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Effect of Plant Extracts on the Yield of Soybean Crop Under Different Climatic Conditions

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Abstract

Soybean (*Glycine max* L., Variety PB-1) is an important oilseed crop though not extensively cultivated in Bangladesh. Five different plant extracts i.e., 'Bara Bishkatali' leaf extract, sesame seed oil, castor seed oil, a mixture of sesame oil and 'neem' seed oil and tobacco leaf extract were sprayed prior to pest infestation. The major insect pests encountered were the leaf roller (*Sylepta derogata*), pentatomid bug (*Nezara viridula* and *Piezodorus hybneri*), noctuid semilooper (*Trichoplusia ni*) and blue butterfly (*Euchrysops cnejas*). Among the applied treatments, tobacco leaf extract showed the best result followed by Bara Bishkatali leaf extract, sesame seed oil and a mixture of sesame oil and neem seed oil and castor oil. Some unidentified beneficial eurytomid, braconid, ichneumonid and encyrtid insect parasites and coccinellid predators played an important role in suppressing the pest population during the study period. The maximum yield was 36.7 maunds per acre in the BCSIR Laboratories Campus, Rajshahi but the yield was only 3 maunds per acre in the Oilseeds Cultivation Centre Patgram, Lalmonirhat.

Introduction

Soybean (*Glycine max* L.) is an important oilseed crop and it is as nutritious as other pulses. It is also a source of protein and oil. Soybean is being increasingly used as a high protein source in human diet.[1] Natural plant materials or stored product and crop pests.[2-4] According to Feinstein,[5] over 2000 species of plants representing 170 families are said to have insecticide properties.

As far as is known, no detail works on the pest occurrence in soybean and their control by plant extracts have been done in Bangladesh. This is also true for the effects of pest control on the yield of soybean. This led to the present investigation.

Materials and Methods

The experiments on pest control of soybean through the application of biopesticide (compatible plant extracts) were conducted during the crop seasons of 2001-2002 under two climatic conditions, e.g., northern region (Patgram Oilseeds Cultivation Centre, Lalmonirhat) and western region (BCSIR Laboratories Oilseeds Cultivation Centre, Rajshahi).

The plant parts for desired extracts were finely chopped into small pieces, air dried, pounded in mortar and pestle into a coarse powder and were finally grounded into fine powder which were subjected to insecticide extraction in methanol solvent kept in differ-

ent air tight bottles. The extracts were utilized for spraying in different soybean crop fields when required.

The pests in both the soybean fields of Patgram and BCSIR Laboratories Centres were collected at weekly interval and preserved in 80 % ethyl alcohol with a drop of glycerine for future study. The status of insect pests, beneficial insect parasites and predators in the soybean crop fields before and after spraying was carefully observed. The data on yield of seed per plant, plant height and number of seeds per plant were recorded. Control (unsprayed) experiment was done for each kind of plant extract sprayed in different soybean fields in order to compare the effects of plant extracts and mode of insect infestation, number of pods / plant and yield. The prevailing field temperatures in two oilseed cultivation centres were also recorded for comparison of pest occurrence.

Results and Discussion

The effects of different plant extracts on the number of pods per plant and yield of soybean per plant in the Oilseeds Cultivation Centre of the BCSIR Laboratories and Oilseeds Cultivation centre, Lalmonirhat are shown in the Tables I and II respectively. Analyses of variance showed that sprays with plant extracts increased both the number of pods per plant and yield of soybean. Among the sprays conducted, tobacco leaf extract exerted the best result.

The major pests were the leaf roller (*Sylepta derogata*), pentatomid bugs (*Nezara viridula* and *Piezdorus hybneri*), noctuid semilooper (*Trichoplusia ni*) and blue butterfly (*Euchrysops cnejas*). *Heliothis armigera* was also recorded as a minor pest. The parasites recorded were the braconid, *Apanteles similis*, eurytomid, *Eurytoma sp.*, ichneumonid, *Campoletis chlorideae* and encyrtid, *Copidosoma sp*. Coccinellid predators, *Coccinella transversalis* and *Brumoides suturalis* were also recorded during the flowering stage. The maximum yield was 36.7 maunds per acre.

In the soybean field of Patgram, Lalmonirhat, sandy soil and drought hampered the growth of soybean plants. The plants were of 50 % less height than those of the soybean plants in the BCSIR Laboratories Campus, Rajshahi. The edaphic factor of the two plots under cultivation did not permit better yield of soybean. The foggy weather, less humidity and less water absorbing capacity of the sandy soil were the major ecological condition of Patgram Oilseeds Centre, Lalmonirhat. But the soil of the BCSIR Laboratories Campus, Rajshahi was loamy and its water absorbing capacity and humidity were higher than those of Patgram Centre which favoured the yield of soybean to a greater extent. In this field, the major pests encountered were the hairy caterpillar, *Spilosoma obliqua*, *Monolepta signata* and *Epilachna variverstis*. *S. obliqua* seriously damaged the plants and skeletonized them. The maximum yield was 3 maunds per acre.

During the course of investigation, hairy caterpillar, *Spilosoma obliqua* seriously damaged the soybean plants and skeletonized them. According to Hill., *S. obliqua* is a polyphagous pest which attacks a wide

Table I. Effect of plant extracts on the number of pods per plant and yield per plant (g) in soybean in the BCSIR Laboratories, Campus, Rajshahi

Treatment	Number of pods per plant (Mean ± S. D.)	F-value (probability)	Yield per plant (g) (Mean ± S. D.)	F-value (probability)
0 (Control)	41.8 ± 4.1	4.719	8.18 ± 0.81	5.012
10 % *Sesamum indicum* seed oil	43.9 ± 4.39		9.24 ± 0.92	
10 % *Ricinus communis* seed oil	37.5 ± 2.75		6.96 ± 0.69	
10 % *Melia azadirachta* seed oil + *Sesamum indicum* seed oil	49.4 ± 4.94		10.96 ± 1.09	
10 % *Polygomum orientale* leaf	58.1 ± 3.81		11.21 ± 1.12	
Nicotiana tabacum leaf	61.5 ± 6.15			

Table II. Effect of plant extracts on the number of pods per plant and yield per plant (g) in soybean in the Oilseeds Cultivation Centre, Lalmonirhat

Treatment	Number of pods per plant (Mean ± S. D.)	F-value (probability)	Yield per plant (g) (Mean ± S. D.)	F-value (probability)
0 (Control)	14.2 ± 1.42	20.595	1.78 ± 0.17	6.071
10 % *Polygonum orientale* leaf	30.7 ± 3.07		2.82 ± 0.28	
10 % *Ricinus communis* seed oil	23.7 ± 2.37		1.90 ± 0.19	
10 % *Melia azadirachta* seed oil + *Sesamum indicum* seed oil	9.2 ± 0.92		1.68 ± 0.16	

number of crop plants.[1] The pyralid leaf roller, *S. derogata* seriously damaged the tender leaves of soybean and thus hampered the yield of soybean to a greater extent. This observation is in conformity with the findings of Hill.[1] The coleopteran pests, *Monolepta signata* (Oliv.) and *Epilachna* sp. sucked the foliages and these pests are encountered in enormous number.[6,7] The noctuid semilooper, *Trichoplusia ni* seriously defoliated the foliages and reduced the crop yield. Huffman-camps *et al.* reported that consumption of this caterpillar remained affected by diet.[8]

In Bangladesh, soybean is not widely cultivated. In southern districts of Bangladesh including Madaripur and Meherpur districts. *Helicoverpa armigera* (Lepidoptera Noctuidae) was encountered in the crop field as a minor pest during study period. This pest can be significantly reduced on predation of its eggs by the bigeyed bug, *Geocoripes punctipes* (Hemiptera: Lygaeidae). Eickel *et al.* observed that a significant interaction existed in three experiments between *H. zea* population levels and paraquat treatment time.[9]

According to Butler and Henneberry pest control of vegetables and cotton can be successfully achieved by household cooking oils and liquid detergents.[10] Plant based extracts are compatible with the suppression of the pests of different stored commodities and many crop pests.[2,11,12] According to Tembo and Murfitt, the treatment of grain with pesticide / vegetable oil mixtures (groundnut, rapeseed and sunflower) could have important implications for parts of the world where pesticides are expensive or in short supply.[3] Finally, it can be concluded that farmers can also use water extract of the leaves of Bara Bishkatali and tobacco leaf extracts, neem seed oil, sesame seed oil and castor seed oil as botanical insecticides against the prevailing pests of soybean under preharvest conditions.

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