

## FORMOSAN RIBBONFISHES (PERCIFORMES: TRICHIURIDAE)<sup>1,2</sup>

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### ABSTRACT

Sin-Che Lee, Kun-Hsiung Chang, Wen-Lung Wu and Hung-Chia Yang (1977). *Formosan ribbonfishes (Perciformes: Trichiuridae)*. Bull. Inst. Zool., Academia Sinica, 16(2):77-84. This paper reports 3 species of ribbonfishes, namely *Tentoriceps cristatus*, *Trichiurus lepturus* and *T. japonicus* from Taiwan. *Tentoriceps cristatus* has been misidentified as *Trichiurus muticus* while *Trichiurus lepturus* and *T. japonicus* have been identified as same species under the name of *T. haumela* in literatures. However, *T. lepturus* and *T. japonicus* are two valid species on the basis of difference in tooth pattern, articular bone, body depth and electrophoretic patterns.

The ribbonfish (Perciformes: Trichiuridae) is a scaleless fish with very elongate and strongly lateral compressed body. The dorsal fin has 3-5 spinous rays. The anal fin is represented by numerous spinules. The pelvics are either a pair of scale or absent and the caudal fin is small or absent.

Economically, the ribbonfishes are important food fishes in Taiwan. They contribute a total of 21,009 metric tons for the fishery production in 1975<sup>(15)</sup>. They are caught mainly by trawlers in deep sea, or by gill-net, hand liner and long liner from inshore waters of sand or mud-sand bottoms.

In the water of Taiwan, family Trichiuridae is represented by 3 valid species, namely *Tentoriceps cristatus*, *Trichiurus lepturus* and *T. japonicus*. *Trichiurus japonicus* is highly variable in its meristic character and it was previously placed as the synonym of *T. lepturus*. How-

ever, they are readily distinguishable on the basis of different electrophoretic activities of muscle myogens, articular bone and divergences of the morphometric parameters.

### MATERIALS AND METHODS

Specimens of *Trichiurus lepturus* and *T. japonicus* were caught by the long-liners from Tungkang and Chengkung respectively. *Tentoriceps cristatus* were collected by trawlers from the waters off Penghu and East China Sea. These specimens are preserved in the museum of the Institute of Zoology, Academia Sinica.

Total length is measured from the tip of the lower jaw to the end of tail whereas the standard length, to the end of dorsal fin. Preanal length is the distance between the tip of the lower jaw and the anus. Body depth is taken as a vertical height at vent. Head length is the distance between the tip of lower jaw and the

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end of opercle. Snout length is measured from the tip of upper jaw to the front edge of orbit. Eye diameter is taken horizontally and the interorbital width is the widest part between eyes. Counts of precaudal vertebrae were made from radiographs. Articular bones and dentary bones were studied after removed.

Test of differences of slopes between pairs of regression lines were performed by covariance analysis. Single (\*) and double (\*\*) stars marked in the figures indicate the significant level of 0.05 and 0.01, respectively.

**SYSTEMATIC ACCOUNTS**

Key to the species of Trichiuridae from Taiwan

- 1a. Upper profile of head strongly elevated forming a sharp sagittal crest; interorbital space narrower than eye diameter; lateral line at median or submedian position; precaudal vertebrae 45-48; first 5 dorsal rays spinuous; pelvics a pair of scale-like structure; first anal spine with a V-shaped scale-like cover ..... *Tentoriceps cristatus*
- 1b. Upper profile of head more or less flat, without crest; interorbital space about the same width as eye diameter; lateral line at the ventral position; precaudal vertebrae 37-40; first 3 dorsal rays spinuous; pelvics

absent; first anal spine very short without scale-like cover.....2

- 2a. More barbed teeth than pointed teeth on lower jaw; ventral process of articular bone longer, 2/5-1/2 of total length of articular bone; anterior end of dorsal process not exceed that of ventral process; body depth 11.66-14.98(mean 13.45) in total length, or 4.7-5.6(mean 5.2) in preanal length; eyes, pectorals and dorsal yellowish when alive ..... *Trichiurus lepturus*
- 2b. More pointed teeth than barbed teeth on lower jaw; ventral process of articular bone shorter, less than 2/5 of total length of articular bone; anterior end of dorsal process extends far beyond that of ventral process; body depth 14.27-17.39(mean 16.06) in total length, or 5.52-6.48(mean 5.9) in preanal length; eyes, pectorals and dorsal not yellowish ..... *T. japonicus*

Genus *Tentoriceps* Whitley, 1948

*Tentoriceps cristatus* (Klunzinger)

(Fig. 1)

*Trichiurus cristatus* Klunzinger, 1884: 120, pl. 13, Fig. 5a.

*Tentoriceps cristatus* Whitley, 1947: 94; Tucker, 1956: 110-112, Fig. 17; Yang, 1974: 5-19,

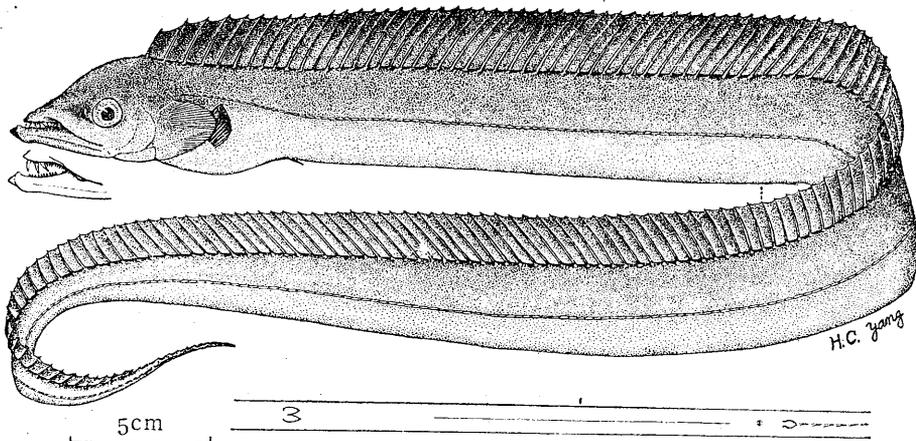


Fig. 1. *Tentoriceps cristatus* from East China Sea, 742 mm total length and 262 mm preanal length.

Figs. 1-9; Senta, 1975: 175-178.

*Trichiurus muticus* Matsubara, 1955: 537; Yang, 1965: 10-11; Chen, 1969: 308.

*Description:* Upper profile of head strongly ridged, forming a sharp cranial crest. Anterior end of dorsal process of articular bone well exceeded anterior end of ventral process. Teeth, 12-23 and 12-27 respectively on each side of upper and lower jaws; teeth small and pointed

except 3 larger frontal teeth of upper jaw. Anal rudimentary, first spine distinct and covered by a piece of V-shaped process, following spinules embedded in skin. Lateral line nearly at median position. Body dark grey above and silvery below. Dorsal fin yellowish with black dots. Whiptail dusky. Anus surrounded by a black ring.

*Morphometrics:* See Table 1.

TABLE 1

Comparisons of body ratio and meristic characters of *Tentoriceps cristatus*, *Trichiurus lepturus* and *T. japonicus*.

Species	<i>T. cristatus</i> N*=25		<i>T. lepturus</i> N=64		<i>T. japonicus</i> N=67	
	Range	Mean±S. E.	Range	Mean±S. E.	Range	Mean±S. E.
Total length/Preal length	1.34- 1.60	1.44±0.07	2.29-2.82	2.61±0.14	2.41- 2.97	2.72±0.13
Total length/Body depth	18.68-21.64	19.57±0.63	11.66-14.98	13.45±0.74	14.27-17.39	16.06±0.76
Total length/Head length	9.61-11.10	10.43±0.32	5.62-7.47	6.71±0.47	6.59- 7.85	7.38±0.46
Head length/Eye diameter	5.58- 7.71	6.32±0.36	6.41-7.71	7.05±0.37	6.14- 9.05	6.90±0.74
Head length/Interorbital width	6.93- 9.20	7.76±0.60	6.89-8.63	7.70±0.37	7.50- 8.62	8.14±0.28
Total number of dorsal rays	125-147		133-146		137-141	
Number of precaudal dorsal rays	46-48		37-40		38-40	
Number of pectoral rays	11-12		10-12		11	
Pelvic rays	present		Absent		Absent	
Number of precaudal vertebrae	46-48		37-40		38-40	

N\*: Sample size

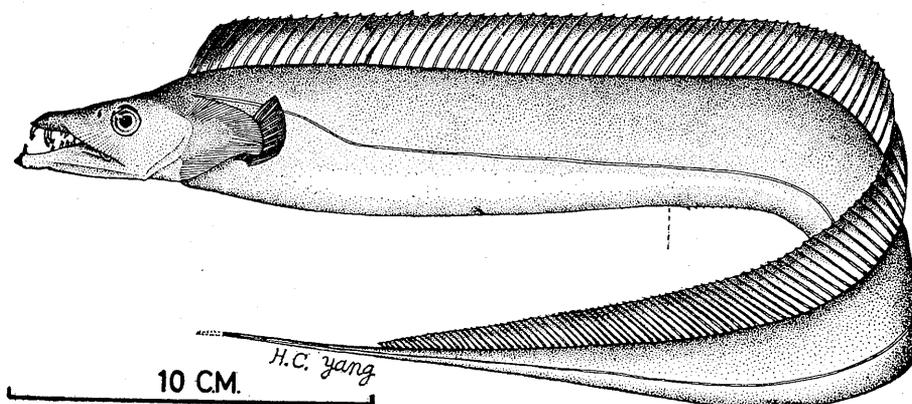


Fig. 2. *Trichiurus lepturus* from Tung kang, 765 mm total length and 293 mm preanal length.

*Type locality:* Kosseir, Red Sea Coast of Egypt.

*Distribution:* Red Sea, Andaman Sea, South China Sea, Hongkong, Taiwan, Chinese Mainland Coast and Southern Japan.

*Remarks:* *Tentoriceps cristatus* is easily recognized by its rather elevated head profile and five anterior spinuous dorsal rays.

*Trichiurus lepturus* Linné

(Fig. 2)

*Trichiurus lepturus* Linné, 1758: 246; Jordan & Evermann, 1920: 290; Smith, 1965: 313; Matsubara, 1955: 307 (in part); Tucker,

1956: 114-118 (in part); James, 1967: 17-23 (in part).

*Trichiurus haumela* Day, 1878: 201; de Beaufort & Chapman, 1951: 194-196; Scott, 1959: 114; Yin, 1960: 76-79; Chen, 1969: 308.

*Trichiurus lepturus lepturus* Yang, 1973: 11.

*Description:* Upper profile of head flattened. Interorbital width about the same as eye diameter. Anterior end of dorsal process of articular bone not exceeding that of ventral process (Fig. 3; Table 2). Teeth 12-22 on each

TABLE 2

Comparisons of the location of the anterior ends of articular process between *Trichiurus lepturus* and *T. japonicus*.

	LL	LMMM	MR	RR	Number of specimens examined	
<i>T. lepturus</i>	0	0	25	12	27	64
<i>T. japonicus</i>	53	4	6	0	0	63

LL: Anterior ends of dorsal articular process of both sides well exceed those of ventral process.

LM: L on one side and M on other side.

MM: Anterior ends of dorsal and ventral articular processes of both sides located at the same vertical line.

MR: M on one side and R on other side.

RR: Anterior ends of dorsal articular process of both sides not exceed those of ventral process.

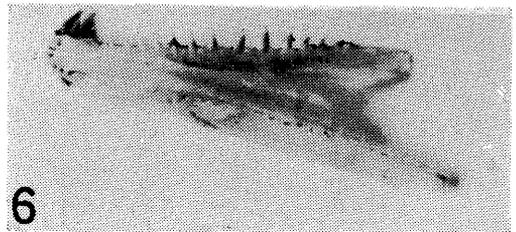
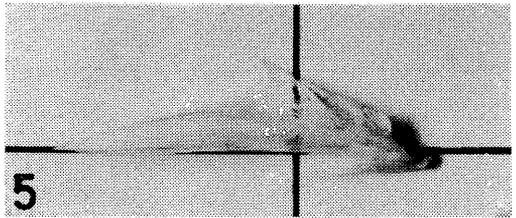
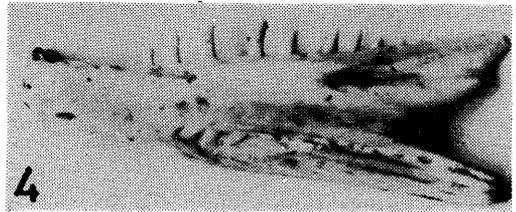
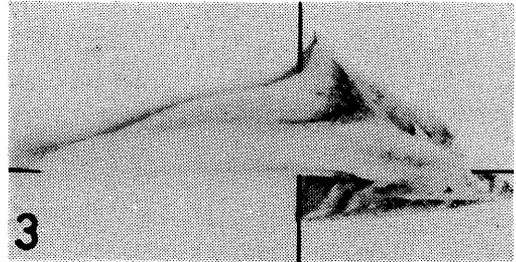
TABLE 3

Comparisons of the mandibular tooth patterns between *Trichiurus lepturus* and *T. japonicus*.

	All P*	P/B** > 2	P/B = 1-2	P/B < 1	Numbers of specimens examined
<i>T. lepturus</i>	0	0	14	50	64
<i>T. japonicus</i>	7	52	4	0	63

\* P: Pointed teeth

\*\* B: Barbed teeth



Figs. 3-6. 4 lateral view of articular and dentary bones. *T. lepturus*: 3, Articular bone; 4, Dentary bone. *T. japonicus*: 5, Articular bone; 6, Dentary bone.

side of upper and lower jaws excluding 1 or 2 pairs of larger frontal barbed teeth. Lower jaw teeth with higher frequencies of barbed teeth (Fig. 4; Table 3). First anal spine minute only external tip exposed, the following spinules rudimentary and embedded in skin. Lateral line descending steeply from shoulder and running parallel to the ventral profile of the body. Color when alive uniformly silvery, dorsal fin black at distal margin and yellowish at base, fin membrane between first three spinuous dorsal rays black. Pectorals yellowish. Eyes yellowish.

*Morphometrics*: See Tables 1-3.

*Type locality*: South Carolina.

*Distribution*: West Atlantic, South Africa, East Africa, Red Sea, Andaman Sea, India, Australia, Indonesia, Philippines, South China Sea, Taiwan, Chinese Mainland Coast and Japan.

*Remarks*: Electrophoretic pattern lacks major band 8<sup>(13)</sup> *T. lepturus* differs from *T. japonicus* in having longer preanal length (Fig. 7), higher body depth (Fig. 8), longer head (Fig. 9) and wider interorbital space (Fig. 10) but comparatively small eyes than those in *T. japonicus* (Fig. 11).

*Trichiurus japonicus* Temminck & Schlegel (Fig. 12)

*Trichiurus lepturus japonicus* Temminck & Schlegel, 1844:102, pl. 54.

*Trichiurus japonicus* Günther, 1860: 347; Lin, 1936: 2-4.

*Trichiurus auriga* Klunzinger, 1884: 120, pl. 12, Fig. 1; de Beaufort & Chapman, 1951: 196-197.

*Trichiurus lepturus* Yin, 1960: 79-80; Mastubara,

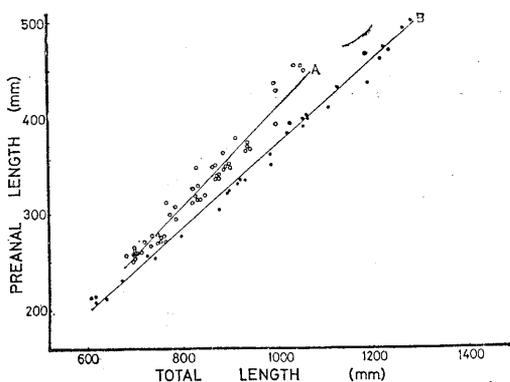


Fig. 7. Relationship between preanal length (mm) and total length (mm) for 58 *T. lepturus* (A) and 63 *T. japonicus* (B).  
A:  $Y = -107.8944 + 0.5197X$  ( $r = 0.9772$ )  
B:  $Y = -73.2849 + 0.4480X$  ( $r = 0.9915$ )  
Difference between slopes:  $F = 15.9673^{**}$

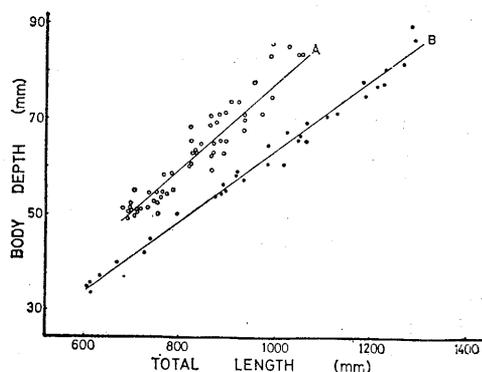


Fig. 8. Relationship between body depth (mm) and total length (mm) for 58 *T. lepturus* (A) and 63 *T. japonicus* (B).  
A:  $Y = -14.581 + 0.0931X$  ( $r = 0.9523$ )  
B:  $Y = -10.0558 + 0.0734X$  ( $r = 0.9898$ )  
Difference between slopes:  $F = 3.93^{**}$

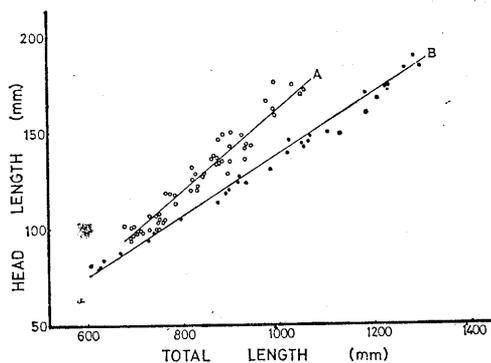


Fig. 9. Relationship between head length (mm) and total length (mm) for 58 *T. lepturus* (A) and 63 *T. japonicus* (B).  
A:  $Y = -50.9929 + 0.2136X$  ( $r = 0.9647$ )  
B:  $Y = -20.5261 + 0.1591X$  ( $r = 0.9874$ )  
Difference between slopes:  $F = 42.6604^{**}$

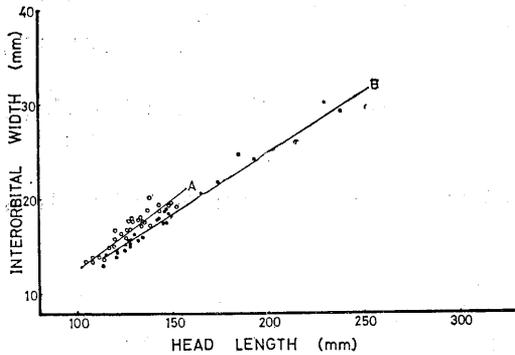


Fig. 10. Relationship between interorbital width (mm) and head length (mm) for 32 *T. lepturus* (A) and 32 *T. japonicus* (B).  
 A:  $Y = -2.6218 + 0.1511X$  ( $r = 0.9445$ )  
 B:  $Y = -0.6004 + 0.1272X$  ( $r = 0.9920$ )  
 Difference between slopes:  $F = 6.0580^*$

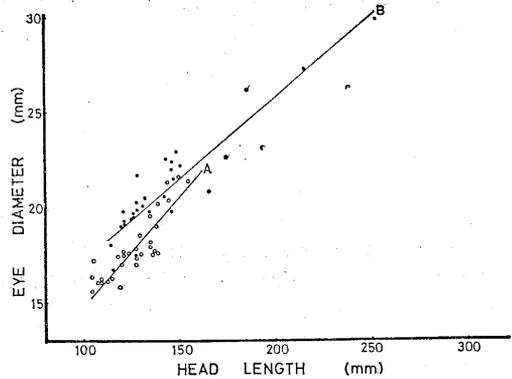


Fig. 11. Relationship between eye diameter (mm) and head length (mm) for 32 *T. lepturus* (A) and 32 *T. japonicus* (B).  
 A:  $Y = 3.1753 + 0.1168X$  ( $r = 0.8839$ )  
 B:  $Y = 8.8794 + 0.0847X$  ( $r = 0.9236$ )  
 Difference between slopes:  $F = 4.1602^*$

1955: 307 (in part); Tucker, 1956: 114-118 (in part); James, 1967: 17-23 (in part).

*Trichiurus lepturus auriga* Yang, 1973: 11.

**Description:** Upper profile of head more or less flattened; interorbital width slightly narrower than diameter of eye. Anterior end of dorsal articular process mostly exceed beyond that of ventral process (Fig. 5; Table 2). Teeth 16-22 and 13-18 on each side of upper and lower jaws respectively (excluding 1 or 2 pairs of frontal larger barbed teeth). Lower jaw teeth with few exceptions exclusively pointed

(Fig. 6; Table 3). Color when alive silvery but darker on back. Dorsal base whitish. Distal half of pectoral fin and the entire whiptail black. Eyes greyish.

**Morphometrics:** See Tables 1-3.

**Type locality:** Japan.

**Distribution:** Red Sea, Taiwan, Chinese Mainland coast and Japan.

**Remarks:** A typical *T. japonicus* usually has uniformly pointed teeth on lower jaw<sup>(8)</sup>. However, specimens with few barbed teeth were found. Thus, tooth pattern is not a reliable

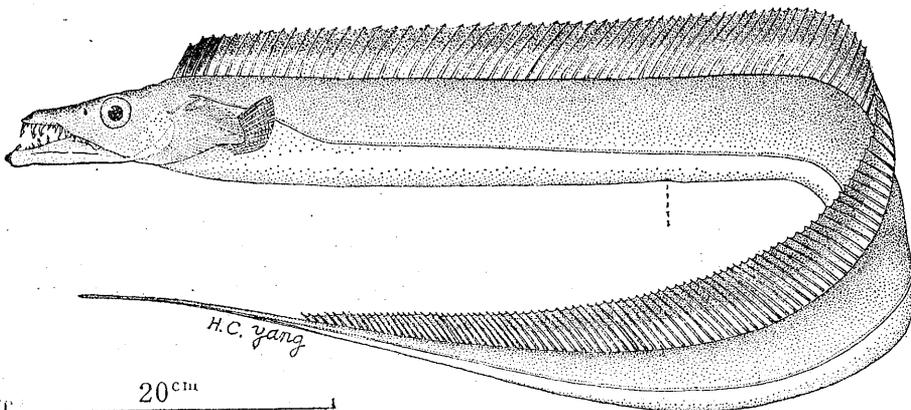


Fig. 12. *Trichiurus japonicus* from Chengkung, 1054 mm total length and 394 mm preanal length.

character for separating *T. japonicus* from *T. lepturus*.

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## 臺灣之帶魚類 (鱸形目：帶魚科)

李信徹 張崑雄 巫文隆 楊鴻嘉

本文記述隆頭帶魚 (*Tentoriceps cristatus*)、肥帶 (*Trichiurus lepturus*) 及瘦帶 (*T. japonicus*) 等三種棲息於臺灣海域之白帶魚。在有關臺灣魚類之報告中 *Tentoriceps cristatus* 曾被誤定為 *Trichiurus muticus*，而 *Trichiurus lepturus* 及 *T. japonicus* 則合併為 *T. haumela*，然此二者可藉下頷齒式，角骨形態，體高及電泳圖等之不同而區分之。