



## RESEARCH PAPER

## OPEN ACCESS

## Phenological studies and habitat characteristic of endemic species *Nepeta oxyodonta* in central Zagros Mountains, Iran

Shahab Mirinejad<sup>\*</sup>, Behrooz Hassanpour<sup>2</sup>, Ghobad Khalili<sup>2</sup>, Kavoos Keshavarz<sup>2</sup>

<sup>1</sup>Agricultural and Natural Resource Center of Kohgiluyeh-va-Boyerahmad Province, Yasouj, Iran

<sup>2</sup>Academic Board in Agricultural and Natural Resource Center of Kohgiluyeh-va-Boyerahmad Province, Yasouj, Iran

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### Abstract

Conservation of plant species and unique habitats of plants have a special importance, and is maintaining the ecological cycle balance in life. The research has been performed to investigate the phenology and habitats ecological condition of *Nepeta oxyodonta* that endemic and endangered medicinal plant in the period of 2008 to 2010. In the first, by using scientific resources and GPS device obtained the geographic characteristics of the region such as latitude, longitude, height, direction and slope and provided the distribution map of *Nepeta oxyodonta* plant in the region. Different stages of phenology of the plant, going biweekly to the region, were registered. In addition, the characteristics of soil samples collected such as EC, PH, Micro and Macro elements levels were measured. The results show that the *Nepeta oxyodonta* plant mostly grows in the mountains regions from elevation (above sea level) 2150 meters to 2800 meters meter (above sea level) in all directions geographical gradient without limitation, from 10% to 75%. The average plant height and the around mean of five plants of have been estimated at 47 cm and 60 cm. According to the references to specific habitats were found that *Nepeta oxyodonta* plant germinates from March and continues its growth with tillering until April. Then, plant flowering stems emerge in late May, and in June and July fruit on stems of flowering plants are exposed. The results of pedological study shows that the amount of the elements Fe, Zn, Cu, Mn are respectively from 7.2 ppm to 36.86 ppm, 0.44 ppm to 3.64 ppm, 0.96 ppm, 2.96 ppm to 26.74 ppm. The type of soil texture is Si-Cl. The research concluded that the plants can growth up in the EC 0.37 to 0.85  $\mu$  mho/cm.

\*Corresponding Author: Shahab Mirinejad ✉ [mirinejad@gmail.com](mailto:mirinejad@gmail.com)

## Introduction

Iran is one of the major centers of endemic plant and animal species in the world. Topographic factors and diverse edaphic conditions in Iran are responsible for the diversity of microclimate that favors more than 8000 plant species (Haghighi and Mozafarian, 2011). Increasing anthropogenic pressures, including deforestation, re-forestation, intensification of agriculture, drainage of wetland, have already had a great impact on the growth, survival and distribution of native species in Iran, especially the rare and endemic species (Jafari and Akhiani, 2008). Kohgiluyeh-va-Boyerahmad (KB) is a mountainous province situated (29° 56' - 31° 29' N, 49° 53' - 51° 53' E) in South West of Iran. About 3.4 of the area are rugged and plains comprise only 1.4 of the province area (Mosaddegh *et al.*, 2012). This varying topography resulted in varying climates that include cold-and-dry as well as hot-and-humid conditions. These factors favor the plant and animal biodiversity in KB province (Mirinejad *et al.*, 2009; Mirinejad *et al.*, 2013a; Mirinejad *et al.*, 2013b). *Nepeta* genus with Persian name Poonesa (Mozaffarian, 1996) has a nearly 300 species and is one of the largest genera of the lamiaceae family in the world (Jamzad and others, 2003). A habitat of *Nepeta* is from North Africa to Europe and Asia. Many morphological characteristic is a in different species, such as shape, leaf size and features a variety of corolla growth in the Hindu Kush Mountains in the Himalayas and Southeast Asia, particularly the Iranian plateau (pojarkova, 1954). So that 75 species of *Nepeta* genus have grown which 39 species is endemic in Iran. (Jamzad *et al.*, 2002). *Nepeta* species have anti-bacterial, anti-fungal, anti viral and anti inflammatory activity (Micelia *et al.*, 2005). Several species of the *Nepeta* can be used as antispasmodic, diuretic, febrifuge, diaphoretic and for tooth trouble, kidney and liver disease (Dinesh *et al.*, 2010; Khanavi *et al.*, 2012). The other effects of *Nepeta* species are analgesic, anticancer, antilzheimeran, antiseptic, antispasmodic, antitussive, carminative, digestive, laxative and sedative (Samadi, 2011; Nazemiyeh *et al.*, 2009). *Nepeta* is also studied for larvicidal effect

(Khanavi *et al.*, 2012). Some of these species are well known folk medicines from ancient times and used for antiseptic, anticonvulsant and anti-cough effects (Zargari, 1992; Kumar *et al.*, 2014). *Nepeta oxyodonta*, (see Fig. 1) is endemic plant in Iran and is growing only on Zagros Mountains in Iranian southern provinces, such as Fars, Charmahal Bakhtiari, and KB provinces (see Fig. 2) (Rechinger, 1982). KB province is located in the southwest of Iran. Primarily, it is a mountainous province and Zagros Mountain Ranges stretch from the northeast to the southwest of KB. There is more than 4000 meters difference of elevation between the highest point of the province in Mount Dena (4,409 meters) and the lowest point in Haider Karrar area in Gachsaran (180 meters). The province is in neighborhood with a variety of climates such as cold-and-dry and hot-and-humid climates have generated a dual climatic characteristic that is cause of plant and animal biodiversity in the province (Mirinejad, 2009). *Nepeta oxyodonta* is herbaceous perennial, with 30-60 cm height, 35-20×20-12 mm size leaves, heart-shaped leaves down to elliptical, stipule and often petiole; oval leaves with, inflorescence with 7-5 flowers, in most cases upper parts of stem, peduncle short, awl-shaped leaflets with 5-3 mm long, to 10 mm long, calyx, corolla up to 18 mm (Mirinejad, 2011). In local language called this plant mountain piyen and use of powder of dried plant in edible on yogurt and buttermilk (Mirinejad, 2013). Familiar with behavior characteristic of different plant and ecological condition of habitat is important with attention on region distribution of rangeland and medicinal plant in different region of country. Thus we can say, study on individual behavior of different plant species and relation with elements ecosystem biotic and a abiotic that saied autecology in ecology, cause to provided some needed information that is involved a basic to manage a rangeland. During recent years numerous studies on the autecology of species rangeland and medicinal took in Iran. For example, a few of which are mentioned: in relation to ecological conditions, cultivation of medicinal plants in endangered studies have been conducted in KB

province (Mirinejad, 2011). autecology of *Dorema aucheri* plant has been studied in rangeland of KB province (Kazemi, 2005). Investigation of the autecology *Prangos ferulaceae* plant has been studied in the rangeland KB province (Kazemi, 2000). Investigation of the autecology of *Astragalus squarrosus* was undertaken in steppes of the Esfahan region (Batoli and Shahmoradi, 2002). Autecology of *Ferula ovina* plant has been investigated in the rangeland Tehran province (Ajir and Shahmoradi, 2007). Study of *Ferula oopoda* plant has been done in the rangeland of Kerman province (Sharifi *et al.*, 2008). The study was undertaken to determine the behavioral characteristics and habitat of *Ferula gummosa* (Bashari and Shahmoradi, 2004). Comprehensive study on medicinal plants in endangered habitat ecological factors was accomplished by Mirinejad (2011) in KB province. In this study, ecological and phenological characteristics and vegetative of *Nepeta oxyodonta* plant reviewed and evaluated in natural areas of Central Zagros Mountains in KB province.



**Fig. 1.** *Nepeta oxyodonta* in Margoon area Yasouj, Iran.



**Fig. 2.** Distribution map of *Nepeta oxyodonta* in Iran.

### Materials and methods

Using library resources, publications, consulting experts in medicinal plants and study the maps, flora and herbarium, habitats of species found in KB province and with field properties refer to field, such as the coordinates, altitude, direction and percentage of slopes notes using GPS device were obtained and plant distribution maps was provided.

To determine phenology and growth duration, from the beginning of growing season, plant growth area was biweekly visited and vegetative stages of plant growth (including start germination, tillering and Multi-leaf, appearance of flowering stems, fruit development, milky seeds, seed maturity, seed abscission, wilting and drying, temporary regrowth falling dormancy and winter dormancy) were recorded in related forms.

In pedological studies, as well as determination of soil appearance condition and stone or grains presence in the soil, profiles were dug in the plant habitat and samples of the soil were collected and transported to the laboratory in order to measure the experimental of soil texture, pH, EC, and the macro and micro elements included in.

### Results and conclusion

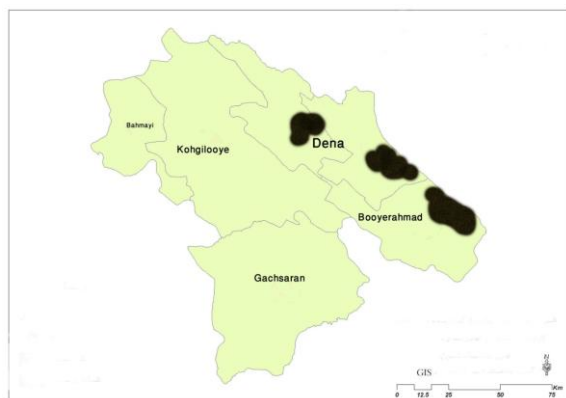
Three sites of Bijan Pass, Dena Kohgol and Margoon, were selected for Data collection provided map

distribution of plant (see Fig. 3). Slopes of 20-75 percent According to observations, *Nepeta oxyodonta* grows at elevation from 2300-2800 meters in all directions as reported previously (Mirinejad, 2011). Height average of five plants *Nepeta oxyodonta* plant

is 40 cm and a mean of plant distance of five plants *Nepeta oxyodonta* is 25 cm (see Table 1). The most important plant species that grow in habitats *Nepeta oxyodonta* include: *Ferulago angulata*, *Daphne mucronata*, *Prangos Sp*, *Hordeum Bulbosum*.

**Table 1.** Required information for habitats of *Nepeta oxiodonta*.

Habitat 1	Habitat 2	Habitat 3	Information
Margoon 2355 30°58'37/8"	Margoon 2620 30°50'29/3"	Bijan Pass 2800 30°52'27/4"	Site Elevation Longitude
51°8'14/3"	51°32'13/6"	51°30'30/3"	Latitude
Mountain East North	Mountain South	Mountain North	Topography condition slope direction
20	75	40	percentage slope
Pataveh	Sisakht	Sisakht	The nearest weather station
Semi Uniform	Random	Uniform	Plant distribution: 1-hill 2-Uniform 3-Random
<i>Hordeum Bolbusum</i>	<i>Prangos Sp</i>	<i>Ferulago angulata</i>	Dominant type name 1
<i>Daphne mucronata</i>	<i>Daphne mucronata</i>	<i>Daphne mucronata</i>	Dominant type name 2
50	30	40	Height average of 5 sample(cm)
30	15	20	The average around of 5 sample(cm)
Soil- rocky	soil	Soil- rocky	Location of the plant rocky-soil and rock-soil
<i>Hordeum Bolbusum</i>	<i>Prangos Sp- Daphne mucronata</i>	<i>Ferulago angulata- Daphne mucronata</i>	Name of associated species



**Fig. 3.** Distribution map of *Nepeta oxyodonta* Kohgilouyeh-va-Boyerahmad Province.

The results of the collected samples from *Nepeta oxyodonta* habitat soil tests shows that the amount of the micro elements and other parameters are as follow: Iron (Fe) 7.2 ppm, Zinc (Zn) 0.44-3.64 ppm, copper (Cu) ppm 0.96, manganese (Mn) 2.96-26.74 ppm, saturation from 31% to 72%, Electrical conductivity (EC) 0.37-0.85 mmho/cm, mud saturated with 7.6-7.8, organic carbon, 0.39-1.56, N 0.052- 0.165 ppm, P 21.46- 41.4 ppm, K 87- 541 ppm, clay 41- 57%, silt 40-48%, sand 3- 11%, soil-type Cl-Si. Considering that non

research has been performed on phenology of *Nepeta oxyodonta* we don't compare results to other. The result (Table 2) shows that *Nepeta oxyodonta* starts to germinate from early April and tillers to late May continues its growth. The initial inflorescences emerge in June and seeds clusters appear in early July. After this stage to early August, seeds pass softness. Seeds rape in late August to early September. The seeds fall from late September to mid November, the plants then wilt and the stems collapse. From late October to early November, seeds found on the ground and vital activities of the plant will stop (Table 2). The soil tests indicated that *Nepeta oxyodonta* grows better in soils with low to moderately low Si-Cl. This result is due to the light soil texture. The rate available element in soil is higher and the soil is rich. More ever if matter limes in soil is less, nutrients and organic carbon in soil is greater. Based on studies done by Low Risk (LR) in the category of classification *Nepeta oxyodonta* plant species are endangered (Jalili and Jam Zad, 1999). The causes of vulnerability of *Nepeta oxyodonta*: difficulty in seed germination (60%), the over use of the plant

and its eradication (20%), Overgrazing of livestock and livestock to rangeland early arrival (20%).

**Table 2.** Phenology of *Nepeta oxyodontha*.

Vegetative stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Germination		■											
Tillering		■	■	■									
Flowering				■	■	■							
Fruits appearance					■	■							
Milky seed						■	■						
Seed maturity							■	■					
Falling acorns								■					
Broken stems									■	■			
Establish the seeds										■	■	■	■
Winter Sleep											■	■	■

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