

SOME DATA ON COMPOSITION, ORIGIN, AND DISTRIBUTION OF CYPRINID FISH SPECIES IN NORTHERN VIETNAM WITH DESCRIPTIONS OF NEW TAXA¹

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Among freshwater fishes, Cyprinidae is the most important family as they consist of the largest number of genera and species and have more economic values. This is why there was much attention directed towards the species in this family by domestic and foreign ichthyologists. However, there were few studies on cyprinid species in northern Vietnam. Among them the study on northern freshwater fishes by Chevey and Lemasson provides the most information on cyprinid species though the number of species are still few and there are many mistakes in taxonomy.

In our studies on aquaculture in the period 1959 to 1966 we focused on the cyprinid species by taking specimens from Chay River, Lo River, Thao River, Gam River, Nang River, Ba Be Lake, Cau River (Viet Bac region), Da River, Nam Na River, Nam Lay River (West North), the lower basin of Red River, Thai Binh River, Duong River, Ninh Co River, and a number of ponds and lakes, rice field (delta regions), Ma River, Xuan Duong Lake, Cam Ky Reservoir (the former Region 4). The number of specimens is quite large.

In the period from 1963 to 1967, we spent time analyzing the specimens and then made a classification of the “cyprinid family in northern Vietnam”. This report is a part of that document. Our classification of the cyprinid species in this report is a common approach based on the appearance and the internal organs of the fish. We had a number of difficulties in the classification. Since most of the specimens collected [i.e., by earlier workers] were kept in the Paris Museum (France) we could not compare with the specimens but only use the original description of the species therefore there might be some errors. Another problem is that there were not many classification references [available for use during the study] so a number of species names might not be correct needing changes and additions. Lastly, there might be errors due to our limited capability; we hope to receive opinions from colleagues.

¹Vietnamese proper names of fish families, genera, and species have been retained in most places where they appear in the original text. The erratic capitalization and spelling (often illegible) of the original version has been standardized. A few seldom used diacritical marks are omitted because they are not included in the Vietnamese font utilized (from *Wikipedia*).—*Tyson R. Roberts*.

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This report is divided into four parts:

1. The composition of cyprinid species in northern Vietnam
2. Corrections of names of some species and introduction of new species
3. The origin and distribution of the cyprinid species in northern Vietnam
4. Conclusion

I. THE COMPOSITION OF CYPRINID SPECIES IN NORTHERN VIETNAM

There were very few efforts devoted to classifying the cyprinid species in northern Vietnam. In the French colonial period, some foreign researchers had done studies on the cyprinid species including H. G. Sauvage (1881–1884), L. Vaillant (1891–1892), J. Pellegrin (1907–1923 and 1928–1932), P. Chabanaud (1924), Bouret (1927), P. Chevey (1932), Petit and Tchang (1933), Pellegrin and Chevey (1934–1935). The researchers described some new species collected in northern Vietnam published in French zoological publications. Only in 1937 did P. Chevey and Lemasson describe quite systematically about freshwater fishes in northern Vietnam. In their last statistics, Chevey and Lemasson stated that the cyprinid family consists of 57 species and 1 subspecies; if excluding 4 species with two names, the number is 53 species and 1 subspecies. These species were classified into 8 groups or subfamilies: the cá chép subfamily Cyprininae (3 species and 1 sub-species), the cá tram subfamily Leuciscinae (8 sub-species), the cá rôi subfamily Barbinae (28 species), the cá mè subfamily Hypophthalmichthyinae (1 species), the cá chày subfamily Xenocyprininae (1 species), the cá vên subfamily Abramidinae (10 species), the cá đuc subfamily Gobioninae (1 species) and the cá thê be subfamily Rhodeinae (2 species). This study has described a large number of the cyprinid species and has been considered a good reference so far. However, since the researchers were foreigners, the classification was only based on the appearance of some specimens collected and sent from Vietnam but did not take into account their biological features. Moreover, the Cyprinidae in northern Vietnam was much closed to that in China; there were many mistakes because the researchers did not have many references about Chinese Cyprinidae. A number of species were given two names such as in the case of “cá chày đỏ mắt” [red-eyed chày fish] being named *Squaliobarbus curriculus* and *Squaliobarbus caudalis*; a number of species were given wrong names such as cá anh vũ *Semilabeo notabilis* being named *Pseudogyrinocheilus procheilus*, cá mai while [correctly] named *Rasborinus lineatus* but the drawing illustrating *Ischikauia hainanensis* or “cá dua”, *Hemibarbus labeo* in the subfamily Gobioninae being mistakenly identified as the species “cá rôi” of the subfamily Barbinae etc.

After the victory against the French colonizers, many Vietnamese zoologists started to study fishes including Dao Van Tien and M. D. Yen who studied fishes in Boi River (Hoa Binh), Thua canal (Yen Bai) in 1959, Ninh Co River (Nam Dinh) in 1960; Tran Cong Tam who studied fishes in Red River (1959–1960); Nguyen Khac Cam (1962) who studied fishes in Lam River (Nghe An); Nguyen Van Thai (1962) who studied fishes in Bua River (Phu Tho), Mai Dinh Yen (1963) who studied fishes in Red River; Hoang Duy Hiep and Nguyen Van Hao (1964) who studied fishes in Thao River; Nguyen Van Hao (1965) who studied fishes in Da River; Doan Thi Le Hoa (1966) who studied fishes in Ma River. The researchers mentioned many species in the cyprinids but merely listing the species collected in the waters studied rather than the description and classification of the species. According to the researcher, the cyprinids in the Red River consist of 61 species and 3 sub-species; if excluding 9 species and

2 sub-species that belong to the Chinese areas and 5 species with two names, there left 47 species and 1 sub-species of cyprinids in the Red River area. The taxonomy still followed that of Chevey and Lemasson (1933). Many species described were not collected; the taxonomy was not correct; mistakes from previous studies were not corrected; some names were wrong; some species still named twice such as cá nhắng *Xenocypris argentea* was named *Xenocypris macrolepis* or “red-eyed cá chầy” *Squaliobarbus curriculus* was named also *Squaliobarbus caudalis* or some species were even classified as two different species in two genera such as cá đòng đòng *Puntius semifasciolatus* being classified as *Puntius hainanensis* and *Barbus semifasciolatus*.²

In the period from 1963 to 1967, we spent time correcting, re-classifying, and adding using specimens of cyprinid species collected from many areas in northern Vietnam. We concluded that there are so far 85 species and 3 sub-species in 52 genera and 9 subfamilies (Table 1 [not printed]). The cá trôi subfamily (Barbinae) is the largest subfamily with 38 species accounting for 43.2%; the cá trắm subfamily Leuciscinae with 13 species and 1 sub-species accounts for 15.9%; the cá vền subfamily Abramidinae with 13 species and 1 sub-species accounts for 15.9%; the cá dục subfamily Gobioninae with 7 species accounts for 7.95%; the cá chép subfamily Cyprininae with 4 species and 1 sub-species accounts for 5.7%; the cá thê be subfamily Rhodeinae with 4 species accounts for 4.55%; the cá mè subfamily Hypophthalmichthyinae with 3 species accounts for 3.4%; the cá nhắng subfamily Xenocyprinae with 2 species accounts for 2.3%; the cá đực subfamily Gobioninae with 1 species accounts for 1.1%. Among the genera and species mentioned above, 3 species namely cá mè hoa *Aristichthys nobilis*, cá mè trắng *Hypophthalmichthys molitrex* and cá trắm co *Ctenopharyngodon idellus* were introduced from China and then raised in many areas in northern Vietnam, and 2 new genera namely cá trư' *Laichowcypris* and pa xam *Paradaniops*; 17 species and sub-species collected for the first time were as follows:

- 1- Cá trư' *Laichowcypris dai*
- 2- Cá dâm dât suôi *Nicholsicypris dorsohorizontalis*
- 3- Pa xam cá m *Paradaniops macropterus*
- 4- Pa xam xét *Daniops* [*nammuensis* omitted in original]
- 5- Pa mi *Crossocheilus namlenensis*
- 6- Cá chát râu *Lissochilus longibarbis*
- 7- Cá dât xô *Lissochilus brevispinus*
- 8- Cá chát soc *Lissochilus laocaiensis*
- 9- Cá mò *Garra laichowensis*
- 10- Cá phôm fac *Puntius takhoaensis*
- 11- Cá dât trắng *Varicorhinus argentatus*
- 12- Cá dât do *Varicorhinus erythrogenys*
- 13- Cá phêng *Varicorhinus* [*microstomus*]
- 14- Pa pin *Onychostoma brevicephalus*
- 15- Pa mom *Onychostoma microcorpus*
- 16- Pa lố *Hemibarbus longianalis*
- 17- Cá thiếu *Erythroculter pseudobrevicauda macrophthalmus*

²Generic placement of this small species is still uncertain. Perhaps it should be in *Systemus*.

The followings are species listed as northern fishes for the first time:

- 1- Cá giếc cô *Zacco macrolepis* Wu
- 2- Cá nhàn *Xenocypris davidi* Bleeker
- 3- Cá chất soc *Lissochilus clivosus* Lin
- 4- Cá đực hoa *Abbottina kachekensis* (Oshima)
- 5- Cá mương *Hemiculter dispar* Peters
- 6- Cá thê be *Rhodeus spinalis* Oshima
- 7- Cá thê be *Rhodeus ocellatus* (Kner)
- 8- Cá đực đá *Gobiobotia longibarba* Fang]

The cyprinid family consists of 43 species and sub-species with economic value including 10 species that provide breeders namely cá chép *Cyprinus carpio*, cá mè trắng *Hypophthalmichthys harmandi* and *Hypophthalmichthys molitrix*, cá mè hoa *Aristichthys nobilis*, cá trôi *Cirrhinus molitorella*, cá trắm đen *Mylopharyngodon piceus*, cá trắm cỏ *Ctenopharyngodon idellus*, á diếc *Carassius auratus*, cá bông *Spinibarbichthys denticulatus*, cá vền *Megalobrama terminalis*. Species of economic value are distributed into genera as follows:

– Subfamily cá chép consists of 4 species and 1 sub-species: cá chép (*Cyprinus carpio*), cá lô (*Cyprinus carpio* var. *multitaeniatus*), (*Laichowcypris dai*), cá diếc (*Carassius auratus*), cá nhàn (*Carassioides cantonensis*).

– Subfamily cá trắm consists of 7 species: cá trắm đen (*Mylopharyngodon piceus*), cá trắm cỏ (*Ctenopharyngodon idellus*), cá hồng (*Luciobrama macrocephalus*), cá măng (*Elopichthys bambusa*), cá chày trắng (*Ochetobius elongatus*), cá chày do mat (*Squaliobarbus curriculus*), cá cháo (*Opsariichthys uncirostris*).

– Subfamily cá nhàn consists of 1 species cá nhàn (*Xenocypris argentea*).

– Subfamily cá mè consists of 3 species: cá mè hoa (*Aristichthys nobilis*), cá mè trắng (*Hypophthalmichthys molitrix* and *Hypophthalmichthys harmandi*).

– Subfamily cá trôi consists of 21 species: cá trôi (*Cirrhinus molitorella*), cá (*Spinibarbichthys denticulatus*), *S.* [illegible], cá chy dat (*Spinibarbus caldwelli*), cá anh vũ (*Semilabeo notabilis*), cá hoa (*Labeo tonkinensis*), cá rầm xanh (*Labeo lemassoni*), cá my (*Labeo graffeuilli*) cá giuôi (*L. xanthogenys*), cá giằm dât (*Osteochilus salsburyi*), cá ngu' a (*Tor brevifilis*), cá chat (*Lissochilus krempfi*), cá chat râu (*L. longibarbus*), cá sình (*Onychostoma laticeps*), cá phao (*O. leptura*), cá biên (*O. ovalis*), cá fang (*O. macracanthus*), pa pin (*O. brevicephalus*), pa mom (*O. microcorpus*), cá phôm pác (*Puntius takhoaensis*), cá đò (*Ageneiogarra imberbi*).

– Subfamily cá đực cỏ thoái [Gobioninae], cá đực ngo (*Hemibarbus labeo*), cá đực chằm (*Hemibarbus maculatus*).

– Subfamily Abramidinae consists of 4 species: cá vền (*Megalobrama terminalis*), cá mương (*Hemiculter leucisculus*), cá thiêu (*Erythroculter pseudobrevicauda*), cá ngao (*Culter erythropterus*).

A comparison of cyprinid species in northern Vietnam and those in the world shows the absence of the subfamily cá vây la (Schizothoracinae). We collected 1 more subfamily, (cá đực râu or Gobioninae), 24 genera, 28 species and 2 subspecies than Chevey and Lemasson (1937). We have made some adjustments so that species were classified into their correct subfamilies. We also corrected names of genera and species of 16 species that were wrongly named by other researchers.

However, we haven't found 8 species already collected by other researchers:

- Pa man *Garra gracilis* Pellegrin³
- Pa ma *Leptobarbus tchangi* Pellegrin⁴
- Pa can kho *Cychocheilichthys microstoma* Pellegrin⁵
- Cá vên *Megalobrama bramula* (C et V)⁶
- Cá vên *Megalobrama affinis* (Vaillant)⁷
- Cá thè be *Acanthorhodeus taenianalis* Günther⁸
- Cá tram co *Ctenopharyngodon idellus* (C et V)

Among the species, two have good economic values:

- The first species is cá tram co (*Ctenopharyngodon idellus*) which was seen by Chevey and Lemasson in the Red River in 1937 but we could not find it there in spite of much of our effort when we were collecting specimens. This species is now only found to live in Ky Cung River (Lang Son) in small number; they breed eggs and small fish in Lang Son but these then were taken by the flow to China.

- The second species not now found is cá vên *Megalobrama bramula*, which was collected by Chevey and Lemasson in 1937 in Hanoi. Therefore we see it necessary to study about the causes of extinction of these species and the solutions to recover them in natural waters.

In 1959 Dao van Tien and Mai Dinh Yen⁹, in their study of fishes in Thua Canal (branch of Red River), mentioned two new species and 1 new sub-species. Our comments about these are as follows:

- The first species the *Coreius tchangi* has major characteristics of small eyes, long barbel while the specimens and drawings by the researchers featured big eyes, short barbel species which resemble the *Gnathopogon argentatus* described by Sauvage and Dabry in 1874. The second species is the *Rostrogobio nikolskii*.¹⁰ The specimens, photo, and features described are not much different from the features of the *Abbotina kachekensis* described by Oshima in 1920.

- The third species is *Spinibarbus macracanthus maculatus*. The features described by the researchers are similar to those of the *Spinibarbus macracanthus* described by Pellegrin and Chevey in 1936 and described again later by Chevey and Lemasson in 1937 with the difference in 5–6 black stripes across the body. We researched and found that difference a special variability of the *Spinibarbus macracanthus*. The small fish have stripes across their bodies while the big fish (grown up) will not. These stripes were not fixed thus it is not reasonable classifying these fish into a separate subspecies.

³*Discognathus gracilis* Pellegrin & Chevey 1936

⁴*Leptobarbus tchangi* Pellegrin & Chevey 1936 now *Percocypris tchangi* (Pellegrin & Chevey 1936)

⁵*Cychocheilichthys microstoma* Pellegrin & Chevey 1936; currently placed as a junior synonym of *Acrossocheilus iridescens* Nichols & Pope 1927

⁶*Leuciscus bramula* Valenciennes in Cuvier & Valenciennes 1844

⁷*Chanodichthys affinis* Vaillant 1892

⁸Günther 1873

⁹Reference apparently not in Eschmeyer's online "Catalog of Fishes" as of 19 June 2007.

¹⁰Neither *Coreius tchangi* nor *Rostrogobio nikolskii* are entered in Eschmeyer's online "Catalog of Fishes" as of 7 Nov 2006

II. CORRECTION OF NAMES OF SOME SPECIES AND DESCRIPTION OF SOME NEW SPECIES IN NORTHERN VIETNAM

1. Correction of names by previous researchers

a) Correction of names of types

– Change genus cá hoa *Varicorhinus* to *Labeo*:

We found that Pellegrin and Chevey (1936) and Chevey and Lemasson (1937) were wrong when they classified 3 species in northern Vietnam into the *Varicorhinus* namely cá hoa (*Varicorlinus tonkinensis*), (*Varicorhinus lemassoni*), (*Varicorhinus graffuelli*). Particularly the *Varicorhinus* by Ruppell (1936), according to Weber & de Beaufort (1916), Lin (1932), Nichol (1943), there's no groove between its lower jaw and lower lip, the post labial groove is interrupted in the middle, lower jaw has sharp keratinous edge, dorsal fin has fewer than 10 branched rays while the features of the *Labeo* by Cuvier (1817), also according to Weber & de Beaufort, Lin, and Nichols, are: groove on lower jaw and lower lip, post labial groove is deep and continuous, the lower jaw is resilient cartilage, there can be either lip or jaw barbels or both, dorsal fin has more than 10 branched rays.

Based on the specimens we collected, drawings and description by Chevey and Lemasson (1937), the *tonkinensis*, *lemassoni*, and *graffueilli* possess the features of *Labeo* and should be classified into this genus as follows:

Cá hoa *Labeo tonkinensis* (Pellegrin & Chevey)

Cá rằm xanh *Labeo lemassoni* (Pellegrin & Chevey)

Cá my *Labeo graffueilli* Pellegrin & Chevey)

– Change genus cá bống *Spinibarbus* into *Spinibarbichthys*:

Chevey and Lemasson (1937) classified three species in northern Vietnam namely cá bống, cá cay, and cá chay dat in *Spinibarbus*. These species have prickles [tubercles] under its skin pointing to the head, short anal fins with 3 non-branched rays and 5 branched rays. Recently these species tend to be treated as different types by ichthyologists with Oshima (1926) starting the trend by classifying cá bống into 1 separate genus: *Spinibarbichthys*. This is similar to the *Spinibarbus* except that the dorsal fin rays are not branched and spines are serrated behind. The point of view is shared by many such as Chu Nguyen Dinh (1935), Vuong Di Khang (1959), Ngu Hien Van (1963) etc. We agreed with the idea of differentiating fish types in the Barbinae based on whether the dorsal fin spines are serrated or not. Therefore, we keep the name given to cá bống by Oshima in 1926: *Spinibarbichthys denticulatus* Oshima. We changed the name of cá Cay into *Spinibarbichthys macracanthus* (Pellegrin & Chevey) while keeping cá chay dat in genus *Spinibarbus* since this species doesn't have serrae.

– Change genus cá ngừ *Labeobarbus* into *Tor*:

Cá ngừ'a was classified by Chevey and Lemasson (1937) as *Labeobarbus brevifilis* Peters. *Labeobarbus* was first described by Rüppell in 1837. However, 4 years earlier, in 1833–1934, Gray described the *Tor* with features identical to the *Labeobarbus*. We therefore use the name described by Gray for cá ngừ'a: *Tor brevifilis* (Peters).

b) For species changed both in genera and species

– Change name of cá anh vũ:

Cá anh vũ is a precious species in the mountainous areas of Vietnam. Its meat is very delicious and has good smell. Chevey and Lemasson were wrong to classify this species

as *Pseudogyrinocheilus procheilus* (Sauvage & Dabry). The reason is Fang (1933) described *Pseudogyrinocheilus* as having a triangular mouth with one forward angle, lips narrow and thick, upper lip notched, anus right in front of anal fin while the description and drawings by Chevey and Lemasson as well as the specimens we collected showed terminal mouth not triangular, upper lip large no notch, lower lip broad almost triangular when seen from front almost reaching chin, anus is far ahead of anal fin. These features resemble the *Semilabeo notalilis* described by Peters in 1880 and described again by Lin in 1935. Therefore, we changed the name of cá anh vũ to *Semilabeo notabilis*.

– Change name of cá trôi:

The taxon of cá trôi has not been agreed on so far. Chevey and Lemasson classified this species as *Labeo collaris* Nichols and Pope while Pham Trong Hau and Mai Dinh Yen (1964) classified it as *Cirrhinus chinensis* (Günther). Vuong di Khang (1958) argued that the species might have variations when they were raised and researchers gave these variations different names. The names are as follows:

- *Leuciscus molitorella* C & V 1844
- *Cirrhinus chinensis* Günther 1868
- *Cirrhina melanostigma* Fowler & Bean 1922
- *Labeo molitorella* Weber & de Beaufort 1916
- *Labeo collaris* Nichols & Pope 1927
- *Cirrhina molitorella* Lin 1933
- *Labeo melanostigma* Nichols 1943

These names indicate only one species.

The genera *Cirrhinus* and *Labeo* are very similar except for *Labeo*: postlabial groove deep and continuous, no horny jaw sheath (đốt nôi) inside lower jaw while for *Cirrhinus*: interrupted shallow post labial groove, with horny jaw sheath inside lower jaw. Cá trôi in northern Vietnam has interrupted shallow post labial groove, with horny jaw sheath inside lower jaw thus should be classified into the genus *Cirrhinus*. According to the priority rule, we choose the name *molitorella* (C et V) since this was the earliest name for cá trôi.

– Change name of cá lư'a:

According to Chevey and Lemasson (1937), cá lư'a in northern Vietnam is *Sarcocheilichthys hainanensis* Nichols and Pope. We think that this is not correct since *Sarcocheilichthys* was described by Bleeker in 1859 as having terminal mouth, lower jaw with sharp keratinous edge while our specimens of cá lư'a together with description from previous researchers show terminal mouth, lower jaw without sharp keratinous edge identical to the genus *Chilogobio* described by Berg in 1914 and is now classified as *Chilogobio nigripinnis* (Günther)

– Change name of cá đò:

According to Chevey and Lemasson (1937), cá đò in northern Vietnam is *Garra poilanei* Petit et Tchang (1933). This species has no barbel. Garman (1912) based on this character classified the species into a new genus which was widely accepted: *Ageneiogramma*. With relation to its species name, we found that the description by Petit and Tchang in 1933 and by Chevey and Lemasson in 1937 show that cá đò is not much different from the *Discognathus imberbis* Vinciguerra (1890). We therefore, changed its name to *Ageneiogramma imberbis* (Vinciguerra).

c) Change in species names

Because of the lack of references, some researchers were wrong in naming some species. Therefore, we, with access to more references, have made some corrections on names of some species basing on the characters of some specimens and the priority rule.

– Cá chấy dat:

Chevey and Lemasson (1937), with reference to Oshima (1926) named cá chấy dat as *Spinibarbus nigrodorsalis* Oshima. This species, however, was described by Nichols in 1925 as *Barbus caldwelli*. So cá chấy dat is *Spinibarbus caldwelli* (Nichols).

– Cá đòng đòng:

Chevey and Lemasson (1937), with reference to Lohberger (1929) named Cá Đòng Đòng *Puntius hainanensis*. This species, however, was described by Günther in 1868 as *Lenbarbus* [sic; should be *Capoeta*] *semifasciolatus*. Thus, Cá Đòng Đòng is *Puntius semifasciolatus* (Günther).

– Cá nhàng:

Chevey and Lemasson (1937) described two species of cá nhàng in northern Vietnam: *Xenocypris macrolepis* Bleeker and *Xenocypris nitidus* Garman. Ichthyologists now consider both species to be *Xenocypris argentea* described by Günther in 1868.

– Cá nhong măng:

Chevey and Lemasson (1937) described Nhung Măng in northern Vietnam to consist of two species: *Luciobrama typus* Bleeker (1871) and *Luciobrama longiceps* Pellegrin (1907). These two are actually the same species with *Luciobrama macrocephalus* (Lacepede 1803).

– Cá tram đen:

Chevey and Lemasson (1937), with reference to Basilevsky (1855) named cá tram đen *Mylopharyngodon aethiops* (Basilevsky). This species, however, was described by Richardson in 1846 in the name *Leuciscus piceus* and its name now is widely accepted as *Mylopharyngodon piceus* (Richardson).

– Cá ngỗng

According to Chevey and Lemasson (1937), cá ngỗng is known as *Culter bevi-cauda* Günther 1868 but it is the same species as *Culter erythropterus* described by Basilevsky in 1855.

2. Introduction of new genera and species in the cyprinid family:

In our research, we collected many new samples and we chose to introduce some new types and species that we have enough references about.

a) New genera:

– Genus cá trũ' *Laichowcypris* new genus

Type¹¹: *Laichowcypris dai* new species (Fig. 1) belongs to the subfamily Cyprininae. The genus is similar to the cyprinid genera *Cyprinus*, *Procypris*, and *Mesocypris* except that it has small head, low nape; pharyngeal teeth in 4 rows: 3.1.1.1–1.1.1.3, last row

¹¹i.e. "type species of the genus"

small, teeth surface diagonal with 1–3 clear grooves; gill rakers strong, short, with many striae and spines; dorsal fin origin posterior to pelvic fin insertion [khoi diem cua vay o sau khoi diem vay bung]. The exception is *Mesocypris*, according to Ngu Hien Van (1963); some specimens show 4 rows of pharyngeal teeth but with short dorsal fin (only 10–11 branched rays).

– Genus Pa xam *Paradaniops* new genus

Type¹²: *Paradaniops macropterus* new species (Fig. 3) belongs to subfamily Leuciscinae. This genus is very close to the genera *Danio* H B (1822) and *Daniops* Smith (19045) in its appearance such as mouth type, jawbone structure, positions of fins, especially dorsal fin at the back of body etc. They, however, still have differences in pharyngeal teeth, pectoral organs, adhesive organ in front of pectoral fin, and number of pectoral fin rays and the shape of lateral line. *Paradaniops* is similar to *Daniops* in that they have 2 rows of pharyngeal teeth while it is different with *Danio* since *Danio* has 3 rows of pharyngeal teeth. *Paradaniops* is different with both types because it has no pectoral fin, sucker is in front of pectoral fin origin, pectoral fin rays low and close, lateral line curved toward belly.

Based on the shape of some organs, the three genera *Paradaniops*, *Daniops* and *Danio* are closely related, might be from the same origin. According to Regan (1924) and Chu Nguyen Dinh (1935), in terms of the evolution of the cyprinid species from having many teeth to fewer teeth, *Danio* is more primitive while *Paradaniops* and *Daniops* are more related. Based on the shape and structure of teeth, it is possible that the latter two types originated from two closely related *Danio* species having variations such as sucker, low pectoral fin because they lived in two geographical areas with different heights and speeds of flow thus developing into two new genera.

b) New species:

The new species belong to the following subfamilies:

– Subfamily Cyprininae 1 species:

+ Cá trũ: *Laichowcypris dai* new species (Fig. 1)

10 specimens body length 49–60 mm, weight 4–3000 g from Da River in Lai Chau and Hoa Binh.

DIV, 18–20, A III 5–6, P 1, 15–16, V 1, 8–9 lateral line scales 42, [transverse scale rows] 71/2 / 51/2–61/2, 4 rows of pharyngeal teeth: 3.1.1.1–1.1.1.3, 20–23 gill rakers on first branchial arch, body length about 2.4–3.0 times body depth, 3.4–4.1 times length of head. Length of head about 3.6–4.6 times eye diameter, 2.5–3.1 times interorbital distance; head small, nape low, snout obtuse. Two pairs of barbels [rang hinh cam, mang mong mong ngan lien voi eo [thin membrane attached to waist?], gill rakers big, short, striated and spinous. Along body side 12–13 odd-looking black stripes crossing scales.

Cá trũ¹ mainly lives in North-west waters, lower boundary is Hoa Binh city (Da River). Lives mostly in stream with lots of small stones. Cá trũ that lives in middle and bottom layers eat many things, produce eggs in March and June in upper stream where flows are strong, lots of stones in bottom; the eggs are sticky. It is a common economic fish in Son La and Lai Chau provinces. Its meat is good. Size 10–12 kg at maximum, normally 5–6 kg.

¹²i.e. “type species of the genus”

– Subfamily cá trâm *Leusiscinae*, 3 species:

+ Cá giâm dât suối *Nicholsicypris dorsohorizontalis* new species (Fig. 2)

5 specimens, body length 49–74 mm, weight 2.9–9 g in Tay Son (Ha Bac province). D 3, 7 P 1, 12–13 V 1, 7 A 3, 7 lateral line scale $6/2-3 = 37$, two rows of pharyngeal teeth 5.4–4.5, 5 gill rakers in first branchial arch, 35–37 vertebral columns, body length 3.9–4.5 times body depth, 3.6–4.2 times head length. Head length is 3–3.5 times snout length, 3.5–4.7 times eye diameter, 2.1–2.5 times interorbital distance. Body thick, back little flat, brownish, belly whitish, gray fins except anal fin pink. Similar to *N. normalis*¹³ (N, P) except the latter body quite thick, body depth small, small belly, back nearly flat, dorsal fin distant from pelvic fin, pelvic fin distant from anal fin, colorful.

– Pa xam cam *Paradaniops macropterus* new species (Fig. 3)

5 specimens, body length 74–80 mm, weight 10.6–11.5 g. Lives in small stream in Sinh Ho (Lai Chau province).

D 3, 8; P 1, 11; V 1, 7; A 3, 13. Lateral line scales 42 $9-10/3-V$. 2 rows of pharyngeal teeth 5.3–3.5, 6–8 gill rakers in first branchial arch, body length 3.2–3.6 times body depth, 4–4.5 times head length. Head length 2.5–2.8 times snout length, 3.6–3.8 times eye diameter, 2.3–2.4 times interorbital distance, fins developed, without serrae, dorsal fin located near caudal fin, pectoral scales, sucker in pectoral fin origin to adapt to the flow, beautiful colors, 7–9 black bars on body side. Similar to *Danio mionshinensis* except that fins developed, lots of scales, only two rows of pharyngeal teeth, especially no pectoral scales, adhesive organ in front of pectoral fin.

+ Pa xam cat *Daniops nammuensis* new species (Fig. 4 [missing])

2 specimens, body length 60–80 mm, weight 6–9 g, collected in Nam mu phong tho (Lai Chau).

D 3, 7; P 1, 10; V 1, 7; A 3, 12, lateral line scales 40 $9/3-V$, 2 rows of pharyngeal teeth 5.3–3.5, body length 3.1–3.2 times body depth, 3.9–4.0 times head length; head length 3.1–3.2 times snout length, 3.1–3.2 times eye diameter, head short, 2 pairs of barbells, interorbital distance large, lower jaw curves up which fits into upper jaw, fin developed, beautiful colors, 8–9 green dark bars from arch to tail. Similar to *Paradaniops macropterus* except: short body, bigger eyes, fewer lateral line scales, with pectoral scales but without adhesive organ in front of pectoral fin, teeth different.

Genus cá trôi, 1 species:

+ Cá mo: *Garra laichowensis* new species (Fig. 5)

3 specimens, body length 85–102 mm, weight 8.5–12 g, collected in Nam mu stream, Phong Tho district (Lai Chau).

D 2, 8; P 1, 13; V 1, 8; A 3, 5, lateral line scales 36 $6/4-V = 38$, 2 rows of pharyngeal teeth 5.4–4.5, 18 gill rakers on first branchial arch, body length 4.2–4.6 times body depth, 4.5 times head length. Head length .9–2.2 times snout length, 4.2–4.6 times eye diameter, 1.8–2.0 times interorbital distance, body long, thick, two pairs of fins, 35 vertebrae, air bladder with two small parts, blackish gray colored, belly yellowish, black stripes lined on caudal fin, small black spot on caudal fin base. Similar to *G. caudofasciatus* Pelleyrin and

¹³*Aphyocypris normalis* Nichols & Pope 1927 (type locality Nodoo, Hainan Island, China).

Chevey except short barbels, many small tubercles on snout, mouth subterminal, scales not similar, caudal fin yellowish with black stripes and 1 black spot on caudal fin origin.

+ Pa mi: *Crossochilus namuenensis* new species (Fig. 6)

3 specimens, body length 40–50 mm, weight 3–4 g, collected at Nam Len, Tuan Giao district (Lai Chau).

D 3, 8; P 1, 16; V 1, 8; A 3, 5, lateral line scales 31 $5\frac{1}{2}$ / $3\frac{1}{2}$ –V 32, 3 rows of pharyngeal teeth, body length 3.6–3.9 times body depth, 3.3–3.5 times head length. Head length 3.3–3.6 times snout length, 3.7–4.1 times eye diameter, 2.9–3.2 times interorbital distance, head size moderate, snout armed with tubercles, 2 pairs of barbels [vien moi khong co tua co], postlabial groove not continuous, fin rays not spinous, back gray brown, belly white yellow, scale edge dark, 1 black spot on caudal fin base. Similar to *C. Benase* except large head, big eyes, short snout, anal fin close to anus, and more colorful.

– Cá chất râu *Lissochilus longibarbis* new species (Fig. 7)

8 specimens, body length 148–390 mm, weight 79–1350 g, collected in Bo canal (Lao Cai).

D IV, 8; P 1, 15–16; V 1–2, 8; A III, 5, lateral line scales 44 $8\frac{1}{2}$ / $9\frac{1}{2}$ / $4\frac{1}{2}$ – $5\frac{1}{2}$ –V 48, 3 rows of pharyngeal teeth 5.3.2–2.3.5, 11–13 gill rakers on first branchial arch, body length 2.7–3.1 times body depth, 4.0–4.7 times head length; head length 2.9–3.0 times snout length, 3.8–4.5 times eye diameter, 2.5–2.7 times interorbital distance, dark gray back, belly lighter, blackish gray fins, 2 long pairs of barbels. Similar to *L. kremphi* with some difference: more and smaller lateral line scales, longer barbel, body deeper, lives in flowing stream, eat water plant and other plant.

– Cá dát xô *Lissochilus bevispinus* new species (Fig. 8)

3 specimens, body length 96–137 mm, weight 21–61 g, collected in Rut stream (Hoa Binh).

D III, 8; P 1, [data omitted]–16; V 1, 8; A 3, 5, lateral line scales 38($7\frac{1}{2}$ / $3\frac{1}{2}$)–V, 3 rows of pharyngeal teeth 5.3.2–2.3.5, body length 3–3.4 times body depth, 3.9–4.2 times head length; head length 2.8–3.0 times snout length, 3.9–4.7 times eye diameter, 2.5–2.8 times interorbital, big head, short snout, postlabial groove interrupted, 2 pairs of barbels, dorsal fin rays spinous, serrated, shorter than the branched rays, black and yellowish, 1 dark black spot on caudal fin base.

– Cá chất soc *Lissochilus laocaiensis* new species (Fig. 9)

8 specimens, body length 35–55 mm, weight 0.8–2.3 g, collected in Trinh Quyen stream (Lao Cai).

D III, 8; P 1, 16; V 1, 8; A III, 5, lateral line scales 36 $6\frac{1}{2}$ / $5\frac{1}{2}$ 38, 3 rows of pharyngeal teeth 5.3.2–2.3.5, 9 gill rakers on first branchial arch, body length 3.3–3.7 times body depth, 3.5–5.4 times head length; head length 2.7–3.2 snout length, 3.7–4.4 times eye diameter, 3.0–3.7 times interorbital distance, 5 evenly separated black stripes. Similar to *L. clivosius* Lin but less deep, shorter head, smaller eyes, longer barbels, no fake arch, short and few gill rakers, fewer lateral line scales, smaller and darker stripes.

+ Cá com pac *Puntius takhoaensis* new species (Fig. 10)

10 specimens, body length 60–90 mm, weight 10–30 g, collected in Nhan Ta Khoa stream (Son La).

D III, 8; P 1, 15; V 1, 8; A 3, 5, lateral line scales $29\ 5\frac{1}{2} / 3\frac{1}{2}$ –V 31, 3 rows of pharyngeal teeth 5.3.2–2.3.5, 9–10 gill rakers on first branchial arch, body length 2.8–3.3 times body depth, 3.6–4.0 times head length, head length 3.6–4.2 times snout length, 3.5–4.0 times eye diameter, 2.2–2.5 times interorbital distance, body long, beautiful but hump-backed, head short, snout obtuse, 2 pairs of barbels, mouth superior, dorsal fin rays spinous, serrated, bladder two parts, back gray, belly yellowish, 1 black special spot under origin of dorsal fin and middle of caudal fin peduncle. Similar to *P.trypides* but back humpier, fewer scales, less colorful.

+ Cá dất trắng *Varicorhinus argentatus* new species (Fig. 11)

2 specimens, body length 140–160 mm, weight 70–80 g, collected in Rut stream (Hoa Binh)

D 3, 8; P 1, 16, V 1, 8; A 3, 5; lateral line scales 46, transverse scale rows $9\frac{1}{2} / 5\frac{1}{2}$; 3 rows of pharyngeal teeth, 4.3.2–2.3.4; body length 3.5–3.8 times body depth, 4.7–4.9 times head length; head length 2.8–3.0 times snout length, 4.5–4.7 times eye diameter, 1.8–2.0 times interorbital distance; head moderate, snout short, obtuse with small tubercle; 1 small pair of barbels at jaw corner, lower jaw with sharp keratinous edge, no postlabial groove; dorsal fin rays not spinous, not serrated, origin behind pelvic-fin insertion; body silver white. Similar to *Onychostoma microcorpus* except one pair of small barbels, body thick, more lateral line scales, dorsal fin rays not spinous, origin behind pelvic-fin insertion.

+ Cá dất đỏ *Varicorhinus erythrogenys* new species (Fig. 12)

3 specimens, body length 145–50 mm, weight 48–70 g, collected in Rut stream (Hoa Binh) and Ba waterfall (Yen Bai).

D 3, 8; P 1, 15; V 1, 8–9; A 3, 5, lateral line scales 46, transverse scale rows $7\frac{1}{2} / 5\frac{1}{2}$, 3 rows of pharyngeal teeth 5.3.2–2.3.5, body length 4.1–4.4 times body depth, 4.5–4.8 times head length, head length 2.7–2.9 times snout length, 4.6–4.7 times eye diameter, 2.3–2.5 times interorbital distance, body elongated, back smaller toward head and tail, head long, snout small, 1 small pair of barbels at jaw corner, mouth bow-shaped, upper jaw with white, soft flesh edge, lower jaw with sharp keratinous edge, no postlabial groove, lateral line complete, dorsal fin rays not spinous, not serrated, origin in front of pelvic-fin insertion, body red. Body sides each with 3 black spots downward but not lined.

+ Cá pheng *Varicorhinus microstoma* new species (Fig. 13)

4 specimens, body length 100–130 mm, weight 19–52.2g, collected in Nham Noc Ta Khoa (Son La).

D 3, 8 ; P 1, 15; V 1, 8–9; A 3, 5, lateral line scales 46–47, [transverse scale rows] $7\frac{1}{2} / 5\frac{1}{2}$; 3 rows of pharyngeal teeth, 5.3.2–2.3.5, or 4.3.2–2.3.4; body length 3.5–4.0 times body depth, 4.5–4.8 times head length, head length 2.4–2.9 times snout length, 4.0–4.2 times eye diameter, 2.4–2.8 times interorbital distance, body elongated compressed, back curved, head moderate or small, snout short, eyes small, mouth small, subterminal, lower jaw with sharp keratinous edge little curved behind, no postlabial groove, no barbel, small, thin membrane on waist, lateral line complete in middle of body depth, dorsal fin rays no ossified spines, origin in front of pelvic-fin insertion, body white gray and pink. Body sides with wide black stripes. Similar to *Varicorhinus erythrogenys* because of black stripes on both sides of body but less colorful, snout shorter, body less deep and no barbel.

+ Pa mom *Onychostoma microcorpus* new species (Fig. 14)

14 specimens, body length 95–180 mm, weight 7.5–60 g, collected in Nam Na and Nam Lay (Lai Chau).

D II, 11–12; P 1, 15; V 1, 8; A 3, 5, lateral line scales 42, transverse scale rows $7\frac{1}{2}$ – $8\frac{1}{2}$ / $5\frac{1}{2}$, 3 rows of pharyngeal teeth 4.3.2–2.3.4, 32–33 gill rakers on first branchial arch, body length [data omitted from original] times body depth, [data omitted from original] times head length, head length [data omitted from original] times snout length, [data omitted from original] times eye diameter, [data omitted from original] times interorbital distance, body sides gray, belly yellow white; eye, cheek, gill cover red, very special. Similar to *Onychostoma macracanthus* described by Chevey in 1936¹⁴ but with smaller body, fewer lateral line scales, fewer vertebral columns, eye diameter, bigger part of head behind eyes, larger distance after dorsal fin, smaller head depth, interorbital distance, body depth, shorter dorsal fin origin. It eats water plant in streams.

+ Pa pin *Onychostoma brevicephalus* new species (Fig. 15)

5 specimens, body length 98–345 mm, weight 15–180 g, collected in Muong Lay (Lai Chau).

D 4, 14–15; P 1, 16; V 1, 8; A 3, 5, lateral line scales 45 $10\frac{1}{2}$ – $11\frac{1}{2}$ / $5\frac{1}{2}$ –V 46, 3 rows of pharyngeal teeth 4.3.1–1.3.4, 38 gill rakers on first branchial arch, body length [data omitted] times body depth, [data omitted] times head length, head length [data omitted] times snout length, [data omitted] times eye diameter, [data omitted] times interorbital distance, back light gray, belly yellow white, dark gray fin edge, light gray fins. Similar to *Onychostoma macracanthus* Pellegrin and Chevey in 1936 but with more dorsal fin rays, lateral line scales and upper and lower scales, fewer pharyngeal teeth, smaller eye diameter, head length, distance after dorsal fin; longer head depth, interorbital distance; body depth at the deepest part deeper. It eats water plants in streams.

– Subfamily Ca Duc Gobioninae, 1 species:

+ Pa To *Hemibarbus longianalis* new species (Fig. 16)

8 specimens, body length 108–123mm, weight 20–32 g collected in Nam Lay, Muong Lay (Lai Chau).

D 2, 7; P 1, 16; V 1, 8; A 3, 6, lateral line scales 45 $6\frac{1}{2}$ / $5\frac{1}{2}$ –V 48, 3 rows of pharyngeal teeth 5.3.1–1.3.5, 12 gill rakers on first branchial arch, body length 4.4–4.8 times body depth, 3.8–4.0 times head length, head length 2.5–2.7 times snout length, 3.7–4.0 times eye diameter, 3.5–4.0 times interorbital distance, upper body dark gray, belly light yellow, 9–12 black spots a long lateral line. Similar to *H. maculatus*¹⁵ because of black spots on body but with fewer lateral line scales, more gill rakers, body less deep, especially anal fin rays very long.

¹⁴*Onychostoma macracanthus* Pellegrin & Chevey 1936 (type locality Muong Hum, Vietnam).

¹⁵*Hemibarbus maculatus* Bleeker 1871 (type locality Yangtze R., China).

– Subfamily cá ven Abramidinae, 1 subspecies:

+ Cá thiếu big eye *Erythroculter pseudobrevicauda macrothalmus* new subspecies (Fig. 17)

10 specimens, body length 105–210mm, weight 14–168g, collected in Ha Noi, Ha Tay, Nam Ha (Red River and Da River).

D II, 7; P 1, 14; V 1, 8; A 3, 28–31, lateral line scales 64 16 / 5–6–V 66, 3 rows of pharyngeal teeth 5.4.2–2.4.4, 26–27 gill rakers on first branchial arch, body length 3.4–4 times body depth, 4.2–4.7 times head length, head length 3.2–4.1 times snout length, 3.2–3.8 times eye diameter, 3.6–4.3 times interorbital distance. Similar to *E. pseudobrevicauda* but with shorter head, eye diameter equal interorbital distance, lower lips not thick and not protruding much, few lateral line scales, more anal fin rays.

III. ORIGIN AND GEOGRAPHIC DISTRIBUTION OF THE CYPRINID FAMILY IN NORTHERN VIETNAM

Little is known about the origin of northern fish fauna. H. E Sauvage (1884) was the first to study this saying “while freshwater fish fauna in the Indochina Peninsular is generally similar to that in Java, Sumatra, Borneo, that in the North is closely related to that in Southern China.” As late as 1937, P. Chevey and Lemasson had the same opinion. There was poor documentation by previous researchers. H. E Sauvage collected only 10 species in northern Vietnam. Mai Dinh Yen, in his studies of Red River fish fauna (1953), said “fish fauna in Red River has the same origin with that in Hoa Nam (Chinese) province and the sub-China region” and suggested to “expand the fish fauna in Hoa Nam, according to Berg, in Chiangjiang [“long river”] to Red River and classify the Red River fish fauna as a separate one”.

When comparing the species we collected (Table [not included]), we found that 52 species and 1 sub-species (60%) were very much similar to Chinese fish that include 45 mainland species (52%), 30 species and 1 sub-species in Hainan island (35.3%). None are similar to India’s and Malaysia’s. Besides, 31 species and 2 sub-species (37.5%) were locally endemic.

A comparison between the cyprinid species in northern Vietnam with those in Chinese provinces like Guangdong, Guangxi, and Hainan island shows that some species are widely distributed in these areas such as cá Chep *Cyprinus carpio*, cá Diéc *Carassius auratus*, cá Nhung *Carassioides canonensis*, cá Giam Dat *Osteochilus salsburyi*, cá Dong Dong *Puntius semifasciolatus*, cá Bong *Spinibarbichthys denticulatus*, cá Chay Dat *Spinibarbus caldwelli*, cá Chay red-eyed *Squaliobarbus curriculus*, cá Chao *Opsariichthys uncicrostris*, cá Mai Dau Soc (striped head) *Rasbora cephalotaenia* Steiner, cá Duc Ngo *Hemibarbus labeo* etc. Each region, however, has its own species:

– Hainan island: 6 species: *Lissochilus barbodon*, *Lissochilus ikedai*, *Varicorhinus discognathoides*, *Rasborinus yau*, *Lencogobio minor*, *Pseudoperilampus hainanensis*.

– Guangdong and Guangxi, 13 species: *Procypris merus*, *Procypris raubandi*, *Onychostoma brevis*, *Onychostoma pognifer*¹⁶, *Varicorhinus rarus*, *Varicorhinus barbatus*, *Lissochilus hemispinus*, *Carssostoma stigmatus*, *Fustis vivus*, *Yaoshanicus arcus*, *Tanichthys albonubes*, *Tanichthys albunoides*, *Toxabramis hoffmanni*.

¹⁶*Varicorhinus pognifer* Lin 1931.

– Northern Vietnam, 35 species and 2 sub-species: cá trư' (*Laichowcypris dai*), cá lô (*Cyprinus carpio* var *multitaeniata*), cá mỗ' (*Garra caudofasciata*). cá mỗ (*Garra laichowensis*), pa man (*Garra gracilis*), cá bầu (*Garra bourreti*), cá biên (*Onychostoma ovalis*), pa pa (*Onychostoma macracanthus*), pa mom (*Onychostoma microcorpus*), pa pin (*Onychostoma brevicephalus*), pa mi (*Crossocheilus namlenensis*), cá pa rai (*Crossocheilus benasi*), cá hân (*Crossochilus elongatus*), pa ma (*Leptobarbus tchangi*), cá dát trắng (white) (*Varicorhinus argentatus*), cá dát đỏ (*Varicorhinus erythrogegens*), cá phêng (*Varicorhinus microcorpus*), cá hoa (*Labeo tokinensis*), cá rằm xanh (*Labeo lemassoni*), cá my (*Labeo graffueilli*), cá guôi (*Labeo xanthogenys*), cá cây (*Spinibarbichthys macracanthus*), cá chát trắng (*Lissochilus krempfi*), cá chát râu (*Lissochilus longibarbis*), cá dát xô (*Lissochilus bevispinus*), cá chát soc (*Lissochilus laocaiensis*), pa can kho (*Cychocheilichthys microstoma*), cá pom pac (*Puntius takhoaensis*), cá chuôn (*Opsariichthys elegans*), cá dầm dát suôi (*Nicholsicypris dorsohorizontalis*), pa xam cá (*Paradaniops macropterus*), pa xam sét (*Daniops nammuensi*), pa lô (*Hemibarbus longianalis*), cá thiếu mat to [big eye] (*Erythroculter pseudobrevicauda macrothalmus*).

Compared to fish in Yunnan province, northern Vietnam's fish species are very different. According to Thanh Khanh Thai (1958), Yunnan's cyprinid species consist of 30 species and only 3 species among these found in northern Vietnam namely ca Chep, ca Diec, and ca Do while 27 species are different and mainly endemic to Yunnan. On the other hand, there are many species in northern Vietnam that are not found in Yunnan or only the types are found. The difference might be due to the geographical difference; in Yunnan, there are many plateaus 2000 m above sea level such as the Kim Sa River area, while in northern Vietnam, there are lower lands. Such difference in geographical features result in many endemic species.

This shows that the cyprinid species in northern Vietnam have two origins: a Chinese origin such as Guangtung, Guangxi and Yunnan and a local origin that results in separate genera and species due to geographical difference.

Chinese cyprinid species are 4.2 times larger than northern Vietnam's (370 species compared to 88 species). On the contrary, Chinese land area is 250 times larger than northern land area. Therefore, northern Vietnam cyprinid species are 58.5 times larger in terms of land/species ratio and with more economically valuable species. The cyprinid species in northern Vietnam are also richer and more tropicalized with more developed defense organs, more species with barbels and spines; many species eat plants, breed more and more regularly, grow fast in early stage etc.

We have the following observations about the distribution of species in studied waters in northern Vietnam (Table 1[lost]).

– Among the species collected, 81 species and 3 sub-species (95%) live in rivers, canals, streams, 22 species (25%) live in lakes or live in rivers but migrate into lakes to eat, 11 species (12.5%) live or rose in ponds and fields.

– Species with economic value are widely distributed in almost all waters such as cá chép, cá trôi, cá chày, cá vền, cá méang, cá nhòng etc. Species that eat plants are mainly distributed in mountainous areas such as Tay Bac and Viet Bac. Species that eat both animals and plants or species that eat bottom animals mainly live in delta areas and static waters (ponds, lakes, and fields).

– In terms of elevation, 65 species (73.5%) live in mountainous areas, 63 species (71.2%) live in middle lands and 23 species (26.2%) live in delta areas. The upper the stream, the

more species and types while the lower the stream, the number of cyprinid species decrease dramatically, for instance, Da River 64 species and 2 sub-species (75%), Thao River 50 species and 1 subspecies (69.4%), Lo River, 52 species and 2 subspecies (61.3%),¹⁷ Chay River 21 species and 1 subspecies (25%), lower basin of Red River 29 species (33%), Thai Binh River 9 species (10.2%). The cyprinid species in Thai Binh River are 7.3 times less than Da River and 6 times less than Thao River; species in rivers in Central Vietnam are much less than in rivers in the north: Ma River 50 species and 1 subspecies (37.2%) are 0.3 times lesser than Da River's; Lam River with 42 species and 1 subspecies (48.5%) has 0.54 times less species than Da River. The difference besides the result of geographical difference is also because central rivers are much shorter than northern rivers.

The factors decisive to the distribution of cyprinid species in northern Vietnam are the difference in height, speed of flowing, food conditions, and latitude (temperature). Among these factors, height, speed of flowing, and food conditions are main ones. The impact of temperature is not so obvious since the difference in temperature is not much in regions in northern Vietnam due to its narrow area. The difference in species in mountainous Tay Bac and the former 4 region is most notable, which is mainly due to the terrain and height.

Geographic classification of species in northern Vietnam is not done much. In 1937, Chevey and Lemasson divided into 2 categories. The first category is species distributed in upstream areas. The second category is the species that live in delta areas. Mai Dinh Yen, in his studies on Red River fishes (1962), still maintained Chevey and Lemasson's opinion but made some complements and divided the Red River fish fauna into 3 categories: upstream, downstream, and widely distributed; the boundary between upstream and downstream is in Phu Tho province. However, the specimens collected by previous researchers are few, the areas studied not many. Mai Dinh Yen only studied fish in Red River thus the fishes there cannot represent northern fishes. Moreover, the part of Red River than runs through Vietnam are only midstream and downstream but not upstream (report by Ministry of Hydraulics in 1959). The species we collected were from Phu Tho to Lao Cai, which were more midland, mountainous than upstream species.

Geographic classification of fishes in northern Vietnam is a big issue which will help in geographic classification of animal fauna in general and in dividing economic areas later. Since we have not collected many species, not covered all the regions especially in the former 4 region, we need to do more studies in order to be able to give conclusion to this issue. However, with the specimens collected, we divide the cyprinid species in northern Vietnam into 4 categories: mountainous and plateau, midland and mountainous, delta, and the widely distributed.

– The mountainous and plateau category consists of mountainous Tay Bac, Lai Chau, Son La, Nghia Lo and some near areas with Moc Chau plateau to the south, Hoang Lien Son mounts (Lao Cai) to the north with main characters of height, high speed of flowing, narrow rivers and streams with bottom rocks, cold weather. The main character of fishes is live in fast flows or have sucker such as pa xám cá (*Paradaniops macropterus*), pa xám sét (*Daniops nammuensis*), species in the genus *Garra* such as cá mỗ *Garra laichowensis*, cá mỗ ở hằng

¹⁷There are problems with percentages in this paragraph that do not add up to 100%.

(*Garra caudofasciolata*), cá bâu (*Garra bourreti*), cá do (*Ageineogarra imberbis*), species in genus *Varicorhinus* such as cá Dat Trang (*Varicorhinus argentatus*), cá dất đỏ (*Varicorhinus erythrogenys*), cá phêng (*Varicorhinus microcorpus*), pa mi (*Crossocheilus namlenensis*), cá pòm pac (*Puntius takhoaensis*), cá trư' (*Laichowcypris dai*), pa mom (*Onychostoma macrocorpus*), pa pin (*Onychostoma brevicephalus*).

– The midland and mountainous category (or midland but close to mountainous areas) consists of species that mainly live in Viet Bac: Lao Cai, Yen Bai, Phu Tho, Ha Giang, Tuyen Quang, Cao Bang, Lang Son which include main rivers such as Thao River, Chay River, Lo River, Nang River etc. Beside these, it's worth mentioning mountainous areas along the former 4 region. The main feature of this category is smaller height and speed of flowing compared to the above category. Though the flowing speed is lower due to large river size, the speed is still quite high. The main species are those in *Labeo* such as cá hoa (*Labeo tonkinensis*), cá rằm xanh (*Labeo lemasoni*), cá my (*Labeo Graffueilli*), cá guôi (*Labeo xanthogenys*), species in genus cá bông *Spinibarbichthys* such as cá bông (*Spinibarbichthys denticulatus*), cá cay (*Spinibarbichthys macracanthus*), cá Chay dat (*Spinibarbus caldwelli*), species in type cá Chat *Lissochilus* such as cá chat trang (*Lissochilus krempfi*), cá Chat rau (*Lissochilus longibarbis*), cá Dat ko (*Lissochilus brevispinus*), cá chat soc (*Lissochilus laocaiensis*), cá anh vũ (*Semilabeo notabilis*).

– The delta category consists of provinces in northern delta and the former 4 region delta characterized by low scope, slow speed of flowing or even static water. Main species include cá me trang (*Hypophthalmichthys harmandi*), cá tram đen (*Mylopharyngodon piceus*), cá chay (*Squaliobarbus curriculus*), cá vên (*Megalobrama terminalis*), cá mai (*Rasborinus lineatus*), cá đầu (*Toxabramis hoedemeri*), cá như'ng (*Carassioides cantonensis*), cá ngỗng (*Culter erythropterus*).

– The widely distributed consists of species that can live in many areas with different conditions such as mountainous areas, plateaus, midlands, deltas, static water, high speed flowing etc. or live in most of these areas. The main species are cá muong (*Hemiculter leucisculus*)¹⁸, cá nhang (*Xenocypris argentea*), cá chép (*Cyprinus carpio*), cá Diec (*Carassius auratus*), cá giam dat (*Osteochilus salsburyi*), cá đòng đòng (*Puntius semifasciatus*), cá măng (*Elopichthys bambusa*), cá không (*Luciobrama macrocephalus*).

CONCLUSION

Through our studies of the components, origin, and distribution of the cyprinid species in northern Vietnam, we have the following comments:

1. The cá chép or carp family Cyprinidae in northern Vietnam is very rich with 85 species and 3 subspecies discovered so far that account for 53.5% of freshwater fishes in northern Vietnam. These species belong to 52 species, 9 subfamilies with subfamily cá trôi (Barbinae) having the most genera and species, many with economic values; cá tram (Leuciscinae) comes next, then subfamily cá trôi vên (Abramidinae), subfamily cá chép (Cyprininae), subfamily cá mè (Hypophthalmichthyinae); other subfamilies consist of fewer types and species or with less value economically. Subfamily cá vảy la or Schizothoracinae was not found.

¹⁸*Culter leucisculus* Basilevsky 1855 (type locality rivers flowing into Bay of Tschili, Peking, China).

2. The cyprinid species consist of 43 species and subspecies with economic values. Three species were introduced from China namely cá mè hoa (*Aristichthys nobilis*), cá mè trang (*Hypophthalmichthys molitrix*), and cá tram co (*Ctenopharyngodon idellus*), 2 new genera namely genus cá trũ' (*Laichowcypris*) and genus pa xam (*Paradaniops*) and 16 species and 1 subspecies newly discovered among which 1 species belongs to subfamily Cyprininae, 3 belong to subfamily Leuciscinae, 1 belongs to subfamily Barbinae, 1 subspecies belongs to subfamily Abramidinae, and 1 species belongs to subfamily Gobioninae.

3. The cyprinid species in northern Vietnam have originated from Chinese areas of Hainan, Guangdong, Guangxi, and local areas due to the geographical distance and subsequently new genera and species were originated.

4. The cyprinid species can be divided into 4 categories namely mountains and plateaus, midlands to mountains, deltas, and widely distributed. The higher the areas, the more the types and species. The lower the lands, the fewer the types and species. The main reasons being the differences in elevation, flow, food sources, and temperature though not very obvious.

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