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Contribution to the knowledge of the genera *Muntiacus* and *Arctogalidia* in the Indo-Australian Archipelago[1])

(Mammalia, Cervidae & Viverridae)

by

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1. A preliminary revision of the genus *Muntiacus* in the Indo-Australian Archipelago.

2. Revision of the genus *Arctogalidia* in the Indo-Australian Archipelago.

[1]) Thesis University of Amsterdam.

1. A PRELIMINARY REVISION OF THE GENUS *MUNTIACUS* IN THE INDO-AUSTRALIAN ARCHIPELAGO.

INTRODUCTION.

As I have pointed out before, big game animals are very scarce in Museum collections. Many treatises are based on material from Zoological gardens, changed by captivity and often from unknown origin, from collections of frontlets, skulls and other trophies, bought haphazardly during expeditions which used all their time in thoroughly collecting the more interesting small animals. As a matter of fact, the rare species are better represented than the common ones, and the more a well-known species of game-animal is hunted, the fewer the specimens in the collections of the official Musea. The same is true for our knowledge of the biology of tropical big-game. Rare species, threatened by extinction, are studied with haste and often when it is too late to collect sufficient data. So, in preparing laws and regulations concerning the subject of hunting, one is always confronted with the fact that even the most necessary information is lacking.

Barking-deer are game which is highly esteemed by hunters in our area, because they give good sport, the heads make nice trophies and perhaps also because the meat is excellent to eat. They are not scarce yet, no expensive hunting-parties are needed for an hour or two of shooting. In fact a man working on one of the large estates in Western Indonesia, may take his gun in spare-time and bring home a good buck before supper with a bit of luck.

Strange though it may seem, there is hardly another species of big-game which is less known, both systematically and biologically, than the Barking-deer! Nevertheless MÜLLER and SCHLEGEL wrote as early as 1840: "This roebuck-like species has been described and figured so often, that we think it to be unnecessary to do this again, the more so because this is one of the most common and most well-known Indian deer". Other treatises, dealing at large with peculiarities of other deer species, are very short and incomplete as soon as Barking-deer are mentioned.

In this study I have tried to fill this gap in our knowledge, but I think the information I could collect is rather incomplete. I had to leave even more questions unanswered than in my previous treatise on the Rusine-deer. Times are not very favourable for extending our knowledge by collecting, field-observations and breeding in captivity. The best collection available to me was the collection in the Museum Zoologicum Bogoriense. Therefore, most types could not be studied and most material from outside Indonesia had to be left out of discussion. Therefore this revision is to be considered as preliminary.

My thanks are due to Mr E. G. A. LAPRÉ, Flores, for much information

on biology of Barking-deer, which he put at my disposal, to Dr G. C. A. JUNGE (Leiden) and Mr H. J. V. SODY for material put at my disposal, to Mr F. E. LOOSJES (Wageningen) for the trouble taken in supplying me with data from literature and to Mr A. SOLLAART (Bergen, Tg. Karang, S. Sumatra) for material collected at my request.

SEXUAL DIFFERENCES.

Sexual dimorphism in *Muntiacus* is much less conspicuous than in other deer of the Indo-Australian Archipelago. The most important secondary sexual characters are the antlers and the tusks of the males. The influence of the mostly light built antlers on the structure of the skull is principally confined to the heavy frontal ridges in the male, the latter being less heavy in females. Moreover, the skull is a little broader in males, which shows best when the zygomatic and the interorbital breadth of both sexes in animals of the same age are compared.

Most interesting is the sexual difference in the shedding of the canines. In the male, the canines are shed in the first month of life. Young bucks of a few months old already enjoy well-developed permanent canines, the rest of the milkdentition still being present. In females the small permanent canines appear at a much later stage of life. Even in young females pregnant for the first time, the deciduate canines often have not been shed yet. Presumably, the shedding of the canines in females takes place at the end of the first year of life. On the other hand, the incisiform teeth in the lower jaw are shed earlier in females than in males, by the former at an age of approximately 9 to 11 months, by the latter at the end of the first year. The canines of the females develop very slowly. Only in old does true, though small, tusks are present. I could not ascertain whether the tusks in females are hinged, just as they are in males.

Sexual colour-differences in Javanese Barking-deer are obvious. Bucks are much darker on breast and belly than does. The outer side of the legs is darker in bucks. Differences become prominent after the first year of life. The back in bucks is somewhat duller, more olive and less fiery red than in does. In poorly developed bucks differences are less obvious, such bucks showing a more female type of colouration.

In Western and Southern Borneo, sexual differences could not be observed, but, as in our collection bucks from this region are all poorly developed, this is perhaps the reason why they have all retained the female type of colouration.

Material from North Sumatra is so scarce in our collection that hardly any conclusion can be drawn, but, as far as could be observed, sexual differences in colour are absent or very slight. According to LAPRÉ (in litt.), in Lombok bucks are darker than does and much heavier built.

SEXUAL CYCLE.

In tropical species of deer, the sexual cycle is much less linked up with the seasons than in species of temperate regions. In Barking-deer often no signs of a pronounced rutting season can be observed. The development of the secondary sexual characters, i.e. the antlers in bucks, can

give us a clue to the sexual condition of the animals. In Java, bucks in velvet have been observed in April, May, August, October and November whilst bucks in rutting condition have been observed the whole year through. The same holds true for pregnant does and new-born fawns, as appeared from the painstaking investigations by SODY. Perhaps there is a slightly increasing frequency of births during some periods of the year. In Lombok there is a well-marked difference between wet and dry season and, according to LAPRÉ (in litt.), the rutting-season of Barking-deer is much more pronounced there than it is in Java.

Another fact demonstrating the sexual cycle, and even individual periodicity as a whole, to be less pronounced in Barking-deer than in the other deer of the Indo-Australian Archipelago, is the absence of periodical shedding of the coat. Seasonal differences in colouration could not be found. There seems to be no correlation between sexual condition viz. condition of antlers and condition of coat.

CHARACTERS OF AGE IN THE DENTITIONS AND THE DETERMINATION OF AGE IN MUSEUM SPECIMENS.

As I have pointed out elsewhere, it is of utmost importance that the factors sex, cyclical stage, season (c.q. year) and age should be eliminated in a systematic investigation of the deer-family. Only animals of the same sex, cyclical stage and age should be compared and seasonal (c.q. year) factors should be taken into account. Most of these factors can be derived without much trouble, the determination of the age of museum specimens, however, requires reliable criteria. During previous work on the Rusine-deer, I had the opportunity to compare my series, which had been arranged according to a scheme on account of the dentitions of European deer, with a collection of skulls from animals in semi-captivity and of exactly known age. I had no such luck in the present study. Of the many Barking-deer formerly kept as pets in gardens and on estates not a single specimen has been preserved in our collection. The only thing to be done was to arrange my material according to some existing scheme of another species, which might be compared with Barking-deer in size and structure. My choice fell on the European Roebuck (*Capreolus capreolus*) and on the schemes as prepared by NEHRING and BALLAUF, which have been compiled by VON RAESFELD (Das Rehwild, Berlin 1923, p. 301—305, fig. 247). Of course, the results obtained in this way are entirely hypothetical, but I preferred giving a hypothetical age to some scheme of numbered stages. I even suppose that the actual differences in the stages of roebuck and Barking-deer are not very large, as the correlation of development of cheekteeth and antlers during youth is nearly the same in both species.

As I mentioned above sexes differ widely in development and shedding of the canines of the upper jaws and slightly so in those of the incisiviform teeth. A preliminary scheme of shedding of teeth in the genus *Muntiacus* is given in table 1. A description of the different stages of the permanent dentition will not be given here, because the ages as given in the tables of measurements should be considered hypothetical for the time being.

Table 1.

Month of life	Incisiviform teeth of ♂	Incisiviform teeth of ♀	Canines of ♂	Canines of ♀	Cheekteeth
1			1 (I)	1	?
2	1 2 3 4	1 2 3 4	I	1	? 1 2 3
3	1 2 3 4	1 2 3 4			1 2 3
4					
5			I	1	1 2 3 IV
6	1 2 3 4	1 2 3 4			1 2 3 IV
7			I	1	1 2 3 IV V
8	1 2 3 4	1 2 3 4			1 2 3 IV V
9					
10			I	I	1 2 3 IV V
11	1 2 3 4	I II III IV			1 2 3 IV V
12			I	I	1 2 3 IV V VI
13	I II III IV	I II III IV			1 2 3 IV V VI
14					
15			I	I	I II III IV V VI
16	I II III IV	I II III IV			I II III IV V VI

Scheme of the shedding of teeth in *Muntiacus muntjak* c. subsp. Deciduous elements in Arabic figures, permanent elements in Roman figures.

AGE DIFFERENCES IN SKULL MEASUREMENTS.

Age differences in skull measurements as described by me for *Axis* (*Hyelaphus*) *kuhlii* (Treubia 19, p. 404, 1948) and the genus *Rusa* (Treubia 20, p. 201, 1949) could be found in *Muntiacus* also, the differences, however being much less obvious. It seems that in *Muntiacus muntjak*, a species which reaches maturity much earlier than true deer, also the definite skull-proportions are reached at an earlier stage of life. Nevertheless slight differences could be found. Just as in deer the zygomatic breadth increases a little with age in both sexes. Length of nasals decreases a little in males but increases in females. The length of frontal suture in males increases a little with age, but decreases in females. Interorbital breadth increases most with age in males, due to the heavier development of the frontal ridges. Old does often show a heavier development of frontal ridges than young does. The length of the toothrows decreases as the crowns wear down. The length of pedicles in males

decreases with age and the pedicles become much broader in old bucks; however, there seems to exist also a correlation between length of pedicles and weight of antlers. So the same phenomena could be observed in *Muntiacus* as in other deer of our region, only on a smaller scale.

Shape of orbit and glandular pit as well as the height of the skull change most during the period in which the deciduate premolars are shed and replaced by the permanent premolars. As soon as the permanent premolars are in place, the skull has its adult shape. MILLER (Proc. Ac. Nat. Sc. Philad. 94, p. 163—165 & plate, 1942) gives an excellent picture of this age difference, being unaware, however, of the fact that the skull characters described by him actually were age characters and not racial characters! This does not mean that the shape of the adult skull is exactly alike in all races, but in most cases the differences are so slight, that they are hardly of any use for diagnostic purposes.

AGE DIFFERENCES OF ANTLERS.

The first traces of the pedicles appear at a rather early age and attain their full length at an age of approximately six months. The development of the first pair of antlers seems to be very variable. These may consist of a pair of small buds which are scarcely swept, soon shed and replaced by a pair of single-tined antlers which are in turn swept at an age of 12 months. In other cases, the first antlers attain a length of a couple of centimeters and are carried much longer. They may be replaced by a second pair of single-tined antlers or by a second set of four points (2 + 2). Horn-shedding in *Muntiacus* seems to be rather irregular as I have observed several cases in which one antler was shed and replaced, the other one being retained for another period. As a rule, the antlers are replaced after regular intervals, which in my opinion are often longer than a year. Most hunters will assure that Barking-deer only shed once, but this is certainly not true. Normally the total number of points is only four (2 + 2). In Lombok, heads with more than four points do not seem to be rare, (MERTENS: Zool. Jahrb. 68, p. 316, taf. 6, 1930 and LAPRÉ in litt.) and heads with six points have been collected also in Java. In Southern and Western Borneo as a rule the antlers consist of a small, single tine, a feature occurring also in some Sumatran populations. This was one of the reasons for KOHLBRUGGE for establishing his *Cervulus pleiharicus*. Normally the antlers grow longer and heavier after each shedding; bucks of about 7 years may carry a splendid head. At old age good heads are no exception, one of our best Javan heads being a buck of at least thirteen years. But often, as in every species of deer, the antlers are "put back". They may present all sorts of irregularities, mostly originating from the burr, often as accessorial points, double burr and other deformations.

Deformations of antlers, due to pathological condition of reproductive organs, which is known as "Perückengeweih" in German and "Pruikengewei" in Dutch hunting-literature and in which the antlers are permanently covered by a thick layer of velvet forming a sort of wig, have been observed several times in Barking-deer.

AGE DIFFERENCES IN COAT.

Age differences in colour are scarcely found. In bucks from Java, younger than a year, the breast, belly and outer legs have not yet taken on the dark coloration characteristic in older animals. In bucks older than a year no differences could be found. In does, the colour of the back is a trifle more reddish in old animals. The nape is less dark in old does which often also present more extensive light markings on the legs.

In Southern and Western Borneo no age differences could be found at all. As to Eastern Borneo, the old doe in our collection is somewhat lighter than the young doe, the colour of the back being less saturated and the legs having the same type of markings as in old does from Java.

SYSTEMATIC PART.

Genus *Muntiacus* RAFINESQUE

Muntiacus RAFINESQUE: Analyse de la Nature, p. 56 (1815); LYDEKKER: Deer of all Lands, p. 202—203 (1898); LYDEKKER: Cat. Ung. Mamm. B.M. 4, p. 10 (1915). MAX WEBER: Die Säugetiere 2, 2d ed., p. 572 (1928); POCOCK: P.Z.S. 1923, p. 207 (1923); P.Z.S. 1935, p. 188 & p. 189, fig. 5A (1935); G. M. ALLEN: N.H. Eastern Asia 11, pt. 2, Mammals China & Mongolia, p 1148—1149 (1940); SIMPSON: Bull. Am. Mus. N.H. 85, p. 153 (1945). G. H. H. TATE: Mammals of Eastern Asia, p. 333 (1947).

Cervulus BLAINVILLE: Bull. Soc. Philom. Ser. 3, Vol. 3, p. 74 (1816); J. E. GRAY: P.Z.S. 1850, p. 234 (1850); V. BROOKE: P.Z.S. 1874, p. 38 (1874). A. H. GARROD: P.Z.S. 1876, p. 765 (1876); V. BROOKE: P.Z.S. 1878, p. 898 (1878); MAX WEBER: Die Säugetiere, 1st. ed., p. 670, p. 672 (1904); F. E. BEDDARD: Mammalia, Cambr. N.H. 10, p. 295 (1909); POCOCK: P.Z.S. 1910, p. 952—954 (1910); H. WINGE: Pattedyrslaegter 3, p. 66—67 (1924); F. B. LOOMIS: Am. Journ. Sc. 5th. Ser., Vol. 16, p. 535 (1928).

Prox OGILBY: P.Z.S. 1836, p. 135 (1836); FITZINGER: Sitzungsber. Math.-Naturw. Cl. Ak. Wiss. Wien, 68, abt. 1, hf. 10, p. 361—362 (1873).

Stylocerus HAMILTON SMITH: Griffith Anim. Kingd. 5, p. 319 (1827).

Definition. Small, slender, plesiometacarpal deer. Raised bony facial ridges, converging anteriorly on the frontals, which are continued by long, skin-covered pedicels in males, supporting small, normally two-tined antlers. Upper canines present in both sexes, large and tusk-like in males, small in females. Cheekteeth short-crowned with ill-developed styli. Rhinarium large, surrounding the nostrils. Supraorbital glands present, pedal glands only present on the hind feet. Preorbital gland large. Tarsal and metatarsal glands lacking. Lateral toes extremely small, coat short and smooth, ears rather short.

Type of genus. *Cervus muntjak* ZIMMERMANN, 1780.

Discussion. The genus *Muntiacus* has been placed in the subfamily *Muntiacinae* POCOCK 1923 (= *Cervulinae* SCLATER 1870) by various authors. It can be distinguished from the other recent genera of this subfamily by the presence of the frontal glands. In the Indo-Australian Archipelago the subfamily is only represented by the genus *Muntiacus*. The definition of the genus, as given above, is founded merely on the only species occurring in this region, because no extra-limital material was at my disposal.

Stature. Small, slender deer. Frontlegs slightly shorter than hindlegs, back arched. The gait is supple and somewhat stealing, the head

is carried more or less stretched forward. During flight, in full gallop, the hoofs are stretched widely apart, the pedal glands of the hind-feet making a heavy scent-track. In trot the hoofs are carried nearly closed.

External characters. The rhinarium is nearly bare, rounded and surrounding the nostrils. Upper lip short. Facial vibrissae at upper-lip, chin and below the eye.

The preorbital gland is large and deep. The supraorbital glands are well-developed, appearing as a long crease with thickened edges. They are better developed in bucks than in does. The pedal glands are only present at the hind feet, consisting of a more or less triangular cleft with protruding hair which is stained green in full-grown animals. The interungual webb is covered with short hair. The ears are rather short, completely covered with hair.

Skin. The coat is smooth and short. The skin is unspotted in older animals but the fawns show four rows of light spots at the back, which dwindle within a few months. Buttocks concolorous with rest of body, no conspicuous "Spiegel". Underside of tail white, narrow white pubic region.

Skeleton. Plesiometacarpal, that is to say: the distal portions of the lateral metacarpals are lost, the proximal portions retained. Naviculo-cuboid and external and median cuneiform bones of the tarsus fused into a single bone.

Vomer short and low, no tendency of the caudal nasal cavity to divide into two chambers.

Bullae auditoriae very small. Nasals short, rhombiform to slightly cruciform. Forehead with two raised bony ridges, converging anteriorly on the frontals and caudally continuing in very long pedicels which support the antlers. Lacrimal vacuity rather small, a well-developed and deep preorbital gland pit.

Antlers. Pedicels very long and covered with skin. The antlers are short, normally two tines (2 + 2) and composed of a burr, a small brow tine and a beam. The main beam is more or less curved inward at the tip.

Dentition. Upper canines present in both sexes, large and tusk-like in males, small in females. The canines are hinged and movable, linked with the gum-pad by elastic fibres which are inserted in a ring-shaped ligament, surrounding the base of the tooth. [1])

The incisiviform teeth are considerably differentiated in size, the median incisor being a little wider than the remaining three teeth of the same side. Cheekteeth short-crowned, with ill-developed styli, molars of the lower jaw with typical "crossing-over", that means with communication between anterior crescent and posterior crest. The posterior crest with or without communication with the anterior crest, posterior crescent more or less isolated.[2]) Molars of the upper jaw with slightly bifurcated caudal

[1]) A most interesting account of the structure and function of the tusks has been given by AITCHISON (P.Z.S. 116, p. 329—338, 1946).

[2]) F. B. LOOMIS (Am. Journ. Sc., 5th ser., 16, p. 535, 1928) is entirely mistaken in assuming that the genus *Cervulus* (= *Muntiacus*) presents the *Blastomeryx*-type of dentition. Crossing-over is present in every specimen of the genus I saw. The structure of both upper and lower dentition, in my opinion, brings the genus at the base of primitive old-world deer, instead of in the special position created by LOOMIS.

ends of crescents. Oral end of posterior crescent broadened and more or less plicated. Styli of upper jaw hardly present at all.

Distribution. The genus is widely distributed over Southern and Eastern Asia. In the Indo-Australian Archipelago it surpasses WALLACE's-line only in Lombok. The genus is represented by a single species in the Indo-Australian Archipelago.

Muntiacus muntjak (ZIMMERMANN).

Cervus muntjak E. A. W. ZIMMERMANN, ex. PENNANT: Geogr. Geschichte II, p. 131 (1780).

Definition. Large to medium-sized representatives of the genus. Tail rather short, white beneath, above varying from deep dark rufous-brown to light-ochraceous rufous, according to the race. Preorbital gland-pit never occupying more than two-thirds of the lacrimale. Premaxillaries in contact with nasals. No frontal tufts, pedicels visible over the whole of the length. General colour varying from deep rufous oakwood-brown to deep shining rufous or light ochraceous rufous. Dark nuchal stripe present in some of the races. Fawns always spotted during early life.

Type of the species. Unknown.

Terra typica. Java.

Biology. Mainly jungle-dwelling. Mostly found in pairs or single. Not gregarious.

Distribution. India, Burma, Malay Peninsula, Siam, Indo-China, Yunnan, Hainan, the whole of Western Indonesia going East as far as Makassar Strait and Lombok I. Formerly imported on Horsburg I. (Cocos Keeling) where it has vanished at the moment.

Muntiacus muntjak muntjak (ZIMMERMAN).

Kangean I

Muntiacus muntjak G. H. H. TATE: Mamm. Eastern Asia, p. 334 (1947).
———— HARTERT: Nov. Zool. IX, p. 420, (1902).

Java.

Cervus muntjak E. A. W. ZIMMERMANN, ex PENNANT: Geogr. Geschichte II, p. 131 (1780).

Cervus muntjac HORSFIELD: Zool. Researches in Java 4, pl. 33 (1823); S. MÜLLER & H. SCHLEGEL: Verh. Nat. Gesch. Ned. Overz. Bezitt. Zool. p. 44—45, p. 225—228 (1839—1844); J. H. VAN BALEN: Album der Natuur, p. 121 (1906).

Cervulus muntjak J. C. KONINGSBERGER: Zoogd. Java, Meded. 's Lands Plantent. 54, p. 63 (1902); Java Zoöl. & Biol. p. 326, 425 (1915); GISIUS: Trop. Natuur 19, p. 197 (1930). K. W. DAMMERMAN: Trop. Natuur 26, p. 50 (1937); Ned. Ind. Jager 7, p. 121 (1937); M. BARTELS Jr.: Trop. Natuur 26, p. 82 (1937); P. F. FRANCK: Trop. Natuur 27, p. 91 (1938); F. J. APPELMAN: Trop. Natuur 27, p. 91 (1938).

Cervulus muntjac V. BROOKE: P.Z.S. 1874, p. 39 (1874); P.Z.S. 1878, p. 899 (1878); F. A. JENTINK: Mus. d'Hist. Nat. Pays Bas 9, Cat. Ost. Mamm. p. 154 (1887); Mus. d'Hist. Nat. Pays-Bas 11, Cat. Syst. Mamm., p. 183 (1892). J. H. F. KOHLBRUGGE: Natuurk. Tijdschr. N.I. 55, p. 263, p. 294—295 (1896); R. LYDEKKER: Deer of all lands, p. 206 (1898); E. L. TROUESSART: Cat. Mamm. 4, p. 871 (1898); S. S. FLOWER: P.Z.S. 1900, p. 372 (1900); E. L. TROUESSART: Cat. Mamm. Suppl., p. 693 (1904—1905); J. H. VAN BALEN: Dierenw. Insulinde 1, p. 187—189 + plate (1914).

Cervulus vaginalis J. E. GRAY: P.Z.S. 1850, p. 234 (1850); Cat. Rumin. Mamm. B.M. p. 94 (1872).

Prox muntjak FITZINGER: Sitzungsber. Math.-Naturw. Cl. Ak. Wiss. Wien 68, 1, hf. 10, p. 362 (1873).

Stylocerus Muntjak W. JARDINE : Natur. Libr., Mamm. 3, Rumin. pt. 1, p. 181—185, Pl. 19 & 20 (1839).

Muntiacus muntjak O. THOMAS & R. C. WROUGHTON : P.Z.S. 1909, p. 392 (1909); H. C. RAVEN : Bull. Am. Mus. N.H. 68, p. 265 (1935); CARTER, HILL & TATE : Mamm. Pacif. World, p. 147, p. 148, fig. 63, p. 206—207 (1945).

Muntiacus muntjak muntjak R. LYDEKKER : Cat. Ung. Mamm. B. M. 4, p. 14 (1915); K. W. DAMMERMAN : Treubia 11, p. 33 (1929); H. J. V. SODY : Natuurk. Tijdschr. N.I. 89, p. 165 (1929); Tectona 30, p. 729—730 (1937); Tectona 31, p. 762—763 (1938); VAN BEMMEL & VAN BEMMEL-LIENEMAN : Trop. Natuur 29, p. 100—101 (1940); F. N. CHASEN : Bull. Raffl. Mus. 15, p. 202 (1940); H. J. V. SODY : Tectona 33, p. 7—8 (1940); Ned. Ind. Jager 11, p. 181, p. 256, p. 264 (1941); C. A. GIBSON HILL : Bull. Raffl. Mus. 22, p. 20 (1950).

Muntiacus muntjac HILZHEIMER & HECK : Brehm's Tierleben, Säugetiere 4, p. 118—120 (1916); A. STEINMANN : Trop. Natuur 23, p. 90, Pl. IIa, IIIc, fig. 4, fig. 12 (1934); K. W. DAMMERMAN : Treubia 14, p. 484 (1934).

———— LOERZING : Trop. Natuur 6, p. 84 (1917); KALSHOVEN : Meded. Inst. Plantenziekten 69, p. 77, Pl. 14 (1926). M. BARTELS Jr. : Trop. Natuur 18, p. 81—82 (1929); K. W. DAMMERMAN : Trop. Natuur 23, p. 232 (1934); WESTRA : Trop. Natuur 20, p. 232 (1931); J. A. v. D. VEGTE : Trop. Natuur 26, p. 79 (1937); DE PRIESTER : Ned. Ind. Jager 7, p. 190—191, p. 233 (1937). A. VAN SCHALKWIJK : Ned. Ind. Jager 7, p. 257 (1937); A. HOOGERWERF : Trop. Natuur 27, p. 27, 39, 43 (1938); A. VAN SCHALKWIJK : Ned. Ind. Jager 8, p. 15, 16, 33, 58 (1938); DE PRIESTER : Ned. Ind. Jager 8, p. 53 (1938); ANONYMUS : Ned. Ind. Jager 9, p. 114, 138, 269 (1939), photographs ; F. J. APPELMAN : Trop. Natuur 28, p. 139—140, fig. 1—3 (1939); J. G. T. LOOGEN : Trop. Natuur 29, p. 154 (1940); F. J. APPELMAN : Trop. Natuur 29, p. 167 (1940); R. H. A. VAN MAARSEVEEN : Ned. Ind. Jager 10, p. 224 (1940).

South Sumatra.

Cervus muntjak MÜLLER & SCHLEGEL : Verh. Nat. Gesch. Ned. Overz. Bezitt., Zool., p. 44—45, p. 225—228 (1839—1834); J. H. VAN BALEN : Album der Natuur, p. 121—122 (1906) — part —.

Cervulus muntjac V. BROOKE : P.Z.S. 1874, p. 39 (1874); P.Z.S. 1878, p. 899 (1878); F. A. JENTINK : Mus. d'Hist. Nat. Pays-Bas 9, 'Cat. Ost. Mamm.' p. 154 (1887) — part —; id. 11 'Cat. Syst. Mamm.', p. 183—184 (1892) — part — ; LYDEKKER : Deer of all lands p. 206 (1898) — part —; E. L. TROUESSART : Cat. Mamm. 4, p. 871 (1898); S. S. FLOWER : P.Z.S. 1900, p. 372 (1900); E. L. TROUESSART : Cat. Mamm. Suppl. p. 693 (1905); J. H. VAN BALEN : Dierenwereld Insulinde 1, p. 187 & plate (1914).

Prox muntjak FITZINGER : Sitzungsber. Math.-Naturw. Cl. Ak. Wiss. Wien 68, 1, hf. 10, p. 362 (1873).

Cervulus vaginalis J. E. GRAY : P.Z.S. 1850, p. 234 (1850).

Cervulus moschatus DE BLAINVILLE : Bull. Sci. Soc. Philom. Paris, p. 77 (1816).

Muntiacus muntjak HILZHEIMER & HECK : Brehm's Tierleben, Säugetiere 4, p. 118 (1916) — part —.

Muntiacus muntjak H. C. RAVEN : Bull. Am. Mus. N.H. 68, p. 265 (1935); CARTER, HILL & TATE : Mamm. Pacif. World, p. 147, p. 148 + fig. 63, p. 223 (1945) — part —.

Muntiacus bancanus H. C. RAVEN : Bull. Am. Mus. N.H. 68, p. 265 (1935).

Muntiacus moschatus H. C. RAVEN : Bull. Am. Mus. N.H. 68, p. 265 (1935); G. S. MILLER : Proc. Ac. Nat. Sc. Philad. 94, p. 163—164 (1942).

Muntiacus moschatus LYON : Proc. U.S. Nat. Mus. 34, p. 632 (1908).

Muntiacus muntjak moschatus LYDEKKER : Cat. Ung. Mamm. B.M. 4, p. 15 (1915); F. N. CHASEN : Bull. Raffl. Mus. 15, p. 203 (1940); H. J. V. SODY : Ned. Ind. Jager 11, p 181 (1941) — part —; id. p. 258, p. 264.

———— D. PIETERS : Trop. Natuur 21, p. 213—214 (1932); W. F. RUDIN : Trop. Natuur 24, p. 129 (1935); D. PIETERS : Ind. Jager 3, p. 87 (1949).

Definition. Large representatives of the species. In full-grown bucks the total length of body amounts to more than 1300 mm, in does generally somewhat less. Colour of upper side deep fiery rufous, a little duller, more olive and less fiery in bucks than in does. No dorsal stripe. The nape more or less dusky, less reddish than rest of back. Face dusky,

Table 3. Best heads of *Muntiacus muntjak muntjak* (ZIMM.) from Java.

Collector	Locality		Greatest length of antlers	Circumference above burr	Circumference of burr	Shortest beam	Circumference above burr	Circumference of burr	Tip to tip	Greatest width
A. J. M. LEDEBOER	Jang Highland,	E. Java	270	—	136	265	—	135	90	190
P. F. FRANCK	Wadung West,	E. Java	246	—	140	245	—	143	72	179
A. VAN SCHALKWIJK	Balurang,	E. Java	240	80	140	—	—	—	—	—
id.	id.		240	100	112	182	100	105	—	—
R. L. SOESMAN (M.Z. 7473)	Silosanen Est.	E. Java	238	114	130	237	115	132	90	193
M. BARTELS Jr.	W. Java		230	135	—	—	—	—	—	—
K. PUFKUS (M.Z. 3831)	Puntjak	W. Java	228	—	120	227	—	117	94	199
VAN BEEKUM	Tjidjulang	W. Java	212	120	135	202	113	140	—	—
J. G. WESTEN	Deling, Japaga	E. Java	210	—	148	210	—	140	—	—
F. J. APPELMAN	Baluran	E. Java	210	—	120	210	—	120	—	—
M.Z. 1718	Tjibarusa,	W. Java	201	117	125	200	117	125	112	210
VELDMAN	Subang,	W. Java	200	93	120	200	102	125	—	—
R. L. SOESMAN (M.Z. 7467)	Silosanen Est.,	E. Java	200	86	100	200	87	102	89	156

forehead light cinnamon-rufous with a deep dark brown line along the frontal ridges and, in bucks, along the pedicles. Ears dusky on the back, inner side of ears light. Tail white beneath, upper side of the same colour as the back. Groins, armpits and pubic region creamy white. Breast and belly light cinnamon rufous, medially darkened to dark oakwood-brown in bucks, more ochraceous-buff and hardly darkened medially in does. Chin and throat creamy white, rest of neck light cinnamon-rufous. Distal parts and outer side of legs darkened to dark chestnut-brown in bucks, much less darkened in does. Hips of same colour as the back, the inner side lighter, with a creamy white stripe running down to the hocks. Young bucks and old, poorly developed bucks often of the same colour as the does. Sexual differences slight, but obvious. Total length of skull amounts to 200—220 mm in well-developed animals. Measurements are given in table 2. Antlers as a rule well developed, greatest length amounts to 270 mm in the best head ever recorded, a length of more than 220 mm being a good head. Accessorial points are rather rare in this race. Fawns are spotted. On the back, on each side of the spine two rows of yellowish ochre spots run down from the shoulders to the hips. The buttocks are irregularly spotted also and the lateral rows often are accompanied by a short row of spots on the blade. The spots soon start dwindling and have nearly vanished at the end of the second month of life.

Terra typica. Conform species.

Type of subspecies. Conform species.

Material. 26 ♂ (22 skulls, 2 skeletons, 11 skins, one mounted specimen), 13 ♀ (12 skulls, 9 skins, one mounted specimen), 3 fawns (3 skulls, 3 skins).

Diagnosis. Differing from the North-Sumatran race by brighter colour, from the East-Bornean race by brighter colour and larger size, from the race in West- and South Borneo by more reddish colour, the absence of the dorsal stripe and larger size, from the Bali and Lombok-race by larger size only.

Discussion. Both the Javanese and the South-Sumatran animals have been placed here in the subspecies *M. m. muntjak*, originally described from Java. I have not seen any animals from Kangean I. nor could I obtain any information about the population inhabiting that island. So the use of the name *M. m. muntjak* (ZIMMERMANN 1780) for that population is merely tentative. In future the population of Kangean I. could prove to belong to a separate race, which in my opinion could be expected because of the rather aberrant forms of other vertebrates occurring in that island. I could not find any differences between Javanese animals and South-Sumatran specimens in our collection, including a topotype of *M. m. moschatus*. Material from Sumatra in our collection being scarce, it proved to be impossible to establish the approximate boundaries between the region inhabited by this race and the other race from Sumatra, *M. muntjak montanus* ROB. & KLOSS. From the original description follows that in the Kerintji-region the two races meet. A specimen from Tebing Tinggi (Deli) is slightly intermediate between both races, but had better be placed within *M. muntjak montanus* (vide postea).

Biology. Barking-deer prefer thick jungle or parkland strewn with small densely wooded plots, giving them sufficient cover. They will

easily become adapted to cultured areas, such as rubber, coffee or tea estates. Barking-deer are browsers, feeding on sprouts, herbs, leaves, fruits, mushrooms and bark but hardly touching any grass at all. They often will become really noxious in young rubber-plantings, both by peeling off the bark for food and by using the trees for rubbing their antlers. In gardens they proved to be especially fond of red-pepper. One of my acquaintances even had red pepper planted along the roads of his estate for the purpose of attracting muntjaks to his hunting-grounds, which worked very well! In cultured woods, especially mahogany, Barking-deer proved noxious as destructors of bark.

Barking-deer are found from sea-level up to high in the mountains. In Java, they are more and more retiring to the hills and mountains since lowland-jungle is rapidly vanishing. They are not to be found in marshy country, excepted in the higher and drier parts or along the rivers. They do not like mudbaths as do the Rusine deer.

Shedding of antlers seems to occur rather irregularly. I have observed several cases in which only one antler had been shed and replaced in an otherwise normal buck. In East Bengal, according to COMBER and DURNFORD (Journ. Bombay N.H. Soc. 18, p. 490—491, 1908) antlers are shed annually, except for some abnormal cases, in which the first pair of single-tined antlers are retained. Presumably in Java the antlers often are retained for more than a year with much individual variation. Bucks in velvet have been observed in April, May, August, October and November.

The most important natural enemy in Java is the leopard, *Leo pardus melas* (CUVIER). In Sumatra, the tiger seems to play a rather important role as predator of Barking-deer (BARTELS, WESTRA, PIETERS).

Barking-deer are very strongly place-bound as the same animal, or the same pair of animals may be observed in the same locality for years in succession. Often their territory is not larger than one to four square kilometers. (PIETERS). An interesting account of the use of the scent track, made by the pedal glands has been given by "L." (Ned. Ind. Jager 10, p. 107, 1940). In flight, during full gallop, a heavy scent-track is made, the hoofs being widely spread apart. The animal will return on this track in slow march for some tens of meters, step aside and follow its way for some distance in slow march, the hoofs now being closed and hardly leaving any track.

Birth-dates. Fawns are born the whole year through with an increasing frequency in Java from Juni till January (SODY).

Rutting season. There is no marked rutting season and most animals seem to be in breeding condition during the greater part of the year. Even hardly full-grown does are found to be pregnant, sexual maturity being attained at an age of approximately 7 or 8 months in does, in bucks somewhat later, at an age of approximately one year. Barking-deer are mostly found single or in pairs. Seldom small families, consisting of a doe, a fawn, a buck and one half-grown animal may be seen (LOOGEN).

Duration of pregnancy is not exactly known but is supposed to be six months (SODY, BLANFORD, HODGSON). Young fawns will stay in their lair during the first life period. Maternal care, however, is not great. Fawns are left to themselves for the greater part of the day,

being suckled usually once a day, at sundown, just as it is the case with the *Tragulidae*. Impregnation of does takes place often only a few days after the last parturition, lactation in does, already pregnant again, being a regular occurrence (PIETERS). Usually one fawn is born at a time, although twins do occur occasionally.

Several authors have expressed their surprise as to the specific name "muntjak". As a matter of fact, this name has been derived from the Sundanese vernacular name "Mentjek", which is widely used for this animal in Western Java.

Distribution. Kangean I., Java, South Sumatra going North at least as far as Kerintji-valley. Imported in Horsburgh I. (Cocoskeeling-group) from Java but extinct again in that locality.

Historical Notes. On the large temple of Borobudur, Barking-deer are often represented in the beautiful basreliefs, the animals playing an important role in Javanese mythology. It is interesting to state that Rusine-deer are very rarely represented in these basreliefs! (STEINMANN).

Prehistoric finds are reported by DAMMERMANN from Sampung-caves (Central Java), where the Barking-deer was a species used most commonly for food. I have measured a large series of dentitions from his material and could not find any differences with recent material from Java.

Muntiacus muntjak nainggolani SODY.

Muntiacus muntjak nainggolani H. J. V. SODY: Natuurk. Tijdschr. N.I. 92, p. 237 (1932); ibidem 93, p. 92 (1933); R. MERTENS: Zoöl. Jahrb. 68, p. 315—316, taf. 6, fig. 3 (1936); F. N. CHASEN: Bull. Raffl. Mus. 15, p. 203 (1940); H. J. V. SODY: Ned. Ind. Jager 11, p. 181, p. 264 (1941);

Muntiacus muntjak muntjak R. MERTENS: Zool. Garten N.F. 2, p. 25 (1929);

Muntiacus muntjak B. RENSCH: Eine Biol. Reise Kl. Sunda-Ins., p. 48 (1930); O. HORST: Trop. Natuur 24, p. 182 (1935); CARTER, HILL & TATE: Mamm. Pac. World p. 147, p. 148 fig. 63, p. 193 (1945);

Cervulus muntjac EVERETT: Nov. Zool. 3, p. 593 (1896); S. S. FLOWER: P.Z.S. 1900, p. 372 (1900); J. H. VAN BALEN: Dierenwereld Insulinde 1, p. 187 (1914);

Cervus muntjac J. H. VAN BALEN: Album der Natuur, p. 122 (1906);

——— ZOLLINGER: Tijdschr. N.I. 9, II, p. 203 (1847); V. D. PAARDT: Tijdschr. Kon. Ned. Aardr. Genootsch. 2d ser., 46, p. 56 (1929); C. N. A. DE VOOGD: Trop. Natuur 26, p. 4, p. 39 (1937); DONKER VAN HEEL: Ned. Ind. Jager 7, p. 191 (1937).

Definition. Rather small representatives of the species. No exact measurements of body are known to me. Colour as in the preceding race (*M. m. muntjak*). Total length of skull amounts to 185—195 mm in well-developed animals. Measurements are given in table 4. Antlers well developed, greatest length amounts to 220 mm in the best head ever recorded, a length of 195 mm being a good head. In this race accessorial points are often met with, especially in Lombok.

Terra typica. Sendang, West Bali.

Type of subspecies. Collection SODY, Leiden, Nr. E 287. Skull, ♂, undated, Sendang, W. Bali.

Material. 12 ♂ (12 skulls and frontlets, one skin), including the type.

Diagnosis. Closely resembling *M. m. muntjak*, but smaller.

Discussion. According to skull-measurements there is no dif-

ference between animals from Bali and Lombok. The only skin available to me was collected in Bali and this specimen exactly matches the skins from Java. Therefore nothing can be said concerning the colour of Lombok-animals and neither concerning differences due to age or sex. According to Mr. LAPRÉ (in litt.), however, bucks are darker than does and somewhat larger and heavier. There seems to be some difference in quality of heads between the different populations in Lombok. The best heads were collected in West, South-west and South Lombok, very good heads are known from Mt. Rintjani, much less good are heads from East Lombok and the heads from the North coast are rather feeble (LAPRÉ, in litt. ; own collection).

Biology. In Bali Barking-deer are reported both from sealevel and from the mountains. In Lombok Barking-deer up till now have only been reported from Mount Rintjani (RENSCH 1930). In fact Barking-deer are widely spread in Lombok (LAPRÉ, in litt.), both in the mountains and on sea level. There seems to be a marked preference for secondary forest surrounding the dry fields, which are temporarily used for rice and other crops (the so-called ladangs), and for young forests surrounding the native villages in slightly hilly country. In Lombok Barking-deer are rather scarce in heavy primary forest. According to SODY (1941), birth of fawns was reported twice in Lombok, once in June (DENNINGHOF STELLING) and once in October (LAPRÉ). Mr LAPRÉ however informed me that the rutting-season in Lombok generally starts with the first days of the wet monsoon and that pregnant does could be observed mostly in that season. Most pregnant does were shot from February till May. Mr LAPRÉ himself never recorded pregnant does during the dry season. He has, however, often heard bucks calling in the months between August and November. Does with fawns were observed between March and May. In our collection there are several young bucks from Bali of different ages, all shot in one and the same month. There is only one record of a fawn from Bali, which was observed in August (DONKER VAN HEEL). In Bali Barking-deer are, according to V. D. PAARDT, caught with large nets during great beats held once a year, in which some hundreds of people may join. In Lombok they are hunted with dogs.

Distribution. Bali, Lombok. According to EVERETT, Barking-deer were imported in Lombok from Bali by the Balinese Rajahs. I think this statement needs some confirmation.

Muntiacus muntjak montanus ROBINSON & KLOSS.

Muntiacus muntjak montanus ROBINSON & KLOSS : Journ. F.M.S. Mus. VIII, pt. 2, p. 69, p. 314 (1918); H. C. RAVEN : Bull. Am. Mus. N.H. 68, p. 265 (1935); F. N. CHASEN : Bull. Raffl. Mus. 15, p. 203 (1940); C. A. GIBSON-HILL : Bull. Raffl. Mus. 19, p. 194 (1949);

Muntiacus montanus G. S. MILLER : Proc. Acad. Nat. Sc. Philad. 94, p. 164 (1942);

Muntiacus muntjak moschatus H. J. V. SODY : Ned. Ind. Jager 11, p. 181 (1941) — part —;

Muntiacus muntjak CARTER, HILL & TATE : Mamm. Pacif. World, p. 147, p. 223 (1945) — part —;

Muntiacus muntjac HILZHEIMER & HECK : Brehm's Tierleben, Säuget. 4, p. 118 (1916) — part —;

Cervus muntjac J. H. VAN BALEN : Album der Natuur, p. 121—122 (1906) — part —;

Cervulus muntjac F. A. JENTINK : Mus. d'Hist. Nat. Pays Bas 9, Cat. Ost. Mamm.,

p. 154 (1887) — part —; Notes Leyden Mus. 11, p. 25 (1888) — part —; Mus. d'Hist. Nat. Pays Bas 11, Cat. Syst. Mamm., p. 183—184 (1892) — part —; LYDEKKER: Deer of all Lands, p. 206 (1898) — part —; J. H. VAN BALEN: Dierenwereld Insulinde 1, p. 187 (1914) — part —;

——— Edw. JACOBSON: Trop. Natuur 8, p. 149 (1919); C. KLEES: Trop. Natuur 9, p. 125 + fig. 2 (1920); BÜNNEMEYER: Trop. Natuur 10, p. 34 (1921); F. J. NAINGGOLAN: Trop. Natuur 19, p. 212—213 (1930) — part —.

Definition. Rather small representatives of the species. Total length of full-grown animals amounts to 1000—858 mm. Colour of upper side dark chestnut, more or less speckled with blackish and mixed with Sanford's brown. Bases of hairs drab gray. Neck Natal brown. Forehead, occiput, pedic les and base of ears between orange rufous and Sanford's brown, with a nearly black line along frontal glands and front of pedicles. Rest of face Bone brown. Ears dark outside, whitish inside. Thighs and shoulders Bone brown, shanks nearly Clove brown, the fore-limbs somewhat lighter than the hind limbs. Pasterns and hoofs of hind-legs with more or less extensive light markings. Centre of throat olive-buff, upper breast buffy brown, chest and belly varying from Bone brown to olive-brown, pubic region whitish, a broad zone down the front of thigh to hocks ochraceous brown. Tail blackish brown above, edges and under surface nearly white.

Total length of skull amounts to 199—182 mm. Measurements are given in table 5. Antlers small, total length of beam not much more than 100 mm in average heads. In many cases, both in topotypical material and on Mt. Indrapura there is never more developed than a single spike, as can also often be observed in the race *pleiharicus*.

Terra typica. Sungai Kering, Kerintji Peak, 7300 ft, W. Sumatra.

Type of subspecies. Formerly in the collection of the Raffles Museum, Singapore. Skin and skull, ♂ ad., 29.IV.1914, Sungai Kering, Kerintji Peak, 7300 ft, W. Sumatra, leg. H. C. ROBINSON and C. BODEN KLOSS. The type was lost during the last war, according to GIBSON-HILL (1949).

Material. 1 ♂ (skin), 1 ♀ (skin & skull).

Diagnosis. Darker in colour than all other races in the Indo-Australian Archipelago, resembling most *M.m. rubidus* LYON, both in size and colour. From the other Sumatran race it can readily be distinguished by much darker colour and smaller size. Distinct both in colour and somewhat larger size from *M.m. naingolani* and *M.m. pleiharicus*.

Discussion. *M. m. montanus* should not be regarded merely as a dark mountain form, because the other race in Sumatra, *M. m. muntjak*, occuring in Java also, does not have the slightest tendency to smaller size and darker colour in the mountains of Java. On the other hand, a specimen in our collection from Tebing Tinggi, lowlands of Deli, East Sumatra, should be regarded as very near to *M. m. montanus*, because the only differences are the general colour which is slightly more reddish than in typical *M. m. montanus*, and a narrow white stripe down the front of the thigh. Therefore this specimen is more or less intermediate between either form, and in my opinion this is a proof that *M. m. montanus* cannot be regarded as a good species, as was proposed by MILLER

Table 2. *Muntiacus muntjak muntjak* (ZIMMERMANN)

Collection number	Locality	Collector	Date	Sex	Approximate age in years or months (m.)	Condylo-basal length	Condylo-basal length from oral border for. magnum	Occipito-nasal length	Total length of skull	Zygomatic breadth	Greatest width of braincase	Greatest width of 2 nasals	Length of nasals in median line	Length frontal suture	Lacrimal notch to the tip of premaxillaries	Interorbital breadth	Width of palatinum between m^3	Length of mandible	Maxillary toothrow	Mandibular toothrow	Length of pedicles from caudal border of orbit	Greatest length of antlers	Distance tip to tip of antlers	Greatest width of antlers	Length x depth of glandular pit	Total length of body	Length of tail	Length of ear	Body weight (in kg.)	Total number of points	Remarks
7461	Bantam, W. Java	?	?	♀	8	191	178	176	204	82.5	62	28 5	45.5	82	109	43 5	35	161	58.0	69.0	—	—	—	—	21 x 14	—	—	—	—	—	—
7451	Udjon Genteng, S. W. Java	P. F. FRANCK	26. VIII. 34	♂	3	203	190	180	216	90.5	61.5	28.5	53.5	80.5	117	49	—	166	64.0	73.5	123	107	90	—	23 x 13	1310	180	98	32.4	$1\frac{1}{2}$ + 3	Freshly swept
7452	Tjilenka, „ „	G. IMBERT	23. X. 33	♀	9 m.	177	162	163	190	74	59.5	24	49	73	101	40	(29)	145	(50.0)	(53.4)	—	—	—	—	21 x 10	—	—	—	—	—	Pregnant
1152	Neighbourhood Bogor, W. Java	O. SCHIFFER	19. IV. 26	♂	$\frac{1}{2}$ m.	104	95.5	94	110.5	45	47	17	19.5	44	49	28.5	(20)	85.5	(33.5)	(33.2)	—	—	—	—	7 x 4	510	80	58	—	—	Fawn
1120	Tjibeber, Bogor, W. Java	v. POLANEN PETEL	29. XII. 24	♂	1	182	167	161	194	83	58.5	25.5	46	74	104.5	46	(32.5)	153	(62.5)	(69.5)	106	15	92	—	23 x 11	1010	130	95	—	1 + 1	In velvet
1145	Tjibarusa, „ „ „	CH. E. JANS	1. XI. 25	♂	3	195	184	176	209	93	62	31.5	48	85.5	111	51	35.5	163	59.5	72.0	114	114	103	142	22 x 11	—	—	—	—	2 + 2	—
2459	Djonggol, „ „ „	E. DAHLER	20. VI. 30	♂	5	—	—	182	213	92	59	30	57	82	119	50	37	165	60.8	68.2	128	121	—	—	26 x 14	—	—	—	—	2 + ?	Left antler shedded
2180	Tjirateun, „ „ „	CH. E. JANS	4. VIII. 29	♂	6	195	180	175	207	93	06	35.5	48	85	117	53	37.5	162	64.0	72.8	113	137	—	—	24 x 14	—	—	—	—	2 + $2\frac{1}{2}$	Right antler in velvet Left antler old and worn
7458	Tjisarua, „ „ „	ZALM	31. VII. 32	♂	6	200	186	180	210	93.5	62	27	50	80.5	118	53.5	37	—	63.2	—	109	175	98	172	25 x 15	—	—	—	—	2 + 2	—
1718	Tjibarusa, „ „ „	?	15 IX. 37	♂	?	—	—	—	—	—	—	—	—	—	—	50	—	—	—	—	125	201	112	210	—	—	—	—	—	2 + 2	—
1719	„ „ „ „	?	29 IX 27	♂	?	—	—	—	—	—	—	31	52	87	—	55	—	—	—	—	102	195	95	167	—	—	—	—	—	2 + 2	Antlers old and worn
1161	— „ „ „	O. SCHIFFER	?	♀	$\frac{3}{4}$ m.	108	95	99	114	46.5	49	16	20	46	50	29	(20)	86	(32.0)	(32.2)	—	—	—	—	8 x 4	—	—	—	—	—	Fawn
1144	Tjibarusa, „ „ „	CH. E. JANS	8 XI 25	♀	6 m.	175	—	153	187	77	54	25	(41.5)	71	97.5	42.5	31.5	143	(41.8)	(44.5)	—	—	—	—	19 x 10	1100	164	101	—	—	—
7455	Puntjak, 1400 m., Bogor W. Java	K. PUFKUS	27. VIII. 39	♂	9 m.	177	164	159	187	83.5	57.5	22	46	72	102	44	34	147	(52.7)	(55.4)	88	—	—	—	19 x 10	1073	134	99	19.5	—	First antlerbuds shedded.
3829	id.	id.	?	♂	11 m.	—	—	—	—	85.5	61	—	—	85	—	44	38	—	(61)	—	111	45	—	—	21 x 10	—	—	—	—	1 + 1	Spikes in velvet
7453	id.	HALEWIJN	18. X. 37	♂	14 m.	189	176	167	198	86	59.5	25.5	45	81.5	106.5	47	34.5	160	(63.0)	(71.8)	107	60	100	113	22 x 12	1165	147	99	—	1 + 1	Broad and well developed spikes
7460	id.	K. PUFKUS	24. X. 41	♂	15 m.	—	—	—	—	88	63	—	—	82	—	46	36	—	(63.5)	—	113 (2) 118 (1)	101 (2) 33 (1)	—	—	21 x 13	—	—	—	—	2 + 1	Left antler in velvet with 2 pts:, right antler a worn spike.
7459	id.	HALEWIJN	29. VI. 37	♂	$1\frac{1}{2}$	193	183	172	203	85	58.5	28	53	78	112	46.5	34.5	162	62 0	68.4	106	147	87	140	25 x 12	—	—	—	—	2 + 2	Freshly swept.
3830	id.	K. PUFKUS	?	♂	6—7	—	—	184	—	89.5	64	27	52	86	—	52.5	36.5	—	60.7	—	110	135	—	—	25 x 13	—	—	—	—	2 +abn.	Left antler an abnormal notch.
3831	id.	id.	8. VIII. 37	♂	13	201	188	180	212	92	65.5	29	48	88	117	56	35	—	54.8	—	99	228	94	199	26 x 15	—	—	—	29.5	2 + 2	Splendid old buck.
7454	id.	HALEWIJN	20. XII. 36	♀	8 m.	179	165	161	190	81	60	24	45	72.5	101	41	(34)	151	(54.2)	(57.1)	—	—	—	—	21 x 10	1120	150	100	—	—	—

Table 2. *Muntiacus muntjak muntjak* (ZIMMERMANN)

Continued

Collection number	Locality	Collector	Date	Sex	Approximate age in years or months (m.)	Condylo-basal length	Condylo-basal length from oral border for. magnum	Occipito-nasal length	Total length of skull	Zygomatic breadth	Greatest width of braincase	Greatest width of 2 nasals	Length of nasals in median line	Length frontal suture	Lacrimal notch to the tip of premaxillaries	Interorbital breadth	Width of palatinum between m^3	Length of mandible	Maxillary toothrow	Mandibular toothrow	Length of pedicles from caudal border of orbit	Greatest length of antlers	Distance tip to tip of antlers	Greatest width of antlers	Length x depth of glandular pit	Total length of body	Length of tail	Length of ear	Total number of points	Remarks
1146	Tegalwaru Est., W. Java	T. L. TAN	18. X. 52	♂	1½	194	182	178	210	85	60.5	27.5	46.5	85	113	47.5	35	162	62.8	71.0	122	47	100	121	25 x 11	1050	130	110	1+1	Freshly swept spikes.
2965	id.	P. F. FRANCK	12. IV. 31	♂	4	187	175	167	198	83	58	27	40	80	108	45	36	155	59.0	67.0	124	110	58	123	24 x 11	1220	165	95	2+2	Poorly developed buck in velvet
2941	id.	ROMSWINCKEL	7. IX. 30	♂	6—7	185	171	171	199	86	62	26	49	75	107	48	35	154	60 0	69.2	104	131	84	146	28 x 14	1160	140	100	2+2	Poor head.
1890	id.	T. L. TAN	9. VI. 28	♂	11 m	179	165	164	195	77	60	25	45	73	102	43.5	32	148	(62.8)	(66.2)	—	—	—	—	21 x 10	1140	135	88	—	Pregnant.
1692	id.	id.	23. II. 27	♀	2	194	181	176	206	80	57.5	23.5	48	81	112	42.5	33	161	61.3	68.9	—	—	—	—	23 x 10	1270	155	95	—	—
2964	id.	id.	11. IV. 31	♀	8—9	192	178	175	204	84	60	24	54	75	114	44	35.5	161	61.7	71.2	—	—	—	—	22 x 14	1240	140	100	—	—
1706	Tasikmalaja, Priangan, W. Java	F. KOPSTEIN	III. 27	♂	?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	93	193	68	154	—	—	—	—	2 +2	—
7457	Gandrungmangung, Banjumas, C. Java	BALGOOY	8. X. 32	♂	6	203	188	185	220	92	61	29	51.5	93	122	50.5	36.5	169	63.5	71.4	123	155	57	146	24 x 13	—	—	—	2+ 2	
3828	id.	id.	27. VIII. 32	♀	½ m	100.5	90	93	108	47	47.5	14	15	44	46.5	25.5	(19.5)	83	(31.2)	(32.0)	—	—	—	—	8 x 4	—	—	—	—	Fawn, young of 7456
7456	id.	id.	27. VIII. 32	♀	8—9	202	188	180	214	87.5	59.5	24	(48)	88	119	45.5	36	170	60.2	74.5	—	—	—	—	27 x 13	—	—	—	—	Mother of 3828
7468	Blora, Rembang, C. Java	N. DE ZWAAN	1932	♀	9	191	178	176	202	80.5	58	27.5	58	75	111	43	35	160	58	68	—	—	—	—	24 x 10	—	—	—	—	
7469	Mt. Lawu, C. Java	Purchased	12. XI. 34	♂	8—9	190	176	173	202	90.5	60.5	30	48	82	110	46.5	37	158	57.0	66.2	113	152	118	178	25 x 13	—	—	—	2+2	Doubled burrs.
7474	Karangredjo Est. Kediri, E. Java	J. C. BRYAN	7. VIII. 41	♂	12 m	200	187	181	214	88.5	58	26.5	50.5	87	115	49.5	36.5	163	(62.0)	(65.8)	113	95	100	115	24 x 11	—	—	—	1+1	Heavy spikes.
7472	Pantjur Angkrek, Besuki, E. Java	Purchased	XI. 37	♂	1½	—	—	174	—	87	58	27	56 5	79	—	49	36	150	58.2	69.2	108	29	118	127	24 x 14	—	—	—	1+1	Deeply worn spikes
7470	id.	id.	XI. 37	♂	ad.	—	—	177	206	88.5	62	27	53	85	113	46 5	—	—	—	—	102	176	107	170	27 x 13	—	—	—	2+2	
7467	Silosanen Est., Besuki, E. Java	R. L. SOESMAN	V. 41	♂	7	—	—	180	—	97.5	61	33	48.5	86	—	52.2	38.5	160	56.1	65.7	94	200	89	156	21 x 15	—	—	—	2+2	—
7473	id.	id.	V. 41	♂	8	—	—	176	—	90	60.5	31.5	50.5	84	—	50	35.5	162	55	64.5	101	238	90	193	26 x 16	—	—	—	2+2	In velvet
7465	id.	id.	V. 41	♀	11 m	179	167	163	190	77	58	23	51	74	102	41.5	(29)	147	(52.5)	(54.8)	—	—	—	—	22 x 8	—	—	—	—	—
7471	Mt. Raung, Banjuwangi, E. Java	J. H. HILLING	XI. 37	♂	ad	—	—	—	—	—	—	(32)	57	86	—	55	—	—	—	—	95	124	145	162	24 x ?	—	—	—	2+2	—
7463	id.	id.	XI. 37	♂	ad	—	—	—	—	—	—	28	—	89.5	—	51	—	—	—	—	103	158	94	150	—	—	—	—	2+2	—
7462	id.	id.	XI. 37	♂	old	—	—	—	—	—	—	28.5	(49)	79	—	52	—	—	—	—	109	147	82	143	—	—	—	—	2+2	—
7464	id.	id.	XI. 37	♂	old	—	—	183	—	—	63	30	56	85	—	56	—	—	—	—	105	127	108	142	25 x 15	—	—	—	2+2	—
7485	Bukit Sanggul, Benkulen, S.W. Sumatra	J. J. MENDEN	22. VIII. 36	♀	1	191	175	180	204	82	(59)	25	56.5	78	110	41.5	(33.5)	162	(63.1)	(73.1)	—	—	—	—	22 x 11	—	—	—	—	—
7484	Kluang, Palembang, S. Sumatra	SUKARNO	?	♀	7	200	185	182	210	88	60	30	56	79	114	40	33.5	164	60.0	70.9	—	—	—	—	25 x 11	1328	177	87	—	Pregnant

Table 4. *Muntiacus muntjak nainggolani* SODY.

Collection number	Locality	Collector	Date	Sex	Approximate age in years or months (m.)	Condylo-basal length	Condylo-basal length from oral border for. magnum	Occipito-nasal length	Total length of skull	Zygomatic breadth	Greatest width of brain-case	Greatest width of 2 nasals	Length of nasals in median line	Length frontal suture	Lacrimal notch to the tip of premaxillaries	Interorbital breadth	Width of palatinum between m^3	Length of mandible	Maxillary toothrow	Mandibular toothrow	Length of pedicles from caudal border of orbit	Greatest length of antlers	Distance tip to tip of antlers	Greatest width of antlers	Length x depth of glandular pit	Total number of points	Remarks
7478	Sumber Klampok, W. Bali	J. J. MENDEN	30. VII. 33	♂	7 m	162	149	149	174	69.5	53	22	(43.5)	70	92	38	(23)	131	(36.8)	(49.7)	75	—	—	—	19 x 10	—	Antlers not yet developed
7477	id.	id.	28. VII. 33	♂	9 m	161	149	151	174	72.5	55.5	19.5	42.5	72.5	93	42	(31)	130	(44.0)	(47.1)	122		—	—	22 x 11	(1 + 1)	Half-developed spikes in velvet
7476	Banju Wetan, W. Bali	id.	18. VII. 33	♂	12 m	175	162	159	186	77	57	26	47	73	99	41	(28)	141	(55.8)	(61.1)	151		93	—	21 x 12	1 + 1	Spikes with half-swept velvet
Coll. SODY E 287	Sendang, W. Bali	H. J. V. SODY	?	♂	3—4	175	165	158	186	81	57	23	48	71.5	100	44	28	—	57.8	65.6	79	137	70	128	21 x 10	2 + 2	Type of subspecies
7475	Banju Wetan, W. Bali	J. J. MENDEN	19. VII. 33	♂	3—4	176	164	157	186	81	55	26	48	74.5	101	43	32	140	56.1	64.0	93	160	57	133	19 x 12	2 + 2	—
7479	id.	id.	22. VII. 33	♂	4—5	184	172	166	194	84	55	27	45	83	104	47.5	30	149	56.1	66.3	103	155	38	123	21 x 13	2 ± 2	—
Exp. RENSCH Nr. 65	Sembalum, Lombok	R. MERTENS	13. IV. 27	♂	?	185	172	150	195	83	55	35	47	78	—	47	33	—	52.3	56.5	—	154	70	—	—	—	cf. MERTENS: Zool. Jahrb. 68, p. 316 (1936)
7487	id.	id.	IV. 27	♂	ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	85	172	101	150	—	2 + 2	Ex. coll. RENSCH (42)
7490	id.	id.	IV. 27	♀	ad.	—	—	—	—	—	—	—	—	74	—	47	—	—	—	—	87	187	94	170	—	2 + 2	id. (47)
7486	id.	id.	IV. 27	♂	old	—	—	—	—	—	—	25	39.5	81	—	49	—	—	—	—	88	142	142	155	—	2 + 2	id. (40) With abnormal burrs
7488	id.	id.	IV. 27	♂	old	—	—	—	—	—	—	—	—	—	—	50	—	—	—	—	75	199	104	160	—	2 + 3	Ex. coll. RENSCH (44) Freshly swept
7489	Asah Seladan, Lombok	id.	IV, 27	♂	old	—	—	—	—	—	—	—	—	—	—	47.5	—	—	—	—	89	195	160	205	—	2 + 2	Ex. coll. RENSCH (50) Deeply worn

Table 5. *Muntiacus muntjak montanus* ROBINSON & KLOSS.

Collection number	Locality	Collector	Date	Sex	Approximate age in years or months (m.)	Occipito-nasal length	Condylo-basal length from oral border for. magnum	Occipito-nasal length	Total length of skull	Zygomatic breadth	Greatest width of brain-case	Greatest width of 2 nasals	Length of nasals in median line	Length frontal suture	Lacrimal notch to the tip of premaxillaries	Interorbital breadth	Width of palatinum between m^3	Length of mandible	Maxillary toothrow	Mandibular toothrow	Length x depth of glandular pit	Total length of body	Length of tail	Length of ear	Remarks
R.&C. 347/14	Sungei Kumbang, Kerintji, C. Sumatra	ROBINSON & KLOSS	IV. 1914	♂	imm.	169	—	—	192	82	—	—	—	72	—	39	—	—	60	66	—	1000	150	91	cf. Journ. F.M.S. Mus. 8, pt. 2, p. 313-314 (1928)
id. 377/14	id.	id.	id.	♂	ad.	170	—	—	197	86.5	—	—	—	81	—	45	—	—	57.3	66	—	975	150	84	id.
id. 398/14	id.	id.	id.	♂	ad.	—	—	—	199	84	—	—	—	81	—	44	—	—	56	63	—	935	135	88	id.
id. 381/14	id.	id.	id.	♂	old	174	—	—	196	89	—	—	—	81	—	46	—	—	54	63	—	858	142	93	id.
id. 329/14	id.	id.	id.	♀	ad.	168	—	—	192	84	—	—	—	77	—	43.8	—	—	57	68	—	1000	145	88	id.
id. 399/14	id.	id.	id.	♀	ad.	171	—	—	194	84	—	—	—	74	—	43	—	—	52.3	64	—	935	150	85	id.
id. 407/14	id.	id.	id.	♀	ad.	175	—	—	198	84	—	—	—	83	—	41.5	—	—	56.5	65	—	915	155	84	id.
id. 661/14	Sungei Kering, Kerintji, C. Sumatra	id.	id.	♂	ad.	160	—	—	182	79.5	—	—	—	78	—	40	—	—	55	63.5	—	—	—	—	id.
id. 456/14	id.	id.	id.	♂	ad.	166	—	—	191	87	—	—	—	77	—	42.5	—	—	57	65	—	985	135	84	id.
id. 479/14	id.	id.	id.	♂	old	164.5	—	—	187	88	—	—	—	75	—	44	—	—	56.5	64	—	910	95	85	Type of subsp. id
id. 660/14	id.	id.	id.	♂	old	168	—	—	199	—	—	—	—	72	—	45	—	—	51.5	62	—	—	—	—	id.
20238 U.S. N.M.	Mt. Löser, Atjeh, N. Sumatra	F. A. ULMER	—	♂	15m.	165	—	—	174	79	55.8	25	39	71	—	—	—	—	54.0	—	25 x ?	—	—	—	cf. Proc. Ac. Sc. Philad. 94, p. 164 (1942)
3108	Redelong, Atjeh ,N. Sumatra	MADZUD	30. VII. 30	♀	9m.	172	159	159	182	75	54	25	(53)	74	95	38	(31.5)	144	(49.6)	(51.1)	24 x 11	1120	130	90	—

Table 6. *Muntiacus muntjak rubidus* LYON.

Collection number	Locality	Collector	Date	Sex	Approximate age in years or months (m.)	Condylo-basal length	Condylo-basal length from oral border for. magnum	Occipito-nasal length	Total length of skull	Zygomatic breadth	Greatest width of brain-case	Greatest width of 2 nasals	Length of nasals in median line	Length frontal suture	Lacrimal notch to the tip of premaxillaries	Interorbital breadth	Width of palatinum between m^3	Length of mandible	Maxillary toothrow	Mandibular toothrow	Length of pedicles from caudal border of orbit	Greatest length of antlers	Distance tip to tip of antlers	Length x depth of glandular pit	Total length of body	Length of tail	Length of ear	Remarks
U.S.N.M. 151863	Pamukang Bay, S.E. Borneo	W. L. ABBOTT	20.III.08	♂	ad.	186	—	—	—	88	—	—	—	—	—	—	—	—	54	—	—	—	—	—	1000	170	—	Type of subspecies. cf. Proc. U.S. Nat. Mus. 40, p. 72 (1911)
1167	Long Petah, Upper Mahakam River, E. Borneo	MADZUD	19.IX.25	♀	2	175	163	163	187	78.5	56.5	24 5	50	69	97.5	41.5	32.5	149	57.1	65.6	—	—	—	22 x 12	1000	152	85	—
1168	id.	DENIN	27.IX.25	♀	10—11	169	156	159	182	72	56	21.5	52	71	97	37	30	145	48.8	56.5	—	—	—	19 x 10	1070	140	80	Pregnant
U.S.N.M. 154383	P. Mata Siri, S.E. Borneo	W. L. ABBOTT	?	♀	ad.	185	—	—	—	88	—	—	—	—	—	—	—	—	54	—	—	—	—	—	1006	150	—	cf. Proc. U.S. Nat. Mus. 40, p. 72 (1911)
R.M.N.H. Leiden, r.	Mt. Kenipai, W. Centr. Borneo	BÜTTIKOFER	28.I.1894	♂	11 m.	161	151	149	169	71.5	52	17.5	43.5	69.5	89.5	34	30	133 5	(54.8)	(62.2)	96.5	—	—	21 x 8	—	—	—	Spikes
R.M.N.H. Leiden, q	Rumah Manual, id.	id.	28.XII.1893	♂	12 m.	166	155	151	173	80	57.5	24	40	65.5	91.5	41.5	35.5	135	(56.5)	(67.3)	113.5	—	—	22 x 9	—	—	—	Spikes
R.M.N.H. Leiden, o.	Mt. Kenipai, id.	id.	25.I.1894	♂	7	173.5	163	159	186	83	61	24.5	48.5	72	100.5	43.5	32.6	145	51.7	62.5	86.5	123	—	24 x 11	—	—	—	Antlers 2 + 2
R.M.N.H. Leiden, n.	Rumah Manual, id.	id.	15.I.1894	♂	10	183	172	167	194	77 5	55	23	46.5	80	107.5	44.5	33	153.5	54.7	62.5	73	abn.	—	24 x 12	—	—	—	Antlers abnormal
R.M.N.H. Leiden, g.	Central Borneo	SCHWANER	1846	♂	6	186	173.5	174	198	85	57	26	58.5	73	105.5	47	34.5	154	56 6	65.1	98	—	—	26 x 15	—	—	—	Antlers shedded
Muntiacus muntjak pleiharicus (KOHLBRUGGE).																												
7498	Sonuwang, Landak, W. Borneo	J. J. MENDEN	29.VII.37	♂	9 m.	162	151	152	175	70	53	19	40.5	76	91	39	(27.5)	135	(48.0)	(52.7)	(91)	(30)	53	20 x 13	969	150	81	Spikes ,typically first set of antlers
7499	id.	id.	5.IX.37	♂	18 m.	167	157	159	180	70.5	55.5	19.5	48.5	74	95	38	28	139	55.9	66.4	(86)	(16)	—	21 x 12	998	153	79	Spikes
7496	id.	id.	31.VII.37	♂	4—5	168	157	156	180	69	54.5	22	44.5	72	94.5	37	29	140	48.6	56.2	(83)	(26)	63	20 x 13	962	160	82	Spikes, much worn
7497	Perbuwak, Landak, W. Borneo	id.	14.VIII.37	♀	5 m.	144	133	133	155	59.5	52	17	33	65	77	32	(24)	115	(40.0)	(41 6)	—	—	—	14 x ?	948	145	74	—
7494	id.	id.	1.VIII.37	♀	7	175	166	163	186	78	57	22.5	49	76	99	39	35	149	56.8	64.9	—	—	—	24 x ?	1030	158	83	—
7495	id.	id.	10.VIII.37	♀	9	177	168	171	190	79	57	21.5	53	78	103	43	34	148	54.1	60.3	—	—	—	22 x 12	1068	188	82	—
7493	Riam, Sungei Kotawaringin, S. Borneo	id.	6.XII.36	♂	9 m.	161	151	155	174	69	53	(18)	47	69	91.5	36.5	(30)	139	(48.2)	(51.7)	73	—	—	18 x 11	914	140	83	Antlers just shedded
7492	id.	id.	1.XI.36	♀	1	167	158	153	174	72	51	20.5	50	69	97	37.5	(31)	144	(56.7)	(64.8)	—	—	—	21 x 11	968	121	84	—
7491	Parit Tjampaga, Sampit, S. Borneo	id.	12.VI.35	♂	18 m.	166	155	155	176	78	51.5	21	49.5	68	95.5	39.5	32.5	143	(54.9)	(64.2)	78	20	44	22 x 12	934	143	84	Spikes
Muntiacus muntjak bancanus LYON.																												
Coll. Sody BK 85	Banka	H. J. V. SODY	?	♂	10 m.	166	151	146	171	73	51.2	20	39	69.5	90.5	37	30	—	43.7	55.3	75	—	—	20 x 7	—	—	—	First antlers newly shedded
7500	Gantung, Billiton	J. H. WESTERMANN	22.IX.39	♀	11—12	177	164	164	187	82	58	26	49	76	100.4	44	35	150	51.3	59.6	—	—	—	24 x 13	—	—	—	—

(1942) and formerly suggested by the original authors. Furthermore the specific characters, as given by MILLER, do not hold true, most of them actually being age characters. MILLER seems to have drawn his conclusions rather hastily, not even having seen the tables of measurements of eleven specimens of this race, attached to the original description. This description is excellent in every respect, in fact the best diagnosis ever given on Indo-Australian Barking-deer. If MILLER had compared these measurements with his own, he would have seen that in this species there is no sense in comparing skulls of immature animals of different ages.

Furthermore, MILLER would not have suggested (p. 165) that *M. montanus* should represent *M. pleiharicus* in Sumatra, if he had compared skins and skulls instead of only skulls. Colour and pattern of these forms differ widely. There is a resemblance between them, not in most characters mentioned by MILLER however, but in the peculiar fact that frequently only spikes are developed in both forms. I think this is merely a convergence due to external factors. I should like to make the suggestion that *M. m. muntjak* and *M. m. montanus* reached Sumatra by different ways and that their isolation has not been long enough to give rise to duplicity of species. This view would be supported by the long zone of overlapping. A thorough investigation into the exact distribution of both races and a search for intermediate specimens in the zone of contact is highly desirable.

Biology. This race is reported from heights of 2150 m (Kerintji, ROBINSON & KLOSS and BÜNNEMEYER), 2400 m (Mt. Ophir, JACOBSON) but also from lesser heights and even from the lowlands of Deli. Exact birth-dates and other notes on propagation are very scarce. Poor development of antlers was observed by LAPRÉ (in litt.).

Distribution. Sumatra, from Kerintji-region north to Atjeh and Deli. With certainty reported from Mount Ophir and Mount Indrapura. Exact distribution unknown. Overlapping the range of the other race in Western Sumatra, Deli and Kerintji-region.

Muntiacus muntjak subspec.

Muntiacus muntjak CARTER, HILL ant TATE: Mamm. Pacif. World, p. 214 (1945);
Muntiacus moschatus G. S. MILLER: Proc. Ac. Nat. Sc. Philad. 94, p. 163—164 (1942);
Muntiacus muntjak moschatus F. N. CHASEN: Bull. Raffl. Mus. 15 ,p. 203 (1940).

Description. Hardly anything is known about the form of Barking Deer inhabiting Nias I., off Sumatra's Westcoast. According to MILLER, who saw 5 frontlets with antlers from Nias I., this form appears to represent an animal that is smaller than true *M. moschatus* (= *M. m. muntjak*), a conclusion which is merely based on the small measurements of the metopic suture.

Material. Not represented in our collection.

Biology. Unknown.

Distribution. Nias I.

Muntiacus muntjak rubidus LYON.

Muntiacus rubidus LYON: Proc. U.S. Nat. Mus. 40, p. 73 (1911), Plate 1 fig. 1 & 3, Plate 2;

Muntiacus muntjak rubidus R. LYDEKKER: Cat. Ung. Mamm. B.M. 4, p. 16—17 (1915); CHASEN & BODEN KLOSS: Bull. Raffl. Mus. 6, p. 18 (1931); H. C. RAVEN: Bull. Am. Mus. N.H. 68, p. 265 (1935); F. N. CHASEN: Bull. Raffl. Mus. 15, p. 203 (1940); H. J. V. SODY: Ned. Ind. Jager 11, p. 181, 258, 264 (1941);

Muntiacus muntjac rubidus BANKS: Journ. Malay. Br. Roy. As. Soc. 9, pt. 2, p. 28—30 (1931); Sarawak Mus. Journ. 4, p. 330 (1935);

Muntiacus muntjak H. C. RAVEN: Bull. Am. Mus. N.H. 68, p. 265 (1935); CARTER, HILL & TATE: Mamm. Pacif. World, p. 147, fig. 63, p. 148, p. 197 (1945); BANKS: Bornean Mamm. p. 77 (1949);

Muntiacus muntjac HILZHEIMER & HECK: Brehms Tierleben, Säugetiere 4, p. 118 (1916); BRETON VAN GROLL: Trop. Natuur 10, p. 161—164 (1921);

Muntiacus bancanus H. C. RAVEN: Bull. Am. Mus. N.H. 68, p. 265 (1935);

Prox muntjak FITZINGER: Sitzungsber. Math.-Naturw. Cl. Ak. Wiss. Wien 68, Abt. 1, hf. 10, p. 362 (1873);

Cervus muntjac MÜLLER & SCHLEGEL: Verh. Nat. Gesch. Ned. Overz. Bezitt., Zool., p. 44—45, 225—228 (1839—1844); J. H. VAN BALEN: Album der Natuur, p. 121—122 (1906);

Cervulus muntjac V. BROOKE: P.Z.S. 1874, p. (1874); P.Z.S. 1878, p. 899 (1878); F. A. JENTINK: Mus. d'Hist. Nat. Pays-Bas 9, Cat. Ost. Mamm., p. 154 (1887); ibidem 11, Cat. Syst. Mamm., p. 183 (1892); Ch. HOSE: Mammals of Borneo, p. 66 (1893); J. H. F. KOHLBRUGGE: Natuurk. Tijdschr. N.I. 55, p. 192, Pl. II, (1896); F. A. JENTINK: Notes Leyden Museum 19, p. 63 (1897); R. LYDEKKER: Deer of all Lands, p. 206 (1898); E. L. TROUESSART: Cat. Mammalium 4, p. 871 (1898); S. S. FLOWER: P. Z.S. 1900, p. 372 (1900); R. LYDEKKER: Great and Small Game of India p, 240 (1900); E. L. TROUESSART: Cat. Mamm. Suppl., p. 693 (1904—1905); J. H. VAN BALEN: Dierenwereld Insulinde 1, p. 187 (1914).

Definition. Rather small representatives af the species. Total length of full-grown animals amounts to approximately 1070—915 mm. Colour of upper parts chestnut, more or less speckled with hazel and somewhat with black. In old animals the colour is less rich and more or less darkening in the middle of the back without forming a dorsal stripe. Bases of hair Wood-brown. Neck nearly of the same colour as back. Forehead Amber brown, darkening to Clove brown in older animals. Rest of face and base of ears dusky. Ears whitish inside. Thighs and shoulders Buffy brown, shanks more or less Olive brown, fore-limbs and hind-limbs of the same colour. Light markings at pasterns and hoofs absent. Centre of throat olive-buff, upper breast buffy brown, chest and belly varying between Olive brown and Wood brown, anal region pale olive buff, a more or less well marked stripe, down the front of thighs to hocks, pale olive buff or olive buff. Tail light Seal brown above, edges and under surface nearly white. Total length of skull aproximately 180—198 mm. Measurements are given in table 6. Pedicles and antlers small, greatest length of antlers 120—130 mm.

Fawns are spotted, the pattern is the same as described for *M. m. muntjak*. A fawn, most probably older than 2 months, still has retained a row of light spots along both sides of the spine.

Terra typica. Pamukang Bay, S. E. Borneo.

Type of subspecies. In collection U.S. National Museum Washington, ♂, skin & skull, Cat. No. 151863, Pamukang Bay, S. E. Borneo, 20.III.1908, leg. Dr W. L. ABBOTT.

Material. 5 ♂ (5 skulls, 2 skins) 2 ♀ (2 skulls, 2 skins), 2 fawns (1 skull, 2 skins).

Diagnosis. Most resembling *M. m. montanus* but lighter, face dark throughout, stripe along the front of thighs well-marked, no light

markings on lower legs. Much darker than the other Bornean race, without distinct dorsal line.

Discussion. Just as in Sumatra, one part of Borneo is inhabited by a dark, the other part by a light-coloured race, in which the dark-coloured race has spread over the mountainous parts of the island, without however avoiding part of the lowlands. As far as I can see, in some areas the boundaries between the races are clearcut by watersheds, in other areas a large zone of overlapping seems to occur. The latter, according to literature, is the case in Sarawak (BANKS, HOSE), where there seems to be a mixed population which is highly variable. When comparing the records from Sarawak with our own records from Western and Southern Borneo, where the population of *M. m. pleiharicus* is absolutely uniform, this mixed character becomes clear at once.

BANKS (1931) is mistaken in assuming that these colour differences are due to age or season, because in our beautiful series from Western and Southern Borneo there is not a trace of such differences, differences in age being slight in our Eastern-Borneo material, just as anywhere else.

Biology. A good account on the biology of Barking-deer in Sarawak was given by BANKS (1931, 1949), and will not be repeated here. Births are recorded in Sarawak in December and January (BANKS), in S. E. Borneo once in the first days of February (DOM cf. SODY 1941). A highly pregnant doe has been observed near Samarinda (E. Borneo) in June, does with a fetus of 1—2 months after conception, in August (KOOT cf. SODY 1941). A pregnant doe killed in September is present in our collection.

Different parts of young spotted fawns are in use with the native population as charms for averting misfortune. These fawns are known as "palis krahau". The same superstition occurs in some parts of Java where especially unborn fawns are highly valuated. (BRETON VAN GROLL 1921).

Distribution. Borneo, in the South only East of Kusan Mts and Meratus Mts, furthermore in East- and perhaps in the whole of North Borneo. Boundaries with the range of the other Bornean race in Central Borneo unknown. In Sarawak there seems to exist a broad zone of overlapping as also to a certain extent in the vicinity of Klumpang Bay, S. E. Borneo. Occurs also on Mata Siri I. (Laut Is., S. E. of Borneo).

Muntiacus muntjak pleiharicus (KOHLBRUGGE)

Cervulus pleiharicus J. H. F. KOHLBRUGGE: Natuurk. Tijdschr. N.I. 55, p. 192—195 (1896); E. L. TROUESSART: Cat. Mamm. 4, p. 872 (1898); Cat. Mamm. Suppl. p. 693 (1904—1905); J. H. VAN BALEN: Dierenw. Insulinde 1, p. 189 (1914);
Cervulus phaeharius (sic!) BRETON VAN GROLL: Trop. Natuur 10, p. 163 (1921);
Muntiacus pleiharicus LYON: Proc. U.S. Nat. Mus. 31, p. 583 (1906); ibidem 33, p. 550 (1907); ibidem 40, p. 71 (1911); Pl. 1 & 2; H. C. RAVEN: Bull. Am. Mus. N.H. 68, p. 265 (1935); F. N. CHASEN: Bull. Raffl. Mus. 15, p. 203 (1940);
Muntiacus muntjak pleiharicus R. LYDEKKER: Cat. Ung. Mamm. B.M. 14, p. 16 (1915).

Definition. Rather small representatives of the species. Total length amounts to approximately 1060—960 mm in full-grown animals. Colour of upper side between Ochraceous-tawny and Ochraceous. A broad dark dorsal stripe, between black and Carob brown, which narrows

on the nape and is very conspicuous there. Forehead of the same colour as dorsal stripe, face dusky. Cheeks, bases of pedicles and ears Ochraceous-tawny. Ears outside of the same colour as forehead, inside nearly white. Dorsal side of tail Mars-brown, fringe and underside white. Groins and pubic region white. Breast and belly Ochraceous-tawny, legs tawny with a little blackish marking at the hocks. A broad white line at the front of the thigh. Chin and throat light buff or white. Pasterns and hoofs faintly marked with blackish brown, hardly any white markings at the legs.

Total length of skull 190—180 mm in full-grown animals. Measurements are given in table 6. Antlers and pedicles thin and poor. I am not sure whether there is ever anything more developed than a spike in this race and this has even been used as a typical character in the original description. A typical skull has been figured by LYON (1911).

Terra typica. South Borneo. The type has been bought by KOHLBRUGGE at Pleihari, but as this locality is at the foot of the watershed dividing the areas of both Bornean races, I am not sure *M. m. pleiharicus* really occurs at Pleihari. The possibility remains that there is some overlapping of the areas of both races in that region, as LYON (1911) recorded both *M. rubidus* and *M. pleiharicus* from Pamukang Bay! Anyway, the material KOHLBRUGGE himself collected in the neighbourhood of Pleihari can only be considered *M. m. rubidus*. So in future it seems best to substitute the type locality a more reliable one, which can only be done after a thorough investigation of the distributional areas.

Type of subspecies. R. M. N. H. Leiden, Coll. KOHLBRUGGE, skin and skull, ♂, bought at Pleihari, Dec. 1894. The frontlet and antlers of the type are figured on a plate facing p. 260, Natuurk. Tijdschr. N. I. 55, 1896.

Material. 5 ♂ (5 skins, 5 skulls), 4 ♀ (4 skins, 4 skulls), including the type.

Diagnosis. Distinguished from all other races in our region by very light colour and distinct dark dorsal stripe.

Biology. No dates on propagation of this race are available. As I mentioned before, I am not sure that anything more than spikes are ever developed in this race. As becomes clear from a young buck in our collection, even here the first antlers are not retained for the whole of life, but may be shed occasionally. According to the young animals in our collection most fawns are born during the last and the first months of the year.

Distribution. S. W. and S. Borneo. A broad zone of overlapping with *M. m. rubidus* seems to exist in Sarawak. In S. E. Borneo Kusan Mts and Meratus Mts obviously form a more or less clear-cut separation between the range of either Bornean race. However, overlapping seems to occur here also in the vicinitiy of Klumpang Bay and Pamukang Bay.

Muntiacus muntjak bancanus LYON

Muntiacus bancanus LYON: Proc. U.S. Nat. Mus. 31, p. 582 (1906); ibidem 40, p. 72 (1911); H. C. RAVEN: Bull. Am. Mus. N.H. 68, p. 265 (1935);
Muntiacus muntjak bancanus LYDEKKER: Cat. Ung. Mamm. B.M. 4, p. 15 (1915); H. J. V. SODY: Temminckia 2, p. 245 (1937); F. N. CHASEN: Bull. Raffl. Mus. 15, p. 203 (1940);

Muntiacus muntjac HILZHEIMER & HECK: Brehm's Tierleben, Säugetiere 4, p. 118 (1916);
Muntiacus vaginalis BLEEKER: Natuurk. Tijdschr. N.I. 2, p. 527 (1851);
Muntjacus vaginalis GRAY: Zool. Voy. Samarang p. 27 (1850);
Prox muntjak FITZINGER: Sitzungsber. Math.-Naturw. Cl. Ak. Wiss. Wien 68, 1, hf. 10, p. 362 (1873);
Cervus muntjak HORSFIELD: Zool. Res. (1824); WAGNER: Die Säugeth., Suppl. 5, p. 388 (1856); MOHNIKE: Blicke Pfl. & Thierl. Niederl. Malaienl., p. 424 (1883);
Cervus muntjac S. MÜLLER: Verh. Nat. Gesch. Ned. Overz. Bezitt., Zool., p. 62 (1839); MÜLLER & SCHLEGEL: ibidem, p. 213 (1839—1844); TEMMINCK: Coup d'oeil gén. poss. neérl. Inde-arch. 2, p. 119 (1847); MOHNIKE: Banka & Palembang, nebst Mitt. Sum., p. 54 (1874); VON MARTENS: Preuss. Exp. Ost-Asien 2, Zool., p. 258 (1876);
Cervulus muntjac V. BROOKE: P.Z.S. 1874, p. 39 (1874); P.Z.S. 1878, p. 899 (1878); F. A. JENTINCK: Notes Leyden Mus. 13, p. 207, p. 209 (1891); TROUESSART: Cat. Mamm. 4, p. 871 (1898); TJEENK WILLINK: Natuurk. Tijdschr. N.I. 65, p. 189 (1905); J. H. VAN BALEN: Dierenwereld Insulinde 1, p. 187 (1914);
Muntiacus spec. CARTER, HILL & TATE: Mamm. Pacif. World, p. 194, p. 195 (1945);
———— TOENGALA MOSA: Ned. Ind. Jager 7, p. 183 (1937).

Definition. One of the smaller representatives of the species. External measurements unknown. Colour presumably as in the nominate race. Total length of skull 190 mm or less. Measurements are given in table 6. Development of antlers unknown.

Terra typica. Banka I.

Type of subspecies. In U. S. National Museum, Washington; ♀ ad., skin & skull, Cat. No. 124726, Tdj. Bedaan, Banka I., 7.VI.1904, leg. Dr W. L. ABBOTT.

Diagnosis. Presumably nearest to true *M. m. muntjak*, but smaller.

Material. 1 ♀ (skull & incomplete skeleton), 1 ♂ imm. (skull).

Discussion. I have never seen a skin of the form inhabiting Banka and Billiton Is., but according to the descriptions given by LYON and LYDEKKER I do not think there is much difference in colour between true *M. m. muntjak* and this form. The only doe in our collection, a very old animal, is so small that I think it cannot be united with *M. m. muntjak*. On the other hand, the dark colour of the nape, described by the authors cited above in my opinion excludes the possibility that this race could be united with one of the other small races occurring in our area, this type of colouration being typically developed only in *M. m. muntjak* and *M. m. nainggolani*. Combination with the latter race is to be excluded a priori.

Biology. Nothing is known about the biology if this form.

Distribution. Banka I., Billiton I.

Muntiacus muntjak robinsoni (LYDEKKER).

Muntiacus muntjak robinsoni LYDEKKER: Cat. Ung. Mamm. B.M. 4, p. 18 (1915); F. N. CHASEN: Bull. Raffl. Museum 15, p. 203 (1940);
Muntiacus muntjak peninsulae H. C. RAVEN: Bull. Am. Mus. N.H. 68, p. 265 (1935);
Muntiacus muntjak subsp. incert. F. N. CHASEN: Bull. Raffl. Mus. 15, p. 203 (1940);
Muntiacus CARTER, HILL & TATE: Mamm. Pacif. World, p. 218 (1945).

Definition. A small form, described on skull-measurements and coloration of the head.

Terra typica. Bintang I., Riouw Arch.

Type of subspecies. ♂, skull with antlers and skin, Bintang

I., Riouw Arch., leg. H. C. ROBINSON, in coll. British Museum, Nr. 9. 4. 1. 505.

Material. No material in our collection.

Discussion. For the moment being, all Barking-deer from the Riouw and Lingga Archipelago are tentatively united in this poorly characterised form. According to CHASEN (1940) perhaps the animals from the Lingga Arch. are different from those of the Riouw Is. These island-populations are mentioned here only for the sake of completeness, a thorough investigation of their affinities and subspecific status being badly wanted.

Distribution. Riouw Arch. (Bintang I) perhaps also Lingga Arch.

II. REVISION OF THE GENUS *ARCTOGALIDIA* IN THE INDO-AUSTRALIAN ARCHIPELAGO.

Introduction: The genus *Arctogalidia* is mostly only rarely represented in Museum-collections. Obviously this is due to the peculiar habits of these animals, which are arboreal, nocturnal and, except for the population of small islands with no or little maiden-forest, typical forest dwellers. The same holds for some other *Viverridae* which perhaps are not very rare in reality, but are only seldom observed due to their hidden way of life.

Many revisions on *Viverridae* were published during the nineteenth century, in which the genus *Arctogalidia* was treated in different ways. In the last century most systematic work on the genus has been done by MILLER and LYON and an excellent revision has been written by POCOCK (1933).

During the preparation of a new card-index of the Mammal collection of the Museum Zoölogicum at Bogor (Indonesia), my attention was drawn to the fact that the beautiful series of *Arctogalidia* from Java did not fit into POCOCK's revision. I reviewed all material at my disposal at that time and soon it became clear to me that unexpected difficulties would arise if the old material from the collection of the Rijksmuseum N.H. Leiden could not be compared with the fresh series in Bogor. After my return to the Netherlands I was able to make a careful examination of all material in Holland, not only of that from the collections at Leiden, but also of the splendid series in the BARTELS collection, of the private collection of Mr SODY and of the material in the Zoölogical Museum, Amsterdam. All material from the Bogor Museum followed me down to Holland, and the material in the RAFFLES Museum Singapore was put at my disposal. Some valuable specimens were sent in loan by the British Museum N.H., London and the Senckenberg Museum, Frankfurt a/Main. The material present in the Musea from the U.S.A. excepted, nearly everything available came to my hands in this way.

My most sincere thanks are due to Prof. Dr H. ENGEL, Dr G. KRUSEMAN (Amsterdam), Prof. Dr H. BOSCHMA, Dr G. C. A. JUNGE (Leiden), Mr. E. BARTELS (Aruba), Mr C. A. GIBSON HILL (Singapore), Mr H. J. V. SODY (Amsterdam), Dr J. STEINBACHER (Frankfurt a/M), Mr T. S. C. MORRISON SCOTT (London) and last but not least to Dr M. A. LIEFTINCK (Bogor) for the way in which these gentlemen have given their support in different respects.

Genus *Arctogalidia* MERRIAM.

Arctogalidia MERRIAM: Science 5, p. 302 (1887); POCOCK, R. I.: P.Z.S. 1915, p. 390—412 (1915); id. P.Z.S. 1933, p. 977—978 (1933); id. Fauna British India, Mammalia, 1, 2e ed., p. 441—450; TATE, G. H. H.: Mammals Eastern Asia, p. 180 (1947).
Arctogale GRAY: P.Z.S. 1864, p. 542 (1864) — Nec *Arctogale* KAUPP, 1829! —.

Arctogalidia was recognized as a separate genus for the first time by GRAY (1864). The genus has been considered to represent a separate subfamily by POCOCK (1933), followed by TATE (1947) in this respect.

Definition. Slender, short-legged, arboricole *Viverridae* with a long tail.

Pattern, when present, at most composed of three dark dorsal stripes, often a median light streak on the nose. Alternating light and dark rings on tail absent or hardly visible.

Perfume gland absent in the male, the long perineal area between the prepuce and the scrotum being continuously hairy. Perfume gland in the female in front of the vulva and clitoris, represented externally by two low ridges of naked skin, capable of being folded over in front of the generative orifice and continuous behind on each side with the naked skin surrounding it.

Toes 5—5. Feet with the pads of third and fourth digits of hindfoot unfused, carpal pads of the forefoot relatively long and narrow, surface of all the pads smooth, not granular or papillate, area between the digital and plantar pads quite hairless.

Nose compressed, flat, and with a central groove underneath. Whiskers long and slender.

Ear with posterior flap of bursa continuous above with the rim of the pinna.

Skull elongate, braincase rather wide, more or less narrowed in front, and subcylindrical. Forehead broad, angular behind and extending beyond the back-edge of the orbits. The orbits nearly complete behind in old specimens, the postorbital processes being very long, and a well marked angle present on the upper edge of the zygomatic arch. Palate markedly convex between pm4 and m1 of each side, the mesopterygoid fossa long and roofed in its anterior half by a prolongation of the palate. The tympanic fusing early with the bulla. Teeth small.

Sex differences in shape of skull rather pronounced, those of females always being broader in the waist than those of males of nearly the same age (fig. 1 & 2). Age-differences in shape of skull marked by a more pronounced constriction in old specimens.

Type of the genus: *Paradoxurus trivirgatus* GRAY (1832).

Diagnosis: Distinguished from *Paradoxurus* by pattern, build of feet, wider waist of skull, longer postorbital processes, convex palate, long and roofed mesopterygoid fossa, fusing of tympanic and bulla, and much smaller teeth.

Distinguished from *Prionodon* by the presence of a perfume gland in the female, from all other oriental genera of *Viverridae* by the absence of a perfume gland in the male.

Discussion: *Arctogalidia* should be considered a genus with several primitive characters. In some respects it approaches the African genus *Nandinia* and the genus *Fossa* from Madagascar. It is strongly adapted to arboreal life.

Distribution: Assam, Chindwin region, Lower Burma, Tenasserim, Siam, Laos, Tonkin, Indo-China, Peninsular Siam, Malay Peninsula and adjacent islands, Sumatra, islands off the east and south-east coast of Sumatra, Riouw Archipelago, Lingga Archipelago, Banka, Billiton, North Natuna Islands, Borneo and Java.

Arctogalidia trivirgata (GRAY).

Paradoxurus trivirgatus GRAY: P.Z.S. 1832, p. 68 (1832);
Arctogale trivirgata GRAY: P.Z.S. 1864, p. 543 (1864).

The genus *Arctogalidia* is represented by one single species. POCOCK (1933) provisionally admitted two species, but later (1939) he united both into a single one. In my opinion the species consists of at least two greges [1]) and one gregal form.[1]) The western part of the distributional range is occupied by the grex *Arctogalidia trivirgata leucotis* spreading to the south as far as Terutau I. and Langkawi I. (cf. POCOCK 1933). The rest of the range on the East-Asiatic mainland is occupied by the grex *Arctogalidia trivirgata trivirgata* spreading to the east over a large part of western Indonesia. *Arctogalidia trivirgata trilineata* WAGNER (= *trivirgata* auct.) from Java should be considered as a gregal form with more affinity to the western than to the eastern grex of the species.

Definition. Conform the genus.

Terra typica: Malacca.

Type of the species: Formerly in the collection of the British Museum, London (?).

Discussion. The species has been described by GRAY (1832). GRAY designated the type as "*Viverra trivirgata* REINW. Mus. Ley." and added: "This species is described from a specimen in the Leyden Museum sent from the Moluccas".

TEMMINCK (Monogr. Mamm. II, 1835—1841, p. 333—336) shortly afterward discussed the material in the Leyden Museum. This author designated as type of the species „un sujet déposé jadis sous ce nom (*Paradoxurus trivirgatus*!) au Musée des Pays-Bas, dont M. GRAY a fait *Viverra trivirgata*".

The species was described by J. E. GRAY under the new generic name *Arctogale* in P.Z.S. 1864, p. 543. Over this description stands: "B.M. type". The distributional range is recorded as: "Java, Sumatra (TEMMINCK), Malacca (FINLAYSON) and Tenasserim (BLYTH)".

However, in the collection of the Rijksmuseum Leiden a specimen is present that, according to the label, has been collected by REINWARDT in the year 1821, with the indication: "captus prope Buitenzorg". This specimen has been designated by JENTINK as "type de l'espèce" (Mus. d'Hist. Nat. Pays-Bas, Cat. Ostéol. Mamm. 9, p. 95, 1887 and ibidem Cat. Syst. Mamm. 11, p. 117, 1892). This specimen has been examined

[1]) Definitions of the terms used here are to be found in: L. J. TOXOPEUS. De soort als functie van plaats en tijd, p. 41—44, Thesis Amsterdam (1930); VAN BEMMEL, Treubia 19, p. 326—327 (1948).

carefully by me and I could establish that it certainly did not come from Java. Furthermore REINWARDT was not in Java during the year 1821 but on a voyage through the eastern part of the Indo-Australian Archipelago. I considered the possibility of this being the reason that GRAY in his first description recorded the type locality as "Moluccas" but the original label does not point in this direction. Anyway, the species certainly does not occur in the Moluccan Is.

The original description by GRAY applies very well to the specimen in Leiden. Nevertheless there remains some doubt as to this specimen being really the type of GRAY's description, considering TEMMINCK (l.c. 1835—1841) described the specimen in question but designated a mysterious other specimen as type. More doubt is justified by the indication by GRAY (l.c. 1864).

In the year 1843, GRAY discussed four specimens in the collections of the British Museum (List Mamm. Br. Mus. p. 55, 1843), viz. two from Malacca and two from Singapore, under the name *Paguma trivirgata*. Commenting on this discussion, POCOCK (P.Z.S. 1933, II, p. 984—990) remarked that the author himself considered the animals from Malacca typical for the species. Therefore POCOCK designated "Malacca" as type locality. However, POCOCK is mistaken in assuming that the record "Moluccas" by GRAY could be due to the possibility of misreading "Moluccas" for "Malacca" from the label of the specimen in Leiden (vide Fauna British India, Mamm. 1, 2e ed., 1939 p. 443, note). If the Leiden specimen really is the type, this is utterly impossible. If there ever was another type in London, it does not seem to be present any longer.

In any case, the type described by GRAY did not come from Java because the description does not apply to Javanese material. The designation by JENTINK (l.c. 1887) and CHASEN (Bull. Raffles Museum 15, 1940, p. 100) certainly is incorrect. Therefore I want to follow POCOCK (l.c. 1933) and propose to fix "Malacca" as type locality. This solution seems to be plausible as the original description applies to material from Malacca, even the doubtful specimen in the Leiden collection being easily fitted into the beautiful series from the Malay Peninsula at my disposal, and as the original author recognized material from Malacca as typical for the species described by himself.

Distribution: As in the genus.

KEY TO THE GREGES IN THE GENUS *ARCTOGALIDIA*.

1. Apical half of outer ear densely clothed with dark hair, the skin similarly pigmented ..... Grex. *A. t. trivirgata*.
   Apical half of outer ear sparsely clothed with light hair, the skin beneath being wholly or partly pink and pigmentless 2

2. No light markings on tail, ears mostly bicoloured, streak on the nose mostly present ..... Grex *A. t. leucotis*.
   Light markings on tail mostly present, ears always unicoloured, streak on nose always absent ..... Gregal form *A. t. trilineata*.

GREX I.

Arctogalidia trivirgata grex *leucotis* (HORSFIELD)

Paradoxurus leucotis HORSFIELD: Cat. Mamm. E.I. Comp. p. 66 (1851).

Definition. The upper half of the outer surface of ear sparsely clothed with light hair, the skin underneath being wholly or partly pink and pigmentless. The proximal half of the outer surface of ear covered with dark hair, the skin underneath being pigmented except in the subspecies *A.t.* (*leucotis*) *macra* MILLER where the ears are (sometimes ?) uniformly pink and pigmentless.

Streak on the nose mostly present. No light markings on the tail. Coat dense and short, the race *A.t.* (*leucotis*) *millsi* WROUGHTON excepted.

Material: 3 ♂♂ (3 skins, 1 skull) from Siam, 1 ♀ (skin and skull) from Terutau I.

Distribution. The subspecies *A.t.* (*leucotis*) *millsi* WROUGHTON occurs in Assam, Laos and Tonkin (no specimens examined by me), the nominal race occurs in southern Burma, Arakan, western Siam, the Amherst district of Tenasserim, southward through that province, part of the Mergui Archipelago. The race *A.t.* (*leucotis*) *macra* MILLER occurs on Domel I., Mergui Archipelago, Langkawi and Terutau (cf. POCOCK: P.Z.S. 1933, p. 978—983).

Note: The subspecies belonging to this grex will not be described here, the grex as a whole being extralimital from the range treated in this revision.

GREX II.

Arctogalidia trivirgata grex *trivirgata* (GRAY)

Paradoxurus trivirgatus GRAY: P.Z.S. 1832, p. 68 (1832).

Definition: Outer surface of ear densely clothed with dark hair, the skin similarly pigmented. Streak on the nose mostly present but often vanishing at old age.

No light markings on the tail, but in some races alternating lighter and darker rings are vaguely visible in a few specimens.

Coat dense and short.

Material: See under subspecific headings.

Distribution: Peninsular Siam, Malay Peninsula and adjacent islands, Sumatra and islands off the east and southeast coast of Sumatra, Riouw Archipelago, Lingga Archipelago, Banka, Billiton, North Natuna Is., Borneo.

KEY TO THE SUBSPECIES OF THE GREX *ARCTOGALIDIA T. TRIVIRGATA.*

1) Greatest length of skull more than 110 mm. in full grown animals ... 2
   Greatest length of skull less than 110 mm. in full grown animals ... 4
2) Sides of neck strongly contrasting with colour of nape and back ... 3

Sides of neck hardly contrasting with colour of nape and back .... *A.t. stigmatica.*

3) General coloration silvery ..... *A.t. sumatrana.*
   General coloration buffy ..... *A.t. trivirgata.*
4) Heavily grizzled on top of head 5
   Slightly or not at all grizzled on top of head 6
5) Coat rather long, grizzling of head continued by light streak on the nose ..... *A.t. inornata.*
   Coat rather short, grizzling on top of head separated by a dark area from streak on the nose ..... *A.t. simplex.*
6) Not grizzled on top of head, tail dark throughout ..... *A.t. minor.*
   Slightly grizzled on top of head, proximal third part of tail grizzled ... . *A.t. fusca.*

Arctogalidia trivirgata (trivirgata) trivirgata (GRAY).

Paradoxurus trivirgatus GRAY: P.Z.S. 1832, p. 68 (1832);
Arctogale trivirgata GRAY: P.Z.S. 1864, p. 543 (1864).[1])

Definition: Large, coat rather short, woolly and thickly set. Underhair mostly somewhat shorter than upper hair.

Pattern consisting of three well-defined longitudinal dorsal stripes. Upper side of head darker than groundcolour of back, mostly slightly grizzled on the brow, the grizzling being more conspicuous in young animals and fading away with age. Light streak on the nose broad, not very conspicuous, even in young animals.

Feet and tail of the same colour as the head, but proximal part of both feet and tail mostly clearly grizzled. Tail in most cases with obsolete traces of lighter and darker rings. Throat and belly lighter than back, sides of neck in most cases contrasting with colour of upper side.

No difference in colour between the sexes, colour hardly varying with age, young animals with a more clearly pronounced pattern and more grizzling.

Groundcolour of back varying from Natal-brown or Olive-brown to Bone-brown or Clove-brown. Dorsal stripes varying between Clove-brown, Fuscous-black and Chaetura-black. Tail between Clove-brown and Fuscous-black, feet Bone-brown, sometimes darkening to Clove-brown or Fuscous-black. Upper parts of head Bone-brown or Clove-brown, often with grizzling between Dark Olive-buff and Buffy-brown. Throat and belly varying between Olive-buff. Dark Olive-buff and Deep Olive-buff, the belly sometimes darkening to Buffy-brown. Grizzling of upper side mostly between Olive-buff and Deep Olive-buff, sometimes in young animals Pale Olive-buff.

Skull long, constriction of waist quite well pronounced. Greatest length of skull measured by the author: 115.6 mm., but it seems the greatest length of the skull may amount to more than 120 mm. in very large animals. Measurements in table 7.

[1]) Bibliographical references are not given here, because the subspecies is extralimital from the range treated in the present study. The subspecies from the Malay Peninsula has only been inserted for the sake of comparison with the forms occurring in the Indo-Australian Archipelago.

Terra typica: As in the species.

Type of subspecies: As in the species.

Material examined: 7 ♂♂ (6 skins, 1 mounted specimen, 7 skulls), 4 ♀♀ (4 skins, 4 skulls).

Diagnosis: Very closely resembling *A.t. stigmatica* but somewhat larger, skull somewhat less constricted in the waist, dorsal stripes in most cases much more pronounced, light sides of neck conspiciously contrasting with upper parts of body.

Distinguished from *A.t. sumatrana* by larger size, less gray, less silvery, more brownish-buff coloration, light streak on the nose broader and less conspicuous.

Larger than animals from Banka and Billiton Is. Colour often resembling that of *A.t. minor* but grizzling more buffy, pattern of tail mostly very clearly developed, the tail being unicoloured in *A.t. minor*.

To be distinguished from animals from Riouw Is. and Lingga Is. by larger size, much more pronounced pattern of back, and less grizzling, especially on the head.

To be distinguished from *A.t. inornata* by larger size, much more pronounced pattern of back, much less grizzling, especially on head and limbs.

Distribution: Southern portion of the Malay Peninsula, including Singapore I.

Note: The question whether *A. t. major* MILLER has to be kept separated from this race will have to be left unsettled here. I have not seen sufficient material from Peninsular Siam and anyway the animals of that region are extralimital from the range treated in the present study. A discussion on the status of *A. t. major* has been given by POCOCK (P.Z.S. 1933, p. 983—984).

Arctogalidia trivirgata (trivirgata) sumatrana LYON.

Arctogalidia sumatrana LYON: Proc. U. S. Nat. Museum 34, p. 653 (1908); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);
Arctogalidia trivirgata sumatrana CHASEN, F. N.: Bull. Raffles Mus. 15, p. 101 (1940);
Arctogalidia trivirgata trivirgata POCOCK, R. I.: P.Z.S. 1933, 2, p. 984—990 (1933);
Arctogale trivirgata GRAY, J. E.: P.Z.S. 1864, p. 543 (1864); St. GEORGE MIVART: P.Z.S. 1882, p. 163—165 (1882);
Arctogale leucotis BLANFORD, W. T.: P.Z.S. 1885, p. 789—790, (1885); LYDEKKER, R.: Handb. Carniv. I, Lloyds Nat. Hist., p. 230—231 (1896); RAVEN, H C.: Bull. Am. Mus. N.H. 68 p. 258 (1935);
Arctogale stigmatica JENTINK, F. A.: Mus. d'Hist. Nat. Pays Bas, Cat. Ostéol. Mamm. 9, p. 96 (1887); ibidem: Cat. Syst. Mamm. 11, p. 117 (1892);
Paradoxurus stigmaticus JENTINK, F. A.: Notes Leyden Mus. 7, p. 35—36 (1885).

Definition: Medium sized. Coat rather short, woolly. Underhair and upperhair of almost the same length. Coat thickly set.

Pattern consisting of three dorsal stripes, mostly more or less inconspicuous, sometimes even lacking altogether. The dorsal stripes are most

strongly pronouced in young animals, fading away at old age. The central dorsal stripe is retained longest, especially in middle part of the back. Upper side of head much darker than groundcolour of the back, sometimes more or less grizzled on the brow. A very pronounced, shiningly silver streak on the nose which may be somewhat reduced in a few aged specimens. Feet and tail of the same colour as the head. Tail unicoloured, sometimes more or less grizzled proximally. Throat and belly much lighter than back, sides of neck of same colour as belly and strongly contrasting with colour of upper side.

No difference in colour between the sexes, colour hardly varying according to age, only the pattern varying in so far that the dorsal stripes and the light streak on the nose are much less pronounced in old animals.

Groundcolour of back Fuscous, changing caudally to Natalbrown. Dorsal stripes, if present, between Chaetura-drab and Chaetura-black. If the dorsal stripes are lacking, the central part of the back is more or less heavily clouded with a colour varying between Chaetura-drab and Chaetura-black. Tail, feet and upper parts of head between Clove-brown and Chaetura-black. Upper side with heavy grizzling of Smoke-gray. Throat and sides of neck Light Grayish Olive, belly between Pale Smoke Gray and Light Grayish Olive.

Skull long, constriction of waist rather pronounced. Greatest length of skull up to 112.9 (LYON). Measurements in table 8.

Terra typica: Makapan, East Sumatra.

Type of subspecies: ad. ♂, skin & skull, Cat. Nr. 144120, U.S. Nat. Mus. Washington, Makapan, E. Sumatra, 19.II.1907, leg. Dr W. ABBOTT, orig. nr. 5054.

Material examined: 3 ♂♂ (3 skins, 1 skeleton), 7 ♀♀ (7 skins, 6 skulls), 1 sex inc. (1 skull).

Diagnosis: Much like *A. t. stigmatica* from Borneo, but less brown, more silvery, and with a more heavy grizzling on back. Light sides of neck much more strongly contrasting with colour of upper back. Light streak on the nose more pronounced than in *A. t. stigmatica*. Somewhat smaller than *A. t. trivirgata* from the Malay Peninsula, more silvery, more grayish, less brownish-buffy, as a rule sides of neck more strongly contrasting with colour of upper side than in animals from the Malay Peninsula and less buffy. Whitish streak on the nose more pronounced than in *A. t. trivirgata*, the streak in *A. t. trivirgata* often being ill-defined or obsolete in old animals. Larger than animals from Banka, Billiton and Natuna Is. Much more silvery and less buffy, with less grizzling on head than both Riouw- and Natuna-animals. Much lighter than Banka-animals.

Discussion: The subspecies *A. t. sumatrana* has been united with *A. t. trivirgata* by POCOCK (1933). Comparison with a beautiful series of ten specimens from the Malay Penins. in the collection of the Raffles Museum, Singapore, clearly showed colour differences and slight differences in measurements to be present.

Distribution: Sumatra, Batu Is. (P. Pinie).

Arctogalidia trivirgata (trivirgata) stigmatica (TEMMINCK)

Paradoxurus stigmaticus TEMMINCK, C. J.: Esquisses Zool. Côte de Guiné, Mamm., p. 121 (1853); GRAY, J. E.: P.Z.S. 1864, p. 543 (1864);
Arctogalidia stigmatica MILLER, G. S.: Proc. Wash. Ac. Sci. 3, p. 131 (1901); LYON, M. W.: Proc. U. S. Nat. Mus. 33, p. 559 (1907); ibidem 34, p. 653 (1908); ibidem 40, p. 116, 117 (1911); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);
Arctogalidia trivirgata stigmatica POCOCK, R. I.: P.Z.S. 1933, 2, p. 996—999 (1933); CHASEN, F. N.: Treubia 15, p. 3 (1935); Bull. Raffl. Mus. 15, p. 100 (1940);
Arctogalidia trivirgata BANKS, E.: Bornean Mammals, p. 46, fig. 20 (1949);
Arctogalidia bicolor MILLER, G. S.: Smiths. Misc. Coll. nr. 21, 61, p. 7 (1913); RAVEN, H. C.: Bull. Am. Mus N.H. 68, p. 259 (1935);
Arctogale stigmatica JENTINCK, F. A.: Mus. d'Hist. Nat. Pays Bas, Cat. Syst. Mamm. 11, p. 117 (1892);
Arctogale leucotis BLANFORD, W. T.: P.Z.S. 1885, p. 789—790 (1885); HOSE, Ch.: Mammals of Borneo, p. 22 (1893); LYDEKKER, R.: Handb. Carniv. Lloyds Nat. Hist. p. 230—231 (1896); BANKS, E.: Journ. Mal. Br. R. As. Soc. 9, pt. 2, p. 70—71 (1931); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 258 (1935).

D e f i n i t i o n: Rather large, coat rather short, woolly, thickly set. Underhair and upperhair of almost the same length.

Pattern consisting of three more or less obsolete dorsal stripes which in most cases are lacking altogether, even in young animals. The dorsal stripes, if present, restricted to the central part of the back. Only twice I saw specimens with dorsal stripes continued on the caudal part of back.

Upper side of head much darker than groundcolour of back, sometimes slightly grizzled on the brow. A narrow, shiningly silver streak on the nose, fading and often hardly visible in old animals.

Feet and tail of same colour as head. Tail unicoloured, sometimes grizzled proximally. Throat and belly lighter than back, sides of neck of same colour as back and hardly contrasting with colour of upper side.

No difference in colour between the sexes, colour darkening with age, the pattern varying with age in that the light streak on the nose becomes more or less obsolete in old animals.

Groundcolour of back Fuscous, darkening to Natal-brown, Buffy-brown or Army-brown with age. Dorsal stripes, if present, Bone-brown or Fuscous-black. If dorsal stripes are lacking the colour of back is very uniform. Tail Chaetura-black, Natal-brown or Bone-brown. Feet Natal-brown or Bone-brown. Upper parts of head Fuscous-black to Bone-brown. Throat and belly varying from Deep Olive-buff to Pale Olive-buff or Wood-brown with heavy Olive-buff grizzling. Upper side with a rather slight grizzling of Drab-gray, Cartridge-buff or Olive-buff.

Skull long, constriction of waist very much pronounced. Greatest length of skull measured by the author 111.4, but perhaps a little more in very large animals. Measurements in table 9.

T e r r a t y p i c a: Duson River, basin of Barito River, South Central Borneo.

T y p e o f s u b s p e c i e s: ♂ ad., mounted skin, nr. a, Rijksmuseum N. H. Leiden, Duson River, Borneo, undated, leg. SCHWANER.

M a t e r i a l e x a m i n e d: 7 ♂♂ (6 skulls, 5 skins, 2 mounted specimens, including the type), 6 ♀♀ (6 skulls, 5 skins, 1 mounted specimen).

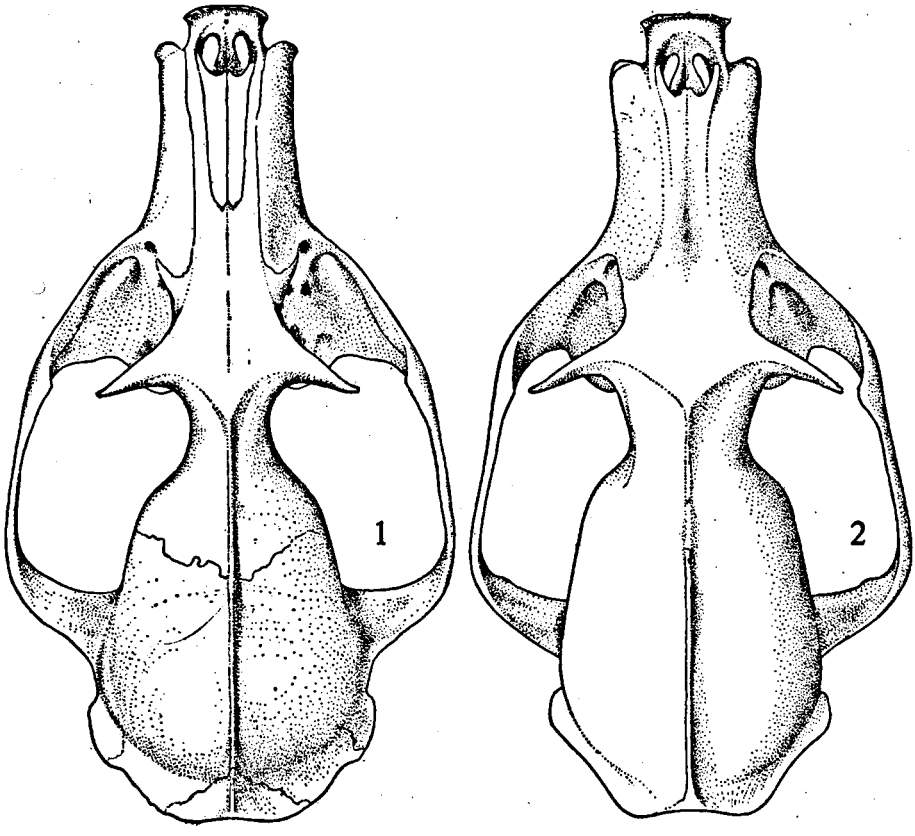

Fig. 1. *Arctogalidia trivirgata (trivirgata) stigmatica* (TEMMINCK).
1) Skull of adult male, collected at Sonuwang, Landak, W. Borneo. (Cat. Nr. 1318 Zoöl. Museum Amsterdam).
2) Skull of old female, from the same locality. (Cat. Nr. 1319 Zoöl. Museum Amsterdam). The remarkable sexual difference in shape of braincase should be noted (compare fig. 2, p. 40).

Diagnosis: Very closely related to *A. t. trivirgata* from the Malay Peninsula but somewhat smaller, skull somewhat more constricted in the waist, dorsal stripes, mostly being well-pronounced in *A. t. trivirgata,* often obsolete or absent, sides of neck not conspicuously contrasting with colour of upper side.

To be distinguished from *A.t. sumatrana* by less gray, less silvery, more brownish general coloration, sides of neck not conspicuously contrasting with colour of upper side, light streak on the nose less pronounced. Skull always more constricted in the waist than in *A.t. sumatrana.*

Decidedly larger than animals from Banka and Billiton Is.

Darker and with less grizzling on body than animals from Natuna Is. The head in *A.t. stigmatica* mostly without any grizzling, that of *A.t. inornata* being always heavily grizzled. No yellowish hue as in *A.t. inornata.*

Darker and with less grizzling than animals of the Riouw Arch. and

Table 7. *Arctogalidia trivirgata (trivirgata) trivirgata* (GRAY)

Cat. Nr.	Collection	Collector	Locality	Sex	Date	Greatest length of skull	Condylo-basal length from oral border of foramen magnum to tip of premaxillaries	Maxillary width	Zygomatic width	Mastoid width	Interorbital width	Postorbital constriction	Mandibular length	p m⁴	M₁.	Head, body & tail	Tail	Ear	Hindfoot	Remarks
1	RAFFLES Mus. Singapore	HAGERDON, C.	Singapore I.	♂ juv.	23.XI.1922	86.2	76.0	15.5	41.7	31.5	14.3	19.9	60.8	—	—	813	438	37	65	Milkdentition
31	id.	Surv. Vert. Mal. Penins.	Rawang, Selangor.	♂ juv.	14.VIII.1914	85.5	76.9	14.6	45.0	31.7	15.2	17.6	61.4	—	—	823	478	41	72	Milkdentition
b.	R. Mus. N.H. Leiden	(REINWARDT)?	"Java" = Malay Penins.	♂	1821	103.5	95.0	16.2	57.5	36.4	17.6	18.0	74.6	5.6	7.3	—	—	—	—	Type of species?
38	RAFFLES Mus. Singapore	?	Pasir Panjang Negri Sembilan	♂	10.XII.1932	106.4	99.2	19.3	56.1	37.0	18.4	19.7	75.8	4.4	7.5	1157	642	44	95	
104/14	id.	Surv. Vert. Mal. Penins.	Pelarit	♂	11.XI.1911	106.4	99.9	18.7	45.8	39.2	19.1	14.2	78.0	4.7	7.2	1095	595	43	89	
105/14	id.	id.	Selangor	♂	27.XII.1913	115.5	107.9	19.9	73.3	41.5	19 9	17.3	86.2	4.3	6.7	1090	586	45	91	Very old male.
85/14	id.	ex Selangor Museum	Rawang, Selangor.	♂	6.VIII.1914	115.6	105.5	21.4	69.6	40.9	21.8	17.9	85.8	4.3	7.2	1169	665	43	114	Very old male.
4 A	id.	SEIMUND, E.	Pasir Panjang Negri Sembilan	♀	14.X.1938	101.9	94.6	17.5	52.1	37.0	16.0	16.8	74.4	6.0	7.8	1097	599	41	88	
106/14	id.	id.	Taiping, Perak	♀	?	102.1	94.3	16.1	49.5	34.2	17.7	20.6	72.5	5.3	6.4	—	—	—	—	
X	id.	?	Pasir Panjang Negri Sembilan	♀	22.IV.1940	108.2	101.2	18.4	55.0	40.7	17.4	16.6	79.8	4.4	7.0	1165	665	45	88	
—	id.	HAGERDON, C.	Singapore I.	♀	15.III.1922	103.7	96.9	19.0	55.4	38.6	17.8	14.7	77.5	4.6	7.1	1020	530	42	82	

Table 8. *Arctogalidia trivirgata (trivirgata) sumatrana* LYON

Cat. Nr.	Collection	Collector	Locality	Sex	Date	Greatest length of skull	Condylo-basal length from oral border of foramen magnum to tip of premaxillaries	Maxillary width	Zygomatic width	Mastoid width	Interorbital width	Postorbital constriction	Mandibular length	p m⁴	M_1	Head, body & tail	Tail	Ear	Hindfoot	Remarks
S 312	BARTELS	M. BARTELS Jr.	S. Sumatra	♂	?	106.7	98.0	17.2	52.0	37.6	16.0	13.9	77.3	5.6	7.0	—	—	—	—	Full grown, but young animal.
S 55	id.	id.	id.	♂	?	108.7	101.2	18.3	54 8	40.0	18.0	14.5	79.4	5.8	7.7	—	—	—	—	id.
a	R.M.N.H. Leiden	B. HAGEN	Tdg. Morawa Deli, N. Sumatra	♂	1883	109	100.5	19.6	63	39.5	17.5	13	81	5.1	6.3	—	—	—	—	—
S 305	BARTELS	M. BARTELS Jr.	S. Sumatra	♀ imm.	?	74.8	67.1	13.9	40.9	29.2	14.1	21.2	53.0	(4.3)	—	—	—	—	—	Milkdention.
7127	M.Z. Bogor	F. W. RAPPARD	Sungei Hitam, Benkulen, S. W. Sumatra	♀	4.V.1935	—	—	—	—	—	—	—	—	—	—	970	490	30	—	—
S 303	BARTELS	M. BARTELS Jr.	S. Sumatra	♀	?	103.3	97 5	17.3	55.8	36.5	—	—	75.9	5.0	7 0	—	—	—	—	adult
F 150	SODY	?	Perlak, Atjeh, N. Sumatra	♀	17.IV.1932	104.5	98.2	17.5	54.5	37.9	16.9	16 5	77.5	5.4	7.0	1095	615	41	90	adult
S 232	BARTELS	M. BARTELS Jr.	S. Sumatra	♀	?	104.8	98 0	17.5	52.8	37.5	16.0	15.6	75.8	6.0	7.2	—	—	—	—	adult
G 24	SODY	?	Giesting, Lampongs, S. Sumatra.	♀	1930	106.5	98.6	16.6	56.0	37.1	16.7	13 5	76.9	6.3	7.5	1005	560	42	81	adult
S 123	BARTELS	M. BARTELS Jr.	S. Sumatra	♀	?	106.4	101.0	16.9	55.5	38.2	18.2	14 4	79.7	5.6	6.2	—	—	—	—	Very old female
S 301	id.	id.	id.	?	?	101.4	94.1	17.2	54.5	36.9	16.3	15.4	75.5	4.8	6.8	—	—	—	—	Full grown, but young animal.

Table 9. *Arctogalidia trivirgata (trivirgata) stigmatica* (TEMMINCK).

Cat. Nr.	Collection	Collector	Locality	Sex	Date	Greatest length of skull	Condylo-basal length from oral border of foramen magnum to tip of premaxillaries	Maxillary width	Zygomatic width	Mastoid width	Interobital width	Postorbital constriction	Mandibular length	p m⁴	M_1	Head, body & tail	Tail	Ear	Hindfoot	Remarks
—	SODY	WITKAMP, H.	Kutai, Tenggarong E. Borneo.	♂ imm.	I.1928	70.3	62.5	12.8	37.9	27.0	11 7	19.5	50.5	(5.0)	(7.5)	555	340	—	58	Milkdentition.
7125	Z.M. Bogor	MENDEN, J. J.	Sonuwang, Landak, W. Borneo.	♂	2.IX.1937	102.5	96.0	20.0	55.5	36 5	15.2	13.4	77.2	6 1	8.2	985	475	40	82	adult
17 L	RAFFLES Mus. Singapore.	?	„Sabah" ?, N. W. Borneo	♂	1889	105 4	95.9	18.0	54.0	36.7	17.2	14.1	76.6	6.1	7.7	—	—	—	—	idem
1318	Z.M. Amsterdam	MENDEN, J. J.	Sonuwang, Landak, W. Borneo.	♂	2.I.1937	107.8	100.7	18.7	58.7	38.8	14.2	10 6	81.4	6.6	7.9	1037	501	45	89	idem
315	RAFFLES Mus. Singapore.	?	Mora Baru, Samarahan N.W. Borneo.	♂	14.XI.1919	108.6	101 0	19.6	62.0	39.7	17.6	14.5	76.4	6.2	7.1	1040	565	43	85	idem
7122	Z.M. Bogor	PLESSEN, V. VON	S. Bahau, Bulungan, N.E. Borneo.	♂	28.V.1935	111.4	106.6	21.8	64.7	40.8	19.1	13.1	84.5	6.9	8.7	1058	556	47	88	Very old animal
2892	Z.M. Bogor	MADZOED	Peniti I., Pontianak, W. Borneo.	♂	2.IV.1931	97.5	91.3	19.0	57.9	36.6	18.7	16.0	72 5	5.7	7.1	1085	580	36	82	adult
26 U	RAFFLES Mus. Singapore.	?	Borneo.	♀	?	—	—	18.8	55.4	—	15.7	14.8	72.3	5.7	7.3	—	—	—	—	idem
7123	Z.M. Bogor	MENDEN, J. J.	Sonuwang, Landak, W. Borneo.	♀	29.VIII.1937	105.3	—	17.5	51.0	—	16.1	13.4	78.5	6.8	7.8	989	508	42	82	idem
6	RAFFLES Mus. Singapore.	DOON, A. L.	Long Akar, Sarawak, N.W. Borneo.	♀	1.X.1920	103 5	96.9	17.3	55.4	37.7	16.7	13.5	76.8	6.2	—	1115	555	37	83	Old animal.
12 G	idem	?	"Sabah" ?, N. W. Borneo.	♀	1889	103.5	95.1	19.3	63.0	37.3	19.2	13.8	77.3	6.3	8.1	—	—	—	—	idem
1319	Z.M. Amsterdam	MENDEN, J. J.	Sonuwang, Landak, W. Borneo.	♀	31.VIII.1937	106.9	101.4	19.5	57.9	37.5	16 5	15.1	81.5	6.0	8.0	530 (without tail)	—	42	83	idem

Table 10. Some islands races of *Arctogalidia trivirgata trivirgata*.

Cat. Nr.	Collection	Collector	Locality	Sex	Date	Greatest length of skull	Condylo-basal length from oral border of foramen magnum to tip of premaxillaries	Maxillary width	Zygomatic width	Mastoid width	Interorbital width	Postorbital constriction	Mandibular length	p m⁴	M_1	Head, body & tail	Tail	Ear	Hindfoot	Remarks
Arctogalididia trivirgata (trivirgata) minor LYON																				
B.K. 70	SODY	?	Banka	♀	?	99	90.5	17.5	54.5	35	15.5	14	71.1	5.5	6.4	930	490	38	80	Old female
Arctogalidia trivirgata (trivirgata) simplex MILLER																				
	Z.M. Amsterdam	KOPERBERG	Singkep I.	♂ imm.	Died in the Zool. Garden N.A.M. Amsterdam.	92	85	17	47	32.5	18	15.5	67	5.1	6.8	—	—	—	—	The specimen has been in captivity during a short time.
317	RAFFLES Mus. Singapore	?	Paku I. off Tdg Pinang, Bintang I.	♀	30.III.1911	104.8	98.0	18 4	56.4	36.4	17.9	17.5	77	5.4	6.9	—	—	—	—	Adult
?	idem	?	Battam I.	♀	14.XI.1908	97.1	91.8	18.0	54.8	35.0	17.2	15.3	71.8	5.5	—	983	508	39	74	Very old female
Arctogalidia trivirgata (trivirgata) inornata MILLER																				
635	RAFFLES Mus. Singapore	CHASEN, F. N.	Bunguran I. (Great Natuna)	♀	3.IX.1928	92.6	84.8	16.0	50.5	34.4	15.0	14.3	64.9	4.7	6.9	905	455	35	70	Adult but young animal

Table 11. *Arctogalidia trivirgata trilineata* (WAGNER)

Cat. Nr.	Collection	Collector	Locality	Sex	Date	Greatest length of skull	Condylo-basal length from oral border of foramen magnum to tip of premaxillaries	Maxillary width	Zygomatic width	Mastoid width	Interorbital width	Postorbital constriction	Mandibular length	$p\,m^4$	M_1	Head, body & tail	Tail	Ear	Hindfoot	Remarks
1320	Z.M. Amsterdam	HALEWIJN, E. K. E.	Puntjak, Mt. Gedeh, W. Java.	♂ imm.	4.V.1941	86.0	76.6	15.4	44.6	31.3	14.8	—	60.4	(4.8)	(7.2)	800	410	38	71	Milkdentition.
1321	Z.M. Amsterdam	idem	idem	♂ imm.	4.V.1941	89.0	79.0	15.2	45.4	32.2	14.1	17.7	61.1	(5.0)	(7.1)	812	415	40	73	idem
7114	Z.M. Bogor	Zool. Park Bandung	Parigi, Tasikmalaja, Preanger, W. Java.	♂ imm.	5.IX.1936	91.4	83.3	16.0	45,0	33.6	15 4	18.3	66.2	(4.2)	(6.8)	859	449	42	76	idem
7112	Z.M. Bogor	KERKHOVEN, T. H.	Gambung, Pengalengan, Preanger, W. Java.	♂	V.1912	97.1	90.6	16 1	53 0	35.5	16.4	14.9	72.5	6.0	7.9	—	—	—	—	Young animal. Second molars not yet in function
487/444	Senckenb. Mus. Frankfurt a/M.	ex coll. R. M. N. H. Leiden.	Java	(♂)	1834	—	—	16.7	53.8	—	18.0	13.3	67.9	5.7	7.1	—	—	—	—	Type of subspecies.
7113	Z.M. Bogor	KERKHOVEN, T. H.	Gambung, Pengalengan Preanger, W. Java.	♂	V.1912	99.0	91.9	17.3	53.4	36.4	18.1	17.2	74.3	5.8	8.0	—	—	—	—	Adult
1092	BARTELS, M.	BARTELS, M. Jr.	Mountains near Wijnkoopsbay, W. Java.	♂	1934	99.2	93.6	17.0	56.9	35.5	18.7	16.2	73.0	5.5	7.7	—	—	—	—	idem
1323	Z.M. Amsterdam	HALEWIJN, E. K. E.	Rarahan Est., Patjet, W. Java.	♂	23.III.1941	104.9	96.5	20.0	59.1	36.1	19.2	15.4	79.0	6.0	7.5	—	—	—	—	Old male
7115	Z.M. Bogor	MÜHLNICKEL, J.	Tjikepoe Est., Bogor, W. Java.	♀	VI.1939	97.0	87.8	16.4	50.1	32.2	16.0	15.4	71.5	—	7.8	—	—	—	—	Teeth shedding
1322	Z.M. Amsterdam	HALEWIJN, E. K. E.	Puntjak, Mt. Gedeh, W. Java.	♀	4.V.1941	102.1	96.6	18.4	56.8	36.6	18.4	15.8	77.4	5.0	5.9	885	418	42	80	Very old female mother of the 2 young males at the top of table
1116	BARTELS, M.	BARTELS, M. Jr.	Mountains near Wijnkoopsbay, W. Java.	sex inc.	1934	97.8	93.7	16.6	54.1	34.2	17.6	15.9	73.4	5.3	7.8	—	—	—	—	Same age as no 1092 (Coll. BARTELS).
b	R.M.N.H. Leiden	?	Java	sex inc.	?	100.1	92.0	18.0	58.1	36.6	19.4	16.3	73.0	5.7	7.2	—	—	—	—	Old animal

Lingga Arch., sides of neck not conspicuously contrasting with colour of upper side as in *A.t. simplex*, belly darker, skull more constricted in the waist.

Biology: Biological notes have been given by BANKS (1931, 1949).

Distribution: Borneo.

Arctogalidia trivirgata (trivirgata) minor LYON

Arctogalidia minor LYON, M. W.: Proc. U.S. Nat. Mus. 31, p. 599 (1906); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);
Arctogalidia trivirgata minor CHASEN, F. N.: Bull. Raffles Mus. 15, p. 101 (1940);
Arctogalidia bancana SCHWARZ, E.: Arch. f. Naturgesch. 78, A 12, p. 28 (1912); Ann. Mag. N.H. (8), 11, p. 297 (1913); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);
Arctogalidia trivirgata bancana CHASEN, F. N.: Bull. Raffles Mus. 15, p. 101 (1940);
Arctogalidia trivirgata fusca POCOCK, R. I.: P.Z.S. 1933, 2, p. 990—992 (1933); SODY, H. J. V.: Temminckia 2, p. 241—242 (1937).

Definition: Small, coat short, smooth and thickly set. Upper hair somewhat longer than underhair.

Pattern consisting of three rather well defined, longitudinal dorsal stripes. Upper side of head, tail and feet somewhat darker than groundcolour of back. Grizzling of upper side of body slight. Light streak on the nose absent, perhaps represented by a faint grizzling between the eyes. Base of tail and feet hardly grizzled at all. Throat and belly lighter than back. Sides of neck lighter than back and contrasting with the dark nape, but this light area is rather small.

Groundcolour of back Verona Brown, dorsal stripes nearly black. Tail, feet and upper side of head dark Warm Sepia. Grizzling slight, Avellaneous, regularly divided over the whole of upper side from nape to the base of tail and feet. Belly and throat between Pinkish Buff and Avellaneous.

Skull short, not much constricted in the waist. Greatest length of skull measured by the present author 99 mm. Measurements in table 10.

Terra typica: Buding Bay, Billiton I.

Type of subspecies: ♀ ad., skin & skull, Cat. Nr. U.S. Nat. Mus. Washington, Buding Bay, Billiton I., 3. VIII. 1904, leg. Dr W. L. ABBOTT, orig. Nr. 3532.

Material examined: 1 ♀ (skin & skull).

Diagnosis: Perhaps the darkest of all subspecies which are united in the grex *A.t. trivirgata*.

Closest to *A.t. trivirgata* from the Malay Peninsula, but much smaller, tail without grizzling and without any trace of markings.

To be distinguished from *A.t. sumatrana* by smaller size and darker colour, less extended light area on sides of neck, absence of white streak on the nose.

To be distinguished from *A.t. stigmatica* by smaller size, more pronounced pattern of back, darker colour and broader waist of skull.

To be distinguished from both *A.t. inornata* and *A.t. simplex* by dar-

ker colour, more pronounced pattern on the back and much slighter grizzling, being most obviously distinguished by absence of grizzling on top of head.

Discussion: POCOCK (1933) and SODY (1937) thought this subspecies should be united with *A.t. fusca*. This seems to be senseless because the distributional range of *A.t. minor* (including *bancana*) and the range of *fusca* as given by POCOCK and other authors are widely separated by the range of *A.t. simplex*, a race clearly different from *minor*. As far as I can decide from the description of *fusca* the latter seems to be very near *trivirgata* or should stand between *trivirgata* and *simplex*.

I want to follow POCOCK (l.c.) concerning the idea of uniting *bancana* SCHWARZ with *minor* LYON. I have not seen any material from Billiton but according to the description of both original authors this seems to be fully justified.

Distribution: Banka I., Billiton I.

Arctogalidia trivirgata (trivirgata) simplex MILLER.

Arctogalidia simplex MILLER, G. S.: Proc. Acad. Sci. Philad., p. 156 (1902); Proc. U.S. Nat. Mus. 31, p. 268 (1906); LYON, M. W.: Proc. U.S. Nat. Mus. 31, p. 655 (1907); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);

Arctogalidia trivirgata simplex POCOCK, R. I.: P.Z.S. 1933, 2, p. 992—994, textfig. 2, A-D (1933); CHASEN, F. N.: Bull. Raffl. Mus. 15, p. 100 (1940);

Arctogalidia mima MILLER, G. S.: Smiths. Misc. Coll. 61, nr. 21, p. 7 (1913); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);

Arctogalidia trivirgata mima CHASEN, F. N.: Bull. Raffles Mus. 15, p. 100 (1940);

Arctogalidia depressa MILLER, G. S.: Smiths. Misc. Coll. 61, nr. 21, p. 8 (1913); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);

Arctogalidia trivirgata depressa CHASEN, F. N.: Bull. Raffles Mus. 15, p. 100 (1940);

Arctogalidia trivirgata fusca POCOCK, R. I.: P.Z.S. 1933, 2 ,p. 990—992 (1933) — part! —.

Definition: Medium sized, coat rather short, thickly set, underhair mostly somewhat shorter than upperhair.

Pattern consisting of three obsolete dorsal stripes, which in most cases are lacking altogether, even in young animals. The dorsal stripes, if present, restricted to the central part of the back, seldom continued faintly on the shoulders.

Upper side of head slightly darker than groundcolour of back, always more or less grizzled. A short broad, light streak on the nose.

Feet and tail of same colour as head, both conspicuously grizzled proximally. Throat and belly lighter than back but much darker than sides of neck which are conspicuously contrasting with colour of upper side.

Colour differences between the sexes and according to age could not be found by me.

Groundcolour of back varying between Buffy-brown and Clove-brown, dorsal stripe(s) Clove-brown. If dorsal stripes are lacking the colour of the back is very uniform. Tail, feet and nose between Natal-brown and Bone-brown. Throat and belly between Wood-brown and Deep Olive-buff. Upper side with a heavy grizzling of a colour between Wood-

brown and Olive-buff, sometimes more or less silvery in young animals. Sides of neck between Deep Olive-buff and Pale Olive-buff.

Skull rather short and broad, constriction of waist not much pronounced (vide POCOCK l.c. 1933, fig. 2, A-D, p. 993). Greatest length of skull 106 mm. (type!). Measurements in table 10.

Terra typica: Lingga Archipelago, South of Riouw Archipelago.

Type of subspecies: ♂ ad., skin & skull, Cat. Nr. 113069, U.S. Nat. Mus. Washington, Lingga I., 30. VIII. 1901, leg. Dr W. L. ABBOTT, orig. Nr. 1254.

Material examined: 2 ♂♂ (2 skins, 2 skulls), 2 ♀♀ (2 skins, 2 skulls).

Diagnosis: To be distinguished from *A.t. trivirgata* by smaller size, less well pronounced pattern of back, much more grizzling on brow and much less well pronounced constriction of skull.

To be distinguished from *A.t. stigmatica* by smaller size, much more grizzling on the brow, lighter colour and darker underside, more conspicuously contrasting colour of sides of neck and much less well pronounced constriction of skull.

To be distinguished from *A.t. sumatrana* by less silvery, more buffy coloration, more grizzling on the brow and on proximal part of tail, less well pronounced constriction of skull and less conspicuous streak on the nose.

To be distinguished from *A.t. minor* by somewhat larger size, less dark general coloration, much more heavy grizzling of body, grizzling of forehead and proximal part of tail and feet and by the presence of a light streak on the nose.

To be distinguished from *A.t. inornata* by shorter coat, somewhat darker general coloration and less heavy grizzling on body and forehead.

Discussion: POCOCK (l.c. 1933) united the animals from Bintang I. (*A. depressa* MILLER) with *A. fusca* MILLER (Kundur I., Western part of Riouw Arch.), *A. tingia* MILLER (Tebing Tinggi I., W. Sumatra), *A. bancana* SCHWARZ (Banka I.) and *A. minor* LYON (Billiton I.) in one and the same subspecies under the name *A. fusca* MILLER. The same author however united animals from Batam I. (*A. mima* MILLER) with *A. simplex* MILLER. I could not find any difference between specimens from Singkep I. (considered to represent typical *A. simplex* by the original author, l.c. 1902), a specimen from Batam I, and a specimen from P. Paku (Bintang I.). Therefore, the distribution of races as given by POCOCK, already highly improbable from a geographical point of view, should be rejected.

Biology: The specimen from Paku I. has been shot in a cocoanut-tree. The species seems to visit the cocoanut plantations (compare MILLER, 1906), often to be found in the small islands of the different archipelagoes between the Malay Peninsula, Sumatra and Borneo, but seems to be a typical forestdweller in the larger islands.

Distribution: Eastern part of Riouw Archipelago, (Batam I., Bintang I. including P. Paku), Lingga Archipelago (Lingga I., Singkep I.).

Arctogalidia trivirgata (trivirgata) fusca MILLER.

Arctogalidia fusca MILLER, G. S.: Proc. U.S. Nat. Mus. 31, p. 269 (1906); LYON, M. W.: Proc. U.S. Nat. Mus. 36, p. 490 (1909);
Arctogalidia trivirgata fusca CHASEN, F. N.: Journ. Mal. Br. R. A. Soc. 2, p. 60 (1924); POCOCK, R. I.: P.Z.S. 1933, 2, p. 990—992 (1933); CHASEN F. N.: Bull. Raffles Mus. 15, p. 100 (1940);
Arctogalidia tingia LYON, M. W.: Proc. U.S. Nat. Mus. 34, p. 652 (1908); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);
Arctogalidia trivirgata tingia CHASEN, F. N.: Bull. Raffles Mus. 15, p. 101 (1940).

Definition: For a description of the subspecies I must refer to the original description and to descriptions by subsequent authors as are cited above.

Terra typica: Kundur I., Western Riouw Archipelago.

Type of subspecies: ♂ ad., skin & skull, Cat. Nr. 122920, U.S. Nat. Mus. Washington, Kundur I., 22.VI.1903, leg. Dr W. L. ABBOTT, orig. nr. 2540.

Discussion: No topotypical material of either *A. fusca* MILLER or *A. tingia* LYON being available, no description will be given here. As far as I can decide from both the original descriptions, they seem to be closely related to *A.t. trivirgata* from the Malay Peninsula, but are decidedly smaller. Perhaps they should stand between *A.t. trivirgata* and *A.t. simplex*. In most respects they seem to come very close to *A.t. minor* (including *A. bancana* SCHWARZ) but, being geographically disconnected with the latter subspecies, they should be kept apart for the moment.

Furthermore, according to the original descriptions, they are to be distinguished from *A.t. minor* by a slight grizzling on top of the head and a grizzling on the proximal third part of tail.

I want to follow POCOCK (1933) in uniting *A. fusca* and *A. tingia* in one subspecies, for which the oldest name, *A. fusca*, should be used, because when the original descriptions are compared there seem to be no characters of any systematic importance by which they could be distinguished.

Distribution: Islands east of Central Sumatra (viz. Tebing Tinggi I., Merbau I.) and western part of Riouw Arch. (Kundur I., Sugi I., and perhaps Bulan I.).

Arctogalidia trivirgata (trivirgata) inornata MILLER

Arctogalidia inornata MILLER, G. S.: Proc. Wash. Acad. Sci. III, p. 131 (1901); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p. 259 (1935);
Arctogalidia trivirgata inornata POCOCK, R. I.: P.Z.S. 1933, 2, p. 994—995 (1933); CHASEN, F. N.: Bull. Raffles Mus. 10, p. 9 (1935); ibidem 15, p. 100 (1940).

Description: Small, coat rather long, woolly, thickly set. Upperhair slightly longer than underhair.

Pattern consisting of three more or less obsolete dorsal stripes. In most cases only the central stripe is present and restricted to the central part of the back. In young animals the lateral stripes may be well developed.

Upper side of head of the same colour as back, both head and back heavely grizzled. Grizzling of head continued by the light streak on the nose.

Feet, nose and apical half of tail of the same colour as the groundcolour of back, proximal part of feet and tail heavily grizzled. Throat and belly of nearly the same colour as grizzling of back, sides of neck conspicuously contrasting with upper side. Obsolete rings on proximal part of tail.

Groundcolour of back between Buffy-brown and Olive-brown, changing to Sepia in old animals. Dorsal stripe(s) between Clove-brown and Bone-brown. Tail, feet and nose between Clove-brown and Bone-brown. Throat and belly between Cinnamon-buff and Chamois, sides of neck Cream-buff. Grizzling between Tawny-olive and Deep Olive-buff.

Skull short and not much constricted in the waist. Greatest length of skull 102 (MILLER). Measurements in table 10.

Terra typica: Lingung I., South of Great Natuna (Bunguran).

Type of subspecies: ♂ ad., skin & skull, Cat. Nr. 104859 U. S. Nat. Mus. Washington, Pulau Lingung, 17.VI.1900, leg. Dr W. L. ABBOTT, orig. nr. 481.

Material examined: 2 ♀♀ (1 skull, 2 skins).

Diagnosis: To be distinguished from all other races of the grex *A. t. trivirgata* by the very heavy grizzling of the upperhead.

To be distinguished from *A. t. simplex,* which is closest to *A. t. inornata,* by longer coat and different coloration.

Biology: In the North Natuna Is. the species seems to visit cocoanut-plantations and may be found in the top of the trees, walking along the leafstalks. (MILLER l. c. 1901).

Distribution: North Natuna Is.

GREGAL FORM III.

Arctogalidia trivirgata trilineata (WAGNER)

Paradoxurus trilineatus WAGNER, J. A.: in SCHREBER: Säugethiere Suppl. vol. 2, p. 346 (1841);

Paradoxurus trivirgatus TEMMINCK, C. J.: Monogr. Mamm. 2, p. 333—336 (1835—1841); MÜLLER, S.: Verh. Nat. Gesch. Ned. Overz. Bezitt., Zoölogie, p. 32, 55 (1839); WAGNER, J. A.: in SCHREBER: Saügethiere Suppl. vol. 2, p. 346—347 (1841) part; HORSFIELD: Cat. Mamm. Mus. E. I. Comp., p. 64 (1851);

Arctogale trivirgata GRAY, J. E.: P.Z.S. 1864, p. 543 (1864); BLANFORD, W. T.: P.Z.S. 1885, p. 789 (1865); JENTINK, F. A.: Mus. d'Hist. Nat. Pays-Bas, Cat. Ostéol. Mamm. 9, p. 95 (1887); ibidem Cat. Syst. Mamm. 11, p. 117 (1892); LYDEKKER, R.: Handb. Carniv. 1, LLOYDS Nat. Hist., p. 231 (1896); RAVEN, H. C.: Bull. Am. Mus. N.H. 68, p 259 (1935);

Arctogale leucotis KONINGSBERGER, J. C.: Zoogd. Java, Meded. 's Lands Plantentuin 54, p. 20 (1902); BARTELS, M.: De Trop. Natuur 18, p. 82 (1929);

Arctogalidia trivirgata trivirgata POCOCK, R. I.: P.Z.S. 1933, 2, p. 984—990 (1933); SODY, H. J. V.: Temminckia 2, p. 242 (1937); Tectona 31, p. 760 (1938); CHASEN, F. N.: Bull. Raffles Mus. 15, p. 100 (1940); BARTELS, M.: Ned. Ind. Jager 11, p. 173, fig. 2 (1941);

Arctogalidia trivirgata subsp. SODY, H. J. V.: Natuurk. Tijdschr. Ned. Ind. 89, p. 164 (1929); BARTELS, M.: Treubia 16, p. 159 (1937); "GREY OWL": Ned. Ind. Jager 12, p. 19, photo (1942).

D e f i n i t i o n: Medium sized. Coat very long, thickly set, but loose, not contiguous. Clearly separated woolly underhair and long, shining upperhair up to five cm. long. The living animal gives the impression of being very shaggy.

Pattern consisting of three, mostly very conspicuous dorsal stripes, running from root of tail to shoulders. Top of head mostly somewhat darker than groundcolour of upperside, sometimes passing into a dark streak on the forehead. Upper part of nose and forehead of same colour as groundcolour of back. No white streak on the nose. Legs of the same colour as groundcolour of back. Light belly conspicuously contrasting with darker upperside, sides of neck of the same colour as belly. Tail often with light-coloured apex, sometimes combined with a subapical ring, sometimes only adorned with a more or less conspicuous subapical ring, in a few cases a unicoloured dark tail.

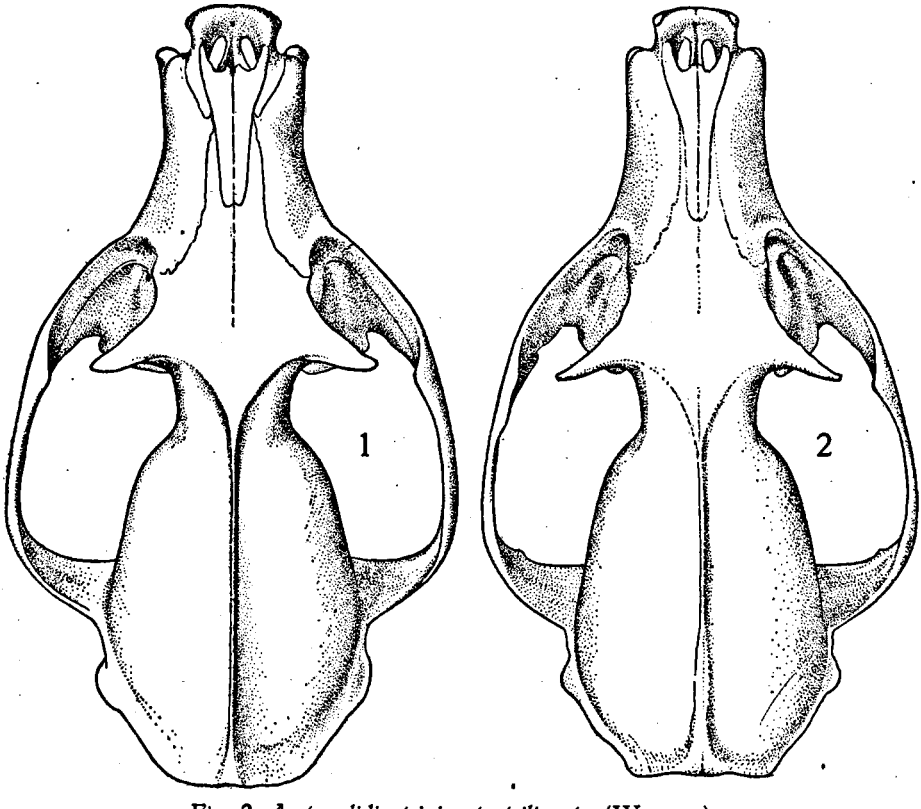

Fig. 2. *Arctogalidia trivirgata trilineata* (WAGNER).

1) Skull of rather old male, collected at Rarahan Est., Patjet, W. Java. (Cat. Nr. 1323 Zoöl. Museum, Amsterdam).
2) Skull of very old female, collected at Puntjak-pass, Mt. Gedeh, W. Java. (Cat. Nr. 1322 Zoöl. Museum, Amsterdam). There is a remarkable sexual difference in shape of braincase (compare fig. 1, p. 34).

Ears always thinly covered with short hair, skin of ears hardly or not at all pigmented, unicoloured.

Colour varying with the age of the animal. There is no difference in colour between the sexes.

Groundcolour of back, according to age of animal, passing from Pinkish Buff via Avellaneous, Cinnamon Buff, Claycolour and Buckthorn Brown to Woodbrown. Colour of the stripes on the back, according to age of the animal, passing from Snuff Brown via Olive Brown, Auburn and Bister to Bone-brown. Ventral side Pale Pinkish Buff or light Ochraceous Buff, sometimes Olive Buff. Tail varying from Tawny Olive via Sayal Brown, Hazel and Saccardo's Umber to Clove Brown, light apex and/or subapical ring Pale Pinkish Buff to Olive Buff.

Skull short, broad in the waist, even in males. Greatest length of skull 105 mm. Measurements in table 11.

Terra typica: Java.

Type of subspecies: ♂ imm., skin nr. 487 (887), skull nr. 444, coll. Senckenberg Museum Frankfurt a/M., Java, purchased in exchange with Rijksmuseum N.H. Leiden, 1834.

Material examined: 11 ♂♂ (10 skins, 8 skulls, 1 mounted specimen, including the type), 6 ♀♀ (4 skins, 4 skulls, 2 mounted specimens).

Diagnosis: Distinguished from all other subspecies by structure of coat and typical coloration in clear, buffy tones, by light markings on the tail; by regular absence of a white streak on the nose, a character sometimes occuring as an aberration or a race-character in some other subspecies.

Distinguished from the other races occurring in the Indo-Australian Archipelago by the characters mentioned above, furthermore by having the ears covered by thin and short hair only, skin of the ears being hardly or not pigmented.

Distinguished from the races belonging to the grex *A.t. leucotis* by structure of coat 1), a more buffy tone of coloration 2), light markings on tail, regular absence of a white streak on the nose and ears always being unicoloured.

Discussion: The representative of the species in Java, although having many peculiar characters, has been overlooked by most authors, notwithstanding the fact that several typical specimens have been described in literature. This may be due to the confusion caused by the type-specimen and the type-locality of the species. Therefore, the real Javanese representative has been looked upon as being a mere aberration. JENTINK (Mus. d'Hist. Nat. Pays Bas, Cat. Syst. Mamm. 11, p. 117,

[1]) I have not seen *A. t. millsi* WROUGHTON, a form that has been described as having a long and shaggy coat. Perhaps this race has some other affinities to *A. t. trilineata*.

[2]) A coloration hardly differing from the Javanese race could be observed in a specimen of *A. t. macra* MILLER from Terutau I. in the collection of the Raffles Museum Singapore. This specimen might represent an aberration in that race.

1892) even applied the name varietas *alba* to the series of specimens from Java present in the collection of the Rijksmuseum N.H. Leiden. The supposed type-specimen in that collection was considered by that author to represent the normal Javanese form. S. MÜLLER (Verh. Nat. Gesch. Ned. Overz. Bezitt., Zoöl., p. 32, 55, 1839) has already been misled by the specimen in question, which certainly had not been collected by himself. The peculiar race from Java has been recorded as different from all other races occurring in the Indo-Australian Archipelago by only a few authors, viz. SODY (1937) and BARTELS (1941).

The name *trivirgata* GRAY (1832) being no longer available as a subspecific name for the race in Java (vide p. 27—28), the oldest name available is *Paradoxurus trilineatus* WAGNER. The description by WAGNER is excellent in most respects, and the type though being recorded by WAGNER as "...ein Exemplar ...als dessen Heimath fragweise Java angegeben ist", leaves no doubt, because it belonged to the Javanese series in the Rijksmuseum N.H. Leiden and represents a very typical Javanese specimen. In the German translation of the Latin description the head of the type-specimen is described as follows: „...längs des Nasenrückens und zwischen den Augen findet sich eine weissliche Stelle...". In fact, the head of the type-specimen does not show any trace of the shining, silvery streak, so prominent in most other races. But in the Javanese specimens, including the type, the head is very light coloured, especially on forehead and nose without forming a light mask as in other species if the family. For these reasons I should like to propose to designate the name *trilineata* WAGNER as nomen conservandum for the subspecies from Java.

Arctogalidia trivirgata trilineata WAGNER has more characters in common with races formerly united in the separate species *Arctogalidia leucotis* (which I should prefer to consider as merely a grex of the species-complex *Arctogalidia trivirgata*) than with the other races occurring in the Indo-Australian Archipelago. Some specimens I have seen of this group do approach rather closely to *A.t. trilineata* as far as coloration is concerned. The ears, covered only sparsely with short hair can be more or less compared with those of the grex *A. leucotis*. Nevertheless *A.t. trilineata* has not sufficient characters in common with *A. leucotis* to be united with these races in the same grex. For the time being *A.t. trilineata* should be considered to represent a gregal form of the species with a strongly pronounced character if its own.

Biology: The only extensive records on biology of the Javanese subspecies were given by BARTELS (1937, 1941) and some brief notes were published by "GREY OWL" (1942).

The notes given by BARTELS concerned the specimens nrs. 1092 and 1116 from his collection and were collected 1934 in the mountains near Wijnkoopsbay, south coast of Western Java. BARTELS mentioned that three animals, two of which were shot by him, had occupied an empty nest of *Ratufa bicolor*, situated in a rather big tree at a height of nearly 20 m. BARTELS' opinion was that the animals were strictly nocturnal, leaving the nest only at dusk. Certainly they are arboreal. I myself have observed a family, consisting of an old female and two halfgrown males

(Museum Bogor nrs. 7119, 7120, 7121) high up in a big tree standing in the mountain forest (Mt. Gegerbenteng, near the Puntjak Pass, W. Java) at eleven o clock in the morning on a bright day. The animals were at play and clambered with great dexterity along the branches. At first I took them for *Ratufa,* but soon I detected their real nature. During play they did not utter a single sound. The voice has, however, been described carefully by BARTELS. In Java the species has, as far as I know, never been observed in cultivated areas, but in the Riouw Archipelago the animal has been collected in cocoanut-plantations.

Observations on the food are very scare. BARTELS has given an account of small forest fruits he found in the stomach of animals he collected himself. Perhaps the species is more or less omnivorous as has been observed by BANKS in specimens from Borneo.

Nothing is known about propagation. BARTELS has given a few notes on behaviour during rutting time. Our nrs. 7120 and 7121 are obviously of the same age, so I am sure they belonged to the same litter. As BARTELS has justly remarked, *Arctogalidia* is one of the least observed and least collected larger mammals from Java.

Distribution: As far as I could establish, the subspecies has been collected in the western part of Java only. (cf. BARTELS 1941).

SAMENVATTING.

INLEIDING. DOEL VAN HET ONDERZOEK.

Het is een diep gekoesterde wens van vele zoölogen die zich met het systematisch onderzoek van de dierenwereld van de Indo-Australische Archipel bezighouden, om in de nabije toekomst het voorbeeld van de botanici te volgen en te komen tot de uitgave van een „Fauna Malesiana". Daarbij zullen echter vele onverwachte moeilijkheden overwonnen moeten worden, want de kennis van de meeste diergroepen is daartoe op het ogenblik nog absoluut ontoereikend. Een van de diergroepen waarvoor dit, vreemd genoeg, geldt zijn de zoogdieren. De samenvattende literatuur over zoogdieren van de Indo-Australische Archipel is op de vingers van één hand te tellen en bovendien meestal sterk verouderd. De specialistische literatuur is verspreid over talloze, vaak moeilijk toegankelijke tijdschriften. De moderne revisies van verschillende genera welke in de laatste jaren vooral van Amerikaanse zijde zijn verschenen, zijn weliswaar verdienstelijk, doch als basis voor de opbouw van een „Fauna" niet altijd even bruikbaar. Daartoe missen ze n.l. de eerste voorwaarde die aan systematisch werk gesteld behoort te worden : een nauwkeurige en critische beschrijving van het bewerkte materiaal. Het moderne Amerikaanse werk bepaalt zich veelal tot literatuurcritiek en enkele differentiaaldiagnoses die, voor wie in de behandelde groep niet door en door thuis is, onvoldoende zijn om tot determinatie te komen van het materiaal dat op een gegeven moment in een gegeven collectie toevallig aanwezig is. M.a.w. ze zijn, zonder dat men over het bewerkte materiaal beschikt, niet bruikbaar. De practische eis immers waaraan een goede „Fauna" zal moeten voldoen is dat men er ieder willekeurig specimen, zonder gebruik te moeten maken van grote series vergelijkmateriaal, met aan zekerheid grenzende waarschijnlijkheid mee kan thuisbrengen. Om daartoe te kunnen komen is dus in de eerste plaats nodig een grondige revisie van het thans bekende, een herbeschrijving en definitie van alle bekende soorten en genera en een samenstelling daarvan in groter verband. Die systematici die zich uitsluitend bepalen tot het speuren naar nieuwe en onbekende vormen zullen in de studie van de Indo-Australische zoogdieren dan ook weinig bevrediging vinden. Ze zullen de dichte nevel die over dit onderwerp hangt slechts helpen verdichten en lopen de grootste kans slechts de twijfelachtige eer te zullen genieten de lange synoniemenlijsten nog langer te hebben gemaakt.

Bij de systematische studie van de zoogdieren doen zich enkele specifieke moeilijkheden voor. In de eerste plaats zijn, en dat geldt vooral naarmate de diersoort groter is, de beschikbare series uiterst klein. Hiervoor zijn begrijpelijke redenen. Daar is allereerst het feit dat de meeste zoogdieren nachtdieren zijn en dus vaak moeilijk te verzamelen terwijl men, om goede resultaten te hebben, van hun leefwijze op de hoogte moet zijn. Een belangrijker punt, speciaal wat de grote zoogdieren van

de Indo-Australische Archipel betreft, is het volgende. De expedities die in de Archipel opereerden waren zelden of nooit „jachtexpedities" zoals Afrika die kent, en waarvan de tropheën in vele gevallen de systematische kennis hebben verruimd. De grote expedities die de Archipel bezochten was het in de eerste plaats te doen om een algemeen inzicht in de fauna van een bepaald eiland te verkrijgen en deze bepaalden zich daarom in hoofdzaak tot het verzamelen van kleine zoogdieren, daar het prepareren van een groot zoogdier te veel tijd, te veel conserveringsmateriaal en te veel van de beschikbare transportruimte opeist. Het verzamelen van grote zoogdieren stelt bovendien aan een zoöloog, die niet in de eerste plaats jager is, te hoge eisen. De jacht vergt dan te veel van de kostbare tijd van de expeditie. Bovendien heerst bij de verzamelende zoölogen algemeen het idee dat de grote dieren wel voldoende bekend zijn en het dus de moeite niet zal lonen. Niets is echter in werkelijkheid minder waar. Het grote jachtwild is bekend genoeg bij de jagers die de jacht als sport bedrijven. Fraaie jachttropheën sieren hun wanden, maar de herkomst is alleen de eigenaar bekend en werd op de stukken zelf meestal niet aangegeven. Komen de stukken t.z.t. in een Museum terecht dan hebben ze nog slechts een betrekkelijke waarde. In andere gevallen blijft de tropheëncollectie voor systematisch onderzoek gesloten en zal vaak bij de dood van de eigenaar verloren gaan. De Zoölogische Musea zijn echter verrassend arm aan materiaal van groot wild. Vele verhandelingen over groot wild zijn daarom gebaseerd op materiaal afkomstig uit dierentuinen, dieren die door de gevangenschap soms onherkenbaar zijn veranderd en vaak van onbekende herkomst. Dit materiaal werd dan aangevuld met allerlei incomplete tropheën zoals geweien, hoorns en dergelijke die lukraak van de bevolking waren opgekocht gedurende expedities die al hun tijd aan de kleinere diersoorten besteedden. In het algemeen kan men zeggen dat de zeldzame soorten in de collecties van de grote musea beter vertegenwoordigd zijn dan de gewone soorten. Hoe meer een soort wordt gejaagd, hoe zeldzamer men deze soort in Musea zal vinden. Ook Nederlandse musea beschikken immers over meer dassen dan hazen!

Hetzelfde geldt voor onze kennis van de leefwijze van het tropische grofwild. Zeldzame soorten die met uitroeiïng worden bedreigd worden haastig bestudeerd en dan is het vaak te laat om nog voldoende gegevens te verzamelen. Wanneer men echter wetten en voorschriften betreffende de jacht moet opstellen bemerkt men steeds opnieuw dat de meest noodzakelijke gegevens ontbreken, een leemte die maar al te vaak door het klakkeloos overnemen van wat in gematigde gebieden gelden zou wordt opgevuld. Deze gegevens te verzamelen is een uiterst tijdrovend werk. Men moet daarvoor aankloppen bij die jagers wier eerste belangstelling meer het wild dan het schot of de jachtbuit geldt. Grote verdiensten op dit gebied hebben zich in Indonesië H. J. V. Sody, D. Pieters en M. Bartels Jr verworven. Dit wat het materiaal en de gegevens betreft.

Afgezien hiervan heeft het systematisch onderzoek van de zoogdieren zelve nog zijn specifieke moeilijkheden, waarmede niet steeds voldoende rekening is gehouden. Speciale aandacht moet besteed worden aan de sexuele dimorphie, die weliswaar bij groepen zoals de *Ruminantia* sterk in het oog valt, doch bij andere slechts bij aandachtige waarneming kan worden vastgesteld. Groter is nog het belang van nauwkeurige ouder-

domsbepaling. Zoogdieren vertonen n.l. de eigenaardigheid dat ook na het bereiken van de geslachtsrijpheid vorm en verhoudingen van het lichaam als geheel en van de lichaamsdelen afzonderlijk zich wijzigen. Het is daarom absoluut noodzakelijk de te bewerken series te rangschikken volgens absolute ouderdom en indien dit niet mogelijk is volgens relatieve ouderdom. Het bepalen van de absolute ouderdom zal bij in het wild verzamelde dieren vaak niet mogelijk zijn. Toch is de juiste leeftijd soms te benaderen door vergelijking met dieren uit gevangenschap, waarbij echter uiterste voorzichtigheid geboden blijft. Ook door vergelijking met wat in kleine, nauwkeurig beheerde revieren door wildspecialisten aan verwante vormen kon worden waargenomen kunnen bruikbare resultaten worden verkregen. In vroegere publicaties ben ik op dit punt reeds in detail ingegaan. (Bijdr. Dierk. 28, pp. 26—31, 1949; Treubia 20, pp. 191—200, 1949).

. Samenvattend laat zich dus vaststellen dat het noodzakelijk is om, alvorens te beginnen met het samenstellen van een „Fauna Malesiana, Mammalia" allereerst aandacht te schenken aan de volgende punten:

1) Een overzicht te krijgen van het materiaal dat van de verschillende groepen in de musea van de gehele wereld aanwezig is en de mogelijkheid na te gaan dit materiaal groepsgewijze in één hand te brengen.

2) Voor zover het jachtwild betreft te trachten een overzicht te krijgen van materiaal in de tropheeëncollecties van particulieren. Voor zover mij bekend heeft de laatste wereldoorlog hieraan echter enorme schade aangericht.

3) Veldwaarnemingen van betrouwbare waarnemers bijeen te brengen, te sorteren en te schiften.

4) Gegevens te verkrijgen van zoveel mogelijk dierentuinen over biologische waarnemingen in gevangenschap, over de juiste leeftijd van in gevangenschap gestorven en voor onderzoek bewaarde dieren, over in gevangenschap uitgevoerde kruisingen die ons vaak opheldering kunnen geven omtrent de waarde van geographische rassen en over de periodiciteit van sexuele en andere uitingen. In dit opzicht zou de waarde van vele „zoölogische" tuinen voor de zoölogie aanmerkelijk kunnen worden uitgebreid.

5) Te trachten, nadat een overzicht, als onder de punten 1—3 is bedoeld, is verkregen, de ontbrekende gegevens aan te vullen. Dit zal in de naaste toekomst voor het gedeelte van de Archipel dat door de staat Indonesia wordt ingenomen nog moeilijk te verwezenlijken zijn.

In de voorgaande bladzijden is een bescheiden poging gedaan om, in het kader van het bovenstaande, een bijdrage te leveren tot de kennis van twee genera van zoogdieren voor zover die in de Indo-Australische Archipel voorkomen. Het ware aantrekkelijker geweest dit onderzoek uit te strekken tot het gehele verspreidingsgebied van deze genera. Bij een van de twee is dit ten dele uitvoerbaar gebleken, n.l. bij het genus *Arctogalidia*. Bij het geslacht *Muntiacus* kon uitsluitend materiaal uit Indonesia worden bewerkt. Dit, het feit dat ook het Indonesisch materiaal lacunes vertoonde en slechts in twee gevallen typen bestudeerd konden worden, maakt dat de revisie van het laatste geslacht als voorlopig moet worden beschouwd.

HET GENUS *MUNTIACUS*.

De Indo-Autralische *Cervidae* behorende tot de genera *Rusa* en *Axis* (subgenus *Hyelaphus*) werden reeds eerder door mij onderzocht (Treubia, hors série, p. 149—154, 1944; Treubia 19, p. 403—406, 1948; Treubia 20, p. 191—262, 1949; Treubia 21, p. 105—110, 1951). Het kwam mij daarom gewenst voor het onderzoek van de Indo-Australische *Cervidae* af te sluiten met enige beschouwingen over het derde en in de Archipel meest voorkomende geslacht van deze familie.

De Muntjaks of Kidangs bieden een sportieve jacht, leveren een fraaie trophee en bovendien een welsmakend wildbraad op en zijn daarom een zeer geliefd jachtwild in de Archipel. Daar komt bij dat deze dieren nog vrij algemeen voorkomen, zodat er geen kostbare tochten ondernomen behoeven te worden om een paar uur te kunnen jagen. Daarom ook zijn ze geen wild voor de luxe-jager. Voor de Zondagsjager is de jacht te moeilijk. De planter en de eenzame liefhebber van de jacht beschouwen hen echter als hun mooiste wild. Doch dergelijke jagers komen er slechts zelden toe hun ervaringen te boek te stellen en zo is er bijna geen soort van jachtwild te noemen waarvan zo weinig biologische bijzonderheden bekend zijn.

Reeds MÜLLER en SCHLEGEL die in hun bekende standaardwerk (Verh. Nat. Gesch. Ned. Overz. Bezitt., Zool. 1840) zoveel aandacht aan het grote wild van de Archipel besteedden deden de Kidangs in een paar woorden af. Des te meer reden bestond er dus een poging te ondernemen deze leemte in onze kennis te vullen.

M a t e r i a a l. Het materiaal voor deze bewerking werd in hoofdzaak verkregen uit de goedvoorziene collectie in het Museum Zoologicum Bogoriense te Bogor (Buitenzorg). Enkele aanvullingen konden worden betrokken uit privéverzamelingen (coll. SODY, Leiden) en ook van het Rijksmuseum van Natuurlijke Historie te Leiden werden enkele waardevolle stukken ter bewerking ontvangen. De heer A. SOLLAART (Bergen, Tg. Karang, Z. Sumatra) verzamelde op mijn verzoek aanvullend materiaal.

S e x u e l e D i m o r p h i e. De kidang vertoont een duidelijke sexuele dimorphie, zij het in mindere mate dan de andere Indo-Australische *Cervidae*. De meest opvallende secundaire geslachtskenmerken zijn het gewei en de lange gebogen hoektanden in de bovenkaak van de mannelijke dieren. Deze laatste zijn ware slagtanden en het voornaamste verdedigingswapen van het dier, terwijl het gewei alleen bij de onderlinge twisten tussen de bokken wordt gebruikt. Interessant is in dit opzicht wat over het wisselen van de hoektanden kon worden vastgesteld. Het mannetje wisselt de hoektanden n.l. in de eerste levensmaand en bokjes van een paar maanden oud hebben reeds goed ontwikkelde blijvende hoektanden, terwijl op dat ogenblik de rest van het melkgebit nog geheel in functie is. Bij de wijfjes daarentegen komen de blijvende hoektanden veel later door. Zelfs bij geiten die voor het eerst drachtig zijn treft men de melkcaninen nog aan. Blijkbaar heeft het wisselen van de caninen bij de geiten eerst aan het einde van het eerste jaar plaats. De hoektanden van de wijfjes groeien zeer langzaam en alleen oude geiten hebben echte, zij het kleine, slagtanden. Bij de bokken vertonen de hoektanden, zoals bekend is (AITCHISON 1946), een merkwaardige inrichting. Deze zijn n.l. beweeg-

baar d.m.v. elastische vezels die het voorste deel van de tandplaat verbinden met een ringvormig ligament dat de basis van de hoektand omgeeft. Bij druk op het enigszins verdikte gehemelte richten de hoektanden zich zijwaarts, zodat bij het herkauwen geen last van deze scherpe apparaten wordt ondervonden. Of bij de vrouwelijke dieren een dergelijke inrichting voorkomt kon tot nu toe niet worden vastgesteld. De snijtanden wisselen bij de geiten ongeveer drie maanden eerder dan bij de bokken.

Sexuele periodiciteit. Bij tropische herten is de sexuele periodiciteit veel minder aan seizoenen gebonden dan bij soorten in gematigde streken en verloopt zuiver individueel. M.a.w. de vastgestelde cyclus verloopt niet, zoals in gematigde streken, bij alle individuen simultaan. Helaas is dit verschijnsel in onvoldoende mate doorgedrongen tot die specialisten die zich met de jachtwetgeving in de Archipel bezig houden, hetgeen de uitwerking van maatregelen als schoontijden, in hoge mate ongunstig beïnvloeden moet. De kidang vertoont als soort in het grootste deel van zijn verspreidingsgebied in de Archipel geen omschreven bronsttijd. Op Java worden het gehele jaar door zowel bokken met bastgewei als bronstige bokken aangetroffen. Hetzelfde geldt voor drachtige geiten en pasgeboren kalveren. Men kan hoogstens zeggen dat de frequentie op verschillende tijden van het jaar groter of geringer is. Mutatis mutandis geldt dit principe voor vele tropische diersoorten. Aangemerkt dient verder te worden dat de data van grootste frequentie in verschillende jaren niet samenvallen. In delen van de Archipel waar de seizoenen met grotere regelmatigheid terugkeren en scherp zijn gescheiden zoals b.v. op Lombok treedt een bepaald sexueel stadium bij een groot aantal individuen gelijktijdig op en zou men dus wel van een bronsttijd kunnen spreken.

Dat de sexuele periodiciteit, zelfs individueel, bij de kidang veel minder uitgesproken is dan bij het geslacht *Rusa* b.v. blijkt uit het feit dat er geen periodieke haarrui optreedt. Men treft bij de kidang dan ook geen correlatie aan tussen de sexuele conditie (welke allermeest uit de toestand van het gewei blijkt) en de conditie van het haarkleed aan.

Ouderdomsbepaling. Het belang van een nauwkeurige ouderdomsbepaling werd hierboven reeds uiteengezet. Het bleek onmogelijk om met zekerheid de absolute ouderdom van de voorhanden exemplaren te bepalen, daar geen materiaal van bekende leeftijd aanwezig was. Daarom werd het materiaal gerangschikt cf. bestaande schemata voor het Europese Ree (*Capreolus capreolus*) dat in afmetingen, bouw en leefwijze veel overeenkomst met de kidang vertoont. Weliswaar zijn de verkregen resultaten daardoor hypothetisch, doch de verschillen met de werkelijke toestand zullen niet al te groot zijn, omdat de correlatie tussen de toestand van het gebit en de ontwikkeling van het gewei bij beide soorten gelijk is.

Ouderdomsverschillen. De kidang is veel eerder geslachtsrijp dan de andere Indo-Australische herten en bijgevolg worden de definitieve schedelmaten ook eerder bereikt dan bij de andere soorten. Toch konden ook hier wijzigingen in de onderlinge verhoudingen van de schedel gedurende de latere levensstadia worden aangetoond. Zo neemt b.v. de jukboogbreedte bij beide sexen met de leeftijd toe, de lengte van de neusbeenderen neemt bij de bokken af en bij de geiten toe, de voorhoofds sutuur wordt bij de bokken langer, bij de geiten korter, de in-

terorbitale breedte neemt vooral bij de bokken op hogere leeftijd toe etc. Uit den aard der zaak neemt de lengte van de kiezenrij af tengevolge van de afslijting van de kronen (VAN BEMMEL, Treubia 20, 1949, Pl. 2).

De vorm van de orbita en de kliergroeve benevens de hoogte van de schedel wijzigen zich het meest en het snelste op het ogenblik dat de praemolaren worden gewisseld. Direct na het wisselen van de praemolaren heeft de schedel de adulte vorm aangenomen. Dit verschil is uitstekend afgebeeld door G. S. MILLER (Proc. Ac. Nat. Sc. Philad. 94, p. 163—165 & plaat, 1942) doch de auteur was zich niet bewust van de werkelijke betekenis van de door hem gevonden verschillen, die N.B. door hem als soortskenmerken werden beschouwd.

Ouderdomsverschillen in het gewei komen op dezelfde wijze tot stand als bij andere *Cervidae*. In het algemeen wordt het stadium van spiesbok voorafgegaan door een stadium waarop twee zeer korte knopjes worden gedragen die spoedig worden afgeworpen. Het eindstadium is in het normale geval een vierender. Het afwerpen van het gewei verloopt zeer onregelmatig, wat wel de reden is dat onder jagers de mening heerst dat na het bereiken van het stadium van vierender het gewei niet meer wordt afgeworpen. In het algemeen dragen bokken van ongeveer 7 jaar oud de beste hoofdtooi, daarna wordt het gewei als regel teruggezet. De ontwikkeling van het gewei verschilt sterk naar het ras. Op Lombok komen geweien met meer dan zes enden geregeld voor en ook op Java zijn zesenders herhaaldelijk aangetroffen. In Zuid en West Borneo bestaat het gewei meestal uit een enkele spies.

Ouderdomsverschillen in kleur zijn nauwelijks te vinden. Jonge bokken zijn meestal lichter dan oude bokken, oude geiten meestal rosser van tint dan jonge geiten.

Geographische rassen en verspreiding. Het geslacht *Muntiacus* komt in de Archipel slechts in een enkele soort voor, n.l. *Muntiacus muntjak* (ZIMMERMAN, 1780). De beide andere soorten die tot nu toe voor de Archipel werden erkend, n.l. *M. pleiharicus* en *M. montanus* konden gedurende het thans verrichte onderzoek tot de rang van subspecies worden teruggebracht. Het centrum van het verspreidingsgebied, Java en Zuid Sumatra wordt door een groot en zeer uniform ras ingenomen. In het oosten sluit zich daarbij op Bali en Lombok een kleiner ras aan. (*M. m. muntjak* resp. *M. m. nainggolani*). Zuid en West Borneo worden door een klein, zeer afwijkend, licht gekleurd ras bewoond dat zich vooral onderscheidt door het bezit van een aalstreep en een licht spiesgewei (*M. m. pleiharicus*). Van het Noorden dringen twee donkergekleurde rassen in dit verspreidingsgebied binnen die beiden in hoofdzaak de bergen bewonen doch ook in de vlakte afdalen. Het ene (*M. m. montanus*) bevolkt Noord en Centraal Sumatra en vormt met het Zuid Sumatraanse ras een breed menggebied in Deli, West Sumatra en het Kerintji complex. Het andere bevolkt Noord Borneo en Oost Borneo (*M. m. rubidus*) en vormt met het Zuidwestelijke ras een menggebied dat in Centraal Borneo en Serawak zeer breed, in Zuid-oost Borneo zeer smal is. BANKS (1931) nam ten onrechte aan dat de grote verschillen in de menggebieden op leeftijds- en seizoensverschillen berusten.

Zoögeographisch is de verspreiding op Sumatra en Borneo m.i. tamelijk ondoorzichtig. Op Sumatra lijkt het aannemelijk dat het ras van Java

van het Zuiden is binnengedrongen en het ras *M. m. montanus* autochtoon is. De toestand op Borneo zal pas begrijpelijk worden indien wij eerst een duidelijk inzicht hebben gekregen in de vormen die de eilanden tussen Borneo, Sumatra en het vaste land bevolken. Beide donkere rassen zijn niet als eenvoudige bergvormen te beschouwen, daar er tussen dieren die op Java, Lombok en Zuid Sumatra op grote hoogte voorkomen en de dieren die daar in het laagland leven niet het minste verschil bestaat.

HET GENUS *ARCTOGALIDIA*.

Het genus *Arctogalidia* is een geslacht van Orientale *Viverridae* en omvat slechts een enkele soort, die echter tamelijk vormenrijk is. In het algemeen zijn de roofdieren van de Indo-Australische Archipel veel beter onderzocht dan de hoefdieren en de familie *Viverridae* is hierop geen uitzondering. Ondanks het feit dat een groot aantal vormen van de Archipel beschreven zijn, vnl. door MILLER en LYON, en er een voortreffelijke revisie over bestaat, geschreven door POCOCK (1933)) bleef omtrent *Arctogalidia* echter toch een grote verwarring bestaan. Dit vond zijn oorzaak in twee omstandigheden. *Arctogalidia trivirgata* is een nachtdier, zoals trouwens de meeste van zijn familieleden en bovendien in het grootste deel van zijn verspreidingsgebied een boombewonend oerbosdier. Hierdoor is de soort moeilijk te verzamelen en in collecties vrij zeldzaam. Aan de andere kant heeft de fee die bij de doop van de soort stond het geboorteregister betoverd en een vrijwel onontwarbare knoop gelegd in de oorspronkelijke beschrijvingen en de aanwijzing van de typen. Hierdoor kon het gebeuren dat een van de meest afwijkende vormen die het geslacht omvat, n.l. het ras van Java, geheel aan de aandacht van de laatste revisoren ontsnapte.

Toen ik destijds bij het aanleggen van een nieuw kaartsysteem van de zoogdiercollectie in het Museum Zoologicum Bogoriense te Bogor (Buitenzorg) het fraaie daar aanwezige materiaal doorzag bleek mij dan ook onmiddellijk dat de Javaanse vorm met zijn opvallende kleur en lange beharing in geen enkel bestaand schema paste. Al spoedig kwam ik tot de conclusie dat met een simpele beschrijving niet kon worden volstaan. Vergelijking met materiaal in het Rijksmuseum van Natuurlijke Historie te Leiden bleek noodzakelijk, de daarover gevoerde correspondentie, verlucht met foto's, kon geen uitsluitsel bieden en pas nadat ik, met het materiaal uit Bogor, in Leiden was aangekomen kon de puzzle worden opgelost. Het middelpunt van de knoop bleek te liggen in een exemplaar dat in oudere Nederlandse publicaties als type van de soort wordt beschouwd, doch zulks waarschijnlijk niet is. Ongelukkigerwijze is dit exemplaar bovendien nog verkeerd geëtiketteerd. Het draagt als vindplaats "captus prope Buitenzorg' en de verzamelaar REINWARDT 1821. REINWARDT bracht echter het gehele jaar 1821 niet in Buitenzorg door, doch bereisde in dat jaar het oostelijk deel van de Archipel, gebieden waar de soort intussen niet voorkomt. De vindplaats is zeker onjuist want het dier komt in geen enkel opzicht met soortgenoten van Java overeen, doch past uitstekend in de fraaie serie van Malakka die ik tot mijn beschikking had. Hoe dit exemplaar in Leiden belandde zal wel altijd een raadsel blijven. Als terra typica van de soort wordt in de oorspronkelijke beschrijving (GRAY, 1832) "Molucca's" vermeld, doch de soort komt daar niet voor. Later werd de terra typica door de auteur reeds in Ma-

lakka gewijzigd. Dit complex van verwarringen werd nog vergroot doordat JENTINK (1887, 1892) de werkelijke vorm van Java als een kleurvariant, een soort albino, beschouwde en zelfs als var. *alba* benoemde. Latere auteurs hebben uit deze gegevens dan ook de meest uiteenlopende conclusies getrokken. Naar mij bleek heeft echter WAGNER (1841) min of meer toevallig de Javaanse vorm uitstekend beschreven. Van de andere auteurs hebben alleen SODY (1937) en BARTELS (1941) de status van de Javaanse vorm ingezien.

Materiaal. Tot mijn beschikking stonden: het gehele materiaal uit het Museum Zoologicum Bogoriense, het Rijksmuseum van Natuurlijke Historie te Leiden, de collectie BARTELS (Leiden), de collectie SODY (Leiden), het Raffles Museum Singapore, het Zoölogisch Museum Amsterdam, enkele waardevolle exemplaren uit het British Museum N.H. Londen en het type van WAGNER uit het Senckenbergmuseum Frankfort a/M. Al ontbraken mij ook de schone series uit de musea in de U.S.A. toch kon het materiaal dat ik gebruikte gerust als uniek worden beschouwd.

Sexuele dimorphie. Deze komt vooral tot uiting in de geurklieren die bij het wijfje een typische bouw vertonen en bij het mannetje ontbreken. De mannetjes zijn voorts groter dan de wijfjes, de vorm van de schedelkapsel is anders en de schedel van de mannetjes vertoont een veel sterkere postorbitale insnoering dan die van de wijfjes. Het is wat dit laatste betreft alweer noodzakelijk om alleen dieren van een gelijke leeftijd te vergelijken, daar de toestand bij de jongere mannetjes sprekend lijkt op die bij de oude wijfjes.

Ouderdomsverschillen. Absolute ouderdomsbepalingen bleken niet uitvoerbaar. Het materiaal werd daarom eerst gescheiden volgens de sexe en vervolgens gerangschikt naar de toestand van afslijting van het gebit en de mate van ontwikkeling van de crista occipitalis. De ouderdomsverschillen komen tot uiting in de postorbitale insnoering die met de leeftijd toeneemt, het vager worden van het typische rugpatroon dat als regel uit drie lengtestrepen bestaat en het onduidelijk worden of geheel verdwijnen van de lichte neusstreep die bij een aantal rassen voorkomt.

Geographische rassen en verspreiding. De enige soort van het geslacht, *Arctogalidia trivirgata*, valt uiteen in drie samenhangende groepen van rassen, die ik met L. J. TOXOPEUS als greges zou willen aanduiden[1]). Het westelijke deel van het verspreidingsgebied wordt ingenomen door de grex *A. t. leucotis* en beslaat Assam, Laos, Tonkin, Zd. Burma, Arakan, West Siam, het Amherst district van Tenasserim en de Mergui Arch. Op Java vindt men de tweede groep die door slechts een enkele gregale vorm wordt vertegenwoordigd. Beiden hebben allerlei eigenschappen met elkaar gemeen. Daartussen in schuift zich als een wig de veelvormige donkere centrale grex *A. t. trivirgata* die het Maleise Schiereiland met omringende eilanden, Sumatra met omringende eilanden, de Riouw en de Lingga Arch., Banka en Billiton, Noord Natuna en Borneo inneemt. Een dergelijke verspreiding, waarbij de vorm van Java zich enger aansluit bij het westelijke deel van het verspreidingsgebied dan bij de vormen van het tussengelegen deel van de Archipel

[1]) Het begrip grex en de gebruikte nomenclatuurvorm is eerder door mij uiteengezet in Treubia 19, p. 326—327, 1948.

treffen we ook in andere diergroepen aan. Als voorbeeld hoef ik bij de zoogdieren slechts het geslacht *Rusa* te noemen, bij de vogels het geslacht *Psittacula*. Een verklaring is hier niet altijd gemakkelijk te geven. Bij het geslacht *Psittacula* wijst alles erop dat de verspreiding naar Java heeft plaats gehad via de eilandenreeks ten westen van Sumatra. Bij *Rusa* en ook bij *Arctogalidia* is voor een dergelijke verklaring geen steun te vinden. Het geslacht *Rusa* komt ten westen van Sumatra alleen op Nias voor en wel in een vorm die niet wezenlijk van die van Sumatra verschilt. *Arctogalidia* is alleen van de Batu-eilanden bekend en, hoewel ik zelf geen materiaal van deze vindplaats heb gezien, schijnt er geen verschil te zijn met de Sumatraanse vorm. Nu mag bekend worden verondersteld dat de fauna van Nias en de Batu-eilanden in wezen niets anders is dan een verarmde Sumatraanse en daarin vrij principieel van die van de andere eilanden ten westen van Sumatra afwijkt. In de onderhavige gevallen zal dus iedere verklaring uiterst hypothetisch moeten wezen.

Wat de vormen van de centrale grex, *A. t. trivirgata* betreft, deze zijn het beste af te leiden van het enige ras van deze grex dat op het vaste land voorkomt (*A. t.* (*t.*) *trivirgata*). Het ras van Sumatra staat het meeste op zichzelf, meer dan het ras van Borneo (*A. t.* (*t.*) *stigmatica*) terwijl het ras van Banka en Billiton (*A. t.* (*t.*) *minor*) zich direct bij dat van het vaste land aansluit en vnl. kleiner is. De hele groep van tussenliggende eilanden heeft een reeks van rassen die een duidelijke „cline" vertonen, duidelijk samenhangen en vooral door het kleurpatroon zijn gekarakteriseerd. De meest extreme vorm van deze reeks vindt men op Noord Natuna terwijl in het westen aansluiting bij de rassen van Sumatra en het vaste land wordt verkregen. Dit beeld past dus geheel in het verspreidingspatroon dat men op grond van het verloop van de Sundarivier heeft ontworpen.