SUMMARY AND CONCLUSION

Pesticides play pivotal role in protecting vegetables, fruits and food grains right from the seed stage through germination to growth and then to storing. However, their use has many consequences and from the studies of many pesticides, the conclusion has been reached that they can induce considerable damage into the human gene pool. Moreover most of the pesticides have been shown to cause toxic effects on plants in various ways. Recent studies on cyto and chromotoxic effects of agro and environmental chemicals and their possible genotoxic effects have prompted several international agencies to recommend the screening of mutagenic and chromotoxic effects of almost all the chemicals being used commercially. The widely used organophosphorus pesticides viz. Metacid and Dimecron used as an insecticide in the form of spray whose residual effect is also known to remain in the environment for a long time. Therefore, it has become the necessity of the day to study the effect of pesticides on structure and function of plant right from their juvenile stage.

In the present investigation, therefore we have chosen widely used organophosphorus pesticides viz. Metacid-50 (methylparathion) and Dimecron (Phosphamidon) to study their effect on seed germination, seedling growth, hydrolytic enzymes, proline induction and mitotic abnormalities in the four vegetables Phaselus vulgaris L. (bean), Abelmoschus esculentus Moench L. (okra) Cyamopsis tetragonolobus L. (guar) and Allium cepa L. (onion).

Method of approach

The seeds of bean, okra, guar and onion were allowed to germinate in dark, in an incubator at $30^{o}C$ in corning glass petridishes with filter paper,

each having 10 ml solution of 0.01, 0.02, 0.03 and 0.04% (v/v) Metacid and 0.005, 0.01, 0.015 and 0.02% (v/v) Dimecron. The solutions were supplied uniformly to the seedlings as per their requirement. Adequate controls were maintained under identical conditions using distilled water. Seedling age was determined from the time of seed soaking in different concentrations. The germination percentage and root shoot length were measured with 24 h time interval. Morphological abnormalities induced by pesticidal treatments were recorded and photographed.

The randomly sampled seedlings from each treatment and control after 72 h germination were used for the preparation of enzyme extract. The activity of some hydrolytic enzymes viz. α-amylase, peroxidase, acid-phosphatase and protease was assayed in crude enzyme extract by using the standard spectrophotometric and titrimetric methods.

The seeds pre-treated for 1 h with 0.03% v/v Metacid and 0.015% v/v Dimecron were allowed to germinate on filter paper in dark at $30^{o}C$ and proline contents were measured after 24 h and 72 h germination by Bates et al method. Similarly the seeds received continuous treatment of 0.03% Metacid and 0.015% Dimecron separately for 24 h and 72 h were also studied to see the fate of proline under pesticidal stress.

Mitotic aberrations induced by different concentrations of Metacid and Dimecron were studied in bean, okra, guar and onion by excising and fixing the root tips in 1:3 acetic alcohol. A routine method was employed for squash preparation. The anomalies observed were photographed with the help of microphotocamera.

The results are discussed under the light of available up-to-date literature and the effects were investigated in the following way.

Effect of different concentrations of Metacid and Dimecron on :

1) Germination percentage, rate of germination and seedling growth.

2) Morphological abnormalities.

3) Hydrolytic enzymes such as α-amylase, peroxidase, catalase, acid-phosphatase and protease.

4) Proline accumulation.

5) Mitotic aberrations.

Conclusions

1) The response of seed germination to both the pesticidal treatment was inhibitory at higher concentration while stimulatory at lower.

2) The rate of germination represented typical sigmoid growth curve in all the vegetable seeds under pesticidal stress. However, the response was different in different treatments and in different seeds.

3) The insecticide treatment did not reduce germination and root shoot length at lower concentrations but did at higher concentrations.

4) The major morphological abnormalities induced by Metacic and Dimecron were coiling, bulging and formation of constrictions in the radicles necrosis of root tips and production of secondary roots.

5) Formation of secondary roots was not linear in both the insecticidal treatments.

6) Higher concentrations of Metacid as well as Dimecron cause sudden rupturing of seed coat and shooting-up of umbrella shaped seedlings.

7) The treatment of Metacid and Dimecron caused considerable inhibition of α-amylase activity. Metacid found to be more toxic than Dimecron in inhibiting the amylase activity.

8) Peroxidase activity was increased with increasing concentration of insecticides. However no siginficant increase was noticed in bean.

9) Lower concentrations of Metacid and Dimecron were stimulatory in action on the enzyme catalase.

10) The response of acid-phosphatase to insecticidal treatment was very less in bean, guar and onion.

11) No consistancy was found in protease activity with the increasing concentration of Metacid and Dimecron.

12) Both the insecticides were successful in inducing proline accumulation however, time factor after the treatment matters much.

13) Metacid and Dimecron treatments were found to induce mitotic aberrations in the treated populations in increased frequency with increase in concentration.

14) Among the four vegetables okra exhibited more cytotoxicity while guar exhibited less.

15) In all respect, guar appeared to be more potential vegetable to withstand pesticidal stress with less cytotoxicity and physiological disturbances.

The overall message of the dissertation is that the widely used organophosphorus pesticides namely Metacid (methylparathion) and Dimecron (phospha-

midon) though are beneficial as a foliar spray, they bring constraints in some of the physiological and cytological events even at lower concentrations than that of one recommended for foliar applicatioin. It is inevitable that the ultimate solution to environmental pesticide problems must be a compromise which will use the smallest possible quantities of pesticides combined with other control measures so that environmental pollution by pesticide is kept at a minimum. Further it is said that the history of earth is written in its layers while the history of living organism is inscribed in its chromosomes. In this respect this dissertation also convey a message that it is equally important to look into plant-pesticide relationship even at germination stage and all the newly manufactured pesticides should be thoroughly screened for their toxic effects on plants right from juvenile stage, before releasing them into the market.