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Short Communication

Comparative effect of propiconazole and triadimefon on membrane integrity of *Solenostemon rotundifolius* (Poir.) J.K. Morton

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ABSTRACT

From germination through senescence, the growth hormones control the growth and development of plants. Numerous plant growth regulators disrupt the natural hormonal equilibrium. The most significant class of systemic compounds created to treat fungus-related illnesses in both plants and animals are called triazoles. These triazole compounds have effects on plant growth regulation as well as fungitoxicity. Triadimefon and propiconazole, two triazoles, were found to have an impact on the Chinese potato (*Solenostemon rotundifolius* (Poir.) J. K. Morton), a significant tuber crop grown in tropical and subtropical areas of the world. Chinese potato leaves and tubers showed reduced electrolyte leakage due to the presence of triazole compounds. Lipid peroxidation was inhibited by triazole treatments, and this inhibition was stronger in leaves than in tubers. Propiconazole, as opposed to triadimefon, was the triazole that inhibited the lipid peroxidation the most.

INTRODUCTION

People who live close to the poverty line in tropical East and West Africa, the East and South Pacific islands, and a portion of South America and India depend heavily on tuber crops as a source of energy [1]. *Coleus* is a genus of herbs belongs to the mint family, Labiatae, which consists of 200 species [2]. Most of the species of this genus are medicinal or ornamental plants cultivated throughout the world.

In India, Sri Lanka, South Asia, and some regions of tropical Africa, the Chinese potato (*Solenostemon rotundifolius* (Poir.) J. K. Morton) is one of the minor seasonal tuber crops that is grown for its edible tubers [3]. Leaves are opposite dark green, petiolate and ovate. Flowers are small and arranged in racemose cymes. The calyx and corolla are mostly greenish brown and violet respectively. Anther and stigma are violet. Pollen grains are sterile in normal condition and no seed settings are seen. The tubers are brownish and aromatic with good flavor. The duration of the crop is four to five months.

The chemistry of Solenostemon is still not well known. Major biochemical constituents of the tubers are 18.2% starch and 2.7% protein [4].

Paclobutrazol, one of the triazole compounds, which induced the tuber initiation and enlargement of potato [5]. It also influences the carbohydrate and antioxidant metabolisms in various plants. The enhancement of yield in tuber crops like Chinese potato will be beneficial to the farmers. There hasn't been much research done on employing triazole chemicals to boost growth and productivity in tuber crops like Chinese potatoes [6]. Therefore, it becomes imperative to conduct research to determine how triazole chemicals affect Chinese potato development and metabolism. The purpose of this research is to assess the effects of triazole chemicals, specifically triadimefon and propiconazole, on the growth and metabolism of *S. rotundifolius*. The main objectives of this study are to assess the effect of Propiconazole and Triadimefon on membrane integrity of *S. rotundifolius*.

MATERIALS AND METHODS

A food crop as well as medicinally important plant species, *Solenostemon rotundifolius* (Poir.) J.K. Morton belonging to the family Labiatae was selected for the present investigation. Its variety namely 'Sridhara' was selected for the study.

Triadimefon (Bayer India Ltd., Mumbai) and propiconazole (Rallis India Ltd., Mumbai) were used for this study. During the experimental studies the average maximum temperature was 28.68o C and minimum was 21.75o C.

Cultivation methods

The area was thoroughly tilled five times, resulting in sandy loam with no stones or pebbles down to a depth of 35 cm. Manure from the farmyard (FYM) was used. For planting, stem cuttings with three nodes that were of the same thickness and size were employed. To prevent fungal infections, the stem cuttings were immersed in 1% Bavestin for 10 minutes prior to planting. Plots measuring 1.5 m by 1.5 m were planted with stem cuttings at a depth of 5 cm, and bunds were spaced 15 cm apart and 60 cm apart.

The entire trial was conducted without the use of inorganic fertilizer. For irrigation, only groundwater was utilized. Chinese potatoes were treated with 10 mg L-1 triadimefon and 10 mg L-1 propiconazole doses to see how these substances affected the plants. For treatment, each plant received one litre of a 10 mg L-1 triadimefon and 10 mg L-1 propiconazole solution, while the control received one litre of irrigation water. Soil drenching was the method used to treat DAP 80, 110, and 140. After the treatment, the soil's pH was 6.8 and its EC was 0.21 dS^{m-1}.

On 90, 120, and 150 DAP, plants were randomly harvested. They were then cleaned with tap water, deionized water, and separated into stem, leaf, root, and tuber sections. These sections were then used to calculate the parameters.

Membrane integrity

Electrolyte leakage

Electrolyte leakage was analysed based on the standard method [7].

Lipid peroxidation (TBARS content)

TBARS was used to estimate LPO [8]. The extinction coefficient of 155 mM-1cm-1 was used to calculate the TBARS content, which was then expressed in units (U). µmole of MDA formed min-1 mg-1 protein is defined as one U.

Statistical analysis

Data testing was done using the analysis of variance (ANOVA) protocol outlined by Ridgman [9]. Tuckey's test was used to evaluate means between treatments based on the error mean square by LSD (Least Significant Difference) at the P=0.05 and P=0.01 confidence levels.

RESULTS

Electrolyte leakage

Leaf (Fig. 1)

The electrolyte leakage increased with age of the control and treated plants. Triazole treatments lowered the electrolyte leakage in the leaf tissue and it was 91.59 and 89.68 per cent over control in triadimefon and propiconazole treated plants respectively on 150 DAP.

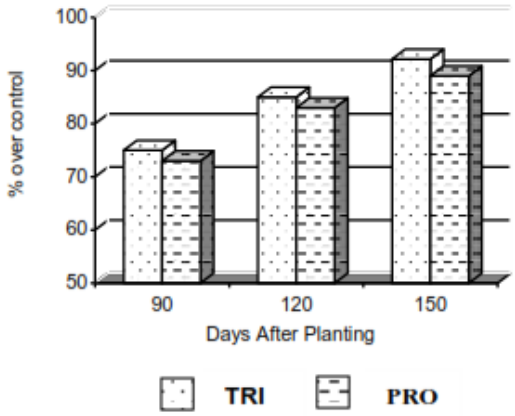

Fig. 1. Triadimefon and Propiconazole induced changes in the electrolyte leakage in Chinese potato leaf tissue.

Tuber (Fig. 2)

Similar results were obtained in tuber tissues also for electrolyte leakage. Triazole treatments significantly reduced the electrolyte leakage when compared to control and it was only 92.74 and 88.32 per cent in the triadimefon and propiconazole treated plants respectively on 150 DAP. The electrolyte leakage in the tuber tissue was very much reduced by the triazole compounds when compared to leaf tissue.

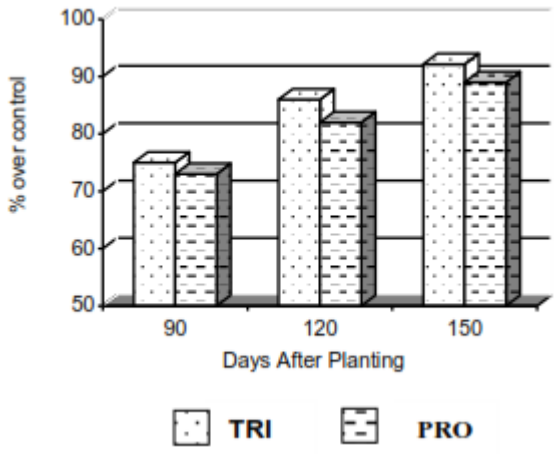

Fig. 2. Triadimefon and Propiconazole induced changes in the electrolyte leakage in the tuber tissue of Chinese potato.

Lipid peroxidation

Leaf (Fig. 3)

Treatments with triazoles resulted in a significant inhibition of the lipid peroxidation of the leaf tissue membranes. Lipid peroxidation on 150 DAP was 80.061 and 79.340 percent over control in the triadimefon and propiconazole treated plants, respectively, with no statistically significant difference between the two triazole treatments.

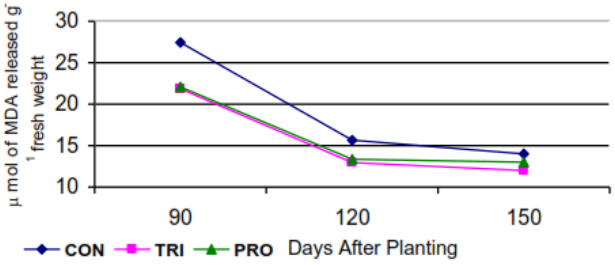

Fig. 3. Triadimefon and Propiconazole induced changes lipid peroxidation in Chinese potato leaf tissue.

Tuber (Fig. 4)

Triazole treatment significantly inhibited the lipid peroxidation level as compared to control and it was only 85.02 and 81.50 per cent when compared to control in propiconazole and triadimefon treated plants respectively on 150 DAP. Among the triazoles, triadimefon treatment inhibited the lipid peroxidation in the tuber tissue to a larger extent when compared to propiconazole.

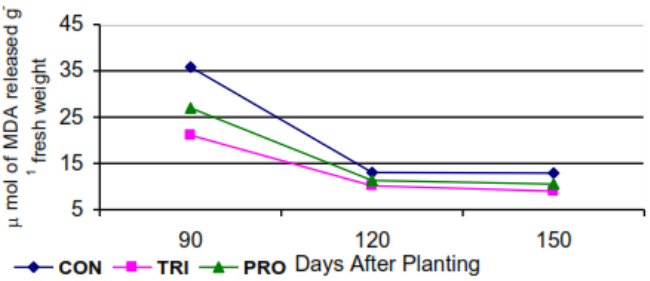

Fig. 4. Triadimefon and Propiconazole induced changes in the lipid peroxidation in Chinese potato tuber tissue.

DISCUSSION

The present investigation was carried out to study the effect of triazole compounds viz. triadimefon and propiconazole on membrane integrity of Chinese potato (*Solenostemon rotundifolius* (Poir) J.K. Morton). The field experiments were designed using CRBD (Completely Randomized Block Design). The plants were treated with 10 mg L^{-1} triadimefon and 10 mg L^{-1} propiconazole on 80, 110 and 140 days after planting (DAP) by soil drenching. The parameters studied in this investigation were membrane integrity in terms of electrolytic leakage and lipid peroxidation.

The triazole treatments reduced the electrolyte leakage from the membrane significantly at all stages of Chinese potato growth in both shoot and in tuber tissues. Inhibited electrolyte leakage was reported in uniconazole treated soybean [10]. Triadimefon mediated reduction in ion leakage has been reported in white spruce by Sailerova and Zwiazek [11]. Paul and Ezekiel [12] also found that triazoles like triadimefon helped in maintaining membrane integrity, reduced ion leakage and slowed down aging in stored potato tubers. Triadimefon and hexaconazole reduced the electrolytic leakage in radish [13].

Triazole modified the composition of sterol in the plasma membrane and the process of sterol biosynthesis [14]. Increased membrane stability could result from these modifications to the sterol composition in the cell membrane [11].

Propiconazole and triadimefon therapy in comparison to the control group, Chinese potato plants displayed reduced levels of lipid peroxidation. As seen in potato tubers, malonoldialdehyde (MDA), a byproduct of lipid peroxidation, harms plant membranes and enzymes. [12,15,16].

In rape plants, uniconazole decreased heat-induced lipid peroxidation by reducing electrolyte leakage and MDA accumulation [17]. Comparable outcomes were noted in tomato plants treated with paclobutrazol [18] and *Egenia densa* leaves treated with triazole [19,20].

CONCLUSION

Triazole compounds inhibited the electrolyte leakage in the leaves and tubers of Chinese potato. Triazole treatments inhibited the lipid peroxidation and this inhibition was high in the leaves than tubers. Among the triazoles, propiconazole inhibited the lipid peroxidation to a higher extent when compared to triadimefon

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