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Baseline Data for Insecticide Resistance Monitoring in Tobacco Caterpillar, Spodoptera litura (Fabricius) (Lepidoptera: Noctuidae) on Cole Crops

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Abstract : The tobacco caterpillar, Spodoptera litura (Fabricius) (Lepidoptera: Noctuidae) is an agricultural important pest species. S. litura has a wide host range of approximately recorded 150 plant species worldwide. In Punjab, this pest attains sporadic status primarily on cauliflower, Brassica oleracea (L.). This pest destroys vegetable crop and particularly prefers the cruciferae family. However, it is also observed feeding on other crops such as arbi, Colocasia esculenta (L.), mung bean, Vigna radiata (L.), sunflower, Helianthus annuus (L.), cotton, Gossypium hirsutum (L.), castor, Ricinus communis (L.), etc. Larvae of this pest completely devour the leaves of infested plant resulting in huge crop losses which ranges from 50 to 70 per cent. Indiscriminate and continuous use of insecticides has contributed in development of insecticide resistance in insects and caused the environmental degradation as well. Moreover, a base line data regarding the toxicity of the newer insecticides would help in understanding the level of resistance developed in this pest and any possible cross-resistance there in, which could be assessed in advance. Therefore, present studies on development of resistance in S. litura against four new chemistry insecticides (emamectin benzoate, chlorantraniliprole, indoxacarb and spinosad) were carried out in the Toxicology laboratory, Department of Entomology, Punjab Agricultural University, Ludhiana, Punjab, India during the year 2011-12. Various stages of S. litura (eggs, larvae) were collected from four different locations (Malerkotla, Hoshiarpur, Amritsar and Samrala) of Punjab. Resistance is developed in third instars of lepidopterous pests. Therefore, larval bioassays were conducted to estimate the response of field populations of thirty third-instar larvae of S. litura under laboratory conditions at 25±2°C and 65±5 per cent relative humidity. Leaf dip bioassay technique with diluted insecticide formulations recommended by Insecticide Resistance Action Committee (IRAC) was performed in the laboratory with seven to ten treatments depending on the insecticide class, respectively. LC50 values were estimated by probit analysis after correction to record control mortality data which was used to calculate the resistance ratios (RR). The LC50 values worked out for emamectin benzoate, chlorantraniliprole, indoxacarb, spinosad are 0.081, 0.088, 0.380, 4.00 parts per million (ppm) against pest populations collected from Malerkotla; 0.051, 0.060, 0.250, 3.00 (ppm) of Amritsar; 0.002, 0.001, 0.0076, 0.10 ppm for Samrala and 0.000014, 0.00001, 0.00056, 0.003 ppm against pest population of Hoshiarpur, respectively. The LC50 values for populations collected from these four locations were in the order Malerkotla>Amritsar>Samrala>Hoshiarpur for the insecticides (emamectin benzoate, chlorantraniliprole, indoxacarb and spinosad) tested. Based on LC50 values obtained, emamectin benzoate (0.000014 ppm) was found to be the most toxic among all the tested populations, followed by chlorantraniliprole (0.00001 ppm), indoxacarb (0.00056 ppm) and spinosad (0.003 ppm), respectively. The pairwise correlation coefficients of LC50 values indicated that there was lack of cross resistance for emamectin benzoate, chlorantraniliprole, spinosad, indoxacarb in populations of S. litura from Punjab. These insecticides may prove to be promising substitutes for the effective control of insecticide resistant populations of S. litura in Punjab state, India.

Keywords : Spodoptera litura, insecticides, toxicity, resistance
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