



Photo: Bill Mull; *Theridion grallator* or Happy-face spider

Terrestrial Invertebrates

Spiders

Order Araneae

ORDER INCLUDES:

Kaua'i Cave Wolf Spider, Federally Endangered

16 Native Families

36+ Native Genera

132+ Native Species

128+ Endemic Species

GENERAL INFORMATION: Spiders have four pairs of legs and no antennae, and they are predaceous. Worldwide there are over 75,000 species. Hawai'i has at least 132 native species which are believed to have originated from 34 founder species. Most Hawaiian spiders are believed to have dispersed to Hawai'i by ballooning, a method of travel where a spider is carried by the wind on a strand of web. Eighty percent of the known Hawaiian native spider species belong to ten genera in seven families: *Cyclosa* (Araneidae), *Orsonwelles* (Linyphiidae), *Pagiopalus* and *Pedinopistha* (Philodromidae), *Havaika* (Salticidae), *Tetragnatha* (Tetragnathidae), *Argyrodes* and *Theridion* (Theridiidae), and *Mecaphesa* and *Misumenops* (Thomisidae). However, many more species remain to be described, particularly in the genera *Tetragnatha* and *Argyrodes*, and perhaps also in *Cyclosa*, *Havaika*, and *Theridion*. Common and widespread native species include *Tetragnatha quasimodo*, *Misumenops anguliventris*, *M. facundus*, and *Pagiopalus* spp. The happy-face spider (pictured above) also is a well-known species that comes in a variety of color morphs. This variation may have evolved to reduce predation by preventing birds from establishing a reliable search image. Like many invertebrates found in Hawai'i, some taxa of spiders have undergone extensive adaptive radiations. For example, the 50 or so species in the genus *Tetragnatha* (long-jawed spiders), occur on all of the MHI and are found in most habitats. The constituent species encompasses a huge spectrum of colors, shapes, sizes, ecological affinities, and behaviors. They reach their highest diversity in montane wet and mesic forests, dry forests, high and low shrublands and scrub. There are likely many species yet to be discovered in this genus. Due to the fact that most species are nocturnal, Hawaiian native spiders remain poorly known.

DISTRIBUTION: Spiders are known from all of the MHI.

ABUNDANCE: As a group unknown. A lack of systematic surveys hampers population estimates. However, the loss of native habitats likely means that species within the order are declining. Of the known species, *Adelocosa anops* (limited to a single cave on Kaua'i) and *Doryonychus raptor* (largely restricted to low elevation habitats on Kaua'i) appear to be the most threatened.

LOCATION AND CONDITION OF KEY HABITAT: Spiders occur in all habitats in Hawai'i including caves, lava flows, forests, and shrublands. Key habitat requirements are poorly known.

THREATS:

- Predation by invasive, non-native species, especially social insects such as ants and wasps, and perhaps also other spiders.
- Loss or degradation of habitat. *Adelocosa anops* (Lycosidae) is known from a single cave on Kaua'i that is threatened by development.
- Insufficient information for species assessments.

CONSERVATION ACTIONS: The goals of conservation actions are not only to protect current populations and key breeding habitats, but also to establish additional populations, thereby reducing the risk of extinction. In addition to common statewide and island conservation actions, specific management directed toward spiders should include:

- Forest restoration. Spider populations have responded positively to reforestation efforts at Auwahi on East Maui.
- Control of invasive non-native invertebrates.
- Conduct surveys to determine the distribution and abundance of known spiders and to document and identify new species.
- Preserve, maintain, and restore habitats supporting existing populations.

MONITORING:

- Monitor known populations to assess trends in abundance.

RESEARCH PRIORITIES:

- Conduct systematic and taxonomic assessments of poorly known taxa, including radiations from the following families and genera: Lycosidae, Theridiidae (*Argyrodes* and *Theridion*), Araneidae (*Cyclosa*), Linyphiidae, Philodromidae, Oonopidae, Salticidae (*Havaika*), Thomisidae, Tetragnathidae (*Tetragnatha*).
- Conduct studies to document the biology, habitat requirements, and life history of native species.

References:

- Blackledge TA, Binford GJ, Gillespie RG. 2003. Resource use within a community of Hawaiian spiders (Araneae: Tetragnathidae). *Annales Zoologici Fennici* 40:293-303.
- Blackledge TA, Gillespie RG. 2004. Convergent evolution of behavior in an adaptive radiation of Hawaiian web-building spiders. *Proceedings of the National Academy of Sciences USA* 101:16228-16233.
- Garb JE. 1999. An adaptive radiation of Hawaiian Thomisidae: biogeographic and genetic evidence. *Journal of Arachnology* 27:71-78.
- Gillespie RG. 1991. Hawaiian spiders of the genus *Tetragnatha*: I. Spiny leg clade series. *Journal of Arachnology* 19:174-209.
- Gillespie RG. 1992. Hawaiian spiders of the genus *Tetragnatha*: II. Species from natural areas of windward East Maui. *Journal of Arachnology* 20:1-17.
- Gillespie RG. 1994. Hawaiian spiders of the genus *Tetragnatha*: III. *T. acuta* clade. *Journal of Arachnology* 22:161-168.

- Gillespie RG. 2002. Hawaiian spiders of the genus *Tetragnatha*: IV. New, small species in the spiny leg clade. *Journal of Arachnology* 30:159-172.
- Gillespie RG. 2003. Hawaiian spiders of the genus *Tetragnatha*: V. Elongate web-builders from Oahu. *Journal of Arachnology* 31:8-19.
- Gillespie RG. 2004. Community assembly through adaptive radiation in Hawaiian spiders. *Science* 303:356-359.
- Gillespie R. 2005. The ecology and evolution of Hawaiian spider communities. *American Scientist* 93:122-131.
- Gillespie RG, Reimer N. 1993. The effect of alien predatory ants (Hymenoptera: Formicidae) on Hawaiian endemic spiders (Araneae: Tetragnathidae). *Pacific Science* 47:21-33.
- Gruner DS. 2004. Attenuation of top-down and bottom-up forces in a complex terrestrial community. *Ecology* 85:3010-3022.
- Hormiga G. 2002 *Orsonwelles*, a new genus of giant linyphiid spiders (Araneae) from the Hawaiian Islands. *Invertebrate Systematics* 16:369-448.
- Hormiga G, Arnedo MA, Gillespie RG. 2003. Speciation on a conveyor belt: sequential colonization of the Hawaiian Islands by *Orsonwelles* spiders (Araneae: Linyphiidae). *Systematic Biology* 52(1):70-88.
- Howarth FG, Mull WP. 1992. Hawaiian insects and their Kin. Honolulu: University of Hawai'i Press.
- Nishida GM editor. 2002. Hawaiian terrestrial arthropod checklist, 4th edition. Honolulu (HI): Biological Survey, Bishop Museum.
- Oxford GS, Gillespie RG. 2001 Portraits of evolution: studies of coloration in Hawaiian spiders. *BioScience* 51:521-528.
- Suman TW. 1964. Spiders of the Hawaiian Islands: catalog and bibliography. *Pacific Insects* 6:665-687.
- Suman TW. 1965. Spiders of the family Oonopidae in Hawaii. *Pacific Insects* 7:225-242.
- Suman TW. 1970. Spiders of the family Thomisidae in Hawaii. *Pacific Insects* 12:773-864.
- Vandergast AG, Gillespie RG. 2004 Effects of natural forest fragmentation on a Hawaiian spider community. *Environmental Entomology* 33:1296-1305.
- Vandergast AG, Gillespie RG, Roderick GK. 2004. Influences of volcanic activity on the population genetic structure of Hawaiian *Tetragnatha*. *Molecular Ecology* 13:1729-1743.