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Notes on Hedgehogs of the Lower Indus Valley

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Indus江 下流의 고슴도치에 관하여

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摘　　要

*P. micropus*와 *H. auritus collaris* 種間의 增殖習性과 生態를 比較검토 하였다. *H. auritus collaris* 새끼의 外部形態와 活動習性을 어미와 比較 觀察하였고 體重과 外部測定値와의 連關性을 특히 重點的으로 比較하였다.

INTRODUCTION

During 1972, specimens of two species of hedgehog were collected in Pakistan. All specimens were collected in the general vicinity of Karachi. While all of the individuals collected were prepared as conventional study specimens, a number of animals were kept alive for varying periods of observation. It is upon these data, as well as specimens viewed in the collections of the British Museum (Natural History), that the following presentation is based.

The pale-faced Indian hedgehog, *Paraechinus micropus micropus* Blythe, 1846, and the long-eared desert hedgehog, *Hemiechinus auritus collaris* Gray, 1830, are largely confined to tropical thorn forests (Siddiqi, 1961). *P. m. micropus* is found in the dry, sandy areas of the Indo-Pakistan subcontinent while *H. a. collaris* is distributed over much of the Middle East and into Chinese Turkestan and Mongolia(Wroughton, 1918; Siddiqi, 1961; Walker, 1964). In Pakistan, Siddiqi (1961) reports the latter as confined to Baluchistan, but Ellerman and Morrison Scott (1966) note localities in Punjab and Sind as well.

In addition to a number of other characters, the two species differ somewhat in size, *H. a. collaris* being the larger species. Color banding of the spines is quite different and albinism has been reported for *P. m. micropus* (Walker, 1964).

Both species are crepuscular and nocturnal, with foraging activities concentrated

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between dusk and midnight. The diet of both species includes insects, worms, slugs, lizards, rats and mice, bird eggs, fruit and roots (Prater, 1965). Walker(1964) and Krishna and Prakash (1955b) note acomplete lack of vegetable matter in the diet. Beddard (1909), Prater (1965), Findley (1967), Burton (1967) and Mathews (1971), however, describe all hedgehogs as omnivorous. Cannabalism among captive animals has been reported (Krishna and Prakash, 1955b; Walker.1964).

Behavioral data on hedgehogs are rather sparse. The phenomenon of rolling into a ball to sleep and when frightened or disturbed is discussed by a number of workers (Krishna and Prakash, 1955a; Gressé, 1955; Gupta, 1961; Walker, 1964; Burton, 1969). Burton (1969) describes an upward jerking motion in *Erinaceous* when the animal is touched and Gould and Eisenberg (1966) describe a similar reaction in tenrecs. General locomotion, running and swimming have been observed by Prakash (1958). Mathews(1971) notes the anointing of the spines with frothy saliva and considers burrow construction. Burrowing is discussed at greater length by Krishna and Prakash (1955a). Both species considered here are reported to build shallow nests lined with leaves, grass and other items (Prater, 1965; Mathews, 1971).

Vocalizations consist of a hissing or huffing sound which increases in intensity when the animals are under stress (McCann, 1937; Krishna and Prakash, 1955; Burton, 1969). High pitched sounds made by mother and infants and a high pitched screech from both male and female *Erinaceous* are described by Burton (1969). Similar vocalizations, hissing sounds and a vocalized buzz, are reported in tenrecs (Gould and Eisenberg, 1966).

Information on reproduction of hedgehogs is scattered and sometimes conflicting. Prenuptial display of the male is described by Mathews(1971). Burton(1969) records the gestation period of *Erinaceous* as 34-39 days with the single exception of 49 days for a captive female. The young of *P. m. micropus* and *H. a. collaris* are born blind and nearly naked except for the presence of short, soft, white spines (Walker, 1964; Prater, 1965; Burton, 1969). Beddard (1909) reports four-six young; and, Prakash (1960) reports two litters of one and two, respectively. For *H. a. collaris,* Walker (1964) notes a breeding season of July-September with one-four young produced; McCann(1937) notes only a single young; Beddard(1909) reports four-six and Prakash (1960), one to four.

The eyes of the young open sometime between the 14th and 22nd day (Gressé, 1955; Gould and Eisenberg, 1966) and the young of *Paraechinus* are able to roll into the characteristic ball at one week of age (Gould and Eisenberg, 1966). Prakash (1960), however, reports this ability to first occur at one month of age. In general, the young abandon the nest to follow the mother between the 19th and 24th day and weaning occurs about the 42nd day. Sexual maturity is reached

at ten months of age(Gressé, 1955).

MATERIALS AND METHODS

Eight specimens of *Paraechinus micropus micropus* and seventeen specimens of *Hemiechinus auritus collaris* were collected from two principal areas: campus of Karachi University and the Malir agricultural area north of Malir City in Lower Sind. Six of the *P. m. micropus* and seven of the *H. a. collaris* were maintained in captivity for observation. All animals captured alive were hand caught.

The animals when sacrificed as study skins or when sacrificed after observation were chloroformed, inspected for ectoparasites and then checked for endoparasites. The ectoparasites are presently being studied by Dr. G. E. Haas and Dr. Nixon Wilson at the University of Northern Iowa and Dr. Bilques Mujib of Karachi University is investigating the endoparasites. Very young specimens were preserved in fluid. All specimens are deposited at the British Museum (Natural History).

Those animals maintained alive were housed in cages prepared from wooden packing cases. The diet consisted of hydrated powered whole milk supplied morning and evening and raw ground beef or buffalo given once a day. Observations were made while the animals were in the cages or when the animals were released in to the garden for a brief period each evening. All animals were weighed at the time of capture or at birth and at regular intervals to the time of death or sacrifice.

In the presentation which follows, each species is treated separately and then the observations compared in the discussion. Information on size, growth, habitat, activity, feeding, offensive and defensive behavior, parturition and parental care is presented where possible. All measurements are in millimeters and weight in grams.

Paraechinus micropus micropus Blythe, 1846

All but one of the individuals captured was taken alive. The exception was a fresh road kill on the Karachi University campus. The semiarid land in this area was generally sandy dominated by thorny shrubs, principally *Acacia* and *Prosopsis*. In the agricultural area, a wide variety of crops were present and extensive irrigation systems. One particular male collected on the Karachi University campus had excavated and occupied a shallow depression at the base of a small shrub. The burrow was approximately two meters from a dirt foot path used by perhaps some two hundred students each day. The animal was curled into a ball to virtually fill the depression and presented only the erected spines to the entrance.

Most of the animals collected had fairly heavy infestations of ectoparasites. particularly ticks. The general mode of living of these animals may be important in maintaining and distributing ticks of certain species.

Color variation in the species was considerable, particularly the relative extent of dark and white banding of the spines. One immature animal had such a reduction in the amount of dark banding as to appear completely white. The white bands of the spines of one lactating female had a distinctive gold tint.

The largest specimen collected, an adult female, had the following measurements: head and body-177, tail-32, hind foot-26, ear-32. The heaviest was an adult male which weighed 435 gms. Several specimens in the collection at the British Museum exceeded the largest of our specimens and one exceeded our heaviest. At the time of capture, 4 nursing young with eyes open weighed 70, 64, 81, and 57 gms. The smallest of these died the day of capture and had the following measurements: head and body-91, tail-8, hind foot-20 and ear-12. After three weeks in captivity and following weaning, the three surviving young weighed 99, 121, and 135 gms. The lactating female weighed 312 gms at the time of capture and 276 gms after weaning the three young.

Of the animals kept for observation, the adult male was active only at night. The adult female with three young began activity at dusk and was active in the mornings for about three hours after dawn. During the day, all animals crawled under newspaper in their cages and rolled into a ball to sleep. During active evening periods in the garden, the animals would move about hesitantly with the body close to the ground, the posterior end lower than the front. Movement consisted of short dashes with pauses between. Once confidence was gained in the surrounings, the legs were fully extended and definite pauses ceased. They were capable of very rapid movement. The behavior of the young in these situations was similar to that of adults except the young tended to move more rapidly and with less caution.

All animals readily consumed the food presented to them each day. The young, however, did not drink milk until weaned. From the time of capture, the female and young exhibited little shyness and would accept food from our hands. The adult male invariably curled into a ball and would not feed until left undisturbed. The forefect were never used to manipulate or hold food although the animals frequently placed the forefeet on the rim of the dish while they lapped milk. When placed in the garden, the young were observed to nibble blades of grass, but we were unable to observe if ingestion occurred. No cannabalism was observed although one dead animal was left in the cage with live ones for several hours. Olfaction appeared to be of particular significance in locating food as well as general investigatory activity.

Wherever the animals were placed in the garden, they were seen to "groom" their spines by anointing them with a frothy saliva. The saliva of the young would frequently be green, apparently from the grass upon which they nibbled.

When subjected to a sudden disturbance, the animals immediately rolled into a ball and erected the spines; in some cases the direction of the tips of some spines appeared to alter as much as 180 degrees when erected. Not all spines were erected unless the animal was touched at which point all spines became fully erect and the body thrust upward with an accompanying hiss or huffing sound. The upward thrust of the body was variable in response, occurring in some animals and not in others. The hissing or huffing was apparently produced by rapid and controlled exhalations, rather than being a true vocalization, and was common to all disturbed animals. Vocalizations were emitted by the female with young the first day in captivity. A rhythmic, high frequency squeak was produced over a period of several hours although left undisturbed with the young. Once during the day, our small kitten climbed into the cage to investigate. This elicited from the female a very loud, high frequency screech that was clearly audible at some 10-12 meters distance.

Prior to weaning of the young, the adult female demonstrated a most determined defense of the young. She repeatedly rushed from one young to another in an apparent attempt to ascertain their status. Attempts to bite our hands were quite clear, although when the hands bore fresh food, she appeared quickly mollified. Although the young quickly formed a ball when disturbed, the female rarely did so except when nursing.

The young were estimated to be at least three weeks of age at the time of capture for they were capable of following the female about. If gestation is approximately 35-39 days, then fertilization probably occurred in April and parturition in May. Similarly, weaning, at the start of the second week in captivity (10~15 June) must have occurred at about 5 weeks of age. The possibility does exist that captivity may have either prolonged or shortened the nursing period.

Two definite nursing periods were observed, early morning from dawn(5~5 : 30) to 7~8 : 00 and again in the evening at about dusk. Each definite nursing period lasted 15-20 minutes. During this time the female lay stretched out on her side with the young lined up, lying very still, at the mammae. The young were never observed to manipulate the mammary area with their forefeet. If disturbed during this time the young would immediately from into a ball and the female would attempt to curl her body around them. After weaning, however, the female paid little or no attention to her young.

If our small sample may be considered representative, we suggest that at the time of weaning the young have attained approximately one-half their adult head

and body length and one-third their maximum adult body weight.

Hemiechinus auritus collaris Gray, 1830

All individuals captured in Pakistan were taken in the desert or agricultural areas in the vicinity of Malir City except for an adult female which was captured at the beach area of Hawks Bay.

With the seventeen specimens collected by us and an additional seventeen in the collection of the British Museum, we have been able to construct what may prove, with future work and additional information, to be a reasonably accurate picture of the growth changes in the long-eared hedgehog. Our specimens range from an individual born in captivity that at the age of one day had the following measurements: head and body-61, tail-7, hind foot-10, ear-6 and weighed 11 gms., to an adult female with the following measurements: head and body-203, tail-33, hind foot-38, ear-41 and weighed 355 gms. Figure 1 presents the relationship of head and body length to weight, Figure 2 the relationship of length of

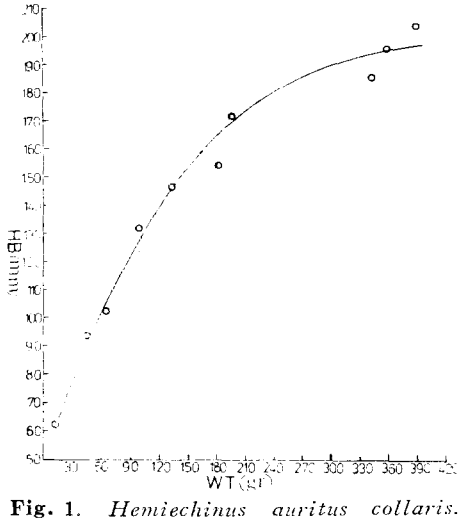

Fig. 1. *Hemiechinus auritus collaris.* Growth changes of head and body length (HB) relative to weight (WT).

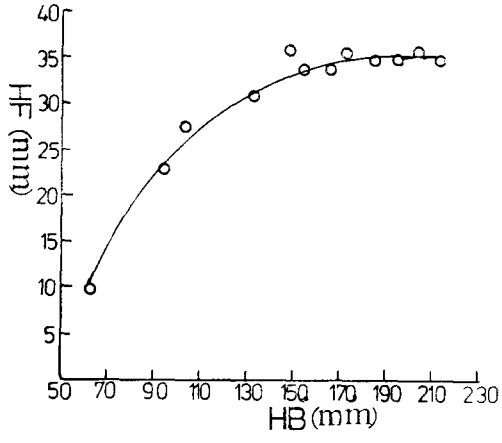

Fig. 2. *Hemiechinus auritus collaris.* Growth changes in length of the hind foot (HF) relative to length of the head and body (HB).

the hind foot to head and body length, and Figure 3 the relationship of height of the ear to head and body length.

Five measurements on the skull were made: greatest length of the skull, width of the rostrum at the sutures of the premaxillae and maxillae, width of the skull at the interorbital constriction, width of the brain case immediately posterior to the the zygomatic arch, and the length of the palate as measured from the medial

suture of the premaxillae to the most anterior margin of the posterior border of the hard palate. The relationship of the latter four characters to greatest length of the skull is shown in Figure 4.

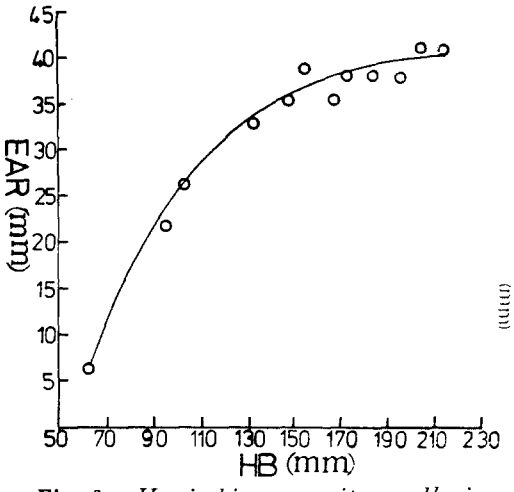

Fig. 3. *Hemiechinus auritus collaris.* Growth changes in height of the ear(EAR) relative to length of the head and body (HB).

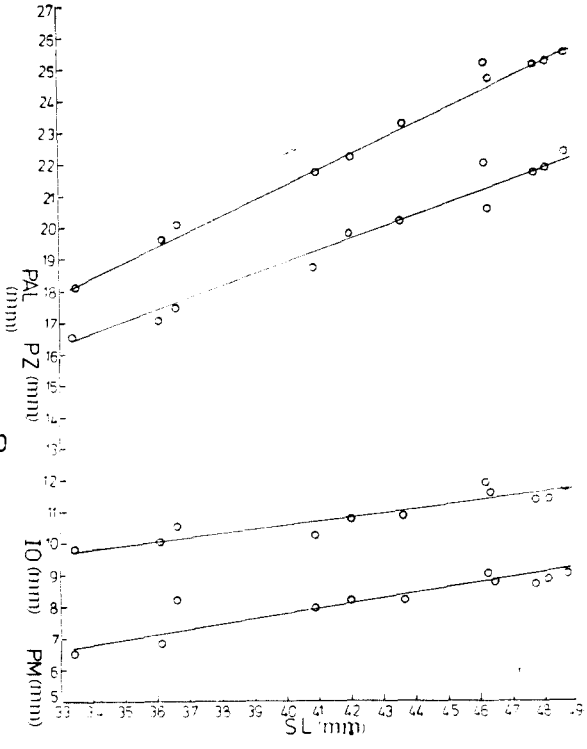

Fig. 4. *Hemiechinus auritus collaris.* Growth changes in width of the rostrum at the sutures of the premaxillae and maxillae (PM), width of the skull at the inter-orbital constriction(IO) width of the brain case immediately posterior to the zygomatic arch(PZ), and length of the palate (PAL) relative to the greatest length of the skull (SL.)

For the treatment of those data on external measurements and weight, specimens were separated into head and body length classes of 100mm. Arithmetic means were then calculated for each character. The various points in Figures 1~3 each represent the actual arithmetic mean for each character relative to the actual arithmetic mean of the specimens in each 10mm head and body length class. For each head and body length class the arithmetic mean of the five measurements of the skull was computed. In Figure 4 mean skull length of each of the classes is presented relative to the mean values of the four other measurements of the skull. Regression lines were placed by inspection.

On the basis of those data shown in Figs. 1~3, the hind foot and ear show a similar growth pattern relative to growth of the head and body. Maturation of the animal, as indicated by these three meristic characters, occurs at a head and body length of approximateyl 155mm, a hind foot length of 35mm, and a height

of the ear of 35mm. Weight, however, appears to lag behind these and the weight increase rate does not appear to alter until a head and body length of approximately 170mm and a weight of 215gms.

Growth processes relative to the skull measurements shown in Figure 4, show a rather smooth pattern with changes in length dominating those in width. We do not suggest that, as these data would seem to suggest, that growth of the skull continues throughout life, but that these data do suggest that few animals reach the age where complete cessation of growth occurs. The lack of specimens of a very young age prevents speculation as to changes in the growth patterns of the skull.

Activity patterns appeared quite similar to that observed in *P. m. micropus*. Feeding habits were similar as well. During her pregnancy, one female readily accepted food from our hands but after birth of the young the food was ignored when presented. Cannabalism was never observed nor were the animals ever observed to nibble on grassas seen in *P. m. micropus*. Anointing of the spines with frothy saliva was observed.

Offensive and deffensive patterns consisted of erection of the spines as previously described followed by rolling into a ball sometimes accompanied by sudden upward thrusts of the body. The animals appeared somewhat reluctant to readily form a ball but to rely on the upward thrust of the body as a defensive measure. Young captured while the eyes were not yet open were able to form a ball, but newborn young were unable to do so. This ability probably is gained in the first week of life. Females with young demonstrated the same determined protection of young as was described for *P. m. micropus*. There did seem less a tendancy to attempt to bite than to drive the body into contact with the intruder accompanied by the upward thrust of the body.

One litter of two was born to one of the captive females during the night of June 13~14. The newborn were blind and short white spines were present. Although a small pool of blood was found on the cage floor, no evidence of palcental material or partially eaten young was evident. Nursing times, duration and manner was as described for *P. m. micropus*. We estimate that breeding occurred sometime in early May in this case but from other litters captured, April and May appear to be active breeding periods.

Vocalizations observed included the typical hissing and huffing sounds as well as the rhythmic, high-frequency squeaks by newly captured females with young.

DISCUSSION

When compared, the behavior patterns of these two species of hedgehogs show

strong similarities in feeding, offensive and defensive activities. Both are crepuscular and nocturnal with the females with young more active at dusk and dawn than were the males. Olfaction appears to be a dominant sense in exploratory and feeding activity. *H. a. collaris* did appear somewhat more aggressive and utilized the upward thrust of the body more readily. Hissing and huffing was common to both as was the rhythmic squeaking of newly captured females with young. These latter sounds may have ultrasonic components and their importance in maternal-infant communications should be considered. The very loud screech observed in *P. m. micropus* was not observed in *H. a. collaris* although it has been observed repeatedly in *Erinaceous* (Burton, 1969).

Annointing of the spines with a frothy saliva was observed in both species, but only *P. m. micropus* was observed to nibble grass.

Breeding season appears markedly different from that described by Walker (1964). Breeding in both species probably occurs in April and May. The maximum litter size observed for both species was four. The young of both species are born blind with small, soft, white spines present. The eyes open at about 2~3 weeks and weaning at about five weeks. As boted for *Paraechinus* by Gould and Eisenberg (1966), the young are able to roll into a ball by the age of one week. Active nursing periods appear to be confined to dawn and dusk with active feeding periods of 15-20 minutes duration.

These animals readily learn to feed from the hand with regular, gentle handling; will not remain tightly rolled when handled.

SUMMARY

Information is presented and comparisons made on the behavior and reproduction of *P. micropus* and *H. auritus collaris*. Comments are made on observations of the apprearance and activities of new born *H. auritus collaris* and on maternal-infant relationships. Observations on size-weight relationships are made, especially for *H. auritus collaris*.

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REFERENCES

Beddard, F. E., 1909. Mammalia. Macmillan and Co., London. pp. 605.

Burton, M., 1969. The Hedgehog. Andre Deutsch Limited, London. pp. 111.

Ellerman, J. R. and T. C. S. Morrison-Scott, 1966. Checklist of Palearctic and Indian Mammals, 1758-1949. Trustees of the British Museum (Natural History), London. pp. 16-29.

Findley, J. S., 1967. Insectivores and Dermopterans, *In:* S. Anderson and J. K. Jones, Jr. (Ed.) Recent Mammals of the World. Ronald Press, New York. pp. 87-108.

Gressé, P. P., 1955. Mammiferes. *In* Traité de Zoologie. Vol. 17. Masson et Cie, Paris. pp. 1669-1671.

Gould, E. and J. F. Eisenberg, 1966. Notes on the Biology of the Tenrecidae. *J. Mamm.* **47** : 660-686

Gupta, B.B., 1961. Investigations of the rolling mechanism in the Indian hedgehog. *J. Mamm.* **42** : 365-371.

Krishna, D. and I. Prakash, 1955a. Hedgehogs of the desert of Rajasthan. Part I. Fossorial habits and distribution. *Jour. Bombay Nat. History Society* **53** : 38-43.

Krishna, D. and I. Prakash, 1955b. Hedgehogs of the desert of Rajasthan. Part. II. Food and feeding habits. *Jour. Bombay Nat. Hist. Sec.* **53**(3) : 362-366.

Mathews, L.H., 1971. The Life of Mammals, Trinity Press, London. Vol. II. pp. 45-72.

McCann, C., 1937. Notes on Hardwickes Hedgehog (*Hemiechinus collaris*, Gray & Hardwicke). *Jour. Bombay Nat. Hist. Soc.* **39**(3) : 616.

Prakash, I., 1958. Swimming and locomotion of captive hedgehogs. *Jour. Bombay Nat. Hist. Soc.* **52** : 584-585.

Parter, S.H., 1965. The Book of Indian Animals. Bombay Natural History Society, Bombay. pp. 323.

Siddiqi, M. S., 1961. Check list of mammals of Pakistan with particular reference to the mammalian collection in the British Museum (Natural History), *London Biologia* **7** : 93-225.

Walker, E.P. 1964. Mammals of the World. Johns Hopkins Press, Baltimore. Vol. I. pp. 103-179

Wroughton, R.C. 1918. Summary of the results from the Indian Mammal Survey of the Bombay Natural History Society, Part II. *J. Bombay Nat. Hist. Soc.* **26** : 19-58.