IMPACT OF SYNTHETIC AND BIO-PESTICIDE ON PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS OF SEEDLINGS OF Lycopersicon esculentum Mill. Variety Pusa Ruby

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Abstract- An experiment was conducted in department of botany, D. N .college, Meerut, to study the effect of three insecticide (two synthetic Endosulfan, Malathion and one biopesticide Neemarin) treatment on growth and biochemical parameters of tomato (variety- Pusa Ruby). Three different concentrations (0.05%, 0.15% and 0.25%) of Endosulfan, Malathion and one (recommended dose 0.5%) concentration of Neemarin was used during the present investigation. The seed germination in higher concentration of insecticides had significantly suppressed percentage germination and delayed emergence period, while lower concentration of Malathion and used concentration of Neemarin stimulated the germination and growth parameters. The biochemical parameters also inhibited in higher concentration of Malathion and all concentration of Endosulfan while Neemarin and lower concentration of Malathion showed stimulatory effect.
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Key Words: Endosulfan, Malathion, Neemarin And Tomato (Lycopersicon esculentum Mill.)

INTRODUCTION

Crop plants are attacked by all kinds of pests and pathogens such as insects, nematodes, fungi, bacteria and viruses. Pesticides are chemicals used to protect crops from insects, weeds and fungal attack and rodents. The use of pesticides has enabled the production of a sufficient quantity of agricultural product (Robert and Giles, 1980). Chemical pest control has a core place in modern agriculture. Most chemicals used as pesticides are toxic and major argument against their use is concern with health risk factor and danger in environmental pollution (Robert and Giles, 1980, Kilmer *et al*., 2001).

Germination in plants could be described as the origination of a new organism from a pre-existing embryo in the seed. Various dynamic processes triggered by hydration signals results in active cell division and elongation and ultimately, embryo emergence through the seed coat (Bewley and Black, 1985). The germination process starts with seed imbibition and ends with the protrusion of the embryonic axis (the radicle) through the enclosing tissues. The process may be influenced by available environmental factors (temperature, pH and pesticide residues) of soil (Dwain, 1999).

Pesticides are used in agriculture mainly for the purpose of increasing plant productivity. A lot of work has been done on the role of pesticides in providing protection of plants against weeds in terms of crop yield (Bewley and Black,1985; Dwain M.,1999 and Davies and Duray, 1992). A little work has been established on the role of pesticides in affecting growth and development of the plant Jerlin, (2001). Kozlwski and Saskin (1970), Mukherjee and Ganguli (1974) worked on the role of pesticides on seed germination and seedling establishments and made appreciable contribution on different crop plants. Inhibition of root growth was considered to be an indication of pesticide toxicity and depletion of the shoot growth might be the secondary effect reflected due to root inhibition (Godbold *et al.*, 1984, Godbold and Huttermann, 1985).

Earlier investigators reported adverse effect of higher doses of neem oil on the interference of seed treatment on germination and seedling growth (Mitra *et al.*, 1970, Das and Chandrika, 1972, Murugesan and Annakkodi 2007 and Murugesan and Kavitha 2009). Acquisition of more amounts of toxic ions by the root from the pesticide contaminated soil might be imparting high toxic effect in root cells. On the other hand the low amount of pesticide probably deposited in shoot might have shown inhibitory action. Very low concentration of pesticides induce stimulation in growth which was confirmed by Sahu (1998).

Some of the pesticides are reported to be beneficial for plant growth if used in their lower concentration but become phytotoxic (Khan *et al.*, 2000) in their higher doses and change the activity of some useful soil micro organisms (Tu, 1994 and Zhang *et al.*, 2002). The repeated and extensive application of pesticides, ultimately percolated in plant body and soil, which in turn may interact with plant growth and soil organism and their metabolic activities (Sharma *et al.*, 2002). Keeping all these in view, present work is one such attempt just to monitor the changes in Lycopersicon esculentum Mill. (variety- Pusa Ruby) in response to treatment with Malathion, Endosulfan and Neemarin. Tomato was selected as target plant because of its worldwide economic importance.

MATERIAL AND METHOD

Tomato (Lycopersicon esculentum Mill.) seeds were surface sterilized in 10% commercial bleach with stirring for 5 min. followed by extensive washing in sterile-distilled water. Batches of 100 seeds of tomato were set for germination in petridishes (diameter 9 cm) on top of two layers of whatmann-42 filter paper moistened with 6 ml of either distilled water or insecticides solutions in concentrations of 0.05%, 0.15% and 0.25% (Endosulfan and Malathion) and 0.5% (Neemarin) maintained in an incubator in darkness at 25° C. At various stages of tomato germination, seeds of each replicate were collected for the germination evaluation and embryonic root and shoot length measurements. Five replicates were performed; germination time was determined as the time of rupture of the seed coats and the emergence of the radical. Percentage of germination was recorded at an interval of two days after soaking till 10 days after soaking.

Endosulfan and Malathion are mostly used insecticides, in all over India. Three solutions were prepared 0.05%, 0.15% and 0.25% of Endosulfan and Malathion and only one solution of 0.5% was prepared of Neemarin with double distilled water using Pearson's Square method. Tap water was used as control.

The growth of seedlings was evaluated by measuring the shoot and root length of seedlings on the 8th day. For this 15 cm scale was used after measuring the length of shoot and root the fresh weight of both shoot and roots were measured separately with the help of an electronic balance. The weighed shoot and roots were kept in an oven maintained 80°C for 24 hours for determining their dry weights in gm. The biochemical constituents such as chlorophylls (Arnon, 1949), proteins (Lowry *et al.*, 1951) were estimated in fresh weight of seedlings. The concentration of free proline was determined in fresh weight with acid ninhydrin complex in toluene (Bates *et al.,* 1973). The mean data of five replicates was analyzed statistically for test of standard deviation and CD.

RESULT AND DISCUSSION

Fig- 1 and 4. revealed the effect of Malathion, Endosulfan and Neemarin on seed germination of tomato (variety- Pusa Ruby). Endosulfan at every used concentration significantly inhibited the seed germination, on the other hand lowest concentration of Malathion and applied concentration of Neemarin (i.e. 0.05% and 0.5% respectively) significantly stimulated the seed germination in tomato. Malathion in other concentrations *viz.* 0.15% and 25% significantly inhibited the germination in tomato seeds. Maximum inhibition was noticed at highest concentrations of both chemical insecticides, Endosulfan was found to be more toxic than Malathion. This is in agreement with the investigations of Chakraborti *et al.* (1980), Trivedi *et al.* (1983), Gupta *et al.* (1983), Rao (1985), Vidyasagar *et al.* (2009), Sammaiah *et al.* (2011) and Chahid *et al.* (2013). Chandra and Mathur (1985) observed concentration dependant inhibition of imbibitions of water, inhibition of translocation of reducing sugars from cotyledons to axis and decreased absorbing/holding capacity of axis and these changes led to the inhibition of seed germination. Kumar and Khanna (2006) reported stimulatory effect of germination of tomato by neem based products.

Fig-2 shows the effect of Malathion, Endosulfan and Neemarin on root, shoot length and fresh, dry weight of root and shoot of tomato seedlings. The root and shoot length of seedling decreased in the all concentration of endosulfan and higher concentrations of malathion while lower concentration of malathion and used concentration of neemarin increased the length of both root and shoot of seedlings. Similar results were observed by Kumar et al. (1987), Dhanpal et al. (1998), Perez et al. (2008), Fatiha and Fouad (2011), Pradhan et al.(2012), Zobayar and Hasan (2013). Fig-3 revealed the effect of various concentration of all the three insecticide on biochemical component of seedlings of Pusa Ruby. The loss of chlorophyll content in treatment may be due to the interference in fat metabolism inhibiting root and shoot growth, photosynthesis, nutrient uptake, biomass etc. Pandolfini *et al.* (1992). Protein are the primary effector molecules of all living systems, therefore any eventual adaptive response to environmental, physiological or pathological conditions will be translated by alterations in protein activity, location and concentration Shepard *et al.* (2000), Bradley *et al.* (2002). According to Constantinidou and Kozlowski (1979) the decrease in protein content may be due to the decrease in photosynthesis.

Proline accumulated in plants under various stress conditions. Proline act as a hydrophobic protectant for enzymes and sub-cellular organelles Lerudulier *et al.* (1994). This helps the plant to tolerate or adapt to the stress condition. It is evident from these studies that an increase in proline content may serve as a mean of protection of plant tissue against oxidative stress.

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Figure-1

Effect of Malathion, Endosulfan and Neemarin on percentage Germination of Pusa Ruby Seeds

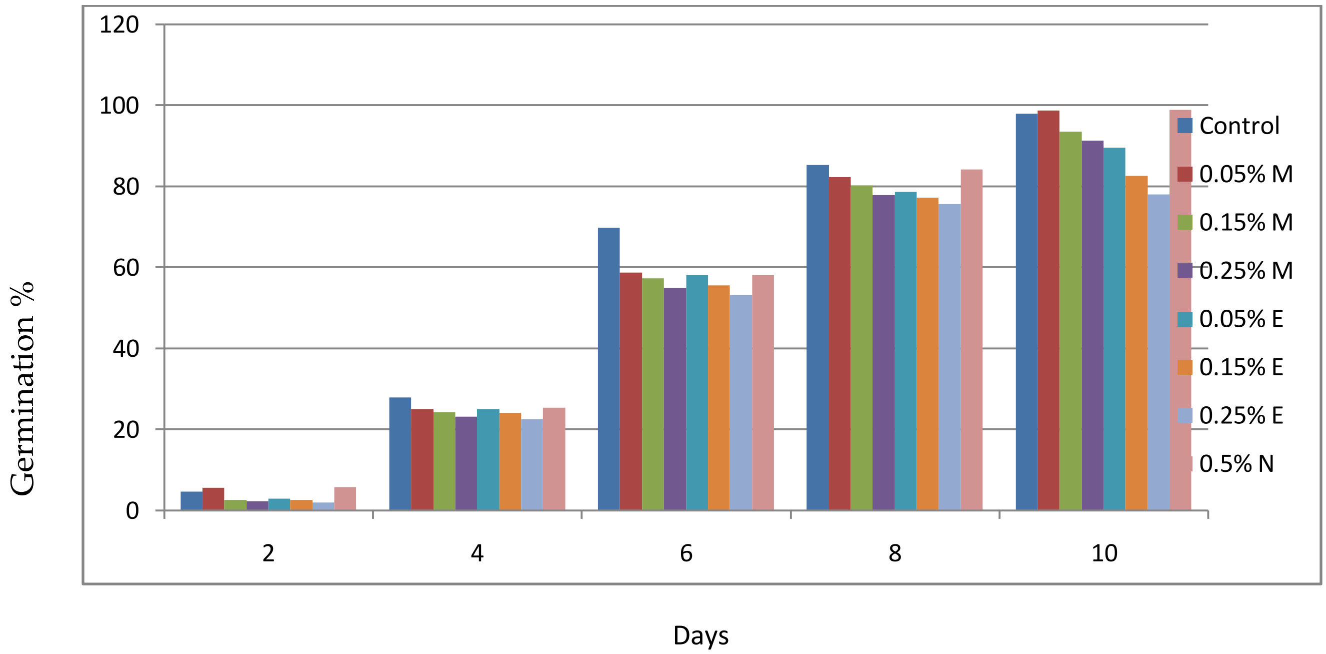


Figure-2

Effect of Malathion, Endosulfan and Neemarin on growth parameters of seedlings of Pusa Ruby.

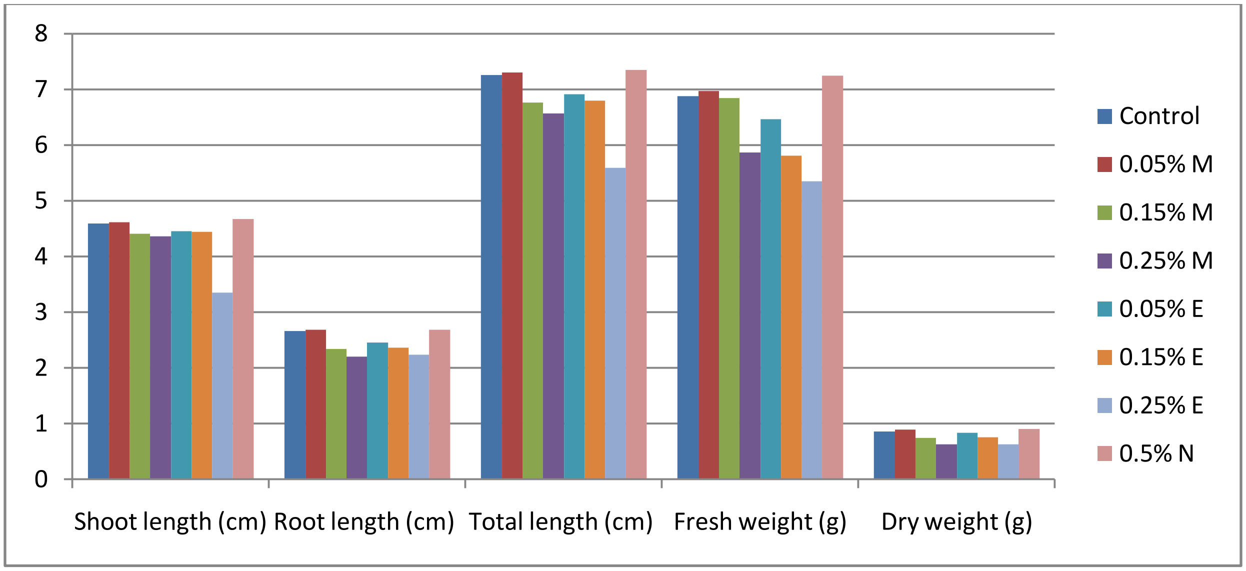
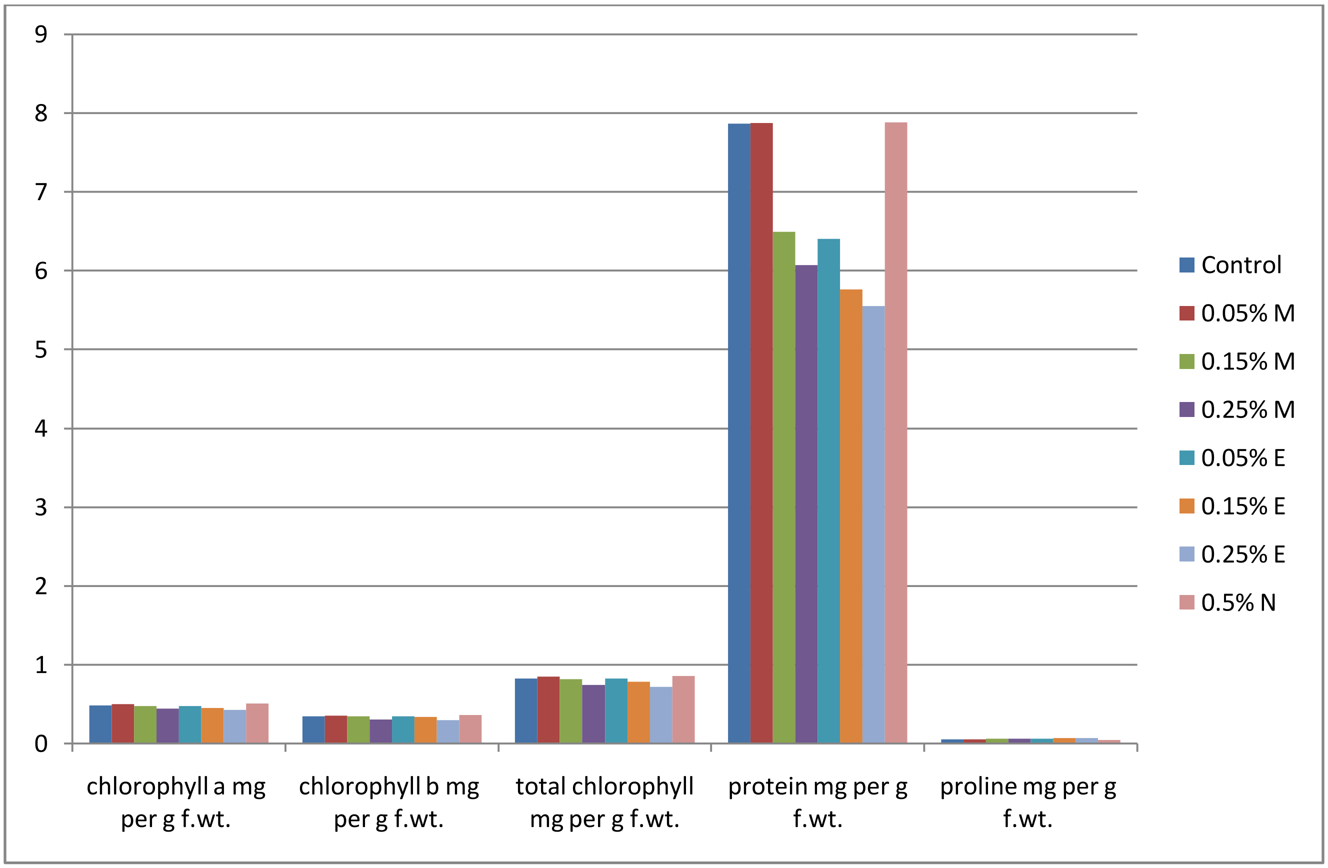


Figure-3

Effect of different concentration of pesticides on biochemical components of Pusa Ruby on 10th day of seedlings



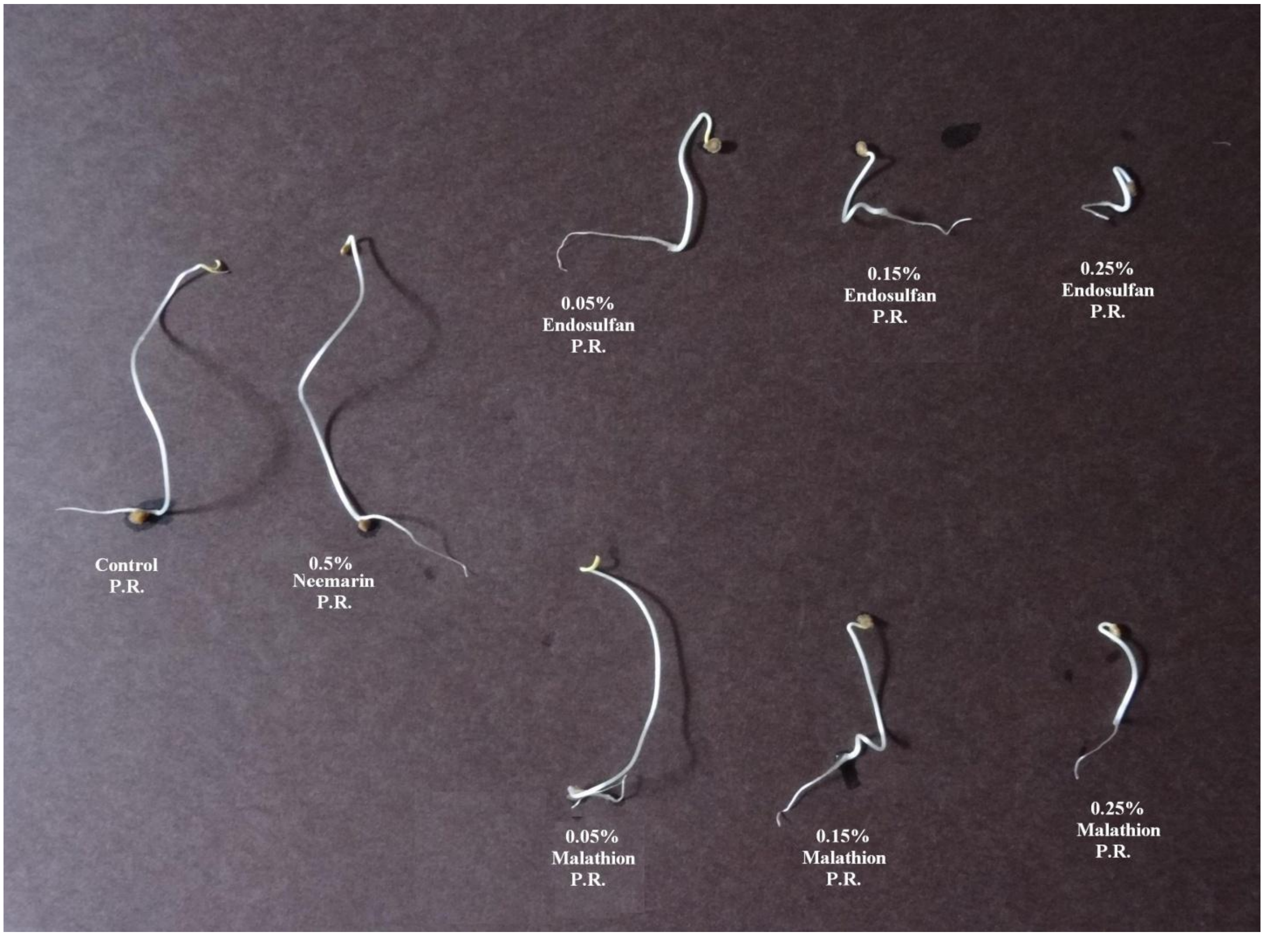


Figure -4

Effect of different pesticide treatmemt on germination of seeds of tomato (variety - Pusa Ruby) on 10th day