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Anatomical study on skull of Tarentola mauritanica

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Abstract

The present work was conducted on the morphological characters and structures of the Tarentola mauritanica skull one of the common species in Gekkonidae family that found in Libya (north Africa). We found that this tarentola skull is depressed and modified as diapsids, its side of the cheek is widely open, presumably in relation to the loss of the lower and upper temporal archs, lacrimal and postparietal bones that are present in the diapsid ancestor. The present study showed that the brain case is composed of four occipital bones, supraoccipital, basioccipital and two exoccipitals beside the single occipital condyle. The premaxilla and frontal bones are single while maxillae, nasal, parietal, vomer and palatine are paired bones. Our study revealed that the pterygoids of the skull are separated with epipterygoids on both side, with small ectopterygoid and the absence of the interpterygoid. The bones that composed the frame of the orbit were, the frontal, prefrontal and posfrontal. Ventrally to the orbit, there is no jugal bone that connect between the maxilla and the quadrate. We found that the mandible is composed of five bones, namely from posterior to anterior: the articular

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that articulate with the quadrate, the angular, supra-angular, coronoid and the dentary.

Key words:- Skull , Tarentola mauritanica , Morphology, diapsid, modification.

INTRODUCTION

The common wall gecko (Tarentola mauritanica), is a small sized lizards and It is the largest gecko in north Africa, Europe, it had been reported in USA and south America for some researches figure (1), it is a hardy, plump-looking lizard with a flattened head and body.The common wall gecko often is of depressed form and looks spiky because it is covered in prominent tubercles.

Most complicated of all reptilian skeletal structures in problems of classification and phylogeny is the skull. This is a highly complex assemblage of bones and cartilages, which had undergone a long history of evolution and modification before reaching the reptilian stage.

The skull in reptiles exhibited a number of modifications like the reduction in size of the dermal bones and there is the appearance of openings in the posterior side of the skull. The neurocranium is ossified and most forms have a single occipital condyle. In this paper our attention is focused on the skull of gecko which is showing diverse in some respects especially in the temporal region, figure (2),The reptile skull includes both dermal bones and structures that formed as cartilages in the embryo, it divided into 3 broad regions based on evolutionary & embryonic origin.

The first region is the neurocranium which includes the brain box and the capsules surrounding the sense organs and it represented by four centers of bones: the occipital, the sphenoid, the ethmoid and the otic centers.

the second region is the splanchnocranium which is the visceral portion of the skull that contributes in jaws and it constructed with Meckel's cartilage, columella auris, quadrate and the articular.

the dermatocranium is the third region that comprises of dermal bones which contributes in the brain case and the jaws. This dermal bones is represented by series of bones like: facial-, orbital-, temporal-, vault-, palatal-, and mandibular-series.

Dermal ossifications (Osteoderms) have been reported to occur on the head and body of several gecko taxa of the subfamily Gekkoninae (Otto 1908; Schmidt 1912; Kluge 1967). Osteoderms are dermal sclerifications and that develop just below the pigment layer of the dermis (Moss 1969). A single supraorbital bone has been noted in Tarentola (Boulenger 1885; Romer 1956). The only non-osteodermal bones reported in the supraorbital position of gecko skull, are a series of elements labeled as palpebral bones by McDowell and Bogert (1954).

Materials and Methods

Total of 6 specimens used in this work collecting from two different areas in Benghazi.

We used anatomical tools which involved different sizes of knife and tweezers, needles, lens, microscope, camera, solid board, cottons, metal wire, heat source , conical flask, and chemical substance such as formalin , Potash, benzene, naphthalene balls and hydrogen peroxide (H_2O_2).

First we gathering the samples from their best habitat which is known from their common name “wall geckos”, to do that it is importance to understand that they are nocturnal, hiding in the wall slits during the daylight, where it preferred to do collecting as they will be less activity and easier to catch.

After collecting we isolating the samples in order to record their sizes, weights and also photographing.

killing the samples then fixing them in the formalin 20% solution which keep the samples soften and safe from degrading. To study the skull we separate the head from the body then skin it, taking the flesh out with small knife and tweezers, then by a metal wire and piece of cotton we

clean the brain case and nose cavity. Heating potash to 5 degree in order to soak the skull in this solution from 30-40 second as maximum to not losing the bones structure. By using tweezers and needle we try to lose and clean the cartilage bond connecting the bones and little piece of wet cotton with the potash can help too.

After finishing we can flow the bones in benzene for removing any remaining fats, then washing them with distilled water, wait until they completely dry, then for bleaching. Bones were soaked in hydrogen peroxide (H_2O_2) with a concentration of 3%-5%. After that we keep the bones in closed box with naphthalene balls until examine them.The specimens were photographed using Canon camera EOS 600D.

Results:

In our work we found that the skull of Tarentola mauritanica contains Premaxilla narrow bone like broom, its anterior end is wide and represents a convex shape, posteriorly in the dorsal side had long pointed process with triangle shape end with notch, while ventrally there is short rode like processes (figure 3).

The maxilla bone is strong large triangle shape, arched and smooth dorsally. Ventrally carrying teeth that roofed by plate process all along the bone margin (figure 4).

Nasals are narrow thin bones, their posterior ends tapered laterally conforming together a half ring shape. The anterior ends of them became narrower and more thicker, with two processes the taller one is inside (figure 5).

Prefrontals are strong, crescent like narrow bones. Their anterior parts end with notch and with quadrate process to inside. There is an other notch in their posterior ends (figure 6).

Frontal is large strong bone, its lateral sides concave to inside. The anterior end of this bone is hollow and represents a half-ring shape dorsally and W-shape ventrally. compared with its anterior end, the posterior one is wide and with straight edge (figure 7).

Postfrontals are small V-shape bones, each with anterior thin process, middle short process pointed to outside and thick posterior process (figure 8).

Parietal are thin, expanded bones firmly connected with each other by a suture along the mid-dorsal line. Its lateral side concave slightly to inside, the left and the right posterior process of this bone form W-shape extends ventrally and laterally (figure 9).

The basisphenoid (figure 11) is in between the eyes and ears,this bone has a thick wide Y-shape. Posterior to the skull, the occipital bones develop below and behind the brain case, these occipital elements encircle the foramen magnum the site at which the spinal cord exits the skull (figure 10). Regions of each otic capsule become the epiotic, prootic, and opisthotic bones (figure 12).

Pterygoid: strong, spoon-shape bone with anterior wide and posterior stick-like part (figure 13).

Epipterygoid: long, thin bar-like structure (figure 14).The ectopterygoid is small, thick leaf-shape bone, with one side more convex than the other (figure 15).

Palatines: are thick, wide bones with two processes anteriorly and smoothed, curved posteriorly (figure 16).

Vomer: rectangular, thin, narrow plate-like bone with convex and smooth ventrally (fgure 17).

Quadrate: wide, strong conch-like bone with broadly expanded laterally and posteriorly there is an articular condyle (figure 18).

Mandible: with long and narrow dentary, elongate and narrow splenials, coronoid that has a triangle-shape process, adductor that has an oval

shape process. This bone also has the fusion of the angular, supra-angular and the articular that end with a process (figure 19).

Fig.1:Libyan Tarentola mauritanica

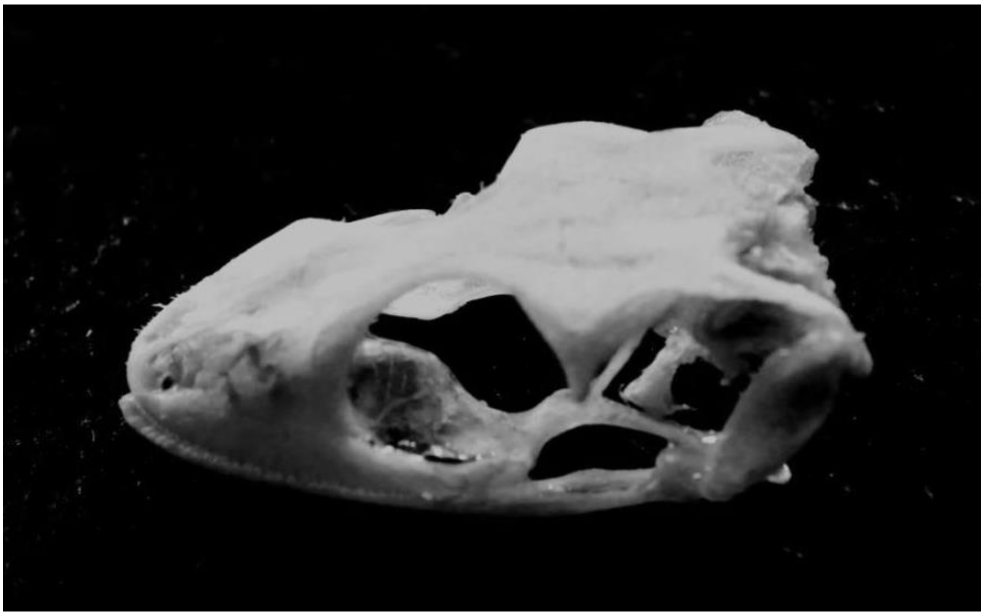
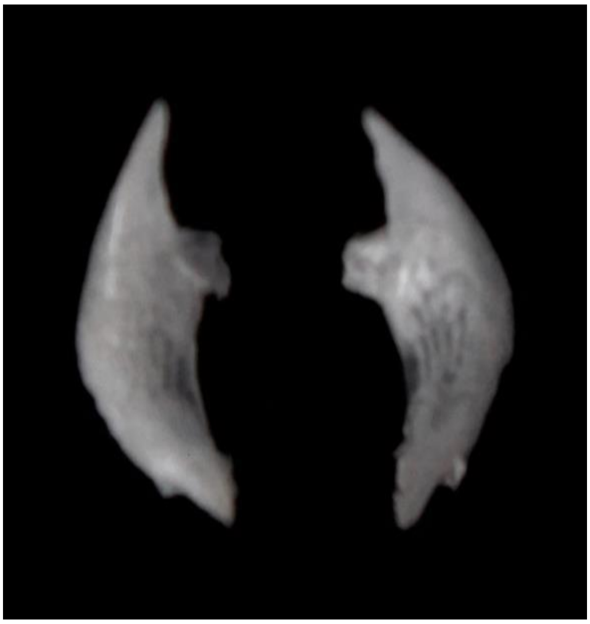


Fig.2: - skull of T.mauritanica in side view

Fig.3: Premaxilla dorsal view

fig.4: Maxilla ventral view

fig.6: Prefrontal external



viewFig.5: Nasal dorsal view

Fig.7: Frontal ventral view

fig.8: Postfrontal dorsal view

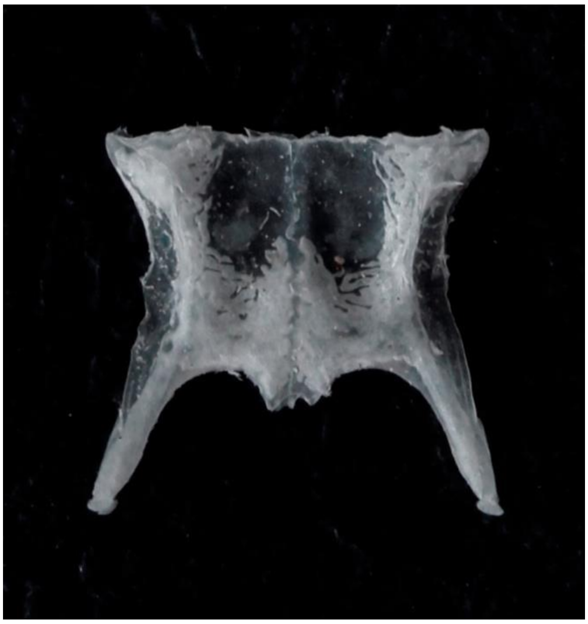


Fig.9: Parietal ventral view

fig.10: Brain case posterior view

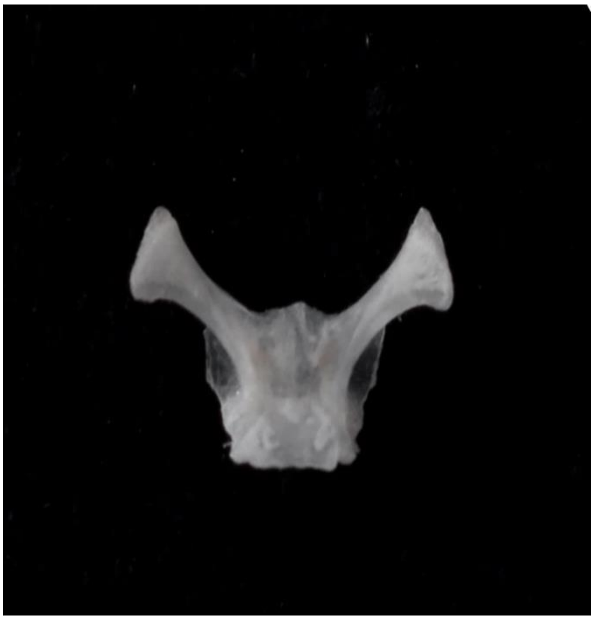


Fig.11: Basisphenoid ventral view

fig.12: Prootic

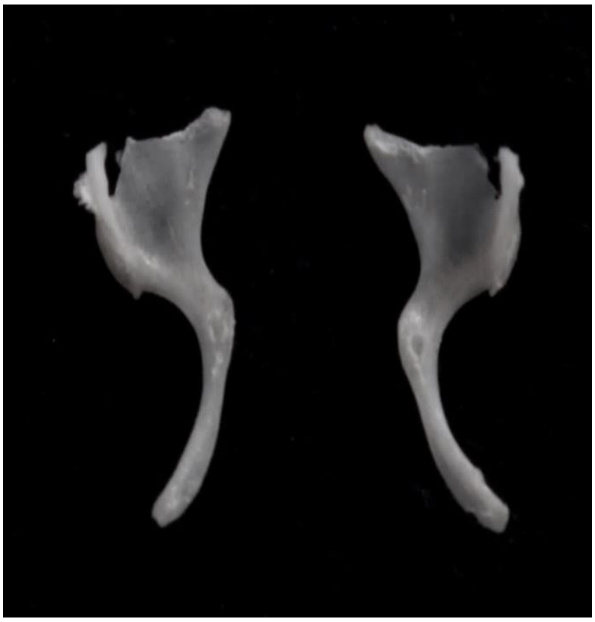


Fig.13: Pterygoid in dorsal view

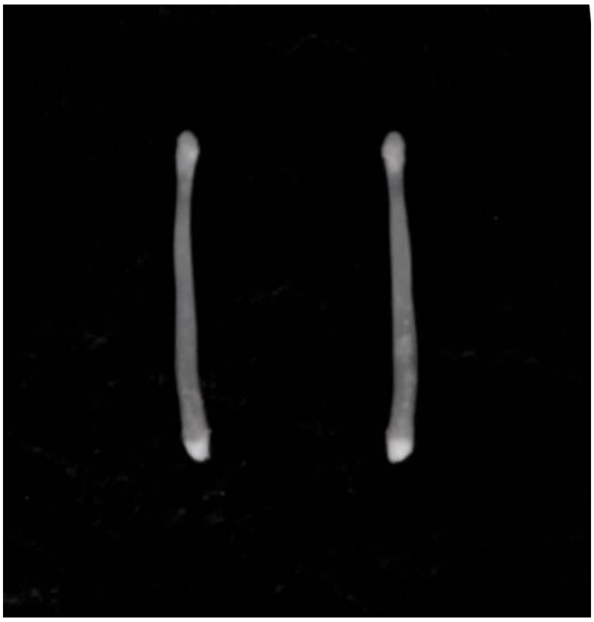


fig.14: Epipterygoid

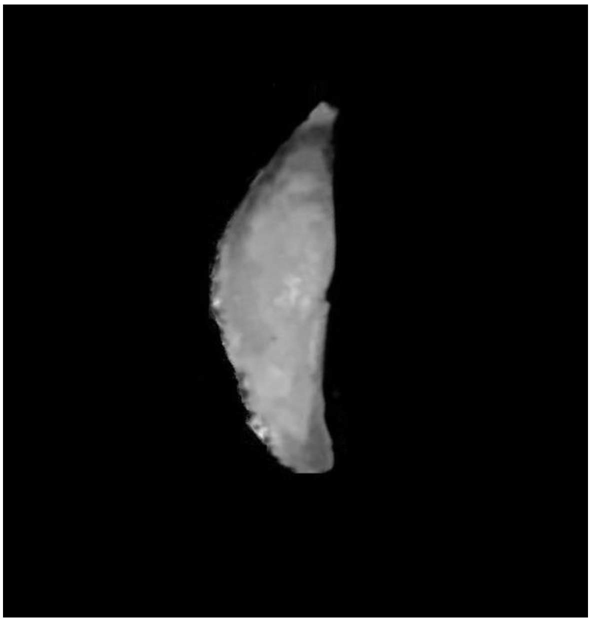


Fig.15: Ectopterygoid

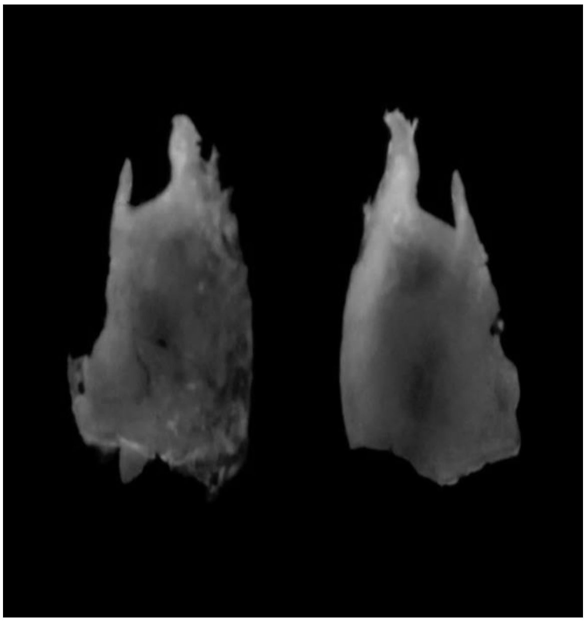


fig.16: Palatine dorsal view

Fig.17: Vomer ventral views

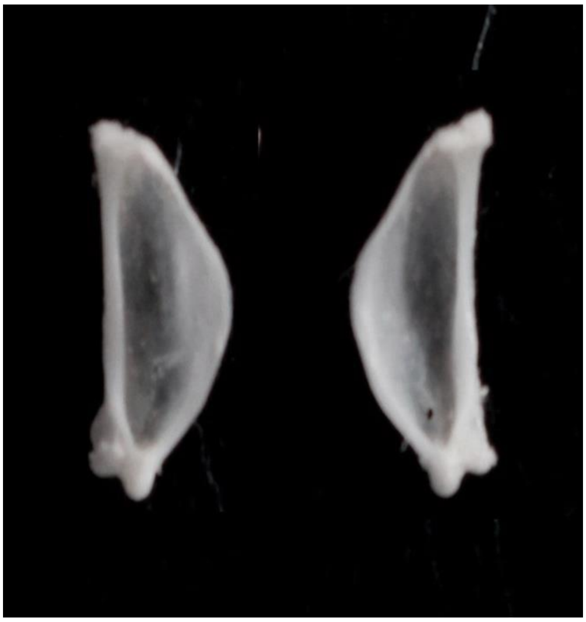


fig.18: Quadrate posterior views

Fig.19: left Mandible, up externally,down internally

DISCUSSION:

In this paper the morphology of cranial bones involved in the skull of tarentola mauritanica was investigated by using the tools that described in material and methods. Detailed descriptions of Geckonidae osteology are also available in the following references (Wellborn, 1933; Jollie, 1960; Kluge, 1962; Daza et al., 2008; Evans, 2009). With respect to the features relevant to our investigation, the skull bones are as shown in the figures of this paper.

The contact between the quadrate and squamosal bones has been reported for various squamates, including the gekkotans G. gecko and P.madagasCar-Iensis (Jollie, 1960; Rieppel, 1978; Grismer, 1986; Herrel et al., 1999), but our Tarentola species that has been studied in this paper demonstrated the absence of Squamosal bone. It has been described in other taxa that the quadrate and squamosal are indirectly connected by ligaments (Rieppel,1984). However,the later phase was not observed in the species studied here but the quadrate is attached dorsally to the supratemporal.

The typical circumorbital series of reptiles consists of five bones: prefrontal, postfrontal, postorbital, jugal, and lacrimal (Romer, 1956, 1970; Evans, 2008). They add, the enormous variation of the orbit in lepidosaurs is due to the presence or absence of some of the ambiguous elements such as the lacrimal and the jugal. The later bones plus the postorbital are absent in our Tarentola mauritanica. The frontal generally participates in the orbit of lepidosaurs, but in squamatan clades, this bone is secondarily excluded from the orbit by contact of the prefrontal with the postfrontal (Conrad, 2008; Conrad et al., 2008; Evans, 2008). The later case in the structure of the orbit is difference in our Tarentola mauritanica spieces and this is due to the absence of the postorbital bone.

The jugal bone also has been observed absent in a group of lizards (McDowell and Bogert, 1954; Underwood, 1957; Jollie, 1960; Kluge, 1976; Rieppel, 1984a, b; Conrad, 2008; Evans, 2008). The presence of the lacrimal among squamates is variable and when it is present in geckos it is very small and indefinite (Conrad, 2008).

In reptiles, the chondrocranium of the ventral distance between the eyes and ears ossifies as the basisphenoid, and further posteriorly, the basioccipital, a pair of exoccipitals, and the supraocciptal bones develop below and behind the brain (Laurie and Janalee, 2009). The later observations are similar to what we found in our Tarentola mauritanica species.

Stephenson N.G. and Stephenson E.M. (1956) observed in Newsealand Geckos that the frontal is less fused in Naultinus gecko but it is more fused in Hoplodactylus Gecko, which is similar in our Tarentola species. They also found that the newsaeland Geckos are characterized by the separation of the occipital elements in the posterior skull of the Naultilus species and this is in contrary to what we found in the cranial osteology of our Tarentola Gecko. The mention occipital elements in Tarentola of this paper are more fused, forming a solid ring of bone similar to what has been noted in Hoplodactylus Gecko.

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دراسة تشريحية لجمجمة

بوبريص " الترنتولا الموريتانى(Tarentola mauritanica) "

عبدالقادر خليفة*
حمد أحمد

الملخص:

من التراكيب المعقدة في كل هياكل الزواحف و التي لها أهمية كبيرة في تصنيفها و تحديد سلالاتها الشكلية هي الجمجمة.

فتراكيب جماجم الزواحف تبدى تنوعا و خاصة في المنطقة الصدغية و المعتبرة تاريخيا صفة مهمة أثناء تصنيفها, و هي أيضا مساعدة في فهم الكثير عن الناحية البيئية و الفسيولوجية لكل نوع.

نتائج العمل الحالي له علاقة بالصفات الشكلية و التركيبية لجمجمة البوبريص " الترنتولا الموريتاني " و هو من أحد أنواع عائلة البوبريصات (Gekkonidae). فقد وجد أن جمجمة الترنتولا مفلطحة و متحورة الى ثنائية الحفر الصدغية ,(Diapsids) و فيها جانبي الحنك مفتوحة باتساع و ذلك لفقدان القوس الصدغي السفلى و العلوى و الموجودان في الأسلاف, أما عظمي الدمعى و خلف جداري فهما مفقودان. كذلك أتضح أن صندوق المخ يتكون من أربعة عظام قذاليه وهي: القذالي العلوى, السفلى و القذاليين الخارجيين أما عظمي الفكي الأمامي و الجبهي فهي فردية بينما الفكي, الأنفي و الجداري فهي مزدوجة الى يمنى و يسرى. اضافة للعظام المزدوجة: المكيعى و الحنكي. عظمي الجناحين مفصولين بوجود فوق-جناحي من كل جانب.

يوجد ممتد الى الأمام, علويا و على جانبي الجبهي عظم يدعى جبهي - أمامي أما من الناحية الخلفية للجبهي فهو عظم خلف-جبهي. اللحى (الفك السفلى) يتكون من خمس عظام و هي المنقارى, السنى, الزاوي, فوق الزاوي و المفصلي الفاقد للمفصلي الأمامي.

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