

European Earwig *Forficula auricularia* Linnaeus (Insecta: Dermaptera: Forficulidae)¹

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The Featured Creatures collection provides in-depth profiles of insects, nematodes, arachnids, and other organisms relevant to Florida. These profiles are intended for the use of interested laypersons with some knowledge of biology as well as academic audiences.

Introduction

The European earwig, *Forficula auricularia* Linnaeus, has omnivorous feeding habits that occasionally result in significant injury to some economic crops. More often, they can be a nuisance by contaminating vegetables with their presence. Yet in some cases they can be beneficial due to their predatory habits.

Distribution

The European earwig is native to Europe, western Asia, and northern Africa, but it has been introduced to North America, Australia, and New Zealand.

The European earwig was first observed in North America in Seattle, Washington, in 1907. It spread quickly, and was reported from Oregon in 1909, British Columbia in 1919, and California in 1923. It reached Rhode Island in 1911, New York in 1912, and most other provinces and northern states in the 1930s and 1940s. Presently it occurs south to North Carolina, Arizona, and southern California, but due to its preference for temperate climates, it is unlikely to become abundant in the southeastern states. Also, it is not

very tolerant of arid environments, but it survives where irrigation is practiced. However, it is often intercepted in Florida and other southeastern states, arriving in shipments of produce and other products as well as hitchhiking on motor homes and other vehicles (Paul Choate, personal communication).

Other earwigs are abundant in North America, but few are as numerous as the European earwig, and none are as damaging. The [ringlegged earwig](#), *Euborellia annulipes* (Lucas), and the African earwig, *Euborellia cincticollis* (Gerstaecker), are probably the only other species of concern to crop producers. Ringlegged earwig is widespread, but African earwig is limited to southwestern states. Neither species is native to North America, though ringlegged earwig has become the dominant earwig in Florida.

Description and Life Cycle

Adult

The adult normally measures 13–14 mm in length, exclusive of the pincher-like cerci (forceps), though some individuals are markedly smaller. The head measures about 2.2 mm in width. Adults, including the legs, are dark brown or reddish brown in color, though paler ventrally. The antennae have 14 segments. Despite the appearance of being wingless, adults bear long hind wings folded beneath the abbreviated forewings. Although rarely observed to fly, when ready to take flight the adults usually climb and take

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off from an elevated object. The hind wings are opened and closed quickly, so it is difficult to observe the wings.

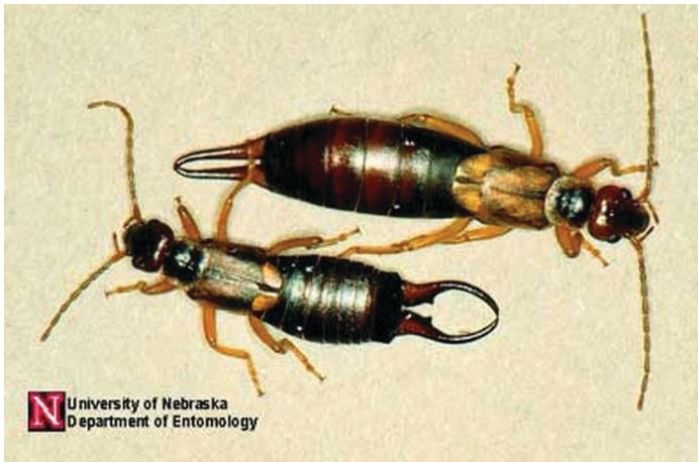


Figure 1. Adult male (bottom) and female (top) European earwigs, *Foricula auricularia* Linnaeus. The forceps help determine the sex of the adult.

Credits: Jim Kalisch, University of Nebraska—Lincoln

Adults bear a set of cerci at the tip of the abdomen. Adults can use the cerci in defense, twisting the abdomen forward over the head or sideways to engage an enemy, often another earwig. The pronounced cerci are the most distinctive feature of earwigs; in the male the cerci are strongly curved whereas in the female they curve only slightly. The forceps of some males are $\frac{3}{16}$ inch (5 mm) long, while others have forceps $\frac{3}{8}$ inch (9.5 mm) long (Jacobs 2009).

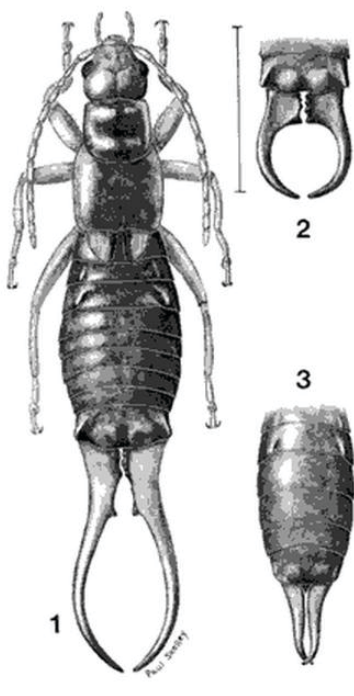


Figure 2. (1) Adult European earwig male; (2) tip of abdomen of male with short, sharply curved forceps; (3) tip of abdomen of female earwig.



Figure 3. Adult female European earwig, *Foricula auricularia* Linnaeus, with eggs and young. Photographed in Chester, United Kingdom.

Credits: Nabokov, en.wikipedia.org

Egg

The egg is pearly white in color and oval to elliptical in shape. The egg measures 1.13 mm in length and 0.85 mm in width when first deposited, but it absorbs water, swells, and nearly doubles in volume before hatching. Eggs are deposited in a cell in the soil in a single cluster, usually within 5 cm of the surface. The mean number of eggs per cluster is reported to range from 30 to 60 eggs in the first cluster. The second cluster, if produced, contains only half as many eggs. Duration of the egg stage under winter field conditions in British Columbia averages 72.8 days (range 56–85 days). The second or spring brood of eggs requires only 20 days to hatch. Eggs are attended by the female, who frequently moves the eggs around the cell and apparently keeps mold from developing on the eggs (Buxton and Madge 1974). Females guard their eggs from other earwigs and fight with any intruders.

Nymph

The nymphal stages, four in number, have the same general form as adults except that the wings increase in size with maturity. The cerci are present in all instars, growing in size with each molt. The body color darkens, gradually changing from grayish brown to dark brown, as the nymph matures. The legs are pale throughout. The wing pads are first evident in the fourth instar. Mean head capsule width is 0.91, 1.14, 1.5, and 1.9 mm in instars 1–4, respectively. Mean body length is 4.2, 6.0, 9.0, and 9–11 mm, respectively. The number of antennal segments is 8, 10, 11, and 12 in instars 1–4. Mean duration (range) of instars under laboratory temperatures of 15–21°C is 12.0 (11–15), 10.2

(8–14), 11.2 (9–15), and 16.2 (14–19) days for instars 1–4. However, development time is considerably longer under field conditions, requiring 18–24, 14–21, 15–20, and about 21 days for the corresponding instars. Young nymphs are guarded by the mother earwig, which remains in or near the cell where the eggs are deposited until the nymph's second instar is attained.



Figure 4. Immature (early instar—first?) European earwigs, *Forficula auricularia* Linnaeus.

Credits: Cheryl Moorehead, Bugguide.net

One generation is completed annually, and overwintering occurs in the adult stage. In British Columbia, eggs are deposited in late winter, eggs hatch in May, and nymphs attain the adult stage in August. Overwintering females may also produce an additional brood; these eggs hatch in June and also mature by the end of August (Lamb and Wellington 1975). In Washington, these events occur about one month earlier (Crumb et al. 1941). Only a single brood of eggs is produced in colder climates, such as Quebec (Tourneur and Gingras 1992).

Behavior

Earwigs are nocturnal, spending the day hidden under leaf debris, in cracks and crevices, and in other dark locations. Their nighttime activity is influenced by weather. Stable temperature encourages activity, and activity is favored by higher minimum temperatures but discouraged by higher maximum temperatures. High relative humidity seems to suppress movement whereas higher wind velocities and greater cloud cover encourage earwig activity (Chant and McLeod 1952). They produce an aggregation pheromone

in their feces that is attractive to both sexes and to nymphs, and they release quinones as defensive chemicals from abdominal glands (Walker et al. 1993).

Social behavior is weakly developed in European earwig. Males and females mate in late summer or autumn, and then construct a subterranean tunnel (nest) in which they overwinter. The female drives the male from the nest at the time of oviposition. Eggs are manipulated frequently, apparently cleaning them to prevent growth of fungi. She will relocate the eggs in an attempt to provide optimal temperature and humidity for the eggs. Although the female normally keeps the eggs in a pile, as the time for hatching approaches she spreads the eggs in a single layer. After hatching, females continue to guard the nymphs and provide them with food. Food is provided by females carrying objects into the nest and by regurgitation. Thus, there is parental care but no cooperative brood care (Lamb 1976).

The most comprehensive treatment of European earwig biology is by Crumb et al. (1941), although the publications by Jones (1917) and Fulton (1924) are informative.

Hosts

This insect is omnivorous, feeding on a wide variety of plant and animal matter. Although its predatory habits somewhat offset its phytophagous behavior, on occasion European earwig can inflict significant injury to vegetables, fruit, and flowers. Bean, beet, cabbage, celery, chard, cauliflower, cucumber, lettuce, pea, potato, rhubarb, and tomato are among the vegetable crops sometimes injured.

Seedlings and plants providing the earwigs with good shelter, such as the heads of cauliflower, the stem bases of chard, and the ears of corn, are particularly likely to be eaten and also to be contaminated with fecal material. Among flowers most often injured are dahlia, carnation, pinks, sweet william, and zinnia. Ripe fruit such as apple, apricot, peach, plum, pear, and strawberry are sometimes reported to be damaged.

The European earwig is reported to consume aphids, spiders, caterpillar pupae, leaf beetle eggs, scale insects, spiders, and springtails as well as vegetable matter. Aphid consumption is especially frequent and well documented (McLeod and Chant 1952, Buxton and Madge 1976a, Buxton and Madge 1976b, Mueller et al. 1988). In addition to the higher plants mentioned above, earwigs consume algae and fungi, and often consume vegetable and animal matter in equal proportions (Buxton and Madge 1976a).

Damage

The economic status of earwigs is subject to dispute. Undoubtedly earwigs sometimes incur damage to vegetable and flower crops, both by leaf consumption and fruit injury. Foliage injury is usually in the form of numerous small holes. Tender foliage and flower petals may be completely devoured. However, the physical presence of earwigs as crop contaminants is perhaps even more important because most people find their presence and odor repulsive. The annoyance associated with their presence is exacerbated by the tendency of earwigs to aggregate, often in association with human habitations; most people simply find them annoying.

The propensity of European earwig to consume other insects is an important element in offsetting their reputation as a crop pest. For example, they can be a significant component of the insect predator assemblage of pear and apple orchards in Washington State (Horton et al. 2002), of citrus orchards in southern Europe (Romeu-Dalmau et al. 2012), and of kiwi orchards in New Zealand (Logan et al. 2011). They have been shown to feed on various pests such as aphids, scale insects, psyllids, and midges (He et al. 2008, Logan et al. 2007 and 2011). The factors limiting abundance of earwigs include insecticide use and availability of shelters where they can avoid predation by birds (Logan et al. 2007, 2011). Use of least toxic insecticides and providing shelter for the earwigs have been suggested and evaluated. However, augmenting the earwig population by field release and providing them with additional shelter to enhance survival have had mixed success in suppressing pest populations (Carroll and Hoyt 1984, Carroll et al. 1985, Logan et al. 2007, He et al. 2008).

Management

Sampling

Population monitoring can be accomplished with baits and traps. Small piles of baits placed among dense vegetation can be used to monitor abundance because they often attract large numbers of earwigs. Wheat bran or oatmeal can serve as bait. Likewise, traps take advantage of the natural tendency of earwigs to hide in crevices and dark spots, and they can be used to detect presence of earwigs and to estimate abundance.

Cultural Control

On residential property or in small gardens, persistent trapping can be used to reduce earwig abundance, though this approach is challenging if the initial earwig density is high. Boards placed on the soil will be attractive to earwigs

seeking shelter. Even more earwigs will accumulate if there are narrow grooves or channels in the board. Moistened, rolled-up newspaper placed in the garden in the evening and disposed of in the morning makes a convenient earwig trap for home gardens. A particularly effective technique is to fill a flowerpot with wood shavings and invert the pot over a short stake that has been driven into the soil. Traps can also be placed in trees because earwigs favor convenient shelters after foraging for food during the evening.

Biological Control

Several natural enemies are known, including some that were imported from Europe in an attempt to limit the destructive habits of this earwig in North America. Some authors have suggested that the most important natural enemy is the European parasitoid *Bigonicheta spinipennis* (Meigen) (Diptera: Tachinidae), which has been reported to parasitize 10%–50% of the earwigs in British Columbia. Others, however, report low incidence of parasitism (Lamb and Wellington 1975). Another fly, *Ocytata pallipes* (Fallén) (Diptera: Tachinidae), also was successfully established, but causes little mortality. Under the cool, wet conditions of Oregon, Washington, and British Columbia, the fungi *Erynia forficulae* and *Metarhizium anisopliae* also infect earwigs (Crumb et al. 1941, Ben-Ze'ev 1986). The nematode *Mermis nigrescens* appears to be an important mortality factor in Ontario, where 10%–63% of earwigs were infected during a 2-year period (Wilson 1971). However, this nematode has not been reported from earwigs elsewhere. Avian predation can be significant (Lamb 1975).

Chemical Control

Commercial products are rarely formulated specifically for earwigs because they rarely are a severe problem. Rather, products sold for grasshoppers, cutworms, slugs, and sowbugs are applied for earwig control. Bait is most effective if applied in the evening.

Pillbugs, Sowbugs, Centipedes, Millipedes and Earwigs

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