Al-Mukhtar Journal of Basic Sciences 21 (2): 84-90, 2023
Doi:

Research Article **Open Access**

Size structure and dynamics of the threatened Laurus nobilis L population in Shahat, AL-Jabal AL-Akhdar, Libya

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Received:
21 September 2023

Accepted:
29 December 2023

Publish online:
31 December 2023

Abstract

The fragrant evergreen leaves of the bay tree, also known as laurel (Laurus nobilis L., Lauraceae), are a large shrub that is extensively used in Mediterranean cooking. The present work aimed to study the size structure of Lauru snobilis populations concerning their soil conditions. Twenty-one terraces (25m × 25m) were selected at Shahat of Al-Jabal Al-Akhder at three different levels. The height-to-diameter ratio was more than unity for Laurus nobilis. This means that the diameter of these species tends to expand vertically rather than horizontally. Five forms of size distribution along the different elevations were recognized. In the present study, it was found that Laurus nobilis exhibited more or less J-shaped distribution along elevation levels (downstream and mid-stream). Laurus nobilis exhibited more or less symmetrical distribution (bell-shaped) along the elevation level (upstream). The negatively skewed distribution of Laurus nobilis indicated the dominance of mature individuals over the juvenile ones. The field observations were consistent with the results of the investigation of soil properties.

Keywords: Population dynamic; Size distribution; Laurus nobilis L; Shahat, AL-Jabal AL-Akhdar, Libya .

INTRODUCTION

The Greeks established the ancient city of Shahat, Cyrene (Qurina), in the northeastern Libyan district of Al-Jabal Al-Akhdar. Overall, recent vegetation studies revealed a high degree of plant diversity. Furthermore, the vast majority of Al-Jabal Al-Akhdar's wild plants are used in biotechnology and medicine. There are medicinal plants all over the nation, although they are concentrated in the areas of Al-Jabal Al-Akhdar (UNEP, 2002). However, a shift in the vegetation within this delicate ecosystem may result from various factors, including desertification, increased rates of dry land degradation, overgrazing, urbanization, and the destruction of natural vegetation (MEA, 2005; El-Barasi *et al*., 2013). Along with extensive human activity, large areas have been reclaimed. Without a doubt, these activities have had a negative impact on species diversity as well as size structure. The ages, sizes, and morphologies of the individuals that make up a plant population can be used to characterize its structure (Harper & White, 1974). The characterize population structure, plant size, and reproductive traits in *Laurus nobilis* commonly known as bay leaves. Its leaves and extracts are used to treat eructation, flatulence, and gastrointestinal issues, as well as to suppress bacterial and fungal infections and high blood sugar. Moreover, it has antioxidant, anti-inflammatory, anticonvulsive, and antiepileptic qualities (Gómez-Coronado & Barbas, 2003;

Ouchikh *et al*., 2011; Ramos *et al*., 2012). The most prevalent phenolic compounds in bay leaves have been reported to be flavonoids, including derivatives of myrcetin, luteolin, apigenin, kaempferol, and quercetin (Lu *et al*., 2011). The current study set out to examine the dynamics and population structure of *Laurus nobilis* in various habitats in Shahat, North-Eastern Libya.

MATERIALS AND METHODS

Location of study area:

The study area is located in the Mediterranean Sea Cost of Libya between latitude 32°35´52.84" N and longitude 21°28´22" E (Al-Jabal Al-Akhder South project, 2005) Cyrene is located about 10Km east of the city of Al-Bayda, in the northeast of Libya. It is found on the second terrace of Al- Jabal Al- Akhdar, at an elevation of around 600 meters, its height is between (555: 578) meters it lies between Latitude 32°49´23.952 ´N And longitude 021°51´11.1888 ´E on the North East region, Al Jabal Al-Akhdar (Newport & Haddor, 1963). The study area is shown in Figure 1.

Climate of the area:

The distinctive features of the climate of the study area are a concentration of rainfall during the cool winter season and summer drought climate data for the study area. December and January have the highest mean monthly rainfall totals, at 63 and 62 mm, respectively. The annual rainfall average is roughly 566 mm, albeit highly variable in terms of location. Just before spring, humidity rises, with a peak of 33% in March. In June, the mean maximum monthly temperature reaches 38ºC; in January and December, it drops to 21ºC and 22ºC, respectively. January and December have the lowest mean minimum monthly temperatures, with 5ºC and 6ºC, respectively (Shahat Metrological Station). Figure 2 (El-Tantawi, 2005).

Collections and population frequency:

Twenty one quadrates (each of 25x25m) were selected to represent the main habitats of *Laurus nobilis* populations along Shahat. The population structure of these species was evaluated in terms of size distribution. The size index of each individual was calculated as the mean of its height and diameter [(H+D)/2]. The size estimates were then used to classify the population into 7 size classes. The size classes (m/ ind.) are (1=0<1, 2=1.1-2, 3=2.1–3, 4=3.1–4, 5=4.1–5, 6=5.1–6 and 7= 6.1–7) (Shaltout *et al*., 2015).

Soil analysis:

In each location, one composite soil sample was collected from soil profiles (0 – 25cm), air dried then physical and chemical parameters of such soil samples were analyzed (Gupta, 2000; Brown, 1998; Allen *et al*., 1974; Blanchar *et al*., 1965).

RESULTS

Size distribution analysis of *Laurus nobilis* population using tree height and diameter, the size was estimated by measuring the height and mean diameter were shown in Table 1. Generally, the height to diameter ratio was more than unity for *Laurus nobilis*. The relationships between the individual heights and diameters of the *Laurus nobilis* population are simple linear with r^2 values of 0.616 Figure 3. The population downstream had highest height-to-diameter ratio (5.32), except the population upstream had the lowest (3.22).

In the present study, it was found that *Laurus nobilis* exhibited more or less J-shaped distribution along elevation levels I (downstream and midstream). *Laurus nobilis* exhibited more or less symmetrical distribution (bell-shaped) along the elevation level (upstream). The distribution of *Laurus nobilis* was negatively skewed, indicating that mature individuals outnumbered juvenile ones. Due to the population's high proportion of larger individuals relative to smaller ones, this distribution is indicative of a declining population. The distribution pattern suggests that there is no recruitment to support the smallest size categories. Furthermore, the study area's high mortality rate is caused by human disturbance, as evidenced by the diminishing numbers of both small and large trees Figure 4.

Soil chemical and physical analysis in different elevation levels indicated that at Shahat, soils elevation downstream were characterized by the highest values of E.C (0.344 ds/m) as well as bicarbonate, sulfate, and sodium (0.75, 5.22 and 6.6 m.eq./L. respectively) Table 2. Soils at midstream were values of clay (58.24), but the lowest value was E.C, silt and chloride (0.144 m.eq./L., 37.51 and 0.71 m.eq./L. respectively). Clay and E.C content in soil showed significant variations between the three levels.

Figure (1): Location map indicating the study

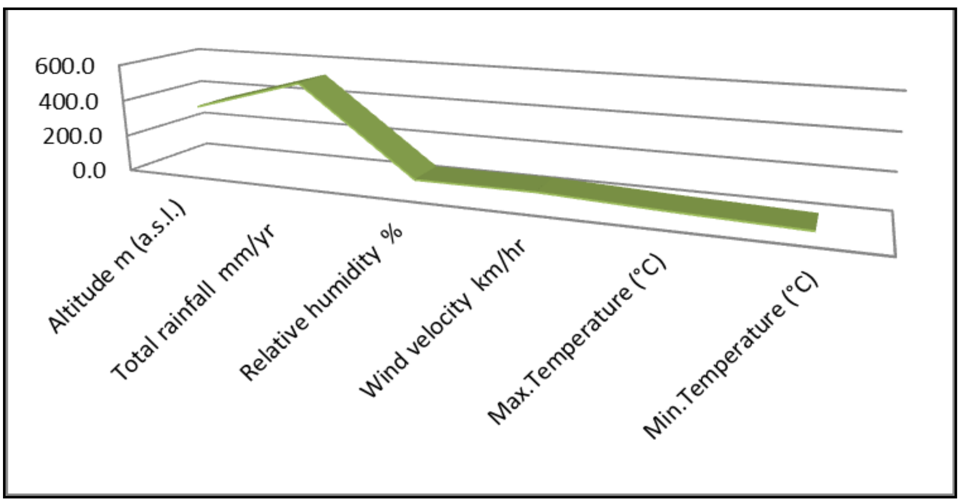

Figure (2): Meteorological data of Shahat station.

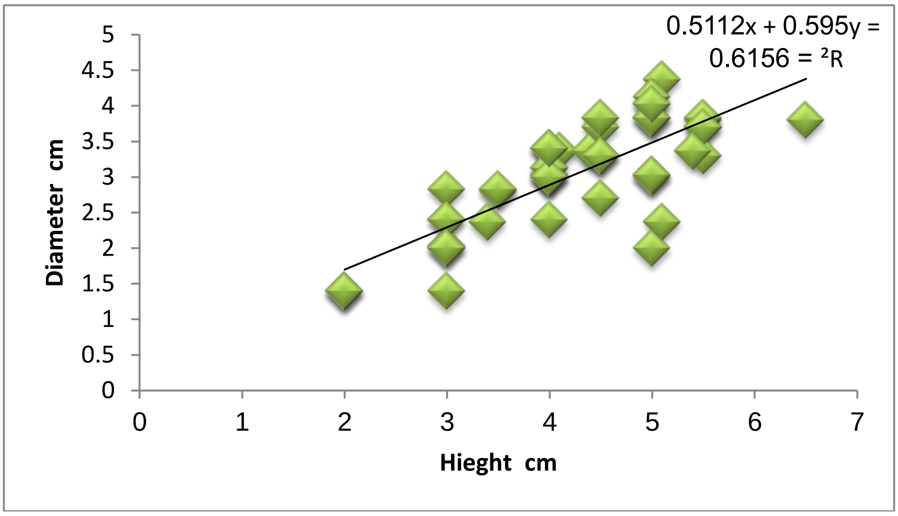

Figure (3): **The** relationships between height, diameter and size index

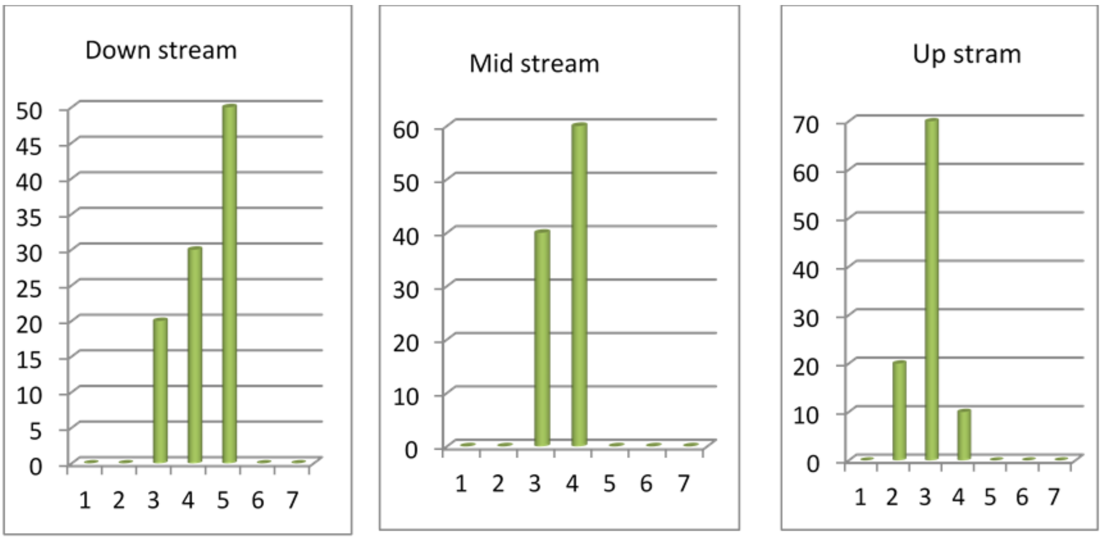

Figure (4): Size frequency distribution of *Laurus nobilis* populations. The ranges of size classes are: 1>1 , 2=1.1-2, 3=2.1-3 ,4=3.1-4 ,5=4.1-5, 6=5.1-6, 7=6.1-7.

Table (1): Size distribution analysis of *Laurus nobilis* population (H: Height, D: Diameter, r: simple linear correlation coefficient between height and diameter and size index

Sites	Species	H (m)	D (m)	H/D	r²	Size index (m)
Downstream	*Laurus nobilis* L.	5.5 ± 0.844	2.1 ± 0.255	2.6 ± 0.532	0.616	5.32 ± 0.811
Midstream	*Laurus nobilis* L.	4.6 ± 0.721	2.2 ± 0.255	2 ± 0.322	0.616	4.56 ± 0.723
Upstream	*Laurus nobilis* L.	3.4 ± 0.511	2.5 ± 0.361	1.4 ± 0.111	0.616	3.22 ± 0.577

Table (2): Soil chemical and physical analysis in each of the three habitats recognized in the study area.

Soil variables	Elevation levels			F – value
	Downstream	Midstream	Upstream	
pH value	8.4±0.32	7.5±0.21	7.5±0.22	0.317
E.C ds/m	0.344±0.247	0.144±0.76	0.283±0.236	2.88*
Sand (%)	26.8±3.77	29.55±6.22	33.22±6.11	0.252
Silt (%)	40.1±7.16	37.51±6.3	42.2±9.1	1.95
Clay (%)	37.1±9.52	58.24±11.22	33.6±12.04	2.97*
CO3-m.eq./L.)	0.0±0.0	0.0±0.0	0.0±0.0	0.0
HCO3-(m.eq./L.)	0.75±0.22	0.55±0.64	0.45±0.44	0.112
SO4 -(m.eq./L.)	5.22±4.3	1.55±1.32	0.75±2.3	0.832
CI ꞁ(m.eq./L.)	0.76±0.12	0.71±1.1	0.94±3.1	1.22
Ca^{+2} (m.eq./L.)	0.51±1.14	0.91±0.44	0.16±0.6	0.163
Mg^{+2} (m.eq./L.)	0.02 ±0.15	0.05±0.88	0.31±0.69	0.362
Na^{+} (m.eq./L.)	6.6±5.79	3.18±0.46	1.44±1.52	0.944
K^{+} (m.eq./L.)	0.09±1.99	0.29±0.58	0.33±0.42	0.937

*= significant at P= 0.05

DISCUSSION

Laurus nobilis was observed in three different habitats (upstream, midstream, and downstream) in this study. Its presence was more significant in the first three habitats (downstream), according to the current study. Accordingly, compared to species with smaller morphological variations, those with larger morphological variations would be more adapted to wide environment gradients (Pang & Jiang, 1995). The height-to-diameter ratio provides insight into the plant's growth habit; changes in this ratio are primarily caused by spacing (Wonn & O'Hara, 2001), indicating a tendency for these species' diameters to expand vertically as opposed to horizontally. This ratio in the current study marginally exceeds unity, indicating that people have a tendency to expand (Galal, 2011).

Furthermore, the distribution of *Laurus nobilis* was negatively skewed, suggesting that mature individuals predominate over juvenile ones. Due to the population's high proportion of larger individuals relative to smaller ones), this distribution is indicative of a declining population. Variations in growth rates brought on by age differences, genetic variation, resource heterogeneity, and competition can also contribute to size differences within the plant population (Weiner, 1985). The population's size structure in the wadi beds was close to the distribution's negative skew, suggesting that mature individuals predominated over juvenile ones. Because there are more large individuals in the population than small ones (limited regeneration capacity), this distribution has been associated with declining populations (Weiner, 1984). The study conducted soil analysis at various elevation levels and found that plant cover and vegetation variables were positively correlated with altitude at Shahat. Additionally, soils at elevation downstream had the highest values of sodium, bicarbonate, sulfate, and E.C. The highest concentrations of clay, silt, and chloride were found in midstream soils, while the lowest concentrations were found in E.C.

CONCLUSION

In summary, the overall demographic makeup of *Laurus nobilis* populations in the studied region is distinguished by a greater proportion of elderly individuals relative to younger ones. Genetic, environmental, or dominance-and-suppression competition can be sources of discontinuous variation. Because only the smaller plants are negatively impacted by this type of competition, it could be regarded as asymmetric (Abdalrhim, 2021). Since human activity contributes significantly to the worsening of the situation, species may be able to adapt to and survive climate change (Mawdsley *et al*., 2009).

Duality of interest: The authors declare that they have no duality of interest associated with this manuscript.

Author contributions: The author did all the work related to the manuscript

Funding: There is no funding to support this manuscript

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