

FINAL MEAL OF A FOSSIL FLY – EVIDENCE OF POLLEN CONSUMPTION AND INFERENCE OF PRESENT-DAY BIOLOGY

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The interaction between flowering plants and insects is believed to date back to the Early Cretaceous and be fundamental to the parallel diversifications in angiosperms and flower-visiting insects. The course of this evolution is shrouded by the lack of fossils providing direct evidence for flower-insect interactions. This study presents a unique fossil fly, from the early Cenozoic of Europe, with the contents of its digestive system still preserved. The fossil was collected in the middle Eocene Messel pit in Germany and was described as *Hirnoneura messelense* Wedmann, Hörnschemeyer, Engel, Zetter & Grímsson, 2021. The fly shows a conspicuously swollen crop inside its abdomen, which is filled with pollen. It was possible to sample pollen grains from the crop and to identify pollen from at least four different plant families. We used this information to interpret its foraging behaviour, to reconstruct its preferred habitat, and to conclude about its pollination role and importance in paratropical environments. This fossil represents the first record of pollen-feeding in nemestrinid flies, both fossil and extant. The research presented crosses disciplinary boundaries by combining paleontological research with present-day ecological research. The palynological methods employed are the same as in extant palynology yet involving pollen from the Eocene. Our study clearly shows that it is possible to deduce detailed and far-reaching insights from fossils by combining information from different disciplines and different methods of investigation; even so far as to provide predictive inferences on the biology and behaviour that have yet to be discovered of extant relatives.