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NEST PREDATION OF CHUKAR PARTRIDGE (*ALECTORIS CHUKAR* GRAY, 1830) IN SOUTHEASTERN BULGARIA: EXPERIMENTAL STUDY

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Abstract

This study aims investigation of chukar partridge losses during the incubation period in species' nesting habitat. From 45 nests set in 2010 and 2011, 19 (42.22 %) were destroyed. In 13 of these, mammal predation was the cause. 4 (8.89 %) were destroyed by birds and 2 (4.44 %) by unknown pest. Statistical differences between the size of destroyed nests and herb vegetation height have not been found. Losses were, more likely, distributed randomly in time. Relationship between setting time and herb vegetation height was not established.

Key words: chukar partridge, nest predation, nest losses.

Introduction

During the last decade chukar partridge remained a species with low numbers in Bulgaria. Its numbers continue to decline. According to the latest data it reaches approximately 1500–3000 (Birdlife Internatinal 2004) or 2000–3000 (Nankinov et al. 2004) pairs.

Bird's reproductive failure is caused mainly by nest predation (Ricklefs 1969), which can influence its population numbers (Martin 1988a, 1988b; Fuller et al. 1995), as well as their choice of nesting habitat (Martin 1988c, Hatchwell et al. 1996, Martin and Roper 1988, Muller 1989, Berg 1992). Moreover, it can affect population's spatial dynamics and become an important factor for predator numbers (Fuller et al. 1995, Robinson et al. 1995). Birds nesting on the forest floor are affected more frequently by predatory birds than mammals (Angelstam 1986). Nesting predation of red-legged partridge *Alectoris rufa* (Linnaeus, 1758) decreases with the increasing height of vegetation cover (Rands 1988).

This study aims establishing of chukar partridge losses during the incubation period in the birds' nesting habitat.

Material and Methods

The current study was conducted during July 2010 and from late April to late June, 2011, in typical chukar partridge habitat near Harmanli Town (Table 1).

According to their geographical location studied areas fall in the lower parts of the Thracian valley and Sakar Mountain. Studied habitat is dominated by herb

and shrub vegetation. At some places outcrops can also be found. Principal shrub species is *Paliurus spina-christi* Mill., having variable cover and 1–3.5 m height. Tree vegetation is composed of sprouting oak forests along the ravines and fruiting tree species in some parts of the studied territory. There are cultivated areas, represented mainly by cereal crops, orchards, vegetable crops and vineyards. Some territories are pastures and others are fallow lands. At the end of April and the beginning of May the vegetation is short and studied habitats are more open. *Paliurus spina-christi* is still leafless. In the middle of May herb vegetation is lush and gradually embraces the shrub bases. Chukar partridge nests, built in these places, are more concealed, which presumes lesser losses. In the end of June, vegetation dries up and the habitat becomes barer. However, dried vegetation continues to secure a good cover, especially in places where grazing of livestock is lacking. The influence of vegetation cover height on nest predation was estimated by division of nest losses in three time periods: 1 – from April 24 to May 15, 2011; 2 – from May 15 to June 20, 2011; and 3 – from July 2 to August 3, 2010.

Aiming to account the advancing change of vegetation cover and habitat heterogeneity 45 chukar partridge nest were located in different parts of its preferred habitat (Table 2).

Table 1. Nest numbers, locality and observation periods.

Nest loss estimation period	Coordinates of set nests	Number of set nests
April 24 – May 21	N 41º 58′ E 25º 59′	5
	N 41º 56 E 25º 56′	5
	N 41º 56 E 25º 50′	11
May 22 – June 20	N 41º 54 E 25º 54′	8
	N41º 54 E 25º 55′	9
July 2 – August 3	N 41º 56 E 25º 56′	3
	N 41º 56 E 25º 50′	4

Loss causes were specified, using chukar partridge model eggs. The model egg was made of farm egg by draining it contents through couple of openings, and then filling it with plaster. Before plaster hardening, through the openings, plastic cord (Hyper carp Brown 0.40 mm), bearing stretch of 22.5 kg, was set. Each nest contained eight eggs. The eggs were put directly on the ground in shallow pit covered with sand (30 cm diameter) enabling

Table 2. Set nest location according to habitat type.

Habitat type	*Paliurus spina-christi* shrub	Other shrubs, *Rosa* and *Prunus* genera	Outcrops	Hedgerows	Vineyards	Orchards
Number of nests set	26	3	8	3	4	1

bird and mammal track observation. Any nest in which at least one egg was bearing markings of shell disturbance was recognized as destroyed.

Loss cause was determined by the markings left in the egg plaster of the destroyed nest. The nests were checked weekly during the whole 24 day period. Each nest contained random combination of egg colors closely resembling the natural chukar partridge nests. Gathered data were statistically analyzed with Past (Hammer et al. 2001).

Results

From 45 nests, set during the two years of study, totally 19 (42.22 %) were destroyed. In 13 (28.89 %) cases, the cause was predatory mammal, 4 (8.89 %) nests were destroyed by birds, and 2 (4.44 %) were ruined by unknown agent (Table 3).

We have not found significant difference between the destroyed nest numbers in the three study periods (H=0.622; p>0.05). Nest losses caused by mammals are significantly greater than bird-caused

Table 3. Confirmed losses by the checking period.

Loss cause	Mammal, number (%)	Bird, number (%)	Unknown, number (%)	Total loss, number (%)
Set date – April 24	–	–	–	–
First week check	3 (15.8 %)	2 (10.5 %)	0	5 (26.2 %)
Second week check	3 (15.8 %)	0	0	3 (15.8 %)
Third week check	0	0	0	0
Fourth week check	0	1 (5.3 %)	0	1 (5.3 %)
Set date – May 22	–	–	–	–
First week check	1 (5.3 %)	0	0	1 (5.3 %)
Second week check	2 (10.5 %)	1 (5.3 %)	0	3 (15.8 %)
Third week check	1 (5.3 %)	0	1 (5.3 %)	2 (10.5 %)
Fourth week check	0	0	0	0
Set date – June 2	–	–	–	–
First week check	2 (10.5 %)	0	0	2 (10.5 %)
Second week check	1 (5.3 %)	0	0	1 (5.3 %)
Third week check	0	0	1 (5.3 %)	1 (5.3 %)
Fourth week check	0	0	0	0
Total loss	13 (68.5 %)	4 (21.1 %)	2 (10.6 %)	19 (100 %)

and than that with unknown cause (χ^2 = 10.848; p<0.01). Five nests were destroyed by canids (Canidae), six by mustelids (Mustelidae), and two nests by unknown mammal species. Canid representatives were domestic dog *Canis familiaris* (Linnaeus, 1758) – one nest; golden jackal *Canis aureus* (Linnaeus, 1758) – one nest; and red fox *Vulpes vulpes* (Linnaeus, 1758) – two nests. In one case, the canid pest was not known. In two cases, the nests were destroyed by Stone marten *Martes foina* (Erxleben, 1777). One was damaged by European polecat *Mustela putorius* (Linnaeus, 1758). Three nests were harmed by unidentified mustelid species. There was not specific mammalian group which destroyed significantly greater nests than the other groups (χ^2 = 2.001; p>0.05). There was no significant difference between the ruined nests in the first two and the second two weeks (χ^2 =0.474; p>0.05). We have not found significant differences between the destroyed nests' size and the vegetation height (χ^2 =1.369; p>0.05). Losses are rather randomly distributed temporarily without any relationship according to setting time and vegetation height.

In two cases the cause of nest destruction was not determined. One of the nests was destroyed before flood rain (June 20, 2011) and traces were lacking. In the second case, there was narrow trail leading toward the nest, with snake traces in the sand, but it cannot be claimed that this was the cause for the missing eggs (July 22, 2010). Snakes were reported as chukar partridge nest pests in the United States (Christensen 1970). It has been observed a snake density increase during the egg-laying period around chukar partridge farm near to Sliven Town (Mikhailov, unpublished). In the current study, confirmed cases of snake-destroyed nests are lacking.

Discussion

Our results show that chukar partridge nest losses in the studied area are caused mainly by predatory mammals (28.89 %). Among the canids potential pests are species like red fox, golden jackal and domestic dog. At the places with livestock grazing accompanying shepherd dogs caused increase of chukar partridge nest losses. Mustelids can destroy the nests too, but in specific habitats, according to their own distribution pattern. According to Chesness et al. (1968), nest predation of pheasant *Phasianus colchicus* (Linnaeus, 1758) is mainly due to polecats and crows. In our study, nests destroyed by birds are significantly lesser than those ruined by mammals. This is probably due to the low bird densities which are potential nest pests. During the field observation of the studied territory single jays *Garrulus glandarius* (Linnaeus, 1758) were noticed. Predatory rate is related to corvid bird abundance. Their density in turn correlates with the extent of agricultural land and human population density, as well as forest fragmentation (Andrèn et al. 1985). Chukar partridge habitats are characterized with the restricted agricultural lands. This determines the lower density of corvid birds there. Therefore, the lesser nest losses in these areas. Corvid birds destroy mainly nests constructed on shrubs, while predatory mammals usually ruin ground nests (Söderstrom et al. 1998). Nest predation of red-legged partridge, occupying olive orchards in Spain, is due mainly to dogs and cats

(Duarte and Vargas 2001). We have not found significant differences between the destroyed nest size and the vegetation height. According to other studies, predation extent is not always associated with the degree of nest concealing (Howlett and Stutchbury 1996, Burhans and Thompson 1998, Braden 1999). This is probably due to non-visual nest searching mode of some predators (Rangen et al. 1999). They can also use the opportunity of finding the parents (Götmark et al. 1995, Cresswell 1997, King et al. 1999). However, other studies show that predation rate in red-legged partridge (*Alectoris rufa*) decreases with the vegetation height increase (Rands 1988). Higher vegetation cover and heterogeneity can reduce the predation percentage (Newton 1998, Willson et al. 2001). Nest predation rate of ground-nesting birds is different in the variable habitats. It depends on predatory mammalian density (Picman 1988). Other chukar partridge habitats, where predator type and density are different, will probably have different extent of destroyed nest compared to our results. There are several specifics associated with our experimental set. It was not clear whether the set nest density in the studied habitats was not too higher. If this was the case, it could lead to higher losses compared to natural populations. Our experimental model does not account the parent birds' presence in the nests. According to Skutch (1949), Willis (1973), Cottfried and Thompson (1978) in Picman (1988), parent presence on the nest or in close proximity to it can attract predators. Therefore, our estimation of predatory rate is probably reduced. Unfortunately, there is lack of data about the chukar partridge reproductive success in Bulgaria. Therefore, our results reflect the relative differences of species' nest predation.

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