

**Article VI.—NOTES ON PTILOSIS, WITH SPECIAL REFERENCE
TO THE FEATHERING OF THE WING.**

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During the past few years the writer has had the opportunity of examining many specimens of birds in the flesh received by the American Museum of Natural History from various sources, chiefly from the New York Zoölogical Park. These represented a majority of the orders and suborders and most of them were utilized for skeletons, affording an excellent chance to examine certain points in the external anatomy, particularly the feathering of the wing, that cannot be satisfactorily studied in dried skins without injury to them. My observations have been supplemented by examination of skins and mounted specimens. The present paper consists mainly of an enumeration of such of my determinations as are at variance with the published statements.

Eutaxy and Diastataxy.—First may be considered the presence or apparent absence of the fifth secondary, resulting in the arrangements known as eutaxy and diastataxy, or formerly as quintocubitalism and aquintocubitalism.

Conflicting statements have been made regarding the arrangement in the Screamers and the Megapodes. I find by careful examination of three fresh specimens of *Chauna chavaria* and a discarded mounted *Megapodius cumingi* that in these particular species at least a superfluous greater covert overlies the space between the fourth and fifth secondaries, or, in other words, that they are diastataxic. *Chauna*, therefore, differs from *Anhima* (*Palamedea*) which Beddard and Mitchell (P. Z. S., 1894, p. 536) state is

eutaxic, and the Megapodes differ in like manner from the rest of the Gallinæ.

It is perhaps hardly necessary to repeat that the Flamingos, as shown by two fresh specimens of *Phænicopterus roseus*, are typically diastataxic. This confirms the determinations of Sclater, Pycraft and Gadow, the statement of Wray to the contrary being unquestionably erroneous.

The Pigeons, as is now well known, possess both styles of wing. I have had many genera for examination and append a list arranged according to this character.

Columbula, and *Lophophaps*, also the first and third species of *Geopelia*, are added on the authority of Dr. Mitchell.

<i>Diastataxic</i>	<i>Eutaxic</i>
<i>Columba arquatrix</i>	{ <i>Geopelia tranquilla</i>
“ <i>flavivirostris</i>	“ <i>striata</i>
“ <i>palumbus</i>	“ <i>cuneata</i>
<i>Ectopistes migratorius</i> (Skin)	<i>Scardafella inca</i>
{ <i>Zenaidura macroura</i> (Skin)	<i>Columbula picui</i>
{ <i>Zenaida zenaida</i> (Skin)	{ <i>Chæmepelia minuta</i>
{ <i>Streptopelia bitorquata</i>	{ <i>Claravis pretiosa</i> (Skin)
“ <i>capicola</i>	<i>Chalcopelia afra</i>
“ <i>vinacea</i>	{ <i>Phaps chalcoptera</i>
{ <i>Spilopelia chinensis</i>	{ <i>Lophophaps plumifera</i>
{ <i>Ena capensis</i>	{ <i>Ocyphaps lophotes</i>
{ <i>Chalcophaps indica</i>	{ <i>Phlegoenas luzonica</i>
{ <i>Leptotila verreauxi</i>	{ <i>Leucosarcia picata</i>
{ <i>Geotrygon montana</i>	{ <i>Starnoenas cyanocephala</i>
<i>Caloenas nicobarica</i>	
<i>Didunculus strigirostris</i>	

The Peristeridæ, to which belong all the 24 genera above enumerated, except *Columba*, *Ectopistes* and *Didunculus*, are divided by Sharpe into seven subfamilies. The two largest of these contain both eutaxic and diastataxic genera. It will be observed, however, that as a rule the most closely allied genera (indicated above by brackets) agree in this respect, an exception being *Chalcopelia* which differs from its supposedly near allies *Ena* and *Chalcophaps*.

The great Gull-Plover group, or Laro-Limicolæ, has been considered as universally diastataxic. It is therefore of considerable interest to find that the American Woodcock (*Philohela*) is eutaxic. Examination of one fresh specimen and two skins prove this beyond a doubt. It would naturally be expected that *Scolopax* might agree in this point with *Philohela*, so I was surprised when inspection of mounted birds showed both *Scolopax* and *Gallinago* (*G. delicata*) to agree with the vast majority of the group in the

presence of the extra fifth covert fully developed. *Philohela* therefore gains a generic character, additional to those of the attenuated outer primaries, narrower outer rectrices and more graduated tail. It is not safe, however, to assume that *Scolopax saturata* (lately separated by Mr. Gregory Mathews as *Parascolopax*) and *Neoscolopax rochusseni* resemble *Scolopax rusticola* in this respect and both should be investigated.

This isolated case of the eutaxial wing in a large and varied diastataxic group is further evidence of the derivation of the former type from the latter.

The Rollers (Coraciidæ) are said by Gadow and by Beddard to be eutaxic. Examination of two fresh and one mounted specimen of *Coracias indicus* (on which genus Gadow's determination was based) one fresh *C. garrulus*, and a mounted specimen of *Eurystomus afer* prove that the typical Rollers (Coraciinæ), at least, are diastataxic. *Corapitta pittoides* is apparently eutaxic but there was available only a mounted bird that did not permit of satisfactory examination. *Leptosoma* has not been investigated.

Sclater (Ibis, 1890, p. 80) enumerates among the genera of Anisodactylous Picarians that he had found on examination to be "quintocubital," *Podargus* and *Steatornis*. Dr. Gadow (P. Z. S., 1888, p. 659) marks these two genera as undetermined. In his table of characters (Tierreich, 1893), and in Beddard's diagnosis of the group, the Caprimulgi (including *Podargus* and *Steatornis*) are stated to be diastataxic. I have carefully examined one wing of a mounted specimen of each of the three following species: *Podargus strigoides*, *Batrachostomus stellatus* and *Steatornis caripensis* and find each one clearly diastataxic, thus agreeing with the Caprimulgidæ. Not only is the superfluous fifth covert present but the peculiar proportions of the coverts observable in many birds with this type of wing is very evident in at least the first two genera, the fifth greater covert being disproportionately longer than the fourth, while the sixth is abruptly shorter than the fifth.

The Hummingbirds (Trochilidæ) are divided by Ridgway (Bds. N. and M. Amer., Pt. V, p. 303) into three subfamilies, based on differences in the nasal operculum and in coloration:—Phæthornithinæ or Hermits, Trochilinæ, or typical Hummingbirds, comprising the vast majority of genera, and Lophornithinæ or Coquettes, etc.

Gadow (1888 and 1893) marks the Hummingbirds eutaxic and Sclater (1890) states: "In the Trochilidæ the fifth c. r. is apparently present." Subsequent authors have universally given this family as eutaxic, doubtless relying on the above statements.

Two genera, *Phæthornis* (*P. guyi*) and *Glaucis*, both belonging to the first subfamily, prove to be eutaxic; but the following, all Trochilinæ, are diastataxic, as determined by very careful examination, and it is probable

that the numerous remaining genera of the subfamily will be found to agree with them in this respect.

Patagona gigas	Chrysolampis elatus
Chlorostilbon sp.	Ensifera ensifera
Colibri iolotus	Boissoneaua flavescens
Oreotrochilus pichincha	Heliothryx sp.
Anthracothorax gramineus	

Of the Lophornithinæ I have examined *Lophornis helenæ*, *L. ornatus* and *L. magnifica* and find them diastataxic.

Here, then, is an additional character separating the Phœthornithinæ from the rest of the family.

For convenience of reference a list is given below showing our present knowledge regarding the occurrence of the diastataxic and eutaxic types of wing among Carinate birds. There is little doubt that further exceptions will be discovered of eutaxic forms in the diastataxic groups.

1. Universally Diastataxic.

Pygopodes	(Loons, Grebes)
Tubinares	(Petrels, Albatrosses)
Herodiones	(Hérons, Storks)
Steganopodes	(Cormorants, Pelicans)
Phœnicopteres	(Flamingoes)
Anseres	(Swans, Ducks, Geese)
Accipitres	(Hawks, Vultures, Secretary-bird)
Ralli	(Rails)
Grues veri	(True Cranes, Limpkin)
Otides	(Bustards)
Lari	(Gulls)
Alcæ	(Auks)
Pterocletes	(Sand Grouse)
Megapodes	(Mound-builders)
Psittaci	(Parrots)
Striges	(Owls)
Caprimulgi	(Oil-bird, Frog-mouths, Nightjars)

2. Groups containing both Eutaxic and Diastataxic forms.

Columbæ	(Pigeons)	Numerous genera of each style.
Limicolæ	(Plovers, Snipe)	<i>Philohela</i> alone known to be eutaxic.
Anhimæ	(Screamers)	<i>Chauna</i> diastataxic, <i>Anhima</i> eutaxic.
Turnices	(Hemipodes)	<i>Pedionomus</i> diastataxic, <i>Turnix</i> eutaxic.
Coraciæ	(Rollers)	<i>Coracias</i> and <i>Eurystomus</i> diastataxic, <i>Corapitta</i> probably eutaxic.
Halcyones	(Kingfishers)	Several genera of each style.
Cypseli	(Swifts)	Mostly eutaxic, <i>Streptoprocne</i> and <i>Collocalia</i> said to be diastataxic. <i>Dendrochelidonidæ</i> (all?) diastataxic.
Trochili	(Hummingbirds)	Phæthornithinæ eutaxic, all others diastataxic.

3. *Universally Eutaxic.*

Tinami	(Tinamous)
Cracidae	(Curassows)
Gallinæ alectoropodes	(Grouse, Partridge, Pheasants)
Opisthocomus	(Hoatzin)
Grues aberrantes	(Seriema, Trumpeter. Kagu, Sun-bittern, Fin-foot)
Coccyges	(Cuckcos, Plantain-eaters)
Meropes	(Bee-eaters)
Momot	(Motmots, Todies)
Trogones	(Trogons)
Bucerotes	(Hornbills, Hoopoes)
Colii	(Mouse-birds)
Pici	(Jacamars, Barbets, Woodpeckers, etc.)
Passeres	(Broadbills, Tyrant-birds, Ant-birds, Lyre-bird, Song-birds, etc.)

Metacarpal Primaries.— In the Tinamous and in all Neognathæ except the Grebes, Storks and Flamingos, the metacarpal primaries are six in number. In the three superfamily groups mentioned and in the Rheas they number seven. Gadow states that *Ciconia* is unique among the Storks in having but six metacarpal quills. I have carefully examined three fresh specimens of *Ciconia ciconia* and one of *C. boyciana* and in each case find twelve primaries of which seven grow on the metacarpus as in other Storks and five are digital (the outermost vestigial).

With this supposed exception eliminated the number of metacarpal quills becomes a constant character of some taxonomic value. It is probable that the larger number is the older condition as it seems hardly probable that the weak-winged Rheas and Grebes would have gained an additional primary. While it is obvious that the identity in number in these families and in the Storks is not the result of any close relationship between the three groups, it seems probable that the resemblance between Storks and Flamingos in this particular is an indication of affinity.

First Primary Covert.— In the great majority of birds the first greater upper primary covert, which lies between the first (innermost) and second primaries, is of normal size and form, closely resembling the second in all respects. I have found it decidedly reduced only in certain alectoropodous Gallinæ, in *Turnix* and in most Parrots. In these the first covert is less than three-fourths the length of the second, while in all other birds examined it exceeds three-fourths. In the Cracidae (*Penelope* and *Ortalis*) and in the Megapodidae (*Megapodius*) this covert is normal. In *Pavo* it is normal or nearly so; in *Ammoperdix* and in *Colinus*, though a trifle more than three-fourths the length of the next covert, it is distinctly degenerate. In *Gennæus*, *Phasianus*, *Syrnaticus*, *Chrysolophus*, *Caccabis* and *Cyrtonyx* it

measures less than three-fourths (but much more than one-half) of the second. *Turnix* (*T. nigricollis* and *T. ocellata*) agrees with the latter.

The condition of this covert in the Psittaci is of particular interest as I believe it will prove of some assistance in the difficult problem of classification in this group. In the Cockatoos (*Cacatoës*,¹ *Eolophus*,² *Liometis* and *Leptolophus*¹) and in *Stringops* the first covert is normal in size, form and texture. In all other Parrots examined it is decidedly less than three-fourths the length of the second, often less than one-half, and is sometimes reduced to a mere tuft of down not one-third the second covert in length. This last stage is reached in *Charmosyna*, *Ara*, *Conurus* and *Conuropsis*, and the feather is nearly or quite as vestigial in *Trichoglossus*, *Vini*, *Anodorhynchus*, *Brotogeris*, *Pionus*, *Pionites*, *Poicephalus*, *Psittacula* and *Myiopsitta*.

In *Amazona*, *Rhynchopsitta*, *Psittacus*, *Palæornis*, *Agapornis*, *Aprosmictus* (*Ptistes* auct.), *Alisterus* (*Aprosmictus* auct.), *Tanygnathus* and *Melopsittacus* the reduction is carried not quite so far, and in none of them is the covert completely downy. It is least reduced in *Coracopsis*, *Pezoporus*, *Platyercus*, *Psephotus*, *Eos*, *Lorius* and *Nestor*, being considerably more than half as long as the second, less vestigial in structure, and firm, not downy, terminally. Between these several groups of species, there is, however, complete intergradation in the size and form of this covert.

It is obvious that the Cockatoos and the Owl Parrot branched off from the early Psittacine stem before the reduction in the first primary covert

¹ As stated by Mathews (*Novitates Zoologicae*, Vol. XVIII, pp. 11-13, 1911) *Cacatua* Vieillot and *Calopsitta* Lesson must be replaced respectively by *Cacatoës* Dumeril and *Leptolophus* Swainson on the grounds of priority. I cannot agree, however, with the contention that *Probosciger* Kuhl and *Conurus* Kuhl should be superseded by *Solenoglossus* Ranzani and *Aratinga* Spix. Though the older names were merely given to "sections" these are equivalent to subgenera and there seems to be no reason why they should not be accepted as such.

² The Rose Cockatoo, *Cacatoës roseicapilla*, is generically distinct from true *Cacatoës*, the proper name for the monotypic group being *Eolophus* Bonaparte (Rev. et Mag. de Zool., 1854, p. 155). The two genera differ conspicuously in the form of the wing and in coloration. In *Eolophus* the crest is shorter and broader, approached but, I think, not equalled by certain species of *Cacatoës*. In *Cacatoës* the secondaries are very ample reaching nearly to the tip of the wing which is broad and truncate, the ninth primary equal to or shorter than the sixth. In *Eolophus* the secondaries are shorter and smaller, and the terminal primaries are elongated resulting in a more pointed wing, the ninth quill much exceeding the sixth.

All the species of *Cacatoës* are wholly white, the inner webs of the remiges and rectrices always tinged with yellow or red, the crest and parts of the body plumage often marked or tinged with these colors. In *Eolophus* the back, wings and tail are gray, crest whitish-pink, rump grayish-white and underparts raspberry-red. According to Garrod (P. Z. S., 1874, p. 588) *Eolophus* has two carotid arteries, while *Cacatoës* has but one, but as Beddard records two present in both genera the number is in doubt.

Reichenow divides the short-tailed Cockatoos into two genera according to the form of the crest, placing the Rose Cockatoo in true *Cacatoës* characterized by a broad-feathered crest, the species with narrow, recurved crest feathers standing as *Lophochroa*. As *Eolophus* stands alone in form of the wing and in coloration this arrangement is certainly not a natural one. Mathews recognizes five segregates of the old genus *Cacatoës*, a degree of subdivision that to many will seem quite unnecessary.

began, and it is unlikely that this reduction took place independently in two or more groups. On this view the Cacatuidæ and Stringopidæ form a group, or two groups, equal in value to all other Parrots combined.¹ This is contrary to Gadow's scheme in which the suborder is divided into Trichoglossidæ with Nestorinæ, Loriinæ, and Cyclopsittacinæ, and Psittacidæ with Stringopinæ, Cacatuinæ and Psittacinæ. The Cockatoos are a strongly marked group. The entire absence of green or blue in any species is very striking and among other characters are the presence of a crest and, in the skull, a peculiar orbital ring.

The arrangement suggested does not appear to be contradicted by any other character and though it is here impracticable to pursue the subject further, it is evident that the first primary covert should be considered in any future attempts to elucidate the classification of the Parrots.

Vestigial Eleventh Primary.—My determination of the number of primaries differs from the figures given by Gadow (Tierreich, 1893) in the case of the Pigeons, Bee-eaters, Rollers, Barbets, Toucans and Woodpeckers.

Gadow states that the Pigeons have eleven primaries but I have failed to find even a trace of a vestigial eleventh quill in any of the twenty genera examined, including *Caloenas* and *Didunculus*. Mitchell² credits *Phlogoenas cruentata* (= *Phlegoenas luzonica*) with only nine primaries, but the two specimens examined prove beyond a doubt that in this species, as in other Pigeons, there are normally ten fully developed primaries.

In *Nyctiornis amictus* I find ten functional primaries and an extremely vestigial outermost, eleventh, only 5 mm. long. *Merops* has ten primaries, the tenth spurious; no trace of an eleventh.

In the typical Rollers and the three families of Pici above mentioned there is in each case a minute vestigial eleventh primary. Examination proves this to be the case in *Coracias indicus* and *C. garrulus*, *Eurystomus orientalis*, *Cyanops* sp., *Chotorhea corvina*, *Ramphastos ariel*, *R. brevicarinatus*, *Aulacorhynchus prasinus*, *Selenidera maculirostris*, *Colaptes auratus*, *Phlæotomus pileatus*, *Brachypternus aurantius*, *Campephilus principalis* and *Dryobates pubescens*. In the latter the vestige is but 2.5 mm. long, and in *Chotorhea* only 3 mm. It is quite possible, therefore, that in some members of the group the eleventh primary has entirely disappeared.

In his 'Birds of North and Middle America,' Part VI, page 451, Mr. Ridgway states: "Although the Momotidæ are said to possess 11 primaries, I have not been able to find more than 10 in any of the 7 genera." There is no doubt, however, that in *Momotus*, at least, there are 11 primaries. In

¹ The Cacatuidæ and Stringopidæ are further mutually allied by the structure of the syrinx and its intrinsic muscle (Beddard).

² Journ. Linn. Soc. London, XVII, p. 213.

a fresh specimen of *M. subrufescens* recently examined, I found a vestigial eleventh (outermost) primary 8.5 mm. long, firm but not stiff nor acute; the shortened tenth quill 57 mm. long. In an individual of *M. lessoni* the "remicle" was 8 mm. in length. In the same work (p. 441) the number of primaries in the Todidae is given as "9-10," evidently taken from Gadow's table in the Tierreich. I have examined all the species of the genus and find 10 well developed primaries in each.

Alula.—The most remarkable alula among the numerous birds investigated is found in the curious Cuckoo, *Tapera*. In this bird alone is the first alula quill about equal to the third,¹ and the fifth much longer than the distance from its tip to the tip of the longest (second) feather. It is well known that in this bird the alula is unusually mobile and is used in display, being thrust out at an angle from the rest of the wing and across the breast. It is large and mobile also in other Cuckoos and in the Turacos. A nestling Yellow-billed Cuckoo (*Coccyzus americanus*) once observed by the writer raised the alula most conspicuously when disturbed. *Dromococcyx*, the nearest relative of *Tapera*, shows only a slight approach to the peculiar alula of the latter.

Psophia, the Trumpeter, is the only other genus examined in which the first alula quill is shorter than the second. In *Tapera* the quills are six (possibly only five) in number, five or six in *Geococcyx*, *Centropus*, *Pavo* and *Psophia*, six in *Turacus*. In many groups, as the Parrots and Hawks, there are only four feathers (all large and well defined in the two groups mentioned), and many Woodpeckers (as *Centurus* and *Dryobates*) and small Oscines have but three, of which the third is small.

It is stated that the Hummingbirds have but a single alula quill and that even this is sometimes wanting (Ridgway, Birds N. and M. Amer., Pt. V, p. 299). My observations do not confirm this statement. In *Patagona gigas* the distal quill is a lanceolate feather 14 mm. in length; next to this is a fairly stiff though not quill-like feather 7 mm. long, then a third feather $4\frac{1}{2}$ mm. long. On carefully cutting out the pollex these three feathers (and possibly a fourth smaller one) are all found to grow from well above the basal end of the bone. It seems to me therefore that they are alula quills beyond a doubt. In several other Hummers examined (as *Colibri* and *Anthracothorax*) at least two feathers must be considered as belonging to the alula, the second one differing greatly in length and shape from the narrow linear first quill.

Outermost Primary Covert.—A remarkable feature of the Trumpeter

¹ In *Chizorhis zonurus* (Musophagidae) also the first feather about equals the third.

(*Psophia*) that I have found in no other bird is the abruptly enlarged outermost upper primary covert. In a specimen of *P. leucoptera* this covert was 82 mm. long, the next four respectively being 37, 45, 54, and 56 mm. As a rule this outermost covert is much shorter than the next.

Rectrices.—The number of rectrices in two genera of Jacamars, *Brachygalba* and *Jacamaralcyon*, is wrongly stated by Ridgway (Birds of N. and M. Amer., Pt. VI, p. 361) to be only "10 (the sixth pair wanting)," an error traceable at least as far back as the British Museum Catalogue of Birds (Vol. XIX, p. 161). In both these genera the outermost (sixth) rectrix is present, as in every other member of the family, but while in *Brachygalba* it is more reduced than in any other genus, in *Jacamaralcyon* it is scarcely smaller than in *Galbula*.

In the Woodpeckers and Wrynecks the tail-feathers number twelve, the outermost or 6th pair (as in the Jacamars) being reduced to a useless vestige, remarkable for its constancy. It is of interest to find that this pair of small rectrices, heretofore supposed to be invariably present, has been lost by *Campephilus pollens* and its place taken by the much reduced fifth pair. On account of this and other peculiarities *C. pollens* may be allowed generic separation under Malherbe's name *Megapicos*.

The Campephileæ are characterized in part by the unique form of the four middle rectrices which are much stronger than the remainder. The tail, at least in the American genera, is more strongly graduated than in other Woodpeckers. These peculiarities reach their maximum in *Megapicos* in which as a result of the great enlargement of the four middle tail-feathers the others have been much reduced and the vestigial sixth pair crowded out altogether.

Beddard states that he "found only ten rectrices in *Tiga shorei*." I have not seen this species but judging by the form of the tail in the related *T. javanensis* it seems probable that the specimen examined by Beddard had lost a pair of its tail-feathers either by molt or accident. In any event additional specimens must be examined before the normal number of rectrices in this species can be regarded as settled.

The number of tail-feathers in the Motmots can now be regarded as definitely settled, the statements in the Tierreich (page 230) and British Museum Catalogue (XVII, p. 313) being erroneous. As correctly given by Mr. Ridgway there are only ten rectrices in every genus but *Momotus* which possesses twelve. In one of the three specimens of *Baryphthengus* examined, however, the right half of the tail has six rectrices, the sixth feather being of about the same relative size as in *Momotus*. The left side of the tail is imperfect.

Oil-gland Tuft.—Statements regarding the presence or absence of a tuft

on the oil-gland prove erroneous or only partly true in the case of the *Bucconidae*, *Picidae*, *Capitonidae*, and *Momotidae*.

Although the Puff-birds (like the Jacamars) are usually credited with a nude oil-gland Gadow states that in some of them it is feathered. On examination of every genus of these two families I find that without exception the oil-gland is perfectly bare.¹

Both in the Woodpeckers and the Barbets the oil-gland normally bears a tuft of down at its tip, and I am not aware that any exception to the presence of this tuft has been recorded. In each of these families, however, there prove to be several genera in which the oil-gland is nude.

Of the Woodpeckers all the genera with the exception of *Sapheopipo* and *Trichopicus* have been examined in this connection. In the majority the tuft of the oil-gland is of small size; fairly large however in the *Celeæ*, *Chrysophlegma mentalis* and *C. flavinucha*, *Megapicos pollens*, *Sphyrapicus* and *Hypopicus*. The genera in which this tuft of down is absent are the mutually allied forms, *Tiga*, *Brachypternus*, *Gauropicoides* and *Gecinulus*, but it is present in the related genera *Micropternus* and *Meiglyptes*.² In *Chrysocolaptes* the tuft varies from vestigial to absent even within specific limits. In the Barbets (*Capitonidae*) we find a small, dense tuft in the four American genera and the seven genera of green Asiatic Barbets. In the very distinct brown *Calorhamphus* of the same region the tuft is thin and sparse.

It is in the same condition in the African forms, *Xylobucco* and (probably) *Trachylæmus*, but is wholly wanting in *Hellobucco*, and the natural group of tooth-billed Barbets comprising the genera *Pogonorrhynchus*, *Erythrobucco*, *Melanobucco*, *Lybius* and *Tricholæma*. The following genera (all Ethiopian)

¹ I am strongly convinced that a primary division of the antiopeimous Picarians should be made into two groups, one containing the *Bucconidae* and *Galbulidae*, the other the *Indicatoridae*, *Ramphastidae*, *Capitonidae*, *Yungidae*, and *Picidae*. This course was suggested by Stejneger (Standard Natural History) but Ridgway in his late treatment of the group, which he considers a suborder, *Picariæ*, divided it at once into four superfamilies: *Pici*, *Capitones*, *Ramphastides* and *Galbulæ*.

In view of the many radical differences between the *Galbulæ* and the remaining superfamilies, as compared with the few and comparatively unimportant differences between the *Capitones* and *Ramphastides*, or even between these and the *Pici*, it seems inevitable that the *Galbulæ* should be given higher rank.

Diagnostic characters of the latter are as follows: Nude oil-gland, well-developed cæca, two carotids, non-oscine wing-coverts, only moderately deep temporal fossæ, thoracic hæmapophyses with lateral ventral enlargements, furcula with hypocleidum, ectepicondylar process of humerus absent. The metacarpus and distal end of metatarsus are both very different from the highly characteristic forms of the other families, and the plumage altogether lacks the bright red so universal in the Barbets, Toucans and Woodpeckers. If the antiopeimous forms are regarded as an order the two primary groups can be ranked as suborders, if, however, we begin with a suborder some less definite term, as section, must be used.

² On account of the bristly feathers covering the nostrils *Gauropicoides* and *Gecinulus* are widely separated by Hargitt (British Museum Catalogue) from the other genera above mentioned. They agree with *Tiga*, however, in the absence of the hallux and the large size of the sixth rectrix, as well as in the nude oil-gland, and in my opinion the six genera enumerated form a natural group.

have not been examined: *Gymnobucco*, *Smilorhis*, *Stactolæma* and *Viridibucco*.¹

It is often stated that in the Motmots the oil-gland is nude, but both Gadow and Beddard record feathered as well as unfeathered oil-glands in this family. Gadow mentions no genera, and Beddard merely states that "in *Momotus* the oil-gland is quite nude; in *Hylomanes* and *Eumomota* the apex is furnished with a few small plumes." On examination of all seven genera I find a small but well-marked tuft in *Hylomanes*, *Aspatha*, *Eumomota* and *Electron*. In the remaining three genera the gland is usually perfectly bare, but close examination with a lens frequently reveals a very minute vestige of the tuft. This has been observed in *Momotus swainsoni*, *Baryphthengus* and *Urospatha*, and presumably occurs in other species of *Momotus*.²

Aftershaft.—It has long been supposed that in the Osprey (*Pandion*) the feathers are without an aftershaft, and time and again has this alleged

¹ The commonly accepted classification of the tooth-billed forms above mentioned appears to represent the natural inter-relationships of the genera very imperfectly. *Erythrobucco* is so strikingly similar to *Pogonorhynchus* in coloration and general form, scarcely differing except in the absence of corrugations on the lower mandible, that the desirability of separating it generically is surely open to question. Whether or not it be kept apart, however, it seems necessary to restrict *Lybius* (type *L. tridactylus*) to the smaller, black-billed species, distinguishing the several white-billed species as *Melanobucco* (type *M. bidentatus*). Despite their simple bill and few bristles the latter are evidently more nearly related to *Pogonorhynchus* and *Erythrobucco* than to *Lybius*. They differ from the latter in larger size, longer tail, larger, distinctly double-notched, white bill, and in coloration, in all of which they agree with or closely approach the former genera. The coloration of the type of *Melanobucco* is remarkably similar to that of *Erythrobucco* and *Pogonorhynchus* with which it shares the tuft of narrow, elongated white dorsal feathers, and the thick almost truncate bunch of white feathers on each side of the body.

That these peculiarities of color and plumage were evolved independently is highly improbable, and it would be fallacious to consider *Melanobucco* as more nearly related to *Lybius* merely because of general agreement in the unspecialized bill and its bristles. Study of the geographical distribution confirms the naturalness of the arrangement suggested.

Since the above was written the second volume of Reichenow's "Die Vögel" has come to hand. This author combines *Erythrobucco* with *Pogonorhynchus* as above suggested.

² The four genera with tufted oil-glands have their center of distribution in Central America, three of them (all monotypic) and one species of *Electron* being confined to this region; the single remaining species of *Electron* ranges from Nicaragua to Ecuador. They are further characterized by the broad, depressed bill with very finely serrate tomia, and their average size is much less than that of the remaining species.

The latter possess a much narrower and deeper, coarsely serrate bill. While well represented in Central America one of the three genera (the monotypic *Baryphthengus*) is confined to Brazil. These two groups may well be regarded as subfamilies, the *Hylomaninae* and the *Momotinae*.

The *Hylomaninae* show a marked approach to the Todidae. This is evident in the depression of the bill and its fine serration, and in the tufted oil-gland. Furthermore, in *Aspatha* and *Hylomanes* the tomium is nearly straight and the middle rectrices of normal form, while in *Hylomanes*, which is by far the smallest member of the family, there is no tuft of black feathers on the chest. The geographical distribution is also significant.

In each of the subfamilies both normal and spatulate central rectrices occur. The intraspecific variation in this respect in *Urospatha martii* and *Electron platyrhynchus*, however, greatly reduces the taxonomic value of this character in the Motmots.

character been cited as diagnostic of the Pandionidæ among the typical Accipitres. In recently examining a fresh Osprey I was therefore surprised to find a perfectly distinct aftershaft with stiff, elastic shaft, on the feathers of the interscapulum, rump and crissum. A feather from each of these regions shows the following measurements of main feather (excluding barrel) and aftershaft respectively: 47 mm., 8.5 mm.; 39,8; 75,10. The plumage of the underparts in general has no aftershaft.