

**Function and evolution of spider genitalic structures, exemplified
by the cheliceral apophyses in Pholcidae and the retrolateral
tibial apophysis in the rta-clade**

BERNHARD A. HUBER

Institut für Zoologie der Universität Wien, Althanstraße 14, 1090 Wien, Austria

In addition to sperm transfer, the male spider genital organ has been attributed further functions in the context of sexual selection. Genital bulbs may function e.g. as "internal courtship devices" influencing the outcome of female choice, or as plugging devices that affect further insemination attempts by other males and thus work in the field of male-male competition. Rapid and divergent evolution of the bulbal structures (documented by their species-specificity) could both be attributed to selection in the context of the function of sperm transfer (mate choice by mechanical fit) and to selection in relation with the additional functions indicated.

How far can these patterns be extended to other, non-bulbal structures that are species (and sex-) specific? This question was investigated by two examples: the retrolateral tibial apophysis (rta) on the male pedipalp in the rta-clade, and the cheliceral apophyses in male pholcids.

The function of the rta was investigated in eight genera by freeze-fixation of copulating spiders and preparation of histological serial sections of the organs in functional contact. In all but one cases, the rta gets fixed to the female at the beginning of copulation and brings the genital bulb into an appropriate position for intromission. This is in contrast with previous views that ascribed to the rta an internal stabilizing function for the genital bulb.

The function of the cheliceral apophyses in Pholcidae was investigated in three genera with the same methods as above. These apophyses are provisionally divided into the frontal and the lateral apophysis. The lateral apophysis is confined to about ten genera and was found to arrest precopulatory pedipalpal rotation by interaction with the pedipalpal trochanter apophysis (presumably a synapomorphy of these genera!). The frontal apophysis is present in nearly all pholcid species and is often one of the best characters for species identification. It is brought into contact with the female at the beginning of copulation and helps the male to position himself correctly relative to the female copulatory organ.

Species-specificity of these structures (rta and frontal cheliceral apophysis) is considered to result from the same selective forces that were also found to effect the sperm transferring organ itself. There is certainly strong selection on the male's ability to position himself correctly as this is a primary condition for successful sperm transfer. So far it cannot be decided with certainty whether there is also active female choice by stimulations (appropriate female sensory structures were not found), but the predominance (or even exclusiveness) of mate choice by mechanical fit for the explanation of rapid divergent evolution in spider genitalic structures is strengthened by the present study.

References

HUBER B. A. in press: The retrolateral tibial apophysis in spiders—shaped by sexual selection? *Zoological Journal of the Linnean Society*.