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Evolution of reproductive strategies in dictyopteran insects—clues from ovipositor morphology of extinct roachoids

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Dictyoptera, which comprises cockroaches, termites and mantids, is a quite successful group of insects in evolutionary terms with a long fossil record—roachoid insects were already abundant 315 million years ago in the Carboniferous forests. One of the most remarkable autapomorphies of extant dictyopterans, and possibly a major factor for their persisting success, is the ability to produce oothecae. Despite the robustness of this sort of egg package, fossils of oothecae are very rare, the oldest direct evidences being from the Cretaceous Crato Formation in Brazil (115 mya). The ability to produce oothecae is presumably linked to a specific ovipositor morphology, including a significant length reduction. Hence, ovipositor morphology can indirectly inform about the reproductive strategy of a species. Herein we describe the ovipositor morphology of various fossil forms of dictyopteran insects. Early fossil roachoids, in contrast to the modern forms, possessed a very long and prominent ovipositor, reminiscent of the ovipositor in orthopterans (Ensifera), indicating that these forms laid individual, rather small eggs into a substrate. We present examples from different fossil deposits, which show the entire range of ovipositor morphologies, from very long forms over forms with ovipositors partly reduced in length to modern-appearing morphologies. Most remarkably, different shapes of ovipositors seem to be present in roachoids in the fauna of the 115 million years old Crato Formation—species with long prominent ovipositors co-existed with species with a reduced short and broad ovipositor. Additionally, females that carry oothecae attached to their abdomen indicate a third type of ovipositor: a further reduced ovipositor as seen in modern forms, which already allowed the internal production of oothecae.

Key words: Dictyoptera, Blattodea, reproductive behaviour, oviposition, evolutionary reconstruction, Palaeozoic.

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