BIOGEOGRAPHIA - vol. XIV - 1988
(Pubblicato il 31 dicembre 1990)
The Biogeography of Somalia

The enigmatic hedgehogs of Somalia

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SUMMARY

Up to now, the taxonomy of the African hedgehogs was treated rather superficially: The search for relevant differentiating criteria was neglected, which resulted in an enigma concerning the identity and taxonomy of the two Somalian hedgehog forms *Aethechinus sclateri* Anderson, 1895 and *Atelerix albiventris* Wagner, 1841.

Multifold research yielded about 35 such criteria, of which only a few suffice to point out the differences between the two genera as also the impact of the very differing vegetation types in their respective biotopes: Savanna for *Atelerix albiventris* in southern Somalia and a more arid habitat in the northern provinces of this state for *Aethechinus sclateri.* However, the rare occurrance of a rudimentary hallux arises the question whether hybridization — as known already from other hedgehog forms —, or a genetically not yet fixed morphological feature might have been the cause of this puzzling phenomenon, which calls for further investigation.

INTRODUCTION

Hedgehogs (Erinaceinae) belong to the oldest recent true mammals. Well-known to everybody, it should be expected that they provoked also extensive scientific research. The Eurasian genus *Erinaceus* was firstly described by Linnaeus in 1758, 12 years later the Afroasian genus *Hemiechinus* by Gmelin. However, only in the last century arose some rather superficial concern on the remaining groups. Not with standing some excellent anatomical research performed by human anatomists, only a paucity of serious work was done by zoologists.

This may have been caused by the scarcity of the available material and the assumption that such a notorious animal cannot be considered as a rewarding scientific object. As a result, even to our days the systematic of these basic mammals remained rather misty. The opinions differed: Although even in classic systematic fat volumes the two genera *Paraechinus* and *Hemiechinus* were considered as distinct from the Eurasian hedgehog *Erinaceus*, the small bodied genus *Atelerix*, occuring only in Africa, as well as the equally African genus *Aethechinus* (which, however, extended its range also to the northwest Mediterranean coast and on some archipelagos like the Baleares, Pityuses, Canaries and on Malta) were included without further ado into the genus *Erinaceus.* Certainly, Thomas, who in 1918 already divided the subfamily Eri-

naceinae in the five genera *Erinaceus, Aethechinus, Atelerix, Hemiechinus* and *Paraechinus*, was of different opinion, which, however, was neglected or rebuked by rather weak arguments, as, f.i., lack of differential criteria as also restricton to irrelevant criteria like colour or tiny osteological differences. Finally, Corbet (1988) at least recognized *Atelerix* as a genus distinct from *Erinaceus,* but even he failed to distinguish it from the genus *Aethechinus* Thomas, 1918. The distribution of the Erinaceinae shows Fig. 1.

Therefore, 26 years ago I began working on this theme, not only by the traditional method of investigating and measuring exclusively dead specimens, but by breeding and even crossbreeding several hedgehogs species. Additionally, the research was extended to comparative viscerology, embryology, propagation, metabolism, communication, pheromones, physiology, and many more items. This resulted in determining more than 35 differentiating criteria. Of course, it is not possible to find them evenly in all the five genera, but — according to the mosaic modus of evolution — quite unevenly and in different intensity. As a result, I was induced and even forced to confirm Thomas proposal of five virtual hedgehog genera. In this paper, it is not possible to deal even superficially with the mentioned abundance of differentiating criteria. These will be presented in the forthcoming revision of the zoological order Insectivora as well as in the first volume of a series of monographs on the Insectivora.

The distribution of the extant African Erinaceinae and its geological background

In the Tertiary, Africa's fauna and flora were subject to radical geological and climatological changes and even to cataclysms, which influenced not only

Erinaceus		Europe, adjacent vast areas in northern and middle Asia to Korea
Aethechinus	**algirus**	Northwestern Africa, Baleares, Pityuses, Malta, Spanish and French southern coast areas (sparce)
	sclateri	Northern Somalia, range undetermined
	frontalis	Southern Africa
Atelerix		African savanna belt from Dakar to Tanzania, including southern Somalia
Hemiechinus		Libya to Mongolia
Paraechinus		Arid North African semideserts, Arabia, Pakistan, Northern India, Afghanistan, Uzbekistan

FIG. 1 - Distribution of the hedgehog genera according to Thomas (1918).

the radiation of African hedgehogs. From the Eocene to the Pliocene there prevailed a relative geological stability, interrupted only in late Miocene by the formation of the great mountain ranges. The average temperature was slightly higher than today, the important faunistic barriere set up by the great Congo Lake was surplaced by the equally efficient Great Rain Forest region.

The Pleistocene glacial epochs of the Palearctic regions did not reach Africa directly, but influenced heavily the rainfall amount and, by this, the african vegetation. Thus, the Pleistocene was also in Africa an epoch of dramatic and even quickly changing climate fluctations, which obviously helped to develop also the widespread Savanna belt extending north, east and south of the great rain forest basin.

With exception of the Palearctic genus *Erinaceus*, all the 4 other genera exist in Africa: *Hemiechinus* in a dry and sandy habitat mostly; the socalled desert hedgehog *Paraechinus* in a still drier, but stony biotop; the small *Atelerix* in the widespread Savanna region ranging from Dakar to Tanzania; the African range of the genus *Aethechinus* was divided by the hitherto enigmatic, enormous expansion of the Savanna hedgehog *Atelerix* in three parts: *Aethechinus algirus* in Northwestern, *Aethechinus frontalis* in Southern Africa and *Aethechinus sclateri* in Northern Somalia. All three *Aethechinus* species have numerous common features, but they show so many differences to *Erinaceus* and *Atelerix* that they neither can be included into the genus *Erinaceus* (Ellerman & Morrison-Scott 1951; St. Girons 1969; Corbet 1971; Honacki et al. 1980) nor into the genus *Atelerix* (Corbett 1988).

Thus, in Somalia exist two different gedgehog genera, *Atelerix* and *Aethechinus*, from with the one species, *Aethechinus sclateri*, is exclusively autochthone, while the former, *Atelerix albiventris*, penetrated into the southern parts of Somalia only. Up to now, there is no photograph of an *Aethechinus sclateri* Anderson, 1895 in the life (Fig. 2).

The Northern Somalian hedgehog Aethechinus sclateri Anderson, 1895

When describing in the British Museum (Natural History) a museum specimen of the scientifically most interesting hedgehog species, *Erinaceus* (= *Aethechinus*) *sclateri*, n. sp. as holotypus, Anderson (1895) was only able to indicate «Somaliland». However, in the same collection in London he found rests of an identical hedgehog from «Taf», a locality difficult to identify.

The Somali hedgehog *Aethechinus sclateri* is the smallest living hedgehog. This may be considered as a response to an unfavourable biotope, as possibly effectuated by advanced dessication providing only poor nutrition for hedgehogs. Anyway, this makes this inconspicuous mammal an outstanding scientific object of interest and might even help to solve unanswered questions on other scientific fields. Up to now, *Aethechinus sclateri* was collected in northern Somalia as to be seen in Fig. 3, which indicates also the known distribution of *Atelerix albiventris* Wagner, 1841 in the southern provinces.

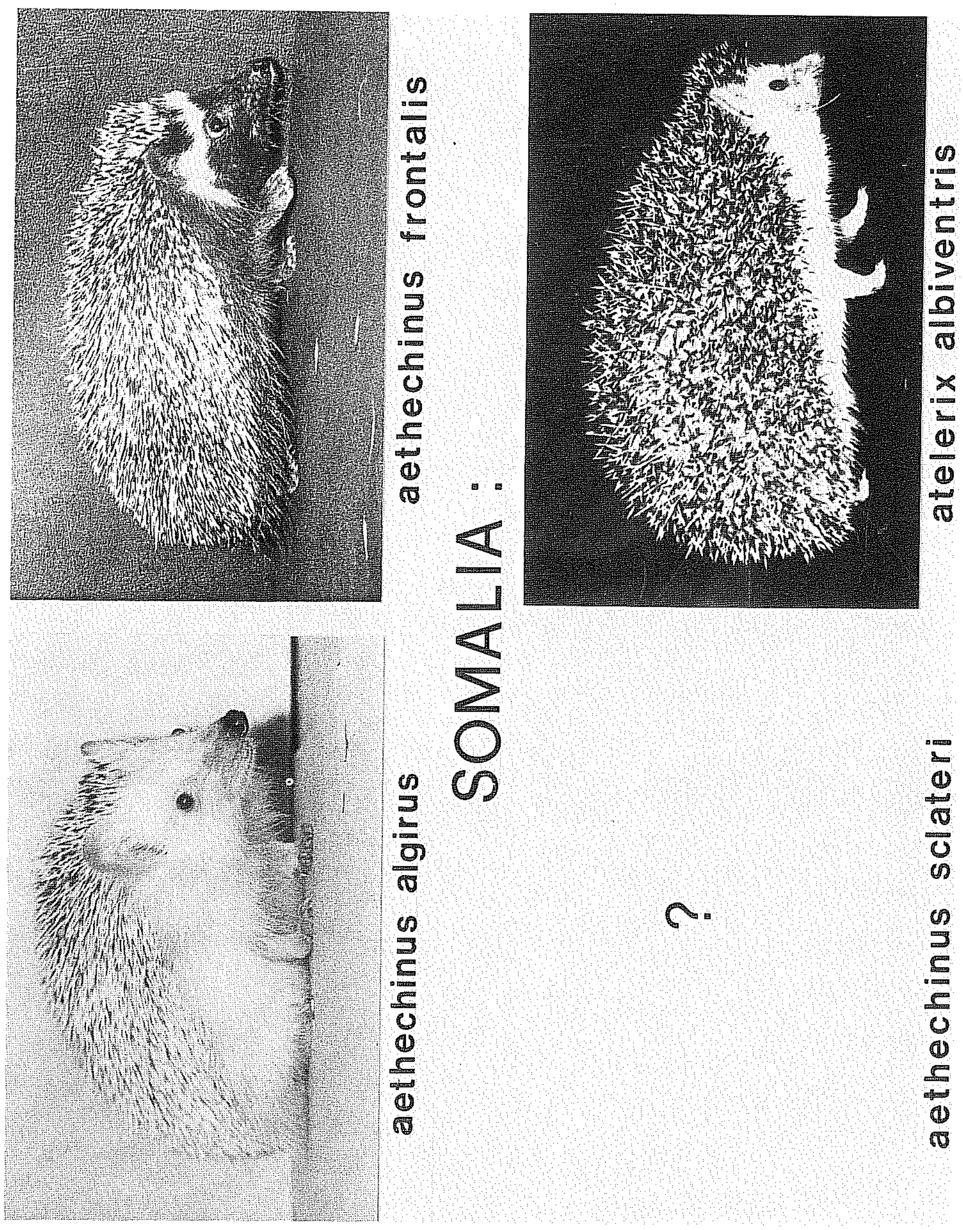


FIG. 2 - Life photographs of 2 *Aethechinus* genera (*algirus* and *frontalis*) and of *Atelerix albiventris*. There exists no life photograph of the northern Somalian hedgehog *Aethechinus sclateri*.

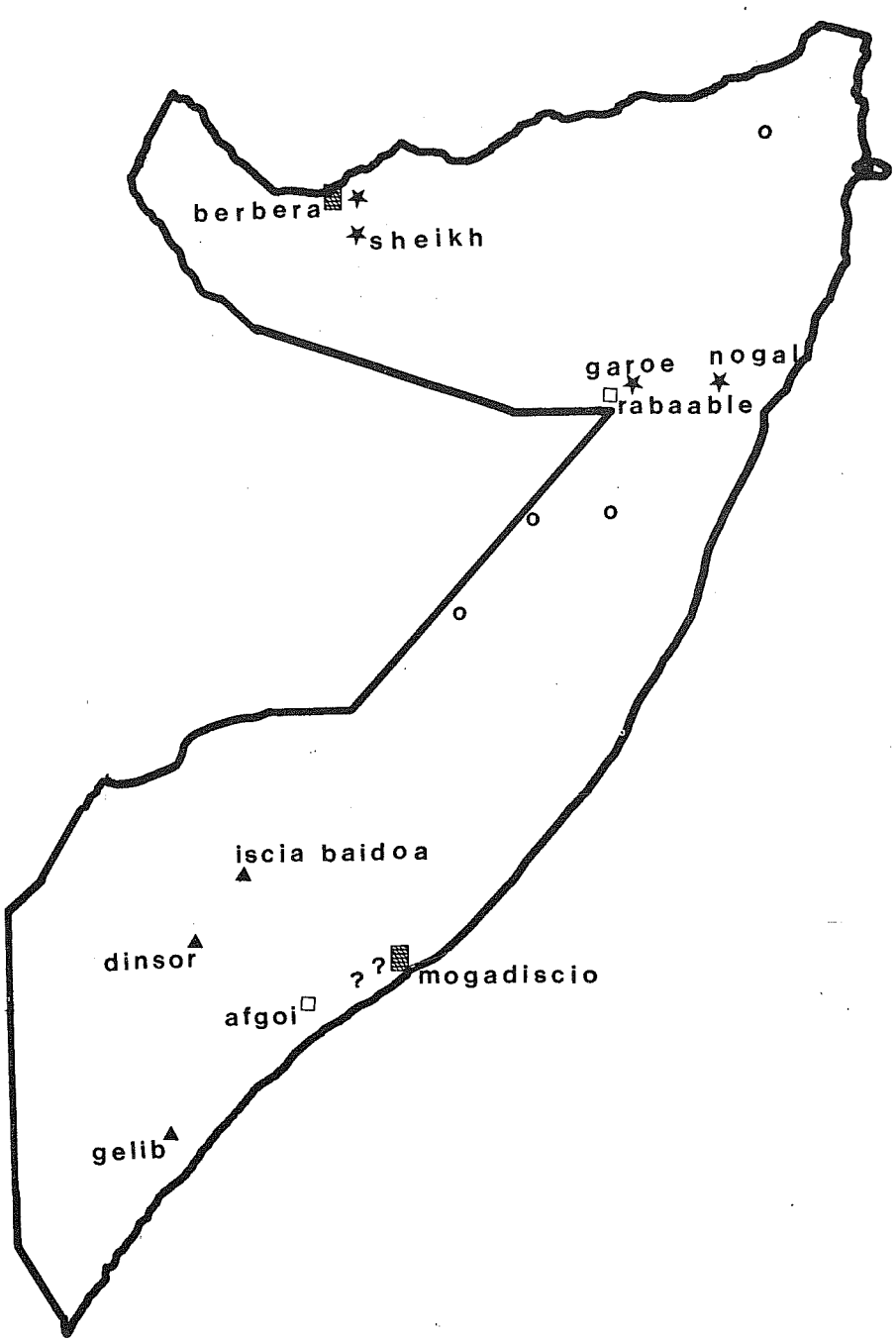


FIG. 3 - Localities of hedgehogs collected in Somalia:
★ = *Aethechinus sclateri* - ▲ = *Atelerix albiventris* - □ = with one hallux only, possibly hybrids - ?? = not exactly determinable - o = additional hedgehogs found by ASH, but not determined.

The problem of the missing Hallux

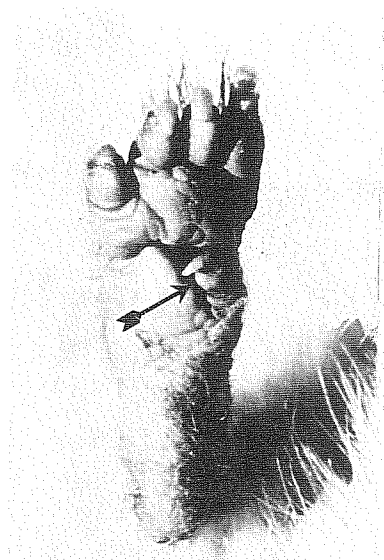
To explain the distribution, the ecology and the biotope's implications to the northern Somalia hedgehog *Aethechinus sclateri*, we have to point out some peculiarities of the Savanna hedgehog *Atelerix albiventris*, which extends his huge range also into Southern Somalia.

Notably, *Atelerix* shows a feature which was known also to some earlier zoologists and caused them not less headaches than to myself: The overwhelming majority of *Atelerix* have on their posterior extremities 4 toes only, lacking the hallux. Described by Wagner (1841) as *Erinaceus albiventris*, this hedgehog got the subgeneric name *Atelerix* by Pomel (1848), who — like before him also Sundevall (1842) — pointed out the lacking hallux, which Wagner seems to have overlooked. The reduced hallux as well as the development of compact cushionlike footpads with stubby toes seems to result from ecological, possibly biotope type influences.

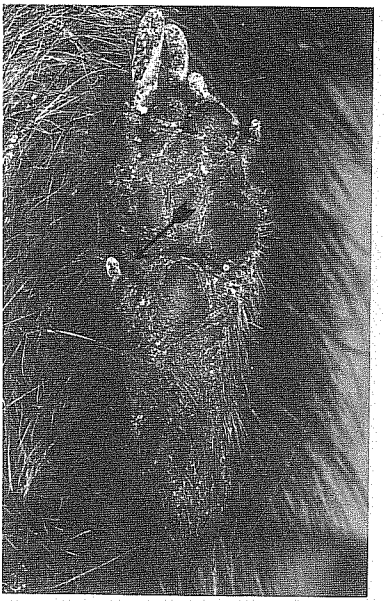
Not only the habitual superficial investigation, restricted to very few conspicuous but meaningless parameters like f. i. prickle colour, but also the easygoing way, to rely only on literature or to study mostly dead, dessicated and therefore shrunken speciments, might have caused two grave errors in systematizing hedgehogs, when taken only on this one criterium: On the one hand, the — in most cases somatically not existing — halluces of *Atelerix* were considered just to be broken off or dried up, on the other hand, the different hallux lenght between *Erinaceus* (long) and *Aethechinus* (short, but present in all the three species (Fig. 4) were overlooked. By this, *Atelerix* was mixed up with *Aethechinus* and the latter with *Erinaceus*, wich resulted in another «waste basket» for the Erinaceinae, like it became notorious for the whole order Insectivora.

The possibility of a not yet fixed genetical pecularity

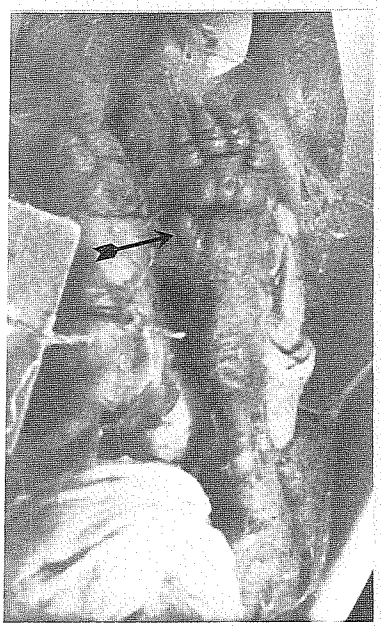
There is, however, a really enigmatic peculiarity in hedgehogs, very probably resulting from their enormous phylogenetical age, their remarkable conservative adaptility and their astonishing morphological plasticity. This can be seen in the eastern range of *Atelerix*, namely in parts of the Sudan, in Southern Somalia and in northeastern Zaire, and indicates the presumable still easternbound spreading direction of this genus: In the mentioned areas, *Atelerix* litters were found, in which the greater parts of the young on their hindfeet have 4 digits only, but a few littermates (about 16%) have one or even two halluces on their hindfeet (Allen, 1922). Additionally, there are some specimens known from the Sudan which are difficult to place on account of having rudimentary hallux bones only on one or on both sides. This indicates, too, that the few millions of years passed since the early Pliocene, when the separation and/or differentiation between *Atelerix albiventris* and *Aethechinus sclateri* took place, were not necessarily enough to fixate a genetic mutation (Fig. 5).



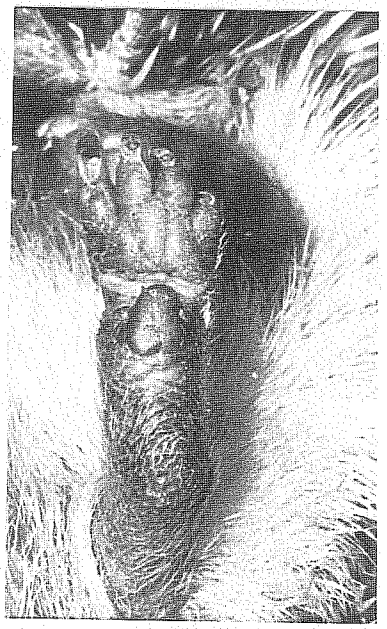
aeth. algirus



aeth. frontalis



aeth. sclateri



atelerix albiventris

FIG. 4 - Hindlegs of the 3 *Aethechinus* species and of *Atelerix albiventris*. The arrows indicate the short but functional halluces in all *Aethechinus* species. *Atelerix albiventris* has neither a hallux nor a tibial pad, but — among the Erinaceinae — a very prominent median tarsal pad.

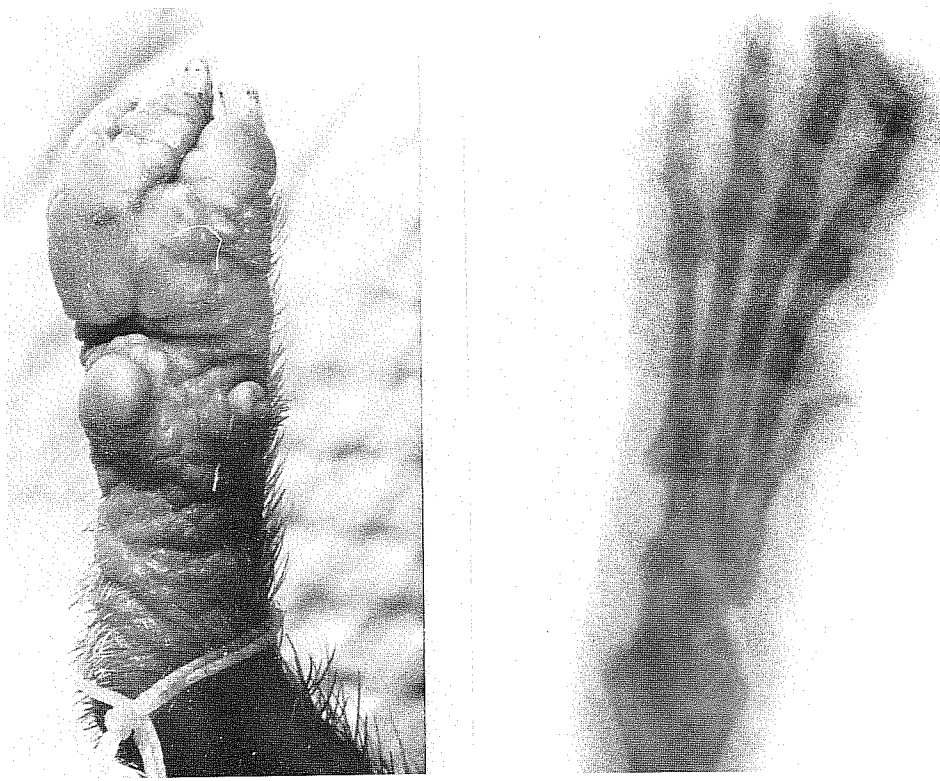


FIG. 5 - Photograph and radiograph of a hindfoot of *Atelerix albiventris*, found in the Senaar/Sudan: The nail is hardly visible, the rudimentary hallux has no function.

Now, we have to assume either a genetically not yet fixed peculiarity and/or the occurance of hybridization between *Atelerix* and another hedgehog group. The latter assumption is backed by a further curious ability of hedgehogs: According to Mayr's (1975) recognized species definition, the conception of a valid species is limited to an animal group forming an isolated propagation unit under natural conditions and with free choosing of partners. However, this does not agree with all Insectivores: Not only some shrews of from each other distinguished species mate successfully, but also hedgehogs of different species. Strictly under the above mentioned conditions, I was able to demonstrate by published photographs (Poduschka & Poduschka 1983) even the mating appetence between different hedgehog genera, *Erinaceus* and *Hemiechinus*. Therefore, it may be suggested that in areas, where *Aethechinus* and *Atelerix* meet or sympatrize, a hybridization zone occurs, or, that in these areas the assumed differentiation between the two genera is not yet fully accomplished. This would allow us to watch a not yet completed evolution process in ethological and in reproductive respects.

Most regrettable, in the museum collections of the world there exist only 22 (nearly) indubitale specimens of genuine Northern Somalian hedgehogs, *Aethechinus sclateri*. Regrettable too is the fact, that the geographical origin of some of them is more than uncertain (Fig. 6).

The plea for further investigations on this theme

For many years, I tried invane to obtain photographs of living Somalian hedgehogs, which might be helpful to drive knowledge on. Up to now, a fairly reliable range determination of both hedgehog genera (*Atelerix* and *Aethechinus*) in Somalia was not accomplished. The available Somali specimens in the museum collections are mostly random findings, thus more or

Aethechinus sclateri specimens from Somalia in the Museum collections

Museum:	Provenance:	Number:
London	«Somalia»	
	Berbera	
	Sheikh	
	Wagar (?)	
	Taf (?)	
München	«median Benadir»	
Genova	Om Ager	
	«Eritrea»	
Firenze	Garoe	
	Nogal	
		13
with one hallux only:		
Firenze	Afgoi	
	Rabaable	
		2
specimen with one hind foot only, thus dubbious		
Firenze	Mogadiscio»	
		1
others, possibly sclateri		
Firenze	«Duna di Afgoi»	3
	«dintorni Mogadiscio	2
Wien	«Somalia»	1
		22

FIG. 6 - Number of supposed *Aethechinus sclateri* specimens in Museum collections: 13 are undoubtedly *Aethechinus sclateri*, 2 might be hybrids, 1 might be added to them, but the specimen has but one hindleg, 6 are uncertain.

less accidentical objects. Their distribution on the map is shown in Fig. 3, indicating these with a hallux and medium sized toes, thus being genuine *Aethechinus sclateri*, as also those with stubby toes and without a hallux (being obviously *Atelerix albiventris*) and those with but rudimentary or a single hallux only, assumed as possible hybrids.

To fill up this gap of knowledge is the reason for my desired and proposed cooperation with Somalian institutions or colleagues interested in Somalian wildlife. Charged with the revision of the basic mammalian order Insectivora, I have to determine the distribution and the relationships of the African hedgehogs.

Therefore, an exact knowledge on the geographical occurence of any Somalian hedgenogs is needed badly. I am happy to state that by the exact and most valuable investigations of Dr. John S. Ash in Northern Somalia (pers. comm. 1988), we have now a better impression of the occurence of Somalian hedgehogs, which, for sure, should be improved very much. However, I want to emphasize that I do not want to induce any extended Northern Somali hedgehog hunt and killing them, which would invariably occur as a result of the difficulty to count the toes of a living hedgehog. As understandable, any hedgehog objects to being handled with great fear of death and will roll into an unpenetrable ball of spines. It has to be emphasized too, that on account of their enormous appetite for insect pests, hedgehogs are eminently beneficial to humans and therefore protected strictly in any cultured countries. In Somalia, they might be decimated enough by shortness of adequate nutrition on account of dessication of the country as well as by predators. Thus, extracting a great number of animals from their natural biotope means to break up nutrition chains so vital for the equilibry of all nature and, by this, for us humans too.

Therefore I want to plead for an official permit to export two pairs of living (!) hedgehogs from their northern range around Berbera (where there are known only genuine and purebred *Aethechinus sclateri*) and two more living pairs from the area around Muqdisho (from where hybrids are known). Dead specimens cannot give any solution to the problems of heredity. The requested specimens would be bred in my Insectivore research center in Vienna/Austria, continuing first breedings of rare Insectivores, by certainly not to kill them. By this, many genetical, propagative and other biological scientific questions like the spreading of the Savanna region could be driven on.

The biotope of the Northern Somalian hedgehogs, Aethechinus sclateri

Unfortunately, after my knowledge, there is no exact investigation available, except some rather vague remarks about a drier and much more stony biotope. At least, Pignatti & Warfa (1983) indicate that the annual rainfall is less than 350 mm, which has to be considered as desert type climate.

The Biotope of the Hedgehogs in Southern Somalia

To understand the dispersion and the expansion of *Atelerix* as best adapted for Savanna climate in the whole Subsaharian savanna belt as well as for its vegetation and cover type and its for hedgehogs adquate prey, the Southern Somalia biotope is to be scrutinized:

a) Climate

Near the coast revails a mean temperature of 26-27°C, with few seasonal fluctuations. In this area, between April and July there is a Southwest Monsun, but from December to May an absolute dry period. Contrary to this, only 30-40 km from the coastline, there occur two rainy seasons with maxima in April/May and October/November.

b) Geomorphology, rainfall and bioclimatical zones.

Southern Somalia is a part of the «Sahelian» vegetation zone and has an annual mean rainfall of 350-600 mm. Only in the southernmost part of Somalia, on the Kenyan border, the annual rainfall even reaches 600-700 mm, which possibly links this area with the «Sudanian zone».

c) Substrate

In the areas most hedgehogs of Southern Somalia were reported from (near Mogadiscio (Mogadishu, Muqdisho), Afgoi and Benadir), prevails the «boscaglia» (to compare with a sort of Macchia). This is a vegetation complex covering a fossil dune system, extending along the (southeatern) coast from Northern Somalia to the Guiba (Juba) river. It is about 1200 kms long with a width of 20-30 kilometres. Built in geological times, it has to be considered as a fossil dune system. From the coastline is it separated by a narrow belt of less than 100 m width, consisting of recent coral sands and partly of rocky sediments.

The highest elevations of about 60 to 120 m are close to the coast. Farther southwards, the dune system becomes flatter and merges into the alluvial river plains of the Shabella river.

The dune itself is composed of reddish sand, rich in silicates and poor in cations. The covering sand is inconherent and is easily blown away by the Monsun. Where vegetation is scarce of aeolian erosion lacks, wandering dunes exist. However, covered by vegetation, the dune is almost stable (Pignatti & Warfa 1983).

d) Vegetation.

The vegetation of the dunes near Mogadishu, up to Balad in the North and Afgoi in the West, was indicated by Pignatti & Warfa (1983) as *Gisekio-*

Tephrosietum pumilae. It occurs in a mosaic with some xerophilous thorny woodland, characterized by *Acacia*-species. The dominant plant species is *Tephrosia pumila*, a perennial herb, which gives hedgehogs an excellent cover by its 5-15 cm long creeping branches and woody base.

In the Boscaglia, especially after the rainy season many hedgehogs can be seen there (Simonetta, pers. comm., 1988). This, however, does not mean that they are more active than to other times of the year, but they cannot be seen during the heavy rains: Practically, there exist no paved routes, which makes locomotion extremely difficult on account of the deep and slippery wet sands.

Conclusion and outlook for interdisciplinary research

Ut to now, the exact ranges of the two hedgehog genera in Somalia, basically residing in two very differing climate, substrate and vegetation types, was not accomplished and not even tried. But we do know that *Atelerix* enlarged its huge range (and, by this, splitted up *Aethechinus*) by following the growing dispersion of the great Savanna belt. The acceptance of this fact, however, could be beneficial also to some anthropological theories, questions, and assumptions: It seems a fact that in the late Pliocene and in Pleistocene, the cradle of humanity was in Eastern and/or Southern Africa, where the Australopithecines either evolved or, at least, reproduced well. Essential to this must have been a not hostile and ecologically positive climate and its effects on the vegetation types, with consequences for optimum living conditions for the fauna. According to the accepted theory, many millions before the Pliocene the evolution into man was already initiated by bipede locomotion in a habitat changing from forest to open savanna, where the small prehumans, the Australopithecinae, drove and propagated so successfully in Africa. But this occured exactly during those epochs, in which also — at least in Africa — the hedgehogs must have undergone a remarkable radiation: *Atelerix*, a small hedgehog form with thin legs, tiny feet and a steeper pelvis (as to mention only a very few of its criteria), better adapted to Savanna life and climate than their predecessors, spread or/and developed in the range of the very probably older genus *Aethechinus*, which obviously was less adapted to this new habitat type and kept preferring dryer biotopes. *Aethechinus* was dispersed and its formerly probably uninterrupted range was split up in three disjointed areas, Northwestern Africa, Southern Africa and Somalia. Thus, *Atelerix* occupies now an ecological niche provided by the forming of savanna habitat, fitting climatologically as well as concerning cover and food. By this, *Atelerix* profited by the same ecological conditions which were equally beneficial for our still primitive human predecessors.

More precisely, the expansion of *Atelerix* must be understood as connected with a changing of vegetation. However, this nowadays seems to have been accomplished in Africa throughout the enormous Subsaharian savanna belt, but did not reach Northern Somalia as also the Eastern Sudan. In these

countries, there seems to be still a shifting of the two Erinaceinae forms and/or a hybridization zone expanding eastwards: while the populations of *Aethechinus sclateri* in northern (and northeastern?) Somalia seem to be unmolested by genetic influence, *Atelerix* is known from Gelib and Dinsor in the South, but hybrids seem to occur near Muqdisho already. This allows the conclusion that the climate and the vegetation of Somalia is still now changing, a fact most considerable to future agricultural evolution of this state.

Concluding, it has to be emphasized that any biological research connected with the climate and vegetation changes in Somalia might be important and could advance research even on the origin of man, and throw attention to the importance of East Africa. Seen from a practical and political point of view, the importance and uniqueness of Somalia can be demonstrated to the world by this and similar research. Therefore, for the sake of any biological science, the proposal for enforced cooperation between any institutions concerned with nature, praehistory and the present of this most fascinating state has to be emphasized. Names and addresses of any interested persons or institutions would be helpful.

ACKNOWLEDGEMENTS

I have to be very grateful to the Stiftung Volkswagenwerk (Hannover/Western Germany) for their generous support of my ample Insectivore research program, as also to Prof. Dr.Dr. Dietrich Starck (Frankfurt a.M./Western Germany) for his most valuable and very necessary advice, critic and encouragment to tackle this difficult theme.

I am deeply indepted to those 4 Italian colleagues who enabled me to study the extremely interesting collection specimens of genuine Somalia hedgehogs, namely Prof. Benedetto Lanza/Firenze, Cattedra di Biologia Generale e Museo Zoologico, Università e Museo Zoologico, Università degli Studi «La Specola», as also Dr. Marta Poggesi and Dr. M. Luisa Azzaroli Puccetti from the same institution; Dr. Gianna Arbocco/Genova, Museo Civico di Storia Naturale «Giacomo Doria». Equally, I have to thank Prof. Alberto Simonetta/Firenze, Istituto di Zoologia ed Anatomia Comparata, Università di Camerino, Prof. Sandro Pignatti/Roma, Istituto Botanico, Università di Roma and cand. phil. Martina I. Steiner/Lana, Völkerkundl. Institut/Vienna University, for badly needed practical advice on local Somalian matters and problems. I am also very grateful to Dr. John S. ASH, Fordingbridge/UK for his generous offert to put at my disposal some unpublished data on hedgehogs collected in northern Somalia.

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