ABSTRACT

This thesis deals with thermoregulation in red wood ants, in *Formica rufa* group. Our aim was to better understand the mechanisms by which red wood ants maintain thermal homeostasis in their nests. Red wood ants are known to keep high and stable temperatures in their nests from spring to autumn. Most emphasis is placed on the role of the nest mound as a solar collector or on a heat production by microbial community present in the nest material. However, some researchers believe that wood ants are able of active nest thermoregulation in which they can affect the nest temperature by behavioural reactions, mainly by sun basking, increased metabolic heat production or heat transport.

The thesis consists of three research articles. The first one is focused on the timing of thermoregulation in red wood ants, the second one investigates in more detail one specific aspect of red wood ant thermoregulation - a sun basking behaviour. These two papers provide data from long-term field observations and experiments. The last paper is based on laboratory experiments where we tested a hypothesis resulting from field observations.

Thanks to the field research we found out that ant activity (traffic on ant trails) significantly correlates with nest temperature; once the activity decreased the thermal homeostasis broke down. In agreement with older authors we observed sunning clusters of red wood ants in early spring. We went further and revealed a breaking point at which a positive phototactic behaviour (sun basking) turned to a negative phototaxis (sun avoidance). The breaking point was 42.8 °C which is slightly above the lethal temperature for *F. polyctena*. Our results suggest there is a trade-off between colony and individual needs, i.e. high temperature inside the nest which speeds up brood development and survival of individual workers.

Laboratory observations enabled us to closely follow individual behaviours in sunning clusters. We found out that not all ants take part in sunning and we hypothesised that sun basking might be a specific task. We also measured a metabolic rate (respiration) at the temperatures encountered during sunning. Our results confirm that sunning increases the metabolic rate temporally, but the increase does not persist. Therefore we suggest that a direct heat transport may play a role in the nest thermoregulation of red wood ants.