

BULLETIN OF THE CALIFORNIA INSECT SURVEY

VOLUME 20

THE EARWIGS OF CALIFORNIA  
(Order Dermaptera)

BY

ROBERT L. LANGSTON and J. A. POWELL

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**BULLETIN OF THE CALIFORNIA INSECT SURVEY**

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# THE EARWIGS OF CALIFORNIA (Order Dermaptera)

BY

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## INTRODUCTION

THE DERMAPTERA comprises a worldwide order of some 900 species of elongate, somewhat flattened insects with incomplete metamorphosis and chewing mouthparts. These characters are common to many Orthoptera and Blattaria, from which Dermaptera can be distinguished by the cerci at the tip of the abdomen, which are modified into a pair of strong, movable forceps. The forceps vary in size and shape among species and higher taxa and may be asymmetrical in the males (particularly in the Carcinophoridae).

Most earwigs have a tough, shiny integument, slender antennae, and three-segmented tarsi. The immature stages are apterous, and the adults may be wingless or fully winged and capable of flight. When present, the forewings are short and leathery and, at rest, conceal all but the tips of the folded hindwings, which are large, semicircular, membranous, and have radial veins. One species, *Euborellia cincticollis* displays alary polymorphism, with adults winged, brachypterous, or wingless, and recent research has shown these morphs to be in part determined by environmental factors (Knabke and Grigarick, 1971).

The common name, earwig, seems to have originated from myths concerning these insects: that they occasionally enter the ears of sleeping humans and even penetrate the brain; that the forceps resemble the pincers used to puncture human ears for the insertion of earrings; or that the expanded wings of the earwigs resemble somewhat the shape of the human ear (Essig, 1942; Imms, 1957).

In evolutionary terms, earwigs are among the more ancient of extant insects. Their fossil record dates from the early Jurassic. In the Tertiary, where they are found frequently in Oligocene and Miocene strata, the fossils differ little from present living forms of Labiduridae and Forficulidae (Riek, 1970).

## CALIFORNIA FAUNA

Twenty-one species of Dermaptera have been recorded in California. Seven are considered to be established in the state. Three additional species are often confiscated in quarantine by the California Department of Food and Agriculture, and have been taken under field conditions in a few instances. These ten species are listed in the table of contents and are treated in detail. The remaining eleven species have been taken only under quarantine conditions, with just one or a few individuals taken only once or twice. (See appendix.)

Of the total of 21 species, only one is considered native to California — *Spongovostox apicedentatus*, a widespread desert species. Three other species, *Anisolabis maritima*, *Euborellia annulipes*, and *Labia minor*, described more than 120 years ago, and known for many years in other parts of the world, have been present in California for so long that no history of their origin and spread can be documented. All of the other Dermaptera species have been shown to be introduced, usually with well-documented records. The first California records in the literature are given in the synonymies, as are records for earliest collections we examined for all species.

## BIOLOGY

Earwigs are nocturnal, terrestrial insects which live in moist, secluded places such as under stones, boards, in cracks in the soil, and in piles of refuse. One of their most interesting biological aspects is the parental care shown for the eggs. The spherical eggs are deposited in groups or clusters, and are guarded by the female. The juveniles

develop usually through five or six instars. Their size varies depending upon availability of food and various ecological factors, but the instars generally can be determined by an increasing number of antennal segments with each successive molt. Juveniles of both sexes have forceps which are similar to those of the adult females. Marked sexual differentiation of the forceps appears in the fifth molt, the beginning of the adult stage (see figs. 1 to 10). The adults in many of the California species also vary markedly in size, with some individuals being only two-thirds the length and half the weight of others.

As in many other insects the time required for incubation of eggs, for growth of immature stages, and the number of nymphal stadia varies with environmental factors, especially temperature.

In cooler regions earwigs appear to be mainly herbivorous, living for the most part on dead or decaying vegetable matter but frequently eating living plants. In the tropics certain species are primarily predaceous and devour many kinds of insects, especially soft larvae.

The biologies of the California earwigs are generally similar in terms of the maternal care of eggs, incomplete metamorphosis, and the nocturnal habits. However, various differences in habits are exhibited among species. Some of the winged species are good fliers and are readily attracted to light. Others are wingless and seldom go to light. Some, although fully winged, have rarely been observed in flight. The species also differ from each other in feeding habits. *Anisolabis maritima* and *Labidura riparia* are primarily predaceous. *Spongostox apicedentatus* feeds on dead or decaying cacti and other desert plants. Most of the other species appear to be such omnivorous feeders that, at times they damage ornamental plants or agricultural crops, yet at other times may be predaceous. Various types of control have been attempted. These include quarantine procedures, chemical sprays, dusts and baits, and the introduction of natural enemies.

Two dipterous parasites (Tachinidae) have been introduced into Oregon (Mote, 1931), and Washington (Getzender, 1936) to control the European earwig, *Forficula auricularia*. The more successful one, *Bigonicheta spinipennis* (Meigen)<sup>1</sup> has been reported established in California (Schoeppner and Hagen, 1963; Arnaud, 1967).

Earwigs sometimes act as hosts for certain internal parasites of vertebrates. *Euborellia annulipes* has been reported as an intermediate host of a cystericoid, a secondary host to a rodent cestode, and an intermediate host of two poultry ascarids (literature summarized by Bharadwaj, 1966).

<sup>1</sup>*Bigonicheta spinipennis* (= *Digonichaeta setipennis* auct. not Fällén)

## HISTORY OF THE ESTABLISHMENT AND SPREAD OF INTRODUCED SPECIES IN CALIFORNIA

Among the seven species of Dermaptera considered to be established in California, only one, *Spongostox apicedentatus*, a desert species, seems to be a native insect. Three others, *Labia minor*, *Euborellia annulipes*, and *Anisolabis maritima* evidently were transported around the world through commerce so early in entomological history that their native ranges are unknown, but probably they were not native in California. The remaining three species are comparatively well-documented aliens, having first been recorded in the state during the past 50 years.

Any attempt to trace the spread of an introduced species is hampered by lack of data, especially if the introduction occurred prior to activities of resident collectors. In California we are somewhat at a disadvantage in this regard, insect sampling having lagged a century or so behind that of the eastern United States. No appreciable survey work was done by resident entomologists prior to Coquillett and Koebele in the last two decades of the nineteenth century. The compiler is at the mercy of the collectors' efforts, so that in general the more conspicuous the insect and the more recent the introduction, the better will be the documentation of its establishment and expanding range. Earwigs are hardly a popular group with collectors, with some species rather poorly surveyed even now. On the other hand, the introduced species tend to live around habitats affected by man and sometimes earwigs are of direct concern to nurserymen and the like, so that much of the record has resulted from California Department of Food and Agriculture surveys.

Nonetheless it must be borne in mind that the apparent spread of an adventive insect is expressed by the more or less randomly accumulated array of specimens in collections. Populations might be established in a given area for 10 or 20 years, for example, before an entomologist chances to preserve a sample, but the occurrence of the species in that region must date from that collection. There is also the possibility that colonies are sampled that do not persist, such as seems to have been the case with *Euborellia annulipes*, which was collected near Sacramento in 1885 but was not taken again anywhere in the Central Valley during the following 47 years. We have considered all records originating from state or federal quarantine inspections to represent this kind of occurrence and have treated some other temporally isolated records as "adventive," or possibly not established. However, in general, we have not attempted to interpret temporary colonization for any collection taken in naturalized situations in the following discussion. Thus the reconstructions of individual species

expansions in California are spotty in actual basis and partly speculative.

The earliest species to have become established in California seems to be *Euborellia annulipes*. Probably this wingless earwig has been transported around the world in ballast or stored products since early shipping times, and quite likely it was introduced into the west coast of North America many times during the nineteenth century. Evidently this earwig was well established in southern California prior to Coquillett's era in Los Angeles (1883-1892; see Essig, 1931), as there are several records, some undated except for month, in his material from the Los Angeles area. The earliest dated specimen is one from Folsom, Sacramento County, taken in 1885 (Hebard, 1917). However, there are no other records in the central or northern part of the state prior to 1905 and no subsequent collections from the Central Valley until 1932, so that whether this early record represents a continuously established population is unknown. Between 1900-1910 *E. annulipes* had become established in the south San Francisco Bay area (Menlo Park, Stanford), on Santa Catalina Island, and at Coronado on San Diego Bay. During the next decade these populations expanded to surrounding areas, there being records all around San Francisco Bay south of the Golden Gate, from Ventura to Redlands and around San Diego. Further extension of these colonies and establishment at Monterey Bay occurred during the 1920's. Records suggest that, as with many introduced insects, a long period of slow spread was followed by a burst of relatively rapid expansion. During 1932-1941 the known range of *annulipes* suddenly enlarged to essentially its present limits: the central coast from San Francisco to Monterey and from Santa Maria to Ventura, the entire Central Valley from Tehama to Kern County, interior parts of southern California including the Coachella Valley, the desert margins in San Diego County, and along the Colorado River from the Yuma area to Needles. The Imperial Valley probably was colonized shortly thereafter, there being a record at Niland in 1949. There are no cismontane records north of San Francisco Bay except at Carquinez Strait in 1965 and 1966.

*Labia minor* may have been established in California for a long time yet overlooked owing to its inconspicuousness. The earliest dated records are 1909 at Pasadena, Los Angeles County, and 1911 at Carmel, Monterey County, and undated specimens were taken by Baker at Claremont (about 25 miles east of Pasadena) during this period. Thus it is likely the species was widespread in California shortly after the turn of the century. Records show *L. minor* occurred north of San Francisco Bay before 1917, and in the South Bay, widely through the Sacramento Valley, and

in Orange County between 1926-1932. No known range extension took place during the following 20 years, but in the mid-1950's this earwig was discovered in the northern Sacramento Valley in Tehama and Shasta Counties, in the San Joaquin Valley at Fresno, and in southern California eastward to Riverside.

The occurrence of *Anisolabis maritima* is equally poorly documented. It was collected at Laguna Beach in 1921 and at Chula Vista near the Mexican border in 1933. However, there has been only a single record in southern California during the following 40 years, so the present status of these populations is unknown. A separate introduction evidently occurred in the San Francisco Bay area, the earliest collection having been made at San Francisco in 1935. Owing to its narrow ecological range, this species could have escaped notice for a long time, so that whether its occurrence in the Bay Area actually dates from a later establishment than in southern California is unknown. In subsequent years the maritime earwig has been collected at various places around the San Francisco Bay, with the earliest records for Marin County in 1947, the east bay shore in 1949, and the north shore of Carquinez Strait in 1966 (Langston, 1974).

The most commonly collected and widespread earwig in California is *Forficula auricularia*, even though there are no known records prior to 1923. It was discovered then at Berkeley, and by 1930 the species was known only along the east shore of San Francisco Bay (Essig, 1931).<sup>1</sup> The spread of the European earwig in California was remarkably rapid. In the 1930's colonies appeared at Humboldt Bay, all around the San Francisco and Monterey bays, in the Central Valley at Oroville, near Sacramento, and at Modesto, and in the Yreka Valley, Siskiyou County, near the Oregon border. During the following decade nearly all the intervening areas were colonized as well as the central coast in San Luis Obispo and Santa Barbara counties, the Sierra Nevada to about 6,000 feet elevation, and coastal Los Angeles and Orange counties. There were many quarantine records in southern California during the 1930's and 1940's, and the species probably was widely established there by 1940. Generally speaking, *Forficula auricularia* is a more boreal insect than *Euborellia annulipes*, so that the two occupy partly allopatric ranges in California, with *auricularia* not known to be established in arid areas of the San Joaquin Valley, neither high nor low deserts, or any place south of Costa Mesa, Orange County, or east of Riverside.

<sup>1</sup> There is a 1929 record from Poso Creek, Kern County, which is inexplicable in view of the rest of the known historical occurrence in California and because *auricularia* is not known to be established in that part of the Central Valley now.



*Euborellia cincticollis* is another earwig that evidently has rapidly spread its range in California. This species was first recorded at three localities near Blythe on the Colorado River in 1946. The following year there were many collections in the Blythe area, by 1949 it was taken in the Yuma area, and in 1950 in the Imperial and Coachella Valleys. In 1953 it appeared at three localities in the San Joaquin Valley and during the next six years at various arid places in intervening areas and northward in the Colorado River Valley near the Nevada border. In 1961, *E. cincticollis* was taken at two stations in Butte County in the northern Sacramento Valley, and in the next decade was discovered populating intervening parts of the Central Valley according to data presented by Knabke and Grigarick (1971). This species is austral in distribution, occurring in xeric parts of the state already colonized by *E. annulipes*.

The latest immigrant among California earwigs is *Labi-dura riparia*, which was first collected at Calexico in November, 1952. Owing to its large size, flight habits, and its attraction to lights, this species is relatively conspicuous so that the recent record of its establishment and spread in the state probably is fairly accurate. This earwig expanded its range northward, reaching Brawley (25 miles) by January, 1954, the Blythe area by 1956, the mountains of eastern San Bernardino County by 1958 and Needles by 1959. Also in 1959 colonies were sampled in the San Bernardino area and on the coast at Malibu. In San Diego County *L. riparia* appeared at Borrego in the desert by 1962, west of the Peninsular Range at El Cajon the following year, and at Chula Vista near the Mexican border by 1967. Southward this species had become established at Ensenada, Baja California, by 1973.

#### ANALYSIS OF DATA

Detailed collection data are given only for less commonly collected species and those for which the status of establishment in the state is uncertain. For this purpose, the following terms have been used to define the categories of occurrence in California.

*Established.* — Records of specimens taken under what are known or assumed to be field conditions. It includes localities where large numbers are taken and/or small numbers on several dates over a period of years. A single record may be considered to represent an established colony if it is within the overall distribution where there are many adjacent or contiguous records.

*Adventive.* — Temporarily or occasionally present at a locality outside of the general distribution, especially isolated collections made more than 20 years ago. Speci-

mens without complete data that are suspected to have been taken in quarantine are also considered adventive.

*Quarantine.* — Records of specimens taken at border or ports-of-entry stations by the California or U.S. Departments of Agriculture. Quarantine also includes many within-state or county records originating in inspection of nurseries, foodstuff transportation vehicles, and at post-offices. These border and within-state records usually include the point-of-origin, and/or the host material.

A copy of the complete, detailed data including numbers of individuals, date, collectors, and institutions in which specimens are deposited is on file with the California Insect Survey, Division of Entomology, University of California, Berkeley.

Data for some early collections that we did not examine are quoted from the literature for purposes of documenting the colonization and spread of introduced species (Burr, 1910; Caudell, 1907, 1913; Hebard, 1917).

#### ACKNOWLEDGMENTS

This project was initiated about 20 years ago by R. F. Smith and the late J. W. MacSwain, who conducted field surveys, canvassed some eastern North American institutions and began assembling the data. After some years postponement we continued the work, and a more detailed version of the present treatment was prepared by Langston in 1964-1967. Modifications and a revised key to species were provided by Powell, and finally an abridged revision was prepared by the two of us in more recent years. Mrs. Celeste Green, Scientific Illustrator, Division of Entomology and Parasitology, University of California, Berkeley, prepared some of the figures and modified others that had been done by an earlier artist.

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## SYSTEMATIC TREATMENT

### CLASSIFICATION

Verhoeff (1902) divided the Dermaptera into three suborders, the Hemimerina, Arixenina, and Forficulina. The Hemimerina and Arixenina are comprised of highly modified, ectoparasitic forms associated with bats and rodents in Africa and the East Indies. This classification has been followed in many general works (e.g., Imms, 1957), and the three suborders were treated by Brues, Melander, and Carpenter (1954), as the Forficulina, Arixenina and Diploglossata (with the single family Hemimeridae). Popham (1961, 1965*b*) stated that the Hemimerina have little in common with the Dermaptera and gave them ordinal status. He further proposed to transfer the Arixenina to the Forficulina with the status of a family.

The following classification of the superfamilies and families follows Popham (1965*b, c*), with the species in California appended under the appropriate families.

#### Order DERMAPTERA

##### Superfamily KARSCHIELLOIDEA

(No species established in California)

##### Superfamily PYGIDICRANOIDEA

(No species established in California)

##### Superfamily LABIOIDEA

###### Family Carcinophoridae

*Anisolabis maritima* (Géné)

*Euborellia annulipes* (Lucas)

*Euborellia cincticollis* (Gerstaecker)

###### Family Labiidae

###### Subfamily Spongiphorinae

*Spongostox apicedentatus* (Caudell)

###### Subfamily Labiinae

*Labia minor* (Linnaeus)

*Marava arachidis* (Yersin)

###### Family Arixenidae

(No species established in California)

##### Superfamily FORFICULOIDEA

###### Family Labiduridae

*Labidura riparia* (Pallas)

###### Family Chelisochidae

*Chelisoches morio* (Fabricius)

###### Family Forficulidae

*Doru lineare* (Eschscholtz)

*Forficula auricularia* Linnaeus

Inasmuch as the few species represented in the California fauna are for the most part distinct in appearance, being members of several different families and subfamilies, the following key based on superficial characters is presented. This alternative is taken in preference to an attempt to modify a key based on more profound characters, such as internal genitalia (e.g., Popham, 1965*a*), which might enable grouping of the species by putative phylogenetic affinities but which would be less useful for purposes of identification.

### KEY TO ADULTS OF THE CALIFORNIA SPECIES OF DERMAPTERA

1. Antenna with 20 or more segments, basal one longer than segments 4-6 combined . . . . . 2
- Antenna normally with fewer than 20 segments (rarely 20), basal one about equal to or shorter than 4-6 combined . . . 3

- 2. Winged; antenna usually with 25-29 segments; body brownish with dark markings, a pair of narrow, longitudinal bands on pronotum extending the length of the tegmina . . . . . *Labidura riparia*
- Wingless; antenna usually with 20-24 segments; pronotum and body entirely black . . . . . *Anisolabis maritima*
- 3. Second tarsal segment lobed or dilated, extending conspicuously beneath third (fig. 1a, b) . . . . . 4
- Second tarsal segment simple, at most only slightly extended beneath third (fig. 1c, d) . . . . . 6

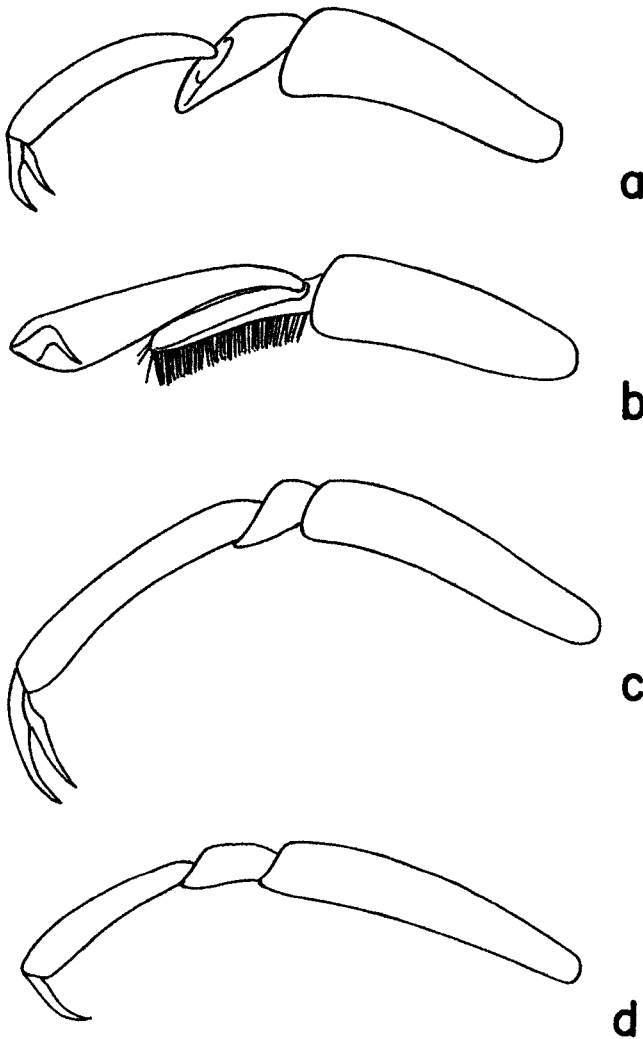


Fig. 1. Tarsal segments of (a) *Forficula*, (b) *Chelisoches* (c) *Euborellia*, and (d) *Labia*.

- 4. Ventral extension of second tarsal segment narrow, not broader than third segment; with long, brushlike pubescence (fig. 1b) . . . . . *Chelisoches morio*
- Ventral extension of second tarsal segment dilated, broader than third; without long, brushlike pubescence (fig. 1a) . . . . . 5

- 5. Antenna with 10-20 segments; forceps of ♂ widely separated at base, with fine, regular dentation on inner side, terminating usually in a larger spur at apical one-fourth; forewing and exposed portion of hindwing yellowish on costal two-thirds, dark on inner one-third (giving appearance of a dark, median, longitudinal band on dorsum when wings are closed) . . . . . *Doru lineare*
- Antenna with 12-15 segments; forceps of ♂ broadened basally, nearly contiguous, with irregular teeth, terminating in a large spur at basal one-third; forewings tan to brown, unicolorous . . . . . *Forficula auricularia*
- 6. Antenna with 14-20 segments, basal one usually about equal to length of segments 4-6 combined; frequently one or two subapical segments pale, remainder darker; pygidium in ♂ strongly turned down . . . . . 7
- Antenna with 12-15 segments, basal one distinctly shorter than segments 4-6 combined; apical segments unicolorous, pale, remainder darker; pygidium in ♂ nearly porrect . . . . . 8
- 7. Wingless; antenna with 14-16 segments; third and fourth (sometimes fifth) subapical segments usually pale; legs yellowish, femora and tibiae usually distinctly banded with black; length including forceps 12-18 mm . . . . . *Euborellia annulipes*
- Wingless, brachypterous or winged; antenna with 17-20 segments; fourth (occasionally third) subapical segment sometimes pale; legs yellowish, usually unbanded; length including forceps 10-15 mm . . . . . *Euborellia cincticollis*
- 8. Third antennal segment about equal to or shorter than fourth, male with terminal margin of pygidium quadrate; body pubescent; length including forceps rarely over 7 mm . . . . . *Labia minor*
- Third antennal segment distinctly longer than fourth; terminal margin of pygidium concave, with lateral pointed tips; body glabrous; length including forceps 8-12 mm . . . . . 9
- 9. Eye diameter about equal to length of first antennal segment; forceps of ♂ with conspicuous subapical tooth, of ♀ with small, quadrate basal spur . . . . . *Spongovostox apicidentatus*
- Eye diameter less than length of first antennal segment; forceps without conspicuous spurs . . . . . *Marava arachidis*

*Anisolabis maritima* (Géné)  
The Maritime Earwig  
(Fig. 2; map 1)

*Forficula maritima* Géné, 1832, Sagg. Monogr. Forfic. Indig., p. 9. (Nice, France; Genoa and Tuscany, Italy; along Mediterranean).  
*Anisolabis maritima*; Fieber, 1853, Lotos, III, p. 257. (Exotic records; South Carolina) (First United States record). Essig. 1922, Pomona College J. Entomol. Zool., p. 75 (Laguna Beach, California) (First California record).

The maritime or seaside earwig is a large, shiny black or brown species. The wingless adult is recognized by its long, uniformly dark antennae and pale yellowish legs. The immatures or juveniles are of the same color, body shape, and have straight forceps as the females, but with fewer antennal segments.

The predaceous habits of maritime earwigs have been noted by Fulton (1924), their prey including crickets, sand-

fleas, and smaller earwigs. This species forages at night, whereas in the daytime individuals quickly crawl into cracks and crevices when exposed (Langston, 1974).

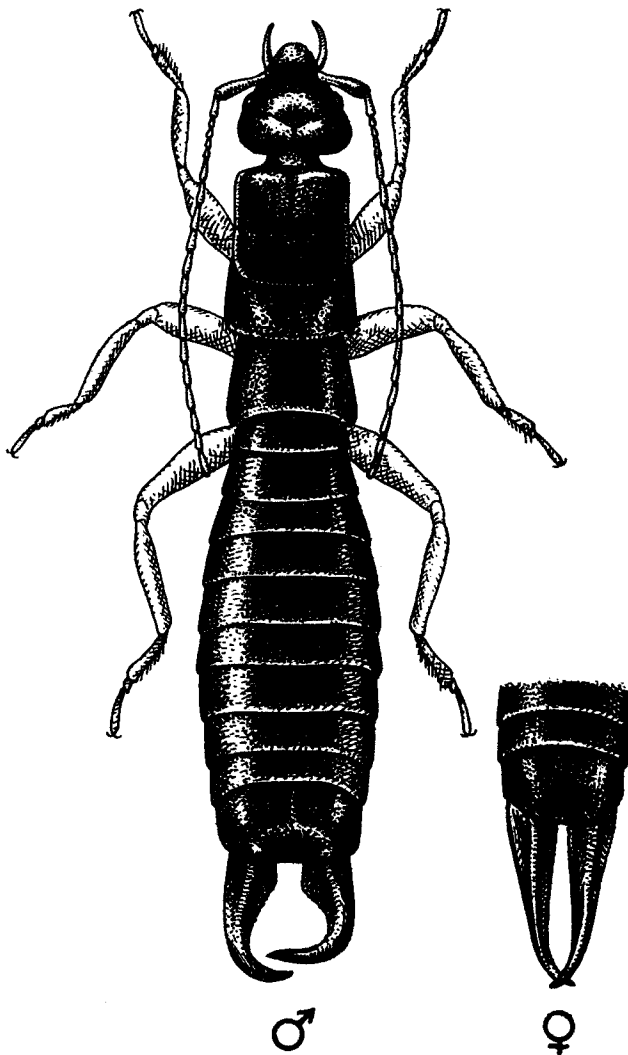
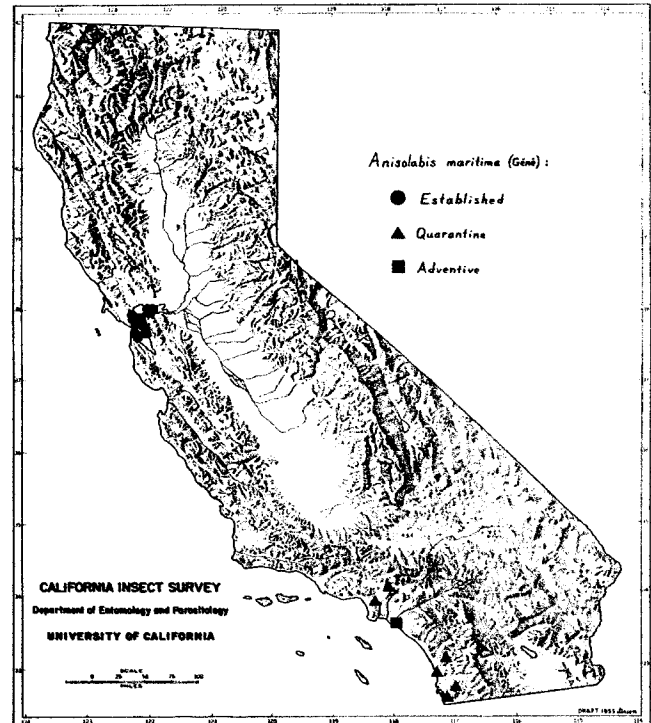


Fig. 2. *Anisolabis maritima* (Géné).

During studies over six seasons (1964-69) in California, most stages have been found throughout the year. However, fewer males were found at all collecting sites, and they seemed more prevalent from late spring through autumn. Eggs were found during the warmer months, and were guarded by the females, as in other species (Langston, 1974).

Caudell (1913) stated that *A. maritima* is found only along the seashore. In California it seems to prefer bays and inlets, with the individuals usually found at the high tide level (Langston, 1967, 1974).

**Geographic distribution.** — *Anisolabis maritima* is worldwide in distribution. It has been recorded from most of the continents and major islands, with the exception of the Arctic and Antarctic regions. Published North American records include British Columbia (Hebard, 1933a; Helfer, 1963); Gulf Coast and Atlantic States as far north as Maine (Hebard, 1917).



Map 1. California distribution of *Anisolabis maritima* (Géné). Circles = established; triangles = quarantine; squares = adventive.

**California records (map 1).** — This species is established in the northern parts of San Francisco Bay, San Pablo Bay, and eastward into Carquinez Strait. However, searches along the ocean coast of the San Francisco Bay area have been negative. The first California records were at Laguna Beach and vicinity during June and July, 1921 (Essig, 1922), with another collection in 1944 at Costa Mesa, also in Orange County. Several interceptions in quarantine in Los Angeles and San Diego counties have been recorded (known origins from San Francisco and Oregon), but the existence of established populations in southern California is unknown.

### *Euborellia annulipes* (Lucas)

The Ring-legged Earwig  
(Fig. 3; map 2)

*Forficesila annulipes* Lucas, 1847, Bull. Soc. Entomol. Fr. (2), V, p. LXXXIV (Jardin des Plantes, Paris; probably introduced from North America).

*Anisolabis azteca* Caudell, 1904, J. N.Y. Entomol. Soc. 12, p. 180 (California, First U.S. and California record).

*Euborellia annulipes*; Burr, 1915, J. R. Microsc. Soc., 35, p. 545.

The ring-legged earwig is a medium-sized, wingless, dark brown species having pale legs usually ringed with dark markings. The antennae are dark with the third and fourth (and sometimes fifth) subapical segments usually pale.

Studies on the life history and bionomics of North American populations of this species have been conducted by Bharadwaj (1966), Bohart (1947), Klostermeyer (1942), and Neiswander (1944), and comparative notes with *E. cincticollis* in California were added by Knabke and Grigarick (1971).

According to Bharadwaj, oviposition usually occurs at night and averages 53 eggs/clutch. Some females produce 4 clutches, on successive nights. By contrast, Neiswander stated that usually a clutch is deposited over a period of

about 3 days. The eggs are spherical, about 0.75 mm in diameter, elongating to about 1.25 mm as the embryo develops. The female guards the eggs until they hatch, and if they become scattered, she gathers them into a pile and hovers over them. With constant handling the eggs are kept continually clean. If an egg becomes injured or is infertile, the mother eats it. When the eggs are all hatched the female ceases to exhibit maternal concern.

Bharadwaj reported incubation to require a minimum of 6-17 days in different clutches at 20-29° C. At this temperature range there were usually 5 nymphal stadia, but occasionally 6, and growth through the 5 stages averaged about 63 days. Under the greenhouse conditions used by Neiswander an average of 73 days was required from egg hatching to the adult. The shortest period from egg to egg was 87 days, and the average was about 120 days. In the greenhouse different stages of the insect were present throughout the year.

The young earwigs, except for size, are similar to the adults in general appearance. The early instars can be differentiated by the number of segments in the antennae. Juveniles of the first instar have 8 segments; in the second they have 11; in the third, 13; in the fourth, usually 14; and the fifth and sixth instar individuals vary in having from 14 to 17.

This species is a general feeder that often occupies situations where it causes economic damage, especially to stored potatoes, flour, and other warehouse products such as those in meat-packing plants, to roots of vegetables in greenhouses, and to plants in gardens and nurseries. However, this earwig also is predaceous, sometimes on other insect pests (see literature review by Bharadwaj, 1966). In the laboratory Bharadwaj reared *E. annulipes* on powdered dog grain meal and occasional freshly killed insects.

The prey is grasped near one end with the forceps and is seized near the other end with the mandibles. Its body is torn apart and the interior structures consumed, followed by most of the other body parts. If the victim is another earwig, often the only remains are the forceps and some of the more heavily sclerotized parts.

*Euborellia annulipes* probably is an important predator on insects in situations such as those on lawns. Studies by Bohart (1947) in the laboratory showed that lawn moth larvae (*Crambus*) were quickly seized and crushed between the forceps of the earwigs. If a caterpillar continued to struggle, the earwig gripped it at one end and began feeding on the other end. In an overnight test one female *Euborellia* consumed 25 first instar larvae of *Crambus*. Another female consumed 25 eggs.

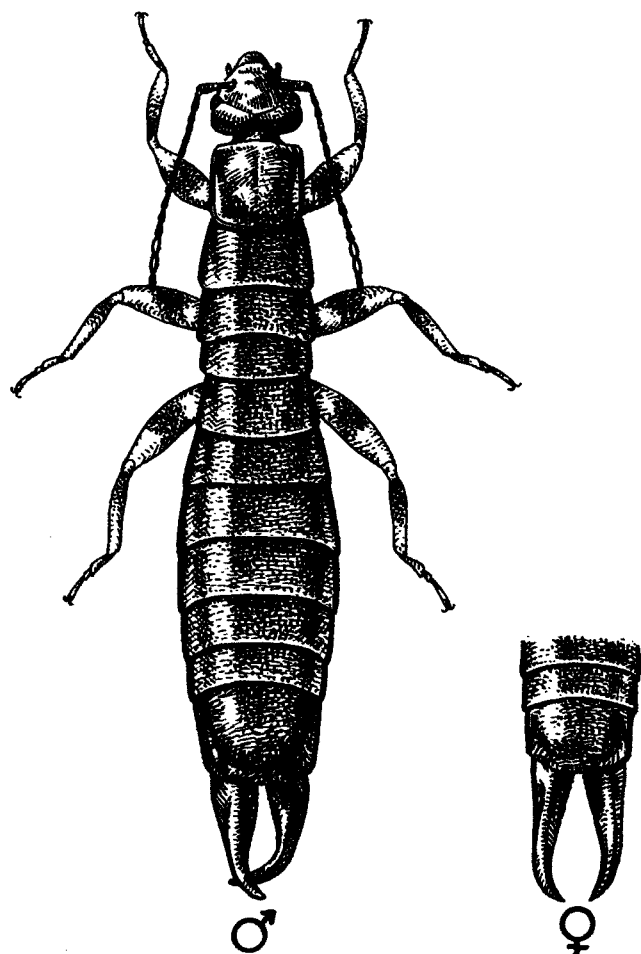
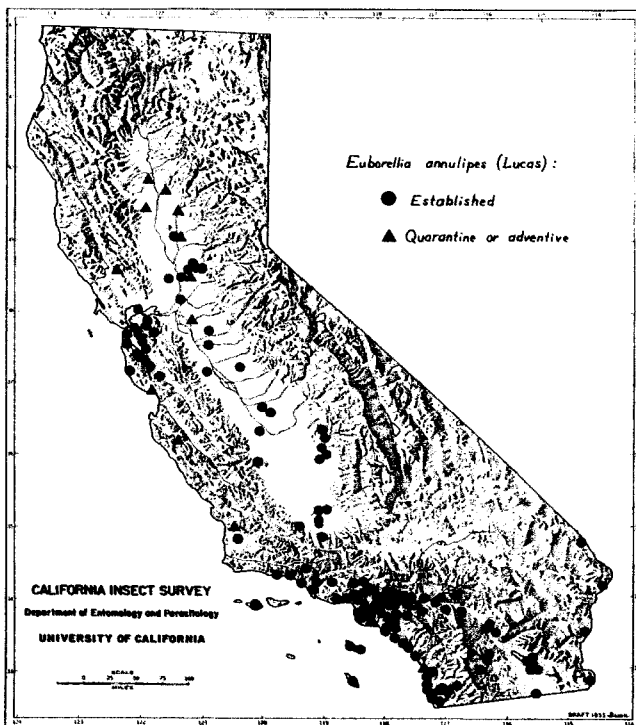


Fig. 3. *Euborellia annulipes* (Lucas).

The introduction and spread of *Euborellia annulipes* in North America is not well documented. Shortly after the turn of the century, this species was considered by Hebard (1917) to be established from North Carolina southward, and was numerous in southern Florida, the Keys, and southern California. By 1944 the ring-legged earwig was reported from about 20 states, being recorded from as far north as Massachusetts, and from several midwestern states (Neiswander, 1944). In the Pacific Northwest *E. annulipes* was known only from a colony established since 1927 in the gardens of the Empress Hotel in Victoria, British Columbia, until Hatch (1949) found it well established and numerous in a greenhouse near Medford, Oregon. Hubbell and Wallace (1955) first published on this species in Arizona from specimens taken in 1951 at Tempe. However, based on specimens at the University of Arizona, Nutting (1960) showed that it had become established much earlier: Tucson, 1922; Buckeye, 1932; and Yuma and Mesa, 1939.



Map 2. California distribution of *Euborellia annulipes* (Lucas). Circles = established; triangles = quarantine or adventive.

*Geographic distribution.* — *Euborellia annulipes* is worldwide in distribution, being recorded from both temperate and tropical parts of the continents and several islands, with the exception of Australia, and the Arctic and Antarctic regions. In North America it

has been recorded from British Columbia (Hatch, 1949); Mexico (Hebard, 1933a); and in the United States published records include Alabama, Arizona, California, Florida, Georgia, Louisiana, Mississippi, North Carolina, Pennsylvania, South Carolina, Texas, Washington, D.C. (Hebard, 1917), Kansas (Hebard, 1934), Connecticut, Iowa, Massachusetts, Nebraska, Ohio (Neiswander, 1944), Oregon (Hatch, 1949), New Mexico, North Dakota, Virginia, and Delaware (Bharadwaj, 1966).

*California records.* — The distribution (map 2) of collections shows this species to be well established in southern California, extending into the margins of the desert in agricultural areas, at the Salton Sea and along the Colorado River. Northward, colonies are restricted to low elevation areas along the coast and in the Central Valley. Many of the more northerly spots are represented by only one or a few individuals. Despite its wingless condition, *E. annulipes* is established on most of the offshore islands, although we were unable to locate it on Santa Cruz Island in 1966.

*Euborellia cincticollis* (Gerstaecker)

The African Earwig  
(Fig. 4; map 3)

*Brachylabis cincticollis* Gerstaecker, 1883, Mitth. Ver. Vorpomm., 14:44 (Cameroons, Africa).

*Psalis picina* Kirby, 1891, Linn. Soc. Lond., 23:516 (Gambia, Africa).

*Psalis cincticollis*; Burr, 1909, Ann. Nat. Hist., 3 (ser. 8):255 (Synonymy).

*Euborellia cincticollis*; Burr, 1915, J. R. Microsc. Soc., 35:544; Gurney, 1950, Proc. Entomol. Soc. Wash., 52(4):200 (Blythe, Palo Verde, Ripley, and Fort Yuma, California) (First United States and California records).

The African earwig is a medium sized, dark brown insect that exhibits alary polymorphism, possessing winged, brachypterous, and wingless forms. It is also recognized by its pale yellowish legs and by its dark antennae with the fourth and occasionally third subapical segments sometimes pale.

Superficially, the California specimens of *E. cincticollis* resemble *E. annulipes* except that in some *cincticollis* both tegmina and flight wings are fully developed. Gurney (1959) noted that winged specimens of *annulipes* have been quoted in earlier literature, but he suggested that at least some of those records were based on misidentified *cincticollis*. Winged specimens of *annulipes*, if they exist, are most unusual in American populations, since Neiswander (1944) and Knabke and Grigarick (1971) found none during biological studies, Gurney (1959) encountered none while studying considerable material, and we have seen none. The three forms of *cincticollis*, winged, brachypterous, and wingless, commonly occur in California according to Knabke and Grigarick, but winged individuals are much more common in collections because they are attracted to light. Ting (1951) gave a diagnosis, drawings, and a photograph to separate these forms, and Knabke and Grigarick have further defined the forms and reviewed literature relevant to them.

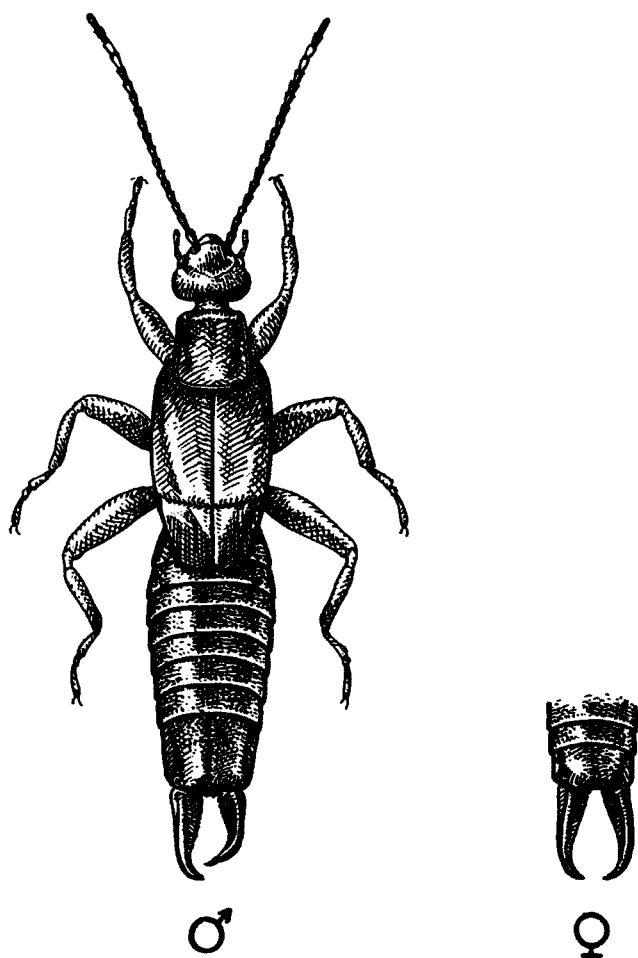


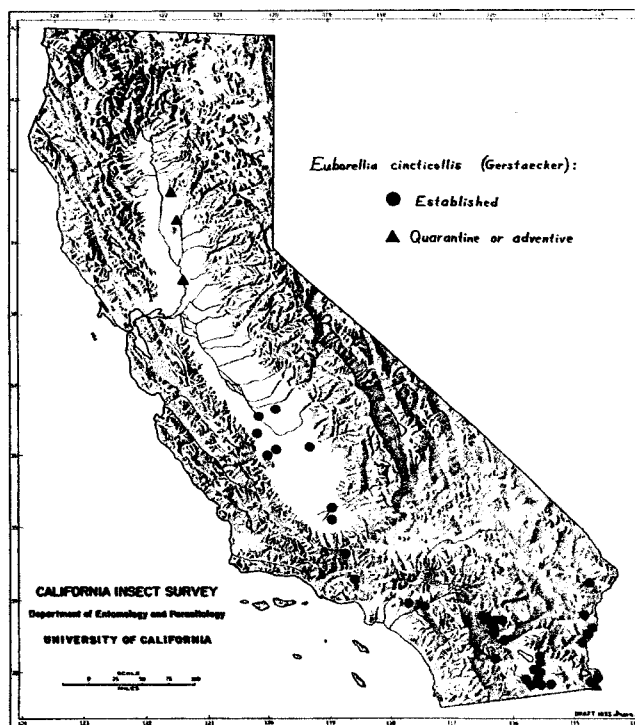
Fig. 4. *Euborellia cincticollis* (Gerstaecker).

Although of comparatively recent establishment in California, this species has been of some concern to agriculturalists and the subject of biological studies by Ting (1951) and a detailed investigation by Knabke and Grigarick (1971). The African earwig is a general feeder, but at times individuals concentrate in large numbers in association with a particular crop, especially on moist ground associated with weeds, such as near irrigation leaks. Thus both Ting and Knabke and Grigarick reported damage to melons resulting from the earwigs' feeding where the melons came into contact with the ground. However, the latter authors believed *cincticollis* to be an opportunist in relatively undisturbed habitats of appropriate moisture conditions. They found that this species feeds on aphids and other arthropods as well as several plant foods in the laboratory (carrots comprised the standard diet) and believed that *cincticollis* sometimes acts as a predator in the field.

Other aspects of the biology as summarized by Knabke and Grigarick are as follows. Females produced several clutches of eggs in the laboratory where field-collected adults survived up to 240 days. First laid clutches averaged 22-23 eggs, and the total deposited by individual females averaged 47-83, varying with temperature conditions. Average time required for growth from egg to adult ranged from 78 to 128 days, and the number and duration of nymphal instars also varied with temperature. There were 5 instars (rarely 4 or 6) at 22-29°C. but 6 or 7 at 37-38°C. Temperature also affected production of different phenotypes; only wingless individuals developed at 22-26°C, while all three alary morphs were produced at 26-38°C.

Light trap sampling by Knabke and Grigarick showed *cincticollis* flight to occur from mid-July to late September at Davis, with peaking in numbers correlating with an index of high temperature, low humidity, and low wind velocity. Presumably adults mature at other times of the year as well, but temperatures fall below that necessary to produce winged individuals.

*Euborellia cincticollis* was described from the Cameroons, Africa, and subsequent literature showed it to be widely distributed in western and equatorial portions of



Map 3. California distribution of *Euborellia cincticollis* (Gerstaecker). Circles = established; triangles = quarantine or adventive.



Africa well before its discovery in North America (Gurney, 1950). No examples from the Western Hemisphere were found by Burr (1910). The first United States collection was made at Ripley, Riverside County, California, on July 24, 1956 and was reported by Gurney (1950) who examined adults from several localities along the Colorado River in California (Blythe, Palo Verde, Ripley, and Fort Yuma). Hubbell and Wallace (1955) recorded *cincticollis* in central Arizona from winged specimens collected in 1951 at lights in Tempe. Earlier Arizona collections at Yuma, in September, 1949, and in 1950 and 1955 were later recorded by Nutting (1960).

*Geographic distribution.* — *Euborellia cincticollis* has been reported only from Africa and North America. In North America it has been recorded from Arizona (Hubbell and Wallace, 1955; Nutting, 1960), and California (Gurney, 1950; Knabke and Gregarick, 1971; Schlinger *et al.*, 1959; Ting, 1951).

In California this species is restricted to arid, Lower Sonoran and Upper Sonoran Zone areas of the deserts and Central Valley (map 3).

*California records.* — BUTTE CO.: Chico, IX-10-1961, at light (T. R. Haig); Gridley, IX-26-1961, at light (T. R. Haig). FRESNO CO.: Five Points, 5 mi. SW, X-2-1963 (J. W. MacSwain); Fresno, IX-14-1953 (L. M. Cox); San Joaquin IX-15-1953 (H. V. Dunnegan). IMPERIAL CO.: Bard, I-12-1951 (R. M. Hawthorne), VII-29-1959 (Salazar); Brawley, VII-11-1959, at light (K. W. Tucker) X-14-1959 (Liebert), VI-28-1951, Persian melon field (S. Lockwood), VI-20-1955 (A. E. Michelbacher), VII-29 and VIII-13-1959, in alfalfa (E. I. Schlinger); Calipatria, VIII-23, 25-1950, on Persian melons (R. M. Hawthorne), I-7-1953, (R. M. Hawthorne), III-11-1958, (E. I. Schlinger); El Centro, VIII-24-1950, (R. M. Hawthorne), X-12, 14-1950, (H. H. Keifer), I-9-1951, (R. M. Hawthorne), VIII-6-1953, in motel (G. Beever); Fort Yuma, IX-5-1959 (on apples from Hondo, New Mexico), XI-16-1949 (J. W. MacSwain); Holtville, I-5, 10-1951, (R. M. Hawthorne); Imperial, I-5-1951 (R. M. Hawthorne); Imperial, 12 mi. W, X-24-1951, (S. Lockwood); Niland, VIII-26-1950, on melons (R. M. Hawthorne), X-25-1951 (S. Lockwood), VIII-29-1958 (E. I. Schlinger); Palo Verde, VIII-17-1946 (J. W. MacSwain); Seeley, IX-16-1960 (Sinclair); Westmoreland, XII-2-1952 (R. M. Hawthorne); Winterhaven, X-15-1950, (H. H. Keifer). KERN CO.: Bakersfield, VIII-28-1958 (E. I. Schlinger); Bakersfield, 12 mi. S, VIII-28-1958 alfalfa field (E. I. Schlinger). KINGS CO.: Murray, VIII-19-1959, light trap (R. P. Allen and R. Snelling); Stratford, VII-30-1959, (R. Snelling). LOS ANGELES CO.: Granada Hills, XII-24-1964 (T. L. Bissell); Gorman, 5 mi. SE, X-19-1966, in crown of woody Compositae (P. Rude and J. Powell). RIVERSIDE CO.: Blythe, VII-6 to VII-20-1947, light trap (W. F. Barr and J. W. MacSwain), X-16-1950, Bermuda grass (H. H. Keifer), VII-4-1951, at light (J. W. MacSwain and R. F. Smith), VII-29-1952 (Donovan), IX-4-1953 (Braasch), VII-10-1954 (A. Menke and L. A. Stange), VII-8 to 31-1956 (Menke, Stange, G. I. Stage, F. S. Truxal), II-20-1958, in alfalfa field (E. I. Schlinger); Blythe, 17 mi. NW, II-26-1946 (W. F. Barr and P. D. Hurd); Cathedral City, VII-21-1952 (D. Shepard and B. Tinglof), VIII-1, 14-1956 (L. W. Isaak); Deep Canyon, VII-10-1963, at light (E. I. Schlinger), VII-22-1964, at light (M. E. Irwin); Indio, X-16-1950, ex puncture vine (H. H. Keifer), IV-24-1953 (R. Durbin and A. Fukushima);

Indian Wells, VIII-28-1956 (A. Menke and L. A. Stange); Magnesia Canyon, VII-22-1952 (W. Miyagawa); Oasis Station, VI-20-1956, (M. Wasbauer); Palm Desert, 4 mi. S, VII-2-1963 (J. D. Birchim); Palm Springs, VIII-16-1965 (A. Menke and L. A. Stange); Rancho Mirage, VII-21-1952 (A. A. Grigarick and R. L. Anderson); Ripley, VII-24-1946, (W. F. Barr and P. D. Hurd); Riverside, no date (J. C. Chamberlin), IX-13-1959, ex lawn (E. I. Schlinger). SAN BERNARDINO CO.: Chino, III-29-1961, chicken feed bins (B. C. Reed); Vidal Junction, II-26-1954 (R. Camblin). SAN DIEGO CO.: Borrego, VIII-13-1959, in alfalfa field (E. I. Schlinger). TULARE CO.: Tulare, IX-18-1953, (O. Hemphill). YOLO CO.: West Sacramento, III-17-1959, Quarantine on *Zea mays* (C. J. Kiddle).

*Spongovostox apicedentatus* (Caudell)

The Toothed Earwig

(Fig. 5; map 4)

*Spongophora brunneipennis*; Scudder, 1876, (in part, not *Psaldiphora brunneipennis* Serville, 1839), Bull. U.S. Geogr. Surv. Terr., II, p. 252 (Arizona.) (First United States record.)

*Labia melancholica*; Rehn, 1904, (not Scudder, 1876), Proc. Acad. Nat. Sci. Phila., 1904, p. 562.

*Spongophora apicedentata* Caudell, 1905, Proc. U.S. Natl. Mus., 28:461, fig. 1a. (Type locality: Tucson, Arizona.) (First California records.)

*S(spongovostox) apicedentatus*; Burr, 1911, Dtsch. Entomol. Nat. — Biblioth., II, p. 59.

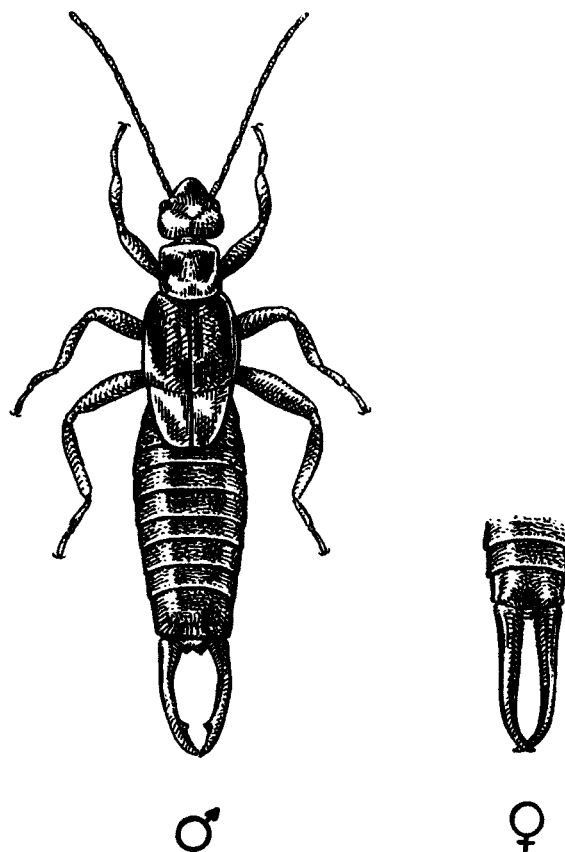


Fig. 5. *Spongovostox apicedentatus* (Caudell).

The toothed earwig is a moderately small, fully winged, reddish-brown species. It is recognized by the forceps of the male, armed with a conspicuous subapical tooth, and by the light hindwings protruding and contrasting with the dark tegmina. Adults of *Spongovostox apicedentatus* are fully winged and are readily attracted to both white and ultraviolet lights.

According to Hebard (1917), this insect has usually been found in dead sahuaro, *Cereus giganteus* Engelm., but extends its range far beyond that of the plant. In California it has been collected on dead *Echinocactus*, in rotten *Opuntia* pads, and in a decaying stalk of *Yucca whipplei* Torrey, and in Arizona it has also been taken on *Agave*. In Baja California we have found this species in decaying *Bursera* wood in large numbers.

Hebard (1917) stated that this species is apparently the only indigenous earwig of the southwestern desert regions. It was recorded from Arizona in 1876, and from New Mexico in 1902. The earliest California specimens deposited in museums were evidently taken in Los Angeles and San Diego counties by Coquillett, probably during the 1880's.

**Geographic distribution.** — *Spongovostox apicedentatus* occurs in the southwestern United States and northern Mexico. Published records include Arizona, California (Burr, 1910; Caudell, 1905; Hebard, 1917, 1933a), New Mexico (Hebard, 1917), and Texas



Map 4. California distribution of *Spongovostox apicedentatus* (Caudell). Circles = established.

(Caudell, 1905; Hebard, 1917), and we have examined material from several localities in Baja California and Sonora.

In California this species occurs in both high and low deserts and at low elevation places west of the Peninsular Range (map 4).

**California records.** — IMPERIAL CO.: Laguna Lake, VI-(9-11)-1950. LOS ANGELES CO.: Black Butte, Antelope Valley, VIII-22-1959 (Gale Sphon); Claremont, X-19-1927 (T. Craig); Irwindale, San Gabriel River, II-16-1963, ex decaying yucca stalk (R. R. Snelling); Lancaster, 20 mi. SE, I-7-1935 (E. C. Van Dyke); Los Angeles, no date (probably during 1880's) (D. W. Coquillett), VIII-30-1938, (R. Tower); "Los Angeles Co." (E. C. Van Dyke); San Dimas, X-18-1933 (K. L. Wolff). ORANGE CO.: Garden Grove, XII-13-1943 (A. H. Klaustermeyer); Newport, VI-18-1927 (A. C. Davis); Orange XII-8-1943, on beet, *Beta* sp. (C. Gammon); Santa Ana River near Atwood, XII-11-1942. RIVERSIDE CO.: Belle Camp, Joshua Tree Nat. Mon., VIII-9-1959 (F. C. Raney); Boyd Desert Research Center, 4 mi. S. of Palm Desert, IV-6-63 (R. L. Langston), VII-2-1963 (J. D. Birchim); Blythe, VII-8-1957 (L. C. Fitzpatrick); Coahuila, 10 mi. S, X-21-1927 (T. Craig); Deep Canyon, X-8-28-1963, at light (M. E. Irwin and E. I. Schlinger), XI-19-1963, on dead *Echinocactus* (E. I. Schlinger), VII-7-1964, at light (E. I. Schlinger); Riverside, XI-1928, VII-12, 14-1933 (A. M. Boyce), VII-24/28-1933, at light (H. L. McKenzie), X-2-1933 (S. E. Flanders), X-9-1933, light trap (P. H. Timberlake), VI-24-1934 (H. L. McKenzie), XI-12-1938 (C. M. Dammers) VIII-3-1939 (P. DeBach). SAN BERNARDINO CO.: Colton 3 mi. S, VII-13-1955 (J. C. Hall); Cucamonga, IX-23-1943, at light (R. Tower); Needles, XI-27-1921 (J. A. Kusche). SAN DIEGO CO.: Borrego, IV-28-1955 (M. Wasbauer); Coronado, no date (F. E. Blaisdell); Earthquake Canyon, Anza-Borrego Park, III-26-1961 (C. A. Toschi); Lakeside, V-20-1949 (G. A. Marsh); Pamo Valley, XI-7-1954, in rotten *Opuntia* (A. Menke and L. A. Stange); "San Diego Co.", April (probably during 1880's) (D. W. Coquillett) II-15-1913 (E. P. VanDuzee).

### *Labia minor* (Linnaeus)

The Small Earwig  
(Fig. 6; map 5)

*Forficula minor* Linnaeus, 1758, Syst. Nat., ed. 10, 1, p. 423, no. 2. (Europe).

*Forficula livida* Gmelin, 1788, Syst. Nat., 1, (4), p. 2040.

*Forficula media* Marsh, 1802, Col. Brit., p. 530, no. 3.

*Labia minor*; Stephens, 1835, Ill. Brit. Entomol., Mand., 6, p. 8.; Doubleday, 1838, Entomol. Mag. 5:270 (Wanborough, New York) (First United States record); Hebard, 1917, Entomol. News, 28 (7):317. (Sonoma County; Claremont, California) (First California records).

*Labia minuta* Scudder, 1862, Boston Jour. Nat. Hist., 7:415 (Massachusetts; Virginia).

The small earwig is a minute, winged, light brown or tan species. It is recognized by its small size, light color, and by the presence of hair on much of its body, legs, head, and antennae. It does not have the shiny appearance of most other Dermaptera in California. (On cursory examination, this species resembles a staphylinid beetle, especially females with the forceps closed, and in museums *Labia minor* may be found among the unsorted Coleoptera.)

Being winged and nocturnal in habits, this species is readily attracted to light. It is also frequently encountered in flight at, or just before dusk. *Labia minor* uses the forceps to comb out the wings, and is apparently unable to take flight without the assistance of this organ according to Fulton (1924) who recorded the habits of this species in detail. Adults were observed to fight, employing the forceps, and food bits sometimes changed hands several times. Small, active manure maggots were eaten without the use of the forceps.

According to Hebard (1917) individuals are often numerous under debris about manure. This insect was found in the Ohio greenhouse in which Neiswander (1944) did biological studies; however it never accumulated to appreciable numbers and has not been observed to cause injury to crops.

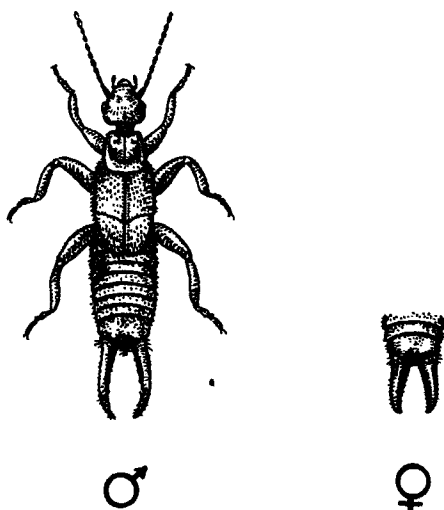
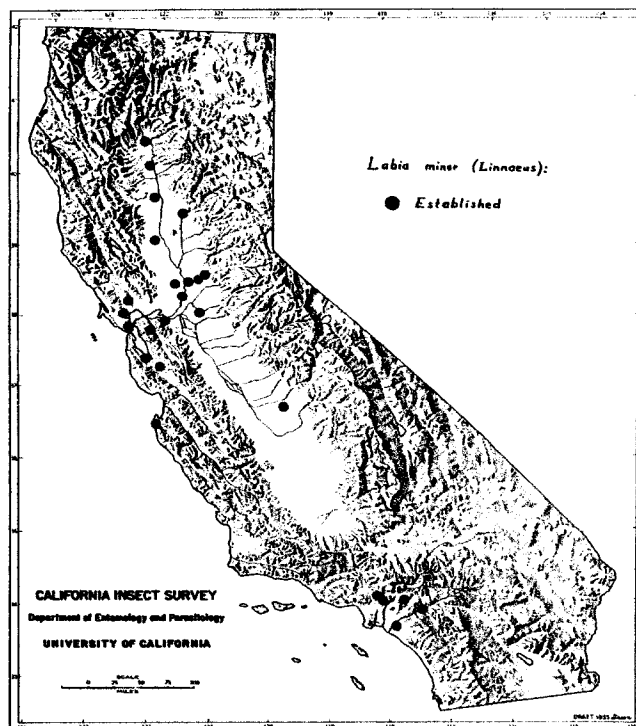


Fig. 6. *Labia minor* (Linnaeus).

The first United States record was published in 1838 and by the early 1900's Caudell (1913) stated that *Labia minor* was a cosmopolitan species widely distributed in the U.S. Excluding three other species in coastal British Columbia, this species is known in more northerly and interior parts of the Nearctic than any other Dermaptera. Hebard (1917) noted *L. minor* as far north as Quebec, P.Q., and Chagnon (1944) indicated this is the only earwig in Quebec.

It is not known with certainty if *L. minor* was introduced on the west coast. The earliest California specimens deposited in museums were apparently the ones cited by Hebard (1917) from Sonoma and Los Angeles counties. Neither record indicated the year. The earliest specimen we have seen was taken April 24, 1909 in Pasadena, Los Angeles County.



Map 5. California distribution of *Labia minor* (Linnaeus). Circles = established.

**Geographic distribution.** — *Labia minor* has been reported from the north and south temperate zones of both hemispheres and from various islands. Published records include Australia (Hebard, 1933b), Europe (Hebard, 1917), Africa, Madeira Island, Galápagos Islands (Helfer, 1963), and the Philippine Islands (Burr, 1910). In North America it has been recorded from Canada and the United States: California, Delaware, Georgia, Maine, Massachusetts, Nebraska, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Wisconsin (Hebard, 1917), Kansas (Hebard, 1934), Maryland (McAtee and Caudell, 1917); Indiana, and Ohio (Neiswander, 1944).

In California this species appears to be widely distributed in the valley and lowland areas. No specimens were taken under quarantine conditions, hence all records are considered established. However, most are based on single specimens. Owing to its small size, probably this insect is overlooked and is much more common and widespread than the records indicate.

**California records.** — BUTTE CO.: Oroville, VII-12-1926 (H. H. Keifer). COLUSA CO.: Williams, X-27-1932, in warehouse trash (W. B. Carter). CONTRA COSTA CO.: Antioch, VII-1936 (E. S. Ross); Lafayette, IX-25-1944, at light in early evening (R. F. Smith). FRESNO CO.: Fresno, IV-9-1956, VI-3-1956 (R. O. Schuster). GLENN CO.: Orland, X-18-1926 (H. C. Lewis). LOS ANGELES CO.: Claremont, no date (C. F. Baker) (presumably 1908-1911, see Essig, 1931), IX-12-1937, at light (V. E. Williams); Pasadena, IV-24-1909 (F. Grinnell); San Marino, VII-5-1942 (G. P. Mackenzie). MARIN CO.: Corte Madera, VII-4-1957 (D. C. Rentz); Novato, VIII-17-1961, at 15 watt blacklight (D. C. Rentz). MONTE-REY CO.: Carmel, IV-16-1911, III-19-1914, VII-16-1915 (L. S.

Slevin). ORANGE CO.: "Orange Co., Calif." VII-14-1929 (R. H. Beamer). RIVERSIDE CO.: Riverside, VII-14-1953, IX-11-1953 (J. C. Hall), VIII-13-1966 (R. J. Gill). SACRAMENTO CO.: Carmichael, VII-4-1966 (D. Wilkey); Sacramento, VII-30-1934 (M. L. Jones), V-26-1945 (A. T. McClay), II-22-1950 (H. F. Robinson), VI-29-1950 (P. H. Arnaud). SAN JOAQUIN CO.: Lodi, IV-23-1956 (G. J. Stipe). SANTA CLARA CO.: Alum Rock Park, south rim, VIII-26-1965, at ultraviolet light (T. L. Erwin); Palo Alto, VI-3-1928. SHASTA CO.: Redding, 1954 (J. Willis). SONOMA CO.: "Sonoma Co., Calif." "Apr. 16". TEHAMA CO.: Red Bluff, V-4-1954 (H. P. Chandler). YOLO CO.: Clarksburg, VII-24-1931, at light (A. T. McClay); Davis, IV-4-1961, light trap (F. E. Strong).

*Marava arachidis* (Yersin)

The Chief Earwig

(Fig. 7; map 6)

*Forficula arachidis* Yersin, 1860, Ann. Soc. Entomol. Fr. (3), 8:509, pl. x, figs. 33-35. (Adventive at Marseilles, France).

*Forficesila nigripennis* Motschulsky, 1863, Bull. Soc. Moscou, 36 (3):1.

*Labia wallacei* Dohrn, 1864, Stettiner Entomol. Z., 25:427.

*Labia burgessi*; Henshaw, 1900, (not Scudder, 1876), Psyche, 9:119. (Adventive at Boston, Massachusetts) (First United States record).

*Labia arachidis*; Burr, 1910, Proc. U.S. Natl. Mus., 38:453. (From ship at San Francisco from India) (First California record).

*Marava arachidis*; Hincks, 1954, Proc. R. Entomol. Soc. Lond. (B), 23:163. (Synonymy).

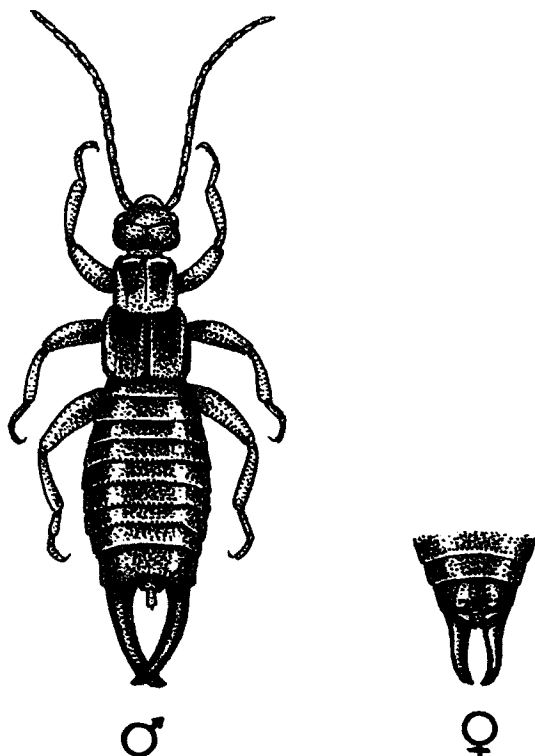
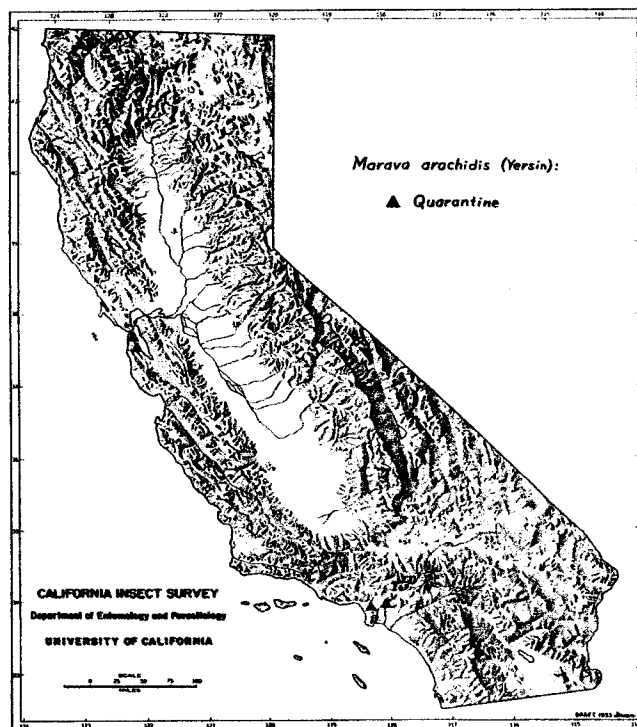


Fig. 7. *Marava arachidis* (Yersin).

The chief earwig is a small, wingless, dark brown insect. It is recognized by its short robust body, shiny appearance, and by the thickened and club-like apical antennal segments. Hebard (1917) transferred *Marava* from the Spongiphorinae to the Labiinae because of its close relationship to *Prolabia*. Although Hincks (1960) preferred to retain it in the Spongiphorinae, Popham (1965a) lists the genus *Marava* in the Labiinae.

Hinton and Corbett (1955) stated that this tropical species is sometimes introduced into England with stored products. Burr (1910) cited two males in the U.S. National Museum labeled "From a ship at San Francisco which arrived from India." Caudell (1913) repeated this record and stated that it is a cosmopolitan species recorded a number of times from just south of the U.S., and as incidental introductions at Brighton, Mass. and Aiken, Florida. Hebard (1917) considered *M. arachidis* to be established in southern Florida.



Map 6. California distribution of *Marava arachidis* (Yersin). Triangles = quarantine.

**Geographic distribution.** — *Marava arachidis* has been cited as a tropical cosmopolitan species. Through introductions it has also been recorded from England (Hinton and Corbett, 1955); France (Hebard, 1917); Hawaii (Burr, 1910; Hebard, 1922). In the United States it has been recorded from California (Burr, 1910), Florida, Massachusetts (Caudell, 1913; Hebard, 1917), and Texas (Hebard, 1917).

The chief earwig is not known to be established in California. No specimens have been taken in natural situations. Individuals recorded for California were taken in quarantine with the point of origin known in all instances.

*California records.* — LOS ANGELES CO.: Los Angeles, IX-24-1932, Quarantine from New York, originating in France, on *Lillium longiflorum* (J. R. Hyans); Montebello, IV-30-1957, Quarantine from Puerto Rico, *Dieffenbachia* (Jim Wood); SAN FRANCISCO CO.: San Francisco, "From a ship at San Francisco which arrived from INDIA." SAN MATEO CO.: San Francisco International Airport, VI-29-1962, Quarantine from El Salvador, in suitcase with food (M. Johnson).

*Labidura riparia* (Pallas)

The Shore Earwig  
(Fig. 8; map 7)

*Forficula riparia* Pallas, 1773, Reise Russischen Reichs, II Buch 2, Anhang. p. 727, no. 75 (shores of Irtysh (Irtin) River, western Siberia).

*Forficula bilineata* Herbst, 1786, Fuessly, Arch. Ins., p. 183, pl. 49, fig. 1.

*Forficula gigantea* Fabricius, 1787, Mant. Ins. II, p. 224, no. 2.

*Forficula maxima* Villiers, 1789, Linn. Entomol. I, p. 427, pl. 2, fig. 53.

*Forficula bidens* Olivier, 1791, Encyl. Method., Ins. 6:466. (Jamaica).

*Psalis morbida* Serville, 1831, Ann. Sci. Nat., 22:35.

*Forficesila gigantea*; Serville, 1839, Ins. Orth., p. 23, pl. 1, fig. 2.

*Labidura riparia*; Dohrn, 1863, Stettiner Entomol. Z., 24:313, no. 5; Scudder, 1876, Bull. U.S. Geol. Surv. Terr., 2:250 (Texas; Florida). (First United States records); Armitage, 1953, Calif. State Dep. Agric. Bull., 42 (1):40 (Calexico, California) (First California record).

The shore earwig is a large, winged, tan to dark brown species. It is recognized by its large size, long antennae, and darker stripes on the wings and dorsum of the abdomen. In living or fresh specimens, usually the dark brown markings on wings and center of abdomen contrast sharply with the lighter tan of the insect as a whole, but some individuals are uniformly dark. Specimens become darker with age in museum collections.

The first California specimens were observed hiding during day on ground under trash, and feeding in the open at night (Armitage, 1953). Extensive biological observations in the laboratory were performed by Schlinger *et al.* (1959) in which rearing, burrow construction, mating, oviposition, longevity, and feeding habits were discussed. They found *L. riparia* to be abundant in alfalfa fields, especially fields that have well-defined ridges between plants. The ridges are not flooded during irrigation, yet approximate the humid microclimate preferred by the insect. The eggs were laid in groups of 20 to 50, and were guarded and moved by the adult. Incubation required about 14 days under laboratory conditions. Their records indicated adult longevity of at least 5 months.

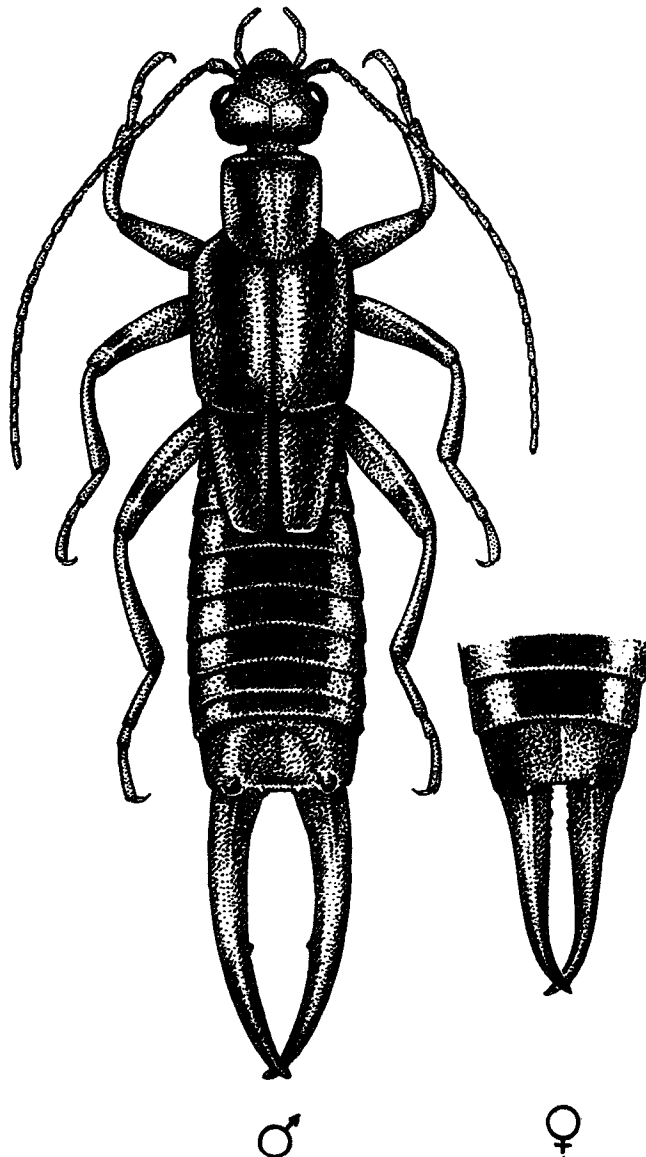


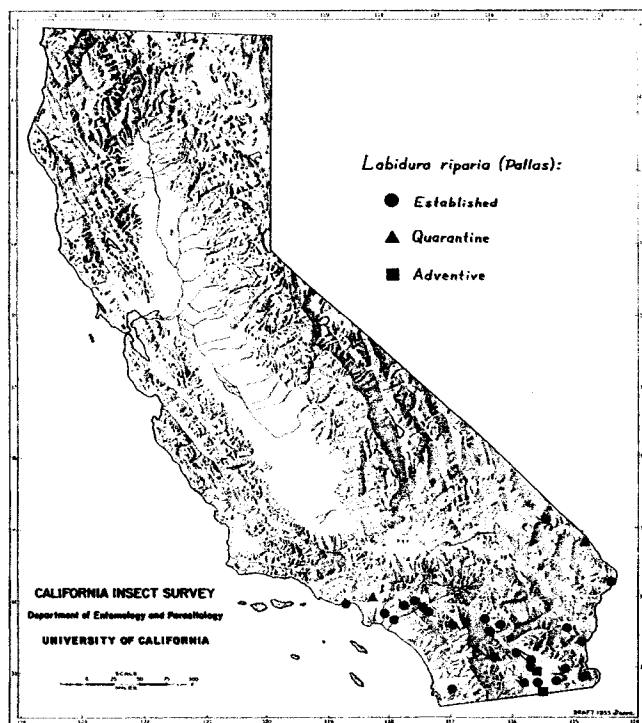
Fig. 8. *Labidura riparia* (Pallas).

Fulton (1924) noted that *L. riparia* has been observed to capture a blue-bottle fly with the forceps and devour it. Schlinger *et al.* (1959) summarized predatory habits of this earwig. It has been recorded as an extensive predator of larvae of the armyworm, *Prodenia litura* (Fabricius) on cotton in Egypt, a single earwig being able to consume 10 to 20 larvae in one night. In Texas, it was reported that one earwig could devour 25 crawlers of Rhodes-grass scale in 60 seconds, and in laboratory tests Schlinger *et al.* found that *L. riparia* feeds ravenously on nearly every type of living insect offered. The earwig seizes the larger living prey with

its forceps, then rapidly attacks the freely moving part with its mandibles. When feeding on small insects such as aphids, only the mandibles are used. When deprived of living prey, *L. riparia* has been seen to eat alfalfa seeds and bread, but premature death invariably followed after a prolonged diet of this type. Individuals were not strongly attracted to recently killed insects, but at times would feed on them. At no time was cannibalism observed. It may be concluded that the shore earwig is primarily predaceous, feeding on plant material only occasionally and is considered beneficial.

Although *Labidura riparia* was recorded from Mexico at the turn of the century, Burr (1910) found none from the United States in the U.S. National Museum. The first Arizona specimen was taken at Yuma on October 15, 1950. This record is 55 miles to the east, and only slightly more than two years earlier than the first known California collection which was from Calexico, Imperial County, Nov. 12, 1952.

**Geographic distribution.** — *Labidura riparia* is worldwide in distribution, having been recorded from tropical and some temperate parts of both hemispheres and several islands.



Map 7. California distribution of *Labidura riparia* (Pallas). Circles = established; triangles = quarantine; squares = adventive.

In the Nearctic it has been reported from Arizona, California (Armitage, 1953; Nutting, 1960), Alabama, Florida, Georgia, Louisiana, Mississippi and Texas (Hebard, 1917; Schlinger *et al.*, 1959) and we have examined museum specimens from northern Baja California and Sonora, Mexico.

**California records.** — IMPERIAL CO.: Brawley, I-12-1954, outside mill litter (G. Beevor, R. M. Hawthorne, and H. C. O'Bryant), VII-29-1959, in alfalfa field (E. I. Schlinger), IX-28-1961, at light (R. M. Hannibal); Calexico, XI-12-52 (R. M. Hawthorne), VI-9-1954, fruit-fly trap (G. Beevor, L. Pineda), IX-23 to XII-3-1957 (E. I. Schlinger); East Holtville, IV-12-1963 (O. L. Ballmer); El Centro, XI-20-1954 (L. Pineda); Glamis, 1 mi. W, XII-21-1963 (F. D. Parker and M. E. Irwin); Obsidian Buttes, I-27-1959 (E. Kirschbaum), III-26-1959 (D. C. Rentz and C. A. Toschi); Ogilby, 6 mi. N, IV-7-1963 (P. H. Timberlake); Palo Verde, IV-24-1963 (F. D. Parker and L. A. Stange); Salton Sea, II-3-1959 (C. A. Toschi); Seeley, IX-16-1960 (Sinclair and Waegner); Westmoreland, XII-13-1963 (L. Pineda). LOS ANGELES CO.: Lawndale, XI-20-1958, Quarantine from Miami, Florida, on nursery stock (Lawndale Nursery); Malibu, IV-15-1959, (A. Beresford); Norwalk, XI-1965 (Breck's Termite Control). ORANGE CO.: Anaheim, VI-3-1961 (H. Garrett). RIVERSIDE CO.: Box Spring Mts., Riverside, V-15-1964, VII-11-1964 (G. E. Wallace); Deep Canyon, VIII-8-1963, at light, VIII-22-1963, at light, X-8, 9-1963, at light (E. I. Schlinger); Hemet, IX-28-1960 (N. Getz); Hopkins Well, I-17-1956 (J. W. MacSwain), X-11-1958 (J. A. Chemsak and J. W. MacSwain); Indio, X-12-1960, at light (K. Hoffmaster), I-23-1964 (L. D. Anderson), VII-7-1964 (J. A. Powell), X-1964 (H. N.); Palm Springs, IX-12-1961 (L. E. Cordill); Riverside, IV-1958, lab. reared (E. I. Schlinger), X-22-1963 (L. D. Anderson), XI-11-1963 (L. D. Anderson), X-19-1964 (G. E. Wallace). SAN BERNARDINO CO.: Bloomington, XI-16-1959 (B. Christian); Chino, I-16-1961 (G. Harper and J. Preston); Earp, 10 mi. NE, VIII-16-1963 (C. D. MacNeill and C. A. Toschi); Ivanpah, 25 mi. S, X-12-1958 (W. E. Ferguson); Needles, IV-7-1959. Quarantine at Border Inspection Station (G. Beevor). SAN DIEGO CO.: Borrego Valley, IV-11-1962 (R. M. Bohart); El Cajon, X-24-1963 (R. Rinder), VIII-10-1966, X-26-1966 (P. Rude); Chula Vista, XII-25-1967 (R. L. Langston).

### *Chelisoches morio* (Fabricius)

The Black Earwig  
(Fig. 9; map 8)

*F(orficula) morio* Fabricius, 1775, Syst. Entomol., p. 270, no. 6. (Tahiti).

*Forficesila oceanica* Le Guill, 1841, Rev. Zool., p. 292.

*Lobophora tartarea* Stål, 1858, Eugenie's Resa, Ins., p. 305.

*Chelisoches morio*; Bormans, 1900, Tierreich, Forf., p. 85, no. 4; Caudell, 1907, J. N.Y. Entomol. Soc., 15:169 (Menlo Park, California) (First United States and California record).

The black earwig is a moderately large, fully winged, jet-black species. It is recognized by its strongly flattened body, large wings, and by its black body, head, legs, and antennae. *Anisolabis maritima* is the only other species in California that may be as dark, but that species is wingless and has pale legs. Adults of *C. morio*, while mostly black, have yellowish tarsi and one or two subapical segments of the antennae pale or yellowish. In the juvenile or immature

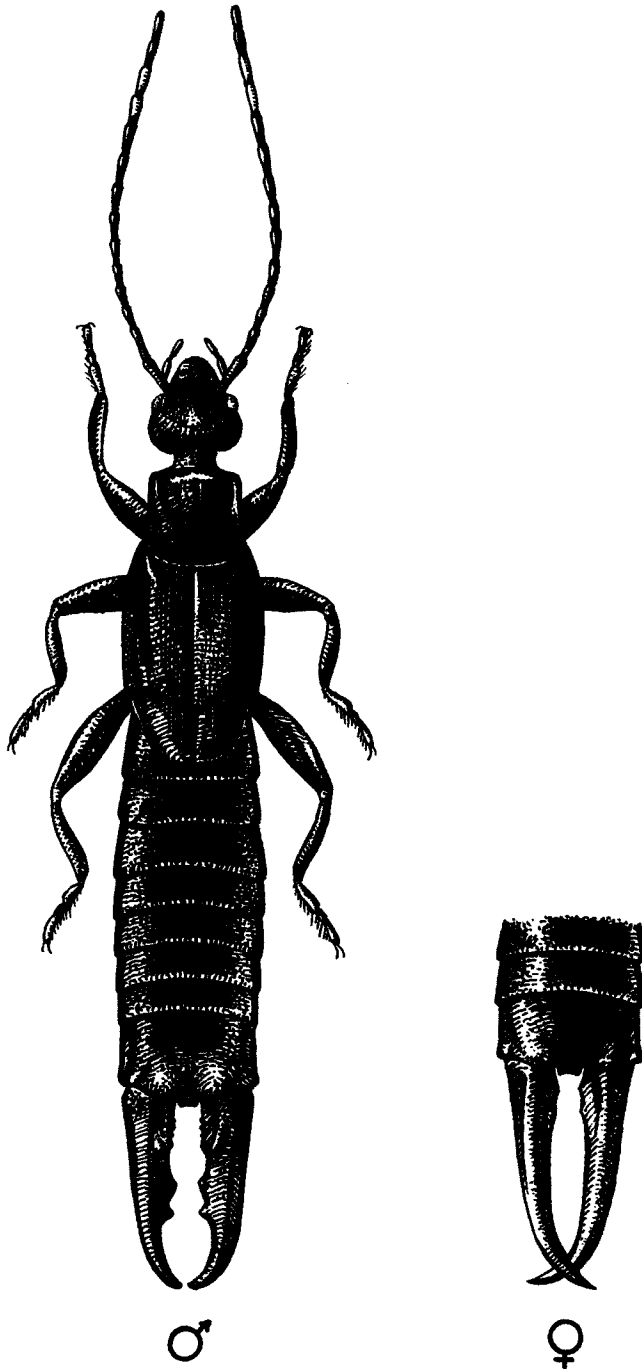


Fig. 9. *Chelisoches morio* (Fabricius).

stages the yellow is more extensive in proportion to the smaller black body. In living or fresh specimens this bright yellow contrasts sharply with the black of the rest of the insect, but the pale areas darken on museum specimens.

The adults are predaceous, fly readily, and are able to fold and unfold their wings rapidly.

The black earwig appears to be a native of numerous islands in the Pacific Ocean. Although there are some mainland records both in the Orient and in North America, many of these are considered as adventive, incidental introductions or definite quarantine records.

The first United States and California specimens were reported by Caudell (1907) and Burr (1910) based on specimens taken at Menlo Park, San Mateo County, in 1905.



Map 8. California distribution of *Chelisoches morio* (Fabricius). Triangles = quarantine; squares = adventive.

In the present study, it was found that most California specimens were taken in quarantine, with Hawaii as the point of origin. The specimens from three of the California localities were not taken under quarantine conditions, and are therefore considered adventive. This includes the legendary Menlo Park record as no specimens have been deposited in the museums since the original 1905 series, although literature reports the species would appear to have become established (Hebard, 1917; Essig, 1942; Helfer, 1963).

There are several colleges and universities featuring entomology in the San Francisco Bay area, in addition to

quarantine stations and other offices of both the California and the U.S. Departments of Agriculture. If *Chelisoches morio* had become established, certainly some specimens of this large, conspicuous earwig would have shown up in the museums. Therefore, the black earwig is considered not established in California.

**Geographic distribution.** — *Chelisoches morio* has been reported from many islands in the Pacific Ocean, and the mainland of Asia and North America. In the Americas thus far it has been recorded only in the Hawaiian Islands (Burr, 1910; Hebard, 1922) and in California (Caudell, 1907, 1913; Burr, 1910; Hebard, 1917; Essig, 1926, 1942; Helfer, 1963).

**California records.** — ALAMEDA CO.: "Alameda County," on bananas from Hawaii (R. Hunt); Oakland, VI-3, 21-1949. COLUSA CO.: Colusa, II-2-1954, Quarantine from Hilo, Hawaii on *Anthurium* sp. (B. Wade). FRESNO CO.: Fresno, IX-10-1959, ex flowers from Hawaii (G. Spitler), IX-17-1959, Quarantine from Hawaii on torch ginger flowers, *Zingiber* sp. (G. Spitler). LOS ANGELES CO.: San Pedro/Port of Los Angeles, III-24-1964, Quarantine from Hawaii on hapuu logs (R. L. Green). MONTEREY CO.: Carmel, III-6-1913 (L. S. Slevin). ORANGE CO.: Stanton, IX-26-1959, ex post office possibly from Hawaii (Lyman). SAN MATEO CO.: Menlo Park, "Jan. '05" (F. Hornung); San Mateo, IV-19-1958, Quarantine from Hawaii on coconut husks (D. R. Haug).

*Doru lineare* (Eschscholtz)

The Lined Earwig  
(Fig. 10; map 9)

*Forficula linearis* Eschscholtz, 1822, Entomogr. I, p. 81 (Santa Catharina, Brazil).

*Forficula californica* Dohrn, 1865, Stettiner Entomol. Z., 26:85 (California) (First United States and California record).

*Forficula taeniata* Scudder, 1876, Bull. U.S. Geol. Geogr. Surv. Terr., II, p. 255 (Exotic localities; Arizona; Texas).

*Forficula exilis* Scudder, 1876, Proc. Boston Soc. Nat. Hist., 18:262 (Texas).

*Doru lineare*; Burr, 1911, (in part), Gen. Ins., Fasc. 122, Dermapt., p. 79; Rehn and Hebard, 1914, J. N.Y. Entomol. Soc., 22:90, figs. 1 to 4 (Synonymy; diagnosis; records).

The lined earwig is a medium-sized, winged, yellow and brownish-black species. It is recognized by its yellow wings with dark markings along the anal third, which forms a dark line down the center of the dorsum when the wings are folded in repose. The yellowish wings and legs contrast with the dark brown to black abdomen.

This insect flies readily and is frequently attracted to both white and ultraviolet lights. *Doru lineare* may be extremely common in the American Tropics, such as the west coast of Mexico, where individuals sometimes come to lights by the thousands, getting into one's clothing, in the camping gear, and in vehicles. Thus, this species is often transported about by man.

*Forficula californica* Dohrn (1865) was described from one male in the Vienna Museum without precise locality,

"Habitat in California (Lorbes)." Burr (1910) considered *californica* a variety, but Caudell (1913) stated that *californica* scarcely deserved varietal distinctness.

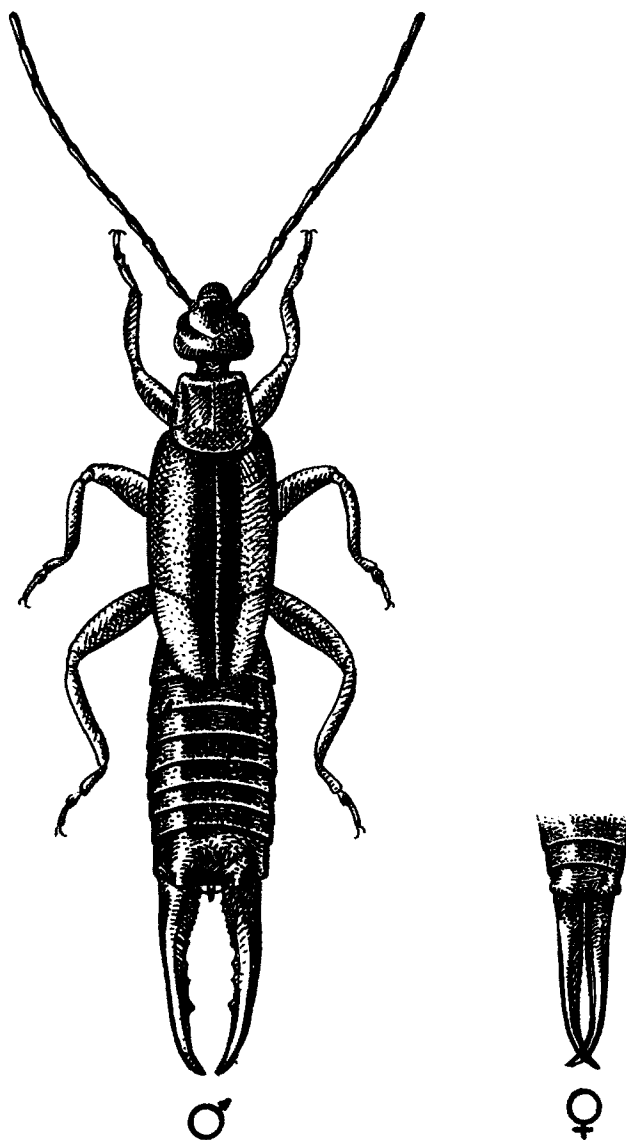


Fig. 10. *Doru lineare* (Eschscholtz).

In museums there are many specimens of *Doru lineare* from Mexico and Central and South America. In the California Insect Survey collection alone there are over 600 specimens representing almost every state in Mexico from Sonora to Yucatan. However, we have found no specimens from Baja California. Thus it seems likely that Dohrn's *californica* was based on an introduced specimen.



Although there are many records from southern and southeastern Arizona, this species has not been found in appreciable numbers in California. Four specimens have been taken in light traps in the extreme southeastern part of the state, primarily as a result of the California Department of Food and Agriculture's survey for pink bollworm. Except for two other lined earwigs with incomplete data, California specimens were taken in quarantine, or under circumstances where they can be traced as being transported through the activities of man. Probably environmental factors such as winter temperature and moisture factors prevent its establishment in coastal and northerly parts of the state.



Map 9. California distribution of *Doru lineare* (Eschscholtz).  
Triangles = quarantine; squares = adventive.

**Geographic distribution.** — *Doru lineare* has been recorded from most countries in South and Central America. In the United States it has been reported from Arizona, Texas (Burr, 1910; Hebard, 1917), California (Dohrn, 1865), and Florida (Strohecker, 1939).

Contrary to all other literature and museum specimens we examined, Helfer (1963) gives the range of *D. lineare* as "New Jersey, southern Ontario, Michigan —" along with the better documented "— Arizona and California to South America." This species was intercepted at Ontario in a shipment from Texas, but we have no evidence that the species is established in the northern U.S. or Canada.

In California *D. lineare* was taken along the Colorado River in naturalized situations in 1947 and 1966, but too few samples are available to ascertain whether these represent established populations.

**California records.** — ALAMEDA CO.: Berkeley, U.C. Campus, VIII-13-1964, numerous living specimens in vehicle on return from Sinaloa, Mexico (J. A. Chemsak, R. L. Langston, and J. A. Powell); San Leandro, XI-1-1938, Quarantine from Alabama on azalea and camellia (G. Laing). IMPERIAL CO.: Bard, VII-11-1966, black light trap, VII-18-1966, black light trap (L. W. Ratcliff). LOS ANGELES CO.: Glendale airport, XI-24-1941, Quarantine from Mexico, V-21-1942, Quarantine from Mexico; Los Angeles, II-29-1932, Quarantine from Mexico on bell peppers, XII-23-1936, IV-27-1939, Quarantine from Mexico on bell peppers (V. E. Williams), VIII-22-1939, Quarantine from Florida in vehicle; Los Angeles International Airport, VII-8-1962, Quarantine from Mexico, X-4-1965, Quarantine from Mexico (E. Tapia); Montebello, IX-19-1937, Quarantine from Texas on bowstring hemp (V. E. Williams); San Pedro/Port of Los Angeles, VI-17-1962, Quarantine from Brazil (E. Tapia), IV-19-1965, Quarantine from Mexico (E. Tapia). ORANGE CO.: Brea, XI-7-1949, ex bananas from market (W. R. Newsom). RIVERSIDE CO.: Blythe, VIII-20-1947, light trap (J. W. MacSwain). SACRAMENTO CO.: North Sacramento, I-12-1938 (F. Kirsten). SAN FRANCISCO CO.: "San Francisco Co." III-1908.

### *Forficula auricularia* Linnaeus

The European Earwig  
(Fig. 11, map 10)

*Forficula auricularia* Linnaeus, 1758, Syst. Nat., (ed. 10), 1, p. 423, no. 1. (Europe.); Fulton, 1924, Oreg. Agric. Exp. Stn. Bull. 207, p. 6 (Portland, Oregon.) (Earliest United States record, 1909); Essig, 1923, J. Econ. Entomol., 16(5):458 (Berkeley, California) (First California record).

*Forficula major* De Geer, 1773, Mém. Ins. III., p. 545, pl. 25, figs. 16-25.

*Forficula bipunctata* Petagna, 1709, Inst. Entomol. II., pl. 3, fig. 11.

*Forficula neglecta* Marsh, 1802, Col. Brit., p. 529, no. 2.

*Forficula infumata* Charpentier, 1825, Hor. Entomol., p. 70.

The European earwig is a medium-sized, winged, mostly brown species with paler wing covers, legs, and antennae. It is recognized by the heavy, much broadened forceps in the male.

Van Heerdt (1946) considered the systematic position, physiology, and ecology of *Forficula auricularia*, emphasizing the influence of temperature on development, and the reaction to humidity for survival.

The size of the forceps, especially in the males, shows considerable variation. According to Van Heerdt (1953) those with long forceps (5-8 mm) have been known as "high males," and those with short forceps (2.5-5 mm) have been known as "low males." The two forms have even been given varietal names, but experiments by Van Heerdt showed production of both high and low males in varying proportions by changing factors in the environment.

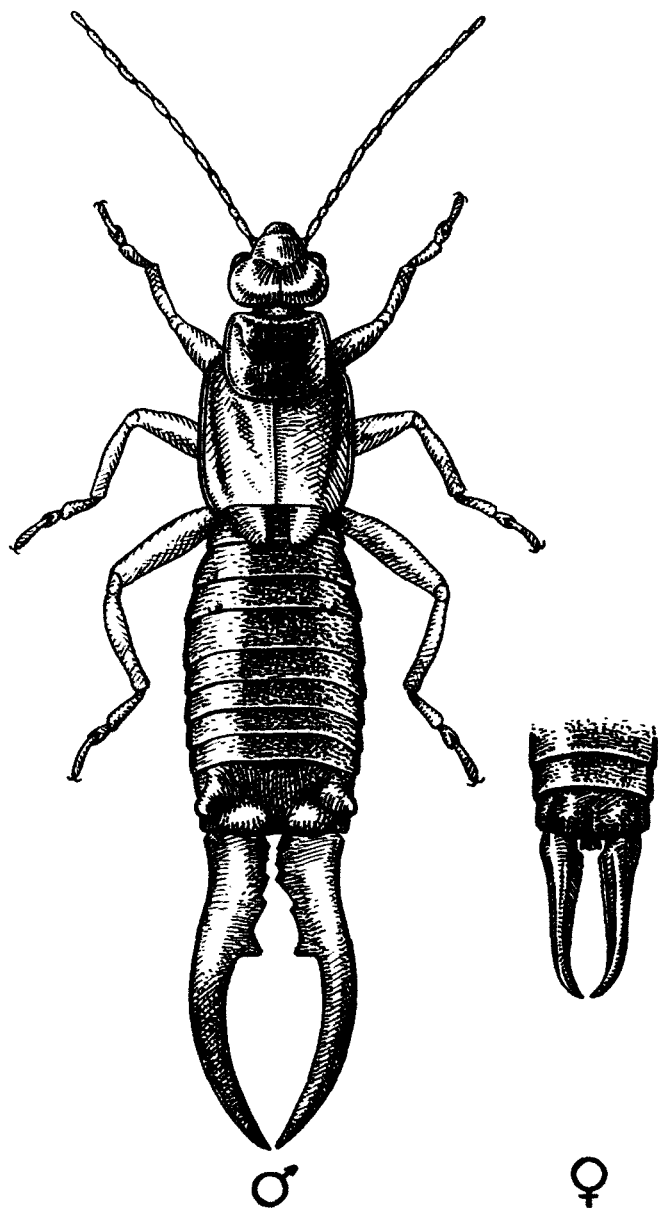


Fig. 11. *Forficula auricularia* Linnaeus.

According to Fulton (1924) the most important use of the forceps seems to be defense, but he has seen individuals fight over a morsel of food in cages where they had not been fed for some time. An earwig with the food would turn and using the forceps drive away others that approached.

Mating probably occurs frequently, may last for a number of hours, and possibly takes place at any time of the year (Fulton, 1924).

The eggs are deposited in burrows or chambers, most often in moist soil. They are kept clean, and in piles guarded by the female. She repels intruders usually with her forceps. We have found eggs in January, February, late spring, and again in October, in California.

Hinton and Corbet (1955) state that this species feeds on a variety of substances, ranging from the tender foliage of plants to living and dead insects. Fulton (1924) observed one devouring a live blow-fly maggot without resorting to use of the forceps. Essig (1925) reported destruction of flowering buds of carnations in great numbers in the San Francisco Bay area. Although this earwig may be predaceous at times, it has often been reported in the literature as being injurious to crops, and as a nuisance household pest.

Chant and McLeod (1952) detailed the effects of certain climatic factors on abundance of *F. auricularia*, using extremely large numbers of individuals in the process of recovering one of the tachinid parasites.

The larvae of two European Tachinidae (Diptera), *Bigonicheta spinipennis* (Meigen) and *Ocytata pallipes* (Fallén) live as internal parasites of the European earwig. These two species were introduced into Oregon in 1924 (Mote, 1931). Along with subsequent shipments from Europe, the parasites were mass-reared and later liberated in the field. It was ascertained that *B. spinipennis* had become established at Portland from liberations made previous to 1930. Another stock of *B. spinipennis* was sent from Europe to Puyallup, Washington, in 1931 (Getzendaner, 1936). Seventeen colonies were established at widely separated points in Washington and Idaho.

In 1934 Flanders introduced *B. spinipennis* into northern California from Oregon. Schoeppner and Hagen (1963) reported that by 1962 it was found to be established widely in the San Francisco Bay area. *Bigonicheta* has been recovered from Humboldt County, Alameda County, and San Francisco. Further inland it was found commonly in Sonoma and Contra Costa counties and south as far as Hollister, San Benito County. The highest parasitism attained by Schoeppner and Hagen (1963) was 18% from the Danville, Contra Costa County, population. Additional California records of the occurrence of *Bigonicheta spinipennis* include Del Norte County, 1960, Marin County, 1961, and San Mateo County, 1966 (Arnaud, 1967).

*Geographic distribution.* — *Forficula auricularia* is widespread in both the Old World and New World, primarily in Temperate Zones. In North America this species is generally distributed in the Pacific Northwest (Hatch, 1949) and in the northern two-thirds of California.

Burr (1910) found no *F. auricularia* from North America in the U.S. National Museum, and Caudell (1913) examined very few Nearctic specimens in collections. The establishment and spread in

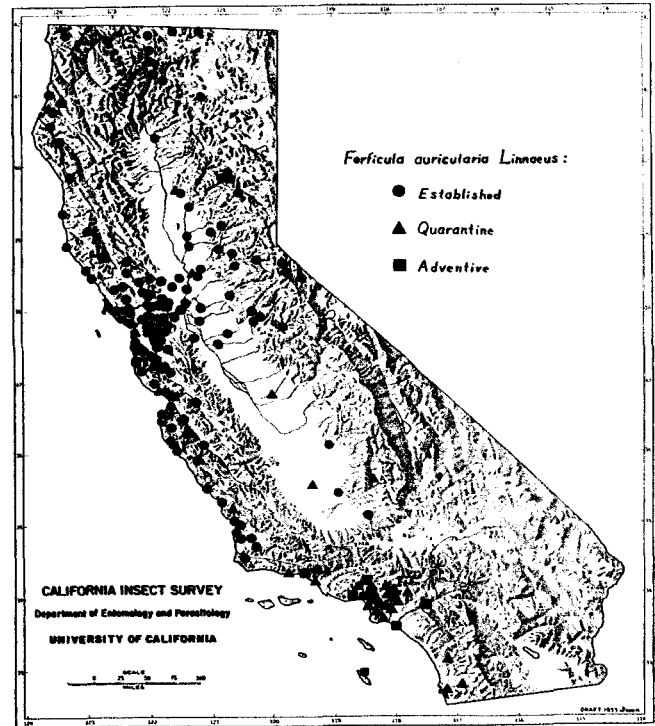
several areas of North America that followed during the subsequent decades has not been well documented but was in part summarized by Essig (1931). A chronology of reports of establishment is as follows, with first collection dates where known.

|      |  |
|------|--|
| 1853 | "America" (South America?) (Fieber, 1853, Lotos III:254) |
| 1909 | Portland, Oregon (Fulton, 1924)                          |
| 1911 | Newport, Rhode Island (Jones, 1917)                      |
| 1913 | New York (Caudell, 1913)                                 |
| 1915 | Seattle, Washington (Jones, 1917)                        |
| 1916 | Vancouver, British Columbia (Treherne, 1923)             |
| 1917 | East Aurora, New York (Felt, 1918)                       |
| 1923 | Berkeley, California (Essig, 1923)                       |
| 1926 | Montana (Essig, 1926)                                    |
| 1936 | Idaho (Getzendaner, 1936)                                |
| 1958 | Phoenix, Arizona (Nutting, 1960)                         |

*California records (map 10).* — The spread of *F. auricularia* from its original discovery site in 1923 in California has encompassed the northern half of the state at low to moderate elevations. It is found throughout the immediate San Francisco Bay area and is widely distributed in northern and central portions of the state. South of the Tehachapi Mountains, most of the earlier collections were made under quarantine conditions. The majority originated from Oregon, but others came from Washington and northern California. The European earwig has been known in Los Angeles County since 1931. Buxton (1966) stated that it was subject to eradication until 1952 when a survey revealed extensive established colonies throughout the Los Angeles basin. In Orange County the first specimens were taken at Costa Mesa in 1942. Eradication was attempted but failed.

Although winged, *F. auricularia* was unknown from the Channel Islands until recently, presumably a consequence of its relatively

late establishment in southern California. In 1972 a single female was taken at the airport on San Clemente Island by J. T. Doyen.



Map 10. California distribution of *Forficula auricularia* Linnaeus. Circles = established; triangles = quarantine; squares = adventive.

## APPENDIX

### Alien Dermaptera Recorded for California

In addition to the ten species comprising the main part of this bulletin, eleven other species of earwigs have been taken in quarantine by the California Department of Agriculture. The following section includes a compilation of these additional species. The arrangement follows the classification as given on page 6, with genera and species within a family alphabetical. Specimens determined by A. B. Gurney except as otherwise noted.

#### Superfamily PYGIDICRANOIDEA

##### Family PYGIDICRANIDAE

###### Subfamily Pyragrinae

###### *Pyragropsis buscki* (Caudell)

LOS ANGELES CO.: Redondo Beach, III-9-1947, Quarantine from Little River, Florida in palm seed (through H. H. Keifer) – Cited by Gurney (1959), who also stated that there are other records for *P. buscki* from Palm Island, Miami Beach and Key Biscayne, Florida. Previously known from Cuba, Jamaica and the Dominican Republic. RIVERSIDE CO.: Corona, II-1-1962, Quarantine from Dania, Florida, adult on frond of *Paurotis* palm (C. Collins).

#### Superfamily LABIOIDEA

##### Family CARCINOPHORIDAE

###### Subfamily Carcinophorinae

###### *Anisolabis eteronoma* Borelli

LOS ANGELES CO.: San Pedro/Port of Los Angeles, III-9-1964, Quarantine from Hawaii, adults on stem of *Hapuu* fern log (A. L. Hand).

###### *Carcinophora* sp. or near

LOS ANGELES CO.: San Pedro/Port of Los Angeles, IV-1-1962, Quarantine from Ecuador on orchids (D. M. Peterson), VIII-7-1962, Quarantine from Ecuador on orchid leaves (L. T. Choate and L. A. Hart).

##### Family LABIIDAE

###### Subfamily Spongiphorinae

###### *Microvostox recurrens* (Burr)

LOS ANGELES CO.: San Pedro/Port of Los Angeles, IX-20-1963, Quarantine from Brazil (Airline baggage) (E. Tapia).

###### *Vostox dugesti* Borelli

LOS ANGELES CO.: San Pedro/Port of Los Angeles, IX-24-1947, Quarantine from Mexico on hardwood logs.

#### Subfamily Labiinae

###### *Labia arcuata* Scudder

LOS ANGELES CO.: San Pedro/Port of Los Angeles, III-22-1965, Quarantine from Guatemala on orchid plants (L. Gilgoly and J. A. Lindsay).

###### *Labia curvicada* (Motschulsky)

SAN DIEGO CO.: San Diego, III-8-1934, Quarantine from Guam in dried leaves (Mrs. G. S. Rosario).

###### *Sphingolabis hawaiiensis* (Bormans)

LOS ANGELES CO.: San Pedro/Port of Los Angeles, III-1966, Quarantine from Hawaii on *Hapuu* fern log (L. W. Barry, A. L. Hand and L. A. Hart) (determined by G. Buxton and A. Gilgoly).

#### Superfamily FORFICULOIDEA

##### Family CHELISOCHIDAE

###### *Hamaxas* sp. near *nigrorufus* (Barr)

SAN FRANCISCO CO.: Port of San Francisco, XI-30-1964, Quarantine from Suva, Fiji on *Zingiber officinale* with root.

##### Family FORFICULIDAE

###### Subfamily Neolobophorinae

###### *Neolobophora lugubris* (Dohrn)

MARIN CO.: San Rafael, III-13-1963, Quarantine from Texas on orchid root (E. R. Nelson and W. A. Bergen).

###### *Neolobophora ruficeps* (Burmeister)

LOS ANGELES CO.: San Pedro/Port of Los Angeles, III-30-1964, Quarantine from Costa Rica on bromeliads (J. A. Lindsay).

SAN DIEGO CO.: San Ysidro, VIII-27-1963, Quarantine from Mexico in stem of bromeliad (J. O. Wible).

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