

synapomorphies which support the sister-group relationship of Vespidae and Scoliidae, only 5 states are unique derivations and the remains are considered as convergent and reversal states. Second, the 3 states of these 5 unique derivations (i.e., an enlarged clypeus, a dorsal production of the pronotal angle, and a sunken prosternum) are difficult to divide into discrete states. In addition, the similar states are also found within a certain members of Formicidae (cf., BROTHERS, 1975). Thirdly, the remaining 2 states (i.e., an elongated labio-maxillary complex by production of glossa and paraglossa, and the third mesosomal phragma expanded laterally with large muscles attaching on the second phragma) are also doubtful. Seemingly these are convincing evidence for sister-group relationship of Vespidae and Scoliidae. However, these character states are considered to be modified uniquely within Formicidae, because the labio-maxillary complex is specialized for trophallaxis and thoracic condition is simplified for its mode of social life in Formicidae.

Thus the hypothesis of BROTHERS & CARPETER (1993) is less plausible. The present study shows that Vespidae is more closely related to Formicidae than Scoliidae.

#### *The abdominal structure of the ant tribe Amblyoponini*

The abdominal character of the ponerine tribe Amblyoponini presents a major puzzle to formicid systematists (HÖLLODBLER & WILSON, 1990). The second abdominal segment of this tribe is attached broadly to the third segment, like taphiids, which is widely acknowledged as ancestral condition of formicid group. In contrast, the second segment is attached narrowly to the third segment in the the oldest fossil ant subfamily Sphecomyrminae.

The present study indicates that the abdominal structure of Amblyoponini are different from that of Taphiidae. Instead, the ant has more laterally expanded anterolateral corners of the pretergum of the third abdominal segment like other modern formicids. This structure is associated with the development of lateral depressions on the posterior foramen of the second abdominal segment in which the anterolateral corners of pretergum of the third segment are received. In addition, the pretergum and presternum on the fourth abdominal segment are developed in Amblyoponini.

Thus I suspect that the taphiid-like abdominal appearance of Amblyoponini may be secondary modification from a narrowly constricted condition as in most ponerine abdomens. This might be the result of the shift in the origins of muscles Nos. 8 and 10. These muscles are usually originated from the part of posttergum of the third abdominal segment. But in Amblyoponini, they are from the part of pretergum of the third abdominal segment, so that the length is increased (Fig. 18).

In the skeletal condition of most ponerine abdomens, because the pretergum