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INTERSPECIFIC RELATIONS IN THE POPULATIONS OF *MEROPS APIASTER* L. (AVES: CORACIIFORMES) OF SOUTHERN ROMANIA

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Abstract. The authors present the predators which attack the bee-eaters in their colonies of southern Romania (strigiforms, falconiforms, mustelids, carabids); birds using their nests for breeding; ectoparasites found on bee-eaters (feather lice and flies); birds and ant-species of the colonies of *Merops apiaster*, which are eating the remains of insects regurgitated by adults; arthropods from nests (dipters and beetles, adults and larva); kleptoparasite sparrows in the bee-eaters colony; vertebrates using the *Merops* nests as refuges.

Résumé. Les auteurs présentent les prédateurs qui attaquent les guêpiers dans les colonies du sud de la Roumanie (Strigidae: rapaces nocturnes, Falconidae: aigles, éperviers, buses, faucons, mustellides, carabides); les oiseaux qui utilisent les nids des guêpiers pour leur propre reproductions; les ectoparasites trouvés sur les guêpiers (malophages et mouches); les espèces d'oiseaux et de fourmis qui se nourrisent avec des restes d'insectes régurgités par les adultes dans les colonies de *Merops apiaster*; les arthropodes des nids (diptères et coléoptères, adultes et larves); les moineaux kleptoparasites dans la colonie de guêpiers; les vertébrés qui utilisent les nids de *Merops* comme refuges.

Keywords: bee-eater, birds of prey, kleptoparasitism, nests, ectoparasites, feather lice, fly, beetles.

Merops apiaster, in every colony we studied, is a part of complex biocoenosis, where it is subject to a multiple control by a great number of species. Bee-eater is a polyphagous species, insectivore and has as prefered food hymenopters, beetles, dragon flies. The bee-eaters could be in its turn a prey for other birds, mammals and carnivorous insects. The effectives of bee-eaters populations are controled by a complex of relations with other species.

MATERIAL AND METHODS

We made this study in colonies of *Merops apiaster* of southern Romania: Poiana (1), Ciuperceni (2), Islaz (3) (Teleorman county), Frăteşti (4) (Giurgiu county), Negureni (6), Băneasa (7), Canaraua Fetii (8), Furnica (9), Şipote (10), Adâncata (13), Agigea (19), Enisala (20) (Dobrogea), Black Sea coast - Eforie Sud (17), Olimp (16), Vama Veche (15). We mentioned also in text other localities: Cireşoaia (5), Basarabi (11), Constanţa (18), Hagieni (14), Lăstuni (21), Medgidia (12), Murighiol (22), Tulcea (23), where the colonies of bee-eaters were studied by other authors. All localities names in text are followed by a number which is represented on the map (Fig. 1).

The data result of observations made in colonies during the years 1990-1998, from 5 a.m. till 9 p.m., in the breeding season, using a Zeiss binocular 15x50 in hides or using several camouflage methods: covering of the observer with a green cloth, or using an observation tent placed near the colony, avoid disturbing the birds during their activity. We captured the birds using ornithological nets at the entry of every nest, after the bird was inside. The capture was difficult, because the birds

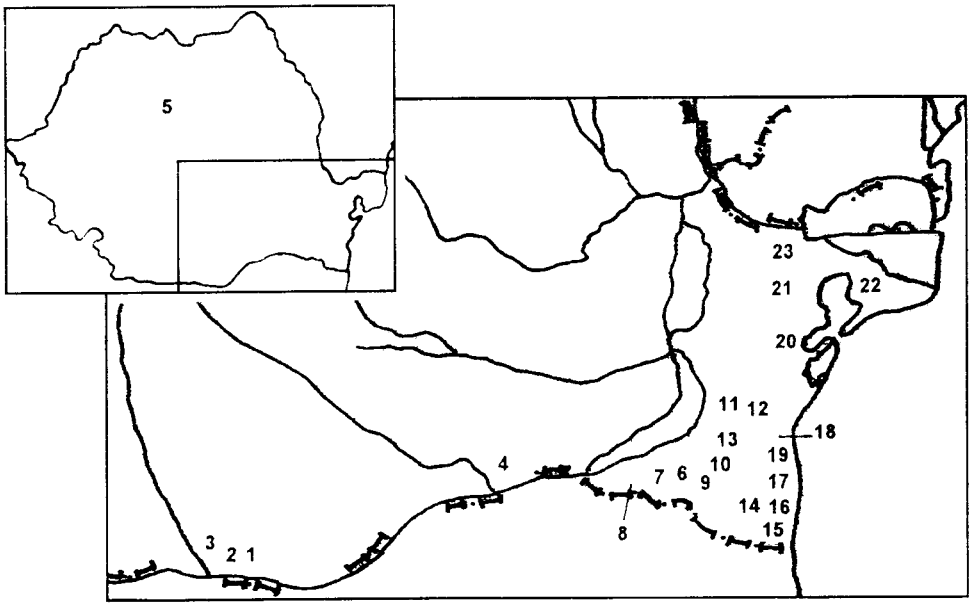

Fig. 1 – The studied colonies of *Merops apiaster*: 1, Poiana; 2, Ciupercenî; 3, Islaz; 4, Frăteşti; 5, Cireşoaia; 6, Negureni; 7, Băneasa; 8, Canaraua Fetii; 9, Furnica; 10, Şipote; 11, Basarabi; 12, Medgidia; 13, Adâncata; 14, Hagieni; 15, Vama Veche; 16, Olimp; 17, Eforie Sud; 18, Constanţa; 19, Agigea; 20, Enisala; 21, Lăstuni; 22, Murighiol; 23, Tulcea.

have a social life and are using sonor communication means in order to announce the danger. Therefore they are very cautitous near the nest, and to be catched in the net is a traumatic experience. All captured birds were weighed, measured and searched for parasites (feather lice, parasite flies). All were ringed with an official ring of the Romanian Ornithological Central, having a number, and marked on the back or on abdomen with a water resistent marker, thus being individualized. The colour marking is necessary when observing the bird activity at her nest with a binocular. Therefore colorous were different depending on sex and nest. The parasite insects were conserved in alcohol 70%. Where it was possible we made also photos, using telescopic lens of 200 mm or 300 mm and with teleconverter of 2x.

The nests from the studied colonies were counted, measured, their inhabitants were identified, which in many cases were not bee-eaters but sparrows, starlings, kestrels, rollers, etc. We digged some nests in order to establish their architecture depending of the soil nature and we measured their inside dimensions (Petrescu, 1998). We collected in those nests the remains of insects regurgitated by nestlings. They are mixed with sand and could weigh 150-3,200 g. We separated the insects from soil passing it through a sive of 1 mm. The remains smaller than 1 mm were separated through a hand net under a water flow and conserved in alcohol 70%.

RESULTS AND DISCUSSIONS

Merops apiaster, adults and nestlings, preys for other species.

Merops apiaster is not a prefered and permanent preys for other bird and mammal species. It appears accidentally in the diet of some owls or diurnal birds of

prey (Tab.1). Our observations are concerning *Asio otus* at Agigea (Petrescu, 1997 and 1999 b), *Falco tinnunculus* on the Black Sea coast, (Petrescu, 1993), Frăteşti (1996), Ciuperceni (1998) or *Falco subbuteo* at Frăteşti (1997) and Ciuperceni (1999), based on rest of feathers, bones (skull or humerus) of the bee-eaters in pellets. At the appearance of any prey bird the bee-eaters utter alarm signals, having the value of interspecific signal, being heard by other bird species as well: sparrows, magpies, etc. It prefers to drive away of the colony surroudings some prey birds, attacking and harassing them in group, as we observed in the colony of Furnica, in 1996, when all the bee-eaters of the colony where chasing a little owl (*Athene noctua*), which was resting near the nests. Althrough we studied the food of the little owl in this zone, we never found in its pellets rests of bee-eater feathers or bones (Petrescu, 1994, 1999 b). If a greater prey bird appears, they prefer to hide between the tree branches, used as watching place and where their dorsal plumage, olive-green, may not be seen from above by a flying bird of prey, no more than their ventral plumage, blue, may not be detected from below. We observed this behaviour at Furnica and Băneasa when a booted eagle, *Hieraaetus pennatus*, appeared, and at Hagieni, in 1996 at the appearance of *Buteo buteo* and *Circaetus gallicus* (Petrescu, 1998, 1999 a). We never found remnants of bee-eater in the pellets of these birds, nor did we observe them attacking *Merops apiaster*. However they are possible predators. *Accipiter gentilis* does consume *Merops apiaster* during the migration. Bee-eaters migrate in group, with their family, and may be easily detected and attacked. Borg (1992-1994) is recording a case of predation of bee-eaters in Malta, by *Larus cachinnans*, who is attacking also other transsaharian migratory birds.

Merops apiaster is a prey for some mammals. The bee-eaters are vulnerable in the moment when they enter into the nest and during all the period in which they stay inside the burrow if it is digged nearer the ground. In July 1996 we saw two attacks of weasel, *Mustela nivalis*, in the colony at Furnica, a female of bee-eater being captured and killed while leaving the nest, which was only 20 cm high over the ground.

In this same colony two specimens of *Mustela nivalis* tried to get near of the nests, in July 1998 and July 1999, but the groups of associate birds, extremely noisy, were attacking the predators and removing then from the vicinity of the nest.

Table 1

Main predators in colonies of *Merops apiaster*

Species	Localities	Year	Observations
Birds			
Asio otus	Agigea	1995, 1996	pellets
Athene noctua	Băneasa, Furnica, Adâncata	1993, 1996	observations, pellets
Falco tinnunculus	Black Sea, Frăteşti, Ciuperceni	1993, 1994	observations, pellets
Falco subbuteo	Frăteşti, Ciuperceni	1996, 1997,1998	observations, pellets
Circaetus gallicus	Furnica, Frăteşti	1995, 1998	observations
Hieraeetus pennatus	Furnica	1994, 1995, 1998	observations
Buteo buteo	Furnica, Frătesti	1994, 1995 -1998	observations, pellets
Mammals			
Mustela nivalis	Furnica	1996, 1999	observations
Reptiles			
Coluber caspius	Lăstuni (Denis Tepe)	1973	
Beetles			
Carabidae	Furnica	1998	killed juveniles

Main enemy for the nestlings is lack of food. Because of less experience in breeding or due to other causes like the appearance of a predator or due to several factors that disturb the parents approaching to the nest, the parents avoid feeding the nestlings for a longer period. The nestlings, in their first period of development (naked) if not enough fed (due to upper mentioned causes), are apathetic and therefore may be attacked and even killed by greater predator insects, like the Carabids. In the colony of Furnica, in 1998, we collected two dead nestlings, who were thrown out from the nest by their parents, having the dorsal epidermis eaten by beetles (Fig. 2 A).

Bee-eater nests used for reproduction by other birds

There are many examples of birds which do not build nests and use for laying their clutch the deserte nests another species has built during the same breeding season. *Falco tinnunculus, Falco vespertinus, Asio otus* are using nests of rooks (*Corvus frugilegus*). The nests of *Merops* are also used by other birds. Mocci De Martis (1994) has made a list of bird species using bee-eater nests in the colonies from Italy.

The bee-eater nests built in sandy-clayey banks, with vertical wall, are more protected of predators than those of other bird species having the form of a cup, placed in trees. They may be arranged, improved by other species so as to satisfy the minimum demands for laying their cluch in secure conditions. The most frequent species using bee-eater nests are *Passer montanus, Passer domesticus, Sturnus vulgaris, Apus apus, Falco tinnunculus, Athene noctua, Coracias garrulus.* The interspecific competition at the nest is mentioned in literature. Neumann (1983), Kiss and Hohn (1980), are recording the following species: *Passer montanus, Corvus monedula, Motacilla alba, Oenanthe oenanthe, Athene noctua, Falco tinnunculus.* Meschini and Fraschetti (1988), mentioned a case of nesting of *Coracias garrulus* in the nest deserted by *Merops apiaster*. In colonies studied by us we observed the following species using for their reproduction bee-eater nests: *Passer montanus* (Furnica, Şipote) (Fig. 3A), *Passer domesticus* (Furnica) (Fig. 3 B), *Sturnus vulgaris* (Olimp), *Apus apus* (Olimp) (Petrescu, 1995), *Motacilla alba* (Furnica), *Oenanthe oenanthe* (Canaraua Fetii), *Coracias garrulus* (Poiana, Canaraua Fetii), *Falco tinnunculus* (Black Sea coast), *Athene noctua* (Enisala) (Petrescu, 1999 a).

Our observations made in 13 colonies stated that bee-eaters are digging their nests in vertical walls of loessoid sandy-clayey bancks with heights between 50-600 cm. The walls are steep, without abundant wooden or grassy vegetation. The excavation of nests at a great height over the ground does not permit the access of predators at the nest. The nests are formed by a tunnel and an incubation chamber. The entrance in the tunnel has 6-7 cm in diameter. There is an interspecific competition between bee-eater populations and the populations of other species, and the competitors assure the success of their reproduction occupying old nests of *Merops apiaster* by enlarging the entrance, and as a result, they are no more used by bee-eaters (Petrescu, 1999 a). Unlike the singing birds which use the nest only for one clutch, building every year a new one, the bee-eaters use the same nests for several years, if these fulfil the necessary conditions, especially the dimensions of the entrance (6/6 or 6/7 cm) and of the incubations chamber, but being migratory birds they have the disadvantage to arrive later to their breeding place, in their colonies, between April 25th and May 2nd. In the meantime their nests are already occupied by sedentary species, opportunist ones, which breed earlier (sparrows,

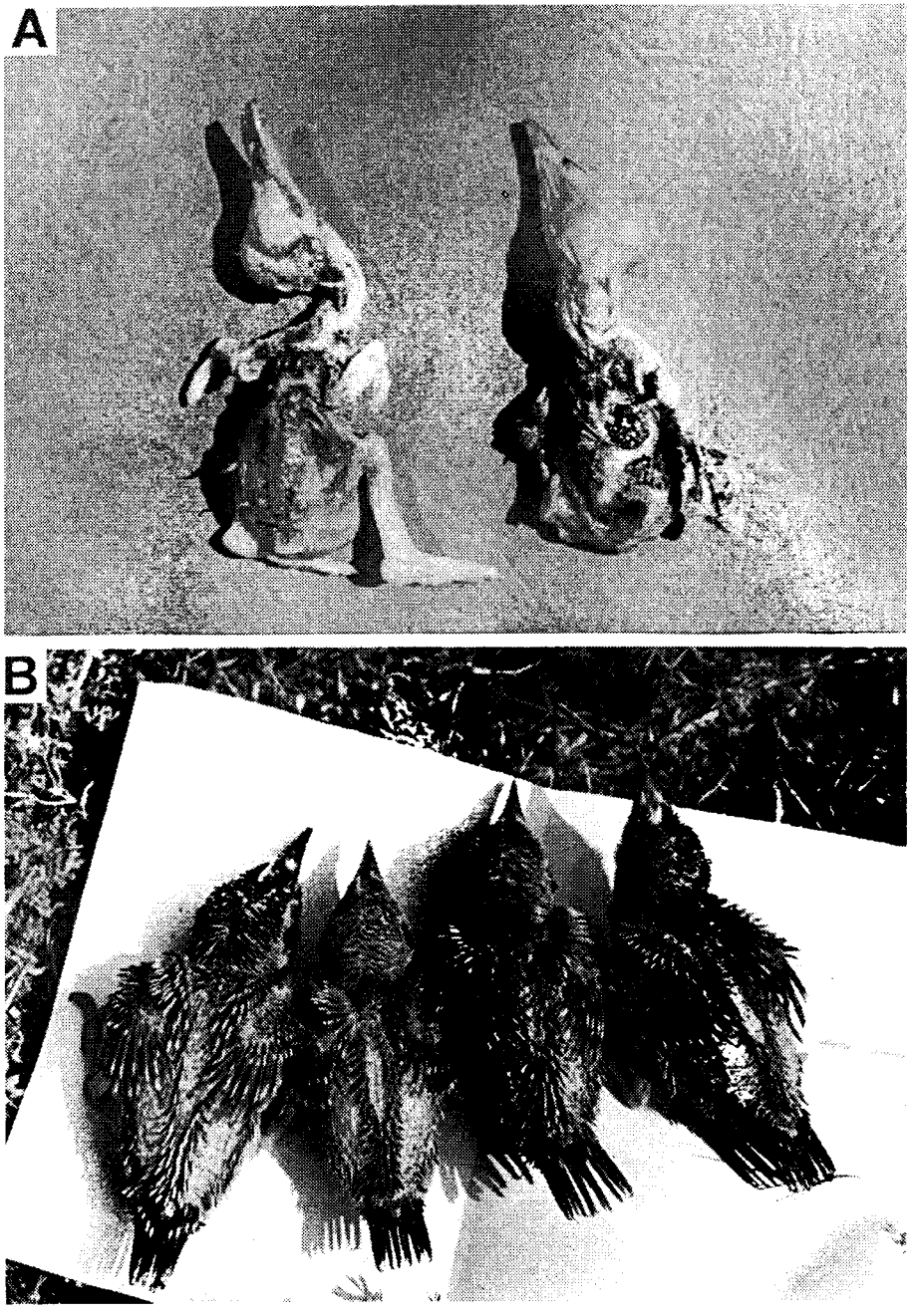

Fig. 2 – A, Nestlings of *Merops apiaster* with their tegument eaten by beetles; B, Nestlings from a nest destroyed by children at Frăteşti, 1997.

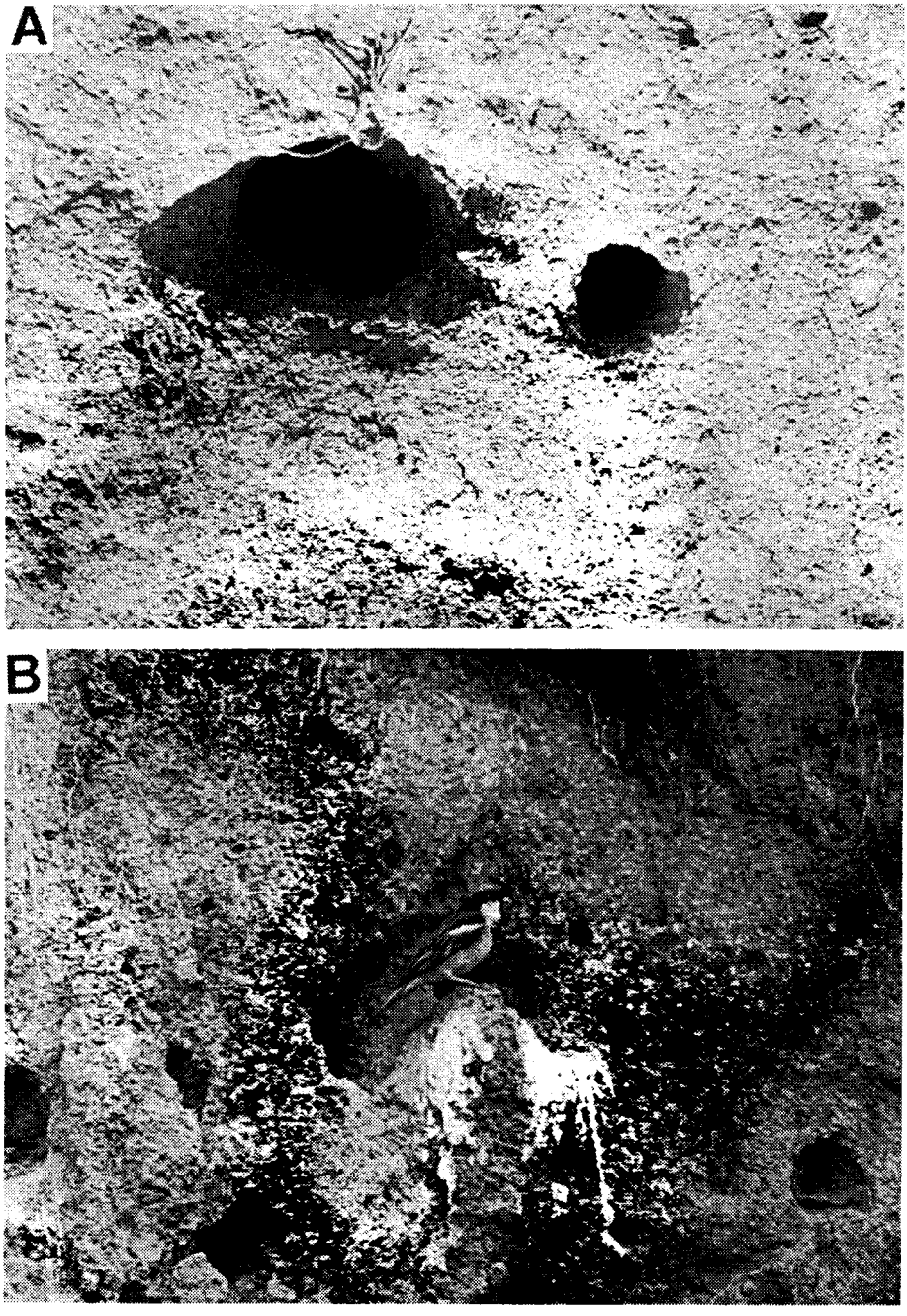

Fig. 3 – A, Nest of *Passer montanus* (left) near a nest of *Merops apiaster* (right); B, *Passer domesticus* near its nest in a colony of bee-eaters at Furnica.

starlings, etc.). The bee-eaters have not aggressive behaviour towards these species and tolerate them in proximity of their nests. Sometimes the distance between two nests, one of the bee-eater and the other of a sparrow, maybe of only 10-15 cm (Fig. 3 A).

From our observations we found that if the dimension of the entrance in the tunnel is modified, the nest will be deserted. Usually, the interspecific competitors for the nest, occupy the nests and enlarge these orifices with their claws, in order to assure their breeding success. They have the advantage to be sedentary species which are breeding earlier than bee-eaters (Petrescu, 1998).

Passer montanus is using bee-eater nests, modifying their entree, the diameter of the nests used by this species being of 11/12 cm – 14/15 cm. *Passer montanus* and *Sturnus vulgaris* are using for their nests vegetal fibers (Gramineae), down, with which they fill up the tunnel of the bee-eaters nests. In the studied colonies the tree sparrow is the most common competitor of the bee-eater. There are colonies where the percentage of the nests occupied by *Passer montanus* is quite equal with the one of nests occupied by bee-eaters (Fig. 4). Other bird species which are nest competitors have a lower frequency, and their impact on the breeding rate of the *Merops apiaster* populations is nearly negligible, compared with *Passer montanus*.

There are mentioned cases when *Merops apiaster* used the nest of European suslik, *Citellus citellus* (Cătuneanu and col., 1958). In a colony of Poiana, in 1998, we found an unifinished nest, because the soil was to hard, which a bee-eater pair tried to build in a old mammal gallery.

Ectoparasites of the bee-eater in colonies of southern Romania

We made investigations on ectoparasites of *Merops apiaster* in the colonies of Furnica, Poiana, Ciuperceni and Frăteşti, sampling feather lice and dipterans.

Order Mallophaga

Three species of feather lice are exclusively parasite on *Merops apiaster* Linnaeus, 1758: *Meropsiella apiastri* (Denny, 1842), *Meromenopon meropis* Clay et Meinertzhagen, 1941 and *Meropoecus meropis* (Denny, 1842). In Romania these three species of fether lice were studied by Negru (1958), who found them on bee-eaters from colonies at Constanța, Basarabi - Medgidia and Islaz; *Meropsiella apiastri* (Denny, 1842) and *Meromenopon meropis* Clay et Meinertzhagen, 1941.

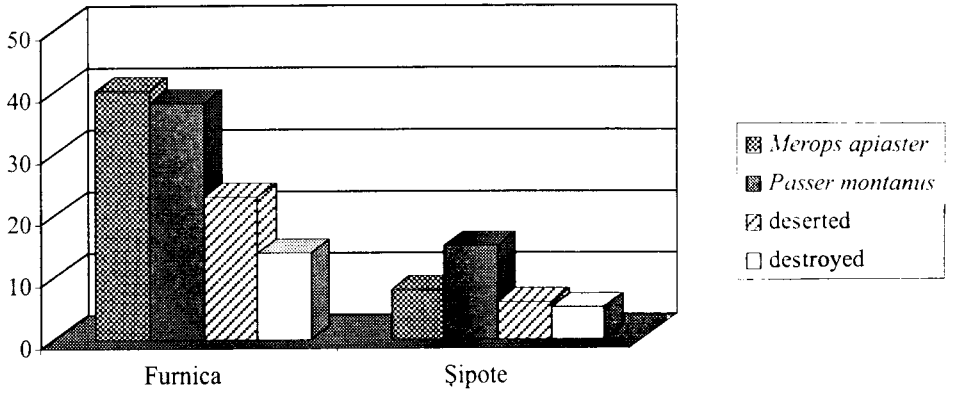

Fig. 4 – Nests of *Merops apiaster* and of *Passer montanus* in two bee-eaters colonies

This species was mentioned also by Rekasi and Kiss (1997), in a feather lice catalogue of Romania, sampled at Murighiol and Tulcea.

We sampled feather lice on bee-eaters of two colonies, Ciuperceni and Furnica, founding only two species: *Meropoecus meropis* (Denny, 1842) (Fig. 5 A, B) and *Meropsiella apiastri* (Denny, 1842) (Fig. 5 C).

The number of feather lice on a specimen is variable. In our study the mean number of feather lice found on a bird varied depending of the year and of the place of sampling. At Furnica, in 1998, we found 3.07 feather lice/bird, and in 1999 it was of 5.55 feather lice/bird. At Ciuperceni in 1998 the mean number of feather lice was of 2.73 specimens/bird, while in 1999 it was of 6.38 specimens/bird. The greatest number of feather lice, 16/bird, was found by us on a ringed female (3560) in the colony of Ciuperceni in 1999.

Table 2

Feather lice sampled in the colony of Furnica 1998

No. nest	Bird sex	*Meropoecus meropis*	No. ring	Date
1	male	2	749	4. 07. 1999
1	female	1	3552	4. 07. 1999
2	female	5	748	3. 07. 1998
3	female	4	750	4. 07. 1999
3	male	3	744	4. 07. 1999
4	female	6	747	3. 07. 1998
4	male	8	3553	3. 07. 1998
5	male	2	3559	4. 07. 1998
6	female	3	745	4. 07. 1998
6	male	1	3551	4. 07. 1998
7	male	5	746	4. 07. 1998
8	male	-	3554	4. 07. 1998
8	male	-	3556	4. 07. 1998

In 1998 at Furnica we captured 13 birds (8 males and 5 females) on which we sampled 40 feather lices, all of them belong to the species *Meropoecus meropis* (21 specimens on males and 19 specimens on females).

Table 3

Feather lice sampled in the colony of Furnica 1999

No. nest	Bird sex	*Meropoecus meropis*	*Meropsiella apiastri*	Date
1	female	9	-	3. 07. 1999
1	male	6	3	6. 07. 1999
1	female	8	1	3. 07. 1999
2	female	2	1	3. 07. 1999
3	male	-	3	3. 07. 1999
3	female	5	9	6. 07. 1999
4	male	2	-	6. 07. 1999
4	female	-	1	6. 07. 1999
5	male	4	-	4. 07. 1999
5	female	2	2	6. 07. 1999
x	female	3	-	3. 07. 1999

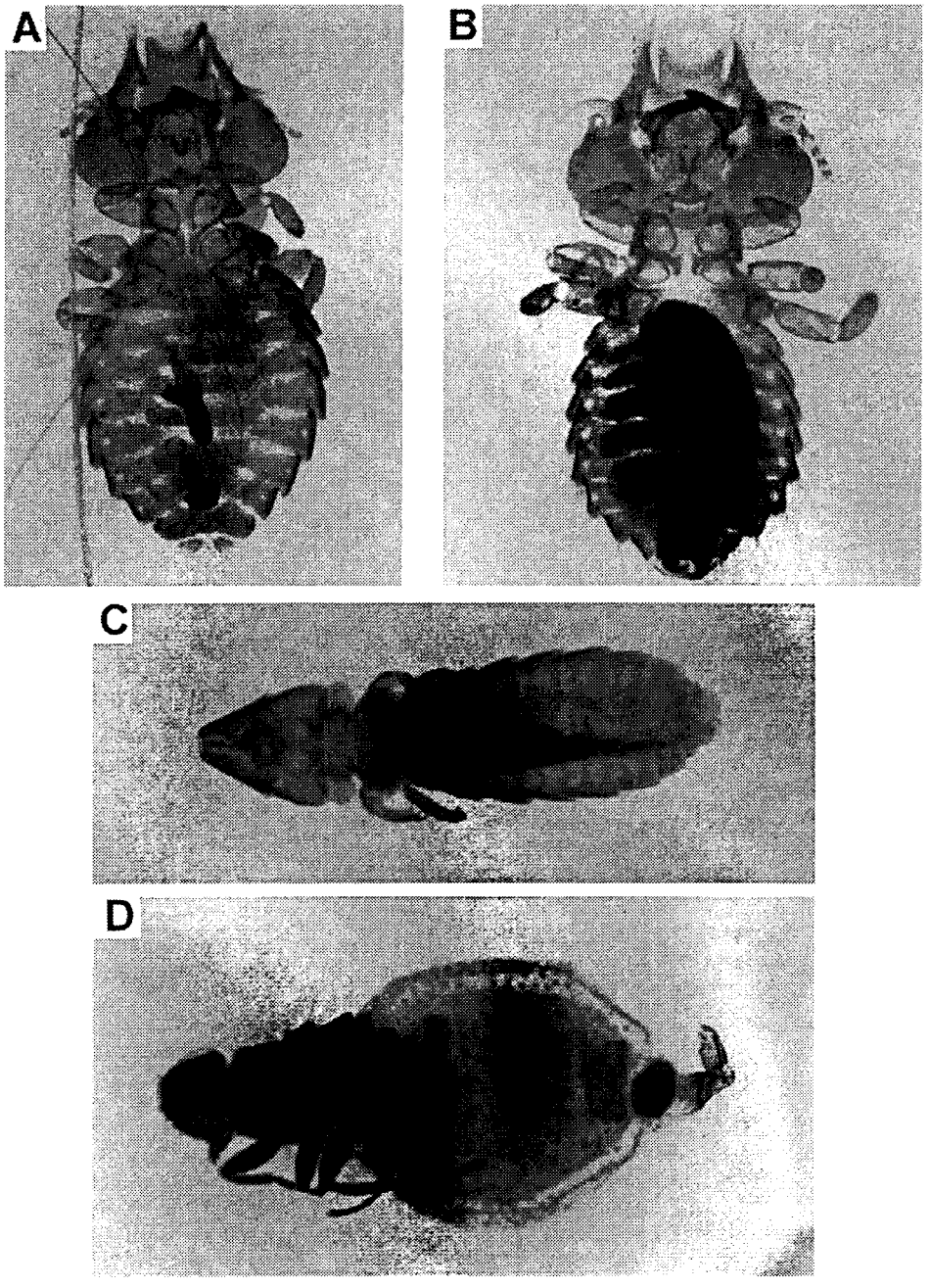

Fig. 5 – A, *Meropoecus meropis* (Denny, 1842), female; B, *Meropoecus meropis* (Denny, 1842), male; C, *Meropsiella apiastri* (Denny, 1842); D, *Carnus hemapterus* Nitzsch, 1818, female.

In 1999 we sampled in the bee-eater colony of Furnica 61 feather lices beloging to two species (*Meropoecus meropis* and *Meropsiella apiastri*), on 11 bee-eaters (4 males and 7 females). This was the only colony where we found two species of feather lices on the same bird specimens. Of the 41 specimens of *Meropoecus meropis*, 12 were on males of *Merops apiaster* and 29 on females. This species is easily collected in the chin zone of the bird with yellow feathers, on the black band of the neck or under the wing. *Meropsiella apiastri* was in small number, only on the rump. Of the 20 specimens sampled, six were on males of *Merops apiaster* and 14 females. On five birds we found both species on feather lice.

Table 4

Feather lice sampled in the colony of Ciuperceni 1998

No. nest	Bird sex	*Meropoecus meropis*	Date
1	female	6	21. 06. 1998
2	male	1	21. 06. 1998
2	male	-	22. 06. 1998
2	female	5	23. 06. 1998
3	male	4	23. 06. 1998
3	female	2	22. 06. 1998
4	female	5	24. 06. 1998
4	male	4	21. 06. 1998
5	male	1	21. 06. 1998
6	female	-	24. 06. 1998
6	male	2	21. 06. 1998

In the Ciuperceni colony we sampled, in 1998, 30 specimens of feather lice on 11 birds (12 specimens on six males and 18 specimens on five females).

Table 5

Feather lice sampled in the colony of Ciuperceni 1999

No. nest	Bird sex	*Meropoecus meropis*	No. ring	Date
1	male	2	3569	26. 06. 1999
1	female	4	3567	28. 06. 1999
2	female	12	3564	27. 06. 1999
2	male	2	3572	29. 06. 1999
3	male	12	3566	28. 06. 1999
3	female	13	3561	26. 06. 1999
4	female	16	3560	26. 06. 1999
4	female	7	3570	29. 06. 1999
4	male	6	3562	26. 06. 1999
5	female	4	3573	29. 06. 1999
6	male	3	3563	27. 06. 1999
6	female	2	3568	28. 06. 1999

In same colony, next year, 1999, we sampled on 12 birds 83 feather lices, all of them being *Meropoecus meropis,* which is distributed as it follows: 13 specimens on the 5 males and 70 specimens on the seven captured females.

During our studies we found in two colonies of Ciuperceni and Furnica on 47 birds (24 females and 23 males) 214 specimens of feather lices (194 specimens of *Meropoecus meropis* – 90.65% and 20 specimens of *Meropsiella apiastri* – 9.35%). Both species of feather lice were found together on five birds; not all the examined birds had parasites, as it results from the tables, in the colony of Ciuperceni (1998) and of Furnica (1998).

The results we obtained are not very different of those obtained by Kristofik (op. cit.) in Slovakia. He sampled on 62 adult birds 443 feather lices from two species: *Meropoecus meropis* (409 specimens – 92.3%) which was collected on 52 bee-eaters (7.3 specimens/bird), and *Meromenopon meropis* represented by only 34 specimens (7.7%) was found on 14 birds (1.8 specimens/bird). Both feather lice species were found together on only eight birds.

Order Diptera

Carnus hemapterus Nitzsch, 1818 (Fam. Carnidae) is a fly of 2-3 mm length, haematophagous, ectoparasite, and ornithophyle. It is distributed in Europe. Larvae are saprophagous and develop into the nest of the bird. In July 1997 we sampled 10 specimens of *Carnus hemapterus* on nestling of *Merops apiaster* at Frăteşti in southern Romania (Petrescu and col., 2000) (Fig. 5 D).

Family Hippoboscidae has seven genera parasites on birds. Only two of them were found on *Merops apiaster*: *Ornithomyia avicularia* (L., 1758) and *Pseudolynchia canarensis* (Maquart, 1840) in Slovakia (Kristofic and col., 1996). *Ornithomya avicularia* is also mentioned by Kiss and Hohn (1980) in a colony of *Merops apiaster* from Transylvania, at Cireşoaia. We did not find Hippoboscidae on the captured bird during our study.

Kleptoparasitism

Kleptoparasitism (piracy) is a behaviour found in birds and it consists in food scrounging used by some bird species against other ones, in certain conditions. The classical exemple of piracy is the one practiced by Skuas (*Stercorarius*), against Gulls (*Larus*). In their turn, Gulls are manifesting the same behaviour, the most common pirat species being *Larus ridibundus*, which attacks, harasses, follows other species till it obtains from them the food. In Europe, *Larus ridibundus* is parasiting *Vanellus vanellus*, (Kallander, 1977), *Egretta garzetta, Limosa limosa* (Amat and col., 1989), *Himantopus himantopus, Pluvialis apricaria* (Thompson and col., 1985).

In our studies we watched only in the colony of Ciuperceni in 1998, 1999 and 2000, flocks of 30-50 young sparrows (*Passer domesticus*), of the first generation, watching the bee-eaters, while sitting in hemlock (*Conium maculatum* L.) plants near the nests, beginning from the first morning hours. At every arrival of bee-eater with food at the nest, 6-8 house sparrows were following it till the entrance in the nest. Other sparrows were hanging up on the cliff all around the orifice of the entry waiting the bee-eater to get in or out the nest, gathering from its beak or feathers remnants of insects, or of the entrance hole. Sometimes the sparrows were so insistent in their pursuit that the bee-eaters having more preys in their beak droped 1-2 smaller ones, which were instantly catched and consumed by the sparrows. Besson (1964) observed this behaviour of the sparrows in a colony of France, without finding an explanation and considerring it only as "a curiosity" of the sparrows, while Kiss and Hohn (op. cit.) think that the sparrows are only "commensal", because they consume only remnants of food fallen from adult birds,

entering inside the nests, what we also observed in other colonies (Furnica, Frăteşti). But our opinionis that the young sparrows are kleptoparasites on *Merops apiaster*.

For reducing the impact of pirats, the hosts may adopt different behavioural tactics. Barnard (1984) distinguishes three different strategy types for reducing the negative effect of kleptoparasitim: the avoidance, the ripost and tolerance. *Merops apiaster* is not a smart host, which could escape using different strategies (to choose a less vulnerable diet, to increase the distance towards the parasites or to maintain the prey out of visibility of the pirates). As we observed it, when the day begins *Merops* is tolerant towards the insistance of the sparrow flock, but when the attacks are more frequent and stronger, because of the greater number of sparrows, meeting the adult near the nest, it tries to avoid the sparrows. They are either watching them and increasing the speed when approaching the nest, or resist to the attack without throwing the food from the bill. We did not count the sparrows attacks and their success, but observing them we may say that the success rate is low, maybe therefore during the second half of the day the sparrows renounce.

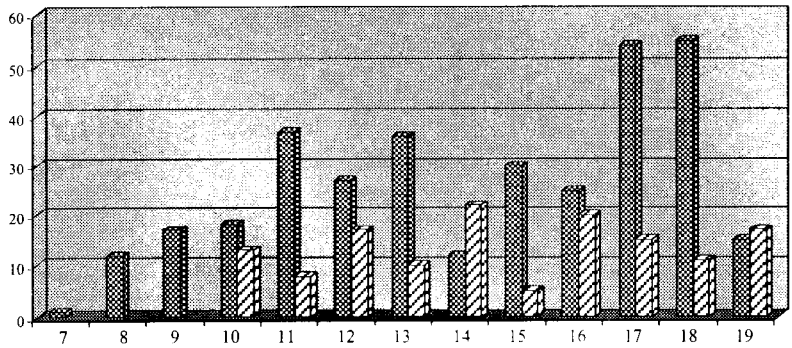

Fig. 6 – Parents arrival with food at nest, per hour (nest with helpers) (bright) and disturbing factors (dark)

In figure 6 there are represented, per hours, the arrivals of the parents with food at the nest, from 7 hours till 19 hours. The observations were made at a nest with aids, which had the greatest number of arrivals with food at nest, 346 (with a feeding rate of 26.6% (Petrescu, 2000) and which was permanently followed by sparrows. In the first part of the day, although the nestlings are hungry, the arrival numbers is low compared with the second half of the day. The low rate of feeding is correlated on one side with stress factors, like horses, carets, people which disturb the normal activity of bee-eaters, but also with the sparrow harassing, causing a great loss of time for the adults, waiting with the prey in their beak, near the nest, a favorable moment for passing unobserved to the nest. Why are the sparrows following and harassing the bee-eaters? We think that they supplement their diet, with a food, which is not easily accessible: insects. All the observed sparrows were juvenile ones, till they left their nest the parents brought them insects as food, which they can now obtain only hunting them, but with their lack of experience the success is poor. When leaving the nest young sparrows are for a time fed by parents, they are

insistent and have the behavior of helpless nestlings, submissive, with fallen and trembling wings, extremely convincing for the parents, which continue to feed their young although these could be able to hunt by themselves. We believe that, when the parents abandon them, they approach to the bee-eaters, which do not have an aggressive behaviour towards them (they chase them not from the nest surroundings). Being in great number they can follow and tease the bee-eaters obtaining in this way the fraction of diet now absent in their food, the insects, which was assured by their parents during the period when they still were nestlings. It is a clever way to obtain easily a food for which they should use a lot of energy.

Pellets or insects fallen near the nest consumed by other birds

In all studied colonies we found birds searching into the entrance of bee-eater nests, or near the resting and watching places of bee-eaters, which defended them with obstinacy of other colony members, and where they regularly regurgitated their pellets. The location of these places varied in every colony. At Frăteşti the dominant males had near stones where they regurgitated pellets. Every morning these places were searched by pair of *Pica pica*. The magpies were picking up fallen or regurgitated insects. At Furnica opposite to the colony were some bushes where the bee-eaters rested. They usually choose for resting dried or nude branches, without leafs. In these conditions, the pellets fallen in the grass were consumed by insects (ants and beetles), those regurgitated near the nests or the remnants brought by birds outside the nest, dragged with the feet and the tail, were consumed by *Motacilla alba, Acanthis cannabina, Passer domesticus* or *Oenanthe oenanthe*. In the colony of Ciuperceni the sparrows and pair of *Upupa epops* were foughting for these resources. Between 6 and 7 a.m. the hoopoes were examining the entrances of the nests, then the sparrows were coming, waiting for the adult bee-eaters coming with food, controling the nest entrances and picking the chitin remnants. During our observations we never saw an adequate behaviour of the bee-eaters when these species were approaching the nest, such as repelling these intruders. In all colony the pellets are consumed by ants and small insectivore mammals, as a neccessary food.

Insects from the *Merops apiaster* nests

Table 6

Birds species which feed on insect remnants in bee-eater colonies

Family	Commensal species	Colony	Year
Upupidae	*Upupa epops*	Ciuperceni	1998, 1999, 2000
Motacillidae	*Motacilla alba*	Furnica	1997, 1999
Turdidae	*Oenanthe oenanthe*	Furnica	1997, 1998, 1999
Corvidae	*Pica pica*	Furnica, Fratesti	
Ploceidae	*Passer domesticus*	Ciuperceni, Fratesti, Furnica	1998, 1999, 2000
Fringillidae	*Acanthis cannabina*	Furnica	1996, 1998, 1999

Order Coleoptera

Many beetle species are using bee-eater or sand martin nest to depose their eggs, in search of food or to rest. Kristofik and col. (op. cit.) found in *Merops apiaster* nest 25 species belonging to 15 families. In the studied colonies we digged four nests of Poiana, Frăteşti, Furnica. We found Staphylinidae (*Haploglossa nidicola*, 61 adults; *Philonthus* sp., 4 adults), Tenebrionidae (*Opatrum sabulosus,*

1 adult), Trogidae (*Trox hispidus*, 1 adult) and many larvae (Dermestidae, 21 specimens, Elateridae: *Agriotes* sp., 12 larvae, Scarabeidae, 8 larvae). The beetles of a these nests are carnivous as adults, and their larvae are necrophagous, saprophagous, detritivore, fungivore or phytophagous, but they are in small number.

Order Diptera

The bee-eater nests are offering to the flies larvae a rich food by the remnants of insects the nestling are regurgitating as pellets. Kristofik and col. (op. cit.) recorded in Slovakia over 14 fly species belonging to 8 families in *Merops apiaster*. Into the nests we digged we found a very great number of larvae of *Fannia canicularis* (Linnaeus, 1761), 57 specimens at Poiana and 83 specimens at Frăteşti. *Fannia canicularis* is a common species which is deposing its eggs in compost and garbage. We found also 12 pupae of Muscidae, *Calliphora vomitoria* (2 spec.) and *Musca domestica* (10 spec.).

Vertebrates using *Merops apiaster* nests as shelter

The bird nests are seeked by other animal species for shelter, for rest, or as reproducing places. The *Merops* nests are very good shelters for amphibians and reptiles. In July 1997 found at Furnica, in a deserted nest we digged, into the incubation chamber, a specimen of *Bufo viridis*; its was an ideal place, the sand was wet, the temperature around 22°C, compared to the 36°C which was outside, where soil, air and vegetation were dried as a result of the drought. In 1996 we found at Frăteşti a specimen of *Pelobates fuscus* in the tunnel of a bee-eater nest placed at a hight of less than 10 cm over the ground. The soil was sandy and *Pelobates* was using during the day the nest entrance as a shelter. In 1998, at Poiana, we found in bee-eater nests a specimen of *Lacerta agilis* as well as a slogh of *Natrix* sp. into an incubation chamber of an abandoned nest. In bee-eater colonies of Dobrogea, in the cliffs of Denis Tepe (Lăstuni), we have an observation, during the summer of 1973, a *Coluber caspius* was visiting the nests of *Merops apiaster* and a specimen of *Bufo viridis* found in a nest (in verbis Mircea Andrei).

Impact of human activities on bee-eaters colonies

The status of bee-eaters is variable in different countries. In some ones they are protected, in other ones they are considered as a pest and exterminated (shot, poisoned with strychnine, cyanide, carbon sulphide or chloropycrine).

In Romania the bee-eater is protected by the last Hunting Law (1996). But they always were the target of beekeepers, which think these birds are harmful. In the colonies studied by us beekeepers do not poisoned them, but they destroy their nests, digging with knives the entrances (Fig. 7 A). In several colonies placed near localities we found digged nests, destroyed by children, by curiosity, in some of them were greater nestlings, as the ones we saved at Frăteşti, in 1997 (Fig. 2 B). When the breeding season begins the nests are obturated with different objects: sticks, electric bulbs, etc., the birds being obliged to abandon the nests and to build other ones. In two colonies (Frăteşti and Ciuperceni) we found at the nests entrances loops improvised of thin wire and sticks for catching the adults (Fig. 8 A). The nestilngs are taken aut of the nests with a simple device made of reed, called „prepeleac" (in Romanian) (Fig. 8 B).

An important problem is the habitat destruction as a result of human activities. In the Danube flood plain, because of dam constructions, 40 years ago, the

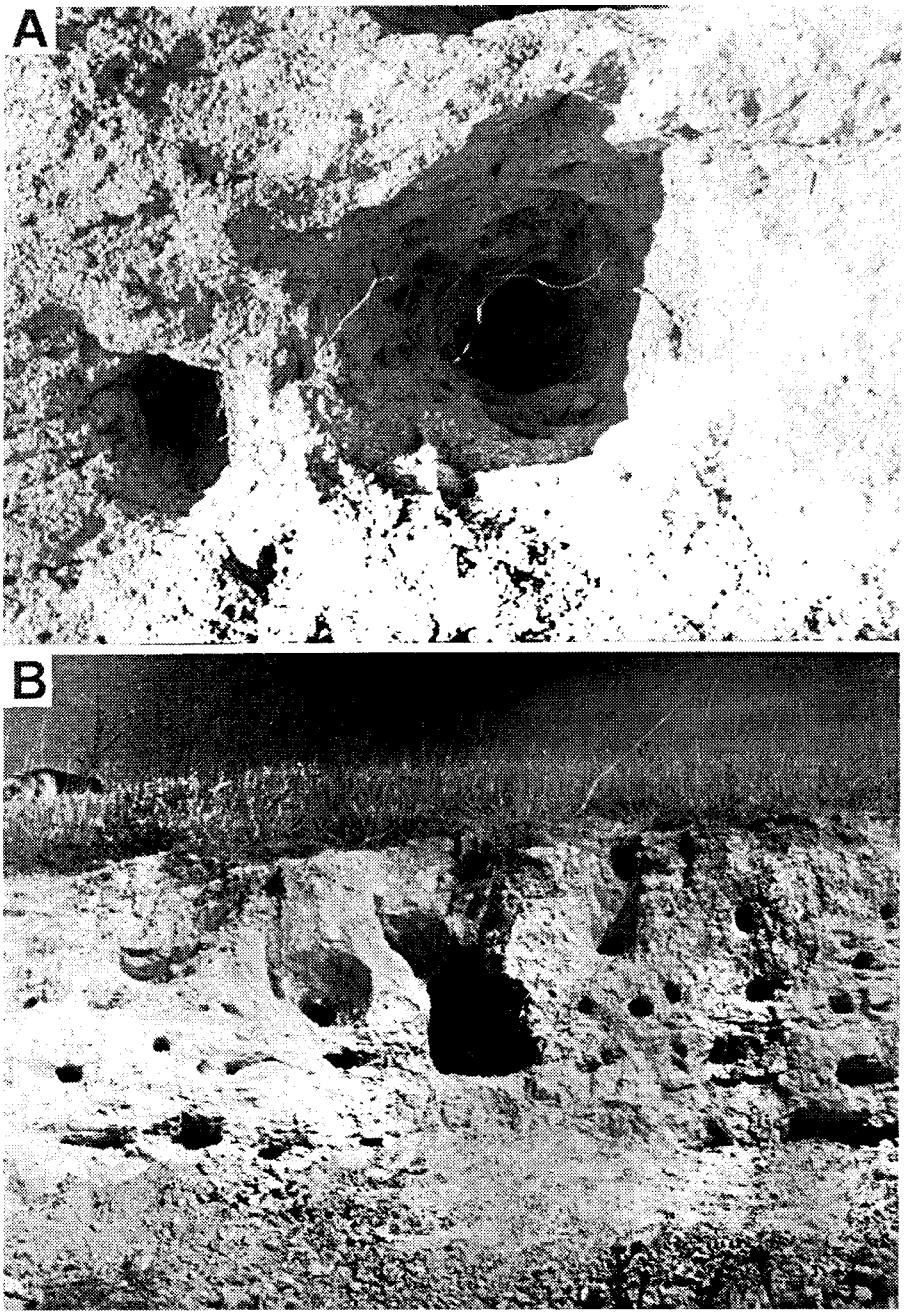

Fig. 7 – A, *Merops apiaster* nest at Furnica, digged by beekeepers with knives; B, nests of *Merops apiaster* at Frăteşti, destroyed by children.

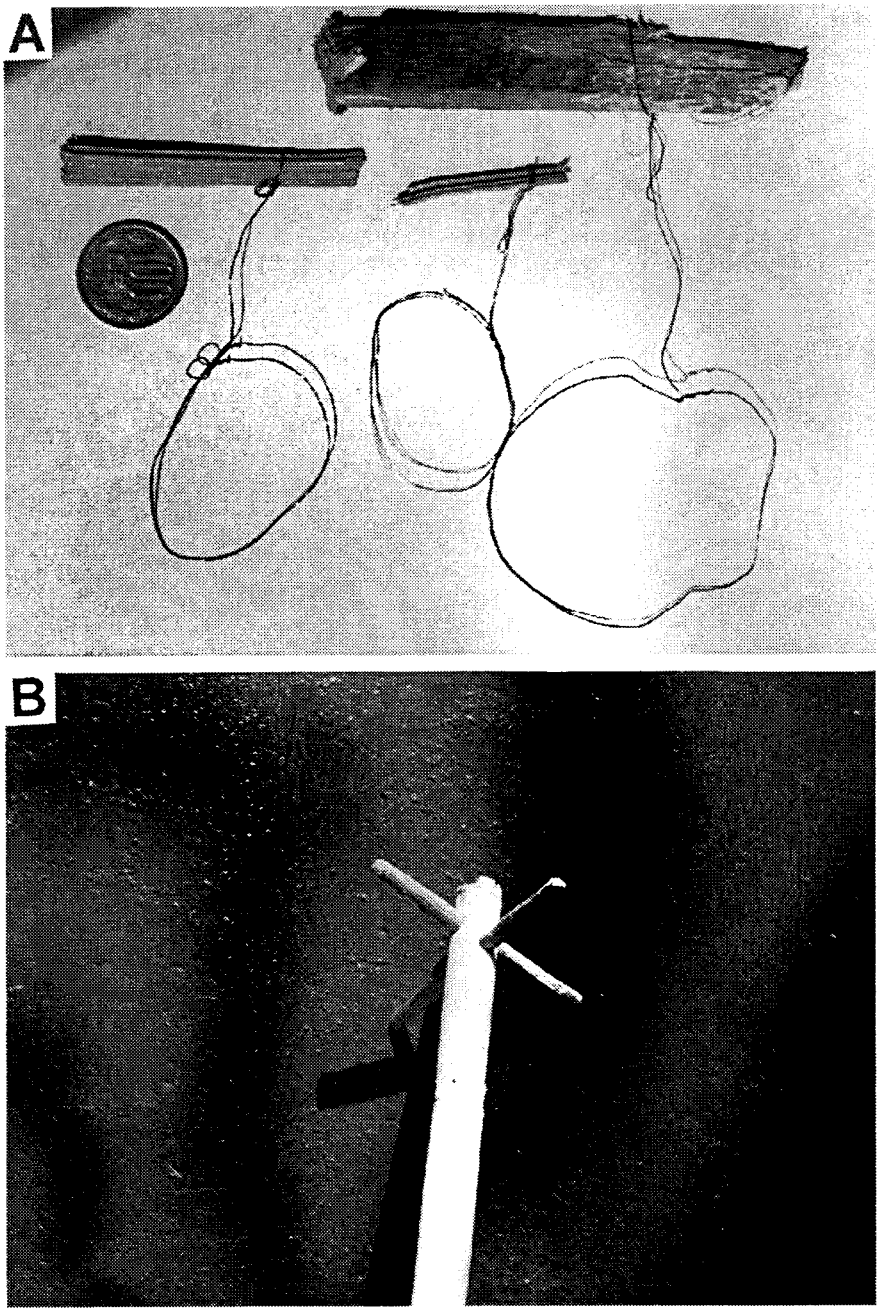

Fig. 8 – A, Loops used at nest entrances for capturing *Merops apiaster* adults; B, Device made of reed used for capturing *Merops apiaster* nestling.

steep shores digged by the water overflowing in the minor river bed dissapeared, crumbling or being covered with vegetation. Therefore the bee-eaters find with increasing difficulty breeding places.

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RELAȚII INTERSPECIFICE ÎN POPULAȚIILE DE *MEROPS APIASTER* L. (AVES: CORACIIFORMES) DIN SUDUL ROMÂNIEI

REZUMAT

În coloniile din sudul României, cercetate de noi în perioada 1990-1999, *Merops apiaster* apare accidental în hrana unor strigiforme sau falconiforme. Este vânată de mustelide, iar puii sunt atacați de carabidae. *Passer montanus*, *Passer domesticus*, *Sturnus vulgaris*, *Apus apus*, *Motacilla alba*, *Oenanthe oenanthe*, *Coracias garrulus*, *Falco tinnunculus*, *Athene noctua* cuibăresc în cuiburile de albinărel. Insectele parazite pe *Merops* sunt *Meropsiella apiasteri* și *Meropoecus meropis* (Mallophaga) care parazitează exclusiv specia *Merops apiaster* și Diptera (Carnidae, Hippoboscidae). *Upupa epops*, *Motacilla alba*, *Oenanthe oenanthe*, *Pica pica*, *Passer domesticus*, *Passer montanus*, *Acanthis cannabina* și furnicile se hrănesc cu resturile de insecte căzute de pe lângă cuiburi sau regurgitate de adulți ca ingluvii. Cuiburile de *Merops* reprezintă adăposturi foarte bune pentru amfibieni și reptile.

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