ECOLOGIA BALKANICA
2009, Vol. 1 *November 2009* pp. 67-77

Data on Bird Mortality in "Sakar" IBA (BG021), Caused by Hazardous Power Lines

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Abstract. Bird mortality caused by 20 kV power lines was studied in "Sakar" Important Bird Area (IBA). In the period between February 2008 - April 2009, six power lines with a total length of 44,6 km and 450 electric poles of different design were monitored once a month. Forty-four victims belonging to 21 taxa, including representatives of 8 orders, were recorded. Suspected collisions represented 34,09% (n=15) of all dead birds found under the lines. Most of the victims were small songbirds (26%). Suspected victims of electrocution represented 65,91% (n=29) of the recorded carcasses. Electric poles of type 1 (p=0,189) – metal tower with jumper wires, proved to be the most dangerous design, followed by type 2 (p=0,067) - concrete poles with pin-type insulators. The monitored power lines ran across four main habitat types: arable lands, vineyards and orchards, forests (*Quercus sp., Pinus sp.*), and open grasslands (pastures and uncultivated lands). Most of the suspected collisions were found in arable lands (60%) and open grasslands. Electrocution was suspected mainly for birds in open grass habitats (0,078 victim/pole), vineyards (0,062 victim/pole), and arable lands (0,054 victim/pole). No victims of electrocution were found in the forests.

Key words: electrocution, collision, bird mortality, power lines.

Introduction

Globally, bird mortality caused by power lines is a very serious problem studied by MARKUS (1972), HAAS (1980), LEDGER & ANNEGARN (1981), FERRER & HIRALDO (1991), FERRER *et al*. (1991), BAYLE (1999), JANSS (2000), VAN ROOYEN (2000), KRUGER & VAN ROOYEN (2000), ARHIPOV (2000), GUYONNE *et al*. (1999), GUYONNE *et al*. (2001), ADAMEC (2004), KARYAKIN *et al*. (2005), KARYAKIN & BARABASHIN (2005), KARIAKIN & NOVIKOVA (2006), MASTINA (2005), MEDZHIDOV *et al*. (2005), PESTOV (2005), CARTRON *et al*. (2006), LEHMAN *et al*. (2007), HARNESS (1998, 2000, 2008). There are two aspects of bird mortality resulting from the power supply

network – electrocution and collision with power lines.

For the most part, power supply network in Bulgaria is dangerous for birds, as the 20 kV power lines pose the highest hazard (STOYCHEV & KARAFEIZOV, 2004; DEMERDZHIEV *et al*., 2009). The first systematic study on bird mortality caused by the risky 20 kV power lines was carried out in 2004 (DEMERDZHIEV *et al*., 2009), although data about bird deaths was reported in previous publications of NANKINOV (1992); STOYCHEV & KARAFEIZOV (2004).

This paper presents the preliminary results of a 15 months' study on bird mortality caused by the 20 kV power lines in "Sakar" IBA (BG021).

Material and Methods

The study was carried out in "Sakar" IBA (BG021) - Fig.1 (KOSTADINOVA & GRAMATIKOV, 2007). This Important Bird Area harbors significant bird diversity – 220 species (STOYCHEV *et al*., 2008). Ninety one of the reported species are listed in the Red Data Book of Bulgaria (RED DATA BOOK OF BULGARIA, in press), as 11 of them are globally threatened (BIRDLIFE INTERNATIONAL, 2004). The greatest part of the Imperial Eagle (*Aquila heliaca*) population in Bulgaria is concentrated in this region – 10 pairs (DEMERDZHIEV, 2009, Sofia, pers. comm.). In spring and autumn, hundreds of raptors and storks migrate across the Sakar Mountains, using the 20 kV poles to roost (STOYCHEV *et al*., 2008; DEMERDZHIEV *et al*., 2009).

The study was focused on the 20 kV power lines, as six power lines, totaling a length of 44,6 km, and 450 electric poles of different types were selected for the monitoring. The length of the particular lines varied between 2,2 km - 13,3 km. The monitored power lines ran across four main habitat types: arable lands, vineyards and orchards, forests (*Quercus sp., Pinus sp.*), and open grasslands (pastures and wastelands).

The power lines were monitored once a month during the period February 2008 - April 2009, as the inspections were carried out at intervals of at least 20 days. The inspections were carried out by walking along the power lines (BIBBY *et al*., 1999), recording victim remains found within 10 meters on either side of the power line.

The information recorded for every single pole included: GPS coordinates, type (concrete or metal), individual code, position of the insulators (up, down, or sideways), number of insulators (3 or 6), safety installations on the electric poles, as well as habitat type within a 50m radius around the pole - arable lands, vineyards and orchards, forests (*Quercus sp., Pinus sp.*), and open grasslands (pastures and uncultivated lands).

The information noted down on a standard data form for every victim found included: name of the power line, individual code of the electric pole (if found under a pylon), species, age and sex (if possible), number of victims, condition of victims (fresh carcass, mummy, feathers and bones, only feathers or only bones with any traces of singing or burning), distance and direction of the position of the victim in relation to the pole and the power lines. After the inventory work, the victims were removed to avoid repeated reporting.

All birds found within a radius of 5 m under the poles were considered to be suspected electrocutions, while birds found under the conductors were considered to be suspected collisions (DEMERDZHIEV *et al*., 2009).

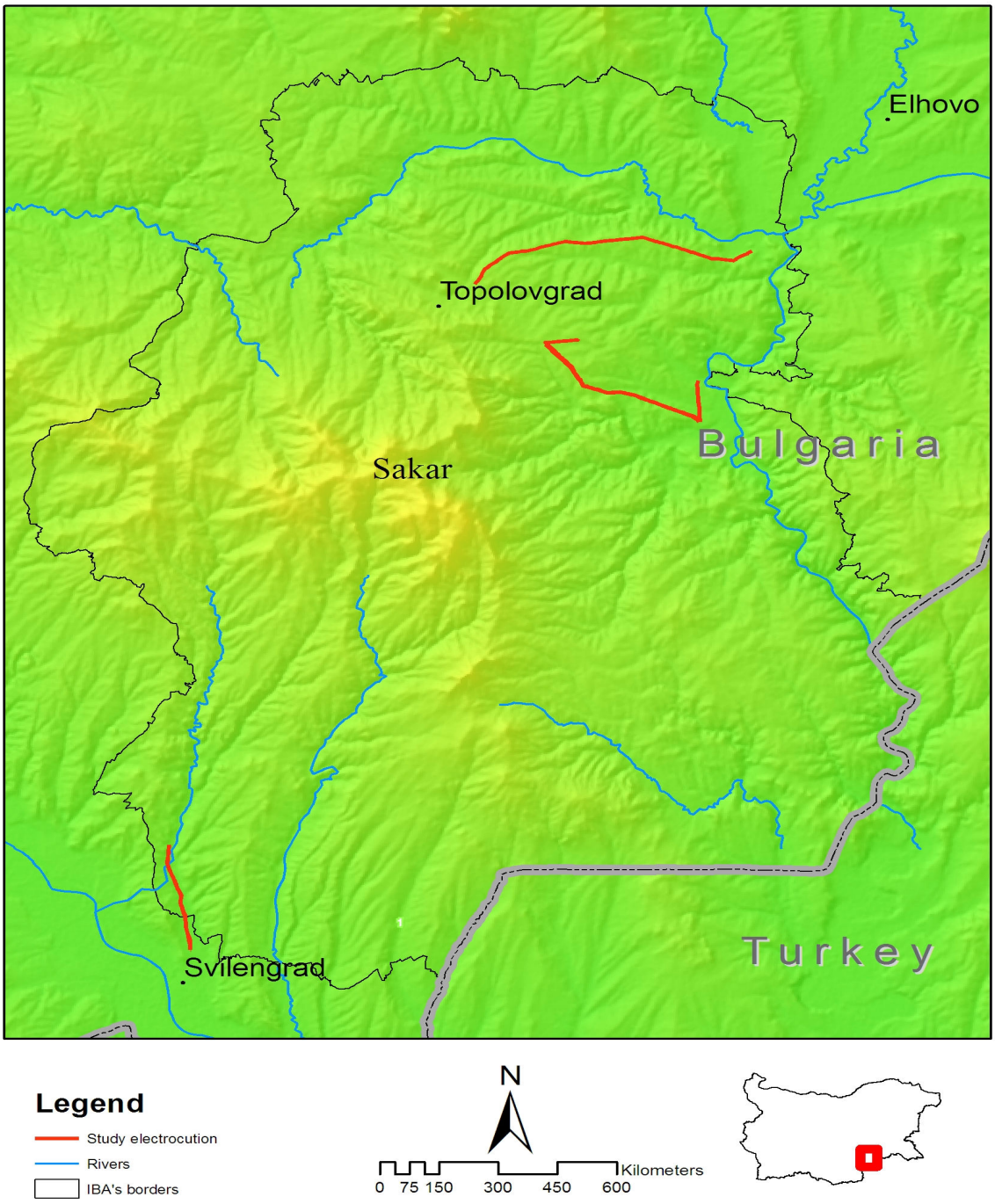

Fig. 1. Location of the monitored power lines in "Sakar" IBA (BG00021).

Results and Discussion

Monitoring of power lines

Forty-four victims belonging to 21 taxa, including representatives of 8 orders, were found as a result of this monitoring (Table 1).

The number of victims taken by scavengers was not assessed. The studied area holds high densities of jackals (*Canis aureus*) and red fox (*Vulpes vulpes*), so a high ratio of losses can be assumed. Probably, the actual

mortality rate is much higher, and this assessment is considerably under-estimated.

Table 1. *Species composition of victims.*

N	Species	Cause of death	
		Electro-cution	Colli-sion
1	*Ciconia ciconia*	4	1
2	*Ciconia sp.*	2	2
3	*Buteo buteo*	3	2
4	*Buteo rufinus*	1	-
5	*Buteo sp.*	1	-
6	*Falco tinnunculus*	2	-
7	Accipitridae	2	-
8	*Galinula chloropus*	-	1
9	Columbidae	-	1
10	*Asio otus*	-	1
11	*Upupa epops*	1	-
12	*Coracias garrulus*	1	-
13	*Sturnus vulgaris*	2	-
14	*Pica pica*	2	-
15	*Corvus corone*	1	-
16	*Corvus corax*	3	3
17	Corvidae	3	-
18	*Turdus merula*	-	1
19	*Carduelis cannabina*	-	1
20	*Emberiza citrinella*	-	1
21	Oscines (non Corvidae)	1	1
TOTAL		**29**	**15**

Due to their small size, songbirds are often eaten by scavengers, while there are usually parts of bodies, bills, and primaries left of larger raptors and storks (DEMERDZHIEV, 2009, Sofia, pers. comm.). Therefore, the number of detected songbird carcasses is probably underestimated too.

Suspected collisions represented 34,09% (n=15) of all dead birds found under the lines (Fig. 2). Most of them were small songbirds (26%), which, flying in flocks, often cross the power lines and fall victims to collision. Birds from the family Corvidae are separated from the other Passeriformes, due to their specific ecology and behavior. Along with Storks (*Ciconiiformes*), they often collide with power lines.

Suspected victims of electrocution represented 65,91% (n=29) of the recorded carcasses (Fig. 3). In most cases these were diurnal birds of prey and Crows. Both systematic groups represented 62% of suspected electrocutions. The losses of Storks were high as well (21%).

Effect of the pole design on the mortality rates

A total of 450 electric poles of six different types were monitored within this study (Fig. 4). Electric poles of types 5 and 6 were not included in the analysis due to the small number of pylons – 1 and 7 poles respectively. Electric poles of type 1 (p=0,189) – metal tower with jumper wires, proved to be the most dangerous design, followed by type 2 (p=0,067) - concrete poles with pin-type insulators. Electric poles of type 3 (a metal tower with suspended insulators) pose a small risk of electrocution (p=0,024). No victims were found under poles of type 4 – concrete pylons with suspended insulators.

Effect of the habitat type on the mortality rates

Characteristics of habitats (vegetation, relief, etc.) are related to bird mortality rates as well (FERRER *et al*., 1991; GUYONNE *et al*., 2001; DEMERDZHIEV *et al*., 2009).

Monitored power lines totaling a length of 44,6 km ran through four main habitat types: arable lands, vineyards and orchards, forests (*Quercus sp., Pinus sp.*), and open grasslands (pastures and uncultivated lands).

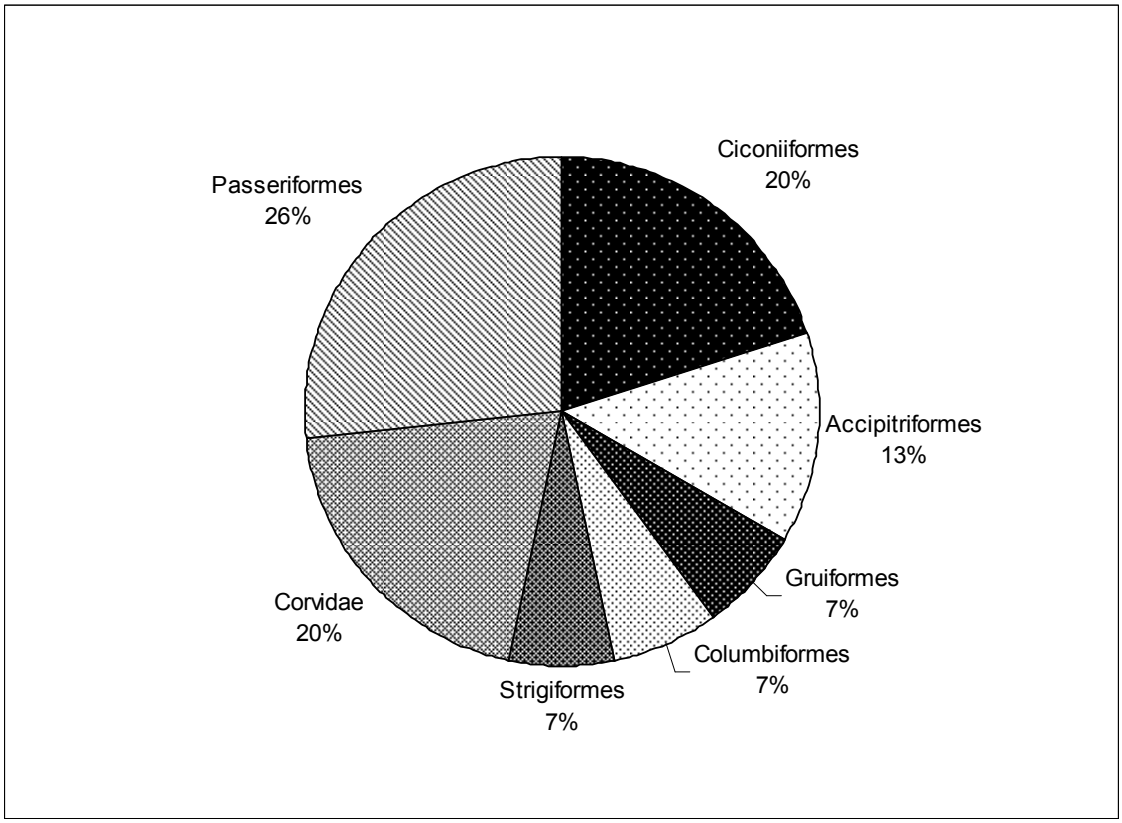

Fig. 2. Distribution of suspected collisions by orders.

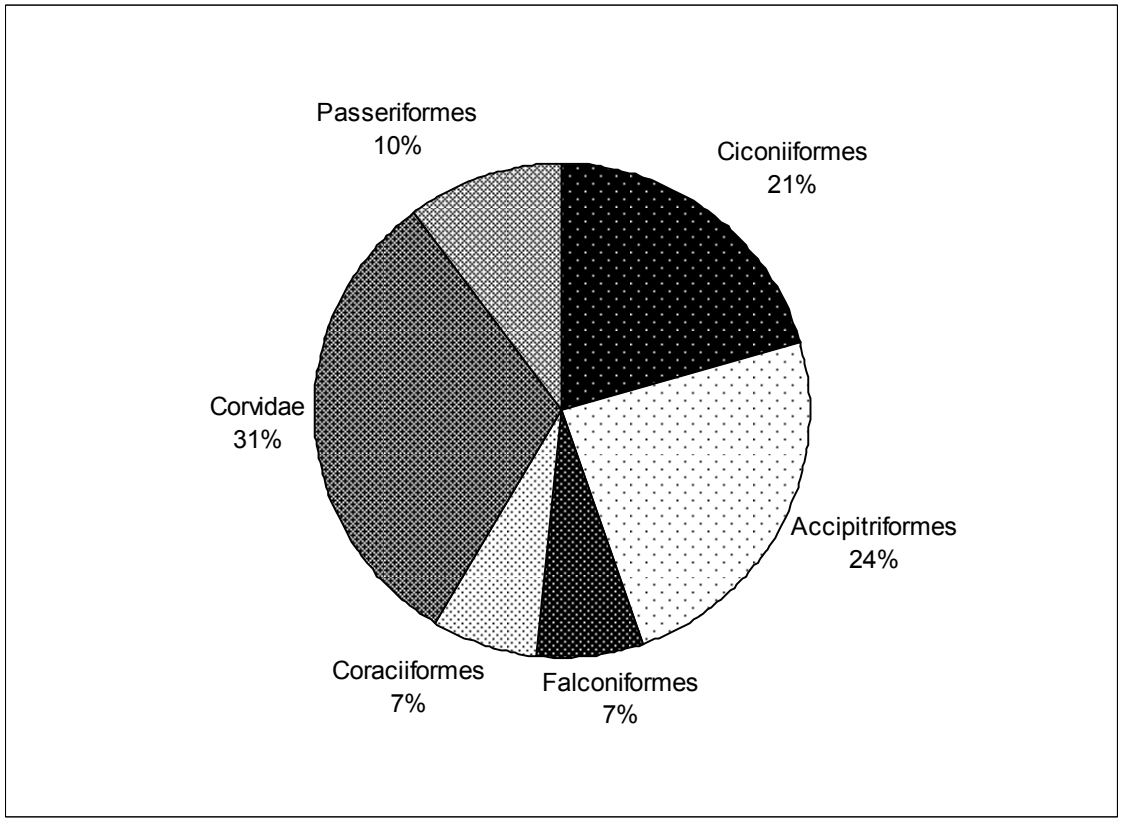

Fig. 3. Distribution of suspected electrocutions by orders.

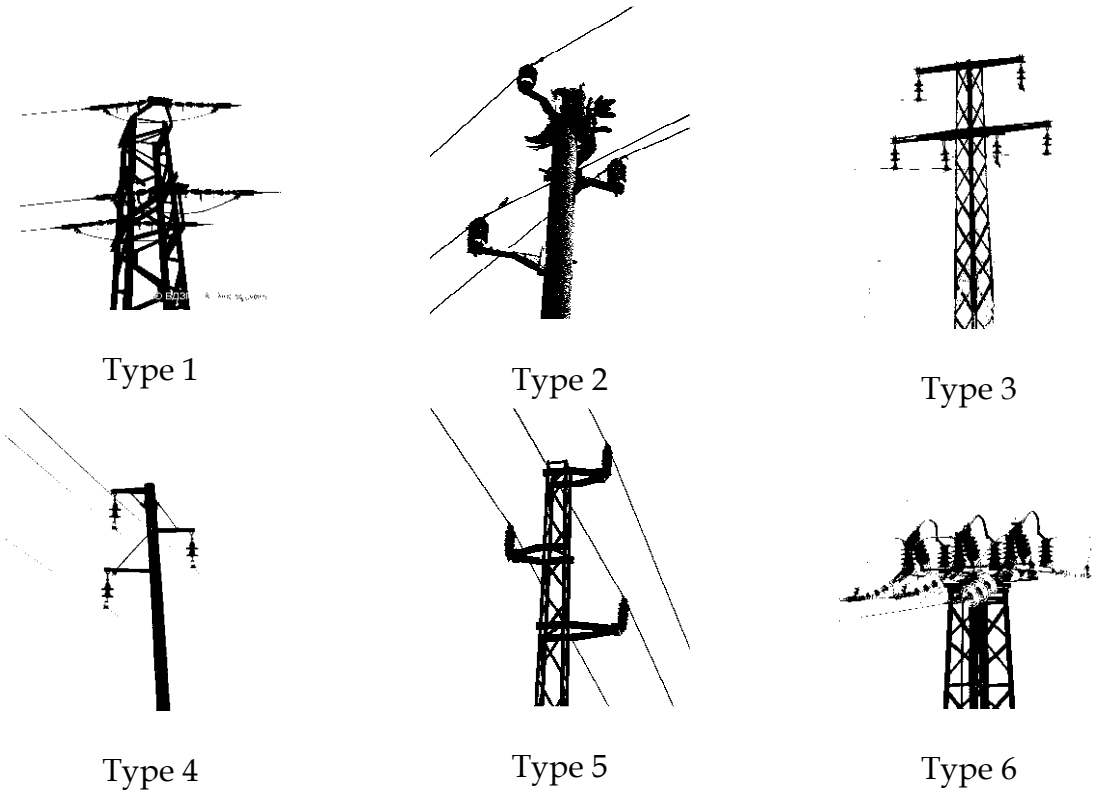

Fig. 4. Different pole types subject to monitoring.

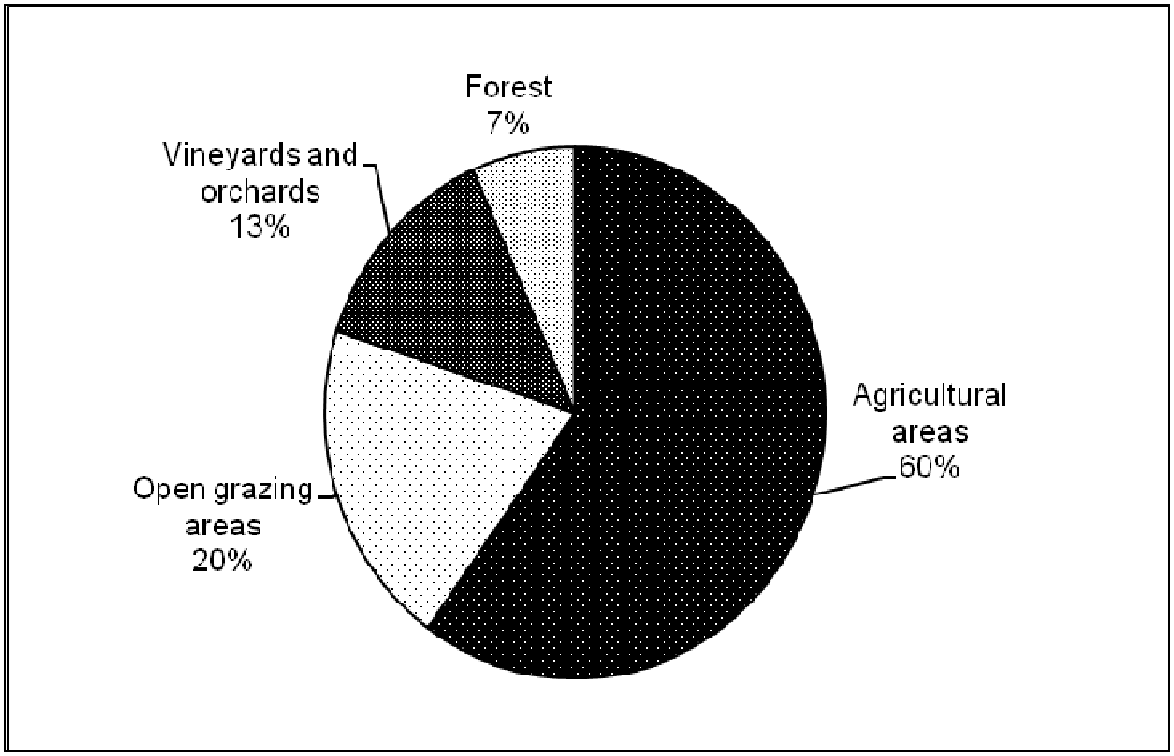

Fig. 5. Suspected collisions by different habitat types.

Suspected collisions in different habitat types are presented in Fig. 5. Most of these victims were detected in arable lands (60%) and open grasslands.

Electrocution was suspected mainly for birds in open grasslands (0,078 victim/pole), vineyards (0,062 victim/pole), and arable lands (0,054 victim/pole). No victims of electrocution were found in the forests.

Monitoring of power lines

Of all 44 victims found during the monitoring, the number of suspected electrocutions was twice higher than the collisions.

Raptors and Crows represented 62% of the losses caused by electrocution. Similar results were presented in the research of DEMERDZHIEV *et al*. (2009), carried out in four IBAs in Southern Bulgaria, where electrocution of diurnal birds of prey and Crows was suspected for 53% of all detected carcasses.

In different parts of Spain these two systematic groups represent 80% to 96% of the suspected electrocutions (GUYONNE *et al*., 2001; MANOSA, 2001). Similar results were reported in southeastern France, where raptors and Crows represent 85% of suspected electrocution (BAYLE, 1999). The high mortality rates of these species are related to their ecology, as they use electric poles as roosts or perches for hunting (DEMERDZHIEV *et al*., 2009). Perching on the poles, the birds sometimes get in contact with parts of the pylons or conductors and die from electrocution (STOYCHEV & KARAFEIZOV, 2004; DEMERDZHIEV *et al*., 2009). The percentage of electrocuted Storks was high, too (21%). During migration stork flocks perch on dangerous electric poles to roost thus falling victims to electrocution.

Sometimes, storks and large raptors die from electrocution while they defecate, due to the semi-fluid feces, which, when touch the live wires, form a voltaic arc. Songbirds get electrocuted when flocks perch on the pylons to roost (DEMERDZHIEV *et al*., 2009).

Most of the suspected collisions involved songbirds, which flying in flocks often cross the power lines and collide with the conductors. In the study by DEMERDZHIEV *et al*. (2009), song birds (Passeriformes) victims of collisions represented 59% of all cases of suspected collision. The percentage of Storks and Crows colliding with the conductors was high, too. Storks collide with power lines mainly during migration, when flocks of hundreds of individuals cross the live wires. Strong wind and bad weather increase significantly the risk of collision (DEMERDZHIEV *et al*., 2009). The percentage of raptors victims of suspected collision was smaller compared to electrocuted individuals.

Species of the orders Columbiformes, Gruiformes, and Strigiformes colliding with power lines were represented by single individuals.

Effect of the pole design on the mortality rates

Electric poles of type 1 (p = 0,189) – metal tower with jumper wires, were the most dangerous configuration of all 450 monitored pylons of six different types (Fig. 4). Although the outer jumpers run underneath the crossarms, the top jumper wire is located where a large perching bird can easily come into contact with. In the work of DEMERDZHIEV *et al*. (2009) this structure type was identified as the most hazardous configuration, constituting 54,3% of the total detected electrocution mortality. Concrete pylons of type 2 (p = 0,067), assumed as dangerous in

STOYCHEV & KARAFEIZOV (2004) and DEMERDZHIEV *et al*. (2009), were confirmed as configurations posing high hazard in this study, accounting for 51,7% of all suspected electrocutions. In Spain, electric poles of similar types were identified as dangerous for birds (FERRER *et al*., 1991; GUYONNE *et al*., 2001). Pylon configurations of types 3 and 4 recorded as less dangerous for birds by DEMERDZHIEV *et al*. (2009) accounted for two victims under type 3 and no victim under type 4.

Effect of the habitat type on the mortality rates

High mortality of birds in cultivated lands and open grass habitats caused by electrocution or collision with power lines is determined by two factors - the lack of high trees on one hand, so birds often use electric pylons as "perches", and, on the other hand, the availability of suitable trophic conditions for many species.

Electrocution in vineyards was suspected mainly for raptors, using these habitats as hunting areas.

Acknowledgements

The authors are grateful to the Bulgarian Biodiversity Foundation (BBF) and the Bulgarian Society for the Protection of Birds (BSPB/BirdLife Bulgaria) for the financial support provided for the field studies. We would like to thank Dimitar Plachiyski, Georgi Popgeorgiev, Stoycho Stoychev, Dilian Georgiev, Vanya Angelova, Vladimir Dobrev, Dobromir Dobrev, and Volen Arkumarev, who helped with the field studies and provided some useful advice on improving this manuscript.

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Данни за смъртността на птиците в ОВМ „Сакар" (BG021), причинена от рисковата електропреносна мрежа

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Резюме. Изследвана е смъртността на птиците при 20 kV елктропреносна мрежа в „Орнитологично важно място (ОВМ) „Сакар" (BG021). В периода февруари 2008 г. - април 2009 г. са обхождани веднъж месечно 6 електропреносни линии, с обща дължина 44,6 км и 450 електрически стълба от различен тип. Установени са общо 44 броя жертви от 21 различни таксона, включващи 8 разреда. Жертвите считани за загинали от сблъсък с електрическите проводници съставляват 34,09% (n = 15) от всички намерени мъртви птици. Най-голям от тях е делът на пойните птици с малки размери (26%). Предполагаемите жертви на токов удар съставляват 65,91% (n = 29) от регистрираните смъртни случаи. Най-опасни се оказват стълбовете от тип 1 (p = 0,189), метален с преходни проводници следвани от тип 2 (p = 0,067), бетонни стълбове с насочени нагоре изолатори. Изследваните електропреносни линии преминават през четири основни типа местообитания: обработваеми площи, лозя и овощни градини, гора (*Quercus, Pinus*) и открити тревни местообитания (пасища и пустеещи земи). Основната част от жертвите на сблъсък с електрическите проводници е в обработваемите ниви (60%). Жертви на токов удар стават птиците основно в откритите тревни местообитания (0,078 жертви /стълб), следвани от лозята (0,062 жертви/стълб) и обработваемите площи (0,054 жертви/стълб). В гора няма открити жертви на токов удар.

Received: 24.06.2009
Accepted:22.07.2009

Union of Scientists in Bulgaria – Plovdiv
University of Plovdiv Publishing House