Original Article

MORPHO-PHYSIOLOGICAL ANALYSES OF *Allamanda blanchetii* A. DC. SEEDLINGS UNDER WATER DEFICIT

ANÁLISES MORFO-FISIOLÓGICAS EM PLANTAS DE Allamanda blanchetii A. DC *SOB DÉFICIT HÍDRICO*

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ABSTRACT: The *Allamanda blanchetii* belongs to the Apocynaceae family, being an ornamental species popularly known as allamanda-roxa and is endemic to the Caatinga. The aim of this research was to evaluate the growth, gas exchange, relative water content, and stomatal density of *A. blanchetii* under water stress conditions. The experimental design was completely randomized with six levels of the maximum water holding capacity (MWHC) (100%, 80%, 60%, 40%, and 20%) with eight replications. Weekly, it was performed the evaluations of plant height and number of leaves. The results for water stress treatment in the *A. blanchetii* plants show that they develop better in the water levels of 100% and 80% of the MWHC, without presenting significant morphological and physiological changes. In turn, 20% of the MWHC does not allow the survival of the *A. blanchetii* plants. The water restriction negatively interfered in the gas exchange in the treatment of 60% and 40% of the MWHC. Therefore, it can be concluded that the *A. blanchetii* plants grow satisfactorily in 100% and 80% of the MWHC, ensuring the growth and survival during the drought period. The water availability to which the plants were submitted does not influence the total chlorophyll and relative water content of leaves. Gas exchanges are adversely affected at levels of water availability below 80% of the MWHC.

KEYWORDS: Water stress. Dry matter. Transpiration.

INTRODUCTION

The drought is a common phenomenon, mainly in the Northeastern Brazil where there is a wide geographic region with a semiarid and arid climate, and is trigged by the irregularity of rainfall. According to Kirono et al. (2011), the drought can be understood as a natural phenomenon of water scarcity in all the systems, depending on its availability, being normally attributed to the reduction of normal precipitation during a prolonged period. So, plants are negatively affected by water scarcity.

Plants had developed ecophysiological adaptations that work saving water due to a decrease in the water potential of leaves, there can have a loss in the turgor and a reduction in the stomatal conductance which is one of the first strategies of the plants toward reducing the transpiration rate and to keep the cell turgor. Marenco and Lopes (2009) report that the low soil humidity leads to a gradual declining of photosynthesis that is characterized by a greater resistance to CO_2 assimilation due to the stomatal closure.

A group of species from semiarid regions needs to be further studied regarding to the ecophysiological behavior, especially those belonging to the Apocynaceae family. This family comprises 3.700 species and 355 genera distributed in five subfamilies which are widespread found in the tropical and subtropical regions (JUDD et al., 2009). *Allamanda blanchetii* is one of the five species of Apocynaceae endemic to the Caatinga, occurring preferably on rocky outcroppings and being distributed throughout the Northeastern Brazil (GIULIETTI et al., 2002). The plant inflorescences open only two flowers per day and the flowers are hermaphrodite and with gamopetalous corolla with five pink-purple petals (ARAÚJO et al., 2011).

The knowledge about *A. blanchetii* regarding to its physiological and morphological aspects is important once studies in this area can contribute to the conservation of this specie in the natural ambient. Researches carried out with plants from the Caatinga under water deficit are very important to comprehend the physiological pattern of growth and dry matter production. Therefore, the aim of this research was to evaluate the growth, gas exchange, relative water content, and stomatal density of *A. blanchetii* plants under water stress conditions.

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MATERIAL AND METHODS

Plant Material and Experimental Conditions

The experiment was carried out in the Plant Ecology Laboratory, Department of Phytotechny and Environmental Sciences of the Center of Agricultural Sciences, University Federal of Paraíba, Areia, Paraíba, from May to October 2015, comprising 112 days.

Seedlings of *A. blanchetii* were obtained using seeds from the municipality of Junco do Seridó, State of Paraíba, in the geographical coordinates: (Latitude 7° 00' 006.6'' S, Longitude 36° 42' 30.5'' W), at 619 meters above sea level. It was carried out a botanical identification by floristic inventory performed by a specialist. The samples were submitted to drying in an oven (70 °C) for 48 h at the Botany Laboratory of the University Federal of Paraíba. Afterwards, the collected exsicata was deposited in the EAN - Jayme Coelho de Moraes herbarium, with the code EMA 1211. Fruits were randomly collected from different plants, presenting a brown color that indicated they were near the onset of spontaneous release of seeds. After collected, the fruits were placed into Kraft paper bags and transported to the Plant Ecology Laboratory where they were manually processed for getting the seeds.

Seedlings production

The germitest paper was used for the germination of seeds, being moistened with an amount of distilled water equivalent to 2.5 times the weight of dry paper. Afterwards, the seeds were placed inside a germination chamber Biochemical Oxygen Demand (B.O.D.) adjusted to a constant temperature of 30 °C. After 10 days, it was verified 96% of germinated seeds.

It was selected 48 uniforms seedlings, with 5 cm length and 1 pair of cotyledons. Then, they were planted in a 5 L pots containing the soil from the site of seed collection which presented the following chemical composition: pH: 5.50, P: 10.96 mg/dm^3, K: 53.29 cmolc/dm^3, Na: 0.08 cmolc/dm^3, Ca: 8.52 cmolc/dm^3, Mg: 2.69 cmolc/dm^3, Al: 0.00 cmolc/dm^3, H+Al: 2.64 cmolc/dm^3, C: 1.03 g/dm^3; O.M: 1.77 g/dm^3, BS: 11.43 cmolc/dm^3, C.E.C. 14.07 cmolc/dm^3, and percent base saturation: 81.23%.

The soil was moistened with 100% of its maximum water holding capacity (MWHC) after free drainage for further application of the treatments, following the method described by Souza et al. (2000). To acclimate the seedlings, it was carried out daily irrigations for the maintenance of 100% of the MWHC in the pots during thirty days. After this period, it was performed the differentiation according to the treatments. The treatments were kept through a daily weighing of the pots and the replacing of the lost water by evaporation until the pots reached the adequate weight correspondent to each treatment, using a Balmak UD balance with a 6 Kg capacity.

The experimental design was completely randomized with six treatments, corresponding to 100%, 80%, 60%, 40%, and 20% of the MWHC and without irrigations, with eight replications for each treatment, totaling 48 seedlings. The pot capacity was accessed through gravimetric method described by Souza et al. (2000).

Growth variables

Weekly, it was evaluated the plant height considering the ground level, the distance between the plant collar and the insertion of the final expanded leaf, measured with the aid of a millimeter ruler; the number of leaves was obtained counting the number of leaves of all the plants in each treatment.

At 112 days after sowing, it was determined the leaf area (LA) which was obtained through the digital leaf images captured by scanning. The digitalization process of images was performed proceeding the scanning of leaves with scanner (HP deskjet Photosmart D110a) and the ImageJ 1.49 software was used for the digital processing. From the data of LA, it was calculated the specific leaf area (SLA) according to Benincasa (1988).

Plants were harvested at 112 days (the end of the experiment) and submitted to the separation of leaves, stems, and roots. Roots were washed with fresh water to remove soil residues. Afterward, the water excess was removed with absorbent paper and was measured the main root with a milliliter ruler. The leaves, stem, and roots were kept in Kraft paper and put in oven of forced air circulation at 65 °C until presenting a constant weight. Then, it was measured the dry matter weight of leaves (DML), stems (DMS), and roots (DMR).

From the data of dry matter, it was calculated the biomass allocation to the leaves (BAL), stems (BAS), and roots (BAR) according to Benincasa (1988). The root system volume (RSV) in milliliters was evaluated by the method of the movement of water column in graduated cylinder.

Photosynthetic variables and (SPAD)

At the 66, 85, and 105 days after sowing, it was analyzed the gas exchange with an infrared carbon dioxide analyzer, LC-Pro Sd Portable, ADC

BioScientific, UK. Measurements were always performed in the leaves in the middle third of each plant, from 10 to 12 hours in the morning with a photosynthetically active radiation (PAR) of 1,200 µmol m-^{2} s-^{1}. It was analyzed the rate of liquid photosynthesis (*A*), stomatal conductance (*Gs*), transpiration (*E*), internal carbon (*Ic*), and the difference between the leaf temperature and the air temperature. The relative content of leaf chlorophyll was determined using the chlorophyll reader SPAD-502, measuring six spots in middle of the leaf.

Relative content of water (RCW)

To get the RCW, ten leaf discs from the same plant (replications) were weighed to determine the fresh weight of leaves (FWL) collected at 10 h. Then, this material was placed in Petri plates and immersed in distilled water where it remained for 24 h at room temperature. After this time, the discs were submitted to a new weighing to get the fresh turgid weight (FTW), packaged in Kraft paper bags, and led to the oven of forced air circulation at 65 °C for 48 h. Then, the leaves were again weighed to get the dry weight of leaves (DWL).

Optic microscopy evaluation

The sampling of the leaves was performed on 8 adult individuals of *A. blanchetii*, collecting 2 leaves per individual. For standardized collection, just the first fully expanded leaf from the apex of the branch was used. Forty-eight paradermal sections (adaxial and abaxial surfaces) were analyzed.

To access the type of the stomata, the leaves were manually sectioned with cutting blade, considering the paradermal sections of the abaxial and adaxial faces. The section was obtained from the median region between the fifth and the seventh secondary veins. Sodium hypochlorite (1%) was used to discolor the sections and then 1% safranin for staining. For the stomatal density in the different treatments, it was also considered section in the abaxial and adaxial faces between the fifth and seventh secondary vein. Slides for the quantification of stomata were prepared with the application of colorless enamel on the abaxial surface of the leaf. After drying the enamel, an adhesive tape was placed on the same surface and then was removed bringing up the negative impression of the leaf epidermis, which was separated from the tape with the aid of tissue forceps. Afterwards, the negative impression was placed on a glass slide followed by the addition of glycerin. After this procedure, the material was put on semipermanent slides and analyzed under a binocular microscope. The images were visualized throughout optical microscope, and captured later on with aid of micro-camera attached to the microscope and a capture card connected to the microcomputer.

Statistical analysis

The data were submitted to analysis of variance and the means were compared through the Tukey's test at 5% of error probability. The results for the number of leaves were submitted to transformation by $\sqrt{x} + 0.5$. The data for height and number of leaves were analyzed applying polynomial regression, using the software Sigma Plot version 13.0.

RESULTS AND DISCUSSION

Plants that were treated with the drier condition (20% of the MWHC) did not survive to the level of water deficit during the evaluation period. Therefore, no data of this treatment will be presented herein. The average height of *A. blanchetii* plants was influenced by the water treatments (100%, 80%, 60%, and 40%) from the 40th day after sowing (Figure 1A). Plants that were submitted to 100% of the MWHC presented higher values (59.11 cm, on average). In turn, the treatment with 80% of the MWHC promoted a linear increase during the experimental time. The others treatments (60% and 40% of the MWHC) presented lower values. However, no significant difference was observed between them (20.0 cm and 12.0 cm, respectively). When compared to untreated plants, those that were maintained with 40% of the MWHC reduced the height in 28.82%. This reduction has an adaptive importance, since the smaller the plant, less resources are demanded. Results reported by Lenhard et al. (2011), in a study with initial growth of Brazilian ironwood (*Caesalpinia ferrea* Mart.) seedlings, show a greater height when the water supply was 70% and 40% of the MWHC.

When the plants were submitted to the treatment of 100% and 80% of MWHC, there was a linear increase in the number of leaves, resulting in the emission of leaves (averages of 29.57 and 32.00 leaves, respectively) (Figure 1B). Plants under a water supply of 40% of the MWHC presented a reduced recovery in the emission of new leaves, but still insufficient to present higher values than the plants treated with 60%. The water deficit decreased the leaf emission for those plants under 40% of MWHC, presenting a reduction nearly 20.88% compared to the control treatment.

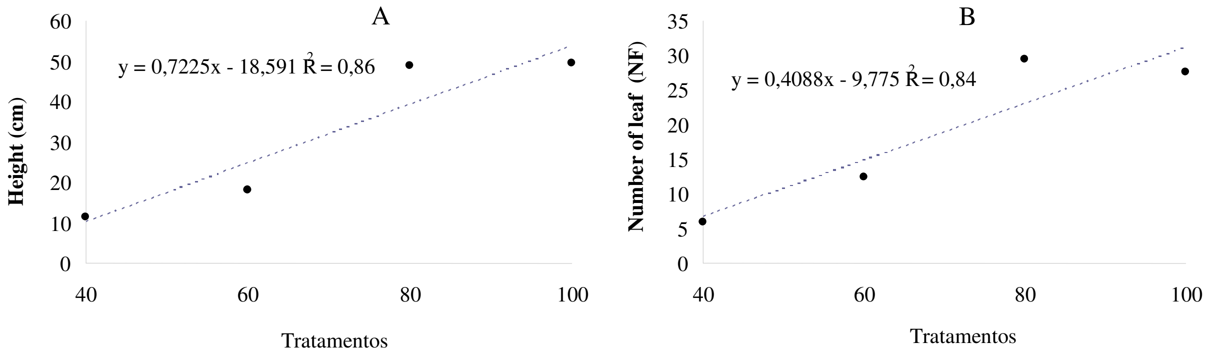

Figure 1. Height and number of leaves *Allamanda blanchetti* after 112 days under water differentiation.

According to Shao et. al (2008), the growth is one of the physiological processes most sensitive to drought due to the cellular turgor, which in turn affects the cellular expansion, restricting the growth and development of plants. Duarte et al. (2015), investigating the effect of water deficit conditions on physic nut (*Jatropha curcas*) seedlings, reported that the number of leaves was, on average, 33% higher in daily irrigated plants compared to those under water stress.

The table 1 presents the biometric variables for the length and volume of root. Regarding to the root length, there was just a difference between the treatments of 80% and 40% of the MWHC (reduction of 51.8%), without presenting any statically significant variation among the others water levels. In turn, the root volume decreased significantly in response to the water availability, being the treatments with 60% and 40% of MWHC the ones which had the lowest values without showing significant difference between them. Compared to the control, the most stressed treatment in terms of reduction of root volume was in 92.1%. From the joint analysis of the length and volume of roots, it was realized according to the experimental conditions that *A. blanchetti* seemed to deepen the root system from its primary root, but the experimental conditions of stress did not allow the generation of a satisfactory root volume to explore a greater volume of soil. According to Scalon et al. (2011), the continuity of root growth under lower water availability depends on the maintenance of a minimum turgor pressure in the cells that is enough to allow the elongation of the cellulosic wall and the cell growth.

Table 1. Mean root length values and root volume of *Allamanda blanchetti* after 112 days under water differentiation.

Treatments	Root Length (cm)	Volume of root system (ml)
100% MWHC	66.57ab	22.42a
80% MWHC	80.42a	16.14b
60% MWHC	52.62ab	5.62c
40% MWHC	38.75b	1.75c

Means followed by the same letter in the column are statistically equal by Tukey test at 5% significance.

The water stress was enough to make *A. blanchetii* plants reduce their development in the different segments [(leaves, stems, and roots in figure 2)]. It was observed a constant reduction of dry matter of roots in the treatment of 60% of the MWHC, where the most severe treatment promoted a decrease of 92.4% compared to the control. Results for the dry matter of the stem showed a significant decline from treatment of 60%, especially when compared to the 80% level. For the leaves, the most severe treatment decreased de weight in 57.2% when compared to the control. Then, it is possible to observe that the root is the most sensitive organ because it responds significantly to the minimum reduction in the water availability (80% of the MWHC), and in the most limiting treatment (40% of the MWHC), the stem seems to be responsive, presenting the biggest reduction in the production of dry matter (reduction of 87%).

The effect of water deficit on the dry matter may have been a consequence of the stomatal conductance decreasing, which is the first mechanism to prevent dehydration (Figure 2). Results found by Martins et al. (2010) in nim (*Azadirachta indica* A. Juss.) plants grown under different water regimes show that the control treatment and the 80% of the MWHC presented the highest averages for dry matter of leaves. Nascimento et al. (2011) reported a different behavior for Brazilian copal (*Hymenaea courbaril* L.), where the treatment with 100% of the MWHC presented the highest averages for the dry matter of leaves, stem, and the total dry matter.

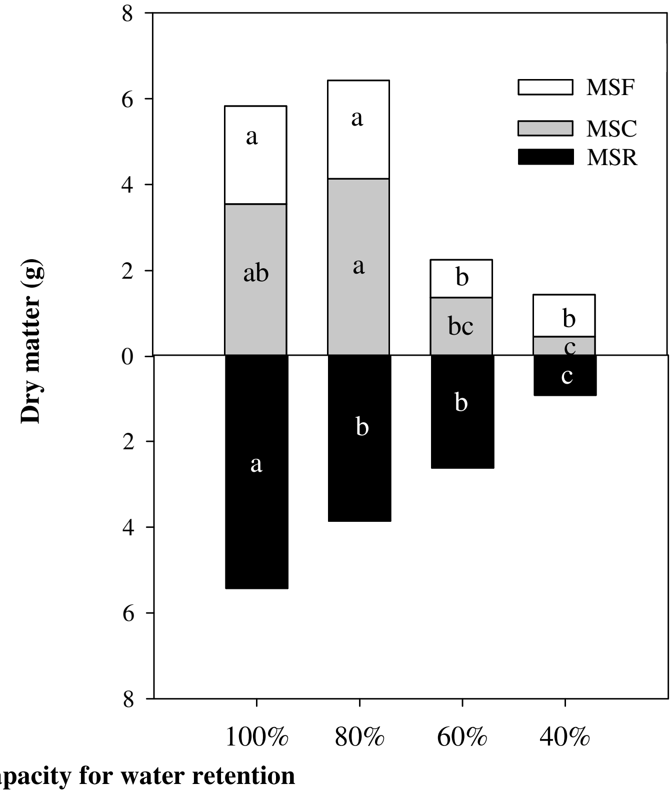

Figure 2. Mean of dry matter of leaves Values (MDF), stems (MSC) and roots (MSR) of *Allamanda blanchetti* after 112 days under water differentiation.

The applied water stress was enough to promote significant alterations in the leaf area from the level of 60% of the MWHC (Figure 3A). Plants treated with 100% and 80% of the MWHC presented the highest values of leaf area (389.37 and 422.18 cm^2, respectively), while plants under the regimes with 60% and 40% of the MWHC presented the lowest values (125.50 and 31.81 cm^2, respectively). On the other hand, there was no statistically significant variation in the specific leaf area (Figure 3B). In turn, the leaf area ratio (Figure 3C) was similar to the leaf area, where there was an effect of water stress in the levels of 60% and 40% of the MWHC (23.64 and 19.43 $cm^2.g^{-1}$, respectively).

The analysis of biomass allocation in different parts of the plant showed that only the leaves had a statistically significant decrease among the water treatments (Table 2). In treatments 100% control and 80% of the MWHC, the biomass allocation to the leaves at the end of the experiment was higher. Then, it can be noticed a significant reduction for this variable when the plants were under the effects of water stress at 40% of the MWHC (reduction of 52% compared to the control treatment). Silva et al. (2008) reported that for the production of dry matter in young plants of ‘aroeira’ (*Schinus terebinthifolius* Raddi) there was no significant difference among the treatments for the allocation of biomass to the leaf (BAL), stems (BAS), and roots (BAR). In neem plants (*Azadirachta indica* A. Juss), Martins et al. (2010) found that for the control 100%, 80%, and 60% of the MWHC, the biomass allocation to the leaves at the end of the experiment was the highest, being 38.9, 40.1, and 43.7%, respectively. Studying the analysis of growth of Brazilian copal (*Hymenaea courbaril* L.) seedlings, Nascimento et al. (2011) reported no significant differences among the studied variables: allocation of leaf area, stem and root allocation, demonstrating that the water stress did not affect the allocation of biomass in the studied treatments.

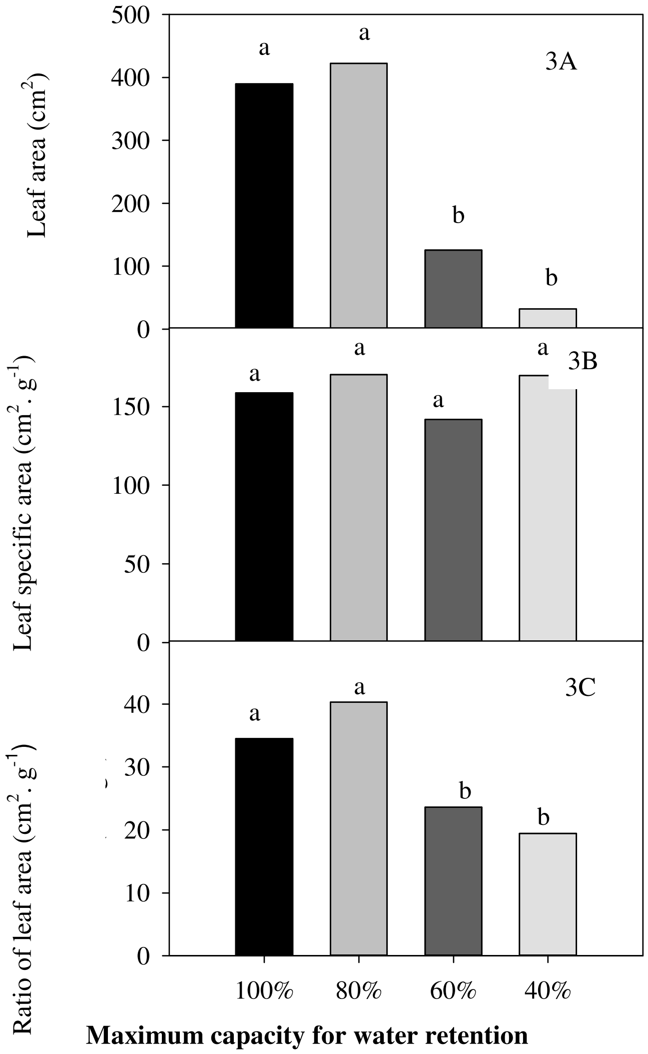

Figure 3. Mean values of leaf area, leaf specific area and ratio of leaf area of *Allamanda blanchetti* after 112 days under water differentiation.
Means followed by the same letter in the column are statistically equal by Tukey test at 5% significance

Table 2. Mean values of leaf biomass allocation, stem and roots of *Allamanda blanchetti* após112 days under water differentiation.

Treatments	Biomass Allocation (%)		
	Sheets	Stems	Roots
100% MWHC	21.85a	30.00a	48.15a
80% MWHC	23.50a	26.31a	49.51a
60% MWHC	17.24ab	27.01a	55.74a
40% MWHC	11.51b	32.15a	56.34a

Means followed by the same letter in the column are statistically equal by Tukey test at 5% significance

The results suggest that *A. blanchetti* uses the reduction of the leaf surface as a strategy to mitigate water loss without, however, promoting the leaf thickening. The leaf area reduction in soils under stress conditions can be an advantageous option, as there is a reduction in the transpiration surface, conditioning the plant to save water. Additionally, the decreasing in the leaf area contributes to the declining in the dry matter of shoots and leaves. Then, it can be inferred that *A. blanchetii* plants do not get to maintain the organic matter production when they have a reduced leaf area. Furthermore, the reductions in the leaf expansion and the declining of the leaf area due to the loss of leaves have been commonly reported as a strategy against drought (GONÇALVES; PASSOS, 2000; CHAVES et al., 2004; COOPMAN et al., 2008). Therefore, it can be affirmed that the leaf area reduction is due, at least partially, to the reduced emission of new leaves in the most severe treatments. Nascimento et al. (2011) reported for Brazilian copal (*Hymenaea courbaril* L.) seedlings under different levels of water in the soil significant differences of leaf area. However, the leaf area ratio (LAR) and the specific leaf area (SLA) did not presente significant differences.

The analysis of variance in the physiological characteristics data of photosynthesis (*A*) and transpiration (*E*) in *A. blanchetii* plants carried out at 66, 85, and 105 days after sowing are in the Table 4. The evaluations during these three periods show a behavior where the photosynthetic rates reduced in 25.37%, 37.58%, and 23.59% at the 66, 85, and 105 days after sowing, respectively.

It was observed that the variations in the transpiration rates (*E*) at 66.85, and 105 days after sowing maintained the same trend as the photosynthesis (*A*), verifying that the control treatment (100%) and the level 80% of the MWHC, resulting in higher transpiration rates and the treatments 60% and 40% of the MWHC were more affected (Table 3). The transpiration reduction is due to the stomatal closure, which is one of the first response of plant to water scarcity. According to Mariano et al., (2009), when plants of 'aroeira' (*Myracrodruon urundeuva*) had the irrigation suspended, there was a decrease of 42% in the photosynthesis rate after 5 days without water.

Table 3. Average Photosynthesis values (A) and transpiration (E) of *Allamanda blanchetii* plants grown after 66, 85 and 105 days under water differentiation.

Treatments	**Photosynthesis (μmol $m^{-2}s^{-1}$)**			**Transpiration (mol $m^{-2}s^{-1}$)**		
	66 dias	85 dias	105 dias	66 dias	85 dias	105 dias
100% MWHC	13.95a	11.12a	9.58a	5.79a	5.32ab	4.57a
80% MWHC	10.25a	13.23a	9.42a	6.38a	5.82a	4.92a
60% MWHC	5.70b	8.93a	5.30b	1.88b	3.50b	2.70b
40% MWHC	3.54b	4.18b	2.26c	1.07b	1.27c	2.25b

Means followed by the same letter in the column are statistically equal by Tukey test at 5% significance

With regard to the stomatal conductance (Table 4), the applied treatments presented a significant effect at 66, 85, and 105 days. Plants treated with 100% and 80% of the MWHC did not differ statistically from each other. On the other hand, there was an increase in the G*s* in the treatments of 60% and 40%. From these findings, it was verified that the stomatal closure decreased the stomatal conductance. The water deficit conditioned a reduction of 33.33% in the treatment of 40% of the MWHC compared to the Control (100%).

Table 4. Mean of stomatal conductance values (Gs) and internal carbon (Ci) of *Allamanda blanchetii* plants grown after 66, 85 and 105 days under water differentiation.

Treatments	**Stomatal conductance (mmol m^{-2} s^{-1})**			**Internal carbon (μmol mol^{-1})**		
	66 dias	85 dias	105 dias	66 dias	85 dias	105 dias
100% MWHC	0.177a	0.123ab	0.150a	212.85a	203.57ab	257.00a
80% MWHC	0.137a	0.190a	0.137a	203.00a	228.14a	242.67a
60% MWHC	0.044b	0.082bc	0.040b	147.5a	171.62bc	194.00b
40% MWHC	0.026b	0.028c	0.050b	185.83a	152.00c	196.00b

Means followed by the same letter in the column are statistically equal by Tukey test at 5% significance

When the internal CO_2 concentration (C*i*) was measured at 66 days after sowing, there was no statistical difference among the studied treatments. After 85 days, the treatment of 80% of the MWHC increased the internal CO_2 concentration. At 105 days, in response to the stress, the levels of 100% and 80% did not differ from each other statistically, but the levels 60% and 40% decreased. The analysis of physiological parameters, including partial stomatal closure (expressed by the decreased stomatal conductance) and the decline in the transpiration rate indicate probably the adaptive mechanisms of *A. blanchetii* specie aiming to reduce water loss when under stress condition. Probably, the stomatal closure had been influenced by the water potential of leaf due to the water stress to which the plants were exposed. Results reported for 'mutamba' (*Guazuma ulmifolia* Lam.) at 60 days of water restriction show that there was partial stomatal closure, reduction of the stomatal conductance, transpiration, and CO_2 assimilation rates in the seedlings grown under 12.5% field capacity (SCALON et al. 2011).

Results for the leaf and air temperatures show no significant differentiation among the studied treatments (Table 5). The consequence of water restriction, there was a modification in the stomatal conductance, evaporation, and in the cooling capacity of the plant, consequently, what was not noticed herein. This is favored by the boundary layer resistance (*rb*) and the heat transference to the air. The behavior observed herein suggests that *A. blanchetti* has a strategy to promote the leaf cooling besides the transpiration during the moment of gas exchange evaluations.

Table 5. Average temperature difference between leaf and air *Allamanda blanchetii* plants grown values after 66, 85 and 105 days under water differentiation.

Treatments	TF-Ta °C		
	66 dias	85 dias	105 dias
100% MWHC	1.77a	1.81a	1.80a
80% MWHC	1.80a	1.80a	1.79a
60% MWHC	1.78a	1.80a	1.80a
40% MWHC	1.80a	1.83a	1.80a

Means followed by the same letter in the column are statistically equal by Tukey test at 5% significance

When submitted to water stress, there was considerable reduction in the density, especially in the lower leaf face, registering 38.5% for the treatment of 40% of MWHC compared to the control. Regarding the adaxial face, despite the significant differences among treatments, it was not possible to detect a pattern response to the water deficit.

The SPAD and the relative content of water (RCW) in the *A. blanchetii* plants grown under greenhouse condition did not show significant differences among the water regimes to which plants were submitted (Table 6). Lenhard et al. (2011) studied the Brazilian ironwood (*Caesalpinia férrea* Mart.) plants and verified that the highest chlorophyll content was obtained in the treatment of 70% of the field capacity followed by the 40% and 12.5% treatments. At the 28 and 35 days, it presented a 41%, declining 10% until the end of the experiment, at 56 days under stress. In a study about the growth of physic nut (*Jatropha curcas*) seedlings, Duarte et al. (2015) verified that the chlorophyll content was not affected by the water deficit conditions, as well as the water content.

Table 6. Mean stomatal density values, SPAD and TRA *Allamanda blanchetti* leaves after 112 days under water differentiation.

Treatments	Stomatal density (stomata.mm^{-2})		SPAD	Relative water content (%)
	Adaxial	Abaxial		
100% MWHC	16.57a	223.14a	49.66a	50.59a
80% MWHC	7.00c	196.14b	49.31a	46.67a
60% MWHC	12.00ab	136.38c	47.81a	55.82a
40% MWHC	7.75bc	137.25c	44.10a	52.91a

Means followed by the same letter in the column are statistically equal by Tukey test at 5% significance

A. blanchetti revealed to be a species of amphistomatic leaves, being its density (number of stomata/mm^2) greater in the abaxial face. Several types of stomata were found, anisocytic, paracytic (more abundant), and tetracytic, clearly characterizing a polymorphism behavior.

CONCLUSIONS

Plants of *Allamanda blanchetii* satisfactorily grow under 100% and 80% of the pot capacity, promoting the surviving and growth without presenting significant morphological and physiological modifications;

A. blanchetti plants did not promote an effective deepening of roots to attenuate the effect of water stress;

The reduction observed for the relative surface, emission of new leaves, and the stomatal density consists in a strategy used by *A. blanchetti* plants to adjust to the water deficit;

The gas exchanges are affected negatively when the water availability is lower than 80% of the MWHC.

RESUMO: *Allamanda blanchetii* pertence à família Apocynaceae, é uma espécie ornamental, conhecida popularmente como allamanda-roxa, endêmica da Caatinga. O objetivo da pesquisa foi avaliar o crescimento, trocas gasosas, conteúdo relativo de água e densidade estomática de *A. blanchetii* sob condições de estresse hídrico. O delineamento experimental foi inteiramente casualizado, com seis capacidade máxima de retenção de água tratamentos hídricos (100%, 80%, 60%, 40% e 20%) com oito repetições. Os resultados obtidos sobre o déficit hídrico aplicado, as plantas de *A. blanchetii* se desenvolvem com níveis de água de 100% e 80% da CMRA, sem apresentar modificações morfológicas e fisiológicas significativas enquanto que com de 20% da CMRA não houve a sobrevivência de plantas. A restrição hídrica interferiu negativamente nas trocas gasosas, nos tratamentos de 60% e 40% CMRA. Portanto pode-se concluir que as plantas de *A. blanchetii* crescem satisfatória sob 100% e 80% CMRA garantindo a sua sobrevivência e crescimento durante a seca. A clorofila total e o teor relativo de água na folha das plantas não foram influenciados pelos regimes hídricos a que foram submetidas. As trocas gasosas são negativamente afetadas em níveis de disponibilidade hídrica abaixo de 80% da CMRA.

PALAVRAS-CHAVE: Estresse hídrico. Matéria seca. Transpiração.

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