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Comparative measurements of running speed in five species of European shrews (Soricidae, Eulipotyphla)

Werner Haberl
Hamburgerstr 11, A-1050 Vienna, Austria
Email: conservation@chello.at

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Abstract
Maximum locomotor performance, defined as flight speed in a nine-meter runway, was measured in the common shrew (*Sorex araneus* Linnaeus, 1758), pygmy shrew (*S. minutus* Linnaeus, 1766), European water shrew (*Neomys fodiens* Pennant, 1771), Miller's water shrew (*N. anomalus* Cabrera, 1907) and lesser white-toothed shrew (*Crocidura suaveolens* Pallas, 1811). Observed maxima ranged from 81 (*C. suaveolens*) to 181 cm/sec (*S. araneus*). *N. fodi*ens was significantly slower than *N. anomalus*.
Keywords: *Sorex*, *Neomys*, *Crocidura*, shrews, locomotion, speed

Introduction
Garland et al. (1988) listed maximum running speeds in various mammals. This list, however, lacks information on shrews. Hitherto, individual observations were made only on *Neomys fodiens*, which were reported to run at an average speed of 30 cm/sec (Ruthardt & Schröpfer, 1985) and a maximum speed of 103 cm/sec (Köhler, 1984). To make comparative statements on maximum locomotor performance in shrews, I conducted experiments with two common shrews (*Sorex araneus* Linnaeus, 1758; 20 trials each), one pygmy shrew (*S. minutus* Linnaeus, 1766; 20 trials), two water shrews (*N. fodiens* Pennant, 1771; 24 trials each), two Miller's water shrews (*N. anomalus* Cabrera, 1907; 28 trials each) and one lesser white-toothed shrew (*Crocidura suaveolens* Pallas, 1811; 13 trials).

Material and methods

The animals had been kept in captivity for various ethological studies (Haberl, 1993) and were used for experiments during their natural activity periods. This was ensured by catching them with live traps set in their home terraria (Cizova, 1987). The shrews have chased down a wooden runway (900 x 15 cm) using a stick with strips of paper attached to its end. Only *S. minutus* was tested in a shorter runway (360 cm). The experimental animals were allowed a minimum of 2 hours rest between trials. When being chased too vigorously the shrews sometimes stopped and turned, uttering high-pitched staccato squeaks at the simulated "predator" or reacted with tail-threshing and -curling. These incomplete runs were omitted from the evaluation. Data were pooled for each species.

Results and discussion

The highest speed was reached by *S. araneus* (max = 181 cm/sec; mean = 127 cm/sec), followed closely by *N. anomalus* (max = 166 cm/sec; mean = 124 cm/sec). *N. fodiens* was significantly (α = 0,001) slower (max = 132 cm/sec; mean = 100 cm/sec). Flight speeds of the smallest species, *S. minutus* and *C. suav*eolens, differed only according to the maxima (106 and 81 cm/sec, respectively), the means being almost equal (70 cm/sec). Standard deviations ranged from 8 to 25 cm/sec. The speed measured in the water shrew corresponded well with data reported by Köhler (1984).

Ranking observed in locomotor performance may be attributed to adaptive and metabolic features within the range of body mass. My definition of maximum running speed, being the velocity reached in flight in this particular experimental situation, must be regarded with caution, as the shrews did not always run in a straight line but rather zigzagged between the walls of the runway, according to their contact-seeking behavior, also shown in open field experiments (Haberl, 1993). One may well question the benefit of these results, especially as shrews are unlikely to encounter even surfaces without obstacles in their natural environment, apart from roads or frozen waters which they might cross in search of new habitats. However, these data are of value for comparisons among different mammalian species, for studies on metabolic and energy expenditure as well as for setting the constraints for simulation experiments in the study of eco-ethological theory.

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