= Timema =

Timema is a genus of relatively short @-@ bodied , stout stick insects native to the far western United States . The genus was first described in 1895 by Samuel Hubbard Scudder , based on observations of the species Timema californicum .

Compared to other stick insects (order Phasmatodea) , the genus Timema is considered basal ; that is , the earliest " branch " to diverge from the phylogenetic tree that includes all Phasmatodea . To emphasize this outgroup status , all stick insects not included in Timema are sometimes described as " Euphasmatodea . "

Five of the twenty @-@ one species of Timema are parthenogenetic , including two species that have not engaged in sexual reproduction for one million years , the longest known asexual period for any insect .

= = Description = =

Timema spp. differ from other Phasmatodea in that their tarsi have three segments rather than five . For stick insects , they have relatively small , stout bodies , so that they look somewhat like earwigs (order Dermaptera) .

= = = Cryptic coloration and camouflage = = =

Timema walking sticks are night @-@ feeders who spend daytime resting on the leaves or bark of the plants they feed on . Timema colors (primarily green , gray , or brown) and patterns (which may be stripes , scales , or dots) match their typical background , a form of crypsis .

In 2008 , researchers studying the presence or absence of a dorsal stripe suggested that it has independently evolved several times in Timema species and is an adaptation for crypsis on needle @-@ like leaves . All of the eight Timema species with a dorsal stripe have at least one host plant with needle @-@ like foliage . Of the thirteen unstriped species , seven feed only on broadleaf plants . Four (T. ritensis , T. podura , T. genevieve , and T. coffmani) rest during the day on the host plant 's trunk rather than its leaves and have bodies that are brown , gray , or tan . Only two species (T. nakipa and T. boharti) have green unstriped morphs that feed on needle @-@ like foliage ; both are generalist feeders that also feed on broadleaf hosts .

The species Timema cristinae exhibits both striped and unstriped populations depending on the host plant , a form of polymorphism that clearly illustrates the camouflage function of the stripe . The earliest ancestors of this species were generalists that fed on plants belonging to both the genera Adenostoma and Ceanothus . They eventually diverged into two distinct ecotypes with a more specialist host plant preference . One ecotype prefers to feed on Adenostoma while the other ecotype prefers to feed on Ceanothus . The Adenostoma ecotype possesses a white dorsal stripe , an adaptation to blend in with the needle @-@ like leaves of the plant , while the Ceanothus ecotype does not (Ceanothus spp. have broad leaves) . The Adenostoma ecotype is also smaller , with a wider head , and shorter legs .

These characteristics are genetically inherited and has been interpreted as the early stages of the speciation process . The two ecotypes will eventually become separate species once reproductive isolation is achieved . At the moment , both ecotypes are still capable of interbreeding and producing viable offspring , as such they are still considered a single species .

= = = Life cycle and reproduction = = =

Timema eggs are soft , ellipsoidal , and about two mm long , with a lid @-@ like structure at one end (the operculum) through which the nymph will emerge . Timema females use particles of dirt , which they have previously ingested , to coat their eggs .

The eggs of many stick insects , including Timema , are attractive to ants , who carry them away to their burrows to feed on the egg 's capitulum , while leaving the rest of the egg intact to hatch . The

emerging nymph passes through six or seven instars before reaching adulthood .

Timema males , in sexual species of Timema , show a consistent pattern of courting behavior . The male climbs onto the back of the female and , after a short display of vibrating and waving , they proceed to mate . (Rejection by the female is possible but uncommon .) The male then rides on the female 's back for up to five days , a behavior often referred to as " guarding " the female .

Several species of Timema are parthenogenetic : that is , females can reproduce asexually , producing viable eggs without male participation .

According to Tanja Schwander of Simon Fraser University , " Timema are indeed the oldest insects for which there is good evidence that they have been asexual for long periods of time . " She heads a team of researchers who found that five Timema species (T. douglasi , T. monikensis , T. shepardi , T. tahoe and T. genevieve) have used only asexual reproduction for more than 500 @,@ 000 years , with T. tahoe and T. genevieve reproducing asexually for over one million years .

= = Habitat = =

The geographic range of Timema is limited to mountainous regions of western North America between 30 ° and 42 ° N. They are found primarily in California , as well as in a few other neighboring states (Oregon , Nevada , Arizona) and in northern Mexico . All are herbivores , primarily feeding on host plants found in chaparral .

Host plants of the different Timema species include Pseudotsuga menziesii (Douglas fir) , Sequoia sempervirens (Californian redwood) , Arctostaphylos spp . (manzanita) , Ceanothus spp . , Adenostoma fasciculatum (chamise) , Abies concolor (white fir) , Quercus spp . (oak) , Heteromeles arbutifolia (toyon) , Cercocarpus spp . (mountain @-@ mahogany) , Eriogonum sp . (buckwheat) , and Juniperus spp . (juniper) .

= = Phylogeny = =

General phylogenetic relationships within Timema (Law & Crespi , 2002) . Species marked with ? are parthenogenetic (female only) .

= = Classification = =

Timema is the only member of the family Timematidae and the suborder Timematodea . Their clade is considered basal to the order Phasmatodea ; that is , many scientists believe that Timema @-@ type stick insects represent the earliest " branch " to diverge from the phylogenetic tree that gave rise to all the stick insects of Phasmatodea . This primal distinction is referenced by the name " Euphasmatodea " , which is given to all the clades of Phasmatodea other than the suborder Timematodea .

Twenty @-@ one species have been described ; in addition there is at least one undescribed species known to exist :