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Development models and larval aggregations of necrophagous beetle *Necrodes littoralis* L. (Staphylinidae: Silphinae)

ABSTRACT

Necrophagous insects are used by forensic entomologists to estimate the post-mortem interval, i.e. the time that elapsed from death to the disclosure of the body. The most studied and most frequently used insects for this purpose are flies. Beetles are the second very important order of insects among the necrofauna. One of the representatives of this order, *Necrodes littoralis*, is often noted on human corpses. Therefore, it has great potential for use in forensic entomology to estimate the post-mortem interval. However, until now, there were no appropriate development models for this species, which limited its use in court cases.

Larvae of necrophagous insect often form aggregations on carrion. This is a common phenomenon, especially in Calliphoridae larvae. It can be very beneficial, as it has a positive effect on the temperature and development of the larvae. Previous studies in flies have shown that aggregation behaviour can be triggered by chemical cues, thermal stimulus, or thigmotaxis. *N. littoralis* has also been observed to exhibit this type of behaviour. However, until now, there was a lack of information on the mechanisms underlying this behaviour in the studied species and its impact on preimaginary development.

The first aim of my research was to investigate the patterns and mechanisms of aggregation of *N. littoralis* larvae. For this purpose, we conducted behavioural tests on the larvae in laboratory conditions. They showed that the larvae form stable aggregations and exhibit thermoregulatory behaviours, responding to thermal signals and accumulating in the warmest places on the research area. The second objective was to check the effect of feeding of larvae in aggregations on their development. In the study, I compared the development of larvae reared individually and larvae reared in aggregations (50 larvae). Results showed that aggregation behaviour is particularly beneficial for insects developing at low temperatures, significantly reducing mortality and facilitating growth. The third aim was to create temperature models of *N. littoralis* development, which can be used in practice by forensic entomologists to estimate the post-mortem interval. I created the models using data collected during extensive development studies conducted at 10 constant temperatures. I created thermal summation models, isomorphen and isomegalen diagrams and growth curves. The last aim was the initial validation of these models. It showed that thermal summation models give the most accurate estimates of physiological age. Most of the development models of *N. littoralis* allowed for a satisfactorily accurate estimation of the age of beetles in laboratory conditions, which initially confirms their usefulness for forensic entomology.