

Presence of insectivorous birds in the forest area of Istanbul University, Turkey

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Abstract: Facilitation insectivorous birds life which is among the significant predators of insects in the forest is extremely important in terms of maintaining an intact natural ecosystem, biological variety and biological fight against over-reproducing harmful insects. The aim of our study is to conduct a preliminary search of insectivorous birds living in the research forest. Observation and field studies were conducted between January–December 2002. Transect observation and counting methods were applied in the simplest way to observe the birds during the research. Aim of the count is to separate the bird species into ordinal categories of their abundance. As a result of this study 47 of 88 bird species found in research area are insectivorous bird species. They belong to 19 families. When encounter rates of insectivorous birds are considered, one of them is common, nine of them are frequent, thirty six of them are uncommon and one species is rare.

Key words: Insectivorous birds, Research forest, Transect observation

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Introduction

Forests with significant wild life are rich in terms of biological variety (Payne and Bryant, 1998; Dreyer and Dreyer, 1999). They provide home, hiding-concealing places and food for many wild animals (Mol, 2006). Trees in the forests constitute a food and nest source for both insects and the birds. Insectivorous birds can nest and feed with insects on or under the crust of the tree. Insects also continue their lives by feeding themselves in various parts of the tree. Insects sometimes over-reproduce, cause epidemic and harm the forests (Schwenke, 1974; Dettner and Peters, 2003). In these situations there are some methods on fighting against the insects. While chemical drugs are included in these methods, they destroy the natural ecosystem by affecting all harmful and beneficial living organisms (Canakcioglu and Mol, 1998). Birds receive these poisons that reach their living area indirectly by the food they eat (Canakcioglu, 1987) and directly in case of contact (Franz and Krieg, 1972).

Birds are among the animals that consume insects most (Perrins, 1987; Bezzel, 1996). For a sustainable and healthy ecosystem, these features of birds should be taken advantage of (Marquis and Whelan, 1994). Directory of fight against forest pests hang bird nests in the forests to enable nesting and reproducing of insectivorous birds as a precaution against pests. This method, useful for regulation of the populations of pests that over-reproduce, is also called biological control. In our country a total of 930956 bird nests were hung in 254724 ha forest area between the years 1972-2002 (Anonymous, 2008). These nests are for certain insectivorous birds and produced in three types.

Birds are warm blooded animals and need extra energy while maintaining their living activities, particularly flying. They feed all day long, intensely in mornings and evenings (Perrins, 1987).

Food of bird species vary based on seasonal needs while basically they consume water, carbohydrates, vitamins and mineral substances (Bezzel, 1996). Since animal food is not much during winter season, insectivorous birds pass this period with herbal food. Various life phases of insects (egg, larva, pupa and adult phases) are food sources for birds.

Insectivorous birds feed with insects as long as they can find them while seed eater birds feed with them during their breeding period. All nestlings are glutton. Because nestlings grow so fast and become ready to fly in two weeks. Weight of the nestling become as much as the mother or even more one day before they leave the nest. A two day old *Turdus* sp. nestling receives 17.8 g food in one day and reaches a weight of 15.8 g in the evening from 9.5 g in the morning (Malazgirt, 1973, 1975). It has been observed that *Phoenicurus phoenicurus* (L.) brought food to its male nestlings food 105 times and females 73 times in 12 hr (Kacar *et al.*, 2004).

The condition of usefulness of birds in the forests is closely related to their feeding with insects in terms of forestry. According to Kacar *et al.* (2004), 378 of 546 insect types that the bird species that incubate in nests hung in Antalya feed their nestlings belong to the team of pests that harm the area's forests (Tosun, 1977). As a result of gastric analyses of 7 insectivorous bird species randomly selected in protected forest areas of Isparta, *Orhotomicus erosus* (Woll.) and *Blastophagus minor* (Hartig) species were found (Gundogdu, 2001). If, in a region, harmful insect population is over the threshold of economical damage, insectivorous birds will naturally feed themselves with these insects since they will exist in high amounts in the area. Amount of this insect will be decreased to safe levels after a certain period of time.

In our study it was aimed to determine insectivorous birds living in the research forest of Istanbul University and to conduct a preliminary search on these species.

Materials and Methods

Study area: The research forest of Istanbul University is located in the north of Istanbul, on A2(E) square according to Grid system of Turkey. Forest area is 738 ha with altitude ranging between 20-240 m. The Research Forest which is a continuation of Belgrad Forest is composed of two parts as south and north parts and found between 28°59'17"-29°32' 25"E meridians ile 41°09'15"-41°11'01"N parallels (Kavgaci, 2002).

According to the data of Bahçeköy Meteorology Station (1948-2003), yearly average rainfall is 1121.5 mm and average temperature is 13°C (Ozhan, 1982; Arslangundogdu, 2005). According to Rubner (1949), vegetation period expressing the time in which monthly average temperature is over 10°C is 8 months (April-November). Research Forest has a climate type close to sea effect and with a water balance at medium-level and lack of water in summer according to C.W. Thornthwaite method (Kantarci, 1980). Birds are of great importance in terms of climate related and seasonal changes. Climate date for the year 2002 covering field work period is given in Fig. 1.

Tree types included in the stand mixture of research forest are as follows; *Quercus petraea* (Mattuschka) Liebl. subsp. *iberica*, *Quercus frainetto* Ten., *Quercus cerris* L. subsp. *austriaca* (Willd.) Loudon (oak types), *Carpinus betulus* L. (hornbeam), *Castanea sativa* Miller (chestnut), *Tilia argentea* Desf. DC. (lime tree), *Laurus nobilis* L. (bay tree), *Cerasus avium* (L.) Moench (cherry), *Alnus glutinosa* (L.) Goertner subsp. *glutinosa* (alder), *Robinia pseudoacacia* L. (false locust) and *Pinus nigra* Arnold. (crimean pine). These constitute 11 stand foundation either purely or as mixtures (Kavgaci, 2002).

Methodology: This study was conducted between January – December 2002 in the research forest. Transect observation method was applied in the simplest way to observe the birds during the

research (Bibby *et al.*, 1995). All the birds seen and heard during field work were recorded. Bird species living in the research area were established with observations carried once in a month. Since research forest was composed of two forest parts, bird species were counted in two transects (Fig. 2). Aim of the count was to separate bird species into ordinal categories of abundance (*e.g.* abundant, common, frequent, uncommon, rare). Encounter rates were used for this purpose (Bibby *et al.*, 2000). During the vegetation period, determined in search field according to Rubner (for 8 months from April to November), encounter rates were calculated by dividing the number of recorded birds into observation hour during this time. Our observation filed consists of 10.5 km as 3.5 km (I. transect) + 7 km (II transect). In forest, road routes and paths were used for transect observation method. Observation hours were 07.00-11.00 in the morning and 14.00-18.00 in the afternoon based on the enlightening and getting dark of the environment. 10x50 binoculars were used for this purpose. Some birds were detected from their voices while walking along the transect. Also, the feeding and breeding behaviors of insectivorous birds within research area were followed. Status of all determined birds in research area during the research was established. Some criteria was taken into consideration in determining the insectivorous birds among all birds. Information on insectivorous feeding was taken from Cramp (1998) and Perrins (1987). Postner (1986) and Schwerdtfeger (1981) were referred to establish their harmfulness in forest because of their feeding. These species were mainly chosen based on their insectivorous feeding and being beneficial for the forest. We were utilized from Kasperek and Bilgin (1996) for the systematic of established species.

Results and Discussion

Eighty eight bird species belonging to 33 families of 15 orders were found in the research area. Status of all birds in research area was established. 32 of these bird species are residents (R), 35 are passage migrants (PM), 14 are summer migrants (SM), 4 are winter visitors (WV), two are summer migrants-passage migrants (SM-PM) and one is resident-passage migrant bird (R-PM). 47 of

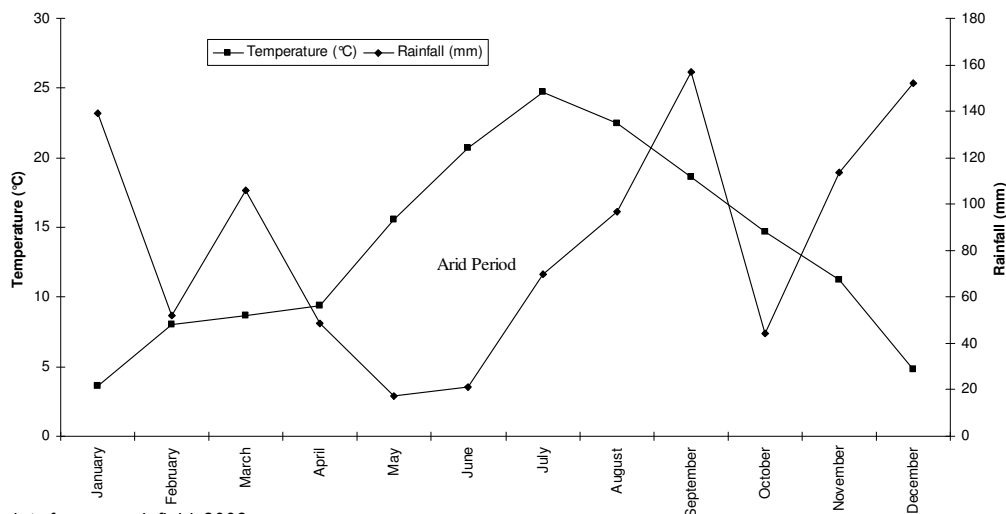


Fig. 1: Climate date for research field, 2002

88 bird species found in research area are insectivorous bird species. Non-insectivorous bird species count is 41. Monthly count of bird species in two separate transects are given in Table 1.

Encounter rates were calculated by dividing counts of 47 insectivorous bird species recorded in research area for four months by the total hours of observation (Table 2). When encounter rates of insectivorous birds are considered, one is common, 9 is frequent, 36 is uncommon and 1 is a rare species. Observation results of feeding and breeding behaviors of insectivorous bird species in research field are given in Table 2.

Forty one bird species belonging to 14 families of 10 orders were found other than the insectivorous bird species (Table 3). 15 of these birds are residents, 18 are passage migrants, 4 are winter visitors, 3 are summer migrant and one is resident-passage migrant.

Eighty eight bird species belonging to 33 families of 15 orders were found in general of research area with transect observation method. 47 insectivorous bird species (53.4%) belonging to 19 families of 5 orders and 41 bird species (46.6%) belonging to 14 families of 10 orders were found. 88 bird species were determined in research area and 7477 birds were counted. Among the defined bird species, all except *Psittacula krameri* were observed in neighbor Belgrad Forest too (Arslangundogdu, 2005).

Seventeen of these insectivorous bird species are resident, 17 are passage migrants, 11 are summer migrants and one is resident passage migrant. 26 of these species were observed to breed, 4 were observed not to breed in forest and 17 species did not breed. *Parus major*, *P. caeruleus* and *Turdus merula* were observed on both transects during the research. *Upupa epops* was seen three times only in 2nd transect as one individual. *P. major* was common, 9 bird species were frequent, 36 bird species were uncommon and *U. epops* was rare when encounter rates were considered. It was observed that 78.7% of insectivorous birds in research forest were not common and frequent. 73.1% of insectivorous bird species breeding in research area is uncommon, 23.1% is frequent and 3.8% is common. As we can see, the count of non-insectivorous bird species is less than insectivorous bird species. Briefly, while species variety of insectivorous birds is abundant, populations in research field are not sufficient.

Apus melba and *A. apus* were seen flying continuously in research area and feeding with flies and mosquitoes in general. According to Malazgirt (1973), *A. melba* travels 1000 km on an average in one day. This bird of 100 g hunts 25-30 g of insects a day. This amount equals to 4000 mosquitoes and 1000 flies. Common presence of *Apus* species in forest is important for balancing flies and mosquitoes. *Hirundo rustica* and *Delichon urbica* were

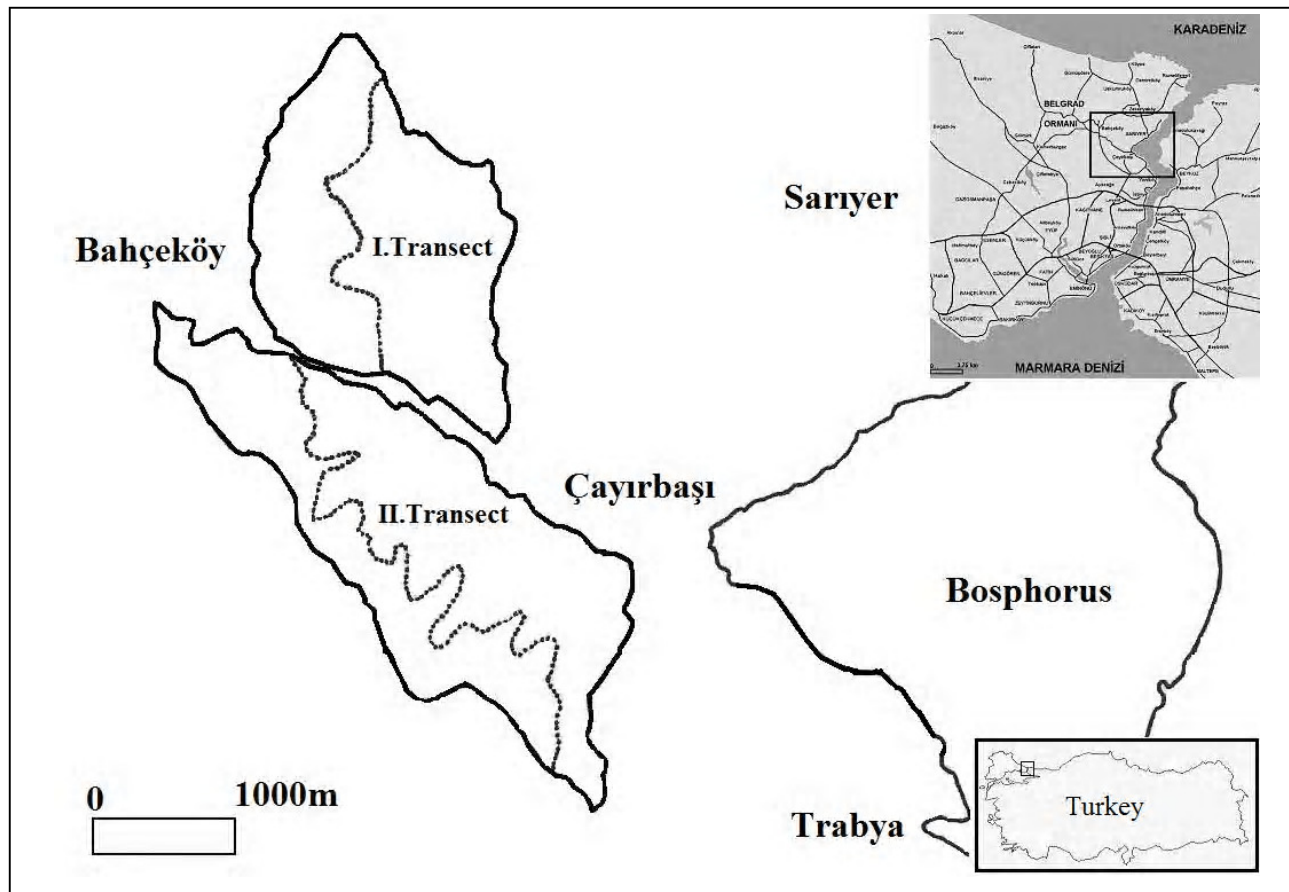


Fig. 2: Observation transect in Research Forest

Table - 1: Number of various insectivorous birds observed during different months

Order family	Bird Species Scientific name english name	Months and transects in which birds were observed																								
		January		February		March		April		May		June		July		August		September		October		November		December		Total
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	
Cuculiformes Cuculidae	<i>Cuculus canorus</i> L. Common cuckoo	-	-	-	-	-	-	-	-	1	2	1	1	1	1	1	2	-	-	-	-	-	-	-	10	
Apodiformes Apodidae	<i>Apus melba</i> (L.) Alpine swift	-	-	-	-	-	-	-	22	18	-	14	19	-	15	-	21	-	-	-	-	-	-	-	109	
	<i>Apus apus</i> (L.) Common swift	-	-	-	-	-	-	18	-	8	-	10	14	-	7	-	16	-	-	-	-	-	-	-	73	
Coraciiformes Meropidae	<i>Merops apiaster</i> L. European Bee-eater	-	-	-	-	-	-	17	14	-	-	-	-	-	-	-	-	16	13	-	-	-	-	-	60	
Upupidae	<i>Upupa epops</i> L. Hoopoe	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	-	-	-	-	3	
Piciformes Picidae	<i>Dendrocopos major</i> (L.) Great spotted woodpecker	1	-	1	1	-	1	-	-	1	-	1	-	1	-	-	-	1	-	1	-	1	-	1	13	
	<i>Dendrocopos syriacus</i> (He.&E.) Syrian woodpecker	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	11	
	<i>Dendrocopos medius</i> (L.) Middle spotted woodpecker	-	2	-	1	-	2	-	1	-	1	-	2	-	2	-	-	2	-	2	-	2	-	-	16	
	<i>Dendrocopos minor</i> (L.) Lesser spotted woodpecker	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	-	10	
Passeriformes Hirundinidae	<i>Hirundo rustica</i> L. Barn Swallow	-	-	-	-	-	-	8	-	9	7	-	11	6	12	8	9	14	12	-	-	-	-	-	96	
	<i>Delichon urbica</i> (L.) House martin	-	-	-	-	-	-	7	6	8	9	7	11	-	-	11	7	5	-	-	-	-	-	-	71	
Motacillidae	<i>Anthus trivialis</i> (L.) Tree Pipit	-	-	-	-	-	-	4	3	-	-	-	-	-	-	-	-	3	4	-	-	-	-	-	14	
	<i>Motacilla cinerea</i> Tunst. Grey wagtail	-	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-	-	4	5	-	-	-	-	14	
	<i>Motacilla alba</i> L. White wagtail	-	-	-	-	-	8	3	4	-	-	-	2	5	3	4	8	6	12	-	-	-	-	-	55	
Troglodytidae	<i>Troglodytes troglodytes</i> (L.) Winter wren	3	4	5	3	6	5	8	9	6	4	5	6	3	2	5	-	6	-	7	4	3	4	2	100	

Prunellida	<i>Prunella modularis</i> (L.)	-	-	-	-	-	-	-	-	-	-	-	-	4	2	-	-	-	-	-	-	-	-	-	-	13	
	Hedge accentor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turdidae	<i>Erithacus rubecula</i> (L.)	4	5	3	2	5	6	7	8	3	5	4	6	3	7	6	9	10	11	12	4	8	2	2	132		
	European robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Luscinia megarhynchos</i> (Brehm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Common nightingale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Phoenicurus ochruros</i> (Gmel.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Black redstart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Phoenicurus phoenicurus</i> (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Common redstart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Saxicola rubetra</i> (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Whinchat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Saxicola torquata</i> (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Stonechat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Oenanthe oenanthe</i> (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Northern wheatear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Turdus merula</i> L.	7	8	6	4	8	7	13	10	12	8	12	8	7	6	4	5	6	12	15	13	9	7	9	7	5	193	
Common blackbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Turdus philomelos</i>	2	3	1	-	1	1	2	1	3	1	3	1	4	1	-	2	1	-	3	-	5	-	2	2	3	38	
Brehmsong thrush	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sylviidae	<i>Cettia cetti</i> (Timm.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	2	-	-	-	-	-	
	Cetti's warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Hippolais pallida</i> (He.&E.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Olivaceous warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Sylvia melanocephala</i> (Gmel.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Sardinian warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Sylvia communis</i> Lath.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Common whitethroat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Sylvia atricapilla</i> (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackcap	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Phylloscopus collybita</i> (Vieil.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Common chiffchaff	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Phylloscopus trochilus</i> (L.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Willow warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Regulus regulus</i> (L.)	2	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Goldcrest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Muscipicidae	<i>Muscicapa striata</i> (Pal.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Spotted flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table - 2: Encounter rates of insectivorous bird species in Research forest and their feeding behaviors, breeding states and status established in field

Bird species	Encounter rates			Field observations		
	Number of individuals	Number of individuals*	Number of individuals**	Feeding behaviors	Breeding	Status
<i>C. canorus</i>	10	0.1563	uncommon	Could not be observed while feeding	Breeds	SM
<i>A. melba</i>	109	1.7031	frequent	Observed feeding while flying	Could not be observed while breeding in the forest	SM
<i>A. apus</i>	73	1.1406	frequent	Observed feeding while flying	Could not be observed while breeding in the forest	SM
<i>M. apiaster</i>	60	0.9375	uncommon	Observed flying after bees and feeding	Does not breed	PM
<i>U. epops</i>	3	0.0469	rare	Observed with a larva in its beak in open area	Does not breed	PM
<i>D. major</i>	7	0.1093	uncommon	Observed while pecking the trunks of Crimean pine trees	Breeds	R
<i>D. syriacus</i>	8	0.1250	uncommon	Observed while feeding in trunk and branches of leaved trees	Breeds	R
<i>D. medius</i>	11	0.1719	uncommon	Observed while feeding in the trunk and branches of oak trees	Breeds	R
<i>D. minor</i>	7	0.1093	uncommon	Observed pecking the trunk of oak trees	Breeds	R
<i>H. rustica</i>	96	1.5000	frequent	Observed feeding while flying when flies were intense on air	Could not be observed while breeding in the forest	SM
<i>D. urbica</i>	71	1.1094	uncommon	Observed while feeding with a fly	Could not be observed while breeding in the forest	SM
<i>A. trivialis</i>	14	0.2188	uncommon	Observed while walking on the ground in open area, not while feeding	Does not breed	PM
<i>M. cinerea</i>	11	0.1719	uncommon	Observed feeding generally on the ground in open area	Does not breed	PM
<i>M. alba</i>	47	0.7344	uncommon	Observed generally in grass and on the ground in open area	Breeds	SM - PM
<i>T. troglodytes</i>	72	1.1250	frequent	Observed feeding from leaf surface, crust and tree branches with insects	Breeds	R
<i>P. modularis</i>	13	0.2031	uncommon	Observed while sitting on the bushes but not while feeding	Does not breed	PM
<i>E. rubecula</i>	103	1.6094	frequent	Observed while jumping and hunting insects on dead cover in forest	Breeds	R
<i>L. megarhynchos</i>	45	0.7031	uncommon	Observed feeding by gripping the flying insect on air while waiting on branches and wandering in dead cover in forest	Breeds	SM
<i>P. ochruros</i>	10	0.1563	uncommon	Observed while sitting on bushes and perching back again after chasing insects on air	Does not breed	PM
<i>P. phoenicurus</i>	13	0.2031	uncommon	Observed while searching the fallen leaves and perching after hunting insects on air	Does not breed	PM
<i>S. rubetra</i>	27	0.4219	uncommon	Observed feeding at stone bottoms while wandering on bushes and in open area	Does not breed	PM
<i>S. torquata</i>	20	0.3125	uncommon	Could not be observed while feeding	Does not breed	PM
<i>O. oenanthe</i>	12	0.1875	uncommon	Observed while flying close to ground and generally in open areas.	Does not breed	PM
<i>T. merula</i>	141	2.2031	frequent	Observed while feeding with insects and worms in dead cover	Breeds	R
<i>T. philomelos</i>	25	0.3906	uncommon	Observed feeding on the ground	Breeds	R
<i>C. cetti</i>	7	0.1094	uncommon	Observed feeding with flies and sitting on bushes near rivers and lakes	Does not breed	PM
<i>H. pallida</i>	24	0.3750	uncommon	Could not be observed while feeding	Breeds	SM
<i>S. melanocephala</i>	57	0.8906	uncommon	Could not be observed while feeding	Breeds	SM
<i>S. communis</i>	23	0.3594	uncommon	Could not be observed while feeding	Breeds	SM - PM
<i>S. atricapilla</i>	44	0.6875	uncommon	Observed eating insects on leaves and feeding on tree tops	Breeds	SM
<i>P. collybita</i>	64	1.0000	uncommon	Observed feeding on tree tops	Breeds	SM
<i>P. trochilus</i>	38	0.5938	uncommon	Could not be observed while feeding	Does not breed	PM
<i>R. regulus</i>	31	0.4844	uncommon	Could not be observed while feeding	Breeds	R
<i>M. striata</i>	25	0.3906	uncommon	Observed hunting on air, catching flying insects by hopping from where it perches and turning back there to swallow its hunt	Does not breed	PM
<i>F. parva</i>	17	0.2656	uncommon	Observed while feeding with flies and insects on and under bushes	Does not breed	PM
<i>F. albicollis</i>	7	0.1094	uncommon	Could not be observed while feeding	Does not breed	PM
<i>F. hypoleuca</i>	19	0.2969	uncommon	Observed feeding with insects, flies, butterflies and caterpillars, grabbing them on air while generally sitting on branches	Does not breed	PM

<i>A. caudatus</i>	58	0,9063	uncommon	Observed while wandering on bushes in small rows (4-12)	Breeds	R
<i>P. palustris</i>	111	1,7344	frequent	Observed while collecting insects from between or under crusts by pecking tree trunks or branches with strong body movements	Breeds	R
<i>P. ater</i>	72	1,1250	frequent	Observed feeding with insects on burs or needle leaves and leaves	Breeds	R
<i>P. caeruleus</i>	138	2,1563	frequent	Observed feeding its nestlings with insects and caterpillars	Breeds	R
<i>P. major</i>	426	6,6560	common	Observed while collecting insects from tree crusts, thin branches and fallen leaves	Breeds	R
<i>S. europea</i>	58	0,9062	uncommon	Observed while pecking the trunk and providing food from trees and branches	Breeds	R
<i>C. brachydactyla</i>	25	0,3906	uncommon	Observed eating insects and larvae in tree cracks	Breeds	R
<i>O. oriolus</i>	16	0,2500	uncommon	Observed wandering on tree tops but no feeding behavior was seen	Does not breed	PM
<i>L. collurio</i>	35	0,5469	uncommon	Observed feeding with cicada on a branch	Breeds	SM
<i>S. vulgaris</i>	49	0,7656	uncommon	Observed feeding its nestlings with insects and larvae	Breeds	R

* = Individual count per 64 field hours during vegetation period, ** = Ordinal scale: Rare:<0.1, uncommon:0.1-1.0, frequent:1,1-5.0, common: 5,1-20,0, abundant:>20.1, SM : Summer migrant, PM : Passage migrant, R : Resident, SM-PM : Summer migrant - passage migrant

Table - 3: Other bird species observed in research area

Order	Family	Bird Species scientific name (English name)	Total	Status
Ciconiiformes	Ciconiidae	<i>Ciconia nigra</i> (L.) (Black stork)	83	PM
		<i>Ciconia ciconia</i> (L.) (White stork)	1421	PM
Accipitriformes	Accipitridae	<i>Pernis apivorus</i> (L.) (European Honey-buzzard)	129	PM
		<i>Milvus migrans</i> (Bodd.) (Black kite)	5	PM
		<i>Neophron percnopterus</i> (L.) (Egyptian vulture)	3	PM
		<i>Circaetus gallicus</i> (Gm.) (Short-toed eagle)	39	PM
		<i>Circus aeruginosus</i> (L.) (Eurasian marsh harrier)	7	PM
		<i>Accipiter gentilis</i> (L.) (Northern goshawk)	2	PM
		<i>Accipiter nissus</i> (L.) Eurasian sparrowhawk	41	R-PM
		<i>Buteo buteo</i> (L.) (Common buzzard)	443	PM
		<i>Buteo rufinus</i> (Cretz.) (Long-legged buzzard)	3	PM
		<i>Aquila pomarina</i> Br. (Lesser spotted eagle)	592	PM
		<i>Hieraetus pennatus</i> (Gm.) (Booted eagle)	15	PM
Falconiformes	Falconidae	<i>Falco tinnunculus</i> L. (Common kestrel)	4	R
		<i>Falco subbuteo</i> L. (Eurasian hobby)	8	SM
Galliformes	Phasianidae	<i>Coturnix coturnix</i> (L.) (Common quail)	22	PM
		<i>Phasianus colchicus</i> L. (Common pheasant)	1	WV
Gruiformes	Rallidae	<i>Crex crex</i> (L.,1758), (Corn crane)	2	PM
Charadriiformes	Scolopacidae	<i>Scolopax rusticola</i> L. (Eurasian woodcock)	5	WV
	Laridae	<i>Larus ridibundus</i> L. (Black-headed gull)	374	R
Columbiformes	Columbidae	<i>Larus cachinnans</i> (Pal.) (Yellow-legged gull)	267	R
		<i>Columba livia</i> Gmel. (Rock pigeon)	189	R
		<i>Columba palumbus</i> L. (Common wood pigeon)	32	PM
		<i>Streptopelia decaocto</i> (Fri.) (Eurasian coll. dove)	28	R
		<i>Streptopelia turtur</i> (L.) (European turtle dove)	19	SM
Psittaciformes	Psittacidae	<i>Psittacula krameri</i> (Scop.) (Rose-ringed parakeet)	17	R
Strigiformes	Strigidae	<i>Athene noctua</i> (Scop.) (Little owl)	3	R
		<i>Strix aluco</i> L. Tawny Owl	4	R
Passeriformes	Corvidae	<i>Garrulus glandarius</i> (L.) Eurasian jackdaw	58	R
		<i>Corvus monedula</i> L. (Jackdaw)	46	WV
		<i>Corvus frugilegus</i> L. (Rook)	68	PM
		<i>Corvus corone</i> L. (Carrion crow)	54	R
		<i>Corvus corax</i> L. (Common raven)	23	PM
	Passeridae	<i>Passer domesticus</i> (L.) House sparrow	134	R
		Fringillidae	<i>Fringilla coelebs</i> L. (Chatfinch)	392
	Emberizidae	<i>Carduelis chloris</i> (L.) (European greenfinch)	9	R
		<i>Carduelis carduelis</i> (L.) (European goldfinch)	26	R
		<i>Coccothraustes coccothraustes</i> (L.) (Hawfinch)	47	R
		<i>Emberiza citrinella</i> L. (Yellowhammer)	8	WV
		<i>Emberiza cia</i> L. (Rock Bunting)	5	PM
		<i>Miliaria calandra</i> (L.), (Corn bunting)	13	SM

PM : Passage migrant, R-PM : Resident-Passage migrant, R : Resident, WV : Winter visitor, SM = Summer migrant

observed while flying and feeding with flying insects particularly flies. Hirundinidae species hunt 0.5-1.0 million flies and leaf lace in a summer period (Malazgirt, 1975). *U. epops* was seen eating larva on the ground in open area within Crimean pine stand. *Motacilla alba* was found feeding on ground and in open area. Other species were generally seen while feeding on tree, carrying food to their nestlings and looking for food in dead cover. One *Troglodytes troglodytes* destroy approximately 8-10 million insects in one year (Malazgirt, 1973). Intensity of *T. troglodytes* is a positive finding. *Cuculus canorus* could not be observed while feeding. However they feed with the feathery caterpillars of butterflies that other insectivorous species don't like (Cramp, 1998). It is therefore the natural enemy of *Thaumetopoea pityocampa* (Den. and Schiff.) pest that feed with feathery caterpillars between March-April (Karaman and Turkles, 2002). Besides this, *Athene noctua*, *Strix aluco* and *Buteo buteo* were not included in the list of insectivorous bird species since they are not completely insectivorous despite being beneficial by feeding with insects.

Woodpeckers are of a separate importance in biological control of insects. However, Picidae species are considered beneficial since that feed with insects and harmful since they harm the tree while feeding and nesting when considered in terms of forestry (Canakcioglu, 1993; Postner, 1986; Schwerdtfeger, 1981). They absorb the juice sap while pecking the tree trunks and cause woodpecker loop to form (Acatay, 1966; Schwerdtfeger, 1970). They also feed with tree seed in winter. However body structures, particularly beak, tongue, foot and tails of Picidae species are developed to easily fit with tree structure. Thanks to this structure, they can easily reach and pull the harmful insects and ants that live in tree trunks. In conclusion, they are extremely helpful for the health of forest trees to fight against harmful insects (Serez, 1982).

Birds belonging to Fringillidae, Passeridae and Columbidae that stay out of insectivorous birds are not considered to be beneficial in terms of forestry since they eat too much seed and rarely feed with insects (Canakcioglu, 1993; Postner, 1986; Schwerdtfeger, 1981). Harms caused by these birds may be significant in nurseries or seed stands. The harmfulness or beneficiary status of birds living in Turkey forests in terms of forestry is very important. However birds are generally mentioned as beneficial animals in forest protection (Acatay, 1966; Malazgirt, 1978). Generally these animals are beneficial and constitute a scale of biological variety.

To maintain balance of insectivorous birds populations in forest, standing dead and old trees enough to provide natural nesting should be kept in the forest. Standing dead trees and old trees are preferred mostly by birds and particularly insectivorous birds (Arslangundogdu and Akkuzu, 2000). Monoculture should be avoided in forests, and plants at different growing levels, fruit trees, leaved and branched trees should be kept together. Precautions to improve living environment of insectivorous birds should be taken and water bowls should be left near nests. Birds should be fed in winter months, if necessary.

General Directorate of Forestry, Division of Battle against Pests hang three types of nests in forests of Turkey for biological control and precaution efforts to fight against pests. These nest types produced suitably to 8-10 different insectivorous bird types. However, concept of this application is narrow when variety of insectivorous birds is considered. This study may be expanded and more species can benefit from artificial nests if nest variety is provided. Also, for the nests to serve their aims, they should not only be hung but their regular maintenance and cleaning should be made.

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