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A NEW APPROACH OF SWEET CHERRY *(PRUNUS AVIUM* L.) POLLINATION: CORIANDER *(CORIANDRUM SATIVUM* L.) ESSENTIAL OIL

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Abstract

The objective of this study was to examine the effect of coriander essential oil applied as an alternative method to increase fruit set of sweet cherry which is an important fruit for the Isparta region. In the trial, coriander essential oil was applied to the branches in blooming period and comparisons were made with branches on which essential oil was not applied (control). When average values are considered, it has been determined that the application increased fruit set from 27.86 to 53.28 in comparison with the control group.

Key words*: 0900 Ziraat, pollination, linalool, aspect, fertilization, bee*

INTRODUCTION

The main factors determining fertilization and yield of the sweet cherry include temperature and rainfall during blooming period, the period of overlapping blooming of the main and pollinizer cultivars and their self and cross incompatibility status. Other environmental factors such as bees are referred to as pollen vectors (Sutyemez and Eti, 1999; Choi and Andersen 2001; Pırlak, 2002). 0900 Ziraat is an export cultivar grown in Turkey which has dark colour, sweet taste and is crack resistant. Fertilization is essential for fruit set and yield in sweet cherry growing (Tosun and Koyuncu, 2007; Beyhan and Karakas, 2009). Successful fertilization of sweet cherries depends on the transfer of compatible pollen by honeybees, as most commercial cultivars are self-incompatible (Janıck and Moore, 1996; Thomson, 2004). Flowers are usually sufficient to obtain a product in cherries 25-50% of the flowers must become fruits. 0900 Ziraat sweet cherry cultivar has some problems in terms of efficiency. The biggest problem that causes decrease in yielding can be caused by self-sterility and late bloom, pollination and outcrossing (Bekefi, 2004). Sweet cherry pollen must come from another – and compatible - cultivar; therefore, a high degree of bee activity on the tree and between trees is required (Tonitti et al., 1991). Entomophily is a form of plant pollination whereby pollen is distributed by insects, particularly bees, Lepidoptera (e.g. butterflies and moths), flies and beetles. Honey bees will pollinate many plant species that are not native to their natural habitat but are often inefficient pollinators of such plants. Pollinators of sweet cherry are honey bees, bumblebees, solitary bees and flies (Bosch and Kept, 2002). Hussein and Abdel-Al (1982) also reported that honey bee consisted more than 67% of the total bees are visiting coriander and others. Diederichsen (1996) attributed that coriander is also a good melliferous plant; one hectare of coriander allows honey bees to collect about 500 kg of honey.

Coriander (*Coriandrum sativum*) is a valuable weed and spice plant from the Umbelliferae family (Baydar, 2009). The essential oil ratio in its fruits varies between 0.03-2.60% (Kaya et al., 2000). Coriander oil is among the 15 most produced essential oils. The previous researches indicate that linalool (1,6-octadien-3-ol, C10H18O, Mr=154.25, d20= 0.862 and boiling point 196– 198°C) is the main component in coriander essential oil, and it has potential usage as antisposmadic immunostimulatory antinociceptive (Peana et al., 2003; Telci et al., 2006). α-pinene, γ-terpinene, geranyl acetate, p-cymene and hexadeconoic acid in the coriander essential oil are also other

important components (Anitescu et al., 1997; Baydar, 2009). In our study, the effect of using the indirect bee activity of essential coriander oil has been examined as an alternative method to increase fruit set in sweet cherry.

In this study, coriander essential oil which is used as an activator to increase bee activity has been applied to cherry branches during blooming period and the number of fruits on the coriander applied branches along with that on the branches with no coriander application have been compared.

MATERIALS AND METHODS

Plant material

In this study, *Coriandrum sativum* essential oil has been applied to Gisela 5 rootstocks of the 0900 agricultural cherry type 10 years old which belong to an individual at the Atabey district of the city of Isparta in order to increase fruit set ratio. Starks Gold species at a ratio of 1/8 is used as a pollinator in the garden where the application was done.

Statistical analysis

The study was planned as a randomized block design with 3 repetitions. Three trees were randomly selected during each repetition and coriander essential oil was applied in 4 directions (North, South, East and West) to the fruit buds on the branches of each tree selected at the same level. Whereas the buds that were left as control were isolated during the application. Fruit set ratio in the study was calculated by counting the number of fruits on the essential oil applied branch along with the number of fruits on the control branch.

Data analyses

Data were subjected to analysis of variance for the essential oil application. All data were analyzed by computer software (Standard ANOVA analysis). The means were compared by using the LSD test described by Steel and Torrie 1980. Mean percentage and standard deviation of essential oil values of the collected samples were calculated by MS Excel program.

Isolation of essential oil

The essential oils were extracted by hydrodistillation for 3 h using Clevenger type apparatus using 10 g of the air-dried aerial parts of the plant samples. The volatile oils were stored in dark glass bottles at 4^{o}C until analysis (British Pharmacopoeia 1980).

GS-MS analyses of essential oil

Essential oil constituents were analyzed by (%) gas chromatography method, and GC-MS analysis was carried out by utilizing Shimadzu GC/MS-QP 5050 A in Suleyman Demirel University Experimental and Observational Student Practice and Research Center. CP Wax 52 CB (50 m x 0.25 mm i.d., film thickness 1.2 μm) capillary column and Helium as a carrier gas were used. The temperature program reached from 60^{o}C to 22^{0}C with 2^{0}C increases in temperature in a minute, and was applied by maintaining 22^{0}C for 20 minutes. Temperature of the injector was of 24^{0}C. Mass spectra were used at 70 eV. After the compounds were ionized in gas chromatography column and separated, mass spectrum of each of them were obtained. Evaluation procedures were conducted using "Wiley, Nist and Tutor" libraries.

RESULTS AND DISCUSSIONS

The effect of coriander essential oil application to increase fruit set in cherry can be seen in Table 1.

Accordingly, it is observed that the application has increased the number of fruits and that this increase is statistically significant.

When the average values are examined, it is determined that the application has doubled the number of fruits.

Table1. Effect of coriander essential oil on cherry fruit set

	Number of Fruits				
	North	**South**	**East**	**West**	**Average**
Control	26.22	27.11	29.22	28.89	27.86 a
Application	48.06	58.99	51.11	54.44	53.28 b
Average	37.44	43.00	40.17	41.67	40.57
$LSD_{app\ (\%1)}$: $LSD_{asp:\ ns}$	4.244				

Even though it was not determined to be statistically significant, it has been observed when the number of fruits in the directions is evaluated that the highest number is 43 on average for the south direction which is an expected result since blooming is expected early and fruit set is expected to be high on

trees that face south (Janick and Moore, 1996). This is followed respectively by west, east and south directions. When directions and application are evaluated together, it is observed that the highest number of fruits is found on essential oil applied on trees and that the increase was almost double in comparison with the control.

It is thought that this increase is due to linalool which is the main component in coriander essential oil (Table 2).

Table 2. Essential oil composition of *Coriandrum sativum*.

Element	Rt	Area (%)
2-dodecenal	59.9	1.80
Geraniol	58.5	2.91
Geranyl acetate	53.3	14.39
Linalool	40.0	80.9

Coriander plant is named in some resources as the honey plant and its attractive effect can be thought of as the reason for this. Raguso and Pichersky (1999) stated that the monoterpene alcohol, linalool, is present in the ßoral fragrance of diverse plant families and is attractive to a broad spectrum of pollinators, herbivores and parasitoids.

Priority in such applications is not only to increase fruit set; the effect on the quality parameters of the fruit should also be examined. Even though there are some studies on the effect of essential oils on seed germination, the number of studies on pollen germination and tube growth is scarce. The effect of coriander oil on pollen germination and pollen tube growth will be examined in future studies and we believe that this will put forth a new perspective for the solution of fertilization problems in cherry.

CONCLUSIONS

Coriander essential oil application increase fruit set in cherries express in the number of fruits is examined.

It has been determined that the application has doubled the number of fruits and linalool which is the main component of the coriander essential oil has been presumed as the reason for this.

In the light of these results, it is thought to carry out the application using different doses of coriander essential oil and that the increase in the number of fruits is due Linalool which is the primary component of the coriander essential oil; carrying out the application with all the other components can be thought of as well.

In addition, carrying out the application of different essential oils on different trees instead of only coriander essential oil on cherry trees will enrich the further studies.

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