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European Bee-eater (*Merops apiaster* Linnaeus, 1758) in Hungary: a review

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Abstract The European Bee-eater (*Merops apiaster* Linnaeus, 1758) is known as 'beekeeper bird' and an effective ecosystem engineer species. The fact that in 2013 it became '**The Bird of the Year**' in Hungary offers the possibility to summarise the information about the distribution, population size, breeding and feeding ecology, dispersion, migration, intra- and interspecific relationships as well as the nature conservation status of the bee-eater population breeding in Hungary. Though this review focuses on the Hungarian population trends, but also summarises the major research results from other countries. In the period of 1992–2013, the number of breeding pairs were surveyed in 5897 2.5×2.5 km UTM squares in the frame of the Monitoring of Rare and Colonial Breeding Birds programme. In the surveyed area during the period of 1992–2013, the most accurate estimate suggests a 10600–19600 breeding pair population. The larger nesting colonies were observed in the following regions: Zala Hills, Outer Somogy, Gerecse, Velencei Hills, Mezőföld, Gödöllő Hills, Tápió, Bükkalja, Taktaköz, Körös region. The annual population indices showed marked fluctuation with stable long term population trend in Hungary. The national monitoring and protection project of the European Bee-eater revealed the most important factors endangering the nesting populations, these are weed invasion and the collapse of vertical banks, mining carried out in the nesting period and direct human-caused disturbance (e.g. shooting, tourism).

Keywords: *Merops apiaster*, Hungary, breeding population, migration, conservation

Összefoglalás A gyurgyalag (*Merops apiaster* Linnaeus, 1758) „méhész madárként" és hatékony ökoszisztéma mérnök fajként is ismert. 2013-ban „**Az év madarának**" választották Magyarországon, ezen alkalomból jelen írás összefoglalja a gyurgyalag földrajzi elterjedésére, állománynagyságára, fészkelésére, táplálkozására, szétterjedésére, vonulására, intra- és interspecifikus kapcsolataira, valamint természetvédelmi helyzetére vonatkozó lényeges ismereteket, kitekintve más országok fontosabb kutatási eredményeire is. 1992 és 2013 között, az MME „Ritka és Telepesen fészkelő Madarak Monitroingja, RTM" program keretében 5897 darab, 2,5×2,5 kilométeres UTM négyzetben mértük fel a költőpárok számát. Felméréseink alapján készült eddigi legpontosabb becslés szerint a gyurgyalag hazai fészkelő állománya évente 10 600–19 600 pár volt 1992 és 2013 között. A legnagyobb költőtelepeket a következő régiókban figyeltük meg: Zalai-dombság, Külső-Somogy, Gerecse, Velencei-hegység, Mezőföld, Gödöllői-dombság, Tápióvidék, Bükkalja, Taktaköz, Körös vidéke. A trendanalízis eredménye alapján a hazai költőállomány a vizsgált időszakban stabil volt. Az országos monitoring és védelmi program által feltárt leggyakoribb fészkelést veszélyeztető tényezők a következők voltak: a partfalak benövényesedése, a függőleges partfalak ledőlése, fészkelési időszakban végzett bányászat, valamint a közvetlen emberi zavarás (pl. vadászat, turizmus).

Kulcsszavak: *Merops apiaster*, Magyarország, költő populáció, vonulás, védelem

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Introduction

The 27 colorful and morphologically uniform species of the Meropidae family is divided into three genera (Dickinson & Remsen 2013). The three species belonging to the *Nyctiornis* (2 species) and *Meropogon* (1 species) genera are confined to the far East, from the Himalaya mountains to Sulawesi, while the 24 species of the *Merops* genus can be divided into two biogeographical and ecological species clade on the basis of phylogenetic analysis (Dickinson 2003). One of them consists of the resident species that are breeding in Africa, while the species of the other clade are obligatory migrants and breed in Africa and Eurasia (Marks *et al.* 2007) and one species even in Australia. The Persian Bee-eater (*Merops persicus* Pallas, 1773) belongs to the latter clade, and occasionally nests in South-East Europe (Cramp 1998), however, the European Bee-eater (*Merops apiaster* Linnaeus, 1758) is fairly common, widespread and regular, colonial breeder in Europe (Fry 1984, Cramp 1998). This species has been breeding in Hungary and the surrounding area since the middle-Pleistocen (Udvardy 1969, Mlíkovský 2009). The area of the species is extended northwards in Europe, and it appeared in areas like the north of Hungary during the last centuries because of the milder winters and warmer average spring temperatures caused by global climate change (Kinzelbach *et al.* 1997). It has still been expanding in Northern Europe in the last decade (Vagg & Hepworth 2006).

In Hungary, the European Bee-eater has been protected since 1954, it became a strictly protected species in 1984. Furthermore it is listed in the National Red Book (Bankovics *et al*. 1989), in the list of the 71 most endangered terrestrial vertebrate species of Hungary (Báldi *et al*. 2001), as well as in the Second Appendices of the Bern and Bonn Conventions (Heath *et al.* 2000). The European Bee-eater was selected for the title 'The Bird of the Year' for the first time, by BirdLife Hungary in 1979 (Kállay 1978). The national monitoring and protection project for the European Bee-eater started due to insufficient nesting and distribution data of the species. Nature conservation conflicts arose from the bee-eaters' nesting site preference and consumption of Western Honeybees *(Apis mellifera)*. The Hungarian European Bee-eater monitoring and conservation program was launched with the following goals:

– to survey the number and distribution of breeding pairs,
– to identify the risk factors for breeding and nest sites,
– to reduce the degradation of nests and breeding sites,
– to change people's attitude towards the species and the natural environment (Gyurácz 1998a, Gyurácz *et al.* 2004).

Between 1992 and 2013, the number of breeding pairs were surveyed in 5897 2.5×2.5 km UTM squares in the frame of Monitoring of Rare and Colonial Breeding Birds Programme (Ritka és Telepesen Fészkelő Madarak Monitoringja, RTM) (minimum in 1992: 29 squares, maximum in 2002: 806 squares) *(Figure 1)*. From the 5897 UTM squares there were 1136 pieces, which were surveyed at least in three different years and which UTM squares were used for estimating trends for the period of 1992–2013 by TRIM software (McCullagh & Nelder 1989, Pannekoek & van Strien 2001, van Strien *et al.* 2001).

The results of the more than twenty years long monitoring and protection program and the fact that in 2013, once again the European Bee-eater became 'The Bird of the

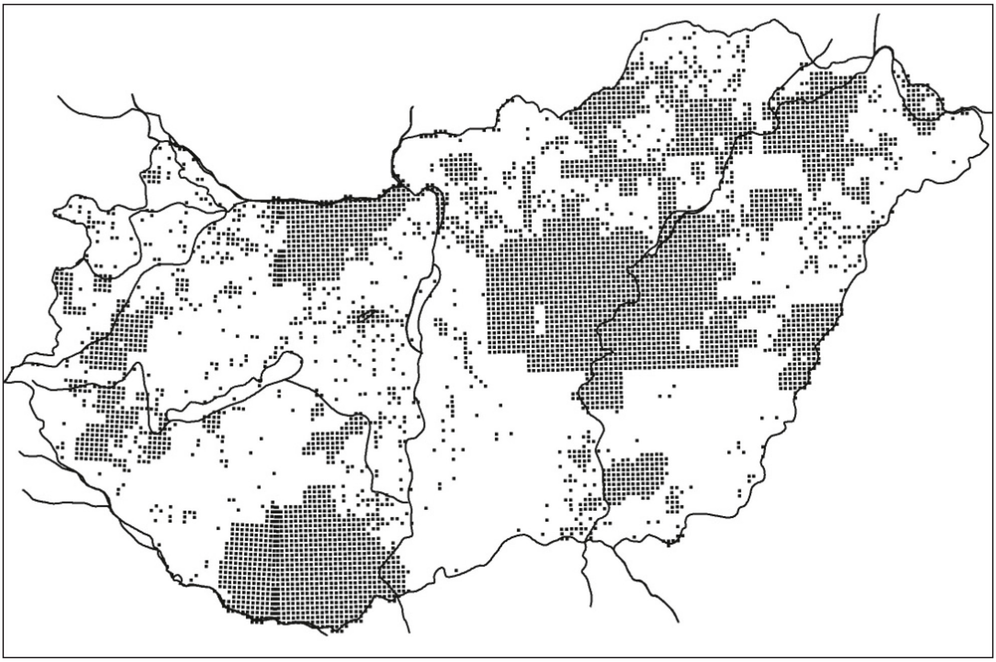

Figure 1. Distribution of 2.5×2.5 km^2 UTM squares in Hungary where number of breeding pairs of European Bee-eaters was surveyed (including zero observation) during 1992–2013

1. ábra A felmért 2,5×2,5 km^2-es UTM négyzetek eloszlása Magyarországon 1992–2013 között

Year' in Hungary (Bagdi 2013), gives an excellent opportunity to summarise the information about the distribution, population size, behaviour and the nature conservation status of the Bee-eater population breeding in Hungary. Though this review focuses on the Hungarian population trends, but also summarises the major research results from other countries as well.

Geographical distribution

The current area of the European Bee-eater expands from North Africa through the Iberian Peninsula, Southern Europe, the Carpathian Basin, Eastern Europe, Small- and Mid-Asia to Kashmir due to postglacial dispersal (Cramp 1998, Snow & Perrins 1998). A few smaller population breeds in South Africa (Fry 1984). The northern border of the area coincides with the 21 °C isotherm of July, but exceptionally some birds expand to the 17 °C isotherm of July (Fry 1984, Krištín & Petrov 1997).

In Europe, the data gathered on its distribution changes revealed the northward expansion of the European Bee-eater from the 1920s and 1930s and its westward expansion from the second half of the 1940s (Fry 1984, Cramp 1998). The European Bee-eater appeared as nesting species due to this area expansion and even its occasional nesting was recorded in further northern regions like in Northern France, the Netherlands, Denmark, Britain, Finland and Russia (Krištín & Petrov 1997, Cramp 1998).

The European Bee-eater was an uncommon bird until the middle of the twentieth century in Hungary, only the nesting of a few sporadic breeding pairs were published in journals including ornithological sources (Aizenpreisz 1929, Máry 1929, Réz 1929, 1932, Sőreghy 1934, Porgányi 1935, Schenk 1935, Páldy 1935, 1939, Radványi 1939, Vertse 1939, Sághy 1942a, 1942b, Thóbiás 1943, Keller 1949, Breuer 1950, Molnár 1950, Dorning 1955, Sághy 1955, Bókai 1957, Randik 1957, Vásárhelyi 1957, Beretzk 1959, Sterbetz 1959, Mile 1964, Halmosi 1978, Keve 1978, Kis 1978a, 1978b, Sághy 1978, Gyovai 1979, Nagy 1979, Radetzky 1979a, 1979b, Horváth 1980, Leposa 1980, Keve 1981, Kovács 1981, Bali 1982, Szalczer 1982, Varga 1982, Lenner 1983, Barta 1998), but migratory birds (Csapó 1918, Greschik 1938, Lenner 1982, Kagyerják 1983) and simple faunistic observations have also been reported in scientific articles (Uhde 1905, Tarján 1929, Rainer 1930, Gönye 1935, Wagner 1935, Merán 1947, Dorning 1949, Sőregi 1955, Bécsy 1966, Farkas 1967, Buschmann & Mester 1988, Kárpáti 1989). In Hungary, its nesting was only proven in the area bordered by the Danube, Drava rivers and Balaton Lake before 1940 (Radványi 1936, Keve 1949), and it expanded to the northwestern part of Hungary (Keve & Udvardy 1951) after 1940. The breeding population concentrated in a handful of sites in the twentieth century (Szijj 1955): there were some major colonies in Tolna County of Southern Transdanubia (Lokcsánszky 1935, Radványi 1936, 1939), Baranya and Fejér Counties (Radetzky 1966, 1979a, 1979b, Halmosi 1978, Tapfer 1978). A lot of nesting data were known from the Gödöllő Hills (Vertse 1939, Dorning 1955, Papp 1980, 1984, Jáky 1990, Kertész 1986, 1991a, 1991b). More significant colonies

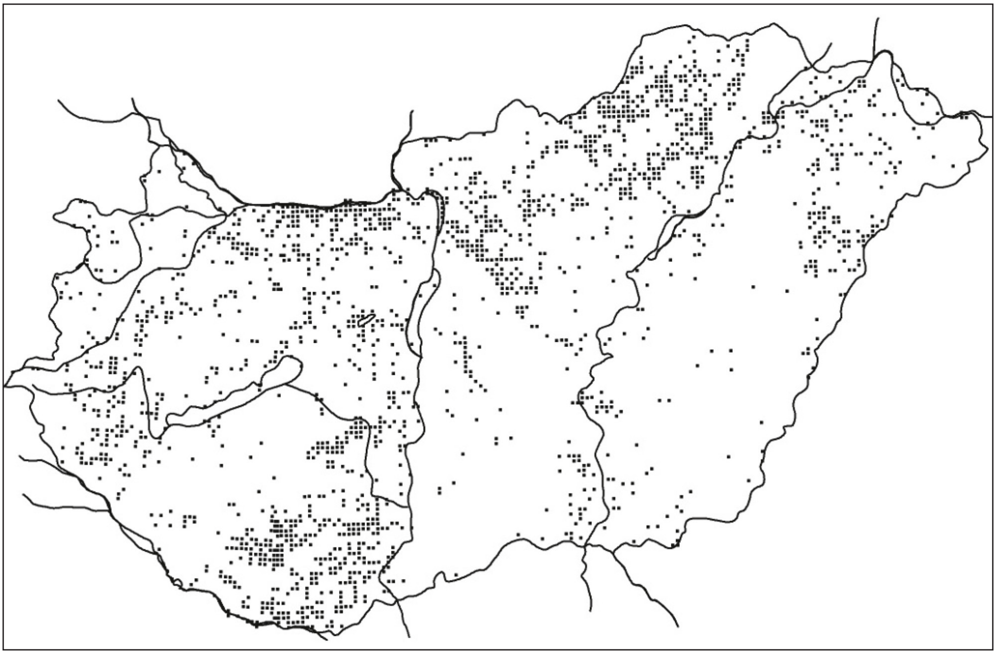

Figure 2. Distribution of 2.5×2.5 km^2 UTM squares in Hungary where breeding pairs of European Bee-eaters were observed during 1992–2013

2. ábra A 2,5×2,5 km^2-es UTM négyzetek eloszlása Magyarországon, ahol a gyurgyalag fészkelt 1992–2013 között formed around Tokaj in Northern Hungary (Radványi 1950, 1964, Mercsák & Mercsák 1980) and along the Szamos river in North-East Hungary (Sőreghy 1934, Sőregi 1955, Fintha 1968, 1969). Recently the majority of the breeding population is found in Zala, Baranya, Komárom-Esztergom, Tolna, Fejér, Pest, Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg Counties according to the surveys conducted since 1992 *(Figure 2)*.

Nesting population

The European nesting population of the European Bee-eater was estimated between 86000 and 380000 pairs (with birds nesting in Turkey included) at the end of 1980s (Fry 1994), between 92000 and 390000 pairs in the late 1990s (Heath *et al.* 2000) and more than 480000 pairs in the early 2000s (BirdLife International 2004). Europe involves 25-49% of the global range, so a very preliminary estimate of the global population size can be more than 1470000 breeding pairs (BirdLife International datazone 2013). The population was not evenly distributed, 44% of the birds bred at the Iberian Peninsula, 26% of them bred at the Balkans and the remaining 23% of the birds bred in East Europe (Kristín & Petrov 1997).

In Austria the European Bee-eater breeds in Burgenland and Lower Austria (Dvorak *et al.* 1993). Its national population was around 250-360 pairs in 1995-97 (Heath *et al.* 2000), there were 81 breeding pairs in Northern Burgenland and 102 breeding pairs in Lower Austria in 2000 (Knogler *in litt.*, in Ragats 2001). At least 700-1000 pairs breed in Slovakia and their number have been steadily rising (Murin *et al*. 1994).

In Romania, the European Bee-eater was regularly nesting everywhere in the southern and the eastern parts, while only sporadically in Transylvania (Muntenau 1998). The national breeding population was estimated between 10000 and 20000 pairs in Romania (BirdLife International 2004). In Northern Serbia (Vojvodina), 1000-2000 nesting pairs were estimated between 1987 and 1990 (Purger 2001).

The first census of the breeding population was conducted in 1949 in Hungary and 1271 pairs were recorded at 59 colonies, out of which 986 pairs nested in Transdanubia (Szijj 1955). About 2000 breeding pairs were estimated in 1955 (Tapfer 1957). In 1977, Glutz von Blotzheim and Bauer (1980) cited Sterbetz and assumed 1350 breeding pairs in Hungary at the known nesting sites. These surveys might not have been complete, consequently the real population number could have been two or three times higher (Fry 1984). 203 colonies and 1761 breeding pairs were counted in the survey conducted in 1984 (Haraszthy *in litt.*, in Ragats 2001). In the early 1990s, the Hungarian breeding population of the European Bee-eater was estimated around 1000-3000 pairs (Bankovics 2000) and 3000-5000 pairs were estimated in the second half of the '90s (Magyar *et al.* 1998). More exact data on the Hungarian breeding population of the European Bee-eater was obtained by the regional and county population monitoring programmes, organised in the last decade of the 20th and early 21st century (Jánoska 1993, Gyurácz & Szanyi 1994a, 1994b, Alexay 1997, Rakonczay 1997, Lajtmann 1998, Bagdi 1999a, 1999b, Gyurácz 1999, 2000, Ragats 2001, Farkas *et al.* 2003, Batta & Misik 2008, Gyurácz 2012). Furthermore BirdLife Hungary started in 1992 the national survey for this species. However, the surveys did not cover the whole country.

Based on the available monitoring data, the estimated Hungarian European Bee-eater population was 20000-30000 breeding pairs in the 1990s (Gyurácz & Nagy 1999, 2000, 2001, Gyurácz 2000). Based on the surveys conducted between 1998 and 2003, there were less than 20 breeding pairs per colony in more than 92% of the breeding sites and 64% of the surveyed population nested in these small colonies (Nagy *et al*. 2008). Colonies with fifty or more pairs constitute 1-3 percent of all surveyed colonies, and 10 percent of the surveyed nesting pairs bred at these larger nesting sites. The larger colonies are typical in the following regions: Zala Hills, Outer Somogy, Gerecse, Velencei Hills, Mezőföld, Gödöllő Hills, Tápióság, Bükkalja, Taktaköz, Körös region. In 2012 the nesting pairs of the Albertirsa (Gödöllő Hills) colony were close to 300, so this was the largest known colony in Hungary, and possibly in Central-Europe (Urbán *et al*. 2013).

In the surveyed area during the period of 1992–2013, the most accurate estimate suggests a 10600-19600 breeding pairs population. The annual population indices showed marked fluctuation *(Figure 3)* with stable population trend (slope=0.890%, SE=0.480%) based on the trend classification of the TRIM. The estimated trend of Bee-eater population during 1992–2013 (RTM) showed difference from the trend estimated in the frame of the Hungarian Common Bird Monitoring (Mindennapi Madaraink Monitoringja, MMM) (Szép *et al.* 2013). The MMM showed significant decreasing trend (slope=-5.6%, SE=2.8, P<0.05) for this species in Hungary between 1999–2012. To understand this difference one need to consider the different selection of the investigated UTM squares during the survey of breeding pairs in the frame of RTM, which based on free choice and focused mainly on the potential breeding habitats. In the case of MMM, the selection of investigated UTM squares was based on random sampling, covering the main habitat types of Hungary. In the case of MMM, the number of foraging bee-eaters is observed and the MMM trend refer

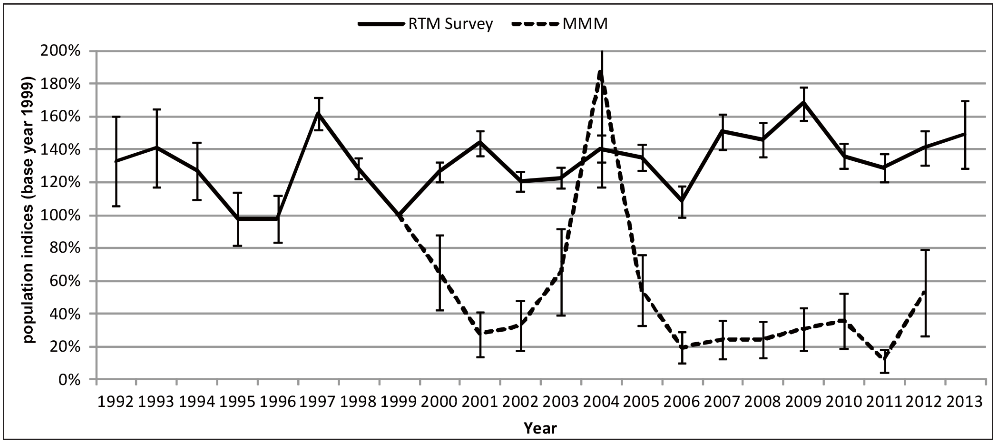

Figure 3. Annual population indices (±SE) of the surveyed European Bee-eater population in the frame of the RTM survey during 1992–2013 and in the frame of the MMM during 1999–2012 (Szép *et al.* 2013), based on TRIM imputed index. Base year was 1999

3. ábra A gyurgyalag felmérés évi populációs indexei 1992–2013 között az RTM, és 1999–2012 között (Szép *et al.* 2013) az MMM keretében felvéve. Alapév 1999 mainly to the number of foraging individuals in the dominant type of habitats (cultivated farmland) in Hungary. The difference between the trends of RTM and MMM survey could reflect either different trends of the breeding populations or different trends in the use of farmland habitats for foraging by the bee-eaters in Hungary. The RTM programme need to be extended to all potential breeding sites of the country in order to refine the estimate of the population size and discover the trends of its change.

Breeding ecology

The European Bee-eater is considered an effective ecosystem engineer bird, as it excavates tunnels ending in a nesting chamber into the natural or artificial vertical loess- and sandbanks, the walls of sand quarries, as well as river banks, and hence significantly contributes to the air circulation of the soil (Ar & Pionkiewitz 1992, Casas-Criville & Valera 2005). The spatial distribution of the nesting populations is mainly determined by the surface presence of loess and sand, but other chemical and physical properties of the soil also play an important role (Smalley *et al.* 2013). In Hungary, 60-65 percent of nesting sites were located in the actively used or closed sand-mines, and 55-65 percent of the breeding pairs bred in these mines recently.

The proliferation of sand, gravel and other building material extraction sites due to the intensive road and housing constructions in the second half of the 20th century may have contributed to the increase and expansion of the European Bee-eater breeding population in our country. The vertical banks of mines lacking vegetation provided excellent nesting opportunities for the bee-eaters. The birds could find undisturbed nesting conditions primarily in the closed, non-used sand-mines. However, the mines, in which the production has been stopped for a long time, were finally abandoned by the birds because of two reasons. Firstly, the vertical banks were cut to askew according to law in the closed mines. Secondly the re-growth of vegetation on the banks prevents the excavating of the nesting-holes and settling of birds. Colonies with more than hundreds of pairs existed in previous surveys, but they are not typical currently in Hungary. One or some pairs can dig their nesting-holes in small-scale land surfaces without vegetation, such as banks of linear facilities (roads, railways, channels). Some bee-eaters could occasionally also settle in a pit of constructions, sand and loess grasslands or roadsides.

The breeding-site preference of the European Bee-eater was investigated by several foreign and Hungarian studies. The soil's particle size, its hardness, slope, exposure and vegetation cover of the banks, and the distance of the bank from the next forest and settlement could all influence the habitat choice of the bee-eaters (Gyovai 1993, Gyurácz & Szanyi 1994b, Nagy 1996, Heneberg & Šimeček 2004). The mean particle size of soil samples from bee-eater nest colonies was 42.76 ± 13.58 µm. Mean particle size differed significantly between samples from European Bee-eater and Sand Martin nest places. There were no bee-eater nests in the soils containing particles over 10,000 µm. The samples from bee-eater colonies contained 20 times more soil grains between 28.0 and 9.2 µm than in those from sand martin holes. These significant differences may explain why these two species do not usually breed in same cliffs (Heneberg & Šimeček 2004). Paying attention on the hardness of the soil, more than half of the nesting colonies were made in sandy loam in the Pannonhalma Hills (Lajtmann 1998). According to Gyovai's (1993) South Great Plains study, the average length of the excavated nesting tunnels was 147 cm (min. 135 cm, max. 170 cm) in the heavier soils and it was 106 cm (min. 90 cm, max. 120 cm) in the soft soils, respectively. The type of soil and the slope of the hillside and bank also had an effect on the lenght of the nesting tunnels. The bee-eaters choosed lower slopes on sand than on loess in the Gödöllői Hills (Kerényi & Ivók 2013).

The egg-laying of the European Bee-eater begins in mid-May, but may be delayed until early July in Hungary. In extreme cases, such as the very late beginning of the laying in 2013 might result in females still developing eggs in mid August (Vas, Z. & Fuisz, T. I. *pers.com.*). The female lays 5-8 eggs with 1-5 day intervals, the incubation time is 20-22 days and the chicks can be fledged out at around 30 days of age (Bankovics 2000). Gyovai's (1993) study gave a detailed description of the nesting cavity, documented the digging of the tunnel, egg-laying, incubation and development of the nestlings. Large colonies could only develop in properly large vertical banks. Nagy (1996) found in the Upper Tisza region that the size of the breeding colonies was correlated with the bank length, but did not correlate with the surface of the bank. In this region, the long, but not too high riverbanks were typical. According to the Little Plain studies (Ragats 2001) there was no strong correlation between the bank surface or length and the number of nesting pairs. Batta and Misik (2008) observed that the bee-eaters preferred banks with smaller surface. Instead of concave parts, flat and convex areas of the banks were preferred by bee-eaters. The birds' view was better from the nesting-holes prepared in convex banks, so they were safer in these holes and the start of digging was easier in convex banks than the concave ones (Gyovai 1993). About two-thirds of the nesting cavities were made in one meter band measured from the top of the bank (Gyovai 1993, Gyurácz & Szanyi 1994a, Batta & Misik 2008).

According to the national studies, the distance of the banks from the forests did not play a serious role in the breeding habitat choice of the European Bee-eaters (Gyurácz & Szanyi 1994b, Ragats 2001), but they preferred banks being further from the settlements. There was more regular human disturbance (occasional sand mining, waste deposition) in mines near villages, while mines being further away were rarely frequented by people, whose presence could disturb the birds.

Ragats (2001) found in the Little Plain, that very small amount of birds bred in banks with northern and western exposure, which were available for birds in a high proportion. This could be mainly because these banks were perpendicular to the typical and common north-northwest direction of the wind. As a consequence, the cool air flowed directly into the nesting-holes and they were very dry and cold. The cool and windy microclimate of the tunnels could adversely affect the development of the nestlings. According to the studies conducted in West Hungary (Gyurácz & Szanyi 1994b, Ragats 2001) the more rapidly warming southern exposure parts of the banks provided better temperature for the development of nestlings, so most nestings have been detected in the southern exposure parts of banks. There were just a few breeding pairs in the sections facing directly to south, which can be explained by the overheating. So the southwest, southeast, west and east facing banks provided really favourable climate to the birds and it is probably not a coincidence that most of the nesting pairs settled down in these parts banks. According to Gyovai's (1993) South Great Plain, Nagy's (1996) Upper Tisza, Lajtmann's (1998) Central Hungary and Batta and Misik's (2008) North Hungary investigations, no clear effect of the exposure of the banks can be identified on the breeding site choice of the European Bee-eaters.

Feeding ecology

The European Bee-eater is known as 'bee-keeper bird' because of catching flying insects (Lepidoptera, Heteroptera, Orthoptera, Odonata, Coleoptera, Diptera), and they readily hunt Hymenoptera, within that group particularly stinging insects such as bees (Apidae) and wasps (Vespidae). Flying or sitting bee-eaters can see bees from long distance and after a shorter or longer chase they can catch them (Fry 1984). The feeding ecology of the European Bee-eater and the harm suffered by apiaries were studied relatively intensely in Hungary (Bendiák 1998, Fehér 1995, 1999, Sík *et al.* 1955, Szederkényi *et al.* 1955, Gyovai 1993, Laczik 1996, Rékási & Haraszthy 2005, Batta & Misik 2008). Fry's summary article (1983) published in an apiary journal was outstanding among many foreign publications, since it summarised the results of studies executed in different countries, and discussed its economic aspects, as well. Those insects were clearly dominant in the diet of bee-eaters, which could be found in the largest numbers at that time in the area. This view was supported by Costa's (1991) Portuguese investigations, in which the food composition of the feeding birds near and further an apiary were compared. He showed that the ratio of honeybees in the diet of the feeding birds near an apiary was significantly higher (almost 50%) than in the diet of those hunting further from an apiary (about 10%). According to a Hungarian study (Fuisz *et al.* 2013) the prey composition also showed marked differences between the individual colonies. Bee-eaters breeding near the Danube shore consumed a large quantity of dragonflies, while at the colony, surrounded by agricultural fields and meadows, orthopterans and coleopterans were consumed in similar quantity as dragonflies.

The economic impact on apiculture by European Bee-eaters was usually negligible, but losses of drones were locally important (Galeotti & Inglisa 2001). Fintha 1968 showed that the composition of the bee-eaters' diet was strongly influenced by weather, because insects usually do not fly under cool and windy conditions. But bees flew in large numbers under these circumstances, therefore their ratio in the bee-eaters's diet also increased. Laczik (1996) found that the food composition of the Bee-eaters varied according to the time of the day. The birds' food composition followed the daily activity of different insect groups, which also proved that the birds always caught the preys that were available in the largest quantities (Gyovai 1993). According to the same study, the birds preferred the large prey items, so they chose the relatively larger sized bumble bees (*Bombus* spp.) among the bees. According to a Southern Hungarian study (Horváth *et al.* 1992) the parent birds often brought more food to the nest than the chicks could consume at once. The surplus food was piled up in the entrance of the nesting-holes, but its amount decreased over time. Parents needed a few days to deliver sufficient amount of food required by chicks.

During the digging and incubation periods, the adults' movements were scarce and concentrated during the morning, but in the chick-rearing stage they flew intensively from the early morning to noon. The start of daily activity and the fly rate of the adults to the nests were strongly correlated to air temperature (Inglisa & Galeotti 1993).

A huge array of prey choice of the European Bee-eater was recorded by various European studies, thus it became evident, it is not exclusively consume Western Honeybees, as previously thought. Variations in diet mainly reflect temporal, spatial and ecological dynamics in insect fauna (Fry 1983).

Migration and dispersion

Each European population are obligate long-distance migrants. The West and South European breeding birds over-winter in the savannahs stretching from Senegal to Nigeria, the Central and Eastern European ones over-winter in Central and East Africa, especially in the Congo Basin. The European populations can be characterised by broad-front overland migration and they migrate through Gibraltar, over the Apennine Peninsula and Sicilian channel, as well as over Cyprus and Greece, towards Israel in the autumn. The autumn migration of the European Bee-eaters starts in mid-August, peaks in September and delays early October in Europe. The first specimens reach Africa in mid-September (Cramp 1998).

Birds predominantly utilise the Central (i.e. via Sicily) and Eastern (i.e. via Israel and Greece) Eurasian flyways during spring migration. Bee-eaters are gregarious diurnal migrants presumably crossing large barriers like the Sahara and the Arabian deserts with non-stop flight. Some nocturnal migration also occurs (Cramp 1998, Snow & Perrins 1998). Yosef (2010) observed a previously unreported thermoregulatory behaviour of migratory European Bee-eaters: diving into the sea and salt ponds with high levels of salinity in Israel. Spring migration begins in early March and the first birds arrive in mid-April in Europe, but some of them are already returning in May. The experienced adults with better condition stop fewer times than juveniles during the spring migration, and returned to their breeding sites before the juveniles (Yosef *et al.* 2006). Sapir *et al.* (2011) suggest that Bee-eaters and other small birds soar and glide during migration and dispersal, and possibly in other stages in their annual cycle too, because it may entail a low energy cost of transport. Spring migrants often overshoot under anticyclonic weather condition, and regularly reach Northwest Europe and exceptionally even nest there (Cramp 1998).

Only three Hungarian ringed birds were recovered abroad, all of them were adults ringed in the breeding season and all were shot in Greece *(Figure 4).* On this basis, we can assume that the main autumn migratory direction of the Hungarian birds was SE. The longest distance covered was 1207 km by a bird ringed at Lake Velence. A bird ringed in Slovakia was found dead and another one was recaptured in Hungary. It is likely that only the Bee-eaters breeding in the Carpathian Basin pass across Hungary and their wintering sites are still unknown. The majority of nesting birds arrive back until the second half of May from their wintering areas according to the monthly distribution of ringing data. In Hungary, the autumn migration begins in August, peaks in the third decade of the month. By the end of September, the last Bee-eater leaves Hungary (Gyurácz 2009).

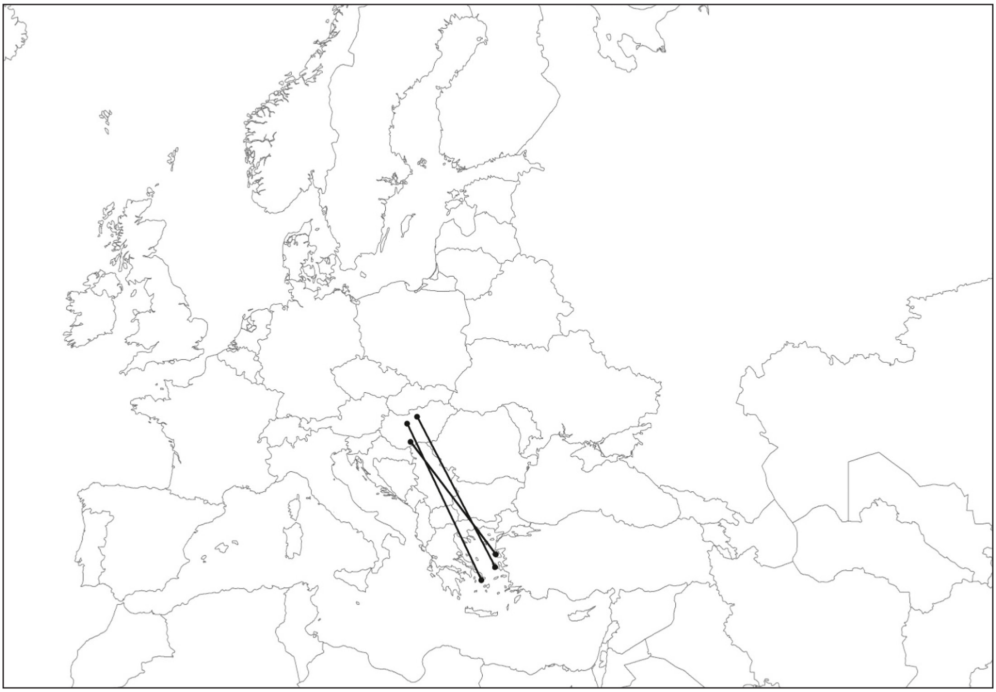

Figure 4. Recoveries of European Bee-eaters ringed in Hungary
4. ábra Magyarországi gyűrűzésű gyurgyalagok visszafogása Európában

Three percent of the Bee-eaters ringed in Hungary were recovered within five kilometres away from their ringing sites. Furthermore, 34.0 and 27.7 percent of the adults returned to their former nesting place, but the return rates of the first year females and males were only 0.4 and 5.9 percent (Lessels & Krebs 1989, Gyovai 1993). This was supposedly because of the relatively high natal dispersion and average 67% mortality rate of juveniles. The intercolony dispersal is known to be very little. Twelve polymorphic microsatellite markers have been developed for the European Bee-eater, which will provide insight into the kin selection and the importance of emigration and immigration in the dynamics in colony size (Dasmahapatra *et al.* 2004). The oldest bird ringed in Hungary lived for at least five years. None out of the nestlings ringed in Hungary has been recovered three years after they were caught (Gyurácz 2009).

Intraspecific relationships

The European Bee-eater is typically a social bird in breeding, migration and wintering, as well. Migrating flocks can contain more than hundreds of individuals. The European Bee-eater is generally a monogamous species and most of the couples remain together throughout their lives. After the death of its pair, the surviving bird chooses a new companion. Males and females are paired according to the courtship ceremony during wintering and arrive back together to the breeding sites (Cramp 1998). The juvenile males are often paired with older females (Gyovai 1993). The proportion of males is usually higher than females in breeding colonies, so the males whose breeding attempts have failed earlier in the year become helpers and take part in fledglings care of the other couples. In Hungary, helpers occurred at one out of 8 pairs (Cramp 1998). A study carried out by Václav (2000) indicates that male helpers took part both in incubation and feeding of the chicks, and interestingly one of them deserted the pair it started to help and shared parental care at another pair. Multilocus minisatellite markers have previously been applied to estimate the connection of helpers to the breeding pair. Various aspects of the ecology role and evolutionary importance of the common European Bee-eater helpers have been discussed by Dyer and Demeter (1981), Lessels and Avery (1989), Jones *et al*. (1991), Lessels (1991), Lessels *et al*. (1994) and Václav (2000). During egg laying the male hunts for insects and gives the larger preys to the female, smaller ones consumed by itself (Avery *et al*. 1988). The European Bee-eater has a typical asynchronous hatching, but all the chicks hatch in 1-2 days. Both parents are involved in the incubation and rearing of chicks (Lessels & Avery 1989). Feeding was carried out in different times of the day by the parents. In most of the cases, they fed in the morning and at noon (Fintha 1968, Gyovai 1993, Laczik 1996). The parents fed more if they had more and older nestlings (Dyer & Demeter 1981). The adult bee-eaters rest, sunbathe and preen in small group on the branches between the two feeding.

Interspecific relationships

Besides feeding the European Bee-eater has other types of interspecific relationships, as well. It is not a popular prey item of most other animals, but it can occasionally be hunted by birds of prey and mammals. According to the Romanian monitoring of Petrescu and Adam (2001), the most common Bee-eater predators can be the following species; reptiles: Caspian Whipsnake *(Coluber caspius)*, birds: Common Kestrel *(Falco tinnunculus),* Eurasian Hobby *(Falco subbuteo),* Short-toed Snake Eagle *(Circaetus gallicus),* Booted Eagle *(Aquila pennata),* Northern Goshawk *(Accipiter gentilis),* Common Buzzard *(Buteo buteo)*, Long-eared Owl *(Asio otus),* Little Owl *(Athene noctua),* mammals: Least Weasel *(Mustela nivalis)*. The one-day-old chicks were often attacked by ground beetles (Carabidae). The Bee-eaters use three different defense modes against predators. They warn each other and other species by alarm-sound, expel the predator together or hide in tree branches.

Nosema ceranae is a Microsporidia recently described as a parasite in honeybees so the regurgitated pellets of European Bee-eaters can be fomites of infective spores (Higes *et al.* 2008).

From the louse (Phthiraptera), three species *(Brueelia apiastri*, *Meromenopon meropis*, *Meropoecus meropis)* are found on European Bee-eaters (Petrescu & Adam 2001). The lice mainly parasitise the adults and the ratio of infected chicks was substantially smaller than of the adults (Darolova *et al*. 2001). Karáth *et al.* (2013) showed that male European Bee-eaters tend to have higher intensity of *Meropoecus* infestation than females. The 2-3 mm sized *Carnus hemapterus* is a common blood sucking fly (Diptera) species that also occurs on the nestlings of European Bee-eaters, whose larvae is saprophagous and develops in the nest of birds (Petrescu & Adam 2000). Two louse flies (Hippoboscidae) species *(Ornithomyia avicularia, Pseodolychia canaren-*

sis) were showed from the European Bee-eater in Slovakia (Krištofík *et al*. 1996). A new mite species *(Acarophenax merops)* was described from the European Bee-eater (Rakha & Kandeel 1983). An internal parasitic tapeworm (Cestoda) species was found in the European Bee-eater, as well (Gyovai 1984).

The nesting-holes of the bee-eaters provide relatively good protection against nest predators and extreme weather, so the following species also utilise their nestholes for nesting: Common Kestrel, Little Owl, Common Swift *(Apus apus),* European Roller *(Coracius garrulus),* Eurasian Tree Sparrow *(Passer montanus),* House Sparrow *(Passer domesticus),* Common Starling *(Sturnus vulgaris).* In South Africa, the presence of Pied Starlings *(Spreo bicolor)* within breeding colonies provides a direct benefit to the bee-eaters because of their aggressive and successful attacks on potential nest predators. It can be a potential cost to the bee-eaters, since the starlings occupy their nesting-holes from previous seasons and occasionally oust bee-eaters from active nests (Török 1999).

Threatening factors

The national monitoring and protection project for European Bee-eater revealed the following threats for the birds and their habitat (Haraszthy 2003):

The human disturbance of breeding sites (e.g. camping, shooting, mining etc.) may prevent the settling of birds in suitable breeding places. The most common destroying method of the nests is plugging the entrance of the breeding-holes with cloth, tree branches etc., often when the parent birds are there. In such cases, the chicks always, the parents occasionally die. Sometimes people put burning sulfur sticks in the breeding-holes and the smoke also kills the birds (Nagy 2000). The breeding banks were often deliberately destroyed, however it occurs mostly due to not intentional destruction against the bee-eaters, but negligence. The nests are usually destroyed because of stripping the banks for its sand material. It also happens that sand-mines earlier used for nesting are filled with municipal waste or slurry, thereby destroying the breeding sites. The small-scale and less steep banks overgrow with vegetation in a few years and bushes grow up in front of the banks, that prevents the birds to enter or leave (Urbán *et al*. 2013). It causes the cessation of breeding sites primarily in the enclosed sand-mines. The Red Fox *(Vulpes vulpes)* and European Badger *(Meles meles)* often dig out the eggs or chiks.

The vertical banks of mines are made to slope due to recultivation of enclosed sand-mines required by law, so they become unsuitable for nesting. The most frequent factors endangering nesting include human disturbance (e.g. mining, shooting, tourism) (27-30%), weed invasion on vertical banks (24-25%) as well as the erosion-collapse of vertical banks (17-21%) in Hungary (Gyurácz *et al.* 2004, Batta & Misik 2008).

The poachers often shoot the bee-eaters to make mounted bird preparations. In recent years, it happened more frequently that bee-eaters have been found in boot of Italian hunters' cars. This is a higher risk due to its magnitude than the hunting for preparation. Birds were often became victims of road-kills. The European Bee-eaters feeding in a stopover sit somtimes fly to the cars during autumn migration.

The concentrations of pesticides used in agriculture may be high in the main preys of bee-eaters therefore the possibility of in-direct poisoning cannot be excluded. The usage of the contact insecticid can be particularly dangerous. Some bee-eater populations bred at a metal mining site were endangered by arsenic and metal stress (aluminium, cadmium, cobalt, chromium, iron) according to feather and regurgitated pellet analyses (Lopes *et al.* 2010).

Legal and practical protection

The following activities and conservation measures are necessary for the stabilisation of the current breeding population and maintenance of largest colonies (Gyurácz 1998b, Haraszthy 2003).

The breeding colonies of more than 50 pairs must be declared protected by the competent authorities. More suitable vertical banks for breeding – at least 6 meter long and 1 meter high – should be created and left untouched in the breeding seasons in sand areas by modification of the legislation for the recultivation of mines. It is necessary to regulate the installation of apiaries so that they can be far enough away from the breeding colonies and the stopover sites to avoid conflicts with beekeepers. The specially protected status of European Bee-eater should be maintained for the prevention of human destruction and disturbance.

The maintenance of loess banks is necessary and the re-growth of vegetation should be prevented. In some regions of the country, there are not enough suitable breeding banks, so the nesting of the European Bee-eaters can be supported by the creation of artificial nesting sites in these areas. The artificial banks must be established preferably in areas owned by local councils, national parks or foundations. Each year, no later than the second half of April, the bank walls should be reshaped by the removal of the disturbing roots and plants with the upper 5-10 cm layer of sand. The fresh bank surface attracts the bee-eaters, while the birds leave the old, crumbling ones (Urbán *et al.* 2013). Foxes and badgers should be kept away from the breeding colonies by the co-operation with the hunting authorities. The conservation authority should do everything in order to prevent the shooting of bee-eaters and the destruction of their nest sites. The shooting of bee-eaters and plugging of their nets-holes for any reason should be avoided by effective awareness raising activities. In order to protect the bee-eaters' nesting in freshly created banks, it is necessary to convince owners to not touch the sand- and loess bank in the breeding season, and it is facilitated by presenting them with well-illustrated information and materials.

The monitoring of the breeding population and sites that began in 1992 should be continued. The effective methods of the prevention of the damage caused by bee-eaters and alert procedures used around the apiaries need to be continued. The impact of chemical plant protection on bee-eaters is necessary to be investigated, and management of crops around breeding colonies should be performed with great care.

The destruction of bee-eater colonies and persecution of birds largely happens due to negligence, but sometimes intentional human activities also harm the species. In order to change this status quo, extensive propaganda activities and campaigns are needed to protect the bee-eaters. Specific information must be disclosed to the beekeepers, and it should be clear for them, that their licence will be suspended if they are either unwilling to co-operate or to comply with the nature conservation act. Co-operating individuals and organisations should be assisted by the possibility of positive discrimination, for example compensation, facilitating access to markets or otherwise. All ways of the media (printed, TV, radio, online) should be involved in the awareness raising activities about the European Bee-eater. The involvement of mine owners, operators, mine inspectorates, national parks, ranger officers, field officers and civilian wardens into the implementation of the practical conservation works is an important task.

The safe and non-disruptive presentation of the bee-eater breeding colonies should be ensured to the general public and the neighbourhood schools in order to better understand how we can contribute to the protection of the species.

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Nestsite characteristics of the European Bee-eater (*Merops apiaster* L.) in the Gödöllő Hills

ZOLTÁN KERÉNYI & EMÍLIA IVÓK

Zoltán Kerényi & Emília Ivók 2013. Nestsite characteristics of the European Bee-eater (*Merops apiaster* L.) in the Gödöllő Hills. – Ornis Hungarica 21(2): 23–32.

Abstract According to our surveys carried out in the Gödöllő Hills between 2009–2012, a relatively high proportion (39–57%) of the known 36–40 Bee-eater nesting sites can be found in natural habitats, on hillsides as opposed to nests excavated into man-made artificial walls. 51.8% of the nesting population breeds under such natural circumstances in loess and sandy hillsides, and the nests are excavated into the soil covered by vegetation. We have shown that 61.9% of the nests were built in loess, 28.4% in sandy and 9.7% in mixed type of substrate. Bee-eaters nesting on hillsides prefer the slopes between 11-30°. The slope of the hill is higher on loess grounds (average: 24.67°) as opposed to the sandy ones (average: 13.97°). The length of the nesting cavities differs significantly between the two substrate, those built in sandy areas being longer. The cavities in loess are deeper underground. The Bee-eaters nesting on hillsides prefer places with low vegetation cover.

Keywords: substrate, length of cavities, hillside, slope, vegetation cover

Összefoglalás A Gödöllői-dombságban 2009–2012 között végzett felméréseink szerint az ismert 36–40 költőterület közül viszonylag magas (39–57%) a természetes körülmények között, vagyis domboldalakon fészkelő gyurgyalag állományok aránya. A löszös és homokos domboldalakon a gyurgyalagok nem függőleges kiképzésű mesterséges, ember alkotta falakba, hanem növényzettel borított talajba ássák üregeiket. Ilyen körülmények között költ a dombság gyurgyalag állományának 51,8%-a. A mi munkánk középpontjában ezen fészeküregeknek a vizsgálata állt. Kimutattuk, hogy a domboldalakba vájt üregek 61,9%-a löszben, 28,4%-a homokban és 9,7%-a löszös-homokos kevert helyeken található. A domboldalba fészkelő gyurgyalagok a 11-30° lejtőszög értéktartományon belül keresnek maguknak helyet. A lejtőszög löszös talajon nagyobb (átlag: 24,67°), mint homokon (átlag: 13,97°). A kétféle alapkőzet típusba vájt üregek átlagos hossza szignifikánsan eltér egymástól, a homokba készített járatok hosszabbak. Ugyanakkor a löszbe vájt üregek a talaj felszínétől számítva mélyebben helyezkednek el. A domboldalba üreget vájó gyurgyalagok előnyben részesítik a kisebb növényzeti borítású helyeket a fészkelőhely kiválasztásakor.

Kulcsszavak: alapkőzet, járathossz, domboldal, lejtőszög, növényborítás

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Introduction

In the Carpathian Basin the European Bee-eater nests in a high diversity of nesting substrates and habitats: loess walls, bigger grooves and eroded riverbanks, hillsides on loess ground and in different types of sand and loess mines (Bankovics 1998, Gyurácz *et al.* 2004). At the end of the 19th and at the beginning of the 20th century the species was found mainly in the southern part of Hungary, usually in riverside banks, where meadows, pastures and plains with patches of woodland could be found (Chernel 1899, Herman 1908). Today the populations on riversides are declining as a consequence of disappearing banks and walls, and hence the importance of loess hillsides and sand- and clay-mines has grown. Nowadays the most important breeding sites are the not very intensively cultivated marginal zones of agricultural fields, where the mosaic of dry and semi-dry grasslands and meadows, pastures, bushes, forest fringes, vineyards, orchards, loess and sand pits show some kind of woodland steppe characters (Bagdi 2007).

In the Gödöllő Hills there are three types of substrates that are important for the Bee-eaters: sand, loess and the mixture of those. Despite this hilly area being basically a woodland steppe, where loess and sand is found in large quantity and hence offering good conditions for the Bee-eater, there are only a few publications on the distribution of the species (Szijj 1955, Papp 1980, 1984, Kertész 1991). Since 1997 data for the whole area can be found owing to the MME RTM (BirdLife MME Hungary Rare and Colonial Breeders Monitoring) program. In the 36-40 colonies regularly monitored today approximately 480-550 pairs of Bee-eaters breed (Ivók 2012).

The Bee-eater population of the Gödöllő Hills is especially important compared to the other nesting places surveyed in Hungary as the ratio of colonies with pairs between 21 and 50 is higher than in other parts of Hungary (Gyurácz *et al.* 2004). In Hungary 75–79% of the colonies can be found in places of anthropogenous origin (e.g. mines, roadsides, potholes, motocross racing tracks) and the proportion of natural colonies is only 10-11% (MME Monitoring Központ 2004). Whereas here the proportion of natural nest sites is 39–57% according to the surveys of the last years (Ivók 2010, 2012). Out of the natural nesting places the loess and sandy hillsides play the most important role, where the nesting cavities are not dig in walls but into the ground with vegetation cover. More than half (51.8%) of the population investigated breeds like that. Although this type of breeding is well-known (White *et al.* 1978, Szalczer 1981), it is very rarely studied and mentioned in the literature. Since measurements were mainly taken only in walls until now, the majority of publication is discussing those (Fintha 1968, White *et al.* 1978, Ar & Piontkewitz 1992, Gyovai 1993, Petrescu 1998, Casas-Crivillé & Valera 2005), hence we focused on the investigation of hillside breeders, besides the comparison with wall-breeding populations.

Our aims were:

(1) to quantify the ratio of nests on loess and sandy grounds,
(2) to give estimations of the vegetation cover near the nest sites in hillsides,
(3) to measure the slope of the hillside at the entrances of nesting cavities,
(4) to investigate the correlation between type of substrate and slope measured,
(5) to compare the length of cavities on loess and sand, in walls and hillsides,
(6) to find correlation between type of substrate and length of cavities,
(7) to estimate the distance of nests from the surface in loess and sand, and in walls or hillsides.

Methods

The monitoring of Bee-eaters was carried out from 2009 according to the RTM (Rare and Colonial Breeders) protocol of BirdLife Hungary (MME) (Nagy *et al.* 2008). We have documented the exposure and size of walls, the numbers of nesting cavities (used and unused).

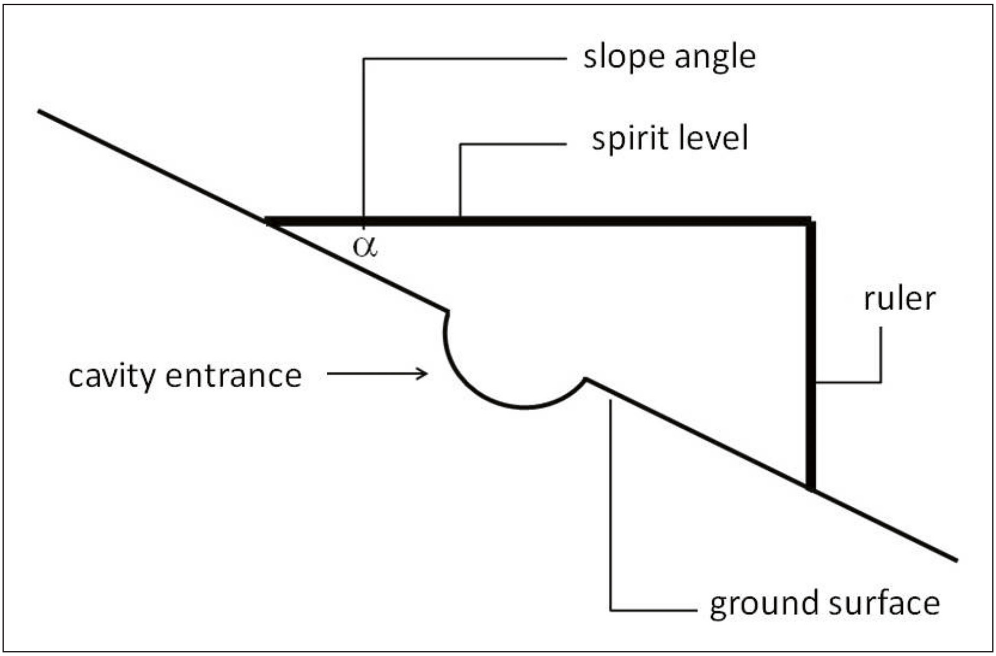

Figure 1. Sketch on the measurement of the slope inclination
1. ábra A lejtőszög mérésének vázlatos rajza

In 2011 and 2012 we measured the length of ducts leading to the nesting chamber, the distance between the entrance and the top of the wall, in hillsides the slope at the entrance and estimated the vegetation cover. In the two years we have measured 346 cavities, 96 in walls and 250 in hillsides (98 on sand and 248 on loess).

To measure the length of ducts, after the breeding season we inserted a 5 meter long measuring-tape into the cavities used in the given year. The distance from top of the wall was measured similarly. The ducts of hillside breeders were regarded as horizontal, and the distance from the surface was estimated taking into account the slope. The slopes were measured with a spirit level and a ruler, according to *Figure 1.*

Around the cavities in hillsides we estimated the vegetation cover in a 1 m^2 area using the Braun-Blanquet scale (coverage < 1%: +, 1-5%: 1, 6-25%: 2, 26-50%: 3, 51-75%: 4, 76-100%: 5) (Borhidi 2003). In case of the walls this was not possible in lack of vegetation on the vertical surfaces.

To process data and for statistical analyses we have used Microsoft Office Excel 2007 and SPSS 16.0. software (Gupta 1999, Huzsvai 2004–2011). To compare the samples t-test were applied with a preceding check of applicability (Kolmogorov-Smirnoff test). According to the results of the F-test we have chosen the appropriate t-test (Précsényi 1995). Linear regression was used to find correlation (Précsényi 1995).

Results

Most of the nesting cavities were found in loess both in the case of hillside breeders and wall breeders *(Table 1)*. 61.86% of hill-

	loess	**sand**	**mixed (sandy loess)**
hillsides (n=257)	61.86%	28.40%	9.73%
walls (n=239)	72.80%	23.43%	3.77%
total (n=496)	67.14%	26.01%	6.85%

Table 1. Distribution of nesting cavities of Bee-eaters on different types of substrate, 2012
1. táblázat A gyurgyalag üregek százalékos aránya a különböző alapkőzetekben, 2012

side nests were excavated into loess, 28.4% into sand, while the remaining 9.73 percent into mixed loess and sand. Among nests excavated into walls the ratio of those in loess is a bit higher: 72.8%, and hence only 23.43% was found in sand walls.

Based on the measurements the Bee-eaters prefer a slope of 11-30° *(Figure 2)*, 76.8% of the nesting cavities were found in this slope range. There is a difference between loess and sandy grounds in this respect: on loess the slope is significantly steeper than on sand (loess: $m = 24.67°$, $SD = 7.43$, sand: $m = 13.97°$, $SD = 4.27$, $t = 14.236$ $p < 0.01$).

The length of the ducts leading to the breeding chambers is different in wall breeders and hillside breeders, and also between sand and loess: ducts in sand are longer (walls: $p < 0.05$; hillsides: $p < 0.01$, *Table 2*). The ducts dug in hillsides are longer than those in walls (loess: $p < 0.05$, sand: $p < 0.01$, *Table 3*).

The distances of breeding chambers from the surface are not different between walls

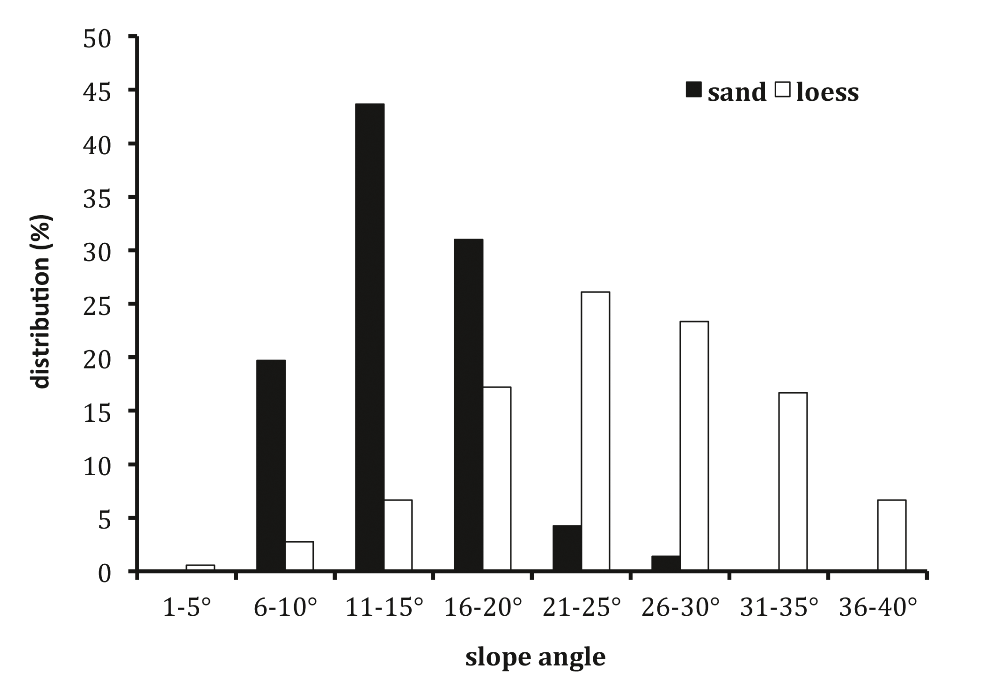

Figure 2. Distribution of the cavities according to inclination of slope, Gödöllő Hills, 2011–2012
2. ábra A gyurgyalag üregek lejtőszög szerinti megoszlása. Gödöllői-dombság, 2011–2012

	sand			loess				
	n	**m**	**SD**	**n**	**m**	**SD**	**t**	**p**
length of duct in hillsides (cm)	71	163.48	27.08	179	136.73	26.38	7.176	0.01
length of duct in walls (cm)	38	136.55	30.84	91	123.52	26.39	2.431	0.05

Table 2. Average lengths of the ducts leading to nesting chambers in hillsides and walls
2. táblázat Fészkelő üregekhez vezető járatok átlagos hossza domboldalakban és partfalakban

	hillside			wall				
	n	**m**	**SD**	**n**	**m**	**SD**	**t**	**p**
length of duct in loess (cm)	179	136.73	26.38	91	123.52	26.39	3.891	0.01
length of duct in sand (cm)	71	163.48	27.08	38	136.55	30.39	4.711	0.01

Table 3. Average lengths of the ducts leading to nesting chambers in sandy and loess grounds
3. táblázat Fészkelő üregekhez vezető járatok átlagos hossza homokos és löszös alapkőzeten

	sand			loess				
	n	**m**	**SD**	**n**	**m**	**SD**	**t**	**p**
distance of nesting chamber from surface in hillsides (cm)	71	40.81	14.39	179	62.86	22.27	–9.25	0.01
distance of nesting chamber from surface in walls (cm)	27	52.11	27.36	69	58.8	39.54	–0.81	n.s.

Table 4. Average distances of the nesting chambers from the surface in hillsides and walls, sandy and loess grounds
4. táblázat A fészkelő üregek talajfelszíntől való átlagos távolsága homokos és löszös alapkőzeten, domboldalakban és partfalakban

and hillsides (walls m = 54.94, SD = 31.10, n = 95; hillsides: m = 56.60, SD = 22.63, n = 250, t = –0.476, NS). There is no difference between ground types in the distance from the surface (in both cases cc. 50-60 cm) in walls, but in the hillside breeders the chambers in loess are deeper ($p < 0.01$, *Table 4*).

On loess the slope and length of the duct show a negative correlation: the steeper the hill, the shorter the duct ($R = 0.297$, $p < 0.01$, *Figure 3*). Such a correlation was not found on sand (R = 0.054, NS).

For Bee-eaters nesting in hillsides a lower vegetation cover could be found in the 1 m^2 area around the entrance. On sandy ground 98.5% of the pairs nest in areas with cover below 25% and 99.9% below 50%. On loess ground this numbers are 43.5% and 71.3%, respectively. Together 60% of pairs prefer coverage lower than 25% and 80% that of 50% *(Figure 4)*.

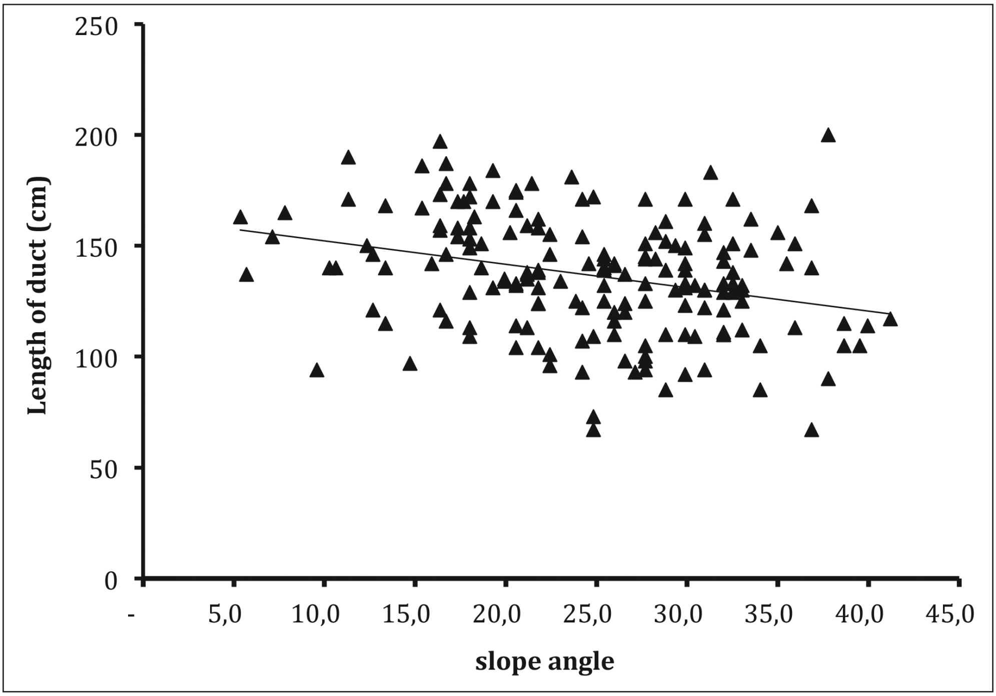

Figure 3. Correlation between length of the duct and slope of the hillside on loess ($y=-1,0555x+162,77$; $R=0,297$; $p < 0.01$)

3. ábra Kapcsolat az üreg hossza és a löszös domboldal meredeksége között (az egyenes egyenlete: $y=-1,0555x+162,77$; $R=0,297$; $p < 0.01$)

Discussion

Bee-eaters prefer to nest in loess. The distribution of the European populations shows significant overlaps with the loess surfaces (Smalley *et al.* 2013). Based on the soil samples taken from the vicinity of nesting cavities water permeability is an important factor in the choice of nesting places. This value is 164.7±89.6 kPa for – the soils of Bee-eater nest locations (Heneberg 2009). In the preferred areas of the species the average diameter of soil granules is 42.763±13.58 µm (min. 20.10 µm, max. 66.82 µm). Bee-eaters favour soils with particle size between 20 and 70 µm (Heneberg & Šimeček 2004). This size is the dominant fraction of a typical loess (Smalley & Leach 1978). In the Gödöllő Hills Bee-eaters prefer loess just like in other parts of their area, e.g. Romania (Petrescu 1998), Serbia (Purger 2001) or the Czech Republik (Heneberg & Šimeček 2004).

Nesting in cavities as opposed to open nests might be advantageous, because the nest cavity offers protection against predators and from harsh weather conditions (Birchard *et al.* 1984, Ar & Piontkewitz 1992), and minimise the stress caused by temperature fluctuations in the period of brooding and chick hatching (White *et al.* 1978). The birds have to optimise the length of the duct and the depth from the surface. Nest predators have more difficulties with detecting and excavating the deeper cavities, but on the other hand the ventilation, the diffu-

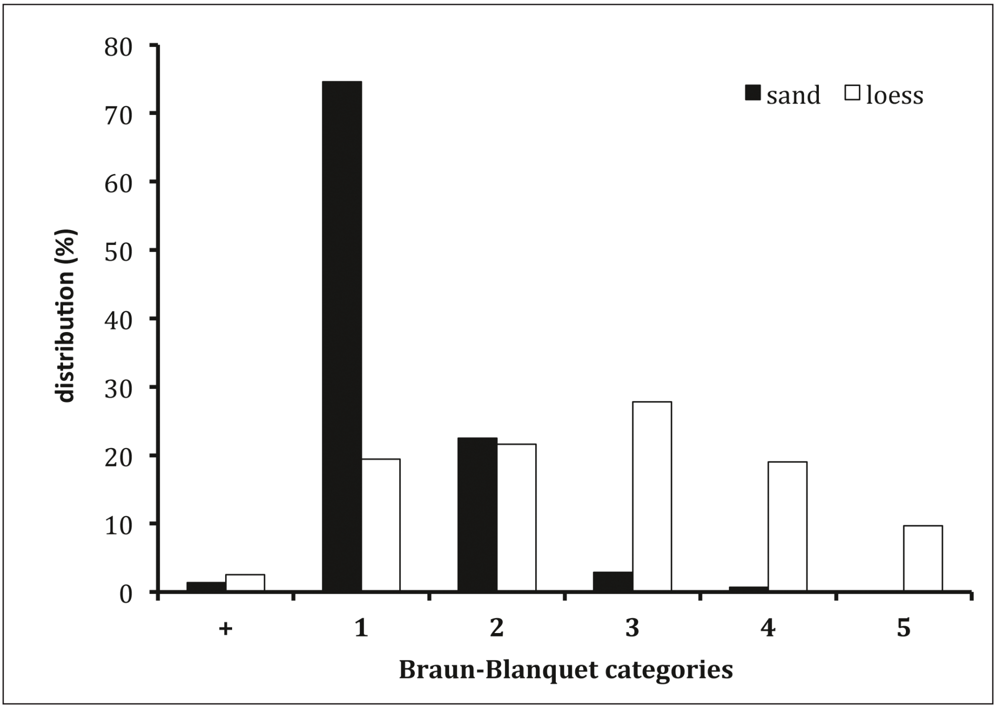

Figure 4. Distribution of Bee-eater cavities according to vegetation coverage, Gödöllő Hills, 2011–2012 (based on the Braun-Blanquet scale: coverage < 1%: +; 1-5%: 1; 6-25%: 2; 26-50%: 3; 51-75%: 4; 76-100%: 5)

4. ábra A gyurgyalag üregek eloszlása a növényzet borítása függvényében. Gödöllői-dombság, 2011–2012 (A Braun-Blanquet skála szerint +: a növényzet a mintaterület < 1%-át, 1: a mintaterület 1-5%-át, 2: 6-25%-át, 3: 26-50%-át, 4: 51-75%-át, 5: 76-100%-át borítja)

sion of oxygen and carbon dioxide is important, too (White *et al.* 1978). Besides protection from predators it is important, how far the nesting chamber is from the entrance and from the surface is.

On different climates the length of ducts was different in the loess walls. A precise comparison is impossible because of the differences in the data presented (mean, minimum-maximum, both). The average length in Israel is 180 ± 21.7 cm (Ar & Piontkewitz 1992), in southern Romania 112 cm (min. 90, max. 143 cm) (Petrescu 1998), in south-eastern Spain 142.8 cm ± 9.9 cm (Casas-Crivillé & Valera 2005). According to former studies this value is 70-120 cm in Hungary (Fintha 1968), but it can reach up to 180-200 cm (Bankovics 1998). The harness of the soil might strongly affect the length of the duct: in a study carried out around Hódmezővásárhely, Hungary in a sand excavation pit, the ducts were 29 cm shorter in hard sand, than in soft sand (Gyovai 1993). The lengths of the ducts were different in the Gödöllő Hills between loess and sand, this result is in concordance with the literature.

The average distance of cavities from the surface was 50 cm (Ar & Piontkewitz 1992), and 40-100 cm (Petrescu 1998) in case of walls. In the Gödöllő Hills the distances showed similar values, both in hillsides and walls or sand and loess. When the birds were breeding on hillsides the breeding chamber was located deeper in loess, than is sand.

Our results suggest that booth the type of substrate and the slope of the hillside have an effect on the length of the ducts leading to the nesting chambers. In walls, where the ducts are more or less perpendicular to the wall surface and parallel with the soil surface above the bank, the length of the duct depends on the type of substrate: in loess, which is harder and consisting of smaller granules, it is shorter. In birds breeding in hillsides the slope has an important effect: the Bee-eaters dig until they reach cc. 40-60 cm depth from the surface, which is a similar value to that measured in birds nesting in walls. As Bee-eaters in the Gödöllő Hills breeding in sandy areas choose less steep slopes, than those breeding in loess area, the ducts are accordingly longer, so that the nesting chambers are in an appropriate depth from the soil surface. This depth is important as a defence against predators and it has implications connected to the microclimate and ventilation ability of the chamber.

Bee-eaters prefer surfaces with a low vegetation cover. This preference could be connected to the differences in water retention and permeability of the soils formed on sand and loess. On sand, where the water flows through quickly (sandy plains and pastures), the vegetation is not that dense, as on loess soils with a better water retention (loess plains). Therefore Bee-eaters find lower vegetation coverage on sand, but at the same time nearly ¾ of them prefer a cover under 50% even on loess.

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Louse (Insecta: Phthiraptera) infestations of European Bee-eaters (*Merops apiaster* Linnaeus, 1758) at Albertirsa, Hungary

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Kata Karáth, Tibor István Fuisz & Zoltán Vas 2013. Louse (Insecta: Phthiraptera) infestations of European Bee-eaters (*Merops apiaster* Linnaeus, 1758) at Albertirsa, Hungary. – Ornis Hungarica 21(2): 33–37.

Abstract Colonial breeding birds such as the European Bee-eater *(Merops apiaster),* are perfectly suited for ectoparasitological studies, as their elaborate social life and frequent body-to-body contacts induce high prevalence of louse (Phthiraptera) infestations. In this study we investigated a large breeding colony at Albertirsa, Hungary, and measured the louse burden of the breeding population. With more than 200 pairs nesting in the loess wall there, it may be Hungary's largest colony of European Bee-eaters. We sampled breeding birds and compared their louse burdens between age groups and sexes. We report the prevalence, mean and median intensity of infestations of the three louse species harboured by the Bee-eaters, and the results of louse burden comparisons between age groups and sexes.

Keywords: ectoparasite, lice, parasitism, preening

Összefoglalás A koloniális fészkelésű madarak, mint a gyurgyalag *(Merops apiaster)* különösen alkalmasak ektoparazitológiai kutatásokra, köszönhetően az összetett szociális viselkedésükből adódó gyakori testi érintkezések miatt fellépő magas fertőzöttségi aránynak. Vizsgálatunk során felmértük az Albertirsán (Pest megye, Magyarország) található kolónia tolltetű (Phthiraptera) fertőzöttségét. Ez a kolónia több mint 200 fészkelő párral valószínűleg Magyarország legnagyobb gyurgyalagtelepe. Jelen dolgozatban közöljük a különböző gyurgyalag kor- és ivarcsoportok fertőzöttségi mérőszámait mindhárom, a gyurgyalagot fertőző tetűfaj esetében, illetve a kor- és ivarcsoportok fertőzöttségének összehasonlítása során kapott eredményeket.

Kulcsszavak: ektoparazita, tetű, élősködés, tollászkodás

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Introduction

The European Bee-eater *(Merops apiaster)* is a suitable candidate for ectoparasitological research as their elaborate social life and frequent body-to-body contacts of the host specimens induce high prevalence of louse (Phthiraptera) infestations (Hoi *et al*. 1998). Representatives of both of the suborders of lice (Insecta: Phthiraptera) (2 species of 2 genera from the Ischnocera suborder, and 1 species of 1 genera from the Amblycera suborder) are harboured by the European Bee-eater (Price *et al.* 2003). Hence, the differences between the infestation levels and dispersion strategies of the members of the two markedly different louse taxa can also be examined.

Lice are wingless obligate ectoparasites living on the body surface of their hosts, feeding on the feathers and dead skin parts. They typically require direct physical contact between the host individuals for transmission (Price *et al.* 2003, Rózsa 2003). Lice affect both life expectancy and reproductive success of the hosts. The feather damage and reduced insulation caused by lice may cause higher mortality rates in infested hosts as it was shown in several bird species (Booth *et al.* 1993, Kose & Møller 1999, Barbosa *et al.* 2003, Pap *et al.* 2005). Additionally, the theory of parasite-mediated sexual selection argues that females directly (evading infestation) and indirectly (securing parasite-resistant alleles for their offsprings) benefit from avoiding infested mates (Hamilton & Zuk 1982, Clayton 1991, Able 1996, Pap *et al.* 2005).

The aim of our study was to survey the feather louse burden of European Bee-eaters in a large colony at Albertirsa, Hungary. We investigated the prevalence, mean and median intensity of infestation of each host-specific louse species of the European Bee-eaters, and compared them between the age groups and sexes of the hosts.

Materials and methods

The study site is located at Albertirsa at a loess wall and the field work was carried out in the breeding season (July-August) in 2012. The history of this colony – which is most probably the largest one in Hungary with more than 200 breeding pairs – is reported by Urbán *et al.* (2013).

European Bee-eaters were captured with mist nets at the breeding site. Sexes and two age groups (2y: 2nd calendar year or 2+: at least 3rd calendar year) of the hosts were identified (Baker 1993). During the ringing procedure the standard condition scores and the following biometric measurements were recorded: 3rd primary's length, wing length, tale length (according to Svensson 1995). We used the standard method of ectoparasitological sampling (Johnson & Clayton 2003, Rózsa 2003). We handled the birds' plumage with pyrethrin powder which is harmless to warm-blooded vertebrates (used and marketed drug in veterinary practise for pet birds), and then with a forceps we moved through gently the birds' plumage above a white tray for a standard 5 minutes time. Louse sampling preceded the measurements as recommended by Vas and Fuisz (2010) to avoid louse loss due to the handling of the host during the ringing procedure. Louse specimens were collected per hosts into an Eppendorf tube containing 70% ethanol. The identification of lice was carried out by the last author in the Hungarian Natural History Museum using a stereoscopic microscope.

Statistical analyses were carried out with Quantitative Parasitology 3.0 (Reiczigel & Rózsa 2005). Prevalences were compared with *Fisher's exact test*, mean intensities with *bootstrap-t test*, and median intensities with *Mood's median test* (Rózsa *et al.* 2000, Rózsa 2003, 2005). All reported *P*-values are two-tailed. The aggregation of louse distribution among host individuals was estimated by the ratio of variance of abundance and mean abundance. Values below 8 indicate aggregated distribution (Rózsa 2003).

Results and discussion

Presence of all the three host-specific louse species of the European Bee-eaters was detected in our samples: *Brueelia apiastri*

	Males (*N*=38)	**Females** (*N*=28)	**2y** (*N*=32)	**2+** (*N*=34)
Brueelia prevalence	0.71	0.86	0.78	0.76
Meropoecus prevalence	0.95	0.89	0.90	0.94
Meromenopon prevalence	0.026	0.14	0.031	0.12
Brueelia mean intensity	2.96	3.92	3.88	2.96
Meropoecus mean intensity	7.75	4.20	7.34	5.34
Meromenopon mean intensity	1.00	1.00	1.00	1.00
Brueelia median intensity	2.00	3.00	4.00	2.00
Meropoecus median intensity	6.50	4.00	6.00	4.00
Meromenopon median intensity	1.00	1.00	1.00	1.00
Brueelia aggregation ratio	2.33	3.120	2.22	3.62
Meropoecus aggregation ratio	4.14	2.07	4.26	3.73
Meromenopon aggregation ratio	1.00	0.89	1.00	0.91

Table 1. Descriptive statistics of louse infestation measures in the hosts' age groups and sexes (host age: 2y: 2nd calendar year, 2+: 3rd calendar year or more)

1. táblázat Fertőzöttségi mérőszámok a gazdamadarak kor- és ivarcsoportjaiban (gazdamadarak kora: 2y: 2. naptári év, 2+: legalább 3. naptári év)

(Denny, 1842)*,* *Meropoecus meropis* (Denny, 1842) (both Ischnoceran species), and *Meromenopon meropis* (Clay & Meinertzhagen 1941) (Amblycera). Hereafter we refer to these species by mentioning only their generic name. Firstly we calculated the descriptive statistics of louse infestation measures of each species for the whole host sample ($N = 66$). Prevalence was 0.76 in the case of *Brueelia*, 0.91 in the case of *Meropoecus*, and 0.07 in the case of *Meromenopon*; mean intensity was 3.42, 6.21, and 1.00, respectively; and median intensity was 3.0, 5.0, and 1.0, respectively. Their aggregation ratios were 2.84, 4.21 and 0.94, respectively. The measures of louse infestation in the age groups and sexes of the hosts are reported in *Table 1*. In general, the prevalences, mean and median intensities of *Brueelia* and *Meropoecus* were relatively high as it was expected by former results of Hoi *et al.* (1998) and Darolova *et al.* (2001). *Meromenopon* was found to be a much rarer ectoparasite of the European Bee-eater. The distributions of each louse species among host individuals were aggregated *(Table 1)*, as expected from contagious parasites (Crofton 1971).

We compared the *Brueelia* and *Meropoecus* louse burden between hosts' age groups and sexes. The sample size of the rare *Meromenopon* did not allow meaningful comparisons. We found no significant difference between the prevalences in either case ($P > 0.05$); however, the mean and median intensity of *Meropoecus* infestation were significantly higher on males than on females ($P = 0.001$, and $P = 0.035$, respectively, *Table 1*). A marginally significant difference ($P = 0.045$) was also found in the case of *Brueelia* median intensity between younger and older birds, as 2y birds were characterised by a higher median intensity of infestation than 2+ birds *(Table 1)*. However, given the marginally significant *P*-value of this latter result, this phenomenon has to be confirmed on a larger dataset before discussing its potential causes.

Our results showed that male European Bee-eaters tend to have higher intensity of *Meropoecus* infestation than females. We discuss some alternative, mutually non-exclusive alternative hypotheses explaining this phenomenon. *Meropoecus* lice live on the head and neck of the hosts, hence can not be removed by self-preening. European Bee-eaters have a biased sex ratio as about 60% of the adults are males (58% in our sample), consequently, some males can not mate and may act as helpers at other breeding pairs (Cramp 1985). Pairs are known to preen each others' head and neck to control the louse infestation (Rózsa 2005), and the lack of this possibility in the unpaired males may be responsible for the higher intensity of infestation. The more frequent bodily contacts of males (e.g. fights) may also affect the results. On the other hand, it is also possible that females experience a louse loss during the breeding season by louse transmission to the chicks. This latter hypothesis requires further research about louse transmission strategies.

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Photographic survey of the prey-choice of European Bee-eaters (*Merops apiaster* Linnaeus, 1758) in Hungary at three colonies

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Tibor István Fuisz, Zoltán Vas, Katalin Túri & Ádám Kőrösi 2013. Photographic survey of the prey-choice of European Bee-eaters (*Merops apiaster* Linnaeus, 1758) in Hungary at three colonies. – Ornis Hungarica 21(2): 38–46.

Abstract Prey choice of European Bee-eaters was monitored via taking pictures of parent birds carrying prey items to their perches in front of the nests between 2011 and 2013 at three colonies in Hungary: at Pócsmegyer, Nagykarácsony and Albertirsa. All the colonies were studied in the breeding season, and prey items were identified from the digital images taken of adults carrying food for their chicks. During the three years 25 days were spent with collecting photographic data, and from the thousands of pictures taken 805 were suitable for analysis. On 775 photographs the prey item was identified at least to order level. Combining data from all the colonies hymenopterans were by far the most often consumed insects (50%), followed by dragonflies (17%), while beetles, orthopterans, lepidopterans and dipterans each contributed approximately 7-9% of the consumed prey. Prey composition showed marked differences between the individual colonies, although the ratio of hymenopterans was everywhere high. Bee-eaters at Pócsmegyer, probably due to the abundance of aquatic habitats nearby on the Danube shore, consumed almost as much dragonflies as hymenopterans, and ate very few orthopterans. While at the Albertirsa colony, surrounded by agricultural fields and meadows in a more arid environment, hymenopterans dominated the prey, and orthopterans were almost as often consumed as dragonflies. Lepidopterans constituted approximately 8% of Bee-eaters' diet in all colonies. From an insect ecological viewpoint, our study provides valuable data on the species pool that might be at risk of predation by Bee-eaters, and enables us to roughly estimate the predation pressure on some taxa, and in certain cases even on species by these birds.

Keywords: prey composition, photographic record, habitat dependence

Összefoglalás A gyurgyalagok táplálékösszetételét a fészek előtt álló beülő fákhoz szállított táplálék fotózásával elemeztük 2011–2013 között három magyarországi gyurgyalag telepen: Albertirsa, Pócsmegyer és Nagykarácsony határában. Valamennyi kolóniánál a költési időszakban, elsősorban fiókanevelési időszakban végeztük a vizsgálatokat, és a hordott rovarokat a digitális képek alapján határoztuk meg. A három év alatt 25 alkalommal végeztünk adatgyűjtést, és a több ezer készített felvételből 805 bizonyult elemzésre alkalmasnak. 775 képen a hozott táplálék azonosítása legalább rend szintig lehetséges volt. A három kolónia összesített eredményei alapján a hártyásszárnyúak (50%) és szitakötők (17%) voltak a leggyakrabban fogyasztott rovarok, míg a bogarak, egyenesszárnyúak, lepkék és kétszárnyúak egyenként nagyjából a táplálék 7-9%-át tették ki. Ugyan az egyes kolóniákon mindenütt a hártyásszárnyúak voltak a leggyakrabban fogyasztott rovarok, határozott különbségeket észleltünk a többi fogyasztott rovar részarányában. A pócsmegyeri kolónia táplálékában, feltehetőleg a közeli Duna ártéren található vízi élőhelyeknek köszönhetően, csaknem ugyanolyan arányban képviseltettek a szitakötők, mint a hártyásszárnyúak, míg az egyenesszárnyúakat meglepően alacsony arányban fogyasztották. A szárazabb környezetben található, mezőgazdasági művelésbe vont területekkel és rétekkel körülvett albertirsai telep esetében a hártyásszárnyúak alkották a táplálék felét, a szitakötők, egyenesszárnyúak és kétszárnyúak hasonló arányban szerepeltek a táplálékban. A lepkék megközelítőleg 8%-át tették ki a gyurgyalagok táplálékának mindhárom kolóniában. A tanulmány rovarökológiai szempontból értékes adatokat nyújt arra nézve, hogy mely rovarfajok szerepelnek a gyurgyalagok táplálékában, továbbá durva becsléseket tehetünk az egyes taxonokat, illetve szerencsés esetben egyes fajokat sújtó predációs nyomásra.

Kulcsszavak: táplálék összetétel, fotográfiai adatgyűjtés, élőhelyi meghatározottság

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Introduction

As their name suggests Bee-eaters are well-known predators of hymenopterans, furthermore they are expertly hunting flying insects on the wing gregariously (Snow & Perrins 1998). Most often they locate prey in the air, but also hunt around their nesting holes in a sit-and-wait manner, observing their surroundings from a perch and chasing the prey in the air, or snatching it from the surface of the vegetation. Even the best fliers among insects, such as dragonflies, are chased and captured with amazing efficiency (Fintha 1968). Although any flying insect is targeted, the speciality of Bee-eaters is the handling of stinging prey like bees and wasps (Snow & Perrins 1998). They kill their prey by knocking them against tree branches, and hence birds arriving to the colony with prey are often detected easiest by the knocking noise as they exterminate the captured arthropods. Bee-eaters can remove the sting of wasps and bees by squeezing the abdomen of the insect with their beak and rubbing it against branches. Hence Bee-eaters can exploit a food source neglected or avoided by other insectivorous birds.

In our study we tried to observe the sort of food Bee-eaters carry for their young at three colonies in three breeding seasons, and whether they live up to their reputation by consuming a higher ratio of hymenopterans. Also, as we observed three colonies we tried to establish whether habitat characteristics around the colonies influence the prey composition of Bee-eaters.

Study Areas and Methods

We started to study Bee-eaters in 2011 in order to survey their ectoparasite load and study the dispersion strategies of different feather louse taxa (see Karáth *et al.* 2013). We tried to ring and sample adult birds before females were forming eggs, and the second peak of ringing activities followed when the chicks hatched, and still flew around in the breeding colonies. Hence, we do not have a good temporal representation of prey choice for the whole nesting period. Parallel with the ectoparasite sampling and ringing, the prey items carried to the nesting holes were photographed.

We studied three Bee-eater colonies: in 2011 at Pócsmegyer in the Szentendrei Island (on four occasions in July), and in Nagykarácsony (once 17th July 2011) in the Mezőföld area of the central part of Hungary. In 2012 the Pócsmegyer colony was sampled again (on five occasions in June and July), and we started to work at the Albertirsa colony (see Urbán *et al.* 2013) located at the boundary of the Gödöllő Hills and the Great Hungarian Plain. We photographed birds bringing prey on 8 days in July and August 2012. In 2013 we worked only at the Albertirsa colony (5 days from June to August). *Table 1.* summarises the dates when the colonies were visited and how many prey items were identified from the taken pictures.

The Pócsmegyer colony is located in an abandoned sand pit, and approximately 30 pairs of Bee-eaters breed in the 40 metres long, 2-4 meter high wall. The colony is surrounded by meadows, sparse locust

Year	Locality	Date	Number of prey items identified
2011	Nagykarácsony	2011.07.19.	66
	Nagykarácsony total		66
	Pócsmegyer	2011.07.05.	24
		2011.07.10.	3
		2011.07.17.	34
		2011.07.27.	23
	Pócsmegyer total		84
2011 total			150
2012	Albertirsa	2012.07.01.	23
		2012.07.04.	28
		2012.07.05.	1
		2012.07.12.	91
		2012.07.14.	24
		2012.07.18.	186
		2012.08.02.	64
		2012.08.05.	35
	Albertirsa total		452
	Pócsmegyer	2012.06.22.	5
		2012.06.24.	24
		2012.06.27.	1
		2012.06.28.	9
		2012.07.14.	45
	Pócsmegyer total		84
2012 total			536
2013	Albertirsa	2013.06.02.	5
		2013.06.19.	11
		2013.07.13.	41
		2013.07.31.	17
		2013.08.07.	45
	Albertirsa total		119
Grand total			805

Table 1. Dates and sites of Bee-eater prey surveys, and number of observed prey-items

1. táblázat A gyurgyalagok táplálékelemzésének helyszínei, dátumai és a zsákmányolt rovarok mennyisége tree stands, and is located near the Danube. Some Poplar (*Populus* sp.) and Black Locust *(Robinia pseudoacacia)* trees and Hawthorn *(Crataegus monogyna)* bushes grow near the sand wall, and birds bringing food land on these perches offering an opportunity to photograph the brought prey. The Nagykarácsony colony is an approximately 10-12 meter high and 40 meters long loess wall, and we estimated around a 50 pairs of Bee-eaters breed there. The colony is surrounded with pastures extensively grazed by Cattle *(Bos primigenius taurus)*. Above the loess wall a wheat field and a dry meadow is situated with black locust trees, hawthorn and Dog Rose *(Rosa canina)* bushes, and many Bee-eaters perched here before returning to the nests with prey. This site provided an opportunity to place our hide and photograph Bee-eaters with the captured insects. The Albertirsa colony is the largest among the three, with approximately 250-300 Bee-eater pairs. Dry Black Locust trees artificially dig 10-15 metres in front of the wall offer perches for the breeding pairs, and allowed the first author to photograph the prey carried for the young.

Prey items carried to the nesting holes were photographed from a hide erected approximately 10 metres from the perches of bee-eaters. In all of the studied colonies near the nest holes there were perches for the birds, and they often engaged in social activities, courtship feeding, transferring food to their mate to feed the chicks. Two camera bodies were used for taking pictures: a Nikon D7100 and a Nikon D200, and pictures were taken from a Manfrotto tripod with a fluid head to avoid camera shake with a 500 mm / 4P Nikkor manual focus tele-photo lens. For birds that were landing outside the scope of the large lens a hand-held camera with an attached 100-400 mm / 3.5-5.6 Sigma Apo macro zoom lens was applied. Of every bird carrying food more picture were taken in order to get views from many angles on the prey items. From the same bird and same prey only one image was entered into the prey composition survey.

The digital images were stored according date and location from each session, and then identified to the best possible taxonomic resolution. As sampling effort was not even between years and locations statistical tests were not carried out, only descriptive comparisons are made and we intend to provide a list of consumed prey for reference for other researchers.

Results

The combined results of the three years observation revealed that Bee-eaters consume hymenopterans in large quantities *(Figure 1)*, half of the prey delivered to the nests belonged to this order. Within hymenopterans the Apidae family was the most numerous, especially bumblebees (*Bombus* spp.) and Western Honey Bee *(Apis mellifera)* dominated (see Appendix). Dragonflies (Odonata) were also frequently consumed, they constituted almost a fifth of the prey, while dipterans, orthopterans, lepidopterans and coleopterans were consumed in similar quantities around 7-9% each. Among orthopterans *Calliptamus* species were most often hunted.

Table 2. gives the proportions of each insect orders at the locations, combined for the sum of all observations. The percentage of consumed insects is quite similar at Albertirsa and Nagykarácsony, the dominance of hymenopterans is evident, they constitute around half of the all consumed prey. At both locations they are followed by dragonflies, but interestingly at the Nagykarácsony site, where the colony is surrounded

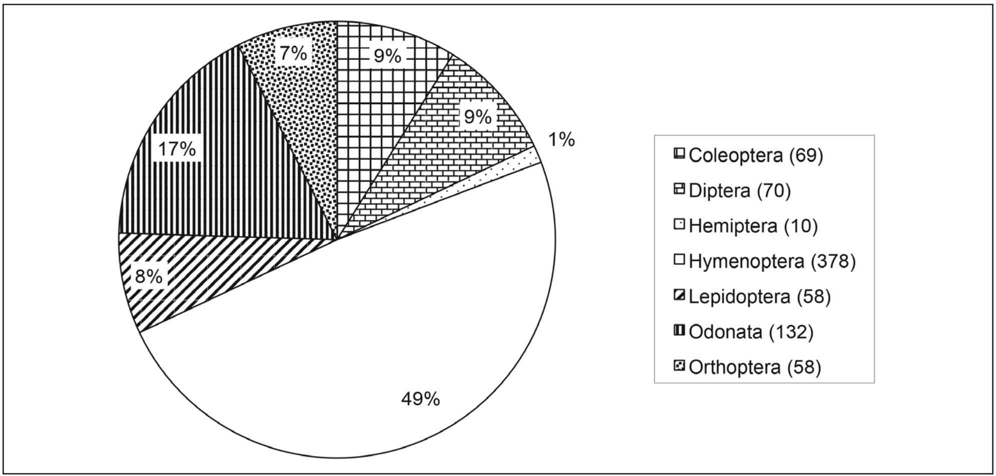

Figure 1. The composition of European Bee-eater prey summed for the three years of the study at the three colonies

1. ábra A gyurgyalagok táplálékösszetétele összesítve a három vizsgált kolóniára és a vizsgálat teljes időtartamára

Colonies / Prey Orders	Coleoptera	Diptera	Hemiptera	Hymenoptera	Lepidoptera	Odonata	Orthoptera	Not identified	Total number
Albertirsa	5%	10%	2%	50%	7%	13%	10%	4%	571
Nagykarácsony	24%	2%	0%	48%	8%	15%	0%	3%	66
Pócsmegyer	15%	6%	0%	35%	8%	29%	2%	5%	168
Total number	69	70	10	378	58	132	58	30	805

Table 2. The proportions of insect orders at the three colonies, summed for all the observation sessions

2. táblázat Az egyes rovarrendek százalékaránya a három kolónián, összegezve az összes mintavételi alkalomra

by a pasture grazed by cattle, we did not observe orthopterans among the captured prey items. At Nagykarácsony high quantity of coleopterans was consumed, but as this colony was observed only for a single day, we can not assess whether they are consumed in high quantities in the whole nesting period. Furthermore, all the possibly identified specimens belonged to the Scarabaeidae family (e.g. *Cetonia* sp.), it might have been a gradation that time.

The comparison of the Albertirsa and Pócsmegyer colonies is more interesting, as both location were sampled for two years and on many occasions. At the Pócsmegyer colony hymenopterans only gave one third of the prey, and dragonflies were consumed in similar quantity, which was unparalleled at the other colonies. But at the Pócsmegyer colony orthopterans were consumed very seldom. At the Albertirsa colony, on the other hand, orthopterans and dipterans

Colonies / Prey Orders	Coleoptera	Diptera	Hemiptera	Hymenoptera	Lepidoptera	Odonata	Orthoptera	Not identified	Total
Pócsmegyer 2011	19%	6%	0%	45%	5%	19%	4%	2%	84
Pócsmegyer 2012	12%	6%	0%	24%	12%	39%	0%	7%	84
Albertirsa 2012	4%	8%	1%	51%	7%	13%	12%	4%	452
Albertirsa 2013	6%	20%	3%	50%	5%	13%	2%	1%	119

Table 3. The comparison of proportions of insect orders at Albertirsa and Pócsmegyer between years
3. táblázat Az egyes rovarrendek százalékarányának összehasonlítása az albertirsai és pócsmegyeri telepeken az évek között

constituted a similar ratio of prey as dragonflies, all around 10%.

The yearly representation of prey composition *(Table 3)* reveals that at Pócsmegyer the amount of hymenopterans in the prey decreased considerably from 2011 to 2012, while the amount of dragonflies doubled. On the other hand, at Albertirsa the proportions of hymenoptrans and dragonflies were stable between 2012 and 2013. Considerable difference was detected in the frequency of consumed dipterans: compared to 2012 in 2013 their ratio doubled, while that of orthopterans decreased very markedly.

We show the 5 most frequently consumed order at the Albertirsa colony in 2012, in the year when we performed the most observations *(Figure 2)*. It clearly indicates the dominance of hymenopterans through the whole breeding season, and the representation of dragonflies was quite even, and showed a peak on the 18th July. Orthopterans were more often preyed upon from the middle of July, and also peaked on 18th July. Interestingly the representation of lepidopterans increased towards the end of the breeding season.

Discussion

Bee-eaters in our study lived up to their reputation as being predators of bees and wasps. We found that similarly to many studies car-

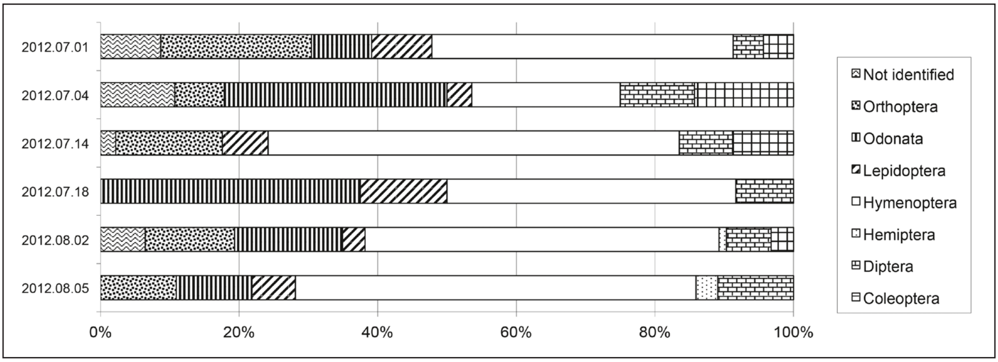

Figure 2. Temporal pattern of prey composition at the Albertirsa colony in 2012
2. ábra Az albertirsai gyurgyalag kolónián hordott táplálék időbeni mintázata 2012-ben

ried out in Hungary (Fintha 1968, Gyovai 1993, Laczik 1996), mainly hymenopterans, and members of the Apidae family, predominantly bumblebees (*Bombus* sp.) and Western Honey Bee *(Apis mellifera)* give the bulk of their prey. Similarly, Fintha (1968) found that based on the analysis of a dozen pellets collected around blooming alfalfa fields and aquatic habitats on the11th July, 1960 around two third of their prey was hymenopterans. On a later sampling on the 2nd August, 1962 he found 70% of the prey belonged to bumblebees, and he explained it by the fact that the plants on the riverbank were blooming and hence attracted a lot of hymenopterans. He also noted that preying on Honey Bees was seldom observed, and happened only on cool, cloudy days, when flight activity of other insects was very low. Although it might be true, their damage might be more serious as stingless drones are selected as prey especially for feeding nestlings (Matousek 1951, Galeotti & Inglisa 2001). Gyovai (1993) also emphasised the dominance of nectar feeding insects, and showed that almost 80% of their prey were hymenopterans. Their opportunistic prey selection was shown by Rékási and Haraszthy (2005), who found analysing pellets from a small colony situated in the great Hungarian Plain at Nagyiván, that one third of their prey was hemipterans, a very seldom hunted prey-type in our study. Laczik (1996) also emphasised that the ratio of Honey Bees in their diet was influenced by the distance of apiaries from the colony. This view is also supported by Costa (1991), who also found that food composition of the feeding birds near and further an apiary mirrors the availability of Honey Bees. Fry's (1983) study also demonstrated that European Bee-eaters prey mostly on those insects that are most available in their surrounding in a given time period. Swift's (1959) study carried out in South France also showed that hymenopterans are the most important prey, followed by dragonflies, coleopterans, lepidopterans, dipterans and orthopterans. He concluded that the prey composition of Bee-eaters reflects the seasonal changes in the availability of flying insects. Three European studies on large samples of pellets showed that well above 60% representation and sometimes even the absolute dominance of hymnopterans. For example Austria: 83% (Ursprung 1979), Denmark: 59% in June then increasing to 91% in August (Larsen 1949), Spain 69% (Herrera & Ramirez 1974), and only the remaining small fraction was composed of coleopterans, dragonflies, orthopterans and lepidopterans, hemipterans dipterans. Our results showed a very similar composition with a dominance of hymenopterans in all colonies. The outstanding representation of dragonflies in 2012 in the food of Bee-eaters in the Pócsmegyer colony probably reflects the influence of nearby aquatic habitats. Likewise, the high ratio of dipterans in 2013 and orthopterans in 2012 in Albertirsa might reflect a local and temporal abundance of these insects.

Birds are widely acknowledged important predators of several insect taxa, for example adult butterflies, although hardly any field studies could demonstrate the degree of bird predation pressure on them, especially at a species level (Shreeve *et al.* 2009). Our study shows that Bee-eaters can occasionally predate on large-bodied papilionids and nymphalids, as well as day-flying moths (mainly noctuids and sphingids), dragonflies and bumblebees. Regarding our relatively short sampling periods, we suggest that predation by Bee-eaters may imply a significant component of adult mortality in some large-bodied butterflies. We found that Bee-eaters occasionally predated on butterflies having deflective properties on their wings.

For example, papilionid species with wing tails *(Papilio machaon*, *Iphiclides podalirius)* and nymphalids having eyespots *(Apatura ilia*, *Inachis io*, *Maniola jurtina)* were equally present on the prey list. Therefore deflective properties of butterfly wings do not seem to effectively prevent Bee-eaters from predating on butterflies (see also Dennis *et al.* 1986, Brakefield *et al.* 1992, Lyytinen *et al*. 2003, Stevens *et al.* 2008). However, further experimental testing is inevitable. Further studies would be clearly necessary in this issue. We suppose that body size of butterflies, as an important determinant of their profitability as preys, influences whether certain species are predated by Bee-eaters or not.

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Appendix

Order	Family	Species	N
Coleoptera			36
Coleoptera	Scarabaeidae	*Cetonia* sp.	13
Coleoptera	Scarabaeidae	*Cetonia aurata*	5
Coleoptera	Scarabaeidae	*Melolontha* sp.	15
Diptera			50
Diptera	Asilidae		3
Diptera	Syrphidae	*Eristalis tenax*	1
Diptera	Tabanidae		13
Diptera	Tabanidae	*Tabanus bovinus*	3
Hemiptera			7
Hemiptera	Pentatomidae	*Palomena viridissima*	3
Hymenoptera			5
Hymenoptera	Apoidea		58
Hymenoptera	Apidae	*Apis mellifera*	34
Hymenoptera	Apidae	*Bombus* sp.	228
Hymenoptera	Apidae	*Xylocopa* sp.	25
Hymenoptera	Crabronidae	*Cerceris* sp.	1
Hymenoptera	Siricidae		1
Hymenoptera	Siricidae	*Sirex* sp.	1
Hymenoptera	Siricidae	*Urocerus gigas*	1
Hymenoptera	Vespidae		12
Hymenoptera	Vespidae	*Eumenes* sp.	1
Hymenoptera	Vespidae	*Polistes* sp.	3
Hymenoptera	Vespidae	*Vespa crabro*	8
Lepidoptera			9
Lepidoptera	Noctuidae		7
Lepidoptera	Noctuidae	*Agrotis segetum*	2
Lepidoptera	Noctuidae	*Autographa gamma*	1
Lepidoptera	Noctuidae	*Cucullia umbratica*	1
Lepidoptera	Noctuidae	*Helicoverpa armigera*	5
Lepidoptera	Noctuidae	*Noctua fimbriata*	1
Lepidoptera	Nymphalidae	*Apatura ilia*	4
Lepidoptera	Nymphalidae	*Inachis io*	1
Lepidoptera	Nymphalidae	*Maniola jurtina*	1
Lepidoptera	Nymphalidae	*Vanessa atalanta*	4
Lepidoptera	Nymphalidae	*Vanessa cardui*	5
Lepidoptera	Papilionidae	*Iphiclides podalirius*	2
Lepidoptera	Papilionidae	*Papilio machaon*	2
Lepidoptera	Sphingidae	*Hyles galii*	5
Lepidoptera	Sphingidae	*Hyles galii v. euphorbiae*	1
Lepidoptera	Sphingidae	*Macroglossum stellatarum*	6
Lepidoptera	Sphingidae	*Sphinx ligustri*	1
Odonata			101
Odonata	Aeshnidae		2
Odonata	Aeshnidae	*Aeshna* sp.	5
Odonata	Aeshnidae	*Aeshna affinis*	7
Odonata	Aeshnidae	*Aeshna cyanea*	2
Odonata	Aeshnidae	*Aeshna viridis*	6
Odonata	Aeshnidae	*Anax imperator*	1
Odonata	Gomphidae	*Gomphus flavipes*	5
Odonata	Libellulidae	*Orthetrum cancellatum*	2
Odonata	Libellulidae	*Sympetrum meridionale*	1
Orthoptera			24
Orthoptera, Ensifera			2
Orthoptera	Acrididae	*Calliptamus* sp.	25
Orthoptera	Acrididae	*Calliptamus italicus*	4
Orthoptera	Tettigonidae	*Tettigonia viridissima*	3

The observed prey listed by taxonomic resolution (A gyurgyalagok által fogyasztott táplálék rendszertani besorolása)

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A successful habitat reconstruction effort, the short history of the European Bee-eater *(Merops apiaster)* colony at Albertirsa (Hungary)

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Abstract In the Golyófogó Valley near Albertirsa natural erosion created near vertical walls in the loess deposited in the last glacial period, offering natural nesting sites for the European Bee-eater. Later the deeply cut coach roads, the pits of loess extraction and the construction works of the motorway nearby created further man-made banks. Hence by the 1970-ies a well-established colony bred here, but by the beginning of the 21st century, disturbance and the demise of vertical banks led to a serious reduction in the number of breeding pairs. The purchase of 5-hectare loess grassland plot and the adjacent loess bank, and later its reconstruction led to an unprecedented growth in the number of Bee-eaters. From 2010 the number of breeding pairs exceeded 200 every year. Not only the Bee-eater colony, but also the natural vegetation and the botanical values of the area are managed to maintain the population of rare and protected element of the local flora and fauna.

Keywords: European Bee-eater, *Merops apiaster*, habitat reconstruction, conservation biology, nature protection

Összefoglalás Az albertirsai Golyófogó-völgyben a jégkorszakban felhalmozódott löszbe vájt eróziós völgy falai régóta természetes fészkelési lehetőséget biztosítanak a gyurgyalagnak. A falu határában a vályogkészítéshez használt lösz kitermelése után maradt gödrök falai, a bevágódott mélyutak, majd később az autóút építkezés révén további ember alkotta fészkelőhelyek jöttek létre. Ennek köszönhetően az 1970-es évekre a partfalban költő kolónia létszáma megnőtt, de a 21. század elejére a zavarásnak, illetve a falak leomlásának köszönhetően a gyurgyalagok száma alaposan megcsappant. A Golyófogó-völgyben egy öthektáros löszgyep és a hozzátartozó partfal megvásárlása, majd 2009-es rekonstrukciója után a költő párok száma 2010-től 200 pár fölé emelkedett. A gyurgyalag kolónia mellett a terület botanikai értékeinek és természetes növénytársulásainak megőrzésére is törekednek a természetvédők, hogy ezzel biztosítsák a helyi állat- és növényvilág ritka és értékes elemeinek megőrzését.

Kulcsszavak: gyurgyalag, *Merops apiaster*, élőhely-rekonstrukció, természetvédelem, természetvédelmi biológia

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Introduction

The European Bee-eater (*Merops apiaster* Linnaeus, 1758) is the sole representative of its family, Meropidae in Hungary. Although no other member of its family breeds in, or migrates through the Carpathian Basin, the species itself is far from solitary, or even scarce. According to a recent study at the beginning of the 21st century the European breeding population is estimated 480000 pairs (BirdLife International 2004). It is a gregarious bird characterised by colonial breeding and intricate sociality (Cramp 1998). The species is strictly protected in Hungary, and its nature conservation value is 100000 Hungarian Forints. The pairs usually breed in colonies in loess- or sandbanks, and the number of pairs can range from a handful to several hundred. The active hole drilling – sometimes the length of the tunnel to the breeding chamber exceeds 2 metres (Bankovics 1998) – helps to turn over the soil, and hence the Bee-eaters is considered an ecosystem engineer species (Casas-Crivillé 2005, Sekercioglu 2006). Besides turning over the soil and hence contributing to its mixing and providing more oxygen the excavated tunnels might give breeding opportunities to other bird species also. We observed, captured and ringed the following hole nesting species breeding in the bank: Common Starling *(Sturnus vulgaris)*, Tree Sparrow *(Passer montanus)* and Sand Martin *(Riparia riparia)*. Hoopoes *(Upupa epops)* were also often observed flying around the bank and searching for insects on the loess wall itself, but we did not find an actual Hoopoe nest in the wall.

The number of breeding pairs in Hungary was estimated between 1000–3000 pairs at the beginning of the 1990-ies (Bankovics 1998, 2000), and its population has been slowly increasing since the 1970-ies (Magyar *et al.* 1998, Hadarics & Zalai 2008). Gyurácz *et al*. (2013) estimates, based on extrapolations of the censuses carried out lately in Hungary that the breeding population is around 20000–30000 pairs.

According to the surveys of the colonies in Hungary during the 20th century 90% of the European Bee-eater population breeds in colonies counting less than 50 individuals. Although Szijj (1955), who compiled the data from the 1949 census on the species, mentioned a colony counting 400 individuals from the vicinity of Simontornya, based on the observation of Dániel Kerekes. Szijj established that 55 (93.22%) of the observed 59 colonies contained less than 80 pairs, only 3 colonies counted between 80–100, and one colony above 100 breeding pairs. The situation remained similar during the second half of the 20th century, the majority of colonies were used by less than 50 breeding pairs (Nagy *et al*. 2008). From 2010 the Albertirsa colony hosts over 200 breeding pairs, so the loess wall itself and the surrounding habitats offer an exceptional nesting site and reliable food source. Colonial nesting in the European Bee-eater is a well-known phenomenon, but from solitary breeding to forming large colonies a whole continuum is reported in the species. Interestingly Hoi *et al.* (2002) reported that colony size had a negative effect on chick condition and survival. It is thought that adult survival might be still better in larger colonies, and hence lifetime reproductive success is higher for birds breeding in larger colonies.

As this species requires almost vertical, vegetation-free walls for breeding, the main threat to the species is the loss of breeding sites. Disturbance of breeding colonies (such as mining activities at the banks in the breeding period) is especially harmful. Other threatening factors for this species include persecution from beekeepers involving shooting, poisoning and intentional blocking of breeding hole entrances (Bankovics 2000, Gyurácz 2009). As many colonies are established in sand and loess excavation sites, human interference is an important threatening factor, just like the natural re-growth of vegetation in abandoned excavation sites.

The history of the Albertirsa Bee-eater colony

Albertirsa town lies in the wide valley of the Gerje Stream, and is situated where the undulating Gödöllő Hills meets the Great Hungarian Plain. Loess and sand deposition in the last glacial period created a 10–20 meters thick layer, later eroded by frost and precipitation, and it provided natural breeding sites for the European Bee-eaters. Human loess and clay excavation for construction beginning in the 18th century created a long bank in the Golyófogó Valley east of the village, which gave even more opportunities for breeding. Also, the dirt roads used by coaches and heavy carts cut deeply into the loess, and their walls provided breeding sites for this species. The bank was further excavated when Road Number 4 was built in the 1960–70-ies. The large excavation area left behind created a suitable breeding area for the Bee-eaters, and the number of breeding pairs rose to 150–180 pairs in the 1970-ies and 1980-ies. The Jászkun Természetvédelmi Szervezet (Jászkun Nature Protection Organisation) started to monitor the breeding of Bee-eaters in the Golyófogó Valley in the 1970-ies. As the area was used as a communal waste deposition till recently, this activity adversely affected the breeding colony. Hence by the beginning of the 1980-ies the colony numbered around 100 pairs. In the worst period (1986-1987) 20–35 pairs bred at the colony. In the 1990-ies the population grew again, and the number of breeding pairs rose to 150–180 between 1999–1997. Due to disturbance and natural erosion of the banks and re-growth of the vegetation lead to a serious decline, by the beginning of the 21st century only 30–40 pairs bred at this colony *(Table 1)*.

Year / Év	Number of pairs Párok száma
2003	35–40
2004	32–37
2005	30–35
2006	37–40
2007	33–35
2008	39–43
2009	53–55
2010	198–202
2011	258–260
2012	294–300
2013	267

Table 1. The number of European Bee-eaters nesting at the colony in the Golyófogó Valley between 2003–2013.

1. táblázat Az albertirsai Golyófogó-völgyben található telepen költő gyurgyalagpárok száma 2003–2013 között

On the 26th September 2003 the Jászkun Természetvédelmi Szervezet (Jászkun Nature Protection Organisation) succeeded to buy the whole bank and the adjacent areas (2.89 hectares of arable fields, 1.98 hectares of grassland, 0.3 hectares of soil excavation area) with the financial help of German nature conservation funds. Their aim was to provide protection for the Bee-eater colony and also to preserve the original loess grassland vegetation.

In April 2009 the whole bank was reshaped with excavators, and a mostly south-facing 320-meter-long wall was created. Average height is 5 meters, and the maximal height is 11 meters. As a consequence the number of breeding pairs immediately started to rise *(Table 1)*. To further improve the colony's attractiveness to Bee-eaters 5–8 meter high Locust-tree *(Robinia pseudoacacia)* stumps were erected at about 5 meters from the wall, for the entire length of the artificially improved bank. These provide suitable observation posts for the sit-and-wait style hunts, and provide substrate for rest and socialising.

To enhance the re-growth of loess steppe vegetation around the loess bank, and hence create diverse vegetation for insects, the leaf litter was removed from a large tract of the area, and the number of Hart's Milk Vetch *(Astragalus exscapus)* rose from the earlier 600–1000 to 2820 in 2012. Besides European Bee-eaters several other valuable species used the loess bank for breeding. Before the 2009 restoration two Common Kestrel *(Falco tinnunculus)* pairs and a Little Owl *(Athene noctua)* used to breed in the bank. After the reconstruction of the bank these species disappeared, but in the fall of 2013 several larger cavities will be formed in the wall in the hope that it will help re-establish these birds in the area.

The concerted efforts of (1) creating an enormous suitable loess wall, (2) maintained through the years to control vegetation growth and prevent abrasion of the wall, coupled with (3) creating natural vegetation to provide diverse food source, and (4) the installation of dry trees in front of the nest-holes for the breeding birds to create a platform for hunting, lookout for prey and socialize created ideal breeding conditions for the European Bee-eater. The number of nesting pairs in the later years approximate 300, and this is the largest known colony in Hungary, and possibly in Central-Europe.

Also while there was a strong European Rabbit *(Oryctolagus cuniculus)* population the otherwise rare Wildcat *(Felis silvestris)* was regularly seen in the Golyófogó Valley. Since the rabbit population was wiped out from the area by myxomatosis the Wildcat also disappeared from here.

The case of the Albertirsa breeding colony proves that serious efforts of local nature conservation organisations are needed to safeguard the populations of even strictly protected species. In the case of species limited by breeding sites first the protection of natural breeding sites, and second the creation and wise management of artificial breeding sites is the only way of increasing the number of breeding pairs. An outstanding example of habitat restoration carried out by the Jászkun Nature Protection Organisation allowed the formation of the largest colony in Hungary for the bird of the year 2013, the European Bee-eater.

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VERSITA

New species in the Hungarian avifauna in 2012

TIBOR HADARICS

Tibor Hadarics 2013. New species in the Hungarian avifauna in 2012. – Ornis Hungarica 21(2): 52–54.

Abstract A new species appeared in the Hungarian avifauna, the Black-shouldered Kite in 2012. The bird was staying in Fornapuszta (coordinate), near Csákvár (Fejér County), between August 22nd and 27th. The number of bird species which occurred in Hungary has risen to 406 with the observation of this species.

Keywords: official bird checklist, Hungarian Checklist and Rarities Committee, Black-shouldered Kite, *Elanus caeruleus*

Összefoglalás 2012-ben egyetlen faunára új madárfaj bukkant fel Magyarországon, a kuhi. A madár 2012. augusztus 22–27. között a Csákvár (Fejér megye) községhatárában lévő Fornapuszta közelében tartózkodott. E faj megfigyelésével a Magyarországon valaha bizonyítottan előfordult madárfajok száma 406-ra emelkedett.

Kulcsszavak: Magyarország madarainak névjegyzéke, MME Nomenclator Bizottság, kuhi, *Elanus caeruleus*

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A new bird species in the fauna of Hungary was accepted by the Hungarian Checklist and Rarities Committee in 2012; the Black-shouldered Kite (Klébert 2012). The number of bird species which occurred in Hungary has risen to 406 with the observation of this species.

Elanus caeruleus (Desfontaines, 1789) – Black-shouldered Kite
August 22th to 27th, 2012, Csákvár (Fejér County), Fornapuszta, near Lake Csukás, 1 *ad.* exemplar (G. Szalai and others).

The Black-shouldered Kite is a small, grey plumaged bird of prey in the family Accipitridae. It’s generally distributed in Sub-Saharan Africa, (ssp. *caeruleus*), in India, Indo-China and the Malay Peninsula (ssp. *vociferus*), as well as in the South-east Asian archipelago (ssp. *hypoleucus*), and in New Guinea (ssp. *wahgiensis*) (del Hoyo *et al.* 1994).

The species also breeds in North Africa (ssp. *caeruleus*), and since the last third of the past century in Southwestern Europe as well, in growing numbers (Rufino 1997). It first nested in Portugal in 1944 (England 1955), in Spain in 1975, and in Souther France in 1983 (Papacotsia & Petit 1984, Guyot 1990, Ferguson-Lees & Christie 2001). The European breeding population showed a strong increasing trend between 1970 and 1990. The pace of the increase slowed down between 1990 and 2000. Around the turn of the millennium the European population was already estimated to be between 810 and 2000 pairs (Spain, Portugal and France) (BirdLife International 2004). The population of four pairs gradually grew to 28 pairs by 2008 (de Seynes 2009) in France. Similarly to its spread and population growth in Southwestern Europe the species is also expanding in the Middle East (ssp. *vociferus*): it first bred in Iran in 1998, in Iraq in the beginning of the 2000s (Salim 2002), in Israel in 2011 (Israeli 2012). The spatial distribution of the species will expectedly grow further as a result of climate change (Huntley *et al.* 2007).

Previously its occurrences outside of its nesting period were known in Southern Europe (Italy, Cyprus) (del Hoyo *et al.* 1994), but in recent decades also in the Netherlands, Belgium, Germany, the Czech Republic, Switzerland, Austria and Poland, moreover they were observed on several occasions in Scandinavia – Denmark, Sweden – which beyond the increase in the number of observers, was probably a result of the expansion and growth of the Southwestern European population.

Late spring observations (May) in Northern and Central Europe are probably of individuals dragged North by Mediterranean cyclones, while summer occurrences undoubtedly after the breeding period, can be connected to individuals dispersing towards the north and north-east.

The bird in Hungary was first observed by Gábor Szalai on August 22nd, 2012, in the late afternoon in the Zámoly Basin, near Fornapuszta located in the municipal boundary of Csákvár. The bird was seen on every one of the five days following its initial observation (last on August 27th) in the same area. During this period several evidentiary photos were taken of the individual. The bird was identified to be in adult plumage.

At the time of the observation and in the preceding period warm southwestern air currents had caused sweltering heat lasting for several days in the Carpathian Basin. It’s probable, that the bird had arrived in Central Europe with these warm air currents coming from the south-west.

A week prior to the Csákvár observation, on August 15th, 2012, a Black-shouldered Kite was also seen and photographed near Maňa in Slovakia (Václav 2013). This was the first recorded sighting of the species in Slovakia as well. The question arises, if at the occurrence of the Hungarian and Slovakian observations the same individual was sighted? Only one week passed between the two observations and the two locations are 90 to 100 kilometers from each other. It is plausible that the same individual was seen in Slovakia as well as in Hungary, however observers have pointed out minor differences in plumage of the two birds: while the individual in Hungary is regarded as a full adult, the Slovakian bird, based on its moulting is considered to be a subadult.

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