A Study on the Water Eco-Physiology of Seabuckthorn in Different Habitats of Loess Plateau

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Abstract: This paper deals with the seabuckthorn water eco-physiological features in different habitats of north of Shaanxi, loess plateau. The typical habitats are classified that hill- top, sunny, shade, semi-shade, semi-sunny hillside. The field collected data of transpiration rate, stamatal conductance, relative water content, loss of water resistance were studied, while analyzed the relationships of these characteristics and environment factor, with surveying their growth conditions and biomass. The main results showed that values of Tr of sunny and shade were relative higher, while the diurnal changes of shade-hillside could keep more steady at a higher level but sunny have declined quickly since midday. There was a positive regression between Tr and soil water content. Generally, the trends of daily variations of Gs and relative humidity were similar, this implies that their correlation was significant.
Keywords: seabuckthorn, water, adaptability, different habitats, loess plateau

1 Introduction

Loess plateau hills area is located the east of northwest area in our country (N-latitude 35°—42° east longitude 102°—116°). It is a small amount rain. Annual average rainfall is only 460mm. Population is excessive increased in the area. The field is unreasonable utilized. Vegetation was serious damaged. So led to loss of water and erosion of soil and ecological environment was continued worsen, adversity-resist stronger variety was choosed in the area recover vegetation, special was at anti-drought trees. Tree growth was better and fast become forest at different standing condition in loess plateau .It had been researched seabuckthorn (*H.rhamnoides L. Subsp. Sinensis Rousi)* adapted wide range of ecology could survival and grow, stronger anti-drought and itself regeneration in diversified standing condition in loess plateau. Liang Z.S *et al*., studies showed seabuckthorn had save water and drought-enduring resistance concurrently keep out the drought resistance. It was important of water relation in relations of plant and environment in arid area .Water went to plant via soil and passed root system, xylem leaves and end diffused in atmosphere from stoma .This series of process was affected by environment factors ,soil water content, atmosphere relative humidity. temperature, besides day, annual of plantself physiology .

The study was tried study water condition from a key environment factor of seabuckthorn formed forest in loess hills area, analyzed and discussed the ecological relations of seabuckthorn transpiration rate, accumulated biomass. Soil water content ambient relative humidity in different standing conditions seabuckthorn water character and growth was explained by water relation of plant different standing conditions.

2 Materials and methods

2.1 Nature conditions

Experiment was located jiugou valley, Xueca, Wuqi counter, Shaanxi. The general configuration of the earth's surface belongs hills and gullies in loess plateau . It was few vegetation and water erosion grow active.

The climate belongs continental monsoon climate. The elevation was mean 1,521m. Annual mean rainfall was 460m. Annual mean temperature was 6.5℃. Warm and rain were same seasons. It was bigger difference of day and night in temperature. Atmosphere relative humidity was lower .

2.2 Materials

Experiment was choosed three typical standing conditions of same elevation's hill top, ridge of hill, and hillside. Every experiment area was about 666.7m^2 .The field was treated before one year transplantation. It was transplanted in autumn of 1998 and the seedling was cutting out of stem and covered the seedling with soil, ensured it had better survival rate in next year. Transplantation distance between plant and plant was 2m×3m.

2.3 Measure index and methods

It was measured air relative humidity by hygrometer. Soil water content was adopted dry-weight. The soil sample depth was 200cm. The soil sample was gotten from every 20cm. Transpiration rate was adopted Licor-1600 steady stomameter. Biomass was measured typical plant in end growth season and dry weight every part. Air relative humidity, soil water content and transpiration rate were measured at same time. Transpiration rate was measured form 3 plants every treatment and measured 3 function leaves in middle-top plant. The total treatment was 9 repeat.

3 Results

3.1 The difference of air relative humidity, soil water content in different standing conditions

Table 1 shows the soil water content of difference depth in 3 standing types that north of hill soil water content was the highest in every depth but south of hill soil water difference was not obvious with hill top because seabuckthorn root system was over than 2m—3m vertical growing , lateral root and adventitious root was growing every way at same time and formed root system density in soil surface (10cm—40cm). So seabuckthorn was better of useful soil water . Table1 shows the soil surface water content and depth water content of north of hill were obvious higher than hill top and south of hill's .So it provided more water during plant growth .Table 2 shows the air relative humidity dayly variation and mean data under 3 different standing conditions which north of hill mean data was the biggest (41.6%) hill top was 40.2%. South of hill was the lowest (39.7%). Day variation curve of 3 treatment were repeated after 17:00.

Table 1 Soil water content under different standing conditions

Standing conditions	Soil water content of different depth soil water										
	5	15	30	50	70	90	110	130	150	170	190
Hill top	3.48	5.03	6.02	6.51	7.21	7.28	6.94	7.12	7.65	6.81	6.88
South of hill	3.89	6.37	6.96	7.39	7.23	6.96	6.94	7.32	7.02	6.81	7.12
North of hill	9.10	8.86	8.85	9.04	9.28	8.01	8.83	8.51	8.35	8.74	8.77

Table 2 The day variation of air relative humidity under different standing conditions

Standing Conditions	Air relative humidity at different time							
	7:00	9:00	11:00	13:00	15:00	17:00	19:00	means
Hill top	69.9	61.1	47.5	38.9	21.2	21.5	21.1	40.2
South of hill	69.2	59.9	47.6	37.3	17.5	24.8	21.7	39.7
North of hill	70.4	61.5	50.8	39.9	21.3	25.5	22.1	41.6

3.2 The character of day transpiration

The leaves transpiration rate was measured under hill top, south of hill and north of hill at same time. Figure 1 shows the south of hill and north of transpiration rate dayly variation were one-peak cure under typical climate (August 30 sunny day, no wind, no cloud), but it was double peak cure in south of hill (It was the biggest at 11:00 at hill top and north of hill, which each was 0.453mmol • m^{-2} • s^{-1} and 0.461 mmol • m^{-2} • s^{-1}. Tr was declined after 11:00 at south of hill and dropped 0.393 mmol • m^{-2} • s^{-1} at 13:00 and a little raised after 15:00, soon afterwards was declined 0.257mol • m^{-2} • s^{-1} at 19:00). The Tr of south of hill means' data was the biggest in 0.372 mmol • m^{-2} • s^{-1} under 3 standing conditions (Fig.2).

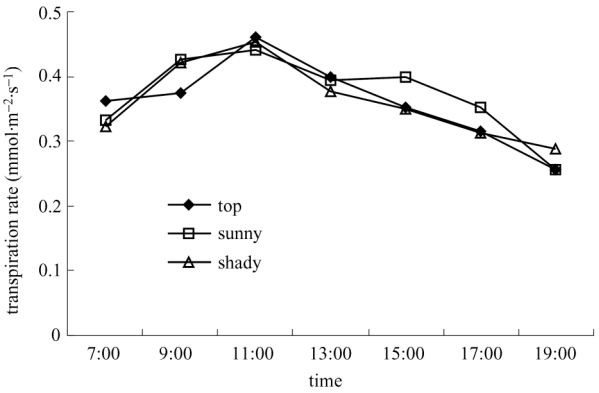

Fig. 1 Tr day variation under different standing conditions each point data was means

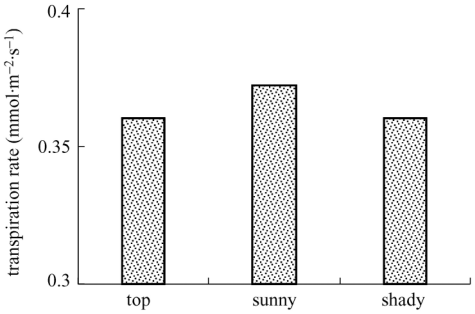

Fig. 2 Seabuckthorn Tr day means under different standing condition

3.3 Seabuckthorn biomass under different standing conditions

Fig. 3 shows the biomass of root, stem leaves were bigger in north of hill than south of hill. Total biomass was 334g (fresh weight)in north of hill and was only 110 g (fresh weight)in south of hill, total

biomass was 245g (fresh weight) in hill top. The biomass of root, stem and total biomass were obvious higher than hill top.

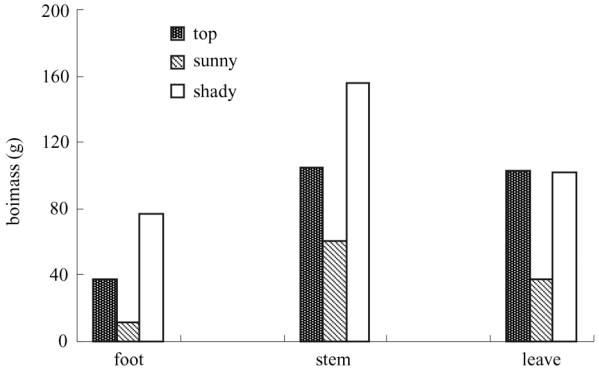

Fig. 3 Seabuckthorn biomass in different standing conditions

4 Discussion

Various standing conditions were different because topographic was various and climate was harsh in hills area of loess plateau, various air relative humidity, temperature intensity light and wind speed were different elevation, slope direction , position of slope, gradient and formed different microclimate. Transpiration of soil water was very big because rainfall was litter and concentrate in June, Aug., Sept. led to air relative humidity was very low nearly earth surface. Transpiration of plant was strong and organic water content was declined.

The north of slope and hill top of soil water content was higher in different standing conditions. Water was more utilized by plants and maintained whole day, special transpiration lost more water at noon. Transpiration was tend declined by south of slope. Soil surface was over-drought and air relative humidity was very low. Seabuckthorn organic water content was caused different by water difference in environment and affected photosynthesis and plant growth. Wu lin studies found seabuckthorn photosynthesis and growth was affected by water stress and plant high, branch sprout out, new branch number and dry of shoot weigh was marked by drought conditions[3,4]. Photosynthesis weaked led to biomass was declined .

The basic reason of biomass relative low was lower of soil water content in south of slope and top hill .The water was little by plant utilization. Air relative humidity of south of slope was declined . Water difference of outside and inside was increased in plant and led to transpiration was strong. Water difference of outside and inside was increased in plant and led to transpiration was strong. Water stress was affected plant growth and productive forces was decreased as fellow.