



On the usefulness of ratios for the identification of some Mediterranean species of the genus *Ameles* Burmeister, 1838 (Insecta, Mantodea)

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Abstract

Identification of *Ameles* species is a difficult task requiring much experience because of ambiguous descriptions with few drawings and great intraspecific morphological variability. Our objective was to find characteristics that could be reliably used for species identification and would be independent of experience. We identified 12 to 60 specimens of each of 5 target species, *A. spallanzania* (Rossi), *A. decolor* (Charpentier), *A. africana* Bolivar, *A. picteti* (Saussure), *A. heldreichi* Brunner and 1 to 4 specimens of 7 additional species, *A. nana* Charpentier, *A. kervillei* Bolivar, *A. modesta* Bolivar, *A. maroccana* Uvarov, *A. dumonti* Chopard, *A. fasciipennis* Kaltenbach and *A. poggii* Lombardo, from the Mediterranean area and based on traditional keys. For our analysis, we focused on ten morphological characteristics (lengths of body, pronotum, supracoxal dilatation, fore coxa, fore femur, fore tibia, tegmina, width of the head, minimum width of the pronotum, and maximum width of the fore femur) and five ratios (length to width of the frontal sclerite, pronotum, femur, subgenital plate, and hypophallus), analysed with non-metric multidimensional scaling and linear discriminant analysis. Fewer mis-assignments of species resulted when ratios were used instead of absolute measurements. Among the target species, *A. decolor* was seldom mis-assigned as another species; *A. spallanzania* was often mis-assigned as *A. africana*, while the opposite occurred less frequently; *A. picteti* was also frequently mis-assigned as *A. heldreichi*. For the target species, we devised an identification key based on ratios along with morphometric descriptions that appears to work well, because ratios are easily applicable and independent of specimen size. Furthermore, we confirm the synonymy of *A. spallanzania* and *A. africana*, recognize that *Ameles nana* is not a synonym of *A. spallanzania*, and find that *A. poggii* is more similar to *A. spallanzania* than to similar to *A. picteti*.

Key words: praying mantids, morphological characteristics, NMDS, LDA, misidentification

Introduction

Mantids are carnivorous insects preying upon a wide array of animals, ranging from springtails to small vertebrates (Prete *et al.* 2002) and are occasionally used in biological pest control (Symondson *et al.* 2002). A number of studies focusing on their evolutionary relationships and phylogeny have been published in recent years (e.g. Deitz *et al.* 2003; Wieland 2006; Svenson & Whiting 2004, 2009). The current, morphology-based mantid classification appears to be largely artificial as it heavily relies on historical concepts of phenetic similarity rather than phylogenetics (Svenson & Whiting 2004, 2009). This poor understanding and the consequent misinterpretation of mantid morphological variability compromises our ability to assign certain populations to a given species, as the boundaries between them have sometimes proven to be difficult to discern when relying on external morphology only.

The problem of species identification is particularly acute for the *Ameles* (Burmeister, 1838). This genus comprises 23 species in the Mediterranean area, the Middle East, and Russia (Harz & Kaltenbach 1976; Ehrmann 2002; Heller 2004; Abu-Dannoun & Katbeh-Bader 2007, Stolyarov 2009) (Fig. 1). Many of the species are sympatric within the range of the genus. *Ameles* species are identified mainly on the basis of their external