CHAPTER 19

Venoms of Coleoptera

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A. Introduction

The order Coleoptera contains more than a quarter of a million species divided amongst about 200 families. The members of this order undergo a complete metamorphosis. Species are known that live on the ground, on plants, in wood, on flowers, in carrion, etc., and in and on water. As will be seen below only 12 families have been studied regarding toxins.

1. Alleculidae: The biology of this family of beetles is not well documented. The species size ranges from 4—19 mm. The larvae live in rotting wood, while the adults are to be found on flowers or under the bark of trees.

2. Cantharidae (soldier beetles): The species of this family are soft-bodies, elongate insects. They are carnivorous, live on flowers preying on other flower-dwelling insects.

3. Carabidae (ground beetles): This family, one of the largest, comprises about 25,000 species of predaceous beetles usually 2—3 cm in length, although certain tropical species attain a length of 6 cm.

4. Cerambycidae (longhorn beetles): There are more than 20,000 species of longhorn beetles, usually cylindrical in shape, measuring anywhere from a few millimeters to 15 cm, as is the case of the South American Titanus giganteus. Several species are injurious to trees and cut timber.

5. Chrysomelidae (leaf beetles): This family is comprised of more than 25,000 species, including the well-known agricultural and garden pests, the asparagus beetle, and the Colorado potato beetle.

6. Coccinellidae (ladybird beetles): This family comprised of 3,400 species, is cosmopolitan and usually beneficial to man. They are well known for their voracity in consuming aphids. Certain Epilachna species are pests in the southern United States and Central America.

7. Dytiscidae (diving beetles): A family of strong swimmers whose 4,000 species are distributed throughout the world. All dytiscid species are predatory. The larvae, in some parts of the world known as water tigers, are also predatory.

8. Gyrinidae (whirligig beetles): A relatively small family of about 400 species, Gyrinids are aquatic and feed on insects caught on the surface of the water.
9. *Meloidae* (blister beetles): There are 2,300 species; the most infamous is *Lytta vesicatoria*, the “Spanish fly”. The usual egg, larval, pupal, adult development is replaced by hypermetamorphosis, a process in which there is a three-stage larval development dependent on the factor of parasitism on other species.

10. *Silphidae* (carrion beetles): A family of 2,000 species, both larvae and adults feed on fungi and decaying plant and animal matter.

11. *Staphylinidae* (rove beetles): A large family of 20,000 species, all are predaceous.

12. *Tenebrionidae* (darkling beetles): A family of about 17,000 species, nearly all are plant feeders or scavengers in decomposing wood.

**B. Morphology and Histology of the Scent Glands**

In adult Coleoptera the defensive gland system is usually located dorsally in the abdomen. Often there is a second system located in the prothorax. The abdominal (pygidial) gland consists of a reservoir and associated secretory area and opens on the membranous cuticle of the eighth tergum (Table 1).

In the Carabidae the gland opens on the membranous area posterolateral to the eighth tergite (FORSYTH, 1972), in the Gyrinidae on the pleural region of the eighth segment (BARTH, 1960), and in the Dytiscidae behind the eighth tergite (FORSYTH, 1968). In the Tenebrionidae it opens ventrally or ventrolaterally between segments 7 and 8 (ROTH, 1945), in the Alleculidae on the posterior margin of sternite 7 (KENDALL, 1968), and in the Staphylinidae on the eighth abdominal segment near the edge of the ninth sternite (ARAUJO, 1973).

Prothoracic glands have been described for the Tenebrionidae (ROTH, 1943, 1945; PALM, 1946), the Dytiscidae (FORSYTH, 1968), and the Alleculidae (KENDALL, 1968, 1974). They open on the dorsolateral margin of the prothorax on either side of the head capsule. In some Cerambycidae the gland openings are located in the metasternum near the articulation of the coxa of the hind legs (VIDARI et al., 1973), and in others the glands are located in the head and open at the base of the mandibles (MOORE and BROWN, 1971).

In the Chrysomelidae and the Cantharidae there are several pairs of glands which in the former open dorsally on the meso- and metathorax and the first seven abdominal segments (BLUM et al., 1972) and in the latter open on the first to eighth abdominal tergites (SULC, 1949).

**I. Pygidial Gland**

1. **Reservoir**

The reservoir may be muscular or consist of a very thin layer of epithelial cells lined with cuticle. In the Alleculidae, Tenebrionidae, and many species of Carabidae, the reservoir has no muscle layer (PALM, 1946; BLUMBERG, 1961; CASNATI et al., 1965; EISSERT et al., 1968; KENDALL, 1968; TSENG et al., 1971; FORSYTH, 1970a and b, 1972). In the carabid genus *Chlaenius* and the tenebrionids *Tenebrio molitor,*