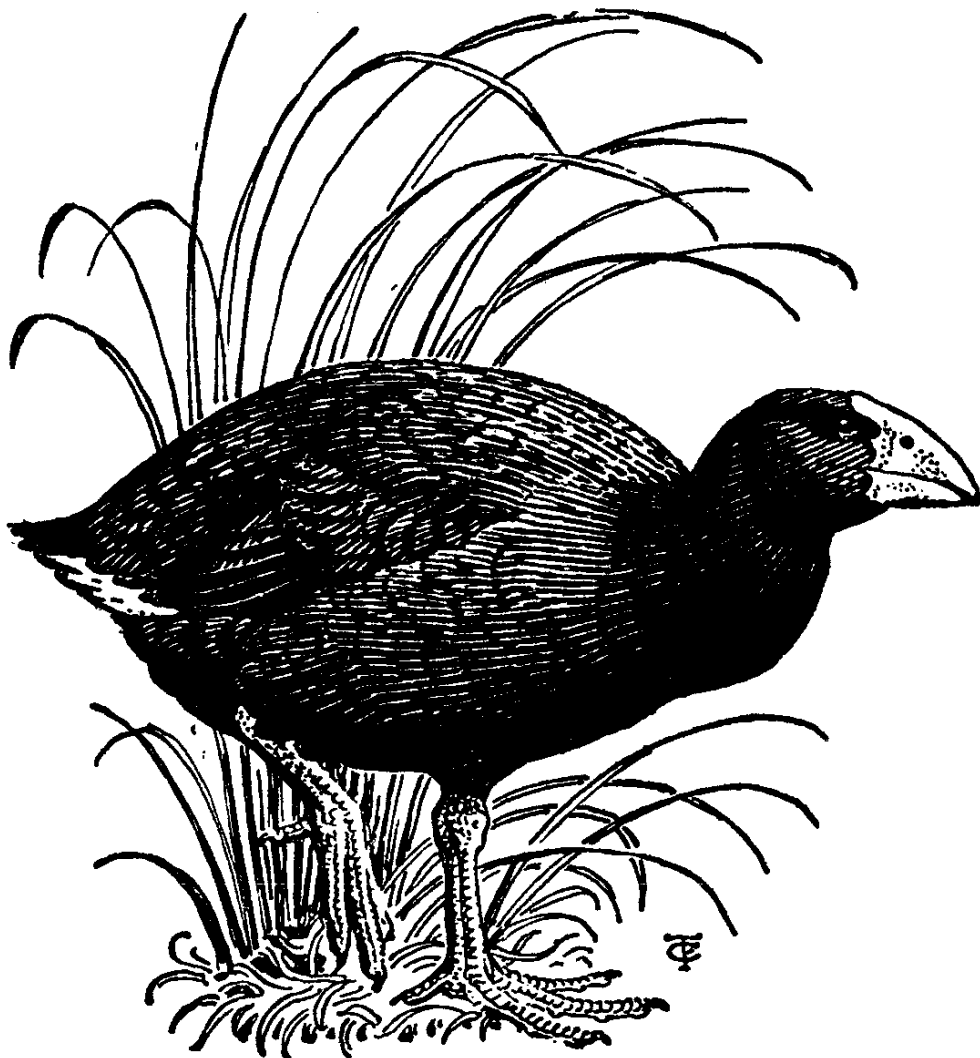


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THE PHYLOGENETIC RELATIONSHIP WITHIN THE GALLIFORMES INDICATED BY THEIR LICE (INSECTA : PHTHIRAPTERA)

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ABSTRACT

A consideration of the distribution of the various genera of Phthiraptera occurring on Galliformes suggests that, while Megapodidae, Cracidae, Tetraonidae, Phasianidae, Numididae and Meleagrididae form a natural group of related hosts, Opisthocomidae, Tinamidae, Turnicidae and Pedionomidae do not fall within the same host group.

Evidence also suggests that Galliformes is more closely related to Columbiformes than is generally accepted.

The general lack of agreement in classifying Galliformes is evident from Table 1, which gives several recent classification schemes. The lice occurring within the order are considered here to help evaluate these schemes.

Hoatzin

All but one of the schemes listed include the hoatzin (*Opisthocomus hoazin*) in the order, but evidence is accumulating that it belongs within Cuculiformes, being close related to *Guira* and *Crotophaga* of the subfamily Crotophaginae of Cuculidae (Sibley & Ahlquist 1973). Sibley & Ahlquist based their conclusions on a study of electrophoretic patterns of egg-white proteins. Harrison (1966), in studying the distribution of pigment in the structure of egg shell, found that the hoatzin apparently does not integrate into Galliformes nor show a close affinity with Cuculiformes, although he did not specifically explore the second possibility.

Consider the Mallophagan genera that occur on Galliformes, shown in Table 2. The lice occurring on the hoatzin (*Hoazineus* Guimaraes, 1940, *Laemobothrion* Nitzsch, 1818, *Osculotes* Keler, 1939, *Wilsoniella* Eichler, 1940 and *Cuculiphilus* (*Carrikeria*) Hopkins, 1947) do not show a close affinity with those of any host order, and they are certainly not closely related to those of Galliformes. On the basis of one common derived character, a row of regular setae on the outer edge of tibia I-III, *Hoazineus* appears to have affinities with *Heleonomus* Ferris, 1916, which occurs on cranes (Gruiformes). *Laemobothrion* is a widespread genus occurring on aquatic birds from a number of orders as well as on Falconiformes and so cannot be used to indicate affinities. *Osculotes* and *Wilsoniella* show no clear associations with

TABLE 1 — Classification of Galliformes

Order Galli		Mayr & Amadon (1951)
	Family Megapodiidae	
	" Cracidae	
	" Phasianidae	
	Subfamily Phasianinae	
	Numidinae	
	Tetraoninae	
	" Meleagrididae	
	" Opisthocomidae	
Order Galliformes		Sibley (1960)
	Family Megapodidae	
	" Phasianidae	
	Subfamily Phasianinae	
	Meleagrininae	
	Numidinae	
	Tetraoninae	
	Cracinae	
	" Opisthocomidae	
Order Galliformes		Wetmore (1960)
Suborder Galli		
Superfamily Cracoidea		
Family Megapodidae		
" Cracidae		
Superfamily Phasianoidea		
Family Tetraonidae		
" Phasianidae		
" Numididae		
" Meleagrididae		
Suborder Opisthocomi		
Family Opisthocomidae		
Order Galliformes		Verheyen (1961)
Suborder Tinami		
Family Tinamidae		
Suborder Opisthocomi		
Family Opisthocomidae		
Suborder Galli		
Family Cracidae		
" Megapodiidae		
" Phasianidae		
Suborder Turnices		
Family Turnicidae	Bustard Quail	
" Pedionomidae	Plains wanderers	
Order Galliformes		Storer (1971)
Superfamily Cracoidea		
Family Cracidae		
" Opisthocomidae		
" Megapodiidae		
Superfamily Phasianoidea		
Family Numididae		
" Phasianidae		
Order Galliformes		Olney (1974)
Family Megapodidae	Mound Builders	
" Cracidae	Guans, Curassows	
" Tetraonidae	Grouse	
" Phasianidae	Pheasants, Peafowls, Francolins	
" Numididae	Guinea Fowl	
" Meleagrididae	Turkeys	

TABLE 2 — Genera of mallophaga on the families of Galliformes

AMLYCERA : Menoponidae	Megapodidae	Cracidae	Tetraonidae	Phasianidae	Numididae	Meleagridae
<i>Cragimenopon</i> Carriker, 1954		+				
<i>Amrysida</i> Ewing, 1927	+		+	+		
<i>Desumenopon</i> Carriker, 1954				+		
<i>Menopon</i> Nitzsch, 1918				+		
<i>Numidicola</i> Ewing, 1927					+	
<i>Somaphantus</i> Paine, 1914				+	+	
<i>Menacanthus</i> Neumann, 1912		+		+	+	+
<i>Clayia</i> Hopkins, 1941				+	+	
<i>Kelerimenopon</i> Conci, 1942	+					
<i>Colpocephalum</i> Nitzsch, 1818	+			+		
ISCHNOCCERA : Philopteridae						
<i>Goniodes</i> Nitzsch, 1818	+		+	+	+	
<i>Gonioctes</i> Burmeister, 1838			+	+	+	
<i>Pachyskelotes</i> Kéler, 1939				+	+	
<i>Passonomedeia</i> Carriker, 1944				+		
<i>Labiactes</i> Kéler, 1939		+		+		
<i>Chelopistes</i> Kéler, 1939		+		+		+
<i>Oxytipurus</i> Mjöberg, 1910	+	+	+	+	+	+
<i>Lipeurus</i> Nitzsch, 1818	+			+	+	
<i>Qualotogaster</i> Carriker, 1936				+		
<i>Numidilipeurus</i> Tendeiro, 1955					+	
<i>Lagopoeus</i> Waterson, 1922			+	+		
<i>Megapodella</i> Emerson & Price, 1972	+					
<i>Calliphilopterus</i> Emerson & Eibel, 1957				+		

other ischnoceran genera, although Clay (1957) suggested that *Wilsoniella* may be related to *Rallicola* Johnston & Harrison, 1911. *Wilsoniella* does not appear to be closely allied to *Vernoniella* Guimaraes, 1942, which occurs on *Guira* and *Crotophaga*. According to Scharf & Price (1965), *Cuculiphilus* (*Carrikeria*) is a monotypic subgenus close to *C. (Cuculiphilus)* Uchida, 1926, from Cuculiformes, *C. (Falcophilus)* Guimaraes, 1942, from the family Cathartidae (Falconiformes) and *C. (Aegyphilus)* Eichler, 1944 from the family Aegyptiinae (Falconiformes: Accipitridae). *Cuculiphilus* has not been reported from either *Guira* or *Crotophaga* but is replaced by *Osborniella* Thompson, 1948. Its presence on *Opisthocomus* bears out the belief that the hoatzin is an aberrant cuckoo and substantiates the scheme of Olney (1974). In short, mallophagan affinities do not substantiate a relationship between the hoatzin and Galliformes but give some support for including the hoatzin in Cuculiformes.

Tinamous

Verheyen (1961) is alone among recent authorities in including tinamous within Galliformes. Tinamous are usually given ordinal status and placed either near the ratites (Storer 1971) or near Galliformes (Olney 1974). The mallophaga from tinamous are most distinctive and, with the exception of *Menacanthus*, which occurs on Galliformes, Piciformes and Passeriformes, are apparently not closely related to those of any other groups. Morphological studies by Ward (1957) and karyotype studies (Kettle, unpub.) suggest that the Hepatapsogasterinae (a group of louse genera found only on tinamous) are related to the *Goniodes* complex and that *Pseudolipeurus* and *Pseudophilopterus* are derived from typical philopterid stock. The distinctive nature of tinamou lice and the large number of species suggest that the tinamou separated from other birds a very long time ago. The evidence from mallophaga appears to support the belief that they should be placed in a separate order Tinamiformes, and adjacent to Galliformes.

Bustard Quail and plains wanderers

Verheyen (1961) also includes the Turnicidae (Bustard Quail) and Pedionomidae (plains wanderers) in Galliformes, although they are more usually placed with Gruiformes (Mayr & Amadon 1951, Wetmore 1960, Storer 1971, Olney 1974). *Turnicola* Clay & Meinertzhagen, 1938, from Turnicidae is the only genus recorded from these families and cannot be used to indicate affinities as it is a philopterid lacking distinctive features.

So far, then, the consideration of lice rejects Opisthocomidae, Tinamidae, Turnicidae and Pedionomidae from Galliformes and so agrees with the classification proposed by Olney (1974).

Affinities of remaining families

Gallinaceous birds are one of the primitive and basic orders

(Mayr & Amadon 1951). They are poorly represented in the fossil record but known as far back as the Palaeocene (Brodkorb 1971). Mayr & Amadon also stated that "certain resemblances between pigeons and game birds may eventually prove to be of significance." Current classifications usually do not place the two orders in adjacent positions but separate them by at least Gruiformes and Charadriiformes. Clay (1951) has drawn attention to apparent close morphological similarities between mallophaga of Galliformes and Columbiformes, and this relationship between lice is supported by karyotype studies (Kettle, unpub.).

Consider Table 2 again. *Colpocephalum* is widely distributed with species occurring on eleven orders, and so it is of little or no value in considering host relationships. *Amyrsidea*, *Cracimenopon*, *Desumenopon*, *Menopon*, *Menacanthus*, *Clayia*, *Numidicola* and *Somaphantus* appear to form a natural group with many characters in common (see Clay 1969). *Somaphantus*, being a quill dweller, however, is anomalous in its body form. This feature is paralleled by some species of *Actornithophilus* and *Longimenopon*, which also are quill dwellers. *Amyrsidea* is the most widespread genus within Galliformes, but the whole Amblyceran complex listed above emphasises the unity of the host order. *Numidicola* and *Menopon* appear to be closely related.

Kelerimenopon Conci, 1942, has been subdivided into two subgenera, *Kelerimenopon* and *Lorimenopon*, by Price & Emerson 1966. Species of *K.* (*Kelerimenopon*) occur on Passeriformes and Galliformes, and *K.* (*Lorimenopon*) is found on Psittaciformes. It is not possible to say which host order is the original one as the seven currently recognised species (Price & Emerson 1966) are almost evenly scattered throughout the above-mentioned orders. The feature in common is the geographical locations of the hosts — New Guinea, Indonesia, and the Philippines.

Ischnoceran mallophaga that are at present of little value to this study are *Megapodiella* and *Galliphilopterus*, both monotypic genera. While the former is considered by Clay (1958) to be related to *Lagopoecus*, the affinities of the latter are obscure.

The gonioidiform genera (*Goniodes*, *Goniocotes*, *Pachyskelotes*, and *Passonomedeia*) form a discrete group with related genera on Columbiformes (e.g. *Campanulotes* and *Coloceras*) and possibly on Tinamiformes (Heptapsogasterinae). *Goniodes* is the most widespread genus and is often found in the company of *Goniocotes*. On Megapodidae, two species of *Goniodes* frequently occur per host species, one species usually being large and typical of *Goniodes* (*sensu stricto*) and the other much smaller and included by Clay (1940) in a species group M, without taxonomic standing, and by Keler (1939) in *Homoceras*. This group appears to be taxonomically intermediate between *Goniodes* and *Goniocotes* and may represent the least differentiated lice of this group — being similar to the stock which gave

rise to both *Goniodes* and *Goniocotes*. Their presence on Megapodidae supports the belief of avian taxonomists who consider Megapodidae the most primitive of galliform families.

Goniodes may represent the primitive stock which gave rise to *Goniocotes*, as mentioned above, in the Old World and to *Passonomedea* in the New World. *Pachyskelotes* is an aberrant elongate monotypic genus living on the Argus Pheasant (*Argusianus argus*), where it appears to have become adapted to occupy the niche normally filled by *Lipeurus*, or related genera of elongate mallophaga.

Chelopistes, *Labicotes* and *Oxylipeurus* are closely related genera with *Oxylipeurus*, on the basis of its present distribution, probably representing the more primitive form. *Chelopistes* and *Labicotes* are almost goniodiform in appearance and appear to occupy the niche which would have been occupied by *Goniodes* were it present on the host. *Chelopistes* occurs also on neotropical Phasianidae and Cracidae in a form that is somewhat different — *Trichomedea* Carriker, 1945 — but that is considered to be congeneric by Hopkins & Clay (1952). *Labicotes* lives on guans (Cracidae).

Related to *Oxylipeurus* and *Chelopistes* is the *Lipeurus* group — *Lipeurus*, *Numidilipeurus* and possibly *Cuclotogaster* and *Lagopoecus*. *Lagopoecus* may belong to the *Degeeriella* complex rather than to *Lipeurus* and its allies (Clay 1958). This point may be resolved when the karyotype of *Lagopoecus* is determined as it appears that the *Lipeurus* group have a male haploid number of 12, whereas the *Degeeriella* group have a male haploid number of 15 (Kettle, unpub.). *Lipeurus* and *Numidilipeurus* are apparently more closely related to each other than either is to *Cuclotogaster*, but they do appear to form a natural group with related genera occurring on Charadriiformes — *Rhynonirmus* Thompson, 1935, and *Otidoecus* Bedford, 1931. This link with Charadriiformes is in contrast to the relationship indicated by the *Goniodes* group.

In conclusion, the mallophaga of Galliformes show affinities in keeping with the classification of Olney (1974) within the order but suggest that perhaps Columbiformes are more closely related to them than is generally believed by avian taxonomists. Lice from Galliformes and Columbiformes appear much more closely related to each other than they do to lice from either Gruiformes or Charadriiformes. Similarities are most clearly seen between *Goniodes* and its allies from Galliformes and *Coloceras* and allies from Columbiformes. In addition, these genera appear to be related to the lice (Heptapsogasterinae) typical of tinamous. While convergent evolution in response to similar selection pressures (feather structure, etc.) cannot be excluded, the similarities are so striking that the possibility of a close relationship between Galliformes and Columbiformes should be given serious consideration by taxonomists.

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SHORT NOTE

PREDATION ON A SPARROW BY A POSSUM

While observing brush-tailed possum (*Trichosurus vulpecula*) behaviour in the captive colony maintained at Forest Research Institute in Rangiora, I saw the predation of a House Sparrow (*Passer domesticus*) by a possum. The event occurred in a pen holding five females and five males. Occasionally small birds become trapped in the pens, having been attracted by the food provided for the possums.

About 1 hour after dusk at 6.23 p.m., a roosting sparrow started to flutter around the pen, apparently being disturbed by a sudden south-westerly shower. Two minutes later, a male possum leapt from a side fence of the pen, caught the sparrow in mid-air with its forepaws, landed on the ground about 1.5 m below, and transferred the bird to its mouth. The event attracted the attention of other possums, notably a dominant male and a dominant female, who briefly chased the captor. After about 20 seconds, he secured a safe position on a fence rail, where he proceeded to bite the dorsal surface of the bird's neck, probably to kill the bird, before eating parts of the head. Four minutes after the bird was seized, all that remained of the head was the beak and rejected pieces of bone tissue. The possum then started removing breast feathers with its teeth and proceeded to feed on the