

**Oponent's review of Doctoral thesis of MVDr. Oldřich Tomášek, Ph.D.
'Condition dependence of sexually selected ornaments in birds'
in the field of Zoology, Faculty of Science, Charles University Prague**

The PhD thesis of MVDr. Oldřich Tomášek, Ph.D., is clearly structured. The aims are briefly but convincingly formulated. The introductory chapter 'Introduction and synthesis' is elaborated at a high scientific level. A brief 'Summary of main findings', Conclusions as well as the extensive list of References confirm author's excellent overview and erudition in the studied topics. Finally, copies of three papers and two manuscripts in prep. are attached.

Oldřich Tomášek is a corresponding and first author of three studies included in this PhD thesis. Two of them were published in highly acclaimed scientific journals, Scientific Reports and Proceedings of the Royal Society B. The third attached study is in the stage of prepared manuscript. The candidate's work on all publications is well-specified; it is required because all these studies have emerged from extensive teamwork, often with international participation. It is obvious that the candidate three times initiated and designed the studies, he participated in data collection including experimental and laboratory analyses (analysis of antioxidant capacity, spectrophotometric analysis of ornaments etc.), participated in statistical processing, interpretation of the results as well as in preparation of manuscripts. In addition, he significantly contributed in data collection and writing in the remaining two papers.

Striking ornamentation and its role in sexual selection in birds is attractive for many researchers who are devoting the effort to study it for more than three decades and Oldřich Tomášek with his team significantly contributed to this topic, using a multidisciplinary approach. In order to deal with complex issues and causalities they applied diverse and nontrivial methodologies from the fields of behavioral ecology, genetics, immunology and physiology. Their studies required a thorough analysis of paternity with subsequent searching of links with indicators of oxidative stress, redox homeostasis etc. on individual levels in order to interpret their possible role in sexual selection on a population level.

Although the thesis title is stated very broadly ('in birds'), the author's studies which are included there are focused exclusively on two model species, Zebra Finch and Barn Swallow, which certainly cannot completely cover the issues across the world of birds. However, the author is conscious of this fact; this is evidenced by a thorough chapter 'Introduction and synthesis', in which he took into account and in relevant contexts diverse results collected for many animal species, not only birds. In this chapter he also appropriately incorporated all key results of his own research, from which, by my opinion, clearly stems his contribution to the present knowledge.

While the Zebra Finch was used as a conventional laboratory model for specific experimental research of sperm morphology and velocity, the Barn Swallow was studied much wider and in the wild. Particularly in this case of Barn Swallow, I welcome a great opportunity to compare two subspecies of one widespread and prominent model species in two geographically distant regions, which subsequently led to interesting conclusions about the differences in sexual selection between the populations of same species.

General introduction and synthesis as well as the papers included in this PhD thesis were carried out with great care and are set well in a broader context. This raises some questions also of a rather general nature:

As Oldřich with his team found, the differences exist among swallow populations in length of tail streamers, darkness of ventral colouration etc. which probably have different signalling content and play different roles in sexual selection in individual populations. In line with this, a question about the general drivers of different coloration may arise. Specifically, how important is the role of various

environmental factors, e.g. food quality, or other breeding or wintering conditions on promotion of the different sexually selected traits?

Given that oxidative stress has been put forward as a universal mechanism maintaining signaling honesty and probably a major constraint in animal life history, can we specify general drivers of increased oxidative stress that could predict trends in sexual selection in some specific environments?

The authors found a long-term trade-off between carotenoid-based ornament expression and sperm resistance to oxidative damage. They stated that early-life stress may result in lower investment in sexual trait expression in adult age (p. 27). Should we thus consider as crucially important to study young individuals in the early stage of life (e.g., on nests) to correctly interpret their ornament expression and sperm resistance later in their adult age? Therefore the factors associated with feeding on the nest before fledging, weather conditions, disturbances, stress situations and parental care in this period may play a determining role?

As Oldřich states, considerable challenges remain to be addressed in future studies. My last question reflects numerous studies indicating differences in various aspects of life between the species inhabiting temperate zones and tropics. Could we expect also fundamentally different tactics of sexual selection in tropical birds compared with temperate birds, of which the author's current studies come from?

Summary of the review: I like to confirm that MVDr. Oldřich Tomášek, Ph.D. is an outstanding scientist with a great potential for systematic interdisciplinary work covering fields of behavioral ecology, physiology, immunology and genetics. He is highly experienced in field as well as laboratory work, in data analysis as well as writing scientific papers. The submitted doctoral thesis I strongly recommend to the defense and its author to award a PhD in Zoology at the Faculty of Sciences, Charles University Prague.

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