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Definition of Vespidae (Insecta: Hymenoptera).

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Definition: Social wasps are insects of the order Hymenoptera, superfamily Vespoidea, family Vespidae, and belonging to the subfamily Polistinae. These insects are popularly known as "marimbondos" and are generally referred to in the specialized literature as vespids. This family builds nests in different ways, using different types of materials, with plant fiber being the main component of the cell. True wasps or hornets are the largest eusocial wasps and are similar in appearance to their close relatives, the yellow wasps *Dolichovespula arenaria* (Fabricius, 1775). Some species can reach up to 5.5 cm in length. They are distinguished from other Vespinae by the relatively large upper border of the head and the rounded segment of the abdomen just behind the waist. Worldwide, 22 species of wasps are recognized. Most species occur only in the Asian tropics, although the European hornet is widely distributed across Europe, Russia, North America, and Northeast Asia (Figure 1) [1-4].

Figure 1. A., B. & C.: Dorsal, lateral & frontal view of *Vespa vivax* Smith, 1870; D., E. & F.: Dorsal, lateral and frontal view of *Vespa velutina variana* Vecht, 1957; G., H. & I.: Dorsal, lateral & frontal view of *Vespa fumida* van der Vecht, 1956. Source: http://zoobank.org/References/02867802-959C-46A4-BB1D-00685757D92F.

Morphology: Intersegmental lines are recognizable on the dorsal and ventral sides of the body, but somewhat indistinct laterally. To some extent, the first and second abdominal segments are lobed ventrally, forming the trophopod. The last segment has the anal opening. Abdominal spiracles exist in the first eight segments, toward the anterior edge of each segment. The head in frontal view is almost rounded and anteroposteriorly compressed. The shape of the head is somewhat variable and is expressed by the use of cranial width. The antenna is a small, slightly swollen circular area, conical in shape, surrounded by a thick ring of cuticle. Each antenna has a sensilla arranged in a straight line or triangle. There are thirteen postcephalic segments. The larva is whitish, soft, and entirely devoid, with few notable structures [5-10].

The body consists of a yellow, well-criticized head, three thoracic and ten abdominal segments, with no constriction between the thorax and abdomen. In the tropics, these nests can last year-round, but in temperate areas, nests die out, with solitary queens hibernating in burlap or other insulating material until spring. Male hornets are docile and do not have stingers. True wasps are often considered pests as they aggressively protect their nesting sites when threatened and their stings can be more dangerous than bees. Like other social wasps, true wasps built communal nests, usually composed of chewed wood and exposed in trees and bushes; some species, such as *Vespa orentalis* Linnaeus, 1771, built their nests underground or in other cavities. Each nest has a queen, who lays eggs and is assisted by workers who, although female, are infertile. Colonies can be started by associations of various females (pleometrosis) or by a single female founder (haplometrosis) (Figure 2) [11-18].

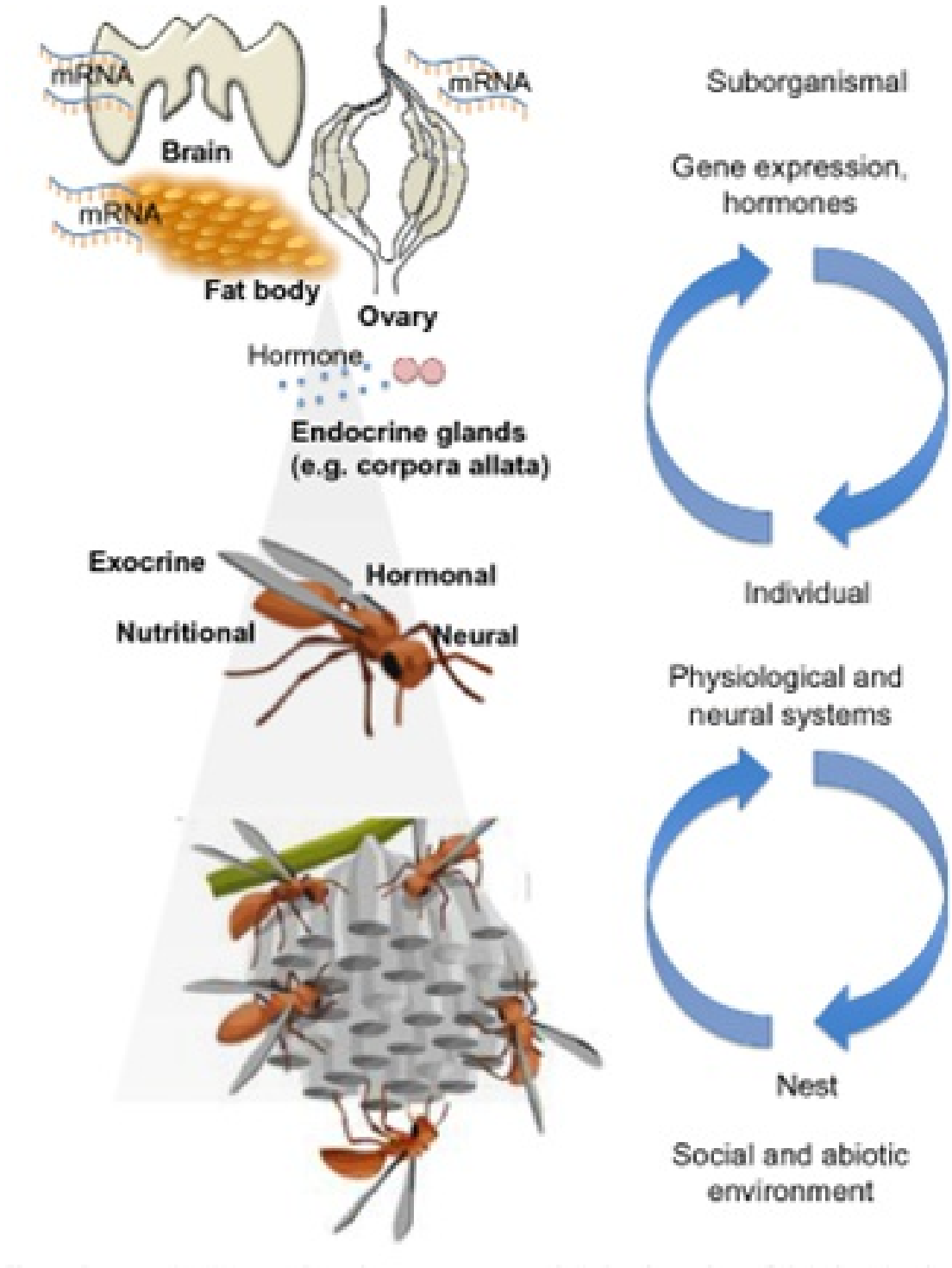

Figure 2. The dynamic interplay between multiple levels of biological organization, from genes to hormones to physiological systems, can affect social organization in paper wasps. Sources: Wasp drawings adapted from Hunt et al. (2011) and https://api.semanticscholar.org/CorpusID:54649525.

Instead of consuming the prey directly, members of the Vespidae family chew it and feed it to the larvae, producing a clear-looking liquid with a high amino acid content that serves as food for the adults. The exact composition of this fluid varies from species to species, but it appears to contribute significantly to adult nutrition. Each wasp colony includes a queen and several workers with varying degrees of sterility relative to the queen. In species from temperate regions,

colonies exist for one year, perishing at the beginning of winter. New queens and males are produced in late summer, and after mating, the queen hibernates in sheltered locations. Hornets have stingers used to kill prey and defend nests. Wasp stings are more painful to humans than typical wasp stings because wasp venom contains a large amount (5%) of acetylcholine. Individual wasps may sting repeatedly; Unlike bees, wasps do not die after stinging because their stingers are very barbed visible only at high magnification, and can be easily ripped off, so they are not ripped from their bodies when they detach. (Figure 3) [18-23].

Figure 3. Nests of social wasps of the subfamily Polistinae (Vespidae). A: Nest of*Mischocyttarus* sp. with exposed brood cells; B: Nest of *Polybia (Myrapetra) bistriata* (Fabricius, 1804), with an envelope to protect the brood cells; C: Nest of

Angiopolybia pallens (Lepeletier, 1836) with an envelope to protect the brood cells; D: Nest of*Polistes canadensis canadensis* (Linnaeus, 1758) with exposed brood cells.

Sources: Photos: M. Aragão and https://www.researchgate.net/figure/Figure-1-Ninhos-de-vespas-sociais-da-subfamilia-Polistinae-Vespidae-A-Ninho-de_fig1_312488169https://www. researchgate.net/figure/Figure-1-Social-wasp-nests-of-the-subfamily-Polistinae-Vespidae-A-Ninho-de_fig1_312488169.

The toxicity of wasp stings varies depending on the wasp species; some cause just a typical insect bite, while others are among the most venomous insects known. Isolated wasp stings are not fatal in themselves, except sometimes for allergic victims. Mandarin wasps are predators of bees and release attack pheromones to attract other mandarin wasps to the hive found. Hornets, like many social wasps, can mobilize their entire nest to defend themselves, which is highly dangerous to humans and other animals. The alert pheromone is usually released in the event of a threat to the nest. In the case of the mandarin wasp, whose main prey is bees, the pheromone trail serves to attract other mandarin wasps to the hive found. In field tests, 2-pentanol alone provoked mild alarm and defensive behavior, but the addition of the other two compounds increased aggression in a synergistic effect. In the European wasp, the main alert pheromone compound. If a wasp is killed near a nest, it can release pheromones that can cause other wasps to attack. Materials that come into contact with these pheromones, such as clothing, skin, and dead prey can trigger an attack, as can certain food scents, such as banana and apple scents, and fragrances that contain C5 alcohols and C10 esters. [24-28].

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