

Identification key of the starfish *Astropecten* of the Mediterranean Sea



IDENTIFICATION KEY OF THE STARFISH *ASTROPECTEN* OF THE MEDITERRANEAN SEA

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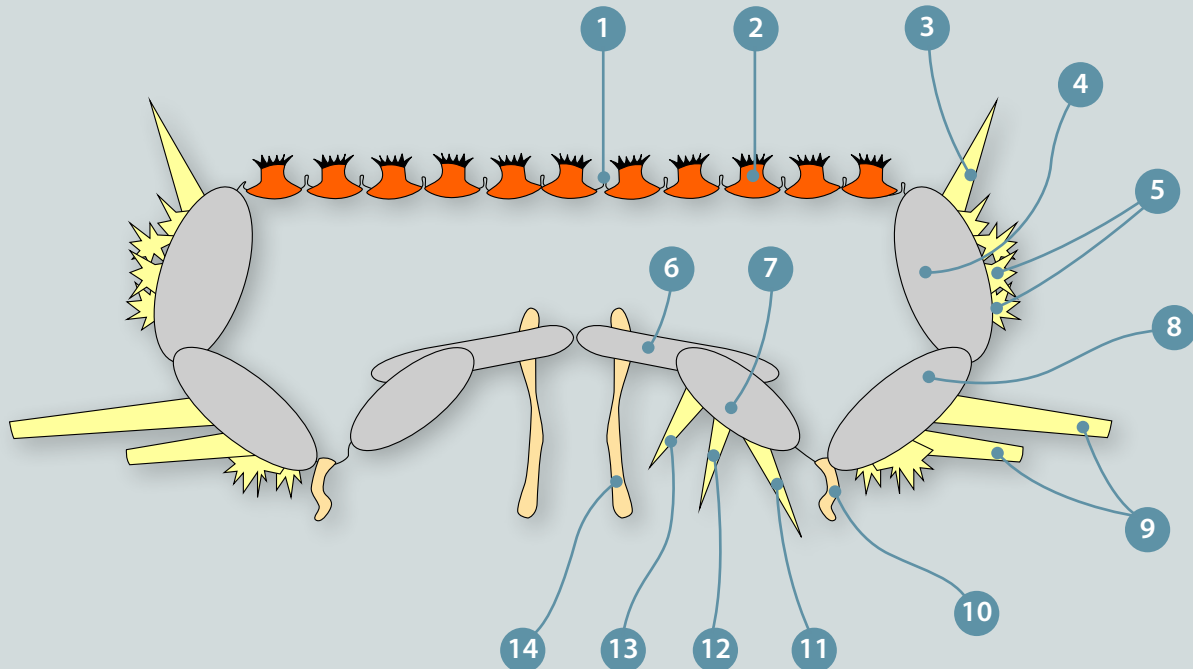
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Astropecten spinulosus emitting gametes, Marseille, France. S. Le Bris

..... Description of an arm's section of starfish genus *Astropecten* :



- 1 - papulas : they are soft and retractable appendages with respiratory functions
- 2 - paxilla
- 3 - superomarginal spine
- 4 - superomarginal plate
- 5 - scales and small spines covering the vertical face of superomarginal plates
- 6 - ambulacral plate
- 7 - adambulacral plate
- 8 - inferomarginal plate
- 9 - inferomarginal spines
- 10 - pedicellaria : special pedicels with prehensile termination necessary to grab bodies and detritus
- 11 - external adambulacral spine
- 12 - median adambulacral spine
- 13 - internal adambulacral spine
- 14 - ambulacral pedicellaria

Starfishes have two sides : an upper side called "aboral side" (which is normally visible), and a bottom side called "oral side" (which rests on the soft bottom).

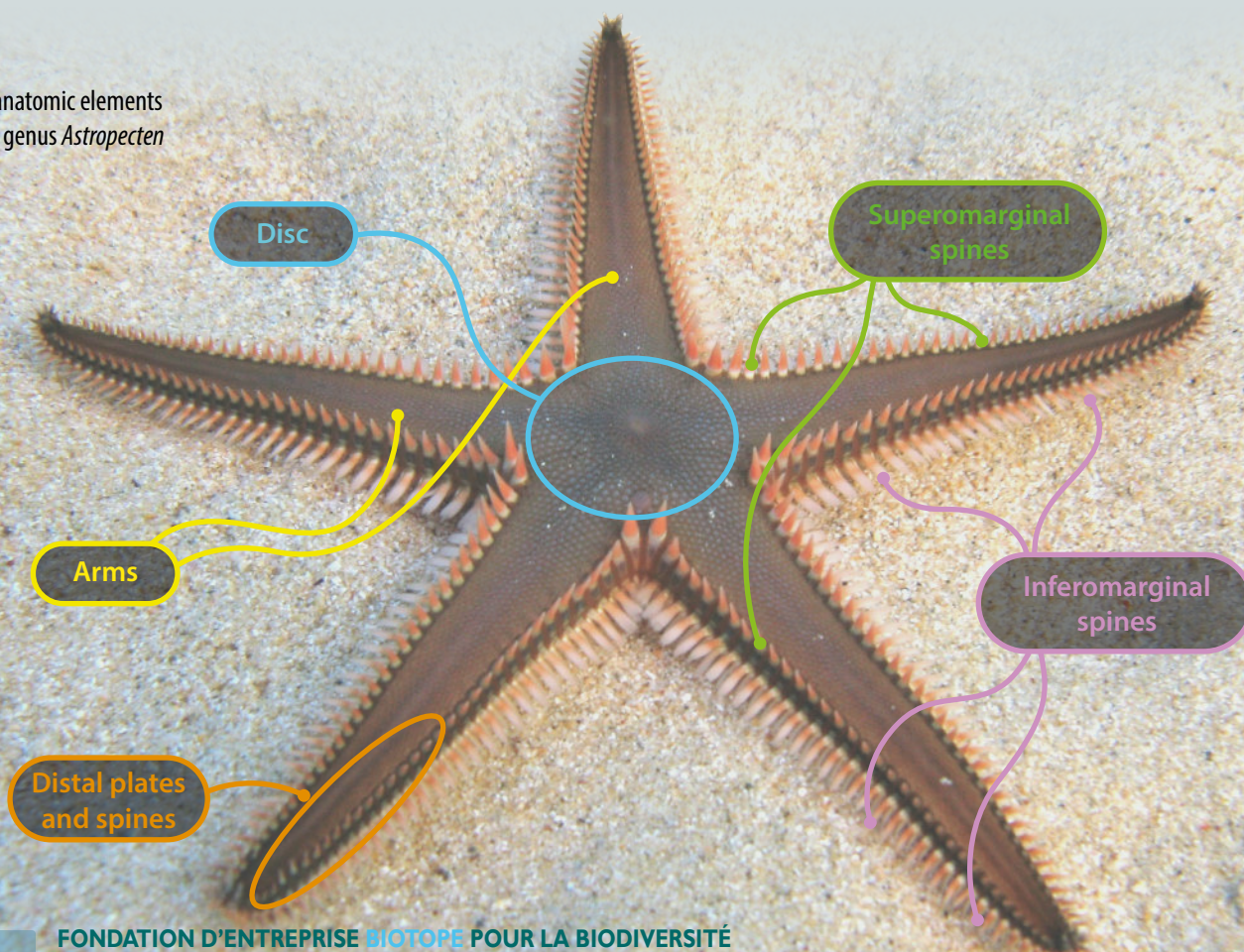
The starfishes of genus *Astropecten* live on mobile soft bottom (sandy, muddy or gravel soft bottom) and they remain usually buried under sediment during the day. In the late afternoon and the night they go out to hunt mainly bivalve molluscs, which are their favourite preys. In turn they are preyed on by large gastropod molluscs such *Charonia lampas*, *Charonia variegata* and probably *Tonna galea*.

In Mediterranean Sea live six species of the genus *Astropecten* :

- *Astropecten aranciacus* (Linnaeus, 1758)
- *Astropecten jonstoni* (Delle Chiaje, 1827)
- *Astropecten irregularis* (Pennant, 1777)
- *Astropecten spinulosus* (Philippi, 1837)
- *Astropecten bispinosus* (Otto, 1823)
- *Astropecten platyacanthus* (Philippi, 1837)

These seastars may look similar in appearance but usually it is possible to determine the species by photo checking the features described by principal authors that have analyzed over the years many specimens in the laboratory. All of the following described the main features found in thousands of specimens encountered and photographed in Mediterranean Sea (Italy : Trieste, Sardinia; France : Corse; Croatia : Istria, Rab, Cres, Krk, Pag, Murter, Hvar; Greece : Lefkada, Kefalonia, Gulf of Arta, Peloponnese, Karpathos, Milos, Kimolos, Naxos, Paros, Antiparos, Ano Koufonissi, Kato Koufonissi, Donoussa, Mykonos, Crete, Limnos, Schinoussa, Sithonia; Spain : Menorca, Formentera) and the features described by the authors Enrico Tortonese, René Koehler, Emil Von Edler Marenzellerin, Hubert Ludwig, Ludwig Heinrich Philipp Döderlein. For *A. aranciacus*, *A. jonstoni*, *A. irregularis*, *A. spinulosus* usually determining the right species is quite easy, but for more complex species as *A. bispinosus* and especially *A. platyacanthus* it needs a more thorough analysis. The main features to determine the species by photo are : the appearance of the superomarginal plates and spines, the shape of disc and arms and the colour of aboral side. For good identifications is therefore useful a whole picture of the specimen and one of detail of the superomarginal plates, this can be done without turning over or disturbing the animal.

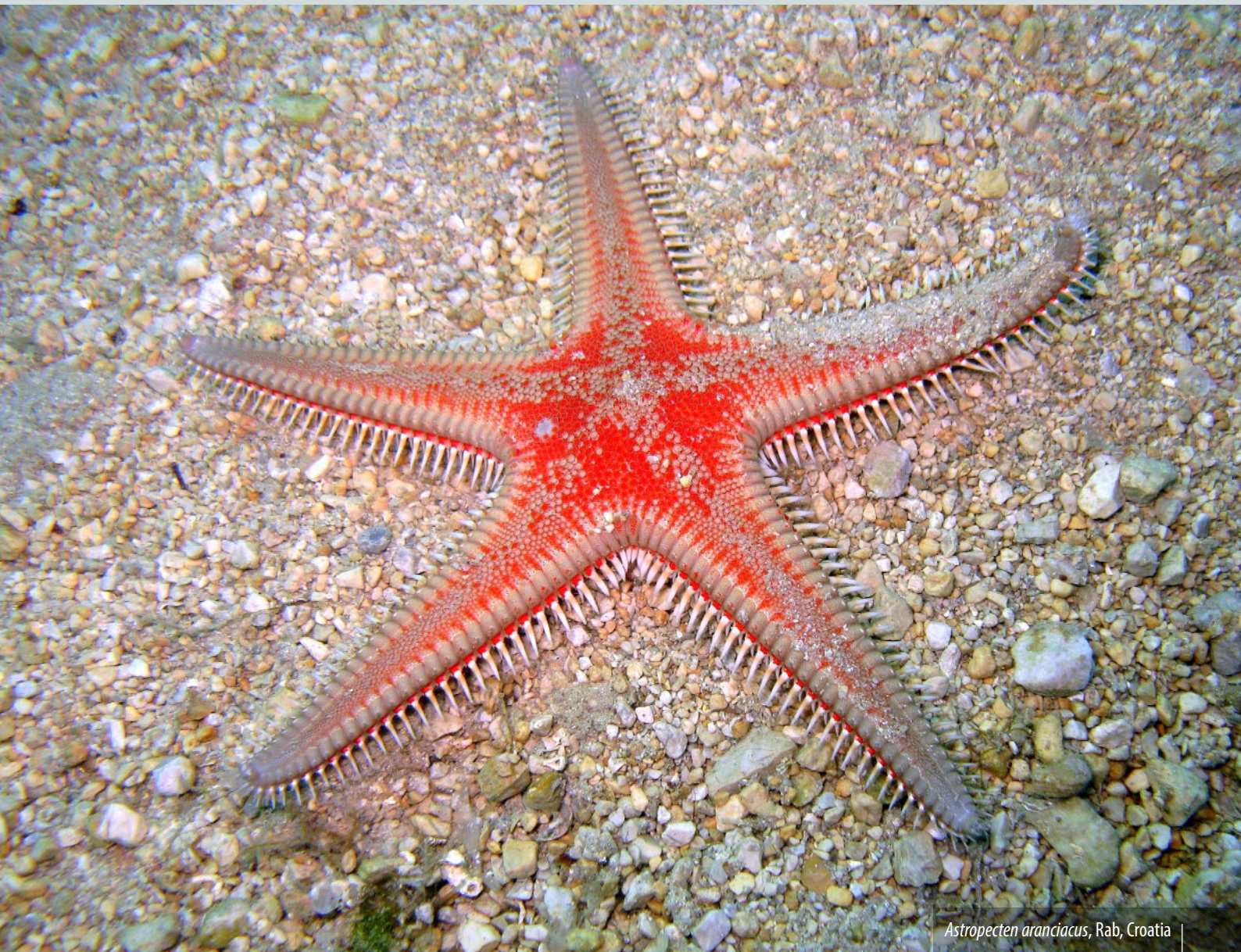
..... The main anatomic elements of starfish genus *Astropecten*



• *Astropecten aranciacus* (Linnaeus, 1758)

This starfish has supermarginal plates low and rounded equipped with 1 to 3 small spines and inferomarginal plates with long, pointed, strong, regularly arranged spines. The inferomarginal spines have orange- yellowish color at the base and white towards the tip. It is rugged with a normal size disc and pointed arms. **The color of the aboral side is given by the succession of the upper extremity of red-orange papillae (from the top they look like round dots) in combination with grey or beige paxillae.** The supermarginal plates are usually grey or beige homogeneous. This is the largest species of *Astropecten* in Mediterranean Sea with a maximum diameter of 55 cm (usually it measures about 30 cm).

A. aranciacus lives on sandy, muddy or gravel bottoms at depths between 2 and 100 m. This species is active and easy to find in the late afternoon and during the night. This species can be distinguished easily from the other species by colors and size. Sometimes it is confused with *A. irregularis* but it is distinguished because *A. aranciacus* has a different color of the aboral side (red-orange usually with grey or beige dots instead of pink) and supermarginal spines (present even if small instead of absent in Mediterranean specimens).



Astropecten aranciacus, Rab, Croatia

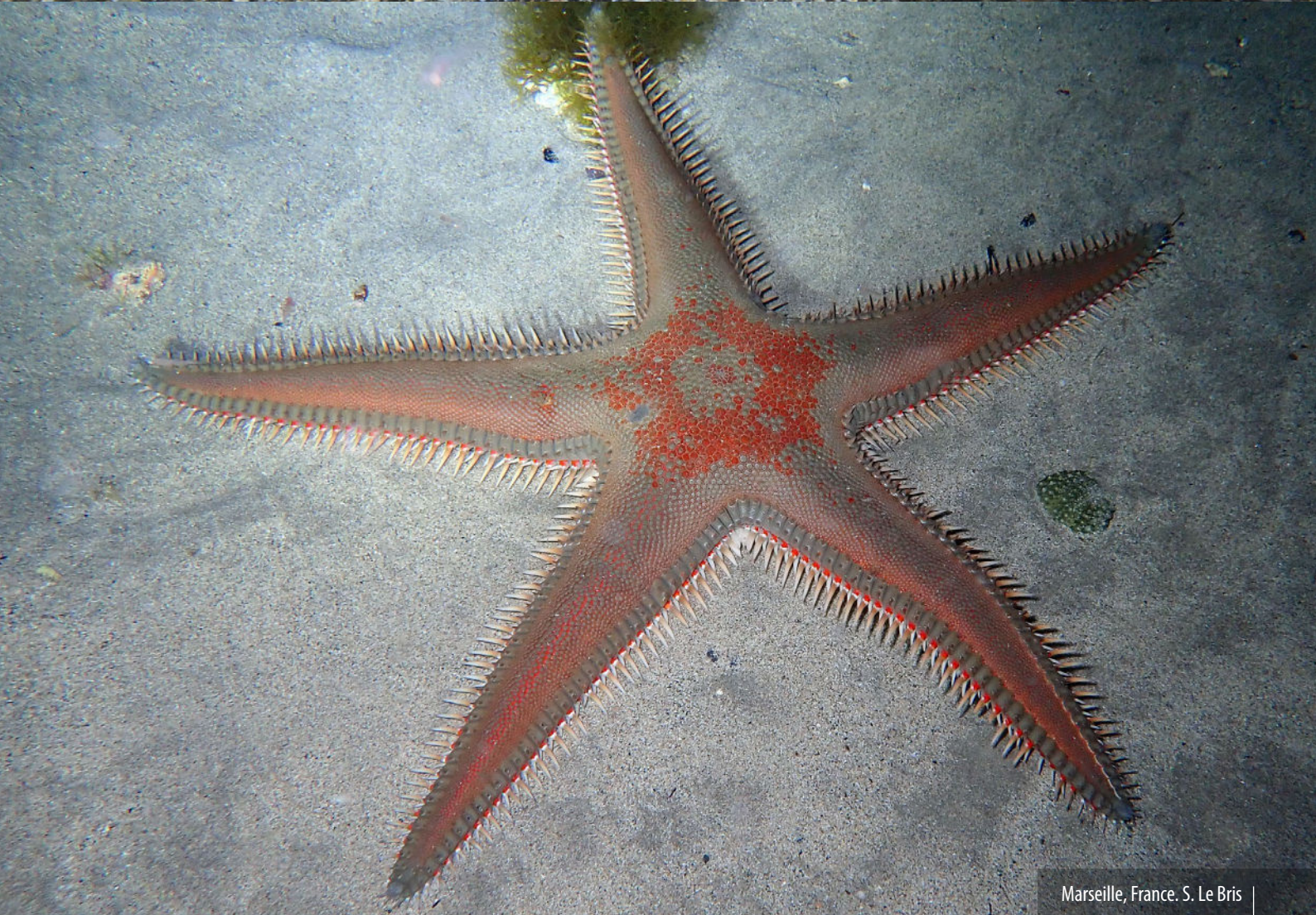
Astropecten aranciacus : emission of gametes. Rab, Croatia



Detail of superomarginal plates and paxillae of *Astropecten aranciacus*. Limnos, Greece



Puerto del Carmen, Lanzarote, Canary Islands. T. Menut.



Marseille, France. S. Le Bris



Nice, France. T. Menut.



Nice, Baie des Anges, France. P. Girard

• *Astropecten jonstoni* (Delle Chiaje, 1827)

This starfish has **superomarginal plates low and rounded with very short spines**, usually only in the distal plates (but in Western Adriatic, many specimens have relative long spines on all the superomarginal plates). The inferomarginal plate has a short and pointed external spine, arranged with great regularity, kept parallel to one another and few mobile. The inferomarginal spines have dark orange color at the base and white-yellowish towards the tip on going to draw a sort of orange outline at the base of the sea star. The overall shape is peculiar with a disc bigger than other species **and rather short, triangular and very pointed arms that accentuates the classic shape of star**. The colors of the aboral side is clear with various nuances that can be tending towards beige, turquoise-green or grey-brown. It is the smallest species of *Astropecten* of Mediterranean Sea with a maximum diameter of about 7-8 cm. This starfish usually can be distinguished easily by its overall shape, the size, the short and rigid inferomarginal spines and colors of aboral size. It can to be confused with young specimens of *A. irregularis* but it is distinguished because *A. jonstoni* has shorter and more rigid inferomarginal spines and a different color of the aboral side (beige, turquoise-green or grey-brown instead of pink). Rarely it is confused also with very young specimens of *A. platyacanthus* which may have superomarginal plates without spines or with very small spines but *A. jonstoni* differs for to have shorter and more rigid inferomarginal spines and a different appearance of the superomarginal plates (low, rounded and totally covered with small scales instead of high, vertical with the top inside edge totally bare). It prefers sandy soft bottom at low depths as between 1 and 12 m. Unlike other *Astropecten*, it is active and easy to find during the day, especially in early morning and late afternoon.



Astropecten jonstoni, Limnos, Greece

Astropecten jonstoni, Limnos, Greece



Detail of superomarginal plates and spines of *Astropecten jonstoni*. Mykonos, Cyclades, Greece

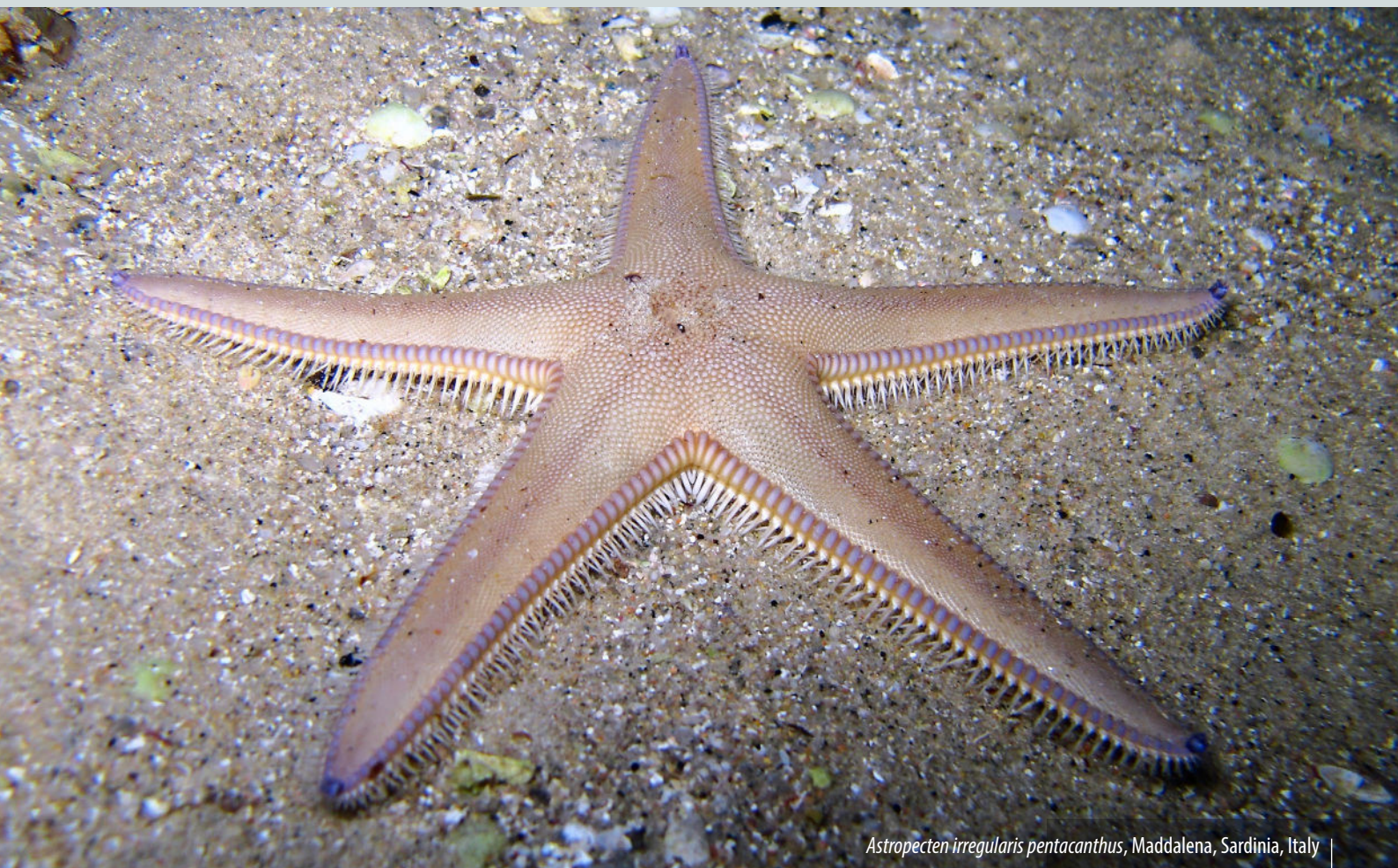
A juvenile, Fos-sur-Mer, France. S. Le Bris



• *Astropecten irregularis* (Pennant, 1777)

This species live in the Atlantic and Mediterranean, but the two populations show differences in superomarginal spines : the Mediterranean specimens have superomarginal plates devoid of spines (considered by some author as the subspecies *Astropecten irregularis pentacanthus*), while the Atlantic populations are provided with one spine for each superomarginal plates (considered as the subspecies *Astropecten irregularis irregularis*) or more spines (considered by some author as the subspecies *A. irregularis serratus* and by some others as a variety of *A. irregularis irregularis*). This starfish has well-defined, medium height superomarginal plates **and the specimens from Mediterranean Sea are totally devoid of spines**. The inferomarginal plates have thin, long, highly mobile spines, sometimes completely white, sometimes with yellowish base. The arms make up among them, at their base where they join the disc, a very clean corner. **The typical color of the aboral side is pink or yellowish-pink homogeneous with the ends of the arms purple**, sometimes with many small darker dots in the central disc. Occasionally, in some specimens of this species, can be observed a noticeable swelling in the center of the disc probably due to the ingestion of some clam or to the respiratory function : when the animal is hidden can use this bulge protrudes to keep the disc out of the sediments for respiratory functions (called by Enrico Tortonese the «aboral-cone»). Usually it has a diameter of about 10-12 cm with a maximum of 19 cm. In Mediterranean Sea this starfish can be distinguished by the superomarginal plates devoid of spines and color of the aboral side. Sometimes it is confused with *A. aranciacus* but observing these features it is always easy to distinguish them. The very young specimen of *A. irregularis* can look a lot like to *A. jonstoni* for the shape having a large disc and pointed arms and for the absence of superomarginal spines and it need to check the inferomarginal spines (long and mobile in *A. irregularis* instead of short and rigid) and the color of the aboral side.

It's a common species in all kinds of mobile soft bottom from 1 to about 1.000 m deep. This species is active during the night, rarely since the late afternoon.



Astropecten irregularis pentacanthus, Maddalena, Sardinia, Italy



Astropecten irregularis pentacanthus, Maddalena, Sardinia, Italy

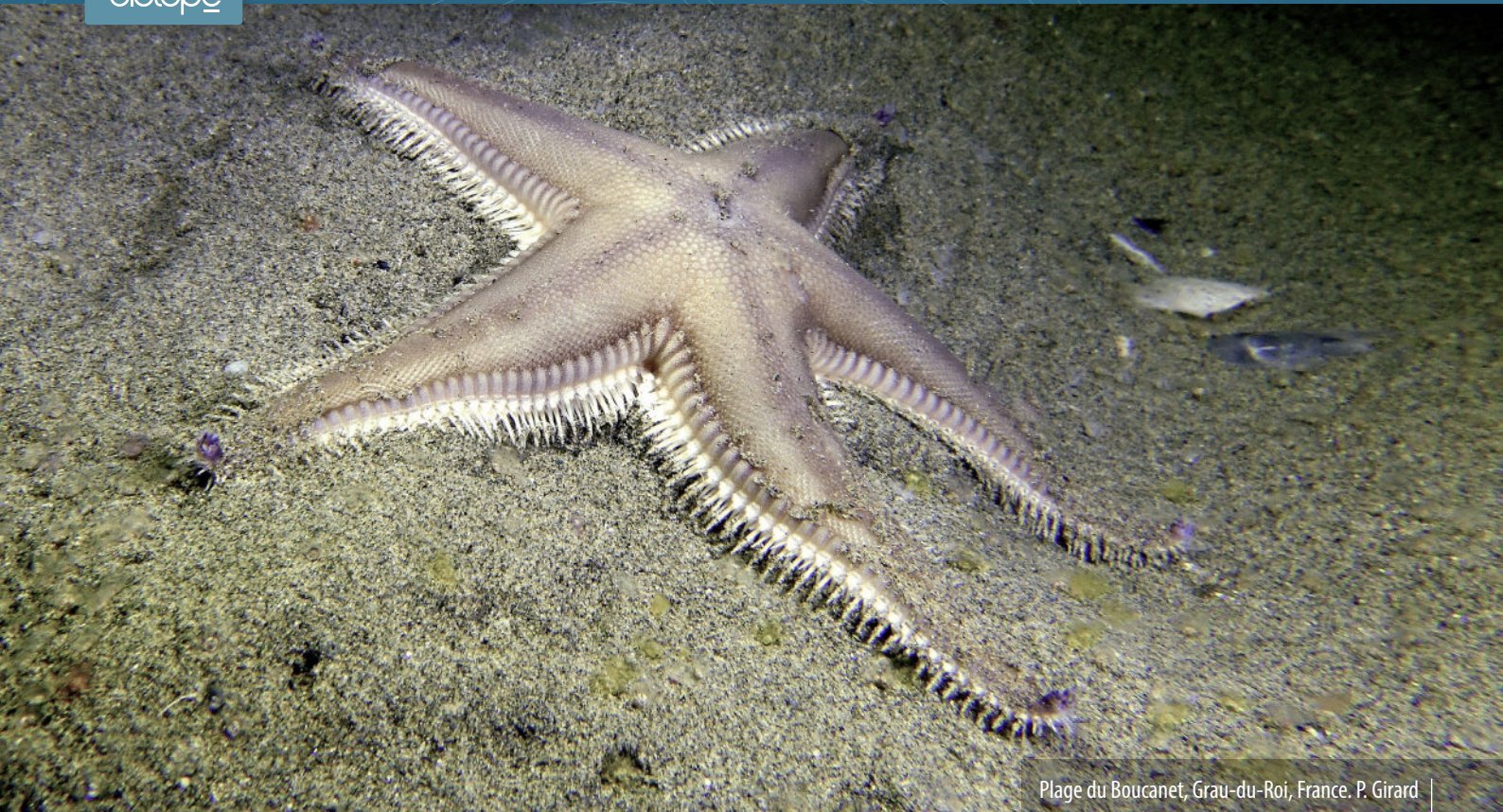


Astropecten irregularis pentacanthus, Maddalena, Sardinia, Italy

Detail of superomarginal plates devoid of spines (feature of *Astropecten irregularis pentacanthus*), Maddalena, Sardinia, Italy



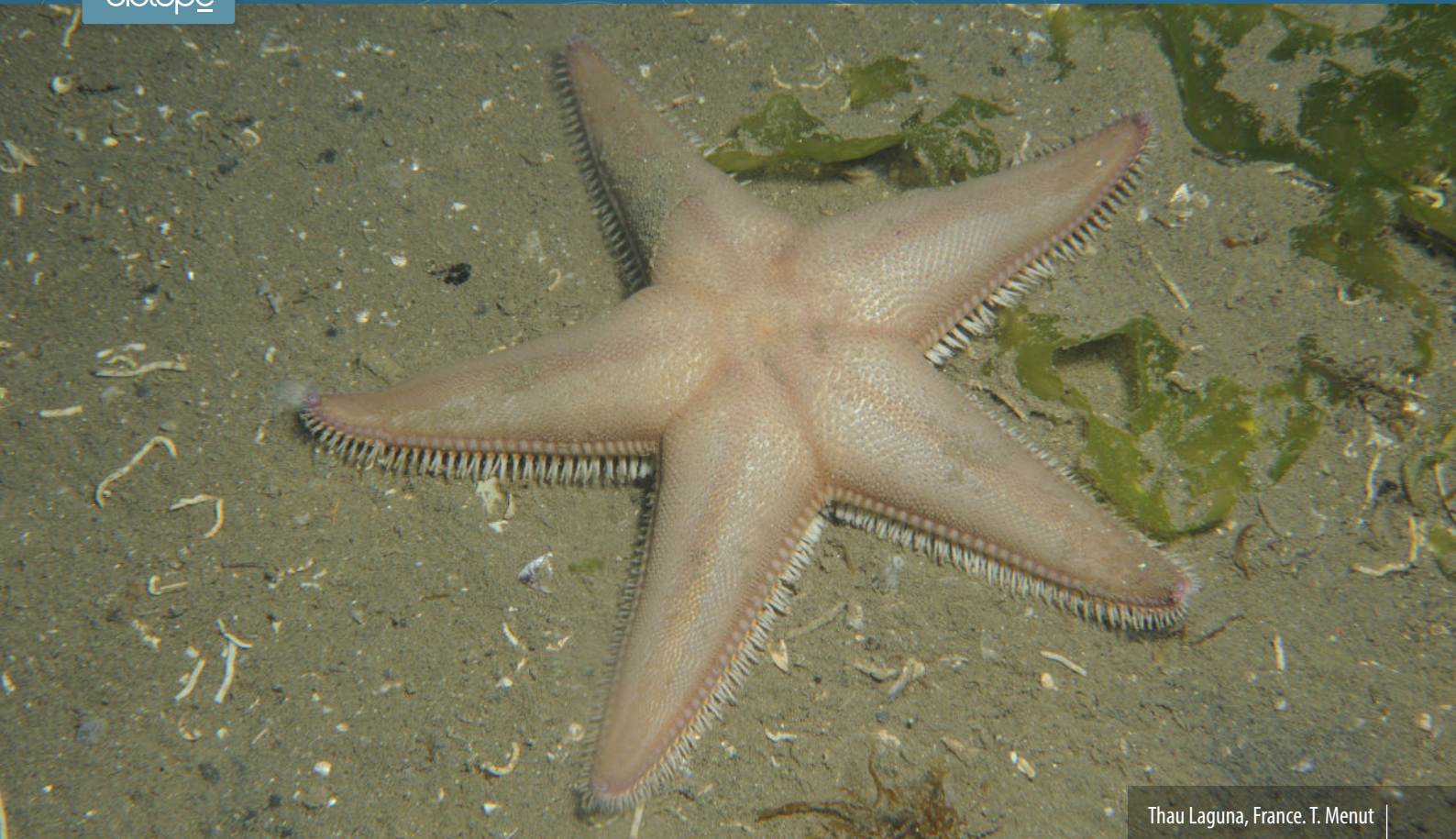
Detail of «aboral-cone» sometimes visible in *Astropecten irregularis*, Maddalena, Sardinia, Italy



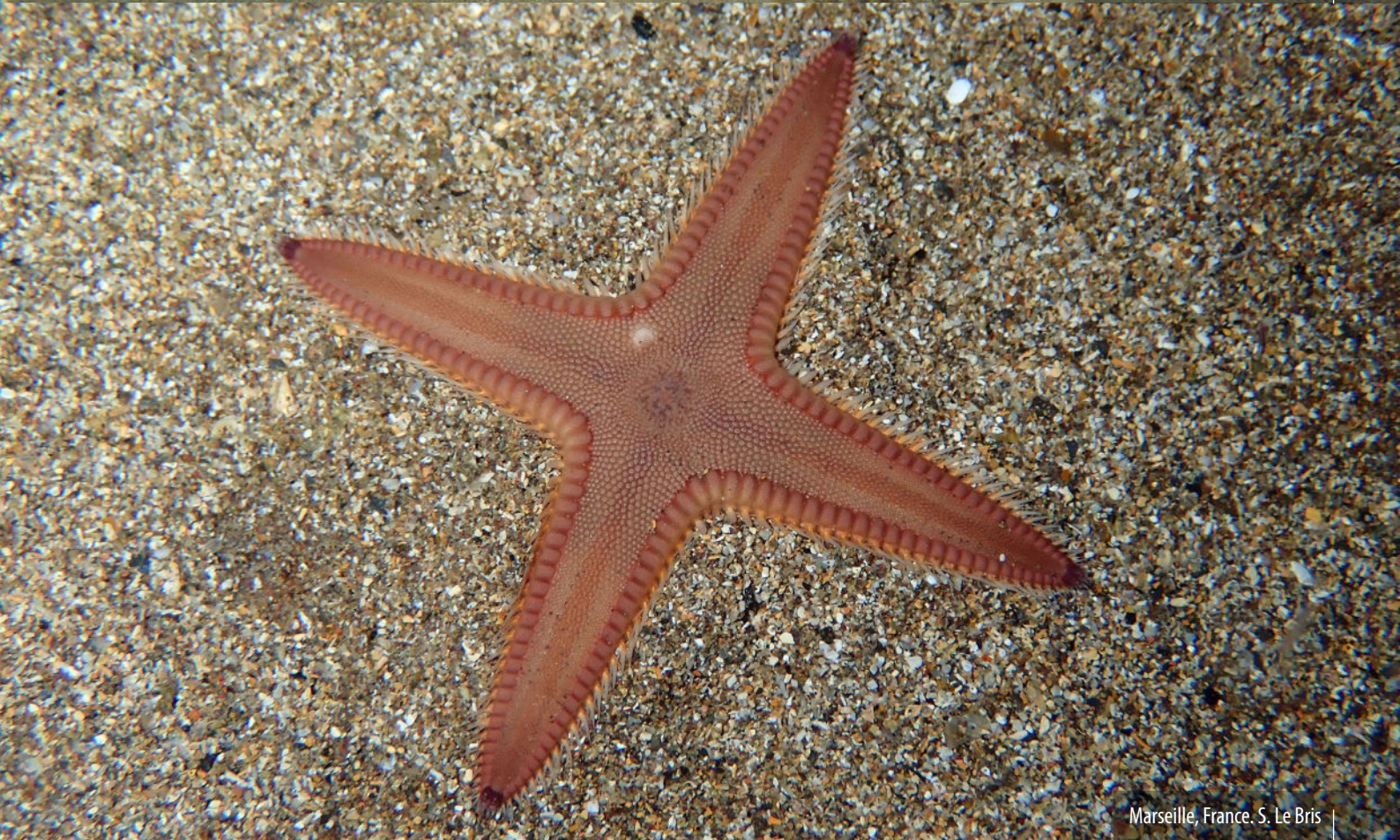
Plage du Boucanet, Grau-du-Roi, France. P. Girard



Cagnes-sur-Mer, France, S. Le Bris



Thau Laguna, France. T. Menut



Marseille, France. S. Le Bris

• *Astropecten spinulosus* (Philippi, 1837)

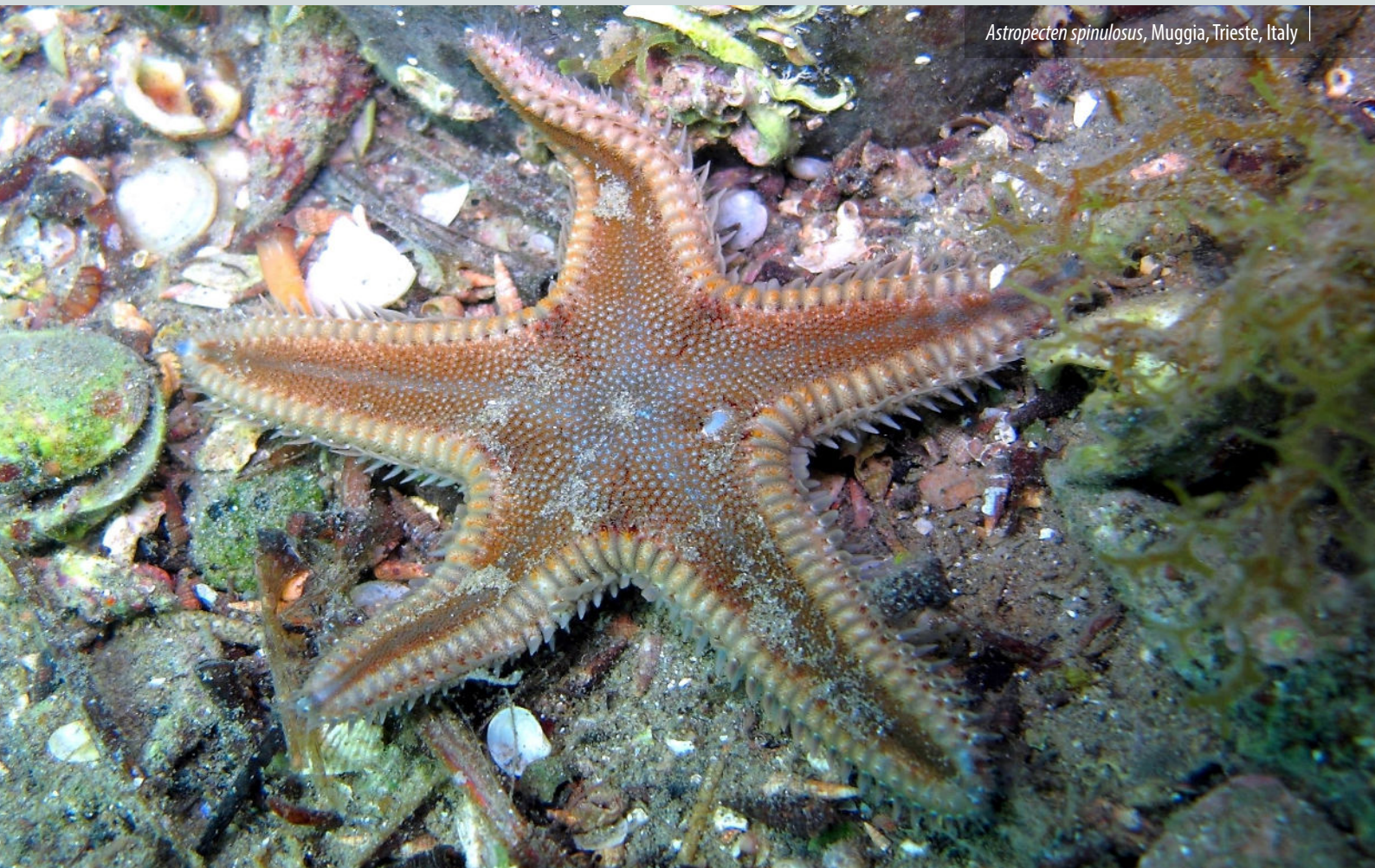
It has very low supermarginal plates (the height of the vertical face is slightly big than the width), completely covered by scales and very small spines. Only from 1 to 3 small spines on the top of each plate can be considered a real spine (the other spines are too small). The color of these spines is the same of the supermarginal plates and it is brown or clear brown. **The inferomarginal spines are long and pointed with a typical brownish-purple color.** It looks like a slender starfish. The aboral side is dark brown, reddish-brown, rarely greenish, usually with clear radial lines well visible at the center of each arms. It is a small starfish, usually 6-8 cm and maximum just under 10 cm in diameter. This sea star can be distinguished mainly by the low supermarginal plates, the small supermarginal spines, the colors of the aboral side and the colors of inferomarginal spines. This species can be confused for shape and color only with *A. platyacanthus* but the differences in the supermarginal plates and spines are considerable because *A. spinulosus* has low supermarginal plates with 1-3 small spines instead of narrow and high supermarginal plates equipped with 1 strong spine.

It prefers sandy soft bottom near meadows of *Posidonia oceanica*, *Cymodocea nodosa* or other mobile soft bottom in areas with algae from 1 to 50 m deep. It is the only species that could be fine in hard bottom, caves or climbing *Posidonia oceanica*. This species is active and easy to find during the night, occasionally also in the late afternoon.

Koehler, R. (1921). Faune de France. Echinodermes; pag. 48-49:- "*Astropecten spinulosus*. . . . L'aire paxillaire est relativement large en raison de l'étroitesse des plaques marginales dorsales. . . . Les plaques marginales dorsales sont assez étroites et la hauteur de leur face vertical est un peu plus grande que la largeur de leur face dorsale."; "La couleur de la face dorsal du corps est brunâtre, brun-olivâtre ou vetr-rougeâtre, toujours assez foncée".



Astropecten spinulosus, Maddalena, Sardinia, Italy



Astropecten spinulosus, Muggia, Trieste, Italy



Astropecten spinulosus, Rab, Croatia



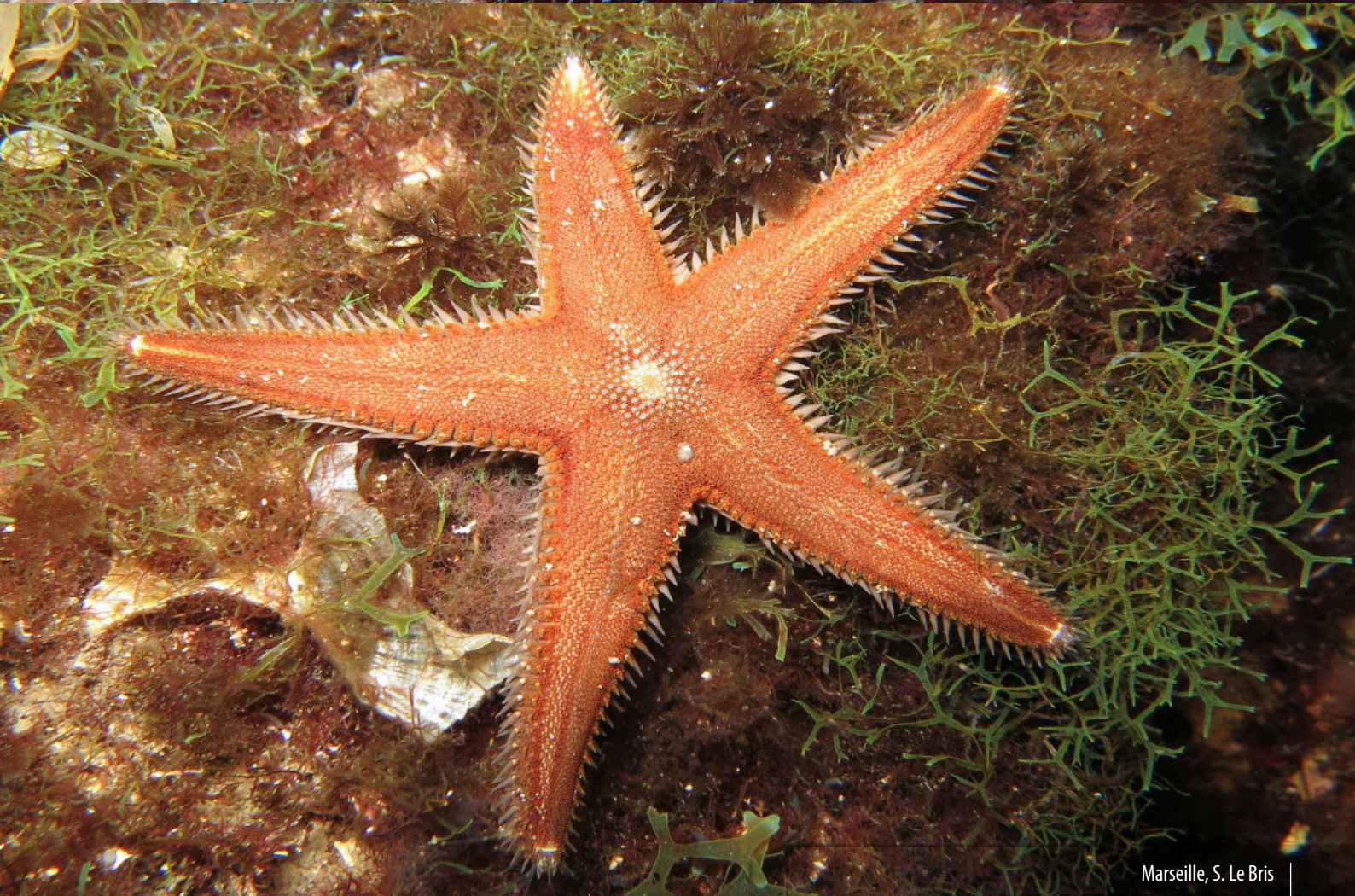
Detail of very low supermarginal plates of *Astropecten spinulosus*, Rab, Croatia



Detail of very low supermarginal plates of *Astropecten spinulosus*, Maddalena, Sardinia, Italy



Marseille, S. Le Bris

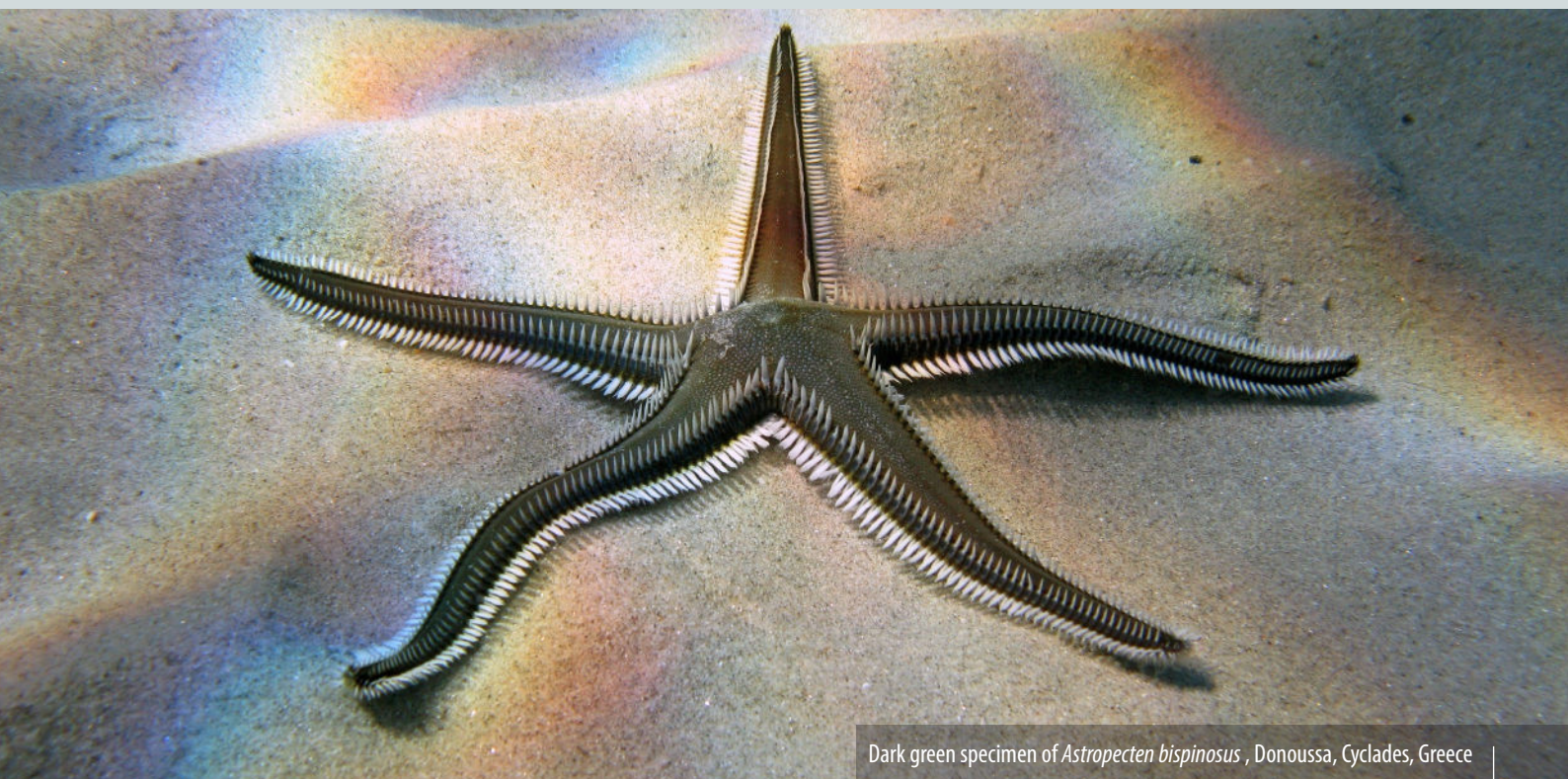


Marseille, S. Le Bris

• *Astropecten bispinosus* (Otto, 1823)

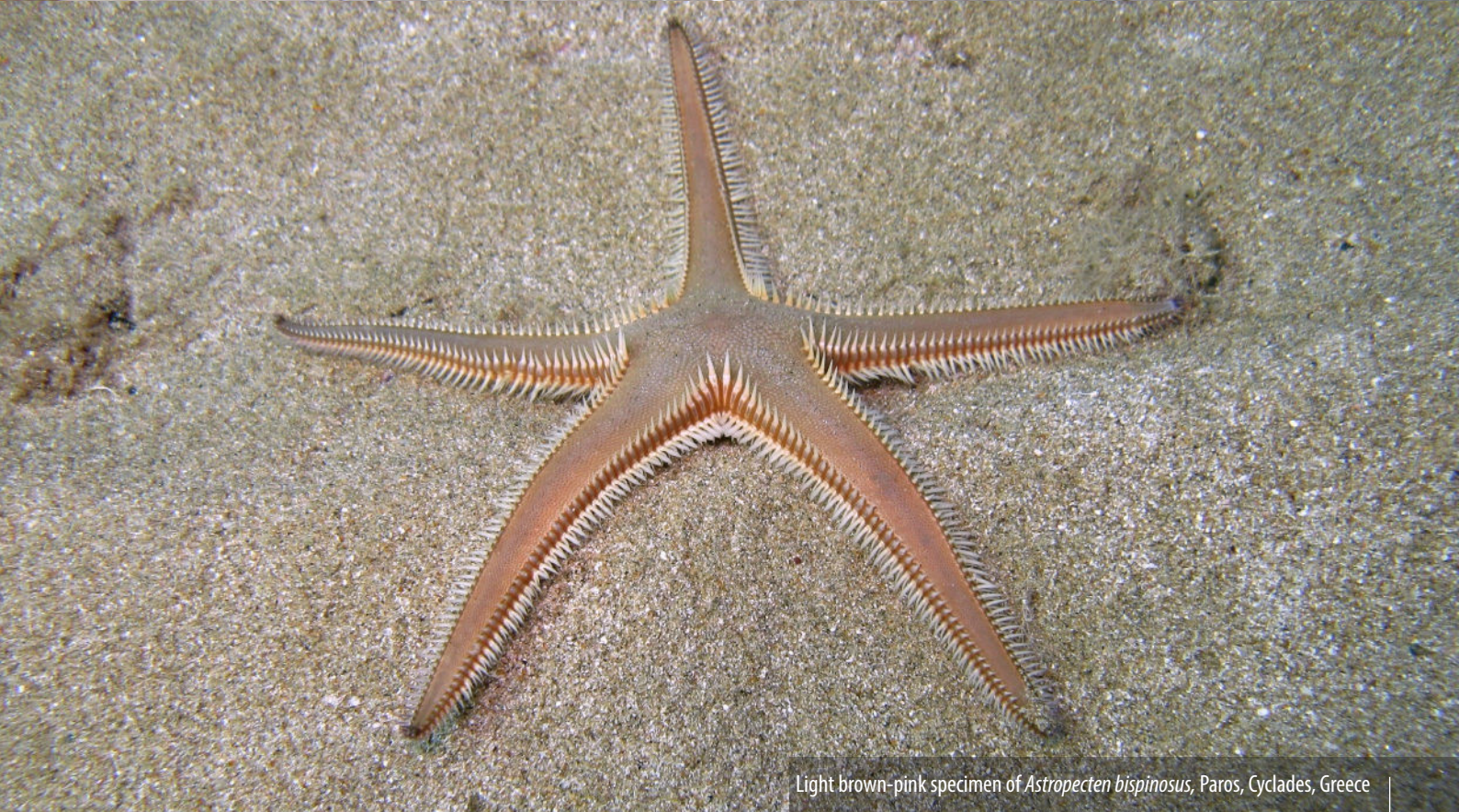
This starfish has very narrow and high supermarginal plates with a bare area on the vertical face of them (visible in the lateral side of arms between inferomarginal spines and supermarginal spines). **Every supermarginal plate is equipped with 1 very long, sharp, clean conical spine** usually with white color but sometimes yellow or orange. **The supermarginal spine is always placed on the top internal edge of plates so there aren't any bare areas on top of supermarginal plates.** The maximum number of supermarginal plates, observed on each arm, is 77; normally the number is between 40 and 60, depending on the size of the starfish. The pair of supermarginal spines between the arms is often longer than all the others spines. The inferomarginal spines can have the same colors of the supermarginal spines and they are long, flat, few pointed, arranged with great regularity, kept parallel to one another and few mobile. This *Astropecten* has a typical shape with a small disc and very long and thin arms, even if this characteristic can be more or less accentuated. The aboral side has uniform color and can be dark green, dark brown or rarely light brown-pink. It has a large size and may reach about 21 cm in diameter. Usually this starfish can be distinguished by its typical shape, the narrow and high supermarginal plates with a strong and conical spine. It may be confused only with *A. platyacanthus*, distinguishing them can be complex, to identify correctly *A. bispinosus* is necessary mainly to check the position of the spines on the top of supermarginal plates (placed on the top internal edge of plates instead of spaced from the inside edge with a small bare area on the top internal edge), the shape of supermarginal spines (quite conical instead of more irregularly shaped and slightly flattened laterally) and the bare area on the vertical face of supermarginal plates (instead of supermarginal plates laterally covered with scales and small spines features of *A. platyacanthus*). It prefers sandy soft bottom near meadows of *Cymodocea nodosa* at depths between 2 and 100 m. This species is active and easy to find especially in the late afternoon, but sometimes it is possible to find it during the day or during the night.

Tortonese Enrico (1965). Fauna d'Italia. Echinodermata; pag. 140-143:- "Astropecten bispinosus. . . . Piastre margino-dorsali strette e alte, con un'ampia zona nuda laterale e un robusto aculeo inserito sull'orlo superiore e interno."; "Astropecten platyacanthus. . . . Queste (piastre margino-dorsali) sono quasi completamente rivestite di aculei e squame e portano un aculeo, più o meno scostato dall'orlo superiore e interno."; "Gli individui (di Astropecten platyacanthus) leptobrachiati (con braccia piccole), naturalmente, presentano una più spiccata rassomiglianza con Astropecten bispinosus ma il diverso aspetto delle piastre marginali facilita sempre la corretta identificazione." (pag. 143); ". . . Astropecten platyacanthus, fra l'altro, differisce da "Astropecten bispinosus per il minor numero di piastre margino-dorsali : nelle due specie i massimi valori noti sono rispettivamente 48 e 77."



Dark green specimen of *Astropecten bispinosus*, Donoussa, Cyclades, Greece

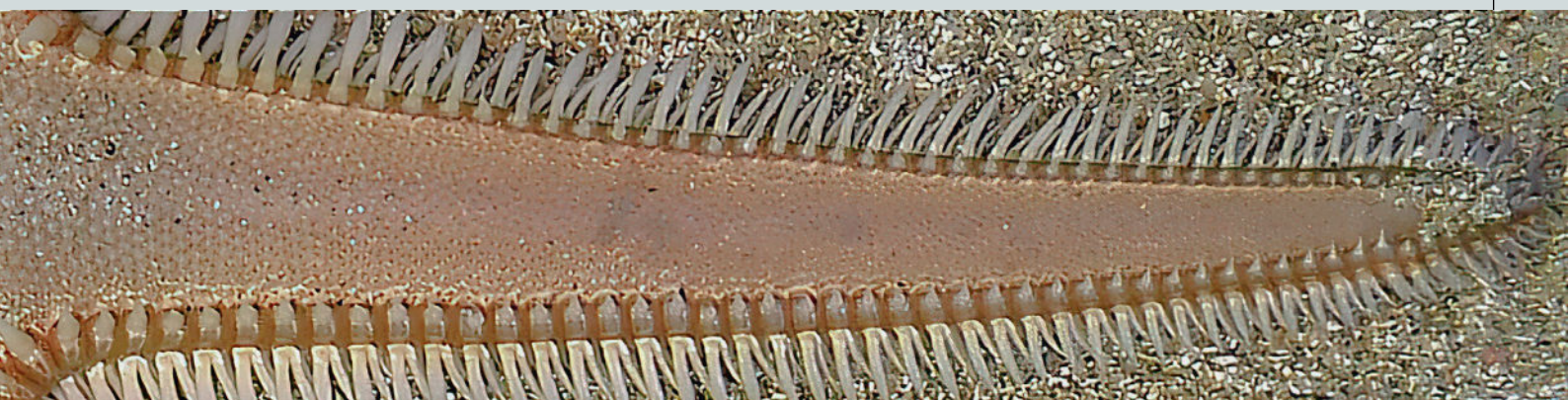
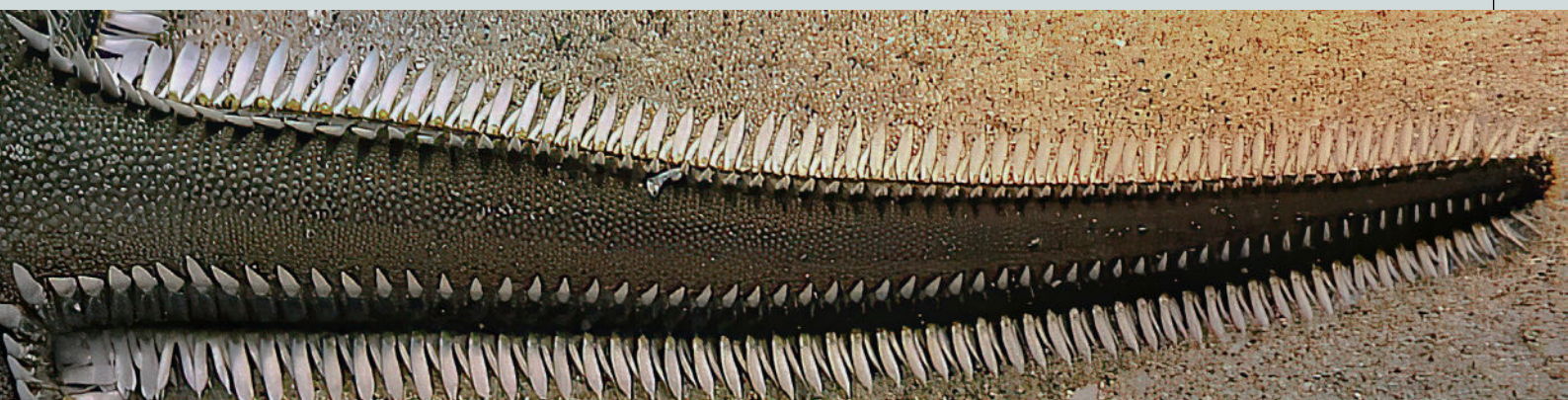
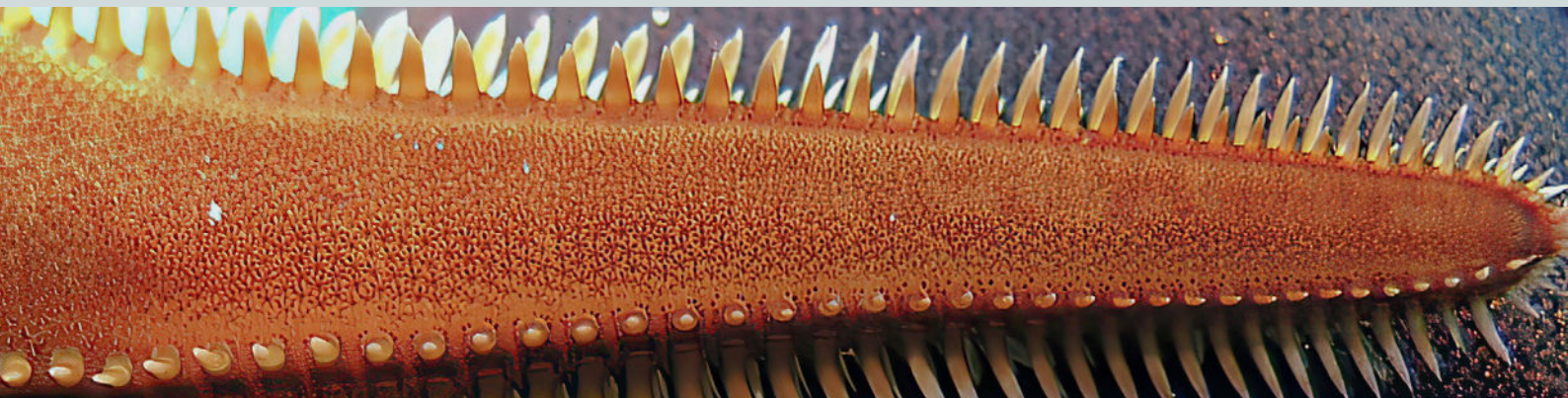
Dark brown specimen of *Astropecten bispinosus*, Corsica, France



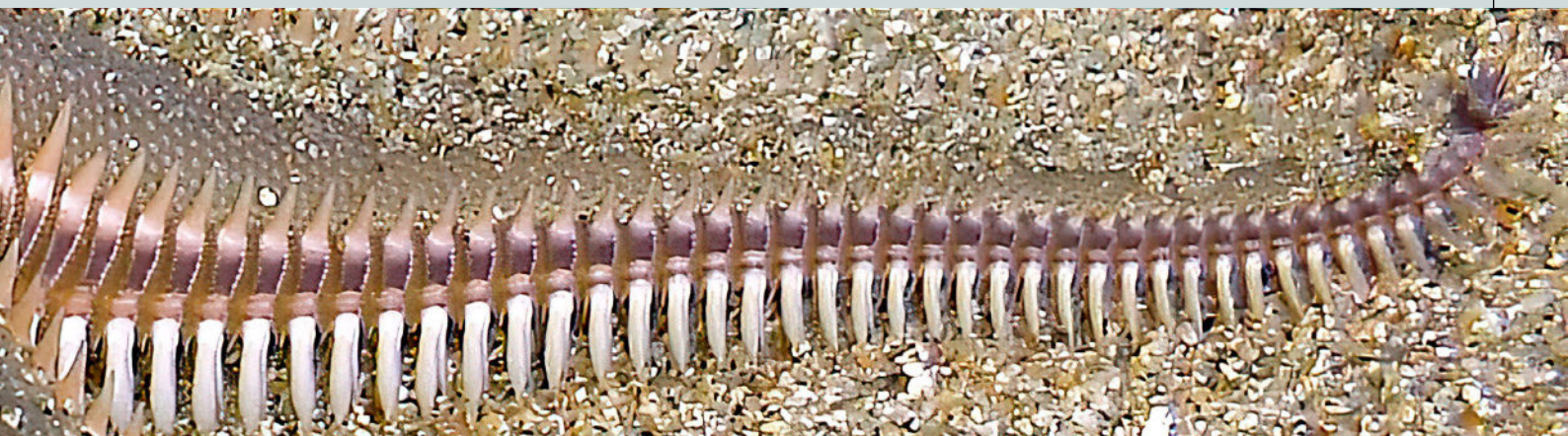
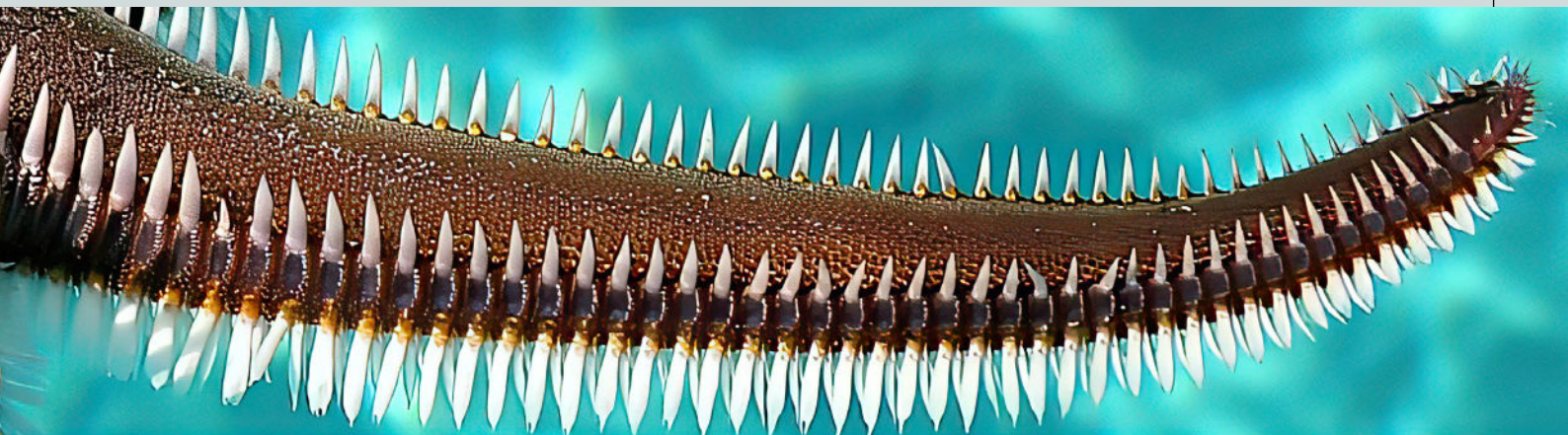
Light brown-pink specimen of *Astropecten bispinosus*, Paros, Cyclades, Greece

Cagnes-sur-Mer, France, S. Le Bris





Detail of the superomarginal spine always placed on the top internal edge of plates so there aren't any bare areas on top of superomarginal plates (feature of *Astropecten bispinosus*) From top to bottom : Corsica, France. Donoussa, Cyclades, Greece. Paros, Cyclades, Greece



Detail of the bare area on the vertical face of superomarginal plates (*Astropecten bispinosus*). From top to bottom : Donoussa, Cyclades, Greece. Corsica, France. Paros, Cyclades, Greece

• *Astropecten platyacanthus* (Philippi, 1837)

It has narrow and high superomarginal plates, laterally (on the vertical face) covered with scales and small spines. **Every superomarginal plates is equipped with 1 strong spine, usually sharp but irregularly shaped, slightly flattened laterally**, usually yellowish but rarely white or orange. Occasionally, especially in young specimen, only the superomarginal plates between the arms are equipped with one strong spine while the distal plates are devoid of spines and very rarely it can have all the superomarginal plates devoid. Only in the populations of certain areas of the Mediterranean (for example, the South of Corsica) this feature is quite frequent. **The superomarginal spines are (more or less) spaced from the inside edge of plates and they leave on top (on the base of each spine) a small bare area that it is white if there is a strong spine in the plate (usually in the plates near the disc) or blue-violet if the plate has very small spine or no spine (usually in the distal plates towards the tip of arms)**. The maximum number of superomarginal plates, observed on each arm, is 48; normally the number is between 29 and 43, depending on the size of the starfish. The inferomarginal spines can have the same colors of the superomarginal spines and they are long, flat and quite pointed. It is an *Astropecten* with very variable features and it can have wide or narrow arms. The aboral side has very variable colors and it can be more or less dark brown, olive green, pink-brown, bluish-grey, usually it is visible a dark radial lines at the center of arms. Usually it reaches a diameter of 9-12 cm and exceptionally it can measure up to 18 cm. It is the Mediterranean *Astropecten* hardest to identify both for the variability of features of the species and for the resemblance to some other species. It lives on all mobile soft bottom at depths between 1 and 60 m, but it is more frequently in soft bottom of mixed coarse sand and mud at 1-4 m depth. This species is active and easy to find during the night but also during the day, especially in early morning and late afternoon.

Koehler, R. (1921). *Faune de France. Echinodermes*; pag. 47-48:- "*Astropecten platyacanthus* est caractérisée principalement par ses plaques marginales dorsales et ventrales munies de petites piques plus nombreuses et plus robustes que celles présentes sur *Astropecten bispinosus*. Les faces latérales verticales des plaques superomarginales, au lieu d'être nues en leur milieu, portent d'assez nombreux petits piques . . ."

Tortonese Enrico (1934). *Annali del Museo civico di storia naturale Giacomo Doria (Volume 57)*; pag. 236:- «Secondo l'insigne echinologo tedesco (Ludwig Heinrich Philipp Döderlein), l'*A. platyacanthus* presenta i seguenti caratteri. ... Le (piastre) margino-dorsali non sono mai così alte e strette come nel *bispinosus*, ed il loro aculeo, invece di essere inserito sull'orlo interno, ne è più o meno scostato - in tutte le piastre o almeno in quelle distali - cosicché tra l'aculeo e l'orlo interno rimane una zona più o meno larga, occupata da un certo numero di granuli allungati e spesso squamiformi, più grossi degli aculei dei passilli. La parte mediana delle piastre marginali, sia dorsali come ventrali, non è nuda, ma porta granuli e squamule più o meno abbondanti. Inoltre le braccia sono di rado allungate e il numero di piastre margino-dorsali è proporzionalmente molto più alto nell'*A. bispinosus* che nel *platyacanthus*. Il Döderlein aggiunge infine che quest'ultimo è una specie molto variabile e a caratteri non ancora ben marcati, mentre il precedente ha ormai fissato ogni sua particolarità morfologica e varia poco.»



Astropecten platyacanthus, Maddalena, Sardinia, Italy



Astropecten platyacanthus, Corsica, France



Corsica, France



Caprerà, Sardinia, Italy



Muggia, Trieste, Italy



Rab, Croatia



Maddalena, Sardinia, Italy



Maddalena, Sardinia, Italy



Paros, Cyclades, Greece



Maddalena, Sardinia, Italy



Maddalena, Sardinia, Italy



Maddalena, Sardinia, Italy

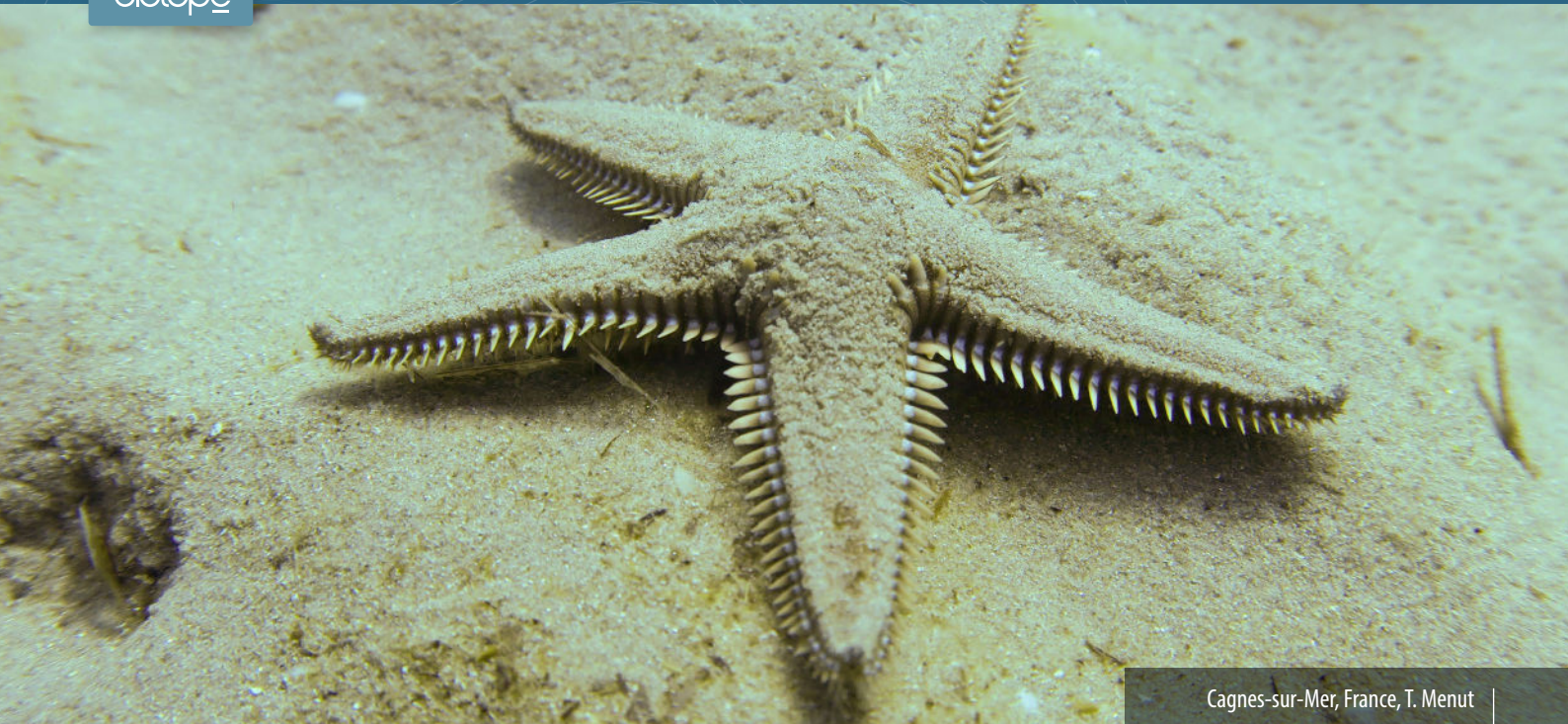


Maddalena, Sardinia, Italy



Koufonissi, Cyclades, Greece





Cagnes-sur-Mer, France, T. Menut

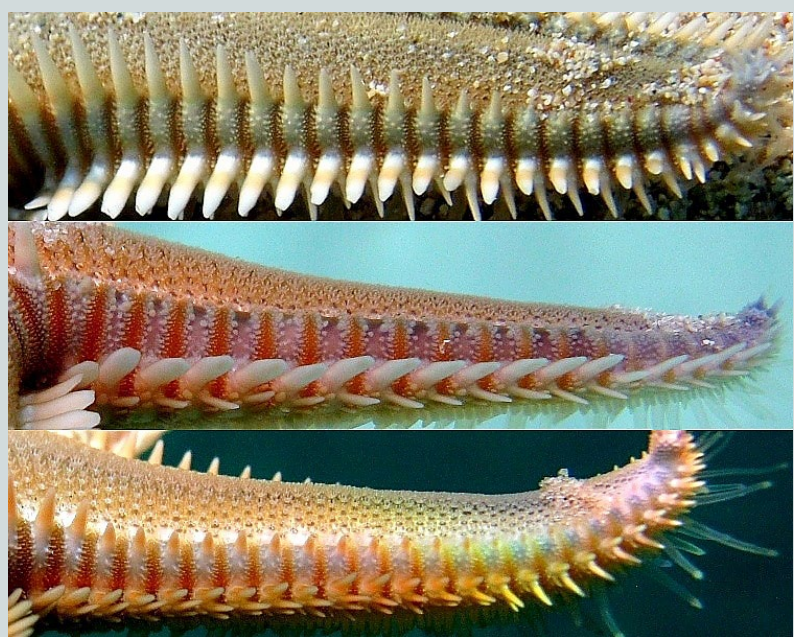


Cagnes-sur-Mer, France, S. Le Bris

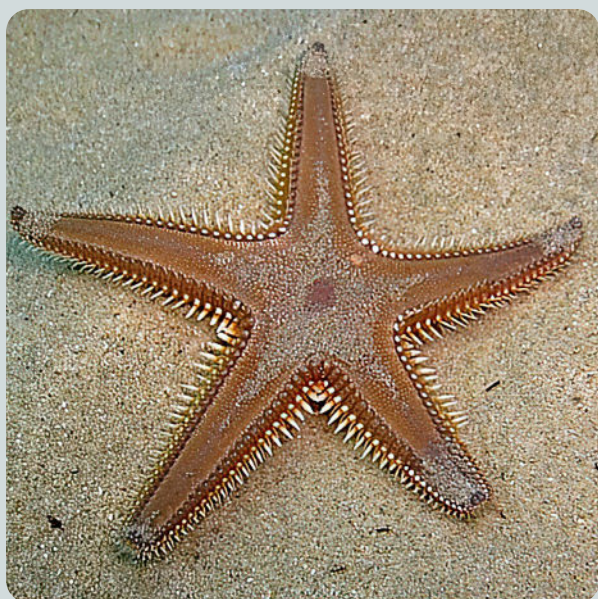
A. platyacanthus is distinguished from *A. bispinosus* mainly for the position of the spines spaced from the inside edge with a visible small bare area on the top internal edge of the plates instead of spines placed on the top internal edge of plates without small bare area on the top. Another important *A. platyacanthus*'s feature is that the supermarginal plates are laterally, on the vertical face, covered with scales and small spines rather than nude. Moreover, it is different because it has irregularly shaped, laterally flattened supermarginal spines (rather than clean conical spine) and because it has average less numerous and therefore less dense supermarginal plates on each arm. In addition, on average *A. platyacanthus* has a central disc larger, a color of aboral side a little different, a small red dot on the tip of arms is usually visible (usually not visible in *A. bispinosus*), it has a body and inferomarginal spines more mobile and usually inferomarginal spines less pointed.



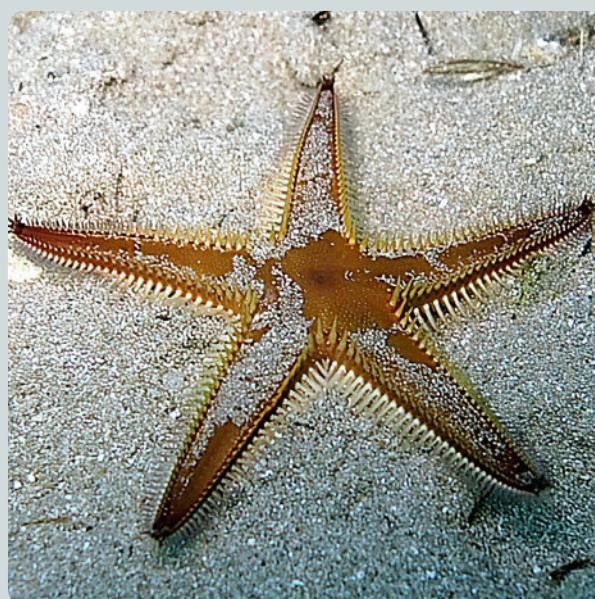
A. platyacanthus's supermarginal spines spaced from the inside edge with a visible small bare area on the top internal edge of the plates. From top to bottom : Donoussa, Cyclades, Greece. Antiparos, Cyclades, Greece. Donoussa, Cyclades, Greece



A. platyacanthus : detail of supermarginal plates, laterally covered with scales and small spines. From top to bottom : Karpathos, Greece. Corsica, France. Rab, Croatia



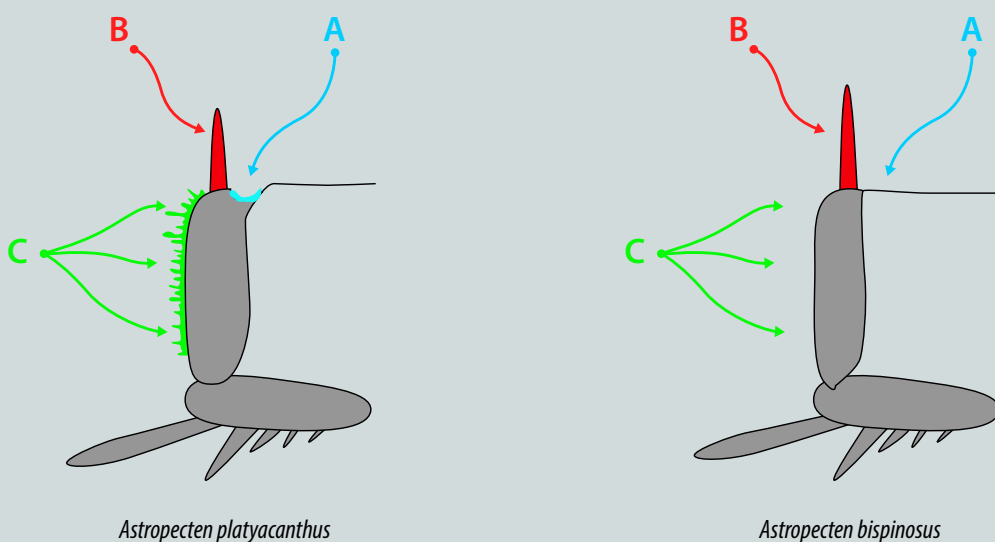
Astropecten platyacanthus



Astropecten bispinosus



Astropecten platyacanthus has a small red point in the point of arms. Top : Karpathos, Greece. Bottom : Crete, Greece



A - *A. platyacanthus* is distinguished from *A. bispinosus* for the superomarginal spines spaced from the inside edge of plates. They leave on top, on the base of spines, a small bare area.

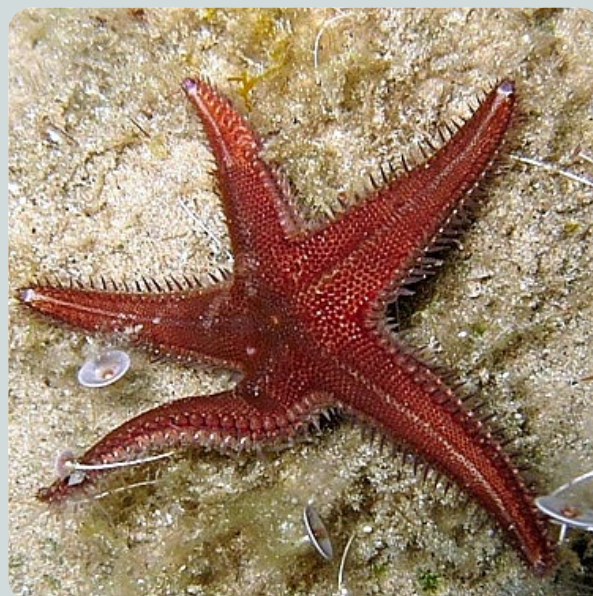
B - *A. platyacanthus* is a bit different from *A. bispinosus* for the superomarginal spines irregularly shaped, laterally flattened (rather than clean conical spine).

C - *A. platyacanthus* is distinguished from *A. bispinosus* for the vertical face of superomarginal plates laterally covered with scales and small spines rather than plates laterally nude

A. platyacanthus is distinguished from *A. spinulosus* by very different supermarginal plates : highest, defined and equipped with very big and strong supermarginal spines. The colors whitish or yellowish of inferomarginal spines are also different in these species because quite different to the typical color blue-purple of *A. spinulosus*. *A. platyacanthus* can measure up to 18 cm, while *A. spinulosus* reaches at maximum just less 10 cm in diameter.

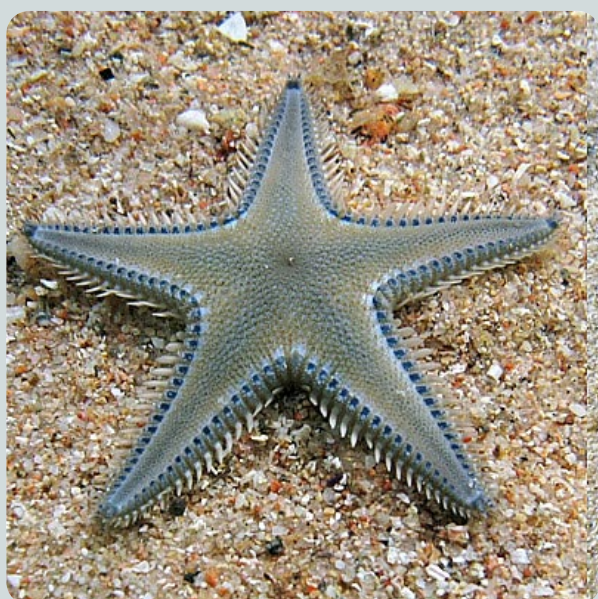


Astropecten platyacanthus



Astropecten spinulosus

The young specimens of *A. platyacanthus* sometimes can be confused with *A. jonstoni* for the shape and the color, but it is always easy to distinguish them by very different supermarginal plates (high with the top inside edge totally bare instead of low, rounded and totally covered with small scales) and longer inferomarginal spines.



Astropecten platyacanthus



Astropecten jonstoni

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