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IX.—*On the Swamp-Rats* (Otomys) *of East Africa.*

By Guy Dollman.

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In the following revision of the East-African swamp-rats it has been found necessary to modify considerably the arrangement adopted by Wroughton in his 1906 paper *. The forms *tropicalis*, *nyikæ*, *angoniensis*, *orestes*, and *denti* are here raised to full specific rank, *tropicalis* taking the place of *irroratus*, which species, on account of its cranial structure and lamina formula, is not considered a near enough relative for the name to be used in connection with the East-African forms; in this manner we confine *irroratus* and its subspecies to the country south of the Zambesi. As subspecies of *tropicalis* we then have *elgonis* and two new forms from the Jombeni Hills and Mt. Nyiro. In this paper descriptions are given of seven new *Otomys*, all from British East Africa and Uganda.

Key to the Species and Subspecies.

A. Lower incisors with one deep groove.
Ventral surface of tail dark.
a. m^3 with 5 laminæ. (Ruwenzori East.) (1) *denti*, Thos.

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* Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 264 (1906).

b. m^3 with 6 laminæ. (Mt. Mikeno, Congo Belge.) ..... (2) *kempi*, sp. n.

B. Lower incisors with one deep outer groove and one very shallow inner groove. Ventral surface of tail light.

a. Skull of arched appearance, interorbital region raised up and nasals and brain-case markedly depressed.

a'. m^3 with 7 laminæ.

a^2. Size larger; hind foot 30 mm. in length. (Molo, B.E.A.) ..... (3) *thomasi*, Osg.

b^2. Size smaller; hind foot less than 30 mm. in length.

a^3. Colour of dorsal surface pale ochreous buff. (Lake Olbollossat, B.E.A.) ..... (4) *t. malleus*, subsp. n.

b^3. Colour of dorsal surface brownish buff. (Aberdare Mts., B.E.A.) ..... (5) *t. squalus*, subsp. n.

b'. m^3 with 6 laminæ.

a^2. Colour of dorsal surface brownish buff. Size of molars larger (alveolar length 9·1 mm.). (Teliki Valley, Mt. Kenya, B.E.A.) .... (6) *orestes*, Thos.

b^2. Colour of dorsal surface dark tawny olive. Size of molars smaller (alveolar length 8·1 mm.). (Mt. Gargues, B.E.A.) ..... (7) *o. dollmani*, Hell.

b. Skull without any marked elevation of the interorbital region; general line of brain-case nearly horizontal anteriorly. m^3 with 7 laminæ.

a'. Nasals not exceptionally broad anteriorly (not more than 8 mm. in width).

a^2. Transition from broad to narrow portion of nasals marked by a distinct angle.

a^3. Size larger; hind foot 27 mm. or more in length, greatest length of skull 40 mm. or more.

a^4. Hind foot 28–30 mm. in length. Colour rich russet-brown. (West slope, Mt. Kenya.) .. (8) *tropicalis*, Thos.

b^4. Hind foot 27 mm. in length. Colour dark sepia-brown. (Elgonyi, Mt. Elgon.) .... (9) *t. elgonis*, Wrought.

b^3. Size smaller; hind foot 26 mm. in length. Greatest length of skull less than 40 mm. (Mt. Nyiro, S. of Lake Rudolf.) .. (10) *t. vivax*, subsp. n.

b^2. No angular transition between broad and narrow portion of nasals. General colour very dark. (Jombeni Range, N.E. of Mt. Kenya, B.E.A.) ..... (11) *t. nubilus*, subsp. n.

b'. Nasals very broad anteriorly (more than 8 mm. in width).
a^2. Transition from broad to narrow region marked by a distinct angle.
a^3. Size larger; hind foot 34 mm. in length, greatest length of skull 46 mm. (Kagambah, Uganda.) ..... (12) *rubeculus*, sp. n.
b^3. Size smaller; hind foot 26·3 mm. in length, greatest length of skull 39 mm. (Rombo, Kilimanjaro.) ..... (13) *divinorum*, Thos.
b^2. No angular transition between broad and narrow portions of nasals.
a^3. Size larger; greatest length of skull 40 mm. or more.
a^4. General colour brownish rufous mixed with buff. (M'Kombhuie, Angoniland.) (14) *angoniensis*, Wrought.
b^4. General colour olive-grey washed with brown. (Naivasha, B.E.A.) ..... (15) *a. elassodon*, Osg.
b^3. Size smaller; greatest length of skull less than 40 mm. Nasals very short.
a^4. Colour rufous brown speckled with buff. (Nyika Plateau, N. Nyasa.) ..... (16) *nyikæ*, Wrought.
b^4. Colour olive-grey tinted with buff. (Kijabe, Naivasha District, B.E.A.) ..... (17) *n. canescens*, Osg.

C. Lower incisors with two deep grooves. Ventral surface of tail light.
a. Skull arched; interorbital region raised up; nasals and brain-case depressed.
a'. m^3 with 6 laminæ. (East Ruwenzori.) ..... (18) *dartmouthi*, Thos.
b'. m^3 with 7 laminæ.
a^2. Size smaller; greatest length of skull 35·7 mm. General colour blackish brown. (Mt. Elgon.).. (19) *jacksoni*, Thos.
b^2. Size larger; greatest length of skull 39·7 mm. General colour bright yellowish buff suffused with brown. (12 miles S. of Lake Olbollossat.) ..... (20) *percivali*, sp. n.
c'. m^3 with 8 laminæ. (Shoa, Abyssinia.) ..... (21) *typus*, Heug.
b. Skull not arched; m^3 with 9 laminæ. (Charada, Kaffa.)..... (22) *fortior*, Thos.

Division A.

Lower incisors with only one very deep groove. General colour very dark; ventral surface of tail dull black.

Group 1.

m^3 with 5 laminæ.

(1) *Otomys denti*, Thos.

Otomys denti, Thos. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 142 (1906).

Lower incisors with only one deep groove, large inner portions terminating in two sharp points, sharper and longer than in the other groups; small outer portions sharply pointed and usually very pale in colour, a feature so marked that the skulls of this group can be immediately recognized. Brain-case flat.

In colour this species is exceedingly dark, the dorsal surface being brownish black ("blackish brown (3)" speckled with "auburn," Ridgway, 1912) speckled with coppery buff. Backs of hands and feet blackish brown. Ventral surface of body slate-black slightly speckled with buff. Tail dull black above and below. With the exception of the following species, all the other East-African *Otomys* have a light under surface to the tail.

Dimensions of the type:—

Head and body 157 mm.; tail 89; hind foot 27; ear 21.

Skull: greatest length 36·7; basilar length 30·2; zygomatic breadth 18·3; breadth of brain-case 15·5; length of nasals 14·7; breadth of anterior expanded portion 7; palatilar length 16·8; length of upper molar series from front alveolar border to back of last molar 8·3.

The molars are rather small, m^3 possessing only 5 laminæ.

Hab. Ruwenzori East. Altitude 6000 feet.

Type. Old female. B.M. no. 6. 7. 1. 69.

Externally *denti* and the following species are immediately recognized by their very dark colour and the dark ventral surface of the tail.

Group 2.

m^3 with 6 laminæ.

(2) *Otomys kempi*, sp. n.

Allied to *O. denti*, Thos., but distinguished by m^3 possessing 6 instead of 5 laminæ.

In general dimensions a trifle larger than the Ruwenzori species. The description given above for the colour of *denti*

may be taken for this species also, as in general colour the two forms are exactly the same.

Skull larger and heavier; molars considerably longer, m^3 with 6 well-defined laminæ. Lower incisors exactly as in *denti*, i. e., with only one groove.

Dimensions of the type (measured in the flesh) :—

Head and body 159 mm.; tail 101; hind foot 28·5; ear 22.

Skull: greatest length 40·5; basilar length 33·3; condylo-incisive length 38·2; zygomatic breadth 21; interorbital constriction 4; squamosal breadth of brain-case 15·7; length of nasals 16·3; greatest width across expanded part of nasals 7; breadth across middle of nasals (taken just behind the anterior expanded portion) 4·7; depth from highest point of orbit to alveolar border at front of m^3 12·2; palatilar length 19·2; length of palatal foramina 7·8; postpalatal length 14·1; length of upper molar series, from anterior alveolar border to back of last molar, 8·9; length from anterior enamel-base of m^1 to back of m^3 8·5; greatest width of m^1 2·5.

Hab. Burunga, Mt. Mikeno, Congo Belge. Altitude 6000 feet.

Type. Old male. B.M. no. 11. 12. 3. 110. Original number 2206. Collected by Mr. Robin Kemp on June 6th, 1911.

The 6 laminæ of m^3 immediately separate this form from the Ruwenzori *denti*.

Mr. Kemp obtained in all a dozen specimens of this interesting *Otomys*, six from the type-locality and six from Buhamba, near Lake Kivu, Congo Belge.

Division B.

Lower incisors with one deep outer groove and one very shallow inner groove. Ventral surface of tail light.

Section I.

The members of this section all possess skulls exhibiting a marked arched appearance, the interorbital region being conspicuously elevated and the nasals and brain-case so depressed as to accentuate this humped or arched character. (This condition is also found in Division C, Section I.)

Group 1.

m^3 with 7 laminæ.

(3) *Otomys thomasi*, Osg.

Otomys thomasi, Osg. Field Mus. Nat. Hist. Publication, 141, Zool. Ser. vol. x. no. 2, p. 9 (1910).

This species is immediately known by its curious arched

or "humped" skull, the interorbital region being raised up into a regular hump, from which point the nasals slope markedly downwards anteriorly, and similarly the cranial region posteriorly, the interorbital or frontal angle so formed being most conspicuous; owing to this feature the depth from the highest point of the orbit to the alveolar border is very great. The general colour is given by Osgood as "from pale cinnamon to wood-brown"; specimens in the Museum Collection identified by the describer seem to agree with this description quite closely. Behind the ears is a conspicuous patch of creamy buff, a feature well developed in the following race. Hands and feet creamy buff. Underparts slate-grey washed with brown.

Skull: in addition to the curious arched character mentioned above, the nasals are rather narrow posteriorly, of the same spoon-shaped pattern as those of *tropicalis*. m^3 with 7 laminæ.

Dimensions of the type (measured in the flesh) :—

Head and body 184 mm.; tail 98; hind foot 30·5; ear 24.

Skull: greatest length 43·3; basilar length 34·6; zygomatic breadth 21·7; length of nasals 20·7; greatest breadth of nasals 7·5; interorbital constriction 3·4; depth from highest point of orbit to alveolar border at front of m^3 14·5; postpalatal length 15·1; palatal foramina 7·5; length of upper molar series 9·2; greatest width of m^1 2·5.

Hab. Molo, British East Africa.

Type. Adult female. In Field Museum of Natural History, no. 16698.

(4) *Otomys thomasi malleus*, subsp. n.

Allied to *O. thomasi*, Osg., smaller in size and paler in colour.

General proportions conspicuously less than in *thomasi*. Colour of dorsal surface pale ochreous buff suffused with brownish on the back, the general effect paler and greyer than in the Molo form. Flanks pale buff. Head and muzzle similar in colour to back, cheeks pale buff. Light areas behind ears much as in *thomasi*, but not so prominent. Backs of hands and feet light greyish white washed with pale buff. Underparts of body slate-grey overlaid with pale buff. Tail greyish white tinted with buff.

Skull of the same arched type as that of *thomasi*, but decidedly smaller and with much shorter nasals.

Dimensions of the type (measured in the flesh) :—

Head and body 150 mm. ; tail 81; hind foot 26 ; ear 23.

Skull: greatest length 37·8 ; basilar length 30 ; condylo-incisive length 35·4 ; zygomatic breadth 19·5 ; interorbital constriction 4·4 ; length of nasals 16·8 ; greatest breadth across expanded part of nasals 6·5 ; depth from highest point of orbit to alveolar border at front of m^3 13·3 ; length of palatal foramina 6·9 ; postpalatal length 13·6; length of upper molar series from anterior alveolar border to back of last molar 9·5 ; length from anterior base of enamel on m^1 to back of m^3 8·6 ; greatest width of m^1 2·3.

Hab. Lake Olbollossat, Naivasha Province, British East Africa.

Type. Adult female. B.M. no. 12. 7. 1. 431. Original number 79. Collected and presented by A. Blayney Percival, Esq.

This *Otomys* is evidently quite closely allied to the Molo species ; the difference in size and much paler colour are the chief distinguishing characters. That a race of the Molo species should occur at Olbollossat is not surprising when the geographical conditions are considered.

Mr. Percival collected two further specimens of this *Otomys* at the type-locality ; the dimensions are given as : head and body 150, 143 mm. ; tail 86, 82 ; hind foot 26, 26. The skulls both show the same curious arched formation, the interorbital region being considerably elevated and the nasals and cranial outline depressed.

(5) *Otomys thomasi squalus*, subsp. n.

Size rather larger than in the foregoing race, colour considerably darker and richer.

Size of body greater than in *t. malleus,* but markedly less than in *thomasi.* General colour of dorsal surface a rich brownish buff, the effect much darker and browner than in *malleus.* Flanks not conspicuously lighter than back. Sides of face and head similar in colour to back, without any prominent light areas behind the ears. Backs of hands and feet white, washed with pale buff. Underparts of body rather darker throughout. Tail as in the other members of this group.

Skull a trifle larger than that of *malleus,* with broader nasals and longer palatal foramina. Cranial dimensions considerably less than in *thomasi.*

Dimensions of the type (measured in the flesh) :—

Head and body 166 mm. ; tail (broken) * ; hind foot 26·5 ; ear 21.

Skull: greatest length 40 ; basilar length 31·9 ; condylo-incisive length 36·7 ; zygomatic breadth 20·7 ; interorbital constriction 3·8 ; length of nasals 18·2; greatest breadth across expanded part of nasals 7·3 ; depth from highest point of orbit to alveolar border at front of m^3 13·6 ; length of palatal foramina 7·5 ; postpalatal length 14·2 ; length of upper molar series from anterior alveolar border to back of last molar 9·5 ; length from anterior base of enamel on m^1 to back of m^3 8·8 ; greatest width of m^1 2·5.

Hab. Mt. Kinangop, Aberdare Range, British East Africa. Altitude 12,000 feet.

Type. Old male. B.M. no. 10. 5. 3. 41. Original number 713. Collected by Mr. Robin Kemp on February 27th, 1910, and presented to the British Museum by Mr. C. D. Rudd.

The smaller size of this Aberdare *Otomys* immediately separates it from the large Molo form, while the darker and richer colour of the fur serve to distinguish it from *malleus*.

Mr. Kemp collected four specimens of this *Otomys* from localities on the Aberdare Mountains ranging between 10,000 and 12,000 feet in altitude ; all four specimens are exactly similar in general colour. This must be regarded as a mountain race of *thomasi*.

Group 2.

m^3 with only 6 laminæ.

(6) *Otomys orestes*, Thos.

Otomys irroratus orestes, Thos. P. Z. S. 1900, p. 175.

The skull in this species exhibits the same striking arched appearance as is seen in *thomasi* and the allied races described above. The last upper molar, however, only possesses 6 laminæ.

In general colour *orestes* is rather similar to the Aberdare race of *thomasi* described above as *T. squalus* ; the dorsal surface is rather richer and browner, but otherwise there is very little difference.

Dimensions of the type :—

Head and body 175 mm. ; tail 62 ; hind foot 27 ; ear 20·5.

* In another specimen from the type-locality the tail is given as 88 mm. in length.

Skull: greatest length 38·6; basilar length 31; zygomatic breadth 20; breadth of brain-case 16·5; length of nasals 17; greatest width across expanded portion 7·1; depth from highest point of orbit to alveolar border at front of m^3 13·2; palatilar length 17; length of upper molar series from front alveolar border to back of m^3 9·6.

Hab. Teliki Valley, west slope of Mt. Kenya. Altitude 13,000 feet.

Type. Old male. B.M. no. 0. 2. 1. 21.

(7) *Otomys orestes dollmani*, Hell.

Otomys orestes dollmani, Heller, Smith. Misc. Coll. vol. lix. no. 16, p. 5 (1912).

Agrees with *orestes* in that m^3 possesses only 6 laminæ, but skull less arched and narrower, with smaller bullæ and teeth, and pelage considerably darker in colour.

The specimens of this Gargues (Urguess) *Otomys* collected by Mr. Blayney Percival are, unfortunately, too young to be of any systematic use.

In colour this race would appear to be similar to *tropicalis*, *i. e.*, a rich tawny olive above and slate-grey suffused with brownish buff below.

The dimensions given by Heller are:—

Head and body 150 mm.; tail 88; hind foot 25; ear 21.

Skull: greatest length 37·4; basilar length 29·2; zygomatic breadth 18·1; interorbital constriction 4·9; nasals 17·2 × 7; postpalatal length 12; length of upper molar series (alveolar) 8·1.

Mr. Heller, when describing this form, mentioned that he had five specimens from the type-locality all agreeing in laminal formulæ, *i. e.*, m^3 with only 6 laminæ.

Hab. Mt. Gargues (Mt. Urguess). Altitude 7000 feet.

Section II.

Skulls without any marked elevation of the interorbital region, the general line of the brain-case nearly horizontal anteriorly. m^3 with 7 laminæ.

Group 1.

Nasals not exceptionally broad anteriorly (not more than 8 mm. in width); transition from broad to narrow region marked by a distinct angle, resulting effect rather spoon-shaped.

(8) *Otomys tropicalis*, Thos.

Otomys irroratus tropicalis, Thos. Ann. & Mag. Nat. Hist. (7) vol. x. p. 314 (1902).

A dark brownish-buff-coloured species, distinguished from

the *angoniensis* and *nyikæ* groups by the shape of the nasals, the expanded portion of which never exceeds 8 mm. in width, and the transition to the narrower part marked by a more distinct angle than in the Nyasa forms.

Size fairly large, hind foot generally about 28–30 mm. in length.

Colour of dorsal surface rich russet-brown lined with black and buff; flanks rather paler. Sides of face and muzzle strongly tinted with buff. Backs of hands and feet dirty brownish buff. Ventral surface of body slate-grey washed with buff. Tail dark brown above, dirty cream-colour below.

Skull large; nasals somewhat spoon-shaped, the expanded anterior portion narrowing rather abruptly, with a marked constriction just behind the expanded area. Molars fairly large; m^3 with 7 laminæ.

Dimensions of the type:—

Head and body 180 mm.; tail 80; hind foot 30; ear 23.

Skull: greatest length 44; basilar length 35·4; zygomatic breadth 21·6; breadth of brain-case 16·5; length of nasals 18·5; breadth across expanded portion 7·8; breadth across middle of nasals, just behind the constriction, 4; depth from highest point of orbit to alveolar border at front of m^3 13·3; palatilar length 19·7; length of upper molar series from front alveolar border to back of m^3 10; crowns 9.

Hab. West slope of Mt. Kenya. Altitude 10,000 feet.

Type. Old male. B.M. no. 0. 2. 1. 20.

In the Museum Collection are a great number of specimens referred to this species; it would seem to extend northwards as far as the Aberdare Mountains, where gradually the race known as *elgonis* begins to become dominant. South of Kenya it seems to be rather rare.

(9) *Otomys tropicalis elgonis*, Wrought.

Otomys irroratus elgonis, Wrought. Ann. & Mag. Nat. Hist. (8) vol. v. p. 207 (1910).

A dark race of *tropicalis*.

General dimensions rather smaller than in the typical *tropicalis*.

Colour like that of the Kenya species, but darker and richer. Flanks, sides of face, muzzle, and entire underparts considerably darker.

Skull same as in *tropicalis*, but rather smaller.

Dimensions of the type:—

Head and body 165 mm.; tail 81; hind foot 27; ear 21.

Skull: greatest length 41; basilar length 34; zygomatic breadth 20·3; breadth of brain-case 16·3; length of nasals 18; breadth across expanded portion 7·4; depth from highest point of orbit to alveolar border at front of m^3 12·4; palatilar length 18·7; length of upper molar series from front alveolar border to back of m^3 10.

Hab. Elgonyi, Mt. Elgon. Altitude 7000 feet.

Type. Adult male. B.M. no. 10. 4. 1. 78.

(10) *Otomys tropicalis vivax*, subsp. n.

Allied to *O. t. elgonis*, but smaller in size and considerably paler in colour.

Dimensions of head and body markedly less than in the Elgon form; tail rather long.

General colour of dorsal surface much paler and more suffused with light brownish buff, lacking the dark wash which is the dominant note in the colouring of *elgonis*. Flanks and sides of head rather lighter and more buff-coloured than back. Muzzle and sides of face bright buff. Backs of hands and feet dirty brownish buff. Under parts of body pale slate-grey overlaid with bright creamy buff, the general effect much lighter and more buff-coloured than in the Elgon race.

Skull considerably smaller with much smaller teeth. Nasals very much as in *elgonis*, the subterminal constriction not quite so well defined. The lamina formula as in *tropicalis*, but the last lamina of m^3 is very small and not entirely separated from the 6th.

Dimensions of the type (measured in the flesh):—

Head and body 147 mm.; tail 83; hind foot 26; ear 21.

Skull: greatest length 38·4; basilar length 30·5; condylo-incisive length 35·3; zygomatic breadth 19·3; inter-orbital constriction 4·2; length of nasals 16·6; greatest width across expanded part of nasals 7; depth from highest point of orbit to alveolar border in front of m^3 11·8; length of palatal foramina 7; postpalatal length 13·7; length of upper molar series from anterior alveolar border to back of last molar 9; length from anterior base of enamel on m^1 to back of m^3 8·3; greatest width of m^1 2·2.

Hab. Mt. Nyiro, south of Lake Rudolf, East Africa. Altitude 8000 feet.

Type. Adult female. B.M. no. 12. 7. 1. 425. Original number 391. Collected by A. Blayney Percival, Esq., on March 24th, 1911, and presented by him to the British Museum.

The chief characters that separate this Nyiro *Otomys* from the Elgon race are its smaller size, smaller teeth, and very much paler-coloured pelage.

Group 2.

Nasals not exceptionally broad (not more than 8 mm. in width), but showing no angular transition between the broad and narrow portions, pattern rather trumpet-shaped.

(11) *Otomys tropicalis nubilus*, subsp. n.

A very dark race, related to *elgonis* and *tropicalis*.

Size and general proportions as in *elgonis*.

Colour of dorsal surface dark sepia-brown speckled with buff, the general effect is very nearly as dark as in *denti* and the allied species *O. kempi*; both *elgonis* and *tropicalis* are considerably lighter in colour. Flanks rather more thickly speckled with buff. Backs of hands and feet as in *elgonis*, ventral surface of body slate-black speckled with pale buff, the whole a shade darker than in the Elgon form.

Skull about equal in size to that of *elgonis*, but distinguished by the shape of the nasals which do not show any sudden subterminal constriction, the expanded anterior portion narrowing gradually without the angular compression so conspicuous in *elgonis* and *tropicalis*. The general appearance of the nasals is rather that of a very narrow example of the *angoniensis* pattern. The inner groove of the lower incisors in this form is fairly well developed, more so than in *tropicalis*, where the inner groove is no more than a very shallow depression. In *elgonis* there would seem to be a certain amount of variation as regards the development of this inner groove, in the type-specimen it is fairly well formed, while in others from the type-locality this groove is very indistinct. The molars are quite like those of *tropicalis* and *elgonis*, m^3 having seven laminæ.

Dimensions of the type (measured in the flesh) :—

Head and body 170 mm.; tail 80; hind foot 28·5; ear 20.

Skull: greatest length 41·5; basilar length 33·7; condylo-incisive length 38·5; zygomatic breadth 19·5; interorbital constriction 4·7; breadth of brain-case 16; greatest length of nasals 17; greatest anterior width of nasals 7·7; median width 4·1; palatilar length 19; length of palatal foramina 8; length of upper molar series from anterior alveolar border to back of last molar 10; width of m^1 2·7.

Hab. Jombeni (Igembi) Range, N.E. of Mt. Kenya. Altitude 6000 feet.

Type. Adult male. B.M. no. 11. 12. 2. 4. Original number 1918. Collected by Mr. Robin Kemp on February 15th, 1911.

The very much darker-coloured pelage and less abruptly narrowing nasals distinguish this form from *elgonis* and *tropicalis*.

In addition to the four specimens collected by Mr. Kemp on the Jombeni Range, this form has also been obtained by Mr. Percival on the Larrogie Mountains (altitude 7700 feet) north of the Northern Guaso Nyiro, and at Mweru (4500 feet), and on the Embu Road (4000 feet).

O. orestes dollmani, its near neighbour, is immediately distinguished by the fact that there are only six laminæ in m^3, while the Jombeni race possesses the same lamina formula as the *tropicalis* group, *i. e.* $\frac{3.2.7}{4.2.2}$.

Group 3.

Nasals very broad anteriorly (more than 8 mm. in width), transition from broad to narrow region marked by a distinct angle.

(12) *Otomys rubeculus*, sp. n.

A very large species related to *tropicalis*.

Size considerably greater than in any other East African species, head and body measuring 201 mm. in length and the hind foot 34.

General colour very much as in *angoniensis*, dull brown lined with buff. Face and sides of head less richly tinted with buff; orange rings around eyes absent. Ventral surface of body much as in *tropicalis*. Tail very long, dull brownish black above, dirty cream-coloured below.

Skull very large and massive. Nasals very broad in front, the transition to the narrow portion marked by a fairly distinct angle, much more so than in *angoniensis* or *nyikæ*. Brain-case very broad; general outline of cranium nearly horizontal. Auditory bullæ exceptionally prominent. Teeth large; m^3 with 7 laminæ.

Dimensions of the type (measured in the flesh) :—

Head and body 201 mm.; tail 112; hind foot 34; ear 25.

Skull : greatest length 46·2; basilar length 37; zygomatic breadth 22; breadth of brain-case 18·2; greatest width across nasals 9; width at constriction behind anterior expansion 5·2; depth from highest point of orbit to alveolar border at front of m^3 15·3; palatilar length 21; length of palatal foramina 9; length of upper molar series from front alveolar border to back of m^3 11; crowns 9·3.

Hab. Kagambah, Uganda. Altitude 4800 feet.

Type. Old male. B.M. no. 11. 12. 3. 87. Original number 2343. Collected by Mr. Robin Kemp on July 10th, 1911.

The great size of this species renders it easily distinguishable from all the other East African *Otomys*.

Mr. Kemp obtained two further specimens of *rubeculus* at Nalasanji, Uganda, both of which, though subadult, are almost equal in size to the type.

(13) *Otomys divinorum*, Thos.

Otomys divinorum, Thos. Ann. & Mag. Nat. Hist. (8) vol. vi. p. 311 (1910).

This species is apparently intermediate between the *tropicalis* and *angoniensis* groups, possessing the broad nasals of *angoniensis*, which, however, exhibit the same angular transition to the narrower part as is found in *tropicalis*.

Size rather smaller than in *tropicalis*.

Colour considerably paler than in the Kenya species, the whole dorsal surface being of a uniform cinnamon-brown and lacking the rather coarsely lined appearance of *tropicalis* and *angoniensis*. Muzzle and light rings around eyes bright orange-buff. Ventral surface of body slate-grey washed with brownish buff.

Skull rather smaller than that of *tropicalis* or *angoniensis*. Nasals very broad anteriorly, the transition to the narrower posterior portion marked by a distinct angle. We thus have a combination of the broad nasals of *angoniensis* and the spoon-shaped pattern of *tropicalis*. Molars rather small, m^3 with 7 laminæ.

Dimensions of the type :—

Head and body 173 mm. ; tail 80 ; hind foot 26·3 ; ear 22.

Skull : greatest length 39 ; basilar length 31·7 ; zygomatic breadth 20·3 ; nasals 17·6 × 9 ; depth from highest point of orbit to alveolar border at front of m^3 12·8 ; length of upper molar series (crowns) 8·4 ; breadth of m^1 2·2.

Hab. Rombo, Kilimanjaro. Altitude 5300 feet.

Type. Adult female. B.M. no. 10. 7. 2. 84.

This species is only known from the type-specimen ; all the other *Otomys* collected by Mr. Kemp at Rombo were *O. angoniensis elassodon*.

Group 4.

Nasals very broad anteriorly (more than 8 mm. in width), without any sudden angular transition between the broad and the narrow portions.

(14) *Otomys angoniensis*, Wrought.

Otomys irroratus angoniensis, Wrought. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 274 (1906).

A large species with very broad nasals, which narrow more gradually than in the *tropicalis* group, the pattern more trumpet-shaped than spoon-shaped. In *tropicalis* and its allies there is usually a sharp constriction just posterior to the expanded portion; in *angoniensis* there is no such constriction, the sides of the nasals forming a simple trumpet-shaped design, without the well-marked "neck" seen in *tropicalis*.

General colour rather like that of *tropicalis*, but more coarsely lined with buff. Ventral surface of body strongly tinged with buff.

Skull about equal in size to that of *tropicalis*; nasals broadly expanded in front and narrowing gradually behind.

Dimensions of the type (from dried skin):—

Head and body 175 mm.; tail 90; hind foot 30; ear 21.

Skull: greatest length 42; zygomatic breadth 20; breadth of brain-case 15·6; length of nasals 19·7; greatest width across nasals 8·9; depth from highest point of orbit to alveolar border at front of m^3 13·9; palatilar length 19; length of upper molar series from front alveolar border to back of m^3 10·7.

Hab. M'Kombhuie, Angoniland, Nyasa. Altitude 8000 feet.

Type. Adult female. B.M. no. 2. 1. 6. 22.

This species may be known by its long and broadly expanded trumpet-shaped nasals.

In the Museum collection are several specimens from the type-locality and a few from the Shire Highlands and Zomba, S. Nyasaland, all referable to *angoniensis*.

(15) *Otomys angoniensis elassodon*, Osg.

Otomys angoniensis elassodon, Osgood, Field Mus. Nat. Hist. Publication, 141, Zool. Ser. vol. x. no. 2, p. 10 (1910).

Related to *O. angoniensis*, rather smaller in size and paler and greyer in colour.

General proportions rather less than in the Nyasa species.

Colour olive-grey mixed with brown, the striking rufous tint of *angoniensis* absent; buff colour on belly considerably paler.

Skull rather smaller and narrower, nasals broadly expanded anteriorly, as in *angoniensis*; teeth slightly smaller, m^3 with 7 laminæ.

Dimensions of the type (ás given by Osgood) :—

Head and body 183 mm.; tail 87; hind foot (c. u.) 29; ear 21.

Skull: greatest length 41; basilar length 34·3; zygomatic breadth 21; length of nasals 17·7; greatest breadth across nasals 8·9; depth from highest point of orbit to alveolar border at front of m^3 13·8; postpalatal length 15; maxillary tooth-row 8·2 (crowns).

The length of the molar series, from front alveolar border to back of m^3 in a Laikipia specimen in the Museum collection, is 10 mm.

Hab. Naivasha, British East Africa.

This race of *angoniensis* is evidently very widely distributed over British East Africa. In the collection is a large series from Rumruti, Laikipia Plateau, all of which agree fairly closely with Osgood's description. There are also specimens from Nairobi and from as far south as Rombo, Kilimanjaro. The Rombo *Otomys* are for the most part rather smaller than the Rumruti ones, but, as this variation in size is not constant throughout the series, it is impossible to regard it as of systematic value.

This Naivasha form is distinguished from its near neighbour *O. nyikæ canescens* by its larger size and longer skull.

(16) *Otomys nyikæ*, Wrought.

Otomys irroratus nyikæ, Wrought. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 276 (1906).

Rather smaller than *angoniensis*; skull much shorter, with exceptionally broad flat nasals; pattern almost triangular.

General dimensions less than in the southern species; hind foot only 27 mm. in length.

Colour very like that of *angoniensis*; under surface of body washed with brownish buff.

Skull short and stout; nasals very broad and flat, in one specimen the greatest width across the nasals is as much as 10 mm.

Dimensions of the type (from dried skin) :—

Head and body 170 mm. (probably not more than 160 mm. in the flesh); tail 70; hind foot 27; ear 20.

Skull : greatest length 38·2 * mm. ; basilar length 32 ; zygomatic breadth 19·6 ; breadth of brain-case 15·7 ; length of nasals 18 ; greatest breadth across nasals 9·5 ; depth from highest point of orbit to alveolar border at front of m^3 12·6 ; palatilar length 17·1 ; length of upper molar series from front alveolar border to back of last molar 9·7.

Hab. Nyika Plateau, North Nyasa. Altitude 6000–7000 feet.

Type. Adult male. B.M. no. 97. 10. 1. 107.

Otomys nyikæ is evidently closely related to the South Nyasa species, *O. angoniensis* ; both forms are very similar in general colour, the ventral surface being more strongly tinted with brownish buff in these two *Otomys* than in any of the other East African forms. In size *nyikæ* is rather smaller ; the skulls may be distinguished by the shape of the nasals, those of *nyikæ* being exceptionally broad and flat and comparatively short, while in *angoniensis* they are narrower, rather more curved, and longer.

(17) *Otomys nyikæ canescens*, Osg.

Otomys nyikæ canescens, Osgood, Field Mus. Nat. Hist. Publication, 141, Zool. Ser. vol. x. no. 2, p. 10 (1910).

Agrees with *O. nyikæ* in having a short thick skull with short, very broad nasals.

General colour much paler and greyer ; on the dorsal surface there is an almost entire absence of the russet tint so conspicuous in *nyikæ*, its place being taken by a pale olive-grey wash.

Skull like that of *nyikæ*, with broadly expanded nasals ; teeth fairly large, m^3 with 7 laminæ.

Dimensions of type (as given by Osgood) :—

Head and body 175 mm. ; tail 84 ; hind foot 29 (c. u.) ; ear 19·5.

Skull : greatest length 37·2 ; basilar length 30·9 ; zygomatic breadth 19·6 ; length of nasals 17·1 ; greatest breadth of nasals 8·5 ; depth from highest point of orbit to alveolar border at front of m^3 12·8 ; postpalatal length 13·8 ; maxillary tooth-row 8·4.

In a specimen from Mt. Suswa, quite close to the type-locality, the upper molar series measures from the front alveolar border to the back of m^3 9 mm. in length.

Hab. Kijabe, Naivasha District, British East Africa.

This race is represented in the collection by specimens

* In Wroughton's original description, the skull-dimensions given are not those of the type.

from the following localities:—Mt. Suswa, Mau, Lemek Valley (Amala District), south side of Aberdare Mountains, Nakuru, and the Larrogie Mountains (N. of Laikipia).

In examining the skins of British East African *Otomys*, it is very easy to mistake *canescens* for small specimens of *angoniensis elassodon*, the general colour of the two forms being very alike. The short thick skull of *canescens*, however, is very distinct from the larger and longer skull of *elassodon*.

Division C.

Lower incisors with two well-marked deep grooves. Ventral surface of tail light.

Section I.

Skull showing the same arched or humped appearance as is found in the *thomasi* group, the interorbital region raised up, and the nasals and general line of the brain-case depressed so as to accentuate this arched character.

Group 1.

m^3 with 6 laminæ.

(18) *Otomys dartmouthi*, Thos.

Otomys dartmouthi, Thos. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 141 (1906).

This species stands by itself among the *Otomys* with two deep grooves in the lower incisors, being the only one with 6 laminæ in m^3.

Externally *dartmouthi* is very distinct, the fur being a great deal more woolly than in any other East African *Otomys*. General colour of dorsal surface pale brown finely speckled with yellowish buff. Backs of hands and feet dirty buff. Ventral surface of body slate-grey washed with buff. Tail rather dark above, almost black; sides and ventral surface buff.

Skull, as in all the members of this division, excepting *fortior*, of the same arched or humped type as is found in the *thomasi* group, but the deep double grooving of the lower incisors immediately distinguishes the skulls of *dartmouthi* and its allies from those of *thomasi* and the other members of that group. Molars fairly large, m^3 with 6 laminæ.

Dimensions of the type:—

Head and body 150 mm.; tail 93; hind foot 26·5; ear 25.

Skull: greatest length 37·6 mm.; basilar length 30·5; zygomatic breadth 19·5; width of brain-case 15·5; length

of nasals 16·5; width across expanded anterior portion 6·8; depth from highest point of orbit to alveolar border at front of m^3 12·5; palatilar length 17; length of upper molar series from front alveolar border to back of last molar 9·5.

Hab. Mubuku Valley, East Ruwenzori. Altitude 12,500 feet.

Type. Adult male. B.M. no. 6. 7. 1. 64.

This species is easily distinguished from the other members of the division by its soft woolly pelage and the presence of only 6 laminæ in m^3.

Group 2.

m^3 with 7 laminæ.

(19) *Otomys jacksoni*, Thos.

Otomys jacksoni, Thos. Ann. & Mag. Nat. Hist. (6) vol. vii. p. 2 (1891).

Otomys jacksoni is distinguished from the other members of the division by its small size; the presence of 7 laminæ in m^3 readily separates the *jacksoni* group from *dartmouthi* with only 6 laminæ, and from the *typus* or 3rd group with 8 laminæ in m^3.

In size *jacksoni* is smaller than any other East African *Otomys*; both the skin and skull dimensions are remarkably small.

General colour a great deal darker than in the foregoing species, back dark blackish brown mixed with orange-buff, the effect almost as dark as in *t. nubilus* described above. Backs of hands and feet greyish brown.

Skull considerably smaller than in any of the other species treated of in this paper. The arched character is not so accentuated as in *dartmouthi* and the following species, the brain-case not being so depressed posteriorly. Molars rather narrow, m^3 with 7 laminæ.

Dimensions of the type:—

Head and body 120 mm.; hind foot 26.

Skull: greatest length 35·7; basilar length 28; zygomatic breadth 18·1; breadth of brain-case 15·5; length of nasals 16; width across anterior expansion 6·8; depth from highest point of orbit to alveolar border at front of m^3 11·2; palatilar length 15·5; length of upper molar series from front alveolar border to back of m^3 9·2.

Hab. Crater of Mt. Elgon. Altitude 13,200 feet.

Type. Adult female. B.M. no. 93. 2. 3. 34.

The small size and dark colour of this Elgon species readily separate it from the other four members of Division C. The *Otomys* obtained by Mr. R. Kemp on Mt. Elgon was a

very different animal, and not in any way closely related to *jacksoni*, a species that is probably only found at the very top of the mountain.

(20) *Otomys percivali*, sp. n.

Agrees with *jacksoni* in that m^3 possesses 7 laminæ, but is very much larger in size, paler in colour, and the general form of the skull considerably more arched than in the Elgon species. Size much larger; head and body 160 mm. in length. Colour of dorsal surface bright ochreous buff suffused with brownish, the general effect yellower and brighter than in *dartmouthi*. Flanks rather lighter and yellower than back. Face and head bright yellowish buff. Eyes surrounded with orange-coloured rings. Long hairs in front of ears with dark bases and orange-buff tips; hairs directly behind ears with creamy-white tips, somewhat as in the *thomasi* group. Backs of hands and feet dirty white. Ventral surface of body much as in *dartmouthi*. Tail brownish orange above; dull orange-buff below.

Skull with interorbital region markedly arched, muzzle and cranial lines considerably depressed. Auditory bullæ and teeth very much larger than in *jacksoni*; m^3 with 7 laminæ and, as in all the other members of this division, the lower incisors marked with two deep grooves, the inner one rather less deeply cut than the outer, but very much more so than in any of the forms in Division B, *i. e.* the *tropicalis*, *thomasi*, and *orestes* groups.

Dimensions of the type (measured in the flesh) :—

Head and body 160 mm.; tail 88; hind foot 27; ear 23.

Skull: greatest length 39·7; basilar length 32·2; condylo-incisive length 37; zygomatic breadth 20·6; interorbital constriction 3·5; squamosal breadth of brain-case 14; length of nasals 17; greatest width across expanded part of nasals 6·5; breadth across middle of nasals (taken just behind the expanded anterior portion) 4; depth from highest point of orbit to alveolar border at front of m^3 13·7; palatilar length 18·1; length of palatal foramina 7; post-palatal length 14·5; length of upper molar series from anterior alveolar border to back of last molar 10·5; length from anterior base of enamel on m^1 to back of m^3 9·5; greatest width of m^1 2·7.

Hab. Twelve miles south of Lake Olbollossat, Naivasha District, B.E.A. Altitude 8700 feet.

Type. Old female. B.M. no. 12. 7. 1. 424. Original number 509. Collected by A. Blayney Percival, Esq., on

June 28th, 1911, and presented by him to the National Collection.

There is no difficulty in distinguishing this new form from the Elgon species; the very much larger size, lighter colour, and more arched skull are characters that at once serve to distinguish *percivali* from *jacksoni*. The lamina formula is sufficient to separate it from *dartmouthi*, *typus*, and *fortior*, while the double grooving of the lower incisors indicates plainly that it cannot be considered a member of the *thomasi* group, with which it has a number of features in common.

Group 3.

m^3 with 8 laminæ.

(21) *Otomys typus*, Heug.

Oreomys typus, Heuglin, Reis. N. Ost-Afr. ii. p. 76 (1877).
Otomys degeni, Thos. P. Z. S. 1902, ii. p. 311.

About equal in size to *dartmouthi* and *percivali*; the presence of 8 laminæ in m^3 easily distinguishes this Abyssinian species from *dartmouthi*, *jacksoni*, and *percivali*.

In general colour very like *O. t. squalus*, dorsal surface brownish buff; head and flanks strongly tinged with buff, yellow rings around eyes very conspicuous. Backs of hands and feet dirty cream-buff.

Skull arched, but not so markedly as in the last species. Molars large, m^3 with 8 laminæ.

Dimensions (from a spirit-specimen):—

Head and body 161 mm.; tail 90; hind foot 28·5; ear 22.

Skull (type of *degeni*): length from back of interparietal to tip of nasals 36·2; greatest breadth 19·7; nasals, greatest length 16·5; greatest breadth across anterior expansion 7·5; palatilar length 17·7; length of palatal foramina 7·4; length of upper molar series from front alveolar border to back of m^3 10·3, crowns 8·2.

Hab. Shoa, Abyssinia.

Thomas has already pointed out* that his *degeni* is identical with *typus* of Heuglin, the original description given by Heuglin being "grossly inaccurate." Wroughton in his paper followed this view, and it seems best to adopt it here. The above description is taken from the type-specimen of *degeni*, which we must now accept as representing *typus*.

* Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 302 (1906).

Section II.

Skull flat, no marked elevation of the interorbital region or depression of the general line of the cranium.

Group 1.

m^3 with 9 laminæ, the last one very small and not entirely separated from the 8th.

(22) *Otomys fortior*, Thos.

Otomys typus fortior, Thos. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 302 (1906).

Larger than the preceding species with a much flatter skull, the interorbital region showing very little of the characteristic arched appearance seen in the other members of this group; m^3 with 9 laminæ.

In colour this species most nearly resembles *angoniensis*, the yellowish suffusion so evident in *percivali*, and to a certain extent in *typus*, is here almost absent; dorsal surface a uniform brown, lined with buff. Light markings around eyes and ears absent. Backs of hands and feet dirty brown. Under parts slate-grey washed with buff.

Skull, as stated above, without any marked elevation of the interorbital region. Incisors and molars large and broad; m^3 with 9 laminæ, the last very small.

Dimensions of the type:—

Head and body 182 mm.; tail 97; hind foot 30; ear 26.

Skull: greatest length 39; basilar length 32·2; zygomatic breadth 19·8; width of brain-case 16·7; greatest width across nasals 7·2; depth from highest point of orbit to alveolar border at front of m^3 11·8; palatilar length 19·1; length of upper molar series from front alveolar border to back of m^3 11·3.

Hab. Charada, Kaffa. Altitude 6000 feet.

Type. Adult female. B.M. no. 6. 11. 1. 29.

This form was described by Thomas as a race of *typus*; on account of its cranial characters and the occurrence of 9 laminæ in m^3 it is here considered as a distinct species.

X.—*Two new Species of* Leuconoe.

By Oldfield Thomas.

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Leuconoe moluccarum, sp. n.

Like *L. horsfieldi*, but the feet larger and the colour browner.

General characters as in the allied species. Fur soft, fine,