Adaptation to a changing world: How do wild bees cope with climate change

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Introduction

Wild bees are the main pollinators of many angiosperm plants [1]. Their decline [2] is thus worrying and its causes [3,4] need to be well understood to adapt mitigation strategies. Numerous scientific programs addressing these conservation issues are carried on all around the world. This is the case of the BELBEES project, dealing with apoids of Belgium. Among the potential factors, climate change might be one of the most important. Indeed, climate change may affect bees by inducing changes in their physiology (fig. 1). These changes could induce mismatches with the pollinated plants [5,6]. Very little is known about phenological shifts in bees whilst they are well understood for other pollinators such as butterflies [7] or hoverflies [8]. This lack of knowledge is a consequence of the absence of long term phenological studies for wild bees around the world. However, new methods using museum data that are validated by scientists [9,10] now allow us to study bee phenology within substantial time series.

Aim of the study

We intend to do a first assessment of the wild bees’ phenological shifts that might have occurred since 1900 in some European regions, including Belgium. This is an important first step that will help us understand the extent of bees phenological shifts and its consistency among species and regions. This will also bring new information for the study of mismatches between bees and pollinated plants. Once this assessment will be achieved, we will investigate the possible correlation with climate parameters, that might support the hypothesis of climate change influence on wild bees’ phenological shifts.

We will also examine the link between phenological shifts and bees’ traits such as sociality level, hibernation stage, nesting type... The aim is to highlight to that generalization of the results would be very helpful to adapt conservation strategies to entire groups of species rather than a few well known species.

Material and Methods

This study is based on long term data sets extracted from the BDFGM (Banque de Données Faunique de Gembloux-Mons) database. This database brings together 2.5 million data from 1750 to present day, spread through whole Europe. It includes now all European data from the FP7-STEP project (Status and Trends of European Pollinators). From preliminary analysis of these data, 19 bee species in 4 European regions (Belgium, England, Nederland, South of France) seem to have suit series are consistent are to be chosen. Then statistical analysis will be performed in order to detect changes in bees’ phenology across time series. Afterwords, climate parameters and species traits will be included in models to determine if these show correlations with the bee phenological shifts.

Perspective

There actually is a great difference in the phenology of social and solitary bees (fig. 6) that has to be considered. Wild bees (Apoidae) are historically little studied compared to other insects. This is why, amongst the 360 bee species in Belgium and the > 900 bee species in France, we only have subsequent datasets to study phenological changes for the most studied and common species. This represents about 20 species, that is to say 5% of the bee fauna of Belgium and less than 2% of the bee fauna of France. This underlines the importance of a generalization of our results to life traits which is the only chance to propose conservation strategies adapted to the whole wild bees’ community.

The BELBEES project

BELBEES is a multidisciplinary assessment of Belgian wild bees’ decline to adapt mitigation management financed by federal scientific policy BELSPO (Belgian Science Policy Office) over 4 years. This project gathers 5 Belgian laboratories and institutions (UNamur, U Gent, U Mons, IRSNB, Gembloux AgroBioTech) that investigate together hypothesis of wild bees decline in Belgium. Climate change is one of the examined theory, making bees’ phenological shifts one of BELBEES research axis. In the end, the BELBEES project aim is to assess the respective role of different factors in wild bee decline.

References