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EPIDERMAL STRUCTURES OF THE BILL AND LINGUA OF THE INDIAN BLACK IBIS *PSEUDIBIS PAPILLOSA*

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ABSTRACT:

The relation between the food, feeding habit and epidermal structures of the bill and lingua of the Indian Black Ibis was studied. Five specimens were used. In Saurashtra, the Indian Black Ibis feeds upon animal and plant matters in various microhabitats like crop fields, manure heaps, sewage and open grasslands. Its epidermal structures of the jaws and tongue are adapted to feed on such food items and helpful in non-visual tactile foraging and probing feeding technique of the bird species.

KEY WORDS: Epidermal structures, Feeding apparatus, Indian Black Ibis.

INTRODUCTION:

Indian Black Ibis *Pseudibis papillosa* (family Threskiornithidae; order ciconiformes) is a resident bird found in Gujarat. It is a winter visitor in other states of the country. Even though it occurs in many parts of Gujarat, it is very common in Saurashtra region (references?). Indian Black Ibis probes in various microhabitats and is an omnivorous bird but feeds chiefly on larvae of insects, beetles, crustaceans, locusts, grasshoppers, frogs, lizards and small slow moving mammals. It also consumes grains, groundnut pods and leaves of cultivated and wild plants (Soni *et al.*, 1993). Chavda (1988, 1997) indicated that Indian Black Ibis is a non visual tactile forager adapted for various foraging grounds. During feeding it chiefly applies either deep or shallow probing technique. During non-visual tactile foraging, it feeds with the bill partially open and closes the tip on encountered prey. The relation between the adaptive modifications in structure and function has been established in the class Aves by Burt (1930) on the relationship between the feeding habits and head morphology of the woodpeckers. The epidermal structures and their outgrowths lining the bill as well as the lining of the buccal cavity and tongue play an important role in handling the food and enhance efficiency of the bill in feeding operations like probing

(Dubale, 1978). The role played by tongue in manipulation and transportation of food in birds is well known and involves a variety of movements (Dubale and Malhotra, 1969). Goodman and Fisher (1962) stated that the morphology of the epidermal lining of the bill appears to be directly correlated with the method of feeding of Anatid birds. The present paper deals with the study of epidermal structures of the bill, buccal cavity and tongue of the Indian Black Ibis and their relationship with the feeding habits.

MATERIALS & METHODS:

To observe the epidermal structures of the bill and tongue, five freshly died birds were chosen. Soon after, they were decapitated and preserved in 40% formalin solution. Epidermal structures were observed carefully with the help of stereoscopic dissecting microscope. Drawings were prepared with the help of camera lucida. Name of various epidermal elements followed Baumel *et al.* (1976).

RESULT:

Epidermal structures of an Indian Black Ibis are as followed:

Epidermal structures of the buccal roof (Figure 1)

Upper bill is slightly larger than the lower bill. A wide gap exists between the two arms of the bill. Upper bill is longer (141.50 mm), thicker, stout, anteriorly slender and decurved. Curvature of the culmen is high and it is wide towards the frontonasal hidge. Rhinotheca is hard and thick and extends laterally up to the junction of Os quadratojugale and dorsally up to posterior margin of naris. Tomium maxillare is thick and blunt edged throughout the length and curved anteriorly. Ruga palatina mediana and ruga palatina lateralis are not well marked but the ruga palatina mediana is better developed. A groove is formed between the ruga palatina lateralis and tomium maxillare which houses the tomium mandibulare in the closed bill. In the buccal region the rhinotheca is hard and thick. Ruga palatina mediana extends up to anterior part of the choanal field whereas ruga palatina lateralis extends up to corner of the rostral choanal field. Choanal rostralis is narrow and its edge bears backwardly directed spines. Choanal caudalis is slightly broad and smooth. Posterior margin of the choanal field bears a row of backwardly directed spines. Rostral choanal field is provided with a small number of taste pits which are irregularly scattered. Caudal choanal field is also provided with 4-5 taste pits. Edge of the choanal caudalis is smooth. Posterior margin of rima infundibuli bears a row of backwardly directed spines.

Epidermal structures of the buccal floor (Figure 2)

Lower bill is stout, long, slender and decurved. Gnathotheca is hard, tough, thick and extends up to the whole length of Os dentale. Gony (part of gnathotheca investing the whole line of union of the mandibular rami) is large about half of the length of mandibula. Mentum is also large, narrow and notched. On the buccal surface gnathotheca bears a prominent median ridge. At the base of lingua, epidermal lining thrown in to a number of infoldings called frenulum linguae which forms a sac like structure called saccus oralis. Tomium mandibulare is sharp and smooth anteriorly and blunt posteriorly.

Lingua (Figure 2)

Lingua is very small (14mm), which is protruded from the epidermal lining and dorsoventrally flattened. It is triangular, thick and fleshy. It is narrow anteriorly and broad posteriorly. 4-5 taste pits on the tip and 3-4 taste pits remain present on the posterior region of the lingua. Posterior margin of the lingua is bounded by the 15-16 long and sharp backwardly directed spines. Gap between the lingua and glottis is wide and soft and a few taste pits are scattered irregularly in this region. Glottis is bordered by a pair of thick pads called mons laryngealis which bears backwardly directed sharp spines. Ventral surface of lingua is covered by muscle genioglossus. There are no taste pits on this surface.

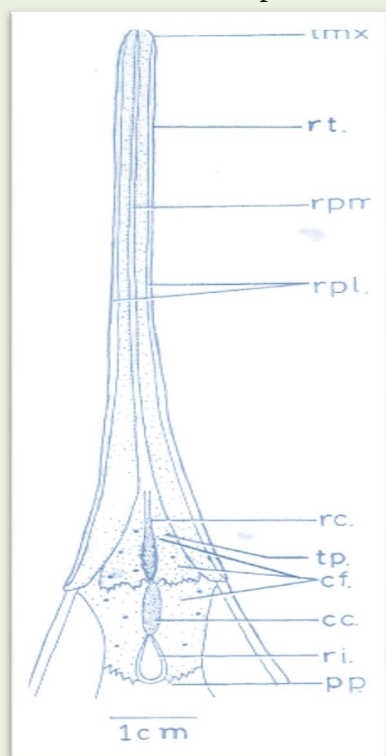


Fig.1: Epidermal structures of the buccal roof of the Indian Black Ibis

Abbreviations

cc	-- choanal caudalis
cf	-- choanal field
fl	-- frenulum linguae
g	-- glottis
gt	-- gnathotheca
l	-- lingua
m	-- mons laryngealis
pp	-- papillae pharyngealis
rc	-- choanal rostralis
ri	-- rima infundibulae
rpl	-- ruga palatina lateralis
rpm	-- ruga palatina mediana
rt	-- rhinotheca
tmx	-- tomium maxillare
t	-- tomium mandibulare
tp	-- taste pits



Fig.2: Epidermal structures of the buccal floor and lingua of the Indian Black Ibis

DISCUSSION:

The bill, tongue and their epidermal structures form the main complex of the feeding apparatus and together play a major role in the capture and ingestion of food. These structures are correlated with the feeding habit, as the Indian Black Ibis is an omnivorous bird but feeds chiefly on animal matter. In the crop fields, it mainly feeds upon groundnut pods through probing. Its bill and epidermal structures are accordingly adapted for the particular mode of feeding. Bill is stout, rigid, thick and extremely elongated which is useful in scratching the soil and handling the hard coats of seeds. Rostrum maxillare is slightly large which makes the bill as a good tool for probing. Tomium maxillare and mandibulare are sharp which requires to crush and crack the large food objects. Provision of longitudinal ridges on the roof of the buccal cavity ensures a tight hold over the prey (Mansuri and Dubale, 1977). Thickness and toughness of the rostrum is an adaptation to tolerate the force during probing. A gap between two arms of the bill ensures powerful grip over the prey (Mansuri and Dubale, 1977). Palate is provided with backwardly directed spines to prevent the food from slipping and maintain a grip (Dubale, 1978). Presence of taste pits is an adaptation for omnivorous diet (Dubale and Thomas, 1978). Presence of inwardly directed spines on the choanal slit prevent the food to enter the choanal slit (Malhotra, 1968). The length of the lingua relative to that of the bill is of basic importance to an understanding of its role in feeding. The lingua is very small in the Indian Black Ibis and it does not reach up to the Pars symphysialis of mandibula. It must not have played any significant role in food handling. Tongue reduction relative to bill length has occurred particularly in species exhibiting pronounced bony reinforcement of the lower jaw, since this occludes much of the bill lumen and reduces the space available for accommodation and movement of the tongue. It may also be related to swallowing large prey whole. In Numenius, the extreme reduction of the tongue prevents its use during probing (Burton, 1974). Though ruga palatina lateralis and ruga palatina mediana serve as guide rails for the forward and backward movement of the lingua are moderately developed in the Indian Black Ibis. As the lingua is small and flat ruga palatina lateralis houses the tomium mandibulare when the jaws are closed. Such an arrangement provides a grip for the closure of the bill and also it does not allow the larger prey to escape out. This tight grip also helps the bird to crush the larger prey (Soni, 1982). Presence of sac like structure called saccus oralis must be used for storage of food and water during breeding season.

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