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Investigation the Phonological and Morphological traits of the some superior genotype of hazelnut in Talesh region of Guilan province

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Abstract
Hazelnut (*Corylus avellana L.*) is the one of the native and valuable shrub in Iran. Identification of the superior genotypes of hazelnut is the firs step for cultivation developing and breeding programs of this nut crop. In this research, had been studied phenological, morphological and pomological characters according to hazelnut's descriptor for two years (2009-2010) on four populations of hazelnut in the category of Mamoli Gerd, nakhonak, Kolaparak and khormaie in four regions of mountain in Talesh. The quantity and quality data from phenological, morphological and pomological characters collecting by method of random sampling and quantity analyzing by the method of ANOVA and Duncan test and quality data by the method of Chi Square (X^2) test. The results of this study showed that studied genotypes have wide range of phonological and morphological characteristics and these were categorized in separate groups. With analysis of data, superior genotypes were identified for high productivity, resistant on spring later cold, high weight of fruit, high percent of fruit brain, and appropriate time for harvesting and resistant on pets and diseases. Development and cultivate of superior genotypes in study area can be useful to local people due increasing income and economic stimulation companion with agriculture and animal husbandry activities.

Key words: *Corylus avellana*, Phonology, Morphology, Genotype, Ag-Evlar Talesh

INTRODUCTION

Hazelnut (*Corylus avellana L.)* is a shrub of **Betulancea** family and its fruit is one of the important nut crop in the world (Sabeti, 2006). Country like Turkey, Italy, USA, Iran, China, Spain, Greece, France, Azerbaijan and Kirgizstan are more important hazelnut producer in the world (Web site FAO). In Iran, hazelnut as a native plant seems in forest of Arasbaran, Talesh, Tarom and Zanjan. According to statistics of FAO, in Iran 19500 hectares the hazelnut, 18000 ton produced annually, and 923 kg is mean production for every hectare (Web site FAO). According to statistics of Iranian agriculture ministry report, cultivation area of hazelnut in Guilan province place on the first step of ranking of the country. Hazelnut more spear on the rustic area in Guilan province. 66000 ton of hazelnut annually produced in Guilan and this figure is equal with 70 percent of total production in Iran (Husseinnia, 2001).

Now a days, in modern horticulture, replacing native plant varieties with new and productive varieties due to gens destroy and reduction in genus resources. Attention to gen destroying and reduction in genus resources, it's necessary to planning for identification, collection and protection of heredity resource. For this reason, attempts to collecting and maintaining the local gerplasms' in world. The principal of genetic protecting is various genetic existence, i.e. they're total various factors (Alleles) of a specie ca be existed in the nature. Therefore genetic diversity has more importance and it's the first step to identification, collection, protection and utilize of the genetic resources. Indeed, to identification, collection, and protection of these resources is one of the important factors to available for them in necessitated time (Romisondo,1967; Mehlenbacher.S.A.1987; Thompson *et al*., 1996).

More main varieties of hazelnut, directly select among the *Avellana* species. So that, in the premier of twenty century, hazelnut growers and nurserymen not only collected the local varieties but also perform hybridization among the collected varieties. Pay attention to quality and quantity characters, like greatness of the fruit,

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soft of shell, resistance again disease and etc in hybridizations (Makhno, 1983; Thompson *et al*., 1996).

Though, any classified report had not be represent about breeding of hazelnut up to 1970, but after this year breeding program wildly start in US, Italy, France, Turkey, Spain and researchers set horticultural important characters as a scale to select varieties or breeding programs (Thompson *et al*., 1978; Thompson *et al*., 1996). For this purpose, Thompson *et al* (1978, 1985), established an evaluated system and considered a series of main characters of hazelnut under the new system, and results represented in a decoded table (Thompson *et al.*, 1978).Romisondo(1983) evaluated the varieties of Tonda Romada, Tonda Jentil den lange, sen jiovani, Day Jifoni and Morterla, while the results showed that tonda Jentil lange has a soft shell nut with high kernel percentage and bearing is better than the others. Makhno(1983) evaluated genotypes exist in Sochi collection and in the Caucasus Mountains and select and represented Sochi varieties with 1 to 5 indexes. Kim (1983) selected some genotypes among the Korean species of Hetrophylla and Seiboldiana, and crossing with *avellana* species and then compared results show that 4 selected genotypes were better against cold, growing and bearing characters.Garcia et al(1985) evaluated Noghret, Morl, Gironel, Calpla, Gerifternet and Ribet and indicated that Neghre and Gironel have bearing more than the other and resist again Mosaic virus more than the others. Mehlenbacher et al (1991) compared Willamette and Barcelona species and result indicated that Willamette have better resistance and bearing than Barcelona species. Mehlenbacher et al (2000) compared Daviana and VR series and indicated that VR series have more resistance again East blight disease than Daviana. McCluskey et al (2001) studied Elviz and Barcelona cultivars for purpose of vegetative and generative characters and results indicated that Elvis had lower generative rate than Barcelona and had a shorter canopy, but observed more bearing, percentage of kernel and resistance again diseases than Barcelona cultivar. Mehlenbacher et al (1991) compared Clerk and OSU series (Series that released from Oregon University) with cultivars like Daviana and Batler; results indicated that Clerk and OSU Series had more resistance than Daviana. Bostan (1997) has been considered and evaluated 16 characters of three cultivars hazelnuts and reported that of cultivars under study on 16 characters showed significant differences among them. He shows that percentage of kernel varied from 34% to 56.28% and highest and lowest percentage observed in Palaz colonies andJacildac colonies respectively. Rovira *et al* (1997) compared selected colonies Jeronel and Neghret and report that weight of Neghret was diverse from 1.4 to 2 and weight of Jeronel was variable from 1.98 to 2.25. Kernel percentage of two cultivars was different and Neghret had more kernel than Jerome. Valentini et al (2001) compared 23 colonies from Jentil Del Lange and AD17 colony had the heaviest hazelnut and BG3 and VM5 weight have the lightest weight respect to dry weight. He also report that colonies efficiency had significant differences and AD17 and MT4 colonies had the most and the lowest efficiency respectively.

In Iran, there are regions with wild jungles of hazelnut in Ardebil and Guilan and can be said with bravery, Iran is the one of the more important genetic bank in hazelnut field and have a more diverse of genotypes. As if, mass of Ag-Elvar jungle in Talesh is one of the main hazelnut habitats in Guilan and have significant role in economy. The first step for informing program is determination of the targets and priorities. It's important to identification and evaluation of the genetic sources. Identification and collection of habitat genotypes regard as the first step for breeding programs (Thompson *et al.,* 1978; Thompson *et al.,* 1996). So that does not identify the habitat trees basically in Iran, especially in Guilan. In spite of efforts for performance of the considering, identifying and collecting hazelnut all over the country, Ghorbani (1994), two types (Gerd and Shastak hazelnut) reported from that regions,. But do not perform a complete study of hazelnut genotypes. Therefore, aims of project briefly consist of:

Identifying the superior compatible genotypes for saving and maintaining in collection garden as genetic resources are useable for breeding programs.

1- Evaluating and determining the continent effects on efficiency of selected genotypes of masses under the study.

2- Determine the similarities and differences of phonological, morphological and pomological characters of in different hazelnut population in region.

MATERIALS AND PROCEDURES

In this research, had been studied phenological, morphological and pomological characters according to hazelnut's descriptor for two years (2009-2010) on four populations of hazelnut in the category of Mamoli Gerd, nakhonak, Kolaparak and khormaie in four regions of Ag-Evlar, Navan, Makash and Tande bin with heights from the sea level 1100, 1400, 1600, and 1450m respectively in Talesh mountain. These regions consist of the most part of hazelnut planting in Guilan. Firs of all, 40 hazelnut shrub (10 trees from every region) according to growing characters, proper bearing, fruit quality, as genotypes for testing selected with premier surveying and recourse to gardeners from the

regions; and recorded these genotype location with GPS. The quantity and quality data from phenological, morphological and pomological characters collecting by method of random sampling and quantity analyzing by the method of ANOVA and Duncan test and quality data by the method of Chi Square (X^2) test .Data outcomes from the experiment perform on statically random plan for thee time and statically analyses use with SPSS software and according to Duncan's domain Averages of comprehension performed.

RESULTS AND DISCUSSION

Results indicate that genotypes exist in Navan region have more productive than the other regions genotypes
(Fig. 1). So as the average of genotypes yield was 741.3 kg/Ha. in this region annually. This amount mean yield had significance differences than the other means (Fig. 1).

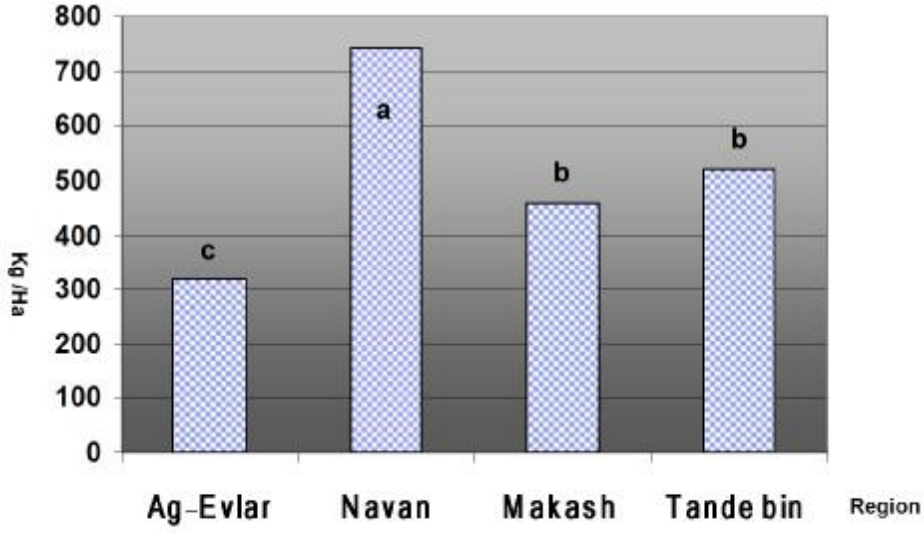

Figure1. Nut yield of four populations of hazelnut in the studying regions

Also the percentage of the kernel in genotypes from Navan region was more than the genotypes out come from other regions (Fig. 2). As if, the mean percentage of kernel weight in genotypes from Navan resulted 53.4% and has a significant deference with weight mean from Makesh and Ag-Elvar. But it has not a significance difference from Tande bin region (Fig. 2).

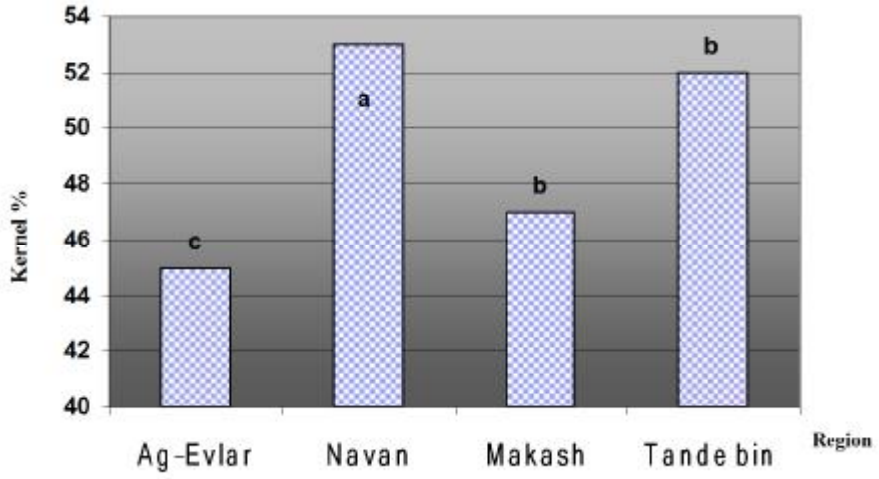

Figure 2. Weight percentage of the kernel in the studying regions

Morphological characters of genotype in studying regions

Morphological characters of genotypes in studying regions represent in Table 1. Height of trees was different from 2.5 to 3 m. leaves appear on 14 March, and fruits appear on 20 June, and the harvest time was 6 Agues on these genotypes. In these genotypes, the numbers of nuts per cluster were 1 to 3. The shape of leaves were various with or without hair. The amount of annual growth shoot was 30 to 45 cm.

Fruit's characters of 15 superior genotypes in studying regions

Data analyses indicated that 15 genotypes are identifiable among four populations of hazelnut in the category of Mamoli Gerd, nakhonak, Kolaparak and khormaie under the surveying in four regions of mountain in Talesh. The mean of some surveying characters represented in Table 2. According to collecting data, the most of yield observed 785 kg from Navan (Table 2). The most kernel percentage observed from Navan genotypes with 55 percent of the fruit weight (Table 2). The lowest yield observed in Ag-Elvar with 250 kg annually. While, the lowest crops in Navan was 712 kg annually. The most weight of kernel was 2.55g observed in genotypes of Navan. The lowest weight was 1.01 g of kernel observed in Ag-Elvar.

Table1. Morphological characteristics of hazelnut genotypes in four regions

Region	Height from sea level	Height of tree(m)	Leaves appearance time	Fruit appearance time	Harvest time	annual growth shoot (cm)	shape of leaves	Lenth of petiole (mm)	Leaves with hair	Number of nut on a cluster
Navan	1400	2.5 to 3	14 March	20 June	6 August	45a	Circle	15 to 18	Without hair	3a
Makash	1600	3.5 to 4	9 April	10 July	1 September	37b	ovate	16 to 18	With hair	1c
Tande bin	1450	3.5 to 4	15 March	26 June	11 August	35b	Circle	12 to 14	Medium hair	2b
Agh- evlar	1100	4 to 4.5	10 March	9 June	31 July	30c	Heart	17 to 20	With more hair	1c

Table 2. Average of fruit's characteristics of 15 selective superior genotype of hazelnut

genotype	yield (kg)	Fruit's volume (cm^3)	Fruit's Weight ((g)	Kernel's volume (cm^3)	kernel's Weight (g)	Percentage of the kernel %
N1	725a	3.85a	4.63a	2.38a	2.55a	55a
N3	735a	3.52a	4.52a	2.31a	2.33a	52a
N5	712a	3.53a	4.45a	2.22a	2.37a	52a
N6	785a	3.42a	4.43a	2.25a	2.40a	54a
N7	763a	3.42a	4.60a	2.24a	2.41a	52a
N8	784a	3.44a	4.84a	2.21a	2.45a	51a
N9	733a	3.50a	4.67a	2.24a	2.35a	50a
N10	754a	3.56a	4.53a	2.28a	2.33a	51a
M4	431c	3.241a	3.89c	1.78b	1.82b	47b
M7	408c	3.12a	3.95c	1.80b	1.85b	47b
T2	501b	3.11a	2.64d	1.14c	1.35c	51a
T6	512b	2.06b	2.73d	1.38bc	1.46c	53a
T7	498c	2.01b	2.67d	2.20c	1.39c	52a
A2	288d	1.98c	2.33d	1.00cd	1.02d	44bc
A9	250d	1.87c	2.15d	1.00cd	1.01d	47b

A=Agh- evlar;M= Makash ;N= Navan;T=Tande bin

The color and length of male inflorescence

The male inflorescence color is green in Kolaparak type and in other types are partial pink. According to this research, Kolaparak type similar to Tombol cultivar and other Kan cultivar.The types according to **length of male inflorescence** viewpoint had significant differences. But did not observed significant differences among different regions. The longest and shortest male inflorescence belongs to Mamoli Gerd and khormaie type respectively. Mamoli Gerd and khormaie whit Tombol type are almost similar according to male inflorescence.

The color and number of stigma on any female floral bud

There were not any differences from the color of stigma among the types and in different regions, and stigmas usually have red color. There were significant differences from the number of flowers among the types. But there were not significant differences in the different regions. Mamoli Gerd type has the most number of stigmas and Nakhonak type has the lowest number of stigma on floral bud.

Blooming time of male flowers and duration of pollination

Comparing the ranks and also statistically consideration indicate that male flower blooming time in different types have significant differences. khormaie type has the earliest and Mamoli Gerd type has the latest blooming time respectively, than the other types. Starting time of blooming among the different types, in the different regions has a significant difference (Table 3 and 4).

Cold weather in height probably is the reason of this different time. In the higher, more early provide the necessity of cold climate for male flowers, while the low temperature prevent to growing of male inflorescence. For this reason, with elevating the height from the sea level, blooming of male inflorescence is late. Also, temperature in northern hillside is lower than

southern hillside that cause to delaying on blooming of male flowers. Among the different types and regions, there is a significant difference during the pollination period and it's observed in this study. It's seems that, blooming begin later with elevating the height of regions, and duration of male flower blooming is shorter; that's because of cold weather.

Blooming time of female flowers and period of pollen reception

The research indicated that among different types and regions, there are no considerable differences in blooming time and period of pollen reception (Table 3 and 4). It seems that, cold weather didn't prevent to growing of inflorescence, so in different regions, simultaneously female inflorescence start to blooming. There for the time of pollen reception among them is the same. At the regions, height from sea level is high, (Table 3 and 4), female flower ready to fertilize earlier but because of cold weather, male flower ready later. So, when female flower ready to receipt pollen, there is no any pollen. This is more influence on fruit set. Therefore , for these regions, attempt to use of types which release pollen earlier and or types of female flower with later reception time of pollen, it means duration of blooming time is longer.

Simultaneity blooming of male and female flowers

There is a remarkable difference according to simultaneity blooming among the different types and regions. In regions 1, all types show the protogyny state but the other only show the prototandry state. In regions 3, Mamoli Gerd type has a protandry state and the other have homogamy state. While in regions 4, all types have protogyny state. According to results, determine that with elevating the height from the sea level decrees the amount of protandry and observed homogamy and protogyny states. Mamoli Gerd type is the majority type of region, has protogyny state in three regions, so for fruit seting, it's necessary to use of pollinizers that release the pollen earlier (figure 3-5). Most of the researchers suggest planting two pollinizers for idealist pollination of hazelnut production that one of them releases pollen early and another one later.

Table 3. Floral character of four hazelnut types in four regions

hazelnut type	variable	period of pollen reception	duration of pollen fall	Blooming time of male flowers	Blooming time of female flowers
Mamoli Gerd	Mean	7.00	5.75	9.75	7.2 5
Nakhonak		7.00	7.25	6.13	6.68
Kolaparak		7.00	7.25	4.63	6.68
khormaie		7.00	10.00	2.50	7.00
P.value		1.00ns	0079ns	0003ns	0099ns

Ns: not significant

Table 4. Floral character of four hazelnut types in four regions

region	variable	Blooming time of female flowers	Blooming time of male flowers	duration of pollen fall	period of pollen reception
Agh- evlar	Mean	2.00	2.33	012.00	12.00
Navan		7.00	6.00	7.88	7.00
Tande bin		7.00	9. 00	4. 83	7.00
Makash		12.00	11.00	2.00	2.00
P.value		0.195*	00157*	00363ns	0.195ns ns

*: significant at $p<0.05$

According to report of Thompson *et al* (1996) commercial cultivars Segorb, Bergeri, Tonda gentil Del Lang and Barcelona show the protandry state, Mervile De Boll Villar and Moller show homogamy state and San Giovani and Tombol (Balta and Karadeniz ,1997) show protogyny state.

Total results indicated that there is no more diversity in vegetative characters of types, just the color of Mamoli Gerd type's leaves are lighter. One of the important characters is amount of suckering; it's more in all types and any there isn't type better than the other. In the other hand, genirative characters like length of male inflorescence and number of stigma on flora bud of Mamoli Gerd type is more than the other types. These two characters can increase yield efficiency. Meanwhile, length and weight of fruit and kernel from khormaie type is more than the other types. Therefore the fruit of this type can be use as dried nuts. While the other types suitable to offer as kernel. Kolaparak has easier detachment of skin from the nut than the other types. So this type is suitable for offer as kernel at the market too. The length of involucres than the length of fruit in Nakhonak type, it's shorter than the other types. So, more percentage of the fruits falls down without involucres at time ripening. That is an idealistic character. Thickness of fruit skin and power need to break it, in Nakhonak type is more than the other types. That is an unfavorable character. But, according to amount of protein, Kolaparak and khormaie type are out classer than the other types. Among

the characters, thickness of the skin and weight of fruits compare with the other characters, are fine index to show the family tie of the genotypes. Finally, results of this research indicate that, hazelnut genotypes in Navan region has more diversity than the other regions and has more producers too. The reason is for topography and edaphically appropriate situation. Height from the sea level is lower than the other and placed on southern hillside and PH is 6.5 to 6.8. Ecological appropriation of this region has a high quality for hazelnut growing. Mean of production is 741 kg for any genotype and also percent of kernel is 53.4. Selective and usage of selective superior genotypes in these regions can be increase the hazelnut production. In addition, the economical results for inhabitants can be export hazelnut with more quality and quantity.

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