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# Determination of pollinator characteristics of different *Pistacia* spp. in Manisa-Yunt Mountain area

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**SUMMARY** – In nuts which seed is used, fertilization and fruit set is of great importance than in other fruits. Taking this into consideration, this research aiming to use different *Pistacia* spp. as source of pollen for pistachio cultivars has been prepared. Thus, an increase together with stability in production will be obtained. In the experiment, pistachio cultivars (Kırmızı and Uzun) were pollinated with *Pistacia* spp. such as *P. vera*, *P. atlantica* and *P. terebinthus*. Besides, viability (TTC and IKI) and germination tests were carried out during pollination.

**Key words:** *Pistacia* spp., pistachio, pollen, pollination.

**RESUME** – "Détermination des caractéristiques de pollinisateurs de différentes espèces de *Pistacia* dans la zone montagneuse de Yunt-Manisa". Pour les fruits dont on utilise l'intérieur, la fertilisation et la fructification sont d'une grande importance par rapport aux autres fruits. En considérant ceci, cette étude vise à utiliser différentes espèces de *Pistacia* comme sources de pollen pour les cultivars de pistachiers. Ainsi, une augmentation allié à la régularité de la production sera obtenue. Dans l'expérience, des cultivars de pistachier (Kırmızı et Uzun) ont été pollinisés avec des espèces de *Pistacia* telles que *P. vera*, *P. atlantica* et *P. terebinthus*. En outre, des tests de viabilité (TTC et IKI) et de germination ont été effectués pendant la pollinisation.

**Mots-clés :** Espèces de *Pistacia*, pistachier, pollen, pollinisation.

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## Introduction

The pistachio is deciduous and dioecious, both male and female flower buds occur laterally on one-year shoots, on different trees, and the female flower that produce the nuts contains a single ovule. In nuts, pollination and fertilization are necessary to obtain fruit than the other fruits, because seed is consumed in this species.

Staminate trees tend to shed pollen before pistillate flowers are receptive. Pollination is by wind and therefore, requires the interspersion of male trees within an orchard. Pollination is one of the most important factors in pistachio culture. It is mainly associated to the time difference between flowering of male and female trees. Besides, pollination may not be satisfactory since male trees are not planted in suitable ratio and in appropriate direction in orchards. This situation results reduction of the production and great proportion of empty fruits.

In order to get nut production it must be sufficient male trees for pollination. For this reason, male selections were done for some female cultivars in different countries (Crane and Maranto, 1988; Vargas *et al.*, 1995). Similar studies were carried out in different regions (Atlı *et al.*, 1995; Ça\_lar and Ka\_ka, 1995; Köro\_lu and Köksal, 1995).

Since the orchards are established with spontaneous rootstocks, they are not in proper orchard. These orchards are pollinated by pollen from the male trees which are scattered in the other orchards. Thus, pollination varies based on years and orchards, leading high production of blank nuts.

When natural pollination is not sufficient, artificial pollination can be applied as a temporary solution. There are attempts on this matter (Kuru, 1995; Ka\_ka *et al.*, 1989; Ayfer and Kuru, 1990; Ak, 1992; Ça\_lar and Ka\_ka, 1995).

In pistachio, all species can pollinate and fertilize each other. Wild pistachio species can be used as pollinator for *P. vera* (Ak, 1992).

In pollinizers, it is necessary to know germination ability and viability of pollen. For this purpose, different viability and germination test are carried out *in vitro* conditions (Therios *et al.*, 1985; Ak, 1992; Atlı *et al.*, 1995).

The pistachio tree is native to western Asia and parts of the Middle East. *Pistacia* spp. is naturally distributed in Turkey. Although the main region for pistachio is south Anatolia, there are microclimates in our country. One of these areas is Yunt Mountain in Manisa province. Crop is obtained from *P. vera* cultivars grafted on wild rootstock. In this region, there is not any investigation based on pollination. Taking this into consideration, the current study aiming to use different *Pistacia* spp. as source of pollen for pistachios has been prepared.

## Materials and methods

This study was carried out in the villages of Küçük belen and Akçaköy of Yunt Mountain area. In the experiment, Alyanak and Çatlayan (Kırmızı), Topan and Söbü (Uzun) as female tree, *P. vera*, *P. atlantica* and *P. terebinthus* as pollinizers were used. Female trees were stated with local name.

Phenological observations were done to study flowering on male and female trees. Female types were crossed with different *Pistacia* spp. such as *P. vera*, *P. atlantica* and *P. terebinthus*. In addition, open pollination was controlled.

Pollens were obtained at the beginning of flowering period (Ak, 1992). The pollens were preserved at a deep freezer until used. To prevent open pollination, female trees were isolated by using white paper before blooming. Pollens were applied as pure. For each female pistachio, two trees were selected. Nine shoots that different pollinizers can be applied were used in each tree. Fruit set was calculated.

For pollen viability, TTC and IKI staining tests were done *in vitro* conditions. In order to pollen germination, investigated media were as follows:

- (i) Agar 1% + sucrose concentrations: 5, 10, 15, 20, 25, 30 and 35.
- (ii) Agar 1% + sucrose concentrations: 5, 10, 15, 20% + 0.01% H<sub>3</sub>BO<sub>3</sub>.
- (iii) Sucrose concentrations: 5, 10, 15, 20% (saturated petri dish).
- (iv) Sucrose concentrations: 5, 10, 15, 20% + 0.01% H<sub>3</sub>BO<sub>3</sub> (saturated petri dish).

All pollen germination tests were performed at 20-25°C. This study was arranged six replications.

## Results and discussion

Phenological observations were carried out on male and female trees in Yunt Mountain in 1999. The dates in relation to beginning of flowering, full flowering end of flowering in male and female trees are summarized in Tables 1 and 2.

Table 1. Phenological observations of male trees

Species	Beginning of flowering	Full flowering	End of flowering
<i>P. vera</i>	April, 5, 1999	April, 12, 1999	April, 17, 1999
<i>P. atlantica</i>	April, 6, 1999	April, 14, 1999	April, 19, 1999
<i>P. terebinthus</i>	April, 13, 1999	April, 18, 1999	April, 23, 1999

According to data, beginning of flowering, full flowering and end of flowering in male trees were changed between 5-13 April, 12-18 April and 17-23 April, respectively. Flowering period was found between 11-14 days.

Table 2. Phenological observations of female trees

Cultivar	Beginning of flowering	Full flowering	End of flowering
Kırmızı (Alyanak)	April, 22, 1999	April, 25, 1999	April, 27, 1999
Kırmızı (Çatlayan)	April, 19, 1999	April, 23, 1999	April, 25, 1999
Uzun (Topan)	April, 21, 1999	April, 26, 1999	April, 29, 1999
Uzun (Söbü)	April, 21, 1999	April, 25, 1999	April, 28, 1999

In female trees, beginning of flowering, full flowering and end of flowering were occurred 19-22 April, 23-26 April, 25-29 April, respectively. Flowering period was calculated between 6-9 days (Table 2).

The flowering period of the male trees does not fully coincide with the flowering of female trees. It was reported that the flowering period of male types were shorter than the females (Ak, 1992). All of the pollinizers flowered before female cultivars (Ak, 1992; Köro\_lu and Köksal, 1995).

In hybridization combinations which different *Pistacia* spp. were used as pollinizers for female pistachios, pollinated flower number, fruit number and the rate of fruit set are seen in Table 3.

Table 3. Pollinated flower number and fruit set ratio in different combinations<sup>†</sup>

Female type	Pollinizers									Natural pollination		
	<i>P. vera</i>			<i>P. atlantica</i>			<i>P. terebinthus</i>			Fr.N.	Fr.S. (%)	
	Fl.N.	Fr.N.	Fr.S. (%)	Fl.N.	Fr.N.	Fr.S. (%)	Fl.N.	Fr.N.	Fr.S. (%)			
A	3244	345	10.64	1638	154	9.40	2422	274	11.31	1732	254	14.66
Ç	1641	167	10.18	1964	152	9.62	2991	427	14.28	1900	193	10.15
T	1561	154	9.87	2283	113	4.95	2033	92	4.52	2058	202	9.81
S	2188	192	8.78	2144	185	8.63	1922	173	9.00	2131	230	10.79

<sup>†</sup>A = Alyanak; Ç = Çatlayan; T = Topan; S = Söbü; Fl.N. = Flower number; Fr.N. = Fruit number; Fr.S. = Fruit set.

According to the data, some differences in relation to average fruit set were found among types. The best fruit set was obtained in Çatlayan x *P. terebinthus* (14.48%). The lowest value occurred in Topan x *P. terebinthus* (4.52%). The fruit set of Kırmızı types were higher than the Uzun types. The best fruit set obtained in Kırmızı variety (Ak, 1998).

When the pollinizers were compared based on average fruit set, *P. vera* and *P. terebinthus* had relatively higher value than *P. atlantica* (Table 3). Usage of *P. vera* pollen resulted with higher fruit set than two species (Ak, 1998). On the other hand, in comparison of female types, Alyanak ranked the first row. Topan type exhibited the lowest fruit set in all combinations including natural pollination.

In the experiment, it was seen that average fruit number was lower than the results of other studies (Ayfer and Kuru, 1990). This situation may be due to weather conditions during pollination period. Besides, except Çatlayan x *P. terebinthus*, Çatlayan x *P. vera*, Topan x *P. vera*, in all combinations that *Pistacia* spp. were tested as pollinizers, average fruit set was lower than natural pollination. The results are parallel with the findings reported by Kuru (1995). In this situation, the date of pollen application is of great importance. Although pollination was carried out at the beginning of flowering, flowers of tree may begin flowering at different time. For this reason, it may be necessary to repeat pollination.

The statistical analysis of the obtained data showed that the differences between *Pistacia* spp. in terms of viability (Table 4).

Table 4. The pollen viability of pollinizers according to IKI and TTC tests

Method	Viability percentage			
	<i>P. vera</i>	<i>P. atlantica</i>	<i>P. terebinthus</i> (early)	<i>P. terebinthus</i> (late)
TTC	58.45 c	58.03 c	56.56 c	0.00 e
IKI	50.17 d	82.73 a	80.99 a	66.25 b

<sup>a,b,c,d,e</sup>Mean separation, within columns, by Duncan's multiple range test, 5%.

The highest viability was obtained in *P. atlantica* (82.73%) and *P. terebinthus* (early) (80.99%) according to IKI test. *P. vera* (50.17%) possessed the lowest value. On the other hand, in TTC test, *P. vera* ranked the first row and this species followed by *P. atlantica* and *P. terebinthus* (later). Statistical difference was not determined among the species. It was stated that pollen viability in TTC test ranged between 85.7 and 98.8% in different male types (Atlı *et al.*, 1995). Similarly, average percentage of pollen viability in *P. vera* and *P. terebinthus* types was found 49% and between 3.33-61.95%, respectively, in TTC test (Ça\_lar and Ka\_ka, 1995). According to this study, pollen viability in IKI test was higher than the other test.

In spite of the fact that different germination media were tested, pollen did not germinate. This situation could be related to the relative humidity due to storage in the deep freezer (Atlı *et al.*, 1995). Similarly, it was reported that temperature and humidity affected in pollen germination (Stanley and Liskens, 1974).

## Conclusions

In this study, some data based on phenological observations and pollination were obtained. Detailed investigations need to be carried out on this subject. Experiments are continued.

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