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Effect of Drought and UV-B Stress on Stoma Characteristics in Two Maple Species

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Abstract: In recent years, changing climatic conditions have brought along many problems. As a result of the increasing destruction of the ozone layer caused by anthropogenic sources, the effect of harmful sun rays reaching our world is increasing. It is estimated that the temperatures on the earth's surface and ultraviolet-B (UV-B) radiation will increase in the coming years due to global climate change. This study used ash-leaved maple (*Acer negundo* L.) and sycamore maple (*Acer pseudoplatanus* L.) seedlings to examine the effects of drought and UV-B radiation levels that may occur in the coming years on forest trees. The study investigated the effect on stomatal characters by applying two different doses of UV-B and drought stress. As a result of the study, it was determined that UV-B stress had a more significant effect on stomatal characters than drought stress. It has been observed that severe drought generally reduces the number of stomata. It was determined that the sycamore maple was more affected by severe drought and UV-B radiation. While UV-B radiation decreased only the stomatal pore length and width in sycamore maple, it increased the stomatal pore length and width in ash-leaved maple. The response of stomatal characters to drought and UV-B stress remains unclear. Therefore, more detailed studies are required.

Keywords: Stoma, drought stress, UV-B radiation, *Acer negundo* L., *Acer pseudoplatanu*s L.

Öz: Son yıllarda değişen iklim koşulları beraberinde birçok sorunu da ortaya çıkarmıştır. Antropojenik kaynakların neden olduğu ozon tabakasındaki tahribatın gittikçe artması sonucunda dünyamıza ulaşan zararlı güneş ışınlarının etkisi de giderek artmaktadır. Gelecek yıllarda dünya yüzeyindeki sıcaklıklarının 1-2 °C artarak daha sıcak olması beklenmektedir. Bundan dolayı kuraklık ve UV-B radyasyon zararının gözle görünür şekilde olacağı beklenmektedir. Bu çalışmada oluşabilecek kuraklık ve UV-B radyasyon seviyelerinin orman ağaçları üzerindeki etkisini incelemek için Dişbudak yapraklı akçaağaç ve Dağ akçaağacı türleri kullanılmıştır. Çalışmada iki farklı doz UV-B ve kuraklık stresi uygulanarak stomatal karakterler üzerindeki etkisi araştırılmıştır. Çalışma sonucunda UV-B stresinin kuraklık stresine göre stoma karakterleri üzerinde daha fazla etkisi olduğu belirlenmiştir. Şiddetli kuraklığın genel olarak stoma sayısını azalttığı gözlenmiştir. Dağ akçaağacı türünün hem şiddetli kuraklık hem de UV-B radyasyonundan daha fazla etkilendiği belirlenmiştir. Sadece UV-B radyasyonun Dağ akçaağacında stoma por boyunu ve enini azaltırken, Dişbudak yapraklı akçaağaç türünde stoma por boyunu ve enini arttırdığı görülmüştür. Stomatal karakterlerin kuraklık ve UV-B stresine karşı tepkileri belirsizliğini hala korumaktadır. Bundan dolayı daha detaylı çalışmaların yapılması gerekmektedir.

Anahtar Kelimeler: Stoma, kuraklık stresi, UV-B radyasyonu, *Acer negundo* L., *Acer pseudoplatanus* L.

1. Introduction

Ultraviolet-B (UV-B) radiation intensities between 280 and 320 nm in the biosphere have increased due to the depletion of the stratospheric ozone layer catalyzed by chlorofluorocarbons and other anthropogenic contaminants [1-2]. UV-B levels reaching the Earth's surface are highly dynamic and are determined by time of day, altitude, latitude, season, shade, and various other factors. How plants adapt to changing UV-B levels and coordinate growth and UV-B stress responses has yet to be fully understood [3]. UV-B radiation has numerous direct and indirect effects on plants, including pollination, transpiration, damage to proteins, DNA, and membranes, changes in photosynthesis and transpiration, and changes in morphology, growth, and development [2], [4-5]. In addition, UV-B radiation can reduce photosynthetically active radiation (PAR) penetration, impair stomatal function, photosynthetic and auxiliary pigments and adjust canopy morphology, thereby indirectly delaying photosynthetic carbon assimilation [6].

UV-B radiation is estimated to increase significantly in the coming years due to global climate change [7-8]. Global climate change, accepted as the most critical global and irreversible problem today [9-11], is a process that will affect all living things and ecosystems on Earth [9], [12-13]. It is stated that the most important effects of global climate change will manifest themselves as an increase in drought [14-15].

Drought stress is one of the most critical stress factors that plants are exposed to and affects plant metabolism in many ways [16-18]. Some studies show that drought stress causes significant changes in plants at the micromorphological level [19-20]. However, it is stated that drought stress has different effects on different plant species [21], and these effects occur primarily at the invisible micromorphological level [22]. Similarly, UV-B stress causes many morphological and physiological changes in plants [23]. However, the number of studies on the possible effects of drought and UV-B stress, considered the most prominent effects of global climate change, on plants is limited. This study investigated the responses of plant stomata characters under drought and UV-B stress in ash-leaf maple (*Acer negundo*) and sycamore maple (*Acer pseudoplatanus*) species.

2. Material and Method

The study was carried out in the plastic-covered greenhouse of the Düzce University Faculty of Forestry. 3-year-old seedlings were obtained from Ordu Forest Nursery Directorate. For the supplied seedlings to have the same soil type, their existing soils were replaced with the same ratio of peat, perlite, and raw soil mixture. In order to apply UV-B stress only to the plants we want, an aluminum-covered cabin was created inside the greenhouse. UV-B doses were determined as 8 and 12 kJ m-2 h-1, taking into account previous studies. Drought stress was set as weekly irrigation. Control groups (Control, UVB1, UVB2) were watered twice a week; moderately drought applications (moderate drought, moderate drought +UVB1, moderate drought +UVB2) were watered once a week; severe (severe) drought applications (severe drought, severe drought+UVB1, Severe drought+UVB2) were irrigated once every two weeks. In irrigation applications, the seedlings were watered until they reached field capacity.

This study was carried out by establishing 9 trials, such as Control (A1), Moderate Drought (A2), Severe Drought (A3), UVB1 (8 kJ m-2 h-1) (A4), UVB2 (12 kJ m-2 h-1) (A5), Moderate drought+ UVB1 (A2+A4), Moderate Drought+ UVB2 (A2+A5), Severe Drought+ UVB1 (A3+A4), Severe Drought+ UVB2 (A3+A5).

The stoma characters (stoma length, stoma width, stoma pore opening, stoma pore opening width) and stoma number of ash-leaved maple and sycamore maple species were measured. Obtained data were evaluated with the help of the SPSS package program with analysis of variance (ANOVA) and the Duncan test.

3. Result

The effects of drought and UV-B stress on stomata numbers of ash-leaved maple and sycamore maple are shown in Table 1. According to the analysis of variance results, it was determined that there was a statistical difference in the variation of the number of stomata between species ($p<0.05$). When the changes in the number of stomata between the applications were examined, it was determined that there was a significant difference at the 99.9% confidence level in the ash-leaved maple species and at least 95% confidence level in the sycamore maple species. According to the Duncan test result, it can be said that the variation in the number of stomata between species is in the form of ash-leaved maple > sycamore maple.

According to Duncan test results, when the variation in the number of stomata was examined between the applications, it was observed that the lowest stomata number in the ash-leaved maple species was in the severe drought applied (A3) application group, and the highest stomata number was in the high-dose UV-B applied (A5) application group. In the ash-leaved maple species, it is seen that the number of stomata is higher in the application groups that are generally moderately drought-treated. However, the number of stomata in the severe drought and high-dose UV-B applied group (A3+A5) was also higher than the control group (A1). In this application, the number of stomata is thought to increase due to the high dose of UV-B.

When the number of stomata of sycamore maple was examined, it was seen that the lowest number of stomata was in the A3+A5 application group, and the highest stomata number was in the low-dose UV-B applied (A4) application group. It was seen that the number of stomata in sycamore maple species generally decreases with the effect of drought and UV-B. When the two species were compared, it was seen that the number of stomata increased in the application groups with simultaneous drought and UV-B effect in the ash-leaved maple species. At the same time, this situation decreased in the application groups that were simultaneously drought and UV-B applied in the sycamore maple species. The physiological structure of the species may cause this situation. This situation needs to be examined in more detail.

Table 1. Number of stoma changes by species and treatment

Application	Ash-leaved maple (number/mm^2)	Sycamore maple (number/mm^2)	F-value	Average
A1	82.67 ± 6.11 bB	34.67 ± 8.32 cdA	64.800**	51.36 b
A2	117.33 ± 12.85 eB	21.33 ± 6.11 abcA	136.421***	76.92 f
A3	61.33 ± 2.3 aB	30.67 ± 6.11 bcdA	66.125**	38.33 a

Application	Ash-leaved maple (number/mm^2)	Sycamore maple (number/mm^2)	F-value	Average
A4	106.67 ± 6.11 deB	38.67 ± 8.32 dA	130.050***	66.43 de
A5	129.33 ± 6.11 fB	34.67 ± 8.32 cdA	144.029***	81.99 f
A2+A4	97.33 ± 6.11 cdB	36.00 ± 12.22 cdA	75.571**	60.58 cd
A2+A5	109.33 ± 6.11 deB	28.00 ± 4.00 abcdA	372.100***	59.56 e
A3+A4	92.00 ± 4.0 bcB	17.33 ± 6.11 abA	280.900***	59.02 c
A3+A5	104.00 ± 4.0 dB	13.33 ± 2.30 aA	1156.000***	70.27 e
F-value	27.524***	3.858**		30.469***
Average	99.99 B	28.29 A	3197.973***	

In the table, the columns show the differences between applications, and the rows show the differences between types. According to the Duncan test, a, b, etc., application lettering indicates statistical differences between species. Statistically, *** p<0.001 and ** p<0.01, is significant at the confidence level.

The effects of drought and UV-B stress on stomata lenght of ash-leaved maple and sycamore maple are shown in Table 2. According to the results of ANOVA, it was determined that there were significant differences in stomatal length change between species ($p \leq 0.05$). It was determined that there was a significant difference of 99.9% confidence level in the ash-leaved maple species and at least 95% confidence level statistically between the applications in the sycamore maple species ($p > 0.05$).

According to Duncan test results, when the variation of stomatal length between applications is examined, it is seen that the lowest stomatal length in the A3+A5 application group and the highest stomatal length in the application groups (drought stress not applied) (A1, A4, and A5) in the ash-leaved maple. In general, the stomatal length of the ash-leaved maple species decreases with the effect of drought.

When we examine the stomata size data of sycamore maple, it is seen that the lowest stomatal length was in the control (A1) application group and the highest stomatal length was in the severe drought and low-dose UV-B applied group (A3+A4). Generally, stomatal length in sycamore maple tree species increases with moderate drought and UV-B effect. However, it was observed at the lowest level in both severe drought and high-dose UV-B applied (A3+A5) application group. When we compare the two species, the stomata size is generally higher in sycamore maple.

Table 2. Variation of stoma length (μm) by species and application

Application	Ash-leaved maple (μm)	Sycamore maple (μm)	F-value	Average
A1	13.18 ± 2.53 dA	15.03 ± 1.80 aB	22.045***	13.97 de
A2	12.90 ± 2.13 cdA	17.02 ± 3.31 bcB	41.816***	13.53 cde
A3	12.25 ± 1.84 bcA	15.43 ± 2.93 abB	30.490***	13.31 bcd
A4	13.49 ± 2.11 dA	16.43 ± 2.29 abcB	39.001***	14.27 e
A5	13.49 ± 2.75 dA	17.06 ± 2.05 bcB	37.698***	14.25 e
A2+A4	12.90 ± 2.79 bcA	16.71 ± 2.28 abcB	53.840***	13.48 bcde
A2+A5	11.86 ± 1.93 abA	16.98 ± 2.19 bcB	111.147***	12.90 bc
A3+A4	11.49 ± 2.20 abA	17.36 ± 2.81 cB	82.603***	12.60 b
A3+A5	11.28 ± 2.58 aA	15.26 ± 1.85 abB	22.092***	11.74 a
F-value	9.857***	2.331*		7.855***
Average	12.53 A	16.36 B	383.034***	

In the table, the columns show the differences between applications, and the rows show the differences between types. According to the Duncan test, a, b, etc., application lettering indicates statistical differences between species. Statistically, *** p<0.001 and ** p<0.01, is significant at the confidence level.

The effects of drought and UV-B stress on the stomatal width of ash-leaved maple and sycamore maple are shown in Table 3. According to the ANOVA results, it was determined that there was no significant difference ($p > 0.05$) in the variation of stomatal width between species in A3+A5 and A3 applications, while there was a significant difference ($p \leq 0.05$) in other applications. It was determined that there were significant differences at the 99.9% confidence level between the treatments in both species in stomatal width change ($p < 0.001$). In general, the stomatal width is ash-leaved maple <sycamore maple.

According to Duncan's test results, it is seen that the lowest stomatal width in the A1 application group and the highest stomatal width in the mild drought and low-dose UV-B applied (A2+A4) application group in the ash-leaved maple species. The stomatal width increases due to stress in the ash-leaved maple species. It is seen that the most significant increase in stomatal width is observed only in the application of high-dose UV-B (A5).

In the sycamore maple species, it is seen that the lowest stomatal width was in the low-dose UV-B applied (A4) application group, and the highest stomatal width was in the A2+A4 application group. The stomatal width in the sycamore maple species is generally higher in the application groups exposed to moderate drought, and UV-B stresses simultaneously. It was determined to be high only in the A5 application, even though it was exposed to a single stress.

Table 3. Variation of stomatal width (μm) by species and application

Application	Ash-leaved maple (number/mm^2)	Sycamore maple (number/mm^2)	F-value	Average
A1	11.37 ± 2.07 aA	12.88 ± 2.07 abcB	19.947***	12.04 a
A2	12.15 ± 1.19 bcA	12.90 ± 1.71 abcB	4.610*	12.27 ab
A3	12.10 ± 1.66 bcB	11.85 ± 3.56 ab	0.152 ns	12.01 a
A4	12.52 ± 1.28 cdB	11.24 ± 3.30 aA	8.609**	12.18 ab
A5	12.74 ± 1.63 dA	14.36 ± 2.74 cB	14.568***	13.08 cd
A2+A4	13.29 ± 1.66 eA	14.42 ± 3.16 cB	5.365*	13.60 d
A2+A5	11.95 ± 1.49 bA	14.16 ± 1.96 cB	31.818***	12.40 ab
A3+A4	12.49 ± 1.39 cdA	13.61 ± 3.32 bcB	4.504*	12.70 bc
A3+A5	12.62 ± 1.25 cd	12.52 ± 1.64 abc	0.062 ns	12.61 abc
F-value	9.059***	4.012***		6.955***
Average	12.35 A	13.10 B	25.042***	

In the table, the columns show the differences between applications, and the rows show the differences between types. According to the Duncan test, a, b, etc., application lettering indicates statistical differences between species. Statistically, *** p<0.001 and ** p<0.01, is significant at the confidence level.

The effects of drought and UV-B stress on the stomatal pore size of ash-leaved maple and sycamore maple are shown in Table 4. According to the ANOVA results, there were significant differences in the variation of stomatal pore size between species ($p \leq 0.05$). It was determined that there was a significant difference of at least 95% confidence level in both species in the variation of stoma pore size between applications.

According to the table values, it is seen that the smallest stoma pore size is in the A3+A4 and A3+A5 application groups, while the largest stomatal pore size is in the A1, A2, A4, and A5 application groups. It can say that stoma pore size decreases in ash-leaved maple species with severe drought and UV-B effect.

Generally, the variation in stomatal pore size between species is seen as ash-leaved maple <sycamore maple. In the sycamore maple species, the smallest stoma pore size is seen in the A3+A5 application, and the largest stoma pore size is in the A2 application. The stoma pore size of sycamore maple species decreases with severe drought and high dose UV-B effect. Both species' smallest stomatal pore size was observed in the treatment groups with severe drought + UV-B application.

Table 4. Variation of stoma pore size (μm) by species and application

Application	Ash-leaved maple (number/mm^2)	Sycamore maple (number/mm^2)	F-value	Average
A1	7.16 ± 1.71 eA	8.49 ± 1.52 abB	25.134***	7.76 b
A2	7.24 ± 1.32 eA	10.57 ± 2.61 cB	59.897***	7.75 b
A3	6.68 ± 1.22 cdA	8.75 ± 1.95 abB	29.174***	7.37 b
A4	7.03 ± 1.25 deA	9.00 ± 2.40 abB	30.660***	7.55 b
A5	7.43 ± 1.49 eA	9.13 ± 1.34 abcB	27.529***	7.79 b
A2+A4	6.50 ± 1.54 cA	9.65 ± 1.86 bcB	73.409***	7.35 b
A2+A5	6.28 ± 1.11 bA	10.56 ± 2.38 cB	143.340***	7.15 b
A3+A4	5.74 ± 1.37 aA	9.69 ± 2.53 bcB	74.719***	6.48 a
A3+A5	5.97 ± 1.31 abA	7.92 ± 1.56 aB	18.720***	6.19 a
F-value	14.485***	3.079**		8.102***
Average	6.67 A	9.30	400.432***	

In the table, the columns show the differences between applications, and the rows show the differences between types. According to the Duncan test, a, b, etc., application lettering indicates statistical differences between species. Statistically, *** p<0.001 and ** p<0.01, is significant at the confidence level.

The effects of drought and UV-B stress on the stomatal pore of ash-leaved maple and sycamore maple are shown in Table 5. According to the ANOVA results, there was a significant difference at a 99.9% confidence level in both tree species in the variation of stoma pore width between applications ($p<0.001$). In sycamore maple species, it was determined to be significant with at least a 95% confidence level. It was determined that the variation of stoma pore width based on species was not a statistically significant difference, only in A4 and A3+ A4 applications ($p>0.05$). All other applications had a significantly differed of at least 95% confidence level.

According to Duncan's test results, it is seen that the smallest stomatal pore size in the A3+A5 application group and the largest pore size in the A1 application group in the ash-leaved maple species. In general, it was observed that the stomatal pore of the ash-leaved maple tree species was negatively affected by the application groups that were exposed to UV-B radiation with severe drought.

In the sycamore maple tree species, it is seen that the lowest stomatal pore width is in the A4 and A5 application groups, where only UV-B is applied, and the highest stomatal pore width is in the moderate drought (A2) application group. The stoma pore size of sycamore maple species is adversely affected by high-dose UV-B.

Table 5. Variation of stoma pore size (μm) by species and application

Application	**Ash-leaved maple (number/mm^2)**	**Sycamore maple (number/mm^2)**	**F-value**	**Average**
A1	4.11 ± 1.77 eB	2.31 ± 0.44 abA	24.105***	3.59 def
A2	3.84 ± 0.64 deB	2.94 ± 0.69 cA	25.944***	3.70 f
A3	3.84 ± 0.84 deB	2.20 ± 0.59 abA	69.574***	3.29 cd
A4	3.75 ± 0.72 dB	2.09 ± 0.57 aA	121.474***	3.31 cde
A5	4.06 ± 0.89 deB	1.93 ± 0.51 aA	133.490***	3.61 df
A2+A4	3.35 ± 0.55 cB	2.35 ± 0.61 abA	60.100***	3.08 bc
A2+A5	3.10 ± 0.80 bcB	2.29 ± 0.41 abA	19.523***	2.94 ab
A3+A4	2.84 ± 0.65 abB	2.22 ± 0.72 abA	11.288**	2.72 a
A3+A5	2.65 ± 0.65 aB	2.57 ± 0.67 bc	0.159 ns	2.64 a
F-value	28.028***	4.536***		14.318***
Average	3.50 B	2.32 A	254.349***	

In the table, the columns show the differences between applications, and the rows show the differences between types. According to the Duncan test, a, b, etc., application lettering indicates statistical differences between species. Statistically, *** p<0.001 and ** p<0.01, is significant at the confidence level.

4. Discussion

As a result of the study, it was determined that the UV-B intensity directly affected the number of stomata in general, and the number of stomata increased as the UV-B intensity increased. It was determined that the number of stomata decreased with the effect of severe drought in the ash-leaved maple species. In this case, it was observed that the number of stomata in the sycamore maple species did not decrease much with the effect of severe drought. However, there was a serious decrease in stomata number when exposed to high-dose UV-B with severe drought.

Studies show that the number of stomata is significantly affected by drought. [24], stated that the number of stomata in limited irrigation applications is higher than in control. [25] stated that stomatal density first decreases and then increases in water deficiency. [26], stated that the stomatal density of *Zinnia elegans* plant increased by 50% (moderate under-irrigation) irrigation and 25% (severe under-irrigation) irrigation. They also found that stomatal size decreased at 25% irrigation.

As a result of the study, it was determined that the number of stomata increased as the UV-B intensity and drought severity increased in the ash-leaved maple species. In this case, it is thought that the ash-leaved maple, which is exposed to UV-B and drought stress, increases the number of stomata. Therefore, it can be interpreted that the change in the number of stomata is generally directly proportional to UV-B and drought severity. However, it was observed that the number of stomata in individuals exposed to severe drought and UV-B radiation in the sycamore maple species decreased. It was determined that sycamore maple increased to a certain severity of drought and UV-B severity but decreased simultaneously with the effect of severe drought and UV-B. Although it was observed that the change in the number of stomata changes depending on the application, the reactions of increasing and decreasing the number of stomata were different in different species exposed to the same applications. [27] stated that the density of axial stomata in *Wedelia chinensis* (Osbeck) Merr. plant, which was exposed to UV-B radiation, increased. Some studies have stated that the decrease in the water supply in the soil increases the stomatal density [28].

In the ash-leaved maple species, drought was observed to increase the stomatal length in general. On the other hand, [26] found that the size of the stomata in *Zinnia elegans* plant decreased in severely deficient irrigation. However, the study determined that the stomatal length was lower in individuals exposed to drought and high-dose UV-B than in the control group. In general, UV-B intensity directly affects the stomatal length, and low doses of UV-B increase the stomatal length. However, as the intensity of UV-B radiation increases, the stomatal length decreases. Therefore, stomatal length is thought to be directly proportional to drought severity and inversely proportional to UV-B radiation intensity. It can be said that stoma width and pore sizes generally vary depending on the species. Previous studies show that stomatal movements are controlled by ethylene, but this needs to be more consistent in the stomatal effect [29-31]. Many studies on stomata have explained UV-B radiation in detail [20], [32].

The results show drought stress is generally more effective on stomatal characters than UV-B stress. Different results have been obtained in studies on this subject. [1], suggested that exposure to UV-B radiation may partially reduce drought stress due to changes in wax deposition or epidermal anatomy. [33], in their study on *C. paliurus*, found that as the drought increased, the stomatal opening decreased. [34] found that drought stress caused a slight increase in the width and length of the stomatal opening in *V. underground* L. Verdc.

As it becomes more intense depending on the intensity of drought stress, it is seen that the thickness of the upper and lower epidermis of the leaf decreases significantly. However, the upper and lower cuticle thickness increases significantly [25] under water deficit conditions, stomatal length, and both upper and lower cuticles of flag leaves. They stated that the area of their surfaces decreased, but it did not affect the stomatal density and width on both surfaces [35]. [28] also stated that the decrease in water supply increases the stomatal density and decreases the leaf area. [33] stated that there are significant differences in stomatal width, stomatal opening, and stomatal density of *C. paliurus* under the influence of drought.

The effects of global climate change are still largely uncertain [36-37]. [38] highlight uncertainties regarding the future terrestrial carbon cycle and the need to understand stomatal behavior during drought better. [39] examined the effect of UV-B radiation on *Pinus pinea* L. and *Pinus halepensis* and stated that UV-B radiation might benefit Mediterranean pines by partially mitigating the adverse effects of summer drought. [40] noted that drought significantly reduced leaf area in *Rosmarinus officinalis* L., *Olea europea* L., and *Lavandula stoechas* species and that exposure of plants to high UV-B radiation before and during drought stress had no significant effect on plant growth or photosynthetic activities. On the other hand, [41] stated that drought and UV-B radiation have a combined effect on photosynthetic gas exchange.

When the studies are examined, it is seen that the effects of UV-B stress and drought stress on plant stomatal characters remain unclear. It is necessary to examine in detail whether this situation changes depending on the species or according to the application. Plant phenotypic characters are shaped by the interaction of genetic structure [42-44] and environmental conditions [13], [45-47]. Stomatal characters are also significantly affected by environmental factors as well as genetic structure. In addition to changes in atmospheric conditions [48-50], changes in edaphic factors such as soil moisture and nutrient status were found to change stomatal morphology [51]. Plant stomata, the vital gateway between atmosphere and plant, may have a central role in vegetation/plant responses to environmental situations investigated at the ecosystem and global levels, as well as from molecular and whole plant perspectives [52].

5. Conclusion and Suggestion

The study results generally show that UV-B stress is more effective on stomatal characters than drought stress. However, the combined effect of drought and UV-B increase on plants, which is predicted to increase due to global climate change, remains unclear. It remains unclear whether the opposite reactions of different species to the same applications in the species subject to the study are due to the structure of the species or whether it is due to the difference in the responses given to the applications. Therefore, it is recommended that studies on the subject be continued by diversifying and increasing.

In conclusion, it was observed that the stomatal behavior of ash-leaved maple was less affected by UV-B and drought stress than sycamore maple species. It could be said that the ash-leaved maple is more resistant to drought and UV-B stress than the sycamore maple. In this case, it may be more appropriate to prefer ash-leaved trees in urban afforestation, where drought and UV-B effects are felt the most, today, where the pace of global climate change is kept up.

It is thought that more successful afforestation areas will be created for ash-leaved maple compared to sycamore maple in forest afforestation studies. Therefore, it may be preferred in such fields.

Competing Interest / Conflict of Interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Author Contribution

Hatice Çobanoğlu: Conceptualization, Methodology, Software, Data curation, Writing- Original draft preparation; Visualization, Investigation. Şemsettin Kulaç: Data curation, Writing- Original draft preparation. Hakan Şevik: Software, Validation, Writing- Reviewing and Editing.

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