ABSTRACT

This thesis focuses on various factors affecting effectiveness of aposematic signals against avian predators. Adult, wild-caught as well as hand-reared juvenile great tits (*Parus major*) were used as predators in the experiments. The thesis consists of the following four studies.

In the first study, we compared the reactions of great tits from two geographically distant populations toward aposematic firebugs (*Pyrrhocoris apterus*) and their non-aposematic artificially made colour variant. The birds from the Bohemian population mostly avoided aposematic firebugs and attacked non-aposematic variant. Finnish birds, which lacked experience with firebugs from their natural environment, were less hesitant to attack both firebug colour forms. Although the Bohemian birds avoided the aposematic prey variant, they were not more neophobic than Finnish birds. We conclude that the geographic differences in reactions of the birds to aposematic prey can be explained by a different population-specific experience of the birds with local aposematic prey communities.

In the second study, we compared effectiveness of two chemical defence strategies in leaf beetle larvae (Chrysomela lapponica) against great tits. The birds avoided larvae devoid of external secretions after the first attack, which indicates the presence of non-volatile defensive compounds within the larval body. However, survival after the first attack was greater for larvae with intact secretions than for larvae with depleted secretions. Hence, both strategies of storage of chemicals, external secretion and storage in the body, act together against bird predation. Birds learned to avoid sequestered secretions faster compared to autogenously (*de novo*) produced secretions. Nevertheless, both strategies of chemical production provided effective protection against birds. We conclude that avian predation could contribute to the evolution of both secreted and stored defensive chemicals in *C. lapponica* larvae.

In the third study, we tested the hypothesis that different aposematic colour morphs of polymorphic leaf beetle (*Chrysomela lapponica*) differ in the effectiveness of their aposematic signals against avian predators. Juvenile great tits attacked beetles of all colour morphs (red-and-black light, red-and-black dark and metallic) at the same rate, while adults attacked light beetles at the first encounter more frequently than both dark and metallic beetles. Avoidance learning was similarly fast for all three morphs; therefore, colour displays of all morphs function as effective warning signals. Morphs differed in their memorability; the dark beetles were attacked more frequently than the other two morphs during the memory test. We hypothesise that, dark colour morphs may have a selective advantage at low population densities but they lose this advantage at high population densities due to the low memorability of their display. Thus, the direction of selective bird predation on aposematic morphs may depend on prey density, contributing to cyclic shifts in the morph frequencies.

In the fourth study, we compared the performance of great tits in sequential and simultaneous prey-discrimination tasks. Colour was more effective discriminative cue than pattern for both adult and juvenile great tits. The birds performed equally well in sequential and two-choice task, but their performance in multiple–choice task was worse than in the other two tasks. Nevertheless, these differences were found only when the birds used pattern as a cue for discrimination. The birds tested with colour, more salient cue by itself, performed equally well in all three tasks. We conclude that the type of the discrimination task may affect learning performance of bird predators, but the effect also depends on effectiveness of a particular discriminative cue; if a cue is highly salient, the type of used task might not be so important.

The results of this thesis contribute to understanding variability in reactions of avian predators toward aposematic prey as well as to understanding origin of the aposematic signal.