

## *Chilodonella hexasticha* (Protozoa, Ciliata) from Korean freshwater fish

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During a study to document more fully the parasitic ciliates of Korean freshwater fishes, we found numerous small ciliates in the gills and skin of crucian carp, *Carassius carassius*. cursory examination indicated that the ciliate were very similar with *Chilodonella* sp. In this study, we described the morphometrics of this ciliate in detail and compared with other species of *Chilodonella* in the world. Numerous small ciliates were observed in the body surface, fins and gills of infected fish and excessive mucus production were seen in those fish. Sometimes ulcer was observed in the body of moribund fish. From the scrutinized observation of the parasite, it was identified as *Chilodonella hexasticha*. The parasite was dorsoventrally flattened body, without a notch in the posterior margin, and it measured 30–45  $\mu\text{m}$  long and 15–30  $\mu\text{m}$  wide. In number of kineties, the right band ciliature was 3–5 and the left band ciliature was 3–5. The right ventral ciliary band shaped arch and was longer than the left, straight band. It had a single oval macronucleus, 8–15  $\mu\text{m}$  in diameter, a single micronucleus, 2–4  $\mu\text{m}$  in diameter. The cytopharynx was reinforced by 10–16 conspicuous nematodesmata, which shaped like a tube and curved at its inner end. Two contractile vacuoles, one anteriorly at right and the second posteriorly at left were observed in wet mounts. This parasite reproduced by a simple division at  $22 \pm 1^\circ\text{C}$ .

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Key words : Parasitic ciliate, Korean freshwater fish, *Chilodonella hexasticha*

The species in the genus *Chilodonella* are mostly free living ciliates. Among them, two species, *Chilodonella cyprini* (Moroff, 1902) and *Chilodonella hexasticha* (Kiernik, 1909) are commonly found on the gills and skin of various freshwater fishes (Kazubski and Migala, 1974; Lom and Dykova, 1992; Bradbury, 1994). The former, regarded as the 'cold-water' form (5 to  $10^\circ\text{C}$  optimum), has been often associated with moderate to severe mortalities of

hatchery-reared juvenile salmonids and cyprinids (Davis, 1953). The latter has been found on diseased warmwater fishes (Hoffman *et al.*, 1979).

Little is known concerning the parasitic ciliates, especially *Chilodonella* spp. of the fish in Korea. During a study to document more fully the parasitic ciliates of Korean freshwater fish, we found numerous small ciliates in the gills and skin of crucian carp, *Carassius carassius*. cursory exami-

nation indicated that the ciliates were very similar with *Chilodonella* sp. In this study, we described the morphometrics of these ciliates in detail and compared with other species of *Chilodonella* in the world.

The crucian carp (mean length, 20 cm) was collected at Keoje, Kyongsangnam-Do, Korea on 3rd July, 1996. Water temperature was about 22°C. Numerous small ciliates were observed in the body surface, fins and gills of infected fish and excessive mucus production were seen in that fish. Sometimes ulcer was observed in the body of moribund fish.

Observations of the ciliate were made from wet mounts of affected fish. In addition, smears were made from the affected tissue and stained with May-Giemsa's solution or impregnated with AgNO<sub>3</sub> according to Klein's (1958) technique. Measurements given below are in micrometers unless otherwise indicated.

From the scrutinized observation of the parasite,

Table 1. Morphometrics of *Chilodonella* sp. from *Carassius carassius*

Parasite morphology	Parasite measurements (µm)		
	Range	Mean ± S.D.	Studied No.
Body dimensions			
Length	30-45	36.5 ± 4.2	35
Width	15-30	23.5 ± 3.8	35
Macronucleus			
Diameter	8-15	9.8 ± 1.7	25
Micronucleus			
Diameter	2-4	2.9 ± 0.5	25
No. of kineties			
Left side	3-5	4.1 ± 0.5	35
Right side	3-5	3.7 ± 0.5	35

it was identified as *Chilodonella hexasticha*. The parasite parentheses was dorsoventrally flattened body, without a notch in the posterior margin, and it measured 30-45 µm long and 15-30 µm wide. In number of kineties, the right band ciliature was 3-5 and the left band ciliature was

Table 2. Morphological comparison of *Chilodonella* sp. from the present material and the literature (Kazubski and Migala, 1974). Data are means with ranges in

Items	<i>Chilodonella</i> spp.		
	<i>C. cyprini</i>	<i>C. hexasticha</i>	Present
Hosts	<i>Cyprinus carpio</i>	<i>Cyprinus carpio</i>	<i>Carassius carassius</i>
Infection site	gills and skin	gills and skin	gills and skin
Locality	Poland	Poland	Korea
Notch (posterior margin)	Present	Absent	Absent
Body dimensions			
Length (µm)	60 (47-80)	58 (48-70)	37 (30-45)
Width (µm)	42 (35-46)	46 (35-61)	24 (15-30)
No. of kineties			
Left side	12.8 (11-15)	8.4 (6-10)	4.1 (3-5)
Right side	11.8 (10-13)	6.1 (5-8)	3.7 (3-5)

Fig. 1, 2. Ventral views of *Chilodonella* sp. from *Carassius carassius*,  $\times 1000$ .

Fig. 1. Silver-impregnated specimen showing 4 kineties in right band of ciliature and 3 in left band. PK, preoral kineties ; RK, right band of kineties ; LK, left band of kineties.

Fig. 2. May-Giemsa's stain. CT, cytopharyngeal tube ; MN, macronucleus ; MI, micronucleus.

Fig. 3. *Chilodonella* sp. from *Carassius carassius*, air dried, stain of May-Giemsa showing binary fission, ciliate divided in two,  $\times 1000$ .

3–5 (Table 1). The right ventral ciliary band shaped arch and was longer than the left, straight band (Fig. 1). It had a single oval macronucleus, 8–15  $\mu\text{m}$  in diameter and a single micronucleus, 2–4  $\mu\text{m}$  in diameter (Fig. 2; Table 1). The cytopharynx was reinforced by 7–10 conspicuous nematodesmata, forming a cyrtos which shaped like a tube and curved at its inner end (Fig. 2). Two contractile vacuoles, one anteriorly at right and the second posteriorly at left were observed in wet mounts. This parasite reproduced by a simple division at  $22 \pm 1^\circ\text{C}$  (Fig. 3).

According to Kazubski and Migala (1974), two species of *Chilodonella*, *C. cyprini* (Moroff, 1902) and *C. hexasticha* (Kiernik, 1909), are serious pathogens of freshwater fish (Table 2). They considered that *C. hexasticha* differs from *C. cyprini* in the absence of a notch at the posterior body margin, in less numerous kineties, and in smaller body size (Table 2). Hoffman *et al.* (1979) recorded that epizootics by *C. hexasticha* occurred when the water temperature was far above the reported optimum of 5 to  $10^\circ\text{C}$  for *C. cyprini*, and they described two variants of *C. hexasticha* (Table 3).

Table 3. Comparison of *Chilodonella* sp. from *Carassius carassius* (current study) with *Chilodonella hexasticha* from USA and Poland

Parasite and host species	Body dimensions ( $\mu\text{m}$ )			No. of ciliary rows		
	Studied No.	Length	Width	Studied No.	LK <sup>6</sup>	RK <sup>7</sup>
<i>C. hexasticha</i>						
<i>Ictalurus punctatus</i> , USA <sup>1</sup>						
Gills, preserved <sup>2</sup>	32	45.8 (38–60)	33.0 (23–43)	28, 27	6.6 (6–7)	6.4 (6–7)
<i>Carassius auratus</i> , USA <sup>1</sup>						
Gills, dried <sup>3</sup>	74, 75	42.1 (31–55)	30.3 (22–49)	57, 60	8.4 (6–10)	6.6 (5–8)
Various species, Poland <sup>4</sup>						
Gills, dried <sup>3</sup>	105	57.0 (48–70)	45.5 (34–62)	105, 105	8.2 (6–10)	6.5 (5–8)
<i>Chilodonella</i> sp.						
<i>Carassius carassius</i> , Korea <sup>5</sup>						
Gills, dried <sup>3</sup>	35	36.5 (30–45)	23.5 (15–30)	35, 35	4.1 (3–5)	3.7 (3–5)

<sup>1</sup> From Hoffman *et al.* (1979).

<sup>2</sup> Preserved in 10% formalin.

<sup>3</sup> Dried and silver impregnated after Klein (1958).

<sup>4</sup> From Kazubski and Migala (1974).

<sup>5</sup> From our collection.

<sup>6</sup> Left band of kineties.

<sup>7</sup> Right band of kineties.

Our result indicated that the present species (Fig. 1) was distinctly smaller than typical *C. cyprini* (Table 2). There is a distinct difference in the number of ciliary rows between *C. cyprini* (8–15) and present species (3–5) (Table 2). Although the present specimens showed smaller number of ciliary rows and smaller body size than *C. hexasticha* described by other authors (Table. 3), We considered these differences as variation of the population. More critical work is needed on the morphometrics and biology of Korean *Chilodonella* sp.

In conclusion, *Chilodonella* sp. from crucian carp was identified as *C. hexasticha* by following characteristics, the absence of a notch at the posterior body margin, less numerous kineties, smaller body size, and 'warmwater' form.

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## 한국산 담수 어류에 기생하는 *Chilodonella hexasticha*에 관하여

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한국산 담수어류에 기생하는 섬모충류를 조사하기 위해 본 연구를 시행하였으며, 본 논문에서는 수온 22°C에서 붕어(*Carassius carassius*)로 부터 *Chilodonella* 속 기생성 섬모충을 검출하여 동정 분류하였다. 감염어의 체표, 지느러미 및 아가미에 무수히 많은 섬모충이 관찰되었으며 감염 부위에 과도한 점액이 분비된 것을 볼 수 있었다. 그리고 빈사 상태의 병어에서는 궤양이 형성된 것을 볼 수 있었다. 감염된 붕어로 부터 검출된 *Chilodonella* 충은 그 모양이 타원형으로 후면의 가장자리에 notch(V자형 새김)가 없고 배복(背腹) 방향으로 편평하였다. 충체의 길이는 30-45  $\mu\text{m}$ 이며 폭은 15-30  $\mu\text{m}$ 인 것으로 측정되었으며 가장자리의 섬모열은 왼쪽과 오른쪽이 각각 3-5열 이었다. 그리고 아치 모양의 오른쪽 섬모열은 직선의 왼쪽 섬모열보다 길이가 더 긴 것으로 나타났다. 충체 내부에는 직경 8-15  $\mu\text{m}$ 의 둥근 대핵과 직경 2-4  $\mu\text{m}$ 의 소핵이 있었으며, 복면(腹面) 앞부분에 있는 세포구는 충체 표면에서 직접 밖으로 열리며 세포인두와 연결된 것으로 관찰되었다. 세포구를 둘러싸고 있는 세포 인두는 10-16 가닥의 간상체(桿狀體)양 흡으로 이루어져 있으며 안쪽 끝이 굽어져 있는 것으로 관찰되었다. 충체는 2개의 수축포를 가진 것으로 관찰되었으며 각각 오른쪽 앞끝과 왼쪽 뒤끝에 위치했다. 그리고 수온 22°C에서 이 기생충의 번식은 단순한 이분열을 나타내었다. 이상의 결과로 부터 이 기생충은 *Chilodonella hexasticha* (Kiernik, 1909)로 분류할 수 있었다.

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Key words : 한국산 담수어류, 기생성 섬모충, *Chilodonella hexasticha*