

Philornis downsi

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Diptera	Muscidae

Common name

Synonym

Similar species

Philornis deceptiva, *Philornis seguyi*, *Philornis carinatus*

Summary

Adult *Philornis downsi* flies feed on fruit, but larvae are semi-haematophagous (blood and tissue-feeding) parasites of birds. *P. downsi* larvae were first discovered in finch nests on Santa Cruz Island in 1997, although retrospective examination of insect collections show that the fly was present in the Galapagos Islands as early as 1964. Since then the parasite has spread to 12 of the 13 main Galapagos Islands and its larvae have been found in 64-100% of Darwin's finch nests. The blood sucking larvae cause mortality in up to 76% of nestlings. For this high impact, it is given the highest risk ranking amongst introduced insects and amongst diseases/parasites.



[view this species on IUCN Red List](#)

Species Description

Eggs: approximately the shape of a rice grain, 2-3mm in length, elongated oval shaped, creamy white in colour. Larvae: 1st, 2nd and 3rd instar phases vary in size and development. Creamy colour, soft-bodied, segmented along thoracic region, mouth hooks and other sensory/feeding apparatus at anterior end, spiracles (for breathing) present at posterior and anterior region (anterior spiracles in 2nd and 3rd instar only). Pupae: Light to dark brown in colour depending on duration, elongated barrel-shaped cocoon tapering towards anterior and posterior ends, rounded on one end and with a cuff-like margin on the other. Adult fly: Similar in size to common house fly, generally dark in colour though colour varies according to size of individual. For full description of developmental stages see Fessl *et al.* 2006

Lifecycle Stages

Female flies lay eggs in the nasal cavities of nestlings or in the nesting material. Larvae pass through 3 instar phases and are principally ectoparasitic feeding on blood and tissue fluids. First and early second instars tend to be subcutaneous feeders, feeding within the nostril of bird nestlings. Later instars are semi-haemotophagous and are free-living within the nest. The larval period in the nest is approximately 5-6 days. Third instar larvae drop to the bottom of the nest where they pupate (Fessler *et al*, 2006a). *Philornis* flies are known to emerge from pupae after approximately 2 weeks (Dodge, 1971).

Habitat Description

In the Galapagos, *Philornis downsi* occurs in most habitat types, including both arid lowland and humid highland zones. No information is available from Brazil and Trinidad

Reproduction

Adult fly mating behaviour is currently unknown though has not been observed in the nest. Females have been observed depositing eggs in the nesting material (O'Connor, unpublished data) and are known to mate with up to 5 males per laying event (Dudaniec *et al*, 2008). Captive breeding experiments are currently being carried out at Charles Darwin Research Station.

Nutrition

The adult *Philornis downsi* fly is vegetarian; its larvae feed on the blood and body fluids of bird nestlings. In Galapagos, documented hosts include Passeriformes and Cuculiformes: Mangrove finch (*Cactospiza heliobates*), Woodpecker finch, (*Cactospiza pallida*), Warbler Finch (*Certhidea olivacea*), Small Ground Finch (*Geospiza fuliginosa*), Medium Ground Finch (*Geospiza fortis*), Cactus Finch (*Geospiza scandens*), Small Tree Finch (*Camarhynchus parvulus*), Medium Tree Finch (*Camarhynchus pauper*), Large Tree Finch (*Camarhynchus psittacula*) (Emberizidae); Galapagos Flycatcher (*Myiarchus magnirostris*), Vermilion Flycatcher (*Pyrocephalus rubinus*) (Fringillidae); Chatham mockingbird (*Mimus melanotis*), Galapagos mockingbird (*Nesomimus parvulus*), Floreana Mockingbird (*Nesomimus trifasciatus*) (Mimidae), Yellow Warbler (*Dendroica petechia*) (Parulidae); Dark-billed Cuckoo (*Coccyzus melacoryphus*), Smooth-billed ani (*Crotophaga ani*) (Cuculidae). In Brazil, documented hosts include: Rufous-capped Antshrike (*Thamnophilus ruficapillus*) (Thamnophilidae). In Trinidad documented hosts include: Cocoa Thrush (*Turdus fumigatus*) (Turdidae); Southern House-wren (*Troglodytes musculus*) (Troglodytidae); Palm Tanager (*Thraupis palmarum*) (Thraupidae); Gray-breasted Martin (*Progne chalybea*) (Hirundinidae); Shiny Cowbird (*Molothrus bonariensis*), Yellow-rumped Cacique (*Cacicus cela*) (Icteridae); Tropical Mockingbird (*Mimus gilvus*) (Mimidae); Piratic Flycatcher (*Legatus leucophaius*), Tropical Kingbird (*Tyrannus melancholicus*), Great Kiskadee (*Pitangus sulfuratus*) (Tyrannidae); Bananaquit (*Coereba flaveola*) (Coerebidae); Rufous-tailed Jacamar (*Galbula ruficauda*) (Galbulidae); Smooth-billed Ani (*Crotophaga ani*) (Cuculidae); Silver-beaked Tanager (*Ramphocelus carbo*) (Thraupidae); Bare-eyed Thrush (*Turdus nudigenis*) (Turdidae). (Galapagos references: Fessler and Tebbich, 2002; Fessler *et al*, 2001, Fessler *et al*, 2006a, Fessler *et al*, 2006b, Dudaniec *et al*, 2007; Wiedenfeld *et al*, 2007; O'Connor *et al*, in prep. Brazil reference: Mendonca and Couri, 1999. Trinidad reference: Dodge and Aitkin, 1968).

General Impacts

In the Galapagos Islands, known *Philornis downsi* fitness costs to Darwin's finches include: high nestling blood loss (18-55%), multiple body wounds and infections, grossly deteriorated nasal openings (Fessl *et al*, 2006a), reduced haemoglobin levels (Dudaniec *et al* 2006) and reduced growth rates (Fessl and Tebbich, 2002). Consequently, it is not surprising that *P. downsi* parasitism has been linked with high brood mortality: 16% to 95% (Fessl and Tebbich, 2002; Fessl *et al*, 2006a; Huber, 2008), and reduced fledging success (Dudaniec *et al*, 2007). Species with small clutch sizes, e.g. tree finch species are higher impacted than species with bigger clutch sizes (Fessl and Tebbich, 2002). As well, parasite intensity is higher in islands with highlands (Wiedenfeld *et al*, 2007).

Impacts of *P. downsi* parasitism especially threaten small remaining populations of the 'Critically Endangered (CR)' mangrove finch (see [Camarhynchus heliobates in IUCN Red List of Threatened Species](#)) with an approximate population of 100 individuals; the 'Critically Endangered (CR)' Floreana mockingbird (see [Mimus trifasciatus in IUCN Red List of Threatened Species](#)), and the the 'Critically Endangered (CR)' medium tree finch (see [Camarhynchus pauper in IUCN Red List of Threatened Species](#)). The Darwin's medium tree finch has recently been uplisted from 'Vulnerable (VU)' to 'Critically Endangered (CR)'. Recent estimates put the total population at not more than 1,660 individuals, and it has recently begun declining rapidly owing to the effects of *P. downsi* (BirdLife International, 2009). No information is available to our knowledge on impacts of *P. downsi* on other places.

Management Info

Preventative measures: Quarantine measures to reduce introduction and dispersal (health standards for importing live birds, inspections of cargo).

Chemical: Charles Darwin Research Station (CDRS) and collaborators are trialing fly traps and lures for short term control. Accessible bird nests can be successfully liberated from parasites by applying a 1% Pyrethrin solution to the inside of the nest (without spraying directly on the nestlings, of course) (Fessl *et al*. 2006b). Currently, CDRS researchers are collecting more biological data on *Philornis* (e.g. life history, mating behaviour, fly distribution over the year and in different zones). They are also trying to breed the flies in the lab in order to evaluate the possibility of using sterile insect techniques to control the fly.

Pathway

Philornis downsi was accidentally introduced from mainland South America. Probably *via* fruit importation or in nesting material with pigeons

Principal source:

Compiler: Jody O'Connor, PhD Candidate School of Biological Sciences, Flinders University of South Australia. Adelaide, Australia & IUCN SSC Invasive Species Specialist Group (ISSG)



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Philornis downsi*

Review: R. Dudaniec, PhD, Post-doctoral Fellow, University of British Columbia, Vancouver, BC, Canada; B. Fessl, PhD, Mangrove Finch Project, Charles Darwin Foundation, Santa Cruz, Galapagos; C. Causton, PhD, Adjunct Researcher Charles Darwin Foundation for the Galapagos Islands (CDF); S. Kleindorfer, PhD, Senior lecturer Flinders University, Collaborating Scientist (CDRS)

Publication date: 2008-08-05

ALIEN RANGE

[1] BRAZIL

[1] ECUADOR

[1] TRINIDAD AND TOBAGO

Red List assessed species 5: CR = 3; EN = 1; VU = 1;

[Camarhynchus heliobates](#) CR

[Camarhynchus pauper](#) CR

[Mimus macdonaldi](#) VU

[Mimus melanotis](#) EN

[Mimus trifasciatus](#) CR

BIBLIOGRAPHY

32 references found for *Philornis downsi*

Management information

[BirdLife International, 2009. Species factsheet: *Camarhynchus pauper*.](#)

Summary: Available from:

<http://www.birdlife.org/datazone/species/index.html?action=SpcHTMDetails.asp&sid=9609&m=0> [Accessed 12 August 2009]

Causton, C. E.; S. B. Peck; B. J. Sinclair; L. Roque-Albelo; C. J. Hodgson, & B. Landry., 2006. Alien Insects: Threats and Implications for Conservation of Galapagos Islands. *Ann. Entomol. Soc. Am.* 99(1): 121-143 (2006)

[Galapagos Conservation Trust \(GCT\) .. December 2002. Response from CDF to article on parasites in Darwin's finches](#)

Summary: Available from: http://www.gct.org/dec02_3.html [Accessed 5 August 2008]

[Wiedenfeld, David A & Gustavo A. Jimenez-Uzategui., 2008. Critical problems for bird conservation in the Galapagos islands. *Cotinga* 29 \(2008\): 22-27](#)

Summary: Available from: <http://www.neotropicalbirdclub.org/articles/29/Galapagos.pdf> [Accessed 5 August 2008]

General information

Arendt, W.J.1985a. *Philornis* ectoparasitism of Pearly-eyed thrashers. I. Impact on growth and development of nestlings. *The Auk.* 102: 270-280

Arendt, W.J.1985b. *Philornis* ectoparasitism of Pearly-eyed thrashers. II. Effect on adults and reproduction. *The Auk.* 102: 281-292

[BirdLife International 2004. *Camarhynchus heliobates*. In: IUCN 2007. 2007 IUCN Red List of Threatened Species.](#)

Summary: Available from: <http://www.iucnredlist.org/search/details.php/3663/all> [Accessed 5 August 2008]

[BirdLife International 2004. *Camarhynchus pauper*. In: IUCN 2007. 2007 IUCN Red List of Threatened Species.](#)

Summary: Available from: <http://www.iucnredlist.org/search/details.php/3664/all> [Accessed 5 August 2008]

[BirdLife International, 2008. Species factsheet: *Camarhynchus heliobates*.](#)

Summary: Available from:

<http://www.birdlife.org/datazone/species/index.html?action=SpcHTMDetails.asp&sid=9612&m=0> [Accessed 5 August 2008]

[BirdLife International, 2008. Species factsheet: *Camarhynchus pauper*.](#)

Summary: Available from: <http://www.birdlife.info/wbdbwebstaging/SpcHarnessDetails.asp?sid=9609&m=0> [Accessed 5 August 2008]

Couri, M.S., Rabuffette, F.L., Reboreda, J.C. 2005. New data on *Philornis seguyi* Garcia (1952) (Diptera), Muscidae

Dodge, H.R. 1971. Revisional study of flies of the genus *Philornis* Meinert. *Studia Entomologica.* 14: 458-459

Dodge, H.R. and Aitkin, T.H.G. 1968. *Philornis* flies from Trinidad (Diptera: Muscidae). *Journal of Kansas Entomological Society.* 41:134-154

Dudaniec, Rachael Y., Sonia Kleindorfer and Birgit Fessl., 2006. Effects of the introduced ectoparasite *Philornis downsi* on haemoglobin level and nestling survival in Darwin's Small Ground Finch (*Geospiza fuliginosa*). *Austral Ecology* (2006) 31, 88-94

Dudaniec, R.Y. Fessl, B., Kleindorfer, S. 2007. Interannual and interspecific variation in intensity of the parasitic fly, *Philornis downsi*, in Darwin's finches. *Biological Conservation*. 139:325-332

Dudaniec R.Y, Gardner M.G, Donellan S, Kleindorfer S., 2008. Genetic variation in the invasive avian parasite, *Philornis downsi* (Diptera, Muscidae) on the Galapagos archipelago. *BMC Ecology*: 8

Dudaniec R.Y, Gardner M.G, Kleindorfer S., 2008. Isolation, characterisation and multiplex PCR of novel microsatellite loci for the avian parasite, *Philornis downsi* (Diptera: Muscidae). *Molecular Ecology Resources*. 8: 142-144.

Dudaniec, R.Y, Gardner M.G, Kleindorfer, S., 2009. Offspring genetic structure reveals multiple mating and nest infestation behaviour of an invasive parasitic fly (*Philornis downsi*) of Galapagos birds. *Biological Invasions*. DOI: 10.1007/s10530-009-9464-x

Dudaniec, R.Y. & Kleindorfer, S. 2006. The effects of the parasitic flies *Philornis* (Diptera, Muscidae) on birds. *Emu. Aust. Ornith.* 106:13-20

[Encyclopedia of Life \(EOL\), 2008. *Philornis downsi*](#)

Summary: Available from: <http://www.eol.org/taxa/16313523> [Accessed 5 August 2008]

Fessl, B., Couri, M.S., Tebbich, S. 2001. *Philornis downsi* Dodge and Aitkin, new to the Galapagos Islands (Diptera, Muscidae). *Studia Dipterologica*. 8:317-322

Fessl, Birgit & Sabine Tebbich., 2002. *Philornis downsi* ? a recently discovered parasite on the Galapagos archipelago ? a threat for Darwin's finches? *Ibis* (2002), 144, 445-451

Fessl, B; R. J. Sinclair and S. Kleindorfer., 2006. The life-cycle of *Philornis downsi* (Diptera: Muscidae) parasitizing Darwin's finches and its impacts on nestling survival. *Parasitology*, Volume 133, Issue 06, December 2006, pp 739-747

Fessl, B; S. Kleindorfer and S. Tebbich., 2006. An experimental study on the effects of an introduced parasite in Darwin's finches. *Biological Conservation* Volume 127, Issue 1, January 2006, Pages 55-61

Huber, K Sarah., 2008. Effects of the introduced parasite *Philornis downsi* on nestling growth and mortality in the medium ground finch (*Geospiza fortis*). *Short Communication Biological Conservation* Volume 141, Issue 2, February 2008, Pages 601-609

[ITIS \(Integrated Taxonomic Information System\), 2005. Online Database *Philornis*](#)

Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals. Available from: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=150620 [Accessed 5 August 2008]

Kleindorfer S, Dudaniec R Y., 2009. Love thy Neighbour? Ectoparasite intensity varies with social nesting pattern and nest size in Darwin's finches. *Behavioural Ecology and Sociobiology*. 63: 731-739

Mendoca, E.C. & Couri, M.S. 1999. New associations between *Philornis Meinert* (Diptera, Muscidae) and *Thamnophilidae* (Aves, Passeriformes). *Revista Brasileira de Zoologia*. 16: 1223-1225

Uhazy and Arendt, W.J. 1986. Pathogenesis associated with *Philornid* myiasis (Diptera, Muscidae) on pearly-eyed thrashers (Aves: Mimidae) in the Luquillo Rainforest, Puerto Rico. *Journal of Wildlife Diseases*. 22. 224-237

Wiedenfeld, David A; Jimenez U, Gustavo A; Fessl, Birgit; Kleindorfer, Sonia; Valarezo, Juan Carlos., 2007. Distribution of the introduced parasitic fly *Philornis downsi* (Diptera, Muscidae) in the Galapagos Islands. *Pacific Conservation Biology*. 13(1). MAR 2007. 14-19.

Summary: Abstract: The avifauna of the Galapagos Islands is characterized by a small number of endemic species, including the 13 species of Darwin's finches. The introduced fly parasite *Philornis downsi* reduces nestling survival and growth rate of altricial birds, and can cause mortality and morbidity of the nestlings. We examined the occurrence of *Philornis downsi* among islands and at different elevations. The parasite was found in nests from 11 of 13 islands sampled. The two islands on which *P. downsi* was not found were Española (n) over Isla and Genovesa, both islands with no humid highlands and distant from the centre of the archipelago. Parasite infection intensity was greater in nests at higher elevations, and on islands that have moist highlands, which may serve as a reservoir for the flies. A full understanding of the fly's ecology may permit the development of eradication or control methods, or at least mitigation of its effects on the birds.

[Wikelski, M., J. Foufopoulos, H. Vargas, and H. Snell. 2004. Galapagos Birds and Diseases: Invasive Pathogens as Threats for Island Species. *Ecology and Society* 9\(1\): 5. \[online\]](#)

Summary: Available from: <http://www.ecologyandsociety.org/vol9/iss1/art5/> [Accessed 5 August 2008]

Young, B. E. 1993. Effects of the parasitic botfly *Philornis carinatus* on nestling house wrens, *Troglodytes aedon*, in Costa Rica. *Oecologia* 93, 256-262. doi:10.1007/BF00317679