THE PTERYLOSIS OF THE KING VULTURE

By HARVEY I. FISHER

The King Vulture (*Sarcoramphus papa*) of Central and South America is the only cathartid genus whose pterylosis has not been investigated. The purpose of this study is to point out major points of similarity and difference between the feather tracts of the King Vulture and the general pattern previously described for New World vultures. In addition, the more significant differentiating characteristics of the pterylography of each genus is summarized in tabular form.

The skin (no. 85525 Mus. Vert. Zool.) and the alcoholic specimen (no. 85524 Mus. Vert. Zool.) which were studied were obtained in El Salvador in February, 1942, by a party from the University of California. Both specimens are adult males.

The placement and the configuration of the feathers of the head are two of the most variable features of the pterylosis of the cathartid vultures. For that reason photographs (figs. 21-24) of the heads of *Cathartes, Coragyps, Vultur* and *Sarcoramphus* are here presented; they have not previously been illustrated.

Fig. 21. Black Vulture (*Coragyps atratus*)

Fig. 22. Turkey Vulture (*Cathartes aura*)

Capital tract.—Although the entire head of *Sarcoramphus* is not covered by feathers, in the regions where feathers (bristles) do occur they are more closely spaced than in any other cathartid; only in the coronal and submalar areas are they sparsely placed. Consequently the covering of the head presents several sharply delimited regions. All the bristles of the head are black.

The lower ocular apterium is ovoid, 1.5 cm. long and lies entirely below the eye; it is not confluent with any other apteria as it is in all other members of the family. The upper ocular apterium is an isolated, narrow band above the eye. There are no eyelashes. An apterium 17 mm. wide and 33 mm. long extends ventrally from the lower part of the loral region, across the anterior end of the auricular tract, past the angle of the mouth, through the middle of the length of the malar area and into the submalar and interramal tracts. Its anterodorsal edge is continuous with the nude cere. The cere together with the caruncle limits the forward extension of feathers in the frontal and loral regions.

There is no connection between the ruff on the neck and the feathers of the head. The extreme upper part of the dorsal-cervical tract is nude except for a middorsal band (3 cm. wide) of bristles 1 to 5 mm. long, spaced at intervals of 1 to 2 mm. No bristles or feathers are present in the postauricular and interramal regions. Except for a dense fringe of bristles in its dorsal one-half and a few scattered bristles in the midline, the submalar region is bare.

In the frontal area the bristles are uniformly spaced at intervals of approximately 1 mm. and in groups of 1 to 6; in length they range from 2 to 7 mm. The most anteriorly situated bristles lie between the posterior ends of the nostrils where they form a V-shaped area bounded on the sides by the cere and on the apex by the caruncle. In the upper half of the loral tract the bristles range up to 7 mm. in length and are spaced at intervals of less than 1 mm.; the ventral half of the loral region has no bristles. The superciliary tract possesses bristles spaced as in the loral area, but they become

shorter dorsally and posteriorly as the superciliary tract merges with the frontal and coronal areas. The dorsal half of the ocular region is without bristles, but the ventral part has closely-set bristles, the longest of which are 7 mm.

The bristles of the middorsal part of the coronal tract are the most widely spaced of any on the head; in places the interval is 3 mm. and on one specimen a circular spot 1.5 cm. in diameter was nude. Laterally the bristles become shorter, and at the junction with the auricular area they are placed only 0.5 mm. apart. In the anterior and posterior thirds of the occipital tract the spacing is the same as in the lateral parts of the coronal tract. However, a band (8 to 12 mm. wide) of closely-set (never more than 0.5 mm.) bristles which originates immediately posterior to the lower ocular apterium passes posterodorsally across the dorsal part of the auricular area and through the middle third of the occipital tract to the dorsal midline (fig. 23). There it meets its counterpart from the opposite side. Almost immediately the bands separate and extend posteriorly on either side of the midline. As they proceed caudally they become narrower, and the bristles become more widely spaced. The bands end 4 cm. anterior to the ruff. Between the bands on the posterior part of the occipital tract are short, sparse bristles.

Another distinctive band (10 to 12 mm. wide) of dense covering starts below the lower ocular apterium, crosses the auricular area and the posterior end of the malar region, and touches the dorsal part of the submalar tract in which it passes anteriorly; in the anterior part of the malar tract it extends dorsally to the angle of the bill.

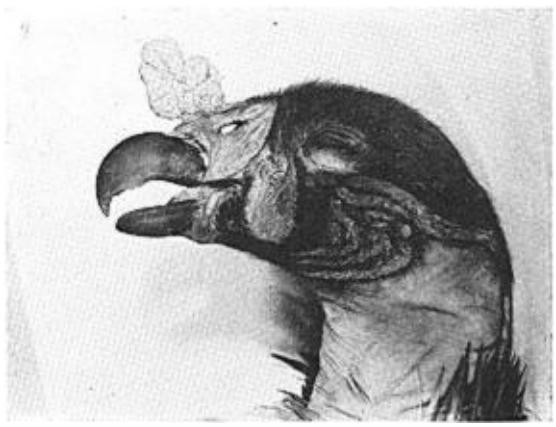

Fig. 23. King Vulture (*Sarcoramphus papa*).

The major part of the auricular area, the anteroventral part of the occipital area and the posterodorsal part of the submalar area are covered by granular folds of skin. On the folds the bristles are short and sparse, but between the folds they range up to 6 mm. in length and are set at intervals of less than 1 mm. (fig. 23). The auricular apterium is incomplete anteriorly, but posteriorly the apterium is widely continuous with the completely nude postauricular area.

The absence of an auricular ring of feathers is significant; the ring is present in all other cathartids and is even a characteristic of all other falconiforms which have been examined.

Spinal tract.—The dense, plumaceous feathering of the ruff begins 4 cm. posterior to the most caudal bristles of the head. The ruff is limited to the dorsal-cervical region and the dorsal edge of the ventral-cervical area on either side. In length the feathers vary from 3.5 to 5 cm.; a few are semi-lanceolate, but the shape of the majority resembles that of the contour feathers of the body. The basal one-third in all cases is white down; the middle fourth or third is made up of white barbs which are downy at their tips. The white barbs of the middle segment are loosely interconnected, but the silver-gray barbs of the distal third of the ruff feather are free. Feathers in the anterior one-half of the ruff project laterally and somewhat anteriorly; in the posterior one-half they extend posteriorly and laterally to merge with the body feathers.

Immediately posterior to the ruff the feathers have tawny-colored tips; a few of the ruff feathers may also be marked in this way. In the interscapular and dorsal regions the feathers are white and typical of contour feathers.

In *Sarcoramphus* as in *Vultur* and *Coragyps* the pelvic region is narrower and more axial than

in *Cathartes* and *Gymnogyps*. The contour feathers of this area are black; the down is white. A few are set on the midline. The oil gland is nude, and there is no postpelvic region.

Ventral tract.—There are no feathers or bristles in the anterior part of the ventral-cervical area, and the ruff is widely incomplete ventrally. Therefore, except for the few scattered bristles in the submalar tract the midline from the bill to the caudal end of the pelvis is an apterium. Only in *Sarcoramphus* of the New World vultures is this true.

All feathers in the ventral tract are white.

The sternal apterium is large and is similar to that in *Gymnogyps*. The abdominal tract has two rows of feathers extending to the anus.

Caudal tract.—Only in *Gymnogyps* and *Cathartes* is there any indication of a second row of minor under tail coverts. All under tail coverts are white; all upper tail coverts are black. The black rectrices which are 19 cm. long have no patagia around their bases.

Fig. 24. Andean Condor (*Vultur gryphus*)

There is no down about the cloaca. The anal circlet is incomplete ventrally, but two rows of small white feathers on the dorsal side extend laterally to connect with the few feathers in the post-ventral tract which shows the same pattern as in the California Condor.

Humeral tract.—The placement of feathers is similar in all cathartid vultures. In *Sarcoramphus* all the feathers are white except those in the two posterior rows; in the most caudal row the feathers are black except for a small amount of white near the base. There are one or two black-tipped feathers in the next to the last row.

Alar tract.—The 10 white tertiaries are approximately 10 cm. long. There are 22 greater secondary coverts which are 10 to 12 cm. in length; these coverts are black except in their basal thirds which are white. The longest secondary is number 21; it is 16 cm. long. The twenty-one secondaries are black except in their basal parts; the lateral vane is white in its basal 3 cm., and the medial vane is white in its basal one-fourth to one-half.

As in other cathartids 11 primaries are present; number 11 is vestigial, 3.5 cm. long and entirely white. The longest primary (34 cm.) is number 8. The 10 medial primaries are black with white areas proximally as in the secondaries.

Ten black greater coverts and 7 white middle upper coverts beginning distal to greater covert number 4 are present on the hand. The carpal covert is white. The 4 large alular feathers, the longest of which is 13 cm., are black with a small amount of white at the base. On the pollex is a sword-like claw which measures 1.5 cm. on one wing and 2 cm. on the other.

All under wing coverts are white.

Femoral and crural tracts.—The feathers in these tracts are white and are placed as in the other cathartids.

As Compton (Univ. Calif. Publ. Zool., 42, 1938:173-211) has shown in his study of the pterylosis of the falconiforms, points of difference and similarity in the feather tracts may be used as aids in determining familial relationships. He found that it was possible to set up a general pattern for each family. Because he used *Cathartes* alone

as an example of the Cathartidae, subsequent studies (Miller and Fisher, Condor, 40, 1938:248-256; Fisher, Auk, 56, 1939:407-410, and Condor, 44, 1942:30-32) of the New World vultures have made necessary the revision of his cathartid pattern. It is now possible to establish a basic pattern common to all the members of the family.

Table summarizing similarities and differences in the pterylosis of New World vultures

	Cathartes aura	*Coragyps atratus*	*Sarcoramphus papa*	*Gymnogyps californianus*	*Vultur gryphus*
ocular tract	2 rows of eyelashes on lower lid; 1 row on posterior ⅔ of upper lid	2 rows on lower lid; 1 row on posterior ½ of upper lid	no eyelashes	no eyelashes	no eyelashes
ocular apteria	narrow; meet posteriorly	continuous with loral apterium; meet anteriorly and posteriorly	wide; do not meet	confluent with bare areas of crown and face	continuous with loral apterium; meet widely posteriorly
interramal tract	feathered posteriorly	as in *Cathartes*	nude	nude	as in *Cathartes*
submalar tract	heavily bristled	few scattered bristles	as in *Coragyps*	as in *Cathartes*	long, semi-plumaceous feathers
auricular tract	long and closely-set bristles; 2 to 3 rows about meatus	as in *Cathartes*	no feathers about meatus	largely nude; isolated ring about meatus	no definite rows about meatus
post-auricular tract	feathered	short, closely-set bristles	nude	semi-plumaceous feathers	sparsely bristled
ruff	least evident; semi-lanceolate feathers	as in *Coragyps* but more evident	pronounced; lanceolate feathers and down	pronounced; lanceolate feathers	most pronounced; downy
pelvic region	broad	narrow	narrow	broad	narrow
oil gland	nude	down often present	nude	nude	nude
ventral cervical apterium	narrow	wide	wide	narrow	wide
sternal apterium	vestigial; 1 to 3 rows of feathers lateral to it	evident; 3 rows lateral to it	pronounced; 1 row lateral to it	as in *Sarcoramphus*	as in *Sarcoramphus*
abdominal region	1 row in front of anus	1 to 3 rows	2 rows	1 row	3 rows
number of minor under tail coverts	12	6	6	6	6 to 8
number of lesser under tail coverts	2	none	none	2	none
anal circlet	2 rows; incomplete	1 to 2 rows; incomplete	2 rows; incomplete	1 row complete; 1 row incomplete	2 rows complete; 3 rows incomplete
number of tertiaries	9	9	10	10	13
number of secondaries	18	19	21	22	25
number of middle upper coverts on hand	8	8	7	7	8

Features of the pterylosis which differentiate the cathartids from other falconiforms are: absence of a submalar apterium, vestigial or obsolete lateral cervical apterium, wide dorsal-cervical region, presence of a ruff, continuous dorsal and pelvic regions, fused sternal, axillar and subaxillar regions, a row of large feathers in the posterior subaxillar area, a definite sternal apterium, a femoral tract consisting of 5 to 7 longitudinal rows of lanceolate feathers on the posterior margin of the thigh, 4 alular quills, absence of a patagium about the bases of the rectrices, an essentially nude oil gland and a reduced number of lower tail coverts.

Other, less important, characteristics common to the New World vultures are: feathers or bristles of the loral region and most closely set of any on the head, reduced covering in the coronal and occipital areas, presence of 12 rectrices, 12 upper tail coverts, 12 major under tail coverts, and 11 primaries (eleventh vestigial), absence of a carpal remex, and presence of a carpal covert and 10 greater upper coverts on the hand.

It is not desirable to use criteria dealing solely with a part of an organ system, as for example, feathers, to set up phylogenies or relationships. However, it is feasible to use these characters in conjunction with a number of others; thus relationships as indicated by the feather tracts may be of significance.

Reference to the table will show that the pterylosis of each genus has certain features peculiar to it. For example, the number of secondaries is different for each; *Cathartes* has 12 minor under tail coverts, and the sternal apterium is vestigial; *Coragyps* often has down on the oil gland; in *Sarcoramphus* the ocular apteria are not confluent, the postauricular tract is nude, and there are no feathers about the auditory meatus; in *Gymnogyps* the head covering is the most reduced; the ruff is downy, and long, semi-plumaceous feathers are found in the submalar tract of *Vultur*.

More important for the study of relationships are the characteristics common to two or more genera. *Sarcoramphus, Gymnogyps* and *Vultur* lack eyelashes, and the ruff is pronounced, as is the sternal apterium. In these three genera a single row of feathers is present lateral to the sternal apterium. The number of secondaries and tertiaries is greater than in *Cathartes* and *Coragyps*; fewer remiges are perhaps to be correlated with lesser weight in the Black and Turkey vultures, but it is significant that *Sarcoramphus,* a bird of approximately one-third the weight of *Gymnogyps,* has only one less secondary than the California Condor.

Although *Cathartes* and *Coragyps* possess certain common characteristics such as eyelashes, feathers in the posterior part of the interramal region, 2 to 3 rows of feathers around the auditory meatus and 9 tertiaries, they differ in several respects. The postauricular tract in the Black Vulture has short, closely-set bristles as compared to feathers in the same region in the Turkey Vulture. The pelvic region is narrow in *Coragyps* and broad in *Cathartes*; the ventral cervical apterium is wide in *Coragyps* and narrow in *Cathartes*. The Turkey Vulture has 12 minor under tail coverts and 2 lesser under tail coverts; the Black Vulture shows only 6 minor under tail coverts and no lesser coverts.

In many of the ways in which the vultures differ, *Coragyps* shows similarity to *Sarcoramphus*, and especially to *Vultur*. On the other hand, *Cathartes* possesses the following characteristics in common with *Gymnogyps*: heavily bristled submalar tract, feathered postauricular region, broad pelvic area, narrow ventral cervical apterium, one row of feathers in the abdominal region anterior to the anus, and 2 lesser under tail coverts.

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