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Aarab, Ahmed; Provençal, Philippe; Idaomar, Mohammed

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Author(s): Ahmed Aarab, Philippe Provençal, Mohamed Idaomar

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ECO-ETHOLOGICAL DATA ACCORDING TO ĠĀĤĪZ THROUGH
HIS WORK *KITĀB AL-ĤAYAWĀN* (THE BOOK OF ANIMALS)

BY

AHMED AARAB,¹ PHILIPPE PROVENÇAL²
AND MOHAMED IDAOMAR³

Introduction

In this paper we are going to analyze a titled work *Kitāb al-ĥayawān*⁴ (The Book of Animals) realized by Ġāĥiz, Arab scientist of 8th/9th century (775-867). It consists of a book composed of seven volumes each containing almost 400 pages. It would therefore be difficult to present in this work all aspects of zoology processed by Ġāĥiz. We will thus be limited by the framework of this study to approach works of this naturalist Arab in connection with some etho-ecological data.

Our author lived during the period of the most important abbasid caliphs (especially al-Rašīd, al-Ma'mūn and al-Mu'tašim) under whose reign the Arab-Muslim civilization reached its peak. It was a period where the intellectual climate was propitious enough to promote science.

This famous humanistic Arab is more known in philosophical and literary areas than scientific. His documents in zoology are brought only by some orientalist⁵ that, unfortunately, have no training in biological sciences. In scientific milieus his works always reside unknown. A specialization in zoological sciences and a knowledge of the Arabic language are therefore two necessary conditions to understand medieval Arabic zoological studies.

Ġāĥiz in his *Kitāb al-ĥayawān* has produced a synthesis of all zoological knowledge during his era. Within this synthesis our author was not merely a simple compiler of data, he also actively challenged and fully explored the works of other scientific authorities, such as Aristotle. In addition he contributed to the scientific

¹ Faculté des sciences et techniques—B.P. 416—Tanger, Maroc.

² Naturhistorisk Museum Arhus, Universitetsparken, Bygning 210. DK-8000 Arhus C. Denmark.

³ Faculté des sciences—B.P. 2121—Tétouan. Maroc.

⁴ Ġāĥiz, *Kitāb al-ĥayawān*, established and annotated by Abdessalām Mohammed Hāroun; ed. Dār el-Gil and Dār el-Fikr, 7 vols., (Beyrouth, 1988).

⁵ See, for example, Palacio, M.A. (1930). El "Libro de los animales" de Ġāĥiz. *Isis*, 14, pp. 20-54. And also, Kopf, L. (1953). The "Book of animals" (*Kitāb al-ĥayawān*) of Al-Ġāĥiz (ca. 767-868). Actes 7^e Cong. Int. Hist. Sci. (Jerusalem), pp. 395-401 etc.

domain of his era by his own observations and advanced opinions that are in agreement with those ideas emitted by scientists of 20th century.

In this work we have tried to gather all relative aspects of ecology and of animal adaptation related to Ğāhiz. This work will give us an appreciation on how this author has processed this subject. We will begin our study by approaching some ideas of Ğāhiz in reference to food chain and biodiversity. We will then study the various eco-ethological aspects in connection with adaptive strategies concerning some zoological groups. In the last part of this work, we will process some questions posed during the period of Ğāhiz that are ecologically linked to problems of the change of the environment, the life in captivity and the domestication of animals.

— *Trophic chain and biodiversity*

Concerning the subject of biodiversity,⁶ Ğāhiz brings to us one of the explanations of the Koranic verse, given by an exegete who Ğāhiz agrees with: “*And God creates what you do not know.*”⁷ In this interpretation the author brings to our attention that in order to fully understand this verse and to have an idea on the unimaginable number of creatures and their diversity, all we have to do is light a designated fire somewhere inside a forest or in a desert. This fire attracts impressive numbers of varieties of species, including those previously never seen. The author also points out that other species are going to appear if the experiment is undertaken in another forest or in another environment such as the sea or mountains. On the other hand he emphasizes that the number of all these creatures that one will encounter in these experiments, is far from what still remains unseen.

The experiment proposed here is an interesting study which is easy to realize in order to understand the immense diversity among the animal kingdom. Redoing the same experiment within another environment permits us to see and appreciate the richness of this diversity among the appearance of other species.⁸ In his *‘Ağā’ib al-Maḥlūqāt*⁹ (The Wonders of Creation), Qazwīnī has reported the same experiment done in the presence of the Abbaside caliph Al-Mu‘taḍid Bi-allāh (9th/10th century). They have collected and enumerated diverse species of flying insects attracted by fire, distinguishing 72 different forms.¹⁰

⁶ *Kūb al-hayawān*, II, 110-111.

⁷ Coran, S 16; V 8.

⁸ This is an attempt to attract and collect species by light trapping, a method which is widely used today to collect photopositive insects (cf. Chauvin, R. 1967, *The world of insects*, World university Library, London, cf. too Wiberg-Larsen, P. (1998) Light Trapping of Trichoptera near the coast of NW Zealand, Denmark. *Natura Jutlandica*, vol. 23 No. 6, pp. 69-77).

⁹ Qazwīnī Zakariyyā (1203-1283). *‘Ağā’ib al-Maḥlūqāt wa Ğarā’ib al-Mawḡūdāt*, ed. Dār el-Fikr, 2 vol. (Beyrouth, 1952).

¹⁰ In the experiment of al-Mu‘taḍid Bi-allāh the insects were trapped on the wax of (burning) candles. The wax was gathered and made up a volume of one makkū = 7,5 liters (Hinz, W. 1970. *Islamische Masse und Gewichte umgerechnet ins metrische System*, E.J.: Brill. Leiden/Köln p. 44). The gathered insects were separated and there were 72 different forms (shakl).

The existence of this immense variety of animals influences our author to reflect upon a question concerning the finality and the wisdom in the creation of harmful or contemptible beings such as snakes, scorpions, flying insects or even carnivorous animals.¹¹ He makes us notice that harmful species are as important as useful species. Their pernicious behavior is, according to our author, an essential necessity. All these creatures are complementary and indispensable to insure the general interest and the global well being. The elimination of one of them will provoke the departure of others. Because, he notes, all these beings function together and are of equal importance where the first is attached to the second, the second to the third, etc. . . .

This theory certainly makes us think of the notion of the ecosystem in natural balance. Indeed it is only during this century that the value of the species that are thought to be useless or even harmful, has been appreciated and that the elimination of these animals provokes an irreversible imbalance in their ecosystem.

Our author then gives an example of a food chain to show the astonishing allotment and distribution of food among the various animal species.¹² It concerns a long chain of ten species where the first feeds upon the second, the second upon the third and so on until the tenth. At the top of the proposed chain, in this example, one finds the wolf then the fox, following the hedgehog, the adder and others species of snakes, the sparrow, the grasshopper, hornet's brood, the bee, the fly and finally the mosquito. This long trophic chain would have been correct if the author had not spoken of the bees as the predators of flies and the flies as predators of the mosquitoes.¹³

Ġāhiz expands upon the principle of the food chain by writing: "*Each species constitutes a food for another. Each of them cannot do without food, and consequently all predators are obliged to hunt. Thus each animal is going to feed upon weaker species than itself. Similarly, each animal is going to be the food for a species that is stronger than itself. Divine Wisdom has wanted that some species are the source of life for others, and some species are the cause of death for others*".¹⁴

In the same passage Ġāhiz explains the particular behaviours existing among animals that are found inside a food chain. It concerns animals that are both predators and preys. These animals, our author notices, are both endowed with a predatory and antipredatory behaviour. Among these examples we have the case of rats that search for small birds and other small creatures as well as for eggs and brood. This rat has to hunt and, at the same time, to avoid its predators such as snakes and birds of prey. Similarly the snake, when it is in search of rats, uses all its skill in order not to fall prey to the desert monitor (*Varanus griseus*) or the hedgehog.¹⁵

¹¹ *Kūāb al-hayawān*, I, 203-207.

¹² *Ibid.*, VI, 313.

¹³ It has to be said, that the flies of the family *Asilidae* are predating to a high degree on *Diptera*. I.e. flies and mosquitoes (Lyneborg, L. 1965 *Tovinger IV*, Danmarks Fauna 70 p. 86).

¹⁴ *Kūāb al-hayawān*, VI, 399-400.

¹⁵ For the modern notions of food chain and food web, see Storer, T.I. et R.L. Ussinger, R.C. Stebbins, J.W. Nybakken (1972) *General Zoology*. McGraw-Hill. New York, London, pp. 246-247.

Ġāḥiẓ then moves on to an interesting analysis concerning the behavior and the food regimen among the dromedary. In this analysis one understands that within the same prairie there are several herbivorous species without one being in competition with the other. He writes, "among these plants in the prairie, there exist plants that are only consumed by dromedaries while there is another category of plants that, although they are not toxic, are not eaten by this species. These plants are consumed by other herbivorous animals".¹⁶ This observation that animals have different ecological niches, i.e. different ways of living and foraging, in order to live together in a given environment with limited supplies is well known in modern zoology.¹⁷

— *Animal adaptation*

One aspect approached by Ġāḥiẓ in his *Kūṭāb al-ḥayawān* concerns the various adaptive strategies adopted by animals in order to adjust to unfavorable conditions of their environment. We will speak of animal migration and its seasonal character, hibernation, small supply of water for desert animals and finally the influence of the environment upon animal's skin/fur coloring:

Animal migration and its causes

According to Ġāḥiẓ, need is the main cause for animals to migrate. Thus, speaking of swallows, this author distinguishes the country where the migratory animal comes from, from where it migrates to out of need.¹⁸

However, evoking the migration of vultures, Ġāḥiẓ reports that during his period scholars did not agree upon the orientation of terrestrial or celestial marks among migratory birds. According to them these birds, leaving their seasonally cold and snowy region, continue their trip until they come across a hotter and more nutrient land where they can establish themselves. By contesting this random character attributed to the migration of birds, Ġāḥiẓ writes: "*The vultures are migratory birds.*¹⁹ *During their migration they cover distances far wider than pigeons. They cross each year deserts, vast lands, islands, marshes, seas and mountains before arriving at our regions. If you object that they have come to us, not by the guiding of the azimuth or by using others directional marks, but only to escape their seasonally cold and snowy region where they can no longer feed upon the land and thus set forth upon their journey until they come across a hotter and more nutrient land, I will reply by asking you: how do they know where their place of origin is?; how do they know that their region has once again seasonally charged?; and, do they not therefore know the path of return? Residents of these distant regions, connoisseurs of birds, and hunters know that*

¹⁶ *Kūṭāb al-ḥayawān*, VII, 43.

¹⁷ Cf. Gause's principle (Storer, T.I. et R.L. Ussinger, R.C. Stebbins, J.W. Nybakken 1972: *General Zoology*. McGraw-Hill. New York, London p. 250).

¹⁸ *Kūṭāb al-ḥayawān*, II, 177-178.

¹⁹ The vultures in question are the species Egyptian Vulture *Neophron percnopterus*. These birds are migratory in Europe, the Middle East and North Africa with wintering grounds south of the Sahara and South Asia, see Cramp, S. (1980) *Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of the western Palearctic*. Volume II. Hawks to Bustards, Oxford University Press, pp. 65-67.

migratory birds return to their country of origin to their specific nest, whether it is situated in the mountains or in the marsh. One finds this characteristic among all migratory birds without an exception. Contrarily to traveler pigeons, the knowledge of their home does not result from an apprenticeship or from training. On the other hand it is from their own instinct that these birds arrive to us and return to their nest. Similarly it is from their own initiative that pigeons regain their starting point. The attachment to the site of origin constitutes a common line among all birds".²⁰

In another passage Ġāḥiẓ talks about the migration among fish.²¹ He reports according to his master Abū Ishāq al-Naḍām that the migration among fish is far more amazing than among birds. He indicates that some species come from distant seas arriving at the Tigris of Basra in search of fresh water.

Ġāḥiẓ speaks about a fish named *barastouj* that migrates from Zinj's (Horn of Africa) seas until the Tigris river in search of fresh water. According to our author, all *Ẓinjys* and sailors know this phenomenon. This fish crosses a great distance during its migration to reach Basra. Those that have not been fished will return to their sea of origin. He also claims that sailors do not fish this species during its journey between Basra and the country of *Ẓinjys*. If it was the case it would be exterminated.²²

In another passage,²³ the time period of the migration of a fish called *Usbūr* is mentioned.²⁴ He writes that at the mouth of the Tigris, the migratory fish called *Usbūr* arrives there at a definite time during the year and stays there for about three months. According to our author, sailors know the date of its arrival and the date of its return as well as the arrival of other migratory fish. Also he indicates that each species possesses its specific time period for its migration. Similarly he notices that these species are bi-annual and during one of their journeys they become fatter. Talking about *Usbūr*, Ġāḥiẓ asserts that this fish arrives at the Tigris from the Horn of Africa. Therefore when it is found in the Tigris it is absent in this African region and *vice versa*. This phenomenon is known by sailors.

In the same passage Ġāḥiẓ speaks of the migration of shrimps, aquatic tortoises and other aquatic animals that leave at their given time for their migratory journey. Then He talks about migratory birds which also travel in great numbers to Iraq during a specific time frame.

Finally Ġāḥiẓ explains that biological rhythms depend on seasons, following only the solar calendar. Thus, he remarks, one can not predict, for example, that such or such phenomenon happens only on Saturday or only during the month of Ramadan because it follows a lunar calendar. Among these natural phenomena that happen during a specific time of the year are the animals in heat and copulation, seasonal time for agriculture, the tide's rhythm, the falling of leaves and

²⁰ *Kūtāb al-ḥayawān*, III, 258-259.

²¹ *Ibid.*, III, 259-260.

²² *Ibid.*, III, 263.

²³ *Ibid.*, IV, 101-104.

²⁴ The zoologic identities of these fish remain obscure. *Usbūr* is a general name for *Sparidae* according to Malouf, A. (1932) *An Arabic zoological dictionary*, Al Mukataf Press, Cairo, p. 232. For a short description of Fish migrations, see Storer, T.I. et R.L. Ussinger, R.C. Stebbins, J.W. Nybakken (1972) p. 676. The migration of fish from salt water to fresh water is called an anadromous migration (Storer *et al. ibid.*).

fruit from trees, the molting of snakes and the falling of deer's antlers, and finally the voicing or silence among birds.

Hibernation

Ġāḥiẓ speaks of the case of snakes that do not eat or eat very little during the winter.²⁵ He also mentions according to Aristotle the case of hibernation among some reptiles such as snakes, lizards and crocodiles which, during the months of the cold season, stay in their nest without feeding.²⁶ In another passage our author speaks of the hibernation among reptiles, insects and scorpions which do not move and do not feed during the winter.²⁷ However, he claims, ants and bees can not survive the winter without feeding. They always have food reserves.²⁸

The limited intake of water among desert animals

Ġāḥiẓ speaks of a general manner among all desert species by saying that due to the lack of water in the desert, especially during the summer period, these animals are adapted to go without drinking water.²⁹ In winter these animals are maintained by the humidity that is found in fresh herb to satisfy their thirst. He explains that this type of adaptive behavior among camels is far more amazing than in the other desert species.

Our author mentions according to a famous scholar Arab Al-aṣma'ī that there exists some goats at the region of Beni Oqueil that have the same adaptive behavior as camels by not drinking water. Ġāḥiẓ believes that they must have sufficient fresh pasture in their valley to feed upon. He notes that the fresh pastures have internal humidity and therefore allow the goats to live. Finally, he returns to the desert species to bring our attention to the fact that if they do not drink water it is because they do not feel the need to take water in. He accounts that if they needed to drink water they would be affected and led by their natural instinct.³⁰

Influence of the environment upon the coloration of animals

Ġāḥiẓ reports that the environment has an essential influence upon the behavior and the nature of humans and animals. He talks about the effect of the colour of the substrate upon the animals' tint. He writes: "One will notice that crickets living in

²⁵ *Kūṭāb al-ḥayawān*, IV, 120.

²⁶ *Ibid.*, IV, 145.

²⁷ The factual descriptions of Ġāḥiẓ regarding hibernation are correct, cf. Storer, T.I. et R.L. Ussinger, R.C. Stebbins, J.W. Nybakken (1972) pp. 159-160.

²⁸ *Kūṭāb al-ḥayawān*, V, 365.

²⁹ *Ibid.*, IV, 282-283.

³⁰ It is well known that ungulate adapted to desert conditions are exceptionally well adapted to avoid desiccation, cf. M. Leberre J. Chevalier (1990) *Faune du Sahara 2, Mammifères* pp. 208-213, p. 216 and pp. 228-229 (descriptions of *Addax nasomaculatus*, *Gazella dama*, *Gazella dorcas*, *Gazella leptoceros* and *Camelus dromedarius*).

greenery have the colour green. This is the same case with caterpillars. These animals will have another colour if they are found in another environment. Even a lice will take the tint of the hair upon which it lives. Thus when the hair loses its colouring, the lice's shade will be between the natural colour and the colour of the dye. We will similarly notice that in the region of Beni Suleim, characterized by its black ground, all creatures (humans, beasts, birds, reptiles and insects) have adopted the same shade."³¹

Influence of the environment's change upon animal reproduction

Ġāhiz points out the difficulty of the rearing of elephants in Iraq as well as the impossibility of their reproduction in this land.³² It is due, according to our author, to the incompatibility of this region with the elephants' nature which causes illnesses making them vulnerable to death. He brings to our attention that there is another factor that provokes an inadaptability among elephants in Iraq which consists in the passage from the wild life to the domestic life. Being wild these animals feed by an instinctual need, following their own diet. Also once captured and domesticated, these elephants undergo a major change in their feeding behavior. Servants are in charge of taking care of all the elephants' needs and impose upon them another food diet which creates many problems.

Ġāhiz observes that this elephants' inadaptability in Iraq is a phenomenon which is not merely singular to elephants, but also exists among other animals. Thus dromedaries cannot live in Byzance, and crocodiles perish once transported to the Euphrates or the Tigris. He also observes that this phenomenon even exists among plants and cites several examples of Indian plants that cannot grow in Iraq.

It is also reported in *Kitāb al-ḥayawān*,³³ the existing polemic during Ġāhiz's epoch concerning the reasons that hinder elephants' reproduction in Iraq. He reports, that according to certain scholars, if the change in the environment and in the climate was really the cause of this phenomenon, this change must effect, in the same manner, other animals that are imported from India like the peacocks which easily breed in Iraq. According to them several species of wild birds living in our fields and gardens cannot breed in captivity in the human habitation even if the region and the climate are the same. These scholars observe that these birds can reproduce in captivity if they are raised from a very young age. They then stated that in order to succeed in rearing elephants, one must try to import them from a very young age in order to minimize their attachment to wild life.

Following the same procedure previously described, Ġāhiz takes account of a certain person named Ġa'far ibn Suleiman who had succeeded in the rearing and the reproduction of gazelles in his own farm in Baṣrā. This phenomenon had astounded the caliph Harūn al Raṣīd, who was very interested in this field of study.

Finally wild animals such as lions, wolves, cheetahs and tigers are cited by Ġāhiz in order to generalize the phenomenon of the nonreproduction of wilds animals in captivity. But our author observes that if one can provide favorable conditions

³¹ *Kitāb al-ḥayawān*, IV, 70-71.

³² *Ibid.*, VII, 134-135.

³³ *Ibid.*, VII, 186-188.

to these animals, like placing them in Iraquian prairies assuring all of their needs, these animals will surely breed. And even if one raises young elephants in these prairies he will probably succeed in reproducing.

Other aspects in connection with ecology are mentioned by Ġāḥiẓ. We will quote, as an example, the case of the cycle of water:

The cycle of water

Ġāḥiẓ gives an interesting reflection about the importance of temperature in the cycle of water.³⁴ His description of the cycle begins by solar and terrestrial heat, which then evaporates water that ascends into the air until it falls in the form of rain, hail, snow or dew. This water then runs and flows towards lower and more stable surfaces or in the ground's depth. The same water will be evaporated by heat and thus, the cycle begins once again. Our author indicates that during this cycle loss of water will not occur. To better illustrate this assertion he compares the cycle of water to the hydraulic mechanism of the noria which takes water from the river in order to pour it into the canal, and then discharges it back into the river. Finally Ġāḥiẓ brings to our attention that water vapor can also come from vegetation, animals and from the underground.

The Cycle of water described by Ġāḥiẓ is essentially correct.³⁵ It was only described adequately in Europe during the Renaissance.

To the light of what we have seen in this work, it is possible to appreciate the contribution of Ġāḥiẓ in the area of eco-ethology. We can also have an idea about the richness of the knowledge in this area by Ġāḥiẓ's epoch. It is interesting to note that our author is probably the first to have introduced diverse factors influencing the problem of reproduction among wild animals. These factors were equally taken into account for the first time to successfully promote reproduction in captivity.

It is surprising to see that in a period where observation and control means were very insufficient, Ġāḥiẓ had such precise ideas upon a subject that is so complex such as orientation and navigation among birds and fish. He had succeeded in promulgating accurate information putting in the hands of his readers necessary elements to understand the various ecological and ethological problems.

Furthermore in *Kitāb al-ḥayawān*, Ġāḥiẓ gives us precious information on the various scientific discussions during his period. These discussions throw into relief some Arab scholars of this period such as Abū Ishāq Naḍām and Al-Aṣma'ī. Ġāḥiẓ participated actively in these encounters contributing, thus to the boom in the scientific development of his period. More interesting again is that his opinions do not differ from those emitted currently by seekers in this area. His ideas are brilliant intuition and therefore he deserves recognition from modern scientists.

In the current views of the History of Science the Arab contribution to the History of Zoology has either not been taken into account, or else if the scientists of the Classical Islamic Civilisation were mentioned, they were almost always

³⁴ *Ibid.*, V, 36-40.

³⁵ Cf. Storer, T.I. et R.L. Ussinger, R.C. Stebbins, J.W. Nybakken (1972) p. 243.

depicted as mere "stepping-stones" for the progress of Western Science.³⁶ This is in large parts due to the fact that the often elaborate biological thoughts, which are found in the Classical Arabic literature is, as previously mentioned, unintelligible for a scholar who is not trained in this discipline. The descriptions of the zoological texts dating from this period and civilisation are in fact always reduced to sometimes quiet elaborate descriptions of the history of zoological literature, but with the same verdict: That the Classical Islamic civilisation did not possess any zoology or botany which went beyond legendary matter, anecdotes, geographical notes or the use of the animal according to fiqh, with perhaps some cynegetic texts as somewhat more elaborate for practical purposes only.³⁷

As a matter of fact this position is not defensible when the Classical texts are studied in the light of modern biology. Not only did the Arabs have an elaborate knowledge of their natural surroundings, which furthermore as Ġāhiz points out was a *conditio sine qua non* for the Desert Arabs in order to survive, beginning with Ġāhiz they also often preferred the empirical knowledge of the dwellers of the desert to the translated information from Classical Greece. It is true that the different Arab authors vary extensively in the quality of their zoological writings, e.g. the famed Egyptian author al-Damirī, who completed his zoological dictionary *Hayāt al-Hayawān*³⁸ in 1372, treats his zoological matter according to literary rather than scientific criteria, and the value of his data goes from precise information to pure legendary matter. On the other hand the Egyptian author al-Qalqašandī (1355-1418) wrote an extensive encyclopedic work *Kūb Subḥu l-A'shā* in which he incorporates a zoological section of good scientific precision.³⁹

³⁶ Cf. Mayr 1982 *The Growth of Biological Thought*, The Belknap Press of Harvard University Press; Cambridge, Massachusetts London, England p. 91.

³⁷ Cf. Ullmann 1972 *Die Natur und Geheimwissenschaften im Islam*, Brill, Leiden p. 5 and p. 62 and Eisenstein 1989 *Tierkundlichen Mitteilungen in der klassischen arabischen Literatur* in: *Der orientalische mensch und seine Beziehungen zur Umwelt. Beiträge zum 2. Grazer morgenländischen Symposium* (2.-5. März 1989) pp. 431-432.

³⁸ Damiri Mohammad Kamāl Eddine (1349?-1405). *Hayāt al-Hayawān al-Kubrā*, ed. Dār el-Fikr, 2 vol. (Beyrouth, 1952).

³⁹ Al-Qalqašandī, Abū l-'Abbās Aḥmad, ed. 1913-1922: *Kūb Subḥu al-A'shā*, vol. 2 ed. Dār al-Kutub al-Ḥidiwiya. Cairo.