PASSALIDAE, INSECTS WHICH LIVE IN DECAYING LOGS

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Summary

The Passalidae form a group of Coleoptera within the superfamily of Scarabaeoidea, which is found throughout the tropical and subtropical humid regions of the world and is calculated as consisting of almost one thousand species in all. The group is little known, owing to the fact that the majority of the species resides in dead tree trunks and is completely inoffensive. They spend their entire life cycle, from the egg stage until adulthood inside the trunks where the larvae and the adults feed off decomposing wood, making them qualify as saproxylophagous organisms. They live in family groups, and the parents, both male and female take care of the offspring from the moment of oviposition until the moment when the adult emerges; behavior which is recognized among insects as representing a high level of subsociability. Communities of Passalidae inhabit tropical and subtropical forests, without either disturbing or being disturbed;

they take advantage of a great diversity of tree species, participating actively and constantly in the decomposition of trunks and they contribute to accelerating the decomposition of wood material until the process of reintegration into the ground humus is completed. An adult processes 4.5 times its weight of wood per day, which is equivalent to producing around a kilogram of organic material every year; depositing phosphate, nitrogen, potassium and sodium into the soil.

1. Introduction

1.1. What are Passalid Beetles?

The Passalidae family constitutes a small group within the enormous Scarabaeoidea superfamily, which is part of the Coleoptera order. The coleopterans (beetles) are without doubt, the most numerous and outstanding group of insects on the planet. Passalidae have an extensive world distribution among tropical and subtropical humid zones, and generally constitute insects which are little noticed and manifest a notably homogenous external morphology, living confined to a specific microhabitat. Their plain appearance and uniform black color contrasts with the bright make up and spectacular colors of other coleopterans; they live inside dead trees during most of their life from the egg stage until they are advanced adults; only the mature adults abandon the dead trees during a short period of dispersal, when it is common to see them walk or fly. The adults excavate long tunnels in the dead tree and chew up the humid wood in order to feed themselves along with their larvae; this activity places them in the category of saproxylophagous organisms. Thus passalid beetles cause no damage to the forest, but instead play an important and beneficial role; as their activity accelerates the disintegration and transformation of rotten wood, resulting in the contribution of elements to the soil, which are then brought into the nutrient cycle.

The first species of Passalidae was discovered by Carolus Linnaeus in 1758, and is today included in the extensive genus of *Passalus* Fabricius 1792. At present, 700 species are recognized and described in the literature and a conservative estimate calculates that around 1000 species exist. Even though there has been considerable expansion in the knowledge concerning this group, it is imperative that their study should continue, as even now new species are being discovered in various parts of the planet and diverse aspects concerning their biology, ecology and behavior have only been partially described and existing knowledge about them is patchy.

1.2. How to Recognize Passalid Beetles?

The body of the adult has a characteristic black and shiny body which measures between 10 and 80 mm in length and can be either fat or thin, depending on the species, but which nearly always has parallel sides. The elytra have 10 lengthwise grooves, and the pronotum has a groove in the middle (see Figure 1). The prothorax is quadrangular in shape and is united to the rest of the body by the mesothoracic peduncle, where the elytra which protect hind wings are completely inserted, covering the dorsal area and sides of the metathorax and abdomen. The head possesses a pair of strong jaws facing forwards (prognathous) and a pair of antennae not elbowed which terminate in the form of a hammer, a club made up of between three and six lamellate segments; the antennae

are rolled up under the head to protect them. This kind of antenna is characteristic of the Scarabaeoidea, known previously as the lamellicorn beetle. The hind wings may be reduced among certain species which live in humid woodland, in mountainous areas, a reduction which affects the terminal areas and back part of the wing, with a long part remaining solely for the production of sound (stridulation).

The egg which is ovoid in shape has a micropyle at each end; the chorion varies in color from green to chestnut depending on its maturity, but becomes translucent prior to the hatching of larvae, whom during the initial stage have two long hardened egg bursters on the metanotum**,** with which they open the chorion in order to emerge from the egg. The larvae have an elongated, cylindrical and slightly curved body at the posterior end, which is a creamy white translucent color, making the internal organs visible, which grow in size in conformity with the ecdysis of the cuticle, corresponding to each larval moult: The head which has a brilliant chestnut color is spherical, strongly reinforced and prognathous; there are two complete long pairs of feet on the thorax and the third one is reduced to a small stump, which is used to produce sounds by scratching it against the coxa of the second pair of feet. The pupa which has a creamy white color is practically immobile and very fragile and is protected within a cocoon.

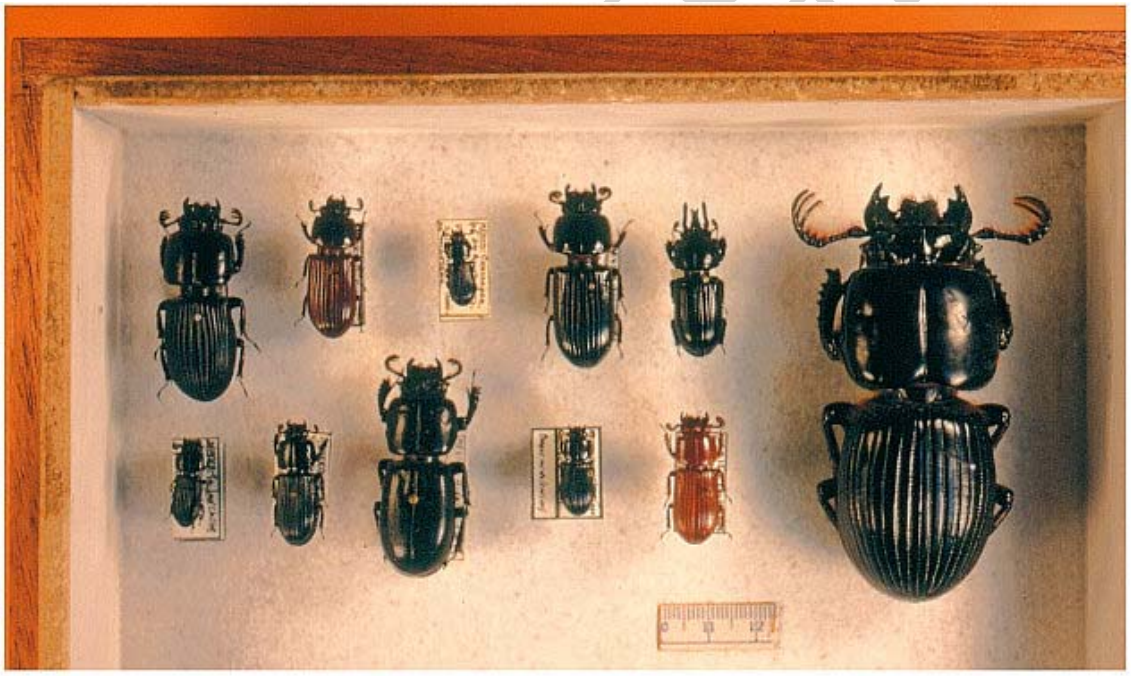

Figure 1. Here it is possible to appreciate the variety in Passalidae species, from different parts of the world, note the differences in size and thickness.

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Biographical Sketches

María Luisa Castillo is an associated researcher in the Department of Soil Biology in the Ecological Institute, Xalapa, Veracruz, Mexico. For a number of years she has dedicated her time to the study of biology, ecology and the behavior of Coleoptera from the Passalidae family. Her interest in this group of Coleoptera has led her to broaden her understanding of their microhabitat; consisting of decomposing trunks, as well as the ecology of saproxylophagous fauna.

Pedro Reyes-Castillo is head researcher in the Department of Soil Biology in the Ecological Institute, Xalapa, Veracruz, Mexico. He has dedicated 45 years, principally to the study of the taxonomy and natural history of the Passalidae Coleoptera and his interest in this group has led him to undertake taxonomic studies of the adults and larvae of the American genus as well as to study the cytotaxonomy of Mexican species. He has expanded the existing knowledge of Passalidae fauna from various countries and contributed to the formation of a biogeography of Mexican Passalidae.