A STUDY OF THE GENERA OF BOTIINAE AND COBITINAE (PISCES, OSTARIOPHYSI, COBITIDAE)

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The fishes of the *Cobitidae* family form a group of the *Ostariophysi* which is spread exclusively throughout the Old World. Numerous studies about this group have shown that they are species with great morphological and anatomic variability. This has lead to a great number, of descriptions, often unjustifiable. Of the *Noemacheilus* genus alone, nearly one hundred species have been described, of which many are uncertain. On the other hand, descriptions are usually incomplete and most of them lack comparative data. When comparisons were made, the fact was overlooked that many genera and species may have similarities between themselves, although without direct affinities. Even attempts at establishing phylogenetical schemes for these fishes are very scarce, because very few fossils are known, and among these it is not known for certain which bloong to the loaches. It has been established that some specialized genera (*Acanthopsis*, *Acanthophthalmus*) may retain some ancestral characters. Moreover, the geographical and paleogeographical factors have been rather disregarded.

Very valuable works on morphology, physiology and systematics have been written by HORA (1922), CHRANILOV (1928), VLADYKOV (1925, 1928), FANG (1935, 1936), RENDAHL (1930, 1933 and 1948), RAMASWAMI (1953) and KOBAYASI (1954, 1956).

Without claiming to exhaust the subject, the present work is a comparative study of the genera of the subfamilies *Botiinae* and *Cobitinae*. The following genera are proposed as new: *Niwaella* (type: *Cobitis delicata* NIWA) and *Madrasia*, nomen novum pro *Jerdonia* DAY (type: *Jerdonia maculata* DAY).

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I remain much obliged to Mr. GEZA MULLER, of the Biological Institute, Mamaia-Constantza, who sent me his East-Asiatic specimens of *Misgurnus*.

Material. All the material I had at my disposal is mentioned after the diagnosis of each genus. I lacked, however, specimens of the following genera and subgenera: *Sinibotia*, *Jordonia*, *Somileptus*, *Lepidocephalus* s. str. *Paralepidocephalus* and *Eucirrichthys*.

Dr. P. BANARESCU has had the kindness to put at my disposal the material concerning loaches which he had been lent by numerous museums. Whenever it was the case, I mentioned the institution from where the examined specimens came. I take this opportunity to express my thanks to the following persons: Dr. E. TREWAVAS, of the British Museum (Natural History), Dr. E. LACHNER, of the United States National Museum, Dr. W. LADIGES, of the Hamburg Museum, Dr. H. KOBAYASI, Okazaki and Prof. G. S. MYERS, Stanford University.

In the present paper I have studied comparatively the following characters: the capsule of the air-bladder, the suborbital spine, the arrangement of the barbels around the mouth, and the struture of the mental lobes, the appearance of the scales, and sexual dimorphism. I have also given some indications on the types of pigmentation, and the position of the fins.

All the figures in this work are originals drawn after the material at my disposal.

I. COMPARATIVE OBSERVATIONS

The Gas-bladder and its Capsula. In the *Cobitidae* the gas-bladder reaches a high degree of specialization. It consists of two chambers, the anterior chamber being enclosed in an osseous and sometimes only fibrous capsule. This chamber, together with the four ossicles, *tripus*, *intercalarum*, *scaphium* and *claustrum*, constitute Weber's aparatus. In the *Cobitinae*,

the osseus capsule is formed out of the dorsal [1]) and pleural [2]) ribs of the fourth vertebra. The origin and structure of the capsule in the three subfamilies have already been studied by CHRAITLOV (1927) and RAMASWAMI (1953). In this paper I shall only give the differential charcters of the bladder in the *Botiinae* and *Cobitinae* genera.

In the *Botiinae* the anterior chamber is not always enclosed in an osseous capsule. Some species of *Leptobotia* and *Botia* have their anterior chamber covered by a fibrous capsule on top of which appear sometimes osseous elements which cover it partially or almost totally. In *Leptobotia xanthi* (Pl. I, fig. 1.) the anterior chamber lacks even the fibrous capsule. In other species, *L. elongata*, according to my material, — *L. compressicauda* and *L. rubilabris* (according to FANG, 1936) — there is only a fibrous capsule (A. Pl. I, fig. 2). In *L. elongata* the capsule is transversally elongated on the axis of the body, while the posterior chamber is relatively small. The same type of bladder appears in *Sinibotia* (FANG, 1936, p. 20, fig. 5), but here the osseous matter has a greater extension. Most of the species of the *Botia* genus have their capsule partially covered by osseous matter. Thus in *B. modesta* (Pl I, fig. 3) the osseous matter only covers the sides of the capsule. FANG ascertained the same thing in *B. kwangsiensis* and in *B. hymenophysa*. On the other hand, according to the same author, the capsule is completely osseous in *B. macracantha* BLEEKER.

In the three species of *Botia* examined by me, the posterior chamber is well developed and is connected with the anterior one by a very short tube.

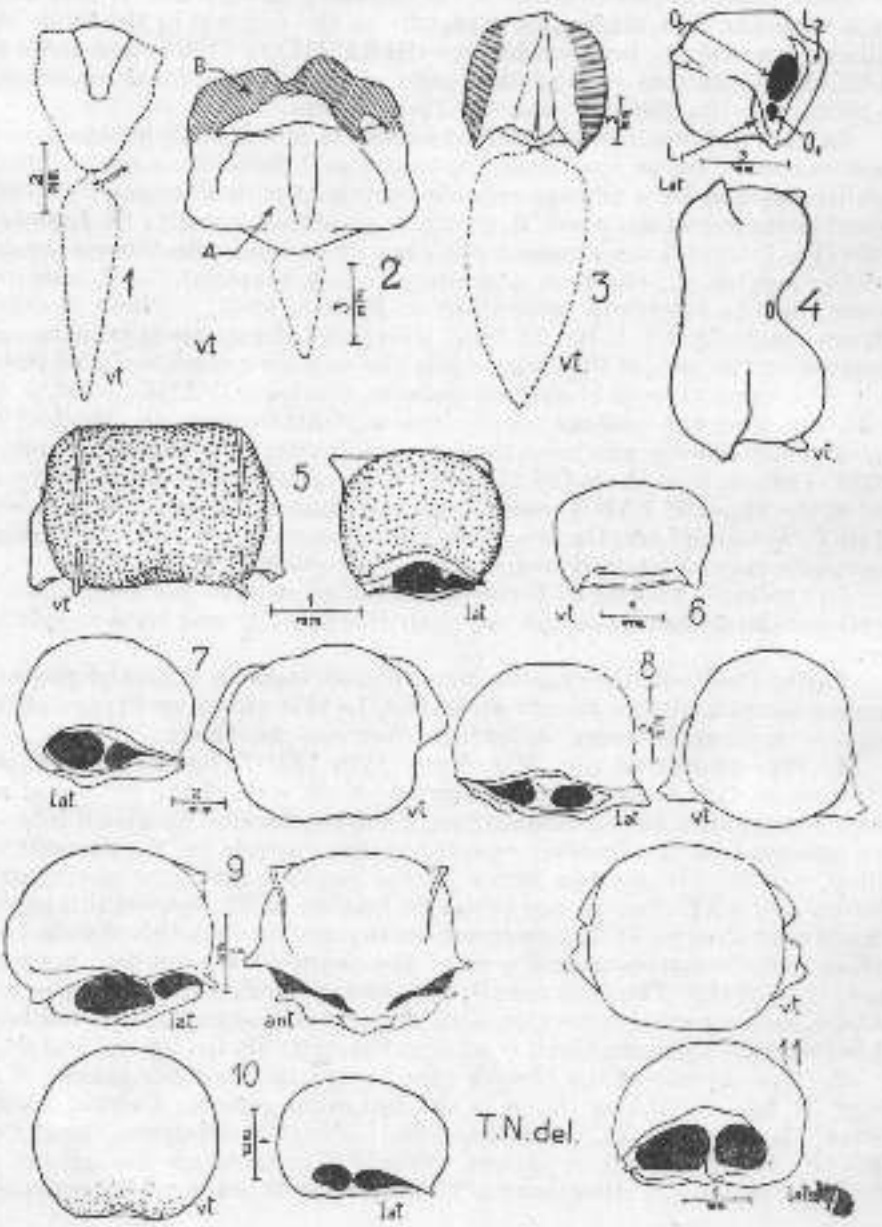
In the *Cobitinae* the capsule is completely osseous while the posterior chamber is reduced to a simple diverticle. In this group two types of capsules are noticeable, very different from one another:

1. The capsule of the *Misgurnus* type (Pl. I, fig. 4) appears only in this genus. It is trasversally elongated on the axis of the body and presents a constriction on the median line. This constriction divides it into two lobes (unequal in *M. fossilis*) resembling the capsule in *Noemacheilus*. A median septum divides the inside of the capsule into two chambers, a right one and a left one. On one prepared bladder of *M. fossilis* this septum appears very clearly. It is, however, quite possible that this should be an artefact. On the latero-ventral part of the capsule there are two apertures (fig. 4, O_1 and O_2). The first ossicle or *tripus*, penetrates through the front aperture, coming into connection with the actual bladder. Above and below and below each aperture there is a lateral osseous blade (fig. 4, 1 and 2).

2. The capsule of the *Cobitis* type is met in the other genera of *Cobitinae*. It has a globular shape in the following genera: *Cobitis*, *Sabanejewia*, *Lepidocephalus*, *Acanthopsoides*, *Acanthophthalmus*, and *Cobitophis* (Pl. I, fig. 7—11) or is transversally elongated on the axis of the body in *Niwaella* and *Acanthopsis*. The aperture through which penetrates

[1]) From the point of view of their origin, the dorsal ribs are membraneous bones. These are also called upper ribs. Sometimes they are erroneously named transverse processes or parapophysae.

[2]) From the point of view of their origin, the pleural ribs are cartilaginous bones. They are also called lower ribs, ventral ribs.



Pl. 1. — Various views of the capsule of the air — bladder. Ventral (vt), lateral(lt anterior (ant.), 1. *Leptobotia zanthi*, 2. *L. elongata* 3. *Botia modesta* 4. *Misgurnus fossilis* 5. *Acanthopsis choirorhynchis* 6. *Nimatila delicata* 7. *Sabanejewia aurata balcanica* 8. *Cobitis taenia* 9. *Acanthopsoides gracilis*. 10. *Acanthophthalmus anguillaris* 11. *Leptocephalus gunteo birmanicus*.

the *tripus* bone is prolonged even to the front part of the bladder (Pl. I. fig. 9.). The lateral blades are present.

The Suborbital Spines represent the lateral ethmoidal bones which in *Cobitinae* and *Botiinae* are mobile. Owing to a system of muscles and ligaments the two spines may be simultaneously taken out or withdrawn, thus constituting a powerful defensive weapon, especially in the species with large ones.

In the *Cobitidae* two types of suborbital spines may be distinguished — the *botinous type* (fig. 1 A) is met in *Leptobotia* and *Botia*. In this type the body the spine is elongated and slightly curved. Mesialy

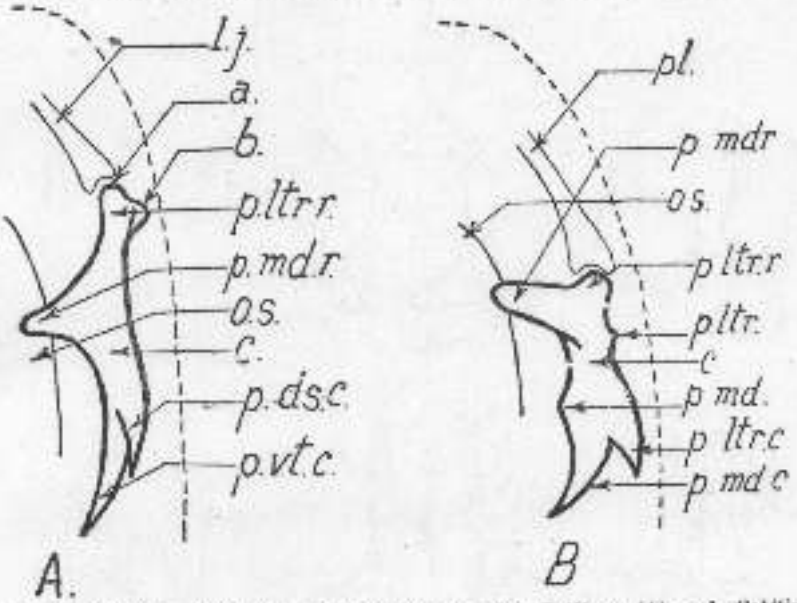
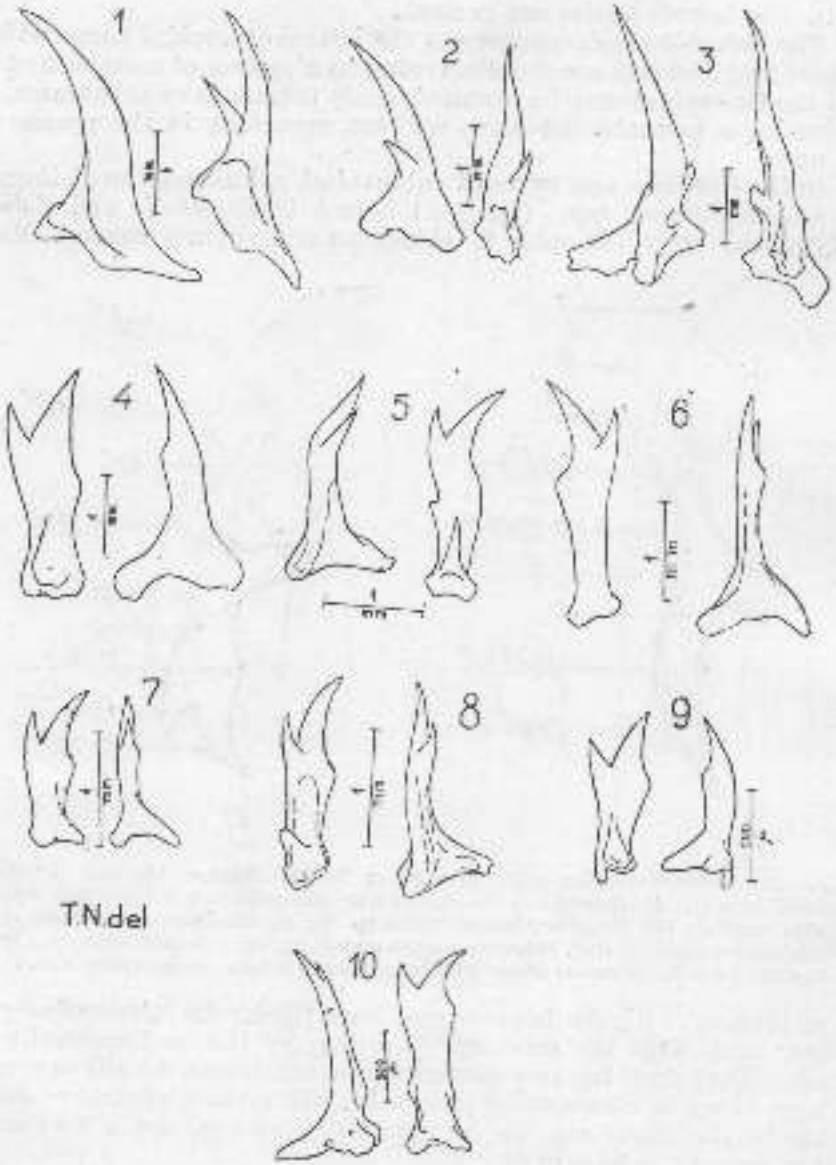


Fig. 1. — The suborbital spine and its relations to the *Botiinae* (A) and *Cobitinae* (B): Os lacrimojugale (lj). Os sphenoidale (s). Corpus ossis ectemoidalis (c.) Eminentia dorsalis (a). Eminentia ventralis (b). Processus laterorostralis (p. ltr. r). Processus mediorostralis (p. mdr). Processus dorsocaudalis (p. dsc). Processus ventrocaudalis (p. vtc.) Os palatinum (pl.). Processus medialis (p. md). Processus laterocaudalis (p. ltrc.). Processus mediocaudalis (p. mds).

it is articulated with the lacrimojugal bone (lj) by the *laterorostral process* (p. ltrr.) and with the sphenoid bone (os) by the mediorostral process (p. mdr.). Distally it has two powerful unequal thorns, usually superposed. The large thorn or *ventrocaudal process* (p. vtc.), has a ventral position relatively to the small one, or *dorsocaudal process* (p. dsc.). The latter is situated nearer the base of the spine.

In the *Botiinae* the spine is operated as follows: the abductor muscle of the spine is inserted on a precominence (*eminentia dorsalis* fig. 1 A, a.) situated on the inner part of the laterorostral process. When the abductor muscle is contracted the suborbital spine is squeezed out. At the outer end of the laterorostral process, the adductor muscle of the spine is inserted on another procminence (*eminentia ventralis* fig. 1 A, b).



Pl. 2. — *Suborbital spine.* 1. *Botia beadmorei* 2. *Leptobotia zanthi* 3. *Misgurnus fossilis* 4. *Sub. orbita balcanica* 5. *Nemacheilus delicata* 6. *Acanthopsis choirorhynchus* 7. *Acanthopsoides gracilis* 8. *Acanthophthalmus anguillaris* 9. *Ac. javanicus* 10. *Leptocephalus gunther birmanicus.*

The contraction of this muscle withdraws the spine. It may be quite possible that yet another muscle, which inserts itself on the mediorostral process, should participate in the withdrawing of the spine-In the *Botiinae* due to this system of insertion of the abductor and adductor muscles, the spine makes during its displacement a slightly helicoidal movement.

In *Leptobotia* the spine differs from that occuring in *Botia* since the dorsocaudal process is reduced or even absent. Where this process exits, it is small and close to the base of the spine. (Pl. II. fig. 2).

— the *cobitinous type* (fig. 1 B) is met in all the genera of *Cobitinae*, with the exception of *Misgurnus*. The body (c) is usually short, straight or slightly curved. Mesially it is joint through a laterorostral process (p. ltrr.) to the palatine bone (pl) while through a mediorostral process (p. medr.) it joins the orbitosphenoid bone (os). The mediorostral process is more developed in *Cobitinae* than in *Botiinae*. The thorns, that is the *mediocaudal process* (p.mdc.) and the *laterocaudal process* (p. ltrc.) have a horizontal position. From here it may be inferred that the laterocaudal process has suffered a 90° displacement as compared to the position of its homologue in the *Botiinae*, the dorsocaudal process. Two additional processes appear in the *Cobitinae* on the body of the spine, namely a *lateral process* (p. ltr.) situated on the outer edge of the spine and closer to the base, and a *medial process* (p. m.) situated on the inner edge and more distally.

Mode of operation (according to CHRANILOV, 1928): by the contraction of the abductor muscle of the palatine arch, the palatine bone reaches a position parallel to the axis of the body; at the same time it presses upon the laterorostral process, thus pushing out the distal end of the spine. The relaxing of the muscle and the contraction of the adductor muscle of the spine which inserts itself on the lateral process, cause the spine to withdraw.

In the *Botiinae* the limitation of the outward movement of the spine is made possible by a membrane which covers almost all of tis distal part, while in the *Cobitinae* the limitation of the outward movement is ensured by a ligament which inserts itself on one side into the medial process of the spine and on the other into the parasphenoid bone.

Differences in the spines of *Cobitinae* as well as their charcters are shown in Pl. II. fig. 3—10 and in the description of each genus.

In order to make a comparison as much accurate as possible, between the two types of spines, I have established, on the basis of the material which I had at my disposal, the values of the angle formed by the median line which passes through the body of the spine (fig. 2) and the straight line which connects the ends of the laterorostral and mediorostral processes. The angle examined was measured on the side of the mediorostral process. For the botiinous type the angle varies between 50° and 67°, while for the cobitinous type its values are comprised between 80° and 98°.

A position completely apart is that of the suborbital spine in the genus *Misgurnus* (Pl. II, fig. 3). In this genus it is nonfunctional, hidden under the skin, and even covered by a layer of muscles. Its characters assign it an intermediary position between the botiinous and cobitinous

types of spines. The curvature of the body and its position very close to the base of the lateralocaudal process brings it closer to the botiinous type. The angle, however, which we mentioned above, has higher values than the botiinous type, i.e. 70°—72°, and tends towards those of the cobitinous type.

The barbels and the mental lobes. The mouth has an inferior position, being more or less arched. The upper lip is prominent and usually conti-

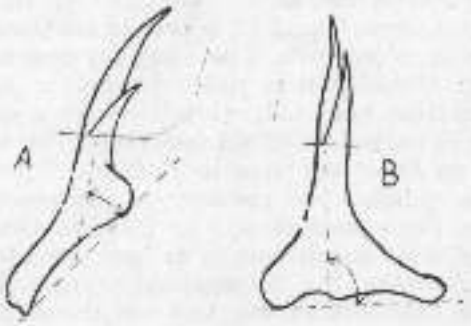


Fig. 2. — The angle between the median line of the spine and the line uniting the ends of the laterorostral and mediorostral processes.

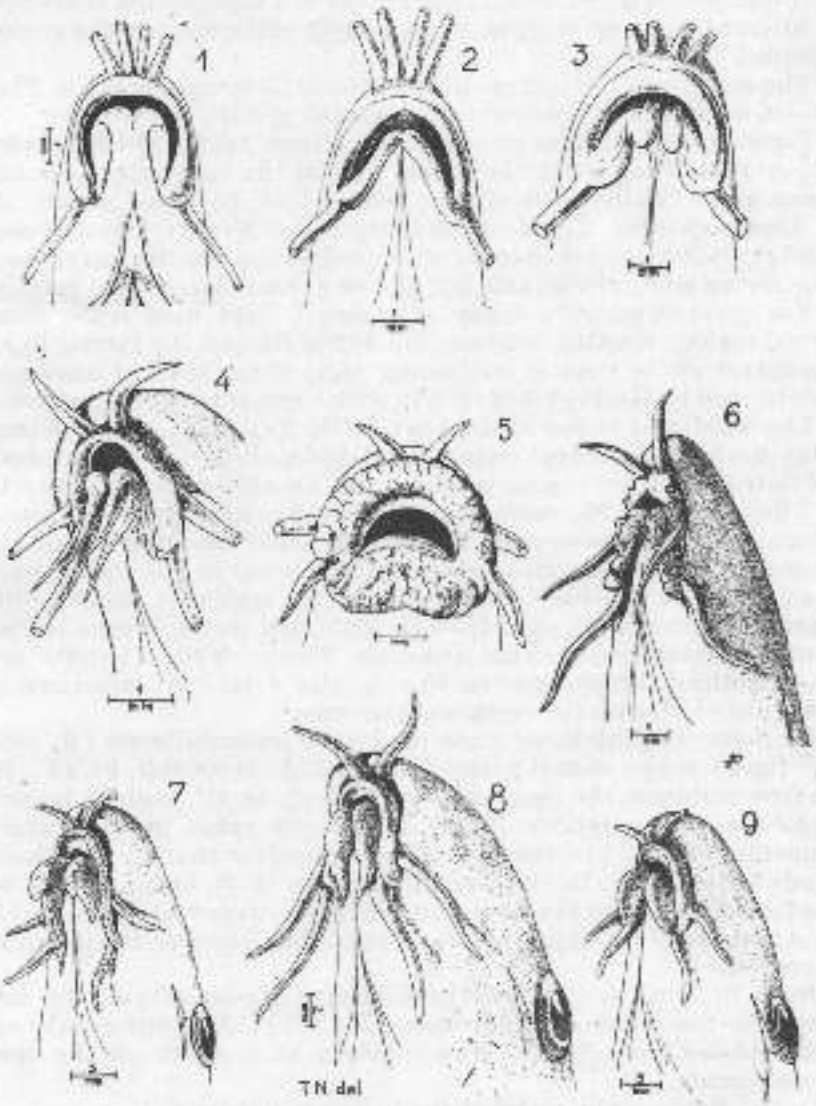
nous; the lower one does not always reach the symphysis of the mandible (*Leptobotia xanthi*, *L. elongata*, Pl. III, fig. 1). Where it reaches the symphysis of the mandible, the lip presents a short interruption. During evolution, the lower lip (beginning with the genus *Botia*) has curled up its two anterior ends, on the median line. Thous appeared the mental lobes which in many genera and species have become very complicated (*Misgurnus*, *Cobitis*, *Lepidocephalus*).

All the genera of the *Cobitidae* family have *only three pairs of barbels*. That which so far was considered as a fourth or fifth pair of barbels was actually an exaggerate development of the mental lobes. In the *Cobitidae* the barbels may have two kinds of arrangements:

1. In the *Botiinae* the are four rostrals (two pairs) very close to each other at the base, and two maxillo-mandibular barbels (one pair) placed one each at either corner of the mouth. The same pattern occurs in *Nemacheilinae* with the single difference that here the rostral barbels are slightly separated at the base, especially in the *Lefua* genus [1])
2. In the *Cobitinae* there is one pair of rostral, one of maxillary and one of maxyllo-mandibular barbels.

The mental lobes cannot be considered as barbels since they are not homologous with the barbels. The phylogenetic value of their existence, size, and pattern is restricted to the subspecific categories, and more in-

[1]) I have examined one specimen of *Lefua costata* KESSLER, of the Liung Tchou Ho river, July 14, 1927, Dr. TARANETZ, in BANARESCU's Collection as well as a specimen of *Lefua oikawai* JORDAN & FOWLER, Jubari-Gun, Hokkaido, Japan, November 1, 1950, Dr. H. KOBAYSI, in I. B. Collection Cat. No. 8181.



Pl. 3. View of the mouth with barbels and mental-lobes.
1. *Lepl. elongata* 2. *Botia berdmorei* 3. *B. modesta* 4. *Misg. fossilis.* 5. *Nemacilus delicata* 6. *Acanthopsis choirorhynchus* 7. *Achanthopsoides gracilis* 8. *Lepid. guntea birmanicus* 9. *Acanthoph. anguillaris.*

frequently to the level of the species. On the contrary, the pattern of the pairs of barbels arranged around the mouth is a more stable character, and may be considered as a good phylogenetic criterion for the genera and subfamilies.

The structural differences in the mental lobes are shown in Plate III figs. 1—9, as well as in the description of each genus.

Lepidosis. The scales are small, sometimes hardly visible, cycloidal, round, or oval. They cover the dorsal part of the body, the sides and the abdomen up to the insertion of the pectoral fins. In some genera (*Leptobotia*, *Lepidocephalus*, *Lepidocephalichthys*, and *Ewirrichthys*) the *operculum* and *preoperculum* are covered with smal scales. On the body, the scales may be imbricated, placed side by side or even isolated (not imbricated).

For the comparative study of scales, I have used scales from the subdorsal region, situated between the dorsal fin and the lateral line. As a nomenclature of the various composing parts of the scales I have adopted that established by KOBAYASI (1954), which seemed very suggestive to me

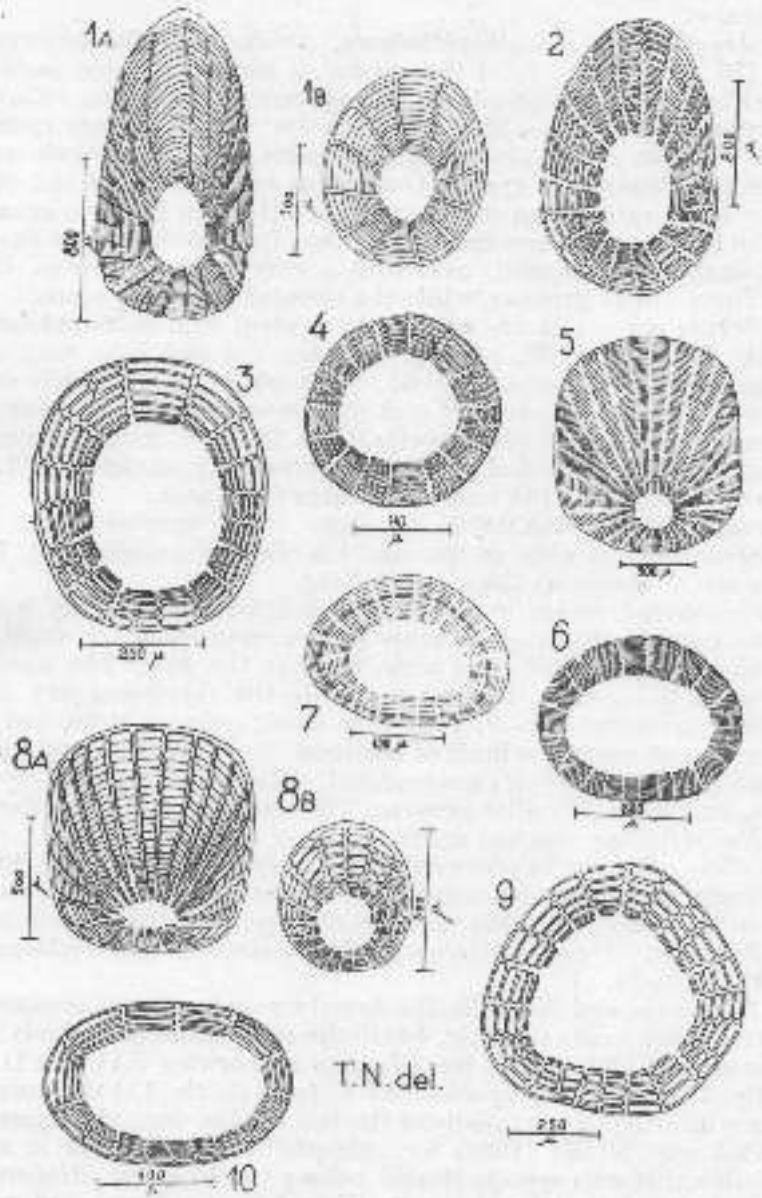
The subdorsal scales of *Leptobotia* (Pl. IV, fig. 1 A) are elongated, tapering towards the apical region (*L. elongata*, *L. curta*). Their basal edge is undulated. The focal area is small and excentric, being closer to the base. There are 15—16, more seldom 17—18, radial grooves. Numerous additional radial grooves may be noticed, some reaching almost to the focal area. The circular striae become scarce towards the apical part but are very dense at the base of the scale. The scales of cheeks (Pl. IV, 1 B) are small, round or slightly oval. Although the focal area is closer to the center, it remains somewhat excentric. There are 10—11 radial grooves and 1—2 additional radial groves. The circular striae are scarcer and homogenously distributed on the surface of the scale.

In *Botia*, the subdorsal scale may have an ovoid form (*B. modesta*, Pl. IV, fig. 2) or one almost round (*B. horae*, *B. berdmorei*, Pl. IV., fig. 3). In the first instance, the focal area is relatively small, slightly larger than in *Leptobotia*, and excentric. There are 17—19 radial grooves, and 2—3 supplementary ones. The circular striae are scarcer than in *Leptobotia* and uniformly distributed. In the second instance, in *B. horae* and *B. bermorei*, the focal area is well developed and stlightly excentric. There are 15—16 radial striae and 3—4 supplementary ones. The circular striae are relatively rarefied.

Both in *Botia* s. str. and the subgenus *Hymenophysa*, the sides of the head are not covered whith scales. FANG (1936) erroneously admits that the species belonging to *Hymenophysa* have scales on the opercula and preopercula.

In the *Botiinae* the scales of the body are imbricated.

The subdorsal scales in *Misgurnus* (Pl. IV, fig. 5) are oval ar almost round, usually with a straight basal edge. The focal area is small and excentric, close to the base. The radial grooves are relatively numerous and sometimes penetrate irregularily into the focal area. The number of supplementary radial grooves may attain 13, the minimum ascertained being 38. The circular striae are dense and uniformly distributed on the surface of the scale. In this genus the scales are imbricated. On the ventral



Pl. 4. Subdorsal scales (A) and scales form the lateral parts of the head (B). 1. *Lept. elongata* 2. *Botia berdmorei* 3. *B. morleti* 4. *B. horae* 5. *Mlsg. fossilis* 6. *Sab. aurata bulgarica* 7. *Ntwoffia delicata* 8. *Lepid. guntea birmanicus* 9. *Acanthoph. anguillaris* 10. *Acanthopsoides gracilis.*

part of *M. mizolepis*, the scales reach the isthmus. The sides of the head have no scales.

In *Acanthopsis*, *Acanthophthalmus*, *Cobitophis*, *Sabanejewia*, and *Niwaëlla* (Pl. IV, fig. 6, 7, 9) the subdorsal scales resemble each other. These are slighthy oval with a large, almost central focal area with 19—28 radial grooves (usually 22—23). There are few supplementary radial grooves. The circular striae are relatively scarce. In *Acanthopsis* as well as in most of *Sabanejewia* species (*caucasica*, *caspia*, *larvata* and in some subspecies of *S. aurata*) the scales are imbricated. In the five genera the sides of the head are not covered with scales. In *Acanthopsoides* the scales are very small, unimbricated, oval with a very large focal area (Pl. IV fig. 10). There are 15 grooves, while the circular striae are scarce.

In *Cobitis* the scales are usualy imbricated, oval or round (see BANARESCU & NALBANT, 1957, p. 287, fig. 7 a and 7 b) with a focal area either small and excentric (*Cob. taenia taenia*, *Cob. bilseli*) or large and almost central (*Cob. elongata* and *Cob. macrostigma*). The number of radial grooves varies with each species, from 19 to 37, usually from 22 to 25. The supplementary radial grooves are relatively numerous. They are scarcer in the instance of the scales with large focal area.

According to KOBAYASI, in some some species (*Cob. biwae*, *Cob. multifasciata*) the edge of the scales is slightly undulated [1]). In *Cobitis* there are no scales on the sides of head.

The subdorsal scales in *Lepidocephalichthys* (Pl. IV. fig. 8 A) are usually elongated, imbricated, of more or less rectangular, or slightly trapezoidal shape, with small focal area, close to the base. The number of radial grooves is between 21 and 43, while the supplementary grooves are relatively numerous, 5—9. There are many circular striae but sometimes they do not reach the limit of the focal area. The scales on the sides of the head (Pl. IV. fig. 8 B) are rounded, with larger, but still excentric focal area, and have 18 radial grooves. The number of the circular striae is small. *Eucirrichthys* also has scales on the of the head.

The Fins . It may be observed that the dorsal and ventral fins may have different positions with respect to one another, as well as to their position on the body. Thus the position of these fins differ much in *Misgurnus*, *Niwaëlla*, *Acanthophthalmus*, *Cobitophis* and *Eucirrichthys* from that in other genera.

In *Misgurnus* and *Niwaëlla* the dorsal fin is placed on the same vertical line of insertion as the ventrals, but in the second half of the body. In the figures given by FANG (1935) for *Misgurnus bipartitus* SAUV & DABRY (p. 137, fig. 7) and *M. dabryanus* SAUV. (p. 143. fig. 11) the dorsal and ventrals are inserted at the middle of the body. Also, from the figure given by WAKYA and MORI (1929) for „*Cobitis*" *rotundicaudata* it appears quite possible that this species should belong to the genus *Misgurnus*. It should be observed that in *Cob. rotundicaudata* the dorsal and ventrals are likevise situated at the middle of the body. According to the same

[1]) According to the same author, the scales of *Cob. taenia taenia* have a very large focal area (1956, p. 25, fig. 9).

authors, in *Cobitis multifasciata* the fins are pushed backwards, somehow recalling the position of the fins in *Acanthophtalamus*.

In *Eucirrichthys*, *Acanthophthalmus*, *Cobitophis* and sometimes in *Lepidocephalus*, both the dorsal and the ventrals are pushed backwards. Unlike in *Misgurnus* and *Nivaëlla*, in these genera the position of the dorsal is behind the ventrals. In *Acanthophthalmus* and *Cobitophis* the last dorsal ray comes sometimes in a line with the first rays of the anal fins.

In the other genera of *Cobitinae*, the dorsal and ventrals are situated about the middle of the body and generally on the same line of insertion.

As regards the shape of the caudal fin, it is well forked in the *Botiinae*, and rounded or slightly emarginate in the *Cobitinae*. The only exception known is that of *Acanthopsis* which has the caudal fin well forked, the lower lobe being longer.

The number of the branched rays in the dorsal fin varies between 7 and 13, more seldom 6 or 14, in *Botiinae*, and between 6 and 9 in *Cobitinae*. Only *Jerdonia* has about 30 branched rays in the dorsal fin, somehow resembling that of the genus *Vaillantella* FOWLER among the *Nemacheilinae*.

Colour and Pigmentation. In the *Cobitidae* two kinds of pigmentation may be distinguished: cross bands which often lend the body a striped aspect, and longitudinal rows of streakes or spots. The type of cross bands is very frequent among *Botiinae*, as it exists in numerous species of *Botia* or *Leptobotia*. In some species of *Botia* s. str. (*almorhae*, *lohachata*) this pigmentation is complicated by the anastomosis of the bands, so that a marmorean aspect of the entire surface of the body is achieved. A more particular type of pigmentation is that of *Botia sidthimunki* KLAUSEWITZ (1959) which has on the middle of tis back a dark band, with large regular white — yellowish spots in its middle. On the sides of the body there is a black, longitudinal stripe, which is discontinued from place to place in the second half of the body. This pigmentation is very peculiar Eithin the genus *Botia*, and it is therefore difficult enough to establish some connection between *B. sidthimunki* and other species. In *B. horae*, *B. modesta* and *B. lecontei* the pigmentary character indicate a particular simplification. In the first species, for instance, there is only a black median stripe on the back, which starts from the tip of the snout to the base of the caudal fin, the rest of the body remaining pale. There are also some *Cobitinae* in the pigmentation of which the type of cross bands is met, as in the case of *Acanthophthalmus kuhli* CUV. & VAL., *A. shelfordi* POPTA, *A. semicinctus* FRAS. — BRUNN., *A. robiginosus* RAUT and *A. cuneovirgatus* RAUT. *Cobitis multifasciata* WAKYA & MORI has a similar pigmentation, but the disposition of the dorsal and ventral fins on the body and the type of pigmentation prove that this interesting form does not belong to the genus *Cobitis*.

In some of the *Misgurnus* species, the pigmentation has a peculiar character by the existnece of some round spots irregularily disposed on the whole body (*M. mizolepis fukien* NICH., *M. miz. hainan*, NICH., *M. mohoity leopardus* (NICH.)

In the other genera, *Misgurnus*, *Cobitis*, *Sabanejewia*, *Nicaëlla*, *Lepidocephalus*, the type of pigmentation is almost unique. On the back and sides there are longitudinal rows of spots, variable in number and dimensions. Between these two rows appears a dorsolateral pigmentation, consisting of smaller spots. In *Cobitis* s. str. this dorsolateral pigmentation is complicated in the form of longitudinal rows of spots which have been very well described by GAMBETTA (1934).

Another pigmentary character which appears relatively constant in many species, is the presence of a black spot in the upper part of the base of the caudal fin. In *Sabanejewia* this black spot is replaced by a brown cross stripe or by two dark spots, one on the upper and the other on the lower part of the base of the caudal fin. The colours of the bands or spots on the body are generally gray, blue-gray, brown or black. The general colour of the body is uniformly yellowish, pink or whitish. In *Sabanejewia aurata bulgarica* a very beautiful brown-purplsh pigment appears on the whole body. It should be noted, that of all the races of the *S. aurata* species, only *bulgarica* has this pigmentation. In some tropical genera, *Botia*, *Acanthophthalmus*, the colour are very vivid with contrasting combinations such as red and blak or orange and black or organge, red and black.

Sexual Dimorphism. The secondary sexual characters could only be discerned in a few genera, in which they are more clearly expressed and especially in the breeding period. So far, the diffferences between the two sexes are not known or are uncertain in the following genera: *Leptobotia*, *Botia*, *Serdonia*, *Nicaëlla*, *Somileptus*, *Acanthopsis*, *Acanthopsoides*, *Lepidocephalus* (Sensu lato), *Paralepidocephalus* and *Eucirrichthys*. The secondary sexual characters appear under several aspects, of which some may appear simultaneously in the same genus and even in the same species, as follows.

♂♂ have the last pectoral ray ossified. Also the last ventral ray is slightly ossified. This character is met in *Lepidocephalus*.

♂♂ have the second pectoral ray longer and thicker. This character is met in *Misgurnus mizolepis*, *M. anguillicaudatus*, *Cobitis taenia*, *Cob. hassi*, *Cob. bivae*, *Cob. misgurnoides*, *Acanthophthalmus*.

♂♂ have an osseous process, [1]) the *lamina circularis* or *Canestrini's* scale at the base of the second pectoral ray. In *Misg. eriksoni* (afer RENDAHL, 1930, p. 20, fig. 20) *Cob. taenia*, *Cob. bivae*, *Cob. misgurnoides* (in the last species, after RENDAHL, 1944, p. 24, fig. 12).

♂♂ have an obvious protuberance on the sides of the body, somhow in front of the dorsal and ventral fins, especially in the breeding period. In *Misg. anguillicaudatus* and all the species of the genus *Sabanejewia* (see also OLIVA and collaborators, 1952, and BACESCU, 1943, 1961).

♂♂ are smaller than ♀♀: in the species of the genus *Botia* (?), *Cob. taenia*, *Cob.* (*Acanestrinia*) *elongata*, *Acanthopsis*, and *Nicaëlla*.

[1]) According to BACESCU (1961 a) the subgenus *Nicanestrinia* (type *Cobitis stumpfi-ctspina* HANKO), has two processes at the base of the second pectoral ray.

In addition to these characters the males may sometimes be distinguished from the females by their more vivid colouring during the breeding period. This is observed in some tropical genera (*Botia*, *Acanthophthalmus*).

In a study of *Misgurnus anguillicaudatus* from Japan, KUBOTA (1961) points out that in this species the secondary sexual characters show themselves under several aspects, in the same specimen. He says:

„I. For the dorsal, pectoral, pelvic anal and caudal fins, the males is superior to female in length.

II. The barbels are also longer in male than in female.

III. The base of anal fin is also longer in male as in the case of I.

IV. The caudal peduncle is higher in male.

V. Dorsal fin is inserted from more posterior part in female.

VI. Body is wider, base of dorsal fin is shorter, anal and pelvic fins and vent are all situated in more posterior part in female than in male, although these sexual differences are by no means so significant statistically".

II. DIAGNOSIS OF THE GENERA

In the diagnosis of the genera are included my own observations implemented by other authors'data which I considered justified. Where I had no material, the diagnoses have been reproduced from the works I had at my disposal.

Subfam. **BOTIINAE**

1. **Leptobotia** BLEEKER

Leptobotia BLEEKER, Verslag. Meded. Akad. Wetensch., Amsterdam. Afd. Natuurk., 1870, IV (2), p. 256. Type: *Botia elongata* BLKR., monotypic.

Fig. 3. *Leptobotia elongata* (BLEEKER), Yangtse-ho, Hupeh prov., China.

Body elongated, compressed, seldom cylindrical. Head slightly coconical with snout elongated. The mouth with six barbels, four rostral and two maxillomandibular. Mental lobes lacking. Suborbital spine relatively small, simple or bifid and in this case with dorsocaudal process small and close to the base. Mesethmoid bone is fixed. Anterior chamber of the air-bladder is covered by a fibrous capsule or more seldom uncovered. Posterior chamber may be enlarged or reduced. Dorsal and ven-

trals are inserted about the middle of the body, generally on the same line. Caudal well forekd. Anal orifice situated in the middle of the V—A space or closer to the anal. Body covered with small but visible scales, ovoid, imbricated, with a small focal area, close to the base. Sides of the head always covered with small, relatively round scales. Lateral line axial and reaches base of caudal. Sexual dimorphism not evident.

Total length up to 300 mm.

Observation. According to OKADA's description (1960) of *Hymenophysa curta* and the specimen I had at my disposal, *Botia (H.) curta* TEM. SCHL. of Japan, also belongs to this genus.

Material. *Leptobotia elongata* BLKR ., one 160 mm, standard length Iang Tse-hu lake, Sechwan, China, no date, H.W.WU.

Leptobotia xanthi GUNTHER, two 31.0 and 76.5 mm, std. 1., Amur river, U.S.S.R., no locality and date.

Leptobotia curta TEM. & SCHL., one 146.0 mm std. 1., Riwa lake, Honsu, Japan, no date, H. KOBAYASI, Inst. Biol. Cat. No. 8141.

2. Botia GRAY

Botia GRAY, Zool. Miscell., 1831, p. 8. Type: *Botia almorhae* GRAY, monotypic.

Body elongated or relatively tall, laterally compressed. Head moderately elongated. Mouth with six barbels of which four rostral and two maxillo-mandibular. Strong suborbital spine, always bifide. Anterior chamber of air-bladder covered by fibrous capsule above which is an osseous one, covering it to a greater or smaller degree. Posterior chamber free, usually developed. Dorsal and ventrals situated in the middle of the body Caudal well forked. Anal orifice situated closer to anal. Body covered with small, ovoid or rounded, imbricated scales, with relatively small central or eccentric focal area. Sides of the head never covered with scales. Lateral line axial. Sexual dimorphism not evident.

Length, up to 300 mm.

Three subgenera are known.

Botia GRAY, s. str.

Botia GRAY, loc. cit. Type *Botia almorhae* GRAY, monotipic.

Mental lobes well developed have the form of barbels. Fontanelle present on top of cranium (FANG, 1936). Anterior chamber of the air-bladder covered almost completely by osseous capsule. Posterior chamber developed.

Material: *Botia almorhae* GRAY, Deutsche Indien Expedition 1955—1958, Nr. 631, one 88.0 mm. std. 1., Kaziranga, Mikir Hills, Assam, India, February 16, 1957.

Botia dario HAM.-BUCH. Deutsche Indien Expedition 1955—1958, Nr. 892, one 61.1 mm std. 1., same locality and date as *B. almorhae*; Deutsche Indien Expedition, Nr. 1290, one 54.5 mm std. 1., Palashari, Brahmaputra, Assam, India, February 26, 1957.

Hymenophysa BLEEKER

Hymenophysa BLEEKER (pro *Hymenophysa* Mc. CLELLAND, 1839) Versl. Meded. Akad. Amsterdam, 1865, XV, p. 34. Type: *Cobitis hymenophysa*, BLKR., tautotypic.

Mental lobes absent or present, in last case very small, not having the aspect of barbels. Fontanelle present on top of cranium. Anterior chamber of air-bladder incompletely covered by osseous capsule. Posterior chamber developed.

Material. *Botia berdmorei* (BLYTH), three 62.1 — 68.0 mm std. l., Meping river at Chieng Mai, North Thailand, January 22, 1933, R.M. de SCHAUENSEE.

Botia modesta BLEEKER, one 62.1 mm std. l., Bangkok, Thailand, Sept. 24, 1934, R.M. de SCHAUENSEE.

Botia horae H.M. SMITH, two 22.5 — 31.0 mm std. l., Meping river at Chieng Mai, North Thailand, January 25, R.M. de SCHAUENSEE.

Sinibotia FANG

Sinibotia FANG, Sinensia, 1936, VII, 1, p. 19 Type: *Botia superciliaris* GÜNTHER, monotypic.

Mental lobes have the form of papillae. Fontanelle on the top of cranium, usually absent. Anterior chamber of the air-bladder completely enclosed in an osseous capsule. Posterior chamber reduced. Suborbitar spine with dorsocaudal process small and close to base.

Subfam. **COBITINAE**

3. **Misgurnus** LACÉPÈDE

Misgurnus LACEPEDE Hist. Nat. Poissons, 1803, V, p. 16, Type: *Cobitis fossilis* LINNAEUS, monotypic.

Body elongated and compressed with relatively small head. Lower mouth with six barbels, two of which are rostral, two maxillary and two maxillo-mandibular. Two pairs of mental lobes very well developed. Suborbital spine non-functional situated under a layer of muscles, is bifid with dorsocaudal process close to base. Subtemporal fossae and epiotic bones present. Anterior chamber of airbladder completely covered by osseous capsule, presents on its median line an evident strangulation Posterior chamber rudimentary. Dorsal and ventrales on the same line of insertion, usually situated in second half of body, more seldom in its middle. Caudal fin rounded. Between dorsal and caudal, and between anal and caudal there is almost always a carina. The anal orifice close to anal fin. Scales visibly oval or rounded, imbricated, with small eccentric focal area. They do not cover sides of head. Lateral line very short, not exceeding length of pectoral.

Sexual dimorphism: ♂♂ have thicker second ray of pectorals during breeding. An osseous process, *lamina circularis*, may exist at base of this ray. Sometimes ♂♂ may also present a protuberance on each side of body, in front of dorsal fin.

Length up to 300 mm.

Observation. FANG (1935) shows that in some specimens of *Misgurnus*, the scales may may be placed isolately, without being imbricated. In the same work, from the figures given for *M. bipartitus* and *M. dabryanus* it ensues that in these two species the dorsal and ventrals are placed at the middle of the body, and the anal orifice in the middle of the V—A space.

Material: *Misgurnus fossilis* LINNAEUS one 135,7 mm std. l., Comana, cca 25 km South of Bucarest, Roumania, 1955, V. DECU; one 96.3 mm std. l., Dimbovitza river at Bucarest, Roumania, March 1955, T. NALBANT.

Misgurnus anguillicaudatus CANTOR, eleven 96.0—106.5 mm std.l., Hyogo Prefecrure, Japan, no date, K. UCHIHASHI; one 164.0 mm std. l., Nagasaki Prefecture, Japan, no date, K. UCHIHASHI; one 170.5 mm std. l., Amur river, East USSR, no locality and date.

Misgurnus mizolepis GUNTHER, two 80.0—90.3 mm. std. l., Viêt-Nam, no locality and date, DAO VAN TIEN (I.E. Cat. Nr. 631 1—2).

4. Cobitis LINNAEUS *)

Cobitis LINNAEUS, Sistema Naturae, 1758, ed. X, p. 303, Type: *Cobitis taenia* L., orthotypic.

Body slightly elongated and compressed. Lower mouth with six barbels of which two rostral, two maxillar and two maxillomandibular. Mental lobes may be small or developed. Suborbital spine present, thin or thick, straight or slightly curved. Anterior chamber of the air-bladder enclosed in a bony capsule of globular form. Posterior chamber rudimentary. Epiotic bones and subtemporal fossae present. Dorsal and ventrals generally situated in middle of body, usually on same line of insertion. Caudal fin truncated. Anal orifice close to anal fin. Small scales imbricated or not, with small and eccentric, or large and central focal area. Operculs and praeopercula without scales. Lateral line reduced, does not exceed length of pectoral.

Sexual dimorphism: ♂♂ usually smaller than ♀♀. They have the second pectoral ray longer and thicker with an osseous process at the base (*lamina circularis*).

Observation. Neacanthopsis gracilentus H.M. SMITH is synonimous with *Cobitis misgurnoides* REINDAHL.

Material: *Cobitis taenia* LINNAEUS, one 89.8 mm std. l., Wien, Austria no date; Three ♂♂ 47.0—60.3 mm std. l., Corunca river, near Tirgul-Mures, Transylvania, Roumania, April. 10, 1955, I.E. FUHN.

Cobitis taenia ssp. five 46.7—57.8 mm std. l., Italy, no locality and date, G. ZANANDREA.

Cobitis taenia paludicola DE BUEN, S.M.F. 4923, one 42.3 mm std. l., Coto Rociana, Huelva, Spain, June 14, 1959, K. KLEMMER.

* Lately, BACESCU (1961) has proposed for the genus *Cobitis* three new subgenera: *Acanestrinia* (type *Cob. elongata*), *Iberocobitis* (type *Cob. paludicola*) and *Bicanestrinia* (type *Cob. simplicispina*)

Cobitis taenia dolichorhynchus NICHOLS, Stanford University 32613, four 61.0—91.0 mm. std. l., Ningpo, Chekiang, China, October 18, 1936, A. W. HERRE.

Cobitis haasi KLAUSEWITZ, S.M.F. 3221 (*Paralypi*) two ♀♀ 65.0 and 66.0 mm std. l. Silla at Valencia, Spain, July 30, 1917, F. HAAS.

Cobitis similplicispina HANKO, British Museum (N.H.), 1927,5.7.7—8, two 44.0—50.7 mm std. l., Emir Gheul (Mohan Gheul), Angora, Turkey, G. de KERVILLE.

Cobitis biwae TEM. & SCHL., British Museum (N.H.) 1903.6.7.79—81, three 52.0—72.5 mm. std. l., Totori, Japan, June 7, 1903, GORDON SMITH; U.S.N.M. 71096, one ♂ 52.0 mm. std. l.; Nanas, Japan, 1906, *Albatross* collection.

Cobitis elongata elongata HECK. & KNER, fifteen ♂♂, ♀♀ 113.0—149.0 mm std. l., Nera river at Sasca Montană, Banat, Roumania, August 22, 1956, P. BANARESCU and T. NALBANT.

Cobitis elongata bilseli BATTALGIL, Zool. Staatinst. Mus. Hamburg, one 172.6 mm. std. l., Beishehir gölü Turkey; Mus. Torino, one 192.6 mm. std. l., Beishehir gölü, Turkey, August 7, 1951, E. TORTONESE.

Cobitis elongata macrostigma DABRY, two 136.0—139.0 mm. std. l., Tang-tse-hu lake, Hupeh, China, no data, H.W.Wu.

Cobitis (taenia ssp.?) British Museum (N.H.), 1905.2.4. 135—136 two 62.5—64.5 mm std. l., Matsushima, Rikunen, Japan.

5. Subanejewia VLADYKOV

Subanejewia VLADYKOV, Bull. Mus. Nation. Hist. Natur. Paris, 1928, I, (2), p. 86. Type: *Cobitis balcanica* KARAMAN, orthotypic.

It differs from *Cobitis* by following characters: stronger suborbital spine, mental lobes developed, unfringed or well fringed (NALBANT, 1957, p. 210, fig. 3). Sexual dimorphism represented in ♂♂ by a protuberance on each side of body in front of dorsal and ventrals. In ♂♂ of *Subanejewia, lamina circularis* lacking. Scales may imbricated or unimbricated, but always with relatively large and central focal area.

Length up to 140 mm.

Material: *Subanejewia aurata aurata* (DE FILIPPI), two 47.7 and 62.3 mm std. l., Murgab river, Sout-East Caspia, 1892, ZAROUDNY; British Museum (N.H.) 1923, 3.5.9., one 42.4 mm std. l., Basra, Iraq, Bombay Nat. Hist. Soc.

Subanejewia aurata aralensis (KESSLER), two 40.5 and 46.8 mm std., l., Delta of Amu-Darjia river, USSR, June 12, 1928.

Subanejewia aurata bulgarica (DRENSKY), five 46.1—80.4 mm std., l., Argesh river at Oltenitza, Roumania, 1956, P. BANARESCU.

Subanejewia aurata balcanica (KARAMAN), ten 44.1—65.0 mm std. l., Nera river at Sasca Montana, South Banat, Roumania, no date,

P. BANARESCU; seven 58.5—68.0 mm. std. l., Tîrnava Mare river at Sighişoara, Transylvania, Roumania, no date, P. BANARESCU.

Sabanejewia aurata radnensis (JASZFALUSI), one 81.0 mm std. l., Mureş river, at Brîncovenești, Transylvania, Roumania, 1958, P. BANARESCU.

Sabanejewia aurata vallachica (NALBANT), twenty-seven 30.1—68.4 mm std. l., Ialomitza river at Crivina, Roumania, Sept. 21, 1951 P. BANARESCU (Paratypi); eleven 41.7—59.5 mm. std. l., Argeş river at Cornet Roumania, Oct. 1954, P. BANARESCU (Paratypi).

Sabanejewia romanica (BACESCU), five 49.5—92 mm. std. l., Berin river at Orăştie, Transylvania, Roumania, no date, P. BANARESCU.

Sabanejewia caucasica (BERG), one 81.9 mm std. l., Tcheldyrka river, Caucasus, USSR, no date.

6. Niwaëlla new genus

Type of Genus: *Cobitis delicta* NIWA, 1937

Elongated, slightly compressed body. Small head. Anterior nasal tube slightly distant from the posterior orifice. Lower mouth with six barbels of which two rostral, two maxillary and two maxillo-mandibular. Barbels relatively short and equal. Broad upper lip is continued by lower one, which is slightly broader, rounded, without individualized mental lobes. Whole aspect of mouth resembles sucker. On surface of lips numerous transversal wrinkles. Suborbital spine relatively thick and curved opposite the caudal processes Anterior chamber of the air-bladder completely covered by osseous capsule. The capsule is slightly elongated trasversally on axis of the body. Dorsal and ventrals approximately on same line of insertion evidently situated on second half of body. A strong carina between dorsal and caudal, as well as between anal and caudal. Anal orifice close to anal fin. Caudal truncated. Small, oval non-imbricated scales with large central focal area. No scales on head and sides of head. Lateral line short, not exceeding length of pectorals. Peritoneum black or pigmented with black or dark brown chromatophores.

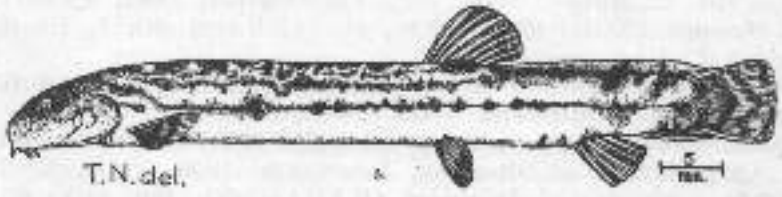


Fig. 4. *Niwaëlla delicata* (NIWA), Gifu Prefecture, Japan.

Ecological differences between
Cobitis delicata **NIWA and** *Cobitis biwae* **TEM. & SCHL.**
After Dr. H. NIWA, July 1, courtesy of Dr. P. BANARESCU

	Cobitis delicata	Cobitis biwae
Ecological distribution	Upper parts of rivers (Cold water stenothermal Polyxybiotic).	Middle or lower parts of rivers or brooks.
Food habits	Algae, especially Bacilariophyta (Diatomeae).	Small animals, Crustacea, Oligochela, Insects etc.
Spawning season	Mid- winter (January)	Late spring to mid-summer.
Breeding habits	Before the spawning season, they creep into the under stream at the bottom of rivers, and then deposit the eggs on gravel.	Before the spawning season, the parents seek the grassy slow streams, and the roots or leaves of water plants in the early morning (OKADA & SEHISHI, 1938).
Size of the ovarian mature egg.	2.0 mm.	1.15 mm.
Number of ovarian eggs	101 (T.L. 94 mm.) 210 (T.L. 113 mm) 304 (T.L.) 113 mm)	1 300 (T.L. 112 mm). 1100 (T.L. 110 mm.)

Sexual dimorphism not evident.
Length up to 115 mm.

The genus was named in honour of the Japanese ichthyologist Dr. IISASHI NIWA who, for the first time, has described this form, under the name of *Cobitis delicata*.

Observation. Dr. P. BANARESCU has had the kindness to show me a letter from Dr. H. NIWA (July, 1, 1961) in which the author of *Cobitis delicata* gives a table showing the ecological and biological differences between this species and *Cob. biwae*. I reproduce the entire synoptical table as the differences are remarkable.

Material: *Niwaëlla delicata* (NIWA), two 58.1—64.0 mm std. l., Gifu Prefecture, Honsu, Japan, no locality and date, K. UCHIHASHI; 74.3—76.0 mm std. l., Kuzuri, Honsu, Japan, no date, I.B. Collection Cat. Nr. 8133.

7. **Somileptus** SWAINSON

Somileptus SWAINSON, Hist. Classif. Fishes, 1839, II, p. 190 (as *Somileptes*, p. 311). Type: *Somileptus gongota* SWAINSON, monotypic.

As I had no material of *S. gongota*, I shall reproduce the description of this genus after DAY (1878, p. 608):

„Body elongated and compressed, dorsal profile very horizontal, snout elongated. Eyes prominent. Six barbels: four on the snout and two on the upper jaw. A small erectile, bifid, suborbital spine. Dorsal fin inserted slightly behind the ventral; caudal entire".

Observation: The arrangement of the barbels is probably the same as in other *Cobitinae*. This ensues from the figure given by DAY (1878, Pl. CLV, fig. 2). The dorsal has eight branched rays.

8. **Madrasia** new generic name

Madrasia new generic name to replace *Jerdonia* DAY, 1871, nomen praeoccupatum in Mollusca (*Jerdonia* BLANFORD, 1861).

In the absence of material, I shall present the diagnosis given by DAY (1878, p. 611):

„Body elongated and modertely compressed. Eight barbels, two of which are manidibular. A free erectile, bifid, suborbital spine. Dorsal fin long (twenty-seven branched rays), commencing before ventrals, the internal ray of pectoral fin modified into a flat osseous spine; caudal slightly emarginate".

Observation: This genus appears very aberrant by the considerable lenght of the dorsal fin, resembling in this way only to *Vaillantella* FOWLER among the *Nemacheilinae* which over 60 branched rays in the dorsal.

According to DAY's description (1878) in *Jerdonia*, the mental lobes are well developed having the aspect of barbels. It is very strange that since DAY's description, *Jerdonia* has not been found anymore (!). The name, *Madrasia*, is given after Madras province from where this loach, interesting by its characteres, has been described.

9. **Acanthopsis** VAN HASSELT

Acanthopsis VAN HASSELT, in FERUSSAC, Bul. Sci. Nat., 1824, II, p. 377. Type: *Acanthopsis dyadizona* V. HASSELT, monotypic.

Body elongated, slightly compressed, with long caudal peduncle. Snout elongated with profile of forehead slightly concave. Lower jaw with six barbels of which two rostral, two maxillar and two maxillo-mandibular. Well developed mental lobes have on their surface numerous papillae. Long, stright suborbital spine situated in frot of eye. Capsule of air bladder completely osseous being transversally elongated on body axis. Epiotic bones and subtempotal fossae absent. Dorsal fin with 7—10 branched rays situated at middle of body slightly in front of ventrals or on same line with them. Caudal well forked, usually with longer inferior lobe. Anal orifice close to anal fin. Small, oval, imbricated scales, with

large central focal area. No scales on the sides of head. Lateral line complete and axial.

Sexual dimorphism not evident ♂♂ probably smaller than ♀♀.

Lenght up to 300 mm.

Material *Acanthopsis choirorhynchus* BLEEKER, five 49.0—62.5 mm std. l., Meping river at Chieng Mai, North Thailand, February 5, 1933, R.M. de SCHAUENSEE; U.S.N.M. 103298, one 75.0 mm std. l., Tadi stream at Ban Ta Iai, Nakon, Sritamarat, Thailand, July 15, 1928, H.M. SMITH.

10. Acanthopsoides FOWLER

Acanthopsoides FOWLER, Proc. Acad. Nat. Sci. Philadelphia, 1934, LXXXVI, p.105. Type: *Acanthopsoides gracilis* FOWLER, monotypic.

Body elongated, gracile, slightly compressed, with relatively large head. Inferior mouth with six barbels of which two rostral, two maxillar and two maxillo-mandibular. Mental lobes well developed, with aspect of barbels. Suborbital spine placed below eyes, relatively short and straight. Osseous air-bladder capsule of globular form. Rudimentary posterior chamber. Dorsal placed on middle of body, approximatiely on same insertion line as ventrals. Caudal truncated or slightly emarginate. Anal orifice close to anal fin. Very small, oval, unimbricated scales with very large focal area. Sides of head bare. Lateral line incomplete (?) only visible as far as opposite dorsal fin.

Sexual dimorphism not observed.

Length 54 mm (FOWLER).

Observation. In this description, FOWLER (1934, p. 105) shows that the dorsal fin is placed behind the ventrals while the lateral line is complete and axial. In the two specimens examined by me, which may be considered as topotypes, the dorsal is placed on the same insertion line as the ventrals, while the lateral line does not exceed the middle of the body.

Material: *Acanthopsoides gracilis* FOWLER, two 28.8—37.5 mm std. l., Meping river at Chieng Mai, North Thailand, January 2, 1933, R.M. de SCHAUENSEE. Topotypic material.

11. Lepidocephalus BLEEKER

Lepidocephalus BLEEKER, Natuurk. Tijdschr. Nederl. Ind., 1858, p. 303. Type: *Cobitis macrochir* BLKR. monotypic.

Body relatively little elongated with short and compressed caudal peduncle. Inferior mouth with six barbels, two rostral, two maxillary and two maxillo-mandibular. Mental lobes well developed. Long, straight or slightly curved suborbital spine with short caudal processes. Medial process of spine evident. Osseous, globular, air-bladder capsule. Rudimentary posterior chamber. Epiotics and subtemporal fossae lacking. Dorsal fin placed on middle of body or in its second half. Ventrals on same line of insertion as dorsal, or in front of it. Caudal may be rounded,

truncated or emarginated, more seldom forked. Anal orifice closer to anal fin. Scales very visible, always imbricated, generally rectangular, with small eccentric focal area. Vertex (!) and sides of head covered with smaller, usually rounded scales. Lateral line absent. Sexual dimorphism : ♂♂ have the last pectoral ray ossified.

Length 112 mm.

To subgenera are known.

Lepidocephalus BLEEKER s. str.

Lepidocephalus BLEEKER, loc. cit. Type : *Cobitis macrochir* BLKR., monotypic.

As I had no material at my disposal, I shall reproduce BLEEKER's diagnosis (1863, vol. III, p. 4) :

„Vertex squamosus. Pinnae, dorsalis analis magis quam ventralibus approximata, ventrales in dimido corporis sitae ; pectorales falcatae. Corpus maxime compressum. Cirri 6, rostrales approximati 4, supramaxillares 2. Spec. typ. *Lepidocephalus macrochir* BLEEKER."

Observation. The arrangement of the barbels is obviously that shown in the diagnosis of the genus.

Lepidocephalichthys BLEEKER

Lepidocephalichthys BLEEKER, Versl. Medeed. Akad. Amsterdam, 1863, XV, p. 35—38. Type : *Cobitis hasselti* CUV. & VAL., monotypic.

It differs from *Lepidocephalus* s. str. by the absence of scales on vertex and a more advanced position of dorsal and ventral fins. Scales reach isthmus. Rest of characters as indicated in diagnosis of genus.

Observation. Following the examination of the *Lepidocephalichthys* I had at my disposal, I found that the positions of the dorsal and ventral fins are very variable : within the same series, some specimens had the dorsal placed behind the insertion of the ventrals, while others had it on the same line of insertion. In the figure given by BLEEKER (1863, vol. III) of *L. macrochir*, the ventrals, and especially the dorsal are placed on the second half of the body. This pleads for the separation of the genus *Lepidocephalus* into the two subgenera described above. Yet, as long as several specimens of these subgenera are not comparatively examined, their separation does not seem a certainty.

Material : *Lepidocephalus guntea guntea* HAM. — BUCH., Deutsche Indien Expedition 1955—1958, Nr. 1272, fourteen 53.2—73.0 mm std. l., Ianali river, Raimona, Goalpara, Assam, April 28, 1957.

Lepidocephalus guntea birmanicus RENDAHL, one 28.2 mm. std. l., Chantabon, S.—E. Thailand, March 1933, R.M. de SCHAUENSEE ; U.S.N.M. 107838, three 36.3—56.0 mm std. l. Sopkhap, system of Meping river at Chiengdao, Thailand, April 22, 1935, H.G. DEIGNAN.

Lepidocephalus guntea octocirrhus VAN HASSELT, one 35.0 mm std. l., Indonesia, no locality, 1879, P. BLEEKER, I.B. cat. Nr. 908. 1.

Lepidocephalus berdmorei BYLTH, Deutsche Indien Expedition 1955—1958, Nr. 667, three 33.7—36.0 mm, std. l., Ianali river, Raimona, Goalpara, Assam, April 10, 1957; Stanford University 32616, one 49.0 mm std. l., 9 miles N.W. of Hlegu, Burma, April 2, 1937, A.W. HERRE.

12. Paralepidocephalus TCHANG

Paralepidocephalus TCHANG, Bull. Fan. Memorial Inst. Biol. Peiping, (Zool.), 1935 VI, p. 17. Type: *Paralepidocephalus gui* TCHANG, monotypic.

As I had no material of this genus, I shall reproduce NICHOLS's description (1943, p. 300):

„An elongated, compressed loach with ereteile, bifid spine below eye and color pattern of *Cobitis*, without a conspicuous caudal spot. Six barbels in all, 4 on the snout and two on the maxillaries; scales lacking; origin of dorsal behind base of ventrals, caudal truncated".

Observation: The arrangement of the barbels is probably similar to that of the other *Cobitinae*. It is remarkable by the complete absence of scales, a character contrary to *Lepidocephalus* which has them relatvely large.

13. Eucirrichthys PERUGIA.

Eucirrichthys PERUGIA, Ann. Mus. Civ. Stor. Nat. Genova, 1892, XII (XXXII), p. 1009. Type: *Eucirrichthys doriae* PERUGIA, monotypic.

In the absence of material, I shall reproduce the diagnosis given by WEBER and DE BEAUFORT (1916, II, p. 26):

„Very elongate, anguilliform, slender. Eyes covered by skin, below them a strong suborbital spine. Head rounded; snout rather long bluntly rounded mouth small inferior with lobate lips. Eight barbels, two nasal ones and six around the month. Scales minute, also present below eye, on preoperculum and on upper half of operculum. Dorsal short, far backward, its last ray above first ray of anal. Pectorals with the second ray elongate, but conspicuously thickened. Ventrals very small about thrice nearer to anus than the base of pectorals. Caudal slightly emarginate. Gill openings subvertical, ending nearbase of pectorals".

Observation. From the figure presented by the same authors, it ensues that the lateral line is very short, not exceeding the length of the pectorals.

14. Acanthophthalmus VAN HASSELT

Acanthophthalmus VAN HASSELT, Algem. Konst. — en Letterbode 1823, II, p. 132. Type: *Acanthophthalmus fasciatus* V. HASSELT, monotypic.

Body elongated or very elongated, laterally compressed or subcylindrical. Small head with inferior month. Six barbels: two rostral, two maxillary and two maxillo-mandibular. Mental lobes well developed and rounded. Suborbital spine short and strong. Epiotic bones and subtemporal fossae absent. Anterior chamber of air-bladder covered by osseous capsule, posterior chamber rudimentary. Ventrals situated on second half

of body but closer to its middle. Dorsal behind ventrals, sometimes with last rays above anal. Caudal truncated. Between dorsal and caudal sometimes a carina. Scales small, slightly imbricated, nearely rounded with large and central focal area. Head and its sides bare. Lateral line short, not exceeding length of pectorals. Anal orifice close to anal fin.

Sexual dimorphism not evident.

Lenght 130 mn.

Two subgenera are known:

Acanthophthalmus VAN HASSELT s. str.

Acanthophthalmus V. HASSELT, loc. cit. Type: *A. fasciatus* V. HASS monotypic.

Body of normal length, laterally compressed. Other characters given in diagnosis of genus.

Material: *Acathophthalmus javanicus* VAN HASSELT, U.S.N.M. 117734, four 36.8—40.0 mm std. l., Menam Kon, branch of Menam Nam river, Thailand, April 20, 1936, H.G. DEIGNAN.

Acanthophthalmus semicinctus FR—BR, Stanford University 32611, four 47.2 — 53.7 mm std. l., Maway, Johore, Malay Peninsula, February 27, 1937, A.W. HERRE.

Cobitophis MYERS

Cobitophis MYERS. American Museum Novitates, 1927, No. 265, p. 4. Type: *Acanthophthalmus anguillaris* VAILLANT, orthotypic.

Body very long, anguilliform, subcylindrical, head small. The other characters correspond to those given in the diagnosis of the genus.

Material: *Acanthophthalmus anguillaris* VAILLANT, five 50.0—57.8 mm std. l., Meping river at Chieng Msi, North Thailand, December 21, 1932, R.M. de SCHAUENSEE; U.S.N.M. 103375, three 64.8—74.0 mm. std. l., Ping river, Thailand, April 22, 1935, H.G. DEIGNAN.

Acanthophthalmus muraeniformis WEB. & BEAUF., Stanford University. 31082, one 48.0 mm std. l., Gunong Pulai, Johore, 1934, M.W.F. TWEEDIE

III. GEOGRAPHICAL DISTRIBUTION.

The loaches belong exclusively to the Old World. They populate both the rapid mountain brooks and the big rivers, lakes and ponds. Most genera and species live in the tropical Indo-Malayan region. Although many species are characteristic of certain regions, their relationship proves that, at certain periods, sufficiently close connections have been kept up in those regions. When these „exchanges" of fauna have ceased to exist, due to physical barriers set up in time, the presence of some geographical races occurring as insular areas (in some instances these related forms occurat considerable distances from one another) proves

conclusively the existence of these „exchanges". Thus *Misgurnus anguillicaudatus* of Eastern Asia is considered by some authors (NIKOLSKY, MYADI and others) as a geographical race of the European *M. fossilis*. In the same way, the area of *Cobitis elongata* is divided into three or four insular areas very remote from one another. The whole area of *C. elongata* extends from Anatolia (*Cob. elongata bilseli*), over the Balkans (*Cob. elongata elongata*), Siberia (*Cob. elongata* ssp.[1]), and as far as China (*Cob. elongata macrostigma*) (See also BANARESCU and NALBANT, 1957 and BANARESCU, 1960). Thus, the present areas are the result of a long historical process of expansions, withdrawals and even disappearence of older areas. The dynamics of the expansion of the areas must be considered from the point of view of the ecological factors. Thus the spreading of some geographical races, as for instance the races of *Sabanejewia aurata*, has been effectuated by fluviatile captures of those river portions in which the population belonging to these races had their ecological optimum.

The present distribution of the loaches as well as their absence and that of their fossils from other continents (North and South America, Australia, and the greatest part of Africa) prove that it is a more recent group than the carp-like fishes and the suckers, but parhaps somewhat more recent than the *Homalopteridae*. The loaches occupy a vast territory in the Holarctic region: Europe (with the exception of Ireland, North England and North Scandinavia), Morocco, Abyssinia, Syria, Anatolia, West and Central Siberia from Irtysh to the Dvina and Petchora inclusively, and almost the whole Sino-Indian region (excluding the Philippine Islands). The center of their genesis has been SE. Asia, spreading northwards to China and Japan and through Siberia as far as Europe. Westwards spread through India into West Asia and Anatolia. The glaciations, which had been very powerful in Siberia have destroyed or pushed towards refugial — places almost the whole Siberian freshwater fauna. Later this territory has been repopulated by the present forms.

From Europe, the loaches have penetrated through Spain into N. W. Africa, and through Anatolia (or more probably through Arabia) into Palestine and as far as Abyssinia (*Noemacheilus abyssinious* BLGR).

The present distribution of the genera of *Botiinae* and *Cobitinae* is as follows:

The genus *Leptobotia* from the Amur river (*L. xanthi* and *Lept.* sp. to Iang-tse-kiang [2]). In Che-kiang *L. tschangi* and in Hunan *L. purpurea* NICH. and *L. citrauratea* NICH. In Japan, *L. curta*. The southernest species of the genus is known from Fukien, *L. compressicauda* NICH. (in NICHOLS), 1943, under the name of *Botia compressicauda*).

The genus *Botia* s. str. is known from Sumatra and Borneo islands (*B. macracantha* BLKR), Indo-China (*B. helodes* SAUV), Burma (*B. histrionica* BLYTH), and from India by numerous species and geograp-

[1] In BERG'S work (1949, vol. II, p. 813) it is mentioned under the name of *Cobitis taenia sibirica* GLADKOV.

[2] According to FANG, 1936 and NICHOLS, 1943, there are many *Leptobotia* species in China, but it is possible that most of them should be representative.

hical races (*B. almorhae*, *B. lohachata* and others). The subgenus *Hymenophysa* has a wider distribution than *Botia* s. str., reaching to the north as far as the Jang-tse-Kiang basin (*B. robusta* WU, *B. pulchra* WU and *B. zebra*). In the Malayan Arhipelago, only *B. hymenophysa*. Numerous species are known in Siam (H. M. SMITH, 1945, and KLAUSEWITZ, 1957 and 1959). According to REINDAHL (1948, p. 112) the subgenus *Hymenophysa* does not go to the West beyond the Irrawaddy basin. The subgenus *Sinibotia* is known only from China.

The genus *Misgurnus* covers Central Europe to the Volga inclusively (*M. fossilis*). It is absent in Scandinavia, Denmark, Crimea and Caucasus. After a great palearctic E—W discontinuity, this genus appears in the basin of the Amur river, and spreads southwards as far as Indo-China (*M. anguillicaudatus*, *M. mizolepis*, *M. mohoity*, *M. bipartitus* and *M. dabryanus*). In Corea, *M. anguillicaudatus* and probably under the name of *Cobitis rotundicaudata* other species of *Misgurnus*. In Japan, *M. ang. rubripinnis* TEM. & SCHL. In the Hainan island *M. mic. hainan* NICH. and *M. miz. punctatus* OSHIMA. In the Taiwan island *M. ang. formosanus* REND. is known. In Mongolia, *M. eriksoni* REND.

The largest area is that of the genus *Cobitis*; it comprises Europe (excluding N. England, N. Scandinavia), Morocco, Anatolia (*Cob. elong. bilseli*, *Cob. simplicispina* HANKO, *Cob. phrygya* BATT. and *Cob. battalgili* BACESCU), Syria, Lebanon, West Siberia (*Cob. taenia granoei* REND), North Mongolia, in the basin of Hubsugul lake (*Cob. elongata* asp.), in the basin of Baikal lake, eastwards to the Ussuri region and Sachalin island. In Japan, *Cob. taenia* with two or three geographical races, and *Cob. biwae*. In Corea, *Cob. taenia sinensis* SAUV. Throughout China (*Cob taenia dolichorhynchus* NICH., *Cob. taenia melanoleuca* NICH. *Cob. taenia sinensis* SCAV., *Cob elong. macrostigma* DABRY, *Cob. arenae* LIN). In Taiwan, *Cob. taenia dolichorhynchus*.

The genus *Sabanejewia* has generally a north aralo-ponto caspian area. Moreover, this genus has been recently signalled in the Baltic Sea-basin by its species, *S. aurata*. The genus is known from the North of Italy *S. larvata* FIL., *S. conspersa* CAN (see BACESCU, 1961 and 1962), the Balkan Peninsula (*S. aurata balcanica*), the Danube basin (*S. aurata* with four geographical races and *S. romanica*, see also NALBANT, 1957 and BANARESCU, 1960), the Don basin *S. aurata*.

The Eastern tributaries of the Black Sea (*S. caucasica*) and of the Caspian Sea (*S. aurata* and *S. caspia* EICHWALD). In Tedjen and Murgab rivers, *S. aurata*, as well as in the tributaries of the Aral Sea, Syr-Darjia and Amu-Darjia (*S. aurata aralensis*). In the Euphrate river, at Basra *S. aurata*.

The genus *Niwaella* is known from numerous rivers of the Honsu island, Japan. The genus *Somileptus* is limited to Assam, while *Madrasia* is mentioned by DAY (1878) as *Jerdonia* only in the „Madras Presidency".

[9] According to BACESCU (1961), there are in Spain three species of *Cobitis*: *Cob. taenia paludicola* DE BUEN, *Cob. hansi* KLAUS. and a new species, *Cob. calderoni* BACESCU.

The genus *Acanthopsis* is spread over Java, Sumatra, Borneo, the Malay peninsula, Siam, Burma (*A. choirorhynchus*), while in South China, in Swatow, it is represented by the *A. tachnostoma* RUTTER. A more limited area is that of *Acanthopsoides* which is being found in the Meping and Mekong basins. It is, however, possible that genus may be more widely spread.

The genus *Lepidocephalus* is known from the Indo-Malayan Archipelago (*L. macrochir*, *L. guntea octocirrhus*), Siam (*L. g. birmanicus*, *L. leniatus* FOWLER, *L. caltractus* FOWLER, *L. berdmorei*), Burma (*L. g. birmanicus* and *L. berdmorei*), India (*L. guntea guntea*, *L. berdmorei*, *L. thermalis*). In Ceylon this genus is represented by the species *L. thermalis* and *L. jonklaasi* DERANYAGALA. The genus *Paralepidocephalus* is known only from China, in the Shiping and Yunan provinces. *Eucirrhichthys* is mentioned only from Borneo, Sarawak).

Acanthophthalmus s. str. is known from Java (*A. javanicus* and *A. robiginosus* RAUT), Sumatra (*A. javanicus* and *A. kuhli sumatranus*). Borneo (*A. borneensis* BLGR., *A. shelfordi* POPTA and *A. fornuti* VEB. —BEAUF). In the Malay Peninsula it is known as *A. pahangensis* BEAUF. *A. semicinctus* and *A. cuneovirgatus* RAUT, in Siam through *A. kuhli kuhli*, *A. myersi* HARRY and *A. javanicus*, while in Burma, Assam and North Bengal through *A. pangia* HAM. — BUCH. The subgenus *Cobitophis* is known from Borneo and Sumatra (*A. anguillaris*), Malaya (*A. murceniformis* WEB. & BEAUF.) and Siam (*A. anguillaris* and *A. perakensis* HERRE).

IV. PHYLOGENY.

The attempts at establishing the phylogeny of the loaches have been particulary difficult owing to the fact that to few fossils are kown, and about many of these there cannot exist any certitude as to their belonging to the *Cobitidae* family. LAUBE (1901) quotes, after AGASSIZ and WINKLER, four species, about which it cannot be established whether they belong generically either to *Cobitis* or *Noemacheilus*. All four belong to the upper Miocene at Ohningen. In the same work LAUBE describes, from the Bohemian Oligocene, + *Noemacheilus tener* p. 139—140, Tabl. II, fig. 2—3). It is hard to establish with certitude whether this species belongs to *Noemacheilus*. Judging by the approximate shape of the body, one of the specimens seems to belong to this genus (Table II, fig. 3), though it has the caudal well forked. From the Neogene of Senogallia a species is described which is attributed to the genus *Cobitis* (+ *Cob. senogalliensis* ERASMO).

The only positive results have been obtained by LEBEDEV (1959) who has discovered numerous suborbital spines in the greenich cliffs of the Saissan Nor lake, near the sources of the Irtysh river. These spines belong undoubtedly to the *Cobitis* genus, and possibly even to some closely related species of *Cobitis taenia*. Thus it may be inferred that *Cobitis taenia* or a very closely related form of this species existed in the midd-miocene epoch.

No other fossils of *Cobitidae* are known, and which have been described as belonging to the loaches, are considered at present as being doubtful (+*Enoplophthalmus schloumbergi* SAUV. and + *Noemacheilus muscoli* PAUCA). One may ask, then : if *Cobitis* may be considered as a relatively recent genus, which existed in the midd-miocene, when and in which group of the Cyprinoid-fishes did the separation of the loaches occur ?

At present this question is difficult to answer. However, we may trust the following data as certain :

— The loaches have appeared after the *Cyprinidae* and this fact is supported by their present geographical distribution.

— The origin of the loaches must be looked for in a group of *Cyprinidae*, „the evolutionary development" of which has begun after the separation of North America from the Euro-Asiatic shield.

NICHOLS's hypothesis (1943, p. 8) of the genus *Gobiobotia* (*Cyprinidae*, *Gobioinae*) having intermediary characters between the Carp-like fishes and the loaches, seems rather interesting. The same idea had been issued earlier by LIU (1940, p. 99) in his work on the air-bladder of the *Gobioinae* :

„4. Besides the degeneration and incasement, some other characters are found in the specialized air-bladders : (1) the lateral expansion of the anterior chamber, (2) approaching of the transversal process of the second vertebra to the modified third rib, (3) the diminuation of the tripus, (4) the connection of the air-bladder with the skin through a meatus. All these modifications indicate the close relationship to *Cobitidae*.

5. When the right conception concerning the air-bladder of *Cobitidae* is apprehended, it will be found that all the specialized air-bladders of *Gobioninae* reported in this paper, including those forms without a bony capsule, apparently fall into the category of *Cobitidae*, more closely related to *Botia* group than *Nemacheilus* and *Misgurnus* groups".

Of the 11 subfamilies of the present Euro-Asiatic *Cyprinidae* only the *Gobioinae* seem closely related to the *Cobitidae* by the anatomic characters of their air-bladder and even by their external aspect. Nevertheless, the *Cobitidae* and *Gobioinae* have evolved independent of one another and their similarities are perhaps due to convergency.

What characters may have a „*phylogenetic value*" ? If the *Cobitidae* are the result of the independent evolution of a group of *Cyprinidae*, then the ancestral from of the loaches ought to have retained some cyprinoid characters too, namely :

1. body laterally compressed. 2. anterior chamber of the air bladder not covered by an osseous capsule ; posterior chamber normally developed 3. scales relatively large and imbricated 4. suborbital spine not individualized. 5. caudal fin well forked. 6. two or three pairs of barbels of which one or two pairs have a rostral position and only one pair is maxillo-mandibular 7. mental lobes absent. We shall therefore follow these characters in their evolution in the present *Botiinae* and *Cobitinae* genera. The approximation to the Cyprinid type of characters will constitute the *characters of primitivity*.

Within the *Cobitidae* family there are three main phyletic series after which, in fact, the three subfamilies, *Botiinae*, *Nemacheilinae* and *Cobitinae*, have separated themselves nomenclativelly. By their characters the *Botinae* seem the most primitive in organization : body relatively tall and compressed, the caudal fin always well forked, the suborbital spine sometimes simple, the four rostral barbels almost united at their base, in some species mental lobes absent, anterior chamber of air bladder sometimes not covered by capsule, at other times only covered by fibrous capsule. Posterior chamber often normally developed. The *Nemacheilinae* retain some of the *Botiinae* characters, with four rostral barbels, caudal sometimes forked, mental lobes absent, but with a more or less cylindrical body. The majority of the species have no suborbital spine. Anterior chamber of air-bladder usually closed within osseous capsule, while posterior one reduced in almost all the species. Within this subfamily there is already an aberrant genus, *Vaillantella* FOWLER. The *Cobitinae* subfamily comprises nowadyas the majority of the most widely spread genera. Their organisation scheme differs substantially from that of the *Botiinae* and *Nemacheilinae*. They have an elongated body, relatively little compressed, with barbels : two rostral, two maxillary and two maxillo-mandibular, with well developed mental lobes, the suborbital spine, though different in each genus, retains almost the same characters. More complicated than in *Botiinae*, the anterior chamber of the air-bladder is always enclosed within an osseous capsule, while the posterior one is reduced. The pigmentation is complicated and in many genera its pattern is set longitudinaly. For these reasons, the *Cobitinae* apper as the most evolved of the whole family.

The study of the osteology and muscles of the scapular girdle in four *Cobitidae* genera (*Leptobotia*, *Noemacheilus*, *Misgurnus* and *Cobitis*) made by RENDAHL (1933) state quite correctly that *Leptobotia* (followed in succession by *Noemacheilus*, *Misgurnus* and *Cobitis*) shows the most „general characters" and at the same time, the fewest „specialized characters". RENDAHL shows that *Leptobotia* and *Botia* are the most primitive.

In one of his studies about the scales of the *Cobitidae*, KOBAYASI (1956) assumes that loaches are derived from the old *Cyprinidae*, *Leuciscinae*, related to *Phoxinus*. The phylogenetic scheme presented by him remains partially close to RENDAHL's scheme.

As a consequence of the results obtained in connection with the structure of the air bladder capsule, the suborbital spine and the other characters which were examined, the following relative phylogeny of the genera of *Botiinae* and *Cobitinae* may be suggested :

From a common ancestor (see phylogenetic scheme), having characters close to the cyprinoid type, three evolutionary lines have risen : the series of the *Botiinae*, that of the *Nemacheilinae* and that of the *Cobitinae*. The first series, that of the *Botiinae*, retains even to — day the most primitive characters. This series is generally unitary, its genera are not much differing. The most primitive genus is *Leptobotia* : the anterior chamber of the air-bladder is incompletely coverd by capsule, which,

when it exists is fibrous; the posterior chamber remains normally developed or is very little reduced; the suborbital spine is not divided or, when it is forked, the dorsocaudal processs is close to the base; mental lobes absent. From an ancestor more closely related to *Leptobotia* has derived the present *Hymenophysa* subgenus, which has more primitive characters (smaller mental lobes, the anterior chamber of air-bladder only partially covered by osseous elements), than *Botia* s. str. but more

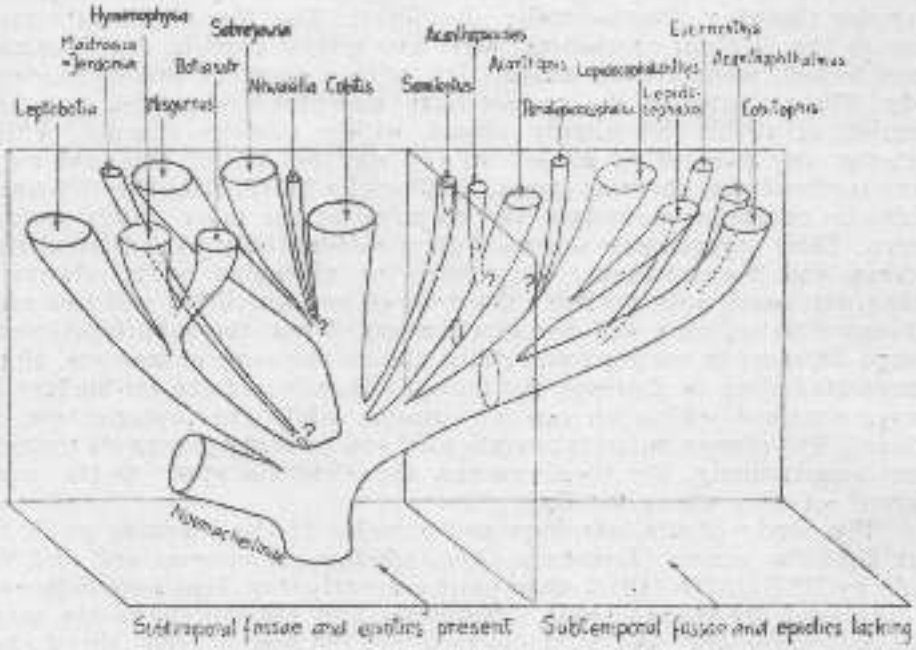


Fig. 2. Phylogenetical scheme of *Botiinae* and *Cobitinae*.

evolved than *Leptobotia*. The phyletic series of the *Nemacheilinae* appear closer to that of the *Botiinae* by a series of common craniological characters (RAMASWAMI, 1953), as well as by the characters of the *Noemacheilus cruciatus* REND, *N. masyae* H. M. SMITH and *N. binotatus* H. M. SMITH species, all belonging to the subgenus *Noemacheilus*

The phyletic series of the *Cobitinae* is not as unitary as that, three directions of evolution being discerned, which start from somwehat different levels of organization. Thus among the *Cobitinae*, *Misgurnus* appears as the primitive genus by the structure of the osseous capsule of the air bladder, which is similar to that of the *Nemacheili*, as well as by the characters of its suborbital spine. The phyletic series *Misgurnus* is the first direction of evolution within the *Cobitinae*. The phyletic series of the *Cobitis*, *Sabanejewia*, *Niwaella* group, appers with more specialized characters: generally the air-bladder capsule has a hemispherical shape, the suborbital spine and the caudal process are situated in the

distal part of the body of the spine and on a horizontal plane. The genus *Sabanejewia* has separated itself comparatively recently from the series of *Cobitis*, probably in the upper Neogene. A little before that period, evolving independently, the series of *Niwaëlla* has separated itself in Japen. The osseous capsule of this latter genus still retains, by its slight transversal elongation, the character of that of *Misgurnus*.

Because of lack of material, I cannot indicate precisely the position of *Somileptus*; however, according to RAMSWAMI (1953) this genus approaches the *Misgurnus-Cobitis* group by the presence of the epiotic bones and the subtemporal fossae, but by the structure of the upper jaw it has affinities with the *Acanthopsis* — *Acanthophthalmus* group. The phyletic series of the four genera (*Cobitis*, *Sabanejewia*, *Niwaëlla* and *Somileptus*) form the second evolutionary line.

The last evolutionary line is that of the *Acanthopsis* — *Acanthophthalmus* group, which is characterized by the strong reduction of the epiotic bones. *Acanthopsis* still retains some primitive characters: osseous air-bladder capsule transversally elongated, and well forked caudal fin. Therefore, this genus seems to have evolved first. Its ancestors probably had scales on the sides of the head, a character which maintains itself in *Lepidocephalus*, *Lepidocephalichthys* and *Eurcirrichthys*. The genus *Acanthopsoides* has probably separated itself from the *Acanthopsis* series. As compared to this, *Acanthopsoides* seems more specialized owing to the shape of the capsule. The phyletic series of *Lepidocephalus* and *Lepidocephalichthys* seems relativ ly independent because of the characters of the two genera: body relatively tall and compressed, scales on the head and its sides. The latter character is also shared by the genus *Eurcirrichthys* and links it to *Lepidocephalus*. The excessive elongation of the body as well as the very backward position of the dorsal fin, places its origin in the *Acanthophthalmus* — *Cobitophis* series. The loss of the scales from the sides of the head in *Acanthophthalmus* and *Cobitophis*, as well as the considerable elongation of the latter, points to a marked tendency to specialization in these two genera.

STUDIU ASUPRA GENURILOR SUBFAMILIILOR BOTIINAE ŞI COBITINAE (PISCES, COBITIDAE)

REZUMAT

În prezenta lucrare autorul face o revizuire critică a genurilor subfamiliilor *Botiinae* şi *Cobitinae* bazat pe caracterele morfologice ale capsulei vezicii înotătoare, oaselor suborbitale, solzilor, dispoziţia mustăţilor în jurul gurii şi conformaţia lobilor mentali, aspectele dimorfismului sexual, dînd totodată unele date asupra pigmentaţiei şi poziţiei înotătoarelor.

Sînt date diagnozele tuturor genurilor valide ale celor două subfamilii fiind descris cu această ocazie ca nou genul *Niwaëlla* (tip: *Cobitis*

delicata NIWA) şi înlocuit numele de *Serdonica* DAY care este preocupat în *Mollusca*, cu numele de *Madrasia*.

Pe baza caracterelor analizate s-au stabilit următoarele :

— Camera anterioară a vezicii înotătoare la *Botiinae* este acoperită de obicei de o capsulă fibroasă peste care apare dezvoltată mai mult sau mai puţin substanţa osoasă. Camera posterioară în general este bine dezvoltată dar sînt cazuri cînd poate fi şi redusă. Camera anterioară la *Cobitinae* este acoperită în întregime de o capsulă osoasă, de obicei de formă globulară. Camera posterioară este întotdeauna redusă.

— Spinul suborbitar la *Botiinae* este în general mai simplu conformat decît spinul de la *Cobitinae*. S-a arătat că spinul suborbitar de la *Misgurnus* este prin caracterele sale, intermediar între spinul de la *Botiinae* şi spinul de la *Cobitinae*. S-a stabilit nomenclatura diverselor părţi ale spinului, precum şi modul de lui funcţionare la *Botiinae*.

— Toate genurile familiei *Cobitidae* au numai trei perechi de mustăţi. La *Botiinae* şi *Nemacheilinae* sînt patru mustăţi rostrale şi două maxilo-mandibulare. La *Cobitinae* sînt două mustăţi rostrale, două maxilare şi două maxilo-mandibulare. Ceea ce s-a considerat o a patra sau a cincea pereche de mustăţi este dezvoltarea mai mare sau mai mică a lobilor mentali.

— Dintre *Botiinae* numai genul *Leptobotia* are laturile capului acoperite cu solzi, iar dintre *Cobitinae* au prezenţi solzi pe laturile capului genurile : *Lepidocephalus* (sensu lato) şi *Eucirrichthys*.

— Dimorfismul sexual se poate manifesta prin prezenţa la ♂♂ la baza celui de-al doilea radiu un proces osos (*lamina circularis*), a unei umflături de fiecare parte a corpului puţin înaintea înotătoarei dorsale, sau la unele specii ♂♂ sînt mai mici decît ♀♀.

Originea Cobitidelor este Asia de sud-est de unde s-au răspîndit spre nord în China, Japonia, iar prin Siberia în Europa. Spre vest au pătruns în India. Din Europa au pătruns în Africa de nord-vest (prin Spania), iar din Asia Mică în Africa de nord-est pînă în Abissinia.

— Se arată că genul cu cele mai multe caractere de primitivitate este *Leptobotia*, iar subfamilia *Botiinae* este cea mai primitivă. Din ea s-a despărţit pe de o parte ramura filetică a subfamiliei *Nemacheilinae*; iar pe de altă parte ramura subfamilei *Cobitinae*, care are reprezentanţi cu cele mai multe caractere ce presupun un stadiu mai evoluat faţă de celelalte două subfamilii.

ИССЛЕДОВАНИЯ РОДОВ ПОДСЕМЕЙСТВ BOTIINAE И COBITINAE (PISCES OSTARIOPHYSI—COBITIDAE)

РЕЗЮМЕ

В данной работе автор дает критическую проверку родов подсемейств *Botiinae* и *Cobitinae*, на основе морфологических особенностей капсюли плавательного пузыря, подорбитальных костей, чешуи, рас-

положению усиков вокруг рта и строению головных сегментов, полового диморфизма, приводя одновременно и некоторые данные в связи с пигментацией и расположением плавников.

Дается также описание всех полноценных родов вышеупомянутых двух подсемейств; при этом был описан в качестве нового рода *Nivaëlla* (тип: *Cobitis delicata*) и название *Ierdonia* перешедшее в *Molusca*, было заменено названием *Madrasia*.

На основании исследования характерных особенностей было установлено следующее:

— Передняя часть плавательного пузыря у *Botiinae* обычно покрыта волокнистым колпачком, над которым имеется более или менее развитое костное вещество. Обычно заднее отделение пузыря хорошо развито, но случается, что оно может быть и небольших размеров. У *Cobitinae* переднее отделение полностью покрыто костным колпачком, обычно шарообразной формы. Заднее отделение всегда невелико.

— У *Botiinae* подорбитальный шип обычно имеет более простое строение, чем шип у *Cobitinae*. Было указано, что у рода *Misgurnus* подорбитальный шип по своим характерным данным является промежуточным между шипом у *Botiinae* и шипом у *Cobitinae*. Была установлена и номенклатура различных частей шипа у *Botiinae*, а также и образ его функционирования.

Все роды семейства *Cobitinae* имеют только пары усов. *Botiinae* и *Nemacheilinae* имеют четыре ростральных уса и два челюстно-мандибулярных. У *Cobitinae* имеются два ростральных уса, два челюстных и два челюстно-мандибулярных. То, что раньше считалось четвертой или пятой парой усов, является более или менее развитыми усовидными продолжениями черепной коробки.

Среди *Botiinae* только у рода *Leptobotia* голова с обеих сторон покрыта чешуей, а среди *Cobitinae* чешую с обеих сторон головы имеют 2 рода: *Lepidocephalus* и *Ewirrichthys*.

Половой диморфизм выражен наличием ♂♂ у основания второго радиуса окостенения (*lamina circularis*) опухоли с обеих сторон тела, немного впереди спинного плавника, или тем, что у некоторых видов экземпляры ♂♂ меньше, чем особи ♀♀.

Местом происхождения *Cobitinae* является юго-восточная Азия, откуда они распространились к северу: в Китае и Японии, а затем через Сибирь проникли в Европу.

К западу они проникли в Индию, а из Европы проникли в северо-западную Африку, (через Испанию), а из Малой Азии в северо-восточную часть Африки, до самой Абиссинии.

— Указывается также, что родом с довольно примитивной характеристикой является *Leptobotia*, а подсемейство *Botiinae* является самым примитивным. С одной стороны от него отошла филетическая ветвь подсемейства *Nemacheilinae*, а с другой — ветвь подсемейства *Cobitinae*, представители которой находятся на более высокой стадии развития, чем представители остальных двух подсемейств.

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