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The spatial complexity in describing leg surfaces of Hymenoptera (Insecta), the problem and a proposed solution

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Abstract

A significant procedural problem in describing the leg surfaces of Hymenoptera, which has not been explicitly treated in the literature before, is identified and a mitigating solution is proposed. The first accurate, three-dimensional illustrations of the surfaces of the three pairs of legs are also provided to illustrate the problem and the proposed solution. In Hymenoptera, the orientation of the front, middle and hind pairs of legs relative to the body can and often do differ in direction by up to 180º between the front and hind legs. Furthermore, the tibiae and tarsi are usually held at an abrupt angle relative to the femora. Because of this, the terms *anterior*, *posterior*, *lateral*, *outer*, *mesal*, *inner*, *dorsal*, and *ventral*, when applied to surfaces of different parts of different legs will frequently refer to non-homologous areas depending on whether the terms are interpreted or used in an anatomic sense or based on the specific direction and orientation of the part of the leg being described (vernacular sense). Authors often use the vernacular interpretation, but we show that such usage makes the terminology on average 53.1% incompatible for the same anatomical surfaces of the femora, tibiae and tarsi of the three sets of legs. To create equivalence between anatomical and vernacular senses, four intuitive vernacular terms are proposed as explanatory or auxiliary terms for the anatomical terms "dorsal", "ventral" "anterior", and "posterior", respectively, *kickface*, *gripface*, *foreface*, and *backface*. The terms are proposed as auxiliary or explanatory terms and not as substitutes for the anatomical terms.

Key words: abduction, Aculeata, adduction, mesosoma, Parasitica

Introduction

Because of phylogenetics, the search for homologous morphological terminology has become crucial. For the Hymenoptera, there are several contemporary publications illustrating the importance of this issue, such as Gibson (1985, 1993), Sharkey (1994), Sharkey & Wharton (1997), Vilhelmsen (1996, 1999), and Mikó *et al.* (2007). Morphological descriptions, however, often consist of two distinct categories of descriptors. The first are the names of body parts proper and the second are adjectives or other words that refer to specific areas of each named body part, such as ventral, dorso-lateral, subapical, basal, etc. The latter terms are usually straightforward because most body parts are unique or have only one right/left component and are not or little movable relative to each other. This is not the case, however, with the legs. In Hymenoptera as well as other insects there are three pairs of legs and these usually are highly movable. Because of their articulation with the thorax not only can the direction of the front, middle and hind legs differ up to 180º but the legs can rotate relative to the vertical plane and the tibiae and tarsi are normally held at an abrupt angle relative to the femora. Consequently, the terms *anterior, posterior*, *lateral*, *outer*, *mesal*, *inner*, *dorsal* and *ventral*, when applied to the orientation of a specific part of a specific leg (vernacular sense) rather than in the anatomic sense, will most of the times refer to non-homologous areas. This can result in confusion when positional terms are interpreted in the vernacular sense if they were originally used in the anatomic sense, or vice versa. For example, the anatomically correct and fully comparable description "posterior face of the femur", which is

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