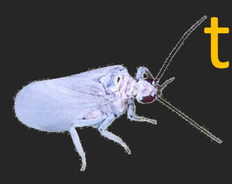
Two subfamilies, two strategies – unexpected differences in the effects of miniaturization in Coniopterygidae (Neuroptera: Insecta)



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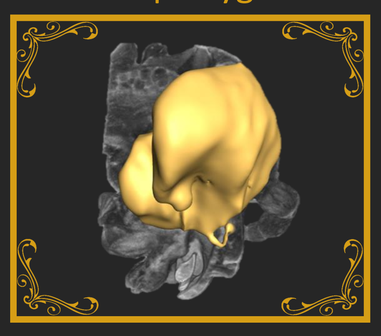
The Coniopterygidae, or “dustywings”, can be regarded as the midgets of Neuroptera. While there are singular species with a small body size in different neuropteran families, they are the only family with a small body size throughout all species. The Coniopterygidae comprise three subfamilies, of which representatives of two, the Coniopteryginae and the Aleuropteryginae, have been examined regarding their head anatomy.

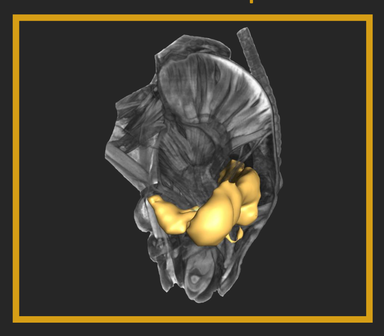
Several structural modifications correlated with miniaturization are recognized in comparison to larger Neuroptera: a relative increase in the size of the brain, a reduction in the number of ommatidia and diameter of the facets, a countersunken bell-shaped ocular ridge, and a simplification of the tracheal system by reduction of the dorsal tracheal stem.

Coniopterygidae

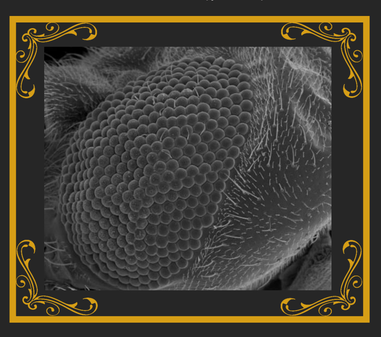


Coniopteryx pygmaea, body length: 1.5 mm
relative size of the brain (yellow)

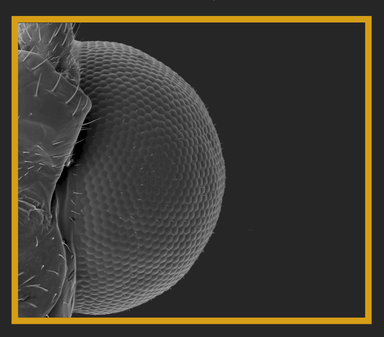
other Neuroptera



Polystoechotes punctatus, body length: 35 mm
relative size of the brain (yellow)

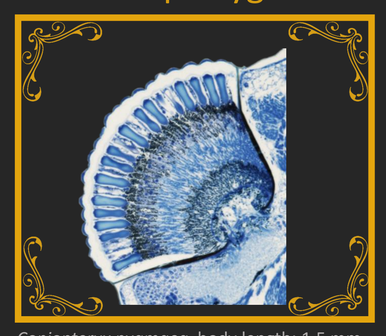


Coniopteryx pygmaea, body length: 1.5 mm
number and diameter of facets ≈280, ≈10 µm



Chrysoperla carnea, body length: 10-12 mm
number and diameter of facets ≈1600, ≈18 µm

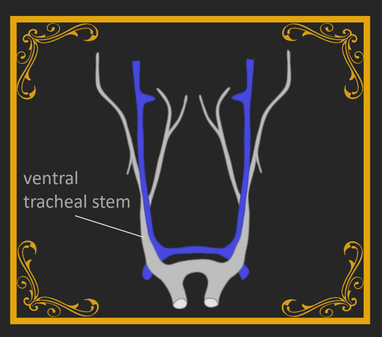
Coniopterygidae



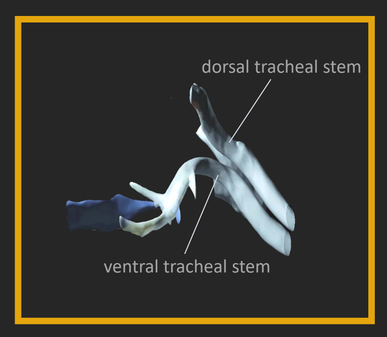
Coniopteryx pygmaea, body length: 1.5 mm
ocular ridge bell-shaped

other Neuroptera

Chrysopa dorsalis, body length: 13 mm
ocular ridge approximately planar



Coniopteryx pygmaea, body length: 1.5 mm
one tracheal stem



Osmylus fulvicephalus, body length ca. 15 mm
two tracheal stems

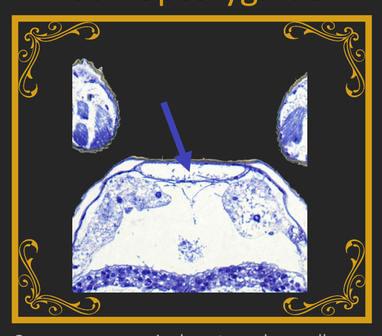
Coniopteryginae

Coniopteryx pygmaea, lateral,
hypostomal bridge (red) and tentorium (yellow)

Aleuropteryginae

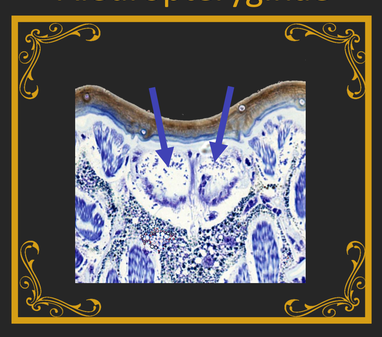
Aleuropteryx juniperi, lateral,
gula (red) and tentorium (yellow)

Coniopteryginae



C. pygmaea, one single antennal ampulla

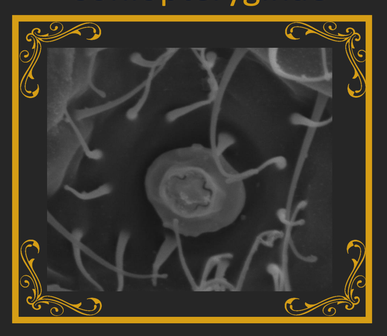
Aleuropteryginae



A. juniperi, two separate antennal ampullae

Beside these miniaturization effects, which both families have in common, some structures evolved strikingly different in response to the constraints correlated with a small body size: the relatively increased suboesophageal ganglion in Coniopterygidae necessitates a forward shift of the mouthparts and thus a ventral closure of the head capsule, which is realized as hypostomal bridge in Coniopteryginae, while it is a gula in Aleuropteryginae. Furthermore, the dorsal tentorial arms are reduced in Coniopteryginae, whereas they are directed posteriorly and fused in Aleuropteryginae, forming an arch. The antennal ampullae are fused in Coniopteryginae but are distinctly separated in Aleuropteryginae. Also the shape of the opening of the wax glands is subfamily specific: four-leaf clover-shaped in Coniopteryginae, and roundish in Aleuropteryginae.

Coniopteryginae



C. pygmaea, wax pore with four-leaf clover - shaped pore opening

Aleuropteryginae

A. juniperi, wax pore with roundish opening

The unexpected intrafamiliar diversity illustrates the increase of variability, observed in other miniaturized taxa, for the first time in insects. As a conclusion we suggest to increase the taxon sampling of miniaturized forms in morphology-based phylogenetic analyses.

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