Abstract:

The taxonomic concept of the algal genus *Mallomonas* (Synurales, Synurophyceae) was based on an extraordinary morphological diversity of their siliceous scales. The main aims of this study were elucidation of phylogenetic relationships among its representatives and reconstruction of shape evolution of particular siliceous structures of their scales. Molecular data for six species were acquired for the first time, enabling a successful assessment of their phylogenetic relationships with the other representatives of the genus. On the basis of molecular data, the genus *Mallomonas* can be divided in two evolutionary lineages and this division is also reflected morphologically (with only a few exceptions) through presence or absence of a V-rib structure. Fine ornamentation of siliceous scales is species-specific and interestingly, the overall differences in morphology of siliceous scales are mostly reflecting phylogenetic relationships among representatives of the genus. In this context, morphological species concept of *Mallomonas* seems to be justified. Morphologically-based sections of the genus are often paraphyletic, because small sections (frequently containing only single species) tend to be nested within particular larger sections. The main reason for this discrepancy is accelerated morphological evolution of some species, which leads to striking differences in phenotypes between such species and their closest relatives. Morphological comparisons of siliceous scales belonging to both recent and fossil accessions of some species of *Mallomonas* suggested that morphology of some of the taxa have not changed over tens of millions years. On the other hand, some other taxa underwent conspicuous changes of their overall morphology in the same time frame. For morphological traits with a significant phylogenetic signal estimated using parameters D and lambda, reconstructed trends of shape evolution were mapped on a phylogenetic tree. The trends of shape evolution of particular morphological structures were quite various. While some of the structures likely had single origin and conserved evolution, the evolution of other structures was more dynamic, with independent origins and secondary losses. Thus the character of evolution of siliceous structures depends both on a morphological trait studied and a particular evolutionary lineage of the genus *Mallomonas*.

Key words: *Mallomonas*, shape evolution, siliceous scale, phylogeny, Synurales