



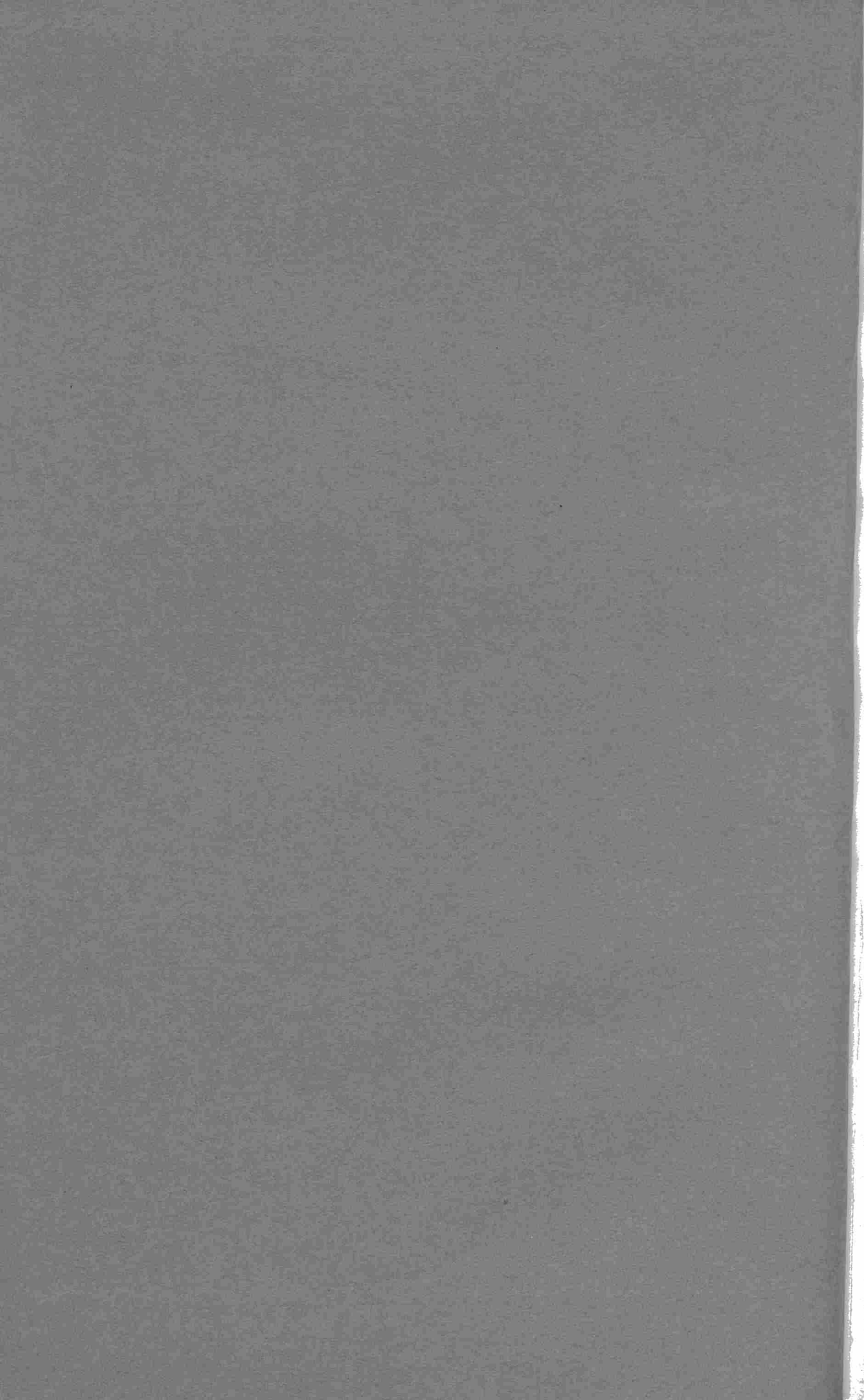
A MONOGRAPH  
OF THE AFRICAN LAND SNAILS  
OF THE  
GENUS LIMICOLARIOPSIS D'AILLY

(Mollusca - Achatinidae)

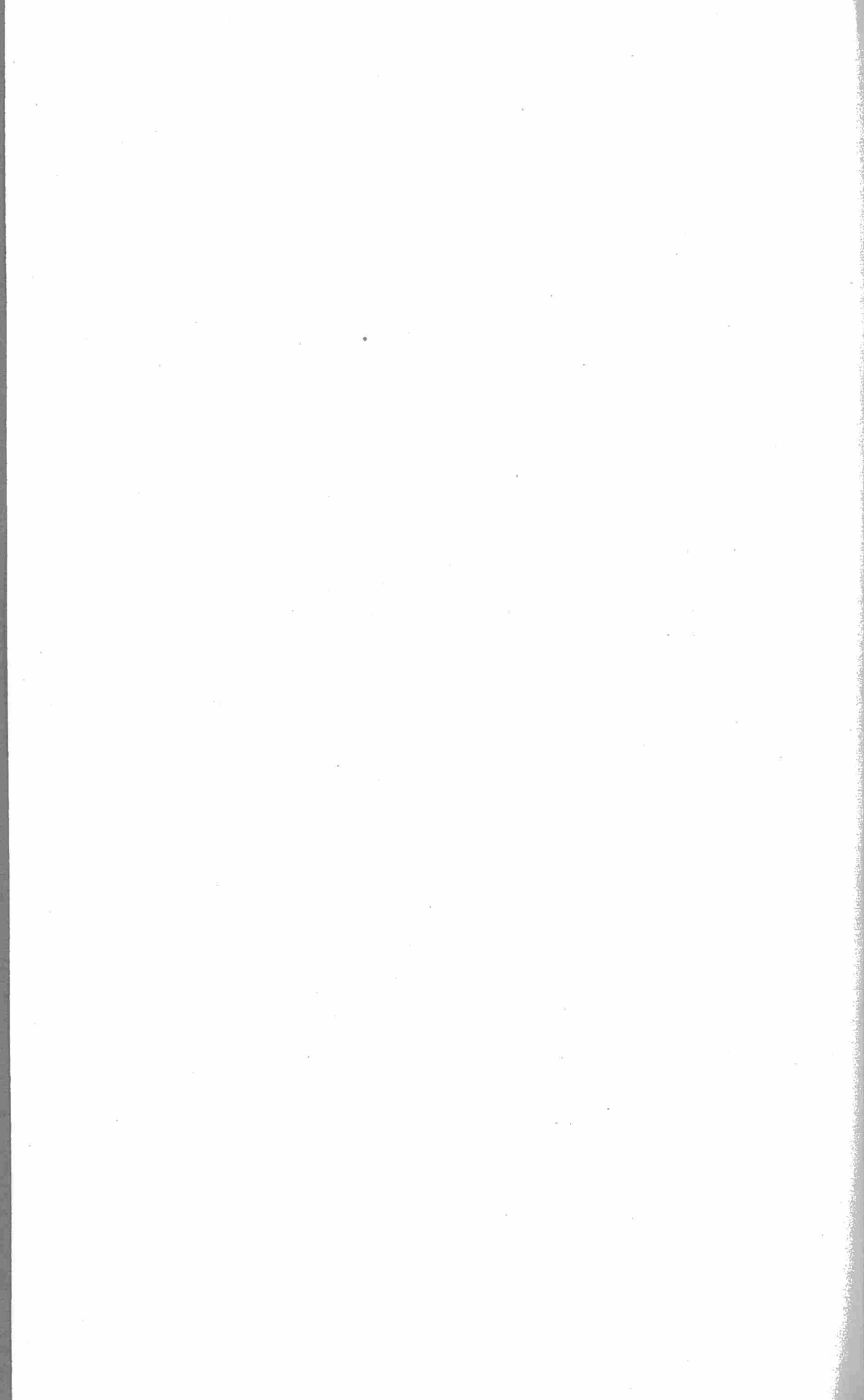
BY

T. E. CROWLEY & T. PAIN









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## INTRODUCTION

The genus *Limicolariopsis* was proposed by D'AILLY in 1910 for a group of mountain-dwelling African land snails allied to the widely distributed *Limicolaria* SCHUMACHER 1817, but distinguished from that genus by the sculptured embryonic shell, including part of the first whorl, often bulbous summit and the large eggs which are few in number. In 1911 PRESTON founded the genus *Rebmaniella*, designating as genotype a typical *Limicolariopsis* (*L. inepta* PRESTON), of which genus *Rebmaniella* becomes a synonym.

*Limicolariopsis* have an extensive but discontinuous distribution in East Central Africa from Abyssinia southwards to northern Tanganyika Territory and westwards to the Ruwenzori Range, along the Uganda-Congo border.

No monograph of the genus as such, exists, the species — often described by their original authors as *Limicolaria* — being published in various periodicals over the best part of a century. Sixteen species are recognised by the present authors, of which four are described herein as new.

PILSBRY and BEQUAERT (1927, *Bull. Amer. Mus. Nat. Hist.*, 53, 506) point out that in the present state of our knowledge, the land snails of the mountains of Central Africa appear to belong to widely distributed genera, but their species are peculiar to each mountain group or range. A beautiful example in point is afforded by *Limicolariopsis*. This is evidently a type of achatinine land snail derived from lowland *Limicolaria* under the influence of the temperate moist conditions of the montane districts. Its origin might be traced to a former period of more extensive glaciation which created temperate and moist conditions over much of the territory occupied before by the typical megatherm *Limicolariae*. With the return of drier and more tropical conditions *Limicolariopsis* migrated to the forest belts of the higher mountains, giving rise by isolation to a number of « representative » species in the various highlands of east and central Africa.

Of the species so far described only one, *Limicolariopsis kivuensis* (PRESTON) is known to occur on more than one mountain group, this species having been taken both on Mount Elgon in Uganda and in the Congo (Mts. of Kivu).

The identification of *Limicolariopsis* is made the more complicated by the fact that not all true *Limicolaria* are lowland forms, a number (in particular *Limicolaria saturata* SMITH), extend their vertical range considerably in the mountainous areas, for instance up to 3000 metres on the Kivu volcanos, and have in consequence been mistaken for and described as *Limicolariopsis*. *L. kahuziensis* DARTEVELLE (1938, *Rev. Zool. Bot. Afr.*, 45, 287-291, two figures) was based upon a somewhat obtuse specimen of *Limicolaria saturata* SMITH.

## ACKNOWLEDGEMENTS

Without the generous help and co-operation of colleagues at home and abroad this monograph could never have been attempted and the authors are deeply indebted to the following for the loan of, or access to, material, photographs or information : Musée Royal de l'Afrique Centrale, Tervuren (Tervuren Museum); the Museum of Comparative Zoology, Harvard, Mass. (M.C.Z.); the British Museum (Nat. Hist.) (B.M.N.H.); the Zoological Museum, Humboldt University, Berlin (Berlin Mus.); the Coryndon Museum, Nairobi; the State Museum of Natural History, Stockholm; the American Museum of Natural History, New-York (A.M.N.H.); Überseemuseum Bremen and the Landessammlungen für Naturkunde, Karlsruhe-i-B.

Also to Dr. J. C. BEQUAERT, Professor P. L. G. BENOIT, Dr. B. VERDCOURT, Dr. W. J. CLENCH, Dr. RUTH TURNER, the Rev. H. E. J. BIGGS, Mr. F. R. WOODWARD, Mr. M. GOODCHILD, Mr. S. P. DANCE, Dr. W. K. EMERSON, Dr. B. HUBENDICK, Dr. R. KILIAS, Dr. H. O. WAGNER, Dr. H. KNIPPER, Mr. C. HEMMING, Dr. P. Å. ANDERSSON; to Mr. and Mrs. F. TINTNER for making certain translations, to Miss D. BEATTY for proofreading and to Dr. H. E. QUICK for the most able dissections which he carried out on five species of *Limicolariopsis* and which are included herein.

The photographs were obtained by courtesy of the following :  
*L. sjostedti* from the Stockholm Museum (photographed by Miss BERG);  
*L. ruwenzoriensis* by the American Museum of Natural History, New-York;  
*L. obtusa* from the Berlin Zoological Museum.

For the remainder, one of the authors (T.E.C.) was responsible.





Family **ACHATINIDAE**

Subfamily **Achatininae**

Genus **LIMICOLARIOPSIS** D'AILLY, 1910

(Genotype *Limicolariopsis sjostedti* D'AILLY)

*Limicolariopsis* D'AILLY, 1910, Wiss. Ergebn. Schwed. Zool. Kilimandjaro, 1, (6), p. 24.

*Rebmaniella* PRESTON, 1911, Ann. Mag. Nat. Hist. (8), 7, p. 471.

*Limicolariopsis* PILSBRY, 1919, Bull. Amer. Mus. Nat. Hist., 40, p. 88.

CHARACTERS.

The general shell characters are :

- 1) The bulimoid shape, the shell being higher than its greatest width. The shell is solid, subtranslucent with spire more or less elongate, having a blunt, often bulbous apex, whorls gradually enlarging, aperture comparatively restricted;
- 2) Columella erect or almost so, sometimes twisted, peristome continuous with the outer lip, umbilicus usually covered or almost covered by the columellar fold;
- 3) Outer lip simple, not reflected, joining the body-whorl roughly at right angles. Parietal callus may be present ;
- 4) Sculpture consists invariably of coarse longitudinal striations. Fine spiral striae are present in some species on one or more of the whorls, thus producing a granular surface which may range from coarsely decussate to extremely fine regular granulations. In unworn shells the sculpture is continued to the apex;
- 5) Suture impressed, crenulate, puckered, often white-margined;
- 6) Colour varies from almost pure white in some species through pale yellow, fawn or buff, to dark streaky brown, frequently marked with flammules of various shapes and sizes;
- 7) Periostracum either shiny or entirely lacking in gloss, often absent from nepionic whorls which are paler in colour than the rest of the shell.

MEASUREMENTS.

We have followed the method advocated by BEQUAERT and used in our revision of the genus BURTOA (Annales du Musée Royal du Congo Belge, 79, 13, 1959). All dimensions are measured to the nearest half millimetre. The

length (or height) is that of the longest vertical axis of the shell, from the spire to the basal edge of the outer lip. The greatest width is the largest diameter in front view, measured at right angles to the vertical axis, from the left margin of the body whorl to the extreme outer edge of the outer lip. In the aperture, the length is the longest obtainable distance from the insertion of the outer lip on the parietal wall, to the basal edge of the outer lip. The width is measured at right angles to the length as the greatest distance from the inner edge of the columella to the outer lip or to the outer margin of the rim if the latter is expanded. This seems to be the only practical way of determining the width of the aperture in *Limicolariopsis*, which, as in *Burtoa*, do not show any particular accretion on the outer lip after full adult size is reached. When the lip thickens in old age it is by accretions to the inner layer of the margin and does not change the total width of the aperture.

#### TYPE MATERIAL.

The authors consider themselves most fortunate in having been able to examine the type or paratypes of all the species so far described. Type specimens are preserved in the following institutions :

British Museum (Nat. Hist.)	<i>L. dohertyi</i> (SMITH), holotype <i>L. keniana</i> (SMITH), holotype <i>L. nyiroensis</i> (PRESTON), lectotype
Musée Royal de l'Afrique Centrale, Tervuren	<i>L. inepta</i> (PRESTON), holotype <i>L. percuta</i> (PRESTON), holotype <i>L. perobtusa</i> (PRESTON), holotype <i>L. scabrosa</i> (PRESTON), holotype <i>L. kivuensis</i> (PRESTON), holotype <i>L. phellislacertae</i> (PRESTON), holotype <i>L. radula</i> (PRESTON), holotype <i>L. kahuziensis</i> DARTEVELLE, holotype
American Museum of Natural History, New-York	<i>L. ruwenzoriensis</i> PILSBRY, holotype
Coryndon Museum, Nairobi	<i>L. verdcourti</i> n. sp., holotype <i>L. laevis</i> n. sp., holotype <i>L. elgonensis</i> n. sp., holotype <i>L. cylindricus</i> n. sp., holotype
Berlin Zoological Museum	<i>L. obtusa</i> THIELE, holotype
State Museum of Natural History, Stockholm	<i>L. sjostedti</i> D'AILLY, holotype
Überseemuseum, Bremen	<i>L. wagneri</i> KNIPPER, holotype
Academy of Natural Sciences, Philadelphia	<i>L. donaldsoni</i> (PILSBRY), holotype

## THE ANIMAL.

Dr. A. R. MEAD (1950), in the course of his anatomical examination of many of the Achatinid genera, reported on the dissection by CLENCH and ARCHER of a single specimen of *L. kivuensis* (PRESTON) from near Burunga in the Belgian Congo. He figured the genitalia. He described the bent penial sheath as being similar to that found in preserved specimens of other species; although this may be due to preservation, he points out that *Limicolaria flammea* has a consistently angulate apical penis and sheath. We have not found this occurrence in other dissections of the genus except in minor degree, in the long-preserved specimens of *L. sjostedti*.

After leaving the sheath the penial retractor was found to be very long and narrow, and clearly inserted on the diaphragm. The basal portion of the retractor and the loose matting of muscle fibres of the apical penis were so intimately intermingled that the retractor seemed to be basally very massive and to have a very broad origin on and in the verge. The vagina of *L. kivuensis* was very similar to that of many *Limicolariae*, and like these also, the spermathecal duct had two distinct sacculations.

MEAD also reported that the relationships of the penial components were almost precisely those found in *Limicolaria felina*, *saturata capitellum* and *ussuwiensis*, and in this respect they appear more nearly related to *L. kivuensis* than to *Limicolaria kambeul* or *flammea*.

The internal economy of the Achatinidae varies considerably in its arrangements, nor are these variations always a good indication of generic differences. This is evident, in the case of *Limicolariopsis*, from a series of dissections carried out for us by Dr. H. E. QUICK, and some of his drawings are reproduced herein.

PILSBRY (1939) gives some useful information on the Achatinidae. As his figures show, one of the most general and conspicuous features of the family is the large and elaborate prostate. He points out that in some genera the penial retractor muscle arises from the tentacular retractor, and in others from the diaphragm. The distribution among the various genera of this however, and of other variations such as the shape of the apical whorls, the size of the eggs and kidney, and viviparity, do not make a very consistent or helpful picture.

THIELE (1931) states that in the vast majority of the Stylommatophora the penial retractor muscle arises from the body-wall (diaphragm), i. e. it is what he terms « *selbständig* », and this is reported to be true of *Burtoa* and *Limicolaria*. In *Achatina* the penial retractor is attached to the tentacular retractor muscle.

The dissections of *Limicolariopsis*, carried out for us with patient skill by Dr. QUICK, indicate that *L. inepta* possesses a « *selbständig* » penial retractor, as do *elgonensis* and — confirming MEAD's findings — *kivuensis*, but that in *verdcourtii* it arises from the tentacular muscle after the fashion of *Achatina*. In the case of *sjostedti* the muscular attachments could unfortunately not be determined owing to the inevitable hardening resulting from half a century of storage in alcohol.

The central tooth of the radula in *Limicolariopsis* is of degenerate character and the cusp, in certain species such as *inepta*, appears to bear a small spine similar to that shown in PILSBRY'S (1939) Figure 83. The radulae of all species so far examined lack endocones on the laterals, and all seem very similar in character.

In *L. sjostedti* the spermatheca appears very globular, and although it is rather longer and more extended in the other species examined, it nowhere gains the length typical of *Limicolaria*. The eggs found in *sjostedti* were calcareous and very much larger in proportion than those of *Limicolaria*, measuring an average of 9 mm. across the major diameter.

The pericardium in the case of *L. inepta* is about one third as long as the kidney : this indicates a relatively rather large kidney, and in *sjostedti* the size is if anything, further increased.

Two specimens of *elgonensis* n. sp. were examined by QUICK. The retractor penis, arising from the diaphragm as already described, is inserted into an apical papilla of the penis; the vas deferens is inserted subapically into the penis. The albumin gland is short and a subapical constriction of the seminal vesical was observed in both examples. The radulae measured approx. 10 mm. by 5 mm. and possess sixty teeth each side of the median; no spine could be observed on the latter. The laterals can be seen to merge gradually into the marginals.

Examination of *kivuensis* confirmed MEAD'S findings, except that the penial retractor was seen to be unusually short. This is probably however, influenced by the conditions of death and preservation, which may account also for the degree of bending of the penial sheath. The spermatheca was globular in form and the general arrangement typical of other species of the genus.

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Material examined consisted of the following :

Paratypes of *L. sjostedti* d'AILLY, kindly provided by the State Museum of Natural History, Stockholm. A paratype of the proposed species *verdcourti* from the Coryndon Museum, Nairobi. Examples of *L. inepta* (PRESTON) from the Nyambeni Hills and from Marimba, 7500 ft. (Coryndon). Examples of *elgonensis* n. sp. from Kitale, 2900 m., Mt. Elgon (Tervuren), and of *L. kivuensis* (PRESTON) from Katana, Kivu (J. BOUILLON : Tervuren).

The Coryndon material was sent to us through the kind offices of Dr. B. VERDCOURT and that from Tervuren through those of Prof. P. L. G. BENOIT.

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REFERENCES.

- CLENCH and ARCHER, 1930. Occ. Pap. Boston Soc. Nat. Hist., 5, pp. 295-300, 3 figs., one plate.  
MEAD, A. R., 1950. Comparison of the Genital Anatomy of some African Achatinidae. Bull. M.C.Z., 105 (2), p. 257, figs 38-9.  
PILSBRY, H. A., 1939. Land Moll. of Amer., 2 (1), pp. 169 ff.



## KEY TO THE SPECIES.

The following key may be found to require a general knowledge of the genus involved, and it is not claimed that it will easily identify every specimen, although it should prove workable for the big majority, especially if the locality is known.

### KEY TO THE SPECIES OF *LIMICOLARIOPSIS*

1. Shell markedly cylindrical ..... *cylindricus*  
- Shell conical with blunt apex ..... 2.
2. Sculpture coarsely or obviously decussate ..... 3.  
- Shell striate, fine reticulations may be observable ..... 11
3. Shell regularly ascending ..... 4.  
- Shell obtusely convex ..... 7.
4. Maximum width of shell approx. half the height ..... *keniana*  
- Maximum width of shell less than half the height ..... 5.
5. Shell surface quite without gloss ..... *kivuensis*  
- Shell with a little gloss ..... 6.
6. Summit very bulbous, 3rd. whorl barely increasing ..... *inepta*  
- Summit small, obtuse, whorls regularly increasing ..... *sjostedti*
7. Shells under 40 mm. long ..... *wagneri*  
- Shells over 40 mm. long ..... 8.
8. Shell noticeably glossy ..... 9.  
- Shell with little or no gloss ..... 10.
9. Shell more obese in shape ..... *dohertyi*  
- Shell more acuminate in shape ..... *ruwenzoriensis*
10. Summit extremely obtuse ..... *perobtusa*  
- Summit merely rounded ..... *elgonensis*
11. Shell elongate, slender ..... 12.  
- Shell stumpy, wide in proportion to length ..... 14.
12. Summit large, blunt and obtuse ..... *verdcourti*  
- Summit small, obtuse ..... 13.
13. Shell finely, obscurely reticulate, mid. whorls only ..... *nyiroensis*  
- Shell coarsely striate ..... *laevis*
14. Shell strongly striate ..... *obtusa*  
- Shell very finely reticulate ..... 15.
15. Shell predominantly white or ivory in colour ..... *donaldsoni*  
- Shell yellow-brown, marked with flammules ..... *percuta*

DISTRIBUTION (see Map)

*Limicolariopsis* was first recorded from the highlands of Kenya, (Mt. Kenya and the Aberdares). It has since been found to occur on high ground in Uganda and Northern Tanganyika Territory, extending Westwards to the Ruwenzori Range and the Mountains of Kivu on the Congo-Uganda border and Northwards into Somalia and Abyssinia. Further extensions to its known range can be expected in suitable mountain areas, when collecting is done there, especially in the little-known highland regions of Somalia and Abyssinia.

The vertical range of the genus extends from about 1000 metres on Mount Marsabit in Northern Kenya to 3500 metres on Mount Meru.

The geographical range of the sixteen species recognised herein is as follows :

SOMALIA	ABYSSINIA
<i>L. donaldsoni</i> (PILSBRY) (Hargeisa)	<i>L. obtusa</i> THIELE (Anderatscha)
KENYA COLONY	
(Mount Kenya & the Aberdares)	(Northern Province)
<i>L. dohertyi</i> (SMITH)	<i>L. cylindricus</i> n. sp. (Malka Murri)
<i>L. keniana</i> (SMITH)	<i>L. nyiroensis</i> (PRESTON) (Nyiro & Marsabit)
<i>L. percurta</i> (PRESTON)	
<i>L. perobtusa</i> (PRESTON)	N. W. KENYA & UGANDA
<i>L. verdcourti</i> n. sp.	<i>L. elgonensis</i> n. sp.
<i>L. laevis</i> n. sp.	<i>L. kivuensis</i> (PRESTON)
S. W. UGANDA & the CONGO	CONGO REPUBLIC
(Mount Ruwenzori)	(Mountains of Kivu)
<i>L. ruwenzoriensis</i> PILSBRY	<i>L. kivuensis</i> (PRESTON)
(Kigezi, Uganda)	
<i>L. kivuensis</i> (PRESTON)	
TANGANYIKA TERRITORY	
(Mts Meru & Kilimanjaro)	(Serengeti Plateau)
<i>L. sjostedti</i> D'AILLY	<i>L. wagneri</i> KNIPPER

*Limicolariopsis donaldsoni* (PILSBRY). Plate I, figs. 1, 2.

*Limicolaria donaldsoni* PILSBRY, 1897. Proc. Acad. Nat. Sci. Phil., 358.

*Limicolaria donaldsoni* KOBELT, 1909. Abh. Senck. Naturf. Ges. 32, pl. 5, figs. 7, 7a.

*Limicolaria donaldsoni* VERDCOURT, 1960. Rev. Zool. Bot. Afr. 61, 239.

Original description. — « Shell narrowly perforate, oblong-ovate, rather thin. Spire terminating in a *very obtuse rounded apex*. Whorls slightly over six, *quite convex*, separated by deep sutures. Surface shining, finely striated longi-

tudinally, the striae cut into oblong granules by decussating spiral impressed lines which become sub-obsolete on the last whorl except below the suture where they persist, although weaker. Aperture ovate, a little less than half the length of the shell, bluish-white within; outer lip thin and sharp; columella straight in the middle and above, slightly concave below, the columellar lip reflexed over the umbilicus. Color white under a very thin yellow cuticle, with faint narrow, sinuous and interrupted brown streaks. Alt. 39, diam.  $20\frac{1}{3}$  mm.; alt. of aperture 17, width of cavity in the middle 10 mm. »

The Haud (Dr. A. DONALDSON SMITH, July 25, 1894).

SPECIMENS EXAMINED :

Somali Republic, Hargeisa ( $9^{\circ}33' N$ ,  $44^{\circ}5' E$ ) (C. F. HEMMING - Coryndon and Tervuren Museums); Borama at 4000 ft. (C. F. HEMMING - Coryndon and Tervuren Museums).

Measurements (in millimetres)

	Length	Greatest width	Aperture length	Aperture width	Whorls	
(1)	41	19	17	9	$7\frac{1}{4}$	Hargeisa
(2)	37	$17\frac{1}{2}$	17	8	7	»
(3)	38	18	16	$8\frac{1}{2}$	$7\frac{1}{4}$	»
(4)	$33\frac{1}{2}$	$17\frac{1}{2}$	$15\frac{1}{2}$	8	$6\frac{1}{2}$	»
(5)	30	16	$14\frac{1}{2}$	8	$6\frac{1}{2}$	Borama
(6)	32	17	15	8	$6\frac{3}{4}$	»

REMARKS.

Although originally described by PILSBRY as a *Limicolaria*, the authors after careful examination of the large series collected by HEMMING, are of the opinion that it is more correctly referred to *Limicolariopsis*. The specimens, although all dead and many bleached, still show the characteristic granular sculpture which extends from the periphery of the last whorl to the apex. The blunt, rather bulbous apex is typical. A few examples show reddish brown flammules on the lower whorls, together with traces of a yellow brown periostracum.

The animal is apparently unknown. HEMMING (in litt. 1954) states that the Hargeisa specimens were obtained on low stony hills in thin scrub.

**Limicolariopsis obtusa** THIELE. Plate I, fig. 3.

*Limicolariopsis obtusa* J. THIELE, 1933 (Dec.). Sitz. Ber. Ges. Naturf. Fr. Berlin, p. 297, pls. I, II.

Original description (translated from the german) : « These shells are characterised by a noticeably blunt apex. They possess seven tumid whorls; the blunt and rounded apex is smooth and glossy: subsequent whorls bear pleated lines of growth imposed on the surface, with a number of fine spiral lines

located below the suture, which is impressed and crenulate. The shell surface, covered by a yellow-brown periostracum, is either plain white or marked with characteristic brown flammules. Shell shape elongated and markedly convex. Columella twisted and reflected over the open umbilicus. Height of shell approx. 67 mm., and approx. diameter 31 mm. Specimens are occasionally found which are perceptibly slimmer than usual. Tumidity of the whorls is not pronounced. ». Abyssinia; Anderatscha (type), Monti Gours.

SPECIMENS EXAMINED :

Abyssinia; Anderatscha (O. NEUMANN : Berlin Museum : Paratype).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	67	31	?	?	7	Holotype
(2)	57	31	27	17.5	7	Paratype

REMARKS :

From the scanty material we have examined, this would appear to be a distinct and well-marked species, the only one so far recorded from Abyssinia. THIELE noted the very blunt apex which is also found in *L. doherlyi* SMITH. The rather strong growth lines, elongated and markedly convex shell are characteristic of *L. obtusa*. The paratype examined by us is yellowish-brown in colour, lacking the flammules. Lack of collectors is probably the reason for the fact that no other *Limicolariopsis* are so far known from the highlands of Abyssinia, a region presumably well suited to the development of this genus.

***Limicolariopsis cylindricus*** n. sp. Plate I, figs. 6, 7.

« Shell noticeably cylindrical, thin and translucent but strong, the last two whorls having almost the same diameter. Apex obtuse, microscopically sculptured with extremely fine longitudinal lines, which are present even on the summit. Whorls  $7\frac{1}{4}$ , rapidly increasing in width but not in diameter, sculptured with shallow longitudinal grooves crossed by transverse grooves of similar depth which become obsolete on the last whorl, the sculpture in general becoming finer on the upper whorls. Shell straw coloured, the upper whorls undecorated, the lower painted with bright brown flammules and blotches, becoming blurred towards the aperture. Suture puckered, very shallow but not impressed. Umbilicus rimate, filled but not covered by the reflection of the columella. Columella slightly curved, receding, not reaching base of shell, milky-white in colour, joined to the peristome by a very thin and faint transparent callus. Peristome simple, ivory white. Aperture noticeably receding from the vertical axis, long and comparatively narrow, ivory white within. » (Type in the Coryndon Museum.)

SPECIMENS EXAMINED :

Kenya Colony : Northern Province, North Frontier District, Malka Murri (J. G. WILLIAMS, Coryndon Museum).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	43.5	16	16.5	9	7¼	Holotype
(2)	38	14	14	8	6¼	Paratype

REMARKS :

This species may at once be distinguished by its noticeably cylindrical form and receding aperture. Its locality is far removed from that of any of the known species of *Limicolariopsis* s. s. and this species is probably confined to the semi-desert region of North Kenya. The animal is unknown. When more material becomes available, consideration might be given to the possible erection of a subgenus of *Limicolariopsis* to contain this unique species.

*Limicolariopsis nyiroensis* (PRESTON). Plate I, figs. 4, 5.

*Limicolaria nyiroensis* PRESTON 1912. Proc. Malac. Soc. Lond. 10 (II), p. 109, fig. in text (with var. *flavida* on p. 110).

*Limicolaria (Limicolariopsis) nyiroensis* GERMAIN 1920. Moll. Terr. et Fluv. in Voy. de M. GUY BABAULT dans l'Afr. Oriental Angl., pp. 103-105, pl. I, figs. 11-12.

Original description. — « Shell cylindrically fusiform with obtuse apex, dark yellowish flesh-colour, stained and painted on the latter whorls with broad flame-like transverse bands of blackish purple; whorls 6½, slightly convex, rather rapidly increasing, somewhat coarsely decussately sculptured except on the lower half of the last whorl, where but for coarse transverse closely-set growth lines, the surface is smooth; suture impressed, narrowly margined with cream colour below; umbilicus narrow, deep, half concealed by the outward expansion and reflection of the columella; columella livid, descending in a very slight curve, labrum simple, acute; aperture rather squarely inversely auriform; interior of the shell blue, edged with a band of dark purple about three millimetres broad behind the labrum. Alt. 49.5, diam. 22.75 mm.; aperture alt. 21, diam. 11 mm. »

Hab. — Kenya, Mt. Nyirò, to the South of Lake Rudolph, at an altitude of 8,300' [A. BLAYNEY PERCIVAL, Brit. Mus. (N. H.) (Two syntypes).]

Original description of var. *flavida*. — « Shell differing from the typical form in being of a uniform pale yellowish brown colour without darker markings of any kind. The columella is rather more curved and the aperture

is proportionately somewhat shorter and more oblique; the interior of the shell is pale lilac without any other colouring. Alt. 47, diam. maj. 21.5 mm. Aperture alt. 19, diam. 11.75 mm. » Hab. — Kenya, Northern slopes of Mount Marsabit, at an altitude of 4,600 ft. (A. BLAYNEY PERCIVAL).

SPECIMENS EXAMINED :

KENYA, Mt. Nyiro, at an altitude of 8,300' [A. BLAYNEY PERCIVAL, British Museum (Nat. Hist.)] Mount Marsabit (B. VERDCOURT, J. G. WILLIAMS, Coryndon Museum.)

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	46	24	20½	13	7½	Lectotype
(2)	50	23				Syntype
(3)	48.5	20	19	11	7½	Mt. Marsabit
(4)	46	22	20	11	7¼	»
(5)	46	19	19	10	6½	»
(6)	40.5	21	19	11.5	6	»

REMARKS :

In this distinctive little species the typical *Achatina* colour scheme of dark irregular flame-like markings upon a light ground is well developed; the granular sculpture is only moderately developed and becomes almost obsolete below the periphery of the last whorl.

PRESTON's var. *flavida*, which lacked the blackish purple flame markings of the typical form, has since been taken along with typical examples on Mount Marsabit. Unicolorous examples of normally banded and patterned species are common amongst both *Achatina* and *Limicolaria*; they are at most mere colour forms and are certainly not in any sense worthy of even subspecific distinction.

The two adjacent mountain groups, Nyiro and Marsabit, lying to the South of Lake Rudolph in Kenya's Northern Province, are far removed from any other locality from which *Limicolaria* have been recorded, and *L. nyiroensis* has in all probability been long isolated from all other species of the genus.

PRESTON did not designate a holotype, and from the two syntypes preserved in the British Museum (N. H.), the smaller has been selected as a lectotype. It is from Mt. Nyiro. A good series of both colour forms and showing all stages of growth was obtained on Mount Marsabit by Dr. B. VERDCOURT and is now in the Coryndon Museum.

**Limicolariopsis percurta** (PRESTON). Plate I, fig. 10.

*Limicolaria (Rebmaniella) percurta* PRESTON, 1912. Proc. Malac. Soc. Lond. 10 (2), p. 110, fig. in text.

*Limicolariopsis percurta* PILSBRY 1919. Bull. Amer. Mus. Nat. Hist. 40, p. 88.

Original description. — « Shell rimate, ovate, light yellowish, painted with blotches, transverse streaks and flame-markings of dark purple; whorls  $6\frac{1}{2}$ , the last somewhat inflated, sculptured with oblique transverse ridges crossed by spiral striae, these presenting a moderately finely decussate appearance, this sculpture becoming obsolete towards the base of the shell, which is marked only with fine wavy, spiral incised striae; suture impressed, irregular, crenulate, narrowly margined below; perforation reduced to a narrow fissure by the reflection of the columella; columella curved, narrowly outwardly bent and reflexed, extending above into a thin, well defined callus which enters the aperture a short distance behind the upper margin of the labrum; labrum acute, simple, aperture inversely auriform; interior of shell pale bluish lilac, the transverse flame-markings being visible through the test.

Alt. 45.5 mm., diam. maj. 24.75 mm. 22.5 mm., aperture alt. 23, diam. 12 m. Hab. — Between the Igembi Hills and Nyiri, British East Africa (ROBIN KEMP).

SPECIMENS EXAMINED :

Kenya, between the Igembi Hills and Nyiri (R. KEMP, Tervuren Mus., holotype).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	45	25.5	22	12.5	$6\frac{1}{2}$	Holotype

REMARKS :

Although PRESTON's type specimen is the only example so far discovered, we have been obliged to maintain this species since it is unquestionably a *Limicolariopsis* and quite distinct from any other known to us from Kenya.

**Limicolariopsis dohertyi** (SMITH). Plate I, Figs. 8, 9.

*Limicolaria dohertyi* SMITH, 1901. J. of Malacology 8 (4), p. 95, fig. 4.

*Limicolaria dohertyi* PILSBRY, 1904. Man. of Conch. 16, p. 281, pl. 22, fig. 41.

*Limicolariopsis dohertyi* PILSBRY, 1919, Bull. Amer. Mus. Nat. Hist. 40, p. 88.

*Limicolaria (Limicolariopsis) dohertyi* GERMAIN, 1920. Moll. Terr. et Fluv., in Voy. de M. GUY BABAULT dans l'Afr. Orientale Angl. 1912-13, pp. 103-105, pl. I, fig. 3-4.

Original description. — « Testa ovato-pyramidalis, ad apicem obtusa, solida, imperforata, vel subrimata, saturate castanea, strigis albis irregularibus

picta, lineis incrementi obliquis striisque spiralibus undique decussata; anfractis 7 convexi, sensim accrescentes, sutura pallida lineari sejuncti; apertura inverse auriformis, intus caerulescens; longit. totius  $\frac{2}{3}$  adaequans; labrum tenue, arcuatum; columella incrassata, reflexa, sordide alba. Longit. 59 mm., diam. 28, apertura 23 long. 13 lata. »

SPECIMENS EXAMINED :

Kenya : near the terminus of the Uganda Railway North of Limuru at 6500'-9000' (W. DOHERTY - British Mus. (N. H.) (Holotype). Tervuren Museum (Paratypes). Limuru, N. W. of Nairobi at 7000' (PRESTON - Tervuren Museum, M.C.Z., PAIN Coll.). Muguga, 18 miles N. W. of Nairobi at 6800' (VERDCOURT, P. J. GREENWAY - Coryndon Museum). W. Aberdares (ALLEN TURNER - Coryndon).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	59	28	23	13	7	Holotype
(2)	59	28	25	14	7	Muguga
(3)	57	25	24.5	15	7	Limuru
(4)	51	28	23	14	6½	»
(5)	44	22	21	13	5½	W. Aberdares

REMARKS :

This distinctive species was the first *Limicolariopsis* to be described. As pointed out by SMITH, it is remarkable for its solidity and pupoid form. The ground colour is deep chestnut marked with irregular wavy or zig-zag stripes. The apex is obtuse, smoother than the rest. The suture is white, deep, impressed and crenulate. The first two-and-a-half to three whorls are white or bluish, devoid of periostracum. Very narrowly umbilicate (rimate). Columella straight, slightly twisted. Interior bluish-white. Peristome simple, brown-edged.

Shells of this species are more solid than those of any other so far described and the granular surface sculpture is often almost obsolete, especially below the periphery in adult examples. The animal is unknown.

***Limicolariopsis keniana*** (SMITH). Plate II, Figs. 1, 2, 3, 5.

*Limicolaria keniana* SMITH, 1903. Quart. Journ. of Conch. 10, p. 318, pl. 4, fig. 7.

*Limicolaria keniana* PILSBRY, 1904. Man. of Conch. 16, p. 281, pl. 21, fig. 33.

*Limicolaria scabrosa* PRESTON, 1913. Proc. Malac. Soc. Lond. 10 (4), p. 281 (fig. in text).

*Limicolaria pellisacertae* PRESTON 1913. Ibid. p. 282 (fig. in text).

*Limicolariopsis keniana* PILSBRY, 1919. Bull. Amer. Mus. Nat. Hist. 40, p. 88.



*Limicolaria (Limicolariopsis) kenianensis* GERMAIN, 1919. Bull. du Mus. d'Hist. Nat. 25 (n° 4), p. 207.

*Limicolaria (Limicolariopsis) keniaensis* GERMAIN, 1920-1923. Moll. Terr. et Fluv. 1-2, in Voy. de M. GUY BABAULT dans l'Afrique Orientale Anglaise 1912-13. Paris, p. 104.

Original description of *L. keniana* (SMITH 1903) : « Shell elongate, ovate, imperforate, blue-whitish, irregularly painted with narrow reddish-brown obliquely arcuate or wavy streaks, covered with a yellowish-olivaceous periostracum. Spire elongate, obtuse above, whorls six, a little convex, striated with growth lines and transversely sculptured with spiral striae, more or less granulated, the last and penultimate whorls margined below the suture with an impressed line, the last whorl slowly descending in front. Aperture inversely ear shaped, about two-thirds the total length of the shell, blue-whitish inside, peristome thin, nearly perpendicular, obsoletely uniplicate above, brown outwardly. Length 50, diam. 25, aperture 21 × 13 mm. » Mount Kenya (S. L. HINDE - British Mus. of Nat. Hist.).

Original description of *L. scabrosa* (PRESTON 1913). « Shell fusiform, with dark flesh coloured apical whorls gradually changing to brownish yellow and painted with transverse blotches streaks and flame markings of a dark blackish-purple; whorls 6½ regularly increasing, the last rather large, coarsely decussate throughout, thus presenting a somewhat scabrous appearance; suture impressed, crenulated by the decussate sculpture and narrowly margined below; columella whitish, descending in a gentle curve; labrum thin, acute; aperture somewhat dilated below, inversely auriform; interior of the shell flesh-coloured, the transverse streaks and flame markings being visible through the test. Alt. 60, diam. maj. 28.5, min. 25, aperture alt. 30, diam. 16.5 mm. » Kenya, between the Nyambene Hills and Nyeri (ROBIN KEMP - Tervuren Museum).

Original description of *L. pellislacertae* (PRESTON 1913) : « Shell allied to *L. scabrosa*, but much larger and paler in colour, being, with the exception of the apical whorls, of a golden yellow colour throughout, occasionally transversely streaked with purple on the median whorls; the last whorl is proportionally much longer than in *L. scabrosa*, the columella is also much more curved and the parietal wall does not bulge over the interior of the shell; moreover the aperture is much more oblique and dilated below than in that species; the interior of the shell is of a beautiful pinkish flesh colour. Alt. 75.25 mm., diam. maj. 34, min. 27, aperture alt. 37, diam. 20.75 mm. » Kenya, Aberdare Range, Mount Kinangop (ROBIN KEMP - Tervuren Museum).

SPECIMENS EXAMINED :

Kenya Colony : Mount Kenya (S. L. HINDE - B.M.N.H.). Mount Kenya at 6500 ft. (PITMAN - PAIN Coll.). Kasarongai River (M.C.Z.). Upper Liki River (COPLEY - Coryndon Mus.). Thika (M.C.Z.). Aberdare Range, Mount Kinangop (R. KEMP - Tervuren Mus.). Between the Nyambene Hills and Nyeri (R. KEMP - Tervuren Mus.). Nairobi District, Ngong Hills (POLHILL - Coryndon Mus.).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	50	25	21	13	6	Holotype
(2)	75.5	32.5	37	21	7½	Type of <i>pellisacertae</i>
(3)	61	28	30	16.5	6½	Type of <i>scabrosa</i>
(4)	84	35.5	35.5	19	7½	» »
(5)	74	36	35	19	7¼	Mount Kenya
(6)	70.5	32	32.5	16.5	7¼	Thika
(7)	68.5	34	31	19	7	Mount Kenya
(8)	63.5	29.5	28	16	7	Upper Liki River

REMARKS :

*L. keniana* is the largest species, sometimes attaining a length of 85 mm. It shows considerable variation in respect of both shape and colour. Besides the typical elongated almost imperforate shells, very obese examples also occur; in these the body whorl is considerably swollen and the umbilicus deep and of moderate width. The reddish-brown streaks become very pale and almost obsolete on some examples seen. The rather coarse granular sculpture extends over almost the entire shell from the beginning of the third whorl to the edge of the outer lip; this may however become almost worn off in some very old shells.

The apex in fresh specimens, examined under a lens, will be seen to be finely striated with vertical wavy growth lines.

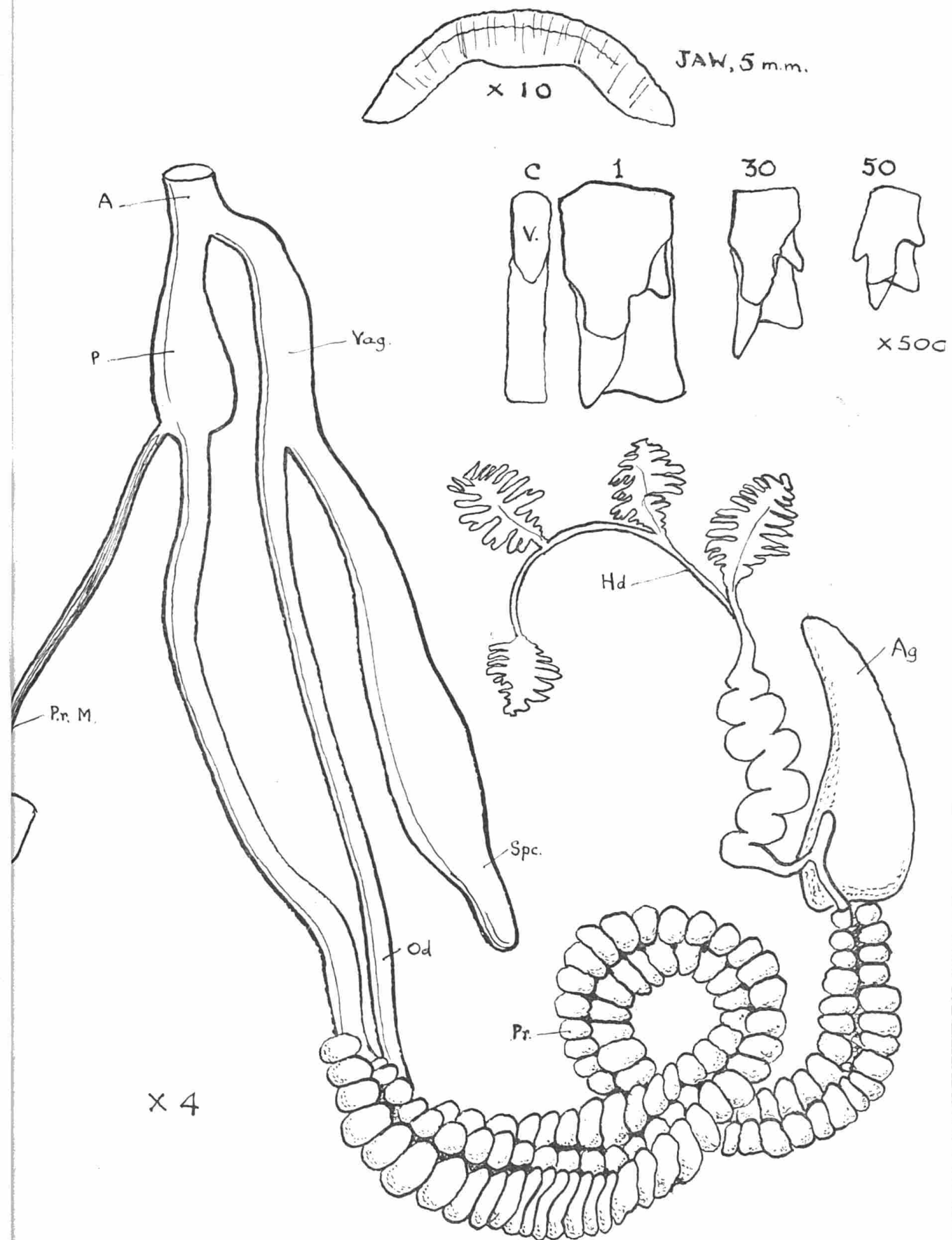
PRESTON'S species *scabrosa* and *pellisacertae* are known only by their unique types, now in the Tervuren Museum. Both are in our opinion somewhat extreme forms of SMITH'S *keniana*, the strong sculpture of which is noticeably present on both PRESTON'S shells. In *pellisacertae* the columella is curved outwardly and the aperture is unusually large; it does not however differ from typical *keniana* in any other respects, and in some of the more globose examples of the latter the same outwardly projecting curve of the columella can be seen.

The difference between the elongated and the globose forms of this species, which may be found living together, is striking. Two similarly distinct shell forms are found amongst the *L. elgonensis* sp. nov., living on Mount Elgon, and to a lesser extent amongst other species also. The same variation is indeed, noticeable in many other genera of the Achatinidae, but its significance, if any, is unknown.

**Limicolariopsis inepta** (PRESTON). Plate II, Figs. 4, 6.

*Limicolaria (Rebmaniella) inepta* PRESTON, 1911. Ann. Mag. Nat. Hist. (8) 8, p. 471, pl. 12, fig. 24.

*Limicolaria radula* PRESTON, 1913. Proc. Malac. Soc. Lond. 10 (4), p. 282 (fig. in text p. 283).



*Limicolaropsis inepta* PRESTON.

*Limicolaria (Limicolariopsis) sjostedti* var.  $\beta$  *inepta* GERMAIN, 1919. Bull. Mus. Hist. Nat. Paris 25, p. 208.

Original description of *L. inepta* (PRESTON 1911) : « Shell fusiform, rather solid, the earlier whorls painted with transverse slate-coloured flame markings, the latter whorls brownish yellow, stained, streaked and blotched with greyish brown; whorls  $6\frac{1}{4}$ , decussately sculptured throughout with spiral striae and transverse riblets; suture impressed, slightly crenulate, margined below; columella descending nearly vertically, diffused above into a thin polished callus which reaches the margin of the labrum, almost truncate below; labrum simple, acute, somewhat receding above and below; aperture rather narrowly inversely auriform; interior of shell pale bluish-white, polished nacreous. Alt. 58, diam. min. 24 mm. Aperture alt. 21, diam. 14 mm. ». Hab. Mount Kenia at an alt. of 6000-8000 ft. (Tervuren Museum).

Original description of *L. radula* (PRESTON, 1913) : « Shell rimate, somewhat cylindrically fusiform with obtuse apex and a rather diaphanous appearance, the earlier whorls pale reddish-yellow, painted with transverse bands and flame-markings of reddish purple; whorls  $6\frac{1}{2}$ , the first three rapidly increasing, the remainder regularly so, the last long, coarsely decussately sculptured, thus giving a granular appearance to the shell with the exception of the immediate umbilical region, which is devoid of granulation and only radiately puckered; suture impressed crenulate and narrowly margined below by a raised yellowish ridge; umbilicus narrow, deep, half-concealed by the narrow outward reflection of the columella; columella lilac coloured, finely granular, narrowly outwardly reflexed, obliquely descending above, somewhat curved below; labrum simple; aperture elongately ovate; interior of the shell lilac-coloured shading to a bluish tinge in places. Alt. 44.5, diam. maj. 18.5 mm. aperture alt. 20.75, diam. 9.5 mm. » Hab. Northern region of British East Africa (A. BLAYNEY PERCIVAL - Tervuren Museum).

SPECIMENS EXAMINED :

Kenya Colony; Mount Kenya at 6000-800 ft. (type, Tervuren Mus.). Mount Kenya at 900 ft. (A. BLAYNEY PERCIVAL - Coryndon Museum). Sagana River at 7000 ft. (COPLEY - Coryndon Museum). West Aberdares (ALLEN TURNER - Coryndon Museum). Mount Kenya at 8500 ft. (M.C.Z., PAIN COLL.). Matthews Range, Urageess (A. BLAYNEY PERCIVAL - Tervuren Museum - type of *radula* PRESTON). Muguga, 18 miles N. of Nairobi (VERDCOURT - Coryndon Museum). Gura River at 8000ft. (COPLEY - Coryndon Museum). Thiba River (M.C.Z.). Meru (VERDCOURT - Coryndon Museum). Nyambeni (or Jombeni) Hills, Kirima Peak at about 7000 ft. (VERDCOURT 1960 - Coryndon Museum).

REMARKS :

*L. inepta*, originally described from Mount Kenya, also occurs on the adjoining range of the Western Aberdares, as does SMITH'S *L. keniana*. As both of these species are very polymorphic, the possibility undoubtedly exists that

this region does in fact support only a single extremely variable species. As however, on the material available to us, *L. inepta* and *L. keniana* appear always to be reasonably distinct, we propose for the present to maintain them as separate species.

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	58	27.5	26	15	6¾	Holotype
(2)	67	32	29	16	7¼	West Aberdares
(3)	60	29	27	17	7	Mt. Kenya 9000 ft.
(4)	59	25.5	25	15	7	Sagana River
(5)	59	26	22.5	15	6¾	West Aberdares
(6)	55	24	23.5	14	6¾	» »

Adult examples of *L. inepta* show little variation in size, the average length of an adult shell being about 58 mm. In typical specimens there are six and three quarters rapidly increasing whorls, separated by crenulate, margined and impressed sutures. The blunt apex is finely striated, the characteristic granular sculpture commencing on the second whorl and extending to the outer lip; it becomes almost obsolete in the region of the umbilicus. The periostracum is straw-coloured or golden brown, marked with irregular streaks and lines of green or brown, the interior of the aperture may be white or blue, the edge of the lip brown-margined. The aperture is comparatively long and narrow, the umbilicus almost concealed by the backward reflection of the columella, which is almost vertical and joined to the outer lip by a thin transparent callus. Specimens with prominent red flammules as well as others completely lacking any colour markings are found living in the same colonies.

PRESTON'S *radula* was founded upon an immature shell, which we are unable to separate from similar examples of *inepta*. The locality, Northern Region of British East Africa, is very vague, but the shell itself is labelled Uraguess, a locality most probably within the range of *inepta*.

***Limicolariopsis perobtusa*** (PRESTON). Plate II, Figs. 7, 8.

*Limicolaria (Rebmaniella) perobtusa* PRESTON, 1912. Proc. Malac. Soc. Lond. 10 (11), p. 111, fig. in text.

*Limicolariopsis perobtusa* PILSBRY, 1919. Bull. Amer. Mus. Nat. Hist. 40, p. 88.

Original description : « Shell rimate, ovately fusiform, with extremely obtuse apex; the earlier whorls pale flesh-coloured, the median whorls yellow, stained here and there with chestnut and painted with blotches and transverse flame markings of livid blackish-purple, the last whorl shading below to reddish-chestnut; whorls 6½, regularly increasing, the last convex below, coarsely granulate throughout; suture impressed, irregularly crenellate, narrowly margined below with white or pale yellow; columella whitish, very faintly tinged with

pale lilac, vertically descending and narrowly reflexed over the perforation; umbilicus reduced to a narrow chink; labrum simple, lilac coloured within; aperture elongately inversely auriform. Alt. 55 mm., diam. maj. 27.5, min. 25.25 mm. Aperture alt. 26, diam. 12 mm. »

Hab. : Mount Kinangop, Aberdare Range, Brit. E. Africa. (ROBIN KEMP - Tervuren Museum).

SPECIMENS EXAMINED :

Kenya, Mt. Kinangop, Aberdare Range (R. KEMP - Tervuren Museum - Holotype). Mt. Kenya, Thiba River (H. COPLEY - Coryndon Museum).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	54.5	27.5	25.5	13	6½	Holotype
(2)	65.5	30	29	14.5	6¾	Thiba River
(3)	56.5	29	26.5	14	6½	»
(4)	54	28	29	14.5	6¼	»
(5)	59	28	26.5	14.5	6½	»
(6)	51	26	25	12.5	6½	»

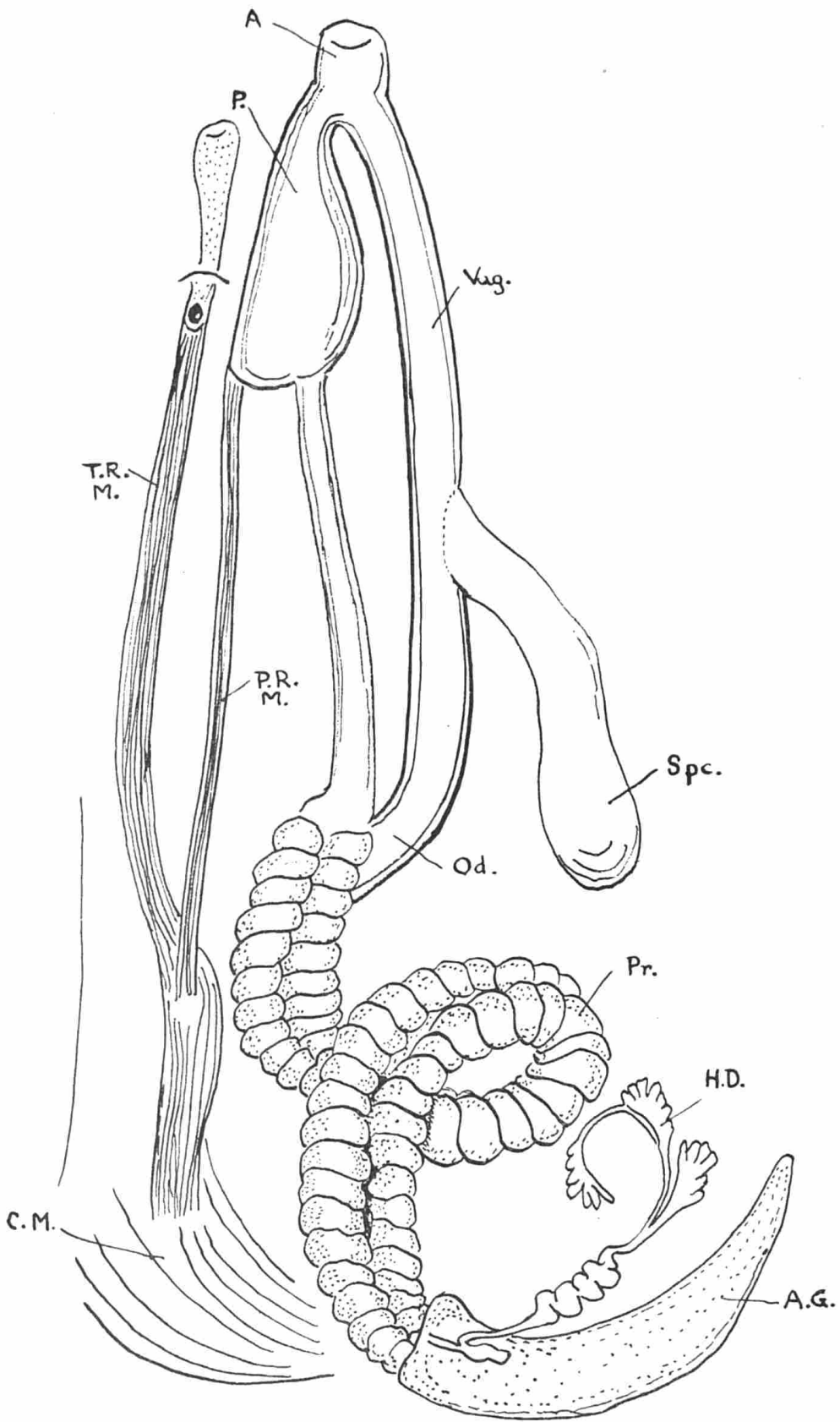
REMARKS :

This somewhat distinctive species was described originally on a single specimen, said to be from the Aberdares (Mt. Kinangop) in Kenya; it has since been obtained in some numbers from Mt. Kenya (Thiba River). Its extremely obtuse apex, together with a rather short spire, long body whorl — half the total length of the shell — and large aperture, readily separate it from other members of the genus.

In the type, the granular sculpture is very strongly developed, it is much less so in the shells from Mt. Kenya, but they are otherwise identical. The reddish-brown flame markings in some specimens are reduced almost to invisibility.

*Limicolariopsis verdcourti* n. sp. Plate II, Fig. 9.

Shell inflated fusiform, conical, transparent, thin but strong; apex very obtuse, lacking periostracum; summit depressed, apical whorl not ascending, finally sculptured with extremely shallow longitudinal lines; on the third whorl faint transverse lines appear. Whorls seven, rapidly increasing, straw coloured without flammules, sculptured with faint irregular, widely spaced longitudinal lines. Suture deep impressed and puckered below. Umbilicus almost completely covered by the backward reflection of the columella. Columella pale brown fading to milky white within, regularly descending, straight and vertical, joined to the outer lip by a thin translucent callus. Peristome simple, brown edged. Aperture ovate, milky-white within (Type in the Coryndon Museum).



X.4

*Limicolariopsis verdcourti* n. sp.

## SPECIMENS EXAMINED :

Kenya Colony; Mount Kenya, Western slopes, in bamboo-*Dombeya* association, Naro Maru River at 9700 ft. (M. COE - Coryndon Museum).

## Measurements (in millimetres)

Length	Greatest width	Aperture length	Aperture width	Whorls	
57	26	23	14.5	7	Holotype

## REMARKS :

This species is easily distinguished by its more conical profile, noticeably obtuse apex and non-cylindrical aspect. The shape of the aperture is more characteristic of *Limicolaria*, from which genus the anatomy of the animal, as well as the general shape and very obtuse apex separate it.

A dissection of this species is discussed under « The Animal », page 11.

***Limicolariopsis laevis*** n. sp. Plate III, figs. 1, 2.

Shell elongated fusiform, fairly solid, apex obtuse, pinkish or horn-coloured, rounded at the summit which is marked with fine vertical growth lines and minute granules; whorls seven, increasing fairly rapidly, moderately convex, painted with numerous irregular vertical brown flame-markings, streaks and blotches on a buff or yellow ground; the suture shallow in the early whorls, becoming impressed and crenulate; the lower whorls finely sculptured with small unequal folds cut into granules by weakly impressed spiral lines; umbilicus reduced to a narrow chink and almost concealed by the outward reflection of the columella; columella pale brown, descending in a very slight curve, joined to the outer lip by a thin, opaque callus; peristome simple, not thickened or reflected, brown-edged, aperture elongate ovate and comparatively narrow, bluish white within (Holotype: Coryndon Museum N° 955).

## SPECIMENS EXAMINED :

Kenya Colony : Mount Kenya, Thiba River (H. COPLEY - Coryndon Mus.) (M. CONNOLLY - M.C.Z. and PAIN Coll.).

## Measurements (in millimetres)

	Length	Greatest width	Aperture length	Aperture width	Whorls	
(1)	54.5	20	18.5	12	7	Holotype
(2)	54.5	21.5	20.5	13	7¼	Paratype
(3)	51	21	19.5	12	7	»
(4)	51	19	18.5	11	7	»
(5)	50	21	20	13	6½	»
(6)	45	19	17	11.5	6½	»



REMARKS :

All the examples of *L. laevis* examined had been referred to PRESTON's *L. radula*, a synonym of *L. inepta* PRESTON, also from Mount Kenya, but quite distinct from the shell herein described, which is known only from the type locality. The comparatively narrow fusiform shell, fine sculpture and bright colouring make *L. laevis* easily distinguishable from all other species so far described. Although all the specimens seen were in fresh condition, the animal is as yet unknown.

*Limicolariopsis elgonensis* n. sp. Pl. III, fig. 3.

Shell moderately inflated, ovate-fusiform, thin but strong. Apex very obtuse, apical whorls minutely granular, summit depressed, flesh coloured. Whorls  $6\frac{1}{2}$  regularly increasing, straw coloured and streaked with numerous irregular blotches of reddish-brown. Sculpture is of strong raised granules commencing on the second whorl and becoming obsolete below the periphery of the last. Suture deep, impressed crenulate. Umbilicus narrow, almost covered by the reflection of the columella. Columella white, slightly twisted below and outwardly curving toward the base, joined to the peristome by a thin transparent callus; peristome simple, thin, not reflected. Aperture elongate-ovate, bluish-white within. The anatomy is described under the heading « The Animal » (Holotype - Mt. Elgon - Mrs. IRWIN - Coryndon Mus.).

SPECIMENS EXAMINED :

Kenya and Uganda; Mt. Elgon, Endebess, on Eastern slope (Mrs. IRWIN - Coryndon), Mt. Elgon at 6700 ft. (PITMAN - PAIN Coll.), Elgonyi at 7000 ft. (A. LOVERIDGE - M.C.Z.), Mt. Elgon (FOSTER - Berlin; CROWLEY Coll.), Mt. Elgon, E.N.E. at 2300 M. (J. BOUILLON - Tervuren).

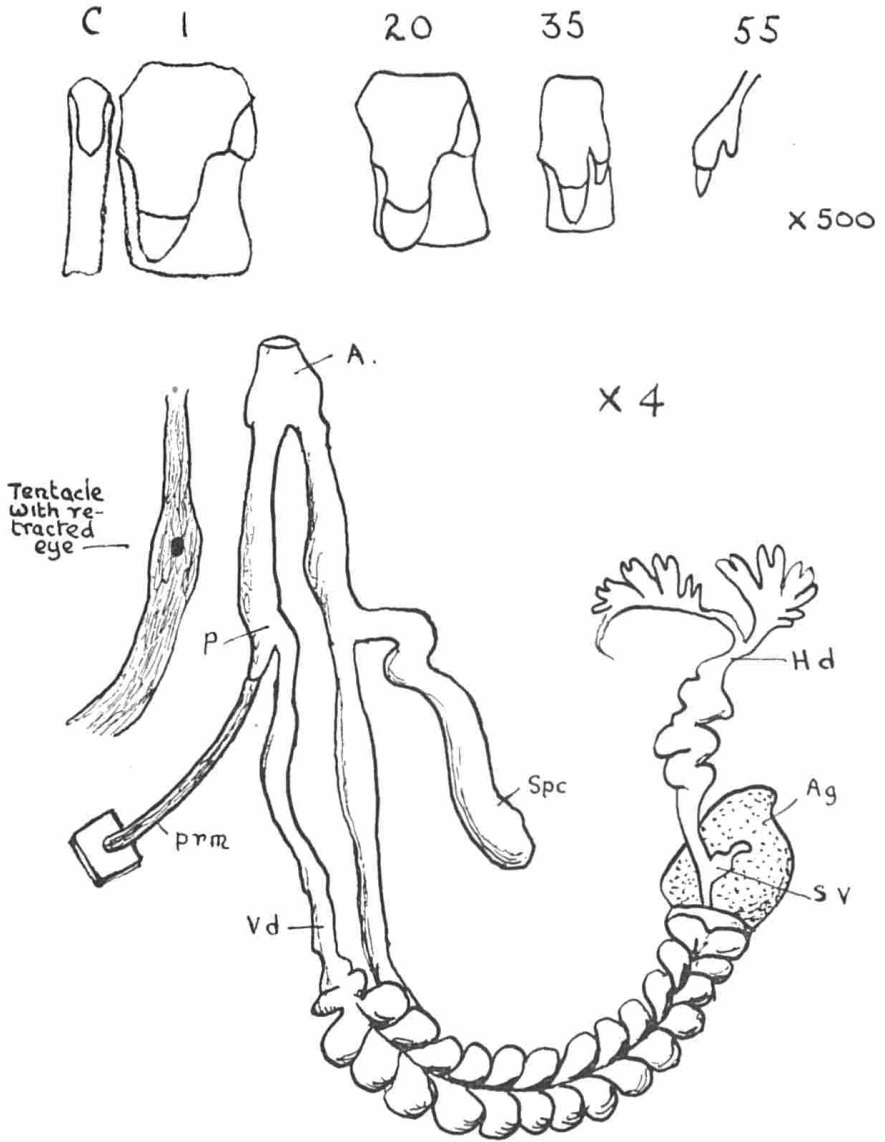
Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	55	29	24	17	$6\frac{1}{2}$	Holotype
(2)	54	33	27	18.5	$6\frac{1}{2}$	Paratype
(3)	46	28	22	14	$6\frac{1}{4}$	»
(4)	65	32	29	18.5	7	Topotype
(5)	62	33	27	17.5	$6\frac{3}{4}$	»
(6)	56	26.5	23	15.5	$6\frac{3}{4}$	»

REMARKS :

*L. elgonensis* is known only from Mt. Elgon, where it would appear to be fairly common. It is extremely variable in both form and colour, and unicolorous examples lacking the reddish-brown blotches are not uncommon. Two distinct forms could be recognised amongst the forty examples examined; a

globose, very obtuse type with moderately deep umbilicus, and a narrow, almost imperforate and considerably elongated variety. The two forms occur in approximately equal numbers; the differences in shell form may be sexual but proof of this is entirely lacking. The elongated form is if anything, the commoner, all shells taken on the E.N.E. slopes of the mountain by BOUILLON belonging to it.



*Limicolariopsis elgonensis* n. sp.

Amongst those obtained by PITMAN on the Kenya slopes at 6700 ft., the ratio is two to one.

Old shells often show a considerable thickening of the peristome within, at its upper insertion, and the sculpture is often greatly reduced due to wear, especially on the spire.

*Limicolariopsis kivuensis* (PRESTON). Plate III, Figs. 5, 6.

*Limicolaria kivuensis* PRESTON, 1913. Proc. Malac. Soc. Lond., 10 (4), p. 277, fig. in text on p. 278.

Original description. — « Shell allied to *L. ponsonbyi* PRESTON from Uganda, but differing from that species in its larger size and in having one whorl less; it also differs in its more obtuse apex, more convex whorls and deeper suture, more obliquely sloping parietal wall, and in the sculpture, which is rather coarsely decussate throughout the whole shell ». Alt. 65 mm. diam. maj. 28.5, min. 25 mm. Aperture alt. 27, diam. 23.5 mm. Hab. Lake Kivu (ROBIN KEMP - Holotype, Tervuren Museum).

SPECIMENS EXAMINED :

Congo Republic; Lake Kivu Highlands (R. KEMP - Tervuren Museum). Tshibinda, N. W. shore of L. Kivu (F. L. HENDRICKX - M.C.Z.). Mount Kinangongo, Ufumbiro, 9000 Feet (J. BEQUAERT - M.C.Z.).

Uganda; Mount Elgon, Buluganyi at 6000 feet (A. LOVERIDGE - M.C.Z.). Mt. Elgon at 7000-9000 feet (HALE-CARPENTER - Coryndon Museum). Kigezi, S. W. Uganda (HALE-CARPENTER - Coryndon Museum; PITMAN - PAIN COLL.). Bugishu, Mt. Elgon (HALE-CARPENTER - B.M.N.H.).

Measurements (in millimetres)

	Length	Greatest width	Aperture length	Aperture width	Whorls	
(1)	66.5	28	28	15	7	Holotype
(2)	60	27.5	26	15	7	Tshibinda
(3)	56	24.5	23.5	14	6¼	Buluganyi
(4)	52	23	23	12.5	6¾	Kigezi
(5)	45	21	22	10	6¼	Buluganyi
(6)	45.5	21	19.5	12	6½	Mt. Kinangongo

REMARKS :

*L. kivuensis* is the only species so far recorded from the Kivu Volcanoes. The holotype is the largest specimen seen, but is otherwise typical of the species as a whole. Considerable variation is seen in the external colour, which can vary from dark golden-brown to pale straw-yellow. All specimens examined are without gloss and show the characteristic coarsely decussate sculpture, which in *L. kivuensis* continues over the whole shell; the suture is deep, impressed, crenulate and white-margined. The columella is erect, vertical and joined to the outer lip by a thin transparent callus; outer lip simple, brown-margined, umbilicus reduced to a narrow chink. The aperture is rather long and narrow, bluish-white within. The somewhat attenuated shell, bright colours and strong sculpture are all constant features of this species and make it unlikely to be confused with any other.

*L. kivuensis* is the only species so far known to inhabit more than one mountain group; obtained originally from the volcanic highlands of the Mount Kivu region in the Congo, it has since been collected in Uganda at several localities on Mount Elgon and at Kigezi in the extreme Southwest of that country. Its occurrence in Uganda may be accounted for as a result of possible migration during a former period of glaciation extensive enough to create moist temperate conditions over wide areas, followed by a return of drier and more tropical conditions which would make impossible any further large-scale movement of these montane, moisture loving snails, and would result in their survival only in the wooded areas of the higher mountains.

***Limicolariopsis ruwenzoriensis* PILSBRY. Plate III, fig. 4.**

*Limicolariopsis ruwenzoriensis* PILSBRY, 1919. Bull. Amer. Soc. Nat. Hist. 40 - Land Moll. of the Belgian Congo, p. 89, pl. 3, figs. 1, 2, 5 and 6 also fig. 36 on p. 89.

Original description. — « The shell is imperforate, rather solid, oblong-conic with convex lateral outlines and obtuse rounded summit. The early whorls are dark vinaceous (but the tone varies individually), last two and a half whorls Naples yellow with irregular stripes of chestnut brown. The early whorls are worn, but the last three have a cleancut *Achatina*-like sculpture of fine, irregular axial wrinkles cut into granules by shallow spiral lines (fig. 36). This sculpture abruptly becomes very much weaker at the periphery of the last whorl. The whorls are moderately convex, the suture at first shallow, becoming deeply impressed and minutely crenulate. The aperture is bluish-white within, with some dark streaks in the throat. The columella is straight, faintly olivaceous above ». Hab. - Belgian Congo, Mt. Ruwenzori (J. C. BEQUAERT - American Museum of Natural History, N. Y. - Holotype).

SPECIMENS EXAMINED :

Congo Republic; Mount Ruwenzori, Western slope, lower mountain forest in the valley of the Lawiri at about 2000 m. (J. C. BEQUAERT - Tervuren Museum, M.C.Z., PAIN Coll. - all paratypes). S. W. Uganda, Toro District, Mount Ruwenzori, Bwamba Pass, 6500 ft. (HALE-CARPENTER - Coryndon Museum).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	53	23	22.5	—	6½	Holotype
(2)	47	22.5	21.5	12.5	6¼	Paratype
(3)	45.5	21	20.5	12.5	6¼	»
(4)	45	21.5	20	13	6¼	»
(5)	49.5	21	20	12.5	6½	Bwamba Pass
(6)	47.5	22.5	21.5	12	6½	»

REMARKS :

We have seen a number of paratypes of this very distinct little species, as well as specimens from the Toro District in S. W. Uganda.

It would appear to be confined to the Ruwenzori Range and shows surprisingly little variation compared with what may be found amongst some of the Kenya species. Examples with or without flammules appear to be equally common. The characteristic sculpture of irregular axial wrinkles cut into granules by shallow spiral lines is well developed on all the examples seen, but it becomes obsolete below the periphery of the last whorl.

PILSBRY (1919, 90) notes its similarity to *L. perobtusa* (PRESTON) from the Aberdare Range in Kenya, this species having likewise a very obtuse dome-like summit and well developed sculpture, but rightly point out that PRESTON's species differs in being far broader in contour and very much larger.

PILSBRY (loc. cit.), describes an egg, apparently fallen out of one of his specimens, broken and discoloured, but to have been white, oval and Measuring  $5 \times 7$  mm.

***Limicolariopsis sjostedti*** D'AILLY. Plate III, figs. 7, 10.

*Limicolariopsis sjostedti* D'AILLY, 1910. Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro 1 (6), p. 24, pl. 1, figs. 31-36.

*Limicolariopsis sjostedti* PILSBRY, 1919. Bull. Amer. Mus. Nat. Hist. 40, p. 88.

*Limicolaria (Limicolariopsis) sjostedti* GERMAIN, 1919. Bull. Mus. Hist. Nat. Paris 25 (n° 4), p. 207-209.

Type description (freely adapted from the original Latin) : Shell oval-elongate, usually imperforate or almost so, the apex rose-tinted, apical whorls pale; longitudinal striae commence on the brownish coloured third whorl, later whorls are patterned with sinuous flammules and spots, fading below the periphery. Spire convexly-conical, apex obtuse, whorls  $6\frac{1}{2}$  inflated, suture impressed, puckered, becoming an impressed, interrupted line round the upper whorls. Apical whorls regularly granular, aperture subvertical, elliptical, interior bluish-white; peristome straight, slightly expanded, merging in adult specimens into a parietal callus; external margin arcuate, columella inclined downwards to the left or sometimes vertical, reflexed, twisted, thickened and angulated at the base, providing a distinctly formed canal underlying the parietal callus. Type locality, Mt. Meru, in decaying leaves in rain-forest at 3000-3500 metres alt. (SJÖSTEDT - State Museum of Natural History Stockholm, holotype and numerous paratypes) and at Kibonoto (two shells) on Mount Kilimanjaro at 2000-2500 metres (SJÖSTEDT).

SPECIMENS EXAMINED :

Tanganyika Territory; Mt. Meru at 3000-3500 metres (SJÖSTEDT - Stockholm Museum and Tervuren Museum, all paratypes). Mount Kilimanjaro, rain forest at 7000 ft. (B. VERDCOURT - Coryndon Museum). Kilimanjaro forest, 5000-8000 ft. (S. J. K. COLLINS - Coryndon Museum).

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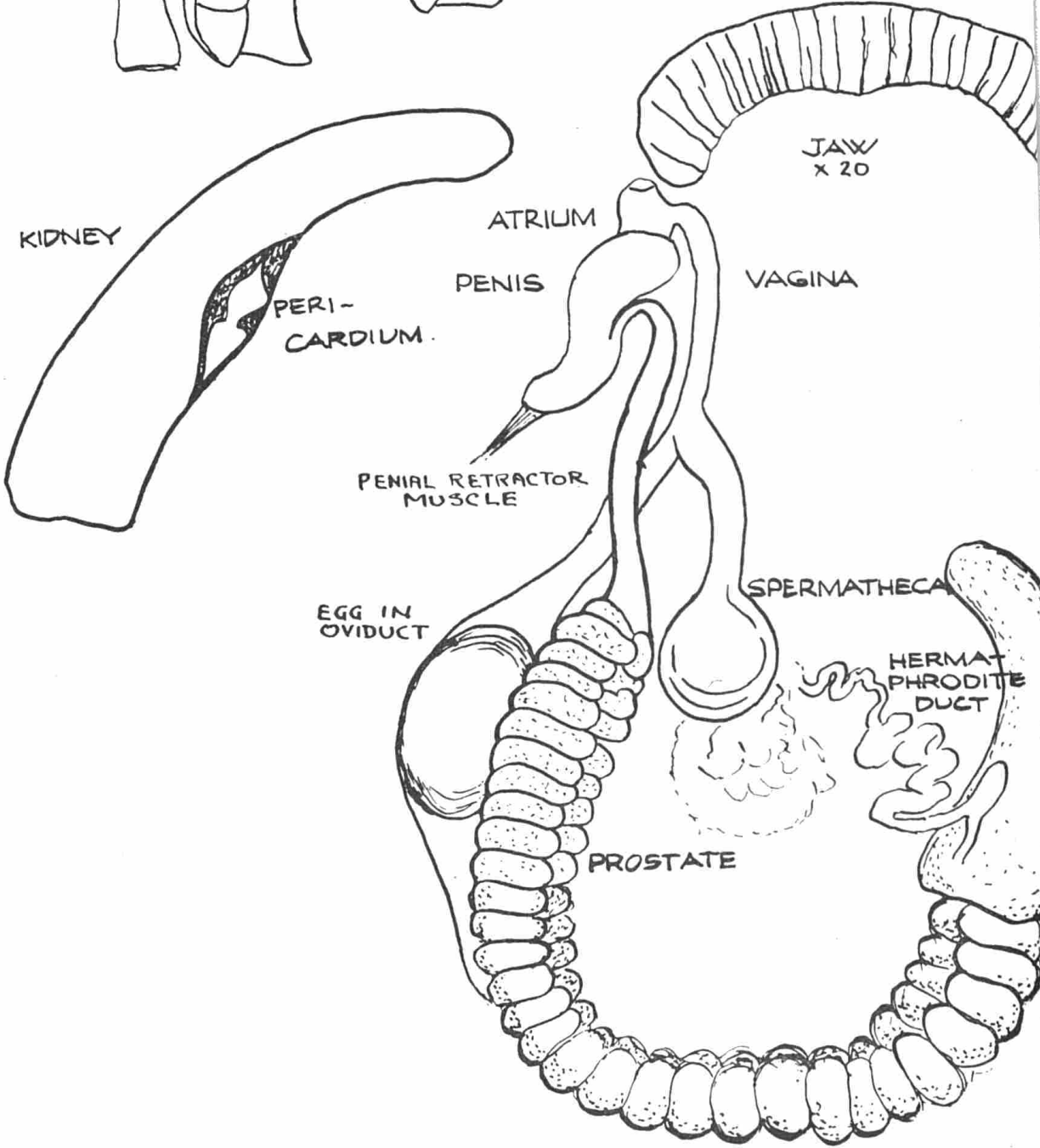
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x. 4

*Limicolariopsis sjostedti* d'AILLY.

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	52	25	21.5	13.5	6½	Mt. Meru (Holotype)
(2)	52	25	23	14	6½	» (Paratype)
(3)	58.5	27	26	16	7	Mt. Kilimanjaro
(4)	57	25	24	15	6½	»
(5)	52	23	22	14	6¼	»

REMARKS :

This species was designated by D'AILLY as the genotype of *Limicolariopsis*. It is apparently confined to Mounts Meru and Kilimanjaro. Specimens we have examined from the latter mountain are somewhat more elongated and are typified by a strong pattern of reddish flammules, not present to the same extent in specimens from Meru, whence the shells are more usually pale and streaky. D'AILLY (1910, 24) refers to a form  $\beta$ , which he describes as being turritid with convex whorls, but he does not make it clear whether the two shells attributed to form  $\beta$  were the two from Kibonoto; nor did D'AILLY give any dimensions for his holotype, merely quoting maximum and minimum measurements as between the 103 specimens collected on Meru by SJÖSTEDT.

GERMAIN (1919, 208) confused D'AILLY's form  $\beta$  with the quite different *L. inepta* (PRESTON) from Mount Kenya, which he makes a variety of *sjostedti* (variety  $\beta$  *inepta* PRESTON = forma  $\beta$  D'AILLY). One can only conclude that GERMAIN had never seen authentic specimens of PRESTON's *inepta*. Although the more elongated shells from Mount Kilimanjaro may represent forma  $\beta$ , we can see no justification for separating them from typical *sjostedti*.

*Limicolariopsis wagneri* KNIPPER. Plate III, Figs. 8, 9.

*Limicolariopsis wagneri* KNIPPER, 1956. Veroffente Uberseemus Bremen, Reihe A, 2 (6), pp. 341-356 (on p. 353), figs. 7c-d and 8b-d, pl. figs. 7-10.

Original description. — (Abbreviated translation from the original German text). « This is a *Limicolariopsis* very similar in appearance to *percurta* PRESTON but smaller in size, with a greater number of whorls and a straight vertical columella without any grooving.

The shell, for a *Limicolariopsis*, is rather small, pointed, convex and with a blunt apex. The greatest width is about half way up the shell, which is solid and almost opaque. Whorls about seven, moderately inflated. The last whorl is practically non-ascending, thereby producing a blunt apex composed of this and the penultimate whorl. The upper half whorl of the nepionic shell is slightly imbedded within the one next to it and only a portion of the periphery is visible; the rim of the last whorl also, is broad, and that of the penultimate whorl is inserted. From there on the profile of the shell expands in a moderately convex line downwards to the point of greatest diameter. Past

that point the curve becomes of smaller radius and inclines sharply to the outer edge of the columella, which it meets at an angle. The columella is narrowly triangular, vertical and the columellar lip is reflexed over the narrow umbilicus. All nepionic whorls possess flat irregular grooving of very fine texture; after the first quarter whorl the grooves increase in number; they are located on the upper part of the periphery from the suture outwards and cut the lines of growth to form granular sculpture.

The periostracum is thin and fragile, yet on fresh shells of animals which lived to an advanced age it can be found complete even on the nepionic whorls. The first  $2\frac{3}{4}$  or 3 whorls are greyish brown in colour and the shell is tinted an even brown and marked with dark brown flammules. ».

SPECIMENS EXAMINED :

Tanganyika Territory; (Masai District). 4-5 km. S. E. of Loliondo on the N. E. edge of the Serengeti Plateau at 2300 to 2400 m. alt. (H. KNIPPER - Ubersee-Museum, Bremen - Paratypes).

Measurements (in millimetres)

	Length	Greatest width	Aperture		Whorls	
			length	width		
(1)	38.4	21	17.8	10.1	7	Holotype
(2)	38	19.5	17	10.5	$6\frac{1}{2}$	Paratype
(3)	39.5	20.5	17	11	7	»
(4)	37.5	21	18	11	$6\frac{1}{2}$	»
(5)	36	18	17	10.5	$6\frac{1}{2}$	»
(6)	33.5	18.5	16	10	$6\frac{3}{4}$	»

REMARKS :

This small species, from a locality widely separated from that of any other member of the genus, does not in any way resemble *L. sjostedti* D'AILLY from Mounts Meru and Kilimanjaro — the only other species so far recorded from Tanganyika Territory. As pointed out by KNIPPER in the original description, *L. wagneri* is similar in appearance to *L. percurta* PRESTON, although smaller in size, and after comparing specimens with the unique type of *percurta*, we can confirm this. *L. percurta* is at present known only from the type locality in Kenya.

*L. wagneri* may be readily recognised by its comparatively small size, even when fully adult; its straight, vertical columella and conspicuous pattern of dark flammules more strongly developed below the periphery of each whorl than above it. All examples seen were narrowly umbilicate.



PLATES

PLATE I

1. *Limicolariopsis donaldsoni* (PILSBRY).
2. Ditto, paratype (immature).
3. *Limicolariopsis obtusa* THIELE, holotype.
4. *Limicolariopsis nyiroensis* (PRESTON), Lectotype.
5. Ditto, syntype.
6. *Limicolariopsis cylindricus* n. sp., holotype.
7. Ditto, paratype (immature).
8. *Limicolariopsis dohertyi* (SMITH), paratype.
9. Ditto, holotype.
10. *Limicolariopsis percurta* (PRESTON), holotype.

All figures are approx. 85 % natural size.



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PLATE II

1. *Limicolariopsis keniana* (SMITH), Mt. Kenya 6500' (PITMAN).
2. Ditto, holotype.
3. *Limicolariopsis pellisacertae* (PRESTON), holotype (= keniana).
4. *Limicolariopsis inepta* (PRESTON), holotype.
5. *Limicolariopsis scabrosa* (PRESTON), holotype (= keniana).
6. *Limicolariopsis radula* (PRESTON), holotype (= inepta).
7. *Limicolariopsis perobtusa* (PRESTON), holotype.
8. Ditto, Thiba River (COPLEY).
9. *Limicolariopsis verdcourti* n. sp., holotype.

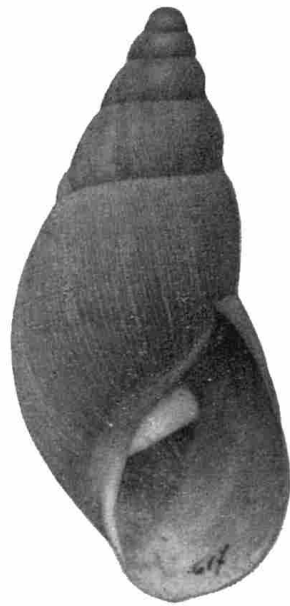
All figures are approx. 85 % natural size.



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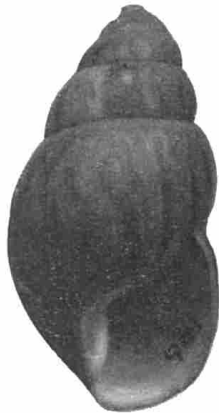
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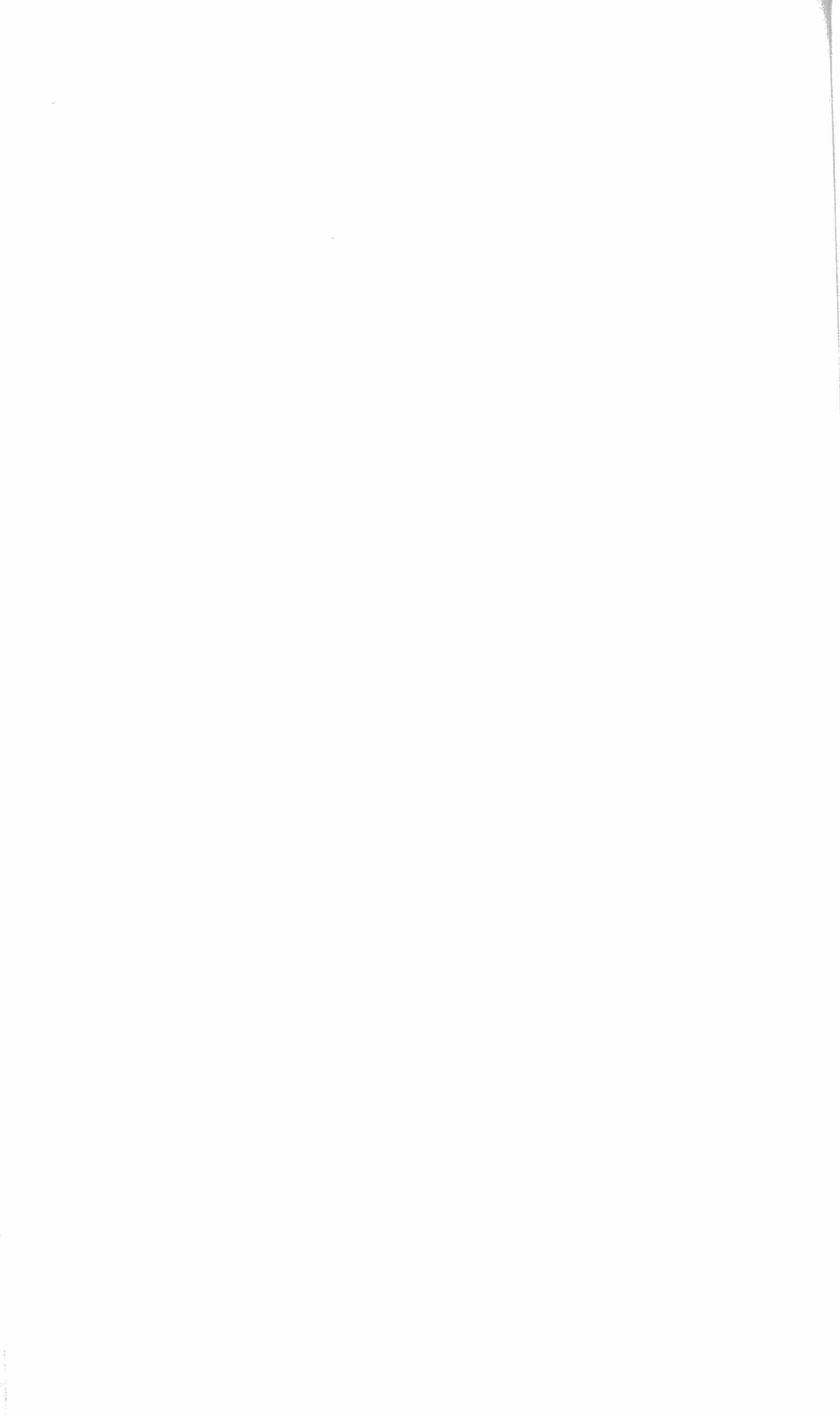






PLATE III

1. *Limicolariopsis laevis* n. sp., holotype.
2. Ditto, paratype.
3. *Limicolariopsis elgonensis* n. sp., holotype.
4. *Limicolariopsis ruwenzoriensis* PILSBRY, holotype.
5. *Limicolariopsis kivuensis* (PRESTON), holotype.
6. Ditto, Mount Elgon, 6000' (LOVERIDGE).
7. *Limicolariopsis sjostedti* d'AILLY, holotype.
8. *Limicolariopsis wagneri* KNIPPER, paratype.
9. Ditto.
10. *Limicolariopsis sjostedti* d'AILLY, Kilimanjaro 7000' (VERDCOURT).

All figures are approx. 85 % natural size.



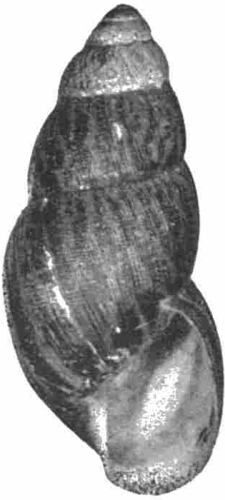
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