RESEARCH REGARDING THE PHYSIOLOGY OF CRATAEGUS MONOGYNA Jack SHRUB GROWN IN OLTENIA REGION CLIMATIC CONDITIONS

BUSE-DRAGOMIR LUMINITA[1], NICOLAE ION[1]
[1] University of Craiova, Faculty of Agriculture and Horticulture

Key words: hawthorn, photosynthesis, transpiration, fruit

ABSTRACT

In Oltenia Region , Crataegus monogyna shrub grows in different conditions, but the variation in climatic factors affects photosynthesis and transpiration in different ways.

The purpose of this study, effectuated at different location, was to quantify the effect of climatic environment and water availability on physiology of Crataegus monogyna shrubs.

The varied condition in shrubs growing influenced physiological processes and by this way, the quality of fruit medicinally used (average weight, *content in C vitamin).*

INTRODUCTION

Crataegus monogyna Jack. is a deciduous shrub growing to 3 m by 6. Suitable for: light,medium, and heavy soils and can grow in heavy clay and nutritionally poor soils. Suitable pH: acid, neutral and basic (alkaline) soils and can grow in very acid and very alkaline soils.It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil and can tolerate drought. The plant can tolerate maritime exposure. It can tolerate atmospheric pollution (Humphries, C.J, 2000).

The flowers can be found from May to June and are produced in corymbs of 6-12, each flower with five white or pale pink petals and one styles. The fruit is red, 6-10 mm diameter, slightly broader than long, containing 1 seed. The berries tend to form in August though they are not ripe until October (Uphof J.C. Th.,1968).

Seed is best sown as soon as it ripe in the autumn in a cold frame, someof the seed will germinate in the spring, though most eill probably take another year. Stored seed can be very slow and eratic to germinate, it showld be warm stratified for another three months at 4^0C (Foster S.,Duke J.A., 1999). It may still take another 18 months to germinate.Scarifing the seed before stratifing it might reduce this time(Mc. Millan, Browse P.,1979). If timed well, it can germinate in the spring (Mc. Millan, Browse P.,1979).

Hawthorn is an extremely valuable medicinal herb. It is used mainly for treating disorders of the heart and circulation system, especialy angina.

The fruit is antispasmodic, cardiac, diuretic, sedativ, tonic and vasodilator. Both the fruitd and flowers of hawthorn are well-known in herbal folk medicine as a heart tonic and modern research has out this use (Temelie Mihaela, 2006).

There are no data in the specialized literature about the physiology of the *Crataegus monogyna* species.

MATERIALS AND METHODS

The study of *Crataegus monogyna* plants physiology was carried in three location in the climatic condition of Oltenia region (Romania): Arginesti forest, Comanesti hill, and Runcu forest, area with plenty of moisture in the soil and with lower temperatures, due to the influence of Valcan Mountains nearby.

Fig. 1. Crataegus monogyna Jack.(original)

The photosynthesis and transpiration processes were established, due to the ultra compact device LCi, which simultaneously measured temperature and active radiation level in the assimilation room.

The pigment content in leaves was determined by Jasco Uv-Vis spectrophotometer, from the extract of one gram leaves and brought to a 50 ml volume, with an 80% acetone concentration.There was determined the extension to a 646, 663, 470 nm wavelengths, and the pigment content were estimated with the following formula:

Chlorophyll a (mg/100g) = (12.21xD663) - (2.81xD646) x5

Chlorophyll b (mg/100g) = (20.13xD646) - (5.03xD663) x5

Carotene + xanthophylls (mg/100g) = (1000 x D470) - (3.27xcl a -1.04 cl b).

The stomatal closure was determinate with alcohol fixation procedure.

For determination of ascorbic acid we used titrimetric method with potassium brommat-bromide solution in the acid medium (Skoog et al.1998, Dobrinas et al, 2004)

RESULTS AND DISCUSSIONS

The intensity of photosynthesis

In Runcu Forest, research regarding the diurnal dynamics of the process of photosynthesis at hawthorn leaves revealed a maximum in early hours of illumination . It remains constant through the period of leaf illumination and decreases when darkness sets in. In this region, the maxim intensity of the process of photosynthesis in hawthorn leaves varies between 11,4 and 12,9 μmol $CO_2/m^2/s$. This values was measured in May, and represented the maximum values (fig. 2).

In Arginesti Forest and and Comanesti Hill, the diurnal dynamics of the photosynthesis revealed in May a maximum in early hours(10-12 a.m) of illumination, decrease in the middle of the day(14 p.m) , and increase again two hours later (fig.2).

The variation of diurnal dynamic in the three location is influenced by temperature, intensity of light, but also the humidity of air and soil. These last factors influence the stomatal closure and indirectly the intensity of photosynthesis (fig. 3).

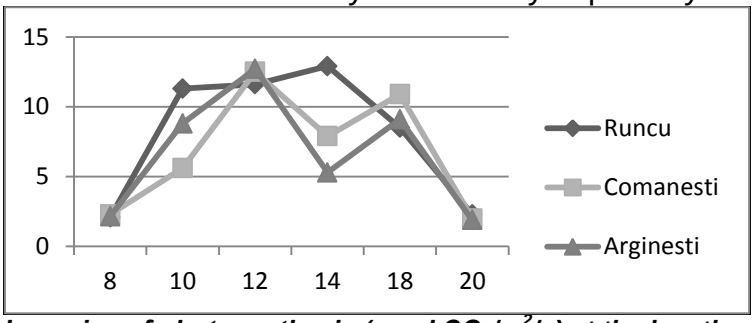

Fig.2.The diurnal dynamics of photosynthesis (μmol $CO_2/m^2/s$) at the hawthorn leaves in Runcu Forest, Arginesti Forest and Comanesti Hill

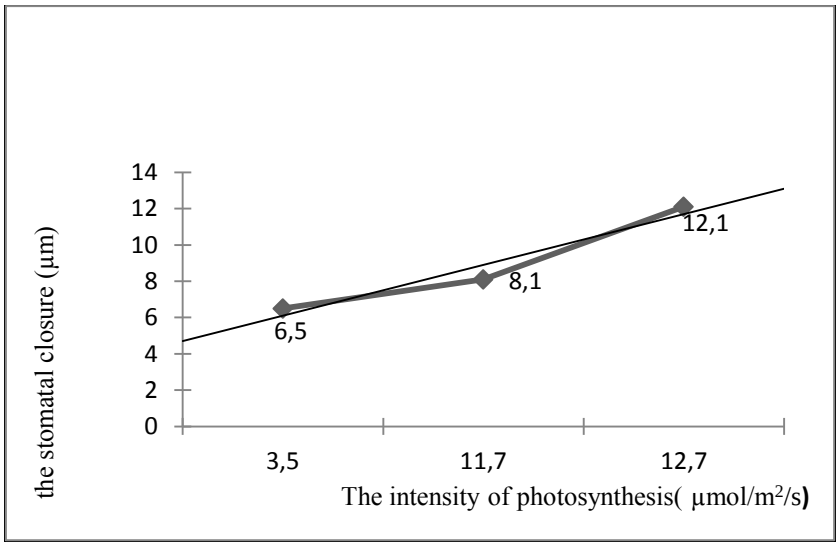

Fig. 3. The correlation between stomatal closure and photosynthesis

The content of assimilatory pigments

At the hawthorn, the leaves formed at various distances from the centre of the shrub, did not heave high differences of chlorophyll content.

The research conducted in hawthorn on chlorophyll content from shaded and sunny leaves showed that shaded leaves have a higher chlorophyll content compared to the sunny leaves (table 1).

The higher values of total pigments was determinate on Runcu Forest, to the shaded leaves (0,813g/ veg. mat).

Table 1

The content of assimilatory pigments (g/100g veg. mat.)

Location of plants	Total pigments		Chlorophill a		Chlorophill b		Yellow pigments	
	Shaded leaves	Sunny leaves	Shaded leaves	Sunny leaves	Shaded leaves	Sunny leaves	Shaded leaves	Sunny leaves
Runcu	0,813	0,780	0,357	0,310	0,148	0,139	0,305	0,332
Comanesti	0,775	0,610	0,322	0,289	0,149	0,138	0,302	0,274
Arginesti	0,738	0,701	0,297	0,235	0,146	0,136	0,295	0,254

The intensity of transpiration process

The young leaves have the highest intensity of the transpiration process and as they get older , the transpiration intensity decrease, the lower values being recorded at senescent leaves (fig. 4). The shaded leaves have a lower transpiration intensity compared to the sunny leaves.

The diurnal dynamics of the process of transpiration is similar with the diurnal dynamic of photosynthesis. To the Runcu Forest plants, a maximum value is determinate in the first hours of day, and minimum values when the night is falling. To the Arginesti and

Comanesti plants, a decrease of transpiration was observed in the middle of the day(fig.5).

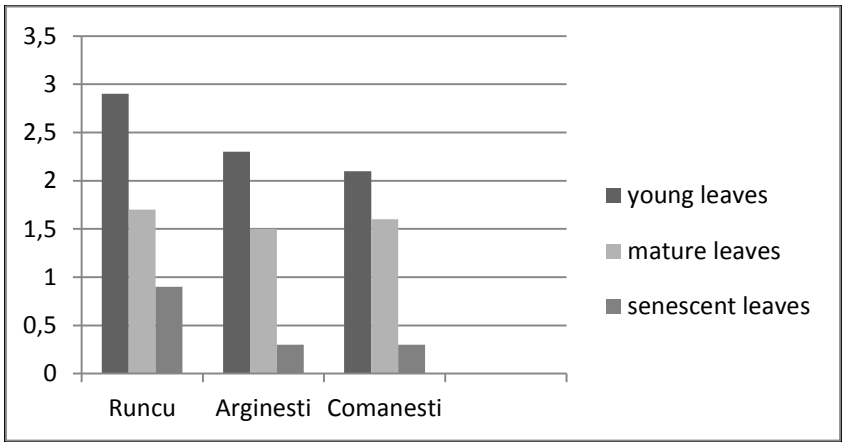

Fig. 4. The intensity of transpiration (mmol $H_20/m^2/s$) on young, mature and senescent leaves of Crataegus monogyna

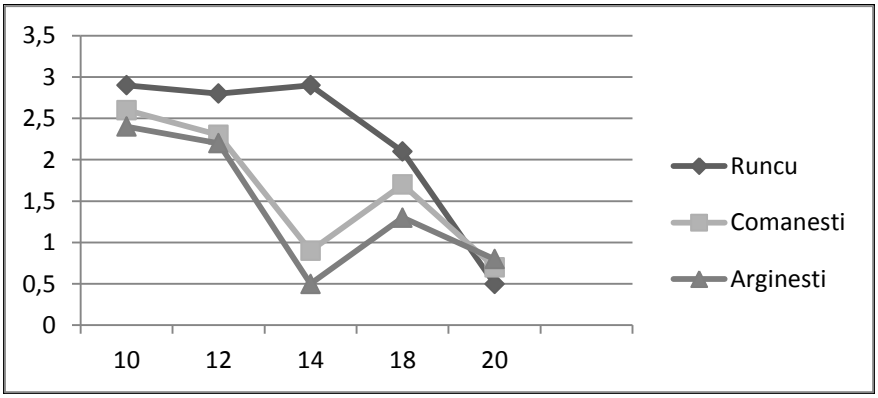

Fig. 5. The diurnal dynamics of the process of transpiration(mmol $H_20/m^2/s$)

The average weight of fruits harvested in September, showed different values at shrubs growing from different areas. The highest values was obtained to the Runcu Forest plants (0,62 g) (fig. 6). At plants from Arginesti forest, growth is reduced directly by decreased cell enlargement and indirectly because decreased leaf area, stomatal closure and the photosynthetic process is damaged. All of these effects reduced the photosynthetic production of the plant and decrease the amount of carbohydrate available for growth.

In the case of vitamin C fruit content, the lowest values were determined at plants from Arginesti forest(25,8mg/100g), average values at plants of Comanesti hill, and almost double values obtaining the fruit brushes from Runcu area(39mg/100 g)(fig.7).

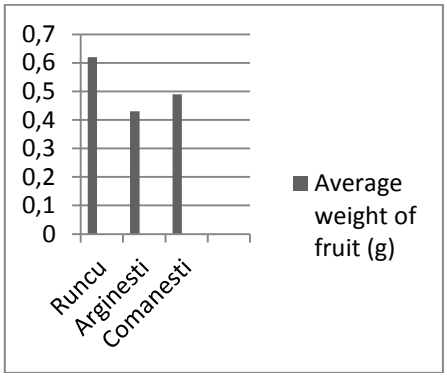

Fig.6. The average weight of fruit(g)

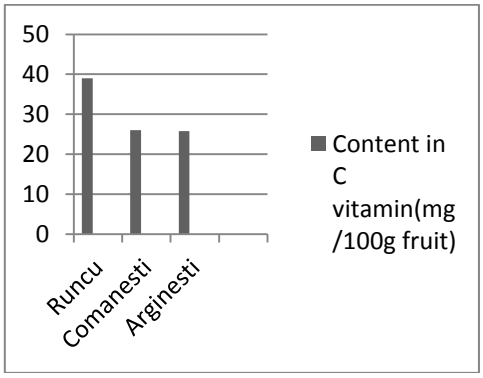

Fig.7. The content in C vitamin (mg/100 g)

BIBLIOGRAPHY

Dobrinas, S. et al, 2004**-** *Environmental Engineering and Management Journal***,** 3(4), 689
Foster S.,Duke J.A., 1999, *A field guide to medicinal plants*, Peterson Guides, 216
Humphries C.J., 2000, *Hamlyn guide to trees of Britain and Europe*, Press G.R. and Sutton, London, 167-169
Mc. Millan, Browse P. , 1979, Hardy *Woody plants from seed*, Grower Books, 126
Skoog,S et al,1998- *Fundamentals of Analytical Chemystry, Seventh Edition,* 845
Temelie, Mihaela, 2006, *Enciclopedia plantelor spontane din Romania*, Rovimed Publischers, 326-327
Usher, G.A. 1974, *Dictionary of plants used by man*, Hafner Press, 456-460
Uphof J.C. Th.,1968 –*Dictionary of economic plants*, Lubrech and Cramer Ltd,417