

The Rove Beetles of Florida (Coleoptera: Staphylinidae)¹

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INTRODUCTION: Rove beetles are often abundant in habitats with large numbers of fly larvae - decaying fruit, carrion, and dung - where they are important predators of maggots. Because they are abundant in decaying fruit, they often are encountered during fruit fly surveys, but frequently are not recognized as beetles. This circular is intended as an introduction to this large, diverse, and important family of beetles. Because the family is so diverse in appearance and habits, the various subfamilies are characterized in more detail here than is usual in a publication of this kind.

Most rove beetles are slender and cylindrical with short elytra, the abdomen is flexible, and the antennae are simple. Adults are about 1 mm - 30 mm long (figs. 1 - 16). Adults of some other families also have short elytra, but in these (*e.g.*, *Meloe*, family Meloidae, *Conotelus*, family Nitidulidae, *Mayetia*, family Pselaphidae, *Rhipidius*, family Rhipiphoridae) the abdomen has little flexibility and the antennae are strongly clubbed at the apex or otherwise modified. As defined here the family includes Micropeplinae and Scaphidiinae (usually treated as separate families). Earwigs (Order Dermaptera) are often confused with rove beetles, but have moveable forceps at the end of the abdomen and many-segmented antennae. Eggs of Staphylinidae typically are white, spherical, spheroidal, pyriform, or cylindrical. Larvae are elongate and campodeiform, their antennae with 3 or 4 articles, with a sensory appendage on the penultimate article and typically facing anteriorly, the abdominal apex with urogomphi typically present and articulated, each leg with a claw-like tarsungulus. Pupae of most Staphylinidae are white and exarate, but those of Staphylininae are obtect, pigmented and sclerotized (Frank 1991).

Adults of most species are nocturnal, or at least hide from light during daylight hours, and are confined to moist microhabitats; some exceptions are *Stenus* and *Paederus* which are active in daylight. Adults and larvae of most species are facultative predators, but some are specialist predators, some are mycophagous or saprophagous or even phytophagous, occasionally damaging flowers and turf. Larvae of *Aleochara* are parasitoids of dipterous pupae. Several species, especially of Aleocharinae, are obligateinquilines of nests of social insects (ants and termites). Larvae of *Stenus*, *Astenus*, and many species of Aleocharinae spin a cocoon before pupating. In general, adults are long-lived, with eggs, larvae and pupae developing in a few days to a few weeks. The few Florida species for which life cycle information is known, albeit unpublished, breed throughout the year, which is more typical of tropical than of temperate species.

Probably more than 462 species occur in Florida, though only 342 are now recorded (Frank 1986; Frank et al. 1989). Habits and appearance vary widely in this large family, so characteristics of the 16 subfamilies recorded from Florida are given below. Only for the small subfamilies Oxyporinae and Leptotyphlinae are there modern taxonomic works allowing identification of all known Florida adults to the species level. Only for a handful of Florida species (in the genera *Apocellus*, *Belonuchus*, *Bledius*, *Cafius*, *Creophilus*, *Myrmecosaurus*, *Osorius*, *Oxyporus*, *Philonthus*, *Platydracus*, *Scaphisoma*, and *Thoracophorus*) are there accounts of behavior of adults or descriptions of immature stages, due almost entirely to studies in other parts of their range. There are no accounts of population dynamics (bionomics).

IDENTIFICATION: Proteininae. Typical adults are 1.5 - 3 mm long, somewhat broader in shape than are most Staphylinidae, with somewhat long elytra, the head with a broad neck, the antennae of 11 articles (9-11 or 8-11 broader than those preceding), and tarsi of 3, 4, or 5 articles (fig. 1). In some genera the elytra cover the entire abdomen, and in some there is a median ocellus near the base of the head. In larvae, the mandible has a prostheca, and the maxillary mala is very long and slender.

Adults and larvae are saprophagous or mycophagous. They live in fungi and decaying vegetation, and sometimes are found in carrion and in caves. Only one species, *Proteinus thomasi* Frank, is reported for Florida (Frank 1979).

Omallinae. Typical adults are 1.5 - 6 mm long, somewhat broader in shape than are most Staphylinidae, with somewhat longer elytra, the head with a broad neck, the antennae of 11 articles which are only slightly broader at the apex, and tarsi of 5 articles (fig. 2). In almost all genera there is a pair of ocelli near the base of the head, and in a few the elytra cover the entire abdomen. The maxillary mala of larvae is strap-shaped, but not as long as in Proteininae, and the mandible lacks a prostheca.

Adults and larvae occur in leaf litter, decaying fruits, moss, and under bark of dead trees. Adults of several species and larvae of a few occur in flowers. Adults and larvae of many genera and species are believed to be predatory (they will feed on freshly-killed small insects), though a few seem to be phytophagous (they damage flowers) or saprophagous (they will feed on decaying fruits). Five species are reported for Florida.

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Micropeplinae. Typical adults are 1 - 3 mm long, ovoidal and somewhat flattened, the antennae of 9 articles of which the last is much broader than the others (giving the appearance of a club), the tarsi of 4 articles (though the first is very small and difficult to see), and the body (head, pronotum, elytra and abdominal tergites) has strong ridges (fig. 3). Larvae have not been studied by modern methods; a 19th century description states that they are exceptionally well-sclerotized, even the abdomen having sclerotized plates, and these abdominal plates project laterally from the body.

Adults and larvae occur in leaf litter and associated with fungus-infested dead trees. Their food has not been investigated. At least one species occurs in Florida, though none has yet been reported (Campbell 1968).

Tachyporinae. Adults are 1.5 - 6 mm long, the head narrower than the thorax and the abdomen tapering strongly ("torpedo-shaped"), many of them glossy, some of them with bright patterns of yellow on a darker background of brown or black, the antennae of 11 articles which are elongate or with the apical articles slightly broader than the basal articles, the tarsi with 5 articles (fig. 4). Larvae with urogomphi or 2 articulated articles.

Adults and larvae occur in various moist habitats such as leaf litter, decaying vegetation and fruits, under bark of fallen trees, and in mushrooms. Adults and larvae are fast-moving and most are generalist predators, though some are mycophagous. Twenty species have so far been reported for Florida, mostly in the genera *Coproporus* and *Sepedophilus* (Campbell 1975, 1976).

Aleocharinae. Adults are <1 - 9 mm long, with short elytra, the antennae inserted into the vertex of the head between the eyes (this characteristic shared only with Steninae), seldom colored brightly, but the abdomen in several with tubercles, ridges and spines, antennae of almost all with 11 articles (in a few, 10) which are simple or broadened toward the apex, tarsi of 3, 4 or 5 articles. Larvae have a single ocellus (or no ocelli) on each side of the head whereas larvae of most other known Staphylinidae have either none or at least 2.

The species of this enormous subfamily occupy almost every conceivable moist habitat. Some inhabit the nests of termites and ants. Adults of some of these resemble their hosts and have behavior enabling them to interact with the social insects, others inhabit the nests of birds and small mammals, while yet others inhabit guano in caves, the dung of epigeal vertebrates, decaying fruits, the leaves of living plants, mushrooms, carrion, and the shores of lakes, rivers and the sea. The larvae of *Aleochara* are internal parasitoids of dipterous pupae. Most are generalist predators, but some are specialists and a few are not predatory but mycophagous with subsocial behavior. Ninety three species are reported for Florida (Seevers 1978; Frank 1986; Frank et al. 1989; Klimaszewski et al. 1990).

Piestinae. Adults are 2 - 7 mm long and flattened, with antennae of 11 articles (the basal ones elongate, the remainder either elongate or quadrate) of which the basal article of the male or of both sexes has a tooth or a tuft of long and coarse setae, and with tarsi of 5 articles (fig. 6). In the larva, the labial ligula and maxillary mala are broad, and the mandibular apex is divided into 3 or 4 points.

Adults and larvae are slow-moving. They live together under the bark of dead trees and in cut banana stems, and probably are saprophagous or mycophagous. The only reported Florida representative is *Hypotelus hostilis* Fauvel.

Osoriinae. Adults are 1.5 - 15 mm long, elongate, flattened or cylindrical, the sclerites fused in a ring around each abdominal segment; in most genera and species the integument is glossy but in some (e.g., *Thoracophorus*) it is sculptured and strongly ridged, the antennae of 11 stout articles, the tarsi of 5 articles (fig. 7). Larvae, too, are flattened or cylindrical and have articulated urogomphi of 2 articles.

Adults and larvae are slow-moving. Their typical habitat is under the bark of dead trees and in decaying wood, though some dwell among plant roots. Most are saprophagous but some may be mycophagous, and some appear to eat living plant roots (there are reports of damage to roots of turf-grass by a species of *Osorius*). Ten species are so far reported from Florida.

Oxytelinae. Adults are 0.5 - 10 mm long, few of them glossy, with a well-developed second abdominal sternite (reduced in other subfamilies), the tergite of abdominal segment IX completely divided medially, the antennae with 11 articles either simple in form or the 3 apical articles forming a loose club, the tarsi with 2, 3, 4 or 5 articles (fig. 8). In the larva, the mandible is divided into 3 points at the apex, and the urogomphus has one articulated article.

This is another subfamily of Staphylinidae in which subsocial behavior has been recorded, by adults of *Platystethus* tending the immature stages, and by adults of *Bledius* maintaining the tunnels inhabited by the eggs (Herman 1986). Adults and larvae are saprophagous, fungivorous or algivorous, with a report of adults of *Apocellus* damaging flowers (Chittenden 1915). Although most Staphylinidae are reported to have 3 larval instars, 5 have been reported in *Bledius*. Adults and larvae live among decaying plant materials, in dung of vertebrates, in tunnels which they construct in diatom-laden sandy or muddy shores, or less commonly in nests of vertebrates.

Scaphidiinae. Adults are 2 - 7 mm long, ovoid, convex, glossy and black with long legs, the elytra almost covering the entire abdomen and truncate at the apex, the antennae of 11 articles which are only slightly broader at the apex, each tarsus of 5 articles (fig. 9). In the larva, the mandible is divided into 2 points at the apex.

Adults and larvae occur among dead leaves and rotten wood where they are associated with slime molds (Myxomycetes) and other fungi, and are believed to be strictly mycophagous (Leschen 1988). There are about 12 species in Florida.

Oxyporinae. Adults are 5.5 - 13.0 mm long, stout, glossy, with long and curved mandibles, with antennae of 11 articles of which articles 5-10 are moderately or strongly transverse, tarsi with 5 articles (fig. 10). In larvae, the mandible is divided into 2 points apically, and the maxillary mala is trilobed.

Adults and larvae feed only on fleshy mushrooms, and they digest their food pre-orally as in Steninae, Euaesthetinae, Paederinae and Staphylininae, in contrast with members of subfamilies listed above (Leschen & Allen 1988). Two species are reported for Florida (Campbell 1969).

Megalopsidinae. Adults are 3.5 - 5 mm long, stout, glossy, with very large and prominent eyes, the pronotum transversely grooved, the labrum with 2 slender projections, the antennae of 11 articles of which articles 9 - 10 are transverse and 11 is large (these 3 together forming a club), antennae fitting into a groove on the anterior and ventral surface of the head, the tarsi of 5 articles (fig. 11). Larvae are undescribed.

Not only is there no modern taxonomic revision of any major section of this subfamily, but no studies of the natural history have been published. Adults are associated with fruiting bodies of fungi growing on decaying wood, but are not abundant. Two species are reported for Florida.

Steninae. Adults are 2 - 6 mm long, elongate, fairly slender, few of them glossy because of punctation and microsculpture of the body surface, the great majority of them black but a few colored metallically, the legs somewhat long and slender, the eyes large and prominent, the antennae of 11 articles with basal articles slender and apical articles broader to form a loose club, the tarsi with 5 articles (fig. 12). The large eyes are reminiscent of those of Megalopsidiinae, but Steninae are more slender, less glossy, with more flexible abdomen, and they move faster. The abdomen of adults of some species is margined by paratergites and parasternites as in Paederinae and Staphylininae, but in others the abdominal segments are unmarginated and tergites are fused laterally with sternites. The labium of the adult forms a telescopic, prey-catching apparatus, extended by hydraulic pressure, whose function is similar to that of the better-known hinged labium of the aquatic nymphs of Odonata. Mandibles of larvae are slender and curved, legs and antennae are long, the ligula of the labium is bilobed, and the head capsule is much better sclerotized than in the subfamilies mentioned above.

Larvae spin silken cocoons in which to pupate. Paired anal glands of the adult secrete a chemical which acts as a surfactant (providing the insect with jet propulsion) on water surfaces: this mechanism seems to be used to regain terra firma when the insects fall onto water surfaces. Adults are active during daylight hours. Some live on banks of bodies of fresh water (lakes, rivers, ditches) and they run on the ground and climb on low vegetation. Others are not restricted to aquatic habitats, and they climb on shrubs. Adults and larvae are predatory on small, soft-bodied insects such as Collembola (Weinreich 1968). Thirteen species so far are reported for Florida.

Euaesthetinae. Adults are 1 - 4 mm long, slender or somewhat stout, yellowish brown or reddish brown, not very glossy, some of them with a feeble metallic lustre, many of them densely punctured, antennae with 11 articles in all species and genera known from Florida and with articles 3-8 much shorter than 1-2 and much narrower than 9-11 which form an apical club, anterior and middle tarsi each with 4 or 5 articles but posterior tarsi in all known species with 4 (fig. 13). Larvae are similar to those of Steninae but with shorter appendages, and the ligula of the labium is conical.

Adults and larvae live among plant debris on the banks of aquatic habits. Unlike Steninae, the adults do not seem to climb on vegetation. The mouthparts suggest that adults and larvae are predatory, but there are no published studies of natural history. Eight species are so far reported for Florida.

Leptotyphlinae. Adults are minute, 1-2 mm long, elongate, pale yellowish-brown, soil-inhabiting insects. Only one species, *Cubanotyphlus largo* Frank (fig. 14), is reported from Florida, known only from the Keys, and its closest relatives inhabit Cuba (Frank & Thomas 1984). It is eyeless and wingless. The immature stages are unknown and the behavior of adults is undescribed.

Paederinae. Adults are 1.5 - >20 mm long, elongate, a few of them brightly-colored, including metallic blue and green; they have long, curved and slender mandibles; the antennae have 11 articles and these are simple, or slightly broadened toward the apex, or all articles distal to the basal 2 are very slender (in *Thinocharis*); the tarsi have 5 articles (fig. 15). The anterior tarsi are greatly expanded in the tribe Pinophilini, the sclerites are fused in a ring around each abdominal segment in the subtribe Palaminina, the antennae are geniculate in the subtribe Cryptobiina. Characteristics uniting the species in Paederinae are very similar to those of the following subfamily, Staphylininae, but pupae are exarate and unsclerotized.

Paederinae inhabit a variety of decaying plant material. Adults of *Paederus* (which have normal anterior tarsi) and *Palaminus* (which have expanded anterior tarsi) climb on vegetation. Adults and larvae are predatory. Larvae as a rule seem to have only 2 instars whereas 3 is the usual number in Staphylininae. Larvae of only one genus (*Astenus*) are known to spin silken cocoons. Sixty-six species are so far reported from Florida.

Staphylininae. Adults are 1.5 - >30 mm long, elongate, some of them brilliantly-colored, including metallic blue, green, purple and red; they have long, curved and slender mandibles; in some species the eyes are large; the antennae have 11 articles and these are simple or broadened toward the apex; the tarsi in almost all genera have 5 articles (fig. 16). Included are members of the tribe Xantholinini in which the elytra overlap slightly, and members of the genus *Atanygnathus* in which the middle and posterior tarsi have only 4 articles. Larvae differ from those of all other subfamilies except Paederinae in having an articulated maxillary mala, and they differ from those in having a conical labial ligula (it tapers in Paederinae). Pupae differ from those of all other subfamilies in being obtect and sclerotized.

If any behavior of adult Staphylinidae has achieved notoriety among entomologists, it is the predatory behavior of large adults of such genera as *Creophilus*, *Ontholestes*, *Philonthus* (Harris & Oliver 1979) and *Platydracus*, because these are observed easily. Larvae, too, are predatory. Adults and larvae occur in many habitats including forest leaf litter, decaying plant materials including fruit, fungi, carrion, dung, and under bark of dead trees. Seventy-seven species so far are reported for Florida.

SURVEY METHODS: Staphylinids can be found in most moist habitats, especially where there is decaying plant or animal material. They can be extracted in numbers from soil and leaf litter in a Berlese funnel, and they are often abundant at light or in blacklight trap samples.

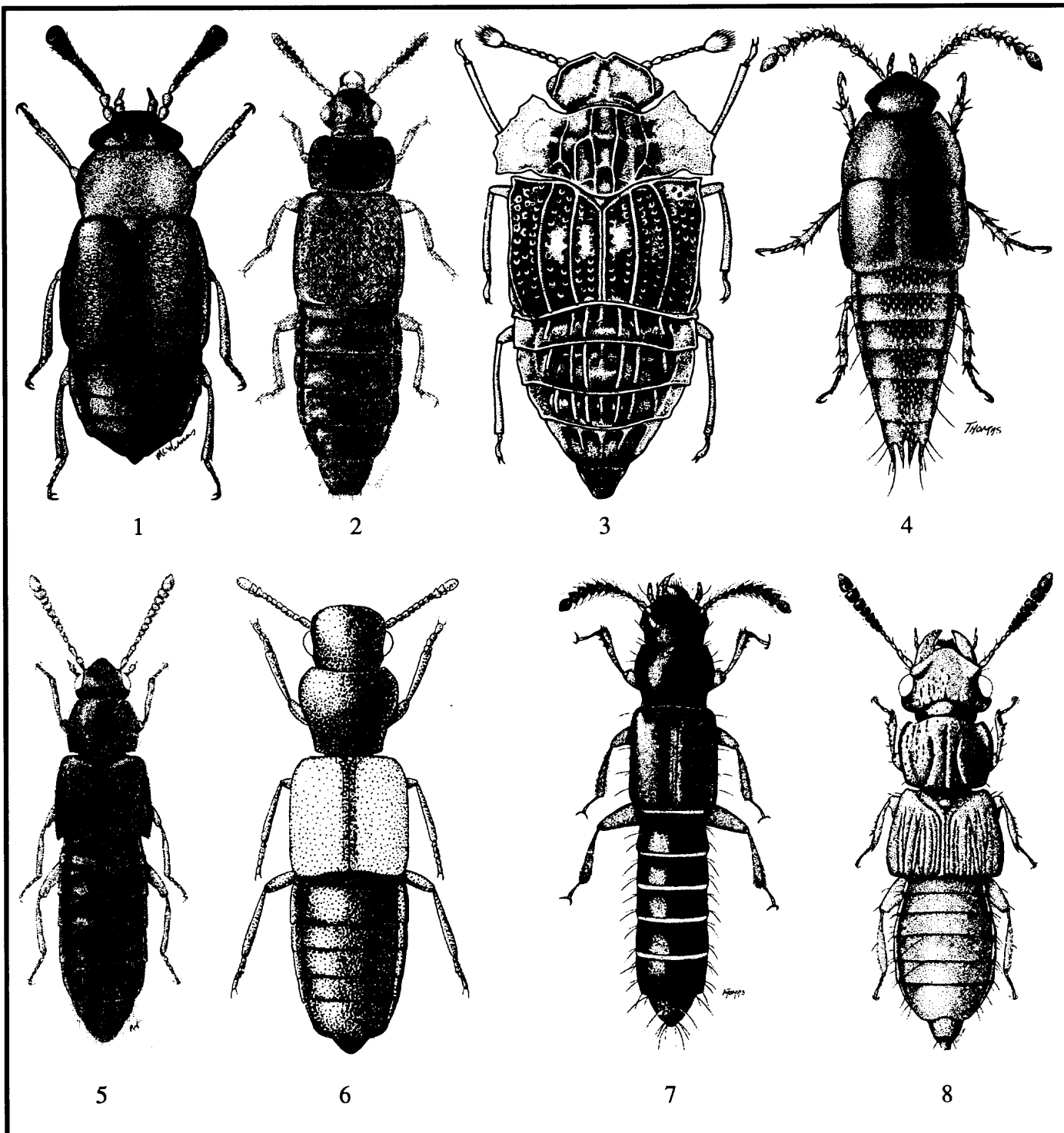
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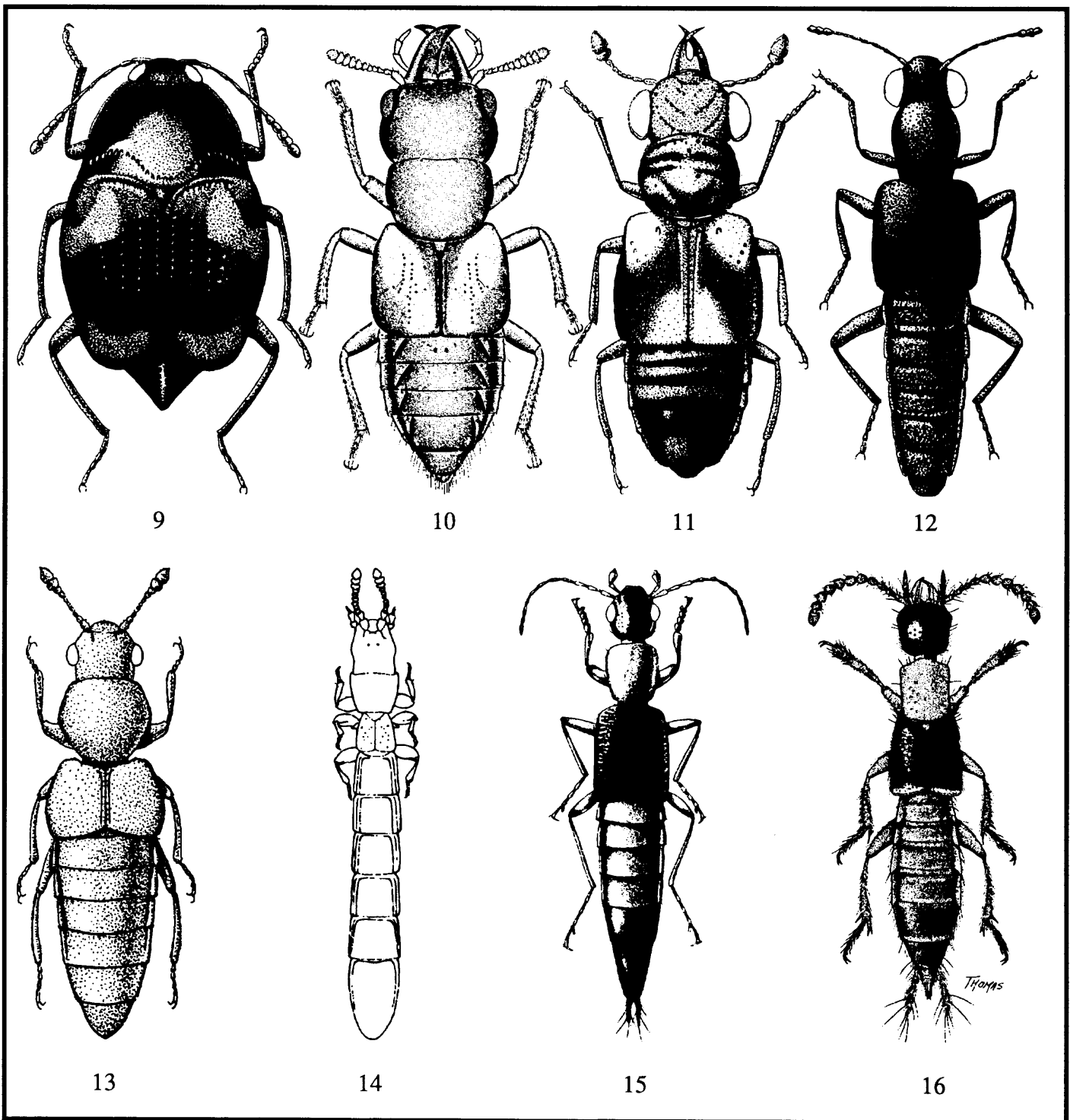
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*One of the pages of the checklist was placed by the publishing company in the wrong sequence (see *Florida Ent.* 69: 770).



Figures 1-8: Representative adults of 8 subfamilies of Staphylinidae with approximate length from anterior margin of head to apex of abdomen. 1) *Proteinus thomasi* (Proteininae) 1.5 mm. 2) *Omalius* sp. (Omaliinae) 3.5 mm. 3) *Peplomicrus* sp. (Micropeplinae) 2.0 mm. 4) *Coproporus rutilus* (Erichson) (Tachyporinae) 3.8 mm. 5) *Heterota plumbea* Waterhouse (Aleocharinae) 2.8 mm. 6) *Hypotelus hostilis* (Piestinae) 1.9 mm. 7) *Nacaeus tenellus* (Erichson) (Osoriinae) 3.5 mm. 8) *Oxytelus incisus* Motschulsky (Oxytelinae) 3.0 mm.



Figures 9-16: Representative adults of 8 subfamilies of Staphylinidae with approximate length from anterior margin of head to apex of abdomen. 9) *Scaphidium quadriguttatum* (Say) (Scaphidiinae) 4.3 mm. 10) *Oxyporus* sp. (Oxyporinae) 7.8 mm. 11) *Megalopinus rufipes* (LeConte) (Megalopsidiinae) 3.5 mm. 12) *Stenus* sp. (Steninae) 4.3 mm. 13) *Euaesthetus* sp. (Euaesthetinae) 1.4 mm. 14) *Cubanotyphlus largo* (Leptotyphlinae) 1.1 mm. 15) *Paederus* sp. (Paederinae) 6.7 mm. 16) *Neobisnius ludicrus* (Erichson) 4.1 mm. (Staphylininae).