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Studies on the role of insectivorous birds in managing insect pests of cabbage (*Brassica oleracea* var capitata L)

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ABSTRACT

Role of insectivorous birds in the suppression of insect pest population affecting cabbage crop was studied in the field using net and perches to exclude birds or help birds to sit and locate the prey easily. A total of 12 bird species were observed feeding on cabbage aphid (*Brevicoryne brassicae*), diamondback moth (*Plutella xylostella*), cabbage semilooper (*Thysanoplusia orichalcea*), cabbage white butterfly (*Pieris brassicae*) and gram pod borer (*Helicoverpa armigera*). Amongst these red vented bulbul (*Pycnonotus cafer*) used the perches maximum times (3.44/h) and made the highest successful attempts (1.26/h) in picking up the insect pests. Significantly higher number of insect pests/plant was recorded in netted plot compared to open and perched plots which showed the predatory potential of birds. Cabbage head yield was maximum in perched plot (31.93 tonnes/ha) and minimum in netted plot (29.18 tonnes/ha).

Keywords: Insect pests; suppression; cabbage; insectivorous birds

INTRODUCTION

Cabbage is an important cash crop grown by the farmers of Himachal Pradesh. Its successful cultivation is hampered due to the incidence of a number of insect pests which not only lower the production but also affect the quality as well. Some of the key insect pests of cabbage are diamondback moth (*Plutella xylostella* L), cabbage caterpillar (*Pieris brassicae* L), painted bug (*Bagrada cruciferarum* Kirk), cabbage semilooper (*Thysanoplusia orichalcea* L) and cabbage aphid (*Brevicoryne brassicae* L) (Sood et al 1995).

A number of insecticides are used repeatedly to keep insect population below the economic injury level. Insecticides are toxic not only to insect pests but to non-target organisms also (predators, parasitoids and pollinators). Excessive use of these leads to the development of insecticide resistance, pest resurgence,

environmental pollution, health hazards etc. It has thus become necessary to adopt insect pest management practices which are economically feasible, environmentally sound and lay stress on the minimal use of insecticides. Insectivorous birds have emerged supreme vertebrate biocontrol agents as they are highly mobile and can congregate quickly in large number when sudden outbreak of insect pests occurs. Many birds have a high rate of insect intake and the recognition of this fact led to the preliminary studies concern either with relationship of birds to the suppression of noxious insects (Sweetman 1958) or to their protection and encouragement in areas with a high risk of insect infestation (Bruns 1955).

Many insectivorous birds viz Indian roller (*Coracias benghalensis*), black drongo (*Dicrurus adsimilis*), rosy pastor (*Sturnus roseus*), common myna (*Acridotheres tristis*), red vented bulbul (*Pycnonotus leucogenys*), large grey babbler (*Turdoides malcolmi*), yellow wagtail (*Motacilla flava*) and house sparrow (*Passer domesticus*) have been reported to feed on *Helicoverpa armigera* larvae (Anon 2002). Jungle babbler (*Turdoides striatus*) preferred larvae of diamondback moth and aphids in cabbage (Bharucha et al 2002). However generating more information on birds as insect control agents and taking advantage of them as tools of integrated pest management strategy are of utmost priority. Therefore the role of insectivorous birds was studied in the suppression of insect pests in cabbage crop.

MATERIAL and METHODS

The cabbage crop (*Brassica oleracea* var *capitata*) cultivar Pride of India was raised as per the package of practices in the experimental farm of the Department of Entomology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during October 2004 to May 2005.

Three plots of cabbage were covered with anti-bird nets of mesh size 2.5 x 2.5 cm. The nets were installed in each bed to the height of 1.8 m with the help of wooden sticks thereby serving as bird free area of the crop. Population of insect pests in this plot was compared with open and perched plots.

The T-shaped perches made of vertical stick of 2" diameter and 6' height with a 2' long horizontal stick with 2" diameter were erected in the three plots of cabbage field for sitting the birds so that they could easily locate their prey. These perches were installed after one month of transplanting so that birds got accustomed to the perches.

Activity of birds was observed visually and with the help of 8 x 50 field binocular at weekly interval. Population density of birds was recorded at three times a day ie morning, noon and evening for one hour in each case at weekly interval and data were recorded on number of birds outside the field (within 10 m outside the

fields in all directions) and their frequency and number of birds visited inside the cabbage fields.

Observations were also recorded on the foraging behaviour whether the birds directly came and searched on the soil surface for any insect prey or they first sat on the perch and after staying on it they picked up the prey or in another case they directly came inside the field and picked up the prey (ie insect) from the host plant or ground. The birds were considered making successful attempts if they picked up the insects and if failed they were considered as making unsuccessful attempts. Insect pest population on cabbage crop was counted at weekly interval on 10 randomly selected plants. Cabbage heads were harvested in mid-April and the mean weight of 10 heads was calculated. The data recorded on different parameters were subjected to analysis of variance (ANOVA) through randomized block design and factorial randomized block design (Gomez and Gomez 1976).

RESULTS and DISCUSSION

A total of twelve avian species viz black drongo (*D adsimilis*), common myna (*A tristis*), grey tit (*Parus major*), house sparrow (*P domesticus*), jungle babbler (*T striatus*), jungle crow (*Corvus macrorhynchos*), magpie robin (*Copsychus saularis*), pied bush chat (*Saxicola caprata*), red vented bulbul, (*Pycnonotus cafer*), sooty flycatcher (*Muscicapa sibirica*), white cheeked bulbul (*P leucogenys*) and white eye (*Zosterops palpebrosa*) were found feeding on insect pests of the cabbage (Table 1).

The cabbage is a ground cover crop and the morphology of the plant is such that the insect pests hide easily in it and it becomes difficult for the birds to locate the prey from outside the field. So the use of T-shaped perches by the birds proved very useful in locating the prey. Being a hilly terrain and presence of trees around the experimental field less number of birds used T-shaped perches which were installed in the field to help the birds for targeting insect pests. However all the recorded bird species were found using artificially installed T-shaped perches. *P cafer* used installed perches in cabbage field maximum number of times (3.44/h) (Table 2). Birds after sitting on T-shaped perches either jumped on to the plant/ground for gleaning the prey or left the field. These birds remained on perches for few seconds in some cases. Rao et al (1998) observed that providing perches in groundnut field helped in attracting drongos thereby facilitating natural insect control. Ojha et al. (2001) found that out of total number of birds which visited the chickpea field 70 per cent used perches that facilitated birds to locate pod borer larvae.

Patel et al (2002) reported that 100 perches/ha or with food bait (based on gram floor preparation) proved effective in

Table 1. Bird species observed feeding on insect pests of cabbage

Common Name	Scientific name	Family
Black drongo	*Dicrurus adsimilis* (Vieillot)	Dicruridae
Common myna	*Acridotheres tristis* (Linnaeus)	Sturnidae
Grey tit	*Parus major* (Linnaeus)	Paridae
House sparrow	*Passer domesticus* (Linnaeus)	Ploceidae
Jungle babbler	*Turdoides striatus* (Dumont)	Muscicapidae
Jungle crow	*Corvus macrorhynchos* (Wagler)	Corvidae
Magpie robin	*Copsychus saularis* (Linnaeus)	Muscicapidae
Pied bush chat	*Saxicola caprata* (Linnaeus)	Muscicapidae
Red vented bulbul	*Pycnonotus cafer* (Linnaeus)	Pycnonotidae
Sooty flycatcher	*Muscicapa sibirica* (Blyth)	Muscicapidae
White cheeked bulbul	*Pycnonotus leucogenys* (Linnaeus)	Pycnonotidae
White eye	*Zosterops palpebrosa* (Linnaeus)	Zosteropidae

reducing late instar large sized larvae of *H armigera* which led to less food damage. Rahman et al (2002) reported that arranging of bird perches @ 20/acre resulted in lower damage by *H armigera* in pigeon pea ecosystem. Considering the effective predatory zone, economics, operational feasibility and adaptability of perch Gopali and Lingappa (2002) suggested the number of perches 2500/ha for animate perches and 25-40/ha for inanimate perches. Mehta (2004) also recorded that out of 5.71 bird species visiting the tomato field in one hour 1.84 birds sat on the T-shaped perches which either jumped on to the plant/ground for gleaning prey or left the field. However Prabhakar et al (2003) reported that installation of 20 perches/ha led to 50 per cent reduction in larvae of castor semilooper, *Achaea janata* in experimental field of castor.

Bird species used different methods of foraging inside the field. Some birds came from outside the field gleaning the prey directly whereas some birds first moved on to the ground and then attacked the prey but few birds used perches for locating the prey. The present studies carried out inside the cabbage field showed that all the twelve bird species used perches before gleaning the prey. In addition to this they also used other methods eg foliage gleaning and ground foraging of prey gleaning. Subramanya and Varesh (1998) classified the avians foraging into plung fishing, hawking, flycatching, perch-to-site foraging, earhead gleaning, foliage gleaning, wet mud gleaning and ground foraging. Among the birds observed in rice fields, insectivorous birds were the dominant group followed by soil invertebrates and granivores.

In addition to foraging techniques the successful or unsuccessful attempts in picking larvae of different insect pests inside the cabbage field were also studied.

P cafer was found making maximum successful attempts (1.26/h) which were significantly higher than any bird population visiting inside the cabbage fields. At the same time the maximum number of times (5.75/h) *P cafer* visited inside the field (Table 3) which revealed the significance of perches inside the field. Similar results were obtained by Mehta (2004) while studying the effect of bird predation on *H armigera* larvae inside the tomato field.

A tristis population per hour in cabbage field was 5.14 out of which in 1.09 cases it picked up the larvae for own consumption or feeding the nestlings (Table 3). Chauhan et al (1998) also found larvae of *H armigera* in the food materials of nestlings of *A tristis*. In case of house sparrow (*P domesticus*) the mean number of birds visiting inside the cabbage fields was 5.64 out of which in 0.89 cases it picked up the larvae of insect pests of cabbage (Table 3). A pair of starling of house sparrow has been reported to bring food (caterpillars, soft bodied insects etc) 220 to 260 times per day to their young ones (Ali 1996).

The mean number of bird visits per hour of *C macrorhynchos* inside the cabbage field was 3.40 out of which in 0.40 cases it picked up the larvae. Jungle crow has been reported to feed on white grubs (Parasharaya et al 1994) and reduce 45 to 65 per cent grub population during 3 subsequent ploughings. In the present studies the most active bird was grey tit, *P major* whose activity in the cabbage field was 5.15 visits/h of which in 0.86 cases it picked up the lepidopteran larvae from crop. During the period of this crop the major component in the diet of *P major* was insect larvae. This may be due to the breeding season of these birds and their nestlings are fed mostly on these larvae/ insects.

In the present studies the influence of visiting birds on insect pests (Table 4) showed that the overall mean population of cabbage aphid, *B brassicae* per plant was significantly different in all the three treatments viz perched, open and netted plots (390.40, 407.60 and 422.10 respectively). The difference in mean population may be due to predation by the bird species visiting inside the field. Gupta and Yadav (1986) recorded common myna preying on aphids *Mysuz persicae* infesting cumin, *Cuminum cyminum*. Similarly Verghese (1994) found ashy wren-warbler (*Prinia socialis*), the tailorbird (*Orthotomea buborius*), purple rumped sunbird (*Necterinia zeylanica*) feeding on *Aphis gossypii* and concluded that factor like bird predation and resource depletion diminished the aphid number.

It was also found that overall mean larval count of diamondback moth, *P xylostella* per plant varied significantly from each other in all the three treatments which may be due to feeding of birds on this insect

Table 2. Effect of T-shaped perches on birds' visits during predation of insect species in cabbage field

Bird species	Mean # bird visits/hour*	
	Inside the field	Alighted on the perch
Acridotheres tristis	5.83	2.42
Copsychus saularis	2.74	1.47
Corvus macrorhynchos	3.36	1.55
Dicrurus adsimilis	4.51	1.48
Muscicapa sibirica	4.91	2.57
Parus major	5.45	1.96
Passer domesticus	5.77	3.22
Pycnonotus cafer	5.58	3.44
Pycnonotus leucogenys	4.18	3.00
Saxicola caprata	2.58	1.49
Turdoides striatus	3.02	1.82
Zosterops palpebrosa	4.35	1.47

*Mean of 12 observations

$CD_{0.05}$

Bird visits 0.42

Table 3. Foraging behaviour of birds in cabbage field

Name of bird species	# bird visits/hour*		
	Inside the field	**Successful attempts	Unsuccessful attempts
Acridotheres tristis	5.14	1.09	1.82
Copsychus saularis	2.75	0.57	1.23
Corvus macrorhynchos	3.40	0.40	1.06
Dicrurus adsimilis	4.51	0.74	1.23
Muscicapa sibirica	5.09	0.80	1.32
Parus major	5.15	0.86	1.51
Passer domesticus	5.64	0.89	1.52
Pycnonotus cafer	5.75	1.26	1.92
Pycnonotus leucogenys	5.20	1.05	1.84
Saxicola caprata	2.92	0.75	1.13
Turdoides striatus	3.25	0.97	1.09
Zosterops palpebrosa	4.12	0.85	1.30
$CD_{0.05}$	-	0.08	0.16

*Mean of 12 observations, **In picking larvae of insect pests

species. Jungle babbler (*T striatus*) was reported to prefer larvae of diamond back moth and aphids in cabbage (Bharucha et al 2002).

Also the impact of avian predation on the population of cabbage semilooper, *T orichalcea* was significantly different among the mean larval count/plant in perched, open and netted plots. The highest mean larval count was observed in netted plot (2.35 larvae/plant) than open (2.22 larvae/plant) and perched plot (2.11 larvae/plant) in cabbage thus showing the role of bird predation in reducing the larval count in open and perched plots. Battu (1987) observed two species of birds viz house crow and house sparrow feeding on the larvae of *P orichalcea* in wheat field. Hooks et al (2003) carried out experiment to examine the impact of avian and spider predation on lepidopteran caterpillars (*P brassicae* L and *Trichoplusia ni*) and concluded that birds were the most important natural enemies of above insect pests.

The results on the bird predation of cabbage butterfly, *P brassicae* in cabbage indicated that mean larval count was 24.85 larvae/plant in perched plot and 25.93 larvae/plant in open plot which were significantly lower than in netted plot (26.94 larvae/plant) thus reflected the role of avian predation in reducing caterpillars densities in open and perched plots. Kristensen

Table 4. Insect pest population in different treatments in cabbage field

Treatment	Mean population of the indicated insect species*			
	Brevicoryne brassicae	*Plutella xylostella*	*Pieris brassicae*	*Thysanoplusia orichalcea*
Perched plot	390.40	1.94	24.85	2.11
Open plot	407.60	2.08	25.93	2.22
Netted plot	422.10	2.19	26.94	2.35
$CD_{0.05}$	2.52	0.03	0.32	0.03

*Mean of 10 observations

Table 5. Yield of cabbage under different treatments

Treatment	*Net head weight (g)	*Net head yield (tonnes/ha)
Perched plot	798.4	31.93
Open plot	772.1	30.54
Netted plot	729.5	29.18
$CD_{0.05}$	9.89	0.07

*Mean of 10 observations

(1994) recorded that the survival rate of *P brassicae* was increased by 11 times if access by birds was prevented. Thapa (1987) observed *Passer domesticus* and *Pycnonotus* species feeding on *P brassicae nepalensis* larvae.

The mean net cabbage head yield was 31.93 tonnes/ha in perched plot and 30.54 tonnes/ha in open plot which was significantly higher than 29.18 tonnes/ha in netted plot (Table 5) which may be attributed to the lesser infestation of this crop by insect pests in open and perched plot. Patil et al (2002) recorded yield of 21.76 g/plant in chickpea in perched area and 15.20 g/plant in unperched area. Similarly Mehta (2004) recorded 11.33 kg/plot of tomato yield in open plot as compared to 8.93 kg/plant in netted plot which support the present studies.

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