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Role of Avian Community in Reduction of *Spodoptera* Pest Population in Sugar Beet at Pune

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Abstract

Experiments were conducted at Vasantdada Sugar Institute, Pune in a RBD with three replications during 2005 to 2007 in sugar beet (var. *posada*) for control of *Spodoptera litura* Fab.

The ornithological studies had shown the major avian community, *Acridotheres tristis* (Linnaeus), *Passer domesticus* (Linnaeus), *Vanellus indicus* (Boddaert), *Corvus splendens* (Vieillot), *Centropus sinensis* (Stephens), *Pycnonotus cafer* (Linnaeus), *Eudynamys scolopacea* (Linnaeus), with a relative abundance of 14.33, 13.26, 11.46, 5.73, 3.87, 3.54, and 2.79 %, respectively.

The reduction in mean *S. litura* population due to the pick up of the larvae by birds during three crop seasons ranged from 33.90 to 69.47%. Installation of minimum 15 bird perches/ha in 60 days after sugar beet sowing noticed effective considering the number of birds sittings (130.66/day), reduction in larval population of *S. litura* (39.99%), and root yield (71.36 ton/ha).

Keywords: Sugar beet, *Spodoptera*, avian community, yield.

Introduction

Beta vulgaris Linnaeus is the second largest crop after sugar cane for sugar production in the world and about 28% sugar is produced from sugar beet. Sugar beet contains 3 to 4 % more sucrose than sugar cane (Baloach *et al.,* 2002). Being a new crop in India, several constraints are noticed in cultivation of sugar beet and severe incidence of pests and diseases is a major (Patil *et al.,* 2007).

Defoliating pests *viz. Spodoptera litura* Fab., *Diacrisia obliqua* Walker, *Plusia orichalcea* Fab. and *Agrotis ypsilon* Rott. have cause the appreciable damage to Tropical sugar beet (Avasthy and Srivastava, 1972; Khan and Sharma, 1971; Singh *et al*., 1980; Tewari *et al*., 1986; Patil *et al.,* 2007). Cent per cent defoliation has resulted, 42% beet root yield loss (Muro and Irigoyen, 1998).

Beet armyworm was a major pest causing severe damage. Young larvae skeletonise the leaves however; the older ones eat the entire lamina and defoliate the crop completely in a very short period (Cooke, 1993 and Patil *et al.,* 2007). The full grown larvae of *S. litura* also feed on beet roots, as they live in the soil during the day time. Development of ecofriendly management practices to obtain the sustained crop yields over a long period is highly essential.

Passer domesticus (Linnaeus) is recorded by Gopi *et al*. (2001) as an avian natural enemy of *Aleurodicus disperses* Russell. Dead sewer rat, offal, carrion, kitchen scraps and refuse, locusts, termites, fruits, grains and eggs or fledgling birds as

the food of *Corvus splendens* (Vieillot) were described by Ali (1989) and Thirumurthy and Annamalai (1994). House crow was noticed to feed on crabs (a destructive pest of paddy), rodents, mice and cattle egret, common myna, red-vented bulbul ate the grasshoppers (Regmi, 2003).

Installation of 8-10 bird perches/hectare in cotton was recommended after 90 days of crop growth for the benefit of predatory birds like black drango, king crow, orange myna and blue jay in cotton were recommended after 90 days of crop growth (Anonymous, 2004).

Considering the pollution, problems of chemical insecticides, related to soil, water, natural enemies of pests, resistance, and residue etc., the present work will help to minimize the pest problem in a cheaper and safe way.

Materials and methods

Experiments were conducted at VSI, Pune (Latitude $18^0 32'$N, Longitude $73^0 51'$E, Altitude 559 m, Temp. 15^0 to 45^0C) in a RBD with three replications during winter (2005-06 and 2006-07) and summer season (2006). Sugar beet (var. *posada*) was sown on 30.11.2005, 07.12.2006, and 03.06.2006, respectively. Row to row and plant to plant distance was 50 and 20 cm, respectively with a plot size of 5 × 4 m^2 and recommended agronomical practices were followed.

'T' shaped wooden bird perches @ 5, 10, 15, 20 and 25 no./ha were installed at 60 days after sowing and effect checked against uninstalled plot, in three seasons. During morning and evening hours, the number of bird species and number of bird sittings were recorded every day for 15 days, in each season as per group of the bird perches. Relative abundance (%) was worked out. Major bird species were identified based on physical features with the help of field guides and reference books (Ali and Ripley, 1983).

Randomly five plants were selected in each plot and live larvae of *S. litura* were counted in each plant before and after the installation of bird perch.

Ten randomly selected beet roots were harvested and weighed from each treatment at a crop age of 5.50 months, juice pol and purity (%) were analyzed by Cold Method (Le Docte, 1927).

Results and discussion

The ornithological studies taken during 2005 to 2007, in sugar beet at Pune indicated that seven major species *viz. Acridotheres tristis* (Linnaeus), *P. domesticus*, *Vanellus indicus* (Boddaert), *C. splendens*, *Centropus sinensis* (Stephens), *Pycnonotus cafer* (Linnaeus), *Eudynamys scolopacea* (Linnaeus), from six families and others had shown their presence (Table 1). The Cattle Egret *Bubulcus ibis* (Linnaeus), family Ardeidae was also noticed during the inter culturing operations. Abdulali (1973) has reported existence of 525 species of birds in Maharashtra State.

The relative abundance (Table 2) of avian community indicated the dominance (58.55%) of common myna during winter 2005-06, Asian Koel (34.04%) in summer, 2006 and House crow (52.31%) in winter, 2006-07. The variation in abundance may be due to coverage of other crops around the beet fields, feeding preference of pests, etc. However, in general, among the major bird species, common myna has a maximum (14.33%) abundance followed by house sparrow (13.26), red wattled lapwing (11.46), house crow (5.73), greater coucal (3.87), red-vented bulbul (3.54) and Asian

Table 1. Birds recorded in sugar beet fields at Pune (India).

Common name	Scientific name	Family
House Sparrow	*P. domesticus*	Passeridae
House Crow	*C. splendens*	Corvidae
Common Myna	*A. tristis*	Sturnidae
Asian Koel	*E. scolopacea*	Cuculidae
Greator Coucal	*C. sinensis*	Cuculidae
Red – Vented Bulbul	*P. cafer*	Pycnonotidae
Red Wattled Lapwing	*V. indicus*	Charadriidae

Season I - Winter (2005-06); II - Summer (2006); III - Winter (2006-07)

Table 2. Relative abundance of birds in various seasons in sugar beet fields.

Common name	% relative abundance			
	Season I	Season II	Season III	Average
House sparrow	57.06	15.30	27.64	13.26
House Crow	17.95	29.74	52.31	5.73
Common Myna	58.55	9.99	31.46	14.33
Asian Koel	28.07	34.04	37.89	2.79
Greator Coucal	29.62	31.65	38.73	3.87
Red-vented Bulbul	33.80	31.58	34.63	3.54
Red Wattled Lapwing	46.36	17.11	36.53	11.46
Other	80.50	8.34	11.16	45.03

Season I - Winter (2005-06); II - Summer (2006); III - Winter (2006-07)

koel (2.79%). The other birds had also shown the relative abundance of 45.03% but it varies due to various environmental factors, food availability, competition, presence of other crops in the area etc. The common crow, myna and sparrow noticed to feed on various stages of white grubs exposed during ploughing (Bhaketia *et al.,* 1984), while common crow and sparrow were recorded as a natural enemies on armyworm (Bindra and Singh, 1973).

House sparrow reported to graze on crops. Rooks were also noticed to kill the sugar beet plant by uprooting them whilst searching for wireworm and other soil invertebrates (Dewar and Cooke, 2006) and, therefore, it is possible to cause the damage by some of the birds during early stage of sugar beet. Therefore, it is suggested that bird perches need to be erected when the appropriate foliage canopy of sugar beet develops. It seems that there is no need to use bird perches for control of *S. litura* during the early growth of sugar beet.

The role of bird perch on number of bird sittings in *S. litura* affected sugar beet field in three seasons with a 5, 10, 15, 20, and 25 bird perches per hectare were studied. It was observed that common myna preferred maximum of 11.41 sittings/perch in winter season of 2005-06 in a 15 days period followed by a house sparrow with 10.29 sittings and red wattled lapwing with 7.23 sittings and the remaining preferred from 1.07 to 6.13 sittings (Table. 3) for picking of live larvae. It was also noticed that these seven species of birds visited the fields during morning and evening hours however, they preferred to visit mostly during the morning hours.

Increase in number of bird perches had increased the more sittings of the birds.

Table 3. Average bird sittings on perch in sugar beet fields.

Common name	Season	No. of birds recorded on bird perches						Avg. bird sittings/ perch
		No of bird perch / ha.						
		5	**10**	**15**	**20**	**25**	**Total**	
House Sparrow	I	75	150	135	202	210	772	10.29
	II	15	50	35	39	68	207	2.76
	III	46	53	89	65	121	374	4.99
House Crow	I	15	29	31	16	14	105	1.40
	II	13	21	33	39	68	174	2.32
	III	54	49	55	66	82	306	4.08
Common Myna	I	89	142	147	245	233	856	11.41
	II	29	22	37	25	33	146	1.95
	III	94	76	91	84	115	460	6.13
Asian Koel	I	7	12	31	16	14	80	1.07
	II	9	20	29	21	18	97	1.29
	III	12	24	28	31	13	108	1.44
Greator Coucal	I	8	12	17	39	41	117	1.56
	II	13	15	20	34	43	125	1.67
	III	5	21	46	25	56	153	2.04
Red – Vented Bulbul	I	21	19	25	24	33	122	1.63
	II	16	16	22	29	31	114	1.52
	III	6	21	23	34	41	125	1.67
Red Wattled Lapwing	I	102	87	99	146	108	542	7.23
	II	60	47	29	36	28	200	2.67
	III	65	64	87	99	112	427	5.69
Other	I	482	646	670	925	976	3699	49.32
	II	68	82	85	76	72	383	5.11
	III	45	79	96	145	148	513	6.84
	Total	**1349**	**1757**	**1960**	**2461**	**2678**	**10205**	

Season I - Winter (2005-06); II - Summer (2006); III - Winter (2006-07)

Placement of 25 perches/ha had shown the maximum of 2678 sittings/ha, while in 5 perches/ha, it was 1349 sittings.

In all the seasons, the mean larval population of *S. litura* ranged from 5.48 to 7.72/plant before the placement of bird perches and it was sufficient to cause the economic damage to sugar beet crop (Table 4). The maximum 14.80 larvae/plant were noticed in a check plot. The mean population of larvae during I, II, and III seasons ranged from 2.05 to 6.93, 2.87 to 8.40, and 2.87 to 4.27/plant, respectively and in control it was 6.80 to 12.11/plant. Therefore, the reduction in larval population due to placement of bird perches in I, II, and III crop seasons ranged from 42.17 to 83.07, 21.71 to 73.25, and 37.21 to 57.79%, respectively. The mean larval population reduction of three seasons ranged from 33.90 to 69.47%.

Table 4. Reduction of *S. litura* population due to bird perch in sugar beet.

Treatment (No. of bird perch / ha.)	Mean larval population/ plant (Pre count)			Mean larval population/ plant (over the season)			
	Season (Year)			Season (Year)			
	Winter (2005-06)	Summer (2006)	Winter (2006-07)	Winter (2005-06)	Summer (2006)	Winter (2006-07)	% reduction of larval population (Mean of 3 seasons)
5	8.80	8.20	5.20	6.93 (42.77)*	8.40 (21.71)	4.27 (37.21)	33.90
10	5.00	5.40	5.60	5.19 (57.14)	5.20 (51.54)	3.73 (45.15)	51.28
15	8.00	7.00	7.80	6.50 (46.33)	6.93 (35.41)	4.20 (38.24)	39.99
20	8.00	5.20	5.40	5.63 (53.51)	6.20 (42.22)	2.87 (57.79)	51.17
25	8.80	1.60	7.40	2.05 (83.07)	2.87 (73.25)	3.27 (51.91)	69.41
0 (control)	14.80	5.80	4.20	12.11 (0.00)	10.73 (0.00)	6.80 (0.00)	-
Treatment Mean	7.72	5.48	6.28	5.26	5.92	3.67	-

* per cent reduction of larval population over control

Table 5. Beet root yield and juice quality in sugar beet.

Treatment (No. of bird perch / ha.)	Pol (%)			Purity (%)			Average beet root yield (t/ha)		
	Season (Year)			Season (Year)			Season (Year)		
	Winter (2005-06)	Summer (2006)	Winter (2006-07)	Winter (2005-06)	Summer (2006)	Winter (2006-07)	Winter (2005-06)	Summer (2006)	Winter (2006-07)
5	14.14	11.28	13.18	80.75	80.86	73.22	62.01	18.00	55.38
10	15.32	10.27	13.56	87.83	71.54	74.12	69.54	20.33	61.06
15	16.22	12.41	12.42	84.40	86.34	76.27	71.36	19.33	65.66
20	14.48	11.00	12.36	82.58	73.70	72.76	72.00	25.00	66.16
25	14.90	10.95	12.70	88.77	81.43	70.56	66.30	28.00	67.62
0 (control)	15.22	10.04	12.35	84.41	67.20	71.54	69.06	18.00	50.92
Treatment mean	15.01	11.18	12.84	84.87	78.77	73.39	68.24	22.13	63.18

At harvest, the maximum pol, purity, and beet root yield was recorded in winter crop (2005-06) and it was 16.22%, 88.77%, and 72.00 ton/ha, respectively while in control it was 15.22%, 84.45%, and 69.06 ton/ha, respectively (Table 5). The summer (2006) crop gave poor beet root yield mainly due to the stagnation of water, which result severe rotting of beet roots. In general, it is concluded that installation of 15 bird perches/ha at 60 days after sowing noticed feasible considering the no. of birds sittings, reduction in larval population of *S. litura*, beet root yield and juice quality, as there is no much differences in placement of 20 and 25 bird perches/ ha.

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