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Anschrift des Verfassers: Prof. Dr. G. Niethammer, Zoologisches Forschungsinstitut und Museum Alexander Koenig, 53 Bonn 1, Adenauerallee 150—164

Species Characters in Rhinoceros Horns

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The rhinoceros owes its name to the horn, or horns, on its nose. This most prominent distinguishing feature has led to the near extinction of four of the five living species due to a hang-over modern times of mediaeval superstitions about the horn's supposed medicinal and aphrodisiae properties. These superstitions, both in Europe and in the Orient, are described by Sody (1959) and by Guggisberg (1966): the latter also stresses the fact that — just in case verification were need — all the supposed properties have been experimentally disproved.

Z. Säugetierkunde 36 (1971) 238—252

The exact structure of the horn is still dubious. Ryder (1962) described its microscopic appearance, showing that it is comparable but not identical to other types of horn, differing mainly in its entirely filamentous nature with little interfilamentous substance, and in having no bore core. Bigalke (1945) mentions an inner and an outer set of fibres in the regenerating horn of a Black Rhinoceros, but Ryder says nothing of this. It seems that more investigation, not necessarily microscopic, is needed.

The ontogeny of the horn has been reconstructed by Neuville (1927), based on the examination of several juvenile specimens in the Paris Museum. The horn develops by a raising of the epidermis on the snout, the soarse-grained nature of the skin becoming gradually smoothed out. A second smooth epidermal field begins to develop a short distance behind the first, and in three of the five species this becomes a second (frontal) horn; but not in the other two species, except as an anomaly (Hill 1958).

With the realisation that the form of the horns varies enormously within a single species, and the rejection of such bogus "species" as *Rhinoceros keitloa, R. oswellii, R. crossii* and *R. holmwoodi,* all based on oddities of horn development, it has become customary to assume that this variability renders it impossible to distinguish one species from another by this means. It is the purpose of this paper to examine to what extent this is true: whether in fact any of the five species does develop a characteristic form of horn, what variations occur within a species, and to what extent the manner of use alters the shape of a horn.

Material and Methods

A large number of rhinoceros horns are housed in the British Museum (Natural History); most of these are in the Osteology Room of the Mammal Section, but some are stored elsewhere. Many are separate; others are attached to mounted heads or complete skins. The specimens concerned were obtained in three ways: some were collected for scientific purposes, and so might be considered „average" specimens; some were trophies, so that the horns would in general be larger than average for the species concerned; and some are from individuals that died in captivity, and so may be considered abnormal in quite a different respect. The first two groups are difficult to disentangle, and will be considered together here; only in size would the „trophy" group be really atypical.

A rhinoceros horn may be conveniently considered to consist of two parts, generally fairly well delimited: the base and the stem. The base is broadened, and its transition to the stem is generally marked by a noticeable and rather sudden slimming; the stem then tapers gradually to the tip. Additionally, the stem is smooth, while the base is either longitudinally corrugated (in Asiatic rhinos) or frayed (in the African species). To what extent this distinction is due to different modes of wear is uncertain, but clearly distinguishable basal and stem portion are visible in quite young animals.

In wild specimens the horn is coloured like the body, dark grey or even black, darker on the stem than on the base, darker in Asiatic rhinos, and darker in adults than in juveniles. It may be supposed that at least some of this dark colouration may be due to ingrained dirt.

The following measurements were taken on each horn studied: length of horn, antero-posterior and transverse breadths, and height of the basal portion, and antero-posterior and transverse breadths, of the stem where it emerges from the base. For reasons explained above, these measurements are not difficult to take with a fair degree of accuracy and objectivity; only in some specimens of *Dicerorhinus sumatrensis* is the emergence of the horn from the snout so gradual as to make the basal measurements somewhat difficult to assess.

Subfamilial and Generic Differences

It has already been pointed out that whether the base is frayed or grooved it tends to discriminate very regularly between African and Asiatic rhinos, i. e. between the subfamilies Dicerotinae and Rhinocerotinae (in the sense of Pocock 1945). The basal part is also much higher in the Dicerotinae (figs. 1, 2), narrowing more suddenly to the stem, and broader (fig. 3).

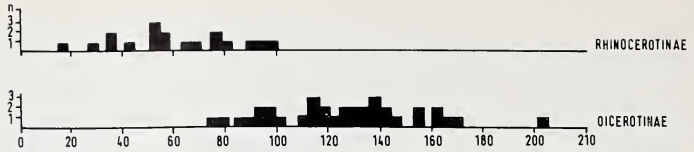

Fig. 1. Height of basal part of horn

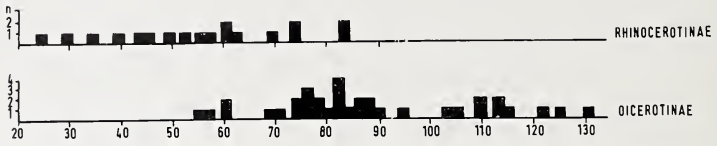

Fig. 2. Basal height index — $\frac{\text{Height of base} \times 100}{\text{Breadth of base}}$

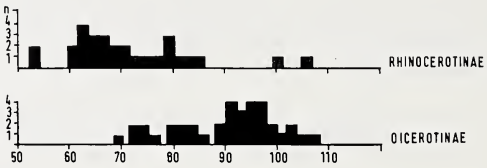

Fig. 3. Basal index — $\frac{\text{Anteroposterior diameter of base} \times 100}{\text{Transverse diameter of base}}$

By and large, African horns attain a much greater length than Asiatic ones. The following maximum lengths are given by Dollman and Burlace (1935) for the three Asiatic species:

Rhinoceros unicornis: 610 mm. Only one other horn above 500 mm.

Rhinoceros sondaicus: 273 mm.

Dicerorhinus sumatrensis: 810 mm. Only one other horn above 500 mm.

All three of these revord horns are in the British Museum; with the exception of the *R. sondaicus* horn they are exeptional specimens, few others even approaching them. As a matter of fact a captive *R. sondaicus,* whose remains are now in the South Australian Museum (see Finlayson 1950, and below), had a horn measuring 366 mm on the curve (305 mm straight), although incomplete; while a more dubious measurement recorded by Sody (1959), quoting Hazewinkel, was 37 cm long. These must replace the British Museum's wild-shot specimen as the world record. For *R. unicornis,* Neuville (1927) mentions a mounted specimen — also from captivity — with a horn 800 mm long, and this too has to stand as a record. Probably the nasal horns of the three Asiatic species average very much the same in

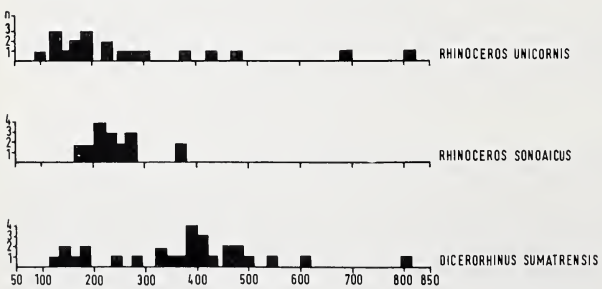

Fig. 4. Length of horn in the three Asiatic species of rhinoceros

length, at least as far as the males are concerned, with *R. sondaicus* simply failing to produce the more extreme lengths cropping up from time to time in the other two (fig. 4)[1].

Among the Asiatic forms the basal corrugations are most marked in *Dicerorhinus*, where they are broad and shallow and may extend well up onto the stem portion; they appear to become abliterated with age. In *Rhinoceros* they are much less marked, with one exception: in all wildshot specimens of this genus a deep, broad groove is seen on the anterior surface of the horn, beginning a short way above the base and extending up the stem towards the tip. This is the very region where the convexity is greatest in *Dicerorhinus*, and there is never in the latter genus any trace of this groove, but it is visible in all *Rhinoceros* horns coming from the wild, including good front-view photos of wild specimens (for example Ullrich and Ullrich 1964, Seshadri 1970) as well as in all museum horns of both Indian and Javan species, provided always that they are of sufficient length and development to show separation of basal and stem portions.

The base of the horn is more extensive, on average, in *Rhinoceros* than in *Dicerorhinus* (fig. 5). In only a few specimens in the sex recorded, but it does not appear that the horns of males are more massive than those of females.

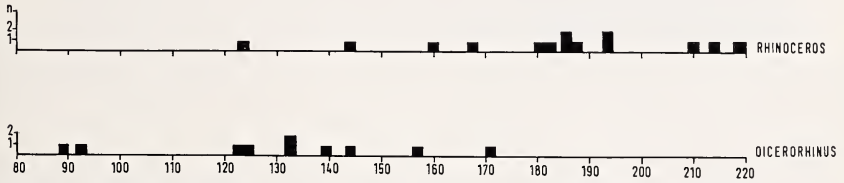

Fig. 5. Anteroposterior diameter of horn base in the Rhinocerotinae

In the subfamily Dicerotinae the two genera show fairly well-marked differences in horn-shape. These will be described in detail later on; in general, the horns of *Ceratotherium* are straighter, squarer and more massive than those of *Diceros*, with more difference in length between the two horns (frontal and nasal).

Rhinoceros unicornis

This species of rhinoceros, monotypic according to the author's studies (unpublished), is normally one-horned, although Hill (1958) records a specimen with a rudimentary frontal horn, and Neuville (1927) speaks of a mounted specimen in Paris with local areas of hyperkeratinisation on the face. This latter specimen, which lived in the old Versailles menagerie, had a horn measuring 80 cm on the curve, by far exeeding the known record (see above; the previous record is shown in Fig. 5 of the present paper).

In captivity the horn is subjected to various forms of abuse which completely alter its appearance. Normally (fig. 7) it is constantly abraded so that it becomes a mere excrescence on the snout; evidently the outer surface is worn away, making it light brown in colour, and constant rubbing prevents the growth of any stem portion at all. The base seems to be stumlated to grow faster than normal, and remains thick and lumpy for the whole length of the horn. All traces of the characteristic anterior groove are lost. In another form of abnormal growth, figured by Sclater (1877), constant

[1] Fig. 4 is based on the author's figures and includes also those given by Evans (1904, 1905), Harrisson (1956), Hubback (1939), Neuville (1927), Peacock (1931), Sody (1959) and U Tun Yin (1956).

Fig. 6 (left). Rhinoceros unicornis: record wild-shot horn, 529 mm. long. B. M. (N. H.) no. 10. 1. 23. 1., — *Fig. 7 (right). Rhinoceros unicornis:* Skull and horn of B. M. no. 722 A, Owen's „old friend", subject of his anatomical monograph (Owen, 1862), showing the typical abrasion of a captive rhino of this species

grinding had caused the horn to grow forward so that it protuded 18 inches (46 cm) beyond the nostrils.

That such extreme mutilation could occur only in captive-reared animals would seem evident; if this is the case then the Versailles rhino, mentioned above, must have been captured when more or less adult, so that it retained its typical horn-shape throughout life. Certainly two specimens from captivity, but captured as adults, in the British Museum show no evident abnormality.

Captive specimens not only grind their horns down; they sometimes rip them off. One such in the London Zoo grew back 1½ inches (38 mm) in under a year (Sclater 1877). According to Gee (1953), the horn reaches a length of 5 inches (127 mm) by 8 years of age.

Rhinoceros sondaicus

The horn of this species differs from that of the previous one primarily in the relatively more slender stem compared to the basal part (fig. 8): at least in the male. Finlayson (1950) reports a specimen, exhibited as an Indian rhinoceros in the Adelaide Zoo from 1885 to 1907, with a strongly recurved horn, far longer than Dollmann & Burlace's (1935) record; indeed it is stated that the tip was cut off in life to prevent threatened contact with the occiput. I am very grateful to Dr. P. Aitken, of the South Australian Museum, for sending me a photograph of this specimen (fig. 9). It is not stated whether the animal was obtained as an adult or as a juvenile; but the peculiar shape of the horn, together with the abnormally thickened stem, argue that the influence of its captive environment was rather great. Whether this also influenced the great length of the horn cannot be stated for sure. A normal wild-type horn for this species is also illustrated here (fig. 10).

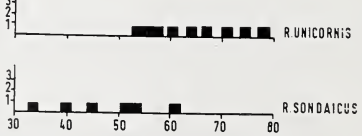

Fig. 8. Stem-to-base index $\frac{\text{Stem diameter} \times 100}{\text{Base diameter}}$ in genus *Rhinoceros*

Fig. 9. Rhinoceros sondaicus: head of the captive specimen described by Finlayson (1952), now in South Australian Museum, Adelaide; it bears the world record horn (Photo courtesy: Dr. Peter Aitken)

Schenkel and Schenkel-Hulliger (1969), assuming a sex-ratio of 1:1, find no difference in the horns of males and females in this species in the Udjung Kulon Reserve, its last remaining habitat. Hoogerwerf (1970) has disagreed with this conclusion, since all the animals identified by him as cows in the same reserve previously were hornless. It would seem valuable at this time to examine all the evidence on the presence or absence of a horn in the female Javan rhinoceros, in an attempt to cast light on this matter.

1. Lesson (1836) described a female shot together with its calf by Lamare-Piquot in the Sunderbans of Bengal as a new species, *Rhinoceros inermis.* The cow was

Fig. 10 (left). Rhinoceros sondaicus sondaicus: typical male horn; shot in Preanger, W. Java. BM (NH), no registration number — *Fig. 11 (right). Rhinoceros sondaicus inermis:* Type specimen, Berlin Museum, An 10603; adult female collected by Lamare Piquot in the Sunderbans, Bengal; described by Lesson (1836) (Photo: by Dr. V. Mazák, Published courtesy Dr. R. Angermann)

stated to have not even a horny plaque on the snout. The specimen concerned is now in the Berlin Museum and is figured here (fig. 11).

2. Fraser (1875), in discussing an adult female shot by himself in the Sunderbans, stated baldly that the female of the species has no horn. It is uncertain whether he based this statement only on the specimen collected by himself, or on sightings of others as well. W. L. Sclater (1891) wrote of a mounted female from the Sunderbans in the Indian Museum, Calcutta (collected by Fraser and J. F. Barckley, and doubtless the specimen described by Fraser), that it had „no trace of a horn", and that it was impossible to say if this was constant feature, but several people . . . who have seen this species alive, confirm this".
3. P. L. Sclater (1876) stated, „According to Mr. Jamrach's information, the females of the species obtained in the Sunderbunds were entirely destitute of any horn, which would not appear to be the case in the Javan animal".
4. Neuville (1827) quoted Diard and Duvaucel (who collected in Java and Sumatra) to the effect that the horn in the female of this species is reduced to a „demi-oval tuberosity".
5. Vageler (1927) described the specimens shot in S. Sumatra by Hazewinkel, stating, „Und die Weibchen hatten sogar gar kein Horn!"
6. Barbour and Allen (1932), listing the complete museum catalogue of this species known to them, figured a mounted female from the Sunderbans in the Indian Museum (undoubtedly Fraser's specimen again), and an immature female from Java in Harvard. The former is destitute of any horn, but the latter has a large knob on the end of the snout.
7. Vicomte de Poncins (1935) described his hunt in the Sunderbans in 1892, giving the only available information on the ecology of this species in the northern part of its range; with an unselfishness rare in trophyhunters, he refrained from killing any having due regard to their rarity. At least one of the 3—4 specimens still existing there at that time was hornless, as he ascertained both by nose-rubbing marks on trees, and by a brief glimpse of the animal.
8. Weatherbe (1940) wrote, speaking of the Javan rhinos formerly inhabiting the Kahilu Sanctuary in Burma, that „the female sometimes carries a horny nasal protuberance".
9. Schuhmacher (1967) photographed and filmed a female of this species in the Udjung Kulon Reserve, Java. The animal was abnormal in having no external ear-pinnae. In the photograph just an indistinct smudge is visible on the snout; but in the motion picture when the animal turns her head sideways this is seen to be a very small horn.
10. The British Museum (Natural History) possesses two mounted skins, both female: an old specimen (1932.10.21.1) from Kroh Forest, Perak, shot by A. S. Vernay (fig. 13), and a young individual (1921.515.1) shot by T. R. Hubback at Victoria point, Tenasserim. The former has a small irregular protuberance 37 mm high; the latter, a well-developed horn 192 mm long. The latter is unfortunately damaged: when on public display in the 1950's, the then-director of the museum ordered its horn removed and replaced by a bigger one, to make a „better" exhibit! Its removal unfortunately resulted in the horn's irretrievable multilation; in the illustration of it here (fig. 12) it has been wedged onto the nose in approximately its original position, but much of the basal part is missing, and lost, especially on the anterior surface. I am however assured by Mr. J. E. Hill, of the Museum's Mammal Section, that the horn is the animal's original one. It is light brown in colour and unusually fibrous around the base, which perhaps one might expect for a horn that is still maturing.
11. Mr. L. M. Talbot, Resident Ecologist at the Smithsonian Institution, has kindly

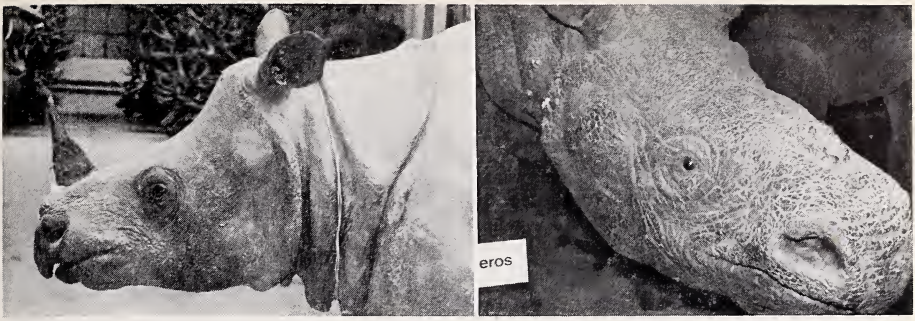

Fig. 12. Rhinoceros sondaicus subsp.: subadult female, BM (NH) no. 1921. 5. 15. 1, collected by T. R. Hubback at Victoria Point, Tenasserim. This appears to be the only known female with a definite horn. Incredibly, the horn was removed by a former director of the museum and replaced by a bigger one for exhibition! The figured horn is original — *Fig. 13 (right). Rhinoceros sondaicus* subsp.: adult female, BM (NH) no. 1932. 10. 21. 1, collected by A. S. Vernay in Kroh forest, Perak. The nasal appendage appears to be of the normal type for females of all races except *inermis*

informed me that a female seen by him in Udjung Kulon, and photographed from a distance of a few feet, has a „raised hump, lump, small horn, knobble or whatever you choose to call it"; and that of the others he saw at various times the females were broadly similar to this but the males were truly horned.

12. Dr. B. Biswas, Superintending Zoologist of the Indian Museum, has kindly informed me that a female skull (no. 3521, from Chillichangpi Creek, Sunderbans) in the collection has a „distinct indication of a horn", not unlike that of a juvenile male skull in the collection, and unlike the mounted Fraser specimen.
13. Hoogerwerf (1970) gives various other references, unavailable to the present author, as well as recounting a number of his personal encounters in Udjung Kulon, from which it would appear that Javan cows were hornless or, rather, had small „knobbles" or „humps" on the nose.

Hoogerwerf (1970) has concluded, from his own observations and those of Schenkel and Schenkel-Hulliger (1969) that the sex-ratio of the last surviving population of this species is very unbalanced, he himself having observed more males than females, an the Schenkels having evidently not observed any females (or at least, any hornless animals except for three "immatures"). On the other hand, footprints of calves were definitely reported by the Schenkels, so that at least some adult females must be present, in 1970, too, calves were reported (Anon, 1970).

We may summarise the information as follows:

Java. "hump" (nos. 4, 6, 11, 13) or a very small horn (9).
Sumatra. "hump" (no. 4?), "no horn at all" (5). (Both these may be regarded as dubious: the former may not refer to Sumatran specimens, the latter has no standard of comparison).
Malaya, Tenasserim. "hump" (nos. 8, 10), or a true horn (10).
Sunderbans. no horn at all (nos. 1, 2, 3, 6, 7) occasionally an "indication" (12).

Omitting the imprecise Sumatran data, it looks as if we have evidence for geographic variation in this character, and that the extinct northern race *inermis* is valid on the characters assigned to it by its describer, Lesson, as least as far as most females are concerned. In the surviving Udjung Kulon population, by now highly inbred, one might expect fixation of some alleles with in general an increase in homozygosity and hence an increase in frequency of "atypical" phenotypes due to recessive genes (for example, Schumacher's earless female). This might result in an unexpected

preponderance of horned females; or alternatively an imbalanced sex ratio, which in man at least is claimed to have a genetic basis (probably Y-linked: Trichopoulos, 1967). If this latter situation occurred in a small population it would result in a very rapid feedback spiral leading to extinction: and there is evidence for such an imbalanced immediately preceding the extinction of more than one mammalian species (Mohr 1968). Either way, the future of the species is very bleak.

In the male the horn appears to rise rather rapidly. A young male, 1 metre high, had a "nasal plaque" some 2.5 cm. high, irregularly contoured and surrounded by tubercular projections (Neuville, 1927) — similar perhaps to the old female shot by Vernay (fig. 13). Hoogerwerf (1970) mentions an exceptionally long horn claimed by Hazewinkel for southern Sumatra, but is somewhat skeptical about it. Due to the almost complete lack of horns from outside Java it is impossible to say whether any geographic variation existed in the horn length of males, but as far as the Sunderbans race is concerned any marked difference from the Javan subspecies seems unlikely. Hoogerwerf (in. litt., 5.4.71) has stated, however, that the photos of Hazewinkel's rhinos, shot in southern Sumatra, do appear to show longer horns than specimen seen by him in Java.

Dicerorhinus sumatrensis

In the Sumatran rhinoceros the essential form of the anterior (nasal) horn is as in the genus *Rhinoceros,* but the deep anterior groove of the latter is missing. If it grows to any length at all, the nasal horn curves back noticeably; the posterior (frontal) horn is of the same shape and is generally very short, and may even be virtually absent; for this reason, individuals of the present species may occasionally be mistaken for *R. sondaicus,* as for example the specimen figured by Ali and Santapau (1958). In occasional specimens the nasal horn may be worn down to such an extent as to be exceeded in length by the frontal (fig. 4e of Groves, 1967; and fig. 14 of the present paper).

Fig. 16 represents a horn made the type of a new species, *Rhinoceros crossii* (Gray, 1854). It shows the typical slenderness and low, narrow, rugose basal portion of an Asiatic rhino, and additionally it shows the longer corrugations, and lack of an anterior groove, of a Sumatran rhinoceros. A similarly shaped, but smaller horn was noted in a Tenasserim specimen of this species by Blyth (1862). Another very long, but straighter horn is in the British Museum (no. 72.6.12.1), and two others are recorded for the small Borneo race by Harrisson (1956), one of which is figured here by courtesy of Mr. John MacKinnon (fig. 15).

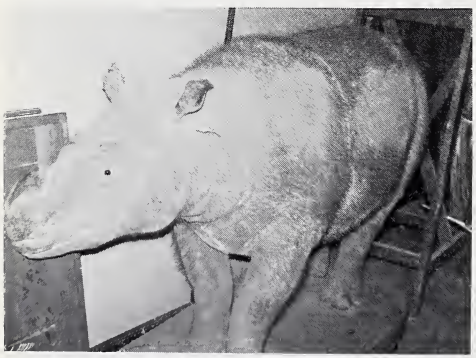

Fig. 14. Dicerorhinus sumatrensis sumatrensis: aged female, BM (NH) no. 72. 12. 31. 1, type of *Ceratorhinus niger* Gray, 1872. Showing extreme wear on nasal horn. The animal died in London Zoo in 1871, shortly after arrival

A common feature of this species is the hyperkeratinisation of the skin around the horn-bases, particularly on the front of the snout. The muzzle itself conspicuously lacks the mobility seen in other rhinos, having only a single transverse groove which runs between the nostrils across the anterior surface; while the upper border of the nostril itself is immoveable, convex, and supported by a strong

Fig. 15 (left). Dicerorhinus sumatrensis harrissoni: near-record horn for this species (record for the subspecies), 480 mm. long; in Sarawak Museum, Kuching (Photo courtesy: Dr. JOHN MACKINNON) — *Fig. 16 (right). Dicerorhinus sumatrensis* subsp.: record horn for the species, BM no. 54. 12. 8. 1, type of *Rhinoceros crossii* Gray

cartilage (see figure in BEDDARD 1889:11). This situation is reproduced accurately in most mounted specimens (fig. 17).

Diceros bicornis

Horns of African rhinos are distinguished by their massiveness, with a broad base (fig. 3), a high basal portion (figs. 1, 2), and a robust, thick stem. The narrowing from base to stem is more abrupt than in Asiatic rhinos, and the base retains its fibrous nature throughout most of the animal's life, never acquiring the corrugations of an Asiatic rhinoceros. The length of the horns is considerably greater in the Dicerotinae, even the posterior one generally attaining quite a respectable size, often (in *Diceros)* even exceeding the anterior one in length (fig. 18).

In *Diceros bicornis,* the Black rhinoceros, the two horns are positioned very much as in *Dicerorhinus,* the posterior one being placed slightly in front of a perpendicular through the eye. The thickness and robusticity of the bases is such that they very commonly meet and fuse, which never occurs in the Sumatran species. In *Ceratotherium* on the other hand, as pointed out by CAVE (1962), the posterior horn (even the back edge of its base) is situated entirely in front of a perpendicular through the eye: this is a function of the length of the skull rather than of a reduced distance between the two horns.

The occurrence of supernumerary horns in this species is a wellknown phenomenon; GUGGISBERG (1966) speaks of localised concentrations of three-horned rhinos, but it

Fig. 17 (above). Dicerorhinus sumatrensis sumatrensis: typical type of horn for this species. Specimen from Malaya, on exhibit in museum — *Fig. 18 (below). Diceros bicornis minor:* BM, not registered; „keitloa" type, with frontal horn longer than nasal. Luangwa Valley, Zambia

seems that this is the maximum that can occur tandem-fashion, one behind the other. A five-horned trophy figured by NEUVILLE (1927) may in fact represent an injury, since in effect the posterior horn is divided almost to the base, into four parts.

The frontal horn is similar to the nasal in form, but straighter and more compressed, narrowing more rapidly over its length.

The longest horn of this species in the British Museum, the type of *Rhinoceros holmwoodi* Sclater, is 42 inches (1067 mm) long; the next longest measures 29½ inches (750 mm) in length on the curve and nearly as much in straight length. The world record horn was 53½ inches (1360 mm), recorded of a cow shot in Kenya (DOLLMAN and BURLACE, 1935). The record posterior horn is 535 mm, for the type of *R. keitloa* A. Smith in the British Museum: in this specimen the anterior horn is shorter, only 485 mm long.

The horn shape varies both sexually and geographically. Two specimens of the extinct nominate race, *D. b. bicornis* from South Africa, have nasal horn bases measuring 167×154 and 175×187; the highest value for other subspecies is 153×147 in a male from Mashonaland. The stem is more slender in Kenya specimens, in which the antero-posterior diameter of the stem measures 50–61 % of the base in adults — in other areas, 71–92 %. In all areas the more slender horns are found in females: this sexual difference is reflected in the nasal bones too (ROTH and GROVES, in preparation).

Only one horn of the distinctive West African race, *D. b. longipes,* was studied (fig. 19). Although this is from a young individual, with M3 in process of eruption, it already begins to show the broad, square *Ceratotherium*-like base characteristic of this subspecies, and visible in the photos published by ZUKOWSKY (1964).

In captivity the horn receives a wear of a far different kind to that in *R. unicornis;* instead of a flattened plaque, a considerable length is often retained but lacking any

Fig. 19 (left above). Diceros bicornis longipes: Powell-Cotton Museum, NN Chad 171, young adult female, showing enlarged, squared basal region of this race — *Fig. 20 (below). Ceratotherium simum simum:* BM no. 1853. 4. 18. 1, type of *Rhinoceros oswellii* Gray; in fact a fairly typical type of horn for this species, merely unusually straight — *Fig. 21 (right above). Ceratotherium simum subsp.:* three unusual horns in British Museum, left to right: slender-based, S-shaped horn (impossible to say which is anterior surface!); slender-stemmed, straight horn; shorter, sickle-shaped horn

differentiation between base and stem. The chief wear seems to be on the lateral surfaces, which makes the horns more compressed than in wild specimens.

According to Jarvis (1967), the nasal horn has reached a length of 4 cm by 4 months of age and 7.5 cm at 8 months; while the frontal horn appears at 5 months and has reached a length of 3 cm at 8 months. A 15-year-old female whose horn was ripped off on an iron fence had regenerated a stump 3 inches (8 cm) on the anterior surface, 2 inches (5 cm) on the posterior, by 6½ months. (Bigalke 1954).

Ceratotherium simum

The longest horns of all have been recorded for the White rhinoceros, Dollman and Burlace (1935) giving several records of over 5 feet (approx. 1500 mm). These horns are also by far the most massive (fig. 22), a basal diameter of 176 × 166 mm being

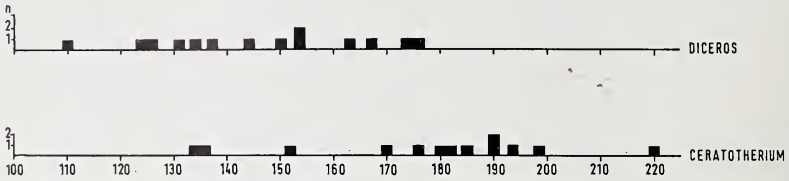

Fig. 22. Anteroposterior diameter of horn-base in the Dicerotinae

measured in the smallest adult female (B. M. 1520 H), which is larger than any *Diceros*. The base is squared, often concave in the midline anteriorly, and fibrous as in *Diceros;* it narrows even more abruptly to the slender stem.

The stem is generally backcurved, but a varriety of shapes are possible. Fig. 20 shows the holotype of *R. oswellii* Gray, in which the nasal horn is slightly inclined forwards, with a well-marked wear facet in front at the tip. Fig. 21 shows three other rather unusual types. Most of the British Museum horns belong to the nominate, South African subspecies; although the material is thus insufficient, no geographic differences are apparent.

Condy and Davison (1964) give some data for horn length in rhinos of known ages, of this species. Player (1967) reports increases in two specimens from 1—3 years and 1½—2½ years respectively; Bigalke et al. (1950) and Wallach (1959) give longitudinal data on younger specimens. The growth rate of the nasal horn varies considerably from one animal to another and also apparently from one phase to another of the growth period (although no uniformity in this respect emerges from comparing one animal's records with another's); the average velocity between 6 months and 3 years appears to be around 7 mm per month. In the specimen studied by Bigalke et al. (1950) the posterior horn was visible as a "slight protruberance" at 3 months but no measurements were given for any age under 18 months, when it was 5 mm long; in one of Player's (1967) specimens it was 4.5 mm long at 18 months.

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Conclusions and Summary

It should be possible in the majority of cases to identify a rhinoceros horn with certainty as to genus, with less certainty to species or subspecies level. This is in spite of admitted enormous variations in form and size between individuals within a single population, which

in the past led to the description of several "species" which are now known to fall within the range of variation of one of the five known species. Indian and Javan rhinos *(Rhinoceros)* have a type of horn characterised by a broad, corrugated base and slender stem; the base shows a broad longitudinal channel on its anterior face; females of the latter species are however generally hornless, the degree of hornlessness apparently varying geographically. The Sumatran rhino *(Dicerorhinus)* has two horns which differ from those of the previous genus in lacking the anterior channel. African rhinos have very long robust horns, broad and fibrous at the base; the basal enlargement is more marked in the White rhinoceros *(Ceratotherium)* than in the Black *(Diceros)*. Females of the African species have longer, more slender horns than males.

Zusammenfassung

In den meisten Fällen ist es mit Sicherheit möglich auf Grund von Ausformung und Größe des Horns rezenter Rhinocerotiden die Gattung zu bestimmen. Etwas schwieriger dagegen ist die Identifizierung der Art oder Unterart. Die starken intraspezifischen Variationen in Form und Größe der Hörner, die zwischen Individuen einer einzigen Population auftreten können, haben früher zu Beschreibungen verschiedener, sogenannter „Arten" geführt. Diese werden hier Individuen einer der fünf echten Arten zuerkannt. Die Hörner von indischen und javanischen Panzernashörnern *(Rhinoceros)* haben folgende Charakteristika: einen breiten, gerunzelten Sockel und einen schlanken Stamm. Der Sockel hat eine breite Längsrinne auf der Vorderseite. Weibliche Tiere dieser Art sind meistens hornlos, und es scheint, daß der Grad von Hornlosigkeit sich mit der geographischen Verbreitung ändert. Das Rhinoceros von Sumatra *(Dicerorhinus)* hat zwei Hörner, die sich von oben erwähnter Art durch das Fehlen der vorderen Längsrinne auszeichnen. Afrikanische Nashörner haben dagegen sehr lange und kräftige Hörner, deren Sockel breit und faserig sind. Dieser Sockel ist beim Breitmaulnashorn *(Ceratotherium)* deutlich größer als beim Spitzmaulnashorn *(Diceros)*. Weibliche Tiere der afrikanischen Gattungen haben längere und schlankere Hörner als die männlichen.

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