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A DISCUSSION OF MALAYAN AND INDONESIAN SHREWS OF THE GENUS *CROCIDURA* (INSECTIVORA: SORICIDAE)

by

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Abstract

An investigation was made into the systematics of white-toothed shrews (*Crocidura*) occurring in Malaya and Indonesia. Most of the forms recorded from this area have been found to represent one of four species: *C. fuliginosa* (Blyth, 1855), *C. attenuata* Milne-Edwards, 1872, *C. maxi* Sody, 1936 or *C. monticola* Peters, 1870, while the status of a few others remains unresolved at this stage. Each species is discussed and distinguishing features are given in tabular form.

Introduction

In an examination of Eurasian *Crocidura* (Jenkins, 1976), the survey of the Malayan and Indonesian areas was incomplete because of inadequacy of material. Sufficient specimens were available only from Malaya and Borneo, where the occurrence of *C. fuliginosa* (Blyth, 1855) was confirmed and Christmas Island, where the named form — *trichura* — was for the first time assigned to *C. attenuata* Milne-Edwards, 1872. Brief comments were made on the status of the other forms recorded from the region.

A more thorough study of this region has subsequently proved possible through the provision of two invaluable loans of material from the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH) by Dr. A. M. Husson and the Museum Zoologicum Bogoriense, Indonesia (MZB) by Dr. S. Kadarsan and Mr. Boeadi. This material has been compared with that in the collection of the British Museum (Natural History) [BM(NH)].

Chasen (1940) recorded 29 species from the Malaysian subregion, some of which have been commented on since by Laurie & Hill (1954), Hill (1960), Davis (1962), Harrison (1964, 1966) and Medway (1965, 1969, 1977, 1978). This report deals with populations of *Crocidura* from Malaya, Sumatra, Borneo, Java, Sumba, Flores, Amboina and some of the smaller Indonesian islands. They have been compared with extra-limital material of the same genus, with the result that some of the Malayan and Indonesian material has been found to represent geographical varieties of species occurring in Asia, rather than distinct species.

TABLE 1

Comparison of the Malayan and Indonesian species of *Crocidura* (measurements in mm)

Character	*C. monticola* (n = 15)	*C. maxi* (n = 25)	*C. attenuata* (n = 15)	*C. fuliginosa* (n = 217)
Condylobasal length	15.2-17.4	17.1-19.5	18.3-20.2	21.3-25.0
	$\bar{x}$ 16.13	$\bar{x}$ 18.03	$\bar{x}$ 19.30	$\bar{x}$ 22.80
Upper toothrow length	6.6-7.3	7.3-8.4	8.1-9.0	9.4-11.5
	$\bar{x}$ 6.85	$\bar{x}$ 7.88	$\bar{x}$ 8.48	$\bar{x}$ 10.40
Width across maxillae at M^2	4.3-5.1	5.0-5.9	5.3-5.8	6.2-7.8
	$\bar{x}$ 4.68	$\bar{x}$ 5.42	$\bar{x}$ 5.60	$\bar{x}$ 6.90
Braincase breadth	7.2-8.5	7.6-8.6	8.8-9.6	9.5-11.1
	$\bar{x}$ 7.72	$\bar{x}$ 8.07	$\bar{x}$ 9.10	$\bar{x}$ 10.10
Tail length	31-55	35-61	63-80	39-88
	$\bar{x}$ 42.15	$\bar{x}$ 48.10	$\bar{x}$ 70.70	see note on variation in systematic section.

Examination of the available material suggests that only four species can be recognised with confidence, namely *C. fuliginosa* (Blyth, 1855), *C. monticola* Peters, 1870, *C. attenuata* Milne-Edwards, 1872 and *C. maxi* Sody, 1936. These species may be clearly distinguished on the basis of size as shown in table 1. Within each of these groups some geographical variation occurs, which is considered to be significant at the infraspecific level and is discussed in the text.

The main metrical characters used were: condylobasal length, length of upper toothrow, width across maxillae at level of second molar, braincase breadth and tail length. Other characters, used to discriminate between populations at a subspecific level were: height of mandible at coronoid process, anterior width of second upper molar, fur length given as an average figure from the mid-dorsal region and to a limited extent, colour. All measurements are given in millimetres.

SYSTEMATIC SECTION

Crocidura fuliginosa (Blyth, 1855)

Although the identity of the holotype of *C. fuliginosa* is in doubt — see discussion in Medway (1965, 1977) and Jenkins (1976) — the name has been accepted and used for some of the large shrews inhabiting southern Asia, Malaya and Borneo (Hose, 1893; Banks, 1931; Chasen, 1940; Medway, 1965, 1969, 1977, 1978; Van Peenen et al., 1969, 1970). It is proposed here that a number of the other large forms occurring in the Malayan and Indonesian areas also belong to this species, since they fall within the size range of *C. fuliginosa* and are otherwise directly comparable. Table 1 gives the size range in comparison with the other three species.

Material. — The following material of *C. fuliginosa* was used as a basis of comparison for the forms listed subsequently:

China. BM(NH) 12.7.25.8: holotype of *C. dracula* Thomas, 1912 and BM(NH) 12.7.25.6-7, 9-10: all from Yunnan; BM(NH) 23.4.1.13: holotype of *C. praedax* Thomas, 1923 and BM(NH) 23.1.1.12, 14-17, 29.3.17.19: all from Lichiang Range, N.W. Yunnan.

Vietnam. BM(NH) 33.4.1.169-188, 190, 192: Chapa.

Borneo. BM(NH) 98.11.3.3: holotype of *C. baluensis* Thomas, 1898, Kina Balu; BM(NH) 63.1212: holotype of *C. fuliginosa kelabit* Medway, 1965, Kelabit Uplands, Baram, Sarawak; BM(NH) 95.10.4.6.-7, 98.11.3.12: Kina Balu; BM(NH) 59.193: Niah Caves; BM(NH) 63.1213: Bario Airstrip; BM(NH) 92.9.6.22: Rajang River, Sarawak; BM(NH) 56.9.19.15, 93.4.1.41: Sarawak.

Malaya. BM(NH) 49.429: holotype of *C. malayana* Robinson & Kloss, 1911, Maxwell's Hill, Perak; BM(NH) 6.10.4.14: Gunong Tahan, Pahang; BM(NH) 0.7.3.1-5: Larut Hills; BM(NH) 65.3750-3760: Kepong, Selangor; BM(NH) 65.3761: Kota Tinggi, Johore.

Material of the other forms considered here to represent *C. fuliginosa*:

Sumatra. BM(NH) 19.11.5.26: holotype of *C. villosa* Robinson & Kloss, 1918, Korinchi; BM(NH) 20.1.15.3-4: Lebong Tandai; RMNH 24669: locality unspecified.

Java, West. RMNH 12719: holotype of *C. brevicauda* Jentink, 1890 and RMNH 12722: holotype of *C. orientalis* Jentink, 1890, both from Tjibodas, Sindanglaja; MZB 2463, 8686, 9564, 9568, 9580, 9665: Tjibodas; RMNH 15473: Pasir Datar, Pangerango; RMNH 15476, 15481, 15493: Podjok, Pangerango; RMNH 15477, 15483-5, 15487, 15491, 15494: Tjiparai, Pangerango; RMNH 12724: holotype of *C. melanorhyncha* Jentink, 1910 and RMNH 12725-6, 15464-6, 15470-2, 15474, 15480, 15486, 15495-6, 15498, 15500, 24033-4 and MZB 819-820, 860, 9565: all from Pangerango; RMNH 23997-24002: Gunung Gedeh; RMNH 24003-4 and MZB 12, 939, 1677-9, 1701, 8681, 8685, 8687: Kandang Badak, Gunung Gedeh; RMNH 15457: Gunung Tjireme; MZB 8684: Lebuksaät; MZB 9566, 9573, 9577, 9700: Tjibeureum; MZB 3248: Salah; RMNH 15492: Tjimahi; RMNH 15497: Wijnkoopsbaai, S. Coast; RMNH 15482: S. Coast; RMNH 24035-63: Tjibuni, Bandung; RMNH 24312: Preanger; RMNH 24314: Tjinjiruan, Malabar; RMNH 24031: Gunung Mas, Buitenzorg; RMNH 24226: holotype of *C. brunnea* Jentink, 1888, no precise locality, but almost certainly W. Java.

Java, Central. RMNH 23987: holotype of *C. orientalis lawuana* Sody, 1936 and RMNH 15461-2: Gunung Lawu; RMNH 15460: Gunung Slamet; RMNH 15501: Rongkop, S. Coast.

Java, East. RMNH 24005-10, 24012-24: Pudjon, Res. Malang.

Timor. RMNH 24665: holotype of *C. tenuis* (Müller, 1840); RMNH 24664: holotype of *C. macklotii* Jentink, 1888.

The main problems in dealing with *C. fuliginosa* arise at the subspecific level, for diagnostically valuable characters are only applicable on a limited geographical basis; those which can be used successfully in one region may be valueless in others. For example, the height of the mandible is an important subspecific character in Java but not elsewhere. Length of the pelage is useful in Java and Borneo, where it is apparently unaffected by seasonal variation. This character, in conjunction with others, is used to divide subspecies in Java into long-, medium- and short-haired forms. However, pelage length is of no value in Asian subspecies, since it is subject to seasonal variation, as discussed later under *C. f. dracula*. Another frequently used character, although often of limited value, is tail length; it is a useful ancillary character in Javan and Bornean subspecies. In addition, differences in size of skull and width of the second upper molar are of lesser importance in distinguishing Javan subspecies.

TABLE 2

Comparison of Javan subspecies of *Crocidura fuliginosa*. The Bornean sample is representative of most other populations from Asia and Malaysia and is included for comparison (measurements in mm)

Character	*C. fuliginosa* Borneo (n = 20)	*C. f. orientalis* W. Java montane (n = 45)	*C. f. brevicauda* W. Java lowland (n = 68)	*C. f. pudjonica* E. Java lowland (n = 19)
Upper toothrow length	9.9-11.5	9.5-10.8	9.8-11.5	9.6-10.6
	$\bar{x}$ 10.7	$\bar{x}$ 10.1	$\bar{x}$ 10.8	$\bar{x}$ 10.2
Mandible height at	5.2-6.3	4.8-5.5	5.6-6.5	5.3-6.0
coronoid process	$\bar{x}$ 5.80	$\bar{x}$ 5.30	$\bar{x}$ 6.00	$\bar{x}$ 5.70
Anterior width of M^2	1.9-2.6	1.9-2.25	2.2-2.9	2.2-2.4
	$\bar{x}$ 2.35	$\bar{x}$ 2.10	$\bar{x}$ 2.50	$\bar{x}$ 2.30
Width across maxillae at M^2	6.4-7.5	6.2-7.2	6.7-7.8	6.5-7.4
	$\bar{x}$ 7.10	$\bar{x}$ 6.70	$\bar{x}$ 7.20	$\bar{x}$ 6.80
Tail length	54-77	60-84	44-64	39-49
	$\bar{x}$ 64.70	$\bar{x}$ 72.00	$\bar{x}$ 55.60	$\bar{x}$ 44.30
	Varies according to subspecies			
Fur length	Varies according to subspecies	long	short	short
		$\bar{x}$ 7.70	$\bar{x}$ 4.30	$\bar{x}$ 4.30

Table 2 compares Javan subspecies with Bornean forms; measurements for the other populations are not given, because they do not differ substantially from the Bornean population and all fall within the range given in table 1. A discussion of the various geographical forms follows:

1. Yunnan, China and Vietnam

C. fuliginosa dracula Thomas, 1912. Exhibits seasonal variation in pelage. Specimens collected from October to April, including the holotype of *C. f. dracula*, have a long (6.8-8.1 mm, $\bar{x}$ 6.9) dense, soft pelage; specimens collected from June to September, including the holotype of *C. praedax* (= *C. f. dracula*), have a shorter (4.4-5.7 mm, $\bar{x}$ 4.8), less dense pelage. The dorsal hairs have slate grey bases and grey-brown tips giving a "greyish" pelage.

2. Malaya

C. fuliginosa malayana Robinson & Kloss, 1911 from the mainland and the holotypes of the following forms from the offshore islands, were distinguished from each other by their authors, who used slight differences in size and colour which are not substantiated when the series are compared with a range of *C. fuliginosa* from Malaya and elsewhere. They may or may not be distinct subspecies of *C.*

fuliginosa. These forms: *aoris* Robinson, 1912; *klossii* Robinson, 1912; *negligens* Robinson & Kloss, 1914; *maporensis* Robinson & Kloss, 1916; *tionis* Kloss, 1917a and *aagaardi* Kloss, 1917b have a short (3.7-4.7 mm, $\bar{x}$ 4.2), fairly soft coat in common with *C. f. malayana.* An exception is *gravida* Kloss, 1917a which is moulting and has a shorter, relatively hard pelage.

3. Borneo

Medway (1965, 1977) commented on the three subspecies recorded from here, differentiating them on the basis of pelage and tail length.

C. fuliginosa foetida Peters, 1870. Short pelage (3-4 mm), tail 70-90% of head and body length.

C. fuliginosa baluensis Thomas, 1898. Long (over 8 mm), soft, dense pelage, dorsal hairs with slate grey bases, dark brown tips. Tail 70-90% of head and body length.

C. fuliginosa kelabit Medway, 1965. Moderately long (5-6 mm), soft pelage. Tail equal to or longer than head and body.

4. Sumatra

There is insufficient material from Sumatra to assess the correct situation, although it is clear from studying the holotype, that *C. villosa* Robinson & Kloss, 1918 should be assigned to *C. fuliginosa* as a subspecies. The holotype has a long (6.5 mm), dense, hard coat with prominent guard hairs, similar in colour to *C. f. baluensis. C. brunnea* has also been recorded from Sumatra (Jentink, 1888), but the material examined also seems to belong to the subspecies *C. f. villosa.*

5. Java

Six forms referable to *C. fuliginosa* have been described from Java: *brunnea, orientalis, brevicauda, melanorhyncha, lawuana* and *pudjonica.* The holotype of *brunnea* from no definite locality in Java, was inadequately described by notes on colour, skin measurements and brief comments on the teeth (Jentink, 1888). The specimen is in very poor condition with a badly damaged skull, preventing critical comparison with any of the other named forms, except to note that the tail length is similar to that of *brevicauda* and in size the specimen falls within the range of *C. fuliginosa.* It is very doubtful if it represents a distinct subspecies. Since its status cannot be properly established, for the present it is provisionally associated with *C. f. brevicauda*, although it should be noted that in fact *brunnea* is the prior name.

Jentink (1890) described *orientalis* and *brevicauda* as new species from single adult animals, both from Tjibodas, Sindanglaja, on the north eastern slopes of Mount Pangerango, W. Java. He differentiated *brevicauda* from *orientalis* by the larger size of the former, its shorter tail and shorter, less dark fur. In 1910 the same author described another new species, *melanorhyncha*, from Mount Pangerango, distinguishing it from *brevicauda* only by its slightly smaller size and black

muzzle. However, the holotype is indistinguishable from a range of specimens of *brevicauda* and the names should be regarded as synonyms.

A number of specimens from localities in W. Java agree in all essential respects with the holotype of *brevicauda*. A similar series is in close agreement with the holotype of *orientalis*. The two series of specimens differ by the characters given in table 2. Both forms occur together at Tjibodas and Tjiparai and most specimens examined are clearly referable to one form or the other. However, a combination of the characters is found in three specimens, which indicates that this area is one of intergradation.

There is some indication that characters are correlated with altitude, but unfortunately many of the specimens are too poorly documented to permit any definite conclusions. Specimens with long fur, long tails and low mandibles generally occur at greater altitudes than the short-furred, short-tailed specimens with high mandibles. An overlap in altitude does occur and in one case, two specimens collected at 1180 m at Tjibodas are clearly separable into *orientalis* and *brevicauda*. There is apparently no other ecological barrier separating the two forms and seasonal variation is not responsible, in this instance, for differences in fur length (unlike the situation in *C. f. dracula* discussed earlier). While the summer pelage of each form is relatively shorter than the winter one, the actual fur length of *orientalis* is at all seasons greater than in *brevicauda*.

A correct interpretation of the situation is difficult. Two apparently distinct forms are present in W. Java but in one of several localities where both forms occur together, a few specimens share features of both forms, indicating that these are areas of intergradation or hybridisation. There are two possible conclusions in the absence of information on reproduction or detailed ecological data. The first is that two distinct species are present and that the intermediate specimens are hybrids, although this seems unlikely in view of the fact that *brevicauda* and *orientalis* are linked to some extent by an intermediate form, *pudjonica*, from E. Java. The second view and the one adopted here, is that three subspecies are present; *orientalis* and *lawuana* are synonymous, representing a generally smaller, long-tailed, long-furred (7.3-8.2 mm, $\bar{x}$ 7.7) montane subspecies, with a relatively low mandible and narrow M^2, occurring in West and Central Java and that *brevicauda* and *pudjonica* are representatives of larger, short-tailed, short-furred (4-5 mm, $\bar{x}$ 4.3) lowland forms. The two lowland subspecies, respectively from western and eastern Java, are separable by the smaller average size of *pudjonica* (see table 2).

The Javan subspecies summarised below, all have dorsal hairs with slate grey bases and reddish brown tips; some specimens of *brevicauda* are greyer than *orientalis*.

C. fuliginosa orientalis Jentink, 1890
  C. orientalis lawuana Sody, 1936
C. fuliginosa brevicauda Jentink, 1890
  ? *C. brunnea* Jentink, 1888
  C. melanorhyncha Jentink, 1910
C. fuliginosa pudjonica Sody, 1936.

6. Timor

Two species have been described from Timor: *C. tenuis* (Müller, 1840) and *C. macklotii* Jentink, 1888. The holotypes of both have damaged skulls, but they are so similar in all respects except colour (an unreliable feature, especially as the holotype of *C. macklotii* has been removed from alcohol) that they should be regarded as representatives of the same form. It is very likely, on the basis of size, that the two specimens are representatives of *C. fuliginosa*, which means that since the name *tenuis* predates *fuliginosa*, this could become the operative name for the entire group. However, the material is damaged and so limited that the status of Timor shrews remains unclarified at this stage. The specimens have a short pelage (4.2 mm).

Crocidura monticola Peters, 1870

Crocidura monticola was originally described and recorded from Java. Koller (1930) recorded specimens from Java, Obi and Sumba; specimens were recorded from Lombok, Sumbawa, Flores and probably also Komodo by Mertens (1936); Chasen (1940) listed it from Java and Borneo; Tate (1944) from Java and the highlands of Sumbawa and Lombok, Obi and Sumba; while Laurie & Hill (1954) reported that it occured on Java, the Lesser Sunda Islands, Lombok, Sumbawa, Komodo, Flores, Sumba and probably Timor. In addition to *C. monticola*, several other small-sized species have been recorded from Indonesia and the entire group is in a confused state, with some species known only from single, damaged specimens. The small-sized species so far recorded are: *C. neglecta* Jentink, 1888 and *C. minuta* Otten, 1917, which are discussed in the section on unresolved species; *C. bartelsii* Jentink, 1910, which is treated here as a synonym of *C. monticola*; and *C. maxi* Sody, 1936, which is regarded as a distinct species. It seems unlikely from the current study that *C. monticola* is present on all the islands listed by Laurie & Hill (1954), but that it is sympatric with, or replaced by, at least one other species — *C. maxi* — on some of these islands.

C. bartelsii was originally considered to differ by its smaller size and dark brown colouration from *C. monticola*, but examination of a series of specimens shows that there is no obvious size difference, skull proportions are similar and colour ranges from light, through medium to dark individuals. Thus *C. bartelsii* is considered to be a synonym of *C. monticola.*

At least on Java and possibly elsewhere, *C. monticola* is sympatric with another small-sized species, *C. maxi.* They can be distinguished by the following characters: *C. monticola* averages smaller than *C. maxi*, with a short, broad skull in which the braincase is short, rounded and deep; in profile, the skull slopes very gently upwards from the rostrum to the lacrymal region, then abruptly steepens so that the top of the braincase is distinctly above the rest of the skull. In contrast, *C. maxi* has a longer, slender skull, in which the braincase is longer, narrower and shallower in relation to skull length than in *C. monticola*; in profile,

the skull slopes gently upwards from the rostrum to the back of the braincase. For measurements see tables 1 and 3.

Two species of comparably small-sized shrews occur well to the north of the known range of *C. monticola*. *C. horsfieldi indochinensis* Robinson & Kloss, 1922 extends to southern Vietnam and *C. suaveolens* (Pallas, 1811) to northern Vietnam and Yunnan. It is possible that *C. monticola* might be no more than a geographical variant of one or other species; however, in view of the apparent gap in distribution and the differences between them, they are all considered to be distinct. *C. suaveolens* has a longer, slightly less rounded and shallower braincase than *C. monticola* and in profile the skull slopes gently upwards from the rostrum to the back of the braincase, the tail length averages shorter (ratio of tail length to upper toothrow length 4.5-5.8:1 in Asian *C. suaveolens*, 5.5-7.5:1 in *C. monticola*) and the upper premolar averages broader (posterior width of premolar 1.2-1.5 mm in *C. monticola*, 1.4-1.8 mm in *C. suaveolens*). *C. monticola* has a relatively long tail similar to that of *C. horsfieldi* (ratio of tail length to upper

TABLE 3

Additional measurements for separating *C. monticola* and *C. maxi* (see also table 1; measurements in mm)

Character	*C. monticola* (n = 15)	*C. maxi* (n = 25)
External length of upper unicuspids	1.5-1.9	2.0-2.3
	$\bar{x}$ 1.76	$\bar{x}$ 2.13
Height of braincase	3.9-4.8	3.5-4.4
	$\bar{x}$ 4.14	$\bar{x}$ 4.04
Ratio of height of braincase to upper toothrow length	55.7-66.7	46.7-55.3
	$\bar{x}$ 59.63	$\bar{x}$ 51.34
Height of mandible at coronoid process	3.3-4.0	3.9-4.9
	$\bar{x}$ 3.64	$\bar{x}$ 4.29
Length of mandibular toothrow	4.5-5.2	5.0-5.7
	$\bar{x}$ 5.09	$\bar{x}$ 5.37

toothrow length 6.5-7.5:1 in *C. horsfieldi*), but the premolar is narrower on average in *C. monticola* (posterior width of upper premolar 1.4-1.7 mm in *C. horsfieldi*) and although the braincase in *C. horsfieldi* is deep, it is longer and not rounded and in profile, the skull slopes quite steeply upwards from the rostrum to the back of the braincase.

C. monticola is readily distinguished from the larger species occurring in Malaya and Indonesia (see table 1).

Material. — The material listed below is referable to *C. monticola*:

Borneo. BM(NH) 93.4.1.41: Sarawak.

Malaya. BM(NH) 73.656, 82.498: near Ulu Gombak, Selangor; BM(NH) 82.194: Ampong

Forest Reserve, Selangor.

Java, Central. Zoologisches Museum, Berlin 3820: holotype of *C. monticola* Peters, 1870: Surakarta.

Java, West. RMNH 12723: holotype of *C. bartelsii* Jentink, 1910 and RMNH 23988-90: Pangerango; MZB 124: Kadang Badak; MZB 11141; Gunung Gedeh; RMNH 15456: no precise locality, but almost certainly Tjigundeng, near Buitenzorg.

Java, East. RMNH 23983-4, 23991: Pudjon, Res. Malang; MZB 2164, 2169, 8716: Malang.

1. Borneo

A single specimen of *C. monticola* is similar to specimens from Java.

2. Malaya

These three specimens represent the first records of this species from Malaya and also an extension of the supposed range. They are similar in appearance to specimens from Borneo and Java.

3. Java

The largest sample of this species is from Java. There are no obvious differences between specimens from the west or those from the central or east of the island.

Crocidura maxi Sody, 1936

C. maxi has hitherto only been recorded from Java, but it now seems clear that this species is present on a number of other islands in the Indonesian chain. *C. maxi* occurs with *C. monticola* on Java and the two species may also be sympatric elsewhere. However, it is also possible that some of the records attributed to *C. monticola* may be erroneous and might be specimens of *C. maxi*. The characters used to distinguish these two species are given under *C. monticola* and in tables 1 and 3.

C. maxi is unlikely to be confused with either of the two small extralimital species — *C. suaveolens* or *C. horsfieldi*. It is larger on average (condylobasal length 15.2-16.9 mm in Asian specimens of *C. suaveolens*, 16.2-17.9 mm in *C. horsfieldi*, 17.1-19.5 mm in *C. maxi*); the external length of the upper unicuspids is greater in *C. maxi* (2.0-2.3 mm) than in *C. suaveolens* (1.5-1.9 mm); width across maxillae at level of second molar averages greater in *C. maxi* (5.0-5.9 mm) than in *C. horsfieldi* (4.8-5.1 mm).

See table 1 for comparison of measurements of *C. maxi* with those of *C. attenuata* and *C. fuliginosa*. *C. maxi* averages smaller than *C. attenuata*, with a distinctly narrower braincase and shorter tail. *C. maxi* is considerably smaller than *C. fuliginosa*.

Material. — Java, East. RMNH 23992: holotype of *C. maxi* Sody, 1936 and RMNH 23993: Besuki; RMNH 23986: Punten, Batu; RMNH 23985: Pudjon, Res. Malang; MZB 8691-2: Mandjang, South Malang; MZB 2168: Malang.

Flores. MZB 8693: Ruteng; MZB 8695-6: Sita; MZB 8697-8703: Roux Nese; BM(NH) 97.4.18.25: S. Flores.

Sumba. MZB 8704-8: Langgaliru.

Amboina. MZB 985/989, 11142-3: no precise locality.

There is little evidence for geographical variation within this species, except in tail length. Specimens from Java, Flores and Amboina have tails of medium length (ratio of tail length to upper toothrow length 4.7-6.5:1), while specimens from Sumba have long tails (6.5-7.0:1).

Crocidura attenuata Milne-Edwards, 1872

C. attenuata, formerly thought to be a purely Asian species, is now considered to occur also on Christmas Island (Jenkins, 1976). It is apparent from comparison with samples of *C. attenuata* from Asia and Christmas Island, that the material listed below is also attributable to this species. Table 1 summarises the characters distinguishing this species from others in Malaysia.

Material. — Christmas Island 10°31'S 105°33'E. BM(NH) 88.7.9.10: holotype of *C. attenuata trichura* Dobson, 1889; BM(NH) 99.8.6.12-21.

Sumatra. BM(NH) 19.11.5.28: holotype of *C. aequicauda* Robinson & Kloss, 1918, Korinchi; BM(NH) 82.718: Gunung Kemiri; MZB 11144: Gunung Leuser.

Java. MZB 9578: Tjibeureum.

The main distributional area of *C. attenuata* is from the Himalayas southwards and eastwards through Assam, Burma and China, specimens from Christmas Island marking the extreme southern limit. If the Christmas Island form, *trichura*, is accepted as a true representative of *C. attenuata*, then the presence of other populations in intermediate areas might be expected. That such specimens, very closely resembling samples of *attenuata*, do exist in various parts of Indonesia, suggests that they are all representatives of an apparently discontinuously distributed species.

The Malayan and Indonesian subspecies are briefly discussed below; more detailed discussion is not feasible because of the small samples. Measurements for the Indonesian representatives of this species are given in table 1.

1. Christmas Island

C. attenuata trichura Dobson, 1889. Light or reddish brown in colour, ratio of tail length to upper toothrow length 7.7-9.2:1.

2. Sumatra

C. attenuata aequicauda Robinson & Kloss, 1918. Darker brown than *C. a. trichura*, ratio of tail length to upper toothrow length 6.8-8.8:1.

3. Java

A single specimen from W. Java is similar in all respects to the above samples, except that it has an even longer tail, ratio of tail length to upper toothrow length 10.7:1. No comments are possible on the subspecific status of this specimen.

4. Malaya

In the original description of *C. aequicauda*, Robinson & Kloss (1918) mentioned two specimens from Gunong Tahan, Pahang, Malaya which they associated with this species. While these specimens have not been examined here, it seems reasonable to assume that they also represent *C. attenuata*, thus Malaya can be included in the range of this species.

Unresolved species names

The holotypes of three further species have been examined, but it is impossible to arrive at any definite conclusions about the validity of their names. The holotype of *C. weberi* Jentink, 1890: RMNH 12721 from Sumatra, is too badly damaged for any useful comparisons to be made, but Robinson & Kloss (1911) in the original description of *C. malayana* (= *C. fuliginosa malayana*) state that it closely resembled *weberi* and might be a representative of the same species. The holotype of *C. vosmaeri* Jentink, 1888: RMNH 24666 from Banka, is also damaged and additionally is a juvenile, as noted in the original description. It is possibly a young specimen of *C. fuliginosa*.

A single specimen labelled *C. lepidura* Lyon, 1908: MZB 307 from Sumatra, is very large, but falls just within the size range of *C. fuliginosa*. The holotype has not been examined, but from the measurements given in the original description it seems likely that these specimens also represent *C. fuliginosa*.

In the original description, *C. paradoxura* Dobson, 1887 from Sumatra is said to resemble *C. fuliginosa*, except for the very long tail (head and body length 66 mm, tail length 105 mm). *C. beccarii* Dobson, 1887 is described in the same paper. Since no specimens of either species have been examined and the brief descriptions give no comparable skull measurements, it is impossible to comment on the status of these species.

RMNH 24663: the holotype of *C. neglecta* Jentink, 1888 from Sumatra, is similar in size to *C. maxi* Sody, 1936, but differs in external length of the upper unicuspids (1.85 mm in *C. neglecta*, 2.0-2.3 mm in *C. maxi*); while not outside the range, the tail is very short and the braincase is damaged so that no critical comparisons can be made. It is possible that the two forms represent the same species, in which case the prior name would be *C. neglecta*, but such a conclusion is impractical on the basis of this single damaged specimen.

C. minuta Otten, 1917 was given a very inadequate description and no type material was selected or kept. Sody (1930, 1932) endeavoured to obtain topotypical material of *C. minuta* and commented on the original description. Of this material, two specimens are badly damaged but probably represent *C. monticola*, the other two are less damaged and are *C. maxi*. It is impossible to speculate on the taxonomic status of *C. minuta*, which might be a synonym of *C. monticola*, a prior name for *C. maxi* or, more doubtfully, a distinct species.

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