

18-40

UNIVERSITY OF KANSAS SCIENCE BULLETIN



JUL 5 1956

UNIVERSITY OF KANSAS PUBLICATIONS
University of Kansas Science Bulletin - Vol. XXXVII, Pt. II
June 29, 1956
Lawrence, Kansas

THE UNIVERSITY OF KANSAS SCIENCE BULLETIN

VOL. XXXVII, PT. II]

JUNE 29, 1956

[No. 15

The Taxonomic Value of the Pretarsal Structures in the Classification of Certain Fulgoroidea¹

BY KATHLEEN C. DOERING

ABSTRACT.—This investigation includes a study of eight North American genera of the subfamily Orgerinae and four North American genera of the subfamily Dictyopharinae of the family Dictyopharidae, Fulgoroidea. To detect variability among species a study was made of seven species of the genus *Orgerius* (Orgerinae) and eight species of the genus *Scolops* (Dictyopharinae).

From the generic studies a characteristic pretarsal pattern seems to be evident for each subfamily. In the Dictyopharinae there are four setae on each unguis and two pairs of setae on the arolium. In the Orgerinae there are two setae on each unguis and one pair of setae on the arolium. The genus *Orgerius* in this group showed a variation from the typical pattern in that three species out of the seven studied showed three setae instead of the typical two on each claw.

Specific characters were the shape of the dorsal plates of the arolium, amount of imbrication on the base of the unguis and the shape of the unguis-tractor plate. Differences in these characters were slight and for the most part the conclusion is that they are of such small magnitude that they could only be useful as additional or corroborative evidence in distinguishing certain species.

INTRODUCTION

Recently two excellent papers have been published which have shown the value of certain structural features of the pretarsus as taxonomic tools in the classification of the order Hemiptera. One of these by Fennah (1945) covers the families of the Auchenorrhyncha (Homoptera) and the other by Dashman (1953) includes twenty families of the Heteroptera (Hemiptera). Fennah's emphasis was on the significance of differences between the four superfamilies and also between families of the superfamily Fulgoroidea. He pointed out that for certain families the pretarsus gave additional

1. Contribution No. 897 of the Department of Entomology, University of Kansas.

corroborative evidence in the placement of certain puzzling genera in their proper family. Dashman describes the unguitactor plate as the main taxonomic character of the pretarsus in the Heteroptera and considers it to be a valuable aid in the classifying of this sub-order into families.

In the present paper the immediate objectives were to test the characters of the pretarsus described by Fennah for the Fulgoroidea as to uniformity within a single family and likewise their significance, if any, as taxonomic tools at the generic and specific levels. Furthermore, as a long range objective it was hoped that some new characters might be found which would throw light on the more fundamental problems as to whether there is justification in the current practice of dividing the superfamily Fulgoroidea into some eighteen or nineteen families.

TECHNIQUE AND MATERIALS

Twelve genera of the family Dictyopharidae were studied, which includes all the North American genera except two. To determine whether any pretarsal characters showed species variation nine species of the genus *Scolops* were studied and seven species of the genus *Orgerius*. To check the stability of the character for a species, specimens of *Scolops pumgens* were studied from eleven geographical locations. For this same group both males and females were compared to determine any sexual variation. Likewise several dissections were made of the pretarsi from all six legs of the same individual in order to test variation as regards the three pairs of legs.

The pretarsi of many species used in this study were minute structures which made them exceedingly difficult to dissect, mount and study in any standard aspect for the purpose of comparison. In order not to lose the minute structures in passing them through the various solutions in the mounting process it was necessary to remove a major part of the legs. Then the separation of the pretarsus was made on the slide just before applying the coverslip. The procedure for mounting was to first boil the leg in caustic potash for a minute or two, followed by thorough washing in water. Next it was boiled in hydrogen peroxide for 3 to 6 minutes. This decolorization was necessary in order to make the setae plainly visible. After washing out the peroxide the specimen could be stained in an aqueous solution of acid fuchsin if desired. It could be first studied in glycerine and later mounted in diaphane. In glycerin a ventrolateral view of the unguis could be obtained

which frequently gave a more accurate picture of the setae. The mounting proved to be a delicate task. In order to make accurate comparative drawings it was necessary to mount the pretarsus in a flat position so that both ventral and dorsal surfaces were completely exposed. But due to the minute size and the natural curvature of the claws the specimens had a tendency to roll to one side or the other as the coverslip was applied.

Specimens were first studied and drawn by using an ordinary microscope. A micrometer disc marked into millimeter squares was used in the eye piece. Corresponding one-half inch squares were marked on drawing paper. All drawings were made to this scale. A final check on setal count was made by using a phase contrast microscope which gave an additional check for doubtful cases.

The writer is indebted to Mr. Ranendra Nath Sinha for making a large proportion of the mounts for this study.

Family Characters in the Pretarsus

In the Dictyopharidae the pretarsus shows the typical auchenorhynchus pattern for the pretarsus, namely a pair of stout ungues, a large median padlike arolium and a strongly sclerotized unguitraction plate. Fennah (1945) set up further standard characteristics for the superfamily Fulgoroidea which he believes to be fundamental characteristics in the identification of this superfamily. He states that "a pair of setae on the plantar surface of the arolium, dorso-lateral sclerites devoid of setae, and a triangular and transversely ridged unguitraction plate constitute the most fundamental of all Fulgoroid characters, transcending in their universality both the presence of tegulae and the nonsegmented condition of the antennal flagellum."

Details of the pretarsus for the Dictyopharidae are as follows: the apices of the ungues usually extend somewhat beyond the apical margin of the arolium; usually their basal lateral surfaces are ornamented with small pointed scales; laterally or ventrolaterally each unguis bears either two, three (exceptional) or four, stout, spinelike setae.

The well-developed arolium which according to Fennah is "essentially an extension of the membrane at the apex of the tarsus between the tarsal claws" is a conspicuous membranous pad bearing on its dorsal surface a pair of heavily sclerotized crescent-shaped plates called the "dorso-lateral sclerites" (Fennah 1945). At base these plates articulate with a condyle on the base of each unguis and distally they are tapered. Ventrally the arolium bears one or

two pairs of minute setae. The presence of this second pair of setae found in several groups is at variance with Fennah's idea of the generality of one pair for the superfamily Fulgoroidea as quoted above.

The unguitactor plate is subtriangular in outline, the distal end is expanded and the margin truncate or shallowly concave where it joins the arolium; basally the plate is bluntly pointed; the convex ventral surface of the plate has a somewhat imbricated appearance due to shallowly scalloped, transverse ridges. Sometimes the scallops are deep enough to appear as overlapping scales.

Generic Variation of the Pretarsus

Following Metcalf's classification (1946) the family Dictyopharidae is divided into two subfamilies, the Orgerinae and the Dictyopharinae. For the subfamily Orgerinae the following North American genera were studied.

Acinaca Ball and Hartzell (*lurida* B. & H).

Deserta Ball and Hartzell (*raptorica* Ball)

Orgamara Ball (*argentina* Ball)

Orgarius Stål (*bicornis* Doering and Darby), *concordus* Ball and Hartzell,

foliatus Doering and Darby, *juncus* Doering and Darby, *pajaronius* Ball and

Hartzell, *hypparus* Stål and *ventosus* Ball and Hartzell)

Ticida Uhler (*cingulata* Uhler)

Timodema Ball (*miracula* Ball)

Timonidia Ball and Hartzell (*solitaria* Ball)

Yucanda Ball and Hartzell (*albida* Ball)

Specimens of two genera, *Aridia* Ball and Hartzell and *Loxophora* Van Duzee were not available for study.

The North American genera of Dictyopharinae studied were:

Nersia Fennah (*florens* Stål)

Phylloscelis Germar (*atra* var. *albonervosa* Melichar)

Rhynchomitra Fennah (*recurva* Metcalf)

Scolops Schaum (*angustatus* Uhler, *grossus* Uhler, *maculosus* Ball, *pallidus*

Uhler, *perdix* Uhler, *pungens* Germar, *snowi* Breakey, *sulcipes* Say and *uhleri* Ball)

This group includes a proportionally small number of genera of the subfamily and is therefore less representative of this category. However a general pattern apparently holds for these four genera. This fact is particularly interesting since it has been suggested that possibly *Phylloscelis* and *Scolops* have more affinity with the Orgerinae than the Dictyopharinae. On the basis of this study it would seem that they belong where they are now placed even though in superficial appearance they resemble the Orgerinae more than they do other genera of the Dictyopharinae.

Pretarsal variations other than the number of setae, are minor characters which can best be understood by a study of Table I below and by looking at the drawings on the accompanying plates. For example there are definite differences in the size and shape of the ungues which are difficult to describe in words but which can readily be noted by a study of the drawings. Also the extent of the imbrication on the base of the ungues is distinctive for some. The size and shape of the dorsolateral sclerites of the arolium vary from broad to linear and in some cases are more crescent-shaped than in others. The Orgerinae showed more variability of this character than did the Dictyopharinae.

The most significant character exhibited by the pretarsus was the number, size and arrangement of the large spinelike setae on the ungues. Fennah (1945) states that in the Dictyopharidae three or four setae are present on each unguis. In this study it was found that the Orgerinae are typically bisetose and the Dictyopharinae quadrisetose. One exception to the rule occurred in the genus *Orgerius* where three setae were found in three species studied and only two in the remaining four species. The position of the setae varied from the condition of all setae being mostly lateral and hence visible from either ventral or dorsal surface or all ventral. In the latter case if the mesal setae are smaller than the lateral ones and lying prone on the claw they can readily be overlooked by the observer. It was for this reason that decolorizing the specimen in hydrogen peroxide proved helpful since by this process the alveolus or socket was generally visible even though the seta might be broken.

Differences in the unguitractor plate and the arolium did not seem to be distinctive enough to attach any significance to them. In the drawings there may appear differences that are more apparent than real. Some of this may be due to slight differences in mountings and also to inaccuracies in drawing. It was difficult to get the plate oriented properly with the rest of the pretarsus; frequently the specimen had to be shifted a little and therefore inaccuracies in width versus length of the plate or the size relationship of the plate to claws and arolium might readily have occurred.

Finally a few isolated differences showed up. One unique character appeared in the distitarsus or last tarsomere of *Acinaca lurida* Ball and Hartzell. In this species the ventral surface of the distitarsus is concave and membranous. This condition did not appear in any other genera. In the genus *Scolops* all species show more sclerotization of the arolium. In tracing the evolutionary trend in

phacidae, the arolium is well developed and the unguis are bisetose.

Applying these interpretations to this study it would seem that the Orgerinae represent the primitive group and the Dictyopharinae the more specialized. The latter claim is further substantiated by another specialization occurring in the Dictyopharinae, namely an additional pair of setae on the plantar surface of the arolium.

Species Variation in the Pretarsus

An attempt was made to see if structural differences were exhibited by the pretarsus among species of the same genus. In view of the fact that only minor differences appeared between genera it was not expected that any very useful differences would be discovered among species. This proved to be true. The amount of variation that occurs is of still smaller magnitude than that between genera, the variable characters being such things as width

TABLE II.—*Synopsis of Pretarsal Characteristics in the Genus Scolops Schaum*

	angustatus Uhler	grossus Uhler	maculosus Ball	pallidus Uhler	perdix Uhler	pungens Germar	snowi Breakey	subcipes Say	uhleri Ball
dorsal plate of arolium									
broad and subtriangular.....	+			+			+		
narrow and crescent-shaped...		+						+	+?
linear (rodlike).....			+		+	+			
arolium narrow and somewhat reduced.....	-	+	+	-	-	-	-	-	-
arolium more heavily sclerotized between dorsal plates.....	-	+	+	-	+	-	+	+	+
unguitractor plate broad.....	+	-	-	-	-	+	+	-	-
setae of unguis, 3 ventral and 1 lateral.....				+					
2 ventral and 2 lateral.....			+		+		+	+	
1 ventral and 3 lateral.....	+	+				+			+
imbrications on unguis heavy.....	-	-	-	-	-	+	-	-	+

or degree of curvature of the dorsal sclerites, amount of sclerotization of the arolium other than the plates, relative position of the setae on the unguis and the width of the arolium and the extent of development as compared to the unguis.

Nine species of the large genus *Scolops* were studied. These species are listed and summarized in Table II. The differences can best be followed by studying this table and the accompanying drawings. By far the most useful character seems to be the relative width to length of the dorsal sclerite on the arolium, which in some species appeared as a slender brown rod (linear in table) but in others was broader and subtriangular.

In the genus *Orgerius* seven species were studied. Here a striking variation occurred in the number of setae on each unguis. Three species distinctly bore three setae on each claw while four species show only two. In the former group the mesal seta was always ventral and quite small and might easily be overlooked. Thinking of this as a possibility for the species where only two setae appeared additional examinations were made but failed to reveal this third seta. Again in this genus as well as in *Scolops*

TABLE III.—Synopsis of Pretarsal Characteristics of the Genus *Orgerius* Stal

	bicornis Doer. & Darby	concordus Ball & Hart.	foliatus Doer. & Darby	juncus Doer. & Darby	pajaronius Ball & Hart.	rhyparus Stal	ventosus Ball & Hart.
dorsal plate of arolium							
broad and subtriangular	+						+
narrow and crescent-shaped		+	+				
linear (rodlike)				+	+	+	
unguitractor plate broad	+	+	+	+			+
elongate					+	+	
unguis bisetose	+		+		+		+
trisetose		+		+		+	
imbrications heavy	-	+	-	-	-	+	-

the size and shape of the dorsal plate was a variable character. Note particularly the differences in the plates of *Orgerius rhypparus* Stål and *Orgerius bicornis* Doering and Darby. The summary of variations for this genus is given in Table III.

In order to test the constancy of the characters within a given species numerous examples of *Scolops pungens* Germar were studied from the following localities: Brazoria, Hidalgo, Cameron and Harris counties in Texas; from Ames, Iowa; from Polk county, Arkansas and from Chautauqua and Douglas counties in Kansas. No apparent differences were noted.

Likewise pretarsi from pro-, meso-, and metathoracic legs of the same specimen were compared. Again no noticeable differences were noted among the different pairs of legs.

Finally no differences could be discovered between the sexes.

To summarize the value of the pretarsal characteristics in species identification it would seem that the characteristics of most value are the number of setae on the unguis in the case of one genus and the shape of the dorsal plates of the arolium. For the most part species differences are slight. Therefore they can be relied upon mainly as secondary and additional data to corroborate other findings.

LITERATURE CITED

DASHMAN, THEODORE

1953. Terminology of the pretarsus. *Ann. Ent. Soc. Amer.*, vol. 46, pp. 56-62.

FENNAH, R. G.

1954. Characters of taxonomic importance in the pretarsus of Auchenorrhyncha (Homoptera). *Proc. Ent. Soc. Washington*, vol. 47, pp. 120-128.

METCALF, Z. P.

1946. General catalogue of the Hemiptera, Fasc. 14, Fulgoroidea, Part 8, Dictyopharidae.

PLATE I

FIGURE

1. Dorsal view of pretarsus of *Phylloscelis atra* var. *albonervosa* Mel.
2. Ventral view of pretarsus of *Phylloscelis atra* var. *albonervosa* Mel.
3. Dorsal view of pretarsus of *Timonidia solitaria* Ball & Hartzell.
4. Ventral view of pretarsus of *Timonidia solitaria* Ball & Hartzell.
5. Dorsal view of pretarsus of *Orgamara argentia* Ball.
6. Ventral view of pretarsus of *Orgamara argentia* Ball.
7. Dorsal view of pretarsus of *Acinaca lurida* Ball and Hartzell.
8. Ventral view of pretarsus and last tarsomere of *Acinaca lurida* Ball and Hartzell.
9. Dorsal view of pretarsus of *Ticida cingulata* Uhler.
10. Ventral view of pretarsus of *Ticida cingulata* Uhler.
11. Dorsal view of pretarsus of *Yucauda albida* (Ball).
12. Ventral view of pretarsus of *Yucauda albida* (Ball).
13. Ventral view of pretarsus of *Timodema miracula* Ball.
14. Dorsal view of pretarsus of *Timodema miracula* Ball.
15. Dorsal view of pretarsus of *Deserta raptorica* Ball.
16. Ventral view of pretarsus of *Deserta raptorica* Ball.

PLATE I

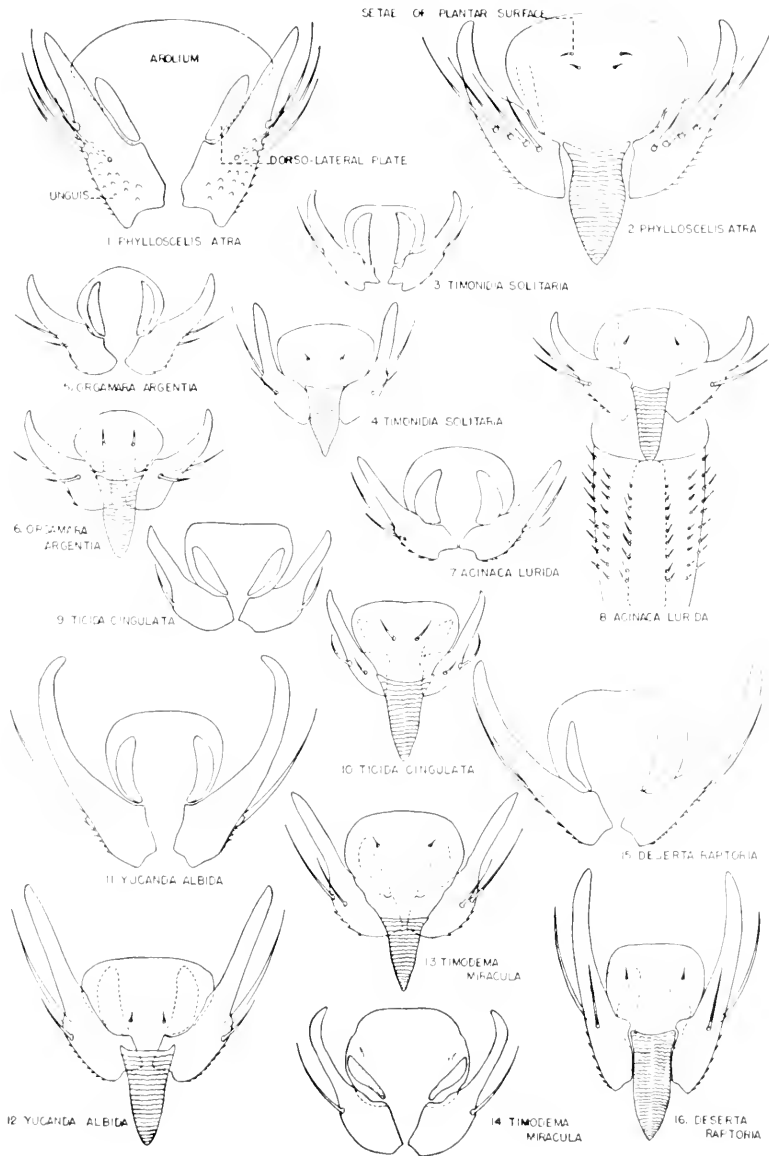


PLATE II

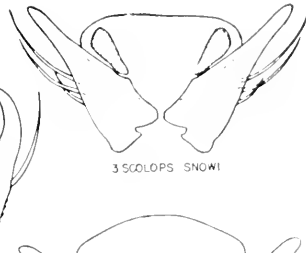
FIGURE

1. Dorsal view of pretarsus of *Scolops perdix* Uhler.
2. Dorsal view of pretarsus of *Scolops uhleri* Ball.
3. Dorsal view of pretarsus of *Scolops snowi* Breakey.
4. Dorsal view of pretarsus of *Scolops pugnans* Germar.
5. Dorsal view of pretarsus of *Scolops maculosus* Ball.
6. Dorsal view of pretarsus of *Scolops angustatus* Uhler.
7. Dorsal view of pretarsus of *Scolops pallidus* Uhler.
8. Dorsal view of pretarsus of *Scolops sulcipes* Say.
9. Dorsal view of pretarsus of *Scolops grossus* Uhler.
10. Ventral view of pretarsus of *Rhynchomitra recurva* (Metcalf).
11. Dorsal view of pretarsus of *Rhynchomitra recurva* (Metcalf).

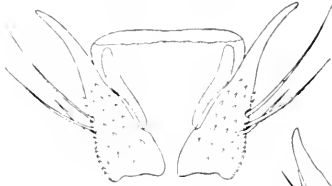
PLATE II



1 SCOLOPS PERDUK



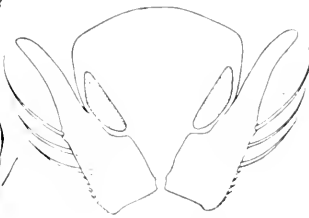
3 SCOLOPS UHLERI



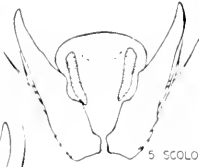
4 SCOLOPS PUNGENS



2 SCOLOPS UHLERI



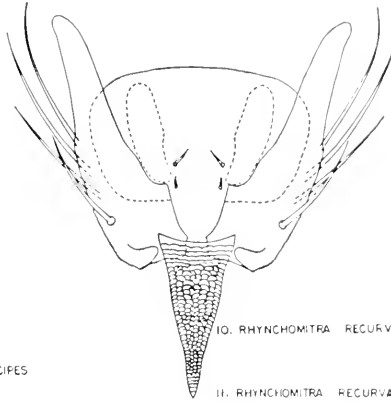
6 SCOLOPS ANGSTATUS



5 SCOLOPS MACULOSUS

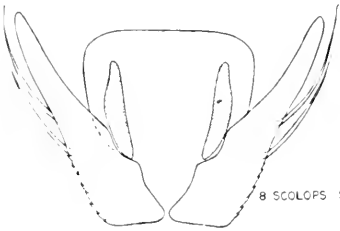


7 SCOLOPS FALLIDUS

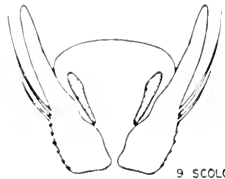


10. RHYNCHOMITRA RECURVA

11. RHYNCHOMITRA RECURVA



8 SCOLOPS SULCIFER



9 SCOLOPS GROSSUS

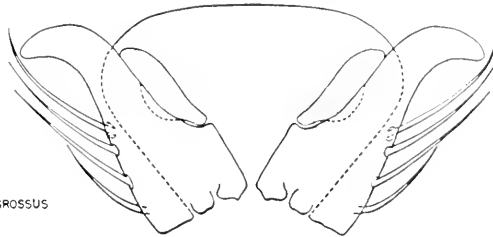
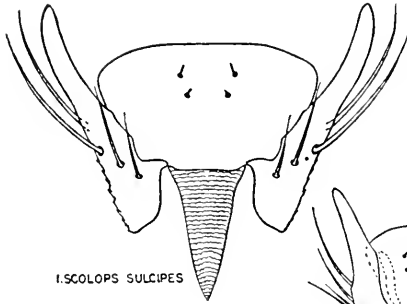


PLATE III

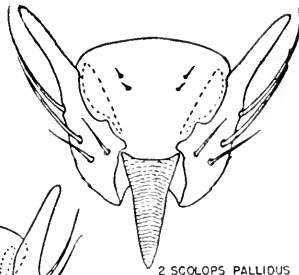
FIGURE

1. Ventral view of pretarsus of *Scolops sulcipes* Say.
2. Ventral view of pretarsus of *Scolops pallidus* Uhler.
3. Ventral view of pretarsus of *Scolops grossus* Uhler.
4. Ventral view of pretarsus of *Scolops snowi* Breakey.
5. Ventral view of pretarsus of *Scolops uhleri* Ball.
6. Ventral view of pretarsus of *Scolops angustatus* Uhler.
7. Ventral view of pretarsus of *Scolops pungens* Germar.
8. Ventral view of pretarsus of *Scolops perdix* Uhler.
9. Ventral view of pretarsus of *Scolops maculosus* Ball.
10. Dorsal view of pretarsus of *Nersia florens* Stål.
11. Ventral view of pretarsus of *Nersia florens* Stål.

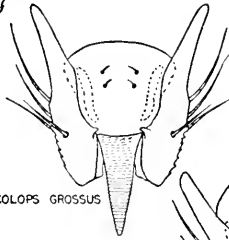
PLATE III



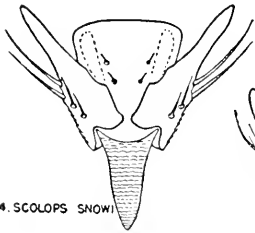
1. SCOLOPS SULCIPES



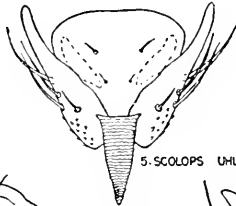
2. SCOLOPS PALLIDUS



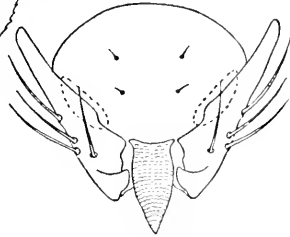
3. SCOLOPS GROSSUS



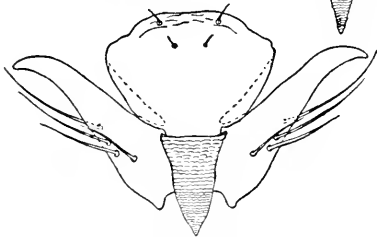
4. SCOLOPS SNOWI



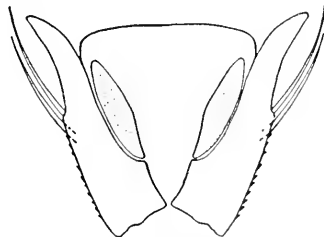
5. SCOLOPS UHLERI



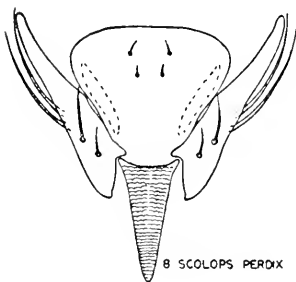
6. SCOLOPS ANGUSTATUS



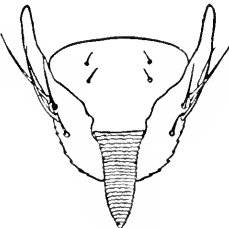
7. SCOLOPS PUNGENS



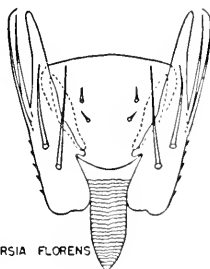
10. NERSIA FLORENS



8. SCOLOPS PERNIX



9. SCOLOPS MACULOSUS



11. NERSIA FLORENS

PLATE IV

FIGURE

1. Dorsal view of pretarsus of *Orgerius junceus* Doering and Darby.
2. Ventral view of pretarsus of *Orgerius junceus* Doering and Darby.
3. Dorsal view of pretarsus of *Orgerius ventosus* Ball and Hartzell.
4. Ventral view of pretarsus of *Orgerius ventosus* Ball and Hartzell.
5. Ventral view of pretarsus of *Orgerius pajaronius* Ball and Hartzell.
6. Dorsal view of pretarsus of *Orgerius pajaronius* Ball and Hartzell.
7. Dorsal view of pretarsus of *Orgerius rhypparus* Stål.
8. Ventral view of pretarsus of *Orgerius rhypparus* Stål.
9. Ventral view of pretarsus of *Orgerius concordus* Ball and Hartzell.
10. Dorsal view of pretarsus of *Orgerius concordus* Ball and Hartzell.
11. Ventral view of pretarsus of *Orgerius bicornis* Doering and Darby.
12. Dorsal view of pretarsus of *Orgerius bicornis* Doering and Darby.
13. Ventral view of pretarsus of *Orgerius foliatus* Doering and Darby.
14. Dorsal view of pretarsus of *Orgerius foliatus* Doering and Darby.

PLATE IV

