

Occurrence of Luminous Organs on the Tongue of Two Scopelid Fishes, *Neoscopelus macrolepidotus* and *N. microchir*.*

By

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JOHNSON (1936) has described a scopelid fish, *Neoscopelus macrolepidotus*, as a monotypic species of his new genus by having examined a single specimen taken from Madeira. Through the detailed examination of Japanese scopelid, Matsubara argued that the fish could be distinctively separated into two species but referable to one genus. Namely, *N. microchir* is when compared with *N. macrolepidotus* characterized by having more numerous photopores organs in the lower side of body in addition to longer head and pectoral fin than the latter species (MATSUBARA, 1943).

Though considerable literatures concerning the luminous organ of fish have been accumulated, the organ developed on unders-surface of the tongue of the scopelid was overlooked by from investigators.

Recently, the author obtained several specimens of two species mentioned above by the courtesy of Prof. R. ISHIYAMA, and found that not only the differences in number and distribution of the luminous organs on the lower lateral side of the body but also organs which were newly found furnish a remarkable distinction between the two species.

The present paper comprises the comparison in number and distribution of the tongue photopores within two species as well as the histological structure of the organs comparing with one of the lateral side of body.

The materials dealt here were taken by means of the motor trawler from depth of about 100 fath's off AICHI and Mie Pref., Kumanonada.

The specimens thus far examined in this study involve the adult forms of fish, measuring about 170 and 150 mm in their total length of *macrolepidotus* and *microchir*, respectively. In the first place, the general topographical features of the tongue organs in the two species were treated macroscopically using the formalin (10%) preserved specimens.

The histological investigation of the organ was followed, by using the method of usual celloidin section cut into 10—20 micra thick of serial sections, which were stained with Heidenhein's iron-haematoxyline and eosine solutions.

Macroscopical observation of the tongue photopores : Having observed macroscopically the tongue *in situ* turning inside out with its apex of the tongue, the photopores are fringing the anterior marginal portion of the tongue in a

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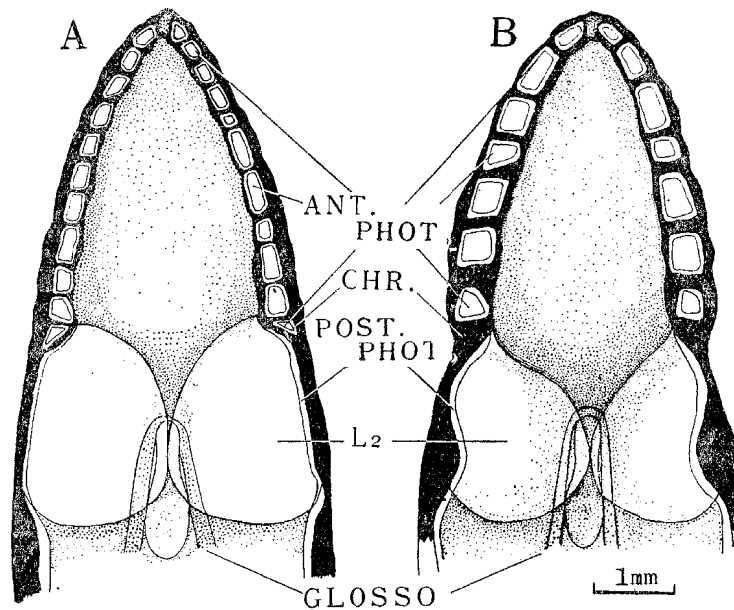


Fig. 1 Shows the tongue photopores in two scopelid fish.
 A, *Neoscopelus macrolepidotus*; B, *N. microchir* :
 ANT. PHOT, anterior photopores; POST PHOT, posterior
 photopores; CHR, chromatophore membrane; L₂, lens;
 GLOSSO, glossophyal bone.

regular series (Fig. 1, A, B). Then, the presence of the photopores never reveal on the dorsal surface of the tongue so that the black pigmented epithelium (CHR) is thickly covering dorsal surface of the organ. Accordingly, it seems that the presence of such organ in the tongue have not been found till now.

Basing on the distribution of the tongue organ it is classified into consisting two different sizes of groups. The one, in which the photopores (labeled ANT. PHOT. in Fig. 1, A, B) are small, mounting in the anterior thinner part of the tongue being gradually smaller in their sizes as they approach to the apex of its tongue. The other one is composed of a couple of large photopores, (POST. PHOT) occupying the space of either sides of the protuberance that laying over the glossohyal bone (GLOSSO). Thus, the number as well as their sizes in those respective group of the tongue organ reveal apparent differences taking the gross anatomy within these two species.

Microscopical anatomy of the tongue photopores : The structure of the luminous organs of these two species of the fish is essentially the same as that of the organ of luminous deep-sea fish with true luminous organ, such as, Polypnus and Myctophids. The organ of the fish consists of five functional components, which were demonstrated by the histological study of both in cross and longitudinal sections of the organ. The five components are a luminous body, which are ranging reasonably corresponded to function, photogenic gland (labeled PHOT, in Fig. 2), reflector (REFT), granular layer (GRAN), lens (L₁, L₂, & L₃) and pigmented membrane (CHR).

Reflector : The part, which has opaque guanophore membrane covering outside

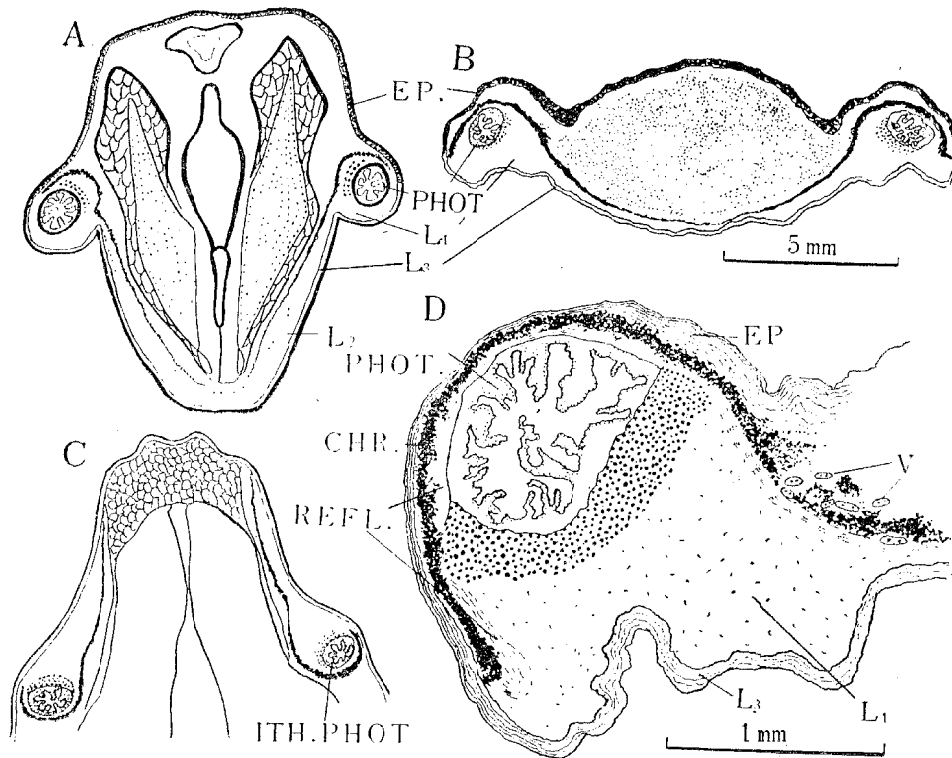


Fig. 2. Shows the cross sections of the tongue photopores. A, posterior; B, anterior; C, isthmus parts respectively, of which magnified view of the photopore in D.

of the photogenic gland and small granular layer consisting of numerous nuclei that will be referred to after immediately, is back with a pigmented membrane.

Granular layer. : Having observed this portion of the granulated layer that occupying a small area in front of the photogenic gland, however, the presence of such elements, the light filter, that have been pointed out by HANEDA (1952) in his crucial experiment in *Yallera* and *Polyipnus*, have fail to reveal it, as unfortunately the author had not an opportunity to ascertain the occurrence of light emitted from the organ of living fish. But, considering the structure of this portion together with its location, this peculiar layer may be correspondent with that of HANEDA's *light filter*.

Lens : As showing in Fig. 1 and 2, it will be assumed that L_1 , L_2 and L_3 might clearly be performed as the function of lens because these portions facing the under surface of the tongue organ are filled with perfect transparent gelatinous substance. Within these three sorts of lens, L_1 is so-called lens which many investigators described as, and L_2 in the posterior organ is very thick by having thicker transparent substance appearing like that of the *aqueous humor* of the eye. Thus' a pair of the posterior photopores in the tongue is characterized by having thickened lens, L_2 , which is possessed neither in the anterior group of the organ nor in the lateral series of the photopores of the body of these fishes.

Further, the lens, L_3 be noted herewith that the translucent superficial layer of the epitherium that covering overall the undersurface from the anterior photopores to the posterior ones which may be designated here as epidermal lens.

Pigmented membrane: The membrane covering backside of the *reflector* is of much obvious, and is constructed by melanophores to under surface of the floor of the main body of the tongue so that the light emitted from the organ might not come through the surface of the tongue. The membrane contains numerous blood vessels (labeled V in Fig. 2, D) in the portion where the photopores close in contact of main axis of the tongue, and is running overlaying the under floor as the thinner membrane. The pigmented membrane that laying the above mentioned melanophore might be able to facilitate the *light reflector* together with these two membrane keeping the light emitted from diffusion upward through the basihyal bone and muscle of the tongue.

Thus, the results obtained in both anatomies of the tongue light organ are essentially similar to that organ of those hitherto known deep-sea fish with own luminous organ (BRAUER; 1904, MANGOLD; 1907, OSHIMA; 1910 — '11 and HANEDA; 1952, etc.). Such being the case, it will not need here further discussion on the luminosity of the organ which in the tongue of these two *scopelids*.

Comparison: The author have ascertained that there are some considerable differences not only in number and arrangement of tongue organ but also degree of development of the organ within the two species. Namely, as the number of tongue photopores was compared, 24 for *microchir* and 14 for *macrolepidotus* were counted, respectively (see Fig. 1, A & B). Moreover, the size of anterior organ of later species is larger than that of the former, conversely, the consequence is reversed within each other in case of characteristic posterior ones.

General conclusion to be drawn from the comparison in the histological anatomy of the organ within two species may suggested that *microchir* is more in advance than *macrolepidotus* as far the tongue luminous organ concerned.

It will be note-worthy fact that the distinction between *microchir* and *macrolepidotus* is more classified by their tongue photopores, which are newly described here in comparison with each other by means of both macro and microscopical anatomies.

Summary

1) Turning inside out with apex of the tongue of two Japanese scopelids, the photopores fringe along the antero-marginal portion of the tongue in a regular series.

2) Basing the structure photopores divide into two groups. Namely, the group of smaller photopores arrange at anterior thinner part of tongue laying in a row, the second is composed of a couple posteriorly.

3) The organ is closed type of light organ without any opening and duct, and

is consisting five components, *photogenic gland*, *lens*, *pigmented membrane*, *granular layer* and *reflector*.

4) Consisting the lenses characterized the tongue luminous organ, especially the large one, L_3 shows thicker quite translucent aqueous substance at posterior group.

5) In number of the organ, *microchir* is 24 and *macrolepidotus* 14, respectively, and the size of the later is larger than former anteriorly, on the other hand the consequence is reverse posteriorly.

6) As far as the tongue luminous organs concerned, *microchir* is more in advance than *macrolepidotus*.

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