

OF HONEYGUIDES AND HUMANS – A UNIQUE INTERSPECIFIC ASSOCIATION FORMED OVER HONEY

MANJISHTHA BHATTACHARYYA* AND SUSANTA KUMAR CHAKRABORTY**

Humans have been fascinated with honey ever since the dawn of civilisation, with honey hunting, i.e. gathering of honey from wild beehives dating back to more than 10,000 years. Although honey hunting has given way to honey husbandry all over the world, there are still some ethnic tribes who gather wild honey. Some of these tribes have developed unique associations with animals to help them in their hunt. This paper is a review of such a unique mutualistic relationship displayed by the birds commonly called Honeyguides with the tribal honey gatherers of Africa.

Introduction

Honey needs no introduction. Its delectable sweetness and wholesomeness are nonpareil and adding to that its amazing story of origin, one feels compelled to wonder if there is an element of divinity to honey. It is perhaps the closest thing to Ambrosia, the drink of the Gods, that man can ever get to tasting. Of all of Nature's gifts that man should be grateful for, honey most certainly ranks near the very top of the list.

Honey is a perfectly balanced natural source of sugar constituted of more than 75% carbohydrates (mostly fructose and glucose), about 18% water and traces of proteins (in the forms of various enzymes) and amino acids, vitamins (B and C), minerals (zinc, calcium, iron, potassium, phosphorus, manganese, etc.) and several organic acids. Honey also contains many antioxidants, of which one, Pinocembrin, a flavonoid found abundantly in honey and bee propolis, has rich antimicrobial, anti-inflammatory and anticancer properties¹. Pollens of flowers, from which nectar is collected by the bees, almost always end up in honey. The whole cocktail is a supremely salubrious concoction that is both food and medicine at the same time, since honey, apart from providing good

energy (about 308 kcal per 100 gms)², also acts as a good antimicrobial agent³. There is, therefore, little wonder that this rich source of sugar and natural wholesomeness would be in continuous demand in human societies since ancient times.

Prehistoric man had very few natural sources of sugar available to meet his dietary requirements. Consequently, the discovery of honey must have been a big event in the history of human civilisation, comparable perhaps to the discovery of fire albeit at a gastronomic level. Ancient man was primarily a honey gatherer, but with time man has shifted from honey gathering to honey husbandry. Although honey gathering in its most primitive form still persists in different parts of the world, chiefly in the tropics, bee keeping and honey harvesting is now a fully formed commercial industry that produces around 1.2 million metric tonnes of honey annually worldwide⁴. Such is the allure of honey.

But is this allure confined to humans only, or are there appreciators of honey among other animals as well? As it turns out, honey is quite popular among a whole gamut of animals, starting from tiny insects like certain species of yellowjackets (genus *Paravespula*)⁵ to big mammals like badgers, civets, racoons and bears⁶. These lovers of honey frequently steal honey from hives, often devouring bee larvae and eggs in the process. However, of all the animals

* UGC Junior Research Fellow, Department of Zoology, Vidyasagar University 721102, email: manjishtha.b@gmail.com

** Professor, Department of Zoology, Vidyasagar University 721102

that rob beehives either for honey or for bee grub, none is as unique in its behaviour as the little birds called Honeyguides.

This paper is a review of the amazing behaviour displayed by Honeyguides in relation to mammals, chiefly humans, on which they rely to plunder the beehives, a task for which they are physically unsuited. In light of the shifting reliance of humans on alternate food sources, whether this behaviour displayed by the said birds shall get affected will also be discussed in the present paper.

Honeyguides and Their Unique Behaviour in Relation to Humans

Keepers of Hive Secrets : Honeyguides are small land birds, belonging to the Order Piciformes. They are grouped under the family Indicatoridae and this name reflects the unusual behaviour these birds show in relation to mammals, chiefly humans. Honeyguides are found predominantly in Africa while two species occur in Asia.

Physically, the honeyguides are small and resemble passerine birds. Usually dull in colour, they may have occasional bright plumage, chiefly light coloured tail feathers which perform crucial role in their bizarre behaviour which shall be discussed shortly. Most of the honeyguides studied so far are known to be brood parasites, laying their eggs in nests of other birds, just as cuckoos do.

Honeyguides usually feed on insects, spiders, occasional fruits, and most importantly on beeswax. These are one of the few birds that can eat and digest beeswax with high efficiency (above 90%)⁷. This dietary requirement mandates frequent pillaging of beehives.

However, the wild honeybees tend to nest in difficult-to-access places, often fortifying the hive entrances. Besides, an angry swarm of wild honeybees is almost a certain death sentence for any marauding honeyguide, which is barely bigger than barn swallows. As such, the honeyguides need help from other agents who would pry open the beehives for them to feast on. This has necessitated the evolution of the unusual behaviour displayed by these unique birds in enlisting help from bigger stronger animals, all of which are mammals.

For centuries, it has been a common knowledge among the people in Africa, where these birds are found extensively, that honeyguide birds will indicate humans, honey badgers and often baboons the direction to beehives and will guide them to the hives. When the hive raider, be it a man or a honey badger, plunders the beehive and leaves, the honeyguide will feed on the bits of hive left

behind, eating the beeswax and the honey and bee larvae. It is this unusual behaviour shown by the birds that has earned them their common name the 'Honeyguides', their family name Indicatoridae, and even their genus *Indicator*, under which there are about 11 different species.

Science Behind the Myth : So is there any merit to this tale? To separate legend from reality, Isack and Reyer (1989)⁸ conducted a three-year study with the Boran people in Kenya. The Borans are a pastoralist herdsman tribe⁹ relying on collection of honey from wild beehives to supplement their diet. Since locating hives in the vast savannah is an arduous task, the Borans rely on the honeyguides to locate suitable hives for them. The Boran honey gatherers signal the honeyguides with a characteristic whistle, which, if picked up by the birds, is answered back by a return call from the birds (Isack and Reyer, 1989). The birds then disappear for a little while and come back to show the gatherers the way to the hive by frequently flying off and perching on branches along the way to the hive, using their light coloured tail plumage as a flag. The arrival at the hive is indicated by a series of calls by the bird which then quietly perches nearby waiting for the gatherer to do his job. The gatherers, aided by smoke and specialised tools, can easily get access to the hives and drive away the bees, which the birds cannot themselves manage to do. When the gatherers leave, having pillaged the nest and broken off most of the honey and grub laden hive, the birds enter the nest and feast on the broken hive with its wax, grub and honey left unguarded by the bees.

It was shown in the same study that the time taken by Boran honey gatherers in finding a hive without the aid of the honeyguides was 8 hours and 54 minutes on average, which was drastically reduced to 3 hours and 36 minutes if help from these birds was enlisted, and on several occasions, the gatherers failed to locate a single hive in a day if they had no help from the honeyguides⁸.

The study showed that the Boran people can also estimate the average distance to the hive from their starting locations from the time taken by the bird to return after disappearing first. The closer the bee hive, the shorter is the duration of the first disappearance by the bird, but if the hive is far away, the duration of the first disappearance is longer. The birds also stopped and perched more frequently, the closer the gatherers got to the bee hives. Isack and Reyer took precise time and distance measurements which confirmed these claims of the Borans.

Such reliance by ethnic African people on the beehive locating skills of the honeyguide birds has been reported from many different tribes across the African continent,

including the Masais¹⁰, the Samburus¹¹ and the Hadza, the later forming the subject of an intensive study published in 2014¹².

Honeyguides Contribute Significantly to Human Foraging : In a study spanning 7 years (2006-2013), Wood *et al.* (2014) discovered significant positive benefits the people of the Hadza tribe obtained by associating themselves with the honeyguide birds¹². The Hadza people still rely on their traditional hunter-gatherer lifestyle for obtaining 95% of their food. An estimate by Marlowe *et al.* (2014)¹³ suggests that as much as 15% of the total yearly calories that Hadza bring back to their camps may be constituted of honey. This high reliance on honey as a source of calories perhaps has necessitated, or has been made possible, by a dependence on the honeyguide birds to direct them to the beehives, which the Hadza people then pillage and plunder. Hadza do not collect the hives for the honey only. Bee brood also serves as an integral part of their diet and as much as 16-20% of their annual diet, obtained by foraging, is constituted of honey and bee brood, of which 8-10% is acquired with the direct help from honeyguide birds¹².

The authors also showed that, when guided by these birds, the chances of the Hadza honey gatherers of finding beehives increased significantly than when they ventured to find the hives on their own. While, unaided, the Hadza spotted hives at the rate of 0.5 nests per hour, when following honeyguides, they found nests at a rate of 3.3 nests per hour, a 560% increase in efficiency of locating hives. Also, if the men were not guided by the birds, they managed to find nests upon inspecting a tree with a success rate of 19%, which drastically increased to 58% when they followed a honeyguide¹². Clearly, from this study, it became evident that the honeyguides are better locators of beehives than men, although they still have to rely on the men to access the hives.

Keeping in tune with the local folklores, Wood *et al.* also found that the honeyguides tend to lead the Hadza to those beehives which promised a greater yield¹². The Hadza recognize 7 distinct honeybee species as potential honey sources, of which 6 are stingless and produce smaller hives with lesser honey compared to one sting-bearing honeybee, *Apis mellifera*, which produces the greatest honey in terms of quantity. The authors found that honeybees led the Hadza honey gatherers to the *Apis mellifera* hives only, and also tended to lead men to the hives which yielded the maximum amounts of honey. On average, thus, the Hadza extracted 7480 kcal of energy from the hives these birds showed them to, a much higher score compared to the yield from the hives these men found on their own - 1390 kcal from

nests of stingless bees and 2320 kcal from *Apis mellifera* nests found without honeyguide help¹².

This might of course be because the honeyguide birds can access the stingless bee nests without the help from humans. It is the big and heavily guarded nests of the stinging honey bee that need the joint effort of the bird and the man to be broken into and looted. This hypothesis, however, needs testing.

Proposed Mechanism of Evolution of This Unique Behaviour : The unique relationship between the honeyguide birds, notably the Greater Honeyguide *Indicator indicator*, and different ethnic African tribes have been the subject of much curiosity in Western science since its first report by Sparrman in the 1780s¹⁴. However, very little has been unravelled about the physiological or evolutionary basis of this unusual behaviour on the part of the birds, although the 2014 study by Wood *et al.* shed some valuable light on the same.

The authors suggest that this unique relationship between the birds and the human gatherers has evolved over the course of millennia, perhaps arising first in the Pliocene when the earliest hominins started pillaging beehives for honey and brood¹². Borrowing an idea expounded by primatologist Wrangham (2012)¹⁵ regarding the earlier use of fire by hominids than usually believed, Wood *et al.* suggested that the relation between the honeyguides and the modern day humans may have started as early as with some Australopithecine or Hominins like *Ardipithecus ramidus*, in the form of a commensalism. They hypothesised that these early hominins must have controlled fire and had used smoke to drive away bees from hives for collecting honey and that opportunistic honeyguide birds started following these earliest honey gatherers to feed on the left over brood and beeswax once the hominids were done with the hives. This commensal phase, with the birds benefitting from their association with the hominids without costing the latter anything, evolved into a mutualistic relationship with time. The evolving hominids, on realising that the birds were better hive locators than them, started to follow the honeyguides instead of inadvertently leading them to the spoils of their caper¹². Evolution has perfected this interspecific communication so that modern day humans and honeyguides perfectly understand each other's intent through vocalisation and embark on this joint venture together for rich spoils that benefit both.

Noting the difference in the way the honey gatherers treat the helping honeyguides, by either rewarding them with pieces of comb laden with wax and brood, as the Borans do, or starving them the Hadza way, by burning or

burying all such leftovers, Wood *et al.*, proposed that the bird-man mutualistic relationship has been transformed into, what the authors prefer to call, ‘*manipulative mutualism*’, at the hands of man. By altering the payoffs the birds receive, either a share of the bounty or none, the humans are perhaps manipulating this mutualistic relationship to their benefit, depending on their local environment. Humans living in areas where there is food scarcity and who regularly harvest honey must benefit by restricting the birds access to pillaged beehives, so as to keep them unsatiated, therefore looking out for more hives. In contrast, humans in areas of greater food security and with less honey harvesting behaviour would benefit by rewarding the honeyguides so as to develop or reinforce this guiding habit in the birds¹².

Fate of Honeyguide – Human Relationship : Manipulative or not, this mutualistic relationship between the honeyguides and humans might be facing a risk of going extinct. Observations have suggested that in areas where honey gathering is no longer practised, the greater honeyguides no longer guide people to bees’ nests⁸. In many parts of Africa today, people have begun to abandon traditional honey gathering in favour of keeping domestic bees and have also begun to substitute refined sugars bought at the market for the honey gathered from hives of wild bees. With wild honey no longer being collected as much, the honeyguide is expected to gradually eliminate this behaviour.

Could there be a strong enough directional selection, if the dependence of humans on honeyguides for locating beehives vanish, forcing the honeyguides to develop resistance to bee stings and enabling them to harvest wax and bee larvae by themselves without the need for human assistance? Or the birds may even come to rely completely on nests of stingless bee to meet their dietary requirements. Only time shall reveal how evolution will shape the future of honeyguides and determine this unique man-animal interaction.

Discussion

The Allure of the Honeyguides : Owing to their bizarre behaviour, the honeyguides have received a lot of attention from the scientific community in recent years. Not just their interaction with men, and supposedly with some animals like the honey badgers (*Mellivora capensis*), although this latter claim has been strongly refuted by some¹⁶, their reproductive behaviour has also been a reason of much intrigue among the behavioural ecologists. The Greater Honeyguide (*Indicator indicator*) females lay eggs in the nests of different host birds, like bee-eaters, hoopoes,

etc. and destroy the eggs of the host birds. Newly hatched honeyguide chicks also kill their foster sibling chicks and eliminate competition for food brought in by the foster parent birds. Now, new research has revealed that there may be a strong genetic basis determining in which host bird nest a particular female honeyguide will lay its eggs and that specificity maybe handed down by mother birds to daughter birds, possibly through the W chromosome (sex determining chromosome in birds, like the maleness determining Y chromosome in humans), giving rise to two distinct lineages of honeyguides – one which lays eggs in bee-eater nests underground, and the other which prefers tree cavity nests of hoopoes. The scientists also found that because of non-selective mating of host-specific female birds with any conspecific male, irrespective of what host the males were raised by, the greater honeyguides have managed to stay as a single species, within which there exist two very distinct female races, preferring two different host species as the foster parents for her chicks¹⁷.

Such uniqueness, in their physiology and behaviour, has no wonder contributed to the unending curiosity these little birds inspire among humans. Among the tribes of Africa they inspire reverence too, stemming from a common belief that, if not rewarded for their guiding, the deceived honeyguides often avenge themselves by leading honey gatherers to a leopard or a black mamba¹⁸. The peculiarities in the biology of these small birds being scientifically proven with every passing day, these local beliefs may soon turn to be more than just folklores. After all, where man and animal live in close proximity, every man is an ethologist. It would, therefore, be wise to assume that modern science has still much to unravel about this unique little bird and its amazing bond with humans, cemented by the sweet liquid gold – honey.

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References

1. A. Rasul, F. M. Millimouno, W. A. Eltayb, M. Ali, J. Li, and X. Li, *BioMed Res Int.* 1-9 (2013)
2. Nutritional information – Honey –Weblink - <http://www.foodnutritiontable.com/nutrition/nutrient/?id=695>
3. M. Deb Mandal and Shyamapada Mandal, *Asian Pac J Trop Biomed.* **1**(2), 154–160 (2011)
4. The Sweet and Sticky Business of a Global Honey Industry – Weblink http://voices.nationalgeographic.com/2010/09/16/inside_the_honey_industry/
5. D.F. Mayer, R.D. Akre, A.L. Antonelli, and D. Miachael Burgett,

- Washington State University Extension factsheet – FS017E (WSU Extension Publishing and Printing, 1988).
6. Pests of honey bees (Mid Atlantic Apicultural Research and Extension Consortium (MAAREC) Publication, 2000) No: 4.3
 7. C.T. Downs, R.J. van Dyk and Paul Iji, *Comp Biochem Physiol A Mol Integr Physiol.* **133(1)**, 125-34 (2002)
 8. H.A. Isack, and Heinz-Ulrich Reyer, *Science, New Series*, **243(4896)**, 1343-1346 (1989)
 9. J.S. Olson, *The Peoples of Africa: An Ethnohistorical Dictionary* (Greenwood Publishing Group), (1996) p 108.
 10. A.S. Kennedy, *Birds of the Masai Mara* (Princeton University Press), (2013) p 112
 11. R. Hanbury-Tenison, *Jake's Safari* (Random House), (2013)
 12. B.M.Wood, H. Pontzer, D.A. Raichlen, and Frank Marlowe, *Evolution and Human Behavior.* **35**, 540-546 (2014)
 13. F. Marlowe, J.C. Berbesque, B. Wood, A. Crittenden, C. Porter, and Audax Mabulla, *Journal of Human Evolution.* **171**, 119–128 (2014)
 14. A. Sparrman, *A voyage to the Cape of Good Hope, towards the Antarctic Polar Circle, round the world and to the country of the Hottentots and the Caffres, from the year 1772-1776* (Translated and published by Robinson, London) (1786).
 15. R.W. Wrangham, *Catching Fire: How Cooking Made Us Human* (Profile Books, the U.K.), (2009)
 16. W.R.J. Dean, W.R. Siegfried, and I.A.W. MacDonald, *Conservation Biology.* **4**, 99–101 (1990)
 17. C.N. Spottiswoode, K. F. Stryjewski, S. Quader, J.F.R. Colebrook-Robjent, and Michael D. Sorenson, *Proceedings of the National Academy of Sciences of the USA* **108(43)**, 17738-17742 (2011)
 18. H. Bishop, *Robbing the Bees: A Biography of Honey—The Sweet Liquid Gold that Seduced the World* (Simon & Schuster, UK, 2006) p 89