ECOLOGİCAL AND PHYTOCHEMİCAL CHARACTERİSTİCS OF ERYNGİUM WANATURİİ WORONOW İN THE NAKHCHİVAN AUTONOMOUS REPUBLİC

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Abstract - This study investigates the ecological characteristics and phytochemical properties of Eryngiumwanaturii Woronow, a rare and vulnerable species belonging to the Apiaceae family, distributed within the Nakhchivan Autonomous Republic. The species is characterized by its limited distribution range, occurring mainly in mountainous regions, including Kukudagh, Arachig Mountain, and the vicinity of Paragha village. It typically grows in grassy slopes and subalpine meadows and is adapted to semi-arid ecological conditions as a mesoxerophytic plant.Field observations and literature-based analyses reveal that E. wanaturii has a restricted population size and limited natural reserves, making it particularly sensitive to environmental and anthropogenic pressures. The species is classified as Vulnerable (VU) according to conservation criteria and is included in the Red Book of Azerbaijan.Phytochemical evaluation indicates that species of the genus Eryngium contain a wide range of bioactive compounds, including essential oils, flavonoids, phenolic compounds, saponins, and terpenoids. Although specific studies on E. wanaturii remain limited, comparative analysis suggests its potential as a source of biologically active substances with antimicrobial, antioxidant, and anti-inflammatory properties.

The study highlights the ecological importance and pharmacological potential of E. wanaturii and emphasizes the need for its conservation and sustainable management. Furthermore, the lack of detailed in vivo studies, toxicological assessments, and dose–response evaluations indicates the necessity for further research. The findings contribute to a better understanding of the species and provide a scientific basis for future investigations and conservation strategies.

Keywords - Eryngium Wanaturii; Apiaceae; Nakhchivan Autonomous Republic; Biodiversity; Ecology; Phytochemistry; Bioactive Compounds; Conservation; Endemic Species; Pharmacological Potential

I. INTRODUCTION

One of the rare and narrowly distributed representatives of the Apiaceae family, Eryngiumwanaturii Woronow, is an important species occurring in the flora of Azerbaijan, particularly within the Nakhchivan Autonomous Republic. Due to its restricted distribution range, this species requires special conservation measures and is included in the Red Book of the Republic of Azerbaijan.E. wanaturii is mainly distributed in mountainous and semi-arid landscapes, reflecting its adaptation to extreme ecological conditions. Its ecological characteristics, responses to soil and climatic factors, and distribution patterns indicate its significant role in shaping the floristic structure and vegetation cover of the region. However, despite its ecological importance, the biological characteristics and adaptive mechanisms of this species remain insufficiently studied.In recent years, the phytochemical composition and pharmacological potential of various species within the Apiaceae family have been extensively investigated. Nevertheless, data on Eryngiumwanaturii remain limited. Existing studies have primarily focused on its morphological and floristic characteristics, while its bioactive compounds—particularly flavonoids, essential oils, and other secondary metabolites—and their mechanisms of action have not been adequately explored.Therefore, the aim of the present study is to comprehensively analyze the distribution patterns, ecological characteristics, and phytochemical composition of Eryngiumwanaturii Woronow in the Nakhchivan Autonomous Republic, as well as to evaluate its significance in terms of biodiversity conservation and potential applications.

II. MATERİALS AND METHODS

The study was conducted in various physical-geographical regions of the Nakhchivan Autonomous Republic, primarily within mountainous and semi-arid zones. Field investigations were carried out during the vegetation periods of 2023–2025, focusing on the distribution range, ecological characteristics, and population status of EryngiumwanaturiiWoronow.Plant specimens were collected from different localities, and their morphological features were observed under natural conditions (in situ). The collected samples were processed as herbarium specimens, and taxonomic identification was performed using modern floristic literature and standard identification keys.To analyze the distribution patterns of the species, the locations where it occurs were recorded, and key ecological factors such as altitude, soil type, moisture conditions, and anthropogenic influences were evaluated. Additionally, the participation of the species in phytocoenoses and its interactions with associated plant communities were assessed.

For the analysis of phytochemical composition, data from scientific literature and recent studies (2020–

2026) were utilized. Information on the major bioactive compounds of the species, including essential oils, flavonoids, and other secondary metabolites, was compiled and systematized.The obtained results were analyzed using comparative and systematic approaches, and the ecological and biological characteristics of the species were evaluated in relation to the climatic and edaphic conditions of the region.

III. RESULTS AND DİSCUSSİON

Taxonomic, Ecological and Biological Characteristics of Eryngium wanaturiiWoronow. Eryngium wanaturii Woronow belongs to the genus Eryngium L. of the Apiaceae family. The genus comprises more than 250 species worldwide and is widely distributed in warm and temperate regions, with the exception of Eastern Asia and South America. In the Caucasus region, seven species of this genus have been recorded, while five species occur in Azerbaijan, including the Nakhchivan Autonomous Republic.The studied species is classified as Vulnerable (VU A1ac; B1b(iii,iv)c(iii)) according to conservation criteria. Within the Nakhchivan Autonomous Republic, it is mainly distributed in the upper mountain belt, particularly in Kukudagh (Daraboghaz) in the Shahbuz district, Arachig Mountain (Khazinedere) in the Julfa district, and the vicinity of Paragha village in the Ordubad district.The species typically grows on grassy slopes and subalpine meadows and is characterized as a mesoxerophytic plant. Due to its restricted distribution range and low population density, its natural reserves are considered limited.

In terms of biological characteristics, E. wanaturii is a perennial herb reaching a height of 40–50 cm, with a greyish-blue coloration. Its leaves are coriaceous; basal leaves are long-petiolate and multi-veined, whereas stem leaves are sessile with margins bearing spine-like appendages. The upper leaves are occasionally bi- or tripinnately divided. The plant possesses a paniculate inflorescence, with nearly spherical flower heads reaching 5–6 cm in diameter. The involucral bracts number 7–9 and are narrow, linear-lanceolate, and rigid in structure.

The species belongs to the Atropatenean floristic geographical element and exhibits a high degree of ecological adaptation. However, the decline in its populations is mainly associated with ecological constraints and anthropogenic pressures. Information on its cultivation remains limited.For conservation purposes, the species has been included in the Red Book of both the Republic of Azerbaijan and the Nakhchivan Autonomous Republic. Considering its current status, it is essential to strengthen conservation measures in its habitats, particularly within the Arpachay State Nature Reserve and Zangezur National Park, and to ensure continuous monitoring of its natural populations.

Phytochemical and Pharmacological Characteristics of Eryngium wanaturiiWoronow. Species of the genus Eryngium L. (Apiaceae) are characterized by a rich phytochemical composition and are considered important sources of biologically active compounds. These species are known to contain essential oils, flavonoids, phenolic compounds, saponins, coumarins, and terpenoids.

Although phytochemical studies specifically focused on Eryngiumwanaturii remain limited, comparative analyses with other species of the genus suggest that this species also possesses a diverse range of bioactive substances. Variations in chemical composition have been observed among different plant organs (leaves, stems, and flowers), which are closely related to the species' adaptation to environmental conditions.Recent studies (2020–2026) indicate that extracts derived from Eryngium species exhibit strong antibacterial and antifungal activities. In particular, their effectiveness against pathogenic microorganisms and their ability to inhibit biofilm formation have been reported. In addition, the presence of high levels of phenolic compounds contributes to their pronounced antioxidant and anti-inflammatory properties.

Furthermore, experimental studies on certain Eryngium species have demonstrated cytotoxic and antiproliferative effects, suggesting their potential application in the prevention and treatment of oncological diseases. In recent years, the application of plant-derived bioactive compounds in nanotechnology has gained increasing attention. This approach enhances the bioavailability and therapeutic efficiency of active components, enabling significant biological effects at lower doses.

However, several research gaps remain regarding Eryngiumwanaturii, particularly in relation to in vivo studies, toxicological assessments, and dose–response relationships. Future investigations in these areas are essential for a more comprehensive evaluation of its pharmacological potential.

IV. CONCLUSION

The results of the present study indicate that Eryngiumwanaturii Woronow is a rare and ecologically significant species within the flora of the Nakhchivan Autonomous Republic, characterized by a restricted distribution range and high conservation value. The species is mainly distributed in mountainous and subalpine zones and is adapted to specific ecological conditions as a mesoxerophytic plant.The findings reveal that its distribution area is limited and its populations are relatively small, resulting in low natural reserves. Under the influence of ecological constraints and anthropogenic pressures, the long-term sustainability of the species is under threat, further emphasizing the need for its conservation.Analysis of phytochemical characteristics indicates that species of the

genus Eryngium are rich in biologically active compounds and possess considerable pharmacological potential. In this context, E. wanaturii can be considered a promising subject for further scientific investigation.At the same time, the limited scope of existing studies—particularly the lack of in vivo analyses, comprehensive toxicological assessments, and clearly defined dose–response relationships—highlights significant gaps and provides broad opportunities for future research.

In conclusion, it is essential to strengthen conservation measures, ensure continuous monitoring of natural populations, and promote the sustainable use of Eryngiumwanaturii. Further detailed investigations of its phytochemical and pharmacological properties may contribute to expanding its potential applications.

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