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Species Diversity and Developmental Patterns of Phorid Flies for Forensic Application

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Structured Abstract

Background: Forensic entomology is a vital field for estimating the postmortem interval (PMI) based on insect development. While blowflies are the primary indicators, phorid flies (Diptera: Phoridae), also known as "scuttle flies," are increasingly significant because they can reach bodies in enclosed, buried, or hidden environments where larger flies cannot enter. Despite their specialized ability to colonize remains in restricted environments, comprehensive data regarding their global species diversity and developmental biology remains scattered. This critical review aims to identify the variety of forensically relevant phorid species and analyse their life cycle patterns. By synthesizing existing research, this study seeks to provide a clearer understanding of how phorid development can be used to improve the accuracy of PMI estimations in complex legal investigations.

Methods: This review involved a comprehensive analysis of global and local literature regarding phorid fly succession and life cycles. Data were synthesized to evaluate species-specific growth profiles under various environmental conditions. Specific attention was given to mathematical models for PMI calculation, particularly the linear regression method by Ikemoto and Takai (2000), which determine the lower development threshold (T_0) and the thermal summation constant (K), and in return complement value for PMI. The study also assessed the application of isomorphen and isomegalen diagrams as visual tools for age estimation. These tools allow for a more precise correlation between ambient temperature and the physiological age of the specimen

Results: This review identifies *Megaselia scalaris, Megaselia spiracularis*, and *Dohrniphora cornuta* as the most prevalent phorid species recovered from forensic cases globally, including reports from Asia, Europe, North and South America continent. *M. scalaris* is highlighted as a highly resilient species capable of colonizing buried remains at significant depths. Studies utilizing the Ikemoto and Takai model reveal that these species exhibit specific thermal requirements, with *D. cornuta* often showing different developmental thresholds compared to *Megaselia* species. Furthermore, isomegalen diagrams provide a reliable method for estimating age based on larval length, though results vary significantly depending on moisture levels and carcass substrate. This review suggests that standardized developmental datasets for these three key species are vital for the advancement of forensic entomology in diverse geographical regions.

Conclusion: In conclusion, phorid flies are essential indicators in specialized death scenes where traditional indicators are absent. Utilizing species-specific developmental data with thermal summation model and visual growth diagram has strengthens PMI estimation in forensic entomological evidence.

Keywords: Phorid flies, Post Mortem Interval, Forensic Entomology.

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