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STUDIES ON THE HOMALOPTERID FISHES OF TAIWAN, WITH DESCRIPTION OF A NEW SPECIES

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Chyng-Shyan Tzeng and Shih-Chieh Shen (1982) Studies on the homalopterid fishes of Taiwan, with description of a new species. *Bull. Inst. Zool., Academia Sinica* **21**(2): 161-169. Four homalopterid species belonging to three genera are recognized, of which a new species *Hemimyzon taitungensis* is included. Morphology and distribution of each species are described. Only *Hemimyzon taitungensis* is distributed in the eastern part and the other three species, *Hemimyzon formosanum*, *Crossostoma lacustre* and *Sinogastromyzon puliensis*, in the western part of Taiwan. *Hemimyzon formosanum* is the commonest homalopterid species in Taiwan.

The members of family Homalopteridae are small benthic, loach-like fishes living in the swift stream of southeast Asia, and has a fairly wide distribution extending from Peninsular India in the west to Taiwan in the northeast and from the islands of the Malay Archipelago in the south to Yangtze River basin in the northwest.

In this group of fishes the head and anterior part of the body are moderately or greatly depressed, and the ventral surface is flattened. The paired fins are horizontally inserted, broad and fanshaped, and some of their outer rays are provided with adhesive pads on their ventral surface enabling the fish to adhere to rocks in swift currents. Ventral fins are separate or completely united under belly; dorsal and anal fins short; caudal fin moderate with lower lobe developed and longer than upper lobe. Body covered with small, cycloid scales which are absent on the head and a part or entire flattened ventral surface.

In 1932, Hora[15] published the first systematic study of Homalopteridae, in which 48 species belonging to 17 genera were described. In 1952, Silas[30] reported 84 species belonging to 28 genera, and Chen (1980)[6] recently reported 98 species, of which 51 species belonging to 12 genera of Homalopterinae and 47 species to 14 genera of Gastremyzoninae.

In 1894, Boulenger[1] described the first new species, *Homaloptera formosana*, which was collected from central Taiwan, and subquently, Steindachner[31] reported a second new homalopterid species, *Crossostoma lacustre*, found in the same area. After a long lapse of time of more than sixty years, Liang (1974)[20] reported a third new species, *Sinogastromyzon puliensis* from central Taiwan.

Although Taiwan is a small island, the distribution of her freshwater fishes is sti l quite

unknown. Since 1979, we have been making extensive collections on the freshwater fishes in Taiwan to study their zoogeographical distributions. This is the first report of this study, in which a new homalopterid species, *Hemimyzon taitungensis*, is established and the morphology and distribution of the four homalopterid fishes collected during 1979–1981 are described.

MATERIALS AND METHODS

Materials used in the present study were mainly collected from different streams in Taiwan by using electric shocking apparatus. Some of them were purchased from local markets. All specimens were deposited in the Museum of the Department of Zoology, National Taiwan University (NTUM), except one kept in University of British Columbia, Canada (UBC).

Meristic counts and morphological measurements expressed in proportions to standard or head lengths are presented in Table 1. The collecting localities of these homalopterid fishes are shown in Fig. 1.

RESULTS

Key to the species of homalopterid fishes from Taiwan

1. Only one unbranched ray in paired fins; ventral fin rays less than 9; posterior tip of pectoral fin not reaching to the ventral origin.....*Crossostoma lacustre*

TABLE 1

Meristic counts and body proportions of the Taiwanese homalopterid fishes. Range of morphometric measurements is enclosed in parenthesis

Species	*Crossostoma lacustre*	*Sinogastromyzon puliensis*	*Hemimyzon formosanum*	*Hemimyzon taitungensis*
No. of specimens	21	17	44	12
Fin rays counted:				
Dorsal	3, 8	3, 8	3, 7	3, 8
Anal	2, 5	2, 5	3, 5	3, 5
Pectoral	1, 13-14	10-12, 12-14	10-12, 9-12	12-14, 12-14
Ventral	1, 7-8	6-7, 14-17	4-5, 9-11	6-7, 10-12
Lateral line scales	82-99(27-28/ 17-18-A)	50-65(10-13/ 10-11-A)	68-80(15-17/ 10-11-A)	79-87(10-11/ 9-10-A)
Total length (mm)	73-133	29-90	44-82	60-98
Standard length (S. L.)	60-114	23.5-74	35.4-66	49-78
In standard length:				
Depth	5.3(4.7-5.9)	5.4(4.8-6.3)	5.9(5.1-7.8)	6.2(5.6-6.7)
Width of body	5.4(4.5-6.3)	3.1(2.6-3.8)	3.9(3.4-5.1)	4.5(4.1-5.1)
Head length (H. L.)	4.4(4.1-5.1)	4.0(3.5-4.4)	4.4(4.0-4.7)	4.4(4.1-4.8)
Snout to dorsal origin	2.0(1.8-2.1)	2.0(1.9-2.3)	2.0(1.8-2.2)	2.1(2.0-2.2)
Snout to anal origin	1.3(1.2-1.3)	1.2(1.2-1.3)	1.3(1.2-1.5)	1.3(1.2-1.3)
Snout to pectoral origin	5.7(5.1-6.6)	7.4(6.0-9.0)	7.3(6.5-8.6)	8.0(7.2-8.5)
Snout to pectoral tip	2.3(2.1-2.6)	1.9(1.8-2.0)	2.1(2.0-2.3)	2.2(2.1-2.4)
Snout to ventral origin	1.9(1.8-2.0)	2.2(2.0-2.4)	2.2(2.1-2.4)	2.5(2.4-2.7)
Snout to ventral tip	1.4(1.3-1.4)	1.2(1.2-1.3)	1.4(1.3-1.5)	1.5(1.5-1.6)
In Head length:				
Snout length	1.8(1.6-1.9)	1.7(1.5-1.9)	1.8(1.6-1.9)	1.8(1.7-1.9)
Eye diameter	7.3(6.6-8.0)	6.3(5.4-7.1)	7.0(6.3-8.1)	7.2(6.1-8.4)
Interorbital	2.5(2.3-2.7)	2.1(1.8-2.6)	2.2(2.0-2.5)	2.4(2.3-2.6)

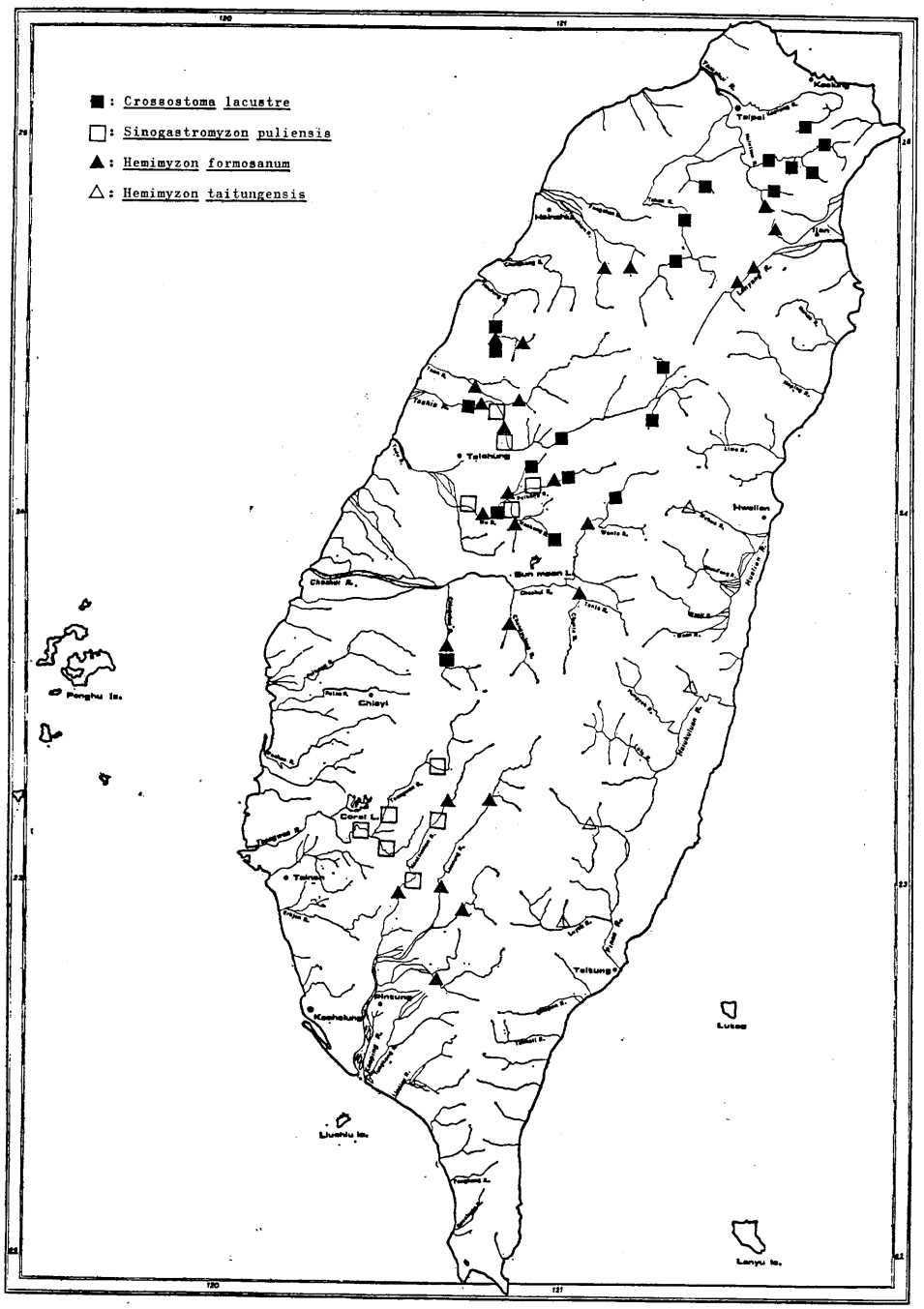

Fig. 1. The map showing the collecting localities of homalopterid fishes. Black square, *Crossostoma lacustre*; white square, *Sinogastromyzon puliensis*; black triangle, *Hemimyzon formosanum*; white triangle, *H. taitungensis*.

Four or more unbranched rays in paired fins; ventral fin rays more than 13; posterior tip of pectoral fin reaching or overlap the ventral origin.....2

2. Ventrals completely united posteriorly to form a suctorial disc..... .....*Sinogastromyzon puliensis*
Ventrals separate or partly united, not forming a disc-like structure.....3

3. Four (rarely 5) unbranched rays in ventral fins, their bases not close to each other.... .....*Hemimyzon formosanum*
Six or seven unbranched rays of ventrals; bases united to each other anteriorly..... ..... *Hemimyzon taitungensis*

Crossostoma lacustre (Steindachner)
臺灣纓口鰍
(Fig. 2)

Homaloptera formosana (non Boulenger 1894) Steindachner 1908a: 89.

Crossostoma lacustre Steindachner, 1908b: 110; Myers, 1929: 2; Tchang, 1932: 228; Chen, 1980a: 103.

Formosania gilberti Oshima, 1919: 194.

Formosania lacustre, Hora, 1932: 311; Fang, 1935: 82; Chen and Liang, 1949: 164; Silas, 1952: 229; Chen, 1969: 168; Liang, 1974: 148.

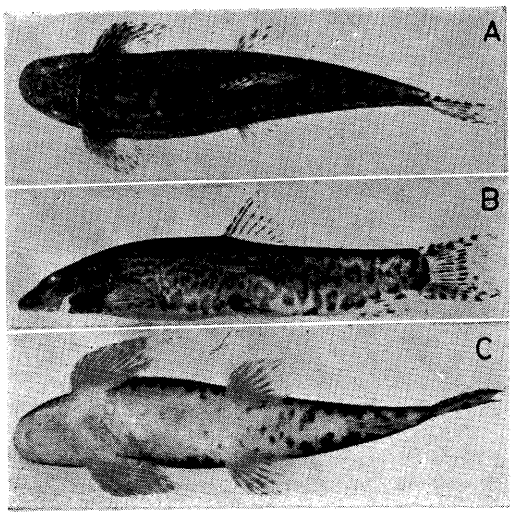

Fig. 2. *Crossostoma lacustre*, 130 mm SL, Ping-ling. A, dorsal view; B, lateral view; C, ventral view.

Materials: 21 specimens, from Pei-shih River (北勢溪, Ping-ling 坪林); Hou-long River (後龍溪, Miao-lee 苗栗); Ta-chia River (大甲溪, Tung-shih 東勢); Ta-du River (大肚溪, Pu-li 埔里); Ching-shui River (清水溪, Chu-shan 竹山).

Diagnosis: D. 3, 8; A. 2, 5; P. 1, 13-14; V. 1, 7-8; L. l. 82-99, L. tr. 27-28/17-18-A.

Mouth with a well-developed barbel at each corner, its length less than eye diameter. Anterior 6 pectoral rays with fleshy appendages. Ventrals small, fan-like, horizontal, separate, rays without fleshy appendage. Body covered with minute cycloid scales, head and ventral surface between the pectorals naked. Lateral line complete, anterior 5-7 pores not covered by scales. Color varies with age and sex, the mature specimens in spirit, generally dark brown above and dull yellow below, with variable dark color patterns as shown in Fig. 2.

Remarks: Specimens in our collection do not show any geographical variation in morphology but show individual variation in color pattern. According to Chen (1980)[6], the morphology of *Crossostoma lacustre* is very similar to *Crossostoma fascicauda* Nichols from Fukien, but is different from the latter only in having transverse ripple-like band on the body side. The band in *Crossostoma fascicauda* is continuous, while that in *C. lacustre* is composed of short, separate bands. Specimens in our collection include both types of patterns. Therefore, it is suggested that *C. lacustre* and *C. fascicauda* are the same species.

Sinogastromyzon puliensis Liang
埔里中華爬岩鰍
(Fig. 3)

Sinogastromyzon puliensis Liang, 1974: 153; Chen, 1978: 343.

Materials: 17 specimens, from Ta-chia River (大甲溪, Ku-kuang 谷關); Ta-du River (大肚溪, Pu-li 埔里); Tzeng-wen River (曾文溪, Yu-jing 玉井) and Nan-tzeu-shan River (楠梓仙溪, Chia-shan 甲仙).

Diagnosis: D. 3, 8; A. 2, 5; P. 10-12, 12-14; V. 6-7, 14-17; L. l. 50-65, l. tr. 10-13/10-11-A.

Eyes with free orbital margins, not visible from the ventral. Rostral barbels 4, the outer pair longer than the inner's; mandibular barbels 2. Unbranched rays of paired fins with developed pads on ventral surface. Ventral fins completely united posteriorly. First anal ray flattened, somewhat hardened and serrated terminally. Body covered with keeled cycloid scales; head and flattened ventral surface of the body naked. Color in fresh dark greyish, with several black patches on dorsal surface, ventral side yellowish; paired fins with irregular cross bars, dorsal and caudal fins with three distinct bars.

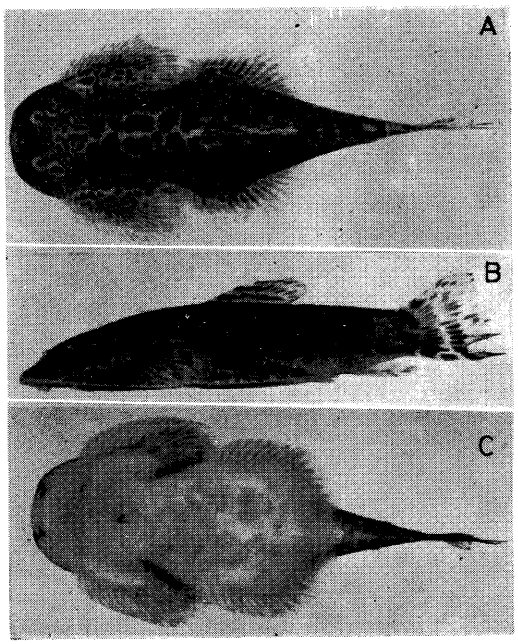

Fig. 3. *Sinogastromyzon puliensis*, 91 mm SL, Pu-li. A, dorsal view; B, lateral view; C, ventral view.

Remarks: Liang's original description of this species was based on a single specimen (the holotype) from Pu-li. Additional 10 specimens collected by the senior author from the same locality on July 26, 1980 are treated as the topotypes (NTUM 04953-04962).

***Hemimyzon formosanum* (Boulenger)**
臺灣間爬岩鰍
(Fig. 4)

Homaloptera formosana Boulenger, 1894: 43.
Hemimyzon formosanus; Regan, 1911: 32.
Hemimyzon formosanum; Hora, 1932: 299; Chen, and Liang, 1949: 162; Silas, 1952: 214; Chen, 1969: 168; Liang, 1974: 152; Chen. 1978: 340.

Materials: 44 specimens were collected from Lan-yung River (蘭陽溪, I-lan 宜蘭); Nan-shih River (南勢溪, Wu-lai 烏來); Tou-chien River (頭前溪, Chu-tung 竹東); Hou-long River (後龍溪, Miao-lee 苗栗); Ta-an River (大安溪, Cho-lan 卓蘭); Ta-chia River (大甲溪, Tung-shih 東勢); Ta-du River (大肚溪, Pu-li 埔里); Cho-shui River (濁水溪, Ho-shae 和社); Ching-shui River (清水溪, Chiu-shan 竹山); Nan-tzeu-shan River (楠梓仙溪, Chia-shan 甲仙) and Lao-nong River (荖濃溪, Pau-lai 寶來).

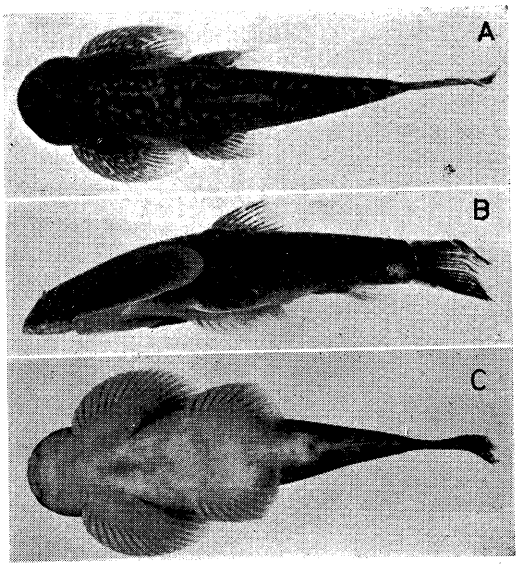

Fig. 4. *Hemimyzon formosanum*, 60 mm SL, Pau-lai. A, dorsal view; B, lateral view; C, ventral view.

Diagnosis: D. 3,7; A. 3,5; P. 10-12, 9-12; V. 4-5, 9-11; L. l. 68-80, l. tr. 15-17/10-11-A.

Rostral barbels 4, mandibular barbels 2, longer than those on rostrum. Inner margins of

ventrals complete separate. Unbranched rays of paired fins with well developed pads on the ventral surface. Body covered with small keeled cycloid scales, naked on the head, ventral surface and the area between paired fins. Color in fresh generally dark green above, with irregular whitish patches and pale yellowish below; dorsal fin with 3 blackish transverse bands, paired fins yellow green, with 2 or 3 diffuse blackish transverse bands, caudal fin with 4 longitudinal blackish bands.

Hemimyzon taitungensis n. sp.
臺東間爬岩鰍
(Figs. 5-6)

Holotype: NTUM 04941, 70 mm, ♀, Shin-wu-leu River (新武呂溪, Lee-daou 利稻). Paratypes: NTUM 04963, 77 mm, ♀; NTUM 04964, 59 mm, ♀; NTUM 04965, 62 mm, ♀; NTUM 04966, 49 mm, ♀; NTUM 04967, 62 mm, ♀; NTUM 04968, 55 mm, ♀; NTUM 04969, 54 mm, ♀; NTUM 04970, 54 mm, ♀; NTUM 04971, 53 mm, ♀; NTUM 04972, 65 mm, ♀; NTUM 04973, 62 mm, ♂; UBC. 81-65, 60 mm. All specimens are mature and collected by the senior author from the Shin-wu-leu River, Lee-daou, Hai-duan (海端), Taitung county, on April 1, 1981.

Materials: 16 specimens from Shin-wu-leu River (新武呂溪, Lee-daou 利稻), Hsiu-ku-luan River (秀姑巒溪, Fu-yuan 富源) and Mu-kua River (木瓜溪, Tong-man 銅門).

Description: D. 3, 8; A. 3, 5; P. 12-14, 12-14; V. 6-7, 10-12; L. l. 79-87, l. tr. 10-11/9-10-A.

Body slender. Snout broad and trenchant. Eyes superior. Mouth inferior, transverse, slightly arched and of moderate size. Anterior lip narrow and pappillated. Rostral fold with 4 barbels and two mandibular barbels; outward from snout and then turn to inferior when beginning in torrential environment. Gill opening extended on the ventral surface for a short distance in front of the pectorals.

Pectorals broader, overlapping with ventrals. Ventrals broad, beginning in advance of dorsal, only 1/4 basal part of ventrals united with 2 small inner branched rays rolling up as a small circle. Caudal fin moderate, lower lobe more developed than upper.

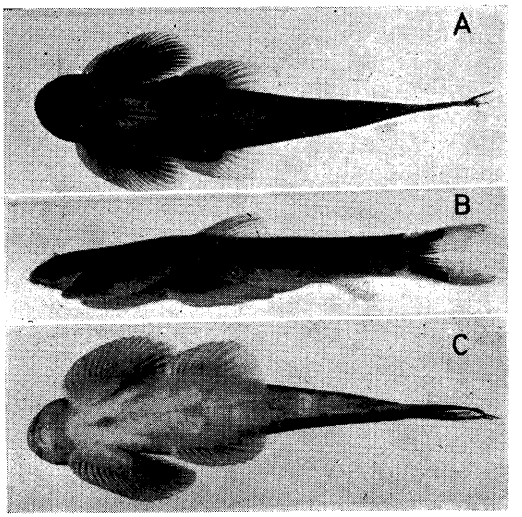

Fig. 5. *Hemimyzon taitungensis* n. sp., holotype, 70 mm SL, female, Lee-daou. A, dorsal view; B, lateral view; C, ventral view.

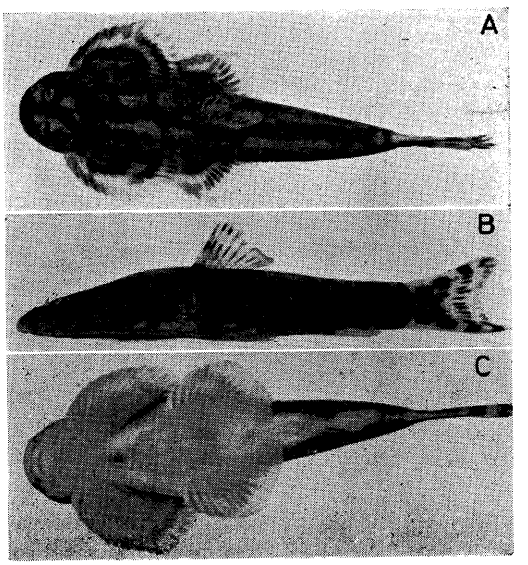

Fig. 6. *Hemimyzon taitungensis* n. sp., allotype, 62 mm SL, male, Lee-daou. A, dorsal view; B, lateral view; C, ventral view.

Body covered with small, keeled cycloid scales with thick mucous membrane coat; naked on head, dorsal surface of pectoral bases, the region between the folded ventrals and the ventral surface from snout to posterior ventrals. Lateral line complete, running along middle portion of trunk and peduncle, slightly curved upward above pectorals.

Colcr in fresh generally gray in dorsolateral; pale on fins margin. In male specimens, a distinct darkgray bar on dorsal surface and two on lateral surface; 3 curved bars on pair fins, 2 longitudinal bars on dorsal fin; 3 vertical black bars on caudal fin.

Etymology: The *taitungensis* is named after the locality, Tai-tung, where the holotype was found.

Local names: "Shih-tae-tsu" (石貼仔). "Chio-da-a" (石答仔), "Sa-su-bi-nan". The last denomination is the calling of the Taitung Bulong natives.

Remarks: This species is distinguishable from *Hemimyzon formosanum* in having a slender body (width of body in S. L. is 4.5 to 3.9) and in having more numerous of lateral line scales and paired fins rays (P. 12-14, 12-14 *vs.* 10-12, 9-12; V. 6-7, 10-12 *vs.* 4-5, 9-11). The ventral fins of the former species are closer, which are fused partly at bases.

DISCUSSION

In 1923, Oshima[26] studied the freshwater fishes of Taiwan. Owing to the inconvenience of transportation at that time, he was unable to collect sufficient field data for an in depth study of the distribution of these fishes. He divided their distributions into two geographical regions, one on the western side of the central mountain range of Taiwan, and the other on its eastern side. For the present study, we have made an intensive collection of freshwater fishes throughout the island and these data provide us with a clearer picture on the distribution of the freshwater fishes of Taiwan with homalopterids in particular.

It was found from our collections that the homalopterid fishes were the group with a largest number of endemic species in Taiwan, and the distribution of each species was restricted to a distinct geographical area.

Hemimyzon taitungensis is a preponderant endemic species restricted to the eastern part of Taiwan where no other homalopterid species have been found. Its well adaptation to swift current allows it to dominate over other species, including *Varicorhinus tamusuiensis*, *Sicyopterus japonicus*, *Gobio* sp., *Rhyacichthys aspro* and *Anguilla marmorata* in the same habitat which are also adaptative to fast running water , in the eastern part of Taiwan.

Although *Hemimyzon formosanum* has the widest distribution among all Taiwanese homalopterid species, it is mostly restricted to the western side of the central mountain range. This species has been found in almost all rivers in that area, including Lan-yung River in the I-lan regions. Interestingly, it is only present in some branches of a river system, but not in the others. Resulting from the extensive survey on several tributaries of Tamsui River including Nan-shih River, Pei-shih River, Keelung River and Da-han River, *H. formosanum* was found only in Nan-shih River and Da-han River. The expansion of the species from Lan-yung River into Nan-shih River is considered to be possible since branches of Lanyung River are close to the upstream of Nanshih River. *Hemimyzon formosanum* usually occurs together with *Crossostoma lacustre*, in the northern west and central west part of Taiwan. The latter species is restricted to the northern west and central west parts of Taiwan, but absent in Lan-yung River and Da-an River.

Sinogastromyzon puliensis and *Hemimyzon formosanum* cooccur in the southern and central west parts of Taiwan.

Crossostoma lacustre, *Hemimyzon formosanum* and *Sinogastromyzon puliensis* are sympatric in Ta-chia River and Ta-du River located in central Taiwan.

Oshima[26] noted that the freshwater fishes of Taiwan should be closely related to those in mainland China and later he[27] considered

them belonging to two different origins; one originated from the Oriental Region and the other from the Palaearactic Region. The freshwater fishes on the island had been preoccupied by the Oriental species.

Lin[22] pointed out that while Taiwan was a part of Mainland, she had two river systems separated by the Formosa Bank extending eastward from the eastern part of Nan leng (南嶺) to the central part of Taiwan. All the freshwater fishes dispersed to Taiwan at the time when it was connected to the Asiatic continent. *Crossostoma lacustre* and its related species distributed only in the northern part of the Nan-leng extensions. It is clear that this Palaearactic species dispersed to Taiwan after the formation of Formosa Bank. Conversely the other three Taiwan homalopterid species are the typical Oriental species which dispersed to Taiwan through the southern river system when it was still connected to the mainland.

Oshima (1923)[27] suggested that the Cho-shui River is the dividing line of the distributions of freshwater fishes of Taiwan. However, it seems more reasonable to say that the extensions of Formosa Bank or the A-li Mountain range, located south of the Cho-shui River is the true dividing line, due to the occurrence of *Crossostoma lacustre* in some branches of Cho-shui River.

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臺灣產平鰭鰍科魚類之研究並記述一個新種

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臺灣產的平鰭鰍科魚類共有4種，其中一種臺東間爬岩鰍係屬新種。每一種平鰭鰍的形態及分佈狀況均有詳細的描述。臺東間爬岩鰍僅分佈在中央山脈以東的臺灣東部河川，而臺灣間爬岩鰍、臺灣纓口鰍和埔里中華爬岩鰍則分佈在中央山脈以西。其中以臺灣間爬岩鰍的分佈最廣。