

# **Evolution of head structures in Coleoptera with special emphasis on the feeding apparatus and miniaturized forms**

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The structure of the feeding apparatus is extremely important, as it determines the biology and ecology of the species. Insect mouthparts display an impressive variability, and adaptations to an extremely broad spectrum of food sources. It is apparent that modifications in this character system had a major impact on the evolution and ecology of Coleoptera and other groups of insects. The megadiverse coleopteran suborder Polyphaga has evolved a plethora of feeding habits, with saprophagy and a specific feeding apparatus as a possible starting point. Ptiliidae (Staphyliniformia) includes the smallest free-living insects (0,325 mm). Head structures of different genera of Ptiliidae with saprophagous and sporophagous feeding preferences and different body size were documented. Obtained data were compared with cephalic conditions in other saprophagous beetles and the evolution of the feeding apparatus in Coleoptera was discussed.

The results suggest that a complex feeding apparatus has evolved early in Coleoptera, probably in the stemgroup, with mandibular grinding molae and setose epipharyngeal and hypopharyngeal bulges (processes) belonging to the ground plan of the order. This condition is preserved in the small suborder Myxophaga and different subgroups of Polyphaga, but is not found in Archostemata and the carnivorous Adepaga. Despite of minute body size, the saprophagous feeding habits of Ptiliidae do not differ strongly from those of Myxophaga or other groups of Polyphaga. Within the family, a shift from primarily saprophagous feeding took place twice: first to sporophagy in the basal branch, and then to microsporophagy in the extremely miniaturized Nanosellini.