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ARTIFICIAL T- PERCHES AS ATTRACTANT FOR INSECTIVOROUS BIRDS AGAINST *HELICOVERPA ARMIGERA* (HUBNER)

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ABSTRACT

Supplementing the foraging efficacy of insectivorous birds by installing artificial 'T- perches' can be used in controlling the cotton boll worm *Helicoverpa armigera* (Hubner) in berseem *(*Trifolium *alexandrinum* L*)* fodder crop. The present study explored this using T-perches placed at two heights (120 and 240 cm). A total of 22 bird species were observed, of which 15 species used 120 cm high perches while nine perched on 240 cm high one. Common myna was the most abundant with seasonal abundance of 31.75 and 35.96% on 120 and 240 cm perches, respectively. In all 12 species were observed in control field, out of which nine were found to be insectivorous. More diversity was observed in the fields installed with T- perches as compared to control field. Comparison of bird species in fields installed with 120 and 240 cm T-perches revealed more preference for 120 cm high one, may be because of low height of the berseem crop. These T-perches also proved effective in reducing the cotton boll worm *H. armigera* incidence- 3.50 larvae/ m^2 in fields installed with 120 cm perches; and 4.70 larvae/ m^2 in fields installed with 240 cm perches as against 6.85 larvae/ m^2 in control field). These results suggest that the perches are acting as attractants for birds and play an effective role in controlling *H. armigera*.

Key words: T-perches, berseem, fodder, *Helicoverpa armigera*, cotton, insectivorous birds, status, resident, migrant, diversity, seasonal abundance, high perches, height, common myna

Agriculture presently utilizes over 40% of total land area in the world (McLaughlin, 2011), and in India this sector occupies approximately 47% and > 70% of rural household is reliant on agriculture (Sutradhar et al., 2018). Punjab with just 1.5% area provides food to 13-14% of total Indian population (Anonymous, 2017). More than 10,000 species of birds are recognized by BirdLife International (Newton, 2003). 1210 species occur in India with 993 being land birds (Kler and Kumar, 2015). Of these, 328 occur in Punjab, reflecting an area of rich bird diversity (Jerath and Chadha, 2006). Land birds have close linkage with raised crops for feeding, breeding, nesting and roosting (Rey and Bullock, 2012). A total of 104 species of birds belonging to 16 orders and 52 families were observed at Punjab Agricultural University (Kler and Kumar, 2015). Majority of birds present in India are insectivorous and depend on such insects which are pests (Ali, 1996). The area with high shrub density will promote more insect diversity thus leading to high foraging opportunities for insectivorous birds (Kler and Kumar, 2015). Berseem or Egyptian clover (Trifolium *alexandrinum* L.) is an important fodder crop, grows very fast and it is also known to maintain soil fertility (Clark, 2007). It is infested by pests, of which the cotton boll worm *Helicoverpa armigera* (Hubner) is important, and can be managed by promoting their natural enemies. This helps sustainable agricultural management as it also promotes ecosystem services and biodiversity (Rey and Bullock, 2012). New practices are needed to promote IPM and reduce usage of pesticide. It can be easily implemented and inexpensive (Kuiper et al., 2000). Installing T-shaped perches encourages birds into the fields and helps in reduction of pest by ecofriendly methods. Artificial perches imitate bare trees which naturally prevails in landscape (Vogel et al., 2018; Kumar and Cheema, 2020). Also, structural complexity is promoted by artificial perches and it aids in increasing local bird diversity (Horgan et al., 2016). The present study has been undertaken to explore "T-perches" as a tool in attracting insectivorous bird species in berseem crop.

MATERIALS AND METHODS

The field experiment was conducted in the farms of the Village-Dyalpura, District-Ludhiana, Punjab, India during November 2019 to May 2020 ($30^0$49'41"N, $76^0$13'24"E, 260 masl). The berseem (*T. alexandrinum*) cultivar BL10 was raised as per approved Package and Practices of fodder crops, Directorate of Extension,

Punjab Agricultural University, Ludhiana (Anonymous, 2019). Berseem seeds were sown by broadcasting method in standing water. No application of pesticide was done. Experimental Design include the selection of three types of fields (in triplicate), out of which two (E1 & E2) were with installed perches and one control field (C) without perches. Two heights of perches were used i.e., 120 cm (E1) and 240 cm (E2). Selection of height was based on the criteria of crop height i.e., one close to crop (120 cm) and other higher (double) than the height of crop. These 'T-perches' were made of vertical wooden pole or stick of 1.5 cm dia, with two sticks arranged in the form of T-shape. Stick which forms the head of 'T' was smaller and 45 cm long, and joined with metallic wire, which is tied in the center of head region of perch. Perches were installed in field after one month of sowing, so that birds get accustomed with them, at 10 m distance from each other (Kler, 2005).

Different species of birds visiting the fields were recorded. Sampling method used was point count method and frequency of sampling was thrice a week. In experimental fields birds utilizing the perches were recorded where as in control fields only birds on the ground were observed. Birds were identified on the basis of visual observations which include their morphological characters such as colour, size, wings and rest of body parts observed with binocular and comparing with those described by Ali (1996). Nomenclature was followed as per Manakadan and Pittie (2001). For observations on *H. armigera*, five sampling plots (1m^2 each) i.e. four towards corners and one in the center of the field of were selected. Observations were made twice a week during March, manually by counting on the foliage of crop and the mean incidence worked out. The data were subjected to one-way ANOVA with SPSS software, with the seasonal abundance of avian species calculated by using formula: Ni/Nx 100, where Ni is the number of birds of the 'ith' species and N is the total number of birds.

RESULTS AND DISCUSSION

A total of 22 species were observed, of which 15 species were on 120 cm high perches, while 9 species were on 240 cm high ones, with the rest seen on the ground level; of the 15 species observed with 120 cm T-perches (E1), 11 were insectivorous. Common myna was the most abundant with seasonal abundance of 31.75% followed by black drongo (25.79%). Birds under five orders utilized 120 cm high perches- 9 belong to Passeriformes, 2 of Coraciformes and 1 each from Columbiformes, Bucerotiformes and Psittaciformes. In fields (E2) installed with 240 cm high T-perches there were nine species, out of which six were insectivorous, and common myna being the most abundant (35.96%) followed by the black drongo (28.24%). Jungle babbler and blue rock pigeon were the least abundant. Birds belonging to five orders utilized 240 cm high perches- 5 of Passeriformes and one each from Columiformes, Bucerotiformes, Psittaciformes and Coraciformes in E2 fields. Thus, more species were recorded in E1 as compared to E2, making 120 cm T-perches more suitable (Table 1). Similar findings with black drongo spending maximum time by utilizing perches are known (Gokula and Vijayan, 2007; Kaur and Kler, 2018). It may be because of the small height of berseem crop ranging from 30-80 cm (Clark, 2007). Avian species in control (C) fields amounted to 12, of which nine were insectivorous, but mostly ground foraging, such as cattle egret (most abundant- 21.88%) and red-wattled lapwing (13.29%); black ibis was the least abundant (1.28%); these belong to five orders- 5, 3, 2, 1 and 1 species under Passeriformes, Pelecaniformes, Columbiformes, Charadriformes and Gruiformes, respectively.

Asian pied starling, black ibis, cattle egret, eurasian collared-dove, indian pond heron and red-wattled lapwing are the species which do not utilize T-shaped perches. On examining the seasonal abundance of bird species in E1, E2 and C fields. There was a preferential trend towards 120 cm height (Table 2). This signifies the effectiveness of T-perches in attracting more bird species in fields by installing artificial T-perches and also these perches were able to attract more species on ground as compared to control field. Similar observations were made by Gokula and Vijayan (2007) that utilization of perch depends on its height and site as it plays important role in selection and predating in case of insectivorous birds. Effectiveness of heights of T-perches was found statistically significant for the months of March and April (Table 2). Based on the foraging habits and feeding guilds of bird species recorded in the fields and the birds utilizing perches, it was observed that insectivorous birds form dominant group (Table 1). On the basis of IUCN categories, all the birds observed during the study were in the category of least concern and observation based on resident status only 4 out of 22 were resident-migrant and others were resident ones (Kler and Kumar, 2015).

Observations on *H. armigera* incidence that occurred in berseem crop was made during March only, as its appeared by the end of February and declined in

Table 1. Seasonal abundance of avian species in agricultural fields of Punjab

Bird species	Scientific name	Order	Family	Status	Food	IUCN status	E1	E2	C
Asian pied starling	*Sturnus contra* L., 1758	Passeriformes	Sturnidae	R	I, F	LC	-	-	7.72
Black drongo	*Dicrurus macrocercus* Viellot, 1817	Passeriformes	Dicruridae	R	I	LC	25.79	28.24	2.13
Black ibis	*Pseudibis papillosa* (Temminck, 1824)	Pelecaniformes	Threskiornitiidae	R	I, G	LC	-	-	1.28
Blue rock pigeon	*Columba livia* Gmelin, 1789	Columbiformes	Columbidae	R	G	LC	1.45	1.66	4.56
Cattle egret	*Bubulcus ibis* (L., 1758)	Pelecaniformes	Ardeidae	RM	I, SI	LC	-	-	21.88
Common hoopoe	*Upupa epops* (L.,1758)	Bucerotiformes	Upupidae	RM	I	LC	0.35	3.63	-
Common myna	*Acridotheres tristis* (L., 1766)	Passeriformes	Sturnidae	R	I,F	LC	31.75	35.96	13.58
Common stone chat	*Saxicola torquata* (L., 1766)	Passeriformes	Turdinae	RM	I	LC	4.89	-	-
Common tailor bird	*Orthotomus sutorius* (Pennant,1769)	Passeriformes	Cisticolidae	R	I, H	LC	1.39	2.96	-
Eurasian collared dove	*Streptopelia decaocto* (Frivaldszky, 1838)	Columbiformes	Columbidae	R	G	LC	-	-	5.19
House crow	*Corvus splendens* Vieillot, 1817	Passeriformes	Corvidae	R	O	LC	4.81	14.17	15.19
Indian pond-heron	*Ardeola grayii* (Skyes, 1832)	Pelecaniformes	Ardeidae	R	I,SI,SV	LC	-	-	4
Indian roller	*Coracias benghalensis* (L.,1758)	Coraciformes	Coraciidae	R	I	LC	1.63	-	-
Jungle babbler	*Turdoides striatus* (Dumont, 1823)	Passeriformes	Timaliinae	R	I, F	LC	0.35	1.66	6.6
Oriental magpie-robin	*Copsychus saularis* (L., 1758)	Passeriformes	Turdinae	R	I	LC	2.72	-	-
Plain prinia	*Prinia inornata* (Skyes, 1832)	Passeriformes	Sylviinae	R	I	LC	1.74	-	-
Purple sunbird	*Nectarinia asiatica* (Latham, 1790)	Passeriformes	Nectariniidae	R	H	LC	6.64	-	-
Red-wattled lapwing	*Vanellus indicus* (Boddaert, 1783)	Charadriiformes	Charadriidae	R	I, SI	LC	-	-	13.29
Rose-ringed Parakeet	*Psittacula krameri* (Scopoli, 1769)	Psittaciformes	Psittacidae	R	F, G	LC	0.89	3.12	-
Streaked fantail warbler	*Cisticola juncidis* (Rafinesque, 1810)	Passeriformes	Sylviinae	RM	I	LC	7.06	-	-
White-breasted Kingfisher	*Halcyon smyrnensis* (L., 1758)	Coraciiformes	Alcedinidae	R	I, SV	LC	8.54	8.6	-
White-breasted Waterhen	*Amaurornis phoenicurus* (Pennant, 1769)	Gruiformes	Rallidae	R	I, SI, H	LC	-	-	4.58

Status: R- Resident (bird species which remains on native place throughout the year); RM- Resident Migrant (bird species which migrates temporarily from their native) Food habit: I- Insectivorous; G- Granivorous; F- Frugivorous; H- Herbivorous; SI- Small Invertebrates; SV- Small vertebrat es; O-Omnivorous; IUCN status: LC- Least Concern

the beginning of April (Kumar and Cheema, 2020). Statistical analysis of these (from E1, E2 and C fields) using one way ANOVA showed significant difference ($p \leq 0.05$); it was low i.e. 3.50 (larvae/ $1m^2$) in fields installed with 120 cm perches and comparatively more number of bird species utilized these perches, among which major were insectivorous. Comparatively, more counts i.e. 4.7 (larvae/ m^2) in field having perch height of 240 cm and high pest population was observed in control field i.e. 6.85 (larvae/ m^2), suggesting that the perches do act as attractant to birds and play effective role in controlling the *H. armigera* in berseem (Table 2).

Table 2. Bird species diversity and incidence of *H. armigera* as influenced by T perches

Months	E1		E2		C		p-value
	No. of birds (on perch+ ground)= Total	MS*	No. of birds (on perch+ ground) =Total	MS	No. of birds (ground)	MS	
November 2019	3+5=8	0.31[a]	2+6=8	0.37[a]	5	0.3[a]	p=0.96
December 2019	4+7=11	0.71[a]	2+10=12	0.61[a]	11	0.84[a]	p=0.74
January 2020	4+11=15	1.47[a]	3+11=14	0.99[a]	11	0.89[a]	p=0.58
February 2020	5+9=14	1.42[a]	5+10=15	1.3[a]	10	0.89[a]	p=0.58
March 2020	7+11=18	2.8[a]	5+12=17	1.85[ab]	12	1.22[b]	p=0.04
April 2020	8+12=20	3.06[a]	5+11=16	1.84[ab]	11	1.04[b]	p=0.04
May 2020	3+8=11	1.47[a]	3+8=11	0.87[a]	7	0.89[a]	p=0.45
H. armigera incidence (mean) in different weeks of March 2020**							
Weeks	E1		E2		C		
1st	3.60		5.00		6.20		
2nd	4.20		4.40		5.80		
3rd	3.20		4.20		6.80		
4th	3.00		5.20		8.60		
Mean	3.50		4.70		6.85		

*MS- Mean value of analysis done by One-way ANOVA (p=0.05%); **f-value= 16.97, p-value= 0.00088.

Insectivorous birds are generalists and rely on structure of vegetation, abundance and distribution of prey which affects height selection by the birds (Ali et al., 2010). Common myna was in abundance in the field of cabbage with perches (Chand, 2005). Majority of birds visiting fields were insectivorous (8 species), one was granivorous (blue rock pigeon) and one was omnivorous (house crow). This observation derives support from the study of analysis of gut of black drongo, revealing it as the most efficient predator of *H. armigera* (Reinert, 1983; Yeishetty et al., 2005). Perches of trees were utilized by white-breasted kingfisher and black drongo in order to monitor their prey (Ali and Ripley, 1983). Black drongo perched individually as well as in group (Kaur and Kler, 2018). Among birds visiting field of chickpea, 70% used perches for their feeding (Vogel et al., 2018). Seven species of insectivorous birds were recorded in berseem field utilizing perches of 1 m height; birds perches do act as predation substrate which was maximum utilized by black drongo; common myna was the most abundant while red-wattled lapwing *Vanellus indicus* was the least abundant in berseem field as observed by Kumar and Cheema (2020). In tomato field, 5.71% insectivorous bird species were recorded during one hour, out of which 2.84 % birds utilized T-perches (Mehta et al., 2010). Similar findings had been known (Chand, 2005; Prabhakar et al., 2003). Common myna used perches maximum number of times in cauliflower fields, birds utilizing T-perches either jumped to the ground for predating the prey or moved away from the field (Chand, 2005). Fifty % reduction in larvae of castor semilooper (*Achaea janata)* by installation of 20 perches/ ha was observed (Prabhakar et al., 2003). Black drongo explores aerial and perch to site foraging guild in rice and wheat agroecosystem (Kler and Prashad, 2011). Black drongo preferred crop fields over orchards, as per observations by Sidhu and Kler (2018).

Comparison of bird species in E1 (fields installed with 120 cm T-perches) and E2 (fields installed with 240 cm T-perches) revealed that the E1 were more preferred then E2 in berseem crop which may be because of low height of the berseem. Statistically significant difference for bird diversity observed suggests that the perches do act as attractant to birds. Installation of artificial T-perches in the fields will certainly increase the feeding efficiency of insectivorous birds as there is shift in strategy of hunting or feeding by birds if perches are installed as before perch placement, aerial feeding is the only option left. T-perches also proved to be effective in controlling *H. armigera*. Thus, more bird diversity, and less incidence of pest observed in field installed with T- perches can certainly be used as an alternative, economic and ecofriendly IPM measure.

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