Ain Shams University
Faculty of Science
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Environmental Niche Modeling of Order Mantodea Using Biodiversity Informatics and Geographical Information System

A Thesis
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بسم الله الرحمن الرحيم

﴿ قالوا سبحانك لا علم لنا الا ما علمتنا

إنك انت العليم الحكيم ﴾

صدق الله العظيم

الآيه(32) سوره البقره

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Abbreviations	Complete Name
ASUC	Ain Shams University collection
Arc-GIS	Aeronautical Reconnaissance Coverage Geographic Information System
AUC	Al-Azhar University Collection
AUC value	Area Under Curve
BIN 21	Biodiversity Information Network 21
CONABIO	Mexican Commission for the Knowledge and use of Biodiversity
CUC	Cairo University Collection
EESC	Egyptian Society of Entomology collection
ENM	Environmental niche Modeling
ERIN	Environmental Resources Information Network
GBIF	Global Biodiversity Information Facility
GCM	Global Climate Model
GIS	Geographical Information System
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
MAC	Ministry of Agriculture Collection
Maxent	Maximum Entropy Algorithm
MRI-CGCM3	Global Climate Model of the Meteorological Research Institute
NABIN	North American Biodiversity Information Network
RCP	Representative Concentration Pathway
SDM	species distribution modeling
SMNK	State Museum of Natural History Karlsruhe
TSA	The Species Analyst
WWF	World Wildlife Fund for Nature

ABSTRACT

The present study was carried out to predict the environmental niche modeling of order Mantodea in Egypt and genus *Eremiaphila* in the Middle East and North Africa. Studying the affinities among ecological zones in Egypt demonstrated that there was a high faunal similarity between Western desert and Eastern desert, Coastal strip and Lower Nile valley. Gebel Elba had lower similarities to any of the other zones. Temporal analysis for *B. mendica* between the two periods (1900-1961) and (1961-2017) showed a current reduction of this species distribution through Greater Cairo and South Delta governorates due to Urbanization and increase in newly protected areas of South Sinai. Under the future climate change scenario, the Maxent model predicted the habitat loss for *B.mendica* in RCP 8.5 for 2070. The results for species of genus *Eremiaphila* indicated that the fundamental niche for these species anticipated in Protected Areas, National Parks and Special Conservation areas. Niche overlapping among *Eremiaphila ammonita*, *E. arabica*, *E. braueri* and *E. genei* indicated that Jordan, Palestine, Syria and Lebanon may be considered as the origin of the desert mantis in this area. Altitude was considered as the most important predictor that effect on the Mantodea distribution.

Keywords: Niche modeling, Mantodea, *Blepharopsis mendica*, *Eremiaphila*, Maxent, climate change, altitude

Chapter I
Introduction and Literature review

I.1. Introduction

Biodiversity inventory represents the main step in understanding any biological community **(Sodhi and Ehrlich 2010)**. In recent years, the world has experienced unprecedented biodiversity loss due to human activities and the use of technologies, which damage the environment and increase climate change rate **(Diaz et al. 2006)**.

Climate change is among the main current environmental changes, threatening biodiversity and ecosystem functioning worldwide (**Walther 2010; Antiqueira et al. 2018).** Extreme temperature and cumulative Carbon dioxide emissions could have many negative impacts on the future of the ecosystem and biodiversity **(Gruner et al. 2017)**. Many studies have reported that organisms, especially predators are more sensitive to environmental and climate changes **(Estes et al. 2011).**

This world's biodiversity crisis is one of the greatest current threats to the planet **(Jones and Solomon 2013)**. World Wildlife Fund for Nature (WWF) noted in 2013 that current biodiversity extinction rates are estimated to be between 1.000 and 10.000 times higher than the background natural extinction rate **(WWF 2013).**

Insect biodiversity is very important as more than 80% of the world's known species are insects **(Scheffers et al. 2012)**. The extinction number of insects is more than any other group of