Identifying Symphylans
and their Natural Enemies

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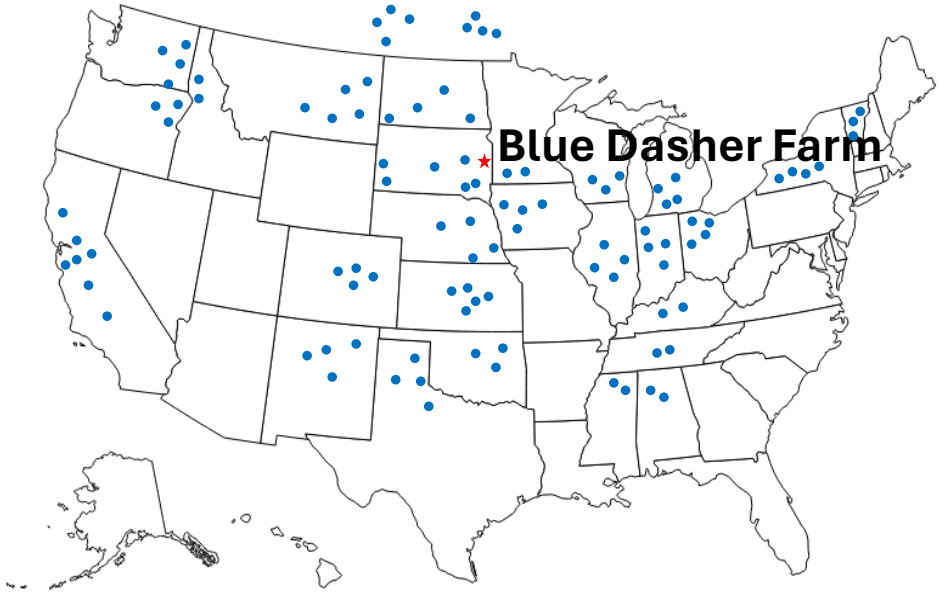
Ecdysis Foundation

- Regenerative agriculture
  - Farmer-developed practices
  - Restoring soils depleted by conventional agriculture
- Blue Dasher Farm
  - Deuel County, South Dakota
- Continent-wide sampling
  - We need big data, fast

ecdysis

BLUE DASHER FARM



1000 Farms Initiative

- Largest agricultural experiment conducted
- Data collection on 1000+ fields and pastures
  - Arthropod samples (quadrats, sweeps)
  - Soil probes (nutrients, microbes, etc)
  - Water infiltration
  - Plant diversity
  - Forage biomass
  - Bird surveys
  - Nutritional analysis
  - Socio-economic surveys

Symphylans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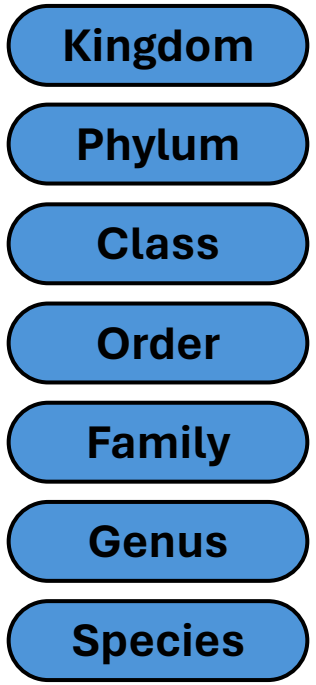
What is a Symphylan?

- A symphylan is… a symphylan
- Class Symphyla
- Other Taxonomic Classes:
  - Mammal (5400 species)
  - Bird (11,000 species)
  - Insect (5,000,000 species)
  - Symphylan (200 species)

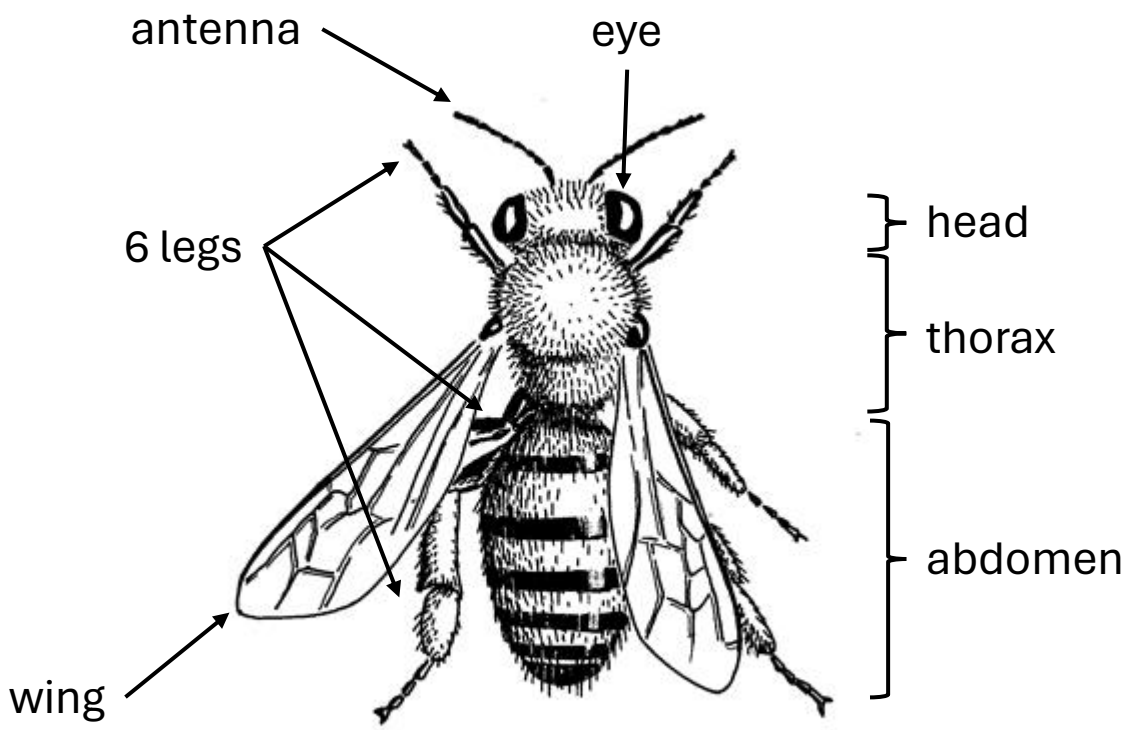


Arthropods

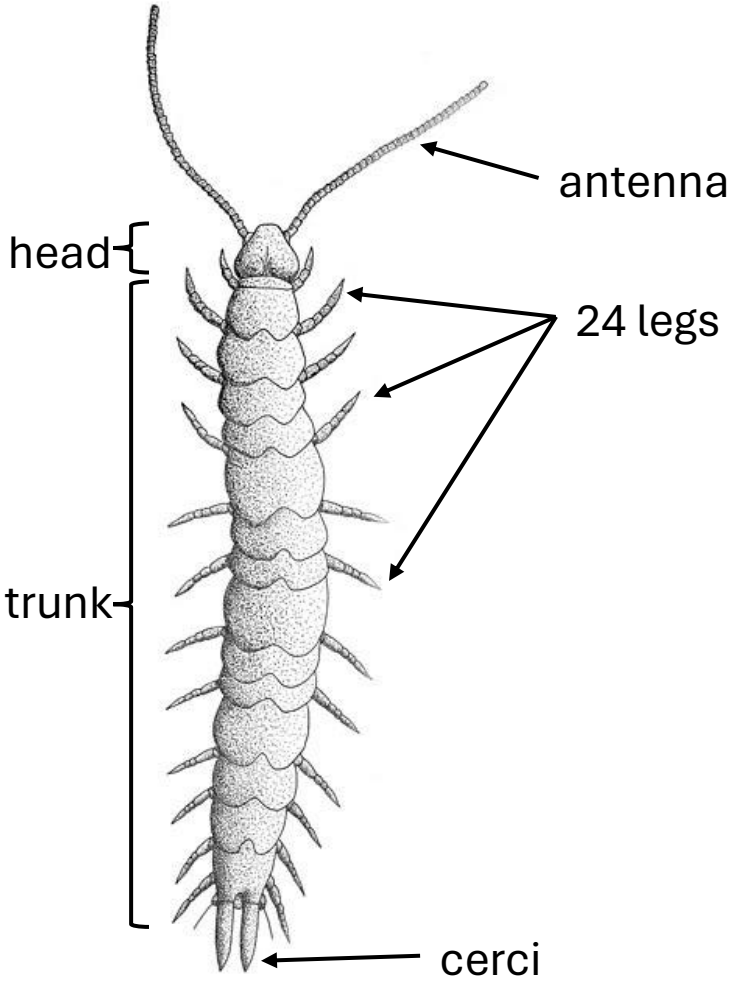
“jointed legs”

NOT an Insect

Insect (Bee)

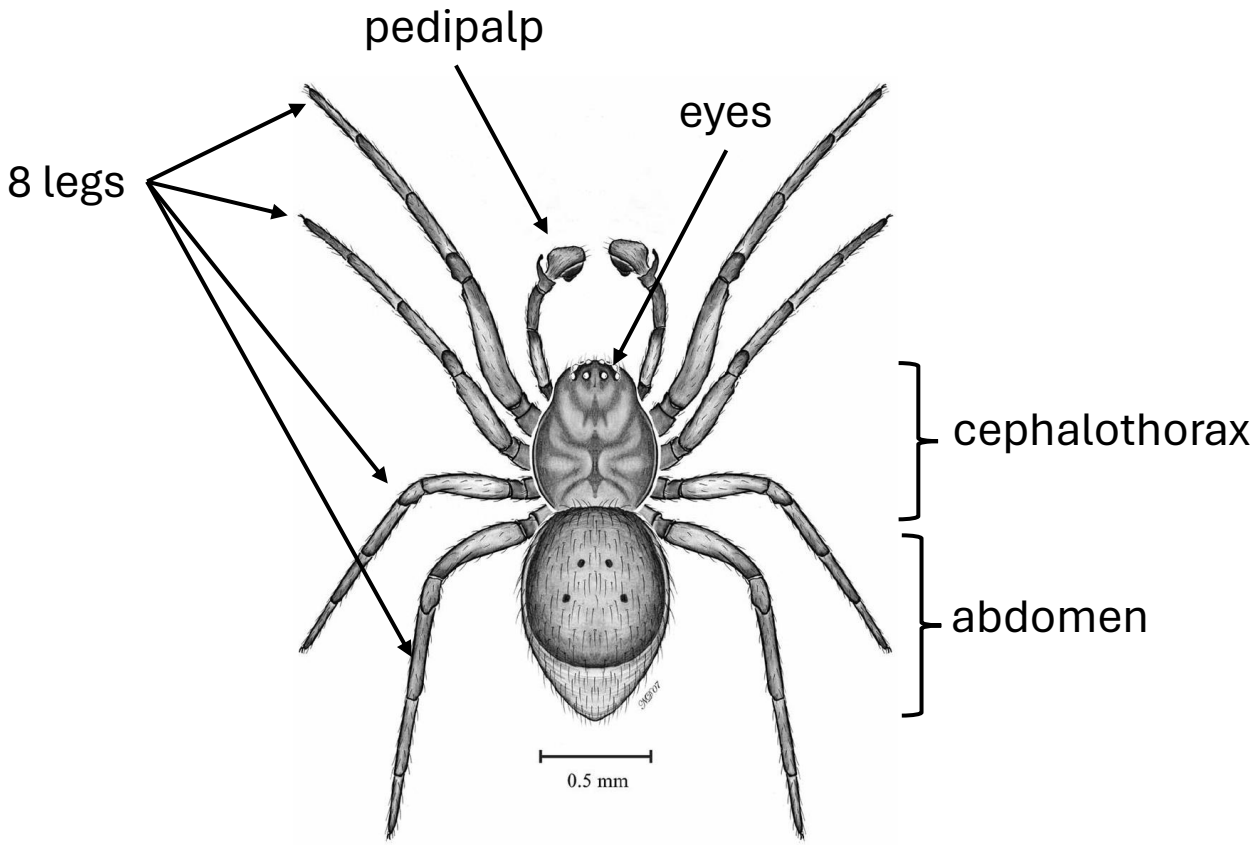


Symphylan

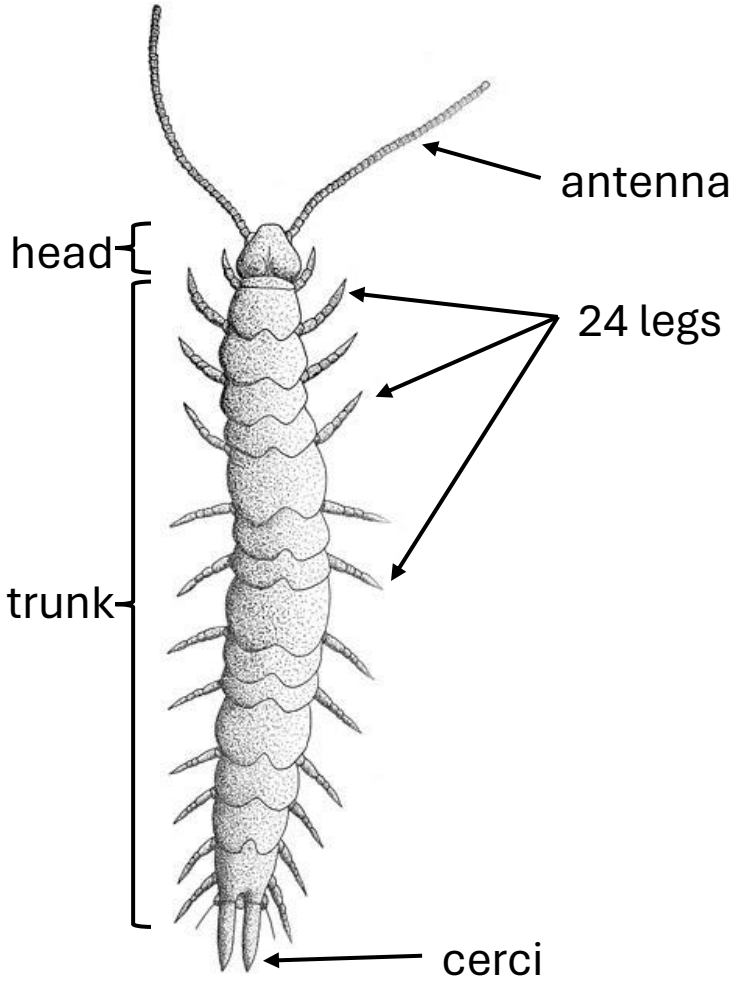


NOT an Arachnid

Arachnid (Spider)



Symphylan



Myriapod

“myriad of legs”

Symphylans

Centipedes

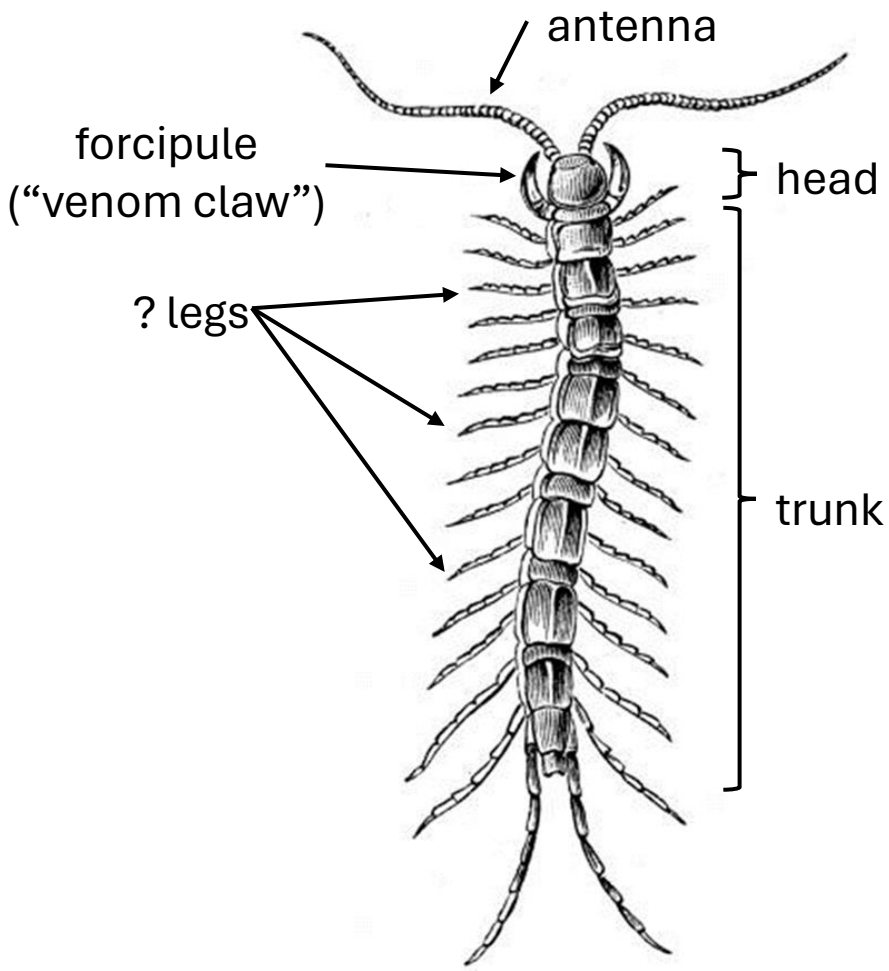
Millipedes

Pauropods

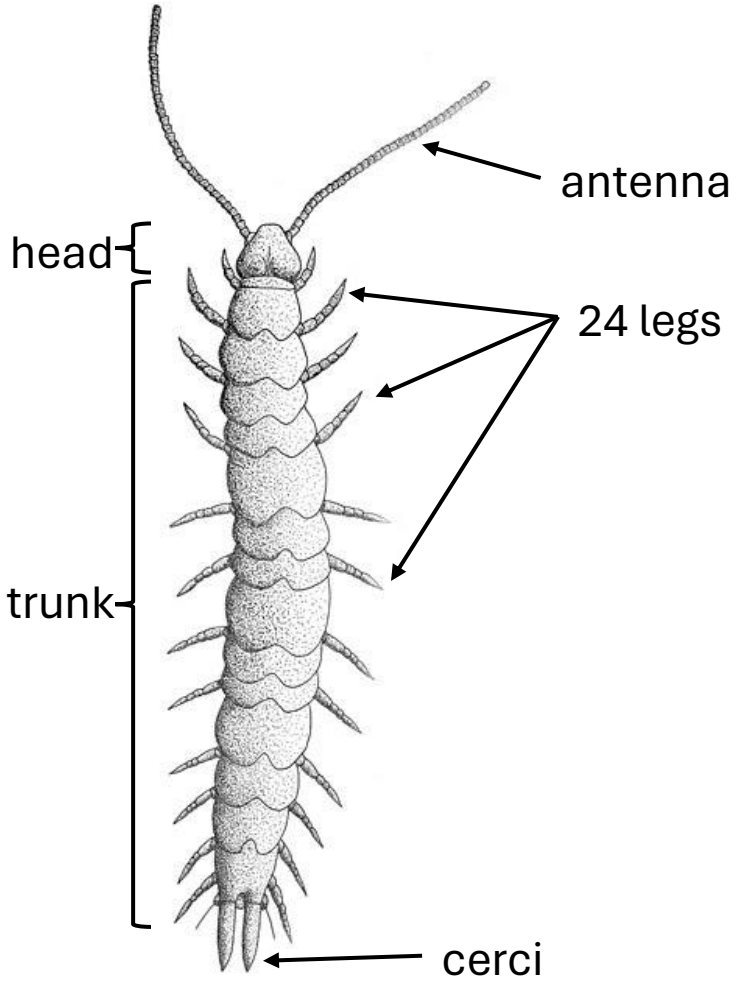
Myriapod

"myriad of legs"

Centipede

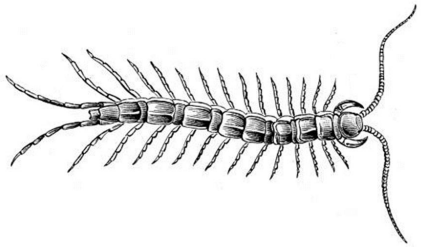


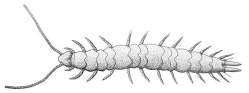
Symphylan

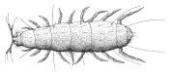


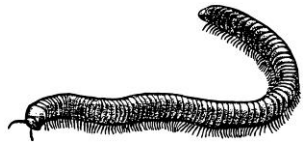
Myriapod

“myriad of legs”









	Centipede	**Symphylan**	**Pauropod**	**Millipede**
Number of legs	15+ pairs	11 or 12 pairs	8-11 pairs	A lot (2 pairs per segment)
Venom claws	Yes	No	No	No
Diet	Carnivorous	Varied	Varied	Herbivorous/ Fungivorous
Speed	Fast	Fast	Fast	Slow
Antennae	Long	Long	Short, branched	Medium
Body Color	Often reddish-brown	Pale	Pale	Varied

Myriapod

"myriad of legs"

Garden Symphylan

AKA, “garden centipede”

https://www.youtube.com/watch?v=uRVsLnf-DP8

Other Soil Bugs

Springtail

Dipluran

Dipluran (forcepstail)

Beetle Larvae

Pillbug

Garden Symphylan

AKA, “garden centipede”

- *Scutigerella immaculata* (Newport 1845)
- Ecology
  - Omnivorous: feed on young plant roots, fungus, worms, eggs
  - High humidity, moderate warmth (50-60° F)
- Reproduction
  - Male leaves a sperm packet for female to find
  - Female guards the egg cluster
  - Born with 6 leg pairs, add new pairs as they grow
  - Several months to adulthood

Natural Enemies of Symphylans

Predaceous Mites (Family Parasitidae)

- Confirmed by studies
  - Can eat ~12 symphylans in a lifetime
  - Abundant enough in agricultural soils?
  - Small (1-2mm long)
  - Reddish-brown
  - Males have modified 2nd "clasper" legs

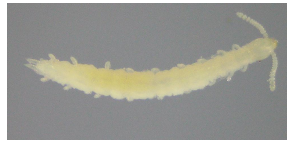
male female

Pergamasus sp.

- **Berry ME** (1973) Biology of the Predaceous Mite, *Pergamasus quisquiliarum* on the garden symphylan, *Scutigerella immaculata* in the Laboratory. *Annals of the Entomological Society of America* 66 (6): 1354-1356

Stone centipede (*Lamyctes* spp.)

- Confirmed by a study
  - Overfeeding?
  - Abundant enough?
  - Reddish-brown
  - ½ inch long
  - 15 leg pairs
  - Legs have hairs, but no spines
  - One eye on each side of the head (other centipedes have a cluster of eyes)



- **Waterhouse JS** (1969) An evaluation of a new predaceous centipede *Lamyctes* sp., on the garden symphylan *Scutigerella immaculata*. *Canadian Entomologist* 101: 1081-1083

Other Reported Natural Enemies

Rove beetles (Family Staphylinidae)

Ground beetles (Family Carabidae)

© Brandon Woo

© Victor Engel

Ants

© Wang et al. 2011. *PLoS Pathogens* 7(6): e1002097

Pathogenic Fungi

- **Getzin LW and Shanks CH** (1961) Infection of the garden symphylan *Scutigerella immaculata* (Newport), by *Entomophthora coronata* (Constantin) Kevorkian and *Metarrhizium anisopliae* (Metchnikoff) Sorokin. *Journal of Insect Pathology* 6(4): 542-543.

Other Possible Predators

Soil Centipedes

Dipluran (forcepstail)

Wolf Spiders

Acknowledgments

- Ellie Andrews
- Amanda Hudson
- Tommy Fenster
- Dozens of Ecdysis employees

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https://www.ecdysis.bio

BLUE DASHER FARM
https://www.bluedasher.farm

UC CE | UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources | UC Cooperative Extension

Academic Bibliography

General Material:

- **Berry ME** (1973) Biology of the Predaceous Mite, *Pergamasus quisquiliarum* on the garden symphylan, *Scutigerella immaculata* in the Laboratory. *Annals of the Entomological Society of America* 66 (6): 1354-1356
- **Edwards CA** (1958) The Ecology of Symphyla: Part I. Populations. *Entomologia Experimentalis et Applicata* 1: 308-319
- **Edwards CA** (1958) The Ecology of Symphyla: Part II. Seasonal Soil Migrations. *Entomologia Experimentalis et Applicata* 2: 257-267
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- **Getzin LW and Shanks CH** (1961) Infection of the garden symphylan *Scutigerella immaculata* (Newport), by *Entomophthora coronata* (Constantin) Kevorkian and *Metarrhizium anisopliae* (Metchnikoff) Sorokin. *Journal of Insect Pathology* 6(4): 542-543.
- **Waterhouse JS** (1969) An evaluation of a new predaceous centipede *Lamyctes* sp., on the garden symphylan *Scutigerella immaculata*. *Canadian Entomologist* 101: 1081-1083

Images:

- **Cokendolpher J, Torrence SM, Anderson JT, Sissom WD, Dupérré N, Ray JD, Smith LM** (2008) Arachnids Associated with Wet Playas in the Southern High Plains (Llano Estacado), U.S.A. *Museum of Texas Tech University Special Publications* #54.
- **Wang SB, Fang WG, Wang CS, St Leger RJ** (2011) Insertion of an Esterase Gene into a Specific Locust Pathogen (*Metarhizium acridum*) Enables It to Infect Caterpillars. *PloS Pathogens* 7(6): e1002097