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Monogeneans from Marine Fishes of Okinawa, Japan

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ABSTRACT: Monogeneans were recovered from 21 of 348 fishes representing 52 families, 115 genera, and 154 species between May and September 1985 in the coastal waters of Okinawa. Three families of Monogenea representing 9 genera and 12 species were recorded, including 6 monogeneans not previously known from Okinawa. Fifteen new host records were established. Only 1 of 12 species identified transgressed family bounds in their hosts. Representatives of *Protogyrodactylus* and *Lepidotrema,* heretofore reported only from freshwater teleosts, were also detected but not described.

KEY WORDS: Monogenea, survey, fish, Okinawa Island, Japan, new host records, new localities.

While contributions to our knowledge of monogeneans from marine fishes of the Japanese Archipelago have been made by numerous workers, probably the most comprehensive studies from this region have been those reported by Yamaguti (1934, 1937, 1938, 1939, 1940, 1942a, 1958). With the exception of the report by Yamaguti (1942b) on the digeneans of marine fishes of Okinawa, information on other helminth parasites of this region of the Japanese Archipelago is lacking. Thus, the present study was initiated to examine over a 5-month period as many fishes as possible from the coastal waters of Okinawa for monogeneans.

Materials and Methods

Between May and September 1985, monogeneans were collected from 348 fishes representing 50 families of teleosts and 2 families of elasmobranchs (Table 1). A variable mesh gill net, seine traps, spearfishing and hook and line supplemented by quinaldine were used to collect species inhabiting shallow waters. Fishes were individually placed in plastic bags containing seawater and held in styrofoam containers for transport to the laboratory. Gills and skin were examined with a dissecting microscope. Specimens were immediately fixed and stored in AFA (alcohol–formalin–acetic acid). Some specimens were mounted unstained in Gray and Wess' medium for observation of sclerotized structures. Others were stained with Harris' hematoxylin, Mayer's carmalum, or Gomori's trichrome solution according to the technique of Kritsky et al. (1978). Voucher specimens have been deposited in the United States National Museum (USNM) Helminthological Collection, Beltsville, Maryland, under the accession numbers listed in Table 1. Other specimens are in the authors' collections.

Locality coordinates are given for each host listed in Table 1 except for a specimen of *Taeniura melanospila* (Bleeker) examined after the stingray died about 1 mo after being placed in the Okinawa Expo Memorial Park Aquarium, Motobu-cho, Okinawa, Japan, and a specimen of *Acanthopagrus sivicolus* Akazaki held at the Prefectural Fish Hatchery also located in Motobu-cho Okinawa.

Results and Discussion

Monogenea were recovered from 21 (6.0%) of 348 fishes representing 15 (28.9%) of 52 families, 17 (14.8%) of 115 genera, and 21 (13.6%) of 154 species. The 12 species of monogeneans collected represented 3 families and 9 genera (Table 1). Of the 21 species of fishes that were infested, none harbored more than 1 species of Monogenea. Fish negative for monogeneans are listed in Appendix 1.

The intensity of a given species ranged from 1 to 1,000 monogeneans per host. Each of 7 fishes yielded 1–10 specimens; 8, 15–25; 1, 50; 1, 60; 2, 200; and 2, 1,000.

Of the fish species examined, the prevalence of infestation was high. Each of 11 (91.6%) of the 12 species of Monogenea recovered occurred on only 1 host species and 1 (20.0%) on 5.

Six of the 12 species are reported for Okinawa for the first time. These include: *Entobdella squamula*; *Ancyrocephalus spinicirrus*; *Haliotrema upenei*; *Pseudohaliotrema sphincteroporus*; *Protolamellodiscus convolutus*; and *Lamellodiscus elegans.*

To our knowledge, the following are new host records: *Benedenia seriolae* on *Cantherhines pardalis*; *Entobdella squamula* on *Taeniura melanospila*; *Metabenedeniella hoplognathi* on *Plectorhynchus chaetodontoides*; *Ancyrocephalus spinicirrus* on *Variola albimarginata*; *Haliotrema alatum* on *Acanthurus bariene*; *Haliotrema japonense* on *Zanclus cornutus*; *Haliotrema upe-*

Table 1. Monogenetic flukes of marine fishes from coastal water of Okinawa, Japan.

Hosts	Parasite	Locality	No. hosts examined/no. infected/ mean intensity	USNM Helm. Coll. No.
Chondrichthyes				
Dasyatididae				
Taeniura melanospila Bleeker	*Entobdella squamula* (Heath, 1902)		1/1/1,000	80216
Osteichthyes				
Acanthuridae				
Acanthurus bariene Lesson	*Haliotrema alatum* Yamaguti, 1942	26°39.18′N; 127°52.32′E	1/1/25	80217
Acanthurus lineatus (Linnaeus)	*Pseudohaliotrema sphincteroporus* Yamaguti, 1953	26°39.71–39.96′N; 127°52.09–52.50′E	1/1/15	80224
Acanthurus nigrofuscus (Forsskål)	*Haliotrema upenei* Yamaguti, 1953	26°37.95′N; 127°52.00′E	2/1/10	80219
Acanthurus olivaceus Schneider	*Pseudohaliotrema sphincteroporus*	26°37.95′N; 127°52.00′E	2/1/4	80225
Belonidae				
Tylosurus crocodilus crocodilus (Le Sueur)	*Ancyrocephalus* sp.	26°37.95′N; 127°52.00′E	1/1/1,000	80210
Chaetodontidae				
Heniochus chrysostomus Cuvier	*Pseudohaliotrema sphincteroporus*	26°39.71–39.96′N; 127°52.09–52.50′E	3/1/20	80228
Heniochus singularius Smith and Radcliffe	*Ancyrocephalus* sp.	26°39.71–39.96′N; 127°52.09–52.50′E	1/1/6	80208
Dactylopteridae				
Dactyloptena orientalis (Cuvier)	*Protancyrocephalus strelkowi* Bychowsky, 1957	26°37.95′N; 127°52.00′E	1/1/60	80223
Gerreidae				
Gerres oyena (Forsskål)	*Pseudohaliotrema sphincteroporus*	26°37.95′N; 127°52.00′E	1/1/50	80227
Lethrinidae				
Lethrinus harak (Forsskål)	*Protolamellodiscus convolutus* (Yamaguti, 1953)	26°37.95′N; 127°52.00′E	4/1/200	80220
Monacanthidae				
Cantherhines pardalis (Rüppell)	*Benedenia seriolae* Yamaguti, 1934	26°39.71–39.96′N; 120°52.09–52.50′E	1/1/2	80213
Pomadasyidae				
Plectorhynchus chaetodontoides (Lacepède)	*Metabenedeniella hoplognathi* (Yamaguti, 1942)	26°37.95′N; 127°52.00′E	1/1/15	80222
Scombridae				
Grammatorcynus bilineatus (Rüppell)	*Caballerocotyla* sp.	24°20.91′N; 123°42.32′E	1/1/1	80214
Scorpaenidae				
Pterois lunulata Temminck and Schlegel	*Ancyrocephalus* sp.	26°40.62′N; 127°49.20′E	1/1/25	80209

Table 1. Continued.

Hosts	Parasite	Locality	No. hosts examined/no. infected/ mean intensity	USNM Helm. Coll. No.
Serranidae				
Cephalopholis urodelus Schneider	*Pseudohaliotrema sphincteroporus*	26°39.71–39.96′N; 127°52.09–52.50′E	1/1/20	80226
Plectropomus leopardus (Lacepède)	*Entobdella* sp.	26°39.18′N; 127°52.32′E	1/1/6	80215
Variola albimarginata Baissac	*Ancyrocephalus spinicirrus* Yamaguti, 1953	26°37.37′N; 127°51.77′E	4/1/15	80211
Sparidae				
Acanthopagrus sivicolus Akazaki	*Lamellodiscus elegans* Bychowsky, 1957		1/1/20	80221
Tetraodontidae				
Arothron mappa (Lesson)	*Benedenia synagris* Yamaguti, 1953	26°37.95′N; 127°52.00′E	1/1/3	80212
Zanclidae				
Zanclus cornutus (Linnaeus)	*Haliotrema japonense* Yamaguti, 1934	26°39.71–39.96′N; 127°52.09–52.50′E	1/1/200	80218

nei on *Acanthurus nitrofuscus*; *Protancyrocephalus strelkowi* on *Dactyloptena orientalis*; *Pseudohaliotrema sphincteroporus* on *Acanthurus lineatus, Acanthurus olivaceus, Heniochus chrysostomus, Gerres oyena,* and *Cephalopholis urodelus*; *Protolamellodiscus convolutus* on *Lethrinus harak*; and *Lamellodiscus elegans* on *Acanthopagrus sivicolus.*

In addition, representatives of 2 additional genera previously reported only from freshwater teleosts were collected. One represents a species of *Protogyrodactylus* from *Parupeneus spilurus* (Bleeker), and the other represents a species of *Lepidotrema* from *Epinephelis fasciatus* (Forsskål). We prefer to withhold description of these until additional specimens are available.

As visiting fish disease specialists, we (E.H.W., L.B.W.) were requested to examine a number of fish mortalities which occurred in Okinawa during our visit. Two of these involved Monogenea.

Two to 3 "minami-kurodai," *Acanthopagrus sivicolus,* 27 cm in standard length, reared in concrete, flow-through tanks at the Prefectural Fish Hatchery, Toguchi, Montobu-cho, Okinawa, began dying each day in each culture tank in late September 1985. We examined apparently stressed specimens on site from these tanks on 24 September. These fishes were heavily infested (51 to 100 parasites) (Williams, 1972) with *Lamellodiscus elegans.* A few nauplii and copepodid stages of a parasitic copepod (to be reported elsewhere) occurred on the skin and gill filaments of the fishes, which also had inflamed areas on their ventral surfaces. A static formalin treatment to remove the Monogenea was recommended.

Very heavy infestations (100+ parasites) (Williams and Phelps, 1976) of *Entobdella squamula* had recently killed 2 specimens of "madara-ei," *Taeniura melanospila,* when we were invited to the Expo Aquarium, Montobu-Cho, Okinawa, on 20 July 1985. We examined a freshly dead 34.5-kg female ray, 174 cm in total length, disc length 96 cm, width 104 cm, that was covered with monogeneans. The ray had been collected on 17 June 1985, at Haneji, Nago, Okinawa, and had survived slightly less than a month in captivity. This parasite has been a long-term problem at the aquarium and has caused mortalities in every species of dasyatid ray held in their large display tanks (Expo Aquarium Staff, pers. comm.). Due to the size of the tank, size, number, and diversity of aquarium animals, no treatment

could be designated that was more satisfactory than periodically replacing moribund rays.

Although 154 species of fishes were examined, the number of individuals of each species was regrettably low, resulting in insufficient data to form convincing conclusions on the prevalence and intensity of their parasites. Table 1 reveals a striking degree of specificity between the Monogenea and their hosts in Okinawa. Only 1 of the 12 species identified in this study, namely *Pseudohaliotrema sphincteroporus,* has been found to transgress family bounds on its hosts. While the present study provides information on new host and locality records, more extensive sampling of marine fishes of Okinawa is needed before a list of Monogenea approaching completeness can be presented.

Literature Cited

Kritsky, D. C., P. D. Leiby, and R. J. Kayton. 1978. A rapid stain technique for the haptorial bars of *Gyrodactylus* species (Monogenea). Journal of Parasitology 64:172–174.

Williams, E. H., Jr. 1972. Parasitic infection of some marine fishes before and after confinement in feeding cages. Alabama Marine Resources Bulletin 8: 25–31.

———, **and R. P. Phelps.** 1976. Parasites of some mariculture fishes before and after cage culture. Pages 216–230 *in* Marine Technology Society, Food and Drugs from the Sea Conference.

Yamaguti, S. 1934. Studies on the helminth fauna of Japan. Part 2. Trematodes of fishes, I. Japanese Journal of Zoology 5:249–541.

———. 1937. Studies on the helminth fauna of Japan. Part 19. Fourteen new ectoparasitic trematodes of fishes. 28 pp. [Published by the author, 25 March.]

———. 1938. Studies on the helminth fauna of Japan. Part 24. Trematodes of fishes, V. Japanese Journal of Zoology 8:15–74.

———. 1939. Studies on the helminth fauna of Japan. Part 26. Trematodes of fishes, VI. Japanese Journal of Zoology 8:211–230.

———. 1940. Studies on the helminth fauna of Japan. Part 31. Trematodes of fishes, VII. Japanese Journal of Zoology 9:35–108.

———. 1942a. Studies on the helminth fauna of Japan. Part 37. Trematodes of fishes, VIII. Japanese Journal of Medical Sciences 2:105–129.

———. 1942b. Studies on the helminth fauna of Japan. Part 39. Trematodes of fishes mainly from Naha. Transactions of the Biogeographical Society of Japan 3:329–398.

———. 1958. Studies on the helminth fauna of Japan. Part 53. Trematodes of fishes, XII. Publications of the Seto Marine Biological Laboratory 7: 53–88.

Appendix 1

Species of Fish Negative for Monogenea

(listed alphabetically by family with the number of individuals examined in parentheses)

Chondrichthyes

Rhincodontidae: *Rhincodon typus* Smith (1).

Osteichthyes

Acanthuridae: *Acanthurus bleekeri* Günther (1), *A. glaucopareius* Cuvier (2). Apogonidae: *Apogon aroubiensis* (Hombron and Jacquinot) (4), *A. cyanosoma* Bleeker (7), *A. doederleini* Jordan and Snyder (45), *Cheilodipterus macrodon* (Lacepède) (2), *C. quinquelineatus* Cuvier (39), *Rhabdamia gracilis* (Bleeker) (1), *Siphamia versicolor* (Smith and Radcliffe) (4). Atherinidae: *Atherion elymus* Jordan and Starks (2). Aulostomidae: *Aulostomus chinensis* (Linnaeus) (1). Balistidae: *Balistoides conspicillum* (Schneider) (1), *Rhinecanthus aculeatus* (Linnaeus) (1). Blenniidae: *Ecsenius lineatus* Klausewitz (3), *E. yaeyamaensis* (Aoyagi) (2), *Istiblennius lineatus* (Valenciennes) (1), *Meiacanthus atrodorsalis atrodorsalis* (Günther) (1), *M. grammistes* (Valenciennes) (2), *Plagiotremus laudandus* Whitley (2), *P. tapeinosoma* Bleeker (2), *Salarias fasciatus* (Bloch) (3). Callionymidae: *Diplogrammus xenicus* (Jordan and Thompson) (3). Carapodidae: *Encheliophis vermicularis* Müller (2). Centriscidae: *Aeoliscus strigatus* (Günther) (2). Chaetodontidae: *Chaetodon argentatus* Smith and Radcliffe (1), *C. bennetti* Cuvier (1). Cheilodactylidae: *Goniistius zebra* (Doderlein) (2). Cirrhitidae: *Cirrhitichthys aprinus* (Cuvier) (1), *C. falco* Randall (3), *Paracirrhites forsteri* (Schneider) (1). Diodontidae: *Diodon holocanthus* Linnaeus (5). Ephippididae: *Platax pinnatus* Linnaeus (1), *P. teira* (Forsskål) (1). Fistulariidae: *Fistularia petimba* Lacepède (2). Girrellidae: *Girella melanichthys* (Richardson) (2), *G. mezina* Jordan and Starks (1). Gobiesocidae: *Diademichthys lineatus* (Sauvage) (1). Gobiidae: *Amblyeleotris fasciata* (Herre) (1), *A. japonica* Takagi (5), *Bathygobius fuscus* (Rüppell) (3), *Chasmichthys dolichognathus* (Hilgendorf) (3), *Ctenogobiops feroculus* Lubbock and Polunin (1), *Eviota smaragdus* Jordan and Seale (2), *Gantholepis scapulostigma* Herre (2), *Istigobius campbellli* (Jordan and Snyder) (2), *I. decoratus* (Herre) (2), *I. ornatus* (Rüppell) (2), *Ptereleotris evides* (Jordan and Hubbs) (1), *P. heteroptera* (Bleeker) (2), *Trimma caudomaculata* Joshima and Araga (1), *Valenciennea puellaris* Tomiyama (2), *V* sp. (1), *V. strigata* (Broussonet) (4). Grammistidae: *Diploprion bifasciatus* Cuvier (1), *Grammistes sexlineatus* (Thunberg) (1). Holocentridae: *Flammeo sammara* (Forsskål) (1), *Myripristis violaceus* Bleeker (1). Labridae: *Bodianus axillaris* (Bennett) (3), *Cheilinus bimaculatus* Valenciennes (1), *Cheilio inermis* (Forsskål) (1), *Cirrhilabrus cyanopleura* (Bleeker) (2), *Coris aygula* Lacepède (2), *Halichoeres melanurus* (Bleeker) (1), *H. trimaculatus* (Quoy and Gaimard) (1), *Hemigymnus fasciatus* (Bloch) (1), *H. melapterus* (Bloch) (2), *Hologymnosus annulatus* (Lacepède) (1), *Labroides dimidiatus* (Valenciennes) (2), *Pseudochelinus hexataenia* (Bleeker) (1), *Pteragogus flagellifera* (Valenciennes) (1),

Xyrichtys dea Temminck and Schlegel (1). Lethrinidae: *Lethrinus semicinctus* Valenciennes (1), *Monotaxis grandoculis* (Forsskål) (2). Lutjanidae: *Lutjanus fulviflamma* (Forsskål) (3). Malacanthidae: *Malacanthus latovittatus* (Lacepède) (1). Monacanthidae: *Parapercis cylindrica* (Bloch) (1), *C. polyophthalma* (Cuvier) (1). Mullidae: *Upeneus tragula* Richardson (1). Muraenidae: *Echidna delicatula* (Kaup) (1), *Gymnothorax flavimarginatus* (Rüppell) (1). Nemipteridae: *Pentapodus nagasakiensis* (Tanaka) (1), *Scolopsis bilineatus* (Bloch) (1), *S. cancellatus* (Valenciennes) (2), *S. dubiosua* Weber (1). Ostraciidae: *Ostracion immaculatus* Temminck and Schlegel (1). Plesiopidae: *Calloplesiops altivelis* (Steindachner) (2). Pomacanthidae: *Centropyge ferrugatus* Randall and Burgess (1), *C. heraldi* Woods and Schultz (3), *C. tibicen* (Cuvier) (2), *Chaetodontoplus mesoleucus* (Bloch) (1), *Genicanthus lamarck* (Lacepède) (1), *Heniochus singularius* Smith and Radcliffe (1). Pomacentridae: *Amblyglyphidodon cauracao* (Bloch) (1), *A. leucogaster* (Bleeker) (1), *Amphiprion clarkii* Bennett (2), *A. frenatus* Brevoort (1), *Chromis flavomaculatus* Kamohava (2), *C. margaritifer* Fowler (2), *C. weberi* Fowler and Bean (1), *Chrysiptera cyanea* (Quoy and Gaimard) (1), *C. rex* (Snyder) (1), *C. starcki* (Allen) (1), *Dascyllus aruanus* (Linnaeus) (2), *D. trimaculatus* (Rüppell) (1), *Paraglyphidodon nigroris* (Cuvier) (1), *Pomacentrus alexanderae* Everman and Seale (2), *P. philippinus* Evermann and Seale (1), Pomadasyidae: *Plectorhynchus diagrammus* (Linnaeus) (1). Priacanthidae: *Priacanthus hamrur* (Forsskål) (1). Pseudochromidae: *Dampieria cyclophthalma* (Müller and Troschel) (2), *Pseudochromis porphyreus* Lubbock and Goldman (2). Scorpaenidae: *Dendrochirus zebra* (Quoy and Gaimard) (3), *Scorpaenopsis diabolus* (Cuvier) (3). Scorpididae: *Microcanthus strigatus* (Cuvier) (2). Serranidae: *Cephalopholis sexmaculatus* (Rüppell) (1), *Cromileptes altivelis* (Valenciennes) (1), *Epinephelus merra* Bloch (7), *E. summana* (Forsskål) (9), *Franzia squamipinnis* (Peters) (1), *Mirolabrichthys pascalus* (Jordan and Tanaka) (2), *Plectropomus leapardus* (Lacepède) (1). Siganidae: *Siganus argenteus* (Quoy and Gaimard) (1), *S. spinus* (Linnaeus) (1), *Variola louti* (Forsskål) (1). Sphyraenidae: *Sphyraena barracuda* Walbaum (1). Syngnathidae: *Corythoichthys haematopterus* (Bleeker) (2), *C. schultzi* Herald (1), *Dunckerocampus dactyliophorus* (Bleeker) (1). Synodontidae: *Saurida gracilis* (Quoy and Gaimard) (1), *Synodus variegatus* (Lacepède) (1). Tetraodontidae: *Arothron meleagris* (Schneider) (1), *Canthigaster valentini* (Bleeker) (1). Tripterygiidae: *Enneapterygius etheostomus* (Jordan and Seale) (1), *Helicogramma* sp. (5).