

of dark brown or black. Sometimes the forward edge was ragged and untrimmed, instead of being sharp and clearly rounded.

In the cases where the operculum was absent altogether, the area left uncovered was not smooth, as it is when one peels off an operculum from a perfect specimen. The surface where the operculum should have been was contracted, wrinkled, and raised into knotty humps, as if the animal were making some effort to compensate for such protection as is afforded by the operculum, by a thickening of the integument in that area.

What particular purpose is served by the operculum in this and many other kindred species of Mollusca is not quite clear, since the animal remains normally adherent to the rock by its foot, on some point on the upper surface of whose hinder portion the operculum is carried. It is only when the animal becomes detached from its position that the operculum closes the mouth of the shell, and it is clear that to become detached is the last thing which is desirable for species which normally live adherent; in many cases they must be unable to regain their position.

In the present case it seemed probable that overcrowding and under-feeding were the cause of the defects of the *Nucella*. In size the shell was not more stunted than specimens to be found on almost any exposed coast. But there must have been thousands of them on the perpendicular cliffs at Lydstep, clinging closely together, and with no food but barnacles and an occasional limpet. Under such circumstances it is not surprising that signs of decadence should manifest themselves.

It never seems possible to predict what particular form of decadence will result from any given diminution of the optimum of environment. The only case at all parallel to this, as far as *Nucella* is concerned, occurred in a group of *N. lapillus* found living at Minehead. Near the harbour, where the water is specially muddy, and the holding ground foul with decayed wood and lumps of rotten clay, specimens occur whose shells are riddled with some boring worm, with the result that they are decollate, the suture often deeply pitted, and the base of the columella and the outer lip eaten away and ragged. so that the whole shell presents a most forlorn and wretched appearance. Yet, in every case examined, the operculum was perfectly normal in shape, size, colour, and thickness.

THE RADULA OF THE GENUS *EUTHRIA*, GRAY.

By the Rev. A. H. COOKE, Sc.D., F.Z.S.

Read 13th April, 1917.

THE generic name *Euthria* appears to cover a variety of species which in certain points differ widely from one another. Founded by Gray in 1850 (Fig. Moll. Anim., No. 67), its type is the Mediterranean *cornea*, L. Kobelt catalogued¹ the genus in 1878. Suter recognizes²

¹ Jahrb. Deutsch. Malak. Gesell., vol. v, 1878, pp. 237-8.

² Manual New Zealand Mollusca, 1913, pp. 373-81.

7 species from New Zealand and the outlying islands, and there is at least 1 Tasmanian species; Bartsch enumerates¹ 9 more from the Cape; 4 species, perhaps not all of them *Euthria*, have been described² from Japan, there is 1 from Kerguelin Island (*chlorotica*, Marts.), and an outlying species, not always regarded as *Euthria* (*dira*, Reeve), ranges from Puget Sound to the Californian islands. The Magellanic region, including the Falklands, appears to be the nucleus of a rich development of *Euthria*. Strebel, under the groups *Pareuthria*, *Glypteuthria*, and *Anomacme*, has enumerated³ 17 species from this region, and Thiele⁴ and E. A. Smith⁵ have added 1 and 2 respectively. Even so, the list of species described is probably not exhausted.

Of the forty-three species mentioned above, the radula of *cornea* was figured by Troschel⁶ (*Gebiss der Schnecken*, ii, pl. vii, f. 11). Hutton has figured the radula of *flavescens*, *linea*, *striata*, and *vittata*, and, doubtfully, of *littorinoides*.⁷ Troschel figures (pl. vii, f. 12) as of *lineata*, Chem. (= *linea*, Mart.), a radula which is certainly that of *littorinoides*. Thiele has figured⁸ the radula of *Pareuthria innocens*, Smith.

In illustration of the present paper the radulæ of ten species are figured, seven of them for the first time. All are from the collection of the late Professor H. M. Gwatkin. The results suggest that the forms hitherto grouped under *Euthria* are susceptible of considerable subdivision, and that some must probably be removed from that genus altogether.

The specimens examined fall into four distinct groups.

Group 1.—Rhachidian tooth tricuspid, cusps somewhat blunt, elevated, base sloping away rapidly, slope interrupted on each side by a blunt knob or tooth, base deeply arched below; laterals tricuspid, simple, not much curved. To this type belong *cornea*, L., and *linea*, Mart.

¹ Bull. U.S. Nat. Mus., 91, 1915.

² *E. badia*, A. Ad., *lirata*, A. Ad., Journ. Linn. Soc. Lond., vii, 1863, p. 108; *Buccinum ferreum*, Reeve, Conch. Icon., iii, 1847, Bucc. f. 102; *Euthria fuscolabiata*, Smith, Ann. Mag. Nat. Hist., ser. IV, vol. xv, 1875, p. 421.

³ Zool. Jahrb., Syst. xxii, 1905, p. 599 f.; Wissensch. Ergebn. Schwed. Südpol. Exped., vol. vi, pt. i, 1908, p. 28. Strebel's groups are founded solely on supposed conchological differences, mainly of structure. "The genus," he remarks, "includes species of such different forms that a revision and fresh grouping appears necessary." He admits that the systematic value of the groups he names, *Pareuthria*, *Glypteuthria*, etc., is questionable, without any simultaneous knowledge of their anatomical relations.

⁴ *Pareuthria plicatula*, Thiele, Deutsch. Südpol. Exped., vol. xiii, 1912, p. 212.

⁵ *Thesbia* (?) *innocens*, Smith, Nat. Antarct. Exped. 1901-4, vol. ii, 1907, Moll. Gastrop., p. 4, pl. i, f. 1; *Euthria atrata*, Smith, Proc. Zool. Soc. Lond., 1881, p. 29, pl. iv, fig. 5.

⁶ Troschel's figure of *Euthria lineata*, Chem. (Gebiss, vol. ii, pl. vii, f. 12), represents by mistake some other radula.

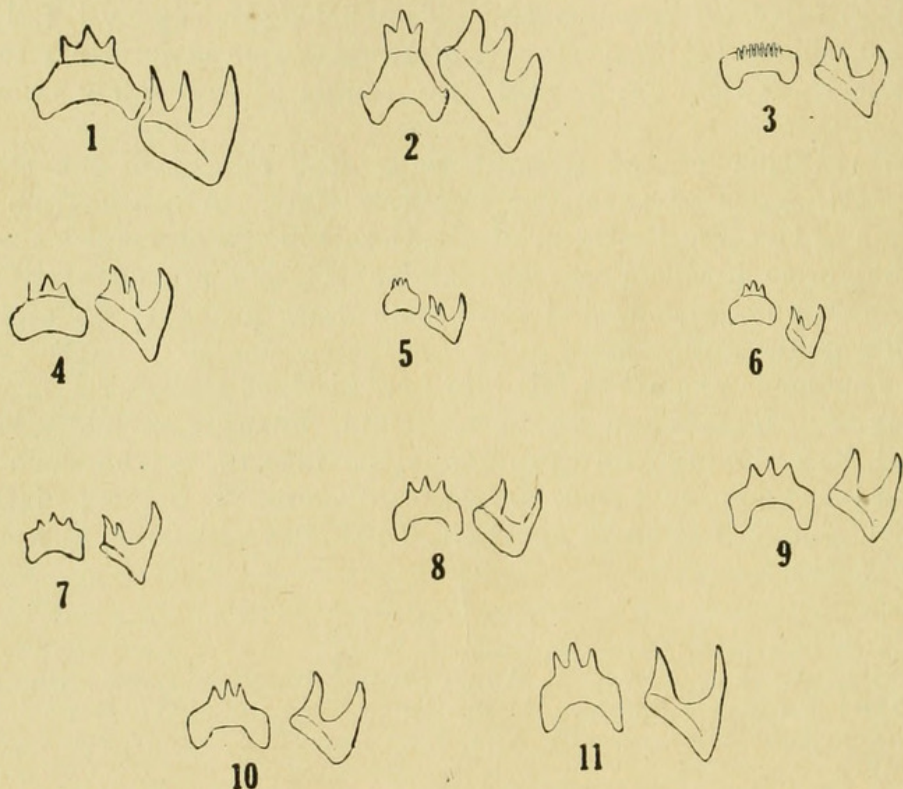
⁷ Trans. New Zealand Inst., vols. xiv, xv, xvi.

⁸ Deutsch. Südpol. Exped., vol. xiii, 1912, p. 212, pl. xvi, f. 22.

In *cornea* the base is much broader than in *linea*, and less deeply arched below, while the interruptions of the slope of the base, which are mere knobs in *cornea*, are distinct denticles in *linea*. The lateral cusps in *linea* are blunt, and of nearly equal size, in *cornea* they are sharper, the external cusp much the longest. In the rhachidian of *cornea* there is no sign of the two subsidiary front denticles, making five in all, as figured by Troschel. *Striata*, Hutt., if Hutton's figure is correct, is exactly the same type as *linea*.

Group 2.—Rhachidian tooth with eight small denticles, nearly equal in size, base broadly oblong, rounded above, arched below, sides slightly prolonged into wings; laterals tricuspid, simple, curved inward, the two inner cusps close together, suggesting the subdivision of a single cusp.

To this type belongs *ferrea*, Reeve.



The general form of radula has a close similarity to that of Group (b) of the Cape *Cominellæ* (*delalandii*, Kien., *lagenaria*, Lam., *limbosa*, Lam., *porcata*, Gmel.), as described *antea*, p. 229.

Group 3.—Rhachidian tooth tricuspid on a simple base, base usually rounded at the top, scarcely arched below; laterals tricuspid, simple, the two inner cusps close together, representing a single subdivided cusp.

The New Zealand species (1) *flavescens*, Hutt., (2) *littorinoides*, Reeve, (3) *vittata*, Quoy, the Tasmanian (4) *clarkei*, T.-Woods, and the Cape (5) *queketti*, Smith, belong to this type.

The radula of *queketti*, however, with its square base, angled at the top and arched below, is scarcely distinguishable from those

of the so-called Cape *Cominellæ*, *elongata*, Dunk., and *tigrina*, Kien. It has further the characteristic that the interior cusp of the lateral is serrated all along the inner edge.

Group 4.—Rhachidian tooth tricuspid on a rather narrow base, base strongly arched below, and more or less prolonged into wings; laterals bicuspid, simple, outer cusp the longer and narrower. To this type belong the Magellanic species *antarctica*, Smith, *fuscata*, Brug., *fuscata*, Brug., var. *curta*, Prest., and *innocens*, Smith. There is strong reason to suspect that Preston's var. *curta* of *fuscata*, Brug.,¹ is a distinct species from *fuscata*; the three rhachidian cusps are differently shaped, and set at a different angle.² It appears from von Martens' description³ of the radula of his *E. chlorotica* that that species also belongs to this group, and here too must be classified the West American *E. dira*, Reeve, which possesses a tricuspid rhachidian, set on a base which is rounded above, and deeply arched below, sides produced into wings; laterals bicuspid,⁴ simple.

A comparison of the radulæ of Group 4 with those of the *Cominellæ* of New Zealand (*antea*, p. 228) will suggest the conclusion that the Magellanic Euthrias are in fact Cominellas, and should be classified as such. It is noticeable that, in the Falklands at least, "Euthria" occurs on muddy shores, and Mr. Iredale tells me that in New Zealand and on Norfolk Island *Cominella* is always found associated with mud.

EXPLANATION OF FIGURES.

1. *Euthria cornea*, L.: Naples.
2. ,, *linea*, Mart.: New Zealand.
3. ,, *ferrea*, Reeve: Japan.
4. ,, *littorinoides*, Reeve: Auckland Island, New Zealand.
5. ,, *vittata*, Quoy: New Zealand.
6. ,, *clarkei*, T.-Woods: South Australia.
7. ,, *queketti*, Smith: South Africa.
8. ,, *antarctica*, Smith: Cape Horn.
9. ,, *fuscata*, Brug.: Chile.
10. ,, *fuscata*, Brug., var. *curta*, Prest.: Falkland Islands.
11. ,, *dira*, Reeve: Vancouver.

THE GENERIC POSITION OF THE GENUS *NORTHIA*, GRAY.

By the Rev. A. H. COOKE, Sc.D., F.Z.S.

Read 13th April, 1917.

THE genus *Northia* was constituted by Gray (Proc. Zool. Soc. Lond., 1847, p. 140) for his *Nassa northiæ*. In his "List of the Genera of

¹ Ann. Mag. Nat. Hist., ser. VIII, vol. xi, 1913, p. 218 (not figured).

² There can be no doubt of the identification, as Gwatkin had his specimens from Preston.

³ "Mittelplatte der Radula mit 3 Zähnen, wovon der mittlere länger, Seitenplatte mit zwei starken einwärts gekrümmten Zähnen, wovon der äussere länger, aber schmaler": Sitzungsber. Naturf. Fr. Berlin, 1878, p. 22.

⁴ One specimen shows the remarkable variation of a normal bicuspid lateral on one side, while the inner tooth of the lateral on the other side is in every case deeply cloven, making the tooth tricuspid.



Cooke, A. H. 1917. "THE RADULA OF THE GENUS EUTHRIA, GRAY." *Proceedings of the Malacological Society of London* 12, 232–235.

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