

THE OSTEOLOGY OF A CAVE-DWELLING BAT, *RHINOPOMA  
MICROPHYLLUM KINNEARI* WROUGHTON (CHIROPTERA :  
RHINOPOMATIDAE) FROM RAJASTHAN.

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(With 9 Text-figures)

INTRODUCTION

Bats being flying mammal, their skeleton has attracted the attention of anatomists mainly to study the extent to which demands of flight have changed their skeletal features (e. g., the radius, metacarpals and phalanges are greatly elongated ; the sternum has a keel for the attachment of the large pectoral muscles ; the cartilaginous rod (calcar) is sometimes attached to the inner side of the ankle for supporting the interfemoral membrane in the fast fliers, the ulna is vestigial to reduce the body weight ; and the scapula is large and broad).

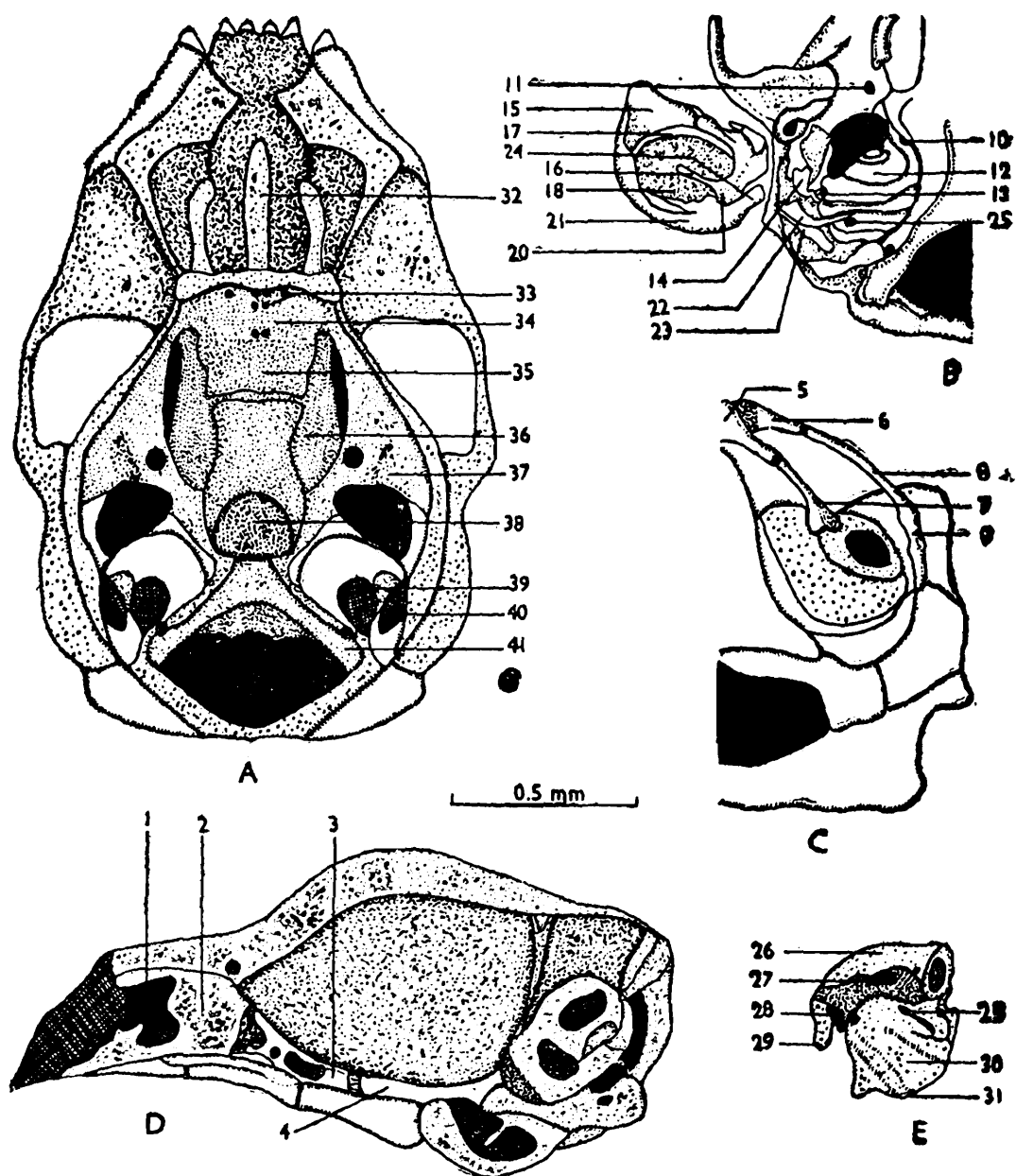
Miller (1907), Andersen (1912), Winge (1941), Tate (1942, 1943), Dobson (1876, 1878), Thomas (1915 *a, b*), and Madkour (1976) studied variations in a few skeletal parts such as skull, shoulder girdle and sternum which have taxonomic value. Supplementary works on the Indian region are those of Khajuria (1952), Prakash (1963), Agrawal (1967), Sinha (1969 *a, b* ; 1970, 1973, 1975) ; Sinha and Chakraborty (1971), Das and Sinha (1971) and Hill (1977). But the only detailed study is that of Vaughan (1970) who has described the skeletal system of the widespread genus *Myotis*, and also made comparative studies in the axial skeleton of the chiroptera. Wassif and Madkour (1963) studied the Osteology of the genus *Rhinopoma* found in Egypt. However, no Indian species has so far been studied in detail.

In the desert and other areas of Rajasthan, *Rhinopoma microphyllum kinneari* is the most common species and lives in caves, tunnels, and dark discarded rooms in old buildings. It is of the "hanging type." It was chosen for detailed study with a view to compare it with a species living in crevices, e. g., *Tadarida aegyptiaca thomasi*.

## The skull

(Text-fig. 1)

The general plan of the skull of *Rhinopoma microphyllum kinneari* resembles that of any other terrestrial mammal and the complete description need not to be repeated. Therefore, here only important



Text-fig. 1. *Rhinopoma microphyllum kinneari* Wroughton. A, Skull (calvarium removed); B, ventral part of skull (tympanic bone and malleus reflected laterally); C, hyoid apparatus; D, sagittal section of skull; E, osseous labyrinth.

characters of the skull are described with special stress to its adaptation for aerial mode of life and different hanging pattern.

The skull of *R. m. kinneari* is medium-sized (total length 19.0-22.5 mm. ; zygomatic width 12-13 mm.) and oval in shape. In adult specimens the sagittal crest is very high in the middle, taking a bow-shape, fused posteriorly with the well-marked overhanging supraoccipital crest.

Basisphenoid not excavated as in *Taphozous* mentioned by Dobson (1876). Zygomatic arch arises from the lower part of the squamosal and fuses anteriorly with the maxillary bone in the region of third molar (in some cases as in *Taphozous* it fuses in the region of 2nd molar). Maxilla carries reduced number of teeth ( $c^{1-1}$ ,  $pm^{1-1}$ ,  $m^{3-3}$ ) as in *Eptesicus*, *Hesperoptenus*, *Tylonycteris*, *Vespertilio*, *Otonycteris*, *Nycticeius*, *Scotomanus* and *Asellia*, (Miller, 1907) among Indian bats. Premaxillaries bony, separate, not fusing with surrounding parts and support slender incisors (1-1). Frontal concave just behind the nasal as in *Taphozous* and triangular in shape (more or less rhomboidal in *Taphozous*). Lachrymal regions have prominent ridge. Unlike *Taphozous*, postorbital process absent.

The space between the exoccipital and the squamosal filled with the bones of the auditory capsule. The latter consists of an inner cochlea and an outer mastoid process. Cochlea (Text-fig. 1 B, E.) internally encloses a series of canals which open outside by two openings—a fenestra cochleae and a fenestra vestibuli. Cochleae large, having three ducts ; firmly attached with the basisphenoid and the basioccipital, making a suture at the junction, and loosely attached to the squamosal. There is a hollow between the mastoid and the inner cochlea, with an opening in the cranial cavity. On the outer surface of the tympanic bulla lies the tympanic membrane. Tympanic bulla encloses the middle ear and supports it which is horseshoe shaped. A chain of three ear ossicles (mallaeus, incus and stapes) lies suspended within the tympanic bulla ; each ossicle is small, delicate and firmly attached at one point.

### Internal feature of skull

(Text-fig. 1A & D)

Extending from the frontal to the presphenoid and vomer is the more or less expanded vertical bony plate, the mesethmoid, the latter joins posteriorly crebriform plate of the ethmoid and is perforated by numerous small foramina for the passage of the olfactory nerves ; it separates the olfactory chamber and the brain case. Fused with the crebriform plate are two lateral, thin and twisted bones, the ethmoturbinales.

The brain case may be divided into three distinct parts the anterior, middle and posterior cranial fossae. The anterior fossa is separated from the middle one by a distinct shelf formed by the posterior rim of the orbitosphenoid ; the middle fossa is separated from the posterior one by the elevated petrous bones that lie inside the external auditory meatus.

*Lower jaw* :—Unlike *Pteropus*, (Flower, 1885) and *Rousettus*, (Madkour, 1976), the mandible of *Rhinopoma microphyllum kinneari* has more longer and thinner coronoid, condylar and angular processes. The curvatures between these processes are relatively much prominent. On the outer lateral margin of the posterior end of the mandible (before these processes start) there is a prominent depression, such depression is not present in either *Pteropus* or *Rousettus*. The mandible bears a row of teeth ( $i_2, c_1, pm_2, m_3$ ) on each side.

*The hyoid apparatus* (Text-fig. 1 c) :—Hyoid apparatus consists of an inverted 'V' shaped bone, the basihyal or body of hyoid, from which articulate the anterior and posterior cornu. The anterior cornu lies on each side of the pharynx and consists of a ceratohyal and a long and curved stylohyal which is fused anteriorly with the epihyal. The posterior cornu consists of a thyrohyal to which the thyroid cartilage of the larynx is attached.

### The vertebral column

(Text-fig. 2)

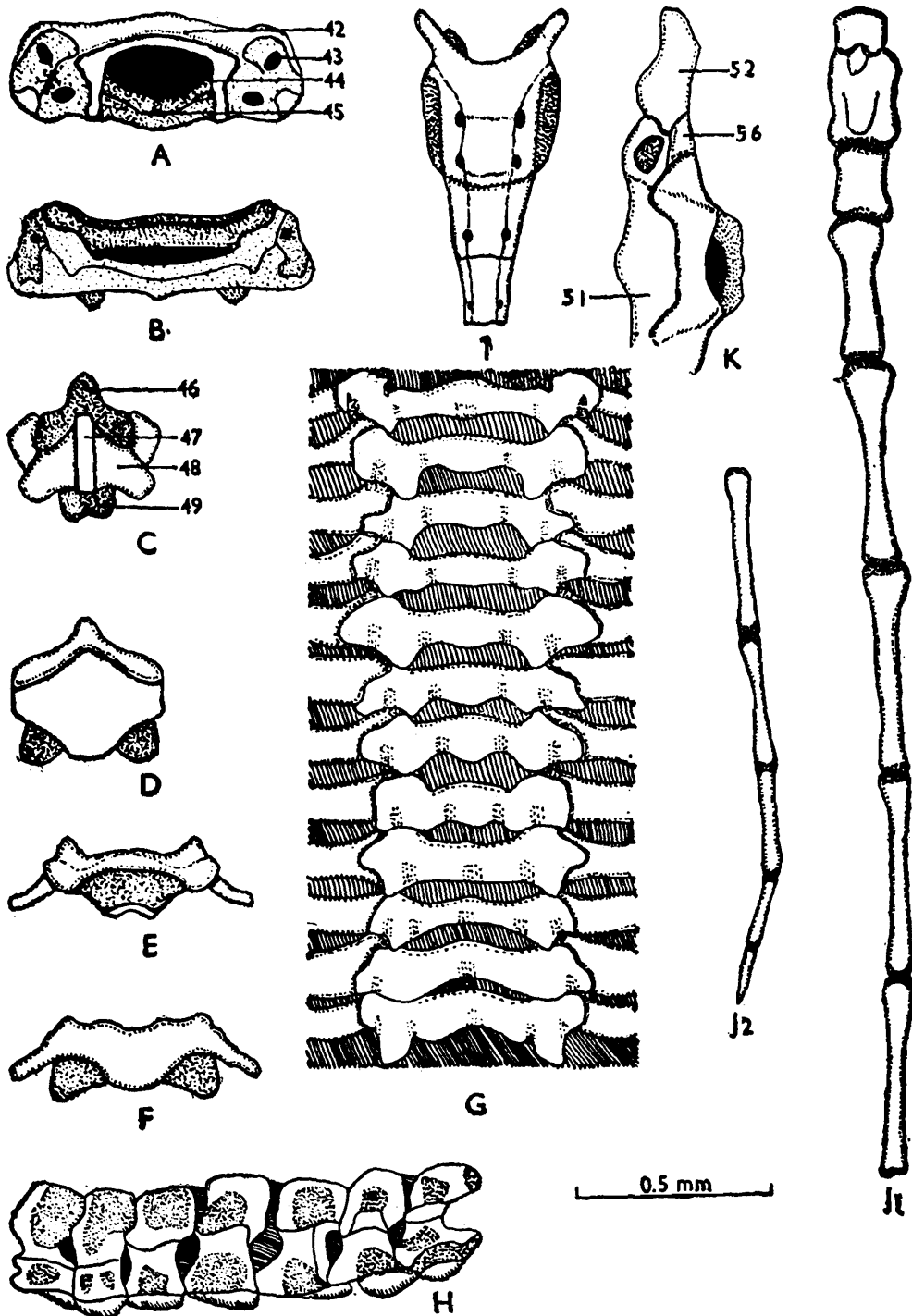
*Cervical vertebrae*.—Like some other bats as mentioned by Flower (1885), there are seven cervical vertebrae in *Rhinopoma m. kinneari*.

Atlas, the first cervical vertebra, is broader than the others (length 2.5 mm, width 8.0 mm.) and ring-like; neural canal large; centrum not discernible; neural spine absent; transverse process broad. Axis, the 2nd cervical vertebra is longer but narrower than the atlas (length 3.7 mm, width 3.5 mm.); its centrum anteriorly bears a prominent peg-like odontoid process; prezygopophysis absent but postzygopophysis present; the neural spine well developed and transverse processes small. The third to seventh cervical vertebrae are almost alike (length 1.5 to 2.0 mm, width 5.5 to 6 mm.); centrum procoelous; anterior odontoid process not visible; prezygopophysis, postzygopophysis and neural spine absent; transverse process well developed.

*Thoracic vertebrae*.—In general feature the thoracic vertebrae of *R. m. kinneari* resemble that of *Myotis*, (Vaughan, 1970). Their number is twelve (eleven in *Myotis*); length 2.5-3.0 and width 4.5-5.0 mm. Centrum similar to that of *Myotis*; last three vertebrae weakly procoelous as against *Myotis* in which the last two are weakly procoelous. A ridge like neural spine present only in the first thoracic vertebrae (in *Myotis* it is present in the last three thoracic vertebrae).

*Lumbar vertebrae*.—Lumbar vertebrae number-seven in *R. m. kinneari* while five in *Myotis* (Vaughan, 1970). Neural arch is very similar to *Myotis*. A ridge-like large transverse process is present in all lumbar

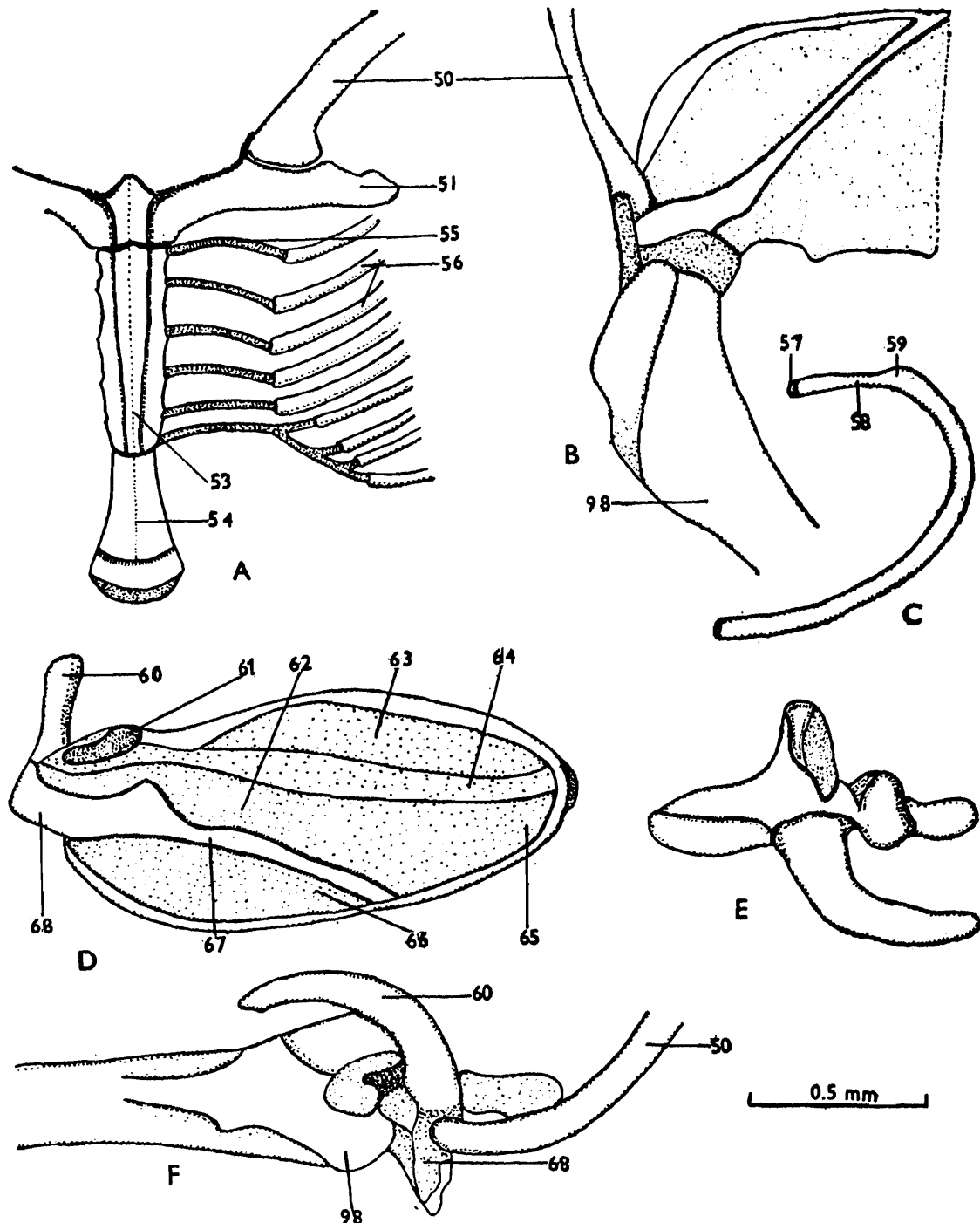
vertebrae of this bat while in *Myotis* it is smaller and only present in the last two vertebrae. Prezygopophysis and the postzygopophysis present, but Vaughan (1970) is silent about these structures while describing lumbar vertebrae of *Myotis*.



Text-fig. 2. *Rhinopoma microphyllum kinneari* Wroughton. A-F, cervical vertebrae; G, thoracic vertebrae with ribs; H, lumbar vertebrae; I, sacrum; J1-J2, tail vertebrae.

*Sacral and Caudal vertebrae.*—The sacral vertebrae of *Rhinopoma microphyllum kinneari* when compared with those of *Myotis*, (Vaughan, 1970), it is found that both have four numbers of vertebrae which are fused to form the sacrum. In *Rhinopoma m. kinneari* the transverse

processes of only first two vertebrae are fused to form a pad-like surface for the articulations of the pelvic girdle while in *Myotis* (mentioned by Vaughan, 1970) all the transverse processes are fused, forming a continuous lateral mass that is thickest in the first two sacrals. In *Rhinopoma*



Text-fig. 3. *Rhinopoma microphyllum kinneari* Wroughton. A, ventral view of sternum, costal cartilages, distal end of ribs and proximal end of scapula ; B, Humerus, clavicle and scapula Joint ; C, a complete rib ; D, dorsal view of right scapula ; E, anterior view of left scapula ; F, posterior view of proximal end of humerus, scapula and distal end of clavicle joint.

*m. kinneari* all the neural spines are completely fused to form a neural crest but sutures present, while in *Myotis*, (Vaughan, 1970) the spines

are partly fused and higher. The number of caudal vertebrae is more in *R. m. kinneari* (13-16 Nos.) than the *Myotis* (10 Nos. ; Vaughan, 1970) and all are without neural foramina.

### The sternum, ribs and pectoral girdle

(Text-fig. 3)

*Sternum and Rib.*—Sternum is very much similar to that of *Myotis* (Vaughan, 1970). It consists of a distal shield like manubrium (length 3.5 ; width 12.5 mm), a middle body of sternum (length 7.5, width 1.4 mm) and a distal fin-shaped xiphoid process.

The number of ribs is higher (12 Nos.) than *Myotis* (11 Nos. ; Vaughan, 1970). The first seven are sternal, the next three are vertebrocostal, and the last two are attached only to vertebrae. The structure of ribs is more or less as described by Vaughan (1970) for *Myotis*.

*Pectoral girdle.*—The pectoral girdle consists of a scapula with a coracoid process and a clavicle or collar bone.

The scapula (length 15.5-17 mm ; width 6.5-7 mm.) is narrow and more alike to *Pteropus* (Vaughan, 1970). Acromium process 3 mm. high and curved downward ; coracoid process long (length 5.5 mm.) and curved ; supraspinous and infraspinous fossa deeply concave ; the former about half the size of the latter ; glenoid fossa much deepen.

Clavicle long (length 14 mm.) and bowed distally ; its proximal end expanded and connected with the distal end of the lateral arm of the manubrium.

### The forelimb skeleton

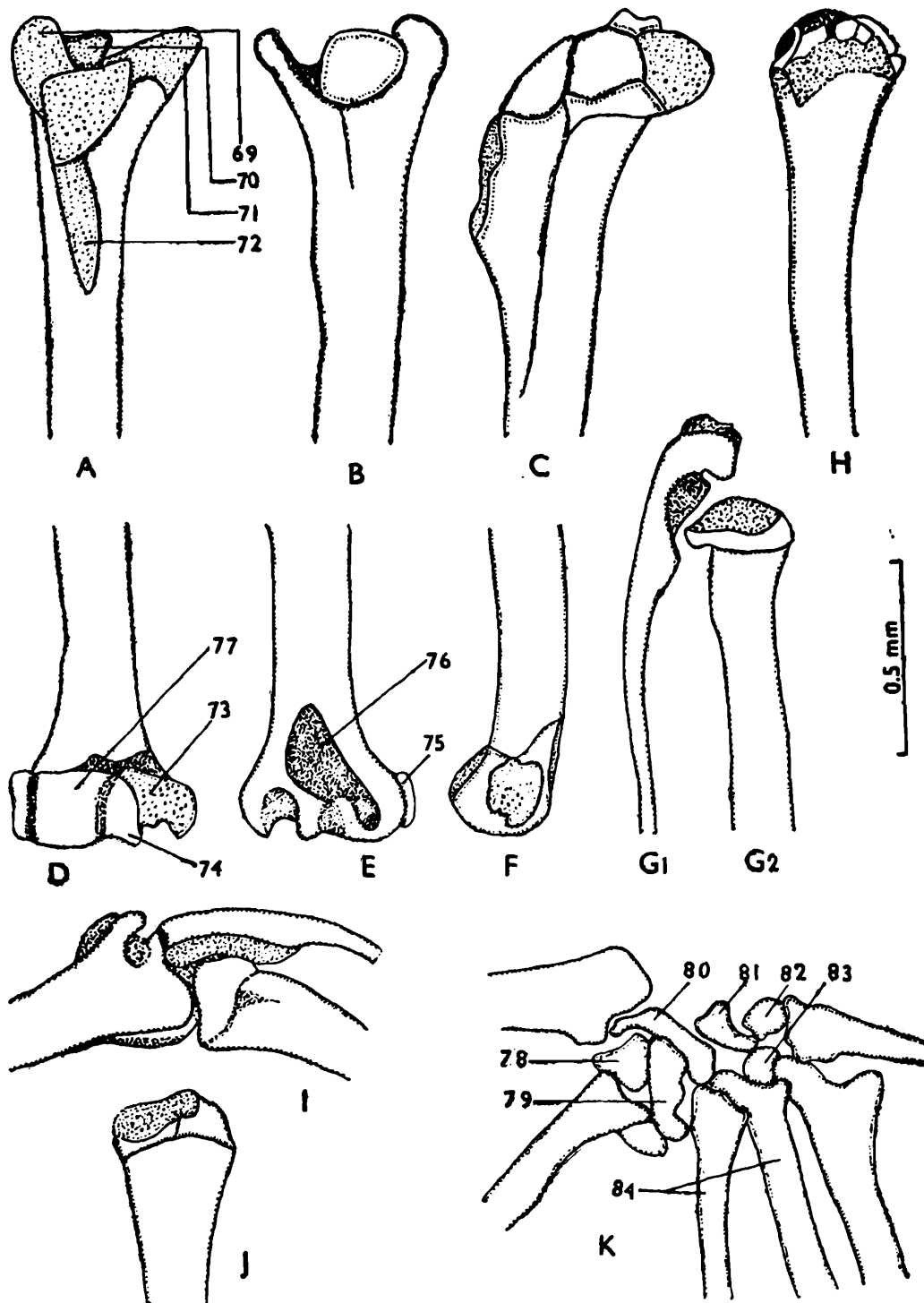
(Text-fig. 4)

The forelimb consists of the humerus, radius, ulna and manus.

The humerus is long (length 36 mm.) and rod-like. Its greater and lesser tuberosities less developed as in other primitive bats and slightly proximal to the head. In this respect it differs from the advanced bats of the family Molossidae and Vespertilionidae in which the greater tuberosity is large and extended well beyond the head (Vaughan, 1970).

The radius is very long (over 170% of the humerus) and bowed slightly forward ; its proximal articular surface is marked by a large and deep central groove and a small shallow lateral groove. The distal articular surface is deeply concave,

The ulna is small (about 60% of the radius) gradually narrowing from proximal end to distal end, latter fused to the radius in the same manner as in *Myotis*, (Vaughan, 1970).



Text-fig. 4. *Rhinopoma microphyllum kinneari*. A-C, anterior, posterior and medial views of distal end of humerus ; C<sub>1</sub>-C<sub>2</sub>, anterior view of proximal end of radio-ulna ; H, anterior view of distal end of radius ; I, distal end of humerus and proximal end of radio-ulna ; J, posterior view of distal end of radius ; K, medial view of right carpus.

Like other bats, the manus consists of the carpal elements, the metacarpals and the phalanges. The proximal surfaces of two carpal elements, the lunar and the cuneiform, articulate with the radius ;

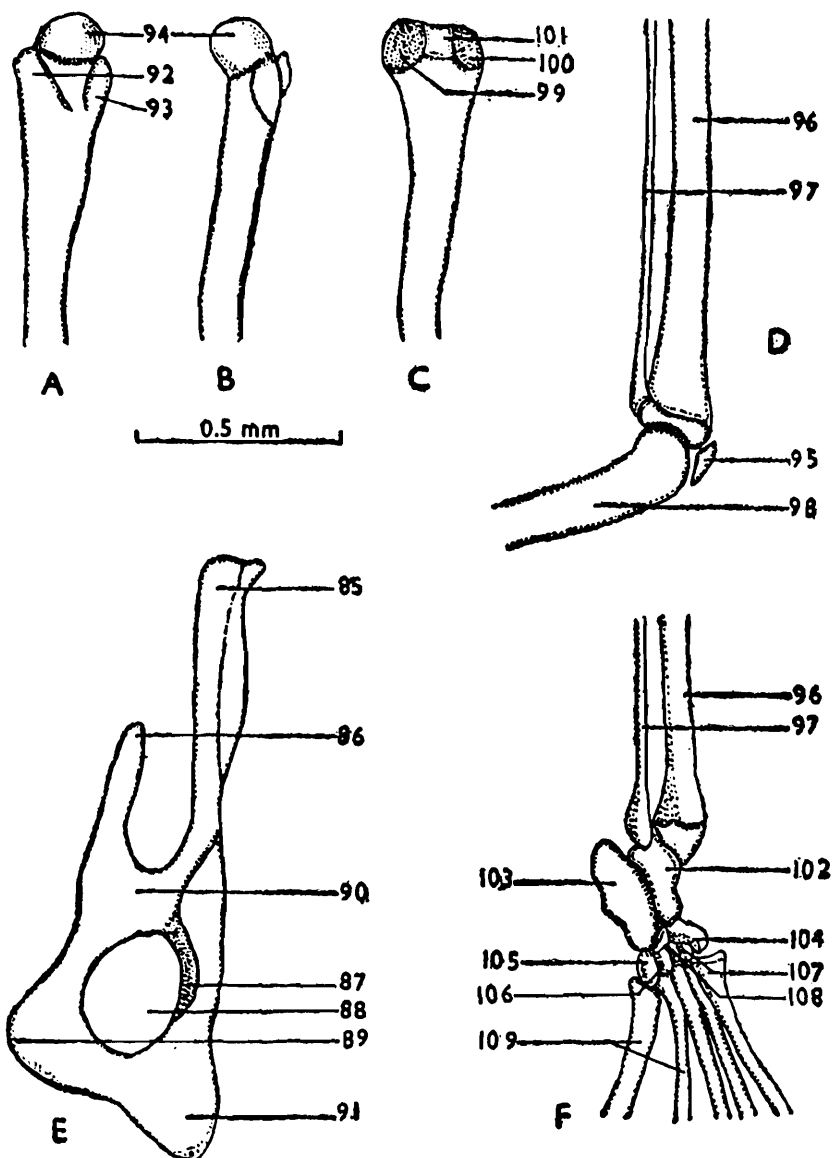


and the rest with the proximal end of the metacarpals. Unlike vespertilionid bats all the digits except thumb have two phalanges each. In *Myotis*, as described by Vaughan (1970), the 2nd digit has one phalanx and the rest digits have three phalanges each, the terminal ones being cartilaginous.

### The pelvic girdle and the hind limbs

(Text-fig. 5)

Like other bats, the pelvic girdle resembles that of terrestrial mammals in general structure. It comprises two long curved bones



Text-fig. 5. *Rhinopoma microphyllum kinneari*. A, anterior view and B, medial view of proximal end of femur ; C, anterior view of distal end of femur ; D, tibia, fibula, femur and patella joint ; E, lateral view of pelvis ; F, dorsal view of distal tibia fibula and tarsal bones.

(length 14.0-15.5 mm.), the innominates which unite with the two sacral vertebrae dorsally and with each other ventrally, forming a pubic

symphysis. The acetabulum is small and faces dorsolateral and slightly posterior as in *Myotis* (Vaughan, 1970). The pubic spine is long (about one third the length of the pelvis) and projects anteriorly and somewhat dorsally. The ilium is long (about 64% of the pelvis) and projects dorso-anteriorly.

The femur is slightly longer (24 mm.) than the tibia (22 mm.) and differs from *Myotis* (Vaughan, 1970) in which it is roughly the same length as the tibia. The tibia is thin and as long as the femur.

The calcaneum (length 2.8 mm.) is longer than the astragalus (length 1.9 mm.) and is without a calcar bone. The foot is long (37% of the hind limb). The phalangeal formula is 1-2-2-2-2 ; and all the five digits are subequal in length.

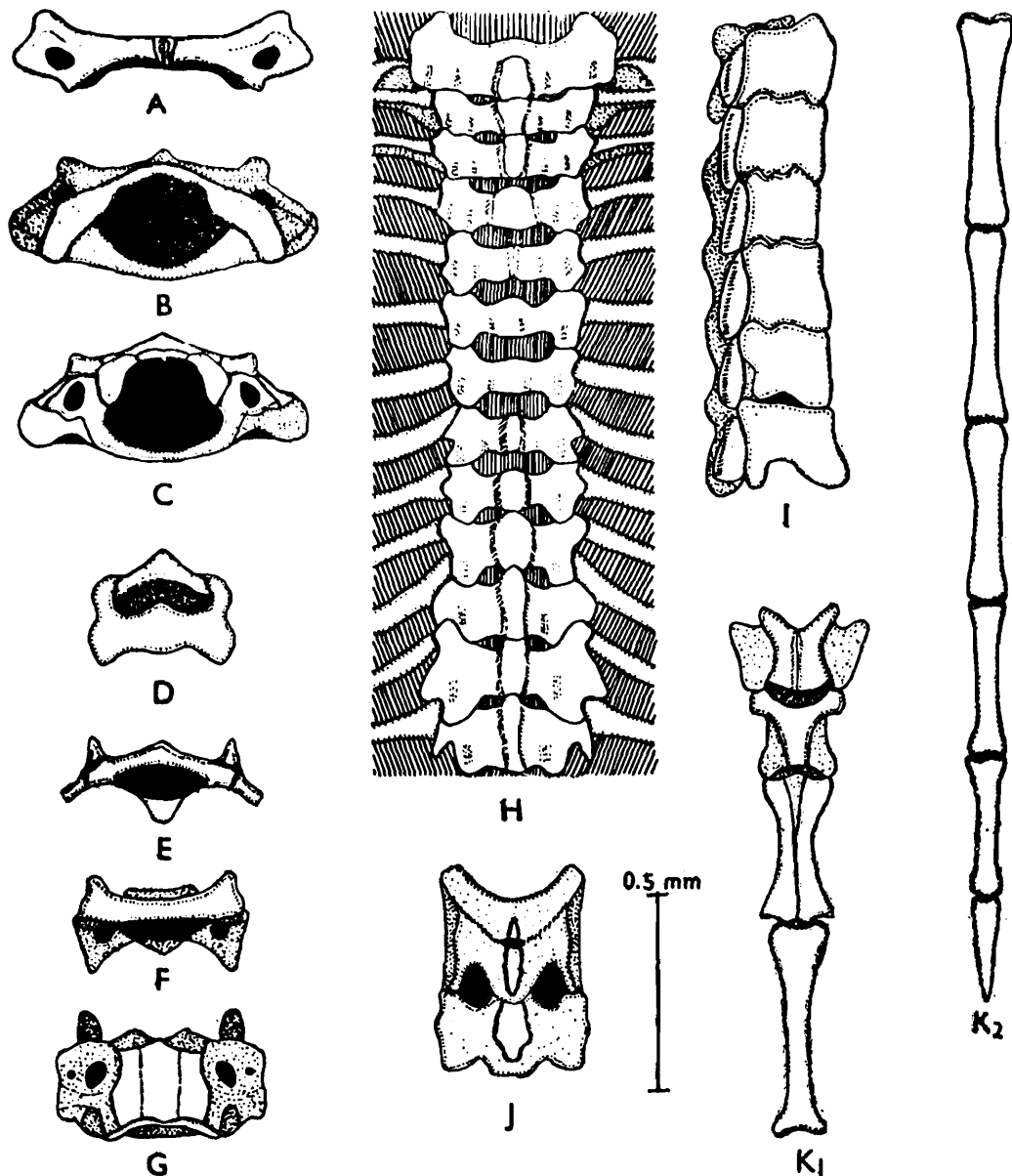
### Skeletal variations in Rajasthan bats

*Post cranial skeleton.*—Many variations occur in the postcranial skeleton of bats, but the functional basis for these differences are not clear. Vaughan (1970) explained some possible causes of these variations. Here is given only a comparative account of postcranial skeleton, with a possible functional basis in the cave dwelling bat, *Rhinopoma microphyllum kinneari* a slow (flier) and crevices dwelling bat, *Tadarida aegyptiaca thomasi* (a fast flier).

*Vertebrae.*—Unlike *R. microphyllum kinneari*, in *Tadarida aegyptiaca thomasi* (Text-fig. 6) the total number of vertebrae is smaller (38 vs. 43-46). There are 6 free cervical vertebrae and the seventh is fused with the first thoracic ; in *R. microphyllum kinneari* are 7 and the seventh is not fused with the first thoracic. The atlas of *T. a. thomasi* (length 3.2 mm., width 7 mm.) is longer in proportion to width than in *R. microphyllum kinneari* (length 2.5 mm., width 8.0 mm.). The neural canal is wider (diameter 3 mm. vs. 2 mm.) in *R. microphyllum kinneari*. The axis is slightly shorter (length 3.4 mm, width 3.2 mm. vs 3.7 mm. and 3.5 mm.) ; the neural spine is poorly developed (height 1 mm.) in *T. a. thomasi* and well developed (height 1.8 mm.) in *R. microphyllum kinneari*. Other cervical vertebrae are similar but slightly higher than in *R. microphyllum kinneari* (height 2.5-2.6 mm. vs. 2.3-2.4 mm.) ; the neural canal is wider (width 4 mm, height 2 mm, vs. 2.2 and 1.5 mm.).

There are 13 thoracic vertebrae in *T. a. thomasi* ; in *R. microphyllum kinneari* 12. The lumbar vertebrae are 6 in number, all nearly alike ; in *R. microphyllum kinneari* they are 7. The neural arch above bears a neural ridge, but is not as developed as in *R. microphyllum kinneari*.

Sacral vertebrae are three in number and completely fused ; in *R. microphyllum kinneari* there are 4. The dorsal and anterior surface of the first sacral vertebrae is deeply concave and crescent shaped anteriorly, the lateral surface of the first sacral vertebra with the lateral surface of the second making a pad-like surface for the articulation of



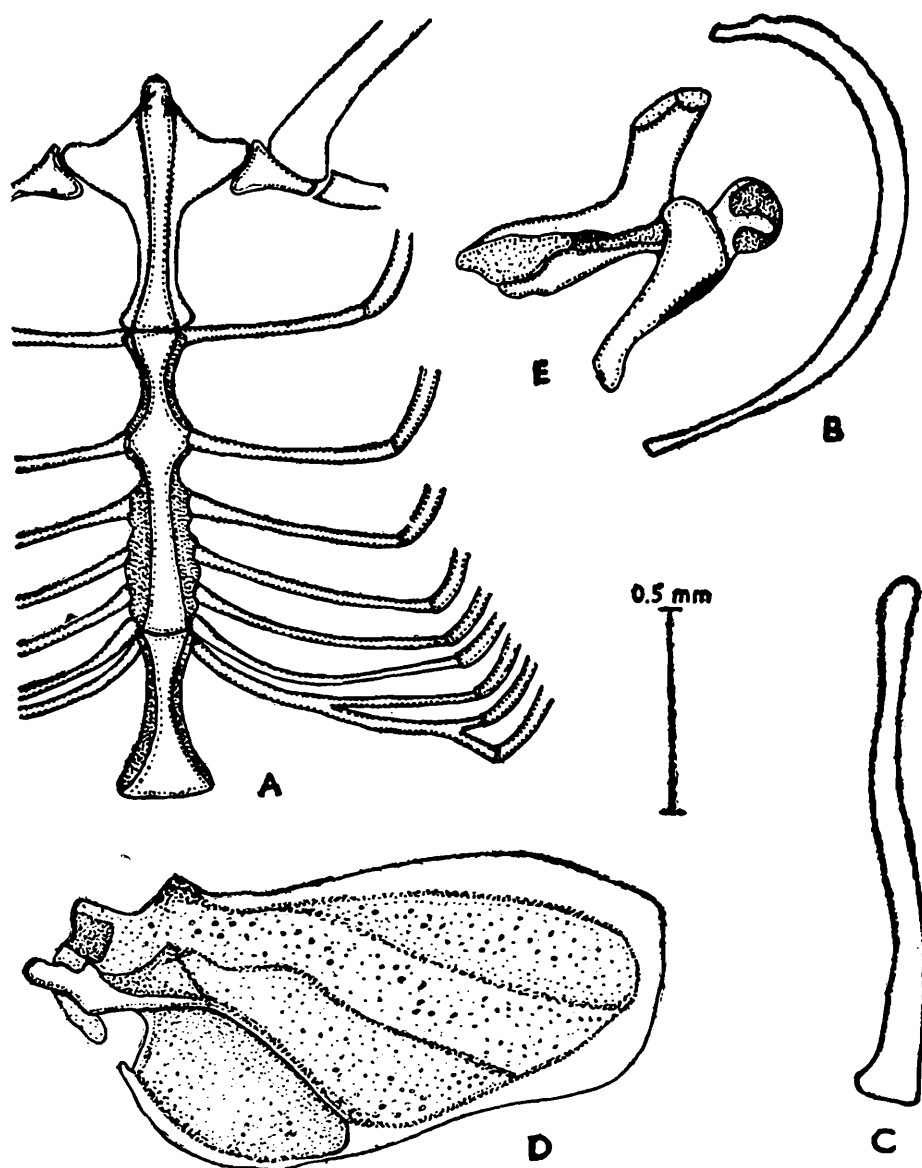
Text-fig. 6. *Tadarida aegyptiaca thomasi*. A-F, cervical vertebrae ; G, 1st thoracic vertebrae ; H, thoracic vertebrae with ribs ; I, lumbar vertebrae ; J, sacrum ; K<sub>1</sub>—K<sub>2</sub>, tail vertebrae.

the pelvic girdle ; ventrally there is a keel-like projection which slopes posteriorly. The neural spines are prominent in the 2nd and 3rd sacral vertebrae ; the neural foramina wider than in *R. microphyllum kinneari*.

There are 9 caudal vertebrae (13-16 in *R. microphyllum kinneari*) ; the first is much broader than the rest.

Reduction in number of vertebrae and fusion help *T. a thomasi* in fast flying by lessening the body weight.

The sternum, ribs etc. (Text-fig. 6).—The sternum of *Tadarida aegyptiaca thomasi* is composed of three parts. The anterior part (the manubrium), unlike *R. microphyllum kinneari*, is longer than broad (length 5.8 mm ; width 4.2 mm.) vs. broader than long (length 3.5 mm., width 12.5 mm.) and is fused with the costal bone as in the latter.

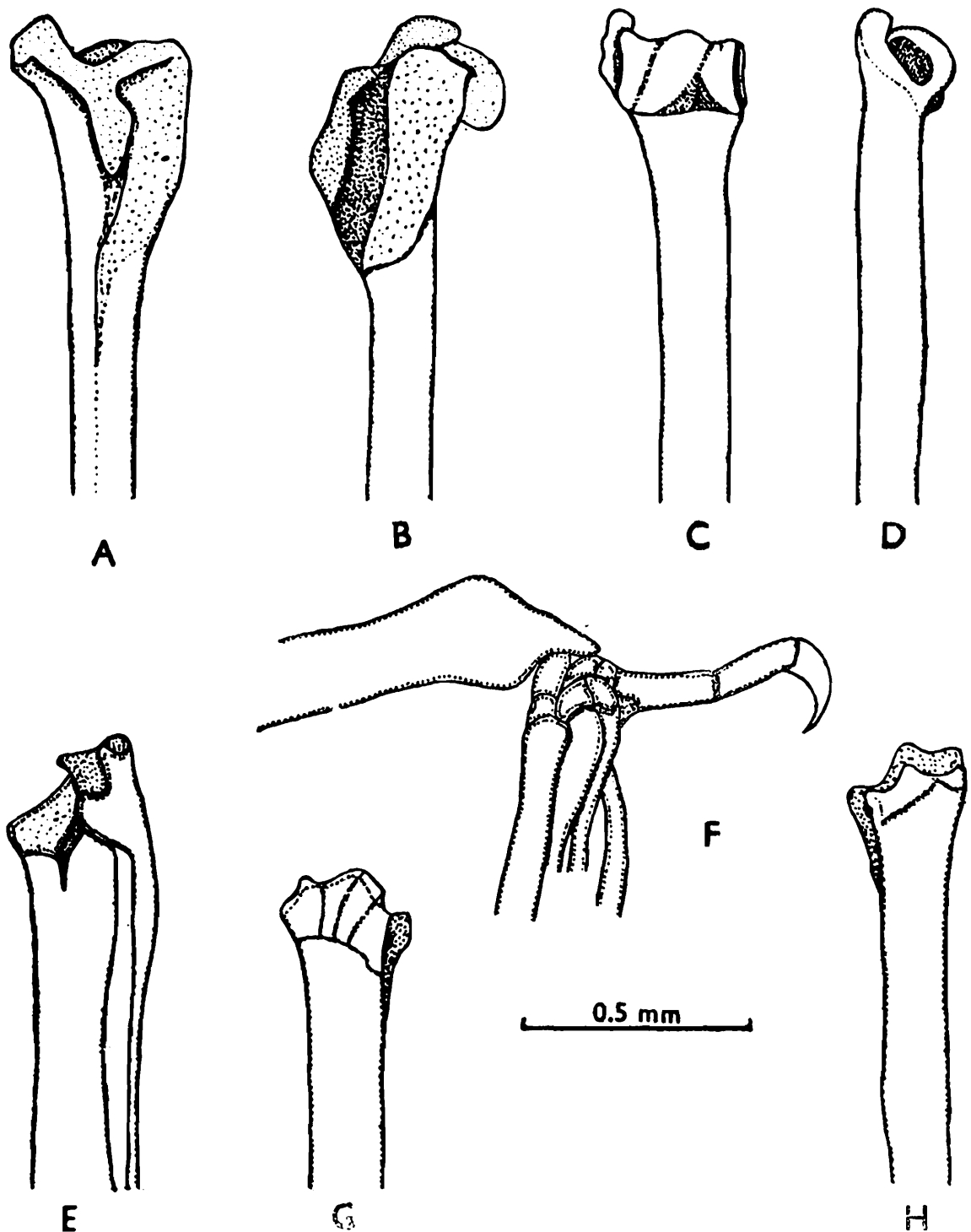


Text-fig. 7. *Tadarida aegyptiaca thomasi*. A, ventral view of sternum, costal cartilages, distal end of ribs, and proximal end of scapula ; B, a complete rib ; C, complete clavicle ; D, dorsal view of right scapula ; E, anterior view of left scapula.

The keel of the sternum is more developed than in *R. microphyllum kinneari* and this is related to its fast flying habit. The middle portion of the sternum is larger in proportion to body size than in *R. microphyllum kinneari* (length 7.7 mm. ; width 1.6 mm. vs. 7.5 mm. and 1.4 mm.). The xiphoid process is as in *R. microphyllum kinneari*.

There are 13 ribs (12 in *R. microphyllum kinneari*), the first nine are sternal, the next two vertebrocostal and the last two are only attached with the vertebrae.

*Pectoral girdle and the forelimb* (Text-figs. 7 and 8).—The scapula is broader than in *R. microphyllum kinneari* (length 50.2% of the humerus and width 26.3% vs. 47.2% and 19.4% respectively). The supraspinous

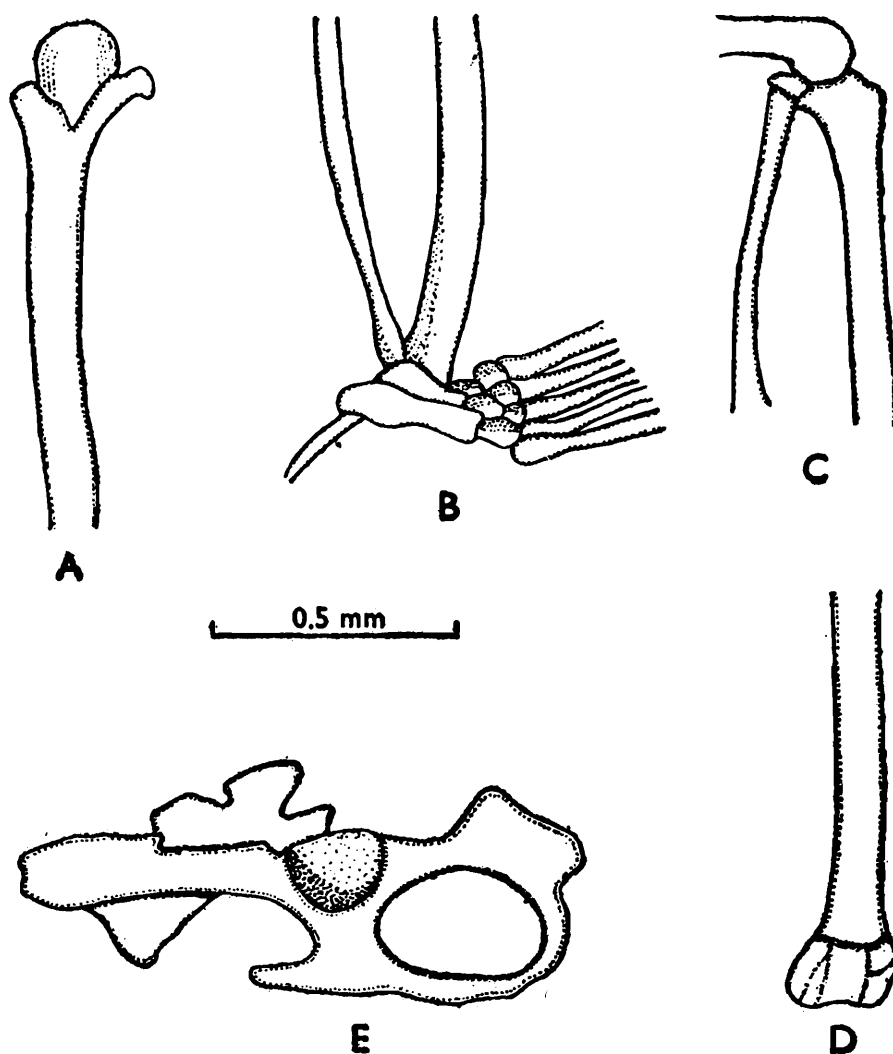


Text-fig. 8. *Tadarida aegyptiaca thomasi*. A-B, anterior and medial views of proximal end of humerus ; C-D, anterior and medial views of distal end of humerus ; E, anterior view of distal end of radio-ulna ; F, lateral view of the right carpus ; G-H, anterior and posterior views of distal end of radius.

fossa is less than half of the area of the infraspinous fossa (*vs.* about half in *R. microphyllum kinneari*). The anterior flange of the scapula is more developed than in *R. microphyllum kinneari*. The coracoid

process is projected medial, but is lateral in *R. microphyllum kinneari*. The anterior emargination of the scapula between the anterior flange and the base of the coracoid process is very deep (*vs.* shallow in *R. microphyllum kinneari*). The acromion process is less flat than in *R. microphyllum kinneari*, its distal end is more apart from the proximal base of the coracoid process and exceeds the lateral border of the scapula. The glenoid fossa is deeper.

The humerus (length 28.2 mm.) is more modified than in *R. microphyllum kinneari*. The greater tuberosity (length 1.5 mm ; 0.5 in *R.*



Text-fig. 9. *Tadarida aegyptiaca thomasi*. A, medial view of proximal end of femur ; B, dorsal view of distal end of tibia, fibula and tarsal bone ; C, medial view of proximal end of tibia and fibula, distal end of femur and patella joint ; D, medial view of distal end of femur ; E, lateral view of pelvis.

*microphyllum kinneari*) is longer and extends beyond the head. On the top of the head there is a pit (1.5 mm. deep) ; no such pit is found in *R. microphyllum kinneari*. The medial ridge of the humerus is higher than in *R. microphyllum kinneari* (7% of humerus *vs.* 5.5%)

and the medial epicondyle bears a spinous process (there is no such process in *R. microphyllum kinneari*).

The radius is smaller than in *R. microphyllum kinneari* (below 170% of the humerus *vs.* above 170%); the ulna is much reduced (46.2% of radius *vs.* 60% in *R. microphyllum kinneari*), thinner and fused within the proximal half of the radius. The metacarpals are longer than in *R. microphyllum kinneari* (86-101% of radius *vs.* 60-75% in *R. microphyllum kinneari*).

The great reduction of the ulna and the considerable lengthening of the metacarpals is related to its fast-flying habit.

*Pelvic girdle and hind limbs* (Text-fig. 9).—There is considerable variation in the posture and proportion of the hind-limbs and the structure of the pelvis in *Tadarida a. thomasi* and *R. microphyllum kinneari*. Such variation is related to their roosting habit and mode of locomotion.

*T. a. thomasi* roosts in narrow crevices and can crawl well and the posture of the hind limbs is "reptilian". The hind limbs and feet are short and strongly built. The femur (17.5 mm.) longer than the fibula (12.2 mm.), but both are much shorter than in the cave dwelling bat *Rhinopoma microphyllum kinneari* (femur 28% and fibula 20% of head and body length *vs.* 33.3% and 30% in *R. microphyllum kinneari*). The pelvis is broad (compressed in *R. microphyllum kinneari*). The depth of the pelvis, from the pubic symphysis to the ischial tuberosity, is about 38% of the total length of the pelvis (about 40% in *R. microphyllum kinneari*). The pubic spine is shorter (19% of the length of the pelvis, *vs.* 36% in *R. microphyllum kinneari*) and the acetabulum is larger.

#### SUMMARY

The Cranial and post-cranial osteology (including the hyoid apparatus) of a cave-dwelling bat (*Rhinopoma microphyllum kinneari* Wroughton) was studied. Post cranial osteology of this species was compared with a crevice-dwelling bat (*Tadarida aegyptiaca thomasi* Wroughton). It is concluded that in comparison with the cave dwelling and slow flying *Rhinopoma m. kinneari*, the crevice-dwelling and fast flying *T. a thomasi* has a more developed sternal keel, broader scapula, fusion and numerical reduction of vertebrae, smaller radius, a reduced ulna, longer metacarpals and the hindlimb bones shorter.

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## ABBREVIATIONS USED IN FIGURES

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| <p>1, maxilloturbinal</p> <p>2, mesethmoid</p> <p>3, vomer</p> <p>4, presphenoid</p> <p>5, basihyal</p> <p>6, ceratohyal</p> <p>7, thyrohyal or posterior cornu</p> <p>8, epihyal</p> <p>9, stylohyal</p> <p>10, foramen lacerum</p> <p>11, foramen ovale</p> <p>12, cochlea or osseous labyrinth</p> <p>13, fenestra vestibuli (oval window)</p> <p>14, incus</p> <p>15, styliform process with semicanal for auditory tube and tensor tympani muscle.</p> <p>16, manubrium mallei</p> <p>17, sulcus tympanicus</p> <p>18, umbo membranae tympani</p> <p>19, membranae tympani (paretensa)</p> <p>20, tuber mallei</p> <p>21, tympanic bone (annulus, tympanicus, ectotympanic)</p> <p>22, stapes</p> <p>23, stylomastoid</p> <p>24, posterior limb of tympanic bone</p> <p>25, fenestra cochleae (round window)</p> <p>26, crista transversa</p> <p>27, semicanal for facial</p> <p>28, canalis facialis</p> <p>29, processus petrosus posterior</p> <p>30, basis cochleae</p> <p>31, cupula cochleae</p> <p>32, mesethmoid</p> <p>33, olfactory foramina</p> <p>34, cribriform plate</p> <p>35, anterior cranial fossa</p> <p>36, alisphenoid</p> <p>37, middle cranial fossa</p> <p>38, sella turcica (turk saddle)</p> <p>39, canalis centralis modioli</p> <p>40, lateral semicircular canal</p> <p>41, posterior cranial fossae</p> <p>42, neural arch</p> <p>43, transverse foramen</p> | <p>44, neural canal</p> <p>45, facet for odontoid process</p> <p>46, odontoid process</p> <p>47, neural spine</p> <p>48, postzygopophysis</p> <p>49, centrum</p> <p>50, clavicle</p> <p>51, manubrium</p> <p>52, lateral arm of manubrium</p> <p>53, body of sternum</p> <p>54, xiphoid process</p> <p>55, costal cartilage</p> <p>56, rib</p> <p>57, capitulum</p> <p>58, neck of rib</p> <p>59, tuberculum</p> <p>60, coracoid process</p> <p>61, glenoid fossa</p> <p>62, infra spinous fossa</p> <p>63, posterolateral process</p> <p>64, intermediate facet</p> <p>65, spine of scapula</p> <p>66, supraspinous fossa</p> <p>67, spine of scapula</p> <p>68, acromium process</p> <p>69, greater tuberosity</p> <p>70, head of humerus</p> <p>71, lesser tuberosity</p> <p>72, medial ridge</p> <p>73, medial epicondyle</p> <p>74, trochlea</p> <p>75, lateral epicondyle</p> <p>76, olecranon fossa</p> <p>77, capitulum</p> <p>78, cuneiform</p> <p>79, unciform</p> <p>80, lunar</p> <p>81, magnum</p> <p>82, trapezium</p> <p>83, trapezoid</p> <p>84, metacarpal</p> <p>85, crest of ilium</p> <p>86, pubic spine</p> <p>87, acetabulum</p> <p>88, obturator foramen</p> <p>89, ischium</p> |
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| <b>90, pubic</b>                               | <b>100, lateral tubercle</b>   |
| <b>91, pubic symphysis</b>                     | <b>101, patellar fossa</b>     |
| <b>92, greater trochanter</b>                  | <b>102, astragalus</b>         |
| <b>93, lesser trochanter</b>                   | <b>103, calcaneus</b>          |
| <b>94, head of femu</b>                        | <b>104, navicular</b>          |
| <b>95, patela</b>                              | <b>105, cuboid</b>             |
| <b>96, tibia</b>                               | <b>106, external cuneiform</b> |
| <b>97, fibula</b>                              | <b>107, middle cuneiform</b>   |
| <b>98, humerus</b>                             | <b>108, internal cuneiform</b> |
| <b>99, adductor tubercle (medial tubercle)</b> | <b>109, metatarsal</b>         |