

A comparative study of the pollen press and nearby structures in the bees of the family Apidae

by

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Abstract: A comparative study of the pollen press and its associated structures in the bees of the family Apidae shows the following: 1) in the Meliponinae it is usually poorly developed; 2) in the Apini and Bombini it is well developed, with its surface extended into an auricle; 3) in the Euglossini it is also well developed but without an auricle. The pollen press is associated with an enlargement of the external and posterior border of the distal tibial foramen, forming a dome-like swelling: the tibial bulla.

The pollen press was variously described by several authors, such as Beling (1931), Casteel (1912), Sladen (1911) and Snodgrass (1942, 1956). Snodgrass (1956), said that in the hind leg of the honey bee "...there is a deep, pincerlike dorsal notch between the adjacent ends of the tibia and the basitarsus. It is this notch that is elaborated in the worker to form the pollen press." The pollen press is an adaptation for pushing pollen from one side of the leg to the other and for compressing it in the pollen basket.

For the classification of the family Apidae that of Winston and Michener (1977) has been followed. The pollen press is present in all the members of the family Apidae, with different degrees of development. A comparative study of the pollen press and the structures associated with it reveal three levels of specialization: 1) Pollen press usually poorly developed, as in the stingless bees (Meliponinae); 2) Pollen press well developed, its surface has been extended posteriorly in what has been called an auricle. This level of specialization is found in honeybees (Apinae) and bumblebees (Bombini); 3) Pollen press well developed, but not extended into an auricle. In the Euglossini we found a new structure associated with the pollen press, namely an enlargement of the external and posterior border of the distal tibial foramen, forming a dome-like swelling, here called the tibial bulla (Lat. *bulla*, a bubble).

MELIPONINAE

In the stingless bees the pollen press is represented by a rather weakly arched carina (Fig. 2), which is fringed with relatively small hairs (Fig. 1). It is located on

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the outer surface of the hind basitarsus, across the base of its neck, and diagonally placed. Because the auricle is absent the pollen press is perhaps less effective than in the honeybees.

The contraction of the depressor of the hind tarsus, which arises on the anterior wall of the tibia and inserts ventrally on the anterior base of the basitarsus, will expose the pollen press, showing a triangular area on the distal end of the tibia (Fig. 1). This triangular area is surrounded by the rastellum, the hairs of the pollen press, and the penicillum. It is possible that the pollen is placed on this triangular area by the action of the rastellum which rakes the pollen from the basitarsal brush of the opposite leg. When the levator and the depressor muscles of the hind tarsus contract, this would tend to flex the basitarsus. By doing so the pollen press may push the pollen grains toward the corbicula, the penicillum could direct the pollen when it is pushed upward.

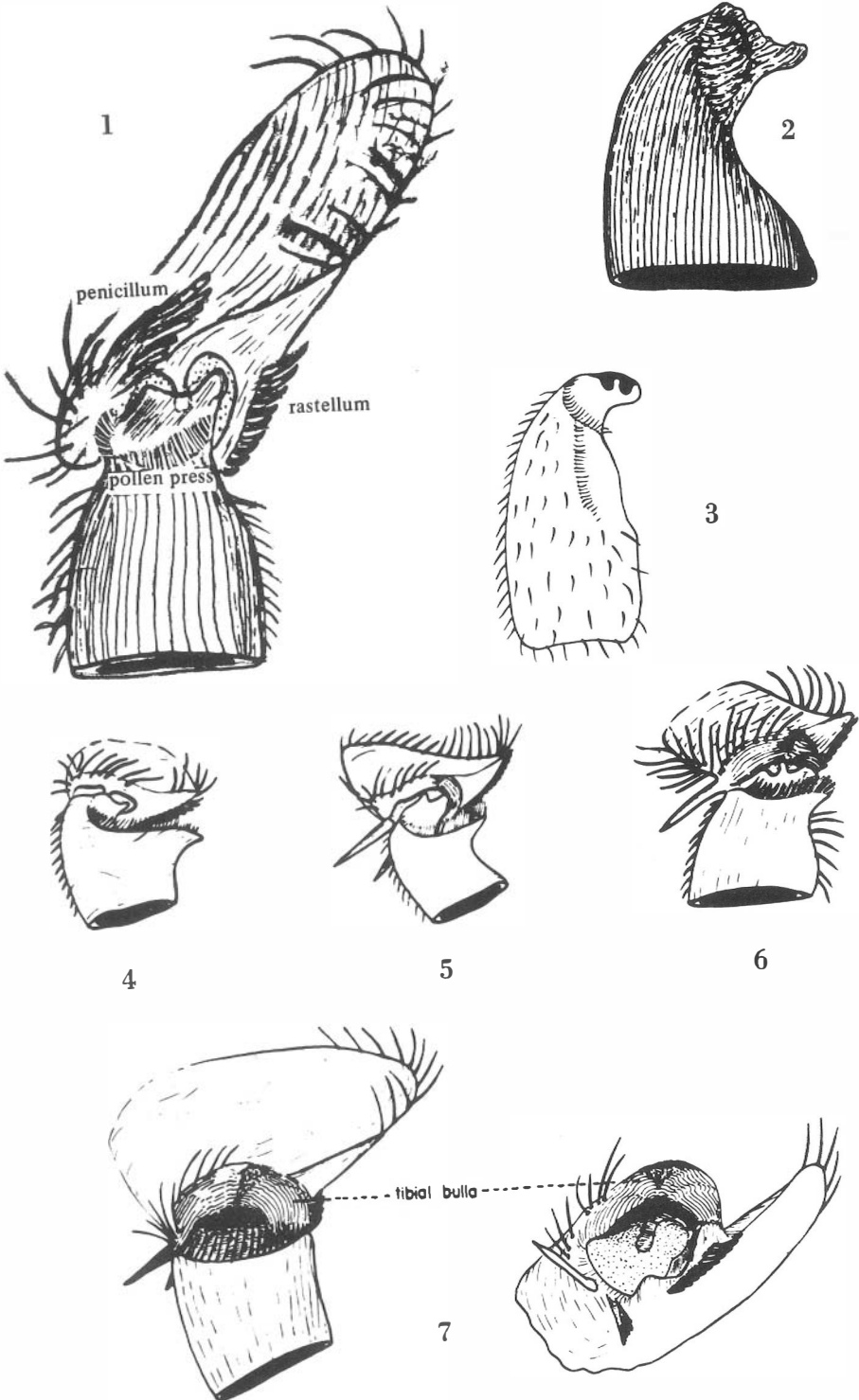
Among the Meliponinae the pollen press can differ in several ways: in the subgenus *Oxytrigona* it is rather well developed, with a larger carina and longer hairs. On the other hand, in the subgenus *Partamona* it is poorly developed and is somewhat vertically located; in the subgenera *Plebeia*, *Paratrigona* and *Nannotrigona* it is small, and usually covers only half the width of the proximal portion of the basitarsus. Finally, in most Indo Malayan *Tetragona*, and *T. pfeifferi* (an American *Tetragona*), the pollen press has an additional row of hairs (Fig. 3).

APINAE AND BOMBINAE

In the honeybees we found the first specialization: the auricle (Fig. 4), which is very effective in transferring pollen to the corbicula as explained by Snodgrass. The auricle is also found in Bombini (Figs. 5,6) and works in the same way as in *Apis*. In the bumblebees, however, we can also detect the beginning of the other specialization, the formation of the tibial bulla (Fig. 6), which is highly developed in the Euglossini (Fig. 7).

In the Euglossini the auricle is never developed, and the pollen press fits very neatly over the tibial bulla. The bulla carries a band of very fine hairs (Fig. 7), also found in several bumblebees (Fig. 6). The bulla is hollow and opens where the basitarsus and the tibia articulate, this leaves a cavity when the basitarsus is well extended (Fig. 7). There is no question that the tibial bulla is a very specialized structure in the Euglossini; its function, however, is not obvious at all. Pollen was found inside the bulla in two specimens.

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- Fig. 1. Lateroapical view of distal portion of tibia and proximal section of basitarsus, showing pollen press and nearby structures of *Trigona (Tetragona) acapulconis*.
- Fig. 2. Basal and outer portion of left hind basitarsus of *Trigona (Tetragona) nigra*, showing pollen press with hairs removed.
- Fig. 3. Outer view of basitarsus of *Trigona (Tetragona) atripes* showing pollen press and additional row of hairs.
- Fig. 4. Pollen press of *Apis mellifera*.
- Fig. 5. Pollen press of *Bombus volucelloides*.
- Fig. 6. Pollen press of *Bombus* sp., showing development of tibial bulla.
- Fig. 7. Pollen press and tibial bulla of *Euglossa cordata*.



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RESUMEN

El estudio comparativo de la prensa del polen y de algunas estructuras asociadas con ella en las abejas de la familia Apidae, demostró tres niveles de especialización: 1) en las abejas Melipónidas la prensa del polen es generalmente poco desarrollada, en otros (*Trigona atripes*) tiene una hilera de pelos adicionales en forma vertical; 2) en Apini y Bombini es muy desarrollada y se extiende posteriormente en una aurícula; 3) en Euglossini, carece de aurícula y está asociada con un engrosamiento en forma de bola en la parte externa y posterior del borde distal del foramen de la tibia. A esta estructura, cuya función se desconoce, se le llamó bula tibial. En las abejas Bombini se puede notar el inicio del desarrollo de la bula tibial.

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