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# EFFECTS OF FOSETYL-AL, A FUNGICIDE ON MEIOSIS OF *LYCOPERSICON ESCULENTUM* MILL.

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*Key words:* Fosetyl-Al, Fungicide, *Lycopersicon esculentum*, Meiosis, Pollens

**Abstract**

Effects of Fosetyl-Al (80% Aliette WG 800), widely applied on tomato plants (*Lycopersicon esculentum* Mill.) grown in greenhouse against *Phytophthora infestans* revealed that at recommended dosage (200 g/100 l water) and the double dosage (400 g/100 l water), the fungicide causes various anomalies in pollen meiosis.

A number of pesticides are generally applied to agricultural plants in order to control pests that indirectly help to increase yield. Pesticides when used in small amounts have several advantages. However, in high concentrations they act on DNA, plant metabolism and regular cell division (Tripathy *et al*. 1993).

Many cytological studies have been carried out to detect the harmful effect of different pesticides (Lee *et al.* 2001, Marcano *et al.* 2004, Ruiz *et al*. 2003). It was stated that fungicides Diathane and Aldrin cause cytogenetic changes in *Vicia faba* (Njagi and Gopalan 1981). Besides fungicides Vitavax and Dithane reduced mitotic index in barley (Najjar and Soliman 1980). Gianessi and Anderson (1995) reported that selective herbicide 2,4-D caused meiotic and mitotic abnormalities in barley, wheat and rice in greenhouse and in fields. Meiotic abnormalities are very important since it causes sterility in pollens (Mann 1978, Singh 1992, Reddy and Annadurai 1992).

Fosetyl-Al (80% Aliette WG 800) is a common fungicide widely applied against *Phytophtora infestans* to tomato plants grown in the greenhouses in different parts of Turkey. The purpose of the present study is to examine the effects of the fungicide at the recommended dosage and the double dosage on pollen meiosis of tomato.

The tomato plants were grown in a greenhouse in the village of Karaçulha in Fethiye. Healthy tomato seedlings were obtained from M-38 $F_1$ type domestic seeds. Aliette WG 800 [Fosetyl-Al (Aluminium tris-o-ethyl phosphonate)], was applied as foliar spray on tomato seedlings grown in the greenhouse. A total of 4 applications, 200 g/100 l water as the recommended dosage and 400 g/100 l water as the double dosage, were made on 10 days interval. Flower specimens were randomly collected from different plants and fixed in Carnoy. Anthers were stained with 2% aceto-orcein (Östergren and Heneen 1962).

For meiotic division, cell shapes, cell sizes and bivalent arrangements of a total of 100 pollen mother cells from each group were reviewed and photographed. Statistical analysis was made on a SPSS 11.0 for Windows Statistical Program. The variance analyses were made using the Chi-square test. The tables show that the differences among 'a' and control group, 'b' and 200 g/100 l Aliette WG 800 group, and 'c' 400 g/100 l Aliette WG 800 group are statistically significant ($p < 0.05$).

The effects of fungicide fosetyl-Al on the pollens shape are given in Table 1. The number of round pollens in the treated group was lower than the control, whereas the number of oval and

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abnormal shaped pollens were higher. It was also observed that the number of round pollens decreased whereas the number of triangular cells increased as the dosage was increased. No triangular pollens were seen in the control. These variations were statistically significant in the 400 g/100 l fungicide treatment as compared to the 200 g/100 l.

According to Yı *et al*. (2003), pollen morphology is another important variable affected by fungicides. The fungicide Chorus 50 WG (50% Cyprodinil) at 40 g/100 l influences to develop some kind of pollen morphological structures, not observed in the control group (Öztürk Çalı 2005). In the present study, Fosetyl-Al appreciation caused triangular-shaped pollen and increased number of abnormal pollens. However, no abnormal pollen structure was seen in the control.

Effects of the Aliette WG 800 on bivalents in tomato pollen are given in Table 1. The number of distinct bivalents in the treatment was lower compared to the control, and that the number of distinct bivalents decreased with the increase of dosages. The number of chromosome abnormalities such as thread-like, ring-shaped, linear, binding and polar distortion increased in the treatment, as compared to the control (Table 1, Fig. 1).

**Table 1. Effects of Aliette WG800 on cell shape, arrangement of bivalents and size of pollens of tomato.**

| Treatments | Cell shape | | | | Arrangement of bivalents | | | | | | | Cell Size | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Round | Oval | Trian-gular | Abnor-mal cells | Dis-tinct | Indis-tinct | Thread-like | Ring shaped | Linear | Binding | Polar distor-tion | Normal | Large | Small |
| Control | 86 $^{bc}$ | 12 $^{bc}$ | 0 | 2 $^{bc}$ | 84 $^{bc}$ | 16 $^{bc}$ | 3 $^{bc}$ | 2 $^{bc}$ | 1 $^{bc}$ | 1 $^{bc}$ | 0 | 99 $^{c}$ | 1 $^{bc}$ | 0 |
| 200 g/100 l | 16 $^{ac}$ | 26 $^{a}$ | 2 $^{c}$ | 56 $^{a}$ | 13 $^{ac}$ | 87 $^{a}$ | 55 $^{ac}$ | 45 $^{ac}$ | 22 $^{ac}$ | 42 $^{ac}$ | 48 $^{c}$ | 88 $^{c}$ | 4 $^{ac}$ | 8 $^{c}$ |
| 400 g/100 l | 4 $^{ab}$ | 28 $^{a}$ | 9 $^{b}$ | 59 $^{a}$ | 4 $^{ab}$ | 96 $^{a}$ | 78 $^{ab}$ | 64 $^{ab}$ | 51 $^{ab}$ | 63 $^{ab}$ | 69 $^{b}$ | 63 $^{ab}$ | 14 $^{ab}$ | 23 $^{b}$ |

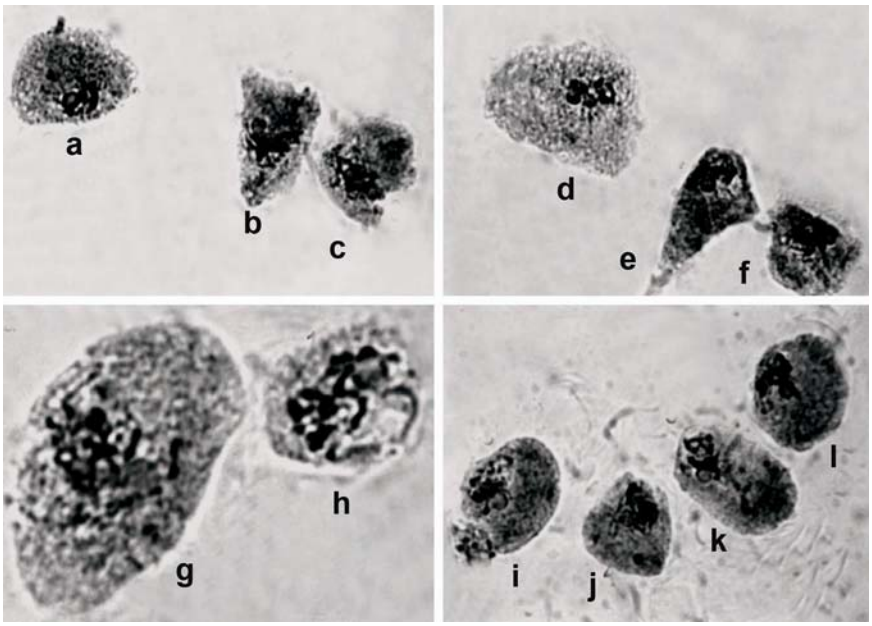


Fig. 1a - l. Abnormal meiotic division due to application of 200 g/100 l Aliette WG 800 (a-f), pollar sliding (a, d - f); triangular cell shape (b, e); and at 400 g/100 l Aliette WG 800 (g - l); large (g) and small (h) cells; polar sliding (i - l).

Singh (1992) stated that the anomalies occurred in meiosis, bring about sterility in pollens. In the present study the number of indistinct bivalents and the number of chromosome abnormalities increased in all treatments compared to control. Reddy and Rao (1981) observed positive relationship between chromosomal damages and pollen sterity in Chilli. Chromosomal abnormalities like, ring shaped, linear, binding and polar distortion were also observed in various studies (Kesercioğlu and Çalı 2007, Bilaloğlu 1985, Devadas *et al.* 1986, Pusztaı 1983 and Badr 1979).

The number of normal-size cells significantly decreased due to application of 400 g/100 l fungicide as compared to the control, whereas the number of large and small cells increased in both treatments (Table 1). Large and small cells had also observed in some pesticide applications (Ajay and Sarbhoy 1987).

It appeared that application of the fungicide Aliette WG 800 caused various anomalies in the meiosis of tomato plants.

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