

Associations between individual behaviour and haemosporidian infections in model species of passerine birds

PhD Dissertation

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This project aimed to examine the presence of associations between behavioural variation of model species of passerine birds and their infections with blood parasites (Haemosporida). I tested two hypotheses:

- there is an association between the behavioural variation among host individuals (Common Nightingale *Luscinia megarhynchos*) and their chronic haemosporidian infections (presence and intensity);
- there are differences in host behavioural traits among uninfected birds, single infections with the genera *Plasmodium* or *Haemoproteus* and mixed infections with both genera (using the Yellow Wagtail *Motacilla flava* as a model bird species).

The differences of body indices in uninfected and infected birds were also tested.

Behavioural tests for either neophilia or neophobia, reaction to a novel environment and handling stress were performed to assess behavioural variation among birds. Blood-samples of each bird were scanned by both microscopic examination and PCR-based molecular diagnostic method for the presence and identification of haemosporidian parasites.

In a sample of 22 wild-caught nightingales (*Luscinia megarhynchos*), we compared uninfected and infected birds in single behavioural traits under the hypothesis that infected birds should show more risk-taking behaviours and quicker exploration. Infected nightingales were more prone to risk-taking and this behavioural trait was significantly correlated with the intensity of infection. No differences were found in exploration speed or body condition and reactions to a stressful situation, such as weight change in captivity and handling.

Following the hypothesis that a mixed infection by different parasite species should have higher effects than single-species infections, we analysed activity and boldness in wild-caught yellow wagtails (*Motacilla flava*) during the energetically demanding spring migration. Eighty-five percent of the birds were naturally infected with *Haemoproteus* or *Plasmodium* and 27% of individuals had parasites of both genera. No differences in activity were found among uninfected, single and mixed infection groups. Birds with infections with both genera appeared to be more fearful when first introduced to a cage. These birds also tended to be less likely to approach a novel object compared to uninfected birds and birds infected by a single genus only.

The results of the present study are described in the following publications:

Marinov, M., Zehtindjiev, P., Dimitrov, D., Ilieva, M., Bobeva, A. & Marchetti, C. 2017. Haemosporidian infections and host behavioural variation: a case study on wild-caught nightingales (*Luscinia megarhynchos*). *Ethology Ecology & Evolution* 29, 126–137. (doi: 10.1080/03949370.2015.1102776).

Marinov, M. P., Marchetti, C., Dimitrov, D., Ilieva, M. & Zehtindjiev, P. (in press). Mixed haemosporidian infections are associated with higher fearfulness in Yellow Wagtail, *Motacilla flava*. *Canadian Journal of Zoology*. (doi: 10.1139/cjz-2016-0121).