Modelling the distribution of *Manica rubida* (Latreille, 1802) in Bosnia and Herzegovina (Hymenoptera: Formicidae)

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Abstract: Ants have an important role in terrestrial ecosystems, and wield considerable ecological and socioeconomic influence. *Manica rubida* (Latreille, 1802) is native to Europe, Asia, and parts of North Africa, and predominantly inhabits high-altitude mountainous environments. In this study, the Maxent was used to forecast and examine the potential geographic range of *Manica rubida* in Bosnia and Herzegovina utilizing established distribution points and climate variables. The model investigates the correlation between *Manica rubida* distribution and environmental factors. We estimated that, in Bosnia and Herzegovina, *Manica rubida* occupies a territory of approximately 4,309.73 km^2, equivalent to 8.42% of Bosnia and Herzegovina's entire surface area, with an extent of occurrence (EOO) spanning 8,191.00 km^2 and an area of occupancy (AOO) covering 112.00 km^2. Models indicate that the distribution of *Manica rubida* in the central Dinaric Alps holds significant potential for the species, with temperature emerging as a primary determinant of habitat suitability. As such, there is a need to consider the potential effects of global temperature change on the high-altitude habitats important to the survival of *Manica rubida*.

Keywords: Bosnia and Herzegovina, distribution, ants, biodiversity, Maxent, ecological niche

INTRODUCTION

Species of the genus *Manica* Jurine, 1807 have a Holarctic distribution. Worldwide, the genus *Manica* Jurine, 1807, is represented by six species, one of which – *Manica rubida* – occurs in Europe. *Manica rubida* inhabits the Palaearctic region, ranging from Central and Southern Europe eastward to the Crimea and the Caucasus, as well as southern Asia Minor and Eastern Siberia. The species *Manica rubida* occupies mountainous areas of Central and (partially) Southern Europe, at elevations of 500–2000 metres above sea level (usually above 700–800 metres) (Seifert, 2007). The species occupies warm rocky open areas covered with low xerophilous vegetation; mainly terraces along rivers, meadows and pastures (Seifert, 2007; 2018). The species nests in the ground, often under flat stones, or under small anthills built from soil by the workers. Colonies are polygynous, and contain several hundred workers, often forming part of larger polygynous systems. Workers move slowly, prey on small soft-bodied invertebrates, and form symbiotic relationships with aphids, from which they obtain honeydew. Swarming occurs in spring (April) or autumn (from August to September) (Seifert, 2007).

Manica is regarded as the least-specialized genus in the tribe Myrmicini (Wheeler & Wheeler, 1970). It is classified as a group of larger ant species, with reddish-brown workers measuring 5–8 mm, queens measuring 10–12 mm, and males 8–10 mm, with queens and males being darker in colour than workers (Forel, 1874; 1915; Wheeler & Wheeler, 1970). Young workers care for the brood and queen, while older workers forage and defend the nest, but do not participate in brood care. Young workers begin foraging at an earlier point in their lifecycle when there is a shortage of older workers. The colony founding of *Manica rubida* was independently undertaken by a single queen, and was completed in the year of the nuptial flight (Wheeler & Wheeler, 1970).

Data on the biology of *Manica rubida* species is generally scarce (Wheeler & Wheeler, 1970). Knowledge of ant biology and ecology in Bosnia and Herzegovina is limited due to the absence of systematic research and lack of data on a national level regarding ant diversity and distribution. The species *Manica rubida* was not recorded by earlier publications dealing with the myrmecofauna of Bosnia and Herzegovina (Wasmann, 1898; Zimmermann, 1934; Georgijevic, 1974; Vesnić, 2011). Data on specific localities of the species showing its distribution is not known for Bosnia and Herzegovina, although the species has been recorded in neighbouring countries (Bracko, 2000; Bracko, 2006; Karaman, 2004; Petrov, 1992).

It should be noted that the species is not recorded within data repositories on the distribution of ants (AntWeb, 2024); *Manica rubida* (Latreille, 1802) in GBIF (2024), while on antmaps.org (Guénard et al., 2017) the species is marked as recorded in Bosnia and Herzegovina. Considering the lack of data on the species' distribution in Bosnia and Herzegovina, remote sensing techniques provide a possibility to close the gap in knowledge on the distribution pattern of the species. The accurate prediction of species distribution holds paramount importance, particularly for geographically isolated populations inhabiting 'mountain islands', as in the case of *Manica rubida*.

In scientific literature concerning ecology, the growth and reproductive patterns of both plants and animals exhibit a strong correlation with climatic variables, with climate change having the potential to significantly alter biodiversity dynamics (Araujo et al., 2005; Zhang et al., 2018). The phenomenon of global climate change is manifested in shifts in temperature and precipitation regimes, which render original habitats unsuitable for sustaining stable populations. Consequently, species are compelled to migrate towards habitats that offer favourable climatic conditions conducive to their survival and reproductive success (Welter et al., 2003). Utilizing models that incorporate temporal and spatial parameters enables the establishment of monitoring protocols that serve as early indicators of climate-induced changes (Midgley et al., 2002).

Advances in geographic information systems (GIS) and computer-based statistical packages have revolutionized the understanding of species distribution patterns. By analysing climatic conditions within suitable habitats, researchers can now predict the potential geographic ranges of various species (Bale et al., 2002). This methodology involves employing algorithms that correlate known distribution points of a target species with relevant environmental variables. Through this process, a model is constructed to elucidate the ecological requirements necessary for a species' distribution. Subsequently, the model's outcomes are extrapolated to forecast the potential distribution of the species within specific timeframes and regions (Kulhanek et al., 2011; Dyderski et al., 2018).

Species distribution models have found extensive applications in ecology, conservation biology and biogeography (Gaston, 1996). Notably, Maxent demonstrates remarkable stability, capable of accurately predicting potential distribution areas even when confronted with incomplete distribution data and environmental variables within a study area (Guisan & Thuiller, 2005; Huntley et al., 2010; Booth et al., 2014; Norberg et al., 2019).

This research focuses on explaining the potential geographical range of *Manica rubida* in Bosnia and Herzegovina.

MATERIALS AND METHODS

The study utilized the findings of field data of *Manica rubida* colonies collected during the period from 2012 to 2023. Species distribution data was recorded using Garmin Oregon 600 GPS devices or by entering Google Earth sampling locations from faunal data. All data was consolidated and processed using the QGIS 3.3.43 software for visualization and raster analysis. Information regarding site elevation and bioclimatic parameters used in model formation was subsequently extracted from the raster data.

Data on the distribution of the species *Manica rubida* was entered into the Geospatial Conservation Assessment Tool (GeoCAT) online calculator in csv format. EOO and AOO were calculated using the GeoCAT tool (Bachman et al., 2011).

Distribution processing and species distribution modelling were conducted using the Maxent model, version 3.4.4 (Phillips et al., 2006).

The bioclimatic variables were imported into QGIS alongside the 28 distribution locations for *Manica rubida*. Utilizing spatial analysis functions within QGIS, climate variables corresponding to these distribution points were extracted, followed by the descriptive statistics of bioclimatic parameters using PAST 4 software (Hammer & Harper, 2001). All 19 bioclimatic variables were formatted in ASCII and employed as input in Maxent (Philips et al. 2006) for initial model generation. Initial model evaluation entailed assessing percentage contributions, variable importance, and jackknife analyses (Phillips et al., 2017).

The Maxent modelling procedure employed specific parameters: 10,000 points were used to establish the Maxent distribution, comprising both background and presence points, with 25% of GPS points allocated for model testing. Environmental layers included continuous variables ranging from BIO1 to BIO19 (Fick & Hijmans, 2017). Regularization values were set as follows: for linear, quadratic, and product features, the threshold was set at 0.05, and the hinge value at 0.50. Feature types included product linear quadratic response curves, along with jackknife analysis, with the equal training sensitivity and specificity threshold rule being applied.

The follow settings were used during the initial and second (final) run: 21 presence records used for training, 7 for testing 10,019 points used to determine the Maxent distribution (background points and presence points). Environmental layers used (all continuous in final model): BIO1, BIO10, BIO13, BIO5, BIO7, BIO8, regularization values: linear/quadratic/product: 0.792, categorical: 0.250, threshold: 1.790, hinge: 0.500. Feature types used: hinge product linear threshold quadratic random seed: true, random test points: 25, threshold: true auto feature: false convergence threshold: 0.05, apply threshold rule: equal training sensitivity and specificity. Model accuracy was evaluated using the area under the curve (AUC) metric (Swets, 1988).

Soil moisture measurements were conducted using the PCE Instrument MMK1 Moisture Meter, measurements were made at a depth of 35 mm, 100 mm from the *Manica rubida* anthill/colony entrance.

Collecting data on the occurrence of species for *Manica rubida*

Data about the distribution of *Manica rubida* was acquired through a combination of field surveys and records from ant collections maintained by the author. Further supplementation of distribution records for Bosnia and Herzegovina involved querying the Global Biodiversity Information Facility database (GBIF, 2024). Subsequently, we attained 28 distribution points for *Manica rubida* in Bosnia and Herzegovina (Fig. 1-2, Tab. 1).

Environmental Variable Screening and Data Processing

We obtained historical (1970–2000) climate data for 19 bioclimatic variables commonly employed in ecological and biogeographic studies for species distribution modelling: (BIO01–BIO 19) at a spatial resolution of 2.5 arc–minutes (~5 km) from the WorldClim database: BIO1 = Annual Mean Temperature, BIO2 = Mean Diurnal Range (Mean of monthly (max temp – min temp)), BIO3 = Isothermality (BIO2/BIO7) (×100), BIO4 = Temperature Seasonality (standard deviation ×100), BIO5 = Max Temperature of Warmest Month, BIO6 = Min Temperature of Coldest Month, BIO7 = Temperature Annual Range (BIO5-BIO6), BIO8 = Mean Temperature of Wettest Quarter, BIO9 = Mean Temperature of Driest Quarter, BIO10 = Mean Temperature of Warmest Quarter, BIO11 = Mean Temperature of Coldest Quarter, BIO12 = Annual Precipitation, BIO13 = Precipitation of Wettest Month, BIO14 = Precipitation of Driest Month, BIO15 = Precipitation Seasonality (Coefficient of Variation), BIO16 = Precipitation of Wettest Quarter, BIO17 = Precipitation of Driest Quarter, BIO18 = Precipitation of Warmest Quarter, BIO19 = Precipitation of Coldest Quarter (https://www.worldclim.org/data/index.html).

The maps for the Bosnia and Herzegovina records of selected species were drawn with QGIS 3.34.3. Regional and state boundaries were obtained from EUROSTAT (https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/countries, ©EuroGeographics for the administrative boundaries).

RESULTS

A total of 28 georeferenced records of colonies of the species *Manica rubida* were collected from Bosnia and Herzegovina. We did not find *Manica rubida* distribution data for Bosnia and Herzegovina in the GBIF biodiversity data repository (GBIF, 2024). All species records are from the Dinaric biogeographical region (Fig. 1). The species has not been confirmed in mountains in the Mediterranean high mountain

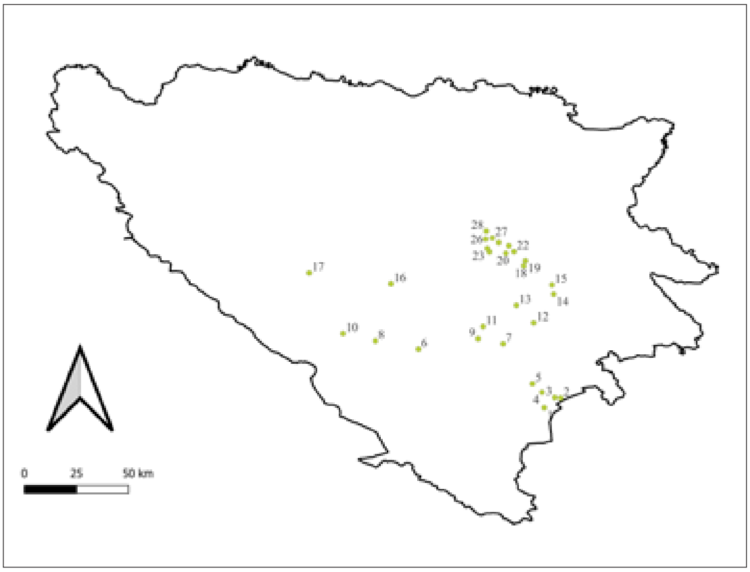

Figure 1. Findings of *Manica rubida* colonies throughout Bosnia and Herzegovina

Figure 2. Workers of *Manica rubida* carrying prey (Photo: A. Vesnić, 2013)

area, such as Mount Orjen, nor in the region of hilly areas heavily influenced by continental conditions, such as Mount Konjuh, nor in mountains in the continental area, e.g. Mount Kozara. *Manica rubida* inhabits high mountains in Herzegovina (Prenj, Čvrsnica), and the area of high karst fields (e.g. the Kupres field). The species is common in the mountainous and subalpine areas of the Dinaric Alps.

Material used in modelling distribution of *Manica rubida*:

Bosnia and Herzegovina: Čemerno, lat. 43.2331, lon. 18.6161, 24.VIII.2022., leg. et det. Vesnić, A.; Maglic, lat. 43.2894, lon. 18.7111, 08.VII.2013., leg. et det. Vesnić, A.; Volujak, lat. 43.2925, lon. 18.6771, 10.VII.2013., leg. et det. Vesnić, A.; Zelengora, lat. 43.3230, lon. 18.6024, 07.VII.2013., leg. et det. Vesnić, A.; Zelengora, lat. 43.3729, lon. 18.5472, 06.VII.2013., leg. et det. Vesnić, A.; Prenj, lat. 43.5736, lon. 17.8839, 15.VII.2017., leg. et det. Vesnić, A.; Treskavica, lat. 43.6049, lon. 18.3757, 06.VII.2015., leg. et det. Vesnić, A.; Vilinac, lat. 43.6222, lon. 17.6335, 09.VII.2013., leg. et det. Vesnić, A.; Treskavica, lat. 43.6345, lon. 18.2305, 06.VII.2018., leg. et det. Vesnić, A.; Vran-Blidinje, lat. 43.6646, lon. 17.4456, 17.VIII.2021., leg. et det. Vesnić, A.; Bjelašnica-observatorija, lat. 43.7054, lon. 18.2596, 24.VII.2020., leg. et det. Vesnić, A.; Jahorina, lat. 43.7272, lon. 18.5545, 11.VII.2012., leg. et det. Vesnić, A.; Trebević, lat. 43.8291, lon. 18.4534, 22.VII.2022., leg. et det. Vesnić, A.; Romanija, lat. 43.8941, lon. 18.6701, 07.VI.2013., leg. et det. Vesnić, A.; Romanija, lat. 43.9475, lon. 18.6609, 15.VIII.2019., leg. et det. Vesnić, A.; Vranica, lat. 43.9542, lon. 17.7241, 21.VIII.2013., leg. et det. Vesnić, A.; Kupres, lat. 44.0178, lon. 17.2484, 02.VI.2023., leg. et det. Vesnić, A.; Šabanci, lat. 44.0585, lon. 18.4966, 14.VIII.2022., leg. et det. Vesnić, A.; Bijambare, lat. 44.0887, lon. 18.5055, 25.VI.2023., leg. et det. Vesnić, A.; Brgule, lat. 44.1315, lon. 18.3922, 15.VI.2016., leg. et det. Vesnić, A.; Perun, lat. 44.1395, lon. 18.2963, 12.VI.2012., leg. et det. Vesnić, A.; Zubeta, lat. 44.1412, lon. 18.4391, 12.VII.2022., leg. et det. Vesnić, A.; Perun, lat. 44.1592, lon. 18.2845, 26.VI.2021., leg. et det. Vesnić, A.; Ponikva, lat. 44.1754, lon. 18.4097, 14.VII.2022., leg. et det. Vesnić, A.; Strica, lat. 44.1943, lon. 18.3506, 21.VII.2022., leg. et det. Vesnić, A.; Igrista, lat. 44.2145, lon. 18.2752, 29.VI.2020., leg. et det. Vesnić, A.; Kopališta, lat. 44.2206, lon. 18.3141, 10.VIII.2023., leg. et det. Vesnić, A.; Duboštica, lat. 44.2603, lon. 18.2788, 13.VII.2020., leg. et det. Vesnić, A.

DISCUSSION

Based on data collected from 28 distribution points and an analysis of 19 climatic variables relevant to *Manica rubida*, the initial model yielded favourable training data: Area Under the Curve (AUC = 0.954) for test data (AUC = 0.950), indicating a high level of accuracy in prediction. The negligible difference of 0.004 between the AUC values of the training and test sets further substantiates the robustness of the model.

These variables encompass a range of climatic parameters crucial for the species' habitat suitability: BIO5 (Permutation contribution) PC = 24.9 and (Permutation importance): PI = 0.0; BIO7: PC = 20.1 and PI = 17.4; BIO1: PC = 13.0 and PI = 52.3; BIO10: PC = 11.5 and PI = 0.0; BIO15: PC = 7.3 and PI = 6.9; BIO13: PC = 6.3 and PI = 8.3; BIO8: PC = 4.2 and PI = 3.9. In total all variables represent PC = 87.3% and PI = 88.8% of model variability.

Utilizing an initial percentage contribution of variables in the model, we refined the pool of 19 climate variables to

Table 1. Values of bioclimatic variables at the localities from which the *Manica rubida* species was collected, based on the values of the parameters taken from the raster maps

Bioclimatic variable	***Mean ± standard deviation (minimum–maximum value); Mode***
Bio_5	20.22±1.78 (16.40, 22.70); Mode = 20.50; V% = 8.80
Bio_7	26.46±0.99 (24.80, 28.90); Mode = 25.80; V% = 3.74
Bio_1	5.73±1,36 (2.31, 7.71); Mode = 6.55; V% = 23.73
bio_10	13.90±1.53 (10.10, 16.13); Mode = 14.17; V% = 11.01
Bio_15	15.93±1.57 (13.52, 19.69); Mode = #N/A; V% = 9.86
Bio_13	121.18±9.93 (109.00, 135.00); Mode = 111.00; V% = 8.19
Bio_8	7.21±5.94 (0.40, 14.62); Mode = 14.0; V% = 82.52
Dem m	1388.33±326.09 (929.97, 2044.93); Mode = NA; V% = 23.49
Soil moisture %	22.75±2.38 (15.98, 26.27); Mode = 24; V% = 10.46

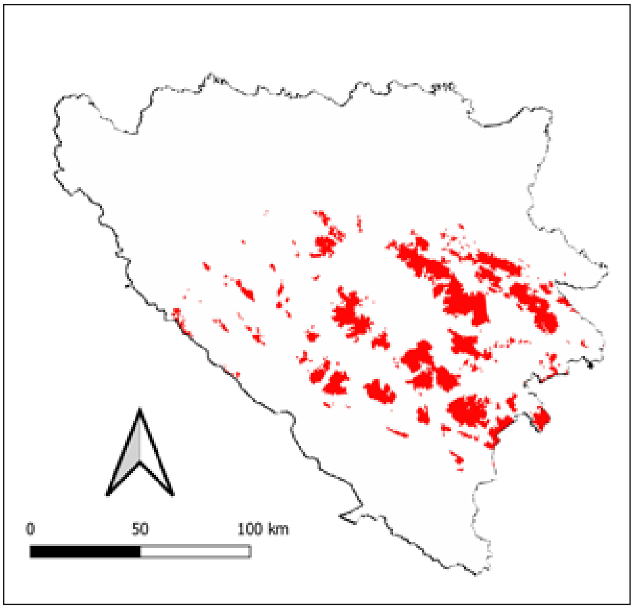

Figure 4. Modelled continuous distribution of *Manica rubida* species in Bosnia and Herzegovina, occurrence threshold at p=0.01

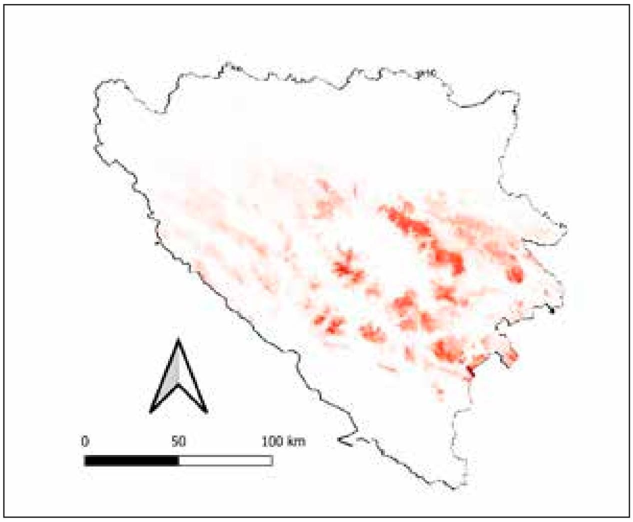

Figure 3. Modelled continuous distribution of *Manica rubida* species in Bosnia and Herzegovina; areas with more intense colour indicate a higher probability of occurrence

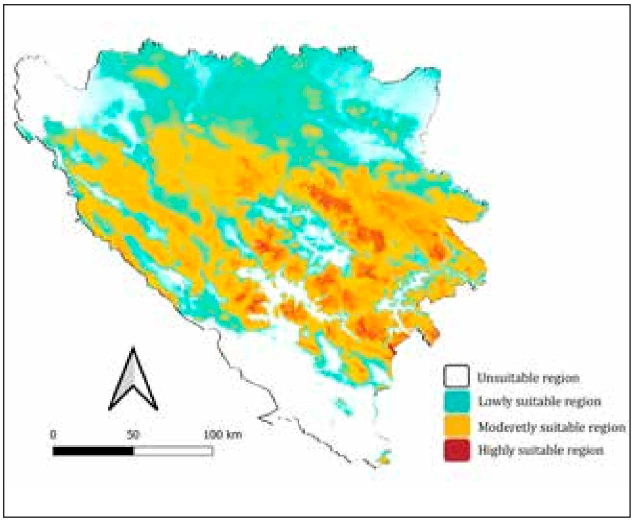

Figure 5. Hierarchical classification and species distribution of *Manica rubida* based on four grades of habitat suitability

seven key variables significantly influencing the distribution of *Manica rubida*. The second model was generated with percentage contribution of variables: BIO1: PC = 49.7 and PI = 7.1; BIO5 PC = 23.7 and PI = 0.0; BIO10: PC = 8.2 and PI = 67.7; BIO15: PC = 7.3 and PI = 6.9; BIO8: PC = 7.1 and PI = 6.6, BIO7: PC = 6.0 and PI = 4.2; BIO13: PC = 5.3 and PI = 14.3. Regularized training gain is 1.621, training AUC is 0.951, unregularized training gain is 1.972, unregularized test gain is 1.455. Test AUC is 0.926, standard deviation is 0.026.

Notably, temperature and precipitation emerged as primary drivers shaping the distribution of *Manica rubida* in Bosnia and Herzegovina. The BIO1: PC = 49.7% exertion of pivotal influence and the relative contributions of temperature variables account for 87.4% of the model's explanatory power. The remainder of the variability is attributable to the precipitation indicator variables BIO13: PC = 5.3 and BIO15: PC = 7.3, which exhibited lower contributions, representing 12.6% of the model's variance.

The potential suitable distribution area of *Manica rubida* in Bosnia and Herzegovina obtained from Maxent is shown in Fig. 5. The total suitable area based on present climatic conditions includes the central Dinaric Alps region in Bosnia and Herzegovina (Figs. 3–5). The moderately and highly suitable areas are distributed on mountains: Zvijezda–Ravan planina, Trebevic, Kompleks Volujak, Zelengora, Maglic, Prenj, Cvrsnica, Kupresko polje, Vranica (Figs. 3–5).

The total suitable area based on occurrence threshold 0.01 comprises 4,309.73 km^2, representing 8.42% of the total land area of Bosnia and Herzegovina (Fig. 4). The extent of occurrence (EOO) and area of occupancy (AOO) for *Manica rubida* were calculated in CatGEO tool; EOO = 8,191.00 km^2 and AOO = 112.00 km^2. The hierarchical classification of regions shows that unsuitable regions occupy an area of 10,441.2 km^2 (20%), low suitability regions 10,875.23 km^2 (21%), moderate suitability regions 20,877.59 km^2 (41%) and high suitability regions 9,002.98 km^2 (18%) (Fig. 5). The unsuitable and low suitability regions are distributed in south, the Herzegovinian karst region, the northwest Krajina region, northeast Semberija region and northern Posavina region. The mountains of northern Bosnia, for example Kozara and Majevica are recognized by the model as being moderately suitable regions, but field data from the mountains did not show the presence of *Manica rubida*. Field data also yielded no evidence of the presence of *Manica rubida* in the high mountain areas of Konjuh, in northeastern Bosnia, or Orjen, located on the border of Bosnia and Herzegovina and Montenegro.

Maxent ecological niche models are used to describe the fundamental niches of species distribution, rather than those realized. These models have inherent limitations, as is also evident with other species distribution models. With the complex interaction of biological–abiotic variables, the realized ecological niche is narrower than the fundamental ecological niche. Our study used Maxent to predict the possible distribution of *Manica rubida* in Bosnia and Herzegovina based on climate parameters. The predictive model produced was accurate insofar as it accounted for those parameters that influence *Manica rubida* distribution. However, other biological determinants synchronize with these abiotic variables to determine the final geography of the species. Additionally, soil characteristics, elevation and other geomorphological characteristics have a significant impact on the range of a species (Anderson et al., 2002; Broennimann et al., 2007; Radosavljevic & Andreson, 2014).

The distribution data shows *Manica rubida* as a species with narrow ecological niche. It is particularly associated with the sub-alpine, high montane region that may be threatened by changes in climate, such as temperature increases and decline in hydrological regimes, as well as the encroachment of competitive species into high mountain habitats (Tab. 1). Furthermore, the region suited to habitation by the species within Bosnia and Herzegovina, as represented in this model, is significantly smaller than the one indicated, and excludes the following: alpine high-mountain habitats, forested areas, and areas with a high level of anthropogenic influence.

Analysis of *Manica rubida* distribution shows that the species inhabits open high-mountain meadows and sunny meadows, as well as microhabitats along the forest edge. In the Dinaric Alps, it reaches its maximum presence in the mountain zone, while in the high mountain areas of Herzegovina it is distributed in the subalpine zone. It is not found on arid midday-exposed slopes or dry soil locations. The average soil moisture of its habitats is 22.75±2.38 (15.98, 26.27); Mode = 24, indicative of moderate soil moisture.

Field data from regions identified in the model as being of low or moderate suitability indicates that the species *Manica rubida* is absent from these areas. In Central Europe, the species *Manica rubida* is moderately thermophilic, preferring slight moisture in the topsoil, with sufficient water in deeper soil layers and adequate levels of insolation. In Northern Europe, this species is also very common in lowland in humid areas, although more prevalent in the northern part than in the southern part, at elevations of 500 metres above sea level (Seifert, 2018).

CONCLUSION

Findings of *Manica rubida* species along riverbanks, mountain streams and in lowland areas have not been confirmed in Bosnia and Herzegovina, where the species inhabits the central Dinaric Alps with an altitudinal range between 930 and 2044 metres ASL, in open habitats on southern exposures or flat terrain. Habitats include coniferous forests at the upper limit of spruce and fir forests, open habitats, mountain meadows, and high-mountain tundra.

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SAŽETAK

Modeliranje rasprostranjenosti *Manica rubida* (Latreille, 1802) u Bosni i Hercegovini (Hymenoptera: Formicidae)

Na osnovu terenskih podataka o distribuciji vrste *Manica rubida* izvršeno je modeliranje ekološke niše i distribucije istraživane vrste u Bosni i Hercegovini. Model je zasnovan na 19 bioklimatskih varijabli koje su u Maxent programu analizirane u odnosu na prostorne podatke te su identificirani najutjecajniji faktori koji oblikuju rasprostranjenost ove vrste u Bosni i Hercegovini. Koristeći napredne tehnike modeliranja ekološke niše, izdvojeno je šest ključnih klimatskih faktora vezanih za temperaturu i padavine, pri čemu je najveći utjecaj imala srednja godišnja temperatura BIO1, dok su od pokazatelja vlažnosti izdvojene varijable: padavine najvlažnijeg mjeseca BIO13 i sezonalnost padavina (izražena kroz koeficijent varijabilnosti) BIO 15 koje nose 13% ukupne snage modela. Koristeći Maxentov model, ova studija je mapirala potencijalnu distribuciju vrste *Manica rubida* otkrivajući njenu koncentraciju u regiji centralnih dinarskih Alpa. Međutim, terenska zapažanja otkrila su neslaganja između modelirane distribucije i stvarnog prisustva vrste, posebno u područjima koja su kategorizirana kao regije niske i umjerene prikladnosti. Utvrđeno je da ova vrsta preferira planinska i visokoplaninska otvorena staništa na južnim ekspozicijama, između 900 i 2030 metara nadmorske visine, uključujući crnogorične šume i planinske livade. Vrsta "izbjegava" sušne izložene padine, a preferira vlažno okruženje. Sveukupno gledano, naši nalazi podižu nivo razumijevanja klimatskih pokretača koji su ključni za distribuciju vrste *Manica rubida* i ukazuje na preferencije staništa vrste i geografsko rasprostranjenje u Bosni i Hercegovini.

Ključne riječi: Bosna i Hercegovina, rasprostranjenost, mravi, biodiverzitet, Maxent, ekološka niša