

CHARACTERISTICS OF THE DERMAL COVERING IN PLATYRHINIDAE (CHONDRICHTHYES, RHINOBATIFORMES)

Pascal P. Deynat¹

ABSTRACT

As part of the ongoing Odontobase[®] Project which intends to identify Chondrichthyes by their dermal covering characteristics (DEYNAT, 2000 a, b, 2003, 2005), Rhinobatiformes were studied in detail and results concerning the Platyrrhinidae Jordan, 1923 are hereby presented. The characteristics of the dermal covering of Platyrrhinidae indicate that they can be discriminated from the other Rhinobatiformes by the absence of corono-peduncular relief of the tubercles, the mode of covering of the basal plate of the tubercles, and the covering of both dorsal and ventral sides of the body by similarly shaped denticles devoid of any superficial relief. *Platyrrhinoidis* Garman, 1881 is set apart from *Platyrrhina* Müller and Henle, 1838 by the presence of rostral tubercles, a well differentiated anterolateral series of small spiny tubercles and the absence of a lateral series on the tail.

Key words: Platyrrhinidae, dermal denticles, tubercles, Odontobase[®] Project.

RESUMO

Características da cobertura dérmica em Platyrrhinidae (Chondrichthyes, Rhinobatiformes).

No quadro do Projeto Odontobase[®], que visa identificar os Chondrichthyes com base em suas características de revestimento cutâneo (DEYNAT, 2000a, b, 2003, 2005), foram estudados os Rhinobatiformes, sendo os resultados referentes à família Platyrrhinidae Jordan, 1923 aqui discutidos. As características do revestimento cutâneo dos Platyrrhinidae mostram que esta família pode ser separada dos outros Rhinobatiformes com base na ausência de relevo corono-peduncular sobre os tubérculos, o modo de cobertura da placa basal dos tubérculos sobre o disco e a cobertura das duas faces do corpo por denticulos de forma idêntica e desprovidos de qualquer tipo de relevo superficial. *Platyrrhinoidis* Garman, 1881 se distingue de *Platyrrhina* Müller e Henle, 1838 pela presença de tubérculos rostrais, uma série antero-lateral de tubérculos bem diferenciada e pela ausência de uma série lateral de tubérculos na cauda.

Palavras-chave: Platyrrhinidae, denticulos dérmicos, tubérculos, Projeto Odontobase[®].

INTRODUCTION

Following Compagno (1999), guitarfishes are grouped in the order Rhinobatiformes, comprising three families (Rhinobatidae Müller and Henle, 1837, Platyrrhinidae Jordan, 1923 and Zanobatidae Fowler, 1928) and seven genera: *Aptychotrema* Norman, 1926, *Rhinobatos* Linck, 1790, *Trygonorrhina* Müller and Henle, 1838, *Zapteryx* Jordan and Gilbert, 1880, *Platyrrhina* Müller and Henle, 1838, *Platyrrhinoidis* Garman, 1881 and *Zanobatus* Garman, 1913.

The family Platyrrhinidae is composed of two species endemic to China and Japan (*Platyrrhina limboonkengi* Tang, 1933 and *Platyrrhina sinensis* [Bloch and Schneider, 1801]) and one species endemic to the Californian coast, *Platyrrhinoidis triseriata* (Müller and Henle 1841) (MÜLLER; HENLE, 1841; RICHARDSON, 1846; JORDAN; GILBERT, 1880; JORDAN; EVERMANN, 1896a, b; NORMAN, 1926; TANG, 1933; WANG, 1933; FOWLER, 1941; CHEN, 1951; NAKAYA, 1984; STEHMANN, 1991; SHEN, 1993; NGUYEN; LAN, 1994; NI; KWOK,

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¹ 12 rue Mouton Duvernet, 75014 Paris, França, e Muséum National d'Histoire Naturelle, Département Milieux et Peuplements Aquatiques USM 0403 "Biodiversité et Dynamique des Communautés Aquatiques", 43 rue Cuvier, 75231 Paris Cedex 05, França – E-mail: pdeynat@free.fr Pesquisa realizada no projeto Odontobase[®] (INPI n° 04 3306163).

1999; COMPAGNO; LAST, 1999; RANDALL; LIM, 2000).

In collecting as much informations as possible on the morphology of chondrichthyan odontodes, new data on the characteristics of the dermal covering have been brought to light regarding their main organization as related to the systematics of the families within the Rhinobatiformes. Results concerning the Platyrrhinidae are hereby presented.

MATERIAL AND METHODS

Morphological comparative studies have been made on 18 platyrrhinid specimens, belonging to the MNHN, AMNH and BMNH collections (acronyms follow Leviton et al., 1985).

Platyrrhinoidis triseriata: MNHN 1884-0486: immature ♀ 63 mm DW, California, MNHN 1884-0485: immature ♀ 69 mm DW, California, MNHN 1985-0795: ♂ 185 mm DW, California, MNHN 1985-0210: ♂ 195 mm DW, ♀ 216 mm DW, California, MNHN 1884-0484: ♀ 280 mm DW, California, BMNH 1881.3.14.245: ♀ 272 mm DW, California, MNHN A3211: ♀ 287 mm DW, California, paratype.

Platyrrhina sinensis: MNHN 1987-0066: immature ♀ 53 mm DW and immature ♂ 77 mm DW, New Caledonia, MNHN 1941-0089: 2 immature ♀♀ 56 mm DW and 54 mm DW, China, Mingkiang basin, AMNH 44055: 2 immature ♀♀ 59 mm DW and 118 mm DW, Taiwan, MNHN 0000-1307: ♂ 195 mm DW, Vietnam, BMNH 1905.5.6.6-7: ♂ 220 mm DW and ♀ 193 mm DW, Japan.

Platyrrhina limboonkengi Tang, 1933: MNHN 1985-0794: immature ♂ 123 mm DW, Vietnam.

Measurements have been made according to Bigelow; Schroeder (1953). Disc width (DW) is employed as reference. Terminology of dermal denticles and skin sample preparation are according to Deynat (1996) and Deynat; Séret (1996). Information regarding the dermal covering of *P. limboonkengi* was completed with data from Tang (1933) on specimens measuring between 197 and 269 mm DW. Data on the dermal covering of Rhinobatiformes and abbreviations used follow Deynat (1996, 1998). Scanning Electron Micrographs were prepared at the "Centre Interuniversitaire de Microscopie Electronique" (CIME-Université Paris VII). Skin samples were covered with a 50 nm gold-palladium coating and observed with a Philips® SEM 505 microscope.

RESULTS

Dermal covering

Platyrrhinidae are characterized by numerous dermal denticles covering both dorsal and ventral parts

of the body and buccopharyngeal cavity. Spiny tubercles arranged in several series are also present (Fig. 1). The anterolateral edges of the dorsal disc are covered by very small spiny tubercles in juveniles, and by larger ones in adults (DEYNAT, 1996). The dorsal side of the disc is covered by minute punctiform tubercles in juveniles and adults, mixed with typical dermal denticles, and sometimes arranged in parallel rows.

Morphology and distribution of the dermal denticles

In both *Platyrrhina* and *Platyrrhinoidis*, the dorsal surface of the body and tail, including the fins and the skin of the eyeballs, is completely covered by minute, deeply imbricated dermal denticles in adults, giving a smooth texture to the skin (Figs. 2B, E, F). In *P. sinensis*, the denticles are present in a 53 mm DW newborn (MNHN 1987-0066): the denticles are already present but embedded in the skin and not yet erupted. Denticles of both dorsal and ventral surfaces of the body show a subcircular crown, which is anteriorly enlarged, and ends in a more or less differentiated tip (Fig. 2). Denticles are arranged in a mosaic on the front edges of disc and fins as observed in most basal batoids (Pristiformes, Rhiniformes and Rhinobatiformes) (DEYNAT, 1996). Larger denticles are sparsely present on the anterior part of the disc and on the full length of the tail in *P. sinensis*.

Denticles of the dorsal side of the body are all morphologically similar (dorsal isomorphy *sensu* Deynat; Séret, 1996), but present a larger size on the middorsal area of the disc and tail, around the orbital crest and on the skin covering the basal plate of the tubercles, especially in *Platyrrhinoidis*. Tang (1933) described this phenomenon in *P. limboonkengi*. The denticles are constituted by a pseudocircular and furrowed basal plate, overlaid by a short and thick peduncle and a circular crown rounded on its anterior part, and ending in a pronounced, slightly erected posterior tip (Fig. 2B). In *Platyrrhinoidis*, the dermal denticles located on the hind part of the tubercles show a retrograde orientation of the tip, which is directed to the center of the tubercle. Denticles cover entirely the front edges of the disc and fins in all studied specimens. They do not show any particular kind of differentiation in the juvenile of *P. limboonkengi* studied, except for the peculiar denticles of the front edges of the disc (Fig. 3A), as observed in *P. sinensis* (Fig. 3B) and *P. triseriata* (Fig. 4A).

Denticles of the ventral side of the body and tail are more tightly imbricated (ventral and dorsoventral isomorphy *sensu* Deynat; Séret, 1996) (Figs. 2E, F). In *Platyrrhinoidis*, the size of these denticles is around 300 µm in total length. This observation shows that the covering of the dorsal side of the body is ontogenetically finalized well before the ventral side, as observed in some species of Rajiformes (DEYNAT, 1996).

Platyrrhinidae present dermal denticles both on the roof and floor of the buccopharyngeal cavity. In all specimens studied, the dermal denticles show a flat, subcircular crown (Figs. 2C, D), without any keel or furrow, overlying a short peduncle and a subcircular basal plate, very similar to those of the body (Figs. 2B, E). The tip of the crown is not in the direct continuation, but is marked after a slight shrinking of the crown as observed in some other taxa as Pristiformes and Rhinobatidae (DEYNAT, 1996, 2005). Buccopharyngeal denticles are close-set and imbricated in adults.

Morphology and distribution of the tubercles

Tubercles of Platyrrhinidae are constituted mainly by an ovoid and pluriradiate basal plate, more or less covered by dermal denticles according to the maturity of the specimen (Fig. 4). They are present as dark marks in newborns (MNHN 1987-0066). The weakly differentiated peduncle is oval and short, erected on its posterior part, with strong furrows on its surface (Figs. 4B, C). It is overlaid by an elongated cylindrico-conical crown, erected and pointed on its posterior tip, showing no distinct relief. The tubercles are comparatively larger in *Platyrrhinoidis* than in *Platyrrhina* and are arranged in several series (DEYNAT; SÉRET, 1996). Comparisons show that the tubercles on the tail have a more elongated and erected crown, without pyramidal differentiation or furrows on the basal plate. Tubercles of *Platyrrhina* have a narrow anterior part and an elongated ovoid crown flattened on its middle part. Some of the tubercles, showing a rudimentary peduncle and white coloration, present in fact the typical characteristics of the denticles being destructed (DIEUZEIDE, 1928).

Juveniles and subadults of Platyrrhinidae bear tubercles that are arranged as anterolateral series on the dorsal side of the body, along the anterior margins of the disc, from the anterior limit of the propterygium to the level of the apex (Figs. 1A; 3C, D; 4A). These spiny tubercles show the same morphology as the main tubercles and are larger in *P. triseriata*.

Anterolateral tubercles are located on the anterior quarter of the rostrum in adults of *P. sinensis*. These thornlets are weakly differentiated in *P. limboonkengi* (Fig. 3A) and their pattern is unknown in adults. In *P. triseriata* (Fig. 3C, D; 4A) and *P. sinensis*, anterolateral tubercles are different from the adjacent dermal denticles by their larger conical crown with a pointed tip and distribution in 2 or 3 irregular rows on the surface of the disc.

In *Platyrrhinoidis*, thornlets of the anterolateral series are located in the same area as that of *Platyrrhina*. They are arranged in 3-4 rows from the tip of the propterygium to the level of the first pairs of gill slits, slightly in front of the apex of the pectoral fins.

Platyrrhina is set apart from *Platyrrhinoidis* by having some minute spiny tubercles located on most of the dorsal disc and on most of the tail, which are sometimes arranged in parallel rows, such as in the closely related genus *Zanobatus* Garman, 1913 (DEYNAT, 1996).

These minute tubercles are constituted by an ovoid or subcircular basal plate with furrows and keels, which are partially or completely covered with dermal denticles. The peduncle is weakly differentiated and is overlaid by a pointed and pyramidal crown (*P. limboonkengi*) or a pointed, elongated and posteriorly erected crown (*P. sinensis*), without any coronopeduncular relief. The partial covering of the basal plate of the tubercles is observed in both species, but is less pronounced in *P. limboonkengi*, most certainly due to the juvenile stage of the specimen examined.

Rostral series

The rostral series (SROS, Table 1) is differentiated only in *Platyrrhinoidis* and is composed of 3 to 6 tubercles dispatched in two rows located on the tip of the snout. These tubercles roughly form a kind of triangle with the tip oriented towards the orbital area but, in larger specimens, a complementary tubercle is located at the extreme tip of the snout, giving to the series a pseudo-circular disposition (BMNH 1881.3.14.245).

Orbitospiracular series

The orbitospiracular series (SORB, Table 1) is composed of largely separated thorny tubercles, without forming a continuous row, except in juvenile specimens of *P. sinensis*. In *P. limboonkengi*, there are around 3 to 6 grouped tubercles arranged as 2 or 3 large tubercles surrounded by smaller ones. The number of orbitospiracular tubercles is between 3 and 9

in *P. sinensis* and 5 to 7 in *P. limboonkengi* (Table 1). Anteorbital tubercles of larger *P. sinensis* are arranged in 2 rows of unequal size, the more external being the smaller one. There is one postorbital tubercle and 2 to 3 suprascapular ones of equal size in *P. limboonkengi*, but of unequal size in *P. sinensis*. In the latter, the more anterior suprascapular tubercles are smaller, but the postorbital tubercle of the BMNH specimen (220 mm DW) shows an unusual shape, the crown being shorter, enlarged and erected. Slight furrows are visible on the lateral margins of the mediobital tubercles of this specimen but not in the others.

In *Platyrrhinoidis*, orbitoscapular tubercles (2 to 6) are widely separated and constitute a continuous row in juveniles, becoming discontinuous in adults. This series is arranged from the anterior part of the eyelid to the posterior level located between the hind part of the orbit and the events. Suprascapular tubercles variably appear in larger specimens.

Nuchal series

The nuchal series (SNUC, Table 1) is constituted by 1 row of spiny tubercles, which are comparatively larger in *Platyrrhinoidis*. In *Platyrrhina*, there are 3 to 6 lined tubercles reaching the anterior edge of the scapular girdle. 1 to 2 mediscapular tubercles (SMED) are located just behind this series, on the middle part of the scapular girdle. In *Platyrrhinoidis*, the nuchoscapular area presents 1 to 4 regularly-lined, evenly spaced, spiny tubercles, from the level of the second pair of gills-slit to the anterior edge of the scapular girdle. The first tubercles are mainly smaller than the other ones indicating a later development. There are always 2 midscapular tubercles (Fig. 5).

Scapular series

The scapular series is constituted by tubercles arranged in 2 rows of 2 to 3 tubercles, more or less lined, disposed in parallel to the mid-dorsal line (Fig. 5). Scapular tubercles are arranged in 2 series comprising 1-2 tubercles for the inner series (SSCI, Table 1) and 1-3 tubercles for the outer series (SSCE, Table 1). These external tubercles form a slightly anteriorly curved line following the shape of the scapular girdle. The inner scapular series shows always 2 tubercles at any stage of development, the anterior being the smaller. The outer scapular series has 2-3 tubercles and shows an intercalated series between the midscapular and the inner scapular series in larger specimens or an external series to the outer

scapular series in *P. sinensis* and *P. limboonkengi* (TANG, 1933) (Table 1).

Middorsal series

Middorsal tubercles constitute a more or less complete row from the posterior edge of the scapular girdle to the level of the second dorsal fin. This series is divided into middorsal truncal and caudal series (DEYNAT; SÉRET, 1996).

Middorsal truncal series

In *Platyrrhinoidis*, the middorsal truncal series (SMDT, Table 1) is constituted by 3 to 8 large tubercles regularly spaced, forming a continuous row from the posterior edge of the scapular girdle to the origin of the first dorsal fin (Table 1, Figs. 1, 5). In *Platyrrhina*, this series is discontinuous, and marked by tubercles on the anterior part of the middorsal line, from the posterior part of the scapular girdle to slightly in front of the pelvics (TANG, 1933).

Middorsal caudal series

The middorsal caudal series (SMDQ, Table 1) is visible in the studied specimen of *P. limboonkengi*. According to the description of Tang (1933), the small middorsal tubercles of the trunk constitute a more or less continuous row from the posterior edge of the scapular girdle to the level of the posterior edge of the pectorals. Tang (1933: 562) indicated that the middorsal tubercles of the trunk in *P. limboonkengi* sometimes reach the tail in larger specimens, between 197 and 269 mm DW. This could indicate that a progressive differentiation of the tail tubercles occurs after that of the disc for constituting a complete middorsal series in adults, as observed in some *Dasyatis* (pers. obs.). This series is also more or less complete in *P. sinensis*, comprising 4 to 22 irregularly spaced tubercles. Two specimens from New Caledonia (MNHN 1987-0066) are separated from all the other ones at a similar stage of growth by the elevated number of the tubercles of tail (14-23) (Table 1).

In *Platyrrhinoidis*, the series is always present and constituted by 8-16 regularly lined tubercles on the tail.

Interdorsal series

The interdorsal series comprises tubercles located in the space between the two dorsal fins (SINT, Table 1). There are 0 to 2 interdorsal tubercles in *P. sinensis* and only 1 in the studied specimen of *P. limboonkengi*. Tang (1933: 562) mentioned 2 pairs of interdorsal tubercles in these species, but examination of the ori-

ginal illustrations shows that these are in fact the tubercles of the parallel series arranged on each side of the interdorsal space, as observed in a large specimen of *P. sinensis* (MNHN 0000-1307). In *Platyrrhinoidis*, 1 to 2 interdorsal tubercles are always present.

Parallel and lateral series

The middorsal series of Platyrrhinidae is completed on each side of the line of symmetry by a series of tubercles between the posterior edge of the scapular girdle and the second dorsal fin in adults (parallel series, SPAR) and some tubercles present on the lower part of the tail, from its insertion to the base of the caudal fin (lateral series, SLAT) (STEHMANN; BÜRKELE, 1984).

Parallel series

These series (SPAR, Table 1) are poorly visible in juveniles. The tubercles show the same morphology as the previously mentioned tubercles, except at the level of the origin of the first dorsal fin where they are represented by some punctiform tubercles. In *Platyrrhina*, tubercles of the parallel series also show a larger size on the hind part of the tail than in *P. limboonkengi*, and are visible under the skin in the larger specimen of *P. sinensis* from New Caledonia (MNHN 1987-0066).

In *Platyrrhinoidis*, the parallel series is constituted in adults by 10 to 37 tubercles positioned just in front of the origin of the pelvic fins and extending to the base of the second dorsal fin (Fig. 5). In juveniles, this series is limited anteriorly to the base of the tail and extends posteriorly to the level of the first dorsal fin. In larger specimens, the parallel series is arranged from the inner scapular series to the level of the second middorsal tubercle of the trunk, and extends posteriorly to the level of the free edge of the second dorsal fin (BMNH 1881.3.14.245).

Lateral series

There is no lateral series in *Platyrrhinoidis*. In *Platyrrhina*, tubercles of the lateral series (SLAT, Table 1) are very different of those of the parallel series. They are punctiform and are regularly arranged from the front edge of the pelvics to the base of the caudal fin.

Posterior discal tubercles

Larger specimens of *Platyrrhinoidis* are characterized by 1 to 3 supplementary spiny tubercles on each side of the basal part of the tail, between the base of

the posterior edge of the disc and the origin of the pelvics in adults (216-272 mm DW). These tubercles are located on the axis of the outer scapular series but are limited to the posterior part of the disc, without forming a continuous row with the latter ones.

DISCUSSION

The family Platyrrhinidae was usually considered to consist of three genera: *Platyrrhina*, *Platyrrhinoidis* and *Zanobatus* (GARMAN, 1913; FOWLER, 1941; COMPAGNO, 1973; MCEACHRAN, 1982). Characteristics of the dermal covering suggested that *Zanobatus* had to be set apart of the group formed by *Platyrrhina* and *Platyrrhinoidis* (DEYNAT, 1996, 1998, 2000), and McEachran et al. (1996) and Compagno (1999) ranked *Zanobatus* in its own family, Zanobatidae Fowler 1928.

In a general analysis of the characteristics of the dermal covering among Rhinobatiformes, it appears that the Platyrrhinidae present a typical 'rhinobatoid-type' dermal covering rather than a 'rajoid' or 'myliobatiform-type' (DEYNAT, 1996). The typical alar and malar thorns of adult rajoids are not differentiated in Rhinobatiformes, but the development of some tubercles on the edges of the dorsal side of the head in *Zapteryx brevirostris* (BIGELOW; SCHROEDER, 1953; DEYNAT, 1998) and the differentiation of anterolateral tubercles in Platyrrhinidae suggest these characters to be homoplastic among batoids *sensu* Compagno (1999).

Rhinobatiformes share in common a dermal covering constituted by numerous dermal denticles covering both dorsal and ventral sides of the body. Crowns of the denticles of the ventral side are tear-shaped or almost rounded, without any superficial relief. Denticles are also present in the buccopharyngeal cavity and are arranged as a mosaic on the front edge of the fins. Tubercles are arranged in several series and there are always 2 scapular series.

Platyrrhinidae are well separated from *Zanobatus* and from all other Rhinobatiformes (DEYNAT, 1996) by characteristics of their anatomy and their dermal covering:

1) Denticles of similar shape on both dorsal and ventral side of the disc and tail. Denticles are larger on the mid-dorsal areas of the disc and tail and are more imbricated on the ventral side (DEYNAT, 1996). Variations observed in adults are mainly due to the enlargement of the crown, as mentioned in some species of sharks (MUÑOZ-CHAPULI; BLASCO,

1981) and at least one fossil genus of Platyrrhinidae (CARVALHO; 2004). In all the other Rhinobatiformes (except for *Rhinobatos blochii* Müller and Henle, 1841 and for the denticles of the hind part of the body of *Rhinobatos rhinobatos* (Linnaeus, 1758)), dermal denticles of the dorsal side of the body are morphologically different from those of the ventral side (DEYNAT; 1996; DEYNAT; SERET, 1996)

2) Differentiation of minute tubercles as antero-lateral series on the anterior dorsal edges of the disc, from the tip of the propterygium to the level of the spiracles (better defined in *Platyrrhinoidis*). Within examined juveniles, denticles of the anterolateral edges of the disc show an undifferentiated shape represented by a sharp and elongated tip on a quadriradiate basal plate.

3) Tubercles with a short peduncle and an ovoid basal plate with around twenty strong furrows. The basal plate is partially or completely covered by dermal denticles and does not show any coronopeduncular relief (which is characteristic of the other Rhinobatiformes) (DEYNAT, 1996, 1998; DEYNAT; SÉRET, 1996)

The main differences between Platyrrhinidae genera are: the relative size of the tubercles (larger in *Platyrrhinoidis*, especially for the tubercles of the anterolateral series), the presence of a complete middorsal truncal series in *Platyrrhinoidis* (discontinuous in *Platyrrhina*), the presence of a rostral series in *Platyrrhinoidis*, and the absence of a lateral series in this genus. It seems that the middorsal series is continuous only in adults of *Platyrrhina*. Interspecific variations observed in this genus are mainly the mode of covering of the basal plate of the tubercles (partially covered in *P. sinensis*, more or less free in *P. limboonkengi* according to the location), and the shape of the tubercles of the lateral and parallel series, showing a smaller size and a punctiform morphology close to the first dorsal fin. Adults of *Platyrrhinoidis* present larger isolated tubercles located on the posterior part of the disc, independent of the above mentioned series.

The morphology and arrangement of the tubercles of the parallel and lateral series in *Platyrrhina* are very similar, but serve to separate both species: the parallel series is mainly characterized by presenting spiny but punctiform tubercles at the level of the first and second dorsal fins in *P. limboonkengi*, whereas they are only located at the level of the second one in *P. sinensis*. Comparisons with *P. triseriata* show that this species,

which presents no punctiform tubercle, is closely related to *Platyrrhina* by the differentiation of a parallel series of spiny tubercles. The presence of a middorsal caudal series in *Platyrrhinoidis* is also a common character shared with adult *Platyrrhina*, following confirmation of the descriptions in Tang (1933).

Key to Rhinobatiformes based on morphological comparisons of the dermal covering (modified from Deynat, 1996)

Dermal covering constituted by closely set dermal denticles covering both sides of the body, fins and buccopharyngeal cavity. Tubercles differentiated on the dorsal side of the body in several series. Always two scapular series.

- 1a. Tubercles showing a coronopeduncular relief 2
- 1b. Tubercles with a pointed and oblong crown devoid of any coronopeduncular relief. Basal plate of the tubercles mutiradiate, sometimes almost covered by dermal denticles 3 (Platyrrhinidae)
- 2a. Differentiation of a pro- and metapterygial series of minute tubercles on the disc Zanobatidae
- 2b. Absence of pro- and metapterygial series on the disc Rhinobatidae
- 3a. Rostral series of tubercles present *Platyrrhinoidis*
- 3b. Absence of rostral tubercles *Platyrrhina*

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TABLE 1 – Variations of the series of tubercles in Platyrrhinidae (modified from Deynat, 1996). Abbreviations follow Deynat (1996, 1998): SROS: rostral series, SORB: orbitospiracular series, SNUC: nuchal series, SMED: midscapular series, SSCI: inner scapular series, SSCE: outer scapular series, SMDT: middorsal truncal series, SMDQ: middorsal caudal series, SPAR: parallel series, SLAT: lateral series, SINT: interdorsal series, Ao: anteorbital, Mo: mediorbital, Po: postorbital, Su: supraspiracular, F: female, M: male, Mi: immature male. Numbers in brackets indicate tubercles not erupted.

Species	N° collection	size	sex	origin	SROS	SORB	SNUC	SMED	SSCI	SSCE	SMDT	SMDQ	SPAR	SLAT	SINT	total number
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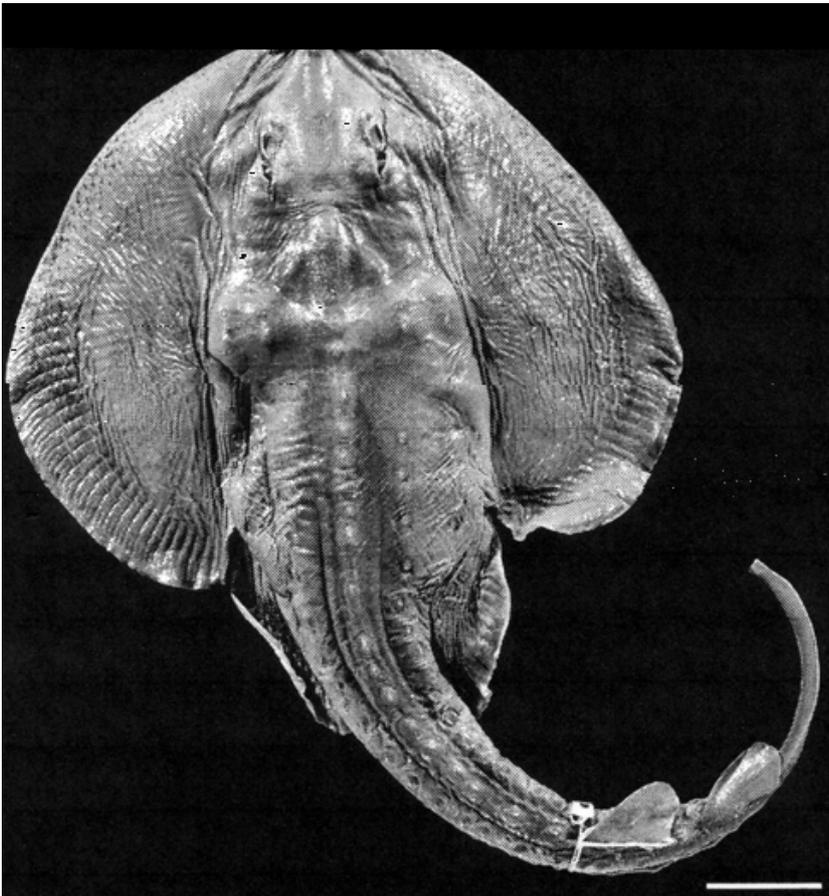


Fig. 1. General morphology of a Platyrrhinidae, *Platyrrhinoidis triseriata* BMNH 1881.3.14.245. Scale bar = 5 cm.

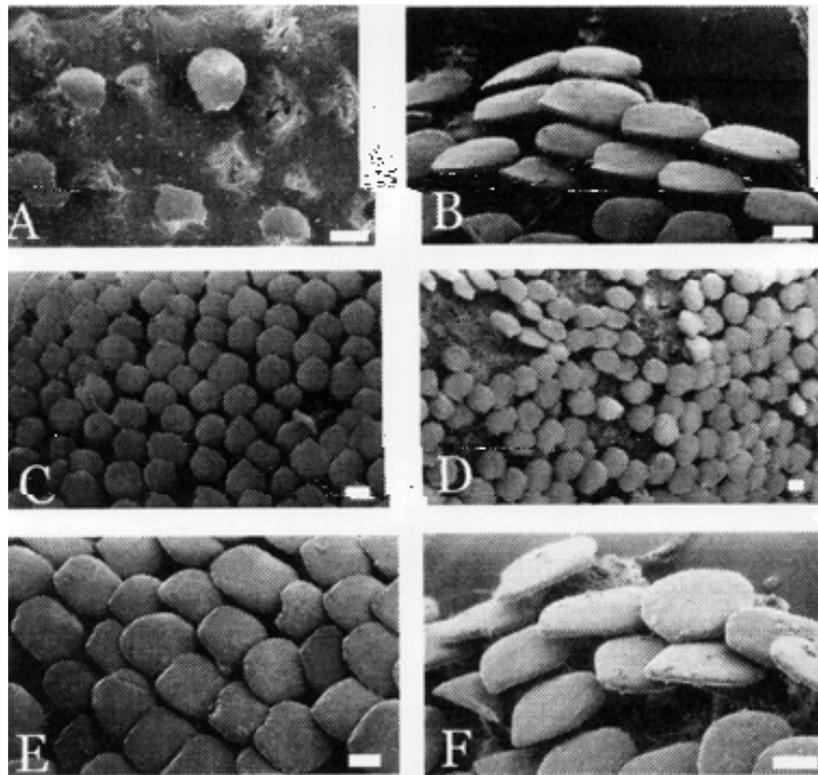


Fig. 2. **A.** Denticles of the anterior part of the disc of *P. limboonkengi* MNHN 1985-89. **B.** Denticles of the dorsal side of the disc of *P. triseriata* MNHN 1985-795. **C.** Buccopharyngeal denticles of *P. sinensis* MNHN 1307. **D.** Buccopharyngeal denticles of *P. triseriata* MNHN 1985-210. **E.** Denticles of the ventral side of the disc of *P. triseriata* MNHN 1985-795. **F.** Detailed view of the same sample. Scale bar = 100 μ m.

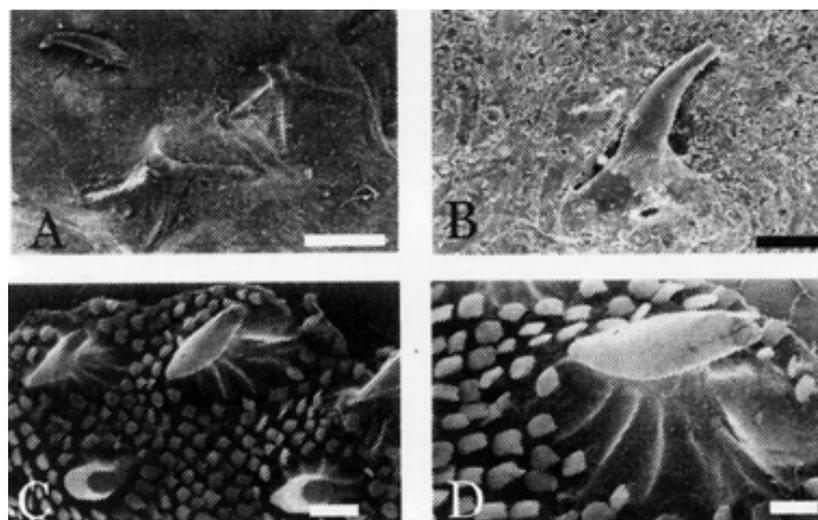


Fig. 3. Anterolateral thornlets and tubercles. **A.** Differentiated thornlets of the edges of the dorsal side of the disc in *P. limboonkengi* MNHN 1985-794. **B.** Denticles of the anterolateral sides of the disc in *P. sinensis* MNHN 1941-89. **C.** Spiny tubercles of the anterolateral series in *P. triseriata* MNHN 1985-210. **D.** Detailed view of the same sample. Scale bar = 100 μ m, except for **C** and **D** = 1 mm.

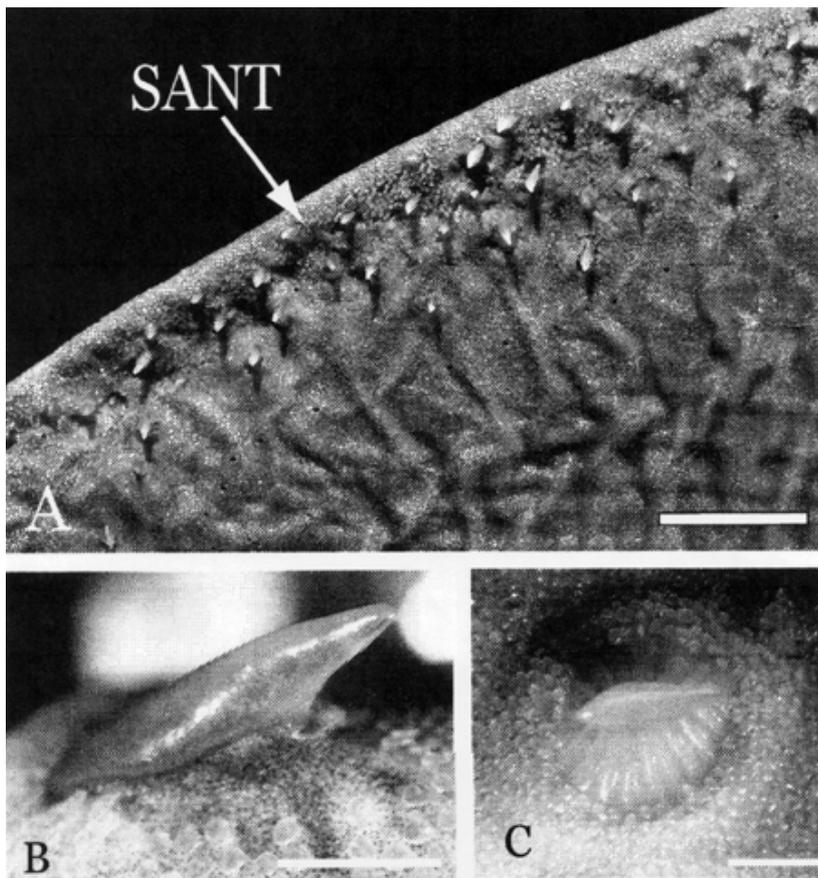


Fig. 4. **A.** Thornlets of the anterolateral series in *P. triseriata* BMNH 1881.3.14.245. **B.** Spiny tubercle of the disc in *P. sinensis* MNHN 1307 showing the radiate basal plate partially covered by dermal denticles. **C.** Detailed view of a spiny tubercle of *P. triseriata* MNHN 1985-210. Legend: SANT: anterolateral series. Scale bar = 5 mm, except **A** = 2 cm.

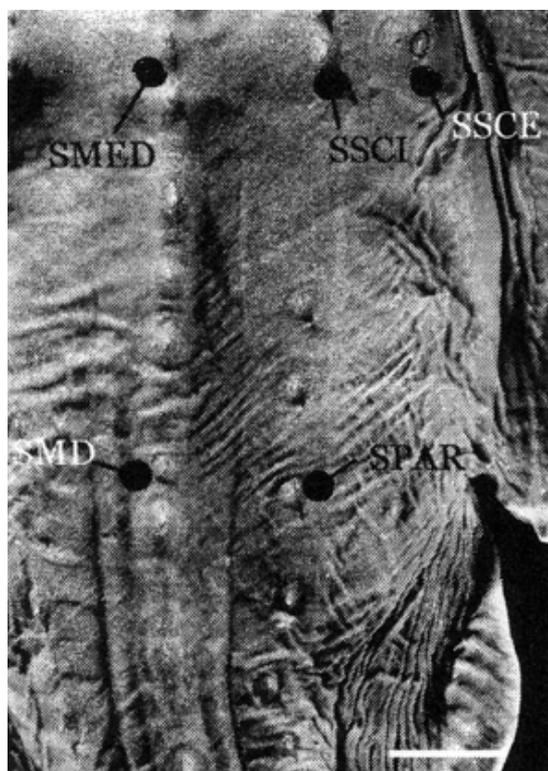


Fig. 5. Hind view of the disc of *P. triseriata* BMNH 1881.3.14.245. Legends from Deynat (1998): SMED: mediscapular series, SMD: mid-dorsal series, SSCI: inner scapular series, SPAR: parallel series, SSCE: outer scapular series. Scale bar = 2 cm.