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RESEARCH

Climate change causes the displacement and shrinking of the optimal habitats of nectar-producing species of *Nepeta* in Iran

Farzaneh Khajoei Nasab[1] · Ahmad Reza Mehrabian[2] · Milad Chakerhosseini[2] · Negin Biglary[2]

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Abstract

The negative impacts of global climate change are accelerating the decline of pollinators and nectar-producing plant populations and threatening local and global food security. Iran is ranked as the fourth largest honey producer in the world due to the high diversity of taxa of nectar plants, but little attention has been paid to the conservation assessment of Iranian nectar plant species in the face of climate change. Therefore, predicting the potential distribution of these species is fundamentally important for the development of conservation strategies. In this study, we established the MaxEnt model to assess the consequences of climate change on five *Nepeta* species as representative of Iranian nectar plants. All species distribution models developed in this study were reliable following the AUC values (≥ 80). Our results show that the temperature and humidity factors such as the mean temperature of the coldest quarter (Bio11), precipitation seasonality (Bio15), precipitation of the wettest quarter (Bio16), and mean temperature of the driest quarter (Bio9), and geological and pedological factors such as elevation, soil organic carbon content, sand content, slope, solar radiation, PH, and silt content are important environmental variables affecting the distribution patterns of the target taxa. The MaxEnt model predicts that the area of the suitable habitats of *Nepeta cataria*, *Nepeta meyeri*, *Nepeta pungens*, and *Nepeta saccharata* will be reduced under two optimistic and pessimistic scenarios in the 2050s and 2070s. Under RCP 2.6, suitable habitats for *Nepeta fissa* are projected to decrease by 22.57% by 2050 and by 25.06% by 2070. It decreases by 14.63% under RCP 8.5 and increases by 16.66% in the 2070s and 2050s. Regardless, regular monitoring and in situ as well as ex situ conservation is the main management action for the conservation of target taxa.

1 Introduction

Determining the priority species (Margules and Pressey 2000) as well as prioritizing zones of threatened species (Myers et al. 2000) and valuable plant species (e.g., nectariferous, medicinal, crop wild relatives) is one of the main targets of conservation biologists. Nectar-producing plants are the primary food source for honey bees and honey production. Honeybees visit a wide range of plant species to collect pollen and nectar for their colonies (Albaba 2015). Honeybees are known commercially key pollinators globally to improve the production of many high-value crops, so about 9.5% of the total monetary value of farming production for human feeding derived from insect pollination equivalent to $200 billion in 2005 (UNEP 2010). The production of honey was evaluated at about 1.9 million tons in 2019 mainly produced by China, Turkey, Canada, Argentina, and Iran respectively (FAO 2020). There is evidence that the impacts of global climate change will not only exacerbate declines in pollinator populations but also threaten ecosystem resilience and food security at regional and global scales (Marshman et al. 2019). Also, several studies (e.g., Abdelaal et al. 2019; Gilani et al. 2020) show that climate change is the main ecological challenge to distribution as well as the survival of diverse plant taxa in the twenty-first century, so they may become endangered or extinct (Parmesan 2006; Abdelaal et al. 2019). Accordingly, identifying the consequences of climate change on the distribution patterns of valuable species is a crucial action for conservation management.

✉ Farzaneh Khajoei Nasab
farzaneh.khajoei@yahoo.com

✉ Ahmad Reza Mehrabian
a_mehrabian@sbu.ac.ir

[1] Research Division of Natural Resources, Chaharmahal and Bakhtiari Agricultural and Natural Resources Research and Education Center (AREEO), Shahrekord, Iran

[2] Department of Plant Sciences and Biotechnology, Faculty of Life Sciences and Biotechnology, Shahid Beheshti University, Tehran, Iran

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