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 with 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 (Fessl *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: Mangove 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 mocking bird (*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: Fessl and Tebbich, 2002; Fessl *et al*, 2001, Fessl *et al*, 2006a, Fessl *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 \r\nhas 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

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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**

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