

A note on the snail host of *Ascocotyle felippeii* Travassos, 1928 (Digenea: Heterophyidae), a parasite of Hawaiian stream fishes¹

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The digenetic trematode *Ascocotyle felippeii* Travassos, 1928 (formerly *A. tenuicollis* Price, 1935; see Santos *et al.* 2007 for synonymy) has been found to parasitize several species of native and alien stream fishes in the Hawaiian Islands (Font 1997a, 1997b, 1998, 2003, 2007). Contrary to earlier accounts, the identity of its first intermediate host in Hawai'i is unknown, but we may assume that one or more species of aquatic gastropods serve this purpose; its second intermediate hosts are numerous species of fresh- and brackish-water fish, and its definitive hosts are fish-eating birds and mammals (Scholz *et al.* 1997a, 2001). Chai (2019) listed several species of *Ascocotyle* (but not *A. felippeii*) as known or potential intestinal parasites of humans.

Ostrowski de Núñez (1976) reported that in Argentina the first intermediate host of *A. felippeii* (as *A. tenuicollis*) is the cochliopid snail *Littoridinia piscium*, now *Heleobia piscium* (d'Orbigny, 1835) (MolluscaBase eds. 2022). Like *A. felippeii*, other species of *Ascocotyle* are also reported to parasitize aquatic snails of the family Cochliopidae: *Littoridinops tenuipes* (Couper, 1844) and *Onobops jacksoni* (Bartsch, 1953) (Schroeder & Leigh 1965; O'Hara *in* Heard 1970), *L. monroensis* (Frauenfeld, 1863) (Leigh 1974; Font *et al.* 1984), various species of *Heleobia*, some formerly placed in *Littoridina* or *Lyrodes* (review in Santos & Borges 2020), and *Pyrgophorus coronatus* (Pfeiffer, 1840) (Scholz *et al.* 1997a, 1997b). Font (1997a, 1997b), on the other hand, stated that the first intermediate hosts of *Ascocotyle felippeii* (as *A. tenuicollis*) in Hawai'i are thiarid or "melanid" snails, and he later (2003) identified the host specifically as the thiarid snail *Melanoides tuberculata* (O.F. Müller, 1774). Font (2007) repeated that assertion, citing Martin (1958) as authority for that statement. Martin's work makes no mention of *Ascocotyle*, however, and the list by Pinto & De Melo (2011) of trematodes known to parasitize *M. tuberculata* does not include any species of *Ascocotyle*. Accordingly, Font's statement as to *M. tuberculata* lacks any basis and is erroneous.

If *Melanoides tuberculata* is *not* the first intermediate host of *A. felippeii* in Hawai'i, alternative candidates would most likely be found among the Cochliopidae. Two species of cochliopids occur in the Hawaiian Islands: the alien *Pyrgophorus coronatus* (Pfeiffer, 1840) (Cowie 1999; Englund 2002) and the native *Tryonia porrecta* (Mighels, 1845) (Hershler 2001; Christensen *et al.* 2021). For neither species have Hawaiian populations been examined for trematodes, but the fact that *P. coronatus* is a known host of another species of *Ascocotyle* (Scholz *et al.* 1997a) suggests it to be a likely host of Hawaiian *A. felippeii*. The matter is not so simple, however; in Hawai'i, *A. felippeii* has only been found to occur on the island of Hawai'i (Font 1997a, 1998, 2007), whereas *P. coronatus* was first found to be present in the Hawaiian Islands in 1998 and has as yet been found to occur

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only on the island of O'ahu, not on Hawai'i (Cowie 1999; Englund 2002). Furthermore, *T. porrecta* has been found to occur at Waiakea on the island of Hawai'i (Hershler 2001), the same location where Font (2007) reported *A. felippeii* to occur. Accordingly, either or both are potential hosts, but the question remains unresolved.

Five species of native gobioid fishes inhabit our streams (Kinzie 1990). Concerns have been voiced regarding the impact on them of parasitic helminths that have become established here as a result of the introduction of various alien freshwater fish species (Devick 1991), and *A. felippeii* has been reported to infect three of the native gobioids, including the endemic *Eleotris sandwicensis* Vaillant & Sauvage, 1875 (Font 1997b, 1998, 2003, 2007); the other two native species infected were not identified by name, but as *Lentipes concolor* (Gill, 1860) and *Sicyopterus stimpsoni* were said not to have been present in sites where *A. felippeii* was found (Font 2007) we can infer that they were *Avouis guamensis* (Valenciennes, 1837) and *Stenogobius hawaiiensis* Watson, 1991. The presence in Hawai'i of *A. felippeii* may also be relevant to the conservation of our native water birds, as another species of *Ascocotyle* has been found to parasitize a congener of the endangered Hawaiian stilt *Himantopus mexicanus knudseni* Stejneger, 1887 (Alda *et al.* 2011).

The distribution of the parasite will necessarily be constrained by that of its host. *M. tuberculata* is abundant in coastal wetlands and slow-moving streams throughout the main Hawaiian Islands, (Hayes *et al.* in prep.), whereas both *T. porrecta* and *P. coronatus* are much more restricted in range. *Tryonia porrecta*, though once as widespread as *M. tuberculata*, is now much reduced in range; in the Hawaiian Islands living specimens have only been observed three times in the last 50 years, in two coastal ponds on the island of Hawai'i (one of them the Waiakea site where *A. felippeii* is present) and in an O'ahu nursery (Christensen *et al.* 2021). *Pyrgophorus coronatus* has as yet been found only in the Pearl Harbor region of O'ahu (Cowie 1999; Englund 2002). Accordingly, improved knowledge of the true identity and range of its snail hosts would assist efforts to manage and conserve the native fishes which are among its second intermediate hosts as well as the endangered birds likely to serve as definitive hosts. Little is known of the biology of either of the two cochliopid snails now present in the Hawaiian Islands, but future studies of them should consider their potential role as hosts of *Ascocotyle*.

In a study of parasites of cats and dogs in Hawai'i, Ash (1962) found *Phagicola longa* [now *Ascocotyle longa* Ransom, 1920, or *A. (Phagicola) longa*] to be present in dogs, and thus two species of *Ascocotyle* are thought to occur in the Hawaiian Islands. The cochliopid snail *Heleobia australis* (d'Orbigny, 1835) is known to be a first intermediate host of *A. longa* in Brazil (Simões *et al.* 2010). As Alicata (1964) noted, the snail host of *A. longa* in Hawaii has not been identified, so either of the two cochliopids present in the Hawaiian Islands would be possible candidates for that function, even though *P. coronatus* is not thought to have been present in Hawai'i at the time of Ash's study. As with *A. felippeii*, the definitive hosts of *A. longa* are fish-eating birds and mammals, but unlike the former species, *A. longa* has been found to be a rare cause of human infections (Chai 2019).

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