COMPARISON OF CLIMATE CHARACTERISTICS OF SLOVAKIA AND IRAQ AS THEORETICAL BASIC FOR STUDY OF WOODY PLANTS INTRODUCTION FROM MEDITERRANEAN TO TEMPERATE ZONE

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Abstract

Mediterranean-type climates have been defined: (1) Geographically, as climates similar to those found around the Mediterranean Sea; (2) Vegetationally, as climates where broad-leaved evergreen sclerophyllous shrub lands (maquis, chaparral, matorral, macchia, fynbos, kwongam) are common or dominant; and (3) Climatically, as regions of summer drought and winter rainfall.

Native plant species are very important source of adapted plant material especially when unfavourable climatic and soil conditions are present. These species are also more effective than non – native species in controlling soil erosion. Once established, since they are adapted to local dry conditions, their care is easer than non – native species.

Mediterranean woody plants are very popular in central Europe countries in landscape and garden architecture as the composition element, also for oil, tea and as medical plants. These are the main reasons for the evaluation of the selected woody species introduction from the Mediterranean zone in the Middle East into Central European conditions of Slovakia (or the Czech Republic).

From this reason were established experimental plots at the Botanical Garden of the Slovak University of Agriculture in Nitra. The study area was planted by the following woody evergreen and deciduous species:

Callistemon laevis Ball., *Cupressus sempervirens* L., *Lagerstroemia indica* L. *Laurus nobilis* L., *Nerium oleander* L., *Pittosporum tobira* L., *Trachycarpos fortunei* (HOOK.) H. WENDL., *Viburnum tinus* L., *Vitex agnus-castus* L., *Zizyphus jujuba* L.

The climate of the Kurdistan Region is semi-arid continental: very hot and dry in summer, and cold and wet in winter. Mean highest temperatures range from 13-18 °C in March to 39-43 °C in July and August. On the upper plains there is two to three times as much rain as at Baghdad, the average annual rainfall rising from about 300 mm in the drier parts to 500 mm. In the forest zone of mountains the rainfall varies from about 600 mm to over 1200 mm.

Slovak Republic belongs to the northern moderate climatic zone, with four seasons. The topography of Slovakia is very diverse and the altitude is also an important factor affecting the air temperature, rainfall, solar radiation and wind. The warmest and driest region of Slovakia is Podunajská nížina (Danube lowland) with an annual average temperature around 10.3 °C and precipitation around 530 mm. The coldest places are mountains as the High and Low Tatras with the annual average temperature of 3-6 °C with precipitation over 1600 mm.

Climate comparison of both countries shows on relative convenient conditions for woody plants introduction on other.

Key words: Mediterranean plants, potential for introduction, adaptation

Introduction

Major natural factors shaping landscape are climate, geology and geomorphology, relief, hydrology, soil and flora. Natural factors change as a result of the interaction of people due to a series of cultural factors. Major cultural factors are settlement areas, transport network, agriculture, forestry and industry (WASCHER, 2005). Classification and identification of landscapes problem to be faced by the responsible organizations and is the first institutions for the development, protection and management of landscape. Because all the decisions related to the future of the landscapes should be in sufficient numbers or the change should be assessed during the process (LUGINBÜHL, 2002). Effective "greening" campaigns may reduce urban heat effect. Probably planted trees seize particulates and reduce nearby air temperatures through both transpiration and shade in the summer and increase temperatures through wind reduction in the winter (MCPHERSON et al., 1998). Tree planting not only can modify microclimate, but also has other ecological as well as economic and aesthetic benefits (GATRELL and JENSEN, 2002). Because of the importance of urban trees, many environmentally conscious planning authorities have taken on the strategy of greening campaigns worldwide (NICHOL, 1994).

Native plant species are very important source of adapted plant material especially when unfavorable climatic and soil conditions are present. These species are also more effective than non – native species in controlling soil erosion. Once established, since they are adapted to local dry conditions, their care is easier than non – native species.

The ecosystem approach of regionalization of the earth's surface assigns and defines so-called vegetation zones, which are the result of two basic natural a biotic factors, namely temperature and total annual rainfall. According to Walter, vegetation zones are allocated from the equator to the poles (HENDRYCH, 1984).

Plants have adaptations to help them survive (live and grow) in different areas. Adaptations are special features that allow a plant or animal to live in a particular place or habitat. These adaptations might make it very difficult for the plant to survive in a different place. This explains why certain plants are found in one area, but not in another and to be described other and main reason for introduction to Slovakia and central Europe region: (1) Because evergreen woody plants mostly shrubs ,(2) Ornamental effect of the new woody plants at flowering and fruiting effect, (3) Woody plants for the production of biomass for energy use and wood industry, (4) For enrichment of culture plants gene pool and for education in botanical gardens, arboretums, city parks and private gardens, (5) Range expansion of plants for social benefits - aesthetic and landscape architecture, applied floristry, types of cultural knowledge and education in the field of greenery and its vegetation zones biodiversity, (6) Woody plants for changed environmental conditions in urbanized landscape (SUPUKA and FERIANCOVA et al., 2008).

Material and Methods

The goal of this study with regard to the mother country of the graduate, which is the Middle East, the State of Iraq, the objectives of the thesis are defined as follows: a) The history evaluation of woody species introductions of the Mediterranean zone, with the emphasis on the Middle East, to Central European conditions of Slovak republic, or

Czechoslovakia.
b) The evaluation of the current genetic resources state of Mediterranean dendroflora in selected arboretums and botanical gardens in Slovakia, and the Czech Republic. Core arboretums and botanical gardens for the purpose of this evaluation are: Arboretum Mlyňany, Botanical garden Nitra, Brno (Mendel University), Lednice Park in Morava. The climate and geographical conditions of original Mediterranean zone - Middle East (Iraq and surrounding areas) will be compared with the conditions of studied objects in Slovakia,
c) Setting up an experiment by pot experiments with 10 lesser-known plants (shrubs) of Mediterranean autochthonous dendroflora. Each type is represented by a number of 3-5 individuals, and research will be conducted during 2-3 growing seasons (2011-2013). The experiment will be based at the premises of the Botanical Garden SAU Nitra.
The aim of the contribution is to describe and to compare selected climate characteristics of Slovakia and Mediterranean zone with emphasize to my home country Iraq. A climate characteristic belongs to the basic dates which are decisive for woody plants introduction between compared countries.
The climate characteristics of Mediterranean region are elaborated by using of publication according to ZELENY (2005), Iraq country is according to EVAN (1966). Climate characteristics of Slovakia were elaborated by using national Landscape Atlas of the Slovak republic (MIKLOS and HRNCIAROVA et al., 2002).The following part of this contribution deals with study requirement while was established at Botanical garden of the Slovak University of Agriculture in Nitra . There are introduced of 10 experimental woody plants composition at two different planting forms as are (1) direct to the land, (2) planting to the plastic pots. To the basic methodical approaches for assessment of experimental woody species belongs: penology phases, year increment, occurrence of hardiness marks, forms of cultivation.

Results and Discussion

Slovakia climate is moderate because Slovakia lies in northern moderate climatic zone. Geographical position in continental Europe, wind circulation from west and altitude are the key factors that influence Slovakia climate. Due to landscape variations, climate in Slovakian lowlands is warmer than Slovakia climate in mountains and altitude is similarly applied to climatic seasons. The warmest part of Slovakia includes Danubian Lowland and Eastern Slovak Lowland. Yearly temperature average in lowlands is around 10°C andyear precipitation around 530 mm. With higher altitudes temperature decreases and amount of precipitation rises. The lowest temperature is on the mountains with yearly temperature averages about 3-6 °C and precipitation reaches over 1600 mm. There are radical weather and precipitation changes throughout the year as well as day and night length. In general weather in Slovakia is very irregular. This is caused because Slovakia climate is mostly influenced by dry continental air and humid oceanic air. (MIKLOS and HRNCIAROVA et al., 2002). Many of the regions with Mediterranean climates have relatively mild winters and very warm summers. However winter and summer temperatures can vary greatly between different regions with a Mediterranean climate. In the case of winters for instance Lisbon experiences very mild temperatures in the winter, with frost and snow practically unknown, whereas Thessaloniki has colder winters with annual frosts and snowfall. In the case of summers for instance, Athens experiences rather high temperatures in the summer (48 °C (118 °F) has been measured in nearby Eleusina). Because most regions with a Mediterranean climate are near large bodies of water, temperatures generally moderate with a comparatively small range of temperatures between the winter low and summer high

(although the daily range of temperature during the summer is large due to dry and clear conditions, except along the immediate coasts). Temperatures during winter only occasionally fall below the freezing point and snow generally is seldom seen. In the summer, the temperatures range from mild to very hot, depending on distance from a large body of water, elevation, and latitude. Even in the warmest locations with a Mediterranean-type climate, however, temperatures usually do not reach the highest readings found in adjacent desert regions because of cooling from water bodies, although strong winds from inland desert regions can sometimes boost summer temperatures, quickly increasing the risk of wildfires (ZELENY, 2005).

During summer, regions of Mediterranean climate are dominated by subtropical high pressure cells, with dry sinking air capping a surface marine layer of varying humidity and making rainfall impossible or unlikely except for the occasional thunderstorm. While during winter the polar jet stream and associated periodic storms reach into the lower latitudes of the Mediterranean zones, bringing rain, with snow at higher elevations. As a result, areas with this climate receive almost all of their yearly rainfall during their winter season, and may go anywhere from 4 to 6 months during the summer without having any significant precipitation.

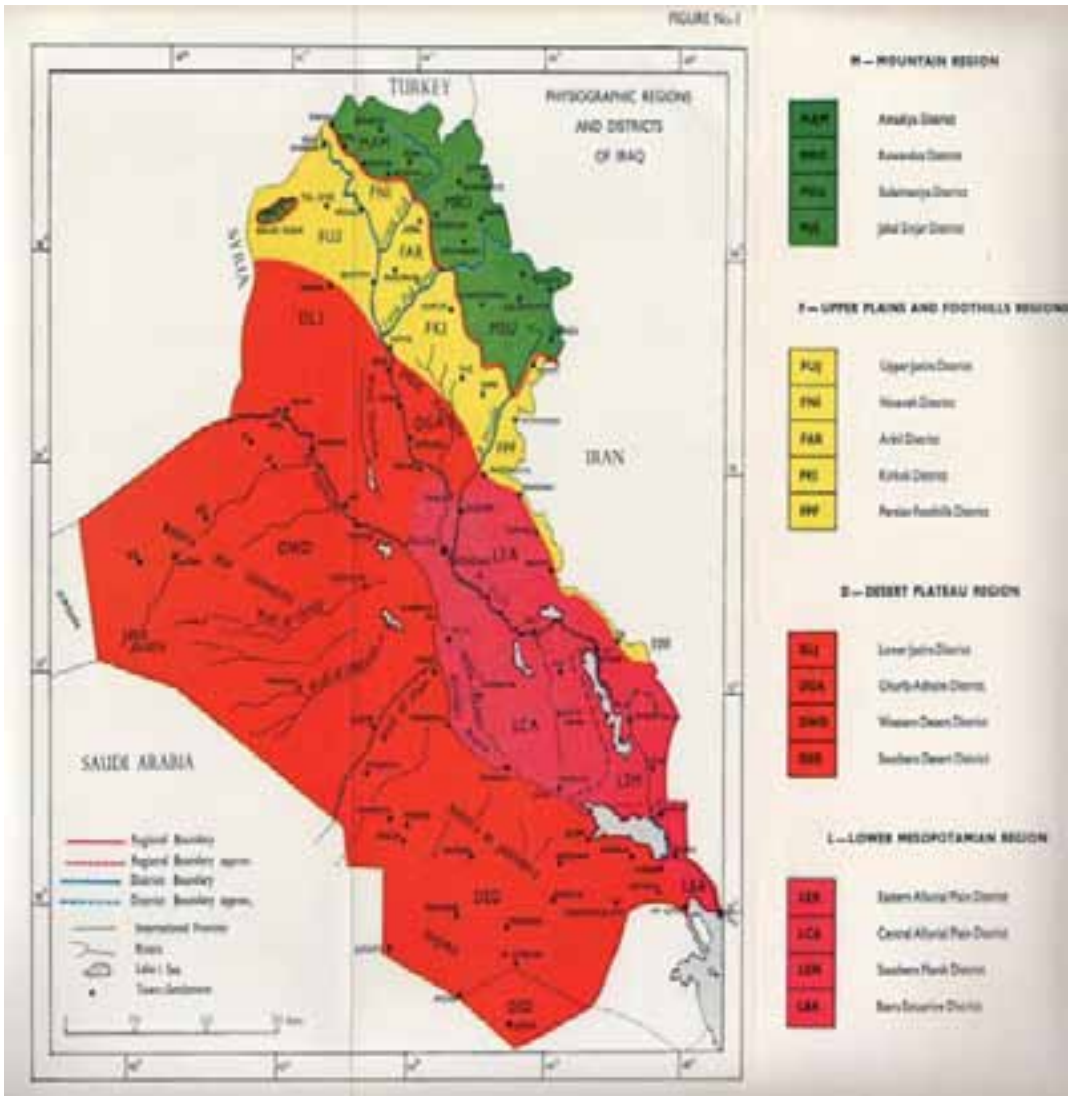

Fig. 1. Regionaly dividing and charasteristics of Iraq country (EVAN, 1966)

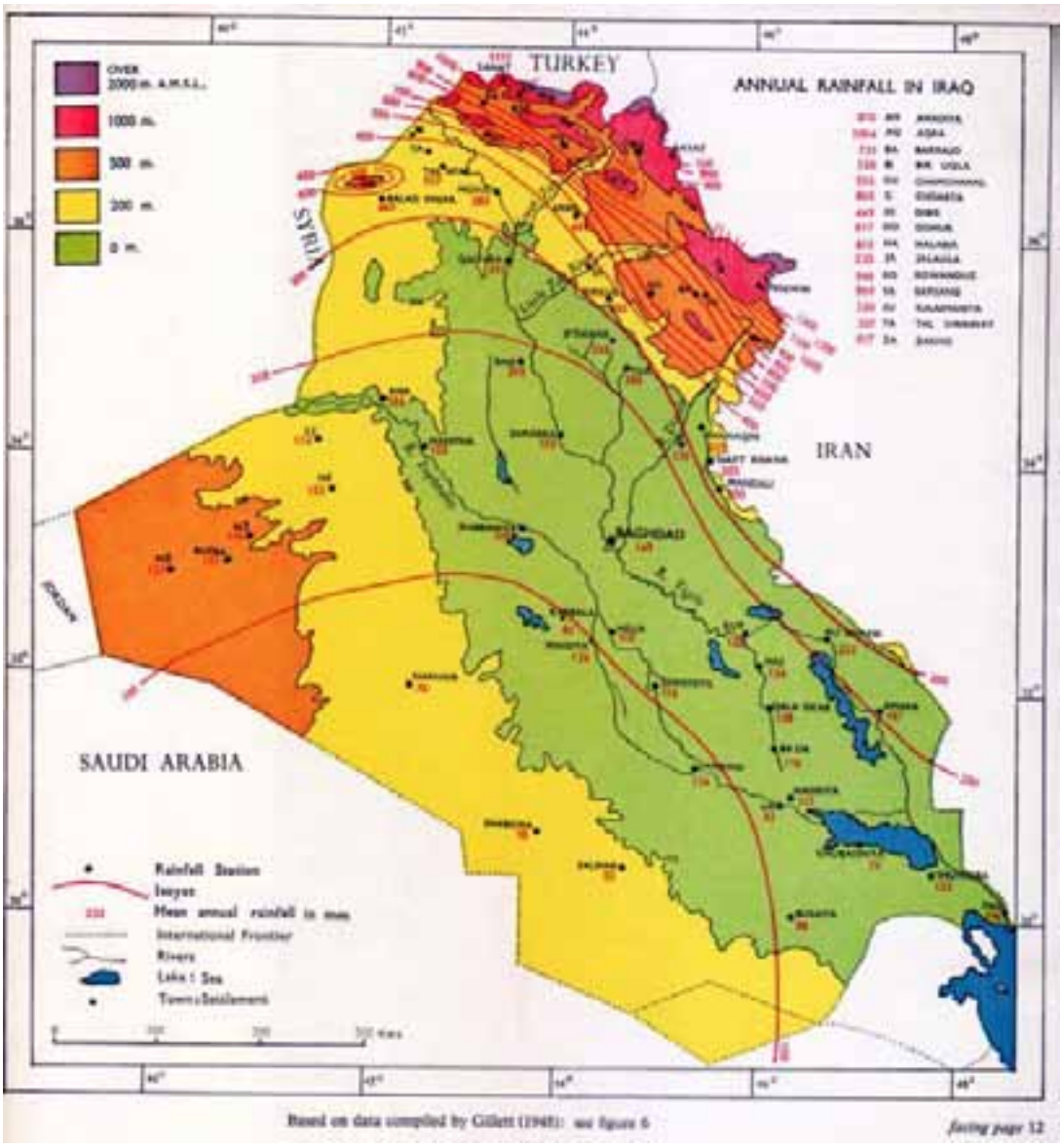

Fig. 2. Mean annual rainfall charesteristics of Iraq (EVAN, 1966)

Temperature, humidity and rainfall, mean monthly maximum, mean and minimum temperatures , the relative humidity (at 3 P.m. and the daily mean) and the monthly rainfall in upper Iraq (Mosul)and Lower (Baghdad) are presented in Table 1. and Table 2. and showed graphically in Fig. 3. Though there is little difference between the temperatures and general aridity of these two locations during the height of summer, the winter at Mosul is colder then at Baghdad and the annual rainfall very much higher; the spring growing season is moreover appreciably longer and the relative humidity greater.

Characteristics of climate. The climate of Iraq semi-arid type, designated as “continental, sub-tropical” chiefly characterized by wide diurnal and annual ranges of temperature.

Tab. 1. Monthly temperatures, relative humidity at Baghdad (B) and Mosul (M) cities (EVAN, 1966).

MONTH	TEMPERATURE (Fahrenheit)									
	MEAN MINIMUM		MEAN		MEAN MAXIMUM		HIGHEST MAXIMUM		LOWEST MINIMUM	
	B	M	B	M	B	M	B	M	B	M
JAN.	60	54	49	43	39	35	77	69	18	12
FEB.	64	58	53	47	42	38	86	78	22	15
MAR.	71	66	59	53	48	42	99	87	26	25
APR.	85	77	71	63	58	49	110	104	37	31
MAY	97	92	83	74	68	58	113	106	47	40
JUNE	105	103	91	86	73	65	119	115	58	50
JULY	110	109	94	92	76	72	123	124	62	56
AUG.	110	110	94	90	76	70	121	119	64	55
SEP.	104	102	87	81	70	61	117	117	51	45
OCT.	92	88	77	69	61	52	108	105	39	32
NOV.	77	73	63	57	51	45	98	95	28	26
DEC.	64	59	52	47	42	38	81	76	19	19
YEAR							123	124	18	12
MEAN	87	82	73	67	59	52				

• Figures extracted from *Climatological Means for Iraq*, Publication No. 10 of the Iraqi Meteorological Department, Baghdad (1954). The means are of 15 years observations (1937–52) at Baghdad airport, alt. 34 m. (columns headed B) and of 24–29 years observations (1937–52) at Mosul, alt. 223 m. (columns headed M). For the highest maximum and lowest minimum temperatures and the maximum falls of rain recorded in 24 hours the earlier records, dating back to 1888 at Baghdad and to 1908 at Mosul, have also been taken into consideration.

Tab. 2. Monthly relative air humidity and rainfall in upper and down Iraq the Baghdad (B) and Mosul(M) cities (EVAN, 1966)

RAINFALL IN UPPER AND LOWER IRAQ*

RELATIVE HUMIDITY (%)				RAINFALL (millimeters)‡					
AT 3 P.M.		DAILY MEAN†		MEAN		MAXIMUM FALL (in 24 hrs.)		No. OF DAYS (with minimum of 10 mm.)	
B	M	B	M	B	M	B	M	B	M
51	64	71	82	24	70	35	38	0·5	4·2
42	57	63	77	26	78	64	57	0·7	2·0
36	47	56	70	28	53	56	36	0·7	1·8
34	41	47	65	10	47	44	75	0·3	1·3
19	26	33	49	4	18	20	39	0·1	1·3
13	15	24	33	0	0	1	3	0·0	0·0
12	15	23	29	0	0	tr.	2	0·0	0·0
13	13	24	29	0	0	12	tr.	0·0	0·0
15	16	28	35	0	1	1	1	0·0	0·0
22	28	36	47	3	5	16	27	0·1	0·2
39	44	56	65	20	48	53	86	0·5	1·6
52	60	71	80	26	62	39	71	0·7	2·1
				140	382	64	86	4	15
29	35	44	55						

† The Daily Mean Relative Humidity is the mean of observations recorded at 6 a.m., 9 a.m. and 3 p.m. daily throughout each month.

‡ Under rainfall tr. (trace) is less than 0·05 mm.

(*a*) a *high mean annual air temperature* (due to the latitude);
(*b*) large differences in temperature between day and night and between winter and summer, i.e. *large diurnal and annual ranges of temperature*. In Lower Iraq the maximum temperature recorded is 51° centigrade (123° Fahrenheit) and the minimum −8° C (18° F). The diurnal range in temperature often

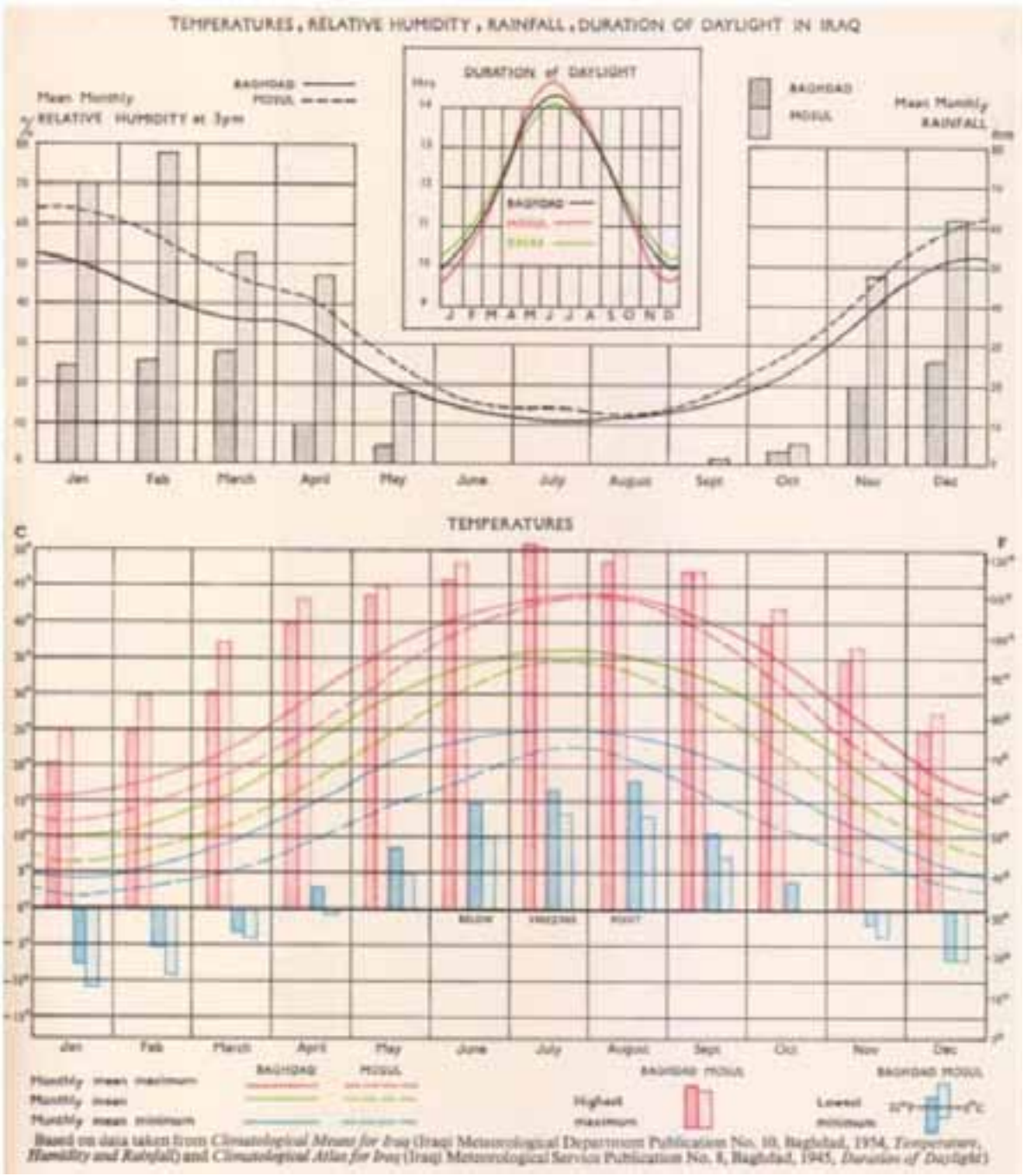

Fig. 3. Temperatures, relative humidity and rainfall duration of daylight at Baghdad and Mosul cities (EVAN, 1966)

Tab. 3. Climate regions of Slovakia and their main characteristics (MIKLOS and HRNCIAROVA et al., 2002).

Climate region main characteristics	T(A) Warm region	MT(B) Moderately warm region	CH(C) Cold region
Number of summer days	50-70	20-50	0-3
Number of days with average 10 °C and more	160-180	120-160	0-140
Number of days with frost	90-130	110-180	140-180
Number of ice days	30-40	30-50	50-80
Mean January temperature °C	-1- -5	-2- -6	-5- -8
Mean April temperature °C	7-10	5-8	0-6
Mean July temperature °C	17-20	15-18	10-16
Mean October temperature °C	7-10	6-8	2-7
Sum precipitation in growing season, mm	300-400	350-600	500-1000
Sum precipitation in winter season, mm	200-300	200-350	350-700
Number of days with snow cover	50-80	60-120	100-200

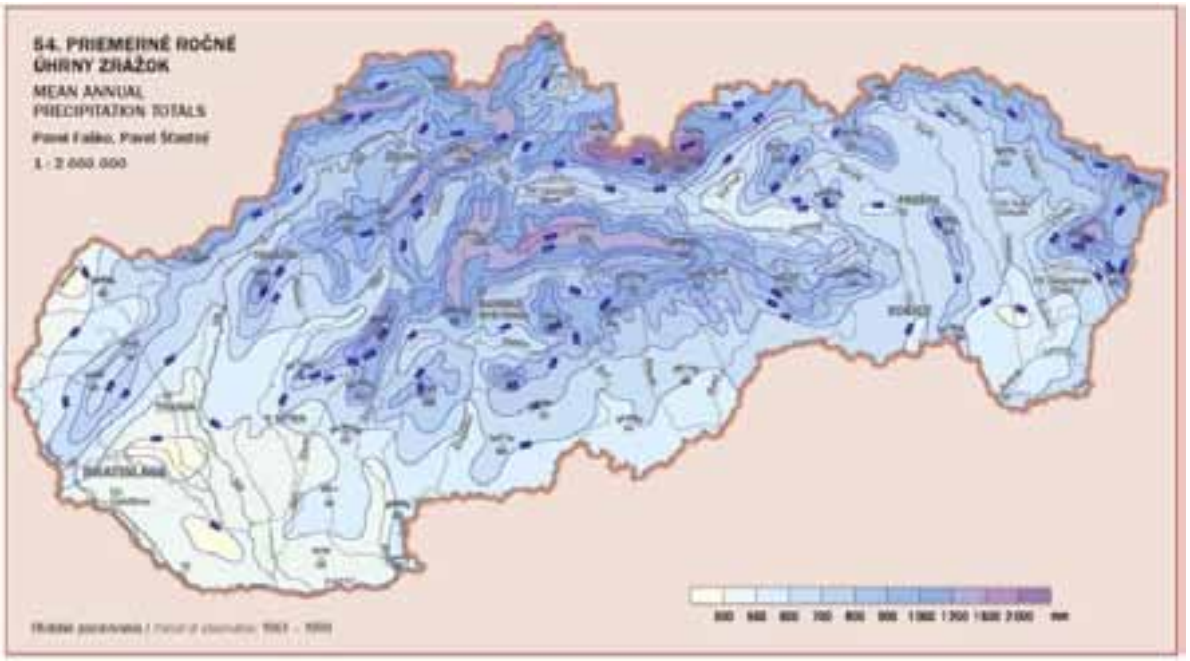

Fig.4. Mean annual precipitation totals at Slovakia territory (MIKLOS and HRNCIAROVA et al., 2002)

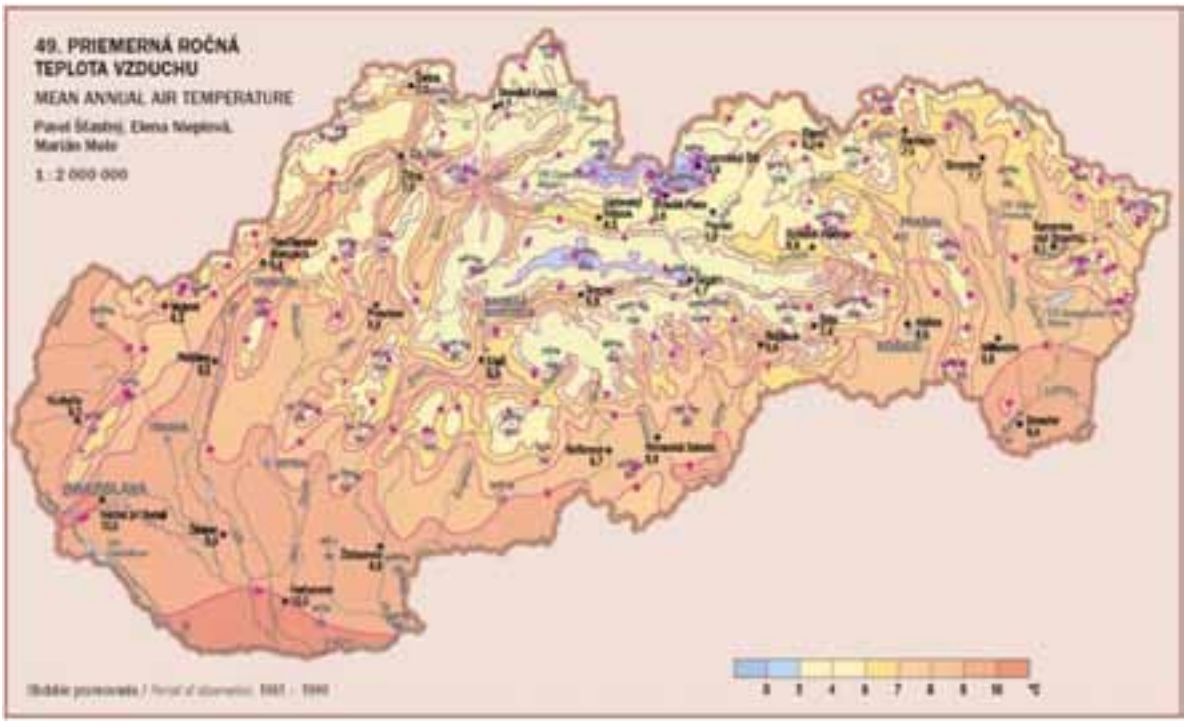

Fig. 5. Mean annual air temperature at Slovakia territory (MIKLOS and HRNCIAROVA et al., 2002)

Establishment of requirement parts in botanical garden SAU and introduction to phenology phase.

The study was conducted 10 species of Mediterranean woody plants (shrubs), including deciduous and evergreens species: *Callistemon laevis* Ball. (ever green, Myrtaceae) *Cupressus sempervirens L.* (ever green, Cupressceae) , *Lagerstroemia indica* L. (deciduous, Lythraceae), *Laurus nobilis* L.(ever green, Lauraceae), *Nerium oleander* L.(ever green, Apocynaceae), *Pittosporum tobira* L.(ever green, Pittosporaceae), *Trachycarpos fortunei* (HOOK) H.WENDL. (ever green ,Palmaceae), *Viburnum tinus* (ever green, Caprifoliaceae) , *Vitex agnus castus* L.(deciduous, Verbenaceae), Zizyphus jujuba L.(deciduous, Rhamnaceae). The selected plants cultivated during spring in 2011, the cultivation comprise in pots and direct in the land, the plants were sprinkler irrigated as a function of evaporative demand. We had measured the following phenological characters as seen bellow:

(Breaking Phase)
Bud swelling.
Bud breaking.
(Foliation Phase)
Beginning of foliation.
Full foliation.
(Blossoming Phase)
Beginning of blossoming.
Full blossoming.
Beginning of blossoming fall.
Full blossoming.
(Fruit bearing Phase)
Beginning of fruit bearing
Beginning of fruit ripening.
Full fruit ripening.
(Leaf coloration Phase)
Beginning of leaf coloration
Full leaf coloration.
(Defoliation Phase)
Beginning of defoliation.
Full defoliation.
(Growth marks)
Starting high in cm.
Year increment in cm.

Conclusion

An assembled phenological key will be used in phonological monitoring of woody plants, for evaluation of the biological characteristics of different plants genotypes and origins as well as for assessment of their reaction on climate conditions.

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POROVNANIE KLIMATICKÝCH CHARAKTERISTÍK SLOVENSKA A IRAKU AKO TEORETICKÝ ZÁKLAD PRE ŠTÚDIUM INTRODUKCIE DREVÍN ZO STREDOMORSKÉHO DO MIERNEHO PÁSMA

Abstrakt

Stredomorský typ podnebia je definovaný: (1) geograficky, ako podnebie podobné podnebiu v okolí Stredozemného mora; (2) vegetačne, ako podnebie, v ktorom sú bežné alebo dominantné porasty listnatých vždyzelených tvrdolistých drevín (Maquis, Chaparral, Matorral, Macchia, Fynbos, Kwongam) ; (3) klimaticky, ako oblasti letného sucha a zimných dažďových zrážok. Domáce druhy rastlín sú veľmi dôležitým zdrojom adaptovaného rastlinného materiálu, najmä v prípade nepriaznivých klimatických a pôdnych podmienok. Tieto druhy sú tiež účinnejšie ako nepôvodné druhy v protieróznej ochrane pôdy. Keďže pôvodné druhy sú prispôsobené miestnym arídnym podmienkam, starostlivosť o ne po založení je jednoduchšia než v prípade nepôvodných druhov. Mediteránne dreviny sú veľmi obľúbeným kompozičným prvkom v záhradno-architektonickej tvorbe v krajinách strednej Európy. Sú využívané taktiež na produkciu oleja, čajov a ako liečivé rastliny. Tieto skutočnosti predstavujú hlavný dôvod vyhodnotenia vybraných druhov drevín na introdukciu z

mediteránnej zóny na Blízkom východe do stredoeurópskych podmienok Slovenska (alebo Českej republiky). Z tohto dôvodu boli založené experimentálne záhony v Botanickej záhrade Slovenskej poľnohospodárskej univerzity v Nitre. Výskumná plocha bola osadená nasledujúcim sortimentom vždyzelených a listnatých drevín: *Callistemon laevis* Ball., *Cupressus sempervirens* L., *Lagerstroemia indica* L. *Laurus nobilis* L., *Nerium oleander* L., *Pittosporum tobira* L.. *Trachycarpos fortunei* (Hook.) H. Wendl., *Viburnum tinus* L., *Vitex agnus-castus* L., *Zizyphus jujuba* L. Klíma Kurdistanského regiónu je semi-arídna, kontinentálna: veľmi horúce a suché letá a chladné a vlhké zimy. Rozsah najvyššých teplôt sa pohybuje od 13 do 18 ° C v marci od 39 až do 43 ° C v júli a auguste. Na horských pláňach je úhrn zrážok približne dva až trikrát vyšší než v Bagdade. Priemerný ročný úhrn zrážok sa pohybuje od cca. 300 mm (v suchších zónach) až do 500 mm (vo vlhších zónach). V lesnej zóne hôr sa úhrn zrážok pohybuje od cca 600 mm do viac ako 1200 mm. Slovenská republika patrí do severného mierneho klimatického pásma, so štyrmi ročnými obdobiami. Topografia Slovenska je veľmi rôznorodá a nadmorská výška je tiež dôležitým faktorom ovplyvňujúcim teplotu vzduchu, zrážky, slnečné žiarenie a vietor. Najteplejšou a najsuchšou oblasťou Slovenska je Podunajská nížina (Danube Lowland) s priemernou ročnou teplotou okolo 10,3 ° C a úhrnom zrážok okolo 530 mm. Najchladnejšie miesta sú horské oblasti Vysokých a Nízkych Tatier s priemernou ročnou teplotou 3-6 ° C a s úhrnom zrážok nad 1600 mm. Klimatické porovnanie oboch krajín vykazuje relatívne vhodné podmienky pre introdukciu drevín z irackej mediteránnej klímy do slovenskej stredoeurópskej miernej klímy.

Kľúčové slová: Mediteránne rastliny, introdukčný potenciál, adaptačná schopnosť (adaptácia)