Hemicentetes semispinosus. By Christopher D. Marshall and John F. Eisenberg

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Hemicentetes Mivart, 1871


CONTEXT AND CONTENT. Order Insectivora, Family Tenrecidae, Subfamily Tenrecinae. Tenrec ecaudatus, Genest and Petter (1975) and Hutterer (1995) consider the genus to be monotypic with two subspecies (semispinosus and nigriceps); however, some authors, such as Eisenberg and Gould (1970), Nicoll and Ratibhun (1990), and Stevenson and Racey (1994) consider each to be a separate species on the basis of morphological characteristics and distribution. Given the similarities, the two forms of Hemicentetes will be treated as subspecies of a single species in a monotypic genus for convenience in order that contrasts and comparisons between the two may be made.

Hemicentetes semispinosus Mivart, 1871

Streaked Tenrec


CONTEXT AND CONTENT. Context noted in generic summary above. We have chosen to follow Hutterer (1993) which lists two subspecies:

H. s. semispinosus (Cuvier), 1797. See above. Includes variegatus E. Geoffroy as a synonym.

H. s. nigriceps Günther, 1875. See above. Includes buffoni Ventenack as a synonym.

DIAGNOSIS. Hemicentetes semispinosus semispinosus is covered with black and yellow quills (Fig. 1). The animal is black with a median yellow stripe down the rostrum and three yellow stripes (one dorsally and two laterally) which run along the length of the body. Quills are more numerous on the head and nuchal area and are longer in this region. The ventral region usually contains no or only a few quills (Eisenberg and Gould, 1970; Gould and Eisenberg, 1966).

In contrast, the stripes of H. s. nigriceps are white (Fig. 2). The rostrum lacks a median stripe present in H. s. semispinosus, but two bold white stripes are present along the length of the body. The density of quills is less than in H. s. semispinosus and the woolly undercoat is more prominent. The modal number of quills within the stridulation organ is 11 in H. s. nigriceps and 14 in H. s. semispinosus (Eisenberg and Gould, 1970; Gould and Eisenberg, 1966). The juvenile Tenrec ecaudatus superficially resembles Hemicentetes, possessing two rows of moveable quills in the midline and cream to yellow horizontal stripes, one on the dorsal midline and two on each side. For a discussion, see Eisenberg and Gould (1970:116).

GENERAL CHARACTERS. The skull has an elongate rostrum and dentition is reduced in size. The zygomatic arch is reduced (Mivart, 1871). The upper molars are zalambdodont (Fig. 3). H. s. semispinosus possesses a black spiny pelage that is marked with three yellow stripes along the length of the body. H. s. nigriceps also possesses a blackspiny pelage, but is not as spinescent compared to H. s. semispinosus. The underfur takes on a woolly appearance. Two white stripes run along the length of the body in a similar manner to H. s. semispinosus. Barbed quills of both subspecies are easily detached and act as an antipredation device. The bright coloration of the yellow or white stripes may serve as a warning to predators (Eisenberg and Gould, 1970). Average body length of both H. s. semispinosus and H. s. nigriceps is approximately 140 mm. Maximum adult body length found for H. s. semispinosus is 172 mm and body weights of adults range from 125 to 280 g. Maximum adult body length found for H. s. nigriceps is 180 mm and adult body weight ranges from 80 to 150 g (Eisenberg and Gould, 1970; Gould and Eisenberg, 1966). Other than genital tracts, morphological differences are not apparent when the sexes are compared. Sensory hairs similar to vibrissae are scattered over the dorsum of both subspecies. A tail is reduced or absent (Eisenberg and Gould, 1970).

DISTRIBUTION. The distribution of the two subspecies is allopatric. H. s. semispinosus is restricted to the rainforests of Madagascar. Specifically, this form is found in the eastern sub-plateau rainforests from Ihôhibe to Maroantsetra. In contrast, H. s. nigriceps is found in the central, upland region of Madagascar from Manandroy south to Fianarantsoa, within the transitional area between the rainforests and the plateau savanna (Fig. 4). Information from the fossil record is lacking for both subspecies (Eisenberg and Gould, 1970).

FORM AND FUNCTION. A group of seven to 16 specialized spines arranged in three rows on the medio-posterior dorsum, together with the underlying dermal musculature, form the stridulation organ that is found in both H. s. semispinosus and H. s. nigriceps (Gould, 1965). The stridulation organ of H. s. nigriceps contains a lower number of specialized spines (mode 12) compared to H. s. semispinosus (13 to 18). Vigorous movement of these spines causes the tips to rub together and produce high-frequency sounds (Gould, 1965). The stridulation organ is thought to be used for communication between members of foraging groups and/or as a warning signal to predators (Eisenberg and Gould, 1970). Petter and Petter-Rousseaux (1963) provide the first report of the stridulating organ, which consists of specialized quills on the medio-posterior dorsum. Quills of the stridulation organ are arranged in parallel rows and move independent of other quills.

The skull is elongated (Fig. 3), tapering anteriorly, and lacks a prominent sagittal crest. The dental formula is i 3/3, c 1/1, p 3/3, m 3/3, total 40. Teeth show a reduction in size compared to other genera of Tenrecidae (Eisenberg and Gould, 1970; Mivart, 1871). There are 20-21 lumbar vertebrae and the pubic symphysis is widely open in some individuals, presumably females (Mivart.

FIG. 1. Photograph of captive H. s. semispinosus at National Zoological Park (JFE).
FIG. 2. Photograph of wild *H. s. nigriceps* in Madagascar (JFE).

1871). The urogenital and excrterory systems exit the body through a common cloaca (Gould and Eisenberg, 1966).

Both subspecies have the ability to enter torpor. Torpor in *H. s. semispinosus* is usually seasonal and dependent upon altitude, ambient temperature, age, and fat reserves (Gould and Eisenberg, 1966). Captive animals have a greater tendency to go into torpor than wild animals (Eisenberg and Gould, 1970; Herter, 1963). Torpor generally occurs during the months of June and July. Torpid animals exhibited a drop in body temperature to ambient levels, decreased activity, and they ceased activity (Eisenberg and Gould, 1970).

Resting metabolic rate (RMR) and body temperature of both subspecies were reduced between mid-April and mid-September and reported to be annually cyclic and unrelated to body mass (Stephenson and Racey, 1994). Mean RMR between mid-September and mid-April was 49% and 69% lower than expected from body mass from the Kleiber (1961) curve for *H. s. semispinosus* and *H. s. nigriceps*, respectively. *H. s. semispinosus* and *H. s. nigriceps* are less active during the austral winter; however, activity levels of *H. s. nigriceps* were much lower than *H. s. semispinosus*. *H. s. semispinosus* is reported to come out of torpor and forage during the winter months. Differences in torpor might reflect different winter strategies in streaked tenrecs; *H. s. nigriceps* appears to be an obligate hibernator in nature, whereas *H. s. semispinosus* appears to be a facultative hibernator (Stephenson and Racey, 1994). Resting metabolic rate was elevated in both forms of pregnant females. A prolonged torpid period may prolong gestation and result in differences in reproductive output. The reduced torpid time of *H. s. semispinosus* may allow a greater annual productivity *H. s. nigriceps* (Stephenson and Racey, 1994).

**ONTOGENY AND REPRODUCTION.** Reproduction is varied but occurs most often during the rainy season (Gould and Eisenberg, 1966). Eisenberg (1975) speculated that tenrecs in general may be induced ovulators, and conception may not always occur during the first copulation. Gestation ranges from 55 to 58 days in both subspecies (Eisenberg, 1975; Eisenberg and Gould, 1967, 1970). The average litter size of *H. s. semispinosus* in the wild (6.3) is greater than that of *H. s. nigriceps* (1.3). Litter size for both subspecies was greater in captivity. *H. s. semispinosus* produced as many as 11 altricial young in captivity (Eisenberg and Muckenhim, 1968). The development of young in *H. s. semispinosus* and *H. s. nigriceps* is very similar. Young are born without spines, weigh approximately 11 g, and range from 55 to 67 mm in length (Eisenberg and Gould, 1966). Development occurs within 24 hours. At day 4, young are able to explore the burrow. Quills appear on the head and nuchal area and teeth erupt at day 5. The ears and eyes open between 8 and 10 days, and the stridulation organ begins to vibrate, although no sound is produced until day 16. Fully coordinated locomotion, as well as complete development of pelage and spines, occurs at day 20; by day 25, young are completely weaned (Gould and Eisenberg, 1966). Females are able to conceive at 35 days of age (Eisenberg and Gould, 1970). *H. s. semispinosus* appears to be the only tenrec that can breed in the same season in which it was born (Eisenberg and Muckenhim, 1968).

Growth curves of *H. s. semispinosus* and *H. s. nigriceps* also are similar. Individuals of both subspecies grow steadily until ap-
proximately day 40. After day 40, growth curves for both subspecies plateau. At this time, the average individual length for both subspecies is approximately 140 mm. The growth curve for *H. s. semispinosus* is slightly lower initially, which is most likely due to the larger litter size and initial limitations on the lactation of the mother (Eisenberg and Gould, 1970).

**ECOLOGY.** A general description of habitats indicates that *H. semispinosus* can be collected near brush lands and forest edges (Rand, 1935). Streaked tenrecs erected the crest of spines located on the head and moved the head upwards repeatedly when disturbed. Individuals also uttered chattering or squeaking sounds when disturbed. The animals observed were active the entire year, but less so from May to October. Individuals from Ivohibé between August and September were sluggish after cold nights, but usually had fine ground material in the intestinal tract indicating that they had not been long inactive.

Streaked tenrecs are likely to be preyed upon by any relatively large carnivore capable of penetrating their antipredator mechanisms. The boa, *Acrantophis dumerilli*, is especially effective. Individuals have been reported to display defensive behavior when exposed to the scents of *Hemicentetes* individuals have been reported to display defensive behavior when exposed to the scents of *Galidia elegans* (Malagasy ring-tailed mongoose) or *Fossa fossa* (Malagasy civet). Both genera kill *H. s. semispinosus* is especially effective. In-...
mounting by the male and lordosis by the female (Eisenberg and Gould, 1970).

Gould (1965) and Eisenberg and Gould (1970) determined experimentally that the stridulation organ produced sound with frequencies between 2 and 200 KHz, but could not determine if this sound was used for echolocation. Maximum amplitude lies between 50 and 150 KHz. Weaver and Herman (1968) reported that maximum cochlear sensitivity ranged from 10 to 15 KHz when potentials were recorded from anesthetized animals. The range of greatest cochlear sensitivity was not correlated with the range of sound produced by the stridulation organ; however, some cochlear sensitivity occurred within the lower range of the stridulation frequencies (18 to 20 KHz). There is is possible that individuals can hear sounds produced by the stridulation organ at distances <10 m (Wever and Herman, 1968). The range of greatest cochlear sensitivity did correspond to the range of sounds (11 to 16 KHz) produced by tongue clicks (as recorded by Gould, 1965). In a series of experiments, observers noted that Hemicentetes individuals use tongue clicks as an echolocating device when exploring an unfamiliar environment.

Observations and recordings of stridulation rates and intensity of stridulation seem to correlate with the activity levels of an individual. However, state of arousal, such as quill erection is not necessarily correlated with stridulation rates and intensity levels. Changes in rates and intensity of stridulation may relay certain information to surrounding individuals such as the motivational state of the stridulating animal or the position of the sender, or to allow females to maintain contact with young during foraging episodes. When the stridulation organ was rendered inoperative in foraging females with young, approximate mother-young distances were significantly closer than when the stridulation organ was operative. Young presumably use sound and/or odor of the mother for recognition, which requires closer contact with the female. Playback of stridulation to solitary young in an experimental arena demonstrated the ability of young animals to “home” in the direction of a speaker producing stridulation as opposed to a control sound of “white noise” of equal amplitude (Eisenberg and Gould, 1970).

When placed into an unfamiliar environment, such as observation pens, individuals explored slowly, alternately testing the air and substrate with their noses. A change in background noise elicited a defensive response and individuals would erect their spines. After sufficient exploration of an area, individuals chose a location for defecation and repeatedly used this area as a latrine. However, burrow entrances occasionally were marked with feces, often an alternate area was selected for a burrow site, and a nest was constructed using grass and leaves. Burrows were excavated with alternate movement of the forelimbs: accumulated soil was kicked out of the burrow with the hind feet. Eisenberg and Gould (1970) reported that burrow sites may be abandoned and new burrows constructed in a nearby vicinity on a 10 to 15 day cycle.

When foraging, animals prod the leaf litter and soil with the tip of the nose. When a worm is detected, an individual will bite and pull at the worm while simultaneously digging at the soil on either side of the worm. Once the worm is pulled from the ground, it is shaken, seized and bitten again, and then forepaws stroke down on either side of the worm in a patting motion. This sequence is observed when individuals first encounter any foodstuff.

GENETICS. The chromosome number for both H. s. semispinosus and H. s. nigriceps is thirty-eight (Borgaonkar, 1966, 1967).

REMARKS. Although the two forms of H. semispinosus have been treated as subspecies for convenience in this account, the taxonomy of the genus Hemicentetes is still unclear. Although Genest and Peter (1975) and Hutterer (1993) refer to the two forms (semispinosus and nigriceps) as subspecies, the authors contend that these two forms are separate species. Clearly, the evidence for classifying these two forms as distinct species warrants further investigation.

LITERATURE CITED


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