), from several species of *Geospiza* ground finches. Finally, Fain and Bochkov (2003) described *Myialges pelecani* from 2 males collected from *P. occidentalis*, without reference to the earlier work of Madden and Harmon (1998). Because juveniles and adult males in this genus are skin parasites of bird hosts, while adult females are hyperparasites of Hippoboscidae, it seems possible the females previously reported as *M. caulotoon* might be those of *M. pelecani*.

The aim of the present study is to describe the present ectoparasite fauna of small ground finches (*Geospiza fuliginosa*, Gould, 1837), and to determine if the prevalence of infection differed among island populations (Lindström et al., 2004). For this purpose, a large number of small ground finches from 4 island populations were surveyed for ectoparasites. We report here on the parasitic Acari recovered from these birds.

MATERIALS AND METHODS

Samples were collected by 2 of us (J.F. and K.L.), with the assistance of H. Pärn, from populations of *Geospiza fuliginosa* captured at 4 different sites in the Galápagos Archipelago: Villamil, Isabela Island; Puerto Ayora, Santa Cruz Island; Basquerizo Moreno, San Cristóbal Island; north coast, Santa Fé Island (Fig. 1). At each location, 100 birds were captured in the same general type of dry, coastal bush habitat. Birds were captured in mist nets between 1 October and 4 December 2002. All birds were visually inspected for the presence of parasites (see Lindström et al., 2004). Approximately 20 randomly selected birds per island were treated with pyrethroid-containing powder using the dust-ruffling method described in Walther and Clayton (1997). Specifically, a small amount of powder was worked gently into all regions of the plumage and left there for approximately 5 min. The plumage was then ruffled over a clean sheet of white paper and the collected material placed in a small vial containing 70% ethanol. Additional samples from both dusted and nondusted birds were collected from 1 crown and 1 flight feather of the bird by clipping individual feathers with heavy mite infestations. Feather clippings were stored in individual vials containing 70% ethanol. All birds were released after processing.

In the laboratory, samples were placed in small Petri dishes and ectoparasites sorted from dust residues or feather parts. Mite specimens were cleared in lactophenol, mounted in Hoyer's medium, dried, and sealed with red insulating varnish (GC Electronics, Rockford, Illinois). Specimens were examined using a Leica DMLB compound microscope, measured using a calibrated ocular micrometer, and illustrated using a camera lucida.

For the taxonomic descriptions, field-collected material was supplemented by slide-mounted preparations of mite specimens collected from bird skins in the Natural History Museum, London, U.K., by W. T. Atyeo and a few specimens obtained by Atyeo from the Los Angeles County Museum (the Atyeo collection is now housed at the University of Michigan Museum of Zoology).

In the descriptions, all measurements are given in micrometers and are given as holotype, mean, range (n = 10). Idiosomal chaetotaxy

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* School of Natural Resources and Environment, The University of Michigan, Ann Arbor, Michigan 48109.

† Program in Biology, The University of Michigan, Ann Arbor, Michigan 48109.

‡ Evolutionary Biology Centre, Department of Population Biology, Uppsala University, 752 35 Uppsala, Sweden.

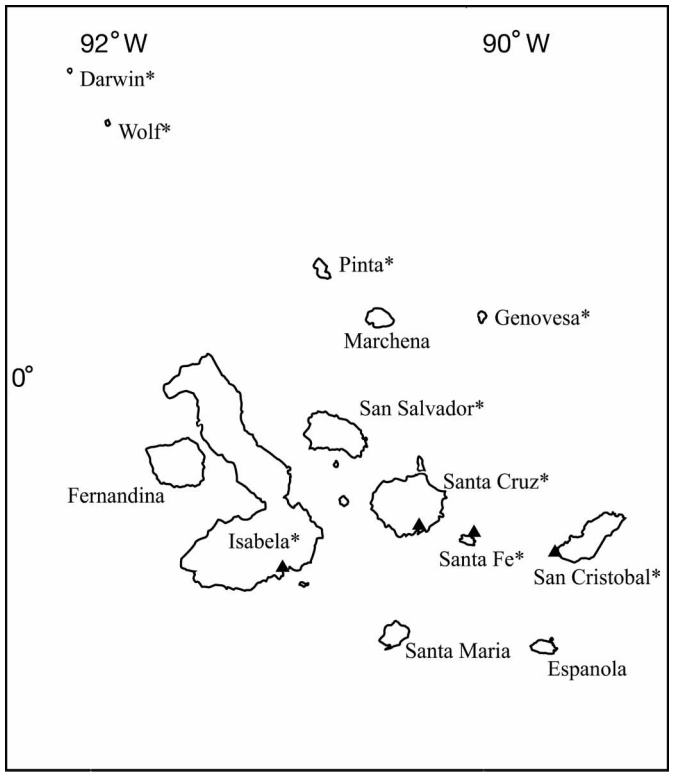


FIGURE 1. Map of the main islands of the Galápagos Archipelago. Collection localities are marked with ▲; islands from which historical material is reported are indicated with an asterisk.

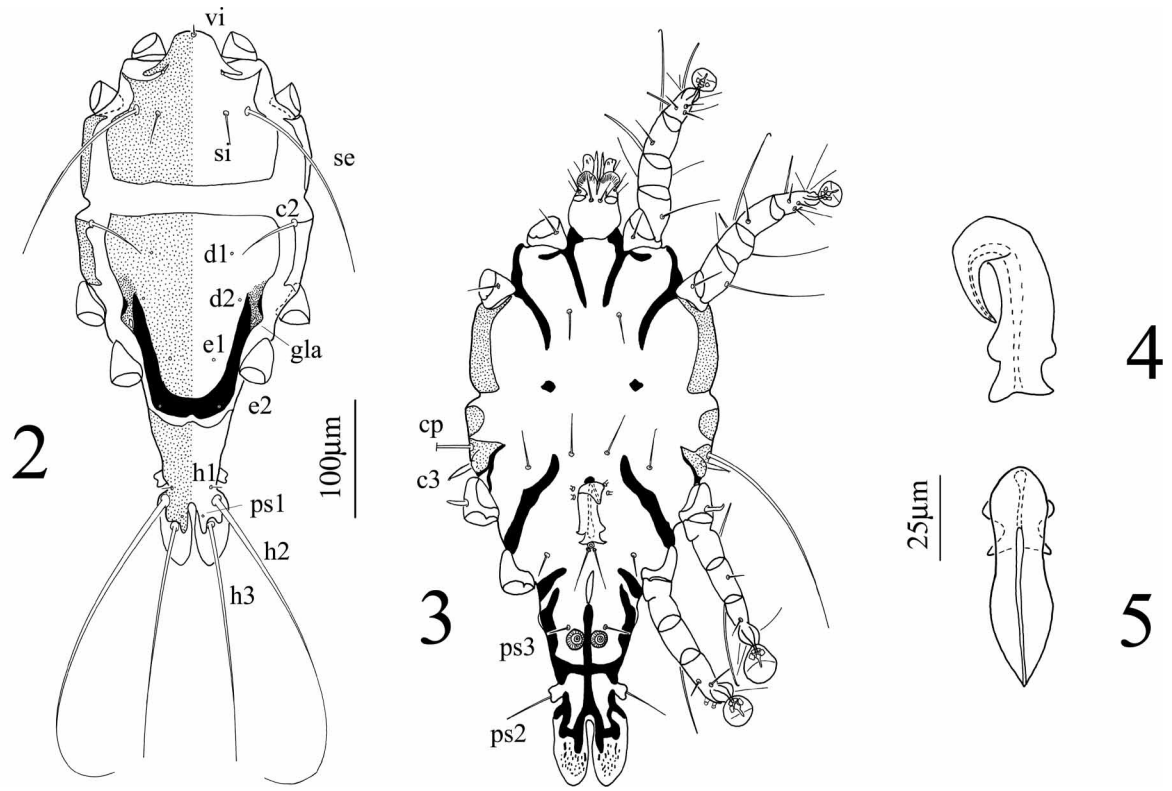
follows Griffiths et al. (1990), and leg chaetotaxy follows Grandjean (1939). Species names are attributed to the 3 authors who prepared the descriptions (B.M.O.C., J.F., D.L.)

Types and voucher specimens are deposited in the University of Michigan Museum of Zoology, Ann Arbor, Michigan (UMMZ), the Natural History Museum, London, U.K. (BMNH), Los Angeles County Museum, Los Angeles, California (LACM), Laboratorio de Acarología, Universidad Nacional Autónoma de México, D.F., México (UNAM), the Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (ZISP), and the Charles Darwin Research Station, Puerto Ayora, Santa Cruz, Galápagos Islands, Ecuador (CDRS).

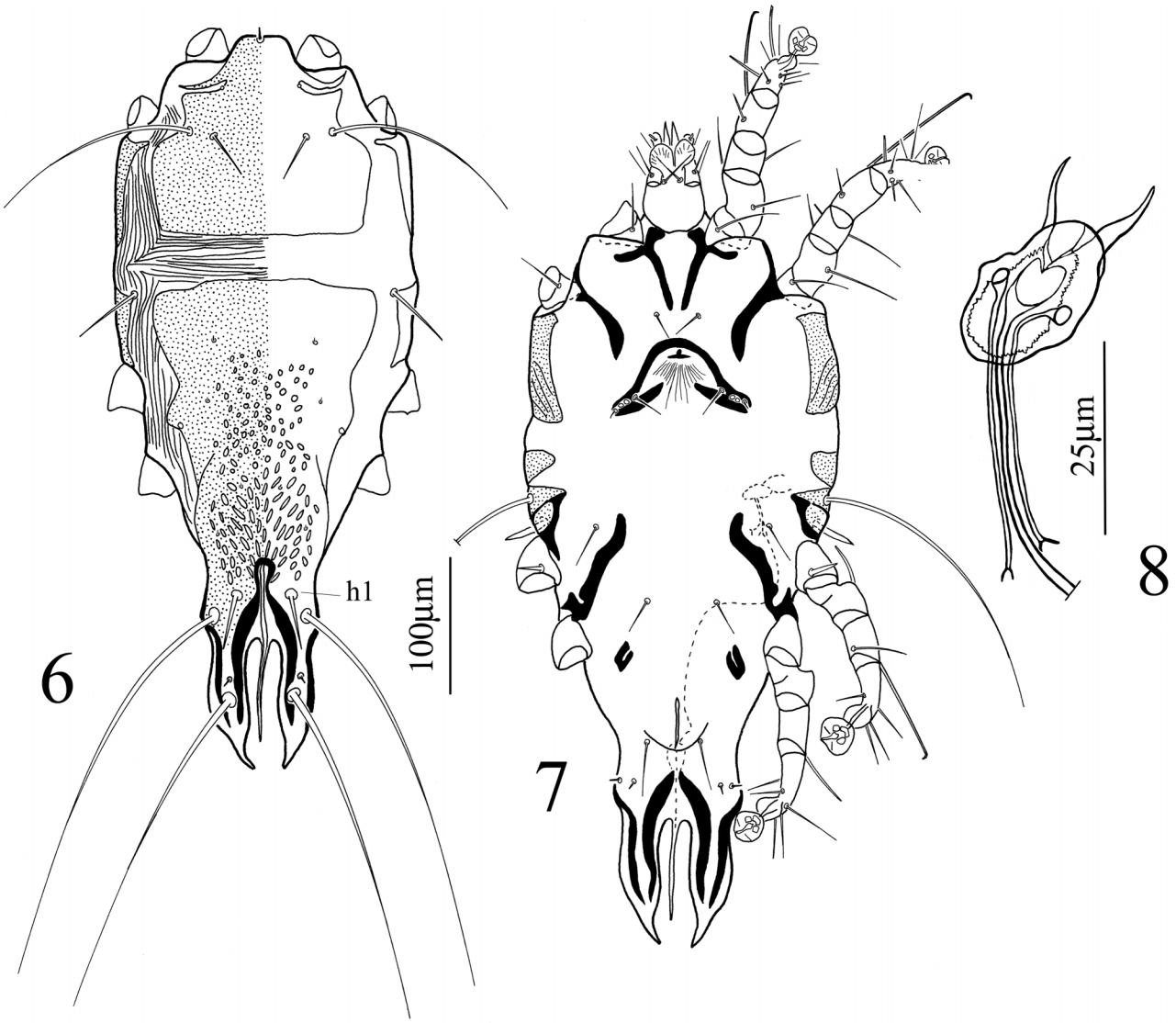
DESCRIPTIONS

Trouessartia geospiza OConnnor, Foufopoulos and Lipton n. sp.

Male (Figs. 2–5): Idiosomal length, excluding terminal lamellae 434 (448, 428–459), width 203 (208, 192–220). Propodosomal shield length 138 (139, 135–144), width 155 (153, 140–161), with thin projections laterally between bases of legs I–II, not fused laterally with scapular shields, surface smooth, without lines or lacunae; internal scapular setae *si* filiform, 25 (26, 23–28) long, separated by 61 (61, 51–69). Humeral shield with setae *c2* setiform, 44 (38, 39–57) in length, setae *c3* lanceolate with slightly bifurcate apex, length 26 (31, 26–33). Dorsal hysterosoma with prohysteronotal shield completely separated from lobar shield. Prohysteronotal shield length 170 (168, 160–172), width 156 (161, 138–175), smooth, without lacunae, posterior margin and lateral margins in posterior half heavily sclerotized, with very weakly differentiated, broad notch at level of legs III, dorsal hysterosomal apertures (DHA) absent, but opisthonotal gland openings (*gla*) distinct between bases of legs III–IV, setae *d1, d2, e2* present as microsetae. Lobar shield length, excluding lamellae, 106 (109, 106–113), apices of opisthosomal lobes divergent distally, separated by terminal cleft, length of cleft from anterior apex to posterior margins of lamellae 58 (60, 58–62), lamellae elongate, bluntly pointed, margins entire. Setae *h1* short, positioned anterior to long setae *h2*, microsetae *ps1* positioned slightly anteriomedial to long setae *h3*.



FIGURES 2–5. *Trouessartia geospiza* n. sp., male. (**1**) Dorsal view. (**2**) Ventral view. (**3**) Genital apparatus, ventrolateral view. (**4**) Genital apparatus, ventral view. Idiosomal setal signatures here and elsewhere follow Griffiths et al. (1990).



FIGURES 6–8. *Trouessartia geospiza* n. sp., female. (**6**) Dorsal view. (**7**) Ventral view. (**8**) Spermatheca.

Venter (Fig. 3) with anterior apodemes of coxae I well separated, posterior apodemes I fused laterally with anterior apodemes II, posterior apodemes II not distinct from scapular shields, anterior apodemes III forming posterior medial edge of humeral shields, anterior apodemes IV long, strongly developed, posterior apodemes IV well developed; small, ovoid sejugal apodemes at level of posterior edge of scapular shields. Genital apparatus situated between levels of trochanters III–IV, length 53 (53, 48–55), width 23 (21, 18–25), appearance and degree of curvature dependant on orientation (Figs. 4–5). Small ovoid pregenital apodeme directly anterior to genital apparatus, both pairs of vestigial genital papillae equidistant from midline. Genital setae *g* filiform, bases separated by 5 (no variation), not situated on protuberance. Adanal apodemes heavily sclerotized, with small, thin lateral apophyses. Translobar apodeme present. Trochanter III with seta *sR* lanceolate, length 16 (17, 16–18). Modified setae *d* and *e* of tarsus IV nearly contiguous, with slightly expanded discoid apices.

Female (Figs. 6–8): Idiosomal length including lamellar processes 525 (513–540), width 208 (182–236). Prodorsal shield as in male, length 150 (144–166), width 162 (146–170), without lacunae; setae *si* filiform, length 27 (25–31) separated by 69 (67–71). Humeral shields with setae *c2* setiform, length 47 (41–55), setae *c3* lanceolate, length 29 (28–30). Hysteronotal shield length 334 (315–346), width 163 (155–170), with sinuous lateral margins at level of trochanter III, DHA absent; slitlike to elliptical lacunae dense from supranal concavity anterior to level of setae *e1*, becoming smaller and rounded anterior almost to level of setae d1. Notogastral setae *f2* present ventrolateral of long setae *h2*; setae *h1* almost lanceolate, length 29 (28–32), separated by 41 (39–42), positioned 15 (14–16) anterior to level of setae *h2*, and 20 (18–21) from lateral margin of hysteronotal shield. Width of opisthosoma at level of setae *h2* 87 (85–89). Setae *ps1* positioned dorsally on opisthosomal lobes 20 (16–23) anterior to level of setae *h3*. Distance from setae *h2* to apices of opisthsomal lobes 115 (111–119). Supranal concavity continuous with terminal cleft. Length of terminal cleft together with supranal concavity 151 (149–157), length of terminal incision 99 (93–101), width of cleft at level of setae *h3* 23 (21–25). External copulatory tube long, length from edge of interlobar membrane to apex 61 (51–64). Trochanteral setae *sRIII* lanceolate, length 17 (15–18). Spermathecal system (Fig. 8) with long primary duct leading to well-sclerotized basal ring with toothed internal margin; secondary spermathecal ducts about 35 long.

Taxonomic summary

Type host: Small ground finch, *Geospiza fuliginosa* Gould, 1837 (Passeriformes: Emberizidae).

Habitat:: Head feathers and flight feathers.

Type locality: 1 km W Puerto Villamil, Isla Isabela, Galápagos Province, Ecuador; 00°56′S, 91°01′W.

Other hosts and localities: Geospiza fuliginosa, Isla Santa Fé, Isla Santa Cruz, Isla San Cristóbal (present study). *Geospiza fortis* Gould, 1837 (Passeriformes: Emberizidae), medium ground finch: Isla San Cristóbal 25-VI-1897 (BMNH 1899.9.1.218), Isla Isabela 27-VI-1897 (BMNH 1899.9.1.204). *Geospiza magnirostris* Gould, 1837 (Passeriformes: Emberizidae), large ground finch: Isla Isabela 17-II-1957, J. R. Northern #457 & 466 (LACM), Isla Genovesa 26-II-1957, J. R. Northern #505 & 729 (LACM). *Geospiza scandens* (Gould, 1837) (Passeriformes: Emberizidae), common cactus finch: Isla Wolf 4-VIII-1897 (BMNH 1899.9.1.374)

Type specimens: Holotype male (BMOC 03-0215-002-m1) in UMMZ; paratype males and females in BMNH, CDRS, LACM, UMMZ, UNAM, ZISP.

Etymology:: The species name is derived from the name of the host genus and is a noun in apposition.

Remarks

The new species is most closely related to *Trouessartia capensis* Berla, 1959, described from both sexes from *Zonotrichia capensis subtorquata* Swainson, 1837 (Emberizidae) from Brazil. The species was redescribed by Santana (1976), who reported additional records from the same and other subspecies of *Z. capensis* from Brazil, Paraguay, Argentina, and Curaçao Island in the Caribbean. Females of the 2 species share the enlarged, lanceolate form of hysteronotal setae *h1,* and the pattern of elongated lacunae on the posterior portion of the hysteronotal shield. Males share the broad form of the genital apparatus and elongate setae *g.* Both sexes of *T. geospiza* differ from those of *T. capensis* in lacking well-developed lateral notches in the hysteronotal shield. Females of *T. geospiza* differ from those of *T. capensis* by the greater extent of the hysteronotal lacunae and the greater length of the external sperm duct (copulatory tube), which extends well past the level of setae *h3* in *T. geospiza* but does not reach the level of these setae in *T. capensis*. Males differ in having the bases of setae *g* almost contiguous (widely separated in *T. capensis*) and not situated on a protuberance.

This species was commonly recovered from both head- and flight-feather clippings as well as dusting collections. Adult mites were often observed with fungal spores in their guts. In the previous report (Lindström et al., 2004), mites reported from visual inspection of the crown feathers (reported as *Trouessartia* sp.) were probably this species because this was the only species we recovered from head feather clippings. This species was also recovered from many of the flight-feather clippings, so the previous data given for wing mites identified as *Proctophyllodes* sp. probably also included this species as well.

Proctophyllodes darwini OConnor, Foufoupolos and Lipton n. sp.

Male (Figs. 9–10): Idiosomal length excluding lamellae 255 (257, 253–264), width 133 (137, 131–149). Propodosomal shield length 85 (87, 83–89), width 76 (79, 76–81), lateral margins entire, without lacunae. Distance between setae *se* 53 (54, 53–56). Humeral shields well developed, bearing setae *c2* at extreme anteriomedial angles. Subhumeral setae *c3* lanceolate, length 13 (14, 13–14), width 2–3. Hysteronotal shield length 152 (154, 152–158), maximum width 86 (88, 86–92), anterior margin slightly concave, without lacunae, without ventrolateral extensions, supranal concavity length 35 (36, 32–39). Lamellae short, ovoid, length 25 (27, 25–28), width 16 (no variation), internal margins approximate, with pinnate venation. Venter with anterior apodemes I fused into a narrow U-shape, without lateral extensions. Coxal fields striate, unsclerotized. Genital arch slightly longer than broad, length 25 (28, 25–30), basal width 23 (24, 23–27), distance from anterior apex of genital arch to base of terminal lamellae 101 (101, 101–104). Aedeagus length 46 (46, 44–48). Genital papillar vestiges laterad of anterior apex of genital arch, papillae separated by a distance of 2–3. Setae *g* and *ps3* forming a trapezoid, distance between setae *g* 9 (9, 7–12), distance between seta *g* and *ps3* 12 (12, 10–12), distance between setae *ps3* 21 (no variation). Opisthogastric shields approximate but not fused. Adanal suckers cylindrical, about twice as long as diameter, with toothed distal margins.

Female (Figs. 11–12): Idiosomal length excluding terminal appendages 362 (356–367), width 164 (159–170). Propodosomal shield length 95 (94–96), width 102 (100–106), lateral margins entire, without lacunae; distance between setae *se* 70 (68–71). Humeral shields well developed, bearing setae *c2* near anteriomedial angles. Subhumeral setae *c3* lanceolate, length 19 (18–21), width 3. Hysterosoma with relatively small lobes and normally formed terminal appendages. Anterior hysteronotal shield length 201 (199–202), width 104 (100–108), anterior margin relatively straight, without lacunae, without supranal concavity. Lobar region fused to anterior shield laterally, length of lobar region 52 (51–54), width at level of setae *h2* 76 (71–78), terminal notch almost square, length 25 (21–28), width 24 (21–29), setae *h3* about 1/3 the length of terminal appendages. Spermatheca rounded. Venter with anterior apodemes I fused in a narrow U-shape, coxal fields unsclerotized.

Taxonomic summary

Type host: Small ground finch, *Geospiza fuliginosa* Gould, 1837 (Passeriformes: Emberizidae).

Habitat: Flight feathers.

Type locality: 1 km W Puerto Villamil, Isla Isabela, Galápagos Province, Ecuador; 00°56′S, 91°01′W.

Other localities: Isla Santa Fé, Isla Santa Cruz, Isla San Cristóbal.

Type specimens: Holotype male (BMOC 03-0215-002-m1) in UMMZ; paratype males and females in BMNH, CDRS, UMMZ, UNAM, ZISP.

Etymology: The species is named for Charles Darwin, who first brought the world's attention to the finches of the Galápagos Islands. The name is a noun in the genitive case.

Remarks

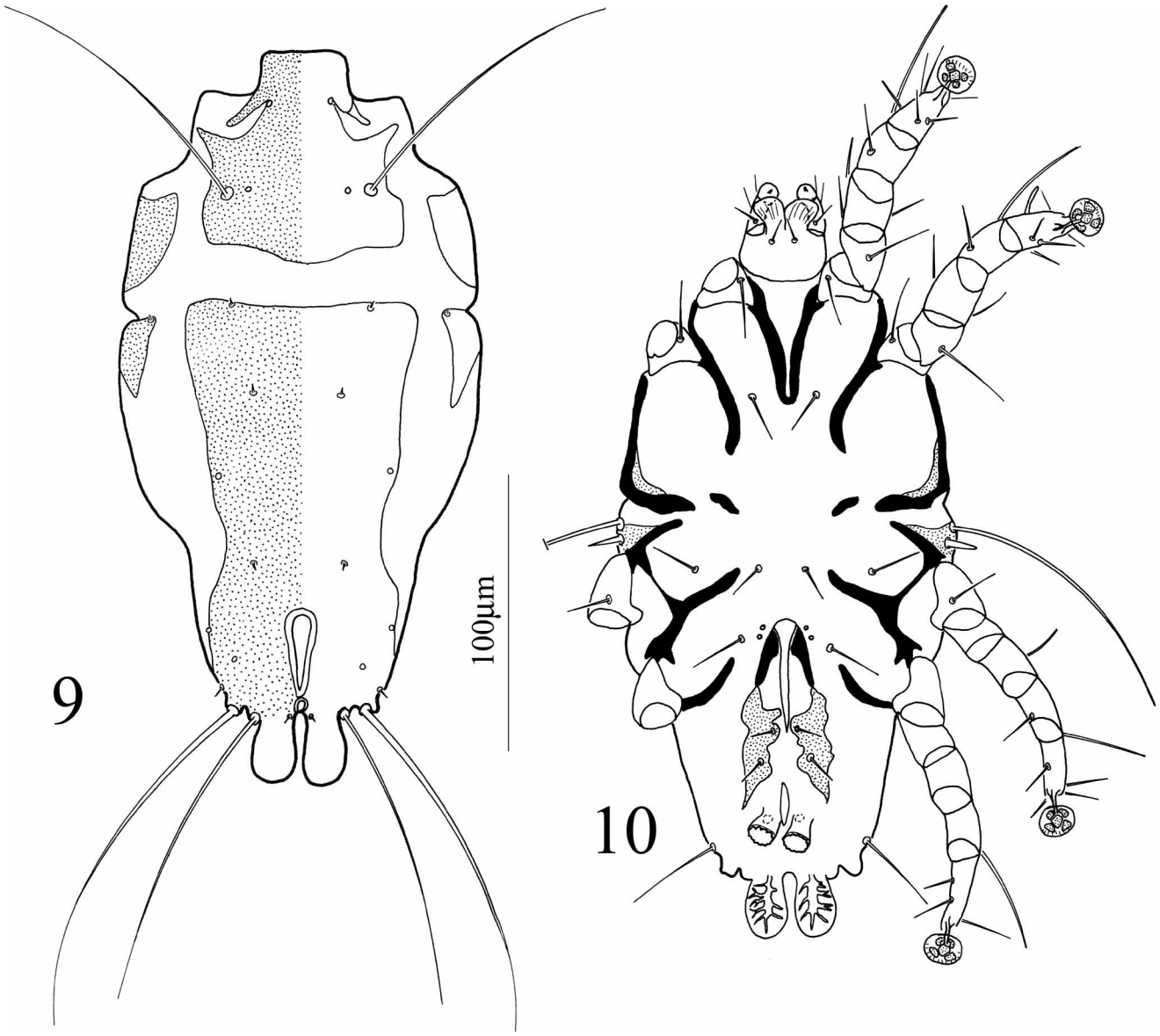
The new species belongs to the *musicus* group of Atyeo and Braasch (1966) and is most similar to *Proctophyllodes tiaris* Atyeo and Braasch, 1966, described from *Tiaris olivacea* (L., 1766) from Jamaica, a species not recorded since the original description. The 2 species share the lateral fusion of the hysterosomal lobes with the anterior hysteronotal shield in the female, short, rounded posterior lamellae and similar aedeagal form in the male. The new species differs in lacking lacunae on the dorsal shields in both sexes (present in *P. tiaris*), the terminal notch of the female about as long as wide (twice as long as wide in *P. tiaris*), and the male opisthogastric shields not fused medially, although approximate (fused in *P. tiaris*).

This species was recovered only from dusting samples and flight feather clippings. As noted above, prevalence data reported previously (Lindström et al., 2004) for wing mites probably include both *P. darwini* and *T. geospiza*.

Pterodectes atyeoi OConnor, Foufoupolos and Lipton n. sp.

Male (Figs. 13–14): Idiosomal length 375 (361, 343–388), width 150 (148, 130–158). Prodorsal shield length 111 (109, 104–118), width 106 (106, 99–116), occupying most of prodorsal area, posterior margin almost straight, sclerotization weaker along posterior margin, with small lacunae sparsely distributed over shield; microsetae *si* closely associated with long setae *se,* distance between setae *se* 51 (54, 50–58). Hysteronotal setae *c2* situated off hysterosomal shield posterior lateral to setae *c1,* setae *c3* lanceolate, length 25 (25, 23–26). Hysteronotal shield length 244 (237, 219–244), width 106 (104, 98–109), slightly concave at level of setae *e1,* with small, sparse lacunae extending from slightly anterior to setae *e1* to slightly posterior to setae *h1*. Supranal concavity present, rounded. Terminal lobes divergent, cleft length 28 (25, 20–29), width just behind anterior apex 11 (11, 9–13), terminal setae *ps2* lanceolate, length 39 (40, 38–44), distance between bases 35 (39, 35–44).

Venter with coxal apodemes I fused in a V shape, with short lateral projections, anterior apodemes II sharply curved at midlength, posterior apodemes II well developed, extending along humeral region and sharply curved ventrally; anterior apodemes III at posterior edge of humeral shields, posterior apodemes III fused with anterior apodemes IV, extending anteriomediad to level of setae *c3*, posterior apodemes IV very weakly developed, extending medially to genital arch. Aedeagus swordlike, extending to level of anterior end of anus, length 84 (79, 74–84); genital arch broad, width 41 (40, 38–43), remnant genital papillae anterior to genital arch. Opisthoventral shields well developed, covering terminal lobes. Setae *ps3* laterad of center of adanal suckers. Distances between levels of ventral setae *4a–g*4 4 (41, 36–44), *g–ps3* 58 (52, 46–



FIGURES 9–10. *Proctophyllodes darwini* n. sp., male. (**9**) Dorsal view. (**10**) Ventral view.

58); adanal suckers with indistinct edges, without teeth. Legs with setae of genua I–II simple, filiform.

Female (Figs. 15–17): Idiosomal length, excluding terminal appendages 488 (455–525), width 173 (148–183). Prodorsal sclerite length 128 (119–136), width 122 (111–131), extending laterally between legs I–II, posterior margin slightly convex, most with few lacunae anterior to scapular setae, few with sparse lacunae over entire shield as in male, 1 teneral individual without apparent lacunae. Distance between setae *se* 72 (69–76). Hysterosoma with setae *c2* positioned off hysteronotal shield, setae *c3* lanceolate, length 27 (25–30), setae *cp* elongate, filiform, humeral shields absent. Hysteronotal shield separated into anterior and lobar portions by narrow band of unsclerotized integument. Anterior hysteronotal shield length 263 (256–279), width 125 (115–135), anterior margin slightly concave, with small round lacunae restricted to region from level of setae *e2* anteriad no further than a point midway between setae *d2* and *e1*. Length of lobar region from edge of lobar sclerite to base of terminal appendages 92 (81–100), width at level of setae *h2* 93 (88–100), supranal concavity weakly developed or absent. Terminal cleft varying from broadly diverging posteriorly to very narrow, length from base to level of terminal appendages 64 (53–74), width at level of setae *ps1* 9 (5–24). Setae *h2* lanceolate, without terminal filament, length 48 (43–53), setae *h3* short, filiform, length 25 (23–31); distance between setae *h1* 33 (28–36), with very few small lacunae immediately adjacent to setae. Total length of terminal appendages 106 (103–113).

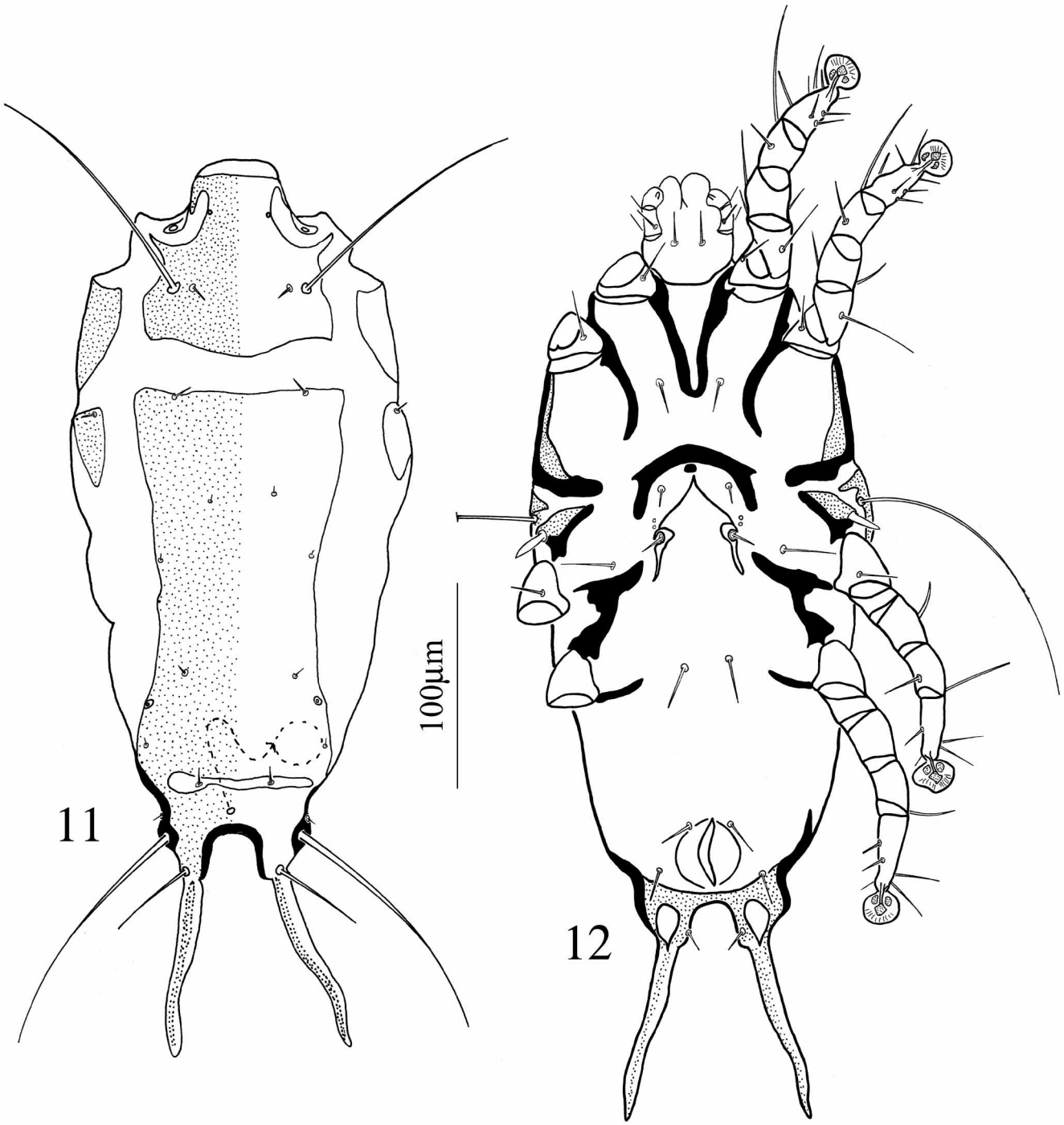
Venter (Fig. 16) with anterior apodemes I fused in a V shape; anterior apodemes II sharply curved; posterior apodemes II thin, at medial edge of scapular sclerites; other apodemal elements as in other *Pterodectes* species (see Park and Atyeo, 1971). Primary spermathecal duct with short, ovoid expansion at apex, spermatheca broadly V shaped, with basal, sclerotized region with apical folds or ridges, varying with preparation from compact (Fig. 17) to expanded, filling space between spermathecal wall. Secondary spermathecal ducts very long. Legs with setae of genua I–II simple, filiform.

Taxonomic summary

Type host: Geospiza fuliginosa Gould, 1837 (Passeriformes: Emberizidae), small ground finch, collected 14-X-2002.

Habitat: Flight feathers.

Type locality: Estación Scientifica Charles Darwin, Isla Santa Cruz, Galápagos Province, Ecuador; 00°44′S, 90°18′W.

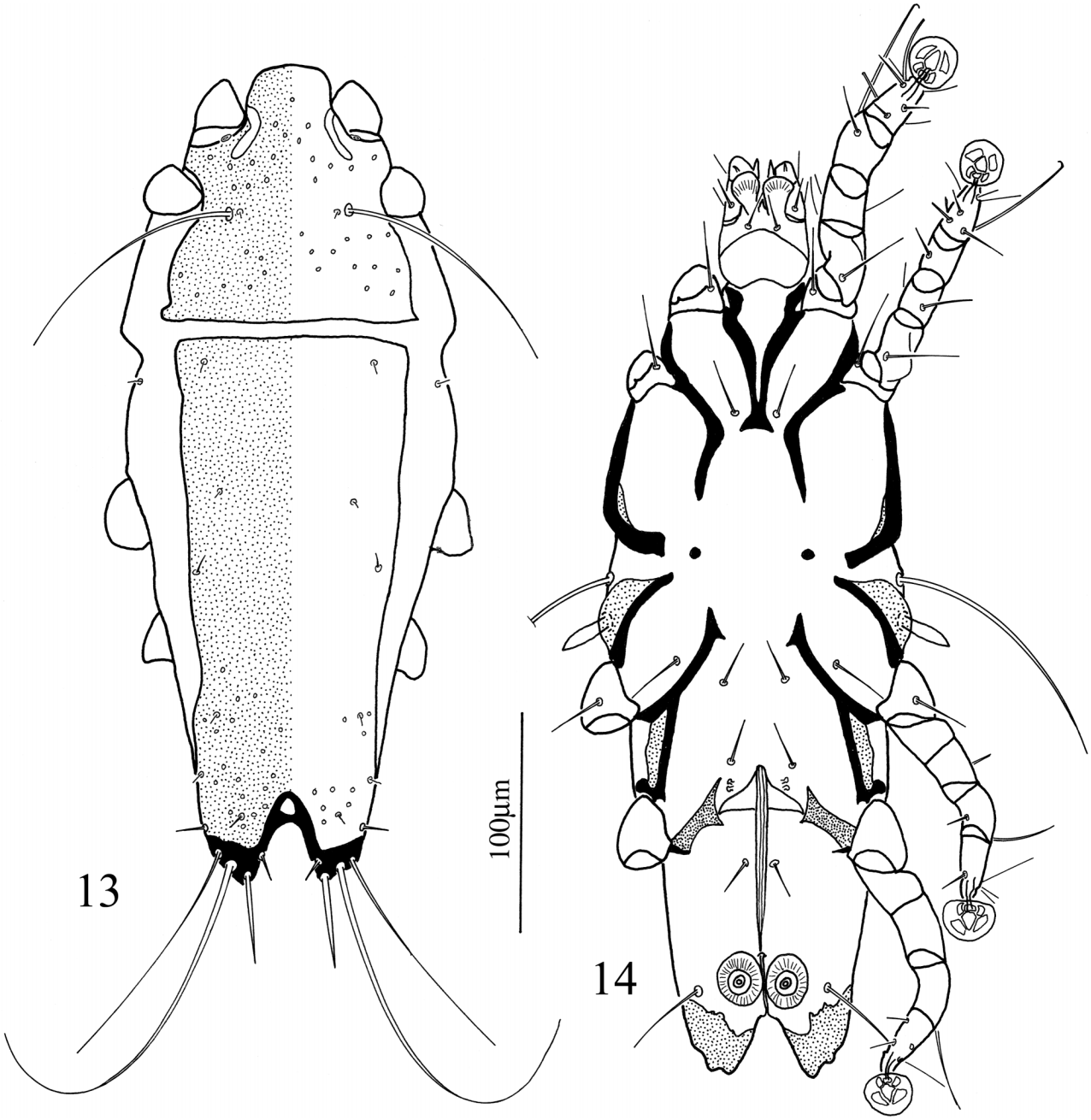


FIGURES 11–12. *Proctophyllodes darwini* n. sp., female. (**11**) Dorsal view. (**12**) Ventral view.

Other hosts and localities: Geospiza difficilis Sharpe, 1888 (Passeriformes: Emberizidae), sharp-beaked ground finch: Isla Pinta 16-VIII-1897 (BMNH 1899.9.1.325), 17-VIII-1897 (BMNH 1899.9.1.321), Isla San Salvador 27-IX-1897 (BMNH 1899.9.1.327) *Geospiza fortis* Gould, 1837 (Passeriformes: Emberizidae), medium ground finch: Isla Santa Cruz, 10-X-1897 (BMNH 1899.9.1.245), 8-X-1868 (BMNH 1885.2.10.64) Isla Santa Maria, 21-VII-1924 (BMNH 1925.12.22.71), Isla San Cristóbal 19-VI-1897 (1899.9.1.213), 25-VI-1897 (BMNH 1899.9.1.218), Isla Isabela 27-VI-1897 (BMNH 1899.9.1.204). *Geospiza magnirostris* Gould, 1837 (Passeriformes: Emberizidae), large ground finch: Isla Pinta collected before 1885 (BMNH 1885.12.14.286). *Geospiza scandens* (Gould, 1837) (Passeriformes: Emberizidae), common cactus finch: Isla Darwin 27-VII-1897 (BMNH 1899.9.1.371), Isla Santa Cruz 1-I-1875 (BMNH 1885.2.10.223), Isla Santa Fé 6-X-1897 (BMNH 1899.9.1.361), Isla San Salvador 28-VII-1924 (BMNH, catalog number not recorded), Isla Wolf, 4-VIII-1897 (BMNH 1899.9.1.374).

Type specimens: Holotype male (BMOC 03-0215-076-m1) in UMMZ; paratype males and females in BMNH, CDRS, UMMZ, UNAM, ZISP.

Etymology: The species is named for Dr. W. T. Atyeo, in recognition of his major contributions to the study of feather mites. The name is a noun in the genitive case.



FIGURES 13–14. *Pterodectes atyeoi* n. sp., male. (**13**) Dorsal view. (**14**) Ventral view.

Remarks

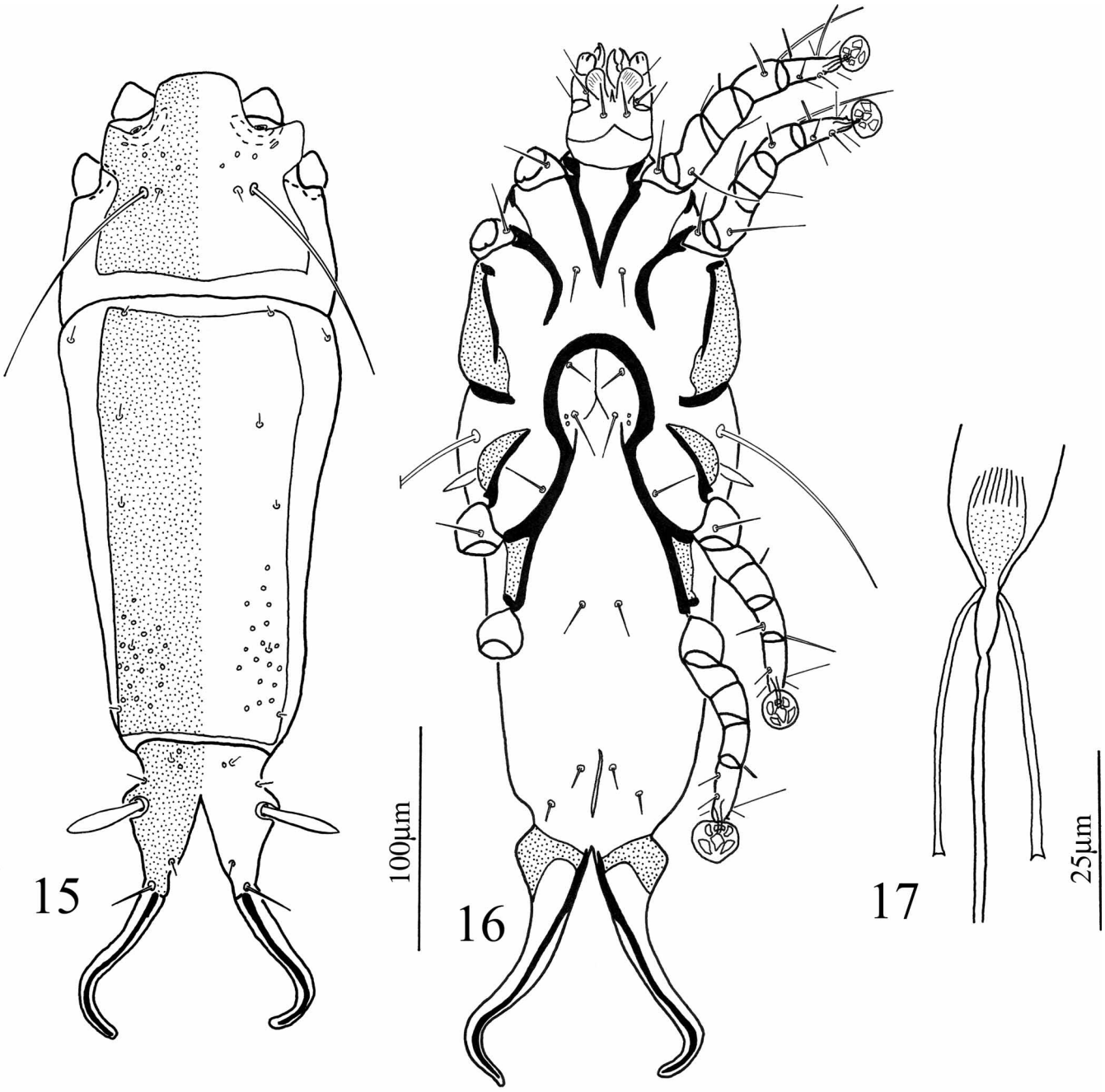
Pterodectes has many species but is poorly studied. In the last revision of the group, Park and Atyeo (1971) restricted the previously broadly defined genus to 9 species, but mentioned that they had observed another 90 undescribed species. Berla (1973) and Černý (1974) described an additional 1 and 6 species from Brazil and Surinam, respectively, bringing the total known from the Neotropical region to 14. The new species may be distinguished from all other described Neotropical species in the female by the restriction of lacunae on the anterior hysteronotal shield to the posterior third, weak development or apparent absence of supranal concavity, and the form of the spermatheca with primary spermathecal duct expanded at entrance to spermatheca and very long secondary spermathecal ducts. Males differ in possessing strongly sclerotized terminal lobes.

ADDITIONAL SPECIES

Family Psoroptoididae

Mesalgoides geospizae Mironov & Pérez, 2002

This species was recently described from *Geospiza scandens* and *G. fortis* from Isla Santa Cruz, and *G. fuliginosa* and *G. conirostris* from Isla Española (Mironov and Pérez, 2002). We recovered this species from *G. fuliginosa* from all 4 sampling sites. Specimens were recovered only from dust samples; none was found on crown or wing feathers, suggesting that this species, like most species of *Mesalgoides,* inhabits the downy por-



FIGURES 15–17. *Pterodectes atyeoi* n. sp., female. (**15**) Dorsal view. (**16**) Ventral view. (**17**) Spermatheca.

tions of the body feathers. Voucher specimens deposited in CDRS, UMMZ, UNAM, ZISP.

Family Xolalgidae

Xolalgoides palmai Mironov & Pérez, 2002

This species was recently described from a total of 5 specimens collected from *G. scandens* and *G. fortis* from Isla Santa Cruz and *G. fuliginosa* from Isla Española (Mironov and Pérez, 2002). We recovered this species from *G. fuliginosa* from all 4 sampling sites and, like *M. geospizae*, the species was recovered only from dust samples, again suggesting a habitat on the body feathers. Voucher specimens deposited in CDRS, UMMZ, UNAM, ZISP.

Family Analgidae

Strelkoviacarus sp.

We recovered 2 females, 2 tritonymphs, and 1 larva from a single *G. fuliginosa* from Isla Santa Cruz (BMOC 03-0215-076). None of the 3 named species in this genus, *S. quadratus* (Haller, 1882), *S. integer* (Trouessart and Neumann, 1888), and *S. critesi* Spory, 1965, is adequately described, so the identity of the new material remains questionable. Collections of this

TABLE I. Infection prevalence of 4 common mite species in dust samples from different island populations of *Geospiza fuliginosa.*

Mite species	Locality			
	Isabela	Santa Cruz	San Cristóbal	Santa Fé
Proctophyllodes darwini	5/21	7/24	4/23	6/20
Trouessartia geospiza	19/21	20/24	21/23	18/20
Mesalgoides geospizae	8/21	11/24	16/23	16/20
Xolalgoides palmai	11/21	8/24	9/23	11/20

genus have been previously reported from *Picus canus* (Picidae), *Sylvia atricapilla*, *S. communis* (Sylviidae), *Oenanthe oenanthe* and *Muscicapa striata* (Muscicapidae), and *Agelaius phoeniceus* (Icteridae) (Trouessart and Neumann, 1888; Dubinin, 1953; Spory, 1965). Other collections have been made from hippoboscid flies collected from a number of bird host species (Hill et al., 1967; Philips and Fain, 1991). Additional specimens in the UMMZ collection from a further diversity of host species and geographic localities are all extremely similar morphologically, suggesting that this genus may consist of a single, widely distributed species. Our specimens were recovered from a dust sample, suggesting the body feathers or skin as the habitat, as has been the case in other collections of these mites we have made; voucher specimens in UMMZ.

Family Dermoglyphidae

Dermoglyphus sp.

A single female specimen of this genus was recovered in a dust sample from a *G. fuliginosa* collected on Isla Isabela (BMOC 03-0215-004). Species of *Dermoglyphus* are normally inhabitants of the space within feather quills, so it is not surprising that we did not recover more specimens using our collecting methods. The genus is in need of revision, and many previously described species are not recognizable from published descriptions. This, and the absence of adequate material, preclude specific identification at this time. The voucher specimen is deposited in UMMZ.

Family Dermanyssidae

Dermanyssus sp.

The only parasitiform mite collected during this study, a single protonymph specimen of this genus was recovered in a dust sample from a *G. fuliginosa* collected on Isla Isabela (BMOC 03-0215-021). Species in this genus are widespread, nidicolous parasites of a diversity of bird hosts and are easily characterized by the very attenuate chelicerae used for piercing skin. Juveniles have not been described for most species of *Dermanyssus*, so this specimen cannot be specifically determined. The voucher specimen is deposited in UMMZ.

RESULTS

Table I reports the infection prevalence of the 4 common mite species collected by the dusting method on the 4 islands. The structure of the mite communities, based on these 4 common species, did not differ significantly between islands, i.e., the infection prevalence of each species did not vary significantly from island to island (ANOVA, $F = 0.5961$ for *P. darwini*, 0.7574 for *T. geospizae*, 0.2291 for *X. palmai*, and 3.4323 for *M. geospizae*, $P > 0.01$ for each species); however, the infection prevalence of each individual species differed significantly from the others (ANOVA, $F = 8.7349$ on Isabela, 9.789 on Santa Cruz, 13.381 on San Cristobal, and 7.7656 on Santa Fe, $P < 0.01$ for each island), and the mean prevalence of infection was high for *T. geospiza* (89%), moderate for *X. palmai* (58%) and *M. geospizae* (44%), and low for *P. darwini* (26%) (Fig 18).

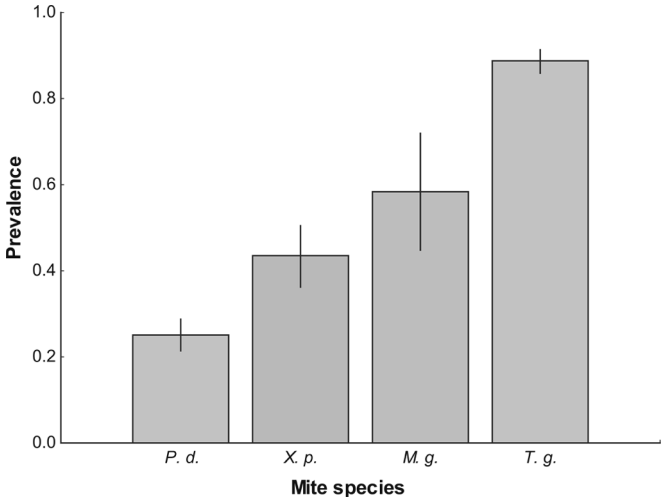


FIGURE 18. The mean and standard error of infection prevalence for the 4 most common mites species on small ground finches; *Proctophyllodes darwini* (*P. d.*), *Xolagoides palmai* (*X. p.*), *Mesalgoides geospizae* (*M. g.*) and *Trouessartia geospiza* (*T. g.*). Prevalence estimates are calculated from 20 to 24 samples each in 4 populations.

DISCUSSION

We found 8 species of mites on *G. fuliginosa*. Four of these species were common, with infection prevalences of >25%; *T. geospiza* was the most common mite species, followed by *X. palmai*, *M. geospiza*, and *P. darwini*. This pattern was consistent across the study populations. The prevalence estimates of *T. geospiza* as obtained from the dusting samples differ somewhat from previously published results that were based on visual examination of the birds (Lindström et al., 2004). Prevalence based on dusting was generally greater than that reported from visual examination, particularly for birds from Santa Fé. This result is not surprising because dusting is more likely to recover parasites that are not observed visually (Walther and Clayton, 1997). This sampling bias was most apparent when the mean intensity of infestation (mites/bird) was low, as it was on Santa Fé.

Comparisons with other Neotropical bird-mite communities are difficult due to the paucity of this type of study in the region. In the only other study of the structure of mite communities on Emberizidae (including Thraupidae and Coerebidae) in the Neotropical region, Lyra-Neves et al. (2003), reported on communities associated with 9 bird species in Brazil. However, given the taxonomic impediment, mites were only determined to genus in that study. Those authors found species

of *Proctophyllodes*, *Trouessartia*, and *Pterodectes* on all 9 host species and species of *Mesalgoides* on 5 of 9. They also recorded species of *Analges*, a genus not collected in our study, on 3 of the 9 species, but did not record any *Xolalgoides* species. A major difference between the community associated with *G. fuliginosa* and those in Brazil was that *Pterodectes* species were common on 8 of 9 species in Brazil, while this genus was rare on *G. fuliginosa*. These findings indicate a general similarity of the community associated with *G. fuliginosa* with communities associated with other Neotropical emberizid species. We found that most of the common species of mites associated with *G. fuliginosa* also occur on other species of *Geospiza* (Mironov and Pérez, 2002, and historical records above). In fact, only *Proctophyllodes darwini* is so far known only from *G. fuliginosa*. From an evolutionary perspective, this is perhaps not surprising. Phylogenetic relationships of species of *Geospiza* and related genera have been the subject of recent study (Sato et al., 1999; Burns et al., 2002; Zink, 2002), with mitochondrial sequence data suggesting a very recent origin for the different species (Sato et al., 1999), if in fact, genetically distinct species even exist in this group (Zink, 2002). The commonality of the mite community across the various species of *Geospiza* is additional evidence for the recent diversification of these insular birds if the general model of parasites speciating more slowly than their hosts, i.e., Manter's first rule (Brooks, 1979), holds true. Too little is known of the specific identity of the mites on closely related bird lineages to conduct rigorous tests of coevolutionary hypotheses, although the relationships of *P. darwini* to *P. tiaris* and *T. geospiza* to *T. capensis* both related species associated with hosts more or less closely related to *Geospiza* (Burns et al., 2002), are suggestive of common ancestry. As more species of mites are described from members of this host lineage, such tests will become possible.

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