

アユ,コイ,ウナギに寄生していた7種の Gyrodactylus(Monogenea:Gyrodactylidae)

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Seven Species of *Gyrodactylus* (Monogenea: Gyrodactylidae) from *Plecoglossus altivelis* (Plecoglossidae), *Cyprinus carpio* (Cyprinidae) and *Anguilla* spp. (Anguillidae)

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Descriptions and identifications are made of seven species of *Gyrodactylus* collected from four species of cultured freshwater fish. Three species of *Gyrodactylus* were obtained from the ayu (*Plecoglossus altivelis*); *G. japonicus* KIKUCHI, 1929, *G. tominagai* n.sp. and *G. plecoglossi* n.sp. *G. tominagai* n.sp. is closely related to *G. japonicus*, but may be distinguished mainly by the shape and size of the marginal hook. *G. plecoglossi* n.sp. resembles *G. japonicus* and *G. tominagai*, but differs in the smaller anchor and different shape and size of the marginal hook. *G. kherulensis* ERGENS, 1974 and *G. sprostonae* LING, 1962 were collected from the carp (*Cyprinus carpio*); they are the first recorded cases in Japan. *G. nipponensis* n.sp. is described from the Japanese eel (*Anguilla japonica*). This differs in the larger anchor and the smaller sickle of the marginal hook from the most closely related species, *G. anguillae* ERGENS, 1960, which is redescribed for comparative study based on the specimens from the European eel (*Anguilla anguilla*) in England.

The present paper deals with the descriptions and identifications of seven species of *Gyrodactylus* parasitic on four species of cultured freshwater fish; the ayu (*Plecoglossus altivelis*), the carp (*Cyprinus carpio*), the Japanese eel (*Anguilla japonica*) and the European eel (*Anguilla anguilla*).

Three species of the parasites are proposed as new; *G. tominagai* n.sp. and *G. plecoglossi* n.sp. from the ayu and *G. nipponensis* n.sp. from the Japanese eel. *G. kherulensis* ERGENS, 1974¹⁾ and *G. sprostonae* LING, 1962²⁾ from the carp are the

first geographical records from Japan. *G. anguillae* ERGENS, 1960¹⁾, the most related species to *G. nipponensis* n.sp., was also examined for comparative study, which had been parasitic on the European eel in England.

Materials and Methods

The ayu, *Plecoglossus altivelis* (Plecoglossidae) (8.5–23.3 cm in total length), from the fins of which three species of *Gyrodactylus* were ob-

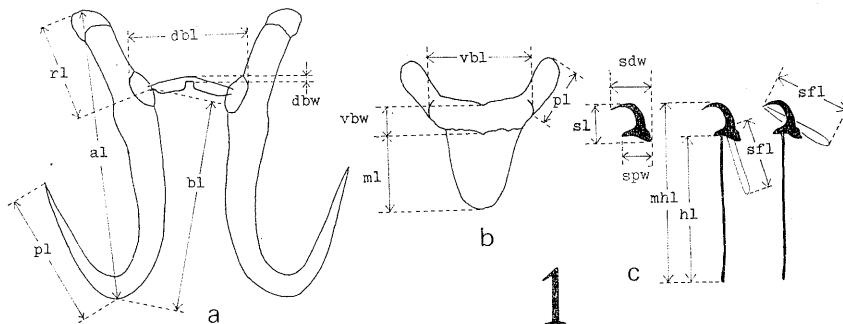


Fig. 1. Methods of measuring chitinous parts in the opisthaptor. a: anchor and dorsal bar. (al: anchor length; bl: base length; dbl: dorsal bar length; dbw: dorsal bar width; pl: point length; rl: root length) b: ventral bar. (ml: membrane length; pl: process length; vbl: ventral bar length; vbw: ventral bar width) c: marginal hooks. (hl: handle length; mhl: marginal hook length; sfl: sickle filament length; sl: sickle length; spw: sickle proximal width)

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tained, had been captured at Lake Biwa, transferred to Nagano and Tokushima Prefs. and cultured there for several months. The carp, *Cyprinus carpio* (10.8–20.4 cm in total length) was obtained from farms in Niigata and Nagano Prefs. *G. kherulensis* was collected from the fins and gill filaments of the fish from both Prefs. and *G. sprostonae* was found from the gill filaments of the

fish from the latter Pref. *G. nipponensis* n.sp. parasitized the gill filament of the Japanese eel, *Anguilla japonica* (29.6–45.0 cm in total length) cultured at farms in Shizuoka and Tokushima Prefs. for several to twelve months. *G. anguillae* was obtained from the gill filament of elvers of the European eel, *Anguilla anguilla* cultured in heated water in England. The fish was fixed in 10%

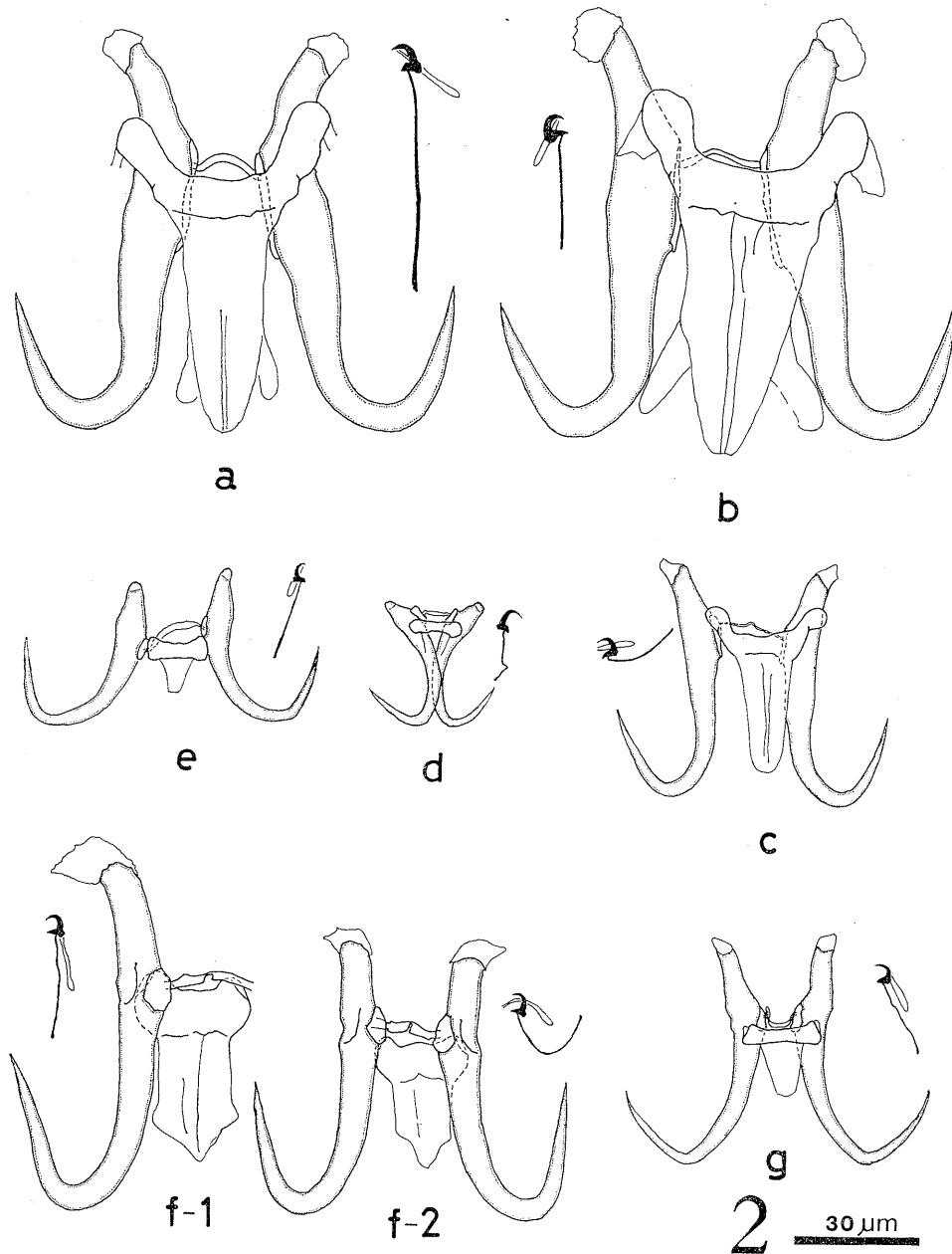


Fig. 2. Anchor complexes and marginal hooks of seven species of *Gyrodactylus*. a: *G. japonicus* KIKUCHI, 1929. b: *G. tominagai* n.sp. c: *G. plecoglossi* n.sp. d: *G. anguillae* ERGENS, 1960. e: *G. nipponensis* n.sp. f-1, f-2: *G. kherulensis* ERGENS, 1974. g: *G. sprostonae* LING, 1962.

formalin and sent to the authors' laboratory.

All the gyrodactylids were fixed in ammonium picrate-glycerin under the coverslips, dehydrated in alcohol and mounted in Canada balsam, except the gyrodactylid from *Anguilla anguilla* which was fixed in formalin and mounted in glycerol geratin.

The shapes and/or the measurements of the anchors, ventral bar, dorsal bar, marginal hooks and cirrus which are the most important taxonomic characters of *Gyrodactylus*, were examined for identification of the species. The terminology and method of measuring these body parts (Fig. 1) are basically followed by the mode of MALMBERG⁴¹, except the mode of numbering the marginal hooks; in this paper, they are numbered from 1 to 8 in a posterior-anterior order according to LLEWELLYN⁵¹.

All the figures were drawn with the aid of a camera lucida.

Descriptions and Remarks of the Species

Measurements of various body parts of the parasites examined in this paper listed on Table 1.

(1) *Gyrodactylus japonicus* KIKUCHI, 1929⁶¹

(Figs. 2 a, 3 a)

Host: The ayu, *Plecoglossus altivelis*.

Habitat: Fin.

Localities and dates: Nagano Pref., Japan, Jul. 1977; Tokushima Pref., Japan, Nov. 1977.

Specimens: Deposited in the Meguro Parasitological Museum, M.P.M. Coll. No. 19246 and in the authors' collection.

Description: The body is large. The anchor is markedly long and stout with the root bending outward. The ventral anchor bears very long, ear-shaped processes at both ends. The membrane of the bar is slender and provided with thin processes at its posterolateral parts. The attachment parts of the dorsal bar are of very characteristic shape; they are very thin and long. The marginal hook is provided with a long and thick handle and stout sickle. The sickle distal part is wider than the proximal part. The latter protrudes dorsally. The cirrus is armed with a single row of spines.

Remarks: The present description is almost identical in shape and measurements with the one originally described by KIKUCHI⁶¹. *G. japonicus* as well as the other two species from the ayu are supposed to be originated in the Lake Biwa, for the host fish was brought from there to Nagano

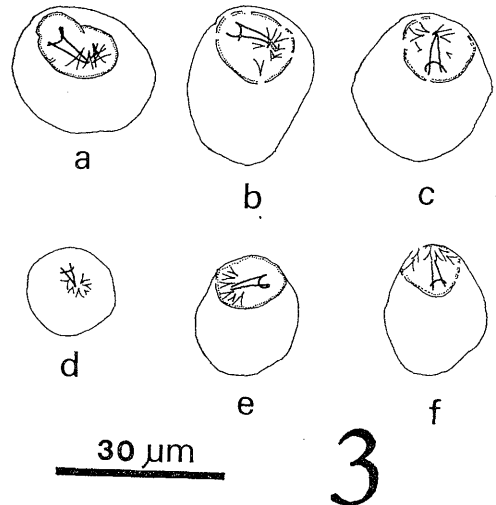


Fig. 3. Cirri of the *Gyrodactylus* species. a: *G. japonicus*. b: *G. tominagai* n.sp. c: *G. plecoglossi* n. sp. d: *G. nipponensis* n.sp. e: *G. kherulensis*. f: *G. sprostonae*.

and Tokushima Prefs.

(2) *Gyrodactylus tominagai* n.sp. (Figs. 2 b, 3 b)

Host: The ayu, *Plecoglossus altivelis*.

Habitat: Fin.

Localities and dates: Nagano Pref., Japan, Jul. 1977; Tokushima Pref., Japan, Nov. 1977.

Specimens: The holotype is deposited in the Meguro Parasitological Museum, M.P.M. Coll. No. 19247, and the paratypes in the authors' collection.

Description: This species is as large as *G. japonicus* in the size of the body and the opisthaptor. The anchor is very similar in shape to that of *G. japonicus*, but slightly longer in its various parts. The processes of the ventral bar are very prominent. The membrane of the ventral bar is wider than that of *G. japonicus*, and provided with processes at its posterolateral parts. The attachments of the dorsal bar are thin and long (29–32 μm long). The marginal hook handle is short. The sickle is slightly smaller than that of *G. japonicus*, and its proximal part lacks dorsal protrusion. The sickle distal part is much the same as its proximal part in width. The cirrus is armed with a single row of spines.

Remarks: This species was collected from the same habitat of the host fish as the most closely related species, *G. japonicus*, but may be easily distinguished from the latter in the shape and the measurements of the marginal hook. The specific name is dedicated to Mr. M. TOMINAGA, Saku

Table 1. Measurements of seven species of *Gyrodactylus*

Host	<i>Plecoglossus altivelis</i>			<i>Anguilla anguilla</i>		<i>Anguilla japonica</i>		<i>Cyprinus carpio</i>	
	<i>G. japonicus</i> KIKUCHI, 1929 Japan	<i>G. tominagai</i> n.sp. Japan	<i>G. plecoglossi</i> n.sp. Japan	<i>G. anguillae</i> ERGENSE, 1960 England	<i>G. nipponensis</i> n.sp. Japan	<i>G. kherulensis</i> ERGENSE, 1974 Japan	<i>G. sprostoniae</i> LING, 1962 Japan		
Nos. of specimens measured	18	5	24	17	42	15	17		
Body;									
length	473-855	607-795	331-544	205-317	373-704	489-780	296-543		
width	125-257	147-247	94-142		71-222	108-346	81-267		
Opisthaptor;									
l.	121-202	132-172	71-117		49-98	96-135	64-105		
w.	175-264	130-242	83-172		73-135	115-176	73-130		
Anchor:									
l.	83-96 (89)	94-103 (100)	56-61 (58)	30-34 (31)	39-44 (42)	64-91 (77)	51-57 (53)		
point l.	31-36 (34)	32-37 (35)	23-26 (24)	13-15 (14)	18-20 (19)	31-40 (36)	21-24 (22)		
base l.	59-68 (63)	67-73 (71)	42-46 (44)	26-29 (27)	30-36 (33)	46-59 (53)	37-41 (40)		
root l.	32-39 (36)	34-42 (38)	16-22 (19)	7-9 (8)	12-16 (14)	22-40 (31)	17-22 (20)		
base l./root l.	1.6-1.9	1.7-2.0	2.0-2.9	3.4-4.0	2.1-2.6	1.4-2.2	1.7-2.4		
Ventral bar;									
l.	29-36 (33)	39-41 (40)	19-22 (21)	12-14 (13)	14-18 (16)	20-29 (24)	17-20 (18)		
w.	7-11	8-11	4-5	2.5-3	3-4	6.5-9	2.5-4		
membrane l.	41-51	53-59	25-32	5-7	7-13	18-33	14-17		
process l.	13-17	14-17	5-8			0.5-1.5	1-1.5		
Dorsal bar;									
l.	19-25	21-27	16-21	12-14	18-21	18-31	18-21		
w.	1-1.5	1	0.5	1	1-2	0.5	1-2		
Marginal hook;									
l.	55-63	34-36	24-25	22-24	22-27	27-30	23-25		
(pair 1 (2 or 3)	55-61	33-35	22-24	22-25	21-25	28-31	23-26		
(pair 8 (7 or 6)									
sickle l.									
(pair 1 (2 or 3)	7.5-8	6-7	4.5-5	5-6	4-4.5	5.5-6	5		
(pair 8 (7 or 6)	7-8	6-7	4.5-5	5.5-6	4-4.5	5-6	4.5-5		
sickle distal w.									
(pair 1 (2 or 3)	6-8	5-6	4-4.5	5-6	3-4	4.5-5.5	3.5-4		
(pair 8 (7 or 6)	6-8	6	4-4.5	5-6	3-4	4-5.5	3-4		
sickle proximal w.									
(pair 1 (2 or 3)	5.5-5	5-6	3.5-4	3-3.5	3-4	4-5	3-3.5		
(pair 8 (7 or 6)	5-5.5	5.5	3.5-4	3-4	3-3.5	3.5-4.5	3-3.5		
handle l.									
(pair 1 (2 or 3)	48-56	28-29	19-20	18-19	18-23	22-25	18-20		
(pair 8 (7 or 6)	48-53	27-28	17-19	17-19	17-21	23-26	18-21		
sickle filament l.									
(pair 1 (2 or 3)	16-20	12-15	10-11	11-12	6-9	12-16	9-11		
(pair 8 (7 or 6)	15-19	13-14	9-11	10-11	6-9	12-16	9-12		
Cirrus pouch;									
diameter	17-27	21-25	11-25	11-12	10-17	14-24	9-17		

Measurements are presented in μ m, and parentheses represent means.

Branch, Nagano Prefectural Fisheries Experimental Station.

(3) *Gyrodactylus plecoglossi* n.sp. (Figs. 2 c, 3 c)

Host: The Ayu, *Plecoglossus altivelis*.

Habitat: Fin.

Localities and dates: Nagano Pref., Japan, Jul. 1977; Tokushima Pref., Japan, Nov. 1977.

Specimens: The holotype and some paratypes are deposited in the Meguro Parasitological Museum, M.P.M. Coll. No. 19248, and the other paratypes in the authors' collection.

Description: The body and the opisthaptor are smallest among the three species of *Gyrodactylus* from the ayu. The anchor is of similar shape to those of *G. japonicus* and *G. tominagai*, but differs in the larger value of the ratio of the base to the root due to a relatively long base and a relatively short root. The ventral bar with ear-shaped processes at both ends lacks lateral processes at the posterior sides of the membrane. The dorsal bar is very thin, and its attachment parts are narrow and long (8.5–12 μm long). The sickle distal part of the marginal hook is as wide as its proximal part, which is pointed ventrally and lacks dorsal protrusion. The cirrus is surrounded by a single row of spines.

Remark: This species may be closely related to *G. japonicus* and *G. tominagai*, because of similar shape of the anchor and the ventral bar, but can be easily distinguished from the two species by the smaller size of the anchor complex and the different shape and size of the marginal hook.

(4) *Gyrodactylus anguillae* ERGENS, 1960³¹ (Fig. 2 d)

Host: The European eel, *Anguilla anguilla*.

Habitat: Gill filament.

Locality and date: Drax, England, Aug. 1976.

Specimens: Deposited in the Meguro Parasitological Museum, M.P.M. Coll. No. 19249 and in the authors' collection.

Description: The anchor is very short with a relatively short root. No processes are recognized at both ends of the ventral bar. The sickle distal part of the marginal hook is markedly wider than its proximal part. The cirrus is surrounded by a single row of minute spines.

Remark: The present measurements almost agree with the ones by ERGENS³¹ and by MALMBERG⁴¹, except in that the anchor length is rather shorter and the ratio of the base length to the root length is larger than that of MALMBERG.

(5) *Gyrodactylus nipponensis* n.sp. (Figs. 2 e, 3 d)

Host: The Japanese eel, *Anguilla japonica*.

Habitat: Gill filament.

Localities and dates: Shizuoka Pref., Japan, Oct. 1976 and Jun. 1977; Tokushima Pref., Japan, Nov. 1977.

Specimens: The holotype and some paratypes are deposited in the Meguro Parasitological Museum, M.P.M. Coll. No. 19250, and the other paratypes in the authors' collection.

Description: The body is of moderate size. The anchor is slender with a relatively long root. The ventral bar lacks processes at both ends. The dorsal bar is slightly widened in the middle. The sickle of the marginal hook is very small and always less than 5 μm long. The sickle distal part is as wide as the proximal part. The cirrus is armed with a single row of minute spines.

Remark: This species is closely related to *G. anguillae*, but may be distinguished from the latter species mainly by the longer anchor and smaller sickle of the marginal hook.

(6) *Gyrodactylus kherulensis* ERGENS, 1974¹¹ (Figs. 2 f, 3 e)

Host: The carp, *Cyprinus carpio*.

Habitat: Fin and gill filament.

Localities and dates: Niigata Pref., Japan, Nov. 1976; Nagano Pref., Japan, Jul. 1977.

Specimens: Deposited in the Meguro Parasitological Museum, M.P.M. Coll. No. 19251, and in the authors' collection.

Description: The body is of moderate size. The anchor length ranges widely from 64 to 91 μm . The ventral bar is short and wide with a pair of small processes at both ends. The ventral bar membrane is wide and pointed distally. The dorsal bar is deeply grooved in the middle. The proximal part of the marginal hook sickle markedly protrudes at the dorsal side. The cirrus is surrounded by a single row of spines.

Remark: The present description of *G. kherulensis* is identical at most points with the original description of ERGENS¹¹, but slightly differs in the following points. 1) The anchor length of the present specimens has a wider range. 2) The proximal part of the marginal hook sickle of the ERGENS' specimens may less distinctly protrude at the dorsal side. 3) The marginal hook sickle of the present specimens is slightly shorter. These differences, however, may be rather insignificant and the present description agrees with the original one at the other points.

(7) *Gyrodactylus sprostonae* LING, 1962²⁾ (Figs. 2 g, 3 f)

Host: The carp, *Cyprinus carpio*.

Habitat: Gill filament.

Locality and date: Nagano Pref., Japan, Jul. 1977.

Specimens: Deposited in the Meguro Parasitological Museum, M.P.M. Coll. No. 19252, and in the authors' collection.

Description: The body is of moderate size. The anchor is slender. The ventral bar is almost straight and slightly widened distally. The processes of the bar are very short. The dorsal bar is simple and widened in the middle. The dorsal protrusion of the marginal hook sickle is indistinct. The cirrus is surrounded by a single row of spines.

Remark: The present description of *G. sprostonae* coincides with those previously reported^{6,7,8,9)}, except in the shorter anchor length both by LING²⁾ and by MATTHEIS and GLÄSER⁷⁾ and the shorter anchor root and ventral bar of the specimens from the carp by STRELKOV⁸⁾.

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