

to point to the general conclusions that Tanganyika is unlike most of its sister lakes in having been contaminated by incursions of marine organisms at a rather remote period of time. It is certain that there are *two* distinct faunas in Tanganyika, but the ultimate determination of the nature of the more peculiar series which I have just described can only be attained by a thorough comparative study of the morphology of the selected specimens which I have brought home.

In the meantime, however, it may not be unprofitable to point out that there is nothing in the geology of the Tanganyika district which precludes the likelihood of that part of Africa having been occupied by an arm of the sea in ancient times. The massive sandstone formations of this district are probably of Jurassic age; and it is by no means improbable that the rift-valley in which Tanganyika now lies began to be formed shortly after these sandstone beds were raised.

2. On some European Slugs of the Genus *Arion*. By
WALTER E. COLLINGE, F.Z.S., Assistant Lecturer and
Demonstrator in Zoology and Comparative Anatomy,
Mason College, Birmingham.

[Received March 2, 1897.]

(Plates XXIX.-XXXI.)

CONTENTS.

	Page
1. Introduction.....	439
2. The Constancy of Anatomical Characters	440
3. A Reversion of a Colour Variation.....	442
4. The Specific Validity of <i>Arion fuscus</i> , Müll.....	443
5. Description of a new Species of <i>Arion</i>	444
6. Synopsis and Classification of the Genus	445
7. Bibliography	449
Explanation of the Plates	450

1. *Introduction.*

During the past five or six years I have been enabled, through the kindness of numerous malacologists and other naturalists, to examine exceedingly large series of the various species of European Slugs from numerous localities. Some of the results obtained are detailed in the following notes.

My best thanks are due to Mr. G. H. Carpenter, the able editor of the 'Irish Naturalist,' for the very kind manner in which he has helped me to obtain material from Ireland. My thanks are also due to the following ladies and gentlemen for material they have from time to time sent to me:—Misses M. J. Delap and Amy Warren, Messrs. A. W. Borthwick, J. Steele Elliot, W. A. Gain, A. Hartley, H. H. Macnabb, W. Moss, Jas. N. Milne,

R. A. Phillips, H. B. Raalburae, R. F. Scharff, E. W. Swanton, J. Taunton, A. T. Wilson, B. B. Woodward, G. W. Wood, and Morris Young.

2. *The Constancy of Anatomical Characters.*

During the last ten years nearly all the new species of Slugs have been constituted upon differences in the form and position of the generative organs, as may be readily seen by a reference to the writings of Simroth, Lessona, Pollonera, Godwin-Austen, and others. The external characters of such a group are exceedingly unreliable, for the colour, markings, &c. are liable to a wide range of variation in each individual species. Mr. Cockerell (3) has very decidedly questioned—strange as it may seem—the validity of anatomical characters for generic or specific distinction. Writing in 1892 (3. p. 4) he says:—"Here there is undoubtedly danger of error, since it is difficult to find out in many cases what is the stability of the apparent anatomical distinction. . . . Nothing should be more strongly insisted upon than the impossibility of applying the same tests of specific validity throughout series of genera; for characters that are generic in one place may not be specific in another." Mr. Cockerell is, I fear, dogmatizing upon a subject which he has not taken the trouble to actually work out; for, so far as I am aware, there is not a single valid genus of European Slugs in which good anatomical features cannot be set forth as characteristic of this or that particular genus. As I have elsewhere stated (8), for the separation of genera the aggregate characters should be the basis for distinction; but for specific distinction the form and position of the generative organs is undoubtedly a reliable basis, provided that undue importance is not attached to minute variations due to age, season of the year, &c.

More recently Messrs. Cockerell & Larkin (4) have attempted to substantiate the statement concerning the stability, or, as I prefer to term it, the constancy, of the form of certain parts of the generative organs in *Veronicella*. A careful perusal of this paper only proves, to my mind, that the results obtained are of little or no value as regards the subject under discussion, for the authors are not certain whether they are dealing with variations in two, three, or four species¹. Some of the specimens, I am of opinion, were not full-grown, while in others the variations noted are of the most trifling character. Where such investigations are undertaken, it is surely necessary, if the results are to be of any value, to be quite certain of the species; further, the number of specimens examined, and the proportion of variations found in each collection, if from more than one locality, should be stated.

With a view to proving how little important variation occurs in the form of the terminal ducts of the generative organs, I have during the past four or five years carried out a series of investi-

¹ In a footnote the authors state that Dr. Simroth considered some specimens submitted to him as distinct species.

gations upon two common and widely distributed species, viz., *Arion subfuscus*, Drap., and *A. hortensis*, Fér., which are detailed below.

ARION SUBFUSCUS, Drap.

The form and position of the generative organs in this species are illustrated on Pl. XXIX. fig. 1. Externally the species is one subject to a wide range of variation. I have myself noted some thirty minor colour-variations in addition to the fifty or sixty varieties which have been described by various authors. If this species assumes different colours, markings, &c. in different districts, which it undoubtedly does, in common with nearly all other species, the value of such as distinctive features is materially lessened, and one is led to ask "Does the form of the generative organs vary to a similar extent?"

I have examined 152 lots of this species, each from different localities in various parts of Europe, including in all 751 specimens. All of these were adult and collected during the months of July and August in 1892-3-4-5. Out of this large collection in only four of the lots were variations found, particulars of which are as follows:—

1. Four specimens collected at Southampton (Pl. XXIX. fig. 2). In three specimens the sperm-duct had a globose ring-like swelling at its commencement, and the free-oviduct showed the globose form figured. Professor Simroth, who examined a specimen, considered it "a very developed *A. subfuscus*."

2. Three specimens from Ireland (Pl. XXIX. fig. 3). All slightly smaller and darker than the typical form. All three specimens exhibited a slight difference in the form of the free-oviduct.

3. Five specimens collected near Knowle, Warwick (Pl. XXIX. fig. 4). All belonging to the variety *griseus*, Cllge. In one specimen the form of the free-oviduct was somewhat like that in No. 1 (fig. 2), only less globose and more constricted in the middle of the lower portion.

4. Five specimens collected in Northern Italy (precise locality uncertain). In two specimens both the sperm-duct and free-oviduct differed slightly (Pl. XXIX. fig. 5).

In all the above variations it will be seen, on comparing figures 2 to 5 with figure 1, that the distinction between the upper and lower portion of the free-oviduct was very sharply marked.

ARION HORTENSIS, Fér.

Only 83 lots of this species have been examined, each from a different locality, including in all 491 specimens. In 19 specimens the generative organs were found to be immature, thus leaving 472. Variations were found in six cases.

1. Two specimens from Tuxford, Newark (Pl. XXX. fig. 7). In one the free-oviduct was longer than usual and the sperm-duct more globose.

2. Ten specimens from Ireland (Pl. XXX. fig. 8). Three speci-

mens showed a peculiar series of constrictions in the sperm-duct, and slight constrictions in the free-oviduct.

3. Seven specimens from Northern Italy (precise locality uncertain). The difference from the typical form was very slight, the most marked character being the gradual tapering of the free-oviduct (Pl. XXX. fig. 9).

4. Nine specimens from St. Andrews, N.B. (Pl. XXX. fig. 10). In one example the sperm-duct had the peculiar form figured, and was sharply marked off from the vas deferens.

5. Twenty-seven specimens from Ireland (Pl. XXX. fig. 11). In two examples in this collection the vas deferens was sharply marked off from the sperm-duct, which approached in form that mentioned in the previous collection (*cf.* fig. 10).

6. Thirteen specimens collected at Bern, Switzerland (Pl. XXX. fig. 12). Three specimens showed the globose form of the lower portion of the sperm-duct, and differed somewhat from the type in the form of the free-oviduct.

It will thus be seen that out of 1223 specimens of *A. subfuscus*, Drap., and *A. hortensis*, Fér., from 235 localities, in only 26 specimens were variations discovered from 10 localities, and three of these were presumably not constant, being found only in individual specimens.

I am of opinion, therefore, from these and other investigations (9) that the form and position of the generative organs in these two species are of the greatest value, and exceedingly reliable for purposes of specific distinction. Further, wherever the form and position of these organs differed, and these differences were constant in a given number of specimens, I should unhesitatingly describe them as distinct species, irrespective of external colouring or markings.

Of course, to anyone acquainted only with the form of the generative organs in a very few species, or a small number of any given species, slight differences are apt to receive a wrong interpretation, and an undue importance is very often attached to such; but the experienced malacologist knows that slight differences due to age, season of the year, &c. are constantly found, and are just as worthless as permanent and well-marked differences are valuable. Until, therefore, the variations in any particular species or group of species are shown to be very great, I do not think we can do better than retain the form and position of the generative organs as our basis for specific distinction.

3. *A Reversion of a Colour Variation.*

A few years ago Mr. Gain described some very interesting observations upon the colour changes *Arion intermedius*, Normand, undergoes (12), and later I have noted similar colour variations in other species.

The present case is, I think, still more interesting than either of the above.

In the autumn of 1896 I received a specimen of the white

variety of *A. empiricorum*, Fér., from Roundhay near Leeds. It was of an almost pure white, not the creamy-yellow variety which is much commoner. For some months the specimen was kept alive beneath a bell-jar on a large flower-pot, and liberally supplied with leaves of lettuce, cabbage, &c. During this period I witnessed a complete reversion to the typical black form. After I had kept the animal for about five weeks, I noticed that it looked much dirtier than previously, and about the seventh week it was a very dirty white, which quickly changed into a faint sepia. About the ninth week it became very inactive, and for three weeks, whenever I examined it, it was drawn up in the peculiar arched form so characteristic of this and a few other species of *Arion*. During this time a large amount of thick dark yellow slime was exuded from the caudal mucous pore, and remained over the postero-dorsal region of the body. Little by little the colour deepened, and the animal became more active about the middle of the fourth month, by which time it was almost black: by the end of the fifth month it was impossible to distinguish it from the typical black forms.

I have previously seen examples of this Slug undergo slight changes in colour, such as the black forms becoming much lighter, a dark sepia; but I know of no instance of so complete a change as the one here described, viz., a complete reversion to the normal colour from a pure white.

4. *The Specific Validity of Arion fuscus, Müll.*

Through the kindness of Signor Pollonera, I was able in 1892 to examine specimens of this species, and from the slight differences I was able to detect in the form of the generative organs in these specimens, I was inclined to regard it as a variety of *A. subfuscus*, Drap. (7). Since then I have been able to make a more careful examination on some better material, for which I am indebted to the kindness of Herr Joseph F. Babor, of Prague University; and I am of now of opinion that, from the differences in the form of the generative organs, it must be regarded as a distinct species.

ARION FUSCUS, Müller, 1774.

Limax fuscus, Müller, Verm. Hist., 1774, vol. ii. p. 11.

Arion fuscus, Mörch, Vidensk. Medd. naturhist. For. Kjöbenhavn, 1863, p. 273.

Prolepis fuscus, Malm, Skand. Land-Sniglar, 1870, p. 43, pl. ii. fig. 4.

Arion rufus (partim), Westerl., Exposé critique Moll. Suède et Norv., 1871, p. 32.

Arion citrinus, Westerl., Exposé critique Moll. Suède et Norv., 1871, p. 35.

Arion stabilei, Poll., Atti Acc. Sci. Torino, 1885, p. 28.

Arion fuscus, Poll., Atti Acc. Sci. Torino, 1887.

This species is much smaller than *A. subfuscus*, with the bands on the mantle distinct; the lines on the foot-fringe vary from dark

brown to pale yellow, when of the latter colour they are usually more intense in the region of the caudal pore. Long. max. 40-55 millim.

There is a single vestibule, from which the sperm-duct opens in the form of an expanded tube; it is comparatively larger than in *A. subfuscus*, and is folded upon itself at the point where the vas deferens commences, which organ is also considerably longer than in *A. subfuscus* (Pls. XXX. & XXXI. figs. 13-14). The free-oviduct is a long, wide, and somewhat S-shaped tube. In none of the specimens I have examined does it approach the form so characteristic of *A. subfuscus* (Pl. XXIX. fig. 1, *f.ov.*). The retractor muscle is attached about the middle, whereas in *subfuscus* it is attached to the upper third. The receptacular duct is long and thin, expanding at its head into the spherical receptaculum seminis. The retractor muscle is attached to the duct just below the head. The common duct is thrown into a series of convolutions terminally, and shorter than in *subfuscus*. The hermaphrodite gland is a small, dark-coloured, ovoid or pyriform body with a long convoluted duct.

Babor's description of the reproductive organs of *A. citrinus*, Wester. (2), leaves no doubt as to it being Müller's *A. fuscus*. I have reproduced his careful figures of these organs (Pl. XXXI. figs. 15-16), and also those of the variety *boettgeri*, Poll. (Pl. XXXI. fig. 17), which according to this author is characterized anatomically by the short receptacular duct, a feature which I can confirm.

5. Description of a new Species of Arion.

In 1892 (5) I recorded a new variety of the well-known *Arion hortensis*, Fér., under the name of *cæruleus*. The specimens had been very kindly sent to me from Ireland by Dr. R. F. Scharff. I pointed out in the description of this variety that possibly, when further investigated, its anatomical characters might prove to be more permanent than I then supposed. Since that date specimens have been sent to me by Mr. B. B. Woodward from Ealing (10), by Mr. H. Horsman Macnabb from Heaton, Lancashire, and I have myself collected examples near Oxford and elsewhere. After having made a careful examination of this material, I feel convinced that this form is sufficiently distinct both externally and internally to be separated from *A. hortensis*, Fér., as a distinct species.

ARION CÆRULEUS, sp. nov.

Arion hortensis, Fér., var. *cæruleus*, Collinge, Conchologist, 1892, vol. ii. p. 26.

Body blue or greyish blue, with conspicuous dark blue lateral bands, and pale yellow ground-colour between these and the foot-fringe; mantle with dark bluish central patch, and darker bands at each side; head and tentacles bluish grey; foot-fringe white, usually without lineoles; foot-sole white or very pale yellow; rugæ flat, large, and elongated; sulci dark.

Length (in alcohol) 27-33 millim.; alive 43 millim.

Hab. Co. Dublin, Ireland ; Berkshire, Lancashire, Oxford, and Middlesex, England.

Anatomy of the Generative Organs.—The organs are generally larger than those in *A. hortensis*, Fér. There are two vestibules, the lower one being considerably larger than the upper. The lower portion of the sperm-duct forms a globose swelling, above this a wide tube gradually tapering as it approaches the vas deferens, which is sharply marked off from the sperm-duct. The vas deferens is rather longer than in *A. hortensis*. The free-oviduct is very distinct from that in any form of *A. hortensis* which I have seen, and quite unlike any species of the *A. hortensis* group, in having the lower portion of the free-oviduct much larger and more globose than the upper, which is a narrow tube (Pl. XXXI. fig. 19). The retractor muscle is attached to the upper part of the lower division of the free-oviduct. The receptacular duct is short, expanding terminally into the spherical sac, the receptaculum seminis. The remaining parts of the generative organs are similar to those of *A. hortensis*, Fér.

A comparison of figures 18 and 19 with those numbered 6 to 12 will illustrate the more striking differences.

In fig. 6 we have the terminal ducts of the generative organs of a typical *A. hortensis*, and a variation (fig. 12) which is the nearest to *A. cæruleus*.

Alcoholic specimens of *A. hortensis*, Fér., and *A. cæruleus* are very readily distinguished from one another, even more so than when alive, although the external features of *A. cæruleus* are much more distinctly marked than in any other member of this group.

6. *Synopsis and Classification of the Genus.*

The genus *Arion* as now understood by malacologists was constituted by Férussac (11) in 1819. Brard (1815) divided Linné's genus *Limax* into two genera, retaining Linné's name for those species without a shell, and constituted the new genus *Limacella* for those species possessing a shell.

Jousseau (13) is the only malacologist I know of who has adopted this classification. Hartman (1821) used the name of *Limacia* for the genus.

Moquin-Tandon in 1855 (17) divided the genus into the two following subgenera:—

Lochea, where the shell-plate was absent and represented only by small, unequal, isolated granulations.

Prolepsis, where the shell-plate was present in the form of an aggregation of separate calcareous particles.

In 1868 Mabille (15) constituted the genus *Baudonia* for two species of Portuguese slugs, *B. timida* and *B. montana*, which were distinguished from *Arion* by being anteriorly enlarged and depressed, with an almost smooth mantle, the head well separated from the body, and the tentacles small. It is hardly necessary to say that such superficial differences are of very little value, and

certainly not sufficient to constitute either a new genus or subgenus.

In 1870 Mabille (16) gave the *Arion fasciatus* group, mentioned on p. 447 in this article, the name of *Carinella*, under the impression that all the species were keeled, which, however, is not the case, as I have elsewhere pointed out (6). Seibert in 1873 (Nachr. malak. Gesell. vol. v. p. 81) proposed the name *Kolbeltia* for the *A. hortensis* group. Later Simroth (22), 1885, divided the genus into two sections, the *Monatriidae* and *Diatriidae*. In the former division all species possessing a single vestibule were grouped, and in the latter all those in which the oviduct before opening into the lower vestibule dilates, thus forming as it were a second vestibule. Pollonera (19), 1887, has very clearly shown that such a character as the presence of either one or two vestibules cannot serve as a basis for classification, it not being a feature of sufficient importance. Further, he thinks that Simroth attached too much importance to such a character, through his having limited his study to the few Germanic forms. Pollonera showed that we not only find in the same groups species which are *Monatriidae* and species which are *Diatriidae*, but also that in the four groups into which he has divided *A. hortensis* two species are *Diatriidae* (*A. hortensis* and *A. celticus*) and two are *Monatriidae* (*A. alpinus* and *A. nilssonii*); further the *A. bavayi* belongs to the so-called *Monatriidae*, while *A. rufus* and *A. ater* are the two species in which the *Diatriidae* condition is most marked. In a later paper (21) this distinguished malacologist points out that the *A. hortensis* from the North of France are all *Monatriidae*, whereas those from Germany are *Diatriidae*, while those from the East of France are intermediate between the two. From these facts I think it will be evident that we can no longer separate the members of the genus *Arion* by the number of vestibules they possess into subgenera, groups, &c. The character is interesting and may possibly be of service in separating species, but as a feature for generic distinctions is useless.

Pollonera has suggested (19) the division of the genus into four groups, viz. :—

1. The *Arion empiricorum* group.
2. The *Arion subfuscus* group.
3. The *Arion hortensis* group.
4. The *Arion bourguignati* group.

I think this suggestion preferable to any yet proposed, and it is the one I have here followed, with some slight alterations, as shown in the following synopsis of the genus.

SYNOPSIS OF THE GENUS *ARION*.

1. THE *Arion ater* GROUP¹.

The animal is large and unicolour in the adult. Rarely banded

¹ I use the name *ater* for this group, as it is an older species than *A. empiricorum*.

or striped, excepting in young specimens. Mantle large. Adult never keeled. Free-oviduct of moderate length, with its terminal portion usually globose or expanded. Sperm-duct usually, but not always, opens into the vestibule by a thickened ring-like swelling. Retractor muscle of the free-oviduct always situated above the lower portion, and joins with that supplying the receptaculum seminis.

2. THE *Arion subfuscus* GROUP.

Usually banded, variable in colour. Varies in size from 35 to 75 millim. Mantle rather large. Adult never keeled. Free-oviduct generally sac-like or wide and long, without well-defined terminal swelling. Duct of receptaculum seminis usually long. Retractor muscles of the free-oviduct and receptaculum seminis usually distinct or only slenderly united.

3. THE *Arion hortensis* GROUP.

Nearly always banded, of dark colour. Varies in size from 30 to 55 millim. Mantle medium-sized, often small. Adult never keeled. Sperm-duct usually long and tapering, passing imperceptibly into the vas deferens. Free-oviduct gradually tapering. Retractor muscles usually united, but only slenderly.

4. THE *Arion fasciatus* GROUP.

Nearly always banded. In external appearance agrees very closely with the preceding group. Body sometimes keeled. Head of receptaculum seminis elongated, duct short.

5. THE *Arion intermedius* GROUP.

Animal usually of small size, varying from 15 to 27 millim. Mantle almost circular. Adult never keeled. Receptacular duct short and broad.

Lesson and Pollonera (14) are wrong in stating, as one of the characters of the genus, that the penis (=sperm-duct) and vas deferens are quite distinct, and do not pass imperceptibly into one another as in *Ariunculus*, for in numerous species there is no marked difference between the two.

The term penis cannot be used for the male organ in this genus; as has been pointed out by Simroth, it is not evertible, and has no retractor muscle, its function being for the storage of the spermatozoa. The free-oviduct assumes the function of the penis in this genus. It is evertible and provided with a retractor muscle. Messrs. Pilsbry and Vanatta (18) have suggested the term *epiphallus* for what I term sperm-duct, and *vagina* for what I term free-oviduct. I think it preferable, however, to retain the term *epiphallus* for the terminal portion of the vas deferens above the sperm-duct; the term *vagina* is not applicable to the genus *Arion*.

CLASSIFICATION.

Family ARIONIDÆ, Gray, 1840.

Subfam. ARIONINÆ, W. G. Binney, 1864.

Genus ARION, Férussac, 1819.

GROUP I.

1. *A. ater*, Linné, 1758. (Continent.)
2. *A. rufus*, Linné, 1758. (Continent.)
3. *A. empiricorum*, Férussac, 1819. (British Isles and Continent.)
4. *A. lusitanicus*, Mabille, 1868. (British Isles and Continent.)
5. *A. brevièrei*, Pollonera, 1887. (Continent.)
6. *A. dasilvæ*, Pollonera, 1887. (Continent.)
7. *A. aggericola*, Mabille, 1870¹. (Continent.)
8. *A. flagellus*, Collinge, 1893. (Ireland and Continent.)

GROUP II.

9. *A. subfuscus*, Draparnaud, 1805. (British Isles and Continent.)
10. *A. fuscus*, Müller, 1774. (Continent.)
11. *A. bavayi*, Pollonera, 1887. (Continent.)
12. *A. pegorarii*, Lessona & Pollonera, 1882. (Continent.)
13. *A. flavus*, Nilsson, 1822. (Continent.)

GROUP III.

14. *A. hortensis*, Férussac, 1819. (British Isles and Continent.)
15. *A. anthracius*, Bourguignat, 1866. (Continent.)
16. *A. cæruleus*, Collinge, 1897. (British Isles.)
17. *A. cottianus*, Pollonera, 1887. (British Isles? a Continent.)
18. *A. nilssoni*, Pollonera, 1887. (Continent.)
19. *A. alpinus*, Pollonera, 1887. (Continent.)
20. *A. hessei*, Simroth, 1894. (Continent.)
21. *A. elongatus*, Collinge, 1894. (British Isles.)

GROUP IV.

22. *A. fasciatus*, Nilsson, 1822. (British Isles and Continent.)
23. *A. subcarinatus*, Pollonera, 1885. (Continent.)

¹ At present this must be regarded as a doubtful species. Mabille placed it in the *A. subfuscus* group (16), but Pollonera (21) states that from the radula it belongs to the *A. ater* group, being a form allied to *A. brevièrei*, Poll., from which it differs by its smaller size, brighter colour, small receptaculum seminis, shorter receptacular duct, and by the great length of the sperm-duct.

GROUP V.

24. *A. intermedius*, Normand, 1852. (British Isles and Continent.)
25. *A. molleri*, Pollonera, 1889. (Continent.)
26. *A. pascalianus*, Mabilie, 1868. (Continent.)
27. *A. vejdvorskijii*, Babor & Kostal, 1893. (Continent.)

7. Bibliography.

1. BABOR, J., & KOSTAL, J. "Note sur une espèce nouvelle d'Arion." Sitzungsber. Gesell. d. Wiss., math.-nat. Cl., Prag, 1893, pp. 1-4, pl. iv.
2. BABOR, JOSEPH F. "Note on *Arion citrinus*, Westerlund." Journ. Malac. 1894, vol. iii. pp. 45-47, pl. i.
3. COCKERELL, T. D. A. A Check-List of the Slugs. London, 1893.
4. — & LARKIN, R. R. "On the Jamaican Species of *Veronicella*." Journ. Malac. 1894, vol. iii. pp. 23-30.
5. COLLINGE, WALTER E. "Descriptions of a New Variety of *Arion hortensis*, Fér., and *Arion circumscriptus*, Johnst." Conchologist, 1892, vol. ii. pp. 26-7.
6. —. "A Review of the *Arionidae* of the British Isles." Ibid. pt. i. pp. 56-66, pt. ii. pp. 76-83.
7. —. "On the Structure and Affinities of some European Slugs." Ibid. 1893, vol. ii. pp. 113-117.
8. —. Appendix and Notes to 'A Check-List of the Slugs.' London, 1893.
9. —. "On the Generative Anatomy of *Amalia marginata*, Drap., and some remarks upon the Genus." Journ. Malac. 1894, vol. iii. pp. 70-73, fig. 1.
10. —. "*Arion hortensis* var. *cæruleus*." Journ. Malac. 1895, vol. iv. p. 73.
11. FÉRUSAC, A. DE. Hist. Nat. d. Mollusques. Paris, 1819-1851.
12. GAIN, W. A. "Some Remarks on the Colour Changes in *Arion intermedius*, Normand." Conchologist, 1892, vol. ii. pp. 55-56.
13. JOUSSEAUME. Bull. Soc. Zool. France, 1876.
14. LESSONA & POLLONERA. Monografia dei Limacidi Italiani. Torino, 1882.
15. MABILIE, J. "Des Limaciens européens." Rev. et Mag. de Zool. 1868 (sér. 2), vol. xx.
16. —. Hist. Malac. bass. Paris, 1870.
17. MOQUIN-TANDON, A. Hist. Nat. d. Mollusques terrestres et fluviatiles de France. Paris, 1855.
18. PILSBRY, H., & VANATTA, E. G. "Revision of the North American Slugs: *Ariolimax* and *Aphallarion*." Proc. Acad. Nat. Sci. Philad. 1896, pp. 339-350, pls. xii.-xiv.

19. POLLONERA, CARLO. "Specie nuove o mal conosciute degli *Arion* europei." Atti d. R. Accad. di Torino, 1886-7, vol. xxii. pp. 290-313, tav. iii.
20. ——. "Nuove contribuzioni allo studio degli *Arion* europei." Ibid. 1889, vol. xxiv. pp. 401-418, tav. ix.
21. ——. *Arionidæ* de la Région Paléarctique." Boll. Mus. Zool. Torino, 1890, vol. v. no. 87, pp. 1-42.
22. SIMROTH, H. "Versuch einer Naturgeschichte der deutschen Nacktschnecken und ihrer europäischen Verwandten." Zeit. f. wiss. Zool. 1885, pp. 203-366, Taf. vii.-xi.

EXPLANATION OF PLATES XXIX.-XXXI.

- Fig. 1. The terminal ducts of the generative organs of *Arion subfuscus*, Drap.
- Fig. 2. The same, showing variation in the form of the free-oviduct.
- Figs. 3, 4, & 5. The same, showing variations in the form of the terminal ducts.
- Fig. 6. The terminal ducts of the generative organs of *Arion hortensis*, Fér.
- Figs. 7, 8, 9, 10, 11, & 12. The same, showing variations in the form of the terminal ducts.
- Fig. 13. The generative organs of *Arion fuscus*, Müll.
- Fig. 14. The terminal ducts of the same in natural position.
- Fig. 15. The terminal ducts of the generative organs of *Arion citrinus* Westerl. (After Babor.)
- Fig. 16. The generative organs of *A. citrinus*. (After Babor.)
- Fig. 17. The terminal ducts of the generative organs of *Arion fuscus*, var. *boettgeri*, Poll. (After Babor.)
- Figs. 18, 19. The terminal ducts of the generative organs of *Arion cæruleus*, Ollge.

LETTERING.

<i>alb.gl.</i> Albumen-gland.		<i>rd.</i> Receptacular duct.
<i>f.ov.</i> Free-oviduct.		<i>r.m.</i> Retractor muscles.
<i>h.d.</i> Hermaphrodite duct.		<i>r.s.</i> Receptaculum seminis.
<i>h.gl.</i> Hermaphrodite gland.		<i>s.d.</i> Sperm-duct.
<i>l.v.</i> Lower vestibule.		<i>u.v.</i> Upper vestibule.
<i>ov.</i> Oviduct.		<i>v.d.</i> Vas deferens.
<i>pr.</i> Prostate.		

3. Field-Notes on the Antelopes of the Mau District, British East Africa. By FREDERICK J. JACKSON, F.Z.S. With Remarks by P. L. SCLATER.

[Received February 15, 1897.]

[Mr. Jackson, who is now in command of 'Ravine Station' at the edge of the Mau Plateau on the main route from Mombasa to Lake Victoria, has, in reply to some enquiries, kindly favoured me with the subjoined field-notes on the Antelopes of the district in which he is resident.—P. L. S.]

1. BUBALIS COKEI (Günth.).

I am doing my best to ascertain the ranges of the various Antelopes, but find it somewhat difficult. I thought I had quite

fixed the northern range of *Bubalis cokei* at the southern shores of Lake Naivasha, but only the other day Lt. G. E. Smith, R.E., shot a bull at Lake Elmenteita some 25 miles farther north. It was one of three. Of course there are sure to be a few stragglers of almost every species found wandering beyond the limits of their usual ranges, but so far, I believe, the southern shores of Lake Naivasha may be taken as the approximate limit of the northern range of Coke's Hartebeest.

2. BUBALIS JACKSONI, Thos.

In the same way the northern end of Lake Elmenteita may be considered as the limit of the southern range of *B. jacksoni*. How far west and north it extends I am unable to say, but I know that it is found in Uganda and Turkwel.

3. DAMALISCUS JIMELA (Matsch.).

D. jimela is found in fair numbers on the Mau plateau (at 8000 feet alt.) S.W. of this station on the borders of Lumbwa. In August, on my way to Elgeya, I saw one of these antelopes in a herd of *Bubalis jacksoni* on the Mau plateau at 7000 feet. It is also found in the Nyando Valley in South Kavirondo. In 1890 I saw a few, and got one, a fine bull, in Turkwel. It is very plentiful in Buddu, one of the large provinces of Uganda. The so-called 'Senegal Hartebeest' of the Tana river and Galla country, though doubtless the same species, appears to me, from memory, to be very much smaller.

4. CONNOCHLETES TAURINUS (Burch.).

The Wildebeest is not found anywhere near this Station, and does not occur north of the Athi plains.

5. CEPHALOPHUS GRIMMI (Linn.).

The Duyker is almost ubiquitous. Here it is more plentiful than anywhere I know of. I consider that 25 lbs. is about an average weight for both males and females.

6. OUREBIA HAGGARDI (Thos.).

7. OUREBIA MONTANA (Cretzschm.).

With regard to these Antelopes, I fear I can do nothing for you in the matter of procuring skins of the East African Oribi, as I am far away from its range, which I believe does not extend far inland from the coast, and I know no one who is sufficiently energetic or keen on shooting to apply to on your behalf. Personally I have never seen it west of a place called 'Maji chumvi' (salt water), the third up-country camp from Rabai. On the mainland near Lamu (*i. e.* in the former Witu Protectorate now merged into the E. A. P.) it is very plentiful, particularly so at a

place called Taka, opposite the island of Patta. It appears to be very partial to the vicinity of cultivations, and particularly to ground formerly under cultivation but from time to time lying fallow, where I suppose it finds better feeding and also good covert. The Abyssinian Oribi, on the contrary, appears to avoid the proximity of mankind, and prefers for the most part the open valley 'downs' far away from habitations, though I have seen them quite close to cultivations in Nandi.

To my knowledge the latter antelope is not found east of the Mau plateau. It ranges from the borders of Lumbwa (possibly farther south) to Turkwel, and west to Lake Victoria. I have lately sent some skins and skulls of this beast to Dr. Bowdler Sharpe, all procured by myself between the Sio river, in Kavirondo, and on the Mau plateau up to 8000 feet. A very noticeable peculiarity of both the species is that when disturbed and retreating they jump high into the air, and when 'landing' do so on their hind legs, and not, as other antelopes do, on their fore legs.

8. RAPHICERUS CAMPESTRIS (Thunb.).

The Steinbuck is found throughout Masailand, but does not range to the west of Mau.

9. COBUS ELLIPSIPRYMNUS (Ogilby).

I believe that the Common Waterbuck (*C. ellipsiprymnus*) does not occur north of the Athi plains and west of Mount Kenia. Lake Naivasha is about the southern limit of *C. defassa*.

10. COBUS DEFASSA (Rüpp.).

The only Waterbuck found in this district is *C. defassa*. I see in the list of mammals at the end of Gregory's book there is a '*C. ellipsiprymnus*' mentioned from Njemps! I think this must be a mistake, as I have lately returned from Njemps, where I saw many herds of Waterbucks, *all* of which were *Cobus defassa*. Again, all the Waterbucks I have seen at Lakes Naivasha and Elmenteita were also *C. defassa*. There is no mistaking the conspicuous white rump of this beast.

11. COBUS THOMASI, Neumann.

This antelope does not, I think, range east of Kabras in Kavirondo. It is plentiful in Kavirondo, along the banks of the Nzoia and Sio rivers, and is also very numerous in Uganda and Toru, but how far west and north it extends I am not in a position to state.

I believe that this beast is never found far from water. Personally I have seen a good many, and they were never more than a few hundred yards from water. It was this fact that led me to believe formerly that they were *C. vardoni*, as I remembered what Selous had said about Vardon's Antelope being always found near water.

12. *CERVICAPRA BOHOR* (Rüpp.).13. *CERVICAPRA CHANLERI*, Rothsch.

I have also sent home some skins and skulls of two species (I say species as I believe them to be distinct and not merely varieties) of Reedbucks. The 'stony-grey' species is much less plentiful than the yellowish-fawn species, and does not extend down into the plains, but appears confined to the higher ground on the hill-sides near this station, where there are no swamps. The Wander-obbo, who live almost entirely by hunting, recognize them as two distinct species, and have two names for them. I am hoping to get a fully adult buck of the former, as the one I have sent is, judging from the soft base of the horns, not quite adult.

14. *ÆPYCEROS MELAMPUS* (Licht.).

The Impala does not, to my knowledge, occur west of Mau Escarpment, but farther north it ranges west into Turkwel. The bucks about here, *i. e.* within a radius of 80 miles S.E. and N., carry far finer horns than anywhere else I know of. A short time ago I killed two bucks with horns 23 inches and 22 inches respectively (from base to tip in a straight line), and lost, through the stupidity of one of my men, another which I believe would have beaten both of them.

15. *GAZELLA GRANTI*, Brooke.

Grant's Gazelle ranges north into Turkwel and the Sak country, but is not found on the Mau plateau. At Njemps and Baringo, and in Turkwel this gazelle is considerably smaller than those found further south at Naivasha and the Athi plains. At Njemps I shot the largest buck out of a herd of 30, in which there were 3 or 4 other bucks. It was an old beast, in good condition, but only weighed 135 lbs. with horns 20 inches. To show you the differences in size, I append some measurements for comparison:—

	<i>G. granti</i> , ♂. Njemps (21.9.96).	<i>G. granti</i> , ♂ (two). Gil-Gil river, Lake Naivasha (2.1.96).		<i>G. granti</i> , ♂. Gil-Gil river, Lake Naivasha (4.4.96).
	ft. in.	ft. in.	ft. in.	ft. in.
Total length	5 3	5 8	5 7	5 7
Height at shoulder	2 11	3 1½	3 2½	3 0½
Depth of chest	1 1½	1 3	1 4	1 3
Circumference of chest...	2 9	3 1	3 3	3 1
" haunch	3 0	3 5
" loins	2 3	2 9	2 10	2 7½
" throat	1 6	1 8	1 8	1 6
" neck	1 8	2 0½	2 1	1 10½
Tail	10½	11	10	10
Horns	20	28½	27	24
Weight	135 lbs.	158 lbs.	167 lbs.	166 lbs.

16. GAZELLA THOMSONI.

Thomson's Gazelle does not, I believe, extend beyond a few miles north of Lake Nakuru. The average weight of a buck is 52 lbs.

The females are *horned*, whatever others may say to the contrary. The horns run up to about 6 inches, but are for the most part malformed and uneven.

17. HIPPOTRAGUS BAKERI, Heuglin.

Captain F. S. Dugmore, now in Kikuyu, killed a bull of this species on the Athi plains. He appears to be quite positive that it is a Roan of some sort. In April last, two marches from here, I saw a herd of 7 antelopes much resembling the Roan. They were about 800 yards off, and I had a good look at them with a powerful telescope before commencing a stalk, which, I regret to say, was unsuccessful through one of them, that I did not notice, seeing me. There were four cows, one bull, and two half-grown calves. In colour they were like an Oryx, and not unlike it in shape, though larger and longer on the leg. The back of the neck was arched, like a Sable, and appeared to have a short dark zebra-like mane. The ears were very long and tufted, and the horns of both the bull and cows were thick in proportion to their length, the bull's perhaps 20 inches or more, and curved backwards like a Roan. With the exception of one calf they were all standing under a big tree in the shade, and as they were all broadside on to me I could not make out what the facial markings were like. As the calf stood facing me, its ears stood out almost at right angles to its head, with a slight droop towards the tips. They appeared to me to be not large enough for Roan (I have only seen those in the Natural History Museum), and I believe that they are more likely to be *H. bakeri*. I feel sure that they are of the same species as that I saw on the northern slopes of Mount Elgon in 1890.

18. ORYX BEISA.

This is a new find for me. It ranges as far south as a point due east of this Station, *i. e.* about on the Equator. Lt. G. E. Smith, R.E., saw a herd of 8 a few days ago. At Baringo I shot 7 in September. There is no doubt whatever about their being true *O. beisa*. I do not believe the *O. callotis* ranges even so far north as the Athi plains. Three bulls that I killed weighed (whole with a scale up to 1000 lbs.) 383 lbs., 355 lbs., and 458 lbs., and a cow weighed 380 lbs.

19. STREPSICEROS KUDU.

The Kudu is found here on Mau, but is very scarce.

20. STREPSICEROS IMBERBIS, Blyth.

The Lesser Kudu, though found on Kilimanjaro, does not, I think, range much farther north, excepting along the coast, and I do not believe that it extends west of Mount Kenia.

21. TRAGELAPHUS sp. inc.

Horns of *Tragelaphus* sp. inc.

There is a species of large *Tragelaphus* found in the forest here. I have a pair of horns brought in by the Wanderobbo. They are respectively $20\frac{3}{4}$ in. and $21\frac{1}{2}$ in. long and $6\frac{3}{4}$ in. and $6\frac{5}{8}$ in. in circumference at the base. The man who brought them in has lived all his life in the forest, and he assures me that they are the horns of a *female* which he killed about 5 months ago. He says that the beast had long hair with black stripes, that it was one of five, that the males have much longer horns, and that they only live in thick forest and dense bush. He says that the animal is red in colour, and as big as a Hartebeest. Needless to say I shall do my utmost to procure a specimen; and since I have promised the very large reward of a *cow*, I may succeed.

Though these Wanderobbo are very accurate in their information, I cannot quite believe these horns belong to a *female*. I will, however, send them to you for examination and perhaps identification.

[I exhibit the two horns in question, which have lately reached me (see figure). They appear to me to indicate the existence in the Mau District of a *Tragelaphus*, possibly the same as *T. angasi* (which we know is found in Nyasaland), but probably distinct.—P. L. S.]

22. *TRAGELAPHUS SYLVATICUS*.

I have also sent home some skins and skulls of the Bush-buck which is plentiful round here. The male strikes me as particularly dark, though I expect it is nothing more than a local variety. The body-skin of the specimen of which I have sent the skull and neck-skin was inadvertently omitted. It is much darker than the one marked no. 1 and has not the vestige of a stripe or spot. I have seen one or two other old males, which appeared to me to be much darker still, almost black.

23. *OREAS CANNA LIVINGSTONII*.

The Eland is very scarce here since the cattle-plague of 1890. Capt. Sclater, R.E., tells me he saw a small herd on the southern slopes of Wonga (=Mt.) Longonot near Naivasha. I observed the fresh spoor of a single Eland near Njemps in September last.

4. Descriptions of new Species of Coleoptera of the Family
Endomychidæ from the Eastern Hemisphere. By the
Rev. H. S. GORHAM, F.Z.S.

[Received March 4, 1897.]

(Plate XXXII.)

The specimens of Coleoptera of the family Endomychidæ, of which it is the object of this paper to give some account, are contained in various collections. A good many are due to the persistent collecting of Mr. Doherty in the East. Some have been known to me for many years, but the material was not sufficient for their description. Among the more interesting, I may call attention to a new *Cymbachus*, two new and very distinct *Eucteani*, and the very curious *Amphisterni*. All the species here described are Oriental; and the descriptions may be regarded as supplemental to my papers on the Erotylidæ and Endomychidæ collected by Signor Fea in Burma, published in the Annals of the Genoa Museum.

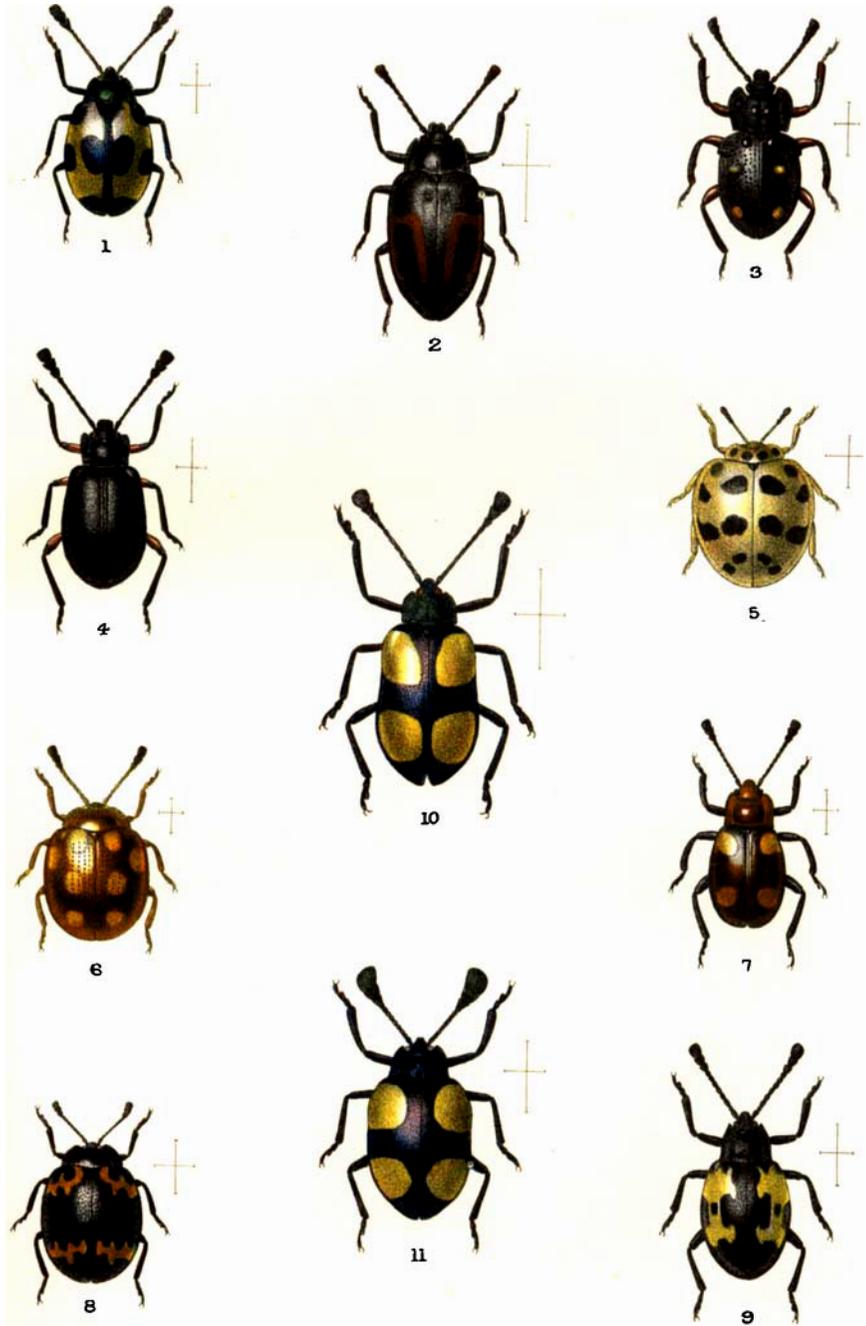
AMPHISTERNUS VERRUCOSUS, n. sp. (Plate XXXII. fig. 3.)

Niger, subopacus, prothorace transverso subcordato, medio bituberculato; elytris depressiusculis humeris late carinatis, grosse et confluentes punctatis, singulis tuberculis duobus subcarinatis, uno basali picescenti, uno discoidali piceo, punctoque subapicali lucido, læte flavo, ornatis; femorum clava rufa. Long. 7·5 millim. ♂ ♀.

Mas: tibiis anticis infra medium dente valido armatis.

Hab. JAVA (Frühstorfer, Mus. Brussels).

Antennæ very stout, their third joint as long as the two basal joints united, the fourth to the eighth fusiform, becoming shorter, the club long and lax, the two apical joints a little wider than long; eyes compressed and kidney-shaped. Head opaque. Thorax at the widest part twice as wide as the length, very much widened



W.Purkiss del. et lith.

West, Newman imp.

New Eastern Coleoptera (Endomychidæ).

below the acute and prominent front angles, and contracted from the middle to the hind angles, which (as the base is sinuate) are also acute; the basal sulci are parallel to the oblique and contracted sides, and are continued as a kind of depression above the middle; the sides are neatly margined and a little reflexed; the disk has two blunt tubercles, one on each side of an obsolete central channel. The elytra are shining near the suture, rather opaque at the shoulders and sides, with large irregularly dispersed punctures, in twos and threes, and become roughly seriate near the suture. The humeral callus is elevated into an arcuate ridge which projects beyond the margin; the basal tubercle is slightly ridged and is faintly pitchy at its summit; the discoidal one is nearer the base than the apex and is pitchy red in the middle, it is gradually and not suddenly elevated. The apical yellow pustule has just a trace of one or two obsolete punctures, it is translucent. The elytra are a little expanded at the margins and pointed at the apex; their texture is pitchy black, and may be likened to caoutchouc. On the underside the only part which exhibits punctures is the intercoxal process of the first abdominal segment, which is deeply and coarsely punctured. The prosternum is coarsely formed, its process bluntly bimucronate. Mesosternum with the raised and margined intercoxal part transversely pentagonal¹.

I have described this species at some length, as with *A. rudepunctatus*, here described, it belongs to a section of *Amphisternus* little known, and which I believe forms the genus *Haplomorphus*, Guérin.

AMPHISTERNUS RUDEPUNCTATUS, n. sp.

Brevior, prothorace lato, elytris breviter ovatis gibbosis; niger, subopacus, prothorace lato lateribus rotundatis postice parum angustatis, angulis anticis parum prominulis; elytris subcordatis, gibbosis, grosse seriatim punctatis, antennarum articulo apicali, palpis tarsisque rufo-piceis. Long. 7.5 millim. ♀.

Hab. ASSAM, Patkai Mountains (*Doherty*).

Thorax very wide, the sides much rounded, the front cut out in an arc, but not so deeply or widely as in *A. verrucosus*, the surface very uneven and very obsoletely punctate; the base very wide, a little sinuous, not margined; the sulci and central channel very obsolete, the transverse basal line very distinct. Elytra much wider than the thorax, without tubercles, a little expanded towards the margins; the apex and humerus nearly free from punctures but opaque. Underside shining, glabrous; epipleuræ very wide at their bases.

A single female example of this rather extraordinary *Amphisternus* is in Mr. Fry's collection; it is entirely black, with

¹ *Obs.*—This portion is generally but incorrectly referred to by authors as though it were the mesosternum. There is a considerable part forming two branches, and partly enclosing the coxæ, in front of this; and this portion is carinate in *Amphisterni*, the carina being received between the points of the divided prosternal process.

the exception of the tarsi, trophi, and small transverse apical joint of the antennæ.

SPATHOMELES ELEGANS, Gorham, Endom. Recit. p. 32.

Island of Marang, Sumatra (*Doherty*).

There is a female of this rare insect in Mr. Fry's collection. It is apt to be overlooked as perhaps an abnormal *Eumorphus*, but the male, with its extraordinary plate on the hind tibia and spines from the elytra, would not be so. I have seen several female examples, but only the male type in the British Museum.

TRYCHERUS ANGOLENSIS, n. sp. (Plate XXXII. fig. 2.)

Ovalis, niger, nitidus; abdominis apice, tarsis, palpis antennarumque apice summo piceis; elytris singulis lineis duabus, una submarginali, altera versus suturam, paulo ante medium per fasciam conjunctis, ante apicem desinentibus rufis. Long. 13 millim.

Hab. ANGOLA.

The antennæ in this insect are about half as long again as the head and thorax; the front angles of the latter are acute and project as far as the bases of the antennæ; the sides are a little thickened, and are sinuate, narrowed in front, widening behind to the hind angles, which are acute. It is in the middle twice as wide as long (excluding the front angles); the basal sulci are almost obsolete, and there is a very short and evanescent central channel, scarcely more than a linear point, near the base; punctation is not visible, either on the thorax or elytra. The design on the latter is two narrow red vittæ in the apical half, united at their basal end rather before the middle, but quite free towards the apex; the vittæ are produced a little backwards beyond the fascia. Very close fine puncturing is visible on the base of the abdomen.

This species seems to be near *T. josephus*, Duvièr (Comptes-rendus Soc. Ent. Belg. 1891), but to differ from it in the elytral pattern, and by the abdomen being pitchy only at the apex, &c.

Two examples.

TRYCHERUS RAFFRAYI, Gorch. Ann. Mus. Genov. ii. p. 4 (1885).

Ovatus, niger, nitidus, fere glaber; corpore infra rufo-piceo, prothoracis disco (medio piceo) fasciisque duabus elytrorum abbreviatis, anteriore juxta suturam recurvata, sanguineo-rufis; prothorace transverso, duplo latiore quam longo. Long. 7 millim.

♀.

Hab. ZANZIBAR (Raffray).

The head is pitchy black, finely punctured, as is the whole of the upper surface, as in *T. senegalensis*; the antennæ have all the joints shorter than in that species, but similar, they are black, the mouth and palpi pitchy red. The thorax is much more transverse than that of *T. senegalensis*, and is blood-red except in the middle, and the margins narrowly. The elytra are rather less ovate, and have the first fascia more arcuate and much less distinctly dentate

on the apical side, and the posterior fascia is also less sharply indented than those in *T. senegalensis*. This is the smallest *Trycherus* I have yet seen.

A single female example.

ENCYMON CINCTIPES, n. sp. (Plate XXXII. fig. 4.)

Niger, nitidus, fere glaber; prothorace transverso, lateribus leviter sinuatis, angulis posticis rectis; femoribus juxta apicem rufocinctis. Long. 9 millim. ♂ ♀.

Mas: abdominis segmentum apicale leviter emarginatum.

Hab. BURMA, Ruby Mines (*Doherty*).

Head smooth but uneven, owing to the raised antennal ridges; antennæ rather long, their basal joint as long as the third, the fourth to eighth gradually decreasing, about half the length of the third. Thorax not twice as wide as long, smooth, with deep basal sulci, which reach half the length; the width in front, across the prominent angles, is about equal to that of the base, but the sides widen a little. The elytra are decidedly oblong, not so convex nor so much rounded on their sides as in *E. immaculatus* or *E. ferialis*; the sutural stria is distinct, but nearly vanishes at the apex, their margins are but narrowly expanded. The underside is black, the abdomen rather dull, the apical segments are a little pubescent and the apex punctured, and this appears to me more so in those examples which have a slight notch, and which from analogy I assume to be the males. I can see no difference in the tibiæ. The femora are rather distinctly clubbed, and are red for about a third of their length over the thickest part. This species is perfectly distinct from *E. ferialis*. The thorax is wider, and the form is more oblong and not so convex as other species allied to it.

There are seven examples before me from Fry's collection.

ENCYMON VIOLACEUS, Gerst.

Perak (Doherty).

This insect has a wider range than I should have expected. I have lately seen examples from the Karen Mountains (*Flea*); and it varies in the colour of the elytra, the one before me from Perak having them nearly black with a faint green reflection.

ENCYMON REGALIS, Gorham, Trans. Ent. Soc. 1874, p. 440.

Var. pedibus totis nigris.

Mas: tibiis anticis et intermediis intus infra medium minute denticulatis; abdominis segmento apicali angulatim emarginato, basi medio subelevato.

Perak, low country (Doherty).

Two specimens, a male and a female, in Mr. Fry's collection present the characters of the insect described by me from the Philippine Islands, with the exception of the colour of the hinder legs. One being a male, I am able to give the sexual distinction. The emargination of the last segment will be found useful in other species in which the tibiæ are simple or nearly so in both sexes.

ENCYMON RESINATUS, Gorham, End. Recit. p. 40.

Perak (*Doherty*).

Nine specimens in Mr. Fry's collection are certainly identical with what I described in 1873, but are better matured, and enable me to supplement that account by stating that while the thorax and body, and sometimes the head, are pitchy red but dark, the elytra vary from dark blue, almost black, to violaceous. A somewhat less matured specimen has the suture and margins of the elytra rufous. The insect seems to occur indifferently on the mountains and in the low country about Perak.

CYMBACHUS FORMOSUS, n. sp. (Plate XXXII. fig. 1.)

Nigro-vividis; ore, antennis, palpis pedibusque nigris; elytris flavis, humeris macula magna discoidali communi, alteraque marginali magis posteriore, apice, epipleuris, sutura tenuiter et regione circumscutellari cœruleis, creberrime minute distincte punctatis. Long. 6.75 millim. ♀.

Hab. BURMA, Ruby Mines (*Doherty*).

The punctuation in this species is a little more distinct than in *C. pulchellus*, ♂, so that that of the thorax is just visible; in size and form it very closely resembles that insect, but diverges in the green colour of the body and in the blue markings of the elytra. The prothorax and femora have a blue tint; the humeral callus is decidedly more elevated, and is covered by the blue spot, which is wanting in *C. pulchellus*. The latter insect is very rare, having apparently always been obtained in single specimens; the example in my present collection is a male from Java. By comparison with this the single example of *C. formosus*, obtained by Mr. Doherty, is a female. The discovery of a second species of this scarce and beautiful genus is among the many most interesting features of Mr. Doherty's travels.

EUMORPHUS WESTWOODI, Gorham, Endom. Recit. p. 35.

BORNEO, Banjarmassan (*German Mission*), Pengaron, Martapura (*Doherty*); PERAK (*Doherty*).

I have now seen a series of specimens of an insect which I can only refer to this. The males have (in addition to the toothed front tibiæ) the middle tibiæ strongly sinuous, and with several minute denticulations on the inner side, while the females have nearly simple tibiæ, but are otherwise like the males. The examples (in my own collection) from Martapura, S.E. Borneo, have the spots suffused, reaching quite to the margins and suture. The club of the antenna is very wide, and the joints connate or nearly so.

EUCTEANUS CRUCIGER, n. sp. (Plate XXXII. fig. 10.)

Oblongus, nigro-subviolaceus; capite prothoraceque creberrime subrugosepunctatis, opacis; elytris fere levibus, minute punctatis violaceis, maculis quatuor permagnis dilute aurantiacis, lateribus subparallelis. Long. 11-15 millim. ♂ ♀.

Mas : abdomine medio late depresso, utrinque alte carinato, segmento quinto ventrali arcuatim emarginato.

Hab. INDIA, N.E. Manipur (*Doherty*), Dunsiri Valley (*H. H. Godwin-Austen, Mus. Calcutta*).

This species is nearly allied to *E. hardwickii* (*cælestinus*, Gerst.), from which it is distinguished by the more shining elytra, which have the yellow spots larger and more nearly united, leaving a much narrower fascia across the middle, the two posterior touch the margin and leave the suture only very narrowly violet. The elytra are of a different form, being more parallel and narrower, especially in the male. The spots do not pass the limb of the margin, the epipleuræ being dark. I have been acquainted with this insect for some years from very old examples from the Calcutta Museum. Mr. Doherty has, however, sent half a dozen beautiful specimens from Manipur.

EUCTEANUS DOHERTYI, n. sp. (Plate XXXII. fig. 11.)

E. marseuli, *Gorham, similis et affinis*; breviter oblongus, nigro-ceruleus, violaceo-nicans, nitidus, crebre, minute, sed distincte punctatus; antennarum capitulo late dilatato; elytris maculis quatuor magnis, dilute aurantiacis, posteriore plerumque transversa. Long. 8·5–9·5 millim. ♀?

Hab. INDIA, Manipur (*Doherty*). BURMA, Ruby Mines (*Doherty*).

The head and thorax are shining, thickly but distinctly punctured; the latter has an oblique transverse fovea on each side, the front is also transversely impressed, and there is an irregular fovea in the middle of the base. The elytra are thickly punctured, the punctures often confluent in lines. The antennæ have the third, fourth, and fifth joints subequal, but gradually decreasing in length to the eighth; the ninth is as long as the third and only a little widened; the tenth is obconic, nearly equilateral, the apical joint enormously enlarged and spatulate. The eyes are but moderately, but under a quarter-inch focus distinctly granulate. The underside is closely and very finely punctured, shining and black. The shoulders are ridged but not projecting, nor is the ridge sharp, it in fact runs on to beyond the middle and forms a sort of false epipleura; the true epipleuræ are black and defined at the shoulder by an indented line. This character will distinguish *E. dohertyi* from *E. marseuli*, where the ridge is acute and does not extend beyond the yellow shoulder-spot.

Although there are eight specimens of this in Mr. Fry's collection, I do not find any sexual distinction, and therefore possibly all are females; but of several examples of *E. marseuli* that I have had the opportunity of examining, and of all the specimens of *Bolbomorphi* to which they are allied, the same remark applies.

BOLBOMORPHUS THERYI, n. sp. (Plate XXXII. fig. 9.)

Oblongus, elytris ovatis, niger, nitidus, crebre ac distincte punctatus; elytris singulis signatura flava e fasciis duabus denticulatis per

lineas duas conjunctis, maculam nigram in medio includentibus, ornatis. Long. 8.5 millim.

Hab. CHINA, Ho-chan (*Thery*).

This pretty insect may be best described by comparison with *B. gibbosus* (Gorham, P. Z. S. 1887, p. 647, t. 53. f. 4), from Japan. It is much less convex, the thorax is narrower and more deeply and thickly punctured. The antennæ have a similarly lax and not much widened club. The pattern of the elytra is very distinct but hard to describe. The black part would, in short, if the middle arms were not divided, form what in heraldry is termed a "cross-crosslet," with a broad square in the middle. I hope, with the aid of the figure now given, this description will be sufficiently clear.

Bolbomorphus seems closely allied to, and in China and Japan to take the place of, *Eucteanus*. The coarser eyes, lax and not much widened club of the antennæ, which are also more coarsely built, perhaps, too, the absence of male characters, separate it. The latter, however, have not yet been found in the two smaller *Eucteani*. I have great pleasure in dedicating this species to M. André Thery, of St. Charles par Philippeville, Algeria, who sent me two examples.

INDALMUS LUZONICUS, n. sp. (Plate XXXII. fig. 7.)

Rufo-piceus, nitidus, glaber; antennis, palpis, pedibus elytrisque nigro-piceis, his singulis maculis duabus subquadratis rufis. Long. 6.5 millim. ♂.

Mas: tibiis anticis infra medium dente obtuso parvo armatis.

Hab. PHILIPPINE ISLANDS, N.E. Luzon (*Whitehead*).

This species is, by the male character, more nearly allied to *I. kirbyanus* than to *I. angusticollis*, not having any denticulation at all on the middle tibiæ. Head, thorax, and body beneath bright blood-red, inclining to be pitchy in parts, as at the base of the thorax; the latter is rather wider than long, formed as in *I. kirbyanus*, but wider at the base, the sides sinuate, narrower at the front angles than behind, the disk smooth and impunctate, the basal sulci sharp and distinct. The elytra are very minutely punctured and have a sutural stria; the spots are rather indefinite, the anterior one occupies the humerus and callus, but does not quite reach the base; the elytral margin is rather expanded from below the shoulder to the apex. The middle tibiæ are bent inwards near their apices.

Two male specimens.

PANOMŒA SUMATRENSIS, Gorham, Notes from Leyden Museum, x. p. 152 (1888).

SUMATRA, Merang (*Doherty*).

One small example about five millimetres long.

SINKIP ISLAND (Motira), one from Calcutta Museum.

These both appear to be female examples.

PANOMŒA INDIANA, n. sp. (Plate XXXII. fig. 5.)

P. coccinellinæ affinis, et statura æqualis, testacea, nitida; elytris subtiliter, creberrime, minute punctatis; prothorace brevi, valde

arcuato, angulis anticis et posticis rotundatis, maculis quatuor nigris; elytris singulis maculis septem, fere ut in P. coccinellina dispositis; antennarum clava et scutello nigris. Long. 7 millim.

Hab. N.E. INDIA, Manipur (*Doherty*). BURMA, Toungoo.

This species is allied to *P. coccinellina*, Gerst., but may be at once distinguished by the four large round black dots on the thorax which extend transversely and at even distances across its arcuate disk. The thorax is at the same time more arcuate and with all its angles more obtuse and round; it is, indeed, very similar in shape to that of many Coccinellidæ. The spots on the elytra are more transverse and in general larger than the corresponding ones in *P. coccinellina*; this is especially true of the intermediate pair, which nearly form a fascia; the exterior spot of these is straight on its outer margin, and even produced a little as if to join the outer subterminal one, but it does not touch the reflexed edge.

The seven species of *Panomœa* which have been described up to the present time are readily distinguished by their markings. The present species with *P. pardalina* and *P. coccinellina* have each seven spots on each elytron, *P. borneensis* has six, *P. undecimnotata*, Frivaldsky, and *P. cinghalensis*, Gorb., have five spots, but the latter has but ten joints to its antennæ. *P. sumatrensis*, Gorb., has no spots.

These insects appear to me to be true mimics of the Coccinellidæ, and that the resemblance is not merely accidental. *P. indiana* so well resembles some species of *Leis* or *Caria*, that it would easily deceive a very good naturalist. Indeed in this insect the whole body, especially the prothorax, has become completely Coccinellid. It is true that those points of structure which are not so obvious, *e. g.* the form of the antennæ and prosternum, the absence of abdominal fossæ from the hind femora, &c., maintain their Endomychid type.

BECCARIA, Gorbham, Ann. Mus. Genova, ii. p. 5 (1886).

BECCARIA WALLACEI, n. sp. (Plate XXXII. fig. 6.)

Picea, nitida, prothorace transverso minute punctato, æquali, sulcis basalibus concinne impressis, lateribus haud marginatis antice angustatis, angulis anticis et posticis acutis, basi sinuato; elytris convexis, sparsim punctulatis, punctis discoidalibus in seriebus quinque haud regulariter digestis, ad apicem evanescentibus, externe confusis, singulis maculis quatuor aurantiacis, una basali, una subhumerali, una pone medium prope suturam, una subapicali; antennis dilute piceis, clava fusca. Long. 5.5 millim.

Hab. ARU ISLANDS (*Wallace*).

Rather larger and rounder and more convex than *B. papuensis*; the thorax more narrowed in front and wider behind, and so forming a more even outline with the elytra than is the case in *B. papuensis*; the antennæ are similar to those of that species, but are thinner, with more linear joints, the apical joint is longer.

The eyes in both species are coarse and wide, but the head is almost sunk in the thorax. The elytra have four distinct rows of large punctures, and one irregular row bordering the confused large punctures which cover the sides, but vanish towards the apex; the striæ are geminate, the external pair pass over the central yellow spot. The legs are pitchy or pale fuscous.

I have great pleasure in calling attention to a second species of this genus, which I found among some undetermined Coccinellidæ obtained by the late W. W. Saunders from Mr. Wallace's collections, which has thus lain nearly forty years undetected.

A single example.

BECCARIA CARDONI, n. sp. (Plate XXXII. fig. 8.)

Late orbiculari-ovata, nigro-picea, capite prothoracæque subtiliter, elytris distinctius fortius punctatis; his annulo irregulari, ætus denticulato, callum humeralem subcingente, et fascia tenui utrinque denticulata, ante apicem, saturate flavis, ornatis. Long. 7, lat. 6 millim.

Hab. INDIA, Barway (*P. Cardon*).

The thorax in this species is at its base about twice as wide as the length; the base is sinuate, and both it and the sides are finely margined but not at all raised or thickened; the basal foveæ are very obsolete; the sides narrow very much to the front angles, the head being very small and received almost entirely into the thorax. The antennæ are as long as the width of the thorax, or nearly so, their club is lax, the intermediate joints a little longer than wide, the third joint twice as long as those succeeding it. The punctuation of the elytra is strong and distinct, that of the thorax distinct but closer; there is no sign of striation. The pattern of the elytra is like that of *Engonius lunularis*, but the posterior fascia does not quite reach either the suture or the margin; both it and the humeral annulus are narrow and ornamented with long denticular projections, which form on the upper side of the fascia three, and on the lower side two sinuses.

I have only seen one example of this insect, and it was in too bad a condition to allow of the underside, trophi, &c. being examined, so that the genus is doubtful; but although larger and differently marked from the other two species I assign to *Beccaria*, it is more in accordance with them in form than with any other Eastern genus known to me.

EXPLANATION OF PLATE XXXII.

- Fig. 1. *Cymbachus formosus*, p. 460.
2. *Trycherus angolenis*, p. 458.
3. *Amphisternus verrucosus*, p. 456.
4. *Encymon einctipes*, p. 459.
5. *Panomæa indiana*, p. 462.
6. *Beccaria wallacei*, p. 463.
7. *Indalmus luzonicus*, p. 462.
8. *Beccaria cardoni*, p. 464.
9. *Bolbomorphus theryi*, p. 461.
10. *Eucteanus cruciger*, p. 460.
11. — *dohertyi*, p. 461.