REVISIONS OF MALLOPHAGA GENERA.

DEGEERIELLA FROM THE FALCONIFORMES

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INTRODUCTION

Before attempting to define the genus Degeerielia, the type species of which parasitizes one of the Falconiformes, it is necessary to consider shortly the whole of the Degeerielia-complex.

The Degeerielia-complex. It is difficult to delimit this group exactly but the following genera should probably be included: Degeerielia Neumann (= Klerinchirus Eichler), Acatifrons Guimaraes, Austrophilopterus Ewing, Capratria Conci, Cotiniporus Carriker, Cuculicola Clay & Meinertzhagen, Lagopus Waterston (= Coliniocola Carriker), Picocola Clay & Meinertzhagen (= Tymannicola Carriker), Trogonichirus Eichler, Uropygicola Clay & Meinertzhagen, a group of undescribed species from the Bucerotidae, and an undescribed species from the Megapodidae, probably an aberrant Lagopus. Buceroniridis Hopkins and Hopkinicola Clay & Meinertzhagen should also perhaps be included here. Possible derivatives from this group include Sylhaphilopterus Waterston, Timanocola Carriker, some of the Ischnocera from the Bucerotidae and also possibly Penechirus. The complex (omitting the doubtful members) can be defined as follows:

Ischnocera with marginal carina of head usually complete dorsally but may be partially interrupted anteriorly, and also partially interrupted each side when a dorsal preantennal suture is present; ventrally it may be complete or interrupted medially. Hyaline margin absent or small, never greatly enlarged and never continuous with hyaline area delimiting a complete dorsal anterior plate. Ventral carina never forms a semicircular band, but is interrupted medially; usually the two carinae pass towards the anterior margin of the head but never form well defined bands continuous with the marginal carina, and only rarely have the strongly sclerotized parallel surfaces to which are attached lobes of the pulvinus as in Brachia (Clay, 1951); pulvinus usually in the form of a single sac-like structure.1 Ocular setae (except in Trogonirhurus and Austrophilopterus) and at least two of the temporal

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1 At one time it was thought possible to use the characters of the ventral carinae and pulvinus to separate the Degeerielia- and Brachia-complexes, however the species of Degeerielia from Ciliatuna and Elamoides have the characters of these structures as in some species of Brachia (see Clay, 1950).
setae elongated. Prothorax with one marginal seta on each side (except in Lagophocus meanertthongeni Clay); third episternum fully sclerotized laterally. Abdomen with postspiracular setae on segments III-VII (exceptionally on IV-V only) with sensillae on II or IV-V. Tergal plates entire or separated medially; sternal plates median, lateral or absent. In the male segments IX-X with a single fused tergal plate (entire or divided medially), separated from XI by a suture and setae; anal and genital openings close together on dorsal surface, dorsal part of XI narrowed with the 3-3 anal setae on the dorsal surface of the abdomen (see Clay, 1953). Male genitalia usually with sclerotized penis, short curved parameres, the outer and inner edges of which are continuous with the basal apodeme, and exummal plate of characteristic form (PI. 8, fig. 2). This basic form which is found in some species of most of the genera is also found modified to a greater or lesser extent in a few species belonging to many of the genera and in some species the basic degereerilline pattern can no longer be recognized, for instance, there may be an articulation between the parameres and the basal apodeme. The genitalia do not provide good group characters in this complex; those structures in Acutihoris megacaulopus Carriere and Degeerilla rufa (Burmeister) for instance, being more similar to each other than are those of A. megacaulopus and A. caracirensis (Kellogg & Mann); and those of Cnupraea suberosiphala (Burmeister) are nearer those of D. fulva (Gielb) than are those of D. fulva and D. moeroerjiae Clay.

The internal male genitalia are too various, even within one related group (see below, p. 127) to be used as diagnostic characters for the complex, but a general type similar to that of D. fulva from Buton (Text-fig. 1) with or without the lateral lobes is found in some of the species of many of the genera, all the species examined with one exception (D. Diciola from one of the Tyrrhenian) have the ductus ejaculatorius long and coiled. An examination has been made of the internal male genitalia of about 150 species belonging to 23 genera of the Ischnocera; it was hoped that the characters of these organs might help in the generic or suprageneric classification of this superfamly. The members of the Gonides-complex (including only those found on the Galliformes and Columbidae) have the vesicular apparatus on the base of the penis, and the ductus ejaculatorius (see below) has formed of two simple lobes, not joined medially and the ductus ejaculatorius modified in some way, they differ in these characters from Astrogonesides, Osulodes, Chalopesides and several of the Hoplogaster-complex. The Otodoces-complex (Otodoces, Rhysonaurus and Culexgaster) have an unpaired diverticulum arising from the ductus ejaculatorius. Apart from these two groups it has not been possible to find characters of generic or suprageneric importance, although they may be of specific or of species group value. Recently Blagoveshchensky (1956) has published a most useful and extensive account with figures of the internal genitalia of both Ischnocera and Anthocera.

In the female the genital plate (when present) does not reach to the upper margin of the vulva (cf. Brachia); genital region without lateral spine-like setae (cf. Radicalia) or clump of setae on tubercle-like area (cf. Brachia). Inner genital setae and

1 As in previous publications roman numerals are used for the true segments, see below, p. 126.
2 The presence of the diverticulum and other characters make it certain that the "Lepidoptera carabidae" in Strässiger, 1944, 623 was in fact Culexgaster gasterophorae (Nitsch).
division into two sclerites. The tegrite of fused IX-X in the male is usually arched and narrowed mediadly to a greater or lesser extent and tergal plate XI when present in a single or double sclerite immediately anterior to the anal and genital openings. Kéler (1909) has been followed in considering the dorsal plates as representing the fused tergal and pleural plates. At the lateral edge of these plates of some or all of segments II-VIII there is, in most species of Degenerella, a characteristic internal thickening. This thickening, here called the pleural thickening, usually consists of an internal sclerotized buttress along the edge of each segment which is continued inwards a short way along the inner anterior margin of the dorsal plate; there is usually a characteristic anterior part passing into the segment above, known as the re-entrant head (Waterston, 1928). Sternal plates II-VI in the form of median sclerites in both sexes: in the male the terminal sternites form a single fused genital plate. Anal and genital openings of male on dorsal surface of the abdomen with the 3 + 3 anal setae as described above under the definition of the Degenerella-complex. The genital region of the female comprises the genital plate (i.e. sternal plate VII) usually not differing greatly from the anterior plates, but sometimes (D. unga) with a median posterior prolongation. It is not possible to be certain to which segments the remaining sclerites of the genital region belong. Below the genital plate is an uncoloured area of the integument with a sclerite each side, perhaps those of VIII. The integument passes to the vulva and turns in to form the ventral wall of the genital chamber. On this wall are two sclerites, sometimes fused to a greater or lesser extent in the mid-line; these are perhaps the median sclerites of VIII and are here called the inner genital sclerites (Text-fig. 96, a.g.).

On the dorsal wall of the genital chamber there is a sclerite each side which projects beyond the vulva; this is perhaps the sclerite of X or IX and X fused and is here called the subvulval sclerite (Text-fig. 97, s). The opening of the spemathecal tube (es.) lies between the subvulval sclerites in the dorsal wall of the genital chamber. The spematheca is a simple thin-walled sac and the catys is lightly sclerotized.

The external male genitalia (see Clay, 1936) comprise a flattened basal apodeme; short curved parameres, the outer and inner edges of which are continuous with the basal apodeme without a point of articulation; an endomeral plate, rather thick dorsoventrally, with diverging dorsal arms (Text-fig. 59, a.d.) which may or may not join the basal apodeme each side and two ventral arms (Text-fig. 52, s.) with setae. Centrally there is a sclerotized tube-like penis which usually has at its base an irregular area of sclerotization (shown in the figure by an interrupted line) joined to the basal apodeme by a narrow sclerite (the penial sclerite, ps.); at this junction there is usually a curved arm each side (the penial arm, pa.) bearing a seta (the penial seta, ps.d.). The dorsal and ventral endomeral arms are joined by an area passing ventro-dorsally (and not always visible) to a line of thickening each side of the ventral surface of the plate (Text-fig. 59-59, a.)

Internal male genitalia have been examined from 40 specimens of Degenerella from only 10 species of hosts belonging to the Falcomorphae, but even these show considerable variation. In D. fulva from Buto sulphureus and Buto fallax the structures conform in general characters to those of Columbicola columnae (Lin.) as described by Schmutz (1935). The vesicular apparatus comprises four separate
The length of the median lobes and the relative size of the lateral lobes may vary considerably in different species; no lateral lobes could be seen in *D. mookerji*. In some cases the material was not in sufficiently good condition to distinguish the internal chambers of the median lobes, but there seems no doubt that in both *D. regalis* and *D. mookerji* there is only a single chamber, as spermatheca could be seen filling the whole of the median lobes as figured for "Lepesurus variabilis" (C.-Caudotogaster heterogaster, see footnote on p. 124) by Schmutz (1955: 203). However, material suitable for sectioning is required before an accurate account can be given of the internal chambers of the median lobes. The ductus ejaculatorius is long and coiled in all species, and in all except *D. rufa* only a short basal portion is strongly muscular, in this latter species this muscular part is carried nearly to the end.

The chaetotaxy of the abdomen has the following features common to all species: the anterior tergal setae of segment II (probably those of the suppressed segment I) are in two number and elongated; postapical setae are present on segments III-VI; VIII has the usual lateral seta in a sunken alveolus. All the above setae are omitted from the specific descriptions. Terga II-VIII and sterna II-VI each with a single line of setae; pleural setae present on some or all of segments III-X. Vulva with some spine-like setae and with a varying number of sensilli; posterior to the vulva there are, apart from the three anal setae, a single spine-like seta and one to three elongated setae (the pleural setae of X) each side.

**Nymphs.** The three nymphal instars are easily separable by the chaetotaxy of the posteroventral margin of the pterothorax (see Clay, 1953), as shown in Text-figs. 11-14; the third instar has the setae arranged as in the adult but at least two of the setae are thinner. The head does not take on the full adult characters until after the final moult. Boetticher & Eichler (1954) have shown the differences between the shape of the preanal region of the head in nymphs and adults in *Degescriella* and based some of their phylogenetic deductions on these findings. The present study of *Degescriella* nymphs from 24 species of hawk shows that the curvature of the anterior margin of the head may be approximately the same in nymph and adult as in *D. puncticollis* and *D. discocephalus*; may be more rounded in the nymph as in *D. fulva* (Text-figs. 15-17) or more pointed as in *D. rufa* (Text-figs. 18-20). In *D. rufa* the anterior margin of the first instar (Text-fig. 18) resembles that of *D. fulva* to a greater extent than do those of the second or third instars (Text-figs. 19-20). The ventral carinae are sometimes better defined in the nymph than in the adult and in those of *D. rufa* (Text-fig. 10) there is a definite inner projection to which is attached a lobe of the pulvini as in the nymphs and adults of *D. guinaruhi*; thus *D. rufa* resembles this latter species to a greater extent in the nymph than in the adult (see Clay, 1953). The second and third instars of *D. rufa* have a semicircular anterior dorsal thickening and a preanal dorsal suture with a partial lateral break in the marginal carina each side (Text-fig. 10); these characters are not visible in the adults. In some species e.g. *D. minus frater* both nymphs and adults have a similar dorsal anterior thickening. There may be considerable differences between the nymphs of two species: thus, although *D. rufa* and *D. fulva* are super-
and that the characters of the nymphs may be useful in the elucidation of relationships within the genus. Some of the difficulties of understanding these relationships are mentioned below under Host Relationships.

Apart from the species of the Degeneriella-complex found on the Falconiformes there are two other groups which have been given generic status, but fall within the definition of Degeneriella as given above, these are Capraziella and part of Piciola.

Capraziella Consi., 1941. This genus was erected for Nirmus subterreatus Burmeister from Coracias garrulus mainly on the character of the pointed head. As will be seen below some Degeneriella from the hawks also have heads pointed anteriorly. It has not been possible to find any characters on which subterreatus can be separated from Degeneriella, in fact the male genitalia considered alone would place this species near D. julia. It is doubtful, therefore, whether Capraziella can be kept as a separate genus but further species may be found on other members of Coraciidae which may throw more light on the relationships of this group.

Piciola Clay & Meinertzhagen, 1938, and the subgenus Tyrannicola Carriker, 1936. This genus contains species found on the Pici and the Passeriformes, some of which can be included in the definitions of Degeneriella as given below. The species may lack the praaternal suture and have the tergites entire as in Degeneriella sens. str., or may have a praaternal suture and divided tergal plates as in Cuculciola. The genitalia may be of the type found in D. julia or a modification of this. These differences cut across the host divisions; for instance, the species from Geocolylodes and Turipis belonging to the Pici and those from Colonia and Sayornis belonging to the Passeriformes have the tergites entire; in the two former species the male genitalia are of the D. julia type. The species from Dendrocopos (Pici) and Ptila (Passeriformes) have the tergites divided; the latter species has the genitalia of the D. julia type, the former the modified form. The species found on the Pici are in general less heavily sclerotized than those found on the Passeriformes and Falconiformes. It is doubtful whether the erection of numerous subgenera is the best solution of this problem.

Within the species of the Degeneriella-complex found on the Falconiformes three genera have been erected: Degeneriella Neumann, 1906 type species Nirmus discocephalus Burmeister; Kleriinimus Eichler, 1920, type species Nirmus fusus Denmy, and Asafrong Guimarães, 1942, type species A. serrus Guimarães. Kleriinimus was described to include the species with elongate heads and abdomen and to separate them from the species with round heads and abdomens represented by D. discocephalus, the type species of Degeneriella. This division, however, appears to be a purely artificial one and places together D. discocephalus and punctifer purely on shape of head and abdomen together with certain characters directly correlated with this shape and of little phylogenetic importance (Clay, 1951). In fact, the characters of the carinae and sutures of the head, the male genitalia and female genital region show that these two species are not closely related. It appears that the discocephalus group and julia group of species, both found on the same host groups, are nearly related to each other and perhaps derived from a common ancestor on these host groups. These two species groups are, for instance, more closely related to each other than is to julia in spite of the superficial
similarities of *ryfa* and *funa*. Thus, it is not possible to recognize *Katarinimus* as a generic division of *Degnerella*. Carriker (1935: 114) suggests the possibility that *Acutifrons* should be included in the *discocephalus* group of *Degnerella*, but again the genus is purely superficial and it is unlikely that the *Acutifrons* group of species are particularly nearly related to *discocephalus*. It is possible that *Acutifrons* is not a monophyletic group, the characters distinguishing the species, the anterior dorsal suture, the temporal carinate and the enlarged head and abdomen having been developed more than once in different but related stocks. Until more is known about the distribution of these species *Acutifrons* should probably be maintained as a distinct genus.

No, sp. *spendidus* Kellogg, 1895. While agreeing with Carriker (1935: 116) that the identity of this species must await the examination of the types, the description and figure are those of a *Cuculicola* not *Acutifrons*. No known species belonging to the *Degnerella* complex from hawks have the abdominal tergites divided medially, a character which is found throughout *Cuculicola*, further, the figure, except for the lateral margins of the temples represents the species found on *Geococcyx californianus*. Since writing this, Carriker (1935) has been seen in which a figure is given of the male genitalia of a paratype of *Nerius spendidus*, this seems to represent those of the species from *Geococcyx californianus* in a somewhat compressed condition, as usually seen within the specimen. There seems little doubt that this is the true host of *Nerius spendidus* Kellogg as figured originally by Kellogg (1895) and recently by Carrinker (1935), and that the species should be included in *Cuculicola*.

**The species, subspecies and local population.** In *Degnerella* there is the difficulty, as always in the case of a widely-distributed homogeneous group, of deciding whether any given form should be considered as a species or subspecies or whether some merit taxonomic rank at all. As Mayr (1951-53) has said, the subspecies is primarily a taxonomic concept which cannot be delimited from the local population on one hand and the species on the other. In the Mallophaga the application of the subspecific concept has been most haphazard and practically no attention has been paid to the amount of variability within populations from the same host form, and it seems that the time has come to consider this problem as a whole and to try to get some uniformity within the subsorder.

In the distribution of the Mallophaga it is usual for an order or suborder of birds to be parasitized throughout by the same genus (or genera) of Mallophaga. The populations of this genus on the different species of birds may be apparently indistinguishable, only statistically distinguishable, or may comprise individuals which are slightly but constantly different, or which are markedly different. The present paper is here used for all the individuals of a taxon of Mallophaga found on one host from which can potentially interbreed because their hosts are potentially capable of interbreeding. Thus, all the *Degnerella* from *Falco buteo buteo* throughout its range would be considered as comprising one population.

distribution and relationships of the mallophagan genera suggest that these allopatric populations have, in general, been separated from each other by the splitting and species formation of the host stock and are thus analogous to populations of free-living animals on a group of continental islands which have been isolated by the disappearance of land connections (Clay, 1949). As in the case of such populations of free-living animals each of the mallophagan populations is an isolated unit without zones of contact with any other populations. Thus, with all isolated allopatric

![Image of Heads of nymphs]

populations, making it more convenient to call each of these population groups, a species divided into a number of subspecies.

It seems probable that there have been two tendencies in the evolution of the Mallophaga. One was to speciate rather rapidly, perhaps due to the original occupation of an empty ecological niche provided by the feathered bodies of birds, a changing environment due to the evolution of the birds themselves, together with the increasing isolation of the populations of the Mallophaga. The second tendency was a conservatism due to the later similarity of the environments afforded by birds belonging to one group, and to the close adaptation to a host which results from the parasitic habit and perhaps limits subsequent morphological change. The first tendency was probably responsible for the formation, in the Ischnocera, of the large number of genera and distinctive species groups, while the second has led to the similarity of the forms comprising these groups. The uniform environment and the necessity of being able to move easily through the feathers has probably been responsible for the relatively smooth uniform surface of the Mallophaga without the development of feathered setae, scales and other modifications of the exoskeleton which provide useful taxonomic characters in many groups of insects. It is rather frequent in the genera of the Ischnocera to find a series of populations superficially similar and differing mainly in the characters of the male genitalia, the uniformity of the environment having led to superficial similarity and the isolation of the populations being shown in differences in such non-adaptive characters as the male genitalia. It must be expected in the Mallophaga that the character differences between related groups will be small, and these must of course be judged for each group of related species; similar character differences cannot of course be used in separating analogous taxa in the Ischnocera and Amblycera, for instance.

The degree and time of isolation cannot be used to determine the specific or subspecific status of a population, the populations of *Deggerella* have been split into *D. aper* on *Mimus* and on *Butorides galapagoensis* are separated by host and geographical distribution, and although there cannot have been any gene flow between these populations over great periods of time, and although the gene pools must now be distinct, there is no clear cut morphological difference between these populations. If distribution is taken into account there is a further difficulty that the exact relationship between the hosts is not always known, so that on the analogy of the free living allopatic populations the exact position of the locality of any one population in relation to another is uncertain and deductions of which are the most nearly related populations cannot always be made. Thus, although some groups may show gradients in such characters as the size and shape of head and number of abdominal setae these cannot be equated with climal variation in free-living populations, as the populations are isolated and they have a host (not geographical) distribution, the most similar forms not necessarily being most nearly related. For instance, in *Deggerella* there are examples of Harrison's law that in related populations those parasitizing the larger hosts tend to comprise larger individuals; correlated with this increase in size there is a tendency towards larger heads, broader anteriorly, and sometimes to a greater number of abdominal setae. This tendency is seen in some of the populations of *D. nula* on *Falcunculus* and *Dppana* on *Butorides*. Thus, sometimes the similarity of characters is partly due to ecological factors and not relationship (although in some cases of course the former may be dependent on the latter). Some of the subspecies of the Mallophaga differ from each other in only one character or in two or three correlated characters perhaps associated with size differences which are themselves dependent on host size. Thus, there may be populations, not very closely related, which are indistinguishable from each other and must be included in the same subspecies (Mayr, Linsley, Nearinger, 1955: 32); these are analogous to the polytopic subspecies of the free-living animal.

It has been suggested (Mayr et al., 1953: 164) that the morphological differences between sympatric species of the same genus might give an indication of the correct status of isolated populations, but Brown & Wilson (1956: 40) have shown that when two species of animals overlap geographically the difference between them is accentuated in the zone of sympatry and weakened or lost entirely in parts of their range outside this zone. This might explain the differences between the species of *Deggerella* (a genus in which sympathy is rare) on *Peromyscus* and *D. mofacrae* on *Papilio*. The two species, *Peromyscus annularis* and *P. iliouropus* might originally have had the same species of *Deggerella*, the populations of which split into two and diverged sufficiently to remain distinct when they later became sympatric (see Clay, 1949): if the fact that they had become sympatric caused them to diverge to a greater extent then it is inferred from species found in birds belonging to the same genus. The two species, *Peromyscus annularis* and *P. iliouropus*, the differences between these two species of *Deggerella* would be more marked than if they had not formerly been sympatric. This explanation is partly supported by the fact that these two species are separated by the characters of the male antennae, a common difference between sympatric species of the same genus (Clay, 1944). It is perhaps for this reason that differences between a pair of sympatric species are sometimes much smaller than those distinguishing sympatric species. If we accept the definition of subspecies as populations which would interbreed under natural conditions if they occurred sympatrically, then any morphological differences which might prevent interbreeding should be considered as specific characters. It seems reasonable to suppose that at least some of the character differences between closely related sympatric species are those which prevent or discourage cross-breeding. In the Ischnocera closely related sympatric species may be distinguished by the male genitalia, male antennae and in one genus (Osidius) the legs of the male, and in size and proportions of the head and abdomen. The former characters would probably all prevent or discourage cross-breeding, while the last two characters might mean that the populations were partly restricted to different ecological niches on the body of the bird resulting in partial isolation from each other. An example of this in the Anoplura is provided by *Pediculus humanus humanus* and *P. a. capitata*, whose occupation of different ecological niches on man has resulted in impaired fertility when they are crossed (Hopkins, 1949: 410). Even gross differences in the form of the male genitalia in insects may not form a mechanical bar to successful copulation (Dobzhansky, 1955: 189). Jordan (1896) in his analysis of the genitalia of *Papilio* showed that in general each of the species was distinguishable by the form of the male genitalia; he also showed that there was geographical variation
in the structure of the male genitalia and concluded that it was not possible to draw a distinction between specific and subspecific characters and that a peculiarity of a structure might be an individual aberration, a subspecific or a specific character. Jordan did, however, believe that divergence in the organs of copulation was a means of preventing intercrossing. Within the Mallophaga the genitalia may be uniform, with only minor or no apparent differences throughout genera, or large species-groups, examples of this are found mainly in the Amblycera (e.g. Colpocephalum and Actinophila), and in some Ischnocera (e.g. Anatisca); in others there may be relatively small but constant differences in the population from nearly every host species, as in some groups of Quadracera, and in other genera the differences may be so great that it is difficult to homologize the sclerites forming the genitalia of the different species. It must, therefore, be presumed that the differentiation of the genitalia has taken place at different rates in different groups and that similarity of genitalia cannot always be used as a criterion of conspecificity, this is especially so in some genera of Amblycera. In Anatisca again, where the genitalia are similar throughout the genus it would seem to be necessary to use the characters of the preanterior region of the head for specific divisions. It is clear therefore, that the delimitation of the specific and subspecific categories in the Mallophaga must be based on criteria which differ in each genus and that a study of the whole genus is necessary before a decision on these categories is made. Moreover, it is necessary to choose completely arbitrary criteria for the decision as to whether a population should have specific or subspecific rank, and this, in spite of some of the critics mentioned above, must be based on the characters of the genus as a whole, the number of character differences present, the characters separating sympatric species of the same genus and to a lesser degree host distribution.

It is apparent that the male genitalia of the Diggerelli-complex (see above p. 124) are rather constant in character, those of Capraea, for instance, being quite near the fulva group of species, and that small differences in these structures may therefore be of significance in distinguishing species. A population has been considered as a full species if the individuals comprising it show one of the following qualifications:

1. Male genitalia quite distinct.
2. Male genitalia differ to a lesser extent, sometimes to a rather minor degree, but there are also a number of other character differences, such as the presence or absence of the pleural setae on certain of the abdominal segments, or more setae on each of the sternae III-VI, together with other morphological characters such as the form of the pleural thickening, marginal carina and ventral suture of the head, and marked differences in the shape of the nymphal heads.
3. Male genitalia apparently indistinguishable but the individuals differ in many of the other characters listed above.

Populations are treated as subspecies when the male genitalia are apparently identical or only differ to a minor degree (e.g. number of setae as in D. rufa caralu), which differ in the shape and proportions of the head and in a minor way in the breadth of the temporal marginal carinae and pleural thickenings or the shape of various sclerites.

The second, and more controversial problem is that of deciding whether certain...
populations should be recognized taxonomically at all. Various procedures have been adopted within the classification of the Mallophaga, one is to describe as new every population occurring on a different host species, in the hope, it is presumed, that 50% or more may prove to be valid and leaving some other worker to find out. Another method is to take single specimens and to describe them as new species or subspecies on some minor character which is likely to be variable within the population or even an artefact due to method of preservation and of no taxonomic significance. These two examples of bad taxonomic procedure, unfortunately still rather frequent in the systematics of the Mallophaga, need not be further considered. The difficult cases are those where there are differences and where the populations must be genetically quite distinct, but it is considered unsatisfactory to recognize them taxonomically. In *Degereillia* it is possible to distinguish three categories, apart from those where insufficient material is available, the taxonomic recognition of which it is considered would not assist in the classification of the group:

1. Certain populations are only separable from each other statistically; here no useful purpose would be served in naming these microspecies, where many individuals would not be identifiable.

2. Certain populations may appear to differ, but when large series are examined too much variation is found to support the divisions, an example of this are the populations from *Aquila* and the various species of *Buteo* (see p. 140).

3. The populations from two hosts may be distinctly separable on such characters as size and shape of head, but if between these two there is a series of populations from related hosts showing a character gradient in these characters it is not considered that any of the populations should be recognized. The populations of *D. rufa* from *Falco* provide a particularly difficult problem (see further p. 183) as they differ from each other in the outline of the anterior margin of the head, showing all degrees from marked differences to very slight ones, the latter being complicated by individual variation. If any subspecies are recognized then the classification of the populations showing minor differences becomes almost impossible; this may be a case where subspecies should not be recognized.

This policy of not overwhelming the classification by naming every statistically or barely separable population is not to discourage the study of populations, their variation and host distribution; there is much interesting information on these subjects to be gathered from detailed statistical analysis, all that is here recommended is that these populations should not be given names. In this present paper an attempt has been made to sort out the populations deserving taxonomic rank and not to study detailed variation.

**VARIATION AND ARTIFACTS.** The populations of *Degereillia* from the various hawks are frequently very similar to each other and forms are separable on rather slight character differences, for this reason it is necessary to consider the amount of variation within populations from one host form. Further, it is necessary to work with specimens which have been treated in various ways so that they can be examined under high-power microscopes and this may cause various artefacts dependent on the methods used. Individuals in populations of Mallophaga, unlike some other groups of insects, tend to show little variation in size and external characters, due no doubt to the similarity of the environment in all stages of development and to the unlimited and easily accessible food supply. The reliability of the morphological characters which have been used in the taxonomy of the group are discussed below.

1. Size. As already mentioned populations of Mallophaga tend to be rather constant in size. A number of experiments were carried out to see which was the most reliable measurement in *Degereillia*. A male and female of each of *D. flavus*, *D. r. regalis* and *D. rufa* were measured at each stage of the following treatments:

![Diagram](image-url)
breath of the temples remained either constant under the different treatments or changed no more than 0.004 mm., while other measurements especially total length, breadth of pterothorax and length and breadth of abdomen were rather variable due to contraction or expansion between the different regions of the body or changes in shape due to pressure by the cover slip. This means that in *Degeeriella* the breadth of the head is a measurement that can be taken quickly and accurately in any media, does not alter with the age of the adult, the abdomen for example in teneral females is usually smaller (Clay, 1956) and it is possible to compare the measurements of other workers as there is no ambiguity about the exact position of where the measurement is taken. The whole of the collected populations from one host can be measured in phenol solution without the labour of mounting them in canada balsam and ensures that not only the larger specimens, which consciously or unconsciously are likely to be picked out for permanent mounts, are measured. This measurement, therefore, is useful in comparing populations from various hosts which differ only in absolute size; the size of the temple breadth being roughly proportional to the total size. It cannot of course be used in comparisons of populations which differ in the shape of the postantennal region of the head. It should be noted that this is a different problem from the consideration of which measurements show the least variation in a population from one host where all individuals have been treated in the same way.

Tjørneland (1955) compiled the variation coefficients for various measurements of 40 males and 40 females of *Degeeriella d. aquilennis* Eichler taken from the same host individual and subjected to the same treatment; it was found that the measurement of the head showed the least variation within the populations. It has been found in numbers of specimens belonging to one species that those from the different hosts may differ in average measurements of head breadth, but that the ranges overlap; it is important therefore to give the range and number of specimens measured. For reasons discussed elsewhere (p. 128) time has not been spent on statistical analysis of the measurements of the different populations of *Degeeriella* presented in this paper. It is doubtful whether subspecies should be recognized on size differences alone and certainly not when only two or three specimens are available.

2. Pigment and sclerotization. As it is frequently necessary to work with material which has been kept long in alcohol or over treated with caustic potash it is difficult to use the characters in the comparison of all species. However, the amount and arrangements of pigment may be a taxonomic character (see D. fusca). The sclerotized plates may vary in outline as some of these, especially the thoracic sternal plates and the male and female genital plates, may have part of the plate more lightly sclerotized and in some specimens, either naturally or due to treatment, the lighter parts are not apparent, thus altering the outline.

3. Head. The shape and size of the head is a useful character and as shown above the breadth is not affected by the various methods of preparation. However, in some populations there appears to be a certain amount of variation in the curvature of the anterior margin (see under D. fusca). The thickness of the marginal carina and the presence or absence of an inner median indentation are usually reliable characters, but there may be intrapopulation variation in these characters, sometimes due to methods of preparation; teneral specimens especially may be misleading in these characters (see below under D. pseudophaeus). Thus, specimens of the full larval group from the same host form may have the typical flattened anterior margin, with broad marginal carina and well marked inner marginal indentation, whereas other specimens may have rather rounded anterior margins, rather narrow marginal carina and the inner marginal indentation not apparent. Specimens which have been left too long in caustic potash may have the marginal carina appearing narrower, the head often more rounded anteriorly and the anterior end of the ventral suture not distinguishable; the extent of the hyaline margin may also vary in mounted specimens according to the position and pressure exerted. The proportions of the head, that is ratio of length of preantennal region to postantennal region and ratio of breadth to length of these regions may be misleading as these show variation within populations. Reduction of these proportions to mathematical terms is unsatisfactory owing to the difficulty of finding exact points of measurement and a more accurate method is that described in Clay & Hopkins (1954: 230) in which an outline of a head is drawn with a camera lucida and comparisons of other heads made by projecting them on to this outline; by adjusting the magnification it is possible to get a fixed measurement such as the breadth of the temples and thus compare the proportions of the head (see also p. 154). If this is done with a large number of specimens from one host it will be seen that proportions are often variable and cannot be used for subspecific divisions. Both the marginal and temporal marginal carinæ may have indentations, the number, shape and position of which show some individual variation. However, the thickness and outline of these carinæ, with the reservations discussed above, may be of taxonomic importance. The conus tends to be variable in shape and length mainly due to the position in mounting and except where the differences are strongly marked (e.g. D. punctifer), this structure has not been used as a taxonomic character. The position of the second ventral submarginal seta (Clay, 1951) shows individual variation being found either above or below the level of the marginal carina.

4. Thorax. The number of sternal setae and the shape of the sternal plate show individual variation (Text-figs. 112-118) and is of no taxonomic value amongst nearly related species. There are usually eight elongated posterodorsal setae on the pterothorax arranged in two groups of two each side, but there may be individual variation in the number and position.

5. Abdomen. In general the presence or absence of a partial division of tergal plate II-III is constant for a given taxa, but there are cases where this character especially in II shows individual variation. The width and the dorsal and ventral outline of the pleural thickening is often a useful character, but in mounted specimens it is liable to distortion; this distortion is particularly marked in the shape and details of the re-entrant head; teneral specimens do not always show the normal characters of the adult pleural thickening. In the female the subvulval sclerites may show slight individual variation.

6. Male genitalia. The basal apodeme may show slight variation in outline either due to individual variation or to distortion in preparation. The shape of the tips of the parameres must again be used with caution as the appearance of these is dependent on position of mounting. The sclerotization round the penial sclerite and penial
arms is irregular and rather variable in outline. The fusion or not of the dorsal
endomeral arms with the basal apodeme may be a specific character or it may show
individual variation and differ on the two sides of the same individual. There is
also frequently considerable variation in the shape and length of the distal ends of

![Diagram](image)

Figs. 42-48. Male genitalia, ventral view of distal area. 42. D. fulica from Aquila
chravacta. 43. D. bombycic. 44. D. carnifex. 45. D. emersoni. 46. D. n. mimus
from Asiopterus mimus. 47. D. n. frater from Asiopterus ludus, Kenya. 48. D. fulica
from Circaetus aeruginosus.

the ventral endomeral arms and the position of the setae, the two sides in one
individual often being asymmetrical in these characters. It is not always possible to
see the relationship of the dorsal and ventral parts of the mesosome to each other
unless the genitalia are dissected and mounted separately on the side.

7. Abdominal chaetotaxy. This frequently forms a useful taxonomic character,
but it is important to consider the amount of individual variation. The presence
or absence of pleural setae on some of the anterior segments and on X in the male
can be used to separate species or species groups, but occasionally an individual will

be found with one seta present on one side of a segment when its absence is characteris-
tic of the species. Another character which can be used to separate species groups
is whether the sternites III–VI normally have 4 or more setae; however, the species
characterized by the absence of 4 setae may have the occasional specimen with
one or two segments with 3 or 5 setae. The number of tergal setae may also be
taxonomically important but here again there is individual variation and a more
useful character is the range in the total number of setae found on segments III–VII.
The dorsal setae on segment X of the male may vary from 1–3 each side, but in some
populations one each side seems to be the rule with occasional exceptions.

Characters of taxonomic importance. The following characters have been found to
be of taxonomic importance in *Degeneriella* and should be given together with their
variation in all descriptions of new taxa: Shape of head; form of marginal and
ventral carinae, and anterior extension of ventral suture; thickness of temporal
marginal carinae; number of elongated marginal temporal setae; presence or
absence of postaxial sutures. Form of tergal plates of segments II–III, and XI
in male and IX–XI in female; width, and dorsal and ventral outline, and develop-
ment of re-entrant head of pleural thickening. Outline of female genital plate,
inter genital sclerites and subovoid sclerites. Presence and absence of pleural
setae on segments II–VI and of X in male and numbers of sternal setae. The male
genitalia should be figured to show the length of the penis and the form of the penial
arms, and a dorsal and ventral view of the endomeral plate.

**SYSTEMATIC SURVEY OF THE SPECIES OF DEGENEI ELLA PARASITIC ON THE FALCONIFORMES**

For convenience in classification and to avoid frequent repetition in descriptions,
the species are divided into a number of species groups. There is naturally not always
a clear cut distinction between the species groups and these may not always form
natural phylogenetic assemblages. The groups are based mainly on the characters
of the head, abdominal chaetotaxy and the male genitalia. Characters given under
the definition of the genus (p. 126) and for the species groups are not usually repeated
again in the descriptions of the species.

**The fulva Species Group**

1. Head index less than 0.90.
2. Dorsal head sutures not apparent.
3. Two of the marginal temporal setae each side elongated.
4. Thoracic sternal plate and chaetotaxy as in Text-figs. 112–118; this plate
shows individual variation in shape and in the number of associated setae.
5. Thorax and abdomen with general shape as in Pl. 1, fig. 1.
6. Tergal plates of segment XI not apparent in male.
8. Pleural thickening of segments III–VI usually with well developed re-entrant
heads.
9. Sternites of II-VI in the form of quadrilateral median plates.
10. Male genital plate of irregular and variable outline.
11. Female genital plate without median posterior prolongation.
12. Female inner genital sclerites never fused in mid-line.
13. Male genitalia of type shown in Pl. 8, fig. 3; penial sclerite present.
14. Setae each side of posteroventral margin of pterothorax: 1 (lateral) spine-like seta, 2 elongated setae, 2 pairs of elongated setae (as Text-fig. 14).
15. Pleural setae absent on segments II-III and usually IV, and on segment X in male.
17. Ventral chaetotaxy of male segments VII-XI as in Text-fig. 102; in some specimens one or both of the outer setae on segment VII may be absent.

*Degereiella fulva* (Giebel), 1874

Type host: *Aquila chrysaetos* (Linn.)


*Normus fulvus* Giebel, 1874. *Insecta epina*: 114. Host: *Aquila fulva* — *A. chrysaetos* (Linn.).


The description, figure and host of *D. fuscus* (Nitzsch) make it certain that this name, already procopposed, is a synonym of *D. fulva* (see also Hopkins, 1947: 76).

The original description of *D. fulva* together with the fact that it was placed between *fuscus* and *fuscus*, both figured, show that Giebel's original specimen must have been the elongated type (Pl. 1, fig. 1) of *Degereiella* found on *Aquila* not the round-bodied type (Pl. 8, fig. 2). As this species appears to be indistinguishable from that on *Buto* there seems a possibility that the known specimens might have been stragglers from this latter genus. However, an examination of all the available material from *Aquila*, that is 15, 16, 17 from nine individuals of seven species of *Aquila*, shows there is no doubt that *Aquila* was the true host of at least three of these records; the hosts of the remainder cannot now be confirmed. It may be assumed, therefore, that the species described below is a natural parasite of *Aquila*.

*Degereiella fulva* is distinguishable from other species in the species group by a combination of the characters of the marginal carina, ventral suture, tergites II-III, pleural thickening, number of pleural setae and the details of the male genitalia.

**MALE.** Inner dorsal margin of marginal carina indented medially; ventral suture passes to anterior margin of head (Text-fig. 109, Fig. 52). Tergite II only with definite median unscerotized indentation. Pleural thickening narrow with inner edges comparatively straight. Genital plate as in Text-fig. 102. Genitalia as in Pl. 8, fig. 3 and Text-figs. 26, 42; there is some variation in the shape of the basal apodeme and of the base of the endonemal plate which does not always show an inner indentation. Internal genitalia as in Text-fig. 3.

**FEMALE.** Tergae of segments IX-XI as in Text-fig. 105 and genital region as in Text-figs. 70, 84.

**CHAETOTAXY OF ABDOMEN.** Tergocentral setae: II normally 6*, range 4-7; III-V normally 8, range 6-8; VI-VIII normally 6, range 4-8. X in the male has

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1. In this and all subsequent descriptions the two anterior setae always found on II are omitted.
from 1-3 setae each side; of 16 males from *Aquila* 11 had one (1+1) each side, 3 had 1+2 and two had 2+2; in 80 males taken at random from various species of *Buteo*, 8 had 1+1, 19 had 1+2, 44 had 2+2, 7 had 2+3 and 2 had 3+3. Tergal setae of segments X-XI of female as in Text-figs. 105. Pleural setae: II-IV o; V, 1 on each side; VI-VII, 2; VIII, 3. In the male IX has 2 each side and X, 0. In the female IX and X each have 1-3 each side. Sterno-central setae of II-VI normally 4 with the occasional segment of the occasional specimen with 3 or 5. In the male total number of marginal setae of last segment dorsal and ventral, varies from 9-14.

**Nymphs.** No nymphs have been seen from any species of *Aquila*; perthoracic setae and heads of the three instars of specimens taken from *Buteo* are shown in Text-figs. 9, 11-13, 15-17.

**Variation and Host Distribution.** The detailed comparison made by Tendeiro (1955: 599) between specimens from *Buteo buteo* and *Aquila chrysaetos* has been studied closely, but the conclusions reached are different; this is probably due to the availability of specimens from a greater number of species of *Aquila* and *Buteo*. Through the kindness of Dr Tendeiro it has been possible to examine three males and six females from *Aquila chrysaetos*; these have been compared with 15 males and 30 females from six other species of *Aquila* and about 250 males and 400 females from 17 forms of *Buteo*. Certain characters were found to be too variable within the

<table>
<thead>
<tr>
<th>Measurements in mm.</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>Breadth</td>
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<tr>
<td>Head</td>
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<td>0.43</td>
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<tr>
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<tr>
<td>Total</td>
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<td></td>
</tr>
<tr>
<td>Genitalia*</td>
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<td></td>
</tr>
<tr>
<td>Head index</td>
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<td>0.77</td>
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* A. Single specimen from *A. chrysaetos*. B. Specimens from *Buteo lagoanus*.

<table>
<thead>
<tr>
<th>Length</th>
<th>Mean</th>
<th>Breadth</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>0.50-0.55</td>
<td>0.53</td>
<td>0.49-0.43</td>
</tr>
<tr>
<td>Prethorax</td>
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<td></td>
<td>0.35-0.38</td>
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<tr>
<td>Postthorax</td>
<td></td>
<td></td>
<td>0.40-0.47</td>
</tr>
<tr>
<td>Abdomen</td>
<td>1.01-1.82</td>
<td>1.13</td>
<td>0.90-0.60</td>
</tr>
<tr>
<td>Total</td>
<td>1.60-1.10</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Genitalia*</td>
<td>0.23-0.37</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>C.I. (10)</td>
<td>0.77-0.80</td>
<td>0.79</td>
<td></td>
</tr>
</tbody>
</table>

C. Specimens from *Aquila clangula* and *A. vulgaris*.

<table>
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<th>Length</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>0.55-0.58</td>
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<tr>
<td>Prethorax</td>
<td></td>
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<tr>
<td>Postthorax</td>
<td></td>
</tr>
<tr>
<td>Abdomen</td>
<td>1.27-1.38</td>
</tr>
<tr>
<td>Total</td>
<td>2.15-2.30</td>
</tr>
<tr>
<td>C.I. (5)</td>
<td>0.76-0.80</td>
</tr>
</tbody>
</table>

D. Maximum and minimum measurements of specimens from *Buteo* species.

<table>
<thead>
<tr>
<th>Length</th>
<th>Breadth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>0.50-0.58</td>
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<tr>
<td>Prethorax</td>
<td></td>
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<tr>
<td>Postthorax</td>
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</tr>
<tr>
<td>Abdomen</td>
<td>1.00-1.32</td>
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<tr>
<td>Total</td>
<td>1.75-2.53</td>
</tr>
<tr>
<td>C.I.</td>
<td>0.75-0.91</td>
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</tbody>
</table>

A. Single specimen from *A. chrysaetos*. B. Specimens from *Buteo lagoanus*.

* Length of genitalia of male taken from anterior margin of basal apodeme to posterior margin of endosomal plate. Number of specimens measured given in brackets. Head index = breadth : length.

**Revisions of Mallophaga Genera**

**C**

**Male**

<table>
<thead>
<tr>
<th>Length</th>
<th>Breadth</th>
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<tbody>
<tr>
<td>Head</td>
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<tr>
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<td>Genitalia*</td>
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<td>C.I. (10)</td>
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**Female**

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<tr>
<th>Length</th>
<th>Breadth</th>
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<tr>
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<tr>
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<td></td>
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<td>Postthorax</td>
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</tr>
<tr>
<td>Abdomen</td>
<td>1.27-1.38</td>
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<tr>
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<tr>
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<td>0.76-0.80</td>
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**D**

<table>
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<tr>
<th>Length</th>
<th>Breadth</th>
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<tbody>
<tr>
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<td>Prethorax</td>
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<td>Postthorax</td>
<td></td>
</tr>
<tr>
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<td>1.00-1.32</td>
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<tr>
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</tr>
<tr>
<td>C.I.</td>
<td>0.75-0.91</td>
</tr>
</tbody>
</table>

**Populations from one host species to be used for taxonomic divisions. These are:**

- exact curvature of the anterior margin of the head and thickness of the marginal carinae, both these characters also seem to be affected by the method of treatment (see p. 149); outline of gular plate and thoracic sternal plates and the number of associated setae (Text-figs. 112-118); shape and extent of unciertized area of tergite II; central narrowing of fused tergite IX-X in male; outline of male genital plate; exact outline of basal apodeme, differences in its total length and ratio of its length to that of the mesosome; shape of penial arms; ratio of height to breadth of female genital plate and exact outline of subuvular sclerites. Pl. 1, figs. 1-7, show the variation in the shape of the head of specimens from various hosts; figs. 3-4 are specimens from the same host individual and mounted on the same slide. 

As already discussed above (p. 134) there is a tendency for the populations on larger
host species to have a greater number of larger individuals. This is true of the populations from the species of *Buteo*: measurements of head breadth of 311 males from 17 forms of *Buteo* and 396 females from 16 forms show a difference in the average breadth of the head between some of these populations. Thus, in males (53 specimens) from *Buteo buteo* (the smaller bird) the average is 0.41 mm., while in those

![Image of genitalia](54-57)

(Figs. 54-57.—Male genitalia, ventral view of distal area. 54. D. elata. 55. D. rufa from *F. immutiuscula*. 56. D. r. repida from *Milocus milaus*. 57. D. punchefer.

(41 specimens) from *Buteo jamaicensis borealis* (the larger bird) the average is 0.44 mm. Populations from other species of *Buteo* have intermediate averages and there is overlap in measurements of individuals of all populations. In addition to size some of the populations are composed of individuals in which the head tends to be more rounded anteriorly, such as that from *Buteo jamaicensis* (Pl. 1, fig. 7), although even in this case there are individuals indistinguishable from those from other

hosts. For these reasons it has not been found possible to recognize taxonomically the populations from the different species of *Buteo* and to separate these from the populations from *Aquila*: this is also true of the population parasitic on *Geranostomus*.

There are considerable difficulties in placing the populations from the following hosts: *Ichthyophaga*, *Polemaetis*, *Lophothis*, *Hieraetisa*, and *Spilornis*. Specimens from *Ichthyophaga* and *Polemaetis* can probably be included with *fulua*, but the available material is not in sufficiently good condition for exact comparison. Those from *Lophothis* and *Hieraetisa* are rather similar and have the anterior inner margin of the marginal carina sloping postero-laterally instead of being nearly parallel with the anterior margin as in typical *fulua*; however in some specimens the difference is less marked and a similar condition is found in some specimens from *Aquila wahberi*. In the specimens from *Hieraetisa* the shape of the penial arms differ slightly from those of typical *fulua*, but in *Lophothis* both types occur. The population from *Meliera* *muscicola* *polioperus* resembles that from *Lophothis* in the characters of the margin carina, but specimens from some subspecies of *Meliera melanota* are intermediate between the latter and *fulua*. Specimens from *Spilornis* resemble the *Lophothis* population but have a broader head anteriorly and may differ in colour pattern but the material is not in sufficiently good condition for identification. Nymphs are available from the *Meliera melanota* population only; these resemble those from *Buteo*. Taking all these facts into consideration it does not seem that at the present time the classification will be simplified by giving subspecific names to all these poorly separable, perhaps inseparable, populations (see above p. 138) and these are, therefore, here kept for the present under the name *fulua*.

The material available from *Meliera* is confusing: as shown above that from *M. muscicola polioperus* (5 from 3 individuals from Kenya) and that from some forms of *M. melanota* (11 from Portugal, E. Africa, Aden (1,000) and 2,068 in spirit) in Morocco and SW. Africa, *fulua* are near *fulua* while 9 from *M. gabar* and 7 from *M. melanota* from two individuals from Uganda differ constantly in the characters of the male genitalia and cannot be included in *fulua*. Specimens from *Hyponomus* (urhokeng) belong to the *fulua* species group but seem to differ in the details of the male genitalia but the available material is not in sufficiently good condition for a decision on this.

**Material Examined.** Three from *Aquila chrysaetos* (Linn.), Portugal; 3 from *Aquila heliaca* Savigny, Kurdistan; 2 from *Aquila rapax* (Temminck), Rajputana and Kenya; 3 from *Aquila clanga* Pallas, Czechoslovakia and Germany; 4 from *Aquila versaceia* Lesson, Rondobosch, South Africa; 3 from *Aquila wahberi*, Sudevall, Uganda; 1 from *Aquila pomarina* Brebi, no data. Many males and females from the following forms of *Buteo*: *B. rufinus rufinus* (Cretzschmar), *B. rufinus cirtensis* (Levaillant), *B. rufinus* (R. J. Forster), *B. r. anguri RupPELL, B. helianus* Temminck & Schlegel, *B. rufinus* (G. R. Gray), *B. jamaicensis alascensis* Grinnell, *B. j. borealis* (Gmelin), *B. j. krideri* Hooper, *B. j. astariensis* Ridgway, *B. kuhlji* (Audubon), *B. l. lineatus* (Gmelin), *B. l. buteo* (Linn.), (including holotype, allotype and paratypes of *D. giebeli* Hopkins), *B. l. astariensis* (Glover), *B. l. nunezii* (Hume), *B. l. lagopus* (Poullipid), *B. l. stocki* (Hume). Four 25 from *Geranostomus melanotus* australis Swan,
Degeberella rima sp. n.

Type host: Kaupifaco monogrammicus (Temminck)

(Text-figs. 101, 123)

This subspecies is distinguished from *fufis* by the head being narrower and more rounded anteriorly (Text-fig. 123), by the pleural thickening of at least some of the segments having the ventral outline rounded and in the male by having a definite lateral slit each side of the basal apodeme (Text-fig. 101). This last character should not be confused with a displacement of the lateral thickening of the basal apodeme at the usual slight interruption of this thickening, which may be found in any of the species.

Material examined. Eleven ♂, 8 ♀ from the type host from Uganda and N. Rhodesia.

Holotype male and allotype female, slide No. 609 in the British Museum from Kaupifaco monogrammicus (Temminck) from Bunyoro, Uganda collected by W. J. Eggleton, 4. iv. 1940 and presented by G. H. E. Hopkins. Paratypes: 10 ♂, 7 ♀ from the same host species with data as given above.

Measurements in mm.

<table>
<thead>
<tr>
<th>Male</th>
<th>Length</th>
<th>Range</th>
<th>Mean</th>
<th>Breadth</th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head (10)</td>
<td>0.049-0.052</td>
<td>0.051</td>
<td>0.044</td>
<td>0.32</td>
<td>0.037-0.040</td>
<td>0.039</td>
</tr>
<tr>
<td>Prothorax (1)</td>
<td>0.049</td>
<td>0.050</td>
<td>0.050</td>
<td>0.32</td>
<td>0.037</td>
<td>0.040</td>
</tr>
<tr>
<td>Pterothorax (2)</td>
<td>0.047-0.052</td>
<td>0.049</td>
<td>0.045</td>
<td>0.31</td>
<td>0.038</td>
<td>0.042</td>
</tr>
<tr>
<td>Abdomen (2)</td>
<td>0.073-0.083</td>
<td>0.078</td>
<td>0.074</td>
<td>0.31</td>
<td>0.039</td>
<td>0.042</td>
</tr>
<tr>
<td>Genitalia (1)</td>
<td>0.067</td>
<td>0.070</td>
<td>0.065</td>
<td>0.31</td>
<td>0.039</td>
<td>0.042</td>
</tr>
<tr>
<td>C.I. (10)</td>
<td>0.072-0.077</td>
<td>0.074</td>
<td>(6)</td>
<td>(8)</td>
<td>(10)</td>
<td>(12)</td>
</tr>
</tbody>
</table>

Female

Head (8) | 0.053-0.059 | 0.057 | 0.046-0.045 | 0.047 |

III with a small median concavity of varying depth. Width of pleural thickening as in *fufis*, but that of segment VII has a smaller re-entrant head. Genitalia as in *fufis*, except that on the available material the sides of the basal apodeme appear to be straighter.

FEMALE. Terga of IX-XI as in *fufis*. Genital plate relatively broader in the anteroposterior line and subbivalval sclerites shorter and blunter (Text-fig. 85).

Chaetotaxy of abdomen. As in *fufis* except that tergocentral setae of III-V are normally 6, range 5-8, and there is no pleural seta each side of V.

Material examined. Six ♂, 8 ♀ from *Stephanonotus coronatus* (Linn.), Nairobi, Kenya, 5. ii. 1927 (skin in Nairobi Museum) collected by G. H. E. Hopkins.
Holotype male and allotype female, slide no 624 in the British Museum (Natural History) from *Stephanoceras coronatis* with data as given above, presented by Mr. G. H. E. Hopkins. *Paratypes*: 5 ♂, 7 ♀ from the same host individual.

**Measurements in mm.**

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(♂)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(♀)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Head</td>
<td>0.58–0.60</td>
<td>0.58</td>
<td>0.60–0.65</td>
<td>0.63</td>
</tr>
<tr>
<td>Prothorax</td>
<td>—</td>
<td>—</td>
<td>0.28–0.33</td>
<td>0.30</td>
</tr>
<tr>
<td>Pterothorax</td>
<td>—</td>
<td>—</td>
<td>0.47–0.50</td>
<td>0.49</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0.10–0.13</td>
<td>0.12</td>
<td>0.35–0.40</td>
<td>0.37</td>
</tr>
<tr>
<td>Total</td>
<td>2.52–2.61</td>
<td>2.56</td>
<td>1.26–1.33</td>
<td>1.29</td>
</tr>
<tr>
<td>Genitalia (♂)</td>
<td>0.43</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>C.I.</td>
<td>0.70–0.82</td>
<td>0.80</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Deegeriella beauvsi** Ansari, 1955

**Type Host**: *B. tabatari* (Franklin)

(Pl. 8, fig. 4; Text-figs. 2, 23, 43, 77)


It is being assumed that the specimens available from *B. tabatari* are this species, although in the first reference the few words of description do not distinguish the species from any other *Deegeriella*, and the second reference, in which the species is also referred to as new, is even less informative.

This species is distinguished from *fulva* by the form of the ventral suture, internal and external male genitalia and the nymphs.

**Male**: Shape of head similar to that of *fulva*, anterior margin varies from flattened to somewhat rounded; ventral suture does not reach anterior margin of head; marginal carinae of temples as in *fulva*. Tergites and pleurites as in *fulva*. Genitalia differ from those of *fulva* in details of the mesosome (Pl. 8, fig. 4, Text-fig. 43).

**Internal genitalia** as in Text-fig. 2.

**Nymphs**: Third instar nymphs differ from those of *fulva* in having the preannular region narrowed to a greater extent anteriorly and somewhat pointed (Text-fig. 23).

**Material Examined**: Eighty-one ♂, 65 ♀ from *B. tabatari* from various localities in India; 1 ♂ from *B. tabatari* (Temminck) from Burma.

*Deegeriella carrikeri* sp. n.

**Type host**: *Leucopterynis polionola* Kaup.

(Pl. 2, fig. 2, Text-figs. 27, 44, 86)

This species is distinguished from *fulva* by the sculpture of the dorsal surface of the head, pleural thickening and details of the male genitalia.

**Male**: Head similar to that of *fulva*, but flattened anteriorly with slight median concavity; inner margin of marginal carina with median indentation; dorsal
sculpturing more marked and forming semicircular patch near anterior margin of head; ventral suture passes nearly to anterior margin and is broad anteriorly; marginal carinae of temples as in fulva. Tergites as in fulva. Pleural thickening broader than in fulva, with ventral outline of segments II–VII and dorsal outline of segments V–VII convex. Genitalia differ from those of fulva in the shape of the basal apodeme and details of mesosome.

**Female.** Terga of IX–XI and genital region as in fulva except for the shape of the subuvulal sclerites (Text-fig. 80).

**Chaetotaxy of abdomen.** As in fulva except for the smaller number of tergoentral setae on segments II–V: II normally 4, range 3–5; III–V normally 6, range 4–7. In the male total number of marginal setae on last segment varies from 13–18.

**Material examined.** Fifteen ♂, 17 ♀ from Leucopteras polinota Kama from S. Paulo, Brazil collected by S. Lima, November, 1946.

Hedotype male and allotype female in the collection of Dr. L. R. Guimarães from *Leucopteras polinota* with the above data. Paratypes: 14 ♂, 10 ♀ from the same host individual.

Named in honour of Mr. M. A. Carriker.

Measurements in mm.

**Male**

|          | Range          | Mean  
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Head (15)</td>
<td>0.69–0.76</td>
<td>0.71</td>
</tr>
<tr>
<td>Prothorax (10)</td>
<td>–</td>
<td>0.37</td>
</tr>
<tr>
<td>Metathorax (10)</td>
<td>–</td>
<td>0.40</td>
</tr>
<tr>
<td>Abdomen (10)</td>
<td>–</td>
<td>0.86</td>
</tr>
<tr>
<td>Total (10)</td>
<td>2.15–2.30</td>
<td>2.21</td>
</tr>
<tr>
<td>Genitalia (♂)</td>
<td>0.40–0.42</td>
<td>0.40</td>
</tr>
<tr>
<td>C.I. (15)</td>
<td>0.39–0.75</td>
<td>0.56</td>
</tr>
</tbody>
</table>

**Female**

|          | Range          | Mean  
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Head (10)</td>
<td>0.62–0.69</td>
<td>0.65</td>
</tr>
<tr>
<td>C.I. (10)</td>
<td>0.79–0.815</td>
<td>0.79</td>
</tr>
</tbody>
</table>

**Degereiella emersoni** sp. n.

*Type host: Butogallus gundlachi* (Cabanis)

(Text-figs. 28, 45, 78, 87)

This species is distinguished from fulva by the form of the marginal carina, pleural thickening and male genitalia.

**Male.** Head with general outline as in fulva, but anterior margin of marginal carina flattened and slightly concave medially; inner margin of marginal carina indented medially; ventral suture reaches to or nearly to anterior margin of head; marginal carinae of temples as in fulva. Abdominal tergites as in fulva. Pleural thickening ventrally as in fulva, that is narrow with straight margin; dorsal outline broader and curved. Genitalia similar to those of fulva, but differ in details of penial arms and endosomal plate.

**Female.** Terga of IX–XI and genital region as in fulva: genital plate and subuvulal sclerites as in Text-figs. 28, 87.

**Chaetotaxy of abdomen.** Tergocentral setae with range as in fulva, but segments II–V normally 6–7 rarely 8. Pleural and sternal setae as in fulva. In the male the total number of marginal setae of the last segment varies from 11–15.

Measurements fall within the range as given for specimens from *Buteo lagopus* (see table).

**Material examined.** Twenty-three ♂, 34 ♀ from Butogallus gundlachi Cabanis from Doce Legues, Cuba (collected by H. S. Peters). 4 ♂, 3 ♀ in rather poor condition from Parabuteo unicinctus (Temminck) seem to belong to this species.

*Holotype ♀ and allotype ♀ in U.S. Bureau of Entomology, Washington from Butogallus gundlachi with data as above. Paratypes: 22 ♂, 33 ♀ from the same host individual.*

This species is named in honour of Dr. K. C. Emerson.

**Degereiella nius** (Giebel, 1866)

Specimens of *Degereiella* have been seen from only nine species of *Acceper* out of the 44 listed by Peters (1931), but even this small number shows more diversity in the populations from the different host species than in the case of the populations from *Buteo*. Four forms are here recognized and placed as subspecies of *nius*, although a greater amount of material is available from *Acceper* it may be necessary to recognize some of the populations as species. For instance, *hispidae* and *frater* are rather different from *nius* and *nigres* and could perhaps be considered as specifically distinct. It should be noted that there tends to be some variation in the outline of the endosomal plate.

**Degereiella nius nius** (Giebel, 1866)

*Type host: Acceper n. nius* (Linn.)

(Pl. 3, fig. 1; Pl. 8, fig. 5; Text-figs. 24, 29, 46, 88, 110)

*N. nius* Giebel, 1866. Z. ges. Natwiss. 28: 304. Host: *A. nius* = *Acceper n. nius* (Linn.).

This species is distinguished from *fulva* by the shape of the head, the form of the marginal carina, the pleural thickening and the details of the male genitalia and from *fulva* as given under that species.

**Male.** Inner edge of marginal carina straight or with slight median indentation; small area of dorsal thickening immediately below marginal carina; ventral suture does not reach to anterior margin of head (Text-fig. 110). Marginal temporal carinae broad with many indentations. Terga II–III indented medially. Pleural
thickening broad with ventral outline convex. Genitalia similar to those of *fulva*
but differ in detail (Pl. 8, fig. 5; Text-figs. 29, 46); there is some variation in the
shape of the dorsal endomeral and penial arms. Internal genitalia, represented
by one example in rather poor condition, appear to be the same as those of *D. fulva*
from Etelä-Baate.

**Female.** Abdominal terga of IX-X as in *fulva*. Genital region similar to that
of *fulva*; subovulval sclerites as in Text-fig. 88.

---

**Chaetotaxy of Abdomen.** Tergocentral setae: II normally 4, range 3-5;
III-VI normally 6, range 4-7, VIII range 4-6; X in the male with 1 seta each side
(58 specimens examined), in the female 2 each side; in the male total number of
marginal setae, dorsal and ventral on last segment varies from 5-12. Pleural
and sternal setae as in *fulva*.

**Nymph.** Anterior margin of head of third instar rather less flattened than in
adult (Text-fig. 24).

**Material Examined.** Sixty-six ♀, 113 ♂ from various subspecies of *Accipiter
nisus* (Linn.) from the British Isles, Hungary, Cyprus, Saudi Arabia, Afghanistan and
Pakistan. Two ♀, 4 ♂ from *Accipiter striatus velox* (Wilson) from British Columbia
and U.S.A. are included under *nisus nisus*, although in the small number of specimens
available the marginal temporal carinae are somewhat narrower.

**Neotype of Nismus nisus Giebel:** Male, slide no. 028, in the British Museum
(Natural History) from *Accipiter n. nisus* (Linn.) from Kilkare, Ireland, presented
by Mr. G. H. E. Hopkins.

**Degeberiella nisus vagans** (Giebel), 1874

**Type host:** *Accipiter gentilis* (Linn.)

(Pl. 3, fig. 2)

*Nismus vagans* Giebel, 1874. *Insecta epipara*: 126. Host: *Aстра fulvescens* = *Accipiter
gentilis* (Linn.).

This differs from the nominate form in the larger average size of both sexes, the
shape of the head, the inner edge of the marginal carina, which is usually rather more
indented medially, the narrower and less indented marginal carinae of the temples
and the number of tergocentral setae. Tergocentral setae: II normally 6 (rarely
5 or 8, often 7); III-V normally 8; VI-VIII normally 6; thus in nisus the total
number of tergocentral setae on segments III-V is 15-20, normally 18 and in *vagans:
22-26, normally 24.

**Nymph.** Third instar nymphs with head similar to those of *nisus nisus*, but
differ slightly reflecting the differences in the adult heads.

**Material Examined.** Forty-one ♀, 44 ♂ from *Accipiter gentilis* (Linn.) from
Germany, Switzerland, Czechoslovakia, Canada and Alaska. Fourteen ♀, 48 ♂
from *Accipiter cooperii* (Bonaparte) from United States of America and British
Columbia are not separable from *vagans*.

**Neotype of Nismus vagans** (Giebel), 1874: Male, slide no. 028 in the British Museum
(Natural History) from *Accipiter gentilis* from Rheinfelden, Switzerland, 15th. 1943
presented by Mr. G. H. E. Hopkins.

**Measurements in mm.**

<table>
<thead>
<tr>
<th>Male</th>
<th>D. n. nisus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td><strong>Breadth</strong></td>
</tr>
<tr>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Head (♂)</td>
<td>0.45-0.52</td>
</tr>
<tr>
<td>Prothorax (♂)</td>
<td>—</td>
</tr>
<tr>
<td>Metathorax (♂)</td>
<td>—</td>
</tr>
<tr>
<td>Abdomen (♂)</td>
<td>0.91-1.10</td>
</tr>
<tr>
<td>Total (♂)</td>
<td>3.55-4.87</td>
</tr>
<tr>
<td>Genitalia (♂)</td>
<td>0.29-0.31</td>
</tr>
</tbody>
</table>

C. I. (♂) | 0.73-0.79 | 0.76 | — | — |
**Male**

*D. n. vagans*

- Head (12)...
- Prothorax (10)...
- Metathorax (11)...
- Abdomen (10)...
- Total (10)...
- Genitalia (1)...
- C.I. (12)...

**Female**

*D. n. australis*

- Head (10)...
- Prothorax (10)...
- Metathorax (10)...
- Abdomen (10)...
- Total (10)...
- C.I. (10)...

---

**Degeeriella nissus frater** (Piaget, 1880)

Type host (emended): *Accipiter badius* (Gmelin)

(Pl. 3, fig. 3; Text-figs. 25, 31-32, 47)


*Nemus frater* is represented in the Piaget collection by a single male labelled as from the original host with "Habesh" in brackets, perhaps Habesh in N. Syria. It has not been possible to separate specimens from *Accipiter badius* (African and Syrian birds, see below) from the type of *frater* (although exact comparison of the male genitalia is not possible) and it is presumed that this bird was the original host.

This subspecies is distinguished from the nominate form by the shape of the head, by the slight convexity of the central part of the outer edge of the marginal carina, by the rather larger dorsal central thickening below the marginal carina, by the narrower and more curved genitalia and the shape of the endocentral plate. There is, however, some variation in this last character (Text-figs. 31-32). Tergum II does not have a narrow median indentation as is usual in *nissus*, but a shallow con-
REVIEWS OF MALLOPHAGA GENERA

badius pelopis) tend to differ from those from the Syrian and African birds in having the outer edge of the marginal carina somewhat more concave medially and in having none or very low indentations in the inner edge of the marginal carina laterally. The specimens from Nepal resemble those from Thailand in the form of the anterior margin of the head and the African specimens in the lateral indentations of the marginal carina. However, there are individuals from all these localities which are indistinguishable from each other; it does not seem reasonable, therefore, to distinguish taxonomically the populations from these different subspecies of Aciciciter badius. There is also some variation in the shape of the dorsal endosomal arms.

Material examined. One ♂ type of Nirmus frater; makes and females from Aciciciter badius (Gemlin) from Syria (1 ♂, 3 ♀), from Africa (Uganda, Kenya, Somaliland, 14 ♂, 26 ♀), from Nepal (23 ♂, 27 ♀), from Burma (7 ♂, 10 ♀) and Thailand (9 ♂, 13 ♀). Three ♂, 8 ♀ from Aciciciter tachiro (Daudin) from Uganda and S. Africa. One ♂, 4 ♀ from Aciciciter virgatus affinis Holmgren from Thailand and 2 ♂, 3 ♀ from A. virgatus gularis (Tennminck & Schlegel) from Thailand.

Lectotype of Nirmus frater Piaget: ♂ (slide no. 1270) in the Piaget collection, British Museum (Natural History).

Measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Breadth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>0·57</td>
<td>0·43</td>
</tr>
<tr>
<td>Prothorax</td>
<td>—</td>
<td>0·30</td>
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<tr>
<td>Metathorax</td>
<td>—</td>
<td>0·47</td>
</tr>
<tr>
<td>Abdomen</td>
<td>1·18</td>
<td>0·58</td>
</tr>
<tr>
<td>Total</td>
<td>2·03</td>
<td>—</td>
</tr>
<tr>
<td>Genitalia</td>
<td>—</td>
<td>0·33</td>
</tr>
<tr>
<td>C.I.</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Breadth of Head of Male Specimens from Aciciciter badius

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Africa (11)</td>
<td>0·38–0·42</td>
<td>0·40</td>
</tr>
<tr>
<td>Nepal (25)</td>
<td>0·38–0·43</td>
<td>0·42</td>
</tr>
<tr>
<td>Thailand (10)</td>
<td>0·38–0·40</td>
<td>0·39</td>
</tr>
</tbody>
</table>

Deegeriella nius haydocki subsp. n.

Type host: Aciciciter minullus (Daudin)

(Pl. 2, fig. 3)

This form is separated from the other known subspecies of nius with the exception of epitulata by having only four tergo-central setae on segments II–VIII. It is separated from this latter species by the size and shape of the head. It resembles frater in the characters of the anterior margin of the marginal carina; in having a dorsal triangular-shaped thickening below the marginal carina, which is rather larger; in the form of tergum II and in the shape of the penis arms.

Material examined. Nine ♂, 11 ♀ from Aciciciter minullus (Daudin) from Gulu, Uganda and N. Rhodesia.

Holotype male and allotype female, slide no. 625 in the British Museum (Natural History). from Aciciciter minullus, Malashi, N. Rhodesia, 27 vi, 1955 collected by Major E. L. Haydock. Paratypes: 8 ♂, 10 ♀ from the same host species with data as given above.

Measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>0·49–0·53</td>
<td>0·50</td>
<td>0·25–0·27</td>
<td>0·26</td>
</tr>
<tr>
<td>Prothorax</td>
<td>—</td>
<td>—</td>
<td>0·34–0·46</td>
<td>0·35</td>
</tr>
<tr>
<td>Metathorax</td>
<td>—</td>
<td>—</td>
<td>0·37–0·39</td>
<td>0·38</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0·05–0·08</td>
<td>0·06</td>
<td>0·10–0·13</td>
<td>0·11</td>
</tr>
<tr>
<td>Total</td>
<td>1·37–1·85</td>
<td>1·38</td>
<td>1·75–2·14</td>
<td>1·92</td>
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<tr>
<td>Genitalia</td>
<td>0·31–0·33</td>
<td>0·32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.I.</td>
<td>0·69–0·73</td>
<td>0·71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Deegeriella nius epsutulata (Carriker), 1953

Type host: Aciciciter bicolor (Vieillot)

(Text-fig. 124)


Through the kindness of Mr. Carriker it has been possible to examine a single female paratype of this form. It resembles haydocki in having only four tergal setae on each of segments III–VIII, but differs from this form in the shape of the head and the larger size.

Measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Breadth</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0·47</td>
</tr>
<tr>
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<td>—</td>
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<tr>
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<td>1·30</td>
<td>0·57</td>
</tr>
<tr>
<td>Total</td>
<td>2·12</td>
<td>—</td>
</tr>
</tbody>
</table>
Degeeriella fusca (Denny), 1842

Type host: Circus ae. aenigmaticus (Linn.).


Hopkins (1947: 76) has discussed the confusion which has arisen over the author of this name and the type host and shown that Denny must be considered as the sole author with Circus ae. aenigmaticus as the type host.

This species resembles most nearly D. n. niger from which it is distinguished by the colour pattern and details of the male genitalia.

MALE. Dorsal surface of head with an area of lighter sclerotization between the anterior dorsal setae. Inner dorsal margin of marginal carina indented medially; ventral suture as in niger. Tergites II—III with median indentation; central area of tergite II more strongly pigmented than lateral areas. Pleural thickening broad and strongly pigmented with dark outer line, contrasting with the rather lightly sclerotized terga; this character is not so marked in specimens from Circus cyanus. Genitalia similar to those of niger but differ in detail. Internal genitalia as shown in Text-fig. 3.

FEMALE. Terga of IX XI and genital region as in niger.

CHARTOTAXY OF ABDOMEN. Tergocentral setae II: normally 6, range 5–7; III–IV normally 8, range 6–9; V normally 7–8, range 5–8; VI–VII normally 6, range 5–8; VIII normally 6, range 4–6; X in the male has 1 seta each side (58 examined), in the female 2 each side; total number of marginal setae on last segment varies from 6–12. Pleural and sternal setae as in niger.

NYMPH. Third instar nymphs have been seen from two host species, Circus cyanus and C. melanoleucus; these have the anterior margin of the head more pointed than in the adult.

HOST DISTRIBUTION. There appear to be no taxonomically recognizable differences between the population from the five species of Circus listed below. Eleven specimens from one host individual of Circus melanoleucus average somewhat smaller (broadest of head: 9.4 mm). Specimens from Circus cyanus do not seem to have the color pattern quite typical of fusca, except for the darker central area of tergum II; it is possible that these may prove to be a distinct subspecies, but fresh material from all hosts is needed.

MATERIAL EXAMINED. Fifty-five 9, 81 9 from Circus aenigmaticus (Linn.) from Czechoslovakia, Malta, Cyprus, Saudi Arabia, India, Ceylon, Cape Colony; 13 9, 37 9 from Circus c. cyanus (Linn.) from Orkneys, Hungary and Czechoslovakia;


From Assam and Thailand. In the Denny collection there are 7 9 labelled Nymus fusca by the person responsible for mounting this collection and who rarely kept Denny's original labels. These specimens have no host label, but three of the specimens have a small circular (probably original) label with what appears to be "aenigmaticus." This must refer either to aenigmaticus, the new name given to fusca by Denny in 1842 or to the name of the host, C. aenigmaticus. The three females so labelled together...
with one other: are the species usually found on C. aeruginosum: two other females are D. regalis and presumably came from Milus titans referred to by Denny (1842: 119) and one other female is D. fulva and presumably came from Buteo lagopus also referred to by Denny. One of the females labelled "aeruginosum" will be selected as lectotype of fascia.

Lectotype: 2, slide no. 350, in the Denny collection, British Museum (Natural History); paratypes, 3 3 in the same collection.

Measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th></th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>Breadth</td>
<td>Length</td>
</tr>
<tr>
<td></td>
<td>(Range)</td>
<td>(Mean)</td>
<td>(Range)</td>
</tr>
<tr>
<td>Head</td>
<td>0.51-0.57</td>
<td>0.54</td>
<td>0.53-0.55</td>
</tr>
<tr>
<td>Prothorax</td>
<td>0.50-0.58</td>
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<td>0.49-0.53</td>
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<tr>
<td>Pierothorax</td>
<td>0.49-0.51</td>
<td>0.50</td>
<td>0.42-0.45</td>
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<tr>
<td>Abdomen</td>
<td>1.88-2.12</td>
<td>1.90</td>
<td>1.89-2.07</td>
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<tr>
<td>Genitalia</td>
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<td>0.38-0.40</td>
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<tr>
<td>C.I.</td>
<td>0.75-0.81</td>
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</tr>
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</table>

Female. Terga of IX-XI as in fulva. Genital region similar to fulva but genital plate narrower from side to side and the subovulval suture shorten with blunter ends (Text-fig. 71); there are fewer sensilla anterior to the vulval margin.

Character of Abdomen. Tergal central setae: II, 6; III-V, 6-8; VI-VIII, 6; X in the male has 1-2 each side and in the female 2. Pleural and sternal setae as in fulva except that there is a pleural seta each side of IV.

Material Examined. Five, 2, 2; from Theraphosus cuniculatus (Daudin) from Lodwar, Kenya, 7, IV, 1934 (skin in Nairobi Museum) collected by G. H. E. Hopkins. Holotype male and allootype female slide no. 623 in the British Museum (Natural History) from Theraphosus cuniculatus with data as given above, presented by Mr. Hopkins. Paratypes: 4, 2, from the same individual.

Measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th></th>
<th>Female</th>
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<td></td>
<td>(Range)</td>
<td>(Mean)</td>
<td>(Range)</td>
</tr>
<tr>
<td>Head</td>
<td>0.53-0.55</td>
<td>0.55</td>
<td>0.43-0.48</td>
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<tr>
<td>Prothorax</td>
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<td>0.49-0.49</td>
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<tr>
<td>Pierothorax</td>
<td>0.47-0.50</td>
<td>0.49</td>
<td>0.42-0.50</td>
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<tr>
<td>Abdomen</td>
<td>1.92-2.07</td>
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<tr>
<td>Genitalia</td>
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<tr>
<td>C.I.</td>
<td>0.81-0.85</td>
<td>0.83</td>
<td></td>
</tr>
</tbody>
</table>

Degeeriella hopkinsi sp. n.

Type host: Theraphosus cuniculatus (Daudin)

(Pl. 4, fig. 2; Text-figs. 33, 40, 71)

This species is distinguished from the rest of the fulva species group by the presence of a pleural seta on segment IV.

Male. Head broad and rounded anteriorly; inner edge of marginal carina indentate dorsally in mid-line; ventral suture extends to or nearly to the anterior margin. Terga II-III indented; pleural thickening narrow with re-entrant heads normal only on segment III, gradually becoming more and more reduced on the following segments. Genitalia similar to those of fulva but differ in detail (Text-figs. 33, 40). There is some variation in the number and position of the setae associated with the ventral arms of the endosomal plate in the male examined: two specimens had an extra seta on each side anterior to the second of the arms, one had three setae on one arm and on the other one anterior to the arm and on the arm, one specimen was normal and in one the setae could not be seen.

Degeeriella leucopraera (Nitzsch), 1874

Type host: Cercophas prosecosa J. W. Muller

(Pl. 4, fig. 1; Text-figs. 34, 35, 39, 80)

Niris leucopraera Nitzsch, 1874. In Giebel, Insecta optica 119. Host: Falco brachy-
dactylus = Cercophas prosecosa J. W. Muller.

Niris leucopraera Pagen, 1930. Tijdschr. Ent. 33: 228. Pl. 8, fig. 6. Host: Buizeris manni-
lensis. Error.

This is a distinctive species separated by the shape of the head, form of the pleural thickening and absence of pleural seta on V.

Male. Head broad with preantennal region rounded; inner dorsal edge of marginal carina with slight median indentation; ventral suture does not reach anterior margin. Abdomen elongated and with neither terga II nor III with a
definite median slit-like indentation although II may show a slight concavity. In spite of the elongated abdomen the pleural thickening does not have the strongly sclerotized re-entrant heads characteristic of this species group. Genitalia as shown in Text-figs. 34, 59.

**Female.** Terga of IX-XI as in *fulva*. Posterior margin of genital plate deeply emarginate and subvilval sclerites stouter than in *fulva* (Text-figs. 79, 89).

**Chaetotaxy of Abdomen.** Tergocentral setae: II normally 6, range 4-6; III-V normally 8, range 6-8; VI-VII normally 6, range 5-7; VII normally 4, range 3-4. X in the male with 1 each side, in female 2 each side. One female has 4 tergoventral setae on II and 6 on III-VII. Pleural setae: II-V, 0; VI-VII, 2 each side; VIII, 3; in the male IX has 3 and X, 0. In the female IX has 3 and X 2 each side. Sternocentral setae: I-II normally 4, one male has 3 on VI and one female has 6 on V; in the male the last segment does not have the usual spine-like seta each side and the second seta therefore, if present, is not distinguishable from the marginal setae which total from 10-15.

**Nymph.** Second and third instars have the curvature of the anterior margin of the head similar to that of the adult; the preantennal region is shorter and the sides less straight, as is usual in nymphs.

*Nirnum temporalis* Piaget said to have come from *Buceros manillensis* is represented in the Piaget collection by a single male which appears to be the same as *D. leucopleura* and is presumably a straggler from *Circatius*.

**Material Examined.** Four ♂, 2 ♀ from *Circatius cinereascens* J. W. Müller from Kapenguria, Kenya and 1 ♂ from the same host species from E. Africa (skin); 7 ♂, 11 ♀ from *Circatius galiinus* (Gmelin) from France, Czechoslovakia, Egypt (skin) and Cameroon (skin); 1 ♂, 1 ♀ from *Circatius cinereus* Vieillot from Portuguese Guinea.

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**Measurements in mm.**

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head (♂)</td>
<td>0.65-0.67</td>
<td>0.66</td>
</tr>
<tr>
<td>Pronotum (♂)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pterothorax (♂)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Abdomen (♂)</td>
<td>1.52-1.43</td>
<td>1.43</td>
</tr>
<tr>
<td>Total (♂)</td>
<td>2.33-2.45</td>
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</tr>
<tr>
<td>Genitalia (♂)</td>
<td>0.43</td>
<td>—</td>
</tr>
<tr>
<td>C.L. (♂)</td>
<td>0.79-0.81</td>
<td>0.80</td>
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<tr>
<td><strong>Female</strong></td>
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<tr>
<td>Head (♀)</td>
<td>0.68-0.69</td>
<td>0.69</td>
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<tr>
<td>Pronotum (♀)</td>
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<tr>
<td>Pterothorax (♀)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Abdomen (♀)</td>
<td>1.40</td>
<td>—</td>
</tr>
<tr>
<td>Total (♀)</td>
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<td>—</td>
</tr>
<tr>
<td>C.L. (♀)</td>
<td>0.77-0.83</td>
<td>0.80</td>
</tr>
</tbody>
</table>

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**The discocephalus Species Group**

1. Head index greater than 0.54.
2-7. As in *fulva* group.
4. Thoracic sternal plate as in Text-fig. 119.
5. Thorax and abdomen shape as in Pl. 9, fig. 1.
6-7. As in *fulva* group.
8. Pleural thickening without well sclerotized re-entrant heads.
10. Male genital plate small and irregular and less indented laterally than in *fulva* group.
11-13. As in *fulva* group.
14. Setae each side of posterior dorsal margin of pterothorax variable in number and position.
15. Pleural setae absent on segments II-III.
16. Sternoventral setae of segments III-VI variable.
17. As in *fulva* group.

This species group is distinguished from the *fulva* group by the shape of head and abdomen; from the *punctifer* group by the absence of head sutures and chaetotaxy of the temples, and in the females by the dorsal chaetotaxy of tergum IX and in the male by the characters of the male genitalia.
Degeeriella discocoephalus discocoephalus (Burmeister), 1838

Type host: Haliaeetus albicilla (Linn.)

(Pl. 9, fig. 1; Text figs. 35, 51, 72, 106, 119)


The specimens used by Burmeister for his description of this species were figured by Nitsch in Giebel, 1874 (pl. 7, fig. 10) and represent the species described below.

**Male.** Marginal carina thick and entire; ventral suture reaches to or nearly to inner margin of marginal carina. Thoracic sternal plate as in Text-fig. 119, but shows some variation in outline; posteroventral marginal setae of pterothorax variable in number and position, 4–6 each side (omitting the lateral spine-like seta and the seta with a small alveolus). Tegum II with median unciliated area, tegum III somewhat narrowed medially. Genitalia of fulva type; dorsal endosomal arms may or may not join basal apodeme.

**Female.** This species differs from all other known Degeeriella in having two (occasionally one) setae in the middle of the anterior region of tegite IX; these setae are occasionally found as an abnormality in species of the fulva group. The subbuvulal sclerites are small and indistinct and almost covered by the vulva (Text-fig. 72).

**Chaetotaxy of abdomen.** Tergocentral setae: II range 6–8; III–V, normally 8, range 6–9; range 6–8; VII–VIII normally 6, range 6–7; X in the male normally 2 each side, range 2–4; in the female IX has 2 (rarely 1) anterior setae; X has 2 each side. Pleural setae: II–III, 0; IV–V, 1 each side; VI–VII, 2 (occasionally 1 or 3 on one side); VIII, 3; IX, 2; X in the male has 1 and in the female 2. Sternocentral setae irregular in number: II, 4–7; III–IV, 5–8; V, 5–7; VI, 4–7; total number of setae of segments II–VI of specimens counted varied from 24–34; in the male the last pair of sternal setae are both elongated. Total number of marginal setae of last segment in male varies from 12–16.

**Nymph.** One third instar from Haliaeetus albicilla has been seen, this resembles the adult in the shape of the head.

**Material examined.** Fourteen ♂, 12 ♀ from Haliaeetus albicilla (Linn.) from Germany, Czechoslovakia, Finland and Russia; 2 ♂, 5 ♀ from Haliaeetus pelagicus (Pallas) from Siberia; 7 ♀, 3 ♂ from Haliaeetus leucocephalus (Linn.) from various localities in N. America. There appear to be no constant characters on which the population (i.e. D. amblyz (Kellogg)) found on this latter host can be separated from discocoephalus.

**Nectype of Nirurus discocoephalus Burmeister:** ♂ in the British Museum (Natural History), slide no. 617 from Haliaeetus albicilla from Samorin, Czechoslovakia, 9. xii. 1952.
Degeeriella discocephalus aquilarum Eichler, 1943
Type host: Aquila n. nipalensis (Hodgson)  
(Pl. 9, fig. 2)

Degeeriella aquilarum Eichler, 1943. 

This subspecies is close to the nominate form, from which it can be separated by the shape of the anterior margin of the head, the slightly better developed pleural thickening, especially on segment III and the fewer number of tergo-sternal setae as follows:

<table>
<thead>
<tr>
<th>Tergocentral II-VII</th>
<th>Sternocentral II-VI</th>
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<tbody>
<tr>
<td>Maximum</td>
<td>Minimum</td>
</tr>
<tr>
<td>D. d. discocephalus</td>
<td>52</td>
</tr>
<tr>
<td>D. d. aquilarum</td>
<td>42</td>
</tr>
</tbody>
</table>

Specimens Examined: Nine ♛, 8 ♀ from Aquila n. nipalensis Hodgson from Somaliland; 1 ♛, 1 ♀ from Aquila nipalensis orientalis Cabanis, no data: 4 ♛, 4 ♀ from Aquila chrysaetos (Linn.) from Norway and Serbia; 1 ♛, 2 ♀ from Aquila fomarina hastata (Lesson) from Rajpata, India and Manipur; 8 ♛, 4 ♀ from Aquila rapax rapax A. E. Brehm from Somaliland; 4 ♛, 3 ♀ from Aquila k. helvaca Savigny from Czechoslovakia, Egypt and Rajpata, India; 1 ♛ from Aquila clanga Pallas from Russia.

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There appear to be no constant differences between the populations from these species of Aquila, although no doubt there will be found some differences in average sizes when larger numbers are available.

<table>
<thead>
<tr>
<th>Measurements in mm.</th>
<th>Specimens from Aquila n. nipalensis</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Male</td>
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<tr>
<td></td>
<td>Range Mean</td>
</tr>
<tr>
<td>Head</td>
<td>0.44-0.47</td>
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<tr>
<td>Prothorax</td>
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</tr>
<tr>
<td>Pierothorax</td>
<td>——</td>
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<tr>
<td>Abdomen (♀)</td>
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<tr>
<td>Total (♀)</td>
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<tr>
<td>C. I. (♀)</td>
<td>0.96-1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurements in mm.</th>
<th>Male</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>Range Mean</td>
</tr>
<tr>
<td>Head</td>
<td>0.44-0.47</td>
</tr>
<tr>
<td>Prothorax</td>
<td>——</td>
</tr>
<tr>
<td>Pierothorax</td>
<td>——</td>
</tr>
<tr>
<td>Abdomen (♀)</td>
<td>0.81-0.94</td>
</tr>
<tr>
<td>Total (♀)</td>
<td>1.43-1.53</td>
</tr>
<tr>
<td>C. I. (♀)</td>
<td>0.96-1.02</td>
</tr>
</tbody>
</table>

**The elani Species Group**

1-5. As in fulva group.
6. As in fulva group; ellen and tendeiroi. Tergal plates of segment XI apparent in male: elani, meierzhageni, guimarãesi.
7. As in fulva group; ellen, tendeiroi and guimarãesi. As in rufa group; elani and meierzhageni.
8-9. As in fulva group.
10. As in fulva group; ellen. Male genital plate laterally indenting to a greater extent; elani, tendeiroi, meierzhageni and guimarãesi.
11. As in fulva group; elani, elani, tendeiroi, meierzhageni. Female genital plate with median prolongation; guimarãesi.
12. As in fulva group; elani, elani, tendeiroi. Inner genital sclerites fused; meierzhageni and guimarãesi.
13. As in fulva group; elani, elani, tendeiroi. Distinctive types: meierzhageni and guimarãesi.
14. As in fulva group.
15. Pleural setae absent on segments II-IV; ellen. Pleural setae absent on segments II-V; elani, tendeiroi, meierzhageni, guimarãesi.
16-17. As in fulva group.

It appears that these five species do not form a very homogeneous group and are here placed together mainly on the form of the ventral carinae which show a greater development anteriorly than those of any other species; this character is more marked in meierzhageni and guimarãesi than in the others. Apart from this character ellen and perhaps tendeiroi could be included in the fulva group; the rest of the species share some rather distinctive characters; guimarãesi has certain characters found elsewhere only in rufa. It is possible that these five species do not, in fact, form a related group.
Degeeriella ebela Clay, 1958

Type Host: Anceda leuphostes burmanica (W. L. Schlater)

(Pl. 7, figs. 3, 6; Text-figs. 52, 76, 90)


This species is distinguished from the rest of the species group by the presence of pleural setae on segment V, by the shape of the head and the male genitalia. It is separated from members of the fulva group, which it resembles in many characters, by the greater development of the ventral carinae anteriorly, and by a combination

of the characters of the ventral suture, the marginal carinae of the temples, the pleural thickening of the abdomen and the details of the male genitalia.

MALE. Inner dorsal edge of marginal carina indented mediately; ventral suture reaches to or nearly to anterior margin; marginal temporal carinae broad. Terigites II and III show all stages from a slight median concavity to a well marked slit. Pleural thickening with dorsal outline narrow and straight and ventral outline broader and more rounded. Male genitalia as in Pl. 7, fig. 6 and in Text-fig. 52. Internal genitalia are similar to those of D. fulva from Buteo buteo but the vesicular apparatus is longer (1 specimen: 0.78 mm.), and the lateral lobes are relatively shorter (0.32 mm.).

FEMALE. Terga of IX-XI as in fulva. Genital region with rather narrower inner genital and subvulval sclerites than in fulva (Text-figs. 76, 90).

Chaetotaxy of abdomen. Tergocentral setae: II, 4; III-VII normally 6, range 5-8; VIII varies from 3-7; X in the male with one each side, in female with 2 each side. Pleural and sternocentral setae as in fulva. Total number of marginal setae of last segment of male varies from 8-10. One female has only 4 tergocentral setae on each of segments III-V.

Nymphs. Second and third stage nymphs have the anterior margin of the head pointed.

Material examined. Holotype male and allotype female and 16 g. 13 ♀ paratypes from Anceda leuphostes burmanica from Dusai District, Thailand. A small number of specimens from Anceda cuculoides Swainson from Africa differ from the above, but are not in sufficiently good condition for identification.

Measurements in mm.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Measurements</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>breadth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range Mean</td>
<td>Range Mean</td>
<td></td>
</tr>
<tr>
<td>Head (17)</td>
<td>0.55-0.58</td>
<td>0.57</td>
<td>0.43-0.47</td>
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<tr>
<td>Prothorax (16)</td>
<td>—</td>
<td>—</td>
<td>0.30-0.32</td>
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<tr>
<td>Mesothorax (10)</td>
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<td>—</td>
<td>0.46-0.52</td>
</tr>
<tr>
<td>Abdomen (10)</td>
<td>1.20-1.29</td>
<td>1.25</td>
<td>0.58-0.63</td>
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<tr>
<td>Total (10)</td>
<td>2.12-2.23</td>
<td>2.18</td>
<td>0.78-0.86</td>
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<tr>
<td>C.I. (10)</td>
<td>0.40-0.42</td>
<td>0.79</td>
<td>0.47-0.50</td>
</tr>
</tbody>
</table>

Degeeriella tenedrol sp. n.

Type host: Campylopus luscinoides vaninumoides Vigors

(Pl. 6, fig. 2; Text-figs. 37, 53, 92)

This species in general appearance resembles elani, but the head is more pointed, the median point being formed by the marginal carinae and not in part by the hyaline
margin as in _elani_. It is distinguished from other species in the species group, except _elobi_, by the absence of tergal plates on segments XI of the male and from _elobi_ by the shape of the head.

**Male.** Marginal carina pointed medially and inner margin indented; ventral suture does not reach to anterior margin. Tergite II only with median indentation. Pleural thickening broad with inner ventral margin rounded. Genitalia of _fulus_ type.

**Female.** Terga of IX–XI as in _fulus_. Inner genital sclerites as in _elobi_; subvalval sclerites as in Text-fig. 92.

**Ceratotaxy of abdomen.** Tergoventral setae: II nearly 4, range 3–4; III–VI normally 6, range 5–6 (one 7 with only 3 setae on III); VII–VIII, range 4–6; X in male 2–3 each side, in the female 2 each side. Pleural setae: II–V, 0; remainder as in _fulus_. Sternocentral setae: II, range 2–4, remainder as in _fulus_. Total number of marginal setae of last segment of male varies from 11–12.

**Material examined.** Four ♀, 3 ♂ from _Camponyx s. swainsoni_ Vigors (skin) from Argentine.

_Holotype ♀, allotype ♀_ in the British Museum (Natural History), slide no. 622 and 3 ♀, 2 ♂ _paratypes_ all from _Camponyx s. swainsoni_ with data as given above.

Named in honour of Dr. João Tendério in acknowledgment for his co-operation during this study of _Degereciella_.

**Measurements in mm.**

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>Breadth</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head (♀)</td>
<td>-</td>
<td>o.48–0.92</td>
<td>-</td>
<td>o.37–0.38</td>
</tr>
<tr>
<td>Prothorax (♀)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>o.25–0.27</td>
</tr>
<tr>
<td>Pterothorax (♀)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>o.37–0.43</td>
</tr>
<tr>
<td>Abdomen (♀)</td>
<td>-</td>
<td>o.37–0.55</td>
<td>-</td>
<td>o.28–0.29</td>
</tr>
<tr>
<td>Total (♀)</td>
<td>-</td>
<td>o.92–0.97</td>
<td>-</td>
<td>o.79–0.75</td>
</tr>
</tbody>
</table>

**Degereciella elani** Tendério

_Type host:_ _Elaus caerulescens_ (Desfontaines)

(Pl. 6, fig. 1; Text-figs. 4, 35, 54, 97)


This species is separated from _elobi_, _meinertzhageni_ and _gumiardesi_ by the shape of the head and other characters as given above under the species group; differences from _tendério_ are given above under that species.

below suture between segments X and XI. Pleural thickening similar to that of _tendério_. Genitalia as shown in Text-figs. 36, 54; there is considerable variation in the height of the ventral endosomal arms. Internal genitalia from a specimen from _Elaus caerulescens_ from Thailand are rather similar to those of _D. fulus_ from _Buteo buteo_ (Text-fig. 4).

**Female.** Terga IX–XI with unsclerotized areas round setae usually as in Text-fig. 105, but there is some variation in this character. Genital region as in Text-fig. 97.
Revisions of Mallophaga Genera

Chaptotaxy of Abdomen. Tergocentral setae: II normally 4, range 4-5; III-V normally 6, range 5-7; VI normally 6, range 4-6; VII normally 4 range 4-5; X in the male 1-2 each side, in the female 2 each side. Pleural setae: II-V, 6; rest of pleural setae and sternocentral setae as in fulca. Total number of marginal setae, dorsal and ventral of last segment of male varies from 11-14.

Material Examined. One ♀ paratype from Eulalus caerulescens without locality; 11 ♂, 12 ♀ from Eulalus c. caerulescens (Desfontaines) from Kenya, Uganda, N. Rhodesia and the Cameroons; 5 ♂, 4 ♀ from Eulalus caerulescens (Latham) from Ceylon, India and Thailand; 3 ♂, 1 ♀ from Eulalus notatus Gould from Cairns, Australia; 3 ♂, 1 ♀ from Eulalus i. leucurus (Vieillot) from S. Paulo, Brazil.

Measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>Mean</td>
<td>Range</td>
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<tr>
<td>Head</td>
<td>0.47-0.52</td>
<td>0.49</td>
<td>0.36-0.40</td>
</tr>
<tr>
<td>Prothorax</td>
<td></td>
<td></td>
<td>0.25-0.27</td>
</tr>
<tr>
<td>Pterothorax</td>
<td></td>
<td></td>
<td>0.35-0.42</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0.96-1.08</td>
<td>1.03</td>
<td>0.45-0.53</td>
</tr>
<tr>
<td>Total</td>
<td>1.71-1.88</td>
<td>1.78</td>
<td>1.71-1.88</td>
</tr>
<tr>
<td>Genitalia</td>
<td>0.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.I.</td>
<td>0.73-0.79</td>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Head</td>
<td>0.59-0.63</td>
<td>0.62</td>
<td>0.38-0.41</td>
</tr>
<tr>
<td>Prothorax</td>
<td></td>
<td></td>
<td>0.23-0.28</td>
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<tr>
<td>Pterothorax</td>
<td></td>
<td></td>
<td>0.42-0.45</td>
</tr>
<tr>
<td>Abdomen</td>
<td>1.23-1.35</td>
<td>1.28</td>
<td>0.55-0.66</td>
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<tr>
<td>Total</td>
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<tr>
<td>Genitalia</td>
<td>0.48-0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.I.</td>
<td>0.75-0.82</td>
<td>0.77</td>
<td></td>
</tr>
</tbody>
</table>

Degeeriella meinertzhageni Clay. 1958

Type host: Chelertia riocornis (Vieillot) (Pl. 7, figs. 2, 5; Text-figs. 60, 61, 73, 93, 125)

This species resembles guinarus in the form of the ventral carinae and is distinguished by the shape of the head and the male genitalia.

Male. Inner dorsal margin of marginal carina indented medially; ventral suture does not reach to anterior margin of head; ventral carinae each with flattened edge parallel to that of opposite carina to which is attached a lobe of the pudibum.
**Revisions of Mallophaga Genera**

**Male.** Marginal carina reduced centrally with hyaline margin in this area; inner dorsal margin of marginal carina indented medially; ventral suture does not reach anterior margin; ventral carinae and pulvinus as in *meanaealagiens*; dorsal preantennal region with sculpture. Tergites II-III without median indentation, but II usually shows a more lightly sclerotized central concave area; shape of fused terga IX-X characteristic (Text-fig. 100); tergal thickening of XI present as a single plate which may be interrupted medially. Pleural thickening narrow.

**Female.** Tergites IX-XI as in *fula*. Genital region as shown in Text-figs. 74, 94, genital plate with median prolongation; inner genital sclerites fused in mid-line and inner edge of vulva toothed.

**Chaetotaxy of Abdomen.** Tergocentral setae of male: 4; III-IV normally 4, range 4-5; V-VI range 4-6; VII-VIII normally 6, range 4-6; X normally 2+2, one specimen with 4+4. In the female tergocentral setae fewer in number: II-VII normally 4, range 3-5; X, 2-2 each. Pleural setae: II-V, 0 (two females have one on each side of VI); VI-VII, 2 each side; VIII, 3; in the male IX has 2 and X, 0; in the female IX-X, 1-2 each side. Sternocentral setae: II, 2; III-VI normally 4, range 3-4. Total number of marginal setae dorsal and ventral, of the last segment in the male varies from 10-14.

**Material Examined.** Holotype male and allotype female and 9 ♀, 15 ♀ paratypes from *Elaeotes f. forficatus* (Lin.) from Florida and from *Elaeides f. yepa* (Vieillot) from Brazil.

**Measurements in mm.**

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
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</thead>
<tbody>
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<td>0.575</td>
</tr>
<tr>
<td>Prothorax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pterothorax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdomen</td>
<td>1.4-2.18</td>
<td>1.45</td>
</tr>
<tr>
<td>Total</td>
<td>2.0-2.15</td>
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</tr>
<tr>
<td>Genitalia</td>
<td>0.45-0.44</td>
<td></td>
</tr>
<tr>
<td>C.I.</td>
<td>0.74-0.79</td>
<td>0.76</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
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<td>0.60</td>
</tr>
<tr>
<td>Prothorax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pterothorax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdomen</td>
<td>1.1-1.38</td>
<td>1.29</td>
</tr>
<tr>
<td>Total</td>
<td>2.49-2.33</td>
<td>2.47</td>
</tr>
<tr>
<td>C.I.</td>
<td>0.75-0.79</td>
<td>0.77</td>
</tr>
</tbody>
</table>

**The *fula* Species Group**

1-3. As in *fula* group.

4. Outline of thoracic sternal plate rather more rounded than in *fula* group, and as in this group shows individual variation in shape, and arrangement and number of setae.

5. As in *fula* group.

6. Tergal plates of segment XI apparent in male.
8–10. As in fulva group.
11. Female genital plate with median posterior prolongation.
12. As in fulva group.
13. As in Pl. 8, fig. 7; penial sclerite absent.
14. As in fulva group.
15. Pleural setae absent on II–III and present on X of male.
16. Sternomental setae of segments III–VI average more than 5 per segment.
17. As in fulva group.

This species group contains a single species which has a superficial resemblance to members of the fulva group, but is, however, quite distinct from these and other species considered here in having 2 pleural setae each side of segment X in the male and in the absence of the penial sclerite; in the female it differs from all other species, except D. guimardiiæ, in the form of the genital plate. The ventral carinae and pulvini of the nymph resemble those of the nymphs and adults of this latter species.

Degeeriella rufa (Burmeister), 1838

Type host: Falco tinnunculus Linn.

(Pl. 6, fig. 3; Pl. 8, fig. 7; Text-figs. 5, 10, 18–22, 38, 55, 75, 95, 104, 107, 111, 120, 129, 139–164)


Nimræ rufæ was described by Burmeister from specimens in the Nitzsch collection from which the figure in Giebel, 1874 (pl. 7, figs. 11–12) were made; these figures represent the species described below.

The characters distinguishing D. rufa are given above under the definition of the species group of which it is the only species.

MALE. Inner edge of marginal carina not or slightly indented medially; ventral suture variable in form, does not reach anterior margin of head (Text-fig. 111). Tergites II–III with median indentation, that of III occasionally being partly occluded; tergites of XI present as two well marked sclerites. Pleurites as in Text-fig. 104. Genitalia as in Pl. 8, fig. 7, and Text-figs. 38, 55; penial sclerite absent. Internal genitalia characteristic (Text-fig. 5).

FEMALE. Fused terga of IX–XI with a continuous unsclerotized area round the two setae each side (Text-fig. 107). Genital region as in Text-figs. 75, 95; genital plate differs from all other known species except guimardiiæ in having a central posterior prolongation (Text-fig. 95).

CHAROTAXY OF ABDOMEN. Tercentrational setae: II, normally 6, range 5–8; III–VI, normally 8, range 6–11; VII normally 6, range 5–8; VIII range 4–8, in the female rarely less than 6; X, 2 each side. Pleural setae: II–III, 0; IV–V, 1 each side; VI–VII, 2; VIII, 3; IX–X, 2 each side. Stercomental setae: II, normally 5, range 4–6; III–VI normally 6, range 5–7. Total number of marginal setae of last segment of male varies from 10–14.

Nymphs. All nymphal instars of this species are available and have been discussed above, p. 129 and figured (Text-figs. 10, 15–22).

Measurements in mm.

D. rufa from Falco t. tinnunculus

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Breadth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Head</td>
<td>0.40–0.55</td>
<td>0.50</td>
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<tr>
<td>Prothorax</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pleurothorax</td>
<td>1.05–1.32</td>
<td>1.15</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0.41–0.44</td>
<td>0.43</td>
</tr>
<tr>
<td>Total</td>
<td>0.75–0.83</td>
<td>0.79</td>
</tr>
<tr>
<td>Head index</td>
<td>0.70–0.76</td>
<td>0.70</td>
</tr>
<tr>
<td>Head index A (28)</td>
<td>0.60–0.66</td>
<td>0.63</td>
</tr>
</tbody>
</table>

* First to pick at random. A: Head index of specimens from F. rusticolus ciliatus.

**Female**

(20)

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>0.50–0.77</td>
<td>0.53</td>
</tr>
<tr>
<td>Prothorax</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pleurothorax</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Abdomen</td>
<td>1.23–1.40</td>
<td>1.31</td>
</tr>
<tr>
<td>Total</td>
<td>2.02–2.25</td>
<td>2.14</td>
</tr>
<tr>
<td>Head index</td>
<td>0.78–0.83</td>
<td>0.80</td>
</tr>
</tbody>
</table>

**Table 1.** — Average Number of Total Tercentrational Setae of Abdominal Segments II–VIII and Breadth of Head at Temples in Males of D. rufa from Various Species of Falco

<table>
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<tr>
<th>Tercentrational setae</th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.33–0.40</td>
<td>0.37</td>
</tr>
<tr>
<td>B</td>
<td>0.37–0.43</td>
<td>0.40</td>
</tr>
<tr>
<td>C</td>
<td>0.38–0.42</td>
<td>0.40</td>
</tr>
<tr>
<td>D</td>
<td>0.37–0.47</td>
<td>0.40</td>
</tr>
<tr>
<td>E</td>
<td>0.38–0.44</td>
<td>0.41</td>
</tr>
<tr>
<td>F</td>
<td>0.40–0.42</td>
<td>0.41</td>
</tr>
<tr>
<td>G</td>
<td>0.40–0.45</td>
<td>0.42</td>
</tr>
<tr>
<td>H</td>
<td>0.41–0.43</td>
<td>0.43</td>
</tr>
<tr>
<td>I</td>
<td>0.40–0.45</td>
<td>0.42</td>
</tr>
</tbody>
</table>

A, F. sparvarius; B, F. fulvus; C, F. calamarius; D, F. tinnunculus; E, F. luggeri; F, F. rusticolus; G, F. gueeninus; H, F. biomerius; I, F. rusticolus; number of specimens given in brackets.

VARIATION AND HOST DISTRIBUTION. Over 1,100 specimens have been examined from 19 of the 33 species of Falco. With the exception of the population from Falco sparvarius no differences could be found between the populations from the various hosts except in measurements, number of abdominal setae and characters
of the preantennal region of the head. In the case of the measurements of the head breadth, some populations averaged larger but there was overlap between individuals of most of the populations measured (Table I). Again, some populations averaged a larger number of tergocentral setae but there were individuals in all populations with a similar number of setae on each segment. A statistical analysis of these numbers may show that the differences between some of these populations are significant, but it is not considered that such populations should be recognized taxonomically on these characters alone. As pointed out by Teodoro (in press) there is in addition marked differences in the shape of the preantennal region of the head in the populations from some of the species of Falco making them easily recognizable, while between others the differences are slight. These differences are also reflected in the nymphs, which in some cases (Text-figs. 21–22) differ more in this stage than in the adults (Text-figs. 144, 147). The problem is further complicated by some populations showing considerable individual variation; three specimens (Text-figs. 151–153) from Falco eleonorae taken from the same host and subjected to the same treatment might be included in three different subspecies; the specimen from F. biarmicus (Text-fig. 139) is more similar to that from F. peregrinus (Text-fig. 140) than are the specimens from these two hosts shown in Text-figs. 140, 148. Variation in specimens from other hosts are shown in Text-figs. 143–145, 146–147 and 163–164. Further, it is not possible to reduce these differences to mathematical terms and the human eye is easily subject to optical illusions.

There is a tendency in some cases for the populations in which the members average larger for these to have the preantennal region of the head more rounded (cf. Text-figs. 146 and 150, 142 and 155) and to average a greater number of abdominal setae; the increase in size of the specimens is roughly related to the size of the host. Thus, similar-sized species of Falco may be parasitized by Degeriella, with similar average size, a similar number of abdominal setae and heads of a rather similar shape even though these falcons may not be closely related. If the subgeneric divisions of Falco as given in Peters (1931) are taken as a measure of relationship, then the not closely related F. peregrinus and F. biarmicus of similar size are found to have parasites with similar average measurements for the breadth of the head, average number of abdominal setae and a rather similar shaped head (Text-figs. 139, 149) whereas those from the related fimbriatus and sparverius differ on the larger host by having a larger average measurement of the head with a less narrowed anterior margin and a larger number of abdominal setae. Thus, two or three differences between two populations may all be associated with difference in size which is itself correlated with differences in host size and does not, therefore, necessarily reflect relationship. This is shown in Table I which gives the head measurements and tergocentral setae; these are arranged in order of increasing size of the breadth of the head. It will be seen that this reflects the size of the hosts, but an exact numerical comparison is not possible as the races of different species of hawks overlap, thus the larger races of the "smaller" Falco may overlap with the smaller races of the "larger" species, and moreover the males of the smaller races of the "larger" species may be smaller than the females of the "smaller"
species. More material is required from some species to confirm that the differences between the Degeeriella populations are significant and adequate samples of parasites from the different races of a species such as F. pergerinum, which vary considerably in size, must be measured to see whether those from the smaller races differ from those from the larger. In addition, there is some similarity between the shape of the heads of specimens from related hosts, e.g. those from *F. rusticulos* and *F. jaggeri*. Thus, the size and shape of the head may reflect either relationship or size of the host irrespective of relationship. Figs. 139-144 show the outline of the anterior margin of the heads of specimens from various species of *Falco* and the related *Ieracidea*; these are not drawn to the same scale but in such a way that the breadth of the temples is the same throughout, this enables a more accurate comparison of shape to be made. It will be seen from these figures that while some of the populations are quite distinct, others, especially taking into account individual variation, are doubtfully separable. As already discussed above it must be largely a matter of personal opinion as to which of these populations should be recognized taxonomically and it is possible that the systematics might be simplified by considering them as belonging to a single species with a tendency to develop local populations on the different species of *Falco*. The recognition by name of the more distinct populations must result in the endless proliferation of names for those which vary slightly in size, proportions and curvature of the anterior margin, often depending on the individual specimen available. Names have been given to many of the populations, as listed below, and the present writer does not at the moment intend to increase these by naming other populations which do not exactly correspond to these; this should perhaps wait until adequate series have been seen from more species of *Falco* and their races.

Names Given to the Different Populations of *D. rufa* from *Falco*


*Degeeriella* *falcinaides* Carriker, 1956. *Florida Ent. 32*: Host: *Falco mexicanus* Schlegel.


1 The interpretation of these names is doubtful, see below, p. 229.

Material Examined. 3 *D. rana* and 2 *D. j. 3* *paratypes of *Nirrus fasciatus* Rudow (see Clay & Hopkins, 1955: 59); 3 *D. rusticolus* and 5 *D. j. 3* *paratypes of* *Nirrus quadratocollis* Rudow (see Clay & Hopkins, 1955: 59); 3 *D. rufipes* (slide no. 1388), Piaget collection in the British Museum (Nat. Hist.) and 1 *D. t. 3* *paratypes of* *Nirrus platyplatypterus* Piaget; 1 *D. j. 1* *paratypes of Degeeriella falconoides* Carriker; 4 *D. j. 3* *paratypes of *D. rufa* *aplana* Tendeiro. Over 1,000 specimens (males and females) from the following species of *Falco*: *F. banniert* Linne from Sinai, Somaliland, Tanganyika, Natal and Cape Colony; *F. chrysa* J. E. Gray from Czechoslovakia and India; *F. mexicanus* Schlegel from U.S.A. and Mexico; *F. jaggeri* J. E. Gray from Afghanistan and India; *F. rusticolus* Linn. from Greenland, Iceland, Norway and Canada; *F. peregrinus* Tindall from Czechoslovakia, Egypt, Sudan, Ceylon, Manchuria and British Columbia; *F. subbuteo* Linn. from Finland, Uganda, Tanganyika, and Afghanistan; *F. cupreus* A. Smith from French Cameroun; *F. eleonorae* Gené from Morocco, Crete and Cyprus; *F. concolor* Temminck from Egypt; *F. hypoleucos* Gould from New South Wales, Australia; *F. fuscocincticeps* Vieillot from S. Paulo, Brazil; *F. colombianus* Linn. from British Isles and Hungary; *F. ardosiacus* Vieillot from Portuguese Guinea and Uganda; *F. vespertinus* Linn. from Fair Isle, Estonia and Cyprus; *F. amurensis* Radde from Korea; *F. nanannon* Fleischer from Palestine, Kenya and Afghanistan; *F. imnicus* Linn. from British Isles, France, Switzerland, Poland, Madeira, Asia Minor, Palestine, Jordan, Egypt, Uganda, Tanganyika, Cape Colony, Aden, Northern India, Ladak, Sikkim, Manipur and Burma; *Falco alophes* (Hougin) from the Sudan. Eleven 3 *D. 3* *and 1* *paratypes of* *Ieracidea orientalis* (Schlegel), no data.

*Degeeriella rufa* *carruthi* Emerson, 1953

Type host: *Falco s. sparrius* Linn.

(Text-figs. 126-128)


This subspecies differs from the nominate form in the narrower preentral region, the anterior margin sometimes being rather pointed, but this pointed appearance is absent in some specimens (cf. Text-figs. 126-128). In addition, both sexes can be recognized by the sculpturing of the middle of the dorsal surface of the head near the anterior margin, this appears as a small dark mark in fresh specimens; this is sometimes also apparent to a lesser extent in specimens of *D. rufa*. In the male there is only one seta each side of the ventral endoral arm instead of the usual two. Second and third stage nymphs resemble those of *D. rufa* in the shape of the head. Breadth of the head in the male: range 0.33-0.46 mm, mean 0.37 (51 specimens) in the female: range 0.37-0.49 mm, mean 0.41 (85 specimens).

Material Examined. One 3 *D. carruthi* Emerson; 81 *D. 90* *from subspecies of* *F. sparrius* Linn. from Alaska, British Columbia, various localities in the United States of America, Cuba, British West Indies and Brazil. Endem. 7, 4.
The regalis Species Group

As in fulva group.

12. Female inner genital sclerites may or may not be fused in mid-line.
13. Male genitalia of unique type (Text-fig. 56): penial sclerite present.
14. As in fulva group.
15. Pleural setae absent on II-III.
17. As in fulva group.

This species group which has a superficial resemblance to the fulva group can be distinguished in both sexes by the greater number of sternocentral setae and in the males by the genitalia.

Degeeriella regalis regalis (Giebel), 1886

Type host: Milus m. milus (Linn.)

(Pl. 5, fig. 1; Text-figs. 6, 39, 56, 80, 81, 121, 130-137)

Nirmus regalis Giebel, 1866. Z. ges. NatWiss. 28: 364. Host: Milus regalis — Milus m. milus (Linn.).
Nirmus appressicollis Pugnet, 1884. Pidicolines: 152, pl. 11, fig. 2. Host: Milus aer — Milus migrans migrans (Boddart) and Milus migrans neotropicus (Giebel).
Nirmus inermis Pugnet, 1885. Pidicolines Supplementum: 20, pl. 2, fig. 9. Host: Tettanus gladiator. [Error. Probably Milus sp.]

Nirmus regalis was the name given by Giebel in 1866 to the description of a "Nirmus spec. indet." from Milus regalis appearing in Giebel, 1861 (Z. ges. NatWiss. 17: 524).

MALE. Head as shown in Pl. 5, fig. 3 with ventral suture as in fulva. Tergite II only with median indentation. Pleural thickening as in fulva but broader. The genitalia (Text-fig. 56) differ from all other known species of Degeeriella in the form of the penis and in the presence of an anteriorly curved sclerite each side. Most specimens have the usual two setae on each ventral arm of the endosomal plate, but some may have one arm with one seta; the dorsal arms are usually fused to the side of the basal apodeme, but may be interrupted on one side. There is variation in the length of the penis and the curvature of the lateral margins of the dorsal endosomal plate. The internal genitalia are of characteristic form (Text-fig. 6).

FEMALE. The genital region differs from all preceding species and from the other normally 2 each side, range 1-3, female 2 each side. Pleural setae: II-III, O; IV-V, 1 each side: VI-VII, 2; VIII, 3; IX in the male normally 2, occasionally 3 each side; X, O; IX-X in the female, occasionally 3 each side. Sternocentral setae: II normally 6, range 4-7, III-VI normally 8, range 6-9; VII in the male varies from 2 to 4 each side; VIII-XI in fulva. Total number of marginal setae, dorsal and ventral, in the male varies from 11-16.

NYMPHS. Second and third instars have been seen from Milus migrans parassius,
except for the normal shorter preantennal region, these resemble the adult in the
curvature of the anterior margin of the head.

Specimens from Butoe galagapeosum appear to be indistinguishable from those from
*Milus* that is *Degeriella regalis*. The shape of the anterior margin of the head and
the thickness of the marginal carina are characters which are found to vary within
the populations from the different host species (see Text-figs. 130-137); other charac-
ters which vary within the populations are the shape of the gular and thoracic
sternal plates, the curvature of the anterior and posterior margins of tegular plate
IX-X in the male and the area of junction between the inner genital sclerites; the
apparent differences in the length of the penis and shape of the parameres probably
depend on the preparation of the specimens. The only character which shows a
degree of constancy is the junction of the dorsal endosomal arms with the
basal apodeme: in specimens from *Milus* the arms are usually joined to the
basal apodeme each side (34 specimens) and rarely interrupted on one side (5 speci-
mens), whereas in specimens from *Butoe swainsoni* and *Butoe galagapeosum* the arms are
usually separate on both sides (10 specimens) and rarely joined on one side (2 speci-
mens). However, the number of specimens especially from *Butoe*, in which this
caracter can be seen is small and as there is some overlap it does not seem to be
desirable to separate the two on this character. Specimens from *Halaiatus leucoryphus* show an even distribution between arms joined on one (6 specimens)
of neither side (8 specimens) and more rarely specimens (3) with the arms joined on
both sides. It is considered, therefore, more satisfactory to include the specimens from
the two *Butoe* species under *D. r. regalis* and to sink the names *D. curvilineata* and
*D. pseudophoba* Carriker as synonyms. The population on *Halaiatus ocellifer* is
however a recognizable subspecies (see below under *D. r. regalis*) and specimens from
*Butoe* are considered to be a separate species on the basis of their characters and
described below as a new subspecies. Specimens from this host collected
in Mulug, Deccan (2, 13), Bharatpur, Rajputana (63, 4), Lucknow
(1, 2), and Deccan, Timor (2, 2), host not confirmed cannot be distinguished from
*regalis*. Collecting records (none from Timor) show that these specimens could
not have come from any species of *Milus*. At present it is not possible to suggest
any explanation for this distribution, further species of *Degeriella* are needed from
*Halaiatus inus* throughout its range.

*Degeriella regalis* has an interesting distribution: it occurs on all the species of
*Milus* (restricted to the Old World), *Butoe galagapeosum* and *Butoe swainsoni*
(both restricted to the New World) and possibly *Halaiatus leucoryphus* (found in
eastern Europe and central Asia), but fresh material is required for certain iden-
tification. Specimens have also been found on one individual of *Butoe jamacensis*
in circumstances which preclude contamination after death. Subspecies are found on
*Cyphoderex angolensis*, *Halaiatus ocellifer* and on *Halaiatus inus* in parts of its
range. It seems possible that *regalis* and *fusca* may derive from a common ancestor,
that they later became sympatric, both having a wide distribution and that *regalis*
has since become extinct on many species, perhaps lingering on rarely on some, as
suggested by the specimens found on *Butoe jamacensis* sympatric with *fusca*;
while *fusca* has become extinct on *Milus inusagyrus* and *Butoe swainsoni.*

*Degeeriella curvilineata* (Kellogg & Kuvana) was described from a male alleged
to have come from *Neoploia galagapeosum* and a female from *Ocimelles gracilis*
collected by the Hopkins Stanford Galapagos Expedition of 1899-1900. The figure
of the male shows this to be a typical hawk *Degeeriella*. The only hawk collected by
this expedition in the Galapagos (see Snodgrass & Heller, 1904) was *Butoe galaga-
peosum* (Gould) which must therefore be assumed to be the true host of *D. curvili-
neata*. Dr. K. C. Emerson has most kindly examined the two syntypes of this species
and tells me that these both have more than four setae on the sternum of abdominal
segment I-V. This fact together with the original figure shows that *D. curvilineata*
must be identical with specimens in the British Museum (Natural History) from
*Butoe galagapeosum* and thus becomes a synonym of *r. regalis*.

*Degeeriella pseudophoba* (Carriker). Through the kindness of Mr. Carriker it
has been possible to examine the type of this species. This is a single female which
in the characters of the chaetotaxy, form of abdominal terga II-III and in having
the subuvular plates fused in the mid-line resembles the species found on *Butoe
swainsoni*. The head in size and general shape also resembles that of this species
but the marginal carina is markedly different; however, a teneral specimen from
this host has a similar form of narrow marginal carina and there seems little doubt
that *psuedophoba* is stranger from this host and a synonym of *Degeriella r. regalis*
(Rabel).
**Degoeeriella regalis deignani** subsp. n.

Type host: *Halictius i. indus* (Boddaert)

(PI. 5, fig. 2; Text-fig. 40)

This subspecies differs from the nominate form in the average larger size of the head (the specimens from Ceylon average rather smaller than those from Thailand) and in the slightly different shape of the preantennal region. In the male the shape of the tergite on fused IX-X is intermediate between that of *regalis* and *castanea*, the shape of the endomeral plate differs (Text-fig. 40) and segments II-VI have fewer sternal setae (normally 6 per segment); in the female the inner genital sclerites are widely separated. This subspecies is distinguished from *r. castanea* by the shape and colour pattern of the head, and the shape of the endomeral plate and tergite of IX-X in the male. A third instar nymph examined has the anterior margin of the head rather more pointed than those of *r. regalis* or *r. castanea*.

**Material Examined.** Five ♀, 7 ♂ from *Halictius i. indus* from Thailand; 3 ♀, 3 ♂ from Burma and 6 ♀, 4 ♂ from Ceylon.

Holotype male and allotype female, slide no. 619 in the British Museum (Natural History) from *Halictius i. indus* (Boddaert), no. RE 4499, from Khlong Khlong district, Thailand, collected by R. Elbel and H. G. Deignan, 28th April, 1953.

Paratypes: 14 ♀, 13 ♂ from the same host form from Thailand, Burma and Ceylon.

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**Degoeeriella regalis castanea** (Piaget, 1890)

Type host (emended): *Halictius vocifer* (Daudin)

(PI. 5, fig. 3; Text-fig. 82)

*Nomus castaneus* Piaget, 1890. *Typhlebe, Ent. 33: 212, pl. 8, fig. 9. Host: *Sala fasciculata*.

There is a single male in the Piaget collection with this name and host which agrees with Piaget's figure; it is the same as specimens from *Halictius vocifer* and presumably came from that host.

This subspecies can be distinguished from the nominate form in both sexes by the greater amount of sculpturing on the dorsal surface of the preantennal region of the head (not always apparent in treated specimens) and by the colour pattern of the marginal carina. In the male the fused sclerite of terga IX-X is less arched and narrowed medially, and in the female the inner genital sclerites are widely separated in the mid-line. The number of sternal setae of segments II-VI average less and both sexes average larger in size. Second and third instar nymphs resemble those of *r. regalis* but have the anterior margin of the head somewhat broader and more rounded.

**Material Examined.** One ♀ (slide no. 967) in the Piaget collection; 15 ♀, 27 ♂ in the collections of the British Museum (Natural History), G. H. E. Hopkins and the Natal Museum from *Halictius vocifer* (Daudin) from Uganda and Natal.

*Lectotype of Nimus castaneus* Piaget: ♀ (slide no. 967) in the Piaget collection, British Museum (Natural History).

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**Degoeeriella regalis** subsp.

Type host: *Gypohierax angolensis* (Gmelin)

(Text-fig. 138)

Tendeiro (in press).

This subspecies resembles most nearly *D. r. casiana* in the form of terga IX-X and number of sternal setae in the male and the form of the inner genital sclerites of the female; it is distinguished by the shape of the head (Text-fig. 138). On the available material it is not possible to say whether the absence of pigment is secondary due to the method of treatment nor whether the male genitalia differ in any details from those of the nominate form. In the female the inner genital sclerites are not fused or approximated in the mid-line. Tergocentral setae of male holotype: II, 6; III-VII, 8; VIII, 6. Sterno-central setae: II, 6; III-IV, 7; V-VI, 6. The tergal setae of the male are somewhat shorter and stouter than in *r. regalis*.

**Material Examined.** Two ♀, 1 ♂ from the type host from Piche, Gabu and Manosa in Portuguese Guinea.

**Measurements in mm.**

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**D. r. regalis from Milhous nilius.**

**Male**

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<tr>
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**Female**

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<tr>
<td>Proboscis</td>
<td>0.41-0.46 (12)</td>
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<td>Pleuroterga (10)</td>
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<td>C.I. (10)</td>
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**Degoeeriella r. deignani**

**Male head**

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<th>Length</th>
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<td>0.57-0.60</td>
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<tr>
<td>0.41-0.46 (12)</td>
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**Thailand (5)**

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<tr>
<td>0.41-0.43</td>
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Revisions of Mallophaga Genera

Degeeriella phytocytopus (Nitzsch, 1861)
Type Host: Pernis a. apivorus (Linn.)

(Pl. 8, figs. 1, Text-figs. 62, 64-67, 96-98)


This species (redescribed by Clay, 1957a) is distinguished from D. mosherjoi by the only other species in the species group, by the antennae and the genitalia in the male and by the shape of the head in the female.

MALE. Anterior margin of head slightly concave, inner margin of dorsal marginal carina slightly indented medially, ventral suture does not reach anterior margin of head. Ventrite II only with definite median indentation. Pleural thickening of segments III-VI with well-developed evaginatory heads (Text-fig. 65). The genitalia (Text-fig. 62) are unlike any other known species of Degeeriella except those of D. mosherjoi.

FEMALE. Terga of IX-XI and genital region as in Text-figs. 66-68.

Chaetotaxy of abdomen. Male. Tergocentral setae: II, 5-6; III-V, 8; IV-V, 7; VI, 6; VII, 7; VIII, 6; IX, 2; X, 1-2 each side. Pleural setae: II, 3; III, 0; IV, 6; V, 2; VI, 2; VII, 3; VIII, 3; IX, 3-5; X-XI, 0. Sternocentral: II, 5-6; III, 6-7; IV-V, 6; VI, 5-6. Total number of marginal setae, dorsal and ventral, III, 6-7; IV-V, 6; VI, 5-6. Total number of setae of last segment (1 specimen): 13. In the female tergocentral setae: II normally 6, range 5-7; III-V normally 8, range 7-8; VI range 6-8; VII-VIII normally 6, range 5-6; X, 2 each side. Pleural setae: II, 2; III-VII, 2; VIII, 2; IX, 3-5; X normally 3, range 2-3. Sternocentral setae: II normally 6, range 4-6; III-VI normally 6, range 6-7; VII-VIII normally 6, range 5-6; VI range 4-6; VII-XI as in Text-fig. 66.

Material examined. 2 males and 2 females from Pernis a. apivorus (Linn.) from Scotland, Germany and Italy.

Measurements in mm.

<table>
<thead>
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<th>Female</th>
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<tr>
<td>Head</td>
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<tr>
<td>Prothorax</td>
<td>0.40-0.42</td>
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<td>Pleurothorax</td>
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<tr>
<td>Abdomen</td>
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<td>Total</td>
<td>2.10-2.20</td>
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<td>C.I.</td>
<td>0.81</td>
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The phytocytopus Species Group

1-12. As in fusa group.
13. Male genitalia of distinctive type; penial sertex present.
14. As in fusa group.
15. As in regulis group.
16. Sternocentral setae of segments III-VI normally more than 4.
17. As in fusa group.

This species group, which has only two known species, is distinguished from all other groups by the form of the male genitalia; in the characters of the chaetotaxy of the abdomen it resembles the regulis group.
Degeberilia mookerjei Clay, 1957

Type Host: Pernis pilorumycus gurneyi Streeusmann
(PL 5, fig. 2; Text-figs. 7, 63, 66, 69, 90)

Degeberilia mookerjei Clay, 1957, Proc. zool. Soc., Calcutta, Moorkerjee Mem., Vol.: 342, pl. 15, figs. 2, 4, Text-figs. 18, c, d, e, f, g, h, i, 20, 49. Host: Pernis pilorumycus gurneyi Streeusmann.

The male of this species is at once distinguished from *phylobotopus* and all other known species of *Degeberilia* by the enlarged antennae: the species is further distinguished from *phylobotopus* in the male by the details of the male genitalia, the greater number of marginal setae on the last abdominal segment and the pleural thickening; and in the female by the shape of the head and the form of the pleural thickening.

**Male.** Marginal carina and ventral suture of head as in *phylobotopus*, shape as in PL 5, fig. 2. Antenna with segment I enlarged and II with distal post-axial angle prolonged (Text-fig. 69). The ocular and marginal temporal setae are shorter and finer than in *phylobotopus*, a reduction which may be correlated with the increased size of the antennae. Tergite II-III as in *phylobotopus*; pleural thickening narrower with smaller re-entrant heads (Text-fig. 68). Genitalia similar to those of *phylobotopus* but differ in detail (Text-fig. 63): it should be noted that the sclerite supporting the penis is curved dorsally and therefore when spread flat on a slide is distorted in various ways. Internal genitalia unlike any other seen, with short broad vesicular apparatus, apparently formed from two single-chambered lobes only and with very few re-enters entering near base (Text-fig. 7); ductus ejaculatorius long and coiled.

**Female.** Similar to that of *phylobotopus* but differs in the shape of the head (see Clay, 1957). There do not appear to be any constant characters distinguishing the genital region of the two species; there is individual variation in the shape of the genital plate, number of setae and a small amount of variation in the shape of the sertules.

**Chasmatology of abdomen.** Tergocentral setae: II normally 6, range 6-7; III-V normally 8, range 6-9; VI-VIII in the male normally 6, range 6-7, in the female VI-VII normally 6, range 4-9; VIII range 3-6; X in the male, 1-3 each side and in the female 2 each side. Pleural setae as in *phylobotopus*. Sternocentral setae: II, 4-7; III-VI in the male normally 5, range 4-6, in the female range 5-8; VII-VIII in male as in *fusa*, the usual spine-like seta may be elongated in some specimens. Total number of marginal setae on last segment of male varies from 18-29.

**Nymphs.** Third instar nymphs have the anterior margin of the head rather similar to that of *D. fusa* but somewhat more pointed.

**Material examined.** 3 holotype and 10 0., 26 0. paratypes from Pernis pilorumycus gurneyi from Thailand and from *P. pilorumycus ruficolis* from Nepal; 8 0., 6 0. from *Pernis pilorumycus* subsp. from Myitkyina, Upper Burma.

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The punctifer *Species Group*

1. Head index greater than 0.94.
2. Postventral dorsal sutures present.
3. Three of the marginal temporal setae each side elongated.
4. Thoracic sternal plate as in Text-fig. 122.
5. Thorax and abdomen with general shape as in PL 9, fig. 3.
6. As in *fusa* group.
7. As in *rufa* group.
8. Pleural thickening of segments III-VI without well developed re-entrant heads.
9. Sternal thickening reduced and irregular in shape.
10. Male genital plate as in Text-fig. 103.
11. As in *fusa* group.
12. Female inner genital sclerites fused in mid-line.
13. Male genitalia as in Text-figs. 41, 57; penial sclerite present.
14. As in *discocephalus* group.
15. Pleural setae absent on segment II and on X of male.
16. Sternocentral setae of segments III-VI normally more than 4.
17. As in *fusa* group but the last pair of sternal setae are both elongated.

This species group is distinguished from all others by several distinctive characters, see 2, 3, 13 and 15 above; it has a superficial resemblance to *discocephalus* due to the rounded form of the head and abdomen.
Degeriella punctifer (Gervais), 1844

Type host: Gyphus barbatus barbatus (Linn.)

(Pl. 9, fig. 3; Text-figs. 8, 41, 57, 83, 103, 105, 122)


Some doubt has been raised about the correct interpretation of Philopterus punctifer: Eichler (1914a: 179 and 1914b: 350) followed Giebel (1874: 209) and Plaget (1928: 290) in believing this to be a Falcipennis, and erected a "neotype": (1944: 283), although without description or figure. However, Neumann (1942: 235) had already shown that Gervais' figure corresponds with the Degeriella from Gyphus barbatus and not at the all with a Falcipennis. Neumann is undoubtedly correct, for although the shape of the head in Gervais' figure of the female is quite unlike the species of Degeriella, the figure is also unlike the description of the head, which is referred to as "discone", which in fact it is; further, the shape of the head of what is obviously meant to be a Stratidactylus on the same plate is also totally unlike that of a Stratidactylus, so that it must be assumed that Gervais was not able to represent shapes accurately. The dorsal view of the female abdomen and the dorsal view of the male abdomen represents that of the Degeriella described below.

**Male.** Head with marginal carina interrupted by ventral suture and only slightly sclerotized at this point dorsally; narrow but definite hyaline margin present. Mandible and mandibular processes smaller and more strongly sclerotized than in previous species. First marginal temporal setae elongated in addition to the two usual elongated temporal setae. Coni more elongated and more strongly sclerotized than in other species. Postantennal suture present and variable in form; may be complete and semicircular as in Lagocephalus or in the form of two lateral sutures. Thoracic plate as in Text-fig. 122; dorsal pterothoracic setae vary from 4-5 each side. Terga II with median unsclerotized area, III narrowed mediad. Sternal plates small and irregular, and variable in outline; genital plate as in Text-fig. 103. Genitalia of distinctive form (Text-figs. 41, 57).

**Female.** Terga of IX-X as in Text-fig. 108. Genital region as in Text-fig. 93. Inner genital sclerites fused in mid-line.

**Chromotaxy of abdomen.** Tergocentral setae: II normally 5, range 5-7; III-IV normally 8, range 7-9; V range 6-8; in the male VI-VII, 6-7, occasionally 4 or 5; VIII, 4-7; IX, 1-3 each side. In the female VI as in male; VII normally 4, range 3-7; VIII normally 4, range 2-6; X, 2 each side. Pleural setae: II, 0; III-V, 1 each side; VI-VII, 2; VIII, 3 (occasionally 4); IX, 2; X in the male, 0 and in the female 2 and occasionally 3 on one side. Sternocentral setae: II-VII normally 8, range 5-10; VI normally 6, range 6-8. In the male the last pair of sternal setae are both elongated. Total number of marginal setae of last segment of male varies from 16-16.

**Nymphs.** First and second instar nymphs have been seen, these resemble the adult in the shape of the head, but the marginal carina is fully sclerotized dorsally.

**Material examined.** Eighteen 5, 34 3 from Gyphus barbatus aurens (Habibil) from Afghanistan and Sikkim.

**Neotype of Philopterus punctifer Gervais:** Male, slide no. 2007 in the Meinitzsch-Ash collection, British Museum (Natural History) from Gyphus barbatus aurens from Sikkim; 16 3, 34 3 neotypetypes from the same host form.

**Neotype of Nymphaeus encomius Nitzsch:** Male, slide no. 20047, in the Meinitzsch-Ash collection, British Museum (Natural History) from Gyphus barbatus aurens from Afghanistan.

**Measurements in mm.**

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<td>Abdomen</td>
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<td>Genitalia</td>
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**Female.**

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<td>Total</td>
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<td>2.13</td>
<td>1.92-2.18</td>
</tr>
<tr>
<td>C.I.</td>
<td>1.09-1.13</td>
<td>1.14</td>
<td>1.09-1.13</td>
</tr>
</tbody>
</table>

Degeriella gyspivorum Eichler, 1943

Type host: Gyphus himalayensis Hume


There is practically no description of this species; it is said to be somewhat smaller than punctifer, but no measurements are given and the preantennal region of the head is said to be parabolic in form, but there is no figure. The figure of the genitalia shows these structures to be similar to those of punctifer. Whether this is a good species, a subspecies or a synonym of punctifer must wait for an examination of the types or material from the type host.
Species Skdis Incertae

Philopterus aquae Gervais, 1844
In Walkerena’s Histoire Nat. Ins. 3: 320. Host: Spizellea melanoleucus = Geronasaurus melanoleucus.

It seems probable that the specimen from which Gervais made his description of Philopterus aquae did not belong to the Degeeriella. In the description he states that the head is twice the breadth of the thorax, but in the Degeeriella species from Geronasaurus the head is not twice the breadth of the prothorax and certainly not of the pterothorax. Monsieur Rui of the Museum National d’Histoire Naturelle in Paris has kindly told me that there is none of Gervais’s type material in that Museum and that it is most probably no longer in existence. Specimens from Geronasaurus melanoleucus are the same as those from Aquila, namely D. fulva. It does not seem reasonable to replace the established name fulva by aquae which doubtfully refers to a Degeeriella and which has never been in general use. The name Philopterus aquae Gervais will, therefore, be submitted to the International Commission on Zoological Nomenclature as a nomen dubium for inclusion in the Official Index of Rejected and Invalid Specific Names in Zoology. While this is under consideration by the Commission the name aquae should not be used to replace fulva.

Nemurus kunsei Giebel, 1874

This species was described from a single female specimen said to have been taken from Falco tinnunculus; according to the original description the specimen was quite different from raja. The type is lost and the original specimen was probably a straggler, and as the species is not identifiable from the description this name should be discarded as a nomen dubium.

Nemurus stenobrychus Giebel, 1874

This species said to have come from Milvus is not the same as raja and is impossible to identify from the original description. It is presumably a straggler, perhaps not even from one of the Falconiformes and as the type is lost this name will be submitted to the International Commission on Zoological Nomenclature for inclusion in the Official Index on Zoological Names as a nomen dubium.

Nemurus secondaria Osborn, 1896

It is not possible to assign this species with certainty to the Degeeriella; if the types are no longer in existence the name should be discarded as a nomen dubium.

Key to the Species of Degeeriella Parasitic on the Falconiformes

1. Three marginal temporal setae elongated, remainder minute; postantennal dorsal sutures present. (Head index more than 0-94). d. stenocephalus
   - Two marginal temporal setae elongated; postantennal sutures absent. 2
2 (1) Head index more than 0-94
   - Head index less than 0-90
3 (2) Temporal setae of segments II-VIII total more than 45; shape of head diagnostic (Pt. 6, fig. 1). d. aquilinarum
   - Temporal setae of segments II-VIII total less than 44; shape of head diagnostic (Pt. 6, fig. 2). d. stenocephalus
4 (3) Sternum-setal setae of segments III-VI normally 4, never total more than 18. 13
   - Sternum-setal setae of segments II-VI normally 6 or more, never total less than 20. (Pleural setae present on segment IV). 5
5 (4) Male without pennisactile and with pleural setae on segment X; female genital plate with median posterior prolongation 6
   - Without above characters
6 (5) One seta each side of ventral endosomal arm; head as in Text-figs. 126-128. r. carpalis
   - Two setae each side of ventral endosomal arm; head as in Pt. 6, fig. 3. r. raja
7 (6) Males
   - Females
8 (7) Anteriorly curved sclerite supporting pennis each side (Text-fig. 56) 9
   - Genitalia not as above (Text-figs. 62-63) 11
9 (8) Shape of dorsal endosomal plate as in Text-fig. 40 10
   - Shape of dorsal endosomal plate as in Text-fig. 39 12
10 (9) Fused tegra of IX-X considerably narrowed and arched medially (Pt. 5, fig. 1) r. regalis
11 (10) First segment of antenna enlarged, third with distal postaxial angle prolonged r. rubripilus (p. 191)
   - Antenna simple
   - Shape of heads of males and females diagnostic, see figures and descriptions.
REVISIONS OF MALLOPHAGA GENERA

12 (7) Inner genital sclerites fused or approximated medially (Text-fig. 80) .  
   - r. regalis
   - r. dregalis
   - r. castanea
   - r. subsp.
   - phyllopygas
   - memoneri

13 (4) Segment IV with one pleural seta each side (terga II-III indent red midly) 
   - kopiensis

14 (13) Segment V with one pleural seta each side 
   - 14

15 (14) Ventral carina with a definite flattened edge antero, to which is attached 
   - 15

16 (15) Penis sclerite not joined to penis; female genital plate with median posterior 
   - 16

17 (15) Pleural thickening without deep re-entrant heads 
   - 17

18 (17) Head broad and rounded antero, breadth at temples: 0.47–0.52 mm. 
   - africana

19 (18) Tergal plates apparent on segment XI of male; genitalia diagnostic (Text-figs. 
   - 36, 54) 
   - elali

20 (14) Ventral carinae developed anteriorly each with a flattened inner edge. (Mar-
   - rendales

21 (20) Tergite III without definite median indentation 
   - 21

22 (21) Tergite III with definite median indentation 
   - 22

23 (22) Ventral outline of pleural thickening at least some segments convex 
   - 23

24 (23) Ventral suture reaches anterior margin of head; male genitalia diagnostic 
   - fulva

25 (24) Ventral suture does not reach anterior margin of head; male genitalia diagnostic 
   - (Text-fig. 43) 
   - 25

26 (25) Male genitalia diagnostic (Text-fig. 45) 
   - emersali

27 (26) Male genitalia diagnostic (Text-fig. 44) 
   - 27

28 (27) Male genitalia diagnostic (Text-fig. 101) 
   - 28

29 (28) Central area of tergite II round median indentation more strongly pigmented. 
   - (Shape of head and male genitalia diagnostic) 
   - fusco

30 (29) Not as above 
   - 30

31 (30) Tergital setae on segments II–VIII, 4 
   - 31

32 (31) Tergial setae on segments II–VIII, 6 or more 
   - 32

33 (32) Head narrower, breadth at temples of males and females: 0.35–0.42 mm. 
   - m. kayoichi

34 (33) Head broader, breadth at temples of single female: 0.47 mm. 
   - 34

35 (34) Tergite II with definite median linst 
   - 35

36 (35) Tergite II with at most shallow concavity 
   - 36

* See footnote on previous page.
### Host Relationships

It seems that the relationships of many of the Falconiformes are still the subject of considerable differences of opinion amongst ornithologists (Clay, 1957: 146), and for this reason any evidence from the distribution of the parasites should be considered. However, as far as *Degerelia* is concerned much of the evidence is difficult to interpret and only tentative suggestions of the relationship of the hosts can be made. Among the reasons for this are the following: (1) The rather close similarity of most of the species of *Degerelia*, and the difficulty of judging the significance of the small character differences in relation to the time of separation of the populations and thus of their hosts. (2) The difficulty of knowing which of the species groups are the most primitive. It is not yet possible to describe with any certainty the form of the primitive mallophagen head. The different genera of lochmonea usually resemble each other in the characters of the anterior margin of the head to a greater extent in the nymph than in the adult and as both nymph and adult live in the same environment, it can be presumed that the head with the complete anterior margin (as found in the majority of nymphs) is the more primitive. It is more difficult to decide whether the primitive lochmonea had the complete semi-circular central carina or the interrupted carina, with the two carinae passing to the anterior margin of the head. In *Degerelia* the ventral carina is interrupted, but the two carinae are poorly developed anteriorly, except in the *elani* group and the nymphs of *D. rufa*. The nymph of *rufa* also has a dorsal preanal suture delineating a semicircular dorsal anterior plate. It is not impossible,
Therefore, the characters of the head of the fulva and discocephalus groups are secondary, even secondarily approaching the primitive condition, if the primitive Ischnoceran Mallophaga is presumed to have this type of head. Or alternatively, the species of the dani group are derived from a discocephalus type, but then it must be postulated that rufa shows a more primitive condition of the head in the adult than in the nymph. (3) The difficulty of distinguishing between primary and secondary absences of the species of Degereriella. Was the discocephalus type evolved on a common ancestor of Agula and Halaecestus after this became separated from other hawks? This would suggest a close relationship between these genera. Or did it once have a widespread distribution later becoming extinct except on these hawks? From the resemblance, perhaps of no significance, between the heads of the nymphs of fulva and the adults of discocephalus it is possible that these species were derived relatively recently from a common ancestor, suggesting an originally wider distribution for discocephalus. It is possible that some of the differences between the mallophaga famines such as those of Buteo galapagonensis and H. swainsoni and the rest of Buteo is due to the extinction of a different member of an original sympatric pair (Clay, 1940: 299). The fulva, regalis, and discocephalus types may all have been found on the ancestral Accipitrinae and since become extinct on some or other of the present members of the family. However, even this may indicate relationships; for instance the fact that fulva is not found on any of the genera included in the Milvinae suggests that it had already become extinct (if ever present) on an ancestral stock which gave rise to these genera and thus continues their relationships.

As an indication of the relationships of the Falconiformes as accepted by at least some ornithologists the arrangement in Peters (1931) has been followed. On pp. 202-3 above is a list of hosts (arranged according to Peters) and their known species of Degereriella together with the species groups to which these belong. It can be seen from this list that in general the distribution follows that of the arrangement of their hosts, but with some notable exceptions. The relationships between species of Degereriella which seem to throw some light on the relationships of their hosts are discussed in the following paragraphs.

1. The Degereriella from Elanus, Chelidonia, Elanoides and possibly Avicida form a related group, with those from Chlidonias and Elanoides probably being the most nearly related. The species from Gannomys, and also possibly Falco and Ieracidae, all belonging to the family Falconidae, should perhaps be included in this group (Clay, 1958: 2). The Degereriella species from Pernis (a genus placed in the Per- minus with Elanoides and Avicida) are quite distinct and perhaps show affinities with those from the Milvinae.

2. The Milvinae are parasitized by a distinctive species of Degereriella; the supposition that this may be a relic of a sympatric pair has already been mentioned, and it is therefore possible that the Milvinae are in fact rather more nearly related to the Accipitrinae than their Degereriella suggest.

3. The Degereriella of the Accipitrinae suggest a fairly close relationship between the members of this subfamily, especially between Agula and Buteo; further that there is little difference between this subfamily and the Circinae, and that Terathopius and Circaetus (but not Spilotus) of the subfamily Circinaeae are similar but rather more distinct. Buteo galapagonensis, B. swainsoni, Halaecestus soefer and H. luscerephon have the same species as found on Milvus (see above). Agula and Halaecestus have a second species discocephalus, the resemblance of the nymphs of fulva to the adults of this species has already been mentioned and perhaps confirms the close relationship of Buteo and Agula which is suggested by both being parasitized by rufa.

4. Few Degereriella species are known from the Aegypini: Gypaetus has a distinctive species 'punctor' not closely related to any other except Gypiornis from Gypaetus hirundinarius. This would suggest that Gypaetus and Gyps are warrantedly placed between the Accipitrinae and the Circinae. Böetticher & Eichler (1954) considered that the Degereriella species found on Agula and Gypaetus showed a relationship between these hosts, but this was based on the erroneous assumption that discocephalus and punctor were closely related, but the two species resemble each other only in shape. The Degereriella of Gypaetus are a subspecies of regalis, rather near that of Halaecestus soefer, this suggests if no secondary infestation has taken place, that Gypaetus is wrongly placed in the Aegypini.

5. It seems doubtful whether the genera included in the Falconidae do in fact, form a related group. As already shown the Degereriella from Gampsonyx and possibly also Neohierax, Falco and Ieracidae show a relationship to those on some of the genera included in the Elanidae and Perminae. The subfamily Polihieracinae do not have any species of Degereriella sens. str. but are parasitized by a species of the closely related genus Actiferum. The parasites of Microhierax and of Polihierax, belonging to the Polihieracea, do not belong to Degereriella and have been dealt with elsewhere (Clay, 1955).

A detailed study of the other genera of Mallophaga living on the Falconiformes may give some further indications of the relationships of their hosts.

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Summary

The characters and distribution of the Degereriella-complex are discussed. Degereriella sens. str., as found on the Falconiformes, is described. Variations and artefacts, characters of taxonomic importance and the concept of the subspecies in this group are considered. A systematic survey of all known species is given followed by a key and notes on names of which the correct interpretation is doubtful.
Finally some suggestions are made on possible relationships within the Falconiformes based on the distribution of the Mallophaga.

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