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SHORT COMMUNICATION

PESTICIDE INDUCED ALTERATIONS IN PHYSIOLOGICAL RESPONSES IN *CAMELLIA SINENSIS*

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Treatment with monocrotophus (pesticide) for four days to tea *(Camellia sinensis* (L) O. Kuntze) seedlings showed a decrease in chlorophyll content, carotenoid content and peroxide content with an increase in thiobarbituric acid reactive substance (TBARS), a measures of lipid peroxidation. Though superoxide dismutase (SOD) and glutathione content increased but activities of catalase (CAT), peroxidase (POX), glutathione reductase (GR) and ascorbate content decreased in pesticide treated plants as compared to control.

***Key words*: *Camellia sinensis*, monocrotophus, oxidative stress.**

Tea is one of the most popular hot drinks the world over. It is prepared from the perennial plant *Camellia sinensis* (L) O. Kuntze, which is a major plantation crop in India. In India tea plants are grown in rainfed ecosystem in the hilly region of Brahmaputra Valley, Bark Valley and other parts of India. Tea is not merely a beverage but a good health drink. Green tea liquor is rich in vitamins K and C and micronutrients required by the body (Kabir 2002). Tea is known to have antimutagenic, anticarcinogenic, antibacterial, anticoagulant, properties and as beverage has potent antioxidant properties (Kabir 2002). As the plant is grown in non irrigated ecosystems, it is subjected to different environmental stresses, which modify morphology and rate of development, limit yield and quality and reproduction (Leinhos and Bergmann 1995). Abiotic stresses are known to cause oxidative stress in plants by producing reactive oxygen species (ROS) like superoxide radical, hydroxyl radical, hydroperoxyl radical, hydrogen peroxide, which are inevitable products of natural redox reactions in various cellular compartments (Zhang and Kirkham 1994, Alscher *et al*. 1997). To withstand the cytotoxic effect of reactive oxygen species produced by different abiotic stresses, plant cells have well developed antioxidant defense systems, such as superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), glutathione reductase (GR) and non-enzymic (carotenoid, ascorbate, glutathione, ∝ tocopherol) (Foyer 1993, Scandialos 1993, Khan and Panda 2002). The present experiment was undertaken to investigate the possible physiological response and oxidative alternations in tea by different pesticide concentrations.

Healthy and uniform one year old seedlings of tea (*Camellia sinensis* (L) O. Knutze) were procured from Tocklai Tea Research Station, Silchar and were acclimatized in laboratory condition. Plants were grown under natural light. Seedlings were treated with different concentrations (control, 1, 5, 10 and 20%) of monocrotophus. On the fourth day of treatment, tea seedlings were sampled for various biochemical and enzymic estimations.

Tea leaves were homogenised in cold 80% acetone and chlorophyll and carotenoid pigments were estimated

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as per the methods of Arnon (1949). Proline content was estimated as per the method of Bates *et al.*, (1973). Leaves were taken and homogenised with 5% trichloroacetic acid (TCA) and homogenate was used for the estimation of total peroxide content (Sagisaka 1976). Lipid peroxidation was measured as the amount of TBARS determined by the thiobarbituric acid (TBA) reaction as described by Heath and Packer (1968). Glutathione was extracted and estimated as per the method of Griffith (1980). Extraction and estimation of ascorbate was done as per Oser (1979). Enzyme extract was centrifuged at 4ºC for 15 min at 17,000 g in a refrigerated centrifuge. The supernatant was used for the assay of catalase (CAT), guaiacol peroxidase (POX), superoxide dismutase (SOD) and glutathione reductase (GR). The assay of CAT and POX was done as per the method of Chance and Maehly (1955). The assay of SOD was done as per the method of Giannopolitis and Reis (1977). Glutathione reductase (GR) was assayed as per the method of Smith *et al*. (1988). Each experiment was repeated five times and data presented are means ± standard errors.

Observations recorded on the 4th day after treatment showed decrease in chlorophyll and carotenoid content with highest decrease in plant treated with 10 and 20% pesticides. However, an increase in proline accumulation was observed, with increase in concentration of pesticide. The decrease in the pigment content indicated an inhibition of chlorophyll biosynthesis. But proline accumulation indicated an osmoprotective effect of proline under pesticide treatment as seen for other pollutants (Khan and Panda 2001).

The endogenous total peroxide content decreased due to pesticide treatment. But at 20% pesticide a little increase (3.12%) in peroxide content was observed. Thiobarbituric acid reactive substance (TBARS), a measure of lipid peroxidation increased in pesticides treated plants. High degree of membrane distortion was reported in pesticide treated *Phaseolus vulgaris* plant (Nirmaladevi *et al.* 1996). CAT activity was highest in plant treated with 10% pesticide, where as 24.62% decrease was observed in SOD and GR activity. Little regain in peroxide content observed at 20% pesticide treated plants could be due to decrease in CAT activity at that pesticide concentration. Lowest SOD and GR activity was observed in plants treated with 10 and 20% pesticides.

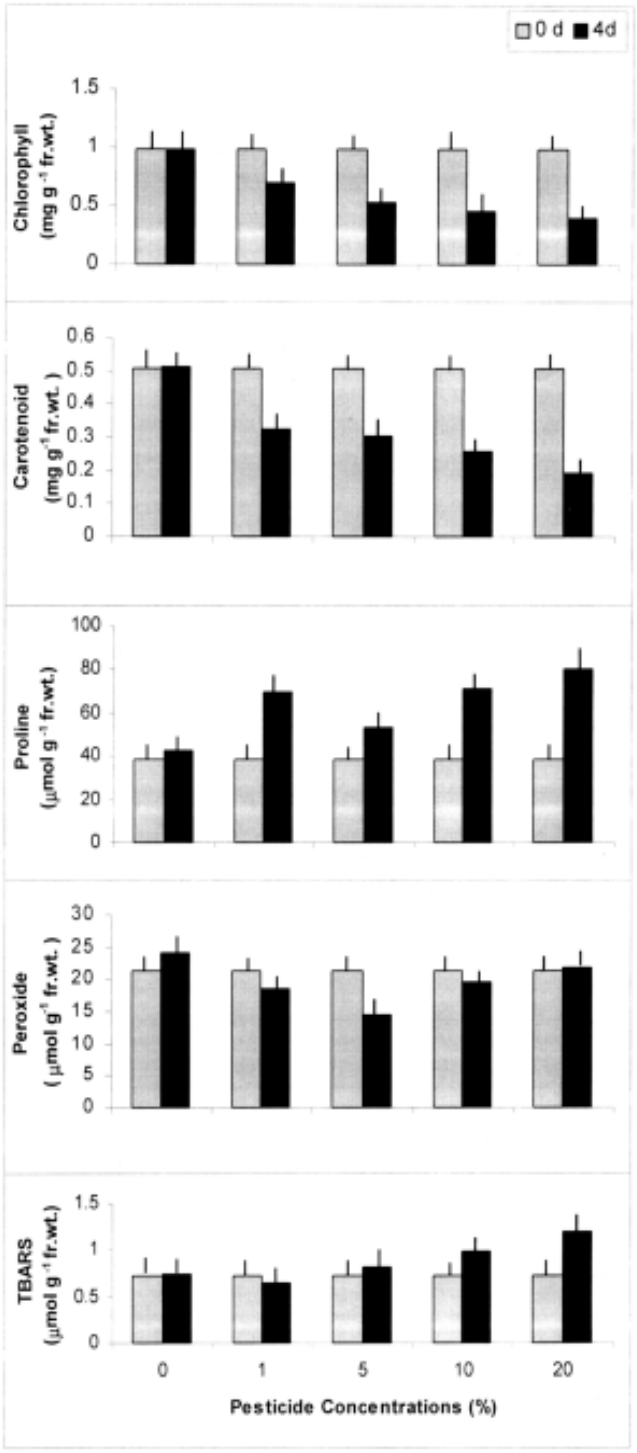

Fig. 1. Effect of pesticide (monocrotophus) on the chlorophyll, carotenoid, proline, peroxide and thiobarbituric acid reactive substance (TBARS) contents in *Camellia sinensis* leaves. Data presented are mean ± SE.

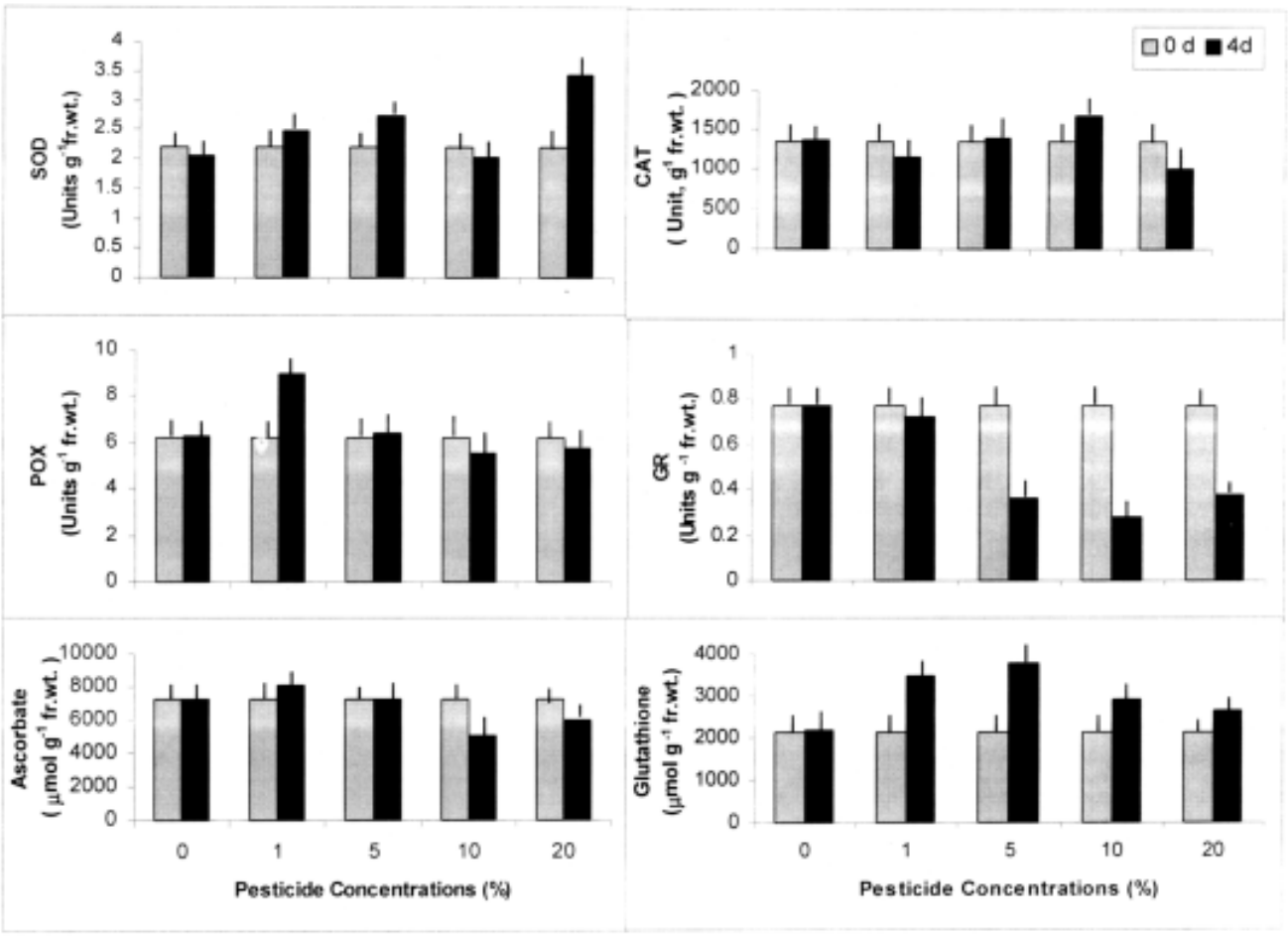

Fig. 2. Changes in activities of SOD, CAT, POX and GR and contents of ascorbate and glutathione in the leaves of *Camellia sinensis* treated with pesticides (monocrotophus). Others same as fig. 1.

A significant increase in POX activity was observed at 1% pesticides resulting in 131.54% increase over control. A decrease in ascorbate content was seeen with increasing concentration of pesticides. Ascorbate content was lowest in plants treated with 10 and 20% pesticides, with 30.3 and 17.14% decrease respectively. Glutathione content was highest in plants treated with 5% pesticide resulting in 114.53% increase. Though the result obtained for peroxide content is non-uniform, but increased peroxide content at higher pesticide concentration was sufficient to induce highest lipid peroxidation at that concentration. The progressive loss of enzymic and non-enzymic antioxidants in tea plants subjected to pesticide treatment indicated a loss of cellular protective machinery with an increase in oxidative damage as evidenced by increase in lipid peroxidation (Panda and Patra 2000)

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