ON A COLLECTION OF SLUGS FROM THE SANDWICH ISLANDS.

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THROUGH the kindness of Mr. E. R. Sykes, I have been permitted to make an examination of the slugs collected by Mr. R. C. L. Perkins in the Sandwich Islands for a Joint Committee of the Royal Society and British Association. Some of the material has been hardened in a solution of corrosive sublimate, which has made dissection somewhat difficult. I have, however, been able to make out fairly well the chief features of the alimentary and reproductive organs.

I am also greatly indebted to Mr. Sykes for the assistance he has rendered me with respect to the bibliography; whilst to Professor Cockerell I must express my thanks for directing my attention to a species of *Janella*, said to have come from the Sandwich Islands.

The first mention of the slug-fauna of the Sandwich Islands is that by Eydoux and Souleyet, in their account of the molluscan fauna of this region in 1852-3. They there describe a new species, *Limax Sandwichiensis*, and figure the animal and shell. Their description is as follows:—

"*Limax Sandwichiensis*, nobis, pl. xxviii, figs. 8-11.—*Limax*, corpore elevato, posticè acuminato, obliquè striato, suprà nigricante, subtus albido; clypeo oblongo, anticè angusto, subrugosa. Ossiculo ovato, crasso, suprà gibboso."

Semper (1) in a foot-note to his description of *Limax tennellus*, Nilss., says that there is a species—*Limax Sandwichiensis*—exceedingly like *L. tennellus*, but somewhat smaller, which occurs in the Sandwich Isles. In external appearance and in the form of the reproductive organs, the two are in complete harmony. The only differences he found were some minor ones in the teeth of the lingual ribbon, and to these he was inclined to attach but little importance. Semper seems to have had but little doubt that the *Limax* he examined was identical with *L. tennellus*, Nilss. Unfortunately he makes no mention of the shell.

It was pointed out by Tryon (14) that in the figure of the shell of *Limax Sandwichiensis*, there was a central nucleus, like a *Patella*. With some reserve, on account of the insufficient description, he placed this species in the genus *Amalia*.

Heynemann (7) records from the Sandwich Islands an *Agriolimax Sandwichiensis* (Souleyet), which he thought to be near *Agr. laevis*.

Whether the slugs examined by Semper and Heynemann were the same as those collected by Eydoux and Souleyet, it is impossible to say. Neither Semper nor Heynemann, one would suppose, could overlook the very peculiar shell.

The slug here described as *Agriolimax globosus* is not unlike that imperfectly characterized by Eydoux and Souleyet in 1852, but it has no specialized shell such as they detail and figure; on the contrary, there were in the three specimens dissected only loose, minute, calcareous discs. Unless other material be forthcoming, I fear that the *Agr. Sandwichiensis*, Eyd. and Soul., will have to remain a very doubtful species, for at present we know of no species of *Agriolimax* or *Amalia* that possesses a shell at all approaching the one figured by Eydoux and Souleyet, and reproduced by Tryon (14), pl. liv, figs. 71-3. It is quite distinct from any of the known genera of Limacidae, and that, I agree with Tryon, is in itself sufficient to justify the constitution of a new genus.

1. *AGRIOLIMAX GLOBOSUS*, n.sp.

Animal, head, mantle, and dorsum of a bluish-grey colour; sides of the body a light yellowish-brown. Posterior portion of the body attenuated, pointed, and keeled. Mantle large, pointed in front. Foot-sole and foot-fringe yellow. Lateral rugae arranged obliquely. Shell consists of a series of loose, minute, calcareous discs. Length (in alcohol) 15-18 mm., mantle 5.75-7 mm.

Hab.—Mauna Loa, Hawaii.

Anatomy.—There are four convolutions in the intestine, and the right lobe of the liver forms the apical portion of the visceral mass. The generative organs are very distinct from those of the other species of the genus, the nearest ally being *Agr. tennellus*, Nilss. The free oviduct is a long wide tube, and opens into a much convoluted sac-like oviduct. There is no distinction between the upper and lower portion of the free oviduct as in *L. tennellus*, Nilss. The penis is a wide short tube, terminating in a bulbous head, to which the retractor muscle is attached; this muscle, unlike that of *L. tennellus*, is short and broad. From the side of the penis (Fig. I), the vas deferens passes off, leading into a wide tube, the prostatic portion of the common duct. There is a small bilobed flagellum (Fig. I, *fl.*), passing off from the posterior portion of the penis. In *L. tennellus* there is little or no flagellum. The receptaculum seminis is an irregularly shaped sac with a short duct, which opens some little distance behind the penis; in this particular it differs from any other species of the genus, so far as I am aware. The albumen gland is small. The hermaphrodite gland (Fig. I, *h.gl.*) is single, and opens into the common duct by a short hermaphrodite duct.

2. *AGRIOLIMAX PERKINSI*, n.sp.

Animal, ground colour light-brown, dorsum, also head and posterior portion of the mantle, darker; sulci black, lighter towards foot-fringe; foot-sole and foot-fringe yellowish-brown. Mantle long and attenuated. Lateral rugae arranged obliquely. Shell absent. Length (in alcohol) 18-21 mm.

Hab.—Lanai, 2000 feet.

Anatomy.—The free oviduct is an unusually long and wide tube, showing a series of constrictions, into the first of which the somewhat

DESCRIPTION OF FIGURES.

- FIG. I. Generative organs of *Agriolimax globosus*, sp. nov. $\times 8$.
 „ II. Generative organs of *Agriolimax Perkinsi*, sp. nov. $\times 8$.
 „ III. Portion of the generative organs of *Amalia gagates*, Drap. $\times 8$.
 „ IV. Sperm-duct of *A. gagates*, Drap. Enlarged.
 „ V. Head and mantle of *A. gagates*, Drap.
 „ VI. Portion of the generative organs of *Tebenophorus striatus*, Hasselt. $\times 8$.

LETTERING.

alb.gl.	albumen gland.	p.	penis.
ac.gl.	accessory gland.	pr.	prostate.
fl.	flagellum.	r.d.	receptacular duct.
h.d.	hermaphrodite duct.	r.m.	retractor muscle.
h.gl.	hermaphrodite gland.	r.s.	receptaculum seminis.
ov.	free oviduct.	sp.d.	sperm-duct.
ov.	oviduct.	v.d.	vas deferens.

long receptacular duct opens (Fig. II, *r.d.*). The receptaculum seminis is small and globular. The oviducal portion of the common duct (Fig. II, *ov.*), is a wide tube folded twice upon itself. The penis is a large twisted organ, and in length considerably exceeds the same organ in any other species of the genus (Fig. II, *p.*). At a point about one-sixth of its length from the genital opening it gives off a blunt flagellum; it then expands into a sac-like portion, thence it continues for a short distance as a straight tube, and then, making a sharp turn, becomes folded upon itself, at its junction with the vas deferens (Fig. II, *v.d.*). This latter is a narrower tube, leading into the prostatic portion of the common duct, which is longer and narrower than in *Agr. globosus*. There is a large oval albumen gland. The hermaphrodite gland (Fig. II, *h.gl.*) is somewhat pyriform in shape, and opens into a short convoluted duct.

I have much pleasure in associating with this interesting species the name of Mr. R. C. L. Perkins.

The differences in the form of the reproductive organs of *Agr. globosus* and *Agr. Perkinsi* are fairly well marked, and easily distinguish them from their nearest allies. The question, however, of how far the form of the penis, free oviduct, etc., vary in a known species, is one of great interest, and must sooner or later be investigated. Dr. J. F. Babor, of Prague (2), has published some interesting notes in connection with this subject, and it is greatly to be hoped that he may find opportunity for further extending his researches.

The species of *Agriolimax*, recently described as new by Simroth (12), seem to me to be established on minute variations common to all mollusca, as do those figured and described by Babor and Kostal (1). Possibly later investigations may prove that in this genus the reproductive organs are subject to a wide range of variation, and that recourse will have to be had to the general anatomy. In *A. Sowerbyi* and *A. gagates* the only variations in the generative organs I have been able to find are in the form and number of the accessory glands and the constrictions in the sperm-duct (4).

3. *AMALIA GAGATES* (Drap.).

The specimens of *A. gagates* which come from Maui differ slightly from those I have examined from various European localities. The groove on the mantle terminates anteriorly as a sharp point (Fig. V); and on the head, in the mid-dorsal line, there is the peculiar groove so conspicuous in *A. robiei*, Simr. Internally there are also slight differences in the form of the sperm-duct (Figs. III and IV, *sp.d.*) and accessory glands. Probably all these characters are due to

isolation, and are not sufficient in themselves to separate them from the European *A. gagates*.

4. *TEBENNOPHORUS STRIATUS* (Hasselt).

There are two examples of this species, which differ somewhat externally, but an examination of the generative system (in part represented in Fig. VI) leaves no doubt that they both belong to this species.

Hab.—Mount Tantalus, near Honolulu.

This species was first described by Hasselt (6) under the generic title of *Meghimatium*. In 1867 Von Martens (10) placed it in the genus *Philomycus*, Rafinesque, 1820. The anatomy has been carefully described and figured by Keferstein (9). I am using Binney's generic title of *Tebennophorus*, which, I think, is preferable, seeing that it is accompanied by a fairly good diagnosis. While admitting many of Professor Cockerell's arguments (3) against the rule, "once a synonym always a synonym," I think the safer plan is to accept such a rule. Concerning Binney's description there can be no doubt.

5. *TEBENNOPHORUS AUSTRALIS* (Bergh)?

There is only one example of this species, and the generative organs are not developed. There is a single black line at either side of the body, and the dorsum is mottled with black. Length (in alcohol) 23 mm.

Hab.—Mount Tantalus, Oahu.

LIST OF SPECIES OF SLUGS RECORDED FROM THE SANDWICH ISLANDS.

Those marked with an asterisk are doubtful.

<i>Limax tennellus</i> , Nilss.	See	<i>Amalia gagates</i> , Drap.
Semper (11).		* <i>Amalia Sandwichiensis</i> , Eydoux.
* <i>Agriolimax Sandwichiensis</i> , Sou-		<i>Tebennophorus striatus</i> , Hasselt.
leyet.		<i>Tebennophorus Australis</i> (Bergh)?
<i>Agriolimax globosus</i> , n.sp.		<i>Janella</i> sp.
<i>Agriolimax Perkinsi</i> , n.sp.		

Dr. J. G. Cooper records a species of *Janella*, "found in a bale of the Palu fern, brought from the Sandwich Islands for mattress-making." (*Vide* Bull. Calif. Acad. Sci. 1871, vol. v, p. 195.)

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