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THORACIC CIRRIPEDS FROM THE ENVIRONS OF BANYULS (1) (*)

by Huzio UTINOMI

INTRODUCTION

The specimens of thoracic cirripeds dealt with in this paper are a part of the collections in the Laboratoire Arago which I have received from Dr C. DELAMARE DEBOUTTEVILLE of that Laboratory. Most of them were collected in the environs of Banyuls-sur-Mer, Mediterranean coast of France, in connexion with the ecological researches. So the collection is not faunistically extensive and consists only of the species common in the Mediterranean. The collection is still of interest, because not much is known about the distribution of cirripeds in the western part of the Mediterranean in contrast to the eastern part.

Particularly interesting is the occurrence of the typical *Chthamalus depressus* (POLI), which is represented by numerous specimens together with those of the well known *Chthamalus stellatus* (POLI). This species had been often confused with the latter and hitherto been regarded only as a variety or subspecies of *Chthamalus stellatus* by most of later taxonomists since DARWIN (1854), although practically treated as separate species by some of ecologists working upon in the field. As will be discussed in detail in this paper for the first time, however, both species of *Chthamalus* in the Mediterranean should be distinguished either as independent species morphologically or ecologically.

Before going further I wish to express my appreciation to the staff of the Laboratoire Arago, particularly Dr Claude DELAMARE DEBOUTTEVILLE, for the privilege of examining this interesting collection. My

(1) Contributions from the Seto Marine Biological Laboratory, Sirahama, Wakayama-ken, Japan, No. 332.

(*) Reçu le 16 mars 1959.

sincere thanks are also due to Mr. Mayumi YAMADA in stay of the Zoological Station, Napoli, Italy for the photocopy of the original paper of POLI'S « *Testacea utriusque Siciliae* », Vol. I (1791).

I. — THE MATERIAL FROM THE ENVIRONS OF BANYULS

FAM. SCALPELLIDAE Pilsbry, 1907

SCALPELLUM SCALPELLUM (Linné, 1767).

Lepas scalpellum LINNÉ, 1767, p. 1109.

Scalpellum vulgare DARWIN, 1851, p. 22, pl. V, fig. 15 and later authors.

Scalpellum scalpellum PILSBRY, 1907, p. 16 and later authors.

Occurrence. Environs of Banyuls. Exact locality and date of collecting unknown.

A single specimen, about 5 cm in total length, is contained. It is dirty yellow colored uniformly. All plates and scales are imperfectly calcified, so that they are widely separated.

Measurement : Length of capitulum 2 cm, width of capitulum 1.1 cm, length of peduncle 3 cm.

Distribution. Abundant in the seas of northern Europe and the Mediterranean, in comparatively deep waters though even thriving as shallow as in some 10 m depth in colder northern areas.

FAM. LEPADIDAE Darwin, 1851

LEPAS ANATIFERA Linné, 1758.

Lepas anatifera LINNÉ, 1758, p. 668.

Lepas anatifera DARWIN, 1851, p. 73 and later authors.

Occurrence. Environs of Banyuls. Exact locality and date of collecting unknown.

Two large specimens (labelled as *L. hilli* Leach) are contained.

Measurement : Length of capitulum 23 mm, width of capitulum 13.5 mm, length of peduncle 16 mm (somewhat shrivelled).

Distribution. Cosmopolitan and pelagic in all seas.

LEPAS HILLI Leach, 1818.

Lepas Hillii DARWIN, 1851, p. 77, pl. I, fig. 2 and later authors.

Occurrence. Environs of Banyuls. Depth 40 m, IX-1932.

One specimen, 35 mm in total length.

Distribution. Cosmopolitan and pelagic in all seas.

LEPAS PECTINATA Spengler, 1793.

Lepas pectinata SPENGLER, 1793 and later authors.

Occurrence. Environs of Banyuls. Exact locality and date of collecting unknown.

Five specimens, almost damaged, are contained.

Distribution. Cosmopolitan and pelagic in all seas.

FAM. CHTHAMALIDAE Darwin, 1854

CHTHAMALUS STELLATUS (Poli, 1791).

Lepas stellata POLI, 1791, p. 29, Tab. V, figs 18-20.

Chthamalus stellatus RANZANI, 1818, tab. 3, figs 21-24.

Chthamalus stellatus FISCHER, 1872, p. 32.

Chthamalus stellatus var. *communis* DARWIN, 1854, p. 456, pl. 18, figs 1a, 1c et 1f.

Chthamalus stellatus var. *communis* (partim) WELTNER, 1897, p. 273.

Chthamalus stellatus var. *communis* GRUVEL, 1905, p. 201, fig. 220.

Chthamalus stellatus stellatus PILSBRY, 1916, fig. 81, pl. 71.

Chthamalus stellatus stellatus NILSSON-CANTELL, 1921, p. 281 and his later papers.

Chthamalus stellatus forma *stellata* BROCH, 1927, p. 19, pl. 1, fig. 3 and his later papers.

Chthamalus stellatus forma *typica* KOLOSARY, 1943, p. 73 and his later papers.

Occurrence. (1) Sijean, station 10 bis. Rochers, 14-VI-1950.

(2) Banyuls, in front of Laboratoire Arago, 15-X-1955.

Distribution. From the west coasts of British Isles to the tropical West African coast, Madeira, Azores and the Mediterranean.

CHTHAMALUS DEPRESSUS (Poli, 1791).

- Lepas depressa* POLI, 1791, p. 27, Tab. V, figs 12-16.
Chthamalus glaber RANZANI, 1818, p. 83.
Nec Chthamalus stellatus var. *depressus* DARWIN, 1854, p. 456, pl. 18, figs 1b, 1g et 1h.
Nec Chthamalus stellatus var. *depressus* WELTNER, 1897, p. 273.
Nec Chthamalus stellatus depressus PILSBRY, 1916, p. 304.
Nec Chthamalus stellatus depressus NILSSON-CANTELL, 1938, p. 177, fig. 2.
Nec Chthamalus stellatus forma depressa KOLOSARY, 1939, p. 169, KOLOSARY, 1941, p. 74, fig. 2; KOLOSARY, 1943, p. 74.
Chthamalus stellatus forma maxima KOLOSARY, 1939 b, p. 169.
Occurrence. Banyuls, in front of Laboratoire Arago, 15 X 1955.
Distribution. Known with certainty only from the Mediterranean.
Remarks. For details as to the morphology and habitat of *Chthamalus stellatus* and *Ch. depressus* together with the discussion on the specific differences between both species refer to a chapter given below.

FAM. BALANIDAE Gray, 1825

SUBFAM. BALANINAE Darwin, 1854

BALANUS (MEGABALANUS) TULIPIFORMIS Ellis, 1758.

- Balanus tulipiformis ex corallio rubro* ELLIS, 1758 (after DARWIN).
Lepas tulipa POLI, 1791, Tab. V, figs. 1 et 6 (Sicily).
Balanus tulipiformis DARWIN, 1854, p. 204, pl. 2, figs 2a-d (Sicily, Malaga et Madeira).
Balanus tulipiformis WELTNER, 1897, p. 261 (Sicily).
Balanus tulipiformis GRUVEL, 1905, p. 216, fig. 236 (Sicily); GRUVEL, 1920, p. 53 (Madeira).
Balanus tulipiformis NILSSON-CANTELL, 1921, p. 308, fig. 63; NILSSON-CANTELL, 1931, p. 108 (Sicily).
Balanus tulipiformis KOLOSARY, 1943, p. 81 (Catania, Sicily).
Occurrence. Environs of Banyuls, 80-100 m. Exact locality and date of collecting unknown.
Five large specimens of a rosy hue are fixed together on shells of *Avicula hirundo*. The largest one measures 27 mm in carino-rostral diameter and 15 mm in height.
Distribution. Mediterranean (Sicily, Malta, Sardinia, Malaga), Madeira, West Africa (Wasin).

BALANUS (BALANUS) EBURNEUS Gould, 1841.

Balanus eburneus DARWIN, 1854, p. 248, pl. 5, fig. 4 *a-d* ; WELTNER, 1897, p. 266 ; GRUVEL, 1905, p. 234, fig. 263 ; PILSBRY, 1916, p. 80, pl. 24, figs 1-1 *c*, 2 ; NILSSON-CANTELL, 1921, p. 309 ; NILSSON-CANTELL, 1931, p. 109 ; NEU, 1935, p. 92 ; NEU, 1939, p. 216, figs 5-6 ; KOLOSVARY, 1940, p. 21.

Occurrence. Agde (Hérault). XI-1952.

Distribution. Atlantic coasts of North America from Massachusetts to the Caribbean coasts of South America. Frequently introduced to European seas by ships, penetrating into the Mediterranean far eastwards to the Adriatic and Black Seas.

This samples from Agde were probably obtained from the ship-bottoms foulings.

BALANUS (BALANUS) PERFORATUS Bruguière, 1789.

Balanus perforatus with varieties *angustus* GMELIN, *cranchii* LEACH, *fistulosus* POLI and *mirabilis* DARWIN, 1854, p. 231, pl. 4, fig. 3 *a, c*, pl. 5, fig. 1 *a-d* ; WELTNER, 1897, p. 263 ; GRUVEL, 1905, p. 230, figs 254 C et 258.

Balanus perforatus PILSBRY, 1916, p. 123 ; BROCH, 1927, p. 22, pl. II, fig. 9 ; NILSSON-CANTELL, 1931, p. 112 et p. 127, fig. 6 ; KOLOSVARY, 1947, p. 14, fig. 1 ; BISHOP *et al.*, 1957, p. 9.

Occurrence. Banyuls, in front of Laboratoire Arago. 15-X-1955.

Numerous specimens are found on rocks just below the mean sea level. They are all conical forms with small orifice and very narrow radii ; the paries is dirty white to pale dull purplish in color, and provided with fine longitudinal ridges. They correspond well to DARWIN's var. *angustus* or var. *cranchii*. But the material is not sufficient to distinguish both forms as varieties.

Distribution. Common from British Isles to tropical West Africa and the Mediterranean.

ACASTA SPONGITES (Poli, 1795).

Lepas spongites POLI, 1795, p. 25, tab. 6, figs 3-6.

Acasta spongites DARWIN, 1854, p. 308, pl. 9, fig. 1 *a-d* (synonymy) ; FISCHER, 1872, p. (31) ; WELTNER, 1897, p. 259 ; GRUVEL, 1905, p. 263, fig. 293 ; PILSBRY, 1916, p. 242, fig. 77 ; KOLOSVARY, 1947, p. 22, fig. 3.

Occurrence. Cap Oulletteil ; L. LAUBIER coll. One specimen imbedded in a tetraxon sponge *Hircinia variabilis*, 4-IV-1958.

Distribution. North Atlantic, from British Isles to Mediterranean ; South Africa ; western part of Indian Ocean ; Japan (Hakodate and Sagami Bay).

SUBFAM. CORONULINAE Gray, 1825

PLATYLEPAS HEXASTYLOS (O. Fabricius, 1798).

Platylepas bisexlobata DARWIN, 1854, p. 428, pl. 17, fig. 1 *a-d* (synonymy).

Platylepas hexastylus PILSBRY, 1916, p. 285, pl. 67, figs. 1-1 c, 3 (synonymy) and later authors.

Occurrence. Environs of Banyuls, on *Caretta caretta*. Exact locality and date of collecting unknown. One specimen damaged.

Distribution. Tropical and subtropical seas, on turtles.

II. — SPECIFIC DIFFERENCES BETWEEN
CHTHAMALUS STELLATUS
AND *CHTHAMALUS DEPRESSUS*

HISTORICAL REVIEW OF NOMENCLATURE

Two littoral cirripeds, *Chthamalus stellatus* and *Ch. depressus*, which are common on coasts of the Mediterranean, were originally described by POLI (1791) as separate species in his classic work «Testacea utriusque Siciliae», Tomus I, though referring both to the old genus *Lepas*.

Since then, DARWIN (1854) in his monumental Monograph, however, combined the two to a single species under the name *Chthamalus stellatus* (Poli), only regarding the commonest conical form equivalent to POLI's *stellatus* as var. *communis* and the much depressed form as var. *depressus* of *Chthamalus stellatus*. It seems that he considered the latter as equivalent to POLI's *Lepas depressa*.

All the successors working on the cirriped taxonomy have followed the systematization authorized by DARWIN. In particular, both of recent eminent systematists of *Cirripedia*, PILSBRY (1916) and NILSSON-CANTELL (1921), who established a new distinguished system taking the characters of the soft parts (especially the mouth-parts) into account.

Both authors have raised some of DARWIN's varieties of *Chthamalus stellatus* to the specific or subspecific rank and added a number of new species or subspecies of the genus *Chthamalus* from everywhere of the world. But the status of POLI's *depressus* has remained unsettled, because in all probability either of the two authors had not actually examined himself any material referable to the typical *depressus* from the Mediterranean.

VARIABILITY

The variability of the outer shell and opercular valves in *Chthamalus stellatus* and other allied species of the genus *Chthamalus* was studied in detail and discussed repeatedly by KOLOSVARY (1939 a, 1939 b, 1941).

He considered in a paper (1941) the variability of all chthamalids, dividing the « Formenkreis » into six categories (*stellatus*-group, *caudatus*-group, *cirratus*-group, *Hembeli*-group, *anisopoma*-group, and *challengeri*-group), and demonstrated on its relation with their geographical grouping. To my opinion, however, his procedure seems highly artificial and not very satisfactory.

As I have pointed out formerly for examples of *Octomeris brunnea* Darwin (syn. *O. intermedia* Nilsson-Cantell) and *Chthamalus malayensis* Pilsbry (syn. *Ch. moro* Pilsbry) (HIRO, 1939, p. 252; UTINOMI, 1954, p. 18), the external appearance of the wall as well as the shape of the orifice is highly variable in genera of the family *Chthamalidae* more than in genera of the family *Balanidae*, and the shape of the opercular valves is apt to vary usually in accordance with the external deformation.

In general, the suture between the scutum and tergum in the normally conical or subconical forms of chthamalids is more or less zigzag and the outline of the tergum is roughly triangular, while in the normally depressed forms the suture is simple, rather straight or evenly curved and the tergum is thus more elongate in outline.

Individuals growing under stones at lower tide levels where are usually wetted or immersed in water at low tide, thus hypobiotic in habitat, are usually much depressed or flattened in form and pale colored, so that the suture between the scutum and tergum tends to straighten as a special case of adaptation.

KOLOSVARY (1939b, p. 168-169) calls the flattened *depressus*-form living under stones *forma depressa* and the gigantic flattened form (*riesenhaften flachen Form*) in the splash zone *forma maxima*, both referring to *Chthamalus stellatus* (Poli) taxonomically.

As might be inferred from the vertical range of occurrence and the habitat of chthamalid populations in the intertidal zone (*vide infra*), KOLOSVARY's *forma depressa* is actually not identical with *Chthamalus depressus* (Poli) but merely a deformed variant adapted to the hypobiotic life which is unusual as habitat in *Chthamalus stellatus*. KOLOSVARY's *forma maxima*, on the other hand, may correspond to the true *Chthamalus depressus* (Poli).

Chthamalus stellatus, when isolated, is normally conical or subconical in form, but when crowded they become cylindrical as in other ordinary species of *Chthamalus*. Such tubular form was called var. (b) by DARWIN (1854) and var. *fistulosus* by GRUVEL (1905).

Furthermore, as the barnacles grow to larger size, they appear much corroded above and often punctured, and the interior also becomes roughened, more deeply excavated and mottled with many punctures or irregular ribs. Such corrosion and puncturation may occur also in the interior of the opercular valves in both species *Ch. stellatus* and *Ch. depressus*, though varying in degree. Therefore, MONTAGU's (1803) *punctatus* is not persistent as a distinct forma or variant.

Recently TENERELLI (1953) and BARNES (1956b) studied the variability of *Ch. stellatus* statistically and proved a significant difference between the two species *stellatus* and *depressus*, although treating as two distinct « varieties » of *Ch. stellatus* (Poli).

HABITAT AND DISTRIBUTION

Detailed studies on the ecology and geographical distribution of *Ch. stellatus* along the Atlantic coasts of the British Isles and France have been made by many ecologists (*e. g.* COLMAN, 1933, 1939; MOORE and KITCHING, 1939; SOUTHWARD and CRISP, 1954; BARNES, 1956a; BISHOP, CRISP, FISCHER-PIETTE et PRENANT, 1957; CRISP and SOUTHWARD, 1958).

According to these authors, *Ch. stellatus* is confined to the Atlantic warm water area, northwards to the northernmost end of Scotland and eastwards to the middle of the English Channel. In most of these districts where it is abundant, its upper limit of vertical distribution is regularly higher than that of *Balanus balanoides*, though their ranges of occurrence overlap. Actually the lower limit is in many districts far above the mean low water spring tides and may be above the high water of neap tides. The upper limit is said to be near high water of spring tides where is often disturbed by splash. However, there is no reliable record of *Ch. depressus* as occurring there from these Atlantic coasts.

Recent advance of ecological studies in the littoral of the Mediterranean area, mainly by French and Italian marine ecologists, has much contributed to the knowledge on the ecology of littoral cirripeds (*e. g.* HUVÉ, 1953, 1957; HUVÉ et HUVÉ, 1954; GILET, 1954; MOLINIER et PICARD, 1953; MOLINIER, 1954; SOÏKA, 1955). Actually with practice these French ecologists seem to have distinguished the two species *Ch. stellatus* and *Ch. depressus in situ* on the rocks from the ecological aspect.

In the Mediterranean area, at least on the French and Italian coasts, *Ch. stellatus* is very common in the midlittoral zone, mostly occurring between mid and high-tide levels. *Ch. depressus* occurs only in the splash zone (uppermost midlittoral zone), namely near high tide levels.

OCCURRENCE OF CHTHAMALIDS IN RELATION TO TIDAL LEVELS

The following account implies the results of examination of samples supplied by Dr DELAMARE DEBOUTTEVILLE. According to him, the collecting survey was made on October 15th, 1955, around Ile Grosse in front of the Laboratoire Arago.

As shown in Fig. 1, cirriped samples were collected along three traverses (A, B et C) and all heights are given relative to the tidal levels as follows :

Traverse A. Located at a sheltered site of Ile Grosse, roughly in a direction of N-S.

1. On stones, 50 cm below the mean sea level.
2. Under stones, 50 cm below the mean sea level.
3. On rocks, at the mean sea level.
4. On rocky pavement in the midlittoral zone.
5. In the splash zone about 100 cm above the mean sea level, where not wetted more than 30 days *per* year.

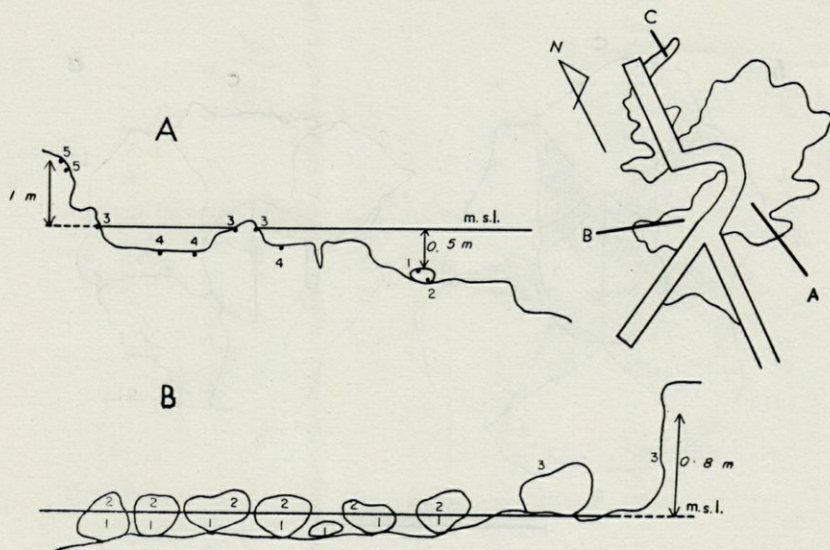


Fig. 1. — Profile of Ile Grosse in front of the Laboratoire Arago, showing the position of three traverses (A, B and C), and diagrammatic section of traverse A and traverse B. Numerals indicate the stations of collecting cirriped samples (refer to text). m.s.l. = mean sea level.

Traverse B. Located roughly in a direction of E-W.

1. On blocks, just below the mean sea level.
2. On blocks, above the mean sea level.
3. On blocks or rocky walls in the medium surf zone, between 0-80 cm high from the mean sea level.

Traverse C. Located in the surf zone, where about 200 days wetted per year.

The cirripeds collected at these stations along three traverses are identified as follows :

Traverse A.

1. All samples are low conic forms of *Ch. stellatus* (Poli), measuring 3-6 mm in carino-rostral diameter and 1.7-2.5 mm in height.
2. Small-sized samples are low conic in form, measuring 4-5 mm in carino-rostral diameter and 1.5-1.6 mm in height. They are all the typical form of *Ch. stellatus* (Poli).

Large-sized samples, about 9-10 mm in carino-rostral diameter with 3 mm wide orifice, are strongly flattened or subconical in form. The parietes are generally smooth, not folded. The alae are largely

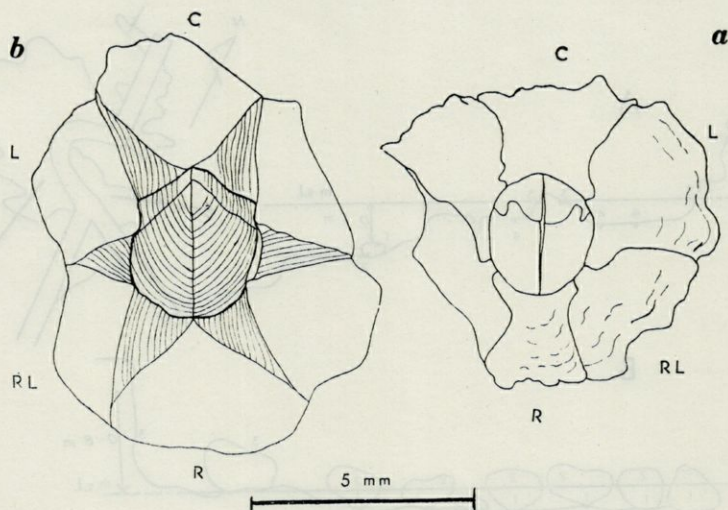


Fig. 2. — Two habitat forms of *Chthamalus stellatus* (Poli), upper view. — *a*, typical low conic form in exposed habitat, from station 3 of traverse A. — *b*, strongly flattened form in protected or hypobiotic habitat, from station 2 of traverse A. C = carina, L = lateral compartment, R = rostrum, RL = rostral-lateral compartment.

exposed and marked by growth-lines (Fig. 2, *b*). The inside of the wall is quite smooth and not punctured. However, the opercular valves as well as the internal body are quite similar to those of the typical form of *Ch. stellatus*. This is the inordinary form of *Ch. stellatus* deformed resulting from the hypobiotic habitat, and may correspond to Darwin's var. *depressus* (cf. DARWIN, 1854, p. 457, pl. 18, figs 1 *b*, 1 *g* and 1 *h*) and to Kölösvary's forma *depressa*.

3. All belong to the typical form of *Ch. stellatus*. They are low conic forms with the rounded orifice, mostly 5 mm wide and 3.5 mm high. Some large ones attain 10 mm in carino-rostral diameter and 3 mm in height.

4. All are low conic forms of medium size (7-10 mm wide and 3-4 mm high). The wall is mostly weakly folded ; the interior is either smooth or punctured radially.

5. All samples are large, robust and depressed conic in form. The wall is mostly corroded and not folded, so that apparently smooth ; the alae are sunken but not distinctly differentiated from the parietes. The wall is rather thin. The inside of the parietes is dark brownish quite smooth, with only a prominent pillar-like ridge projecting on each side, thus distinctly differentiated from the alae (Fig. 3, *b*).

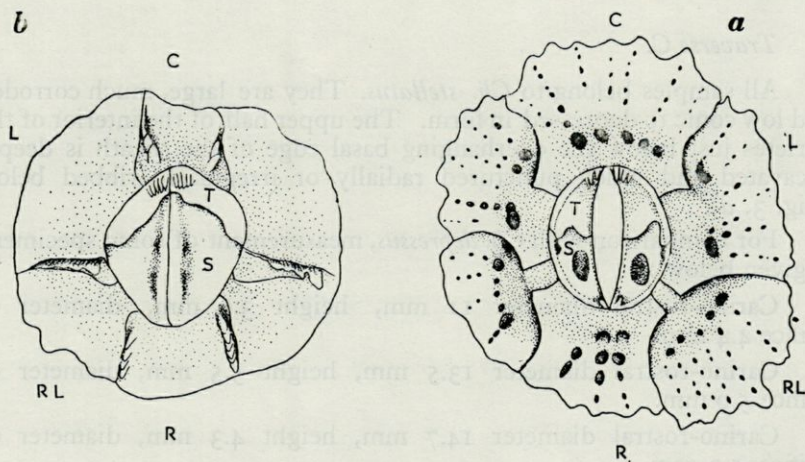


Fig. 3. — Shell of *Chthamalus stellatus* (Poli) (*a*) and shell of *Chthamalus depressus* (Poli) (*b*), under view. — *a*, a specimen collected at station 3 of traverse A. — *b*, a specimen collected at station 5 of traverse A. C = carina, L = lateral compartment, R = rostrum, RL = rostrrolateral compartment, S = scutum and T = tergum.

The external appearance resembles that of weakly folded, somewhat depressed forms of *Ch. stellatus*, but the orifice is distinctly larger and sub-hexagonal instead of almost circular as in the latter. So they can be rather easily distinguished from *Ch. stellatus*.

These samples coincide well with *Ch. depressus* (Poli). For example, three larger specimens measure as follows :

Carino-rostral diameter 11 mm, height 2.7 mm, diameter of orifice 5 mm.

Carino-rostral diameter 12.5 mm, height 2.7 mm, diameter of orifice 7 mm.

Carino-rostral diameter 14 mm, height 4.5 mm, diameter of orifice 7 mm.

Traverse B.

1. All samples belong to *Balanus perforatus* Bruguière, nearest to var. *angustus* Gmelin.

2. I could not find any corresponding material among samples. But if present, they may be either *Ch. stellatus* or *B. perforatus*.

3. Both species *Ch. stellatus* and *Ch. depressus* are found. Owing to the lack of data as to the position of occurrence it cannot be proved whether both species are actually associated within the range of 80 cm above the mean sea level.

Traverse C.

All samples belong to *Ch. stellatus*. They are large, much corroded and low conic to depressed in form. The upper half of the interior of the parietes just below the overhanging basal edge of the sheath is deeply excavated and much punctured radially or irregularly ribbed below (Fig. 3, a).

For comparison with *Ch. depressus*, measurement of some specimens is given below :

Carino-rostral diameter 11 mm, height 3.6 mm, diameter of orifice 4.4 mm.

Carino-rostral diameter 13.5 mm, height 5.5 mm, diameter of orifice 5.0 mm.

Carino-rostral diameter 14.7 mm, height 4.3 mm, diameter of orifice 5.0 mm.

Carino-rostral diameter 16.0 mm, height 6.0 mm, diameter of orifice 4.7 mm.

DISCUSSION ON THE SPECIFIC DIFFERENCES BETWEEN THE TWO SPECIES OF *CHTHAMALUS*

As mentioned above, *Ch. depressus* (Poli) is well differentiated from *Ch. stellatus* (Poli) ecologically. Since the time of DARWIN, this species has been confused with much depressed (or flattened) form of *Ch. stellatus* (Poli) occurring under stones in the midlittoral zone, thus in protected or hypobiotic habitat.

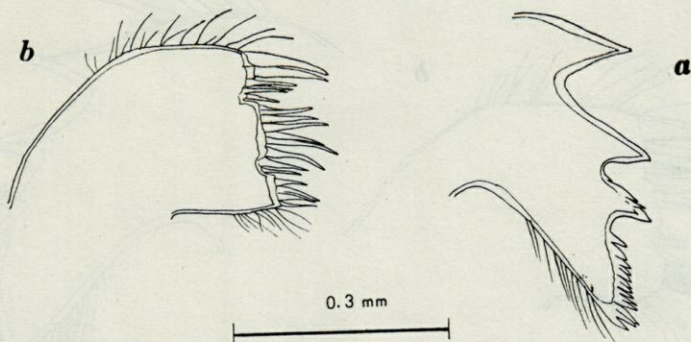


Fig. 4. — Mouth-parts of *Chthamalus depressus* (Poli). — a, mandible. — b, maxilla I.

Although apparently alike, the differences between the two species can be confirmed by the examination of the internal body, especially the structure of the mouth-parts. For comparison, the mouth-parts of the two species are shown in Figs. 4 and 5.

In *Ch. depressus* occurring at high tide levels, the mandible has three large teeth and a broad lower angle set with many spines which are largest at the end, decreasing above, and the maxilla I has a pair of large upper spines followed by three groups of smaller spines distinctly cutted by three deep notches along the frontal edge (Fig. 4).

In *Ch. stellatus* at mid-tide levels, however, the mandible has four teeth followed by an even comblike row of narrow spinules and at the end a bifid lower extremity. The maxilla I has a rather straight frontal edge, the notches being rather indistinct (Fig. 5).

From these peculiarities, *Ch. depressus* belongs obviously to NILSSON-CANTELL's *Hembeli*-group, not to the *stellatus*-group.

Accordingly, against earlier views POLI's *Lepas depressa* is not equivalent to DARWIN's var. *depressus* of *Ch. stellatus* which was recorded from St. Jago in the Cape de Verde Islands (DARWIN, 1854, p. 457) and from the mouth of River Congo (NILSSON-CANTELL, 1938, p. 177), both lying on the west coast of Africa.

For the differences in the opercular valves and others refer to Figs. 6-7 and the table given below.

It is of great interest that *Ch. depressus* is very similar both in habitat and in morphological peculiarities to *Ch. pilsbryi* Hiro on the Japanese coasts, and *Ch. stellatus* is likewise similar to *Ch. challenger* Hoek on the Japanese coasts. Actually with practice the two species can nearly always be distinguished *in situ* in the field in each of the districts, although their geographical distributions are quite different.

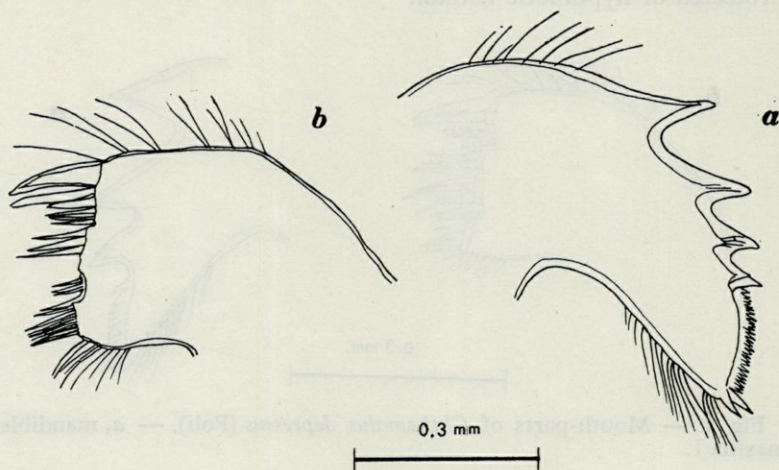


Fig. 5. — Mouth-parts of *Chthamalus stellatus* (Poli). — *a*, mandible. — *b*, maxilla I.

The specific differences between the two species *Ch. depressus* and *Ch. stellatus* described in the foregoing pages may be summarized in the following table.

	<i>Ch. depressus</i> (Poli)	<i>Ch. stellatus</i> (Poli)
<i>Shape of shell :</i>	subconical or depressed.	conical to much depressed.
<i>Exterior of wall :</i>	nearly smooth or slightly roughened.	normally folded, much corroded.
<i>Interior of wall :</i>	smooth, not punctured.	deeply hollowed, usually punctured.
<i>Thickness of wall :</i>	rather thin.	moderately thick.
<i>Sutures of compartments :</i>	moderately plain, distinct.	crenated or obliterated.

Ch. depressus (Poli)

Ch. stellatus (Poli)

<i>Outside of alae :</i>	broadly exposed, sunken from parietes.	distinct as « ears » of parietes in exposed habitat ; broadly exposed in protected habitat.
<i>Inside of alae :</i>	bordered by a prominent ridge (or pillars) from parietal area.	not differentiated from parietal area, but only produced.
<i>Outline of orifice :</i>	sub-hexagonal, large.	oval or circular, rather small.
<i>Suture between scutum and tergum :</i>	rather plain outside.	typically much sinuous <i>in situ</i> .
<i>Scutum :</i>	pit for adductor muscle and for lat. depressor muscle indistinct or even absent ; inside often finely punctated.	pit for adductor muscle large and deep ; that for lat. depressor muscle also distinct and large.
<i>Tergum :</i>	narrow with upper margin evenly arched ; articular ridge moderately reflexed but not high ; crests for depressor muscles numerous but not so strong.	broad with upper margin normally strongly arched ; articular ridge very broadly reflexed and highly projecting ; crests for depressor muscles strongly developed.
<i>Mandible :</i>	with three strong teeth and a strongly pectinated lower angle.	with four teeth followed by comblike row of spinules and a bifid lower angle.
<i>Maxilla I :</i>	with two large spines and smaller spines of three groups on frontal edge, distinctly separated by notches.	with two large spines and smaller spines of unequal size on rather straight frontal edge.
<i>Habitat :</i>	living at high tide levels (uppermost midlittoral zone — supralittoral fringe).	living above the mean sea level (upper — middle midlittoral zone).

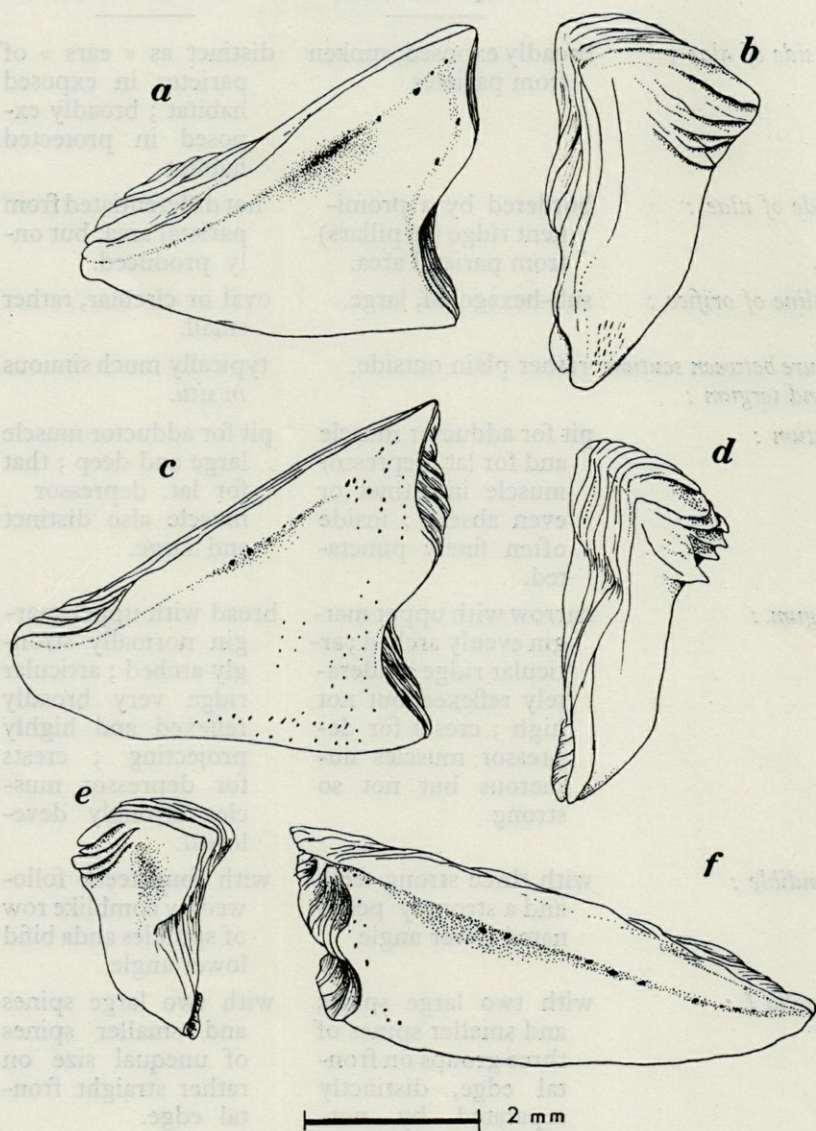


Fig. 6. — Opercular valves of *Chthamalus depressus* (Poli), inner view. — *a-b* and *c-d* are of the typical form. — *e-f* is of the form having the scutum unusually much elongated. *a*, *c* and *f* = scutum, *b*, *d* and *e* = tergum.

III. — SUMMARY

1. By inspecting a small collection of thoracic cirripeds in the Laboratoire Arago which was made mainly in the environs of Banyuls-sur-Mer, Mediterranean coast of France, the following 11 species were revealed :

Scalpellum scalpellum (Linné), *Lepas anatifera* Linné, *L. hilli* Leach, *L. pectinata* Spengler, *Chthamalus stellatus* (Poli), *Ch. depressus* (Poli), *Balanus tulipiformis* Ellis, *B. eburneus* Gould, *B. perforatus* Bruguière, *Acasta spongites* (Poli) and *Platylepas hexastylus* (O. Fabricius).

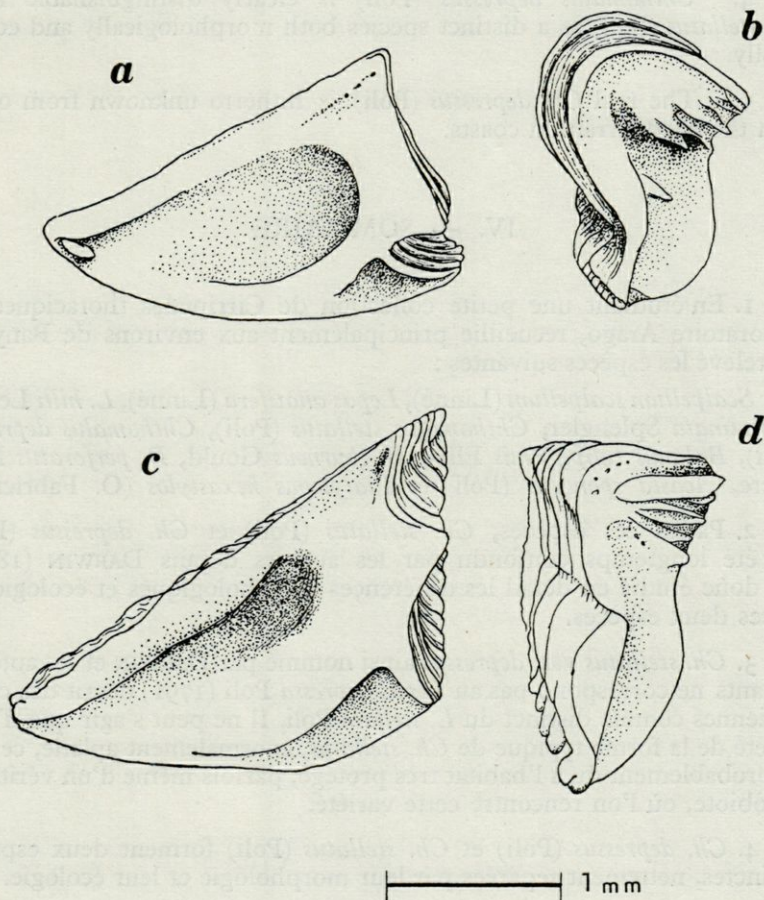


Fig. 7. — Opercular valves of *Chthamalus stellatus* (Poli), inner view. — *a-b* is of the typical, low conic form collected at station 3 of traverse A. — *c-d* is of the unusually very flattened form collected at station 2 of traverse A.

2. Of these species, *Ch. stellatus* (Poli) and *Ch. depressus* (Poli) have long been confused by earlier authors since DARWIN (1854). So I have discussed in detail on the distinctness of the two species from the aspects of their morphology and ecology.

3. *Ch. stellatus* var. *depressus* as called by DARWIN and later authors is not equivalent to *Lepas depressa* Poli (1791) described from Sicily as distinct from *L. stellata* Poli. It may be but only an extreme variant of the typical *Ch. stellatus*, unusually much flattened due to the hypobiotic or protected habitat where they may occur.

4. *Chthamalus depressus* (Poli) is clearly distinguishable from *Ch. stellatus* (Poli) as a distinct species both morphologically and ecologically.

5. The real *Ch. depressus* (Poli) is hitherto unknown from other than the Mediterranean coasts.

IV. — SOMMAIRE

1. En étudiant une petite collection de Cirripèdes thoraciques du Laboratoire Arago, recueillie principalement aux environs de Banyuls, j'ai relevé les espèces suivantes :

Scalpellum scalpellum (Linné), *Lepas anatifera* (Linné), *L. hilli* Leach, *L. pectinata* Splengler, *Chthamalus stellatus* (Poli), *Chthamalus depressus* (Poli), *Balanus tulipiformis* Ellis, *B. eburneus* Gould, *B. perforatus* Brugière, *Acasta spongites* (Poli) et *Platylepas hexastylus* (O. Fabricius).

2. Parmi ces espèces, *Ch. stellatus* (Poli) et *Ch. depressus* (Poli) ont été longtemps confondu par les auteurs depuis DARWIN (1854). J'ai donc étudié en détail les différences morphologiques et écologiques de ces deux espèces.

3. *Ch. stellatus* var. *depressus* ainsi nommé par DARWIN et les auteurs suivants ne correspond pas au *Lepas depressa* Poli (1791) décrit des côtes siciliennes comme distinct du *L. stellata* Poli. Il ne peut s'agir que d'une variété de la forme typique de *Ch. stellatus*, anormalement aplatie, ce qui est probablement dû à l'habitat très protégé, parfois même d'un véritable hypobiotisme, où l'on rencontre cette variété.

4. *Ch. depressus* (Poli) et *Ch. stellatus* (Poli) forment deux espèces distinctes, nettement séparées par leur morphologie et leur écologie.

5. Le véritable *Ch. depressus* (Poli) est actuellement inconnu ailleurs que sur les côtes méditerranéennes.

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