English and Continental entomologists do not recognize so many different orders.

The two principal criteria used in the modern classification of insects are the structure of the mouth-parts and the character of the development. Of these, the development condition is held to be the more fundamental, although this may be open to question. However, on a primary basis of development and mouth-part conditions, combined with character of wings, antennæ, and to a less extent, of legs and abdominal appendages, insects are now classified into orders in the following way:

Metamorphosis very slight; biting mouth-parts; wingless ..... APTERA

Metamorphosis incomplete.

With biting mouth-parts.

Wings membranous ..... EPHEMERIDA, PLECOPTERA, ODONATA, ISOPTERA, CORRODENTIA

Fore wings parchment-like ..... ORTHOPTERA, EUPLEXOPTERA

Wingless ..... MALLOPHAGA

With sucking mouth-parts ..... HEMIPTERA, THYSANOPTERA

Metamorphosis complete.

With biting mouth-parts.

With wings membranous ..... NEUROPTERA, MECOPTERA, TRICHOPTERA

With fore wings thickened ..... COLEOPTERA

With sucking mouth-parts ..... LEPIDOPTERA

With lapping or piercing and sucking mouth-parts ..... DIPTERA, SIPHONAPTERA, HYMENOPTERA

Order Aptera.—The *Aptera* undoubtedly include the most primitive of living insects. This primitiveness is shown not alone by the absence of wings, which is the characteristic which gives the order its name, but is manifest also in the very simple and generalized condition of most of the body parts, internal as well as external.

All the insects of the order are small, but a group of them

of houses, and in the southeastern states they have been found infesting living plants, particularly orange trees, guava bushes, sugar cane and pampas grass. The largest and most abundant species, *Termopsis augusticollis*, on the Pacific coast, makes its nest by mining in dead stumps and logs and sometimes ruins telephone and telegraph poles in this way. A single community of this species may include thousands of individuals.

Order Corrodentia.—The order *Corrodentia*, or book-lice and bark-lice, is composed of very small insects most of which, composing the family *Psocidæ*, have two pairs of wings and a plump rounded body, while the others, forming the family *Atropidæ*, have no wings or only small wing scales or buds and a flattened body. The Psocidæ are the bark-lice and are commonly found in small clusters on bark, while the Atropidæ are the so-called book-lice, common in old books and on dry dead organic matter.

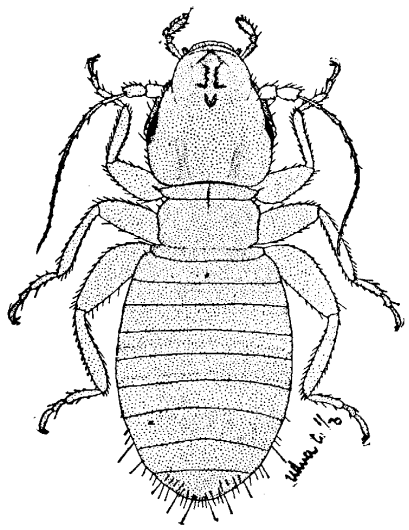

FIG. 74.—A wingless book-louse, *Atropos* sp. (Much enlarged.)

In both families the mouth-parts are of the biting type, with the jaws especially strong and heavy for the successful biting off and chewing of hard dried food. *Atropos divinatoria* is the species usually found in books. It is about 1/25 of an inch long, grayish-white, with slender projecting antennæ, and small eyes looking like distinct black spots on the head. It does not limit its feeding to the paste of book bindings but does much damage to dried insects in collections.

Order Mallophaga.—The *Mallophaga*, or biting bird-lice, compose a group of about 1500 known species, all of which live as external parasites on the bodies of birds and mammals. They have strong biting mouth-parts, and feed exclusively on the hairs or feathers of their host. They do not, like the true lice, suck blood.

The body varies from 1/25 to 1/3 of an inch long, is wholly wingless and much flattened. The insects have no compound

eyes, and in this and their winglessness show the degeneration which a parasitic life almost always produces. The eggs are fastened to the hairs or feathers, and the young undergo little change during their development except an increase in size to become like the parents.

Almost every species of bird or mammal is infested by one or more kinds of *Mallophaga*, and sometimes the host must suffer much annoyance and even injury from the irritation produced by its many small parasites. All of the common barnyard birds are troubled more or less by these biting lice, and their presence may become a serious matter in hen-houses. An account of certain special Mallophagan pests and of remedies for them is given in Chapter XXX.

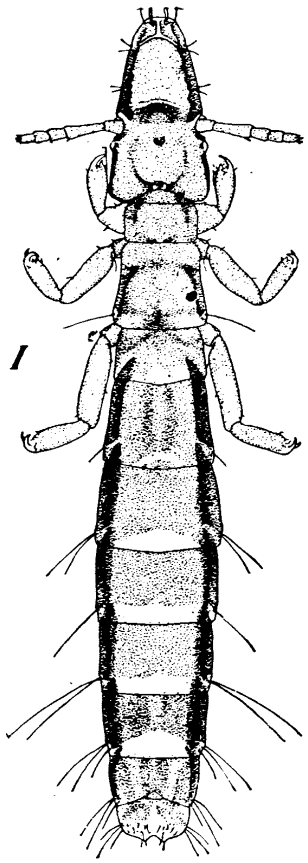

FIG. 75.—A biting louse of pigeons, *Lipeurus baculus*. (Natural size indicated by line.)

Order Orthoptera.—The order *Orthoptera* is much larger than any of the other orders so far considered, and includes many familiar insects, such as the grasshoppers, katydids, crickets, cockroaches and praying mantises. The order is divided into six families, of which three include all the well-known singing insects, except the cicada or harvest flies. The insects in these three singing families are also the best known leaping insects, the hind legs being especially long and strong, so that when the insect is at rest the "knee joints" of these legs stand up conspicuously above the body.

All the *Orthoptera* have strong biting mouth-parts and nip off and chew their food, which is usually green leaves and stems. The mantises (family *Mantidæ*) are, however, predaceous, preying on other insects, and the cockroaches (family *Blattidiæ*) prefer dried vegetable or animal matter. The metamorphosis is incomplete, and the young, which resemble the parents

The *Hemiptera* have an incomplete metamorphosis, the young at birth resembling the parents in most essential characteristics except size and the presence of wings.

The order is sub-divided into three sub-orders, one, the *Parasita*, composed of wingless species living as parasites on man and other mammals; another, the *Homoptera*, winged species with fore and hind wings of the same texture throughout and usually held sloping or roof-like over the back; and

FIG. 77.—A water-bug, *Serphus dilatatus*. (Natural size.)

another, the *Heteroptera*, with four wings held flat on the back when folded and with the bases of the front wings thickened, hence the name of the order (*hēmi-*, half, *ptera*, wings). The *Parasita* include the sucking lice; the *Heteroptera* the squash-bugs, chinch bugs, water-boatmen, assassin-bugs and stink-bugs; while the *Homoptera* include the cicada or harvest-flies, the tree- and leaf-hoppers, the aphids, or plant-lice and the degenerate scale-insects. Some of the more injurious species of this order are described in Chapters XXX to XXXVII.