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# THE DIET OF LARGE GREEN BEE-EATERS *MEROPS SUPERCILIOSUS* SUPERSP. AND THE QUESTION OF BEE-EATERS FISHING

by C. H. Fry

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By 'large green bee-eaters' are meant the Madagascar Bee-eater *M. superciliosus*, the Blue-cheeked Bee-eater *M. persicus* and the Blue-tailed Bee-eater *M. (s.) philippinus*, together comprising the *M. superciliosus* superspecies (Snow 1978). This paper deals in particular with the second and third taxa but its conclusions doubtless apply also to the nominate one.

As predators, bee-eaters are of course decidedly specialist. They take a wide variety of flying insects and within size limits probably most that they encounter. But large proportions of their diets are Hymenoptera, in particular dangerous stinging wasps and bees, which other aerial-feeding birds like drongos, broad-billed rollers, flycatchers, pratincoles, swifts and swallows mainly avoid.

At first appearance Blue-cheeked Bee-eaters seem to have the same foraging behaviour and diet as most of their congeners. They feed by making forays after passing insects, from an elevated vantage point like a dead limb or - particularly favoured - telegraph wires. Larger prey items can sometimes be identified when the bird returns with it to its perch: butterflies, dragonflies, or stinging hymenopterans like sandwasps (Sphecidae) and spider-hunting wasps (Pompilidae); and, as with other bee-eaters, Honeybees *Apis mellifera*, when plentiful, may be eaten to the exclusion of other prey (Borrett 1973).

But appearances can be deceptive, and to investigate the diet of this bird in detail I analyzed the content of 44 regurgitated pellets collected at Malamfatori, 13°43'N, 13°29'E, on the shores of Lake Chad in Bornu State, Nigeria, on five dates in March 1967, 12 at the same place in April 1968, and 40 at a nesting colony at 09°45'N, 04°43'E, on the River Niger, Kwara State, Nigeria, in May 1967. In addition I examined the contents of two gizzards collected at Bangui in the Central African Republic on 10 December 1969, in forested country near the Ubangui River. Only a few small or soft sclerites of insects pass from bee-eaters' gizzards (where food is triturated) into their intestines for ultimate excretion; nearly all are regurgitated as well-formed blackish pellets which microscopic examination shows to contain even such insignificantly small parts as mandibles, tongues, stings, antennae and compound-eye fragments. I am therefore confident that, contrary to the fears expressed by Hartley (1948) about this very species, bee-eater pellet examination gives an unbiased and accurate picture of their diet.

RESULTS

Prey consisted exclusively of insects, of which 924 were recovered from pellets. Results from the Nigerian material are given in Table 1 and indicate, surprisingly, that numerically dragonflies and demoiselle-flies (Odonata) comprise about two-thirds of the diet. By weight and hence probably nutritionally, odonates will feature even more importantly in Blue-cheeked Bee-eaters' diets, since they are individually larger on average than other prey items. Hymenoptera comprise roughly one-sixth of the diet, two-thirds of them being stinging worker Honeybees. The remaining prey, in sequence of decreasing importance, are bugs, flies, butterflies, beetles, grasshoppers and mantises.

Table 1 Dietary composition of *Merops persicus*, Nigeria

| | Prey numbers | | | Prey percentages | | | |
|---|---|---|---|---|---|---|---|
| Sample: | (a) | (b) | (c) | (a) | (b) | (c) | Combined |
| ODONATA | 369 | 51 | 185 | 69.5 | 83.6 | 55.7 | 65.5 |
| ORTHOPTERA | 2 | | 3 | 0.4 | | 0.9 | 0.5 |
| DYCTYOPTERA | 1 | | | 0.2 | | | 0.1 |
| HEMIPTERA | 58 | | 5 | 10.9 | | 1.9 | 6.9 |
| LEPIDOPTERA | 10 | | 26 | 1.9 | | 7.8 | 4.0 |
| DIPTERA | 41 | | 17 | 7.7 | | 5.1 | 6.3 |
| HYMENOPTERA | 25 | 6 | 93 | 4.7 | 9.8 | 28.0 | 13.4 |
| COLEOPTERA | 25 | 4 | 2 | 4.7 | 6.6 | 0.6 | 3.3 |
| Totals: | 531 | 61 | 332 | 100.0 | 100.0 | 100.0 | 100.0 |

Sample (a) 44 pellets L. Chad 1967, (b) 12 pellets L. Chad 1968, (c) 40 pellets R. Niger 1967.

Insect families: ODONATA (see text); ORTHOPTERA Acrididae; DYCTYOPTERA Mantidae; HEMIPTERA Cicadidae, Reduviidae, Gerrididae, Lygaeidae, Coreidae, Pentatomidae, Cydnidae, Gelastocoridae, Nepidae; HYMENOPTERA Ichneumonidae, Scoliidae, Chalcidae, Formicidae, Pompilidae, Vespidae, Sphecidae, Halictidae, Apidae; COLEOPTERA Scarabaeidae, Curculionidae, Bostrychidae. Further taxonomic detail available from the author.

The presence of odonates was detected by mandibles rather than wings. Odonate mandibles are remarkably uniform morphologically, even between Anisoptera (dragonflies) and Zygoptera (demoiselle-flies), so that further identification was not possible. However, mandibles recovered from pellets were matched for size with those on entire insects, and suggest that the odonates eaten range in size from small Zygoptera with body length of 30 mm to large Anisoptera, e.g. *Anax*, up to 80 mm long.

The two Bangui gizzards contained 13 odonates, 4 flying ants, a coreid bug, a butterfly, and a ? fly. The proportion of odonates is again 65% (see Table 1).

## DIETS OF ALLOSPECIES

I collected 20 Blue-tailed Bee-eater pellets from Universiti Malaya hockey-pitch, Kuala Lumpur, in October 1980 and found that the diet was overwhelmingly hymenopteran, mainly the honeybees *Apis indica* and *A. dorsata*. Out of insect 585 prey items in total, only 5 were odonates. They had also been feeding on fish (see below).

## PREDATION TECHNIQUE

Dyer (1980) described for the first time the peculiar way in which a Blue-cheeked Bee-eater, having flown out towards an airborne insect from a perch, may catch it from below. The bird seizes its prey with the tips of the mandibles, the head being thrown back and the beak pointing vertically skyward. I have not seen such a technique used in Africa; but in October and November 1980 I made a long series of observations on Blue-tailed Bee-eaters predating in this manner in Malaysia.

Unlike Dyer's birds, the Blue-tailed Bee-eaters never caught more than one insect per foray, nor evidently did they mandibulate prey before they had returned with it to perch. Many insects were captured in normal bee-eater fashion, but others were seized from below with the beak pointing straight upward, which behaviour was remarkable for being sustained up to 1.5 secs. I observed it in three places : birds hawking over extensive paddy-fields from power cables 7 m high; hawking low over a 120-m broad estuary from adjacent mangrove; and hawking very low over a campus hockey-field from 2-m high goal posts.

In the first situation the bee-eaters scanned into the 2-4 knot wind and flew to intercept prey (small wasps) flying towards them down wind. A bird flew straight and level or rising slightly on a course to pass immediately below the insect, but at the last moment it reached its beak up and masterfully plucked the insect from the air. Incidentally, the strike was made up to a measured 65 m from the birds' perch after a flight of up to 6.5 secs duration. During that time the insect would have moved 14-28 m and was therefore discerned by the perched bee-eater, against a background of sky and perhaps distant trees, at a distance of 80-95 m!

In the second situation the birds were feeding on the large and fearsome wasp *Vespa tropica*, taken singly after a declining 10-70 m flight over

water, and always seized from below. Perhaps because of the size and danger of this prey, the bee-eaters held their beak-up capture-posture for a long time, estimated at 1.5 secs, while making several wing-beats for the return to the perch, where the wasp was "bee-rubbed" and beaten until immobile.

The third situation, when the birds were feeding mainly on the large honey-bee *Apis dorsata*, was chiefly remarkable for their ability to fly below an insect which was itself only 0.5 m above the short grass sward. All the same the sky-pointing posture was used and momentarily sustained.

## THE QUESTION OF FISHING

From time to time claims have been made that various species of bee-eaters feed by diving into water. Never having seen such behaviour myself in hundreds of hours watching these birds, I had privately dismissed such reports as being somehow in observational error for bathing, which is quite common and could easily be mistaken by the unwary as splashing onto the surface of water for food. Bathing in bee-eaters, when I have seen it, involves a slow glide from a low waterside perch, skimming over still water and with a sudden twist or stall splashing onto the surface, partly but momentarily immersing the body. It is followed by vigorous preening at the perch, and never by prey-beating behaviour nor even swallowing that I have been able to observe.

I have been able to find 13 published references to bee-eaters diving into water; they are listed in Table 2 and involve eight species of *Merops*. Most authors have briefly discussed whether their birds were bathing or feeding. There are seven positive indications of the latter, as follows -

(1) (Table 2): "Mr. Blyth informs me that he had seen a number of them assembled round a small tank, seizing objects from the water in the manner of kingfishers."

(3): A young bird dived into a pool and "emerged with a white larva-like object in its bill".

(4): Under the title "Bee-eaters diving into water for floating insects" Foenander stated that birds splashed onto water but in his text made no remarks in substantiation of the inference in his title.

(6): "... gliding a foot or two above the water and dropping down to pick small insects from the surface" (*M. persicus*) and "... dived into the water with considerable force so that the head and most of the body were submerged, and when they came up some sort of insect could be seen in the bill" (*M. apiaster*).

(8): "... after rising from the water, *[the bird]* dropped something and immediately turned to plunge in after it ... *[it was then]* seen to be swallowing ..."

(11): "... emerged from the water with prey which I was unable to identify" (*M. superciliosus*).

Table 2 Literature references to diving in bee-eaters

| | Date | Authors | Reference | Species | Location |
|---|---|---|---|---|---|
| (1) | 1885 | H.E. Dresser | 'Monograph of Meropidae': 34 | *M. orientalis* | s.e. Asia |
| (2) | 1953 | B.E. Smythies | 'Birds of Burma': 342 | *M. leschenaulti* | Burma |
| (3) | 1956 | K.E.I. Barham, P.J. Conder & I.J. Ferguson-Lees | Bird Notes 27: 40 | *M. apiaster* | England |
| (4) | 1956 | E.C. Foenander | Malay Nat. J. 10: 126 | *M. viridis* | Malaysia |
| (5) | 1960 | A.J. Tree | Brit. Birds 53: 130 | *M. apiaster* | Zimbabwe |
| (6) | 1960 | B.L. Sage | Brit. Birds 53: 222 | *M. persicus, M. apiaster* | Iraq |
| (7) | 1960 | C.A. White | Brit. Birds 53: 404 | *M. persicus, M. orientalis* | Egypt |
| (8) | 1961 | A.J. Tree | Brit. Birds 54: 286 | *M. apiaster* | Zambia |
| (9) | 1961 | A.J. Tree | Ostrich 32: 188 | (summarizes publs. (5)-(8)) | |
| (10) | 1963 | J.M.E. Took | Ostrich 34: 176 | *M. superciliosus** | Zambia |
| (11) | 1965 | J.F. Reynolds | E. Afr. Wildl. J. 3: 129 | *M. pusillus, M. superciliosus** | Tanzania |
| (12) | 19. | G.S. Cansdale | Niger. Field 44: 82 | *M. ?viridis* | Sumatra |
| (13) | 1980 | R.A. Conant | Bull. Zambian Orn. Soc. 12 | *M. nubicus, M. persicus* | Zambia |

(* Might mean *M. (s.) persicus*.)

(12): "The fry were subsurface and the birds half immersed themselves, coming out with the small fish in the beak." Three months after the observation the author added "I could see fry in the beak as they emerged ... they did not seem to be over 2-3 cm long", but a further two years later he qualified it with "I had little doubt that they were fishing and thought I could see clearly the flash of fish being taken in the beak" (both in litt.).

Observations (6) and (11) were of the *M. superciliosus* superspecies, and even if they are not entirely convincing, I have now been brought around to the realization that this superspecies (and some other *Merops* species too) does occasionally fish, by my finding fish bones in pellets. As mentioned above I collected Blue-tailed Bee-eater pellets at a hockey-pitch in Kuala Lumpur in October 1980. One or two pellets were found daily under a goal-post cross-bar which was the favoured perch throughout the month of a pair of bee-eaters. All except two of 20 pellets collected were normal in appearance and typical in content (in sum 572 insects: 91.3% honeybees *Apis indica* and *A. dorsata*, 5.2% other Hymenoptera, 3.5% other alate insects). The exceptional two, collected together, were smaller and finer-textured than usual and grey rather than black. They contained 60 fish vertebrae with centra 1.0-1.2 mm long, other fish bones, and 14 insects (8 ants, vespid, scoliid and pompilid wasps; a beetle, a bug and a grasshopper). The fish were identified as almost certainly *Gambusia affinis* (Cyprinidontiformes, Poeciliidae). Males reach 35 mm long and females 60 mm; each has 33 vertebrae, so the contents of the pellets very probably represent two males.

A small stream usually less than 150 mm deep ran alongside the hockey-pitch and the bee-eaters spent much time hawking insects from streamside bushes. The fishes were likely to have been taken there. *Gambusia affinis* is a mosquito-fish commonly occurring at the surface film, making it a far more likely prey than deep-dwelling animals. Although I did not see the bee-eaters diving onto the stream, I am confident that the pellets had been regurgitated by no other bird species. The only other large-pellet-casting bird present was a single kingfisher *Halcyon smyrnensis*; I have studied that species elsewhere and its pellets look quite different. Moreover, although the two pellets were abnormal in some characters they were of typical bee-eater shape and consistency; and the insects in them are practically diagnostic of *Merops*.

Two further observations are additional to the foregoing and substantiate the notion that bee-eaters occasionally fish. In 1972 I collected a few pellets of Blue-breasted Bee-eaters *M. variegatus* near the shore of Lake Victoria at Usengi, Kenya; they were stored away and analyzed only after my 1980 visit to Malaysia. All were normal in appearance and content except one which was slightly smaller, greyish, dense and fine-textured. It contained no insect remains; but a few fish bones and large numbers of ctenoid scales, almost certainly of cichlids (Perciformes, Cichlidae) and very probably of a small, neustonic (surface film feeding), vegetarian species. From scale size the fish or fishes were judged to be < 30 mm long.

Last, Richard Harris (unpubl.) studied the behaviour of Red-throated Bee-eaters *M. bulocki* in Ghana in July-August 1978 and had the following to say (Aberdeen University Hons. Zool. thesis, 1979):

"Flights that involve bee-eaters coming into contact with water fell into two categories."

"1 Feeding flights that involved the birds picking insects from the surface. This was observed on three occasions .... on each the birds were observed to make a minimal contact with the water by swooping from a perch to a point just above the point of contact with the water, stalling and stabbing their bills into the water, the rest of the bird making only fleeting contact. Each time the bird returned immediately to its perch and twice was seen to beat what is presumed to have been a prey insect in a manner identical to normal prey immobilization behaviour."

"2 Definite bathing behaviour, as opposed to feeding from the water, was recorded 71 times ...."

## DISCUSSION

The spectrum of insects captured by bee-eaters varies widely from place to place according to local circumstances. In Africa, pellets collected from suburban situations with honeybee-attracting flowerbeds always have a higher proportion of honeybees in them, I have found, than pellets collected 'in bush'. That is probably the reason for the high proportion of bees in the suburban sample of *Merops superciliosus* food from Kuala Lumpur. In another Malaysian study odonates featured far more importantly, with 26% by weight (Avery & Penny 1978). Many regional bird books mention odonates as common prey of this species and of its allospecies *M. persicus*, and there is every reason to suppose that the larger sample from four central and west African localities, with 65% numerically of odonates, is representative of the diet of the superspecies.

A specialization on odonates is not unexpected, since of all bee-eater species *M. superciliosus sens lat.* evidently has the greatest predilection for waterside habitats, and odonates are of course strongly associated with water, where they hatch. Breeding habitats of these bee-eaters in Africa are river valleys, open sandy plains with scattered trees usually near rivers or lakes; swamps and riparian vegetation in shallows with trees; and coastal dunes with nearby creeks and mangroves. Wintering grounds are greener - well-watered and well-wooded country as around Lake Victoria and the southern part of Lake Chad (Fry 1981). Other insect families in the pellet samples which are aquatic are Nepidae and Gerrididae, doubtless airborne when taken. As for fish and insects taken from water, only the *M. superciliosus* superspecies is certainly implicated (my finding above and references (6) and (11); reference (12) could refer to *M. superciliosus* as probably to *M. ?viridis*). *M. apiaster* evidently feeds similarly; see (3), (6) and (8). Perhaps *M. orientalis* does too (1). With whatever species, it must be a rare event, probably depending upon the special circumstance of fish or insects being easily visible at the surface of still water.

While *Merops superciliosus* supersp. favours the proximity of water, it also nests, somewhat paradoxically, in waterless semi-desert. What Blue-cheeked Bee-eaters foraging in semi-desert eat is poorly known; at Biskra, Algeria, prey included large Hymenoptera and Coleoptera (*Ammophila, Psammophila, Philanthus, Sphenoptera, Gymnopleurus*) (Koenig 1953). They may also feed upon odonates, since migratory ones often occur in arid terrain far from water (pers. obs.).

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SUMMARY

*Merops persicus*, an allospecies of *M. superciliosus*, is literally a bee eater but it specializes on Odonata (65% of 944 prey items sampled in four localities). Cases of fishing by *M. superciliosus* in Malaysia, *M. variegatus* in Kenya, and *M. bulocki* in Ghana are described, and literature claims for fishing by bee-eaters are reviewed. They suggest that *M. persicus*, *M. apiaster* and *M. orientalis* may also fish rarely.

RESUME

*Merops persicus*, allo-espèce de *M. superciliosus*, est bien apivore mais spécialisé en Odonates (65% des 944 proies réparties sur quatre localités). L'auteur décrit des observations de *M. superciliosus*, *M. variegatus* et *M. bulocki* pêchant en Malaisie et en Afrique, et cite les références bibliographiques de guêpiers pêchant, ce qui suggère que *M. persicus*, *M. apiaster* et *M. orientalis* puissent le faire à l'occasion;

REFERENCES

AVERY, M.L. & PENNY, N.D. (1978) Analysis of pellets from Blue-tailed and Blue-throated Bee-eaters in Province Wellesley, Malaysia. *Malay. Nat. J.* 32: 223-226

BORRETT, R.P. (1973) Notes on the food of some Rhodesian birds. *Ostrich* 44: 145-148

DYER, M. (1980) Notes on prey-capture by Blue-cheeked Bee-eaters. *Malimbus* 2: 76

FRY, C.H. (1981) The residential status of the Madagascar Bee-eater *Merops superciliosus* L. in Africa. *Scopus* 6: 000

HARTLEY, P.H.T. (1948) The assessment of the food of birds. *Ibis* 90: 361-381

KOENIG, L. (1953) Beobachtungen am afrikanischen Blauwangenspint (*Merops superciliosus chrysocercus*) in freier Wildbahn und Gefangenschaft, mit Vergleichen zum Bienenfresser (*Merops apiaster* L.). *Z. Tierpsychol.* 10: 180-204

SNOW, D.W. (ed.) (1978) An Atlas of Speciation in African Non-Passerine Birds. BMNH, London.

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