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FISHES OF THE ASIAN CYPRINID GENUS *CHAGUNIUS*

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ABSTRACT.—*Rainboth, Walter John, 1986. Fishes of the Asian cyprinid fish genus Chagunius. Occ. Pap. Mus. Zool. Univ. Michigan, 712:1-17, figs. 1-3.* The barbin genus *Chagunius*, previously monotypic, is redescribed and expanded to include three species. Examination of preserved material from the known range of the genus indicates that the original member of the genus, *Chagunius chagunio* (Hamilton), is found only in the Gangetic plains of India, and two additional species are from Burma. *Chagunius nicholsi* Myers is known from the upper Irrawaddy basin of northern Burma, and *Chagunius baileyi*, described herein, is found in the Salween basin of eastern Burma and western Thailand. The Burmese species resemble each other more than either resembles the Indian species, which has pronounced differences in measurement proportions and several non-overlapping counts. These species have patterns of intestinal coiling which are among the simplest found in barbines, and the type species has a single loop, the simplest pattern found in cyprinids. The genera most closely related to *Chagunius* are parapatric, with one genus in southeastern Asia and at least one other genus in peninsular India.

Key words: *Chagunius*, *Cyprinidae*, *barbin*, *classification*, *taxonomy*, *Burma*, *India*, *Thailand*.

INTRODUCTION

The genus *Chagunius* Smith has three species, all found in different drainages, one in the Irrawaddy, one in the Brahmaputra and Ganges along the Himalaya foothills, and the third known species in the Sal-

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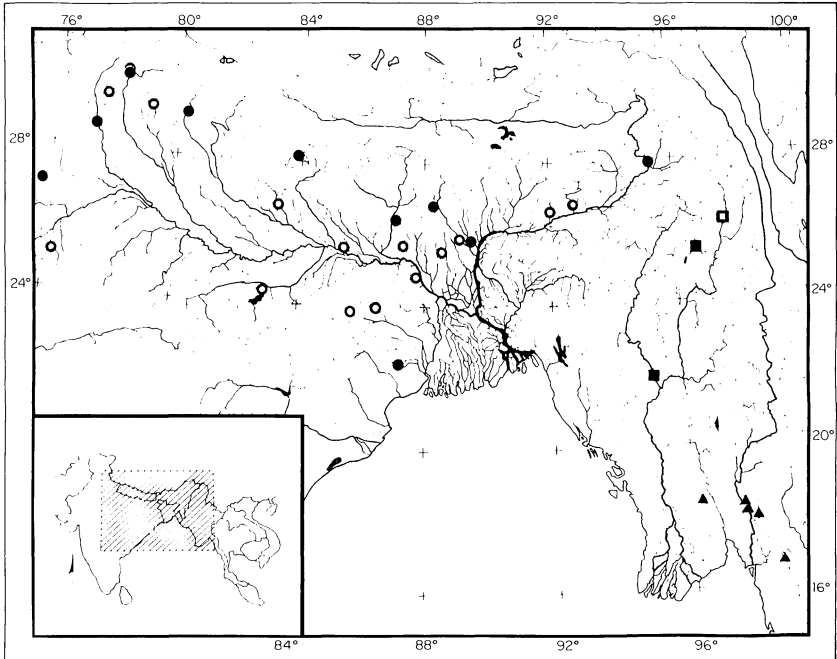


FIG. 1. Distribution of fishes of the genus *Chagunius* in Asia. Inset at lower left shows the general location. Circles represent localities of *C. chagunio* specimens examined (solid) and reported in the literature (open). Squares represent localities of *C. nicholsi* specimens examined (solid) and reported (open). Triangles represent localities of *C. baileyi* n. sp.

ween and Sitang (Fig. 1). Whether any of these species penetrate to Tibet in the upper Salween or Brahmaputra (Tsangpo) is not known. This genus was erected by Hugh M. Smith (1938) for a species which, at the time, was included in the heterogeneous generic assemblage *Barbus* in the sense of Günther (1868) and Day (1878). The type-species, from the Ganges-Brahmaputra, was originally called *Cyprinus chagunio* by Hamilton (1822). *Barbus chagunio* (Hamilton) was elevated to generic level by Smith because of its peculiar physiognomy, relative to other southeast Asian barbins.

Barbus nicholsi Myers (1924) from the Irrawaddy in Burma, belongs to *Chagunius*. However, all specimens subsequently reported from the Irrawaddy have been misidentified as *chagunio* rather than *nicholsi*. A third species, described in this paper, is found in the Salween and Sitang drainages of Burma and Thailand (Fig. 2).



FIG. 2. Holotype of *Chagunius baileyi* n. sp. UMMZ 210700, 55 mm S.L.

The species of the genus *Chagunius* bear such close resemblance to one another that without detailed examination one might assume them to be identical. However, their distinctiveness is shown by squamation and body proportion differences, as indicated in the following discussion.

MATERIALS AND METHODS

Measurements were made to the nearest 0.1 mm with dial calipers. Standard length was measured from the snout tip to the posterior edge of the urocentrum, which, in these species is .975 of the distance to the base of the caudal rays. Standard length measurements given in Prashad and Mukerji (1929) for Irrawaddy specimens were multiplied by .975 to obtain lengths equivalent to my own for statistical comparison. Predorsal length extends from tip of snout to base of first unbranched ray at fin origin. Body depth is taken from dorsal fin origin to pelvic fin insertion. Caudal peduncle length is the distance from anal fin insertion to posterior edge of urocentrum. Head length is measured from snout tip to pectoral-fin insertion. Preoccipital length, preopercular length, and snout length are measured from tip of snout to posterior edge of supraoccipital bone, posterior edge of preopercle, and anterior bony margin of eye, respectively. Orbital measurements are taken to bony margin. Head width is measured at preopercle and gape width is distance between the two articulation points of upper and lower jaws. Dorsal spine length extends from basal articulation to the first of the non-fused lepidotrichia. Other measurements displayed as proportions in Appendix I are self-explanatory.

Fin-ray counts are expressed with lower case Roman numerals signifying unbranched rays, and Arabic numerals for branched rays. The deeply divided final branched ray in both dorsal and anal fins is counted as one. Lateral-line scales were counted on body and tallied separately from those on caudal fin base. Lateral transverse counts include median scale at dorsal fin origin, lateral line with a slash (/), and median ventral row anterior to vent. Circumferential counts encircle scale row immediately anterior to dorsal and pelvic fins. Circumpeduncular counts include all scale rows around caudal peduncle at narrowest region. The number of anal scales refers to median scale rows between vent and anal fin. The two tailed *t*-test for identity of mean proportions was performed according to Simpson, et al. (1960).

The specimens at the Zoological Survey of India ZSI lot F10909/1, were identified to genus by me during a stay in Calcutta, because I was not aware at the time that *Chagunius* was anything other than a monotypic genus. They have been identified here as *C. nicholsi* because of close correspondence in body proportions to the type specimen, as is demonstrated herein.

Symbols denoting museum locations are given in the Acknowledgments along with the names of the personnel who facilitated the use of specimens.

The distribution map is part of a drainage map of the southern half of the continent drafted by the author from world-wide series 1300, 1:5,000,000-scale topographic maps prepared by the U.S. Defense Mapping Agency.

GENERIC ACCOUNT

Chagunius Smith, 1938:157(Monotype *Cyprinus chagunio* Hamilton; gender masculine)

DESCRIPTION.—Medium to large barbins of southern central Asia, inhabiting large upland rivers, and having pronounced sexual dimorphism in fin shape and tuberculation in at least one species of the three known.

The fin-ray counts are: dorsal v/8; anal iii–iv/5; pelvic i/8; pectoral i/15; caudal procurrent rays ix–x above, viii–ix below. Fin coloration same in all three species with dorsal apex darkened variably to black. Caudal fin in one species with lowermost principal ray and adjacent branched ray milky white, with rest of fin progressively darker posteriorly. Principal pectoral ray same with remainder of fin dark. Dorsal spine serrated in all species but varying considerably in strength. Dorsal-spine denticles usually strong and recurved, although weak and recurved in one species.

Scales medium to small, diamond-shaped. Pored lateral-line scales 42 to 45 on body and 2 or 3 (rarely 4) on caudal base. Some slight longitudinal scale-count variability. Greater consistency in circumferential counts. Scales medium to thin with about 9 to 17 divergent radii more than half of them primary, originating along entire base of exposed area on lateral trunk scales. Radii in lateral and anterior fields rarely present, never more than one in any non-posterior field. Circuli fine and smooth distally with scattered globular swellings spanning multiple circuli on proximal exposed surface. Circuli on unexposed area of posterior field narrow and regular. Lateral-line tubes simple, extending halfway across exposed scale, pores on short, usually ventral diversions from main tube. Scales between anus and anal fin variable, although among the higher counts for Asiatic barbins.

Gill rakers on outer edge of first ceratobranchial, each composed of slender, laterally-emerging, ossified spine with a large fleshy fold of tissue connecting the spine to the center of the ceratobranchial bone, giving a flat triangular appearance. Pharyngeal bone wide, compressed antero-posteriorly, having 3 rows (5.3.2) of broadly-faced teeth with small terminal hooks. Outer row substantially enlarged, penultimate tooth largest, with pointed rather than flattened crown. Ala expanded giving the bone a sickle shape, with teeth steeply inclined towards dorso-mesial orientation of the masticatory surface.

Lips fleshy, with loose skin appearing rough due to dense covering

with tiny papillae. Postlabial groove incomplete, no demarcation between lower lip and jaw. Lower jaw never sharp or keratinized on narrow subterminal mouth. Hyoid artery passing through hypohyal-ceratohyal junction. Eyes high, cheek deep, giving the head a high, compressed appearance.

Four long barbels always present. Tuberculation variable, ranging from extremely heavy across snout and cheek to possible absence in one species. Individual tubercles very heavy when present, leaving deep scars when shed.

Color patterns fairly regular throughout genus. Black in fins as discussed above, with black on body at scale margins, accentuated at bases giving a spotted appearance. Young with black bases of scales developing irregularly, causing random crescentic vertical streaks along upper part of body. Dark opercular bar running along first scale row from pectoral to dorsal midline. Ground color grayish, silvery below with a general pinkish tint. Fins pinkish with dorsal and caudal red.

KEY TO THE SPECIES OF *CHAGUNIUS*

- 1a. Circumferential scales 40 or more, circumpeduncular scales 23 to 25. Ganges and Bramaputra *chagunio* (Hamilton)
- 1b. Circumferential scales 36 or less, circumpeduncular scales 18 to 20. Burmese drainages 2.
 - 2a. Anal scales 2, circumferential scales 34, eye approximately 4 times in head. Irrawaddy system *nicholsi* Myers
 - 2b. Anal scales 4 or 5, circumferential scales 36 (rarely 35), eye 3.0 to 3.4 times in head. Salween and Sitang systems . . *baileyi* sp. nov.

SPECIES ACCOUNTS

Chagunius chagunio (Hamilton)

Cyprinus chagunio Hamilton, 1822:295,387 (original description, no type specimens, Yamuna River and northern rivers of Bihar and Bengal); Day, 1873:745-746 (taxonomy); Day and Hamilton, 1877:51 (Tista River, Rangpur Dist.), 65 (Purniah Dist.), 102 (Gorakpur Dist.); Hora, 1929:21, fig. 7 (publ. of Hamilton's orig. figures).

Rohita chagunio Valenciennes, 1842:257.

Barbus chagunio Bleeker, 1853:60 (synonymy); Day, 1871:637 (taxonomy); Day 1878:559, pls. 136 & 140 (synonymy, description, figures); Hora, 1928:415–417 (taxonomy, Dinajpur, Barani, Yamung R., Tista R., Kosi R.); Hora and Mukerji, 1933:137–139, 2 figs (sexual dimorphism); Hora and Mukerji, 1936:139 (feeding habits, eastern Doons); Hora, 1938:174 (Gumani R., near Dhamni, Santal Parganas); Shaw and Shebbeare, 1938:35–36 (Terai and Duars, Balasan R.); Menon, 1950:71 (Isri R., Parasnath Hills); DeWitt, 1960:72 (Pokhara and Biratnagar, Nepal).

Barbus (Barbodes) chagunio Day, 1869:373–374 (Cossye R. at Midnapore, Orissa).

Barbus (Chagunius) chagunio Hora and Gupta, 1941:79 (Kalimpong and Siliguri).

Barbus (Puntius) chagunio David, 1953:245 (Barakar, Konar, and Damodar rivers).

Chagunius chagunio Smith, 1938:157 (generic definition); Menon, 1962:26 (Gangetic distribution); Lal and Chatterjee, 1963:241 (eastern Doons); Datta and Majumdar, 1970:86 (Parwan R., Kotah Dist., Rajasthan).

Puntius chagunio Hora, 1949:2 (Rihand R.); Sehgal, 1956:720 (Tangla and Lokra, Darrang Dist., Assam); Mahajan, 1965:446 (Muzaffarnagar Dist., Uttar Pradesh).

Barbus spilopholus McClelland, 1839:272, 341–342, pl. 39 (orig. description, types in BMNH, northern Bengal; *Cyprinus chagunio* Hamilton listed as a variety); Valenciennes, 1842:171; Chaudhuri, 1913:250–251, pl. 8 (description, figures, Abor Hills, Brahmaputra R.).

Barbus spilopholis (name emendation) Günther, 1868:96 (Gong R.).

Barbus beavani Günther, 1868:96–97 (orig. description, types in BMNH, Cossye R.); Günther, 1869:136 (taxonomy); Günther, 1871:764–765 (taxonomy); Günther, 1872:875–878, 2 figs. (taxonomy).

MATERIAL EXAMINED.—INDIA: DARJEELING: FMNH 51278 (2, 118 and 148 mm SL) Svoke stream, H. Stevens, 3 XI 1930. UTTAR PRADESH: USNM 106877 (1, 173) Suswa R., Dehra Dun Dist., S.L. Hora; USNM 165096 (1, 92) Sarda R. at Tanakpur, Nainital Dist., 8 III 1949; ZSI F1503/2 (12) Sarda R. at Tanakpur, Nainital Dist.; BMNH 1889.2.1.426–428 (3, 54–77) Hardwar, F. Day. DELHI: MCZ 4226 (1, 102) Yamuna R. at Delhi, F. Day; BMNH 1889.2.1.429–430 (2, 106 and 138) Delhi, F. Day. WEST BENGAL: BMNH 1867.5.12.11,27 (2, 39 and 116) Cossye R., R. Beavan; (syntypes of *Barbus beavani* Günther). ASSAM: BMNH 1889.2.1.422 (1, 161); BMNH 1889.2.1.423–4 (4, 60–198); BMNH 1889.2.1.425 (1, 175) Suddya, F. Day; RAJASTHAN: BMNH 1889.2.1.431 (1, 191) Jeypore, F. Day; BMNH 1889.9.26.64–65 (2, 73 and 83) Deoli, Rajputana, Biddulph coll. BENGAL: BMNH 1934.10.17.39 (3, 95–138) Das coll.; ZSI F11400/1 (4) N. Bengal, Shaw and Shebbeare. BANGLADESH: RANGPUR: UMMZ 208864 (9, 19–27) Dharla R. at Kurigram, Rainboth and Rahman, 2 IV 1978. NEPAL: CAS 52919 (3, 101–179) Phewa Tal near Pokhara, A.C. Taft, 8 XI 1955; CAS 52920 (2, 101 and 103) Biratnagar area, A.C. Taft, 25–30 XI 1955.

DIAGNOSIS.—Distinguishable from other species of *Chagunius* by several scale counts: transverse scale rows 11/9, scale rows between lateral line and pelvic fin 6, circumferential scales 40 to 44, circumpenduncular scales 23 to 25, and scale rows between vent and anal fin (anal scales) 3. Proportional measurements are presented in tabular form (Appendix I).

SEXUAL DIMORPHISM.—Pronounced sexual dimorphism in tuberculation and anal fin shape. Nuptial tubercles most heavily developed in males, densely covering snout and cheek, thinning at preopercle.

Small tubercles on dorsal surface of head, spreading onto scales of the anterior dorsum. Tuberculated areas on cheek have heavy epithelium which is shed with the tubercles, causing an area of deep scars which slowly disappear. Last two anal rays elongate in males, extending to base of caudal fin. Anal fin of females uniformly curved, with no elongation of the last two elements.

Males with highly developed dimorphic characters were once thought to be a separate species, *spilopholus* M'Clelland, a tendency in classification persisting into this century (Chaudhuri, 1913) despite Day's (1878) discussion of synonymy. The seasonal development of secondary sexual characters in males occurs prior to and during the winter breeding season. It has been stated that more females of this species exist (Hora and Mukerji, 1933, 1936), but reasons for a higher proportion of females are unclear.

NATURAL HISTORY.—Hora and Mukerji (1936) discussed the basic natural history of *C. chagunio* which is found in large rivers characterized by rocky bottom, clear and fast water, and little or no vegetation. I collected juveniles in the Dharla River at Kurigram (Bangladesh), some distance from hilly areas, where the channel is sandy-bottomed with moderate current, no rapids, and has scattered clumps of submerged vascular plants, mostly *Anacharis*. None of the juveniles came from pool or backwater areas, but rather, they were taken by minnow-seine sweeps near clumps of vegetation growing in areas of stronger local current. Adults are found in habitats with stronger current than juveniles prefer, and often co-occur with large cyprinids of the genus *Tor* (David, 1953). *Chagunius chagunio* is not known to be a long-range migrant, unlike *Tor* spp., and according to Hora and Mukerji (1936), its movements are fairly restricted. It is reported to reach a maximum length of about a half-meter.

An examination of stomach contents of *C. chagunio* in the eastern Doons by Hora and Mukerji (1936) revealed a diet of insect larvae and gastropods. The alimentary tract is fairly short, about 1.7 times the body length, and of the simple S-form (Fig. 3B), type I of Kafuku (1958).

TAXONOMY.—*Chagunius chagunio* has had a complicated taxonomic history, at one time being a minor contributing factor to a series of rather acrimonious controversies between Günther and Day (Whitehead and Talwar, 1976). There was never any doubt about the synonymy of *Barbus chagunio* of Day and *Barbus beavani* of Günther. Rather, the argument was whether *Cyprinus chagunio* Hamilton was the same species as *B. chagunio* of Day, and the disagreement was not solved until this century. *Chaguni* was the only vernacular name of the

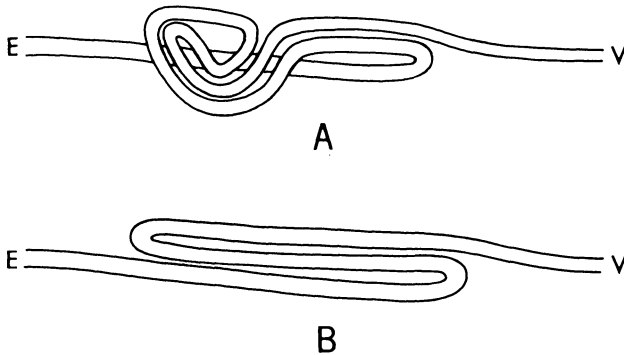


FIG. 3. Intestinal loop-patterns of *C. baileyi* (A), and *C. chagunio* (B). E means esophagus, V signifies the vent.

species *Cyprinus chagunio* given in Hamilton's (1822) book, and the original of Hamilton's unpublished figure (later published by Hora, 1929) was labelled with another name. Day did not find the vernacular name *chaguni* in Hamilton's notes although he did find three other vernacular names for the fish. The problem was solved when Hora (1928) examined Hamilton's original notes and discovered a full series of vernacular names, including *chaguni* along with the vernacular name found on the original of the figure, and the others given by Day (1873) for the species described as *Cyprinus chagunio* Hamilton.

Chagunius nicholsi (Myers)

Barbus nicholsi Myers, 1924:3-4 (orig. description, type specimen AMNH 8352, Monywa, Sagaing).

Barbus chagunio (not Hamilton) Prasad and Mukerji, 1929:195-197 (description, measurements, Namkawng Chaung, Myitkyina); Mukerji, 1934:67-68 (taxonomy, Phungkin Hka, Myitkyina).

MATERIAL EXAMINED.—BURMA: SAGAING: AMNH 8352 (1, 133 mm SL) Monywa, B. Brown, IV 1923 (holotype of *Barbus nicholsi* Myers, 1924). MYITKYINA: ZSI F10909/1 (2, 195, 210) Namkawng Chaung at Kamaeng, B.N. Chopra.

DIAGNOSIS.—This species resembles the new species *C. baileyi* more than it resembles *C. chagunio*. Important scale counts are: 34 circumferential, 20 circumpeduncular, 9 upper transverse rows and 8 lower transverse rows, and 5 scale rows between lateral line and pelvic fin. *Chagunius nicholsi* can be distinguished from *C. baileyi* by the anal-scale count which is 2 in *nicholsi*, and 4 or 5 in *baileyi*. Dorsal fin-spine weaker than in the other two species, its denticulations weak and recurved.

Measurement proportions (Appendix I) differ strongly from *C. baileyi*, with *t*-tests for differences between means exhibiting significance at $p \leq .05$ for numerous proportions. When characters (mean proportions) which already differ are supplemented with additional proportions taken from published measurements on Irrawaddy specimens by Prashad and Mukerji (1929), the probability that species means are the same decreases in all but one instance, peduncle length. Difference in method of measuring described earlier probably accounts for the disparity of results for peduncle length.

SEXUAL DIMORPHISM.—Little has been published about the pattern of sexual dimorphism in this species, although Mukerji (1934) stated that a 125-mm specimen from Phungkin Hka was a female, had no trace of tubercles or pores on the snout, and that the anal rays were not elongated as on males of *chagunio*. The type specimen has no tubercles or scars and the anal fin has no elongated rays. Whether or not this species is dimorphic cannot be determined until breeding males are found.

NATURAL HISTORY.—Prashad and Mukerji (1929) stated that this species comes from rivers and streams near Indawgyi Lake, but not from the lake itself. Its preferred habitat is expected to be like that of *C. chagunio*, discussed earlier. Mukerji (1934) reported a maximum weight of about 2 lbs (0.9 kg).

Chagunius baileyi Sp. Nov.

Figure 2

Chagunius chagunio (not Hamilton) Smith 1938:157–158 (in part definition of new genus, *Chagunius*, description); Smith, 1945:195–196 (Salween R., Huey Mekong Kha).

HOLOTYPE: UMMZ 210700 (1, 55 mm S.L.) Huey Lamao at Ban Mae Lamao, 16°48'N, 98°44'E, Tak Province, Thailand, J. Karnasuta coll. 9 III 1973.

PARATYPES: THAILAND: TAK: UMMZ 209122 (1, 52 mm S.L.) same data as holotype; NIFI 01309 (9, 44–140) same data; NRM 10437 (1, 119) Mekane, 20 Km E of Myawaddy, R. Malaise. MAEHONGSORN: UMMZ 209139 (3, 26–47) Salween R. at Mae Sam Laep, 18°09'N, 97°41'E, T. Roberts coll., VI 1973; USNM 107807 (1, 68) Salween R. at Ta Fang, Deignan and Charles colls., 14 X 1936; USNM 107808 (2, 90 and 97) Huey Mekong Kha at base of Doi Mekong Kha, Deignan coll., 18 X 1936; NIFI 01308 (1, 201) Yuam R. at Mae Sarieng, S. Ukkateawat, 2 III 1981; NIFI 01310 (39, 43–70)

Pai R. at Pang Mu, J. Karnasuta, 18 VI 1973; NIFI 00979 (4, 126–154)
Pai R. at Tung Yao, S. Ukkatewewat, 26 III 1981. BURMA: PEGU:
BMNH 1888.10.22.13–14 (2, 31 and 37) Zamayi R., Major Bingham,
IV:88.

DIAGNOSIS.—*Chagunius baileyi*, like *C. nicholsi*, is distinguished from *C. chagunio* by reduced circumferential counts: transverse scale rows 9/8, scale rows between lateral line and pelvic fin 5, circumferential scales 36 (rarely 35), and circumpeduncular scales 18 (19 or 20 less commonly). *Chagunius baileyi* can be separated from *C. nicholsi* by the presence of 4 or 5 anal scales (2 in *nicholsi*, 3 in *chagunio*). These count differences are supported by a series of proportional measurement means demonstrating significant differences between Irrawaddy and Salween specimens.

SEXUAL DIMORPHISM.—Males of *C. baileyi* may possess tubercles by the time they reach 70 mm S.L. Adult females are less extensively tuberculated. In males, larger tubercles cover the cheeks, leaving deep scars when shed. Tiny and more persistent tubercles cover the top of the head, extending from the snout to the posterior edge at the orbit. In contrast to *C. chagunio*, no lengthening of the last two anal rays is evident on any of the males examined. The maximum length known is about 200 mm S.L.

NATURAL HISTORY.—The intestine of *C. baileyi* has additional loops not found in *C. chagunio* (Figure 3). A 97 mm S.L. specimen (USNM 107808) and a 47 mm S.L. specimen (UMMZ 209139) of *C. baileyi* had similar patterns and do not seem to indicate developmental changes as reported in *Carassius* (Kafuku, 1958). A cursory examination of gut contents revealed mostly arthropod remains in small specimens with increasing amounts of fine sediment in larger specimens. Little or no plant material was found in the intestine. The holotype of *C. nicholsi* was not opened for examination of its gut and contents because the specimen is in poor shape. Its intestinal loop-pattern and dietary habits are not known.

RELATIONSHIPS

At least two genera of cyprinids of southern and southeastern Asia seem to be related fairly closely to *Chagunius*. However, these related genera are poorly understood, still undefined, and can receive only minimal clarification here.

One genus, *Gonoproktopterus* Bleeker, 1859 (type *Barbus kolus* Sykes,

by subsequent designation of Bleeker, 1860) has not been recognized since Bleeker's listing in his "Atlas Ichthyologique" (1863). Bleeker (1860, 1863) considered *Gonoproktopterus* to be a subgenus of the genus *Hypselobarbus* Bleeker, 1859 (type *Barbus mussullah* Sykes, by subsequent designation of Bleeker, 1860). Unfortunately, Bleeker probably based his image of *Barbus mussullah* on the illustration by Sykes (1841). That illustration turned out to be very misleading and *Barbus mussullah* was eventually shown to belong to the genus *Tor* Gray (Hora, 1943). Thus, *Hypselobarbus* must be placed in subjective synonymy with *Tor* Gray, leaving *Gonoproktopterus* as the only generic name applicable to this group of fishes. Members of *Gonoproktopterus* are found only in peninsular India. Species which certainly belong to this genus are *G. kolus* (Sykes), *G. curmuca* (Hamilton), *G. dubius* (Day), *G. lithopidos* (Day), *G. micropogon* (Valenciennes), *G. periyarensis* (Raj), and *G. thomasi* (Day). The taxonomy and systematics of these species are poorly known, and specimens are found in few museum collections. The geographical ranges and ranges of variation of each species, not to mention ecology and other important information, are very difficult to ascertain.

Chagunius seems to resemble *Gonoproktopterus* of peninsular India more closely than it does genera from southeastern Asia. That *C. chagunio* is similar to species of this south Indian genus was observed by Hamilton (1822) who also described *Cyprinus* (now *Gonoproktopterus*) *curmuca*. The large gill rakers, which are similar to those in species of *Chagunius*, have even more exaggerated development in *G. curmuca* and are very large throughout the genus. The shape of the fleshy lips, their dense covering with tiny papillae, as well as squamation patterns are close between the two genera. Although the dorsal fin-ray counts of the genera are different (iv/9 in *Gonoproktopterus*, v/8 in *Chagunius*) the total number of elements is the same for both. The dorsal spine of *Chagunius* is serrated in contrast to the smooth (either weak or strong) spinous first dorsal ray in *Gonoproktopterus*. *Gonoproktopterus* has different but variable tuberculation, with development in some species limited to the cheek posterior to the lacrimal groove. This is the pattern found in *Tor* and its affiliates and is not seen in genera limited to southeastern Asia. *Gonoproktopterus* species are found in large upland rivers just as are species of *Chagunius* and the overall body shapes and sizes are similar.

The most obvious differences between *Chagunius* and *Gonoproktopterus* are in the scales of the species in the two genera. Lateral trunk scales of *Chagunius* rarely have any radii, and never more than a single

radius, in any non-posterior field. *Gonoproktopterus* species have extensive radius development in the anterior and lateral fields. Further, the unexposed circuli of the posterior field are continuous, narrow and symmetric in *Chagunius*, in contrast to the discontinuous and highly irregular circuli in the same location on scales of *Gonoproktopterus*. Similar expression of this scale character is found in adults of all *Gonoproktopterus* species, although less extensive in small individuals and small-scaled species such as *G. dubius*. If a large adult of *G. dubius* is found, this character will be examined. Other species of Southern India with uncertain generic affiliation also display this character, which may be indicative of their relationship to *Gonoproktopterus*. Besides the possible relatives on the Indian Subcontinent, some species from western Asia exhibit this character such as *Carasobarbus luteus* (Heckel) and *Mesopotamichthys sharpeyi* (Günther), as well as *Labeobarbus bynni* (Forsskål) and *L. intermedius* (Rüppell) from northeastern Africa. In southeastern Asia, *Probarbus jullieni* (Sauvage) as well as other barbels display circulus development similar to *Gonoproktopterus*. Interestingly, the same pattern is found on regenerated parts of *Tor* scales, although these circuli are regular if the scale is an intact original.

Among southeastern Asian genera, a new genus with three and possibly four species is closest to *Chagunius* in several respects, and possesses a complementary distribution. The three species of the new genus have multiple rows of anal scales, fin coloration, and opercular bars as seen in *Chagunius*. The dorsal fins have weak spines which are smooth to finely serrate, the latter resembling *C. nicholsi*. The pinkish body tint is also similar, as are the triangular gill rakers which resemble juvenile *Chagunius* rakers. Species of the new genus are found in upland rivers and streams. The new genus and its relationship to *Chagunius* and *Gonoproktopterus* will be discussed in a paper now in preparation.

Although not including a large number of species, the genus *Chagunius* is one of the more interesting genera of barbels. Geographically, this genus straddles the region separating the southeastern Asian barbels from the peninsular Indian barbels. These species possess characters which may indicate intermediacy to genera of both regions. The genus *Chagunius* possibly represents the link between species grading into *Gonoproktopterus* in southern India (and through them the African large "Barbus", and *Tor* of Asia) and other groups of barbels of southeastern and eastern Asia. The possibility deserves consideration, but must await greater availability of specimens from several difficult-to-obtain species.

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APPENDIX I. Selected proportions, percent standard length.

S.L.	Ganges- Brahmaputra <i>C. chagunio</i> n=6	Salween <i>C. baileyi</i> n=8	Irrawaddy <i>C. nicholsi</i>		<i>baileyi</i> vs. <i>nicholsi</i> <i>t</i> -test, two-tailed			
	8.9–169.1 mm	42.8–137.0 mm	n = 1 ¹ 132.5 mm	n = 3 ² 190.1 mm, 204.7 mm	columns 2 and 3 df = 7		Columns 2 and 4 df = 9	
	$\bar{x} \pm s$	$\bar{x} \pm s$		$\bar{x} \pm s$	<i>t</i>	<i>P</i>	<i>t</i>	<i>P</i>
Predorsal l.	51.4 ± 1.6	52.3 ± 1.3	48.6		2.67 (<.05)			
Body depth	27.7 ± 1.1	28.8 ± 0.9	32.8	32.1 ± 0.6	4.30 (<.01)		5.92 (<.001)	
Caud. peduncle l.	16.0 ± 0.9	15.7 ± 0.8	13.0	14.4 ± 1.4	3.01 (<.02)		1.94 (<.1)	
Head l.	26.7 ± 1.7	27.0 ± 1.9	23.1	23.4 ± 0.3	1.88 (<.2)		3.11 (<.02)	
Preoccipital l.	24.4 ± 1.6	25.7 ± 2.0	20.5		2.40 (<.05)			
Preopercle l.	20.4 ± 1.6	20.3 ± 1.4	16.8		2.43 (<.05)			
Snout l.	10.8 ± 1.4	10.1 ± 1.0	8.5	8.7 ± 0.2	1.44 (<.2)		2.24 (<.1)	
Orbital w.	7.0 ± 0.7	8.4 ± 0.7	5.6	5.8 ± 0.2	3.59 (<.01)		5.94 (<.001)	
Interorbital w.	8.3 ± 0.5	8.4 ± 1.0	7.7	7.0 ± 0.7	1.47 (<.2)		2.29 (<.05)	
Head w.	13.8 ± 0.8	14.4 ± 0.9	11.9		2.69 (<.05)			
Gape w.	6.0 ± 0.7	6.3 ± 0.4	5.1		2.81 (<.05)			
Head d. at pupil	16.8 ± 0.3	17.5 ± 1.0	14.7		2.76 (<.05)			
Head d. occiput	21.3 ± 0.5	21.5 ± 0.6	19.5		2.92 (<.05)			
Maxillary barbel	7.5 ± 0.7	7.4 ± 1.0	2.8		4.35 (<.01)			
Rostral barbel	6.6 ± 1.2	6.7 ± 1.0	2.8		3.68 (<.01)			
Dorsal fin height	23.9 ± 3.0	21.8 ± 1.0	18.3		3.15 (<.02)			
Dorsal spine l.	22.3 ± 2.7	17.7 ± 1.4	12.7		3.36 (<.02)			
Pectoral fin l.	21.5 ± 0.6	20.7 ± 1.3	17.5	18.2 ± 0.6	2.38 (<.05)		3.23 (<.02)	

¹Holotype (AMNH 8352)

²includes data from Prashad and Mukerji (1929)

