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The House Centipede (*Scutigera coleoptrata*; Chilopoda): Controversy and Contradiction

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I objurgate the centipede,
A bug we do not really need.
At sleepy-time he beats a path
Straight to the bedroom or the bath.
You always wallop where he's not,
Or if he is he makes a spot.

—Ogden Nash[1]

ABSTRACT

The common house centipede, *Scutigera coleoptrata*, has a long and storied history in the annals of zoology. The species has been through five scientific name changes since it was first described by Linnaeus in 1758. Its widespread distribution throughout the Northern Hemisphere has resulted in substantial debate as to its place of origin. Among the centipedes, its morphology is unique and highly specialized, including compound eyes, elongated legs for sprinting, and posterior legs that function as rear antennae. It is a formidable and efficient predator, which sets it apart from others in the Chilopoda. The highly adaptable *S. coleoptrata* thrives in human habitation, and as such, is referred to as the house centipede despite the fact that its natural habitat is in moist crevices and detritus on forest floors. House centipedes may well reign as the ultimate house cleaners, preying on a multitude of invasive invertebrates. Nevertheless, it is still considered a pest to humans and has become a prime target of the pest control industry. This review summarizes some interesting aspects of the biology and ecology of *S. coleoptrata*, with focus on records from North America.

INTRODUCTION

Ogden Nash's irreverent ode to the lowly centipede seemed unjustly aimed at the house centipede, *Scutigera coleoptrata* (Frontispiece). The house centipede is a common member of the fauna of many households throughout the United States and Canada, and it is one of three species of centipedes found in Kentucky. Its natural habitat in the Ohio region is under moist rock ledges, detritus, and crevices in woodlands (Lee 1980), but it readily adapts to basements, drainage fixtures, and other cool moist environments of human habitations. House centipedes may actually be beneficial to humans because they prey on many household pests, including insects, small spiders, and sow bugs. Yet, a recent search of the Internet using the keywords "centipede AND pest" yielded ca. 35,000 websites of pest management companies and extension agen-

[1] Used by permission of Curtis Brown Ltd. ©1935 by Ogden Nash, renewed.

cies that listed the house centipede as a major pest. Along with this seeming contradiction is the controversy on the taxonomic status of house centipedes. Is *S. coleoptrata* a single species or several species? Introduced or native? Friend or foe? These and many other questions remain unresolved, despite the ubiquitous presence of house centipedes in our daily lives.

TAXONOMY AND DISTRIBUTION

The house centipede was originally described as *Scolopendra coleoptrata* by Linnaeus in 1758 in Systema Naturae. The same species was subsequently re-described variously as *Selista forceps* (Rafinesque 1820), *Cermatia coleoptrata* (Say 1821), *Scutigera forceps* (Meinert 1885), and finally as *Scutigera coleoptrata* (Pocock 1893). It was described as *S. coleoptrata* in the 1928 Ohio Biological Survey (Williams and Hefner 1928). House centipedes have large heads, prominent compound eyes, long annulated antennae, and very long legs. The body is 25–30 mm long, but total length may be 150 mm from tip of antenna to tip of the last leg. Body coloration is variable, ranging from olive green to yellow. Three longitudinal lines of green, blue, violet, or black run the length of the body, and the legs have black rings.

The current taxonomy of the genus *Scutigera* contains this single North American species. *Scutigera coleoptrata* (Chilopoda: Scutigeromorpha) is a member of a suite of 130 species in the Family Scutigeridae, most of which are tropical. The most reliable records suggest that the house centipede may be native to the Mediterranean region, but it is common throughout Europe, Asia, and much of North America supposedly as a consequence of introductions. There are many anecdotal references to the house centipede introduced to the United States from Mexico, but this has not been substantiated. However, its presence has been systematically documented from the southern states through Massachusetts by 1890 to southern Canada in 1914 (Hewitt 1914), suggesting that the species' range is spreading. The possibility remains that the species was always native to these various locations where it was simply being systematically documented for the first time. It is now considered common from the east coast of the United States to the Rocky Mountains and has been recorded as far west as Washington state (Johnson 1952).

MORPHOLOGY AND PHYSIOLOGY

Scutigerid centipedes have a distinctive anatomy quite unlike that of other Chilopoda. The body shape is not dorso-ventrally flattened but is more rounded, similar to the Diplopoda. The head capsule is hemispherical with laterally-placed, multiarticulated antennae. The dome-shaped head houses very large mandibles that Manton (1964) considered to be the most specialized and advanced in the Chilopoda. The coxosternite of the first maxillae has regions covered with hair and spindle processes that serve as grooming structures for cleaning the antennae and legs. The forcipules contain poison glands that discharge via ducts behind the tip of the claw.

The antennae of the house centipede are long with up to 300 annulations. The basal segment of the antennae bears openings to the chemosensory Schaftorgan. Behind the antennae is a pair of modified compound eyes, in contrast to other chilopods which have simple ocelli. Small Tömösvary organs are located between the antennae and eyes. While the precise function of the Tömösvary organs is still unclear, there is contradictory indications that they function as auditory (Meske 1961), humidity (Tichy 1973), or olfactory receptors (Lewis 1981).

There are 15 body segments with paired legs, but the terga are fused into seven plates. The 15 pairs of legs are extraordinarily long, increasing in length from anterior to posterior. The coxa are well developed with a ventral spine, but the trochanter is greatly reduced (Manton 1965). The prefemur, femur, and tibia bear longitudinal rows of teeth and terminate with three long spines. The tarsus contains up to 500 annulations and terminates with an apical claw. The annulations of the tarsus bear ventral setae and pegs used to firmly grip the substratum. Each leg is powered by at least 34 separate muscles, compared to two in other centipedes (Manton 1965). The first 14 pairs of legs are used for running, each bearing an equal load. The last pair of legs is directed posteriorly and does not appear to function for locomotion but instead may serve as "rear antennae." Scutigerids are sometimes observed resting under leaves or debris with both antennae and rear legs left out to monitor their surroundings.

Regeneration in *S. coleoptrata* is a highly ordered and efficient process. Legs that are lost are usually replaced in fully-developed form after one molt (Cameron 1926). If the loss of legs does not hamper mobility significantly, house centipedes molt in the normal 30 to 60 day cycle, depending on ambient temperature. However, the loss of all legs may decrease the molting interval by half. Cameron (1926) suggested that the long legs helped to prevent predators from reaching the vulnerable body, and autotomy of legs reduced mortality due to predation. Legs can be autotomized instantly, and autotomized legs continue to twitch for several minutes. In the tropical species *S. decipiens* from the caves of Malaysia, autotomized legs produce loud stridulating sounds (Lewis 1981). This is a particularly effective distraction for reducing the impacts of predatory attacks.

The seven tergites each bear a median dorsal spiracle for gas exchange, unlike the lateral paired spiracles of other myriapods. The spiracles lead to regularly branching tracheal tubes that terminate near the pericardial cavity where they are bathed by blood. The blood contains the respiratory pigment hemocyanin, also unique among the myriapods (Hilken 1997; Mangum et al. 1985). The lung-like tracheal system and efficient oxygen uptake by hemocyanin, aided by active ventilatory compressions from 90 to 200 beats/min., may be adaptations for high-speed movement during flight from predators or in pursuit of prey.

Male scutigerids have differentiated macrotestes that produce large sperm and microtestes that produce small sperm (Bouin 1934). This process of double spermatogenesis produces sperm that are different in number of organelles and size, including tails up to 3.5 mm long on the macrosperm (Mazzini et al. 1992). However, there are no differences in DNA content (Prunescu et al. 1995). The functional significance of double spermatogenesis in scutigerids is still unknown.

Females lay relatively few eggs (average four eggs per day; Lewis 1981), singly in soil. Laying and hatching occurs from late spring through early summer. The first instar larva hatches with 4 pairs of legs, then via subsequent molts, increases to 5, 7, 9, 11, and finally 15 pairs of legs (Verhoeff 1938a) (Figure 1). The first two larval stages lack tracheae and feed on stored yolk reserves, but the third larval stage is well developed and preys on springtails and small spiders. Knoll (1974) suggested that patterns of early development of *S. coleoptrata* is more similar to development in primitive insects than to the scolopendromorph centipedes. Maturity is attained following the eighth molt. The maximum life span is estimated to be 3 years.

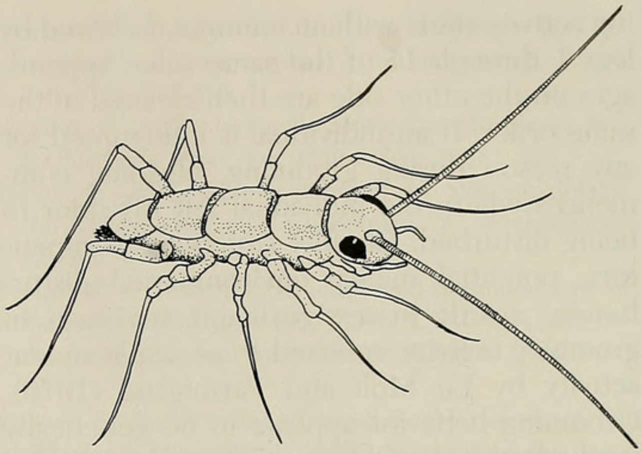

Figure 1. House centipede, *Scutigera coleoptrata*. The second instar has five pairs of running legs but lacks feeding mouthparts. At this stage, the larva still relies upon stored yolk reserves for food. Redrawn by by Scott L. Stauber from Knoll (1974).

BEHAVIOR AND ECOLOGY

The well-developed compound eyes of scutigerids are unique among Chilopoda. Each modified compound eye lacks crystalline cones but contains 100 to 200 highly ordered ocelli that converge to form optic rods (Paulus 1979). The highly convex corneal lens may aid in image formation, similar to the compound eyes of insects and crustaceans. This advanced level of vision may be another adaptation to rapid pursuit of mobile prey. Le Moli (1970) suggested that *S. coleoptrata* was able to visually distinguish between certain mutant types of the fruit fly *Drosophila melanogaster*.

House centipedes meticulously groom themselves on a strict schedule (Le Moli and Parmigiani 1976). The antennae and legs are gripped by the forcipules and passed through the cleaning setae on the first maxillae (Verhoeff 1938b). Particular attention is paid to cleaning the tarsi of legs 1 through 6. Grooming activity starts with an antenna, followed by legs 1 through 15 of the same side. Appendages on the other side are then cleaned in the same order. If an individual is interrupted for any reason during grooming, cleaning commences where the individual left off prior to being disturbed. Conflict situations (competitors, potential mates, environmental disturbance) result in a significant increase in grooming activity, referred to as displacement activity by Le Moli and Parmigiani (1976). Grooming behavior appears to be genetically hard-wired because house centipedes will still attempt to clean legs that have been amputated.

House centipedes are deadly and efficient predators. But compared to many other centipede species, the venom of the poison glands of *S. coleoptrata* is far less toxic, at least to humans. Description of bites range from "severe pain" (Herms 1939) to a "minor nuisance" (Johnson 1952), but more serious consequences are most likely due to secondary infections rather than the bite itself (Ewing 1928). However, the house centipede is deadly to many common invertebrates including flies, silverfish, moths, cockroaches, termites, bees, wasps, sowbugs, and spiders (Cameron 1926; Johnson 1952; Verhoeff 1938b). They are also known to kill other centipedes including *Bothropolys* and *Lithobius*, as well as other scutigerids. Newly molted male house centipedes are especially susceptible to predation by females. The long legs of *S. coleoptrata* function primarily for chasing and catching mobile prey. House centipedes are the greyhounds of the Myriapoda. They have been clocked at 420 mm/sec with a 33 mm stride, which was impressive enough to be listed as among the fastest arthropods in the 1973 Guinness Book of World Records. The long, flexible legs also serve to hold multiple prey securely while one prey item is being leisurely consumed (Johnson 1952).

SUMMARY

Among the Chilopoda, scutigerids appear to be an anomaly. The spider-like body with long legs is built for speed and agility. The setae and pegs of leg segments provide traction. The hemocyanin pigment in the blood efficiently supplies oxygen for fast sprinting. The modified compound eyes may enable acute vision necessary for quickly discerning prey types. The forward antennae and sensory structures of the last pair of legs monitor all activity in the surrounding environment. Autotomy of legs provide distraction for predators but not for the house centipede itself. *Scutigera coleoptrata* is a superbly designed predator that thrives in its natural habitat as well as in human habitats. Curran (1946) referred to house centipedes as "uninvited guests in the house," and pest managers have embraced this designation. But it is clear that house centipedes are far more beneficial than harmful in human domiciles.

A number of questions about this species remain unresolved. Is its distribution really a result of human-facilitated introductions throughout much of its range, or is the present distribution a result of natural large-scale biogeographic processes? What is the function of dimorphism in spermatogenesis? Is the functional morphology simply a highly specialized adaptation to a predatory lifestyle? Is this the sole reason why the house centipede is so radically different from other chilopods? Is its domestic ecology substantially different from its natural ecology? At closer inspection, the lowly house centipede certainly appears to be much more than a mere annoyance in Ogden Nash's imagination.

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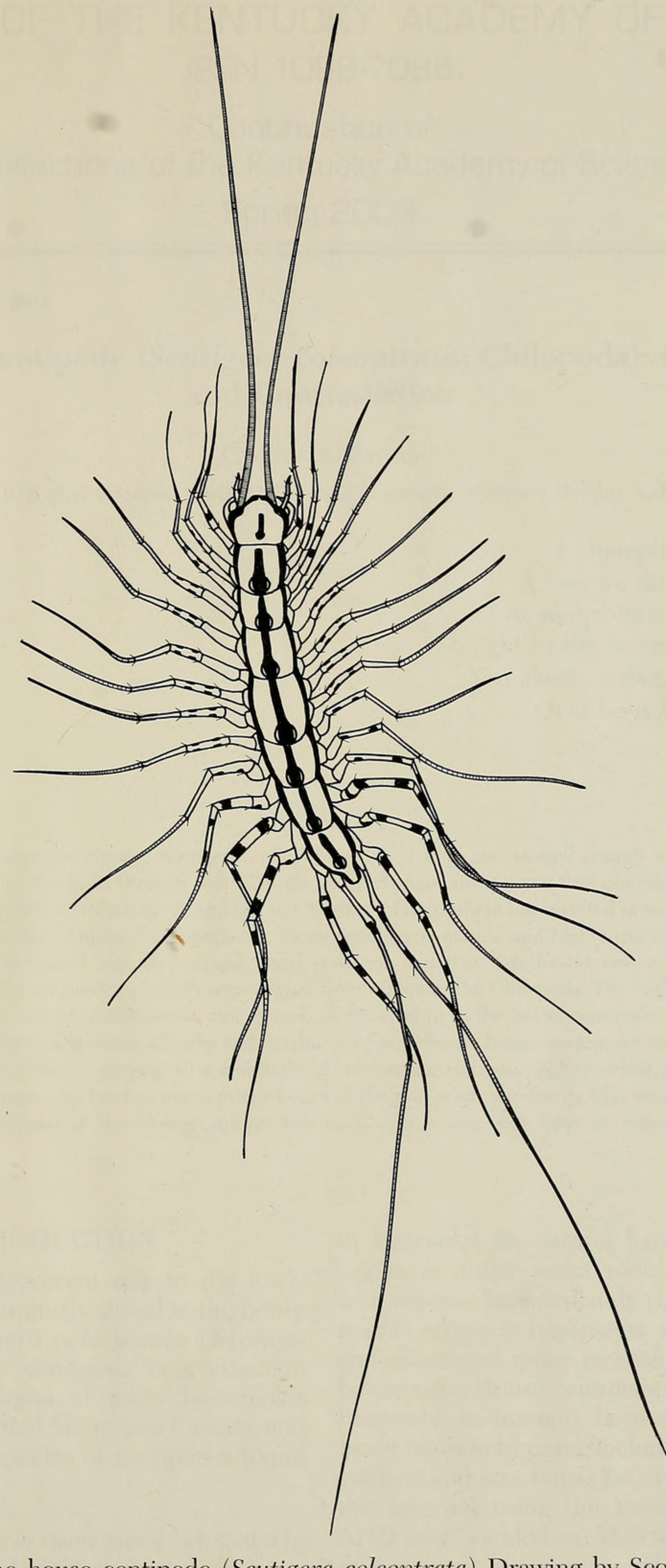

Frontispiece. The house centipede (*Scutigera coleoptrata*) Drawing by Scott L. Stauber. See article starting on page 1.