Original Research

Morphological Study on the Skull of Wild Boar of Mizoram (*Sus scrofa*)

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Abstract

The dorsal surface was deeply excavated at the level of the supraorbital foramina. The sutures between the bones involved in the formation of this surface were fused and were represented by shallow grooves. The nuchal crest showed a central tubercle and thickened lateral extremities. The nuchal tubercles were very large and were placed between the apex of occipital fossa and foramen magnum. The orbital rim was caudally incomplete as the zygomatic process of the frontal bone was separated from the frontal process of the zygomatic bone by a large gap. The external acoustic meatus was on the posterior surface of the zygomatic arch. The lacrimal foramina were two in number. Fossa canina was very deep and rough while the eminentia canina was very large. The muscular process was very large and did not converge rostrally. The tympanic bulla was small and laterally compressed and the styloid process was absent. The hypoglossal foramen was oval in shape and lied between the muscular process and the jugular process.

Key words: Wild boar, Morphology, Skull

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Introduction

The wild boar (*Sus scrofa*) is one of the most widespread mammals which have been hunted by people for millennia. According to Albarella *et al.* (2009) wild boar not only acted as an important protein source in human diet but has also given rise to the domesticated pig (*Sus domestica*). They also reported that the large geographical range occupied by the wild boar population is reflected in their great morphological and size variability that characterised the species. Keeping these facts in view this study was carried out to record the gross morphological features of the skull of wild boar found in the state of Mizoram, India.

Materials and Method

The present study was carried out on the skull of a short/ high headed adult wild boar that was brought for post-mortem to the Department of Veterinary Pathology, College of Veterinary Sciences and Animal Husbandary, Central Agricultural University, Selesih, Aizawl, Mizoram. The atlanto-occipital joint was disarticulated to separate the skull from the neck and then the skull was macerated and processed (Tasbas & Terirlioglu, 1996) for recording the various morphological characteristic of the skull.

Result and Discussion

Dorsal Surface

The dorsal surface of the skull of short headed wild pig was strongly curved dorsally at its cranial part as this surface was deeply excavated at the level of the supraorbital foramina which was in accordance to the findings of Nickel *et al.* (1981) where he reported that short headed breeds of pig bears a notch in the frontonasal region due to which the parietal and the frontal bones were sharply elevated.

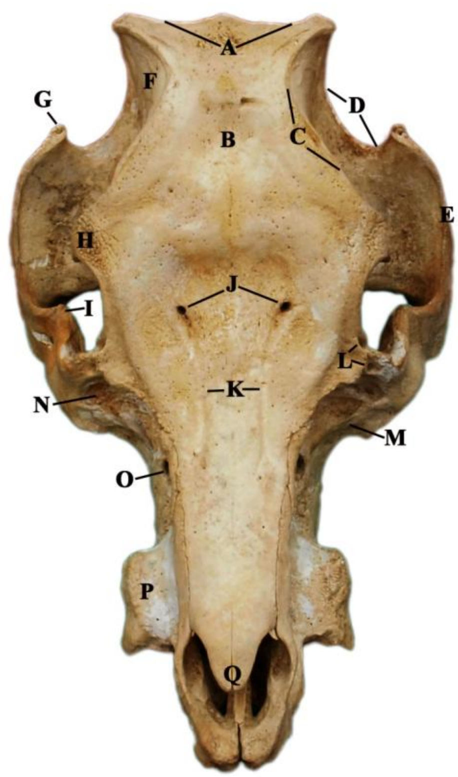

Fig. 1: Dorsal view of the Skull of Short Head Wild Pig of Mizoram showing Nuchal crest (A), Frontal fossa (B), Temporal line (C), Temporal crest (D), Zygomatic arch (E), Temporal fossa (F), Caudo-dorsal process (G), Zygomatic process of frontal bone (H), Frontal process of zygomatic bone (I), Supraorbital foramina (J), Supraorbital grooves (K), Lacrimal foramina (L), Facial crest (M), Fossa canina (N), Infraorbital foramen (O), Eminentia canina (P) and Rostral process of nasal bone (Q).

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The sutures between the bones involved in the formation of this surface were fused and were represented by shallow grooves except the rostral part of the internasal sutures. The cranial part of this surface was roughly pentagonal in shape and its lateral margins were formed by the medially concave temporal line of parietal and frontal bones and the caudal margin was formed by the nuchal line. This part was widest at the level of the zygomatic process of the frontal bone and narrowest at the level of the middle of the temporal fossa. Similar studies were also carried out by Sarma *et al.* (2002) in dum pigs of Assam where they reported that the frontal surface was extensive in its middle portion and constricted at its caudal portion due to the well developed temporal fossa. The supraorbital foramina were rostromedial to the zygomatic process of the frontal bone while the supraorbital groove was in the form of a rostrally directed laterally concave groove which almost reached the caudal end of the nasal process of the incisive bone. These findings were similar to the observations Kalita *et al.* (2015) in Pygmy Hog. Rostral to the orbit the dorsal surface of the skull of short headed wild pig was flat and gradually narrowed down upto the caudal margin of the nasoincissive notch and beyond the notch it narrowed down sharply to form a single median rostral process which was similar to the findings of Konig *et al.* (2009) where they reported that the rostral process of the nasal bone ends medially in pig, sheep and horse, laterally in carnivores and has separate apiece for each nasal bone in ox. The frontal fossa which was earlier reported to be present only in cats and dogs (Nickel *et al.*, 1981) was also seen in short headed wild pig and was in the form of a single median deep fossa on the frontal bone.

Lateral Surface

The laterally flattened zygomatic arch was short and massive and projected laterally far beyond the temporal line. Its root was formed by the zygomatic process of the temporal bone which presented the obliquely directed external acoustic meatus on its caudal surface. The dorsal border of the zygomatic arch was concave and presented the frontal process of the zygomatic bone at its center. The caudal half of this border beyond the frontal process was strongly curved dorsally and ended on a caudo-dorsal process infront of the external acoustic meatus. These findings were in accordance to the findings of Kalita *et al.* (2015) in Pygmy Hog where they reported that the caudal end of the zygomatic arch projected as a process far beyond the external acoustic meatus. The ventral border of the zygomatic arch was convex and grooved laterally while its lateral surface showed a rough tuberosity near the root of the temporal process of the zygomatic bone. The mandibular fossa was shallow and the articular area for the condyles of the mandible was in the form of a transversely elongated centrally grooved articular area. These findings were similar to the findings of Getty (2012) in pigs except the central groove observed in wild pig was absent in domesticated pigs. The superior caudal aspect of the lateral surface of the skull of short

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headed wild pig was formed by the temporal fossa which was deep and lied in a vertical plane which was similar to the findings of Nickel *et al.* (1981) in short headed pigs.

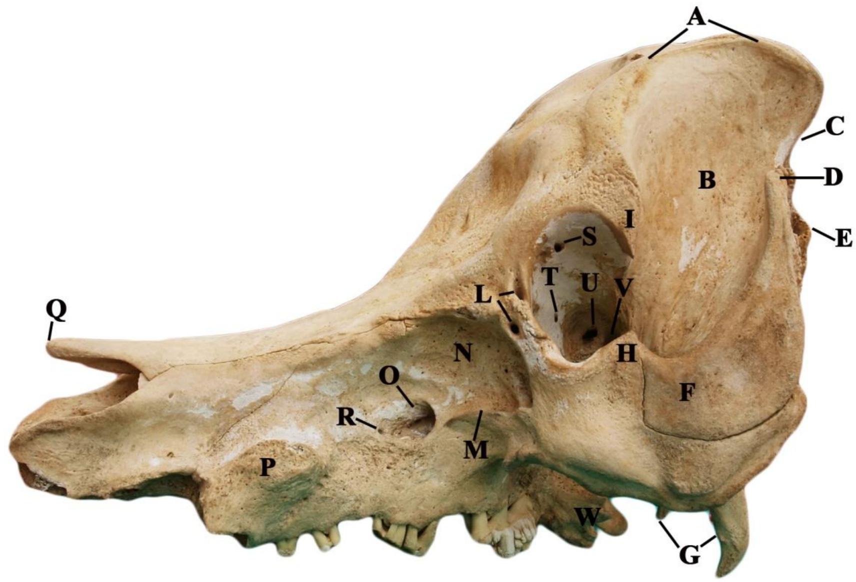

Fig. 2: Lateral view of the Skull of Short Head Wild Pig of Mizoram showing Temporal line (A), Temporal fossa (B), Temporal crest (C), Caudo-dorsal process (D), External acoustic meatus (E), Zygomatic arch (F), Paracondyloid process (G), Frontal process of zygomatic bone (H), Zygomatic process of frontal bone (I), Lacrimal foramina (L), Facial crest (M), Fossa canina (N), Infraorbital foramen (O), Eminentia canina (P), Rostral process of nasal bone (Q) External opening of the alveolar canal (R), Internal opening of supraorbital canal (S), Ethmoidal foramen (T), Optic foramen (U), Foramen orbitorotundum (V) and Pyramidal process of palatine bone (W).

The medial wall of the temporal fossa was rostrocaudally concave and smooth with no suture lines visible between the contributing bones which were unlike the findings of Nickel *et al.* (1981) where clear suture lines were visible between the contributing bones. The temporal crest was in the form of a dorsally concave laterally directed crest that terminated on the caudo-dorsal process of the zygomatic bone. The cone shaped orbital cavity was separated from the temporal fossa by the zygomatic process of the frontal bone and by a crest extending between the later and the root of the pterygoid process which was in accordance to the findings of Getty (2012) in pigs. The apex of the orbital cavity was formed by the optic foramen and the foramen orbitorotundum. Both these foramina were separated by a sharp crest that ran laterally to join the rostral margin of the orbital rim. The orbital rim of short head wild pig was oval in outline which was unlike that of dum pig of Assam where it was reported to be roughly quadrilateral in shape by Sarma *et al.* (2002). The posterior wall of the bony orbital rim was incomplete as the zygomatic process of the frontal bone did not reach the frontal process of the zygomatic bone while the rostral

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margin of the orbital rim showed two lacrimal foramina which was in accordance to the findings of Nickel *et al*. (1981).

The wall of the orbit caudomedial to the lacrimal foramina showed a deep large fossa ventrally and a shallow fossa dorsally. The internal opening of the supraorbital canal was large and was on the caudo-dorsal aspect of the dorsal fossa. The ethmoidal foramen was the smallest foramen on the wall of the orbit and lied midway between the internal opening for the supraorbital canal and the optic foramen. The foramen orbitorotundum was the largest foramen in the orbital cavity and was connected to the pterygopalatine fossa by a rostroventrally directed groove which was in accordance to the findings of Getty (2012) where he reported that the pterygopalatine fossa was well defined in pig and its dorsal part formed a deep groove which leads from the foramen orbitorotundum to the very big maxillary foramen.

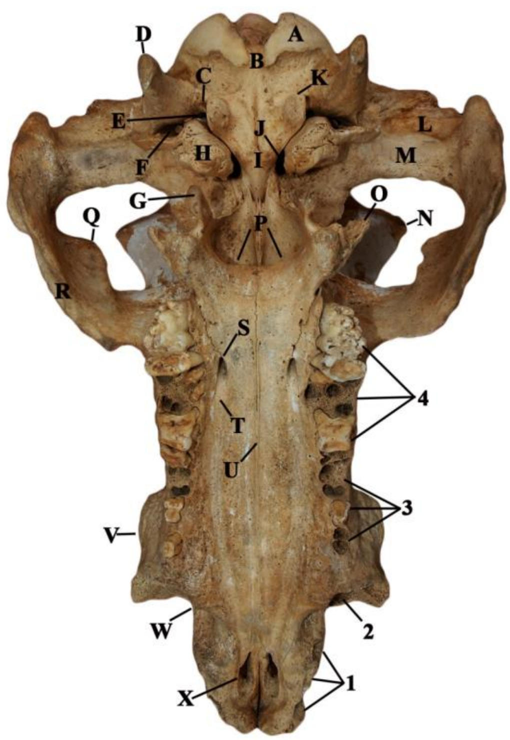

Fig. 3: Ventral view of the Skull of Short Head Wild Pig of Mizoram showing Occipital condyle (A), Intercondyloid notch (B), Hypoglossal foramen (C), Paracondyloid process (D), Jugular foramen (E), Stylomastoid foramen (F), Hamulus (G),Tympanic bulla (H), Basilar tubercle (I), Foramen lacerum (J), Muscular tubercle (K), Mandibular fossa (L), Articular condyle for the mandible (M), Zygomatic process of the frontal bone (N), Pterygoid process (O), Posterior nares (P), Frontal process of the zygomatic bone (Q). Zygomatic arch (R), Carnial palatine foramen (S), Palatine groove (T), Median longitudinal Palatine ridge (U), Eminentiacanina (V), Interalveolar space (W), Palatine fissure (X), Alveoli for incisors (1), Alveoli for canine tooth (2), Alveoli for Premolar (3) and Alveoli for Molar (4).

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The maxillary foramen was very large and led to a wide but very short infraorbital canal. The sphenopalatine foramen was larger and was on the medial wall of the maxillary hiatus while the smaller caudal palatine foramen was on the floor of the maxillary hiatus. The caudal part of the lateral facial region showed a very deep and rough fossa canina which was separated from the dorsal nasal and frontal region by a prominent ridge. Similar findings were also observed by Nickel *et al.* (1981) where he reported that the fossa canina which is characteristic of pig was situated on the lateral surface of the face in front of the orbit. The facial crest was in the form of a short sharp ridge while the infraorbital foramen was very large and was infront of the facial crest which was in accordance to the findings of Getty (2012) where he observed that in pig the facial crest was short and prominent and the infraorbital foramen was some 2 cm rostral to it. However this finding was different from the findings of Konig *et al.* (2009) where they reported that the facial crest is less distinct in carnivore and pig, very prominent in horse and S-shaped in ruminants. The external opening for the alveolar canal was in the form of a very small foramen on the rostral aspect of the infraorbital foramen and the caudo-dorsally directed eminentia canina was very large. Similar findings were also made by Nickel *et al.* (1981) in pigs where they reported that the canine tooth curves upwards and its root caused an irregular enlargement on the maxilla called the eminentia canina.

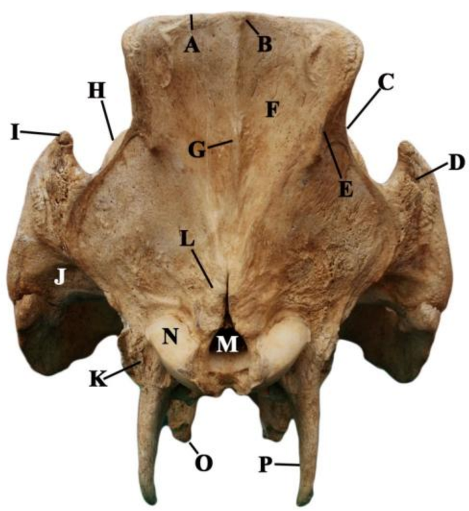

Fig. 4: Posterior view of the Skull of Short Head Wild Pig of Mizoram showing Nuchal crest (A), Central tubercle of nuchal crest (B), Temporal crest (C), Zygomatic arch (D), Linea oblique (E), Occipital fossa (F), Rough area resembling external occipital protuberance (G), Zygomatic process of frontal bone (H), Caudo-dorsal process (I), Mandibular fossa (J), Nuchal process (K), Nuchal tubercle (L), Foramen magnum (M), Occipital condyle (N), Hamulus of pterygoid (O) and Paracondyloid process (P)

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Basal Surface

The cranial and choanal region of basal surface of was at a higher plan than the palatine region which was in accordance to the findings of Nickel *et al.* (1981) in pigs. The caudal most part of this surface was made up of the occipital condyles which appeared as a pair of ventrolaterally directed triangular articular areas separated by a non articular groove. Rostral to the condyles was the basi-occipital which was triangular in outline and showed the pharyngeal tubercle on its ventral surface. Similar studies were carried out by Getty (2012) where he reported that the basilar part of the occipital bone was hexagonal in shape and its external surface was marked by a narrow median ridge, the pharyngeal tubercle. The muscular process was very large and was seen on the lateral margins of the basi-occipital at the level of the stylomastoid foramen and did not converge rostrally as was earlier reported by Getty (2012) in domesticated pigs. The hypoglossal foramen was oval in shape and lied between the muscular process and the paracondylar process which was in accordance to the findings of Nickel *et al.* (1981) where they reported that the canal for the hypoglossal nerve lied medial to the origin of the thorn like paracondylar process. The basilar tubercle was in the form of a transverse ridge present at the junction between the basi-occipital and the sphenoid. The rostral half of the body of the sphenoid was ventrally overlaid by the vomer. The tympanic bulla was small and laterally compressed as was earlier reported in dum pig of Assam (Sarma *et al.*, 2002) and the styloid process was absent which was similar to the findings of Konig *et al.* (2009) where they reported that as the styloid process was absent in pig so the hyoid apparatus articulated with the nuchal process. The choanal part of this surface was short and roughly triangular in shape which was similar to the findings of Getty (2012) where he reported that the choanae were small and were wider ventrally. The palatine part of this surface was comparatively long and was traversed by a median longitudinal ridge throughout its length and showed transverse ridges at its rostral half which was in accordance to the findings of Getty (2012) in domesticated pigs. The interalveolar space was very short and the alveolar process of the maxilla showed alveoli for seven cheek teeth and one canine while the alveolar process of the incisive bone showed three alveoli for the incisors which was in accordance to the findings of Nickel *et al.*(1981) in pigs. The oral surface was widest at the level of the canines and premolars and narrow at the ends and was slightly concave at the level of the last two premolars and the first two molar teeth. These findings were similar to the findings of Getty (2012) in domesticated pigs. The cranial palatine foramina were at the level of the junction between the last two upper molar teeth which was slightly rostral to those of the dum pig of Assam (Sarma *et al.*, 2002). The palatine grooves were shallow and extended between the cranial palatine foramen and the incisive fissure.

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Nuchal Surface

The nuchal surface was extensive showing a great height and width which was in accordance to the findings of Getty (2012) and Sarma *et al.* (2002) in pigs. The sutures between the bones forming this surface were not visible as they were completely fused together. The nuchal crest showed a central tubercle and thickened lateral extremities which were in accordance to the findings of Sarma *et al.* (2002) in dum pig of Assam. The thickened lateral extremity was may be due to the overlapping of the nuchal crest with the temporal line. The ventral margin of the lateral extremity gave rise to a ventro-laterally directed parietal crest and a ventro-medial linea oblique. The parietal crest continued distally as the temporal crest and blended over the caudal surface of the external acoustic meatus which was similar to the findings of Getty (2012) where he reported that the nuchal surface was separated from the temporal fossa by the temporal crest which curved ventrorostro-laterally to blend with the external acustic meatus. The linea oblique ran ventromedially over the nuchal surface for a short distance and ended abruptly forming a tubercle. As a result the upper half of the lateral wall of the occipital fossa was formed by the linea oblique and the lower half of the wall was formed by a very thick ridge which was unlike the findings of Popesko (2011) where he observed that the linea oblique formed the lateral wall of the occipital fossa and extended between the lateral extremity of the nuchal crest and the nuchal tubercle. The occipital fossa was deep and triangular and its apex was connected to the roof of the foramen magnum by a deep fissure running between the nuchal tubercles.

Sarma *et al.* (2002) carried out a similar study and reported that the occipital fossa was deep and triangular in the dum pig of Assam. The external occipital protuberance was reported to be absent in domesticated pigs (Nickel *et al.,* 1981) but in short headed wild pig a rough elongated ridge resembling the external occipital protuberance was present at the centre of the occipital fossa which was connected to the central tubercle of the nuchal crest by a thick ridge. The nuchal tubercles were much larger and were placed between the apex of the occipital fossa and the triangular foramen magnum which was unlike that of dum pig of Assam (Sarma *et al.,* 2002) where the nuchal tubercles were reported to be on the dorsal aspect of the occipital condyles and the foramen magnum was reported to be oval in shape. As the nuchal tubercles of short headed wild pigs were very large they were placed close to each other and formed the roof of the foramen magnum. The occipital condyles were elongated in shape and formed the lateral walls of the foramen magnum which was in accordance to the findings of Sarma *et al.* (2002) where they reported that the occipital condyles of dum pig were elongated in shape and were found in the lateral parts of the occipital bone on either side of the foramen magnum. The part of the lateral occipital above the occipital condyles was excavated and rough and was separated from each other by a deep groove. The slightly caudally inclined dorso-ventrally directed paracondyloid process was very long and showed a thick base and rostrally curved pointed apex which was similar to the findings of Konig *et al.* (2009)

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where they reported that the paracondyloid process are elongated in pig and considered to be the rudimentary transverse processes analogous with those of the cervical vertebrae and also to the findings of Getty *et al.* (2012) where reported that the jugular process in pig is extremely long, less flattened than horse and ox and nearly vertical. The inter condyloid fossa was devoid of any foramen while the process nuchalis was tuberous and remained attached to the base of the paracondyloid process which was similar to the findings of Konig *et al.* (2009) where they reported that nuchal process was tuberous and lied very close to the base of the paracondyloid process.

Conclusion

It may be concluded that the skull of short/ high headed adult wild boar morphologically varies from that of the domesticated boars. The most sticking difference present on its dorsal surface was the prominent frontal fossa while on its lateral surface was the very deep and rough fossa canina, an incomplete orbital rim with two lacrimal foramen on its rostral margin and the very large eminentia canina. The nuchal surface was characterised by the absence of the suture lines, a pointed tubercle on the distal end of the linea oblique and very large nuchal tubercles placed on the dorsal aspect of the triangular foramen magnum. The basilar surface did not show much difference except that the basilar tubercle was in the form of a transverse ridge present at the junction between the basi-occipital and the sphenoid.

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