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RECORD OF AMBICOLORATION IN *CYNOGLOSSUS* (PISCES : CYNOGLOSSIDAE) FROM THAILAND

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ABSTRACT

An almost ambicolorate "Four-lined tongue-sole", *Cynoglossus bilineatus* (Lacepede), is reported from Thailand. It is presumably the first record for the genus. Except for most of the head on the blind side and its corresponding finrays, which are pale as in normal specimens, the body and fins are pigmented. The normally cycloid scales on the blind side in the pigmented area are wholly replaced by ctenoid scales, but those on the unpigmented part on the head are cycloid. The lateral line scales of the pigmented area on the blind side are cycloid. The pelvic fins are entirely separated from the anal fin by the absence of membrane. No other major external anomaly is found.

PREVIOUS ACCOUNTS

Abnormalities in coloration are more common among members of the order Pleuronectiformes than in any other group of fishes. Other anomalies occasionally in those fishes are a hooked dorsal fin, incomplete eye migration and side reversal. Abnormal pigmentation in flatfish is divided into three main types: ambicoloration, albinism, and xanthochromism (DEVEEN, 1969; COLMAN, 1972). Partial or incomplete ambicoloration is more common than trunk pigmentation, nearly complete ambicoloration and complete ambicoloration (JONES & MENON, 1950). NORMAN's (1934) previous explanation of this phenomenon, later accepted by many authors, was that "...ambicoloration merely represents variation in the direction of the original bilateral symmetrical condition of the ancester of flatfishes." It is also regularly observed that wholly ambicolorate fishes normally display a higher degree of symmetry than normal specimens in pigmentation, scales, paired fins and final position of the eyes (NORMAN, 1934; COLMAN, 1972). Development of asymmetry may have been retarded during metamorphosis.

DEVEEN (1969) made a study of such pigmentation in plaice, *Pleuronectes platessa,* and considered this phenomenon as a possible tool in the study of populations. JORDAN & EVERMAN (1898) noted that the blind side of *Trinectes maculatus,* from the Gulf of Mexico, is normally immaculate, but in Atlantic population it is usually covered with dark spots. CHABANAUD (1935) separated the Gulf and Atlantic populations on the basis of the absence *(T.m. fasciatus)* or presence *(T.m. maculatus)* of ambicoloration on the blind side, but HOESE and BERGLUND (1958) and DAWSON (1962) regarded this difference as insignificant.

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Ambicoloration is reportedly correlated with adverse environmental factors. POWELL & SCHWARTZ (1972) agreed with NORMAN (1934) and DEVEEN (1969) and summarized previous diverse theories as follows: innate vs. acquired pigment deformities; strong light intensity at metamorphosis; susceptibility during larval hatching in total darkness; population density during metamorphosis; temperature during larval development, and low food availability during larval rearing. These theories relate to the early life stages of the fish, especially preceding metamorphosis. However, DEVEEN (1969) revealed that abnormal coloration in plaice, *Pleuronectes platessa,* may develop throughout life. Additionally, EISLER (1963) indicated that ambicoloration may be caused by damage to the brain by excess exposure to light, or it may be hereditary. CUNNINGHAM (1907) reported that the pigmentless condition of flatfish is not very strongly inherited, and that pigment is produced after a comparatively short exposure to light. His experiment showed that light can produce some pigment where it was previously absent.

A search of the literature (JORDAN & EVERMANN, 1898; CUNNINGHAM, 1907; NORMAN 1934; CHABANAUD 1935; GUNTHER, 1943; JONES & MENON, 1950; MCCORMICK & BALDWIN, 1952; SESHAPPA & BHIMACHER, 1955; DEUBLER & FAHY, 1958; HOESE & BERGLUND, 1958; MCKEEVER, 1958; LUX, 1959; FOLLETTE et al., 1960; GRAY, 1960; DAWSON, 1962; EISLER, 1963; SCOTT, 1965; DEVEEN, 1969; OKIYAMA & TOMI, 1970; HOUDE, 1971: COLMAN, 1972; and POWELL & SCHWARTZ, 1972) yielded many records of pigmentation anomalies in Pleuronectidae[1] and Bothidae[2] but fewer in Soleidae[3]. The only report for the Cynoglossidae, the most specialized family of the Pleuronectiformes, is that of DAWSON (1962) who recorded an ambicolorate specimen of *Symphurus plagiusa* from Grand Isle, Louisiana, U.S.A. SESHAPPA & BHIMACHER (1955) reported failure of eye migration in the tongue sole, *Cynoglossus semifasciatus* when postlarvae were kept in the dark, but gave no record of color anomalies.

Thus far such anomalies have been reported only from temperate regions, viz., American, European, Australian, New Zealand, South African, and Japanese waters, except for one case of ambicoloration reported by JONES & MENON (1950) in the soleid, *Brachirus pan,* from Hooghly River, India, The paucity of tropical records could be due to less flatfish fisheries, less biological collecting as well as differences in environmental conditions (light intensity, temperature and food).

It has also been postulated that ambicoloration in flatfishes, aside from partial

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1. *Glyptocephalus cynoglossus, G. zachirus, Hippoglossoides dubius, H. platessoides, Hippoglossus hippoglossus, Limanda ferruginea, L. limanda, Microstomus pacifirus, Platichthys stellatus, Pleuronectes* sp., *Poecilopsetta plintus, Pseudopleuronectes americanus, Rhombosolea leporina, R. plebeia, R. tapirina, Tanakius kitaharae.*
2. *Engyophrys* sp., *Lophosetta maculata, Paralichthys californicus, P. dentatus* (syn. *P. melanogaster, Platessa oblonga), P. lethostigma, P. oblongus* (syn. *Hippoglossus oblonga), Rhombus* sp., *Scophthalamus aquosus, Taeniopsetta* sp.
3. *Achirus japonicus, A. lineatus, A. zebias, Brachirus pan, Solea* sp., *Trinectes maculatus.*

albinism, may be associated with morphological anomalies or injury prior to metemorphosis (NORMAN, 1934). This is especially true in specimens of *Paralichthys dentatus* and *P. lethostigma,* which often naturally display the hookshaped incomplete eye rotation. Norman found that this is chiefly due to injury of the vertebral column. However, there may be injuries without associated pigment anomalies. SCOTT (1965), for example, did a classic investigation on the sand flounder, *Scophthalamus aquosus,* and experimented by cutting, blocking and stimulating nerves. This revealed unequivocally functional pigment aggregation in the absence of nerve fibres.

DESCRIPTION OF AMBICOLORATE *CYNOGLOSSUS BILINEATUS* (LACEPEDE)

(Figure 1)

On 25 February 1975, I collected an almost ambicolorate specimen of *Cynoglossus bilineatus,* a common species in Thai waters, at the Bangkok Wholesale Fish Market. I believe that it constitutes the second finding of abnormal coloration in Cynoglossidae and first instance of partial ambicoloration for the genus and species. This specimen, 249 mm in total length and 230 mm in standard length, was taken together with a representative specimen of the same species for comparison. The dealer could not reveal whether the fish came from the Gulf of Thailand or the Andaman Sea. The specimen is now in the Chulalongkorn University Museum of Zoology, Bangkok, No. CUMZ 2528.9.17.1.

Morphologically, the anomalous specimen is entirely normal on the eyed side. Musculature and nostrils of both sides are as usual. Both eyes are normally on the left side of the head, and there is no sign of incomplete eye migration when compared with normal specimens. The specimen has unusual pigmentation only on the blind side (Figure 1).

All scales which normally should be cycloid on the blind side are ctenoid in the unusual pigmented area, but remain cycloid and interspersed with tiny fleshy appendages on the pale area, especially on the anterior half of the head. Scales on the lateral line, however, are cycloid on both sides as is normally the case.

The pelvic fins are entirely separated from the anal fin by the absence of a connecting membrane. This condition was previously recorded by DAWSON (1962) for a specimen of *Trinectes maculatus* from Louisiana. The urogenital opening, which should normally be located on the blind side just above the first anal fin ray, is placed a little farther forward and nearer to the ventral margin.

Coloration of most of the head and gill cover of the blind side remains normal. Dark, abnormal coloration extends forward to the eleventh dorsal ray and to the isthmus ventrally.

Other data are : dorsal rays 109; anal rays 84; pelvics normal, with 4 rays, caudal rays 13. Lateral scales of eyed side counted from vertical gill opening 87, on blind side 89; scales rows between the lateral line at middle of body on both sides 14. Greatest depth of body 69 mm, length of head 58 mm, horizontal lower eye diameter 6 mm. A dark blotch on gill cover of the eyed side is in the normal position. There are no other

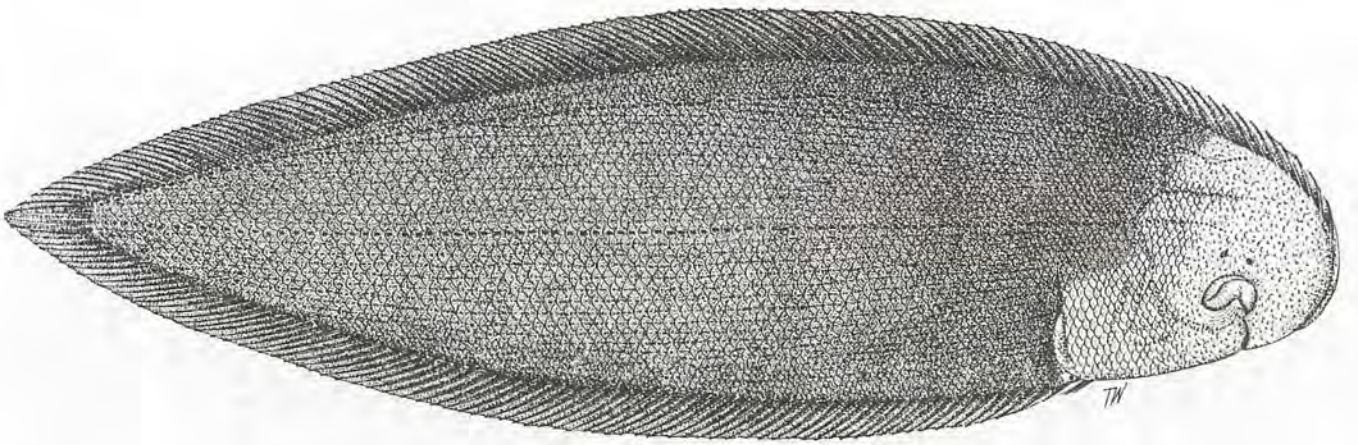

Figure 1. Partial ambicoloration of a specimen of *Cynoglossus bilineatus* (Lacepede), 330 mmSL, from the Bangkok Wholesale Fish Market (CUMZ 2528.9.17.1).

darker markings on the body. The above counts and measurements are within the normal range of the species. Radiograph of the lateral view revealed no anomalities of skeletal structure.

Note added in proof: Since this paper went to press more information was received from Dr. John V. Gartner Jr. It is now known to me that prior to the present study the partial ambicoloration was found in *Cynoglossus lida* from Madras, India, by SIVAPRAKASAM (1966). Cases of ambicoloration in the Pleuronectiformes from the tropics should be added by the following works: PRADHAN & PRADHAN (1962) for *Brachiurus orientalis* and SIVAPRAKASAM (1966) for *Bothus ovalis,* all from India. Full records of such color abnormalities in the Pleuronectiformes from western Atlantic and eastern Gulf of Mexico were given by GARTNER (1986).

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