

Zoraptera

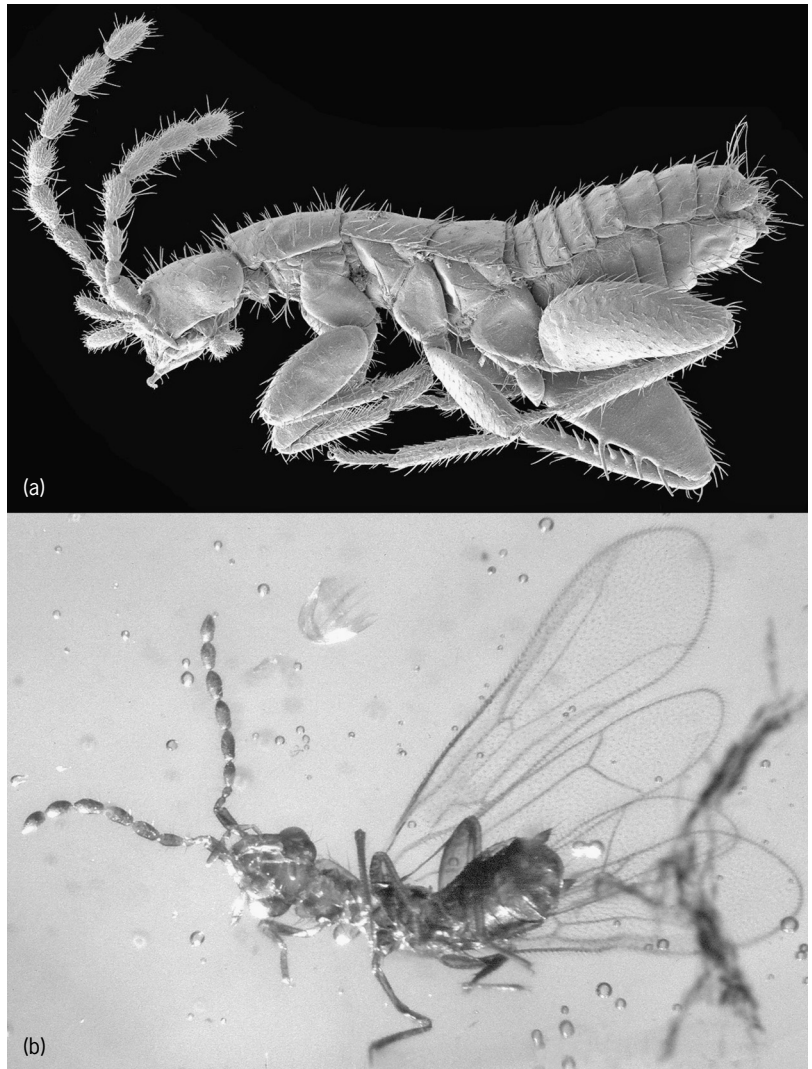
An order of minute insects superficially resembling termites (Isoptera) or booklice (Psocoptera). Although species nest in decaying wood, they are of no economic importance. Interest in the group principally derives from their unique biology, anatomy, and evolutionary relationship to other insects.

Morphology and development. Zorapterans are generally less than 3 mm (0.11 in.) in total body length and can be distinguished by their characteristic two-segmented tarsi; unsegmented cerci; nine-segmented antennae (which is reduced to eight segments in two fossil species from the Cretaceous); dehiscent, paddle-shaped wings with uniquely reduced pattern of venation; greatly enlarged hind femora bearing rows of stiff spines along their undersurfaces; asymmetrical male genitalia; and vestigial ovipositor. Individuals of each species occur in two morphs (sometimes referred to as “castes” but not to be confused with the actual castes of truly social insects): eyed and winged forms that shed their wings after dispersal (becoming what are called “dealates”), or blind and wingless forms that predominate in colonies (see **illustration**).

Development progresses through a series of nymphal stages. The relatively soft integument of zorapterans is pale in nymphal stages and typically reddish brown in adults.

Ecology. Zoraptera are gregarious, living in small colonies of 15–120 individuals in crevices or under bark of moist, decaying logs. Zorapterans will sometimes settle in human-made sawdust piles, but such colonies tend not to last as long as those in logs or stumps. Species prefer rotting wood that has decomposed to the point that logs can be easily torn through by hand or with an ordinary garden tool. Colonies harbor in naturally formed spaces in logs that are not reached by light. Once the wood is disturbed, individuals quickly scatter to avoid detection. Species feed principally on fungal hyphae and spores but can also be generalist scavengers or predators, victimizing nematodes, mites, or other tiny arthropods.

Distribution. Zoraptera are principally distributed pantropically, with only four species occurring north of the Tropic of Cancer (that is, North of 23.5°N): two species in North America and two in Tibet. Fossil records for Zoraptera are all from ambers formed in warm, tropical paleoclimates. Although species have at times been considered highly endemic, due to their poor dispersal abilities, they are increasingly being discovered to have larger geographic ranges than previously understood and are apparently capable dispersers. The presence of zorapterans on distantly isolated islands of relatively recent geological age attests to their dispersal capabilities. In fact, the “rarity” of Zoraptera may be more the result of poor collecting than any actual scarcity. While some species are assuredly uncommon, the actual abundance of zorapterans does not live up to its reputation for scant occurrence.



Representative zorapterans. The greatest length of both individuals is 2.5 mm. (a) Adult female of *Zorotypus hubbardi* (blind and wingless morph). (b) Adult female of *Zorotypus goeleti* (winged morph). (Modified from D. Grimaldi and M. S. Engel, *Evolution of the Insects*, Cambridge University Press, 2005; photos © M. S. Engel)

Classification. Zorapterans are notable for having only 32 modern species and six fossil species known, these classified into two genera (*Zorotypus* and *Xenozorotypus*) in a single family. Once believed to be related to termites or booklice, current hypotheses associate the zorapterans with webspinners (Embiodea, Embiidina, Embioptera), as the two groups share a unique pattern of musculature in the hind legs, a reduced anal region in the wings, occurrence of wingless morphs, and a gregarious biology.

Fossil history. Zorapterans are clearly of ancient origin, perhaps diverging from their webspinner relatives during the Late Triassic or Early Jurassic (approximately 200 million years ago). Relatively modern-looking species of Zoraptera are documented in amber from as long ago as the Early Cretaceous, and fossils from this time already exhibit the development of dual morphs within species. See INSECTA; ISOPTERA; PSOCOPTERA. Michael S. Engel

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