

Effect of 2,4-D and Ethephon Foliar Sprays on Induction of Pollen Sterility in Eggplant

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A STUDY was conducted to investigate the effect of spraying plants of eggplant the "Roumi" cultivar with 10, 20 and 40 ppm 2,4-D and 100, 200 and 400 ppm Ethephon on pollen sterility and seed set due to open cross pollination. Application of 20 and 40 ppm 2,4-D and 400 ppm Ethephon induced complete male sterility as judged by stainability with acetocarmine. However, application of 40 ppm 2,4-D resulted in complete pollen sterility, it also caused a remarkable reduction in average seed number per fruit. On the other hand, application of both 20 ppm 2,4-D and 400 ppm Ethephon resulted in considerable seed set after subsequent open pollination, compared with hand emasculation. It is feasible to use either 2,4-D at 20 ppm or Ethephon at 400 ppm successfully as a selective gametocide for commercial hybrid seed production in eggplant.

Hybrid varieties are not commercially feasible without some forms of male sterility or incompatibility in both cross and self pollinated crops (Briggs and Knowles, 1967). Male sterility in vegetable crops can be induced by some chemical treatments. Rehm (1952) reported that male sterility was induced in tomato as a result of spraying plants a week before the first flowers opened with 10, 20 or 50 ppm 2,4-D. Mokhov and Kononkov (1970) obtained carrot male-sterile plants by chemical emasculation without severely damaging the ovaries. High levels of pollen sterility were also found in lettuce plants when immature flower buds were sprayed with Ethrel compared with the untreated controls (Han and Lee, 1972). Spraying GA₃ on young lettuce flower buds induced male sterility while female fertility stayed normal (Eenink, 1976).

Male sterility in eggplant was induced by spraying the flower buds with 10 ppm 2,4-D without causing female sterility. It resulted in an increase in fruit set and hybrid seed was obtained by cross pollination (Jyotishi and Hussain, 1968). Jyotishi and Chandra (1969) found also that a 10 ppm 2,4-D spray produced complete pollen sterility and an average of 109 seeds per fruit were obtained after subsequent open cross pollination, while emasculation and pollination by hand produced an average of 563 seeds per fruit. A later study conducted by Diki and Anikeenko (1975) showed that spraying eggplant plants at a concentration of 31-50 ppm 2,4-D induced pollen sterility 11-27 days after treatment.

The object of this investigation was to study the gametocidal effect of 2,4-D compared with that of Ethephon and the capacity of chemically emasculated eggplant flowers for outcrossing.

Material and Methods

Studies were conducted at the Faculty of Agricultural Science, Moshtohor, in both 1978 and 1979 seasons. Plants of eggplant (*Solanum melongena* Linn.) c.v. "Roumi" were transplanted in the field during the first week of April. A complete randomized block design with four replicates was adopted. The plot area was about 10 m². Each plot consisted of about 25 plants. Cultural practices were carried out as commonly followed in the district. A week before the first flower opened, plants were sprayed with an aqueous solution of 2,4-Dichlorophenoxy acetic acid (2,4-D) or 2-Chloro-Ethyl phosphonic acid (Ethephon), the following concentrations were used :

1. 2,4-D at a concentration of 10, 20 and 40 ppm.
2. Ethephon at a concentration of 100, 200 and 400 ppm.
3. Distilled water to act as control.

Two weeks after spraying, 10 uniform plants were chosen from each experimental plot for pollen viability determination. Samples from about 20 flowers of the chosen plants were collected at 10 am. Anthers from such samples were smeared, stained with acetocarmine and pollen stainability was recorded in four microscopic fields. The average percentages of pollen viability were calculated.

Moreover, the percentage of unviable pollen was transformed to absolute numbers for statistical analysis according to Fisher (1963).

For studying the effect of the used treatments on female fertility and hybrid seed set, additional 8 plants from each plot were randomly chosen. All flowers formed two weeks after spraying were labeled. At the same time, flowers of the control plants were hand emasculated. The chosen plants were left for open cross pollination. At the seed maturity stage, 20 fruits produced from the labeled flowers in each plot were harvested, seeds were extracted and average seed number per fruit was recorded. The obtained data were statistically analyzed according to Snedecor (1962).

Results and Discussion

1 — Pollen viability

Results of microscopic examination of pollen viability as judged by acetocarmine stainability are given in Table 1 and Fig. 1. It is evident that the highest level of pollen viability was noticed in

TABLE 1. Effect of 2,4-D and Ethephon foliar sprays on percentage of pollen viability of "Roumi" eggplant cultivar.

Treatments	1978 season		1979 season	
	Viable	Unviable	Viable	Unviable
2,4-D 10 ppm	35.0	65.0	42.0	58.0
2,4-D 20 ppm	0.0	100.0	0.0	100.0
2,4-D 40 ppm	0.0	100.0	0.0	100.0
Ethephon 100 ppm	17.0	83.0	20.0	80.0
Ethephon 200 ppm	13.0	87.0	14.0	86.0
Ethephon 400 ppm	0.0	100.0	0.0	100.0
Control	85.0	15.0	83.0	17.0

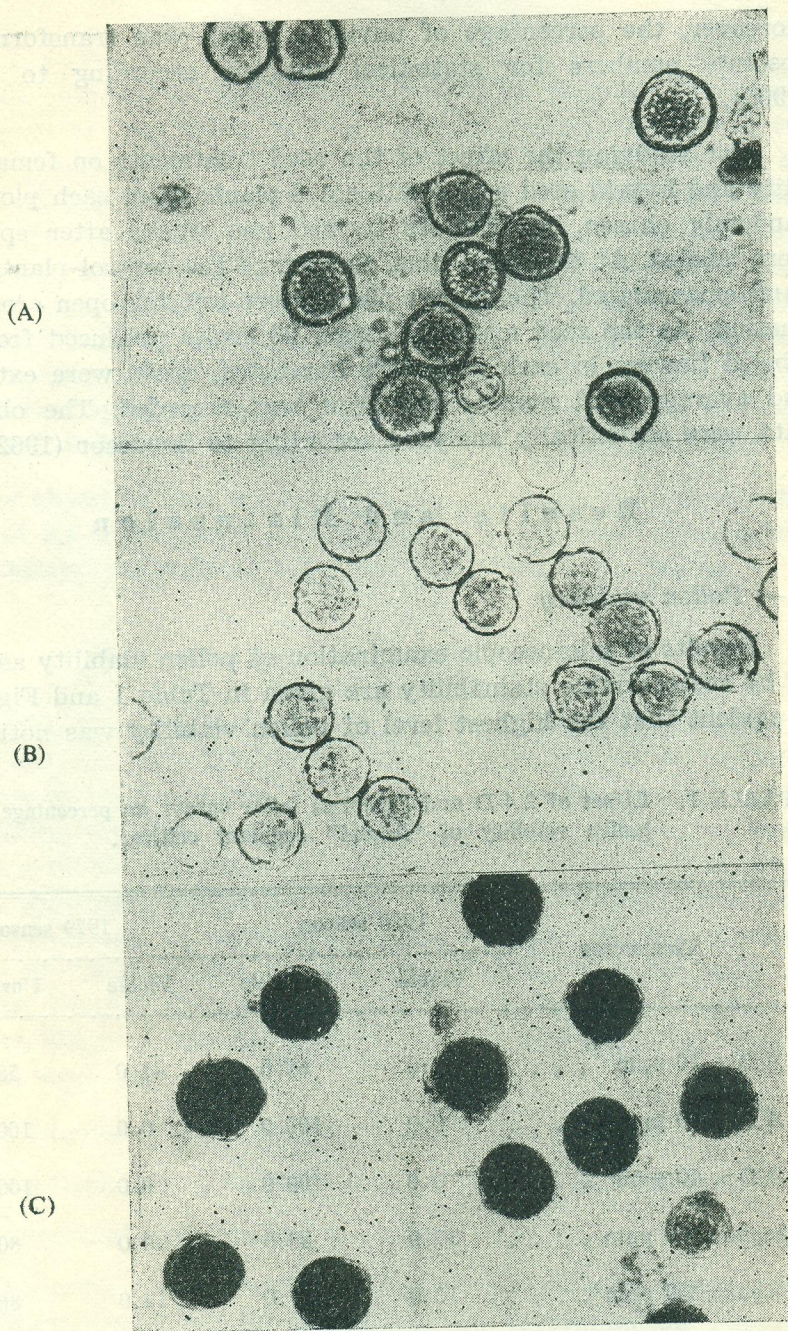


Fig. 1. Eggplant pollen viability as influenced by 2,4-D and Ethephon sprays.
(A) Sterile pollen induced by 20 ppm 2,4-D.
(B) Sterile pollen induced by 400 ppm Ethephon.
(C) Stained pollen of the control plants (viable).

the untreated plants (control). On the other hand, higher levels of pollen unviability were observed in those treated with the various concentrations of 2,4-D and Ethephon. In this respect 20 and 40 ppm 2,4-D and 400 ppm Ethephon induced complete pollen sterility in both seasons. These results confirmed those obtained by Rehm (1952) on tomato; Han and Lee (1972) on lettuce; Jyotishi and Hussain (1968); Jyotishi and Chandra (1969) and Diki and Ani-keenko (1975) on eggplant. Statistical analysis of the observed percent pollen unviability after Fisher's transformation is shown in Table 2. Significant differences were detected between control on the one hand and each of the other treatments on the other hand. No significant differences were noticed between 20, 40 ppm 2,4-D and 400 ppm Ethephon as well as between 100 and 200 ppm Ethephon in both seasons.

TABLE 2. Effect of 2,4-D and Ethephon foliar sprays on percent pollen unviability of "Roumi" eggplant cultivar.

Treatments	Percent pollen unviability after transformation*	
	1978 season	1979 season
2,4-D 10 ppm	53.73 b	49.60 b
2,4-D 20 ppm	90.00 d	90.00 d
2,4-D 40 ppm	90.00 d	90.00 d
Ethephon 100 ppm	65.65 c	63.44 c
Ethephon 200 ppm	68.87 c	68.03 c
Ethephon 400 ppm	90.00 d	90.00 d
Control	22.79 a	24.35 a

* Percentage of pollen unviability as transformed by Fisher's Tables. Values followed by a similar alphabetical letter do not differ significantly from each other at the 5 % level of significance.

2 — *Seed set*

Data on average seed number per fruit after subsequent open cross pollination are presented in Table 3. It is clear that using either 10 or 20 ppm 2,4-D led to an increase in average seed number per fruit, compared with the hand emasculated control. This

TABLE 3. Effect of 2,4-D and Ethephon foliar sprays on average seed number per fruit of "Roumi" eggplant cultivar.*

Treatments		1978 season	1979 season
2,4-D	10 ppm	1226 d	1365 e
2,4-D	20 ppm	1103 c	1221 d
2,4-D	40 ppm	755 a	809 a
Ethephon	100 ppm	804 a	917 b
Ethephon	200 ppm	969 b	1029 c
Ethephon	400 ppm	1012 bc	1172 d
Control (hand emasculated)		1060 bc	1210 d

* Values followed by a similar alphabetical letter do not differ significantly from each other at the 5 % level of significance.

increment was only significant after application of 10 ppm 2,4-D solution in both seasons. Since this concentration did not induce complete pollen sterility, a certain level of self pollination may have occurred which can be responsible for increase of seed set. In addition increasing 2,4-D concentration up to 40 ppm caused a significant reduction of seed set in both seasons. This may be due to its damage effect on the ovaries. With regard to Ethephon, all used concentrations led to a reduction in seed set compared with hand emasculatation. It appears from these data that spraying either 2,4-D at 20 ppm or Ethephon at 400 ppm had no damage effect on the ovaries. These results are in accordance with those of Jyotishi and Hussain (1968) and Jyotishi and Chandra

(1969) on eggplant. Furthermore, it confirms those obtained by Mokhov and Kononkov (1970) on carrot and Eenink (1976) on lettuce regarding the effect of the chemical emasculation on female fertility.

Generally, it may be concluded that although application of 10 ppm 2,4-D solution led to the highest seed set, it did not induce complete pollen sterility. Using either 2,4-D at 20 ppm or Ethephon at 400 ppm induced complete pollen sterility and maintained female fertility. Therefore, it is feasible to spray eggplant plants a week before the first flower opens as a selective gametocide in hybrid seed production.

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تأثير الرش بال ٢ ، ٤ - دوالايشيفون على احداث عقم حبوب اللقاح في الباذنجان

رفعت محمد هلال ، و محمد السعيد زكى

كلية الزراعة ، جامعة عين شمس وكلية العلوم الزراعية بمشتهر

اجريت دراسة عن تأثير رش نباتات الباذنجان (الصنف الرومى) قبل
تفتح أزهارها باسبوع بمادتي ٢ ، ٤ - د بتركيزات ١٠ ، ٢٠ ، ٤٠ جزءا
فى المليون والايشيفون بتركيزات ١٠٠ ، ٢٠٠ ، ٤٠٠ جزء فى المليون على
احداث العقم الذكري فى الباذنجان وكذلك على عقد البذور الناتجة عن
التلقيح الخلطي المفتوح .

وقد اوضحت النتائج ان استخدام ٢ ، ٤ - د بتركيزات ٢٠ ، ٤٠ جزءا
فى المليون والايشيفون بتركيز ٤٠٠ جزء فى المليون احدث عقمًا ذكريًا كاملاً
اما عن خصوبة البويضات وقابلية المبايض لعقد البذور فلم تقل نتيجة
لاستخدام اى من ٢ ، ٤ - د بتركيز ٢٠ جزءا فى المليون او الايشيفون بتركيز
٤٠٠ جزء فى المليون - على حين ادى استخدام ٤٠ جزءا فى المليون ٢ ، ٤ -
- د الى انخفاض نسبة عقد البذور وذلك بالمقارنة بالخصى اليدوى
للزهار .

وعلى ذلك فانه يمكن رش نباتات الباذنجان بمادتي ٢ ، ٤ - د بتركيز ٢٠
جزءا فى المليون او الايشيفون بتركيز ٤٠٠ جزء فى المليون عند الرغبة فى
احداث عقم ذكري كامل مع عدم الاضرار بمبايض الازهار لتسهيل انتاج
بذور الباذنجان الهجين .