ON A SPECIES OF THE LAND MOLLUSCAN GENUS *DYAKIA*
FROM SIAM.

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PLATE X.

I AM indebted to Captain Stanley Flower, who was in Siam in 1898, for the land shell I now describe. He collected and preserved a good many species in spirits which he was good enough to place in my hands. The genus *Dyakia*, type *Hugonis*, Pfr., was described by me in 1891 in a paper on a collection of land mollusca formed by the late Mr. A. Everett in Borneo, a naturalist who discovered so many new and beautiful species in that island.¹

In this genus I included certain species described by Professor Semper,² which he had placed in *Ariophanta*, a genus almost restricted to Peninsular India, which has since been proved to be very distinct and very distantly related to these Malayan forms. These species were *Rumphii*, v. d. Busch, sinistral, from Java; *nemorensis*, Müller, dextral, from Celebes; *rareguttata*, Mousson, dextral, from Adanara, near Flores; and *striata*, Gray, dextral, from Singapur, this last collected by Von Martens. It is the same shell as *naninoides* of Benson, from the same locality. On a comparison of the shells in the Natural History Museum a variety of this last species is, I find, the subject of this paper, and was collected at Chantaboon. I show further on its anatomical characters; it well agrees with Professor Semper's description and figures of this species on pl. iii, figs. 21a-b, with a few small specific differences. The interest lies in the generic extension of range from Borneo and the Malay Archipelago and peninsula very much more to the north up to the continental area. Pfeiffer (Mon. Helic. Vivent., vol. i, p. 70) gives the island of Chusan as a habitat of *conicoides*. This would be a remarkable distribution for the genus, and I should like to see it really confirmed by examination of the animal.

DYAKIA STRIATA (Gray), var.

Hab.—Chantaboon (Capt. Stanley Flower).

Specimen dissected. Diam. maj. 27, min. 24.75 mm.; alt. 13 mm.

Animal.—Sole of foot (Fig. III) rather smooth, not divided, folded down the centre by contraction in the spirit specimen. The extremity of the foot very square (Fig. I), no lobe above the mucous gland (Fig. II), which is an oval depression, and in life I imagine somewhat pit-shaped (*vide* Wiegmann's drawing, pl. xxxvi, fig. 13, of *D. Hugonis*?).

Sides of foot rather smooth, the peripodial grooves distinct, with a broad fringed margin below them (Fig. I). The dorsal lobes

¹ Proc. Zool. Soc., 1891, pp. 22-47.

² Reisen im Archipel der Philippinen.

(Fig. IV) are small, especially the left. The visceral sac is sparsely speckled, with occasional dots on the apical portion. The buccal mass is short and globose, with a very strong retractor muscle at the base. The salivary glands are quite separate and well developed.

The jaw (Fig. XIII) is slightly arched, with no central projection.

The formula of the radula (Fig. XIV) is $61 : 17 : 1 : 17 : 61$, or $78 : 1 : 78$. The central tooth is tricuspid, narrow, and elongate, the first admedians also tricuspid. The cusps get gradually smaller until about the 14th tooth, and they merge into the curved, aculeate teeth of the laterals (Figs. 22, 25). The marginal teeth (Fig. marg.) are very minute.

The Genitalia (Figs. V–XII).—Commencing at the generative aperture, the penis (Fig. Va) is a simple shaft, joined by the vas deferens and retractor muscle at the posterior end, the epiphallus being exceedingly short. Close adjacent and just within the vestibule is the opening of the amatorial organ (Fig. VII), a much larger muscular eversible tube than the penis, about 6 mm. in length. At its further end is situated a short, sharp-pointed, transparent calcareous dart, on the point of a conical tubercle (Fig. XI). The tube is here contracted into a long, gradually tapering, rope-like duct (Fig. VIII) about 8 mm. long. To the eye this has a twisted appearance, but closer examination shows it to be a thinly sheathed cord (Fig. XII), closely convoluted or puckered; it may thus possibly act as a spring on the extension of the dart. This cord bifurcates more than once (Fig. IX), and the ends are buried in a close, solid, cellular mass of ellipsoidal form, folded and pointed at the anterior end, where it is attached to the uterus by a short membrane (Fig. V), and thus kept in position. In life no doubt this mass is less solid than as I represent it; hardened and contracted by the spirit, it would be divided into lobes more or less separable. When the animal retires within the shell, this glandular mass lies packed alongside, and almost covers the basal portion of the dart-sac (Figs. VI and VII), the cord-like connection being folded beneath it (Fig. V). The spermatheca (Fig. VI) is small, with rather a thickened base, thin and fining to a point, having an attachment to the uterus, close to that of the dart-sac gland.

Although the form of the teeth approaches those of *D. striata* from Singapur, as described by Professor Semper (p. 54), there are not nearly so many in the row, 156 : 190 respectively. The jaw of *striata* has a central projection which is absent in this Siam species. The form of the darts also differs (*vide* Semper's fig., pl. iii, fig. 21b). It is thus a variety of *striata*. The genus can be divided into two distinct sections by the form of the spermatheca, which is quite long in *Hugonis*, *nasuta*, *rareguttata*, *nemorensis*, and *Martini*, moderately long in *Rumphii*, very short in *striata*. In the first six species the secretory glands of the amatorial organ are foliated, while in the last two they are massed together.

It is interesting to note that this genus is not recorded by Drs. Paul & Fritz Sarasin, in their valuable and excellent work on the fauna of Celebes (p. 33), as being found on the main island. On

anatomical grounds they record *D. rareguttata* under *Nanina* (*Xesta*), from the small island of Saleyer, lying off the south coast, and thus in connection with and through Flores, Sumbawa, and Bali, the extreme eastern limit of its range, as yet known.

Borneo would appear to be its centre of dispersal, whence it extended westward to the Malay Peninsula and as far as South Siam. It will be interesting to see by what species it is represented in Cambodia and Annam. The same interest applies to another very remarkable genus, *Everettia*, the type, *jucunda* (P.Z.S., 1891, p. 33), possessing curious multifid secretory glands on the amatorial organ. The bounds of its distribution are unknown. Wiegmann's researches have shown that it extends to Celebes (see his excellent drawings of *Everettia Möllendorffii*, Kobelt, pl. xxiv, figs. 1-14), and it is recorded by the brothers Sarasin (Land Moll. Celebes, p. 132). A species, *fulvocornia*, Marts., is placed with a doubt in the genus by Wiegmann; the Sarasins put it into *Macrochlamys*, which, in spite of the radula being as in that genus, is very doubtful. Its true position cannot be known until the generative organs are seen, and these I do not expect will be like those of the typical Indian species; the shell-lappets are quite unlike, to begin with.

The Bornean shell *consul*, Pfr., is undoubtedly an *Everettia*, but I see the Sarasins overlooked this, and in dealing with the distribution of the fauna of Celebes (p. 38), in a comparative list of land shells of Java, Sumatra, and Borneo, *consul* is put into *Macrochlamys*, and its range extended to Sumatra. This requires verification by anatomical examination of the animal. *E. consul* belongs to a type of shell most difficult to determine by shell character, and it has been recorded from very unlikely habitats, such as Buru, probably from this cause. We now know that very different animals construct very similar shells, particularly those in the family Zonitidæ, so that the shells alone become very dangerous and deluding material in the study of present distribution in relation to past geological change.

The genus *Dyakia* now contains the following nine species, conclusively shown by the work of Professor F. Wiegmann in his excellent contribution to the *Abhandlungen Senckenbergisch naturforsch. Gesellschaft*, 1898, vol. xxiv, pp. 287-557, 11 pls., entitled "Landmollusken (Stylommatophoren): Zootomischer Teil," with very accurately drawn plates:—

Dyakia:

Hugonis, Pfr., type of the genus. Figured by Godwin-Austen, P.Z.S., 1891, pl. v, figs. 5-5b. Borneo.

Hugonis, Pfr. (?). Figured by Wiegmann, l.c., pl. xxvi, figs. 13-23. Borneo.

nasuta, Metcalfe. Figured by Godwin-Austen, l.c., pl. v, figs. 4-4c. Borneo.

Rumphii, v. d. Busch. Figured by Semper, Reisen, pl. iii, fig. 18. Java.

rareguttata, Mouss., var. *sparsa*, Semper, l.c., pl. iii, fig. 17. Wiegmann, l.c., pl. x, figs. 16-20; pl. xi, figs. 1-3. Flores,

Solor (Wallace).

Javanica, Lam. Java.

nemorensis, Müller. Figured by Wiegmann, l.c., pl. ix, figs. 15-22; pl. x, figs. 1-5; Semper, l.c., pl. iii, fig. 19. Flores.

cidaris, Lam. Figured by Wiegmann, pl. ix, figs. 12-14. Rotti. Wiegmann states that although the generative organs were incomplete, the five secretory glands were present on the amatorial organ.

amphidroma, v. Mart. (= *Martini*, Pfr.). Sumatra.

striata, Gray (= *naninoides*, Benson). Figured by Semper, l.c., pl. iii, figs. 21a-b. Singapur.

The following (all from Borneo) are provisionally placed in this genus, but the animals have yet to be examined:—*intradentata*, God.-Aust.; *regalis*, Benson; *Busanensis*, God.-Aust.; *janus*, Pfr.; *Mindaiensis*, Bock; *Moluensis*, God.-Aust.

Malacologists are frequently led to speculate on the function of accessory glands and cæcum-like appendages of the genitalia of the land mollusca, more particularly when they assume the large and striking structure exemplified in the genera *Dyakia* and *Ecerettia*, situated at the distal end of the dart-sac. It seems unlikely that we shall ever know what their true office may be, whether of an excitant sensory nature or some nature unknown to us. Pilsbry calls them the 'coronal glands,' a good term indicating their position with respect to the dart itself. We may assume they are in a measure associated with the beautifully formed calcified darts, because in other eastern genera the amatorial organ is less specialized, the dart more or less soft and muscular, and the organ as a whole of simple cylindrical form. Yet in contradiction to this we are met with the fact that equally elaborately formed calciferous darts are present in *Damayantia*, *Parmarion*, *Microparmarion*, etc., with accessory coronal glands absent.

This leads me to allude to another anomalous, inexplicable condition of the generative organs having reference to the dart-sac, viz. that in species of *Sitala*, *Durgella*, *Taphrospira*, etc. The amatorial organ is absent altogether, thus robbing it of much of its importance in the reproductive economy, a state of things even more difficult to account for than the presence and use of the complicated coronal glands in the genera I have mentioned.¹

EXPLANATION OF PLATE X.

FIGS. I-XIV. *Dyakia striata*, var.

D. amatorial organ; *D.gld.* gland of amatorial organ; *ov.* ovary; *P.* penis; *r.m.P.* retractor muscle of penis; *sp.* spermatheca; *ut.* uterus; *v.d.* vas deferens.

¹ While writing this paper the October part (vol. xi, No. 8) of the Journal of Conchology has come to hand, which contains a list of the sinistral shells in the Manchester Museum by Mr. R. Standen. I notice the genus *Ariophanta* is still made the receptacle for animals differing most widely from each other. Mr. Standen has evidently not seen what has been published by myself in 1891, and later by Professor Wiegmann in 1898. In this list only *lavipes* (the type), *foveata*, *thyreus*, and *Bajadera* represent the genus *Ariophanta*.

H. H. G.-A. del.

ANATOMY OF DYAKIA STRIATA, VAR.