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Reviewer's report on the PhD dissertation by RNDr. Tereza Petruskova "Ecology and behaviour of two European pipit species"

The doctoral dissertation by RNDr. Tereza Petruskova deals with selected aspects of behavioural ecology of two common pipit species. The research was carried out in five sites in the Czech Republic over several years. The two pipit species were without doubt insufficiently studied in the context of intraspecific and interspecific aggressive behaviour, habitat selection, and song structure and function. The results of the study importantly contribute to our knowledge of the behaviour of the study species and mechanisms of their coexistence, and provide a lot of new and important information about the structure and micro- and macro-geographic variation of the tree pipit song.

The dissertation consists of an introductory chapter and five chapters containing four research articles (mostly published in high-ranked scientific journals, the first paper with 8 citations according to ISI Web of Science) and one manuscript (which to my knowledge has just been accepted for publication in a good ornithological journal). Its structure is appropriate and satisfies the formal requirements for a PhD thesis.

All the papers contained in the dissertation are a joint work. Unfortunately, I have found no formal statement in the thesis about the contribution of Mrs Petruskova to each of these papers, which are included in the dissertation. However, seeing that Mrs Petruskova is the first author of all five papers, I have faith in that her contribution to these papers was significant enough for these papers to be included in her doctoral dissertation.

There are three main themes to the dissertation by Mrs Petruskova. Below I will talk them over one by one in the order in which they appear in the dissertation.

First theme of the thesis is the mechanism allowing the coexistence of the two pipit species, and results of the study are reported in first two papers (chapters). The first paper (Chapter I) concerns the spatial and habitat relationships of the study species; in particular it focuses on the habitat selection and habitat preference. I like this study. It has been well designed and the results well analysed statistically and presented. Although the conclusions concerning the different habitat selection in these pipit species are not innovative nor unexpected for me, the paper is important as it for the first time describes quantitatively habitat relationships between the tree and meadow pipits. Such an analysis is the first step in research concerning mechanisms allowing coexistence of two bird species.

As regards this paper, I have got one question to the Author:

Question #1: Presumably, pipit males that were followed for delineating of territories were not individually marked (although it was not clearly stated in the paper). Impossibility of identification of individual males is usually a serious flaw in studies of territory size and location. Please justify why pipit males were not marked individually in your study.

The second paper (Chapter II) concerns interspecific aggressive behaviour in the study species, and directly corresponds with the first one. The study has been properly designed. The hypothesis has been properly stated and tested. I appreciate much that the authors paid attention to the importance and consequences of the order of stimuli in interpretation of results of playback experiments. The main conclusion that it is different habitat preferences that are responsible for the observed pattern of spatial distribution in the study species is convincing for me.

As regards this paper, I have got one comment:

Comment #1: I have got one objection concerning the use of one-tailed statistics in this paper. The authors hypothesized *a priori* that male aggression was stronger in the case of conspecific song than in the case of congeneric song, and that in the case of congeneric song it was stronger than in the case of unrelated heterospecific song. This is clearly an one-tailed test situation. However, one-tailed tests have an inherent dilemma of how to handle 'surprising' experimental results, where there is strong evidence of non-compliance with the null hypothesis but in the unanticipated direction. This problem should be resolved by calculating directed tests (see Rice and Gaines 1994, TREE 9:235), with an asymmetrical pair of critical regions specified. Such directed tests retain most of the power advantage of one-tailed testing without compromising analytical reliability.

With mechanisms allowing species coexistence (Chapter I and II), the authors took into account two possible mechanisms: different habitat selection (including habitat shift) and interspecific territoriality, and they did not take into account the potential effect of density of populations of both species on the processes responsible for interspecific spatial relationships. I have got two comments regarding this approach:

Comment #2: Authors have not considered the possibility of territorial avoidance (e.g. Bourski and Forstmeier 2000, Oikos 88:341, Hogstad 1975, Norwegian Journal of Zoology 23:223). I feel

intuitively that this mechanism is of a low importance in these pipits (as it is in the case of interspecific territoriality that was studied in this research). However, in my opinion such an mechanism should be considered in this study. For example, the space use by territories of the two species in different years could be studied and the effect (if any) of space occupancy by the meadow pipit on that by the tree pipit could be estimated.

Comment #3: Authors have not taken into account the possible effect of population density of the studied pipit species. Almost no information about population density is given in both papers (detailed information appears only later, in bioacoustic papers). The effect of population density can be of considerable importance in shaping spatial relationships between two species that are supposedly involved in competitive relations (e.g. Martin 1986, Current Ornithology 4:181). Spatial relationships in particular, but also interspecific aggressive response, could be studied in a few sympatric locations differing in population densities of the respective species.

Another theme of the thesis is the intraspecific aggressive response of the meadow pipit males in relation to the presence of the female (Chapter III). This paper is clearly a by-product of research concerning the spatial relations between the pipit species, and is only loosely related with these studies. The topic of this paper is interesting and deserving further study, and hence I am astonished why this study was not continued (main experiments were carried out in 2004), so that the exact mechanism behind the higher aggression in males in the presence of females might have been resolved. As an effect, this part of research is not completed. Nevertheless the study is nice and it is a very tempting to think that it is a 'show off' by males who try to impress females, particularly in light of the very high incidence of extra-pair fertilizations in this species.

My questions and comments regarding this paper are following:

Question #2: What females were doing while they were 'absent'? Were they visiting neighbouring territories or communal foraging sites or simply were foraging in another part of the focal male's territory, far from the test arena?

Question #3: Were these females social mates of focal males?

The last theme of the dissertation is song structure and variation in the tree pipit (Chapters IV and V). Both papers are elegant studies concerning basic descriptions of song and its individual and geographic variation in the tree pipit. The papers are very well prepared. The bioacoustical and statistical analyses are proper and up-to-date. The results of these papers are valuable as they provide first quantitative analysis of the tree pipit song and as a source of firm data for further evolutionary comparative analyses covering a range of different species. Bioacoustics is a young discipline and at present such studies utilizing modern song analysis and statistical analysis methods are of a high value.

As a whole, the thesis presents very interesting papers, which can contribute significantly to our knowledge of the ecology and behaviour of both studied pipit species. The main achievements of the thesis, in my opinion, are:

1. Evaluating the mechanism allowing coexistence of two related and ecologically similar pipit species, which were not studied in this context.

2. Qualitative description of song structure and variation in the tree pipit in the population and geographical scale.

However, the thesis has got one fault. Namely, there is no common themes running through all the chapters, and hence the dissertation is not coherent as a whole. This incoherence simply results from unsuccessful testing of a hypothesis that was stated at an early stage of the research and from the subsequent evolution of the author's research interests. Lack of success in testing of a priori stated hypotheses is an inherent aspect of all scientific research, and researchers typically modify or switch their research directions in such situations. In the present case the author switched her research to bioacoustics, preparing two elegant papers utilizing the data originally collected for the failed study. Such an approach proves the flexibility and dynamism of the doctoral candidate, which deserve acknowledgement.

Summing up, Mrs Petruskova made a solid piece of ornithological and behavioural-ecological work with bird species that are relatively difficult to study and thus rarely studied. She carried out an impressive work collecting material, carrying out experiments in the field, laboriously analysing sonograms, and published the results in high-ranked journals. She finished her thesis with a handful of ideas and hypotheses for future studies, which reflects a high quality of the research and creativity of the author. My critical comments are rather minor and chiefly concern details of the research. It is an unrewarding task of the reviewer to point out shortcomings of a doctoral thesis. My overall impression of the research is very positive. In my opinion, the dissertation presented by Mrs Petruskova is suitable for defence and its quality fulfils the criteria necessary for obtaining the PhD degree. For my part, the dissertation deserves a faculty or university reward.

Dr Piotr Matyjasiak