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Two Species of Cavefishes from Northern Thailand in the Genera *Nemacheilus* and *Homaloptera* (Osteichthyes: Homalopteridae)

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ABSTRACT. Two new species of cavefishes from Mae Hong Son Province, northern Thailand represent the first record of cavefishes from that country. *Nemacheilus oedipus* n.sp. from Tham Nam Lang has degenerate eyes and is the first member of the Nemacheilinae with vestigial eyes and the seventh cavernicole. *Homaloptera thamicola* n.sp. from Tham Susa completely lacks eyes and is tentatively referred to *Homaloptera*, although it differs in details of mouth structure. It is the first blind cavernicolous representative of the Homalopterinae.

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Cavefishes are known to occur in several areas of Asia, particularly in south-west Asia and in south China, areas which have extensive karstic formations. Although there are quite extensive karstic areas in Thailand, no cavefishes have been recorded from that country. In the last seven years I made several unsuccessful attempts to collect in a number of Thai caves. Despite this, I still think that some of the caves I visited without reward may have fishes. For example, the famous Chiang Dao caves, where I observed only shrimps (i.e., an unidentifiable juvenile of *Macrobrachium* which does not show any character that might indicate an adaptation to subterranean life; L.B. Holthuis, in litt.), are the subject of several tales involving cavefishes. According to inhabitants of Chiang Mai province, subterranean waters in Chiang Dao caves are inhabited by fishes which have numerous magical properties: they have no shadow and when they meet an obstacle, they can split, with each half going its own way and then fusing together once the obstacle is passed, etc. Unfortunately, I was unable to catch or see this very peculiar fish, if it exists, or any other cavefish in Thailand.

It was particularly pleasing when Dr. D. Hoese, of the Australian Museum, Sydney, sent me three specimens of two species of loaches which had recently been collected in caves in Thailand. Although it is doubtful that the "magic" fish is among them, they are nevertheless of interest, one of them being the first known cave species of Homalopterinae and the other one being a new *Nemacheilus* with vestigial eyes.

Methods

The methods for making measurements and counts follow Kottelat (1984) except for the nomenclature of the cephalic lateral line system which is that of Illick (1956). When measurements are expressed as percent of head length, dorsal head length along the sagittal plane is meant. In anal and dorsal fin ray counts, ½ refers to the last branched ray born by the same pterygiophore as the penultimate ray.

Measurements refer to standard lengths (SL) and head length (HL).

Nemacheilus oedipus n.sp.

Fig. 1

Type material. HOLOTYPE: AMS I.25986-002, 70.4 mm SL; Thailand: Mae Hong Son Prov.: Tham Nam Lang [= Nam Lang Cave], 19°31'N 98°09'E; J. Dunkley; 7 May

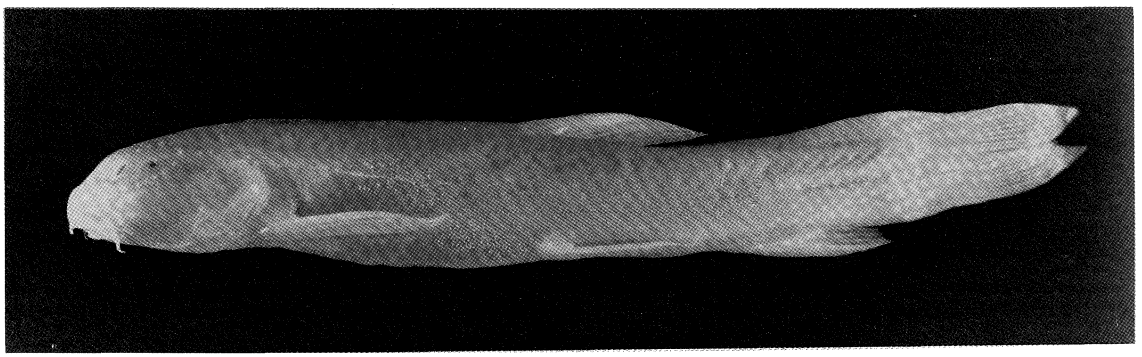

Fig.1. *Nemacheilus oedipus* n.sp. Holotype, AMS I 25986-002, 70.4 mm SL.

1985; PARATYPE: AMS I.25986-001, 1 ex., 74.3 mm SL; same data as holotype.

Diagnosis. The new species is distinguished from any known nemacheiline by the combination of the following characters: no colour pattern, and no externally visible eye but a pit in the center of the skin covering the orbit. See discussion below for differences from epigean species occuring in same basin.

Description. Morphometric data in % of SL (data of holotype first, followed by those of paratype in brackets): total length 120.9 (122.5); lateral head length 24.6 (24.0); dorsal head length 22.3 (21.5); predorsal length 54.4 (54.4); prepelvic length 57.7 (58.1); pre-vent length 72.9 (75.1); preanal length 80.0 (80.9); head depth (at eye) 11.5 (11.2); head depth (at nape) 13.6 (13.3); body depth (at dorsal fin origin) 15.5 (13.2); depth of caudal peduncle 11.5 (9.4); length of caudal peduncle 13.5 (13.6); length of dorsal crest on caudal peduncle 16.8 (14.9); length of ventral crest of caudal peduncle 10.2 (8.3); snout length 12.2 (11.2); head width at nares 10.8 (11.0); maximum head width 16.8 (16.8); body width at dorsal fin origin 11.1 (10.1); body width at anal fin origin 6.4 (5.9); width of bony interorbital 5.7 (5.8); width of mouth gape 6.7 (7.1); height of dorsal fin 15.9 (15.1); height of anal fin 17.0 (16.6); length of pectoral fin 19.3 (19.1); length of pelvic fin 17.2 (16.7); length of upper caudal lobe 23.0 (21.5); length of lower caudal lobe 21.6 (20.6); length of middle caudal rays 17.9 (13.9).

Elongate species of nemacheiline with compressed body, blunt snout. Pectoral fin (12 rays) reaching slightly beyond halfway to pelvic fin base. Axillary pelvic lobe present. Pelvic fin (8 rays) origin below 2nd to 3rd branched dorsal ray, not reaching vent which is situated some distance in front of anal fin. Anal fin (3/5½ rays) not reaching base of caudal fin. Caudal fin (9+8 branched rays) forked. Caudal peduncle 1.17 (1.44) times longer than deep, with dorsal and ventral crest present, in part sustained by rudimentary rays. Dorsal fin (4/8½ rays) with straight or slightly concave distal margin.

Body entirely covered by embedded scales, each circular in form with a wide (about half of scale diameter) focus. Scales are slightly more sparsely set in front of dorsal fin. Scales immediately above and below lateral line not conspicuously larger than those of adjacent rows. Complete lateral line, with about 100 (87) pores which are difficult to count with precision. Cephalic lateral line system with 7 (6) supraorbital, 3+13 infraorbital, 12 (11) preoperculo-mandibular and 3 supratemporal pores. No externally visible eye but pit in center of the skin covering orbit (Fig. 2); vestigial remains of eye deep under skin clearly distinct as small black area. Anterior nostril pierced at base of front side of triangular flap which, when folded back, completely covers posterior nostril (Fig. 3c).

Mouth arched, its gape about 2½-3 times wider than long (Fig. 3a). Upper jaw with well-developed processus dentiformis. Lower jaw with shallow median depression. Lips thin, nearly smooth, upper one with very slight median incision, lower one with median interruption. Maxillary barbels reaching somewhat beyond vertical of eye pit. Outer rostral barbels reaching slightly beyond base of maxillary barbel; inner rostral barbels not reaching corner of mouth. Intestine with bend immediately behind stomach (Fig. 3b). Stomach of paratype (a male) nearly empty, its content not identifiable. Air bladder without free posterior chamber.

No unculi or tubercles. No known sexual dimorphism, but in 2 specimens, the second pectoral ray is thickened. This is known to be secondary male sexual feature in several other nemacheilines.

Colouration. Body and fins whitish.

Distribution and habitat. Only known from the type locality, Tham Nam Lang, Mae Hong Son Province, Thailand. Tham Nam Lang is an outflow cave east of Nam Khong, a tributary of Nam Mae Pai, itself a tributary of Salween River. The stream flowing out of Tham Nam Lang is probably part of Nam Lang which sinks at about 19°32′N 98°13′E. Nam Lang is one of several streams now flowing in karstic endoreic basins which formerly constitued a single drainage tributary of Nam Khong (as judged from topographic information on 1:250,000 maps of

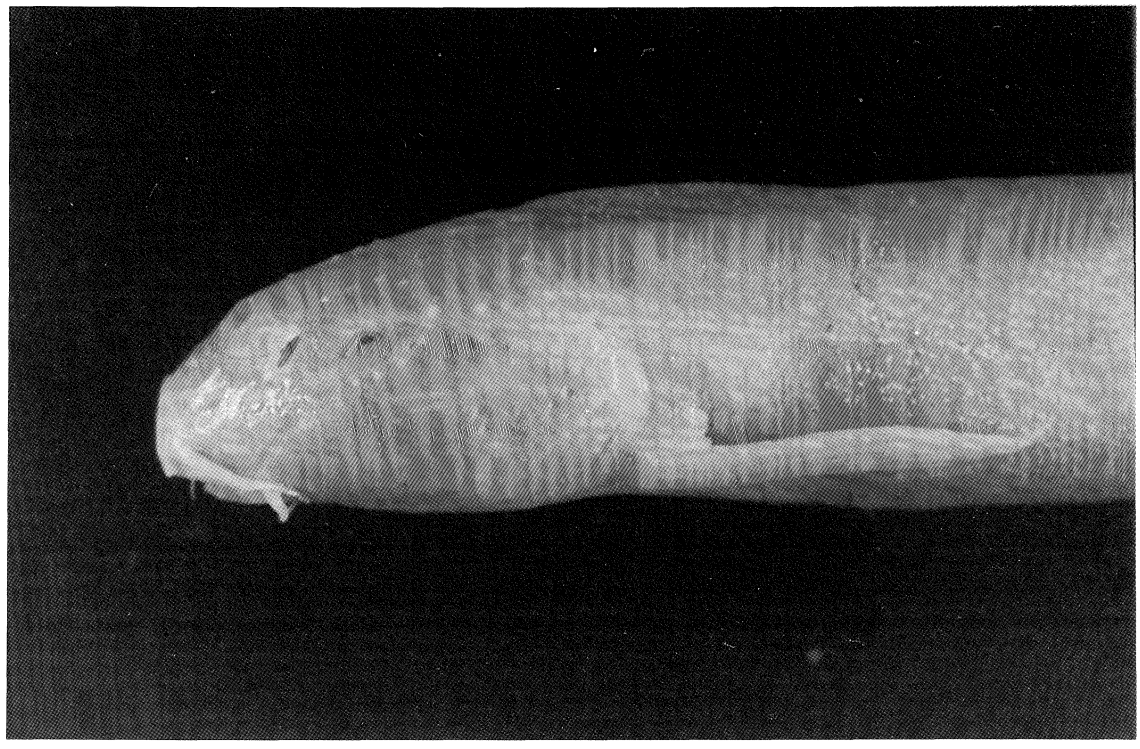

Fig.2. *Nemacheilus oedipus* n.sp. Holotype, AMS I 25986-002, 70.4 mm SL. Note black occular pit.

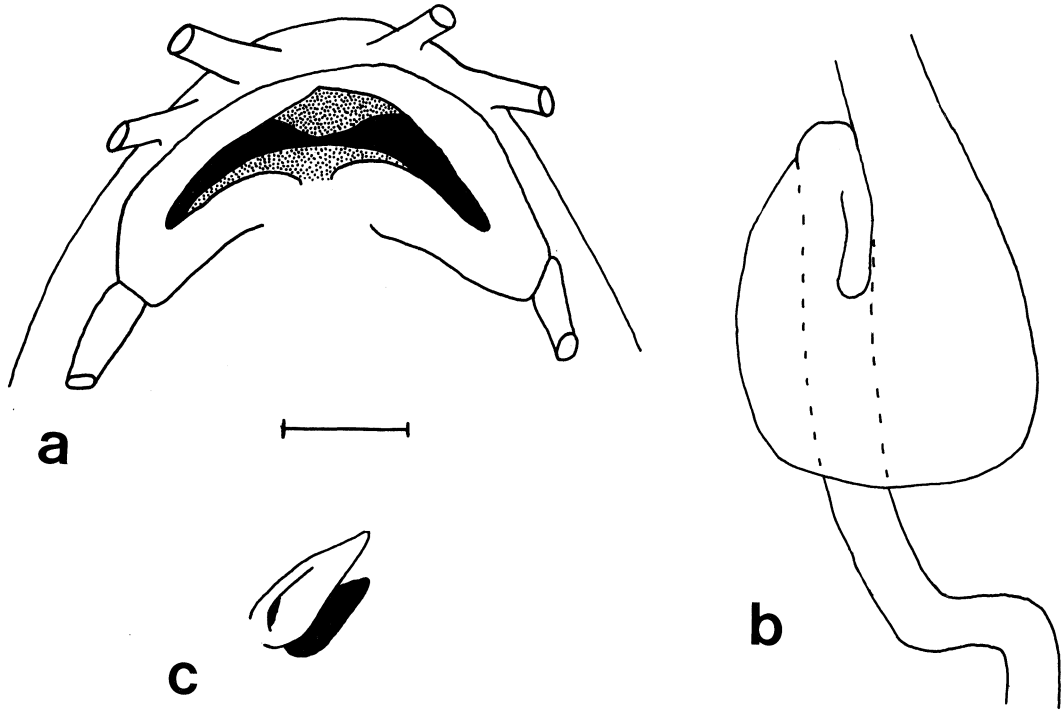

Fig.3. *Nemacheilus oedipus* n.sp. Paratype, AMS I 25986-001, 74.3 mm SL. a: mouth, b: digestive tract, c: left nostril. Scale bar: 2 mm.

the Thai map series 1501 S). The fishes were collected in a pool of moving water about 1 km inside the entrance.

Etymology. Oedipus, a mythic Theban king who tore out his eyes (see classical tragedies by Aeschylus, Sophocles, Euripides, Seneca and Corneille). Treated as a name in apposition.

Discussion. Several species of nemacheilines have already been reported from caves. Some have normal eyes and colour pattern, e.g. *Nemacheilus fasciatus* (Valenciennes, 1846) from cave Guva Gremeng in Java (Weber & de Beaufort, 1916; Kottelat, 1984). Others are colourless with normal eyes, e.g. *N. evezardi* Day, 1878 from an unspecified cave in India (Greenwood, 1978), and a species from Siju Cave in Meghalaya, India, identified as *Nemacheilus* sp. by Hora (1924), *N. beavani* Günther, 1868 by Hora (1935) or *N. multifasciatus* Day, 1878 by Pillai & Yazdani (1977). Others are white and eyeless, such as *N. smithi* Greenwood, 1976 from Iran, *N. gejiuensis* Chu & Chen, 1979 from Yunnan Province of China, *N. starostini* Parin, 1983 from Turkmenia, *N. xiangxiensis* Yang, Yuan & Liao, 1986 from Xiangxi, Hunan Province, China, and *N. anophthalmus* (Zheng, in Guangxi Fisheries Research Institute etc., 1981) from Guangxi Province, China (Zhao, 1983). *Nemacheilus oedipus* is the first species with vestigial eyes.

None of these cavernicolous species are apparently closely related. Their respective habitats are very distant from each other. Nemacheilines are benthic fishes usually hiding under stones; this habitat preference certainly favoured their entering subterranean waters. This almost certainly occurred independently in the various cave systems and relationships must be looked for with epigean species. The subfamily Nemacheilinae includes some 430 nominal species, about 260 of them are considered valid (Kottelat, ms). Their systematics is still chaotic both at specific and supraspecific level. A few genera only are actually diagnosed by sets of synapomorphies and all remaining species are placed in the catch-all genus *Nemacheilus* Bleeker, 1863. *Nemacheilus oedipus* belongs to this last category. Its relationships will probably remain unclear as long as those of epigean species are unresolved. As *N. oedipus* is possibly derived from one of the epigean species presently in the Nam Mae Pai basin (to which Tham Nam Lang belongs), it is worth comparing it with them. However, one must remember that organisms living in caves may also be relicts of a former fauna. The following nemacheilines have already been reported from Nam Mae Pai basin: *Acanthocobitis zonalternans* (Blyth, 1860), *Neonoemacheilus labeosus* (Kottelat, 1982), *Nemacheilus poculi* Smith, 1945, *N. reidi* Smith, 1945 and two undescribed species (Kottelat, ms).

Acanthocobitis zonalternans is distinguished by strongly papillated lips, a rounded caudal fin, more branched dorsal rays (9–11½ vs 8½) and less branched caudal rays (8+7–8 vs 9+8). The largest recorded *A. zonalternans* is 44 mm SL, while the two *N. oedipus* are 70.4–74.3 mm SL, and the males of *A. zonalternans* have a suborbital hook (an external process of lateral ethmoid), a feature not present in the paratype of *N. oedipus* which is a male. *Neonoemacheilus labeosus* has hypertrophied lips forming a preoral cavity (Kottelat, 1982; Zhu & Guo, 1985) and the presence of a suborbital hook in males. *Nemacheilus poculi* has less branched caudal rays (8+7 vs 9+8). The two undescribed species have a suborbital hook in males, a smaller size, and one has a differently shaped upper jaw and an emarginate caudal fin.

Nemacheilus reidi is one of the most widely distributed nemacheilines in the Nam Mae Pai and Mae Nam Yuam basins (Salween drainage) in northern Thailand; it reaches at least 89 mm SL and, if the ancestor of *N. oedipus* is still living in the Nam Mae Pai basin, *N. reidi* could be a likely candidate. Beside absence of colour pattern, possession of degenerate eyes, the new species is distinguished from *N. reidi* by its forked caudal fin (vs emarginate) and by the following morphometric characters: greater dorsal head length (21.5 & 22.3 vs 18.6–21.3% SL), smaller lateral head length (110 & 111 vs 116–126% HL), greater prepelvic length (57.7 & 58.1 vs 49.6–53.3% SL), greater pre-vent length (72.8 & 75.1 vs 66.1–71.0% SL), greater preanal length (80.0 & 80.9 vs 72.6–78.7% SL), slenderer body (depth at dorsal fin origin 13.2 & 15.5 vs 15.9–20.9% SL; 61 & 69 vs 80–112% HL), slenderer caudal peduncle (depth 9.4 & 11.5 vs 12.7–14.2% SL; 44 & 52 vs 64–76% HL; length 13.5 & 13.6 vs 13.4–17.9% SL; 61 & 63 vs 67–96% HL), thinner body (10.1 & 11.1 vs 12.2–14.9% SL at dorsal fin origin; 5.9 & 6.4 vs 7.8–9.9% SL at anal fin origin); smaller bony interorbital width (5.7 & 5.8 vs 5.8–7.3% SL; 26 & 27 vs 31–36% HL) [morphometric data for *N. reidi* were obtained from 18 specimens 40.8–71.3 mm SL]. Some of these differences (widths and depths) are possibly related with the reduced food availability in the cave environment.

Homaloptera thamicola n.sp.

Fig. 4

Type material. HOLOTYPE: AMS I.25987-001, 28.4 mm SL; Thailand: Mae Hong Son Province: Tham Susa [= Susa Cave], 19°28′N 98°08′E; J. Taylor, 7 May 1985.

Diagnosis. The new species is immediately distinguished from any other species of *Homaloptera* by the following unique characters: absence of eyes; body naked, colourless; pectoral fin with 22–23 rays (vs 20 or less), 15–16 of them being branched (vs 13 or less), 10 branched pelvic rays (vs 9 or less) and two barbels at each corner of mouth.

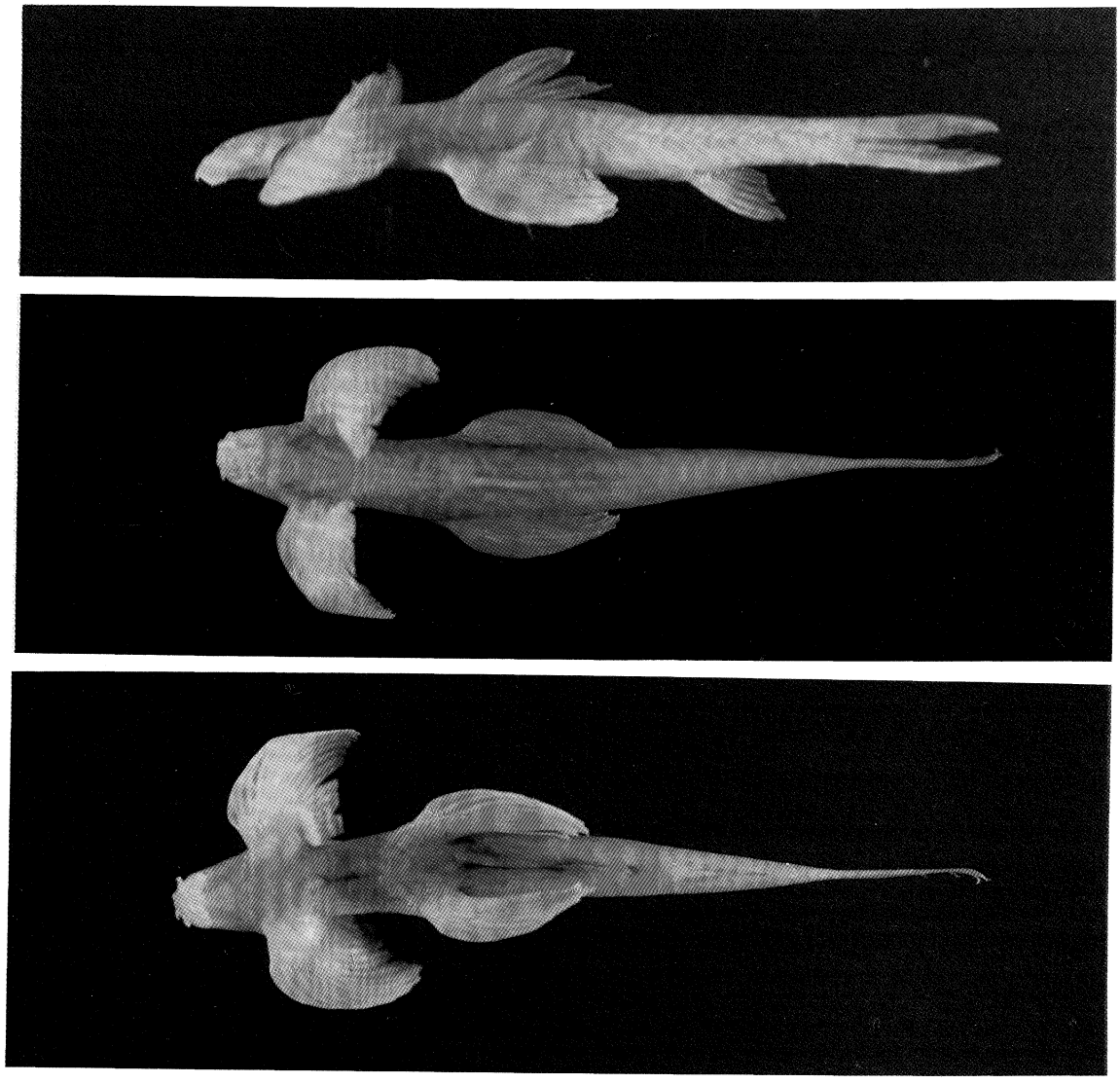

Fig.4. *Homaloptera thamicola* n.sp. Holotype, AMS I 25987-001, 28.4 mm SL.

Description. Morphometric data (in % of SL): total length 130.3; lateral head length 16.5; dorsal head length 19.7; predorsal length 43.3; prepelvic length 39.1; pre-vent length 74.3; preanal length 79.2; head depth (at nape) 8.1; body depth (at dorsal fin origin) 10.9; depth of caudal peduncle 7.4; length of caudal peduncle 20.1; head width at nares 9.9; maximum head width 13.0; body width at dorsal fin origin 13.7; distance between posterior extremity of pelvic fin bases 7.7; height of dorsal fin 19.4; height of anal fin 18.7; length of pectoral fin 28.5; length of pelvic fin 29.9; length of upper caudal lobe 26.8; length of lower caudal lobe 27.8; length of middle caudal rays 15.1.

Elongated homalopterine, with short, blunt head; nearly terete trunk, large fins. Gill opening extending to ventral surface in front of pectoral fin base. Pectoral fin (7 simple, 15–16 branched rays) reaching to base of pelvic fin with its length much greater than body width. No axillary pelvic flap. Pelvic fin (2 simple, 10 branched rays) origin below dorsal fin origin, not reaching vent which is somewhat in front of anal fin. Anal fin (3/5½ rays) falcate. Caudal fin (9+8 branched rays) deeply forked with subequal lobes. Caudal peduncle 2.71 times longer than deep. Dorsal fin (4/9½) with straight distal margin. Unculi forming adhesive pads on inferior surface of 7 anterior pectoral rays and 3 anterior pelvic rays.

Body naked; skin smooth, without tubercles or unculi. About 32 myomeres. Lateral line complete with about 70 pores. Cephalic lateral line system apparently consisting only of infraorbital canal, without pores. No eye.

Mouth arched. Both jaws exposed. Anterior lip thin and smooth. Preoral and rostral groove present. Posterior lip inconspicuous, smooth, not continuous with anterior lip, with deep postoral groove and no postlabial groove. Four short rostral barbels situated

anteriorly on snout, not forming stiff lobes between them. Two barbels at each corner of mouth: small one continuous with lower lip, longer one originating from below anterior lip (Fig. 5).

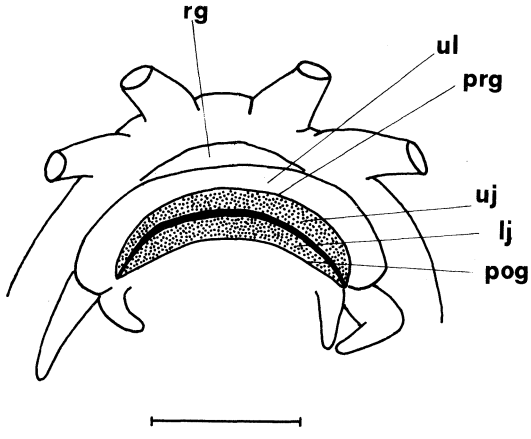

Fig.5. *Homaloptera thamicola* n.sp. Holotype, AMS I 25987-001, 28.4 mm SL. Mouth. rg: rostral groove, ul: upper lip, prg: preoral groove, uj: upper jaw, lj: lower jaw, pog: postoral groove. Scale bar: 1 mm.

Colouration. Body and fins whitish; unculiferous pads under pelvic and pectoral rays orange brown.

Distribution and habitat. Only known from the type locality, Tham Susa, in Mae Hong Son Province, Thailand. Tham Susa is an outflow stream cave rising to the east of Nam Khong, a tributary of Nam Mae Pai, itself a tributary of the Salween River. The holotype was found on a ledge apparently climbing up a small waterfall about 0.6 km from the cave entrance.

Etymology. Based on *tham*, latin transcription of the Thai word for cave; *cola*, from the latin colere, meaning to inhabit.

Discussion. Relations among and within homalopterin 'genera' are presently poorly understood. In addition to characters which obviously are adaptations to the cave environment (lack of eyes, pigmentation and scales), the new species exhibits some unique characters as listed in the above diagnosis and in the organisation of lips and barbels. I find them to be close to the range of variation in *Homaloptera* and thus suggest that this is the approximate position of the species. The mouth organisation is somewhat peculiar, especially the two barbels at each corner. The lower lip structure is similar in several species (e.g. *H. gymnogaster* Bleeker, 1853, *H. sexmaculata* Fowler, 1934 and a species from Thailand tentatively identified as *H. zollingeri* Bleeker, 1853). *Homaloptera* as presently understood seems to be a somewhat unnatural assemblage consisting of three distinguishable units possibly worth consideration at the generic level. I am investigating this problem and once it is solved, a more appropriate statement of the relationships of the new species might be possible.

Neohomaloptera Herre, 1944 is distinguished from *Homaloptera* nearly only by the possession of two maxillary barbels. I agree with Alfred (1969) that its type and only included species *N. johorensis* Herre, 1944 is better considered as a member of *Homaloptera.* I demonstrated that in another homalopterine lineage (*Balitora* and related genera; Kottelat & Chu, 1988a) the second maxillary barbel is merely an elongate papilla. Most keys to genera of Homalopteridae (Smith, 1945; Silas, 1954; Chen, 1978) are based on Hora (1932) and are incorrect in at least one important character: all consider that in *Homaloptera* the rostral groove is absent or poorly developed. In all species of *Homaloptera* (about 15) that I have examined, the rostral groove is well developed and conspicuous. Following Hora's classification, Smith (1945) described a new *Homaloptera* as a new genus, *Balitoropsis*; *Balitoropsis yunnanensis* Chen, 1978 also is a *Homaloptera* s.l. (Kottelat & Chu, 1988b).

Inclusion of *Homaloptera thamicola* in any other genus is not possible as all others have a more complicated mouth structure. Also known from this area are *Balitora* (Kottelat, 1988) and *Hemimyzon* (Kottelat, unpublished); they belong to a distinct lineage characterised by lips with numerous well-developed papillae and rostral barbels inserted below the snort and forming between them stiff lobes. In addition, *Hemimyzon* has three or more simple pelvic rays (Kottelat & Chu, 1988b).

This is the first record of either a subterranean or blind member of the subfamily Homalopterinae.

Formerly, the absence of eyes, scales and pigment would have been sufficient to consider the new species as belonging to a distinct genus. However, I agree with Roberts & Stewart (1976) that too much importance has been attributed to such characters and that, in the absence of more significant characters, specific distinction only is warranted.

ACKNOWLEDGMENTS. It is a pleasure to thank Douglass F. Hoese (AMS) for allowing me to examine and describe these two species and John Dunkley for providing information concerning collection localities.

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