On a shell-deformation of Littorina littorea (Linné) caused by Balanus

by

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Introduction

Deformations of molluscan shells, both recent and fossil, have been described many times. These deformations result from various causes and they may show very different characters. Sometimes, as in the case of certain divergences of the axis of gastropod spires, or in those instances, where gastropod shells with otherwise normally coiled spire (whorls in contact) show separated whorls, we cannot attribute the anomalies to ordinary causes, such as influences of the substratum or damage of the shell-secreting mantle, but then the anomaly may be of a pathological character.

One of the most striking examples of deformation is the abnormal development of a shell caused by commensalism, but it is not often noted in mollusca.

When sifting molluscan collections, recent and fossil, one often observes shells which are overgrown by oysters, Polyzoa or Vermetus, but abnormal shell-development of gastropods caused by these „guests" if they settled on a living mollusc has not been described up to now, as far as I am aware. Nearly the same applies to mollusca covered with Cirripedia: only three examples of anomalies produced by these strange Crustacea have been mentioned, but the present writer is of opinion that deformation caused by Balanus will be commonner than would be concluded from the scanty data known at the moment.

Bayer (1936) apparently was the first who described examples of abnormal development of — recent tropical — gastropod shells caused by Balanus, and in 1943 the present writer observed similar deformations of fossil gastropoda from the Dutch Peel-borings Miocene (Beets, 1945). I was so fortunate as to observe the same phenomenon in a recent, well-known North Sea inhabitant, the periwinkle.

In my former paper I discussed the different points which must be attended to in such cases. These points were derived from the available literature which deals with Cirripedia in connection with palaeontology, and from new observations. In addition it may be mentioned, that Miss Van Benthem Jutting has observed many examples — which I could compare also — of Balaus improvisus fixed to the dorsal anterior portion of Hydrobia ulvae (Pennant) and Hydrobia stagnalis (Baster) from the former „Zuiderzee": Van Benthem Jutting, 1936, pp. 137—144, textfig. 2, 3. The Cirripedia are extended in an anterior direction, most probably to obtain better conditions for nutrition and

oxygen supply, as Miss Jutting supposed. Apparently the habitat of these small gastropods offers no opportunities to the cirriped larvae for settling on their parietal wall, which phenomenon in certain other gastropods causes anomalies: vide infra.

One of the problems connected with the combination of empty molluscan shells, recent or fossil, and Balanus or other organisms, is the question, if the Cirripedia have settled on the shells of living mollusca or on empty shells, whether lying on the sea-bottom or carried by a wandering hermit-crab. Another interesting problem is, whether the Balanus colonies have caused the death of their host or not.

Deformation in an empty shell covered with Balanus is a proof that the crustacean settled on the shell of a living animal.

The Littorina littorea discussed below is kept in the collection of the „Comité ter bestudeering der Nederlandsche mariene fauna" in the School-museum of The Hague. I have to thank Mr. A. Bloklander and Mr. P. H. Creutzberg for kindly showing me this collection and putting the Littorina at my disposal for study.

Description

The Littorina described in the present short paper was collected alive — the operculum being still present — by the late Mr. B. Immerzeel in August 1940 on the mudflats near the island of Terschelling, North Sea; it is number 146 of the collection mentioned above.

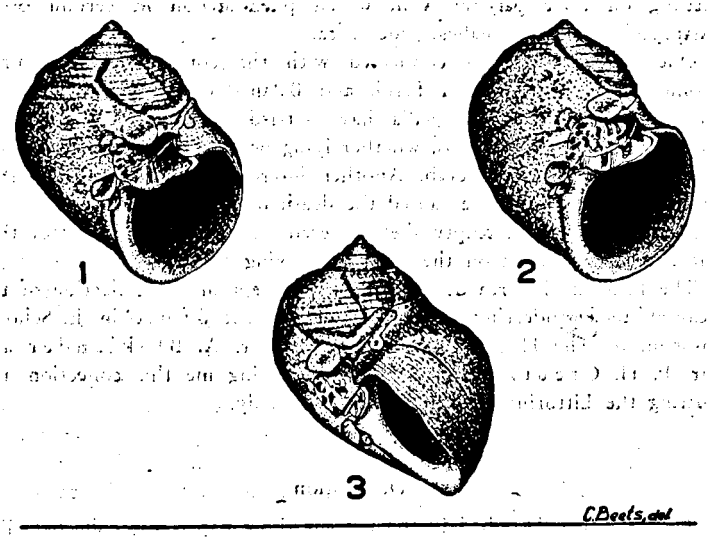
The maximum length of the specimen is 15 mm, measured along a line parallel to the axis of the spire. Figure 1 shows the shell in a way generally adopted for figuring gastropods; figure 2 has been taken almost perpendicularly to the plane of peristome and base, while in figure 3 especially the outer part of the right lip and the columella may be examined. The shell is in a rather worn condition, as considerable portions of the outer, spirally sculptured shell-layer have been corroded, apparently by the algae which give the shell a green to brownish colour.

In certain parts, for instance above the aperture of the shell, the sculpture is preserved. The corroded surface is separated from the sculptured portions by a fairly sharp talus. Growth-lines are very indistinct, except on the youngest part of the outer lip: vide infra.

A striking feature is that four representatives of Balanus spec., appearing in more than one „generation", have settled on the parietal wall of the Littorina, causing abnormal growth of inner and outer lip. These Balanus specimens are of the „conical type" of the German literature.

We see the remains of the biggest Balanus, which has settled on the left of the posterior part of the former aperture of the shell;

afterwards it was partly overgrown by the inner lip. which reaches more to the left below this Balanus.



Figs. 1—3

More to the left, below the big Balanus, a second, smaller specimen has settled at a later date. It has not yet influenced the development of the inner lip, but two other smaller balanids are covered more or less by this lip. One is fixed between the two cirripeds already mentioned and the parietal side of the inner lip, the other on the middle portion of the columella, partly covered by the margin of the left lip.

Consequently the Littorina has tried to build its inner lip over the big Balanus, in anterior direction obliquely around it. Therefore the right lip is bent forward, causing a fairly steep fall of the upper suture: figure 3. Below the cirriped a cavity was formed between the parietal wall and the left lip; precisely here a fine opportunity for settling presented iself and another generation of Balanus larvae took fortune at the tide.

Apparently it was not by chance that coarse growth-lines suddenly appeared on the part of the right lip which was formed — and perhaps with more speed than normally — in another direction, during the effort to evade the big Balanus. Apparently the strong secretion of shell-matter was reflected in the structure of the lip, but only after the base of the Balanus had been reached, for the outer lip had already taken abnormal direction before.

Immediately above and at the left of the big balanid, as well as on the upper portion of the outer surface of the right lip, some oval shelly spots are visible. They agree very well with the bases of other Balanus which I broke away from Buccinum undatum L. and other recent North Sea species and consequently will represent the remains of more juvenile Balanus specimens; some of them have settled in the corner between the parietal wall and the abnormal right lip.

According to literature algal activity may be the cause of the numerous exceedingly fine perforations in various parts of the Littorina-surface, perhaps not for the much coarser perforations which are visible on the base of the big Balanus.

Infection of Balanus with „boring" algae is well-known and apparently the big balanid had been killed and the greater part of its shell destroyed before the Littorina reached the margin of its orificium, thus making it perhaps less necessary to cover this Balanus as quickly as possible. Perhaps therefore the Littorina tried to embed the other, younger Balanus before evading the first, but more probably the protruded part of the inner lip already mentioned will be only due to the growth of the upper part of the lip laying behind the normal growth of its anterior portion. The coarse perforations mentioned above might be due to activity of Polydora instead of by algae.

Discussion

The example of abnormal shell-development in Littorina littorea corresponds closely to the anomaly described by Bayer (1936); he described two recent shells of the tropical Cassis cornuta (Linné), in which the inner lip and upper portion of the right lip have overgrown Balanus colonies or partly evaded them.

The fairly rough surface of these Cassididae offered sufficient opportunities for settling to the Balanus larvae and in the case of the smaller cirripeds on the Littorina shell it is also clear, that a good settling place was offered. In both cases the upper neritic to littoral habitat of the host will have favoured settling and further development of balanid larvae.

The same features are shown by the fossil examples which I could observe a short time ago (1945): a specimen of Aporrhais alata (d'Eichwald) in which the inner lip has grown around a Balanus settled on the upper part of the parietal wall (figure 4), and another shell, belonging to Turritella eryna d'Orbigny (figure 5), where we meet just the same fall of the outer lip as in Littorina littorea, caused by the effort to evade a growing Balanus, of which only poor remains are present: below the big Balanus in figure 5; cf. the abnormal direction of the outer lip as indicated by the spiral keels.

It is not surprising that only this kind of abnormality has been hitherto observed, for such anomalies as described above are only to be found in those parts where growth of the shell proceeds.

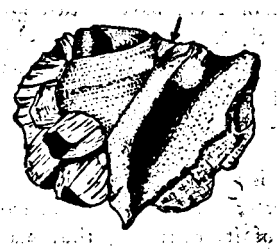


Fig. 4. Aporrhais alata (d'Eichwald); after Beets, 1945.

Fig. 5. Turritella eryna d'Orbigny; after Beets, 1945.

In the five examples hitherto described the gastropods did not succeed in removing the Balanus larvae with their feet, and on the other hand the cirripeds, in spite of their usually fairly quick growth, seem to have had no time to try to escape overwhelming and embedding by forming a shell of „infundibuliform type", as has been described in other cases, where lack of space has forced cirripeds to grow chiefly in but one of the normal directions.

Settling of Balanus larvae on molluscan shells will have been increased in the case of the Littorina as well as of the fossils mentioned above, by the absence of rocks or other suitable material [1]). We may expect more examples from the southern parts of the North Sea than from other parts, where the balanid larvae have fine opportunities for settling.

It is unlikely that any special host will have been „chosen" by the Balanus larvae, but most probably, as I pointed out in 1945, we see

[1]) Gerth (Wetensch. Meded. Dienst Mijnb. Ned.-Indië, n. 25, p. 3, 1933) described a valuable analogy: all individuals examined of the Javanese Upper Eocene coral Bathyactis eocenica Gerth are fixed to benthal foraminifera Discocyclina dispansa Sowerby; according to Gerth the absence of other material suitable for settling will have caused this phenomenon. The East Indian Neogene contains other corals showing settling on mollusca under the same conditions, e.g. Heterocyathus, and Stephanoseris carthausi Felix fixed on numerous shells of Potamides jonkeri Martin in pliocene deposits of Timor, a well-known and beautiful example of settling of corals (a series of specimens of the last-mentioned species bearing Stephanoseris may be examined in the collections of the Geological Museum, Leiden, and especially of the „Instituut voor Mijnbouwkunde", Delft).

the result of accidental settling, combined with and raised by the absence of other objects for settlement.

In concluding these remarks we must pay attention to the algal (and Polydora?) activities mentioned. Without damage to the Littorina shell we cannot examine the character of the perforations more closely and determine their originators, but they form a notable complication, especially as regards the big Balanus. The investigation of „boring" algae has offered many interesting points; we may refer to Wetzel's study (1938), which contains more references. It is well-known, that even living mollusca may be perforated by elements of primitive plants and animals with „boring" capacity, sometimes even by higher organisms: vide Fischer's „Manuel de Conchyliologie", 1883—'87, p. 21, fig. 18.

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