

Effect of chloropyrifos and malathion on pollen germination in tomato and brinjal

M. Nasrabadi^{a*}, N. Ghayal^b, K.N. Dhumal^c

^a Department of Environmental Science, Science and Research branch, Islamic Azad University, Sistan and Baluchestan, Zahedan, Iran.

^b Department of Botany, Abasaheb Garware College, Karve Road, Pune-411004, (MS), India (gnivedita_ghayal@rediffmail.com).

^c Department of Botany, University of Pune, Pune-411 007 (MS), India (dhumal@unipune.ernet.in).

Abstract

The germination of pollen grains is the most important aspect in fertilization and fruit or seed/grain setting and yield. Hence the influence of pesticides on pollen germination is the key issue in improvement of crop yield. Pollen grains from the anthers of fully opened flowers of tomato and brinjal plants treated with different concentration of chloropyrifos and malathion along with control were freshly collected at morning and immediately brought to the laboratory. Pollen germination was studied by using the method of Heslop-Harrison. The results showed that the percentage of inhibition of pollen germination in tomato was highly increased with increasing concentrations of chloropyrifos and malathion. But in brinjal the percent inhibition of pollen germination was not significant and mostly at par with control. The highest percentage inhibition of pollen germination in tomato treated with chloropyrifos was 67.08% and by malathion it was 73.19%. The inhibition of pollen germination in brinjal treated by chloropyrifos was 54.69% and by malathion it was 54.76%. The results indicated that malathion had more adverse effect on pollen germination in tomato and brinjal as compared to chloropyrifos. The higher concentrations of pesticides affected the growth, development, yield as well as physiology, biochemistry and enzymology of treated plants.

Keywords: Pesticides, chloropyrifos, malathion, pollen germination, tomato, brinjal.

Introduction

The germination of pollen grains is the most important aspect in fertilization and fruit or seed/grain setting and yield. Hence the influence of pesticides on pollen germination is the key issue in improvement of crop yield.

The events like pollination and fertilization, which are main aspects in grain formation and seed setting, are negatively influenced by pesticide application like chloropyrifos and malathion.

Materials and Methods

Inhibition of pollen germination

Pollen grains from the anthers of fully opened

flowers of tomato and brinjal plants treated with different concentration of chloropyrifos and malathion along with control were freshly collected at morning and immediately brought to the laboratory. Pollen germination was studied by using the method of Heslop-Harrison, (1987) and Steer and Steer (1989). Pollen germination medium prepared as per the method given by Brewbaker and Kwack (1963) was used for assessment of inhibition of pollen germination. The percent pollen germination was calculated. Pollen grain is considered to be germinated, when the length of its tube was more than its diameter.

*Corresponding author's email: nilofar.nasr@gmail.com

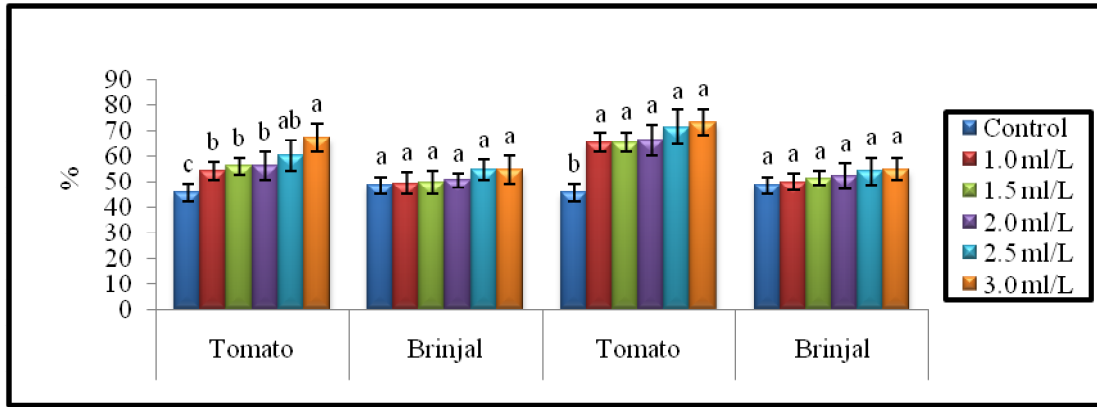


Fig 1. Effect of chloropyrifos and malathion on inhibition % in pollen germination in tomato and brinjal

Statistical analysis

The treatments of chloropyrifos and malathion were laid out in a completely randomized design with three replicates. Data were expressed as mean value of three replicates. One way ANOVA was used to compare the mean values. Duncan's Multiple Range Test (DMRT) was applied as post hoc test at $p = 0.05$ to compare the mean difference and determine the significance. All the calculations were made by using a Statistical Package for Social Science (SPSS) for windows version 14.0 and Microsoft Excel 2007 to analyze the data.

Results

The results presented in Fig.1 showed that the percentage of inhibition of pollen germination in tomato was highly increased with increasing concentrations of chloropyrifos and malathion. But in brinjal the percent inhibition of pollen germination was not significant and mostly at par with control. The highest percentage inhibition of pollen germination in tomato treated with chloropyrifos was 67.08% and by malathion it was 73.19%. The inhibition of pollen germination in brinjal treated by chloropyrifos was 54.69% and by malathion it was 54.76%. The results indicated that malathion had more adverse effect on pollen germination in tomato and brinjal as compared to chloropyrifos.

Discussion

The highest inhibition in pollen germination might be one of the reasons for reduction in fruit number and fruit yield in both the vegetables, when treated with higher concentrations of chlo-

ropyrifos and malathion. Zhang *et al.*, (2006) reported that N-ethylmaleimide caused significant inhibition of pollen germination and pollen tube growth with pesticides as compared to control. Jiang *et al.*, (2007) also reported the negative influence of different pesticides and germicides on pollen germination and pollen tube growth in strawberry. They claimed that the germination of pollen grains was highly susceptible and sensitive to pesticides and germicides. Nikolov *et al.*, (2000) noted inhibition of pollen germination in grapes by different insecticides and acaricides. Mehri, *et al.*, (2007) recorded adverse effects of dimethoate, deltamethrin and oleparathion on pollen germination and fruit formation and recorded reduced pollen germination and pollen tube growth, reduced fruit set and shortening of flowering period.

Conclusion

Germinability and viability of pollen grains is also affected negatively by organophosphorous pesticides.

The higher concentrations of pesticides affected the growth, development, yield as well as physiology, biochemistry and enzymology of treated plants. The basic reason for reduction in yield at these concentrations may be the inhibition of pollen germination, resulting into reduction in fertilization and fruit setting, fruit number per plant and finally the fruit yield. Pesticides like chloropyrifos and malathion at higher concentrations might be including some harmful biochemical reactions, inhibiting the pollen germination and growth of pollen tube. Once the growth of pollen tube is inhibited the male gametes will not be able to reach to the ovule and there will not be fertilization and fruit formation. The poisonous and phytotoxic pesticides had adverse

impact on the process of pollen germination in tomato and brinjal under the influence of higher concentration of chloropyrifos and malathion.

References

- Jiang, G. H., Xie, M., Fang, Li., Wang, H. R., Wu, Y. J., Zhang, H. Q., Huang, P. L. and Sun, C. B. (2007) Effects of boron, calcium, pesticide and germicide on pollen germination and tube growth of strawberry. *Journal of Fruit Science*. 24(2): 234-236.
- Mehri, H., Mehri-Kamoun, R., Dhiab, A. B. and El-Mahjoub, M. (2007) Adverse effects of insecticidal sprays on bloom onset, pollen germination and fruit set of three olive cultivars. *International Journal of Agricultural Research*. 2(2): 102-114.
- Nikolov, A., Botiyanski, P., Kehayov, D. and Roichev, V. (2000) Effect of some insecticides on pollen germination of grape varieties Bolgar and Cabernet Sauvignon. *Bulgarian Journal of Agricultural Science*. 6(1): 29-31.
- Zhang, X. Q., Chen, Y., Yuan, M. and Wang, X. C. (2006) Inhibitory effect of N-ethylmaleimide (NEM) on pollen germination and tube growth in lily. *Jiangsu Journal of Agricultural Sciences*. 22(4): 374-378.