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Lagenophryid ciliophorans on Japanese freshwater ostracods

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Abstract

Lagenophryidae is one of the ectosymbiotic ciliophoran groups found on freshwater ostracods. In Japan, one unidentified lagenophryid species (*Lagenophrys* sp.) was reported on the candonid *Cryptocandona* sp. collected from Makkari in Hokkaido Prefecture. Here we provide two further examples of *Lagenophrys* epibionts found on Japanese ostracods. One was discovered from the candonid *Cryptocandona* sp. from Gudari-numa spring in Aomori Prefecture and the other from the candonid *Cyclocypris* sp. from Jokai-shimizu spring in Akita Prefecture. Including one likely record from *Fabaeformiscandona dolabella* in Lake Biwa, there are currently four records of lagenophryids on ostracods in Japan.

Key words: benthos; epibiont; freshwater; seed shrimp

Lagenophryidae is a group of crustacean ectosymbiotic ciliophorans, with five genera (Mayén-Estrada and Clamp 2016). More than 80 species have been found on various host crustacean groups, including decapods, amphipods, isopods, tanaidaceans, copepods, cladocerans, and ostracods (Clamp 2006; Mayén-Estrada and Clamp 2016).

All the lagenophryids found so far on ostracods belong to *Lagenophrys* (Chatterjee et al. 2020, 2022). *Lagenophrys discoidea* Kellicott, 1887 has been reported from 18 ostracod species in three families and has a worldwide distribution (Table 1; Chatterjee et al. 2020). *Lagenophrys stammeri* Lust, 1950 was found on the candonid *Cypria ophthalmica* (Jurine, 1820), one of the host species for *L. discoidea*, in Germany (Lust 1950; Schödel 2004). In addition to those two, unidentified *Lagenophrys* species have been found on *Elpidium* sp. (Limnocytheridae) in Brazil, *Cryptocandona* sp. (Candonidae) in Japan, and *Candona* sp. (Candonidae) in Russia (Sabagh et al. 2011; Khalzov et al. 2020, 2021; Malfatti et al. 2020, 2022; Chatterjee et al. 2022; Kakui and Munakata 2022).

Table 1. Host ostracod species for *L. discoidea*.

Family/species names
Entocytheridae
Ankylocythere ancyla Crawford, 1965
Ankylocythere hobbsi (Hoff, 1944)
Ankylocythere sinuosa (Rioja, 1942)
Dactylocythere daphniodes (Hobbs, 1955)
Dactylocythere jeanae Hobbs, 1967
Donnaldsoncythere donnaldsonensis (Klie, 1931)
Thermastrocythere riojai (Hoff, 1943)
Candonidae
Candona sp.
Cyclocypris ovum (Jurine, 1820)
Cyclocypris sharpei Furtos, 1933
Cypria obesa Sharpe, 1897
Cypria ophtalmica (Jurine, 1820)
Neglecandona neglecta (Sars, 1887)
Pseudocandona elliptica (Furtos,1933)
Cyprididae
Chlamydotheca arcuata (Sars, 1901)
Cypris sp.
Cypridopsis vidua (Müller, 1776)
Heterocypris similis (Wierzejski, 1893)

In Japan, lagenophryids have been reported from the candonid *Cryptocandona* sp. from a spring in Makkari, Hokkaido Prefecture (Kakui and Munakata 2022). The epibionts found on the candonid *Fabaeformiscandona dolabella* Smith and Janz, 2008

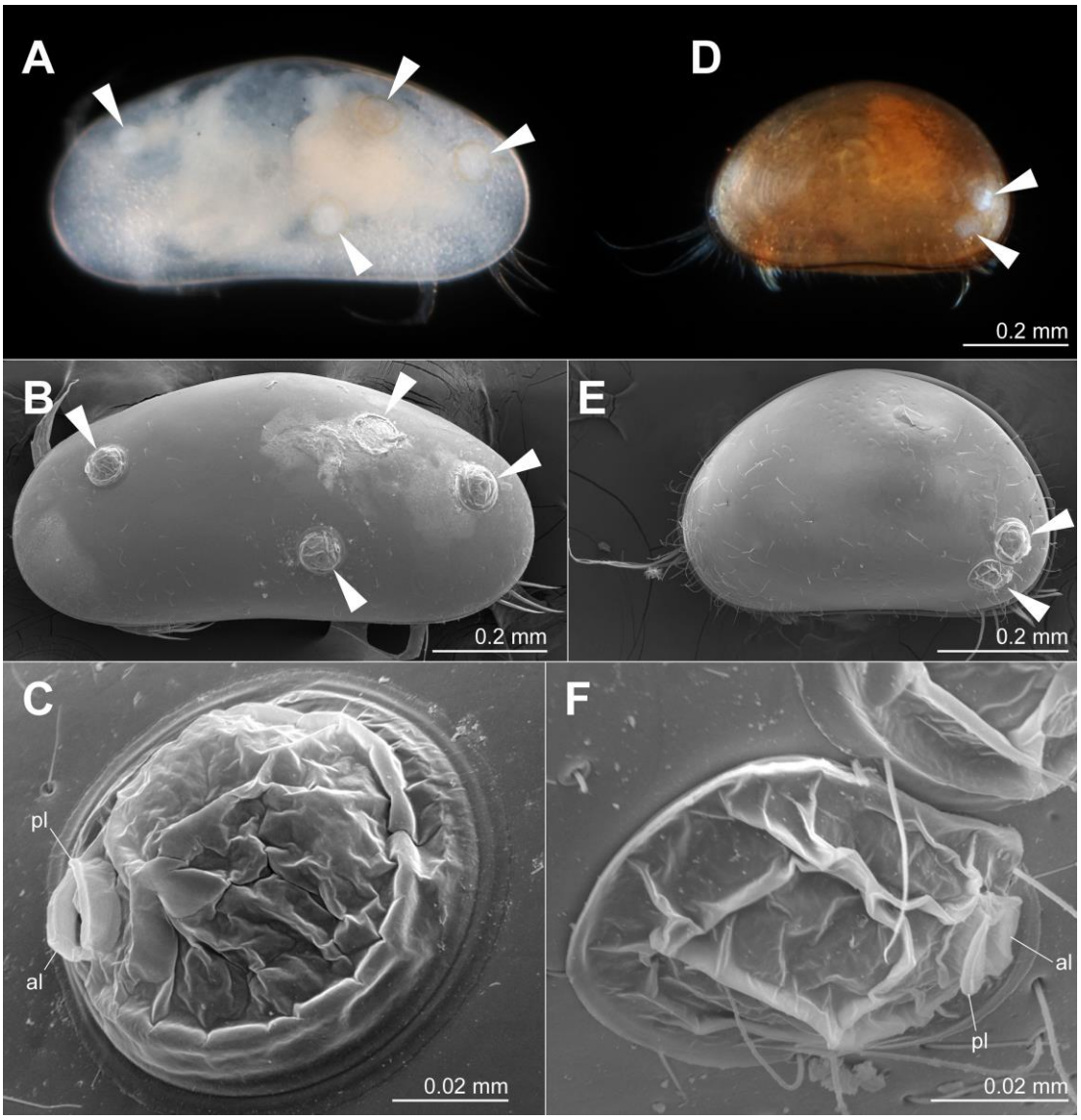

Fig. 1. *Lagenophrys* epibionts (arrowheads) on *Cryptocandona* sp. (A–C) and *Cyclocypris* sp. (D–F). A, D, habitus, ethanol fixed specimen, left view. B, C, E, F, scanning electron microscopic images of habitus (B, E) and an epibiont (C, F). Abbreviations: al, anterior lip; pl, posterior lip.

from Lake Biwa, Shiga Prefecture are also likely lagenophryids (Smith and Janz 2008; see also Smith 2024).

During a survey of Japanese spring ostracods by the first author, lagenophryid epibionts were found on ostracods collected at two sites. At Gudari-numa spring, Aomori Prefecture, they were found on the candonid *Cryptocandona* sp. collected on 13 October 2022 (Fig. 1A–C). The sample prevalence was 41 % (epibionts found on seven of 17 ostracods). At Jokai-shimizu spring, Akita Prefecture, they were found on the candonid *Cyclocypris* sp. collected on 28 October 2021 (Fig. 1D–F). The sample prevalence was 47 % (epibionts found on 72 of 154 ostracods). The epibionts from the two sites show the following combination of characters: closure apparatus composed of anterior and posterior lips present; both lips flexible; edges of lips met when the closure apparatus close; lips perpendicular to long axis of body; operculum absent (Fig. 1C, F). Our lagenophryids thus belong to *Lagenophrys* (Clamp 1991). Unfortunately, PCR amplifications of their 18S rRNA sequences were unsuccessful (for method, see Kakui et al. 2021), and we only have ethanol-fixed

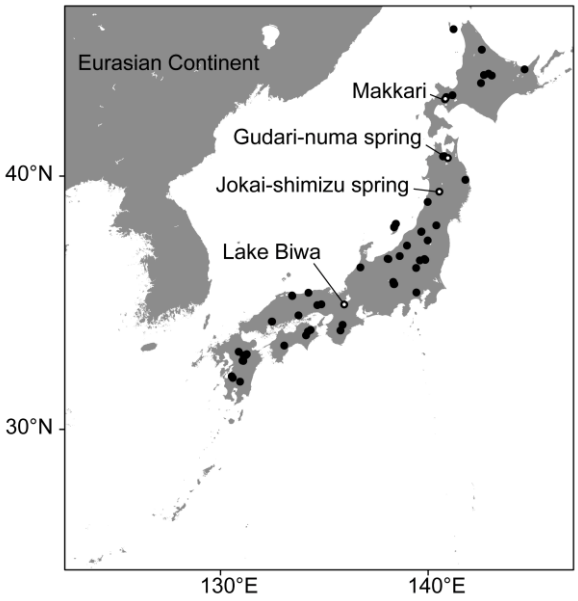

Fig. 2. Map showing sites where *Lagenophrys* epibionts on ostracods were found (open circles; including the site for epibionts on *F. dolabella*) and ones where the first author collected uninfected ostracods only (filled circles; Mizuho Munakata unpublished data).

specimens. We thus refrain from making morphological comparisons of our specimens with those of Kakui and Munakata (2022).

Among 66 sites where the first author successfully collected ostracods, lagenophryids on ostracods have been found only at three sites so far (Fig. 2; Kakui and Munakata 2022; this study). All ostracod hosts currently recorded in Japan belong to Candonidae. At least in spring environments, the density of candonid ostracods is generally quite low (Mizuho Munakata personal observation). Gudari-numa and Jokai-shimizu springs were unusual sites where candonid densities were not low. That ostracod-epibiotic lagenophryids have only been discovered from a few springs may result from low host density.

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