

A REVIEW OF NORTH AMERICAN *ARDEICOLA* (Mallophaga: Philopteridae)¹

DONALD W. TUFF²

ABSTRACT

Three species and one subspecies of *Ardeicola* are described as new. Records and figures of the nine remaining North American species are included along with a key to the North American species. The *Ardeicola* species are distributed as follows: *A. ajajae* Carriker from *Ajaia ajaja* (Linn.), *A. elongata* Carriker from *Eudocimus albus* (Linn.), *A. loculator* Giebel from *Mycteria americana* Linn., *A. rhapsidius* (Nitzsch) from *Plegadis falcinellus* (Linn.) and *Plegadis chihi* (Vieillot), and *Ardeicola* sp.n. from *Eudocimus albus* Linn. This last species is unusual in that it is the second member of the genus found on the same host species.

The remaining species of *Ardeicola* are found on members of the Ardeidae: *A. gaibagla* Ansari from *Bubulcus ibis* Linn., *Casmerodius albus* Linn., and *Florida thula* (Molina); *A. botauri* (Osborn) from *Botaurus lentiginosus* (Rackett), *Ardeicola* sp.n. from *Ixobrychus exilis* (Gmelin), *A. cruscula* Carriker from *Ardea herodias* Linn., *A. florida* Carriker from *Florida caerulea* (Linn.), *A. florida* ssp.n. from *Dichromanassa rufescens* (Gmelin), *Hydranassa tricolor* (Müller) and *Butorides virescens* (Linn.); *A. goisagi* Uchida from *Nycticorax nycticorax* (Linn.), and *Ardeicola* sp.n. from *Nyctanassa violacea* (Linn.).

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² Present Address: Department of Biology, Southwest Texas State College, San Marcos.

The members of the genus *Ardeicola* are restricted to the avian order Ciconiiformes. Of the twelve species of *Ardeicola* reported here from North American ciconiiforms, three species and one subspecies are described as new.

In Hopkins' and Clay's check-list (1952) and the 1955 additions and corrections, 52 names were included in this genus of which 31 are considered valid. The only recent work dealing specifically with *Ardeicola* is that by Carriker in 1960. In his paper he describes six new species, three of them from hosts known to occur in the United States. One species, *A. hoactli* Carriker, is considered herein to be a synonym of *A. raphidius* (Nitzsch).

The male genitalia of the *Ardeicola* are unique. This is especially true of the *Ardeicola* from the Threskiornithidae and from the Wood Ibis, the sole North American member of the Ciconiidae. The form of the male genitalia in those species from the Ardeidae is similar with the exception of *Ardeicola gaibagla* Ansari.

All measurements given herein are in millimeters.

The *Ardeicola* of the Threskiornithidae and Ciconiidae

Ardeicola ajajae Carriker

(Figs. 1, 2, 13)

Ardeicola plataleae ajajae Carriker, 1961. Novedades Cientificas, Museo de Histori Natural, LaSalle, Zoological series No. 28:50, figs. 51-53, Host: *Ajaia ajaja* (Linn.).

Ardeicola ajajae Carriker, Emerson, 1962. Tentative List of Mallophaga for North American Birds, p. 45.

Carriker (1961) considered *A. ajajae* to be a subspecies of *A. plataleae*. Emerson (1962) elevated *A. ajajae* to specific rank. Emerson and Clay (in litt.), believe as does this writer that *A. ajajae* should have specific rank. The male genitalia of both species and the shape of the females of both species are greatly different.

Material examined: Twelve males and 15 females from *Ajaia ajaja* (Linn.) skin, K. G. Emerson; Waller Co., Texas, 26 July 1960, D. W. Tuff; and Galveston Co., Texas, 13 May 1961, D. W. Tuff.

Ardeicola elongata Carriker

(Figs. 3, 4, 16)

Ardeicola elongata Carriker, 1960. Novedades Colombianas, 1(5):321, fig. 8, Host: *Eudocimus albus* (Linn.).

As far as is known, the species referred to in the material examined are the first to have been collected since the original collection by Carriker in Costa Rica in 1902.

The White Ibis is normally a host to two species of *Ardeicola*, both of which have been collected by myself in large numbers. Although two species of *Ardeicola* on the same host is unusual, there is no evidence of conspecificity between the two. The question of contamination or straggling can be eliminated by noting that both species have been recovered in large numbers from each host collected.

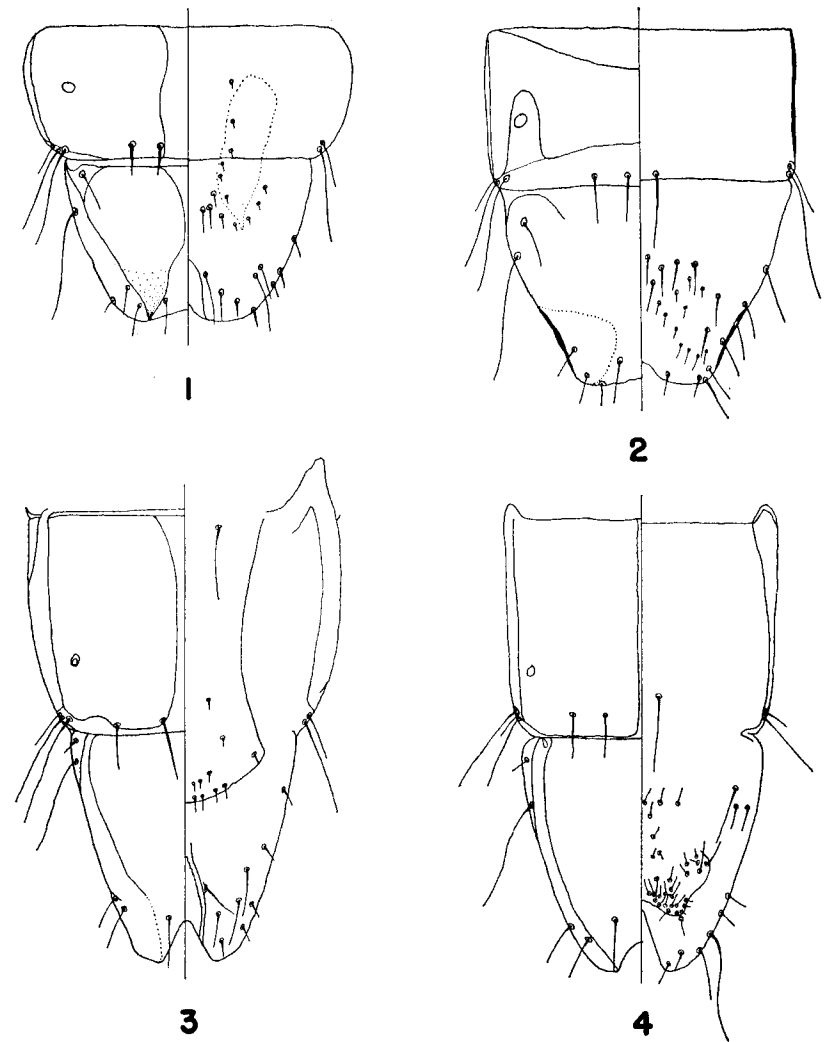


FIG. 1, *Ardeicola ajajae* Carriker, dorsal-ventral view of terminal abdominal segments of female. FIG. 2, *Ardeicola ajajae* Carriker, dorsal-ventral view of terminal abdominal segments of male. FIG. 3, *Ardeicola elongata* Carriker, dorsal-ventral view of terminal abdominal segments of female. FIG. 4, *Ardeicola elongata* Carriker, dorsal-ventral view of terminal abdominal segments of male.

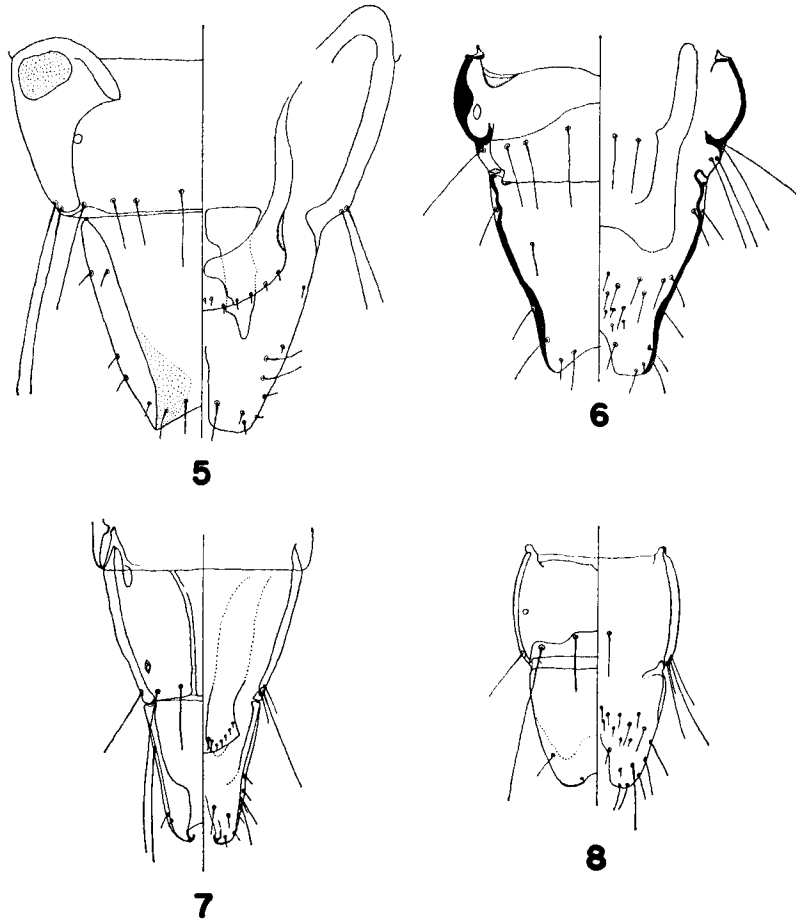


FIG. 5, *Ardeicola loculator* (Giebel), dorsal-ventral view of terminal abdominal segments of female. FIG. 6, *Ardeicola loculator* (Giebel), dorsal-ventral view of terminal abdominal segments of male. FIG. 7, *Ardeicola raphidius* (Nitzsch), dorsal-ventral view of terminal abdominal segments of female. FIG. 8, *Ardeicola raphidius* (Nitzsch), dorsal-ventral view of terminal abdominal segments of male.

Material examined: Twenty-eight males and 30 females from *Eudocimus albus* (Linnaeus), Waller Co., Texas, 25 May and 29 June 1960, D. W. Tuff; and Galveston Co., Texas, 13 May 1961, D. W. Tuff.

Ardeicola loculator (Giebel)
(Figs. 5, 6, 14)

Lipeurus linearis Rudow, 1869 (nec Nitzsch, 1866). Beitr. Kenntnis Mallophaga, p. 35, Host: *Myceteria americana* Linn.

Lipeurus loculator Giebel, 1874. Insecta Epizoa, p. 228, Host: *Myceteria americana* Linn.; Piaget, 1880. Les Pediculines, p. 313; Taschenberg, 1882. Nova Acta. Leop.-Carol., 44(1):127.

Esthiopterum loculator (Giebel) Harrison, 1916. Parasitology, 9(1):137.

Ardeicola loculator (Giebel) Thompson, 1940. Ann. Mag. Nat. Hist., (11), 5:301.

Piaget (1880) gives only brief mention of Giebel's description of *A. loculator*. Taschenberg (1882) refers to Giebel's species, gives a brief description of the male and female, and includes the measurements of the female. Taschenberg also refers to the identity between Rudow's *A. linearis* and *A. loculator*.

Material examined: Four males and eleven females from *Mycertia americana* Linn., 15 mi., S.W. Lake Placid, Highlands Co., Florida, 21 July 1960, Braasch and Atyeo; Romeros, Peru, 2 June 1933, M. A. Carriker, Jr., No. 6383; Uvalde, Texas, 23 Sept. 1922, D. C. Parman, Bish. No. 10948; Hooper, Utah, 8 Aug. 1930, G. F. Knowlton, Bish. No. 15533; and Tlacotalpan, Ver., Mexico, 22 June 1961, D. H. Janzen.

Ardeicola raphidius (Nitzsch)
(Figs. 7, 8, 15)

Lipeurus raphidius Nitzsch, 1866. In Giebel, Zeit. ges. Natwiss., 28:384, Host: *Plegadis f. falcinellus* (Linn.); Giebel, 1874. Insecta Epizoa, p. 229; Taschenberg, 1882, Nova Acta Leop.-Carol., 44:128, pl. 5, fig. 5.

Lipeurus argentinus Kellogg, 1906. J. New York Entomol. Soc. 14:46, pl. 2, fig. 2, Host: *Plegadis falcinellus guarauna*.

Esthiopterum raphidium (Nitzsch) Harrison, 1916. Parasitology, 9:140; Dubinin, 1938. Trav. Reserve Etat Astrakhan, 2:174.

Ardeicola raphidius (Nitzsch) Clay, 1936. Proc. Zool. Soc. London, pt. III, 1936:616; Hopkins, 1947. Ann. Mag. Nat. Hist., (11), 14:99.

Ardeicola guaraunae Eichler, 1943. Mem. Estud. Mus. Zool. Coimbra, 140:1, fig., Host: *Plegadis falcinellus guarauna* (Linnaeus).

Ardeicola hoactli Carriker, 1960. Novedades Colombianas, 1(5):319, fig. 3, Host: *Nycticorax nycticorax hoactli*; (a straggler). (nec) *Lipeurus raphidius* Nitzsch, Piaget, 1880. Les Pediculines, p. 317, pl. 26, fig. 3; Mjoberg, 1910. Arkiv. Zool., 6(13):90; Seguy, 1944. Faune de France, 43:356, figs. 31 and 82.

Hopkins and Guimaraes considered *A. argentinus* (Kellogg) and *A. guaraunae* Eichler to be absolute synonyms of *A. raphidius*, (Hopkins, 1947).

Most of the early confusion evidently began with Piaget who described and illustrated "*raphidius*," (nec Nitzsch). Taschenberg alleviated the situation by proposing the name *pseudoraphidius* for Piaget's "*raphidius*." Seguy (1944) unfortunately modified Piaget's description but used Piaget's figure. Seguy's innocent propagation of Piaget's error has been noted in the synonymy.

Emerson (1962) listed *A. hoactli* Carriker as a synonym of *A. raphidius*.

Carriker obtained the single type specimen from a Black-crowned Night Heron, [*Nycticorax nycticorax hoactli* (Gmelin)].

In reviewing Carriker's description, diagnosis and illustration, it is readily apparent that *A. hoactli* is in reality *A. raphidius* (Nitzsch) and was possibly a straggler on the night heron.

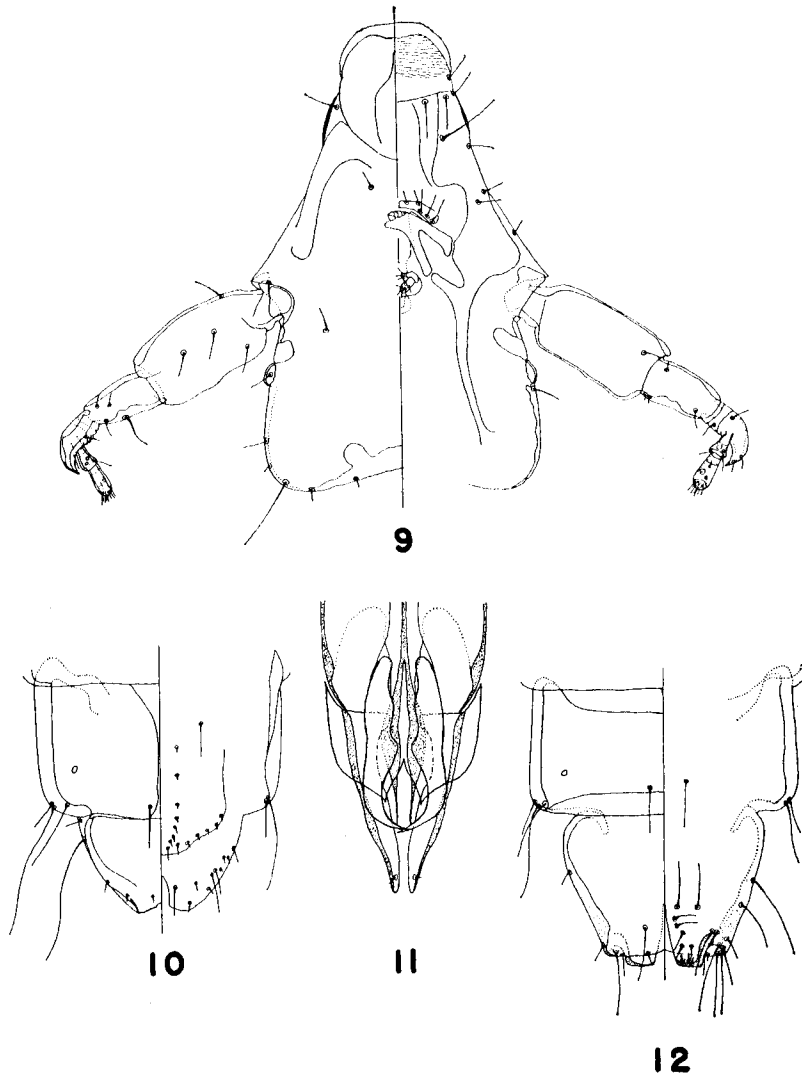


FIG. 9, *Ardeicola robusta*, sp.n., dorsal-ventral view of head of holotype male. FIG. 10, *Ardeicola robusta*, sp.n., dorsal-ventral view of terminal abdominal segments of allotype female. FIG. 11, *Ardeicola robusta*, sp.n., ventral view of genitalia of holotype male. FIG. 12, *Ardeicola robusta*, sp.n., dorsal-ventral view of terminal abdominal segments of holotype male.

Straggling from the ibis is entirely possible. This writer has observed night herons and White-faced Glossy Ibises "battling" for position on the same branch. Numerous night herons and ibises have been encountered in the same rookery.

Generally all *Plegadis chihi* (Vieillot) collected have been heavily infested with *A. raphidius*. Emerson (1962) notes *A. raphidius* to be a common parasite on *Plegadis falcinellus* and *P. chihi*.

Material examined: Sixteen males and 27 females from *Plegadis falcinellus* (Linn.), Galveston Co., Texas, 14 June 1946, K. C. Emerson, No. 11; Waller Co., Texas, 29 June 1960, D. W. Tuff. Fifty-four males and 66 females from *Plegadis chihi* (Vieillot), Waller Co., Texas, 17 May, 25 May and 8 Aug. 1960 and 12 July 1961, D. W. Tuff; Aransas Co., Texas, 19 July 1960, D. W. Tuff; and Brigham City, Utah, 13 May 1930, G. F. Knowlton, Bish. No. 17907.

Ardeicola robusta, sp.n.

(Figs. 9, 10, 11, 12)

Type material: Holotype male and allotype female from *Eudocimus albus* (Linnaeus), Waller Co., Texas, 25 May 1960, D. W. Tuff, U.S.N.M. No. 69353. Two male and three female paratypes with same data as holotype. Seventeen male and 15 female paratypes from type host, Waller Co., Texas, 29 June 1960, D. W. Tuff; and four male and 12 female paratypes from type host, Galveston Co., Texas, 13 May 1961, D. W. Tuff.

Description: Holotype male. Head with clypeal margin shallowly emarginate, papillae somewhat flattened; preantennal width distinctly greater than width across temporal lobes, preantennal margins strongly convergent; eyes present, each with a well developed ocular seta; lateral margins of postantennal region straight, parallel; temporal lobes rounded at angles, with a single medium length seta; dorsal premandibular setae small as are the occipital setae; antennae unusual, first three segments appear digitate, first segment robust, second segment with base equal in width to apex of first, third resembles a claw (without lateral expansion), fourth arises from basal one-third of third segment on proximal side.

Prothorax wider than long, lateral margins sigmoidal; spiracle on posterolateral angle weakly tuberculate; postspiracular seta short, stout; dorsal posterior margin straight medially with a pair of medium length setae.

Pterothorax wider than long, margins straight and slightly divergent posteriorly; meso- and metasternal areas each with two long medial setae; dorsal posterolateral angle with a submarginal group of four long pustulated setae, middle pair longest; posterolateral angle with two medium-long subequal marginal setae; pterothorax with a slight mesal division; posterior margin converging to an acute angle.

Abdomen elongate, widest at segment 4, narrows posteriorly; all segments wider than long; tergites 1, 2 and 3 divided medially, tergites

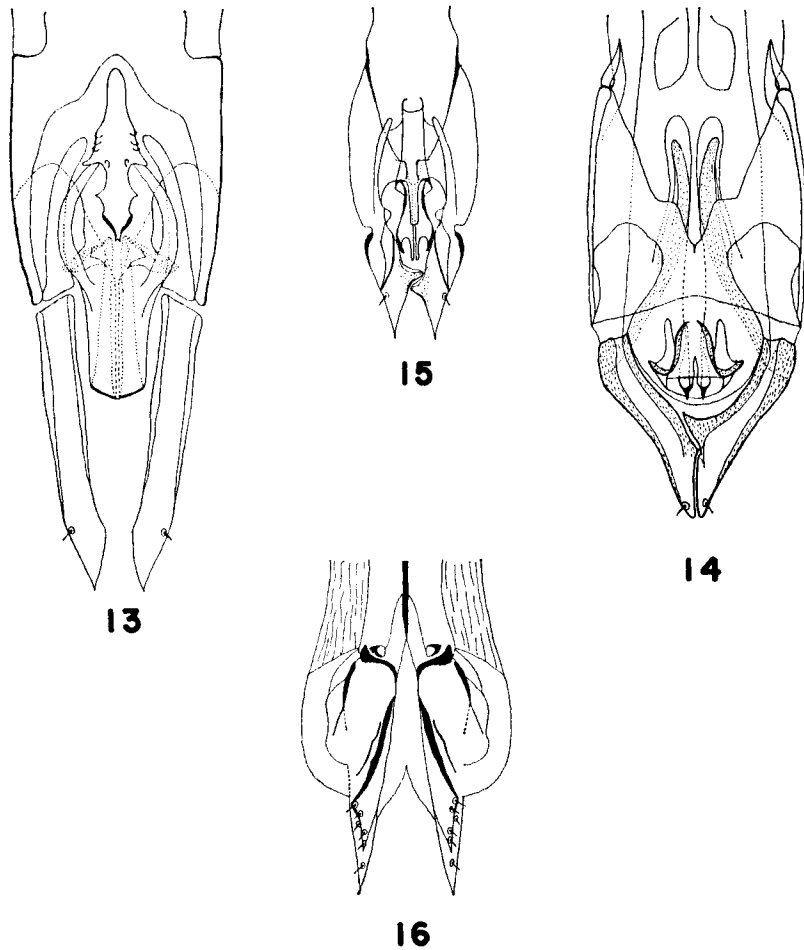


FIG. 13, *Ardeicola ajajae* Carriker, ventral view of male genitalia. FIG. 14, *Ardeicola loculator* (Giebel), dorsal view of male genitalia. FIG. 15, *Ardeicola raphidius* (Nitzsch), ventral view of male genitalia. FIG. 16, *Ardeicola elongata* Carriker, ventral view of male genitalia.

4 to 7 with entire transverse band typical of males; pigmentation of tergites present but reduced; spiracles small, submarginal; tergite 1 with a short seta at each anteromesal angle; posterior margin of tergites 1 to 7 with two medium length setae of same size, tergites 5 to 7 with an additional short posterolateral submarginal seta; posterolateral angle of segment 1 with one short seta, 2 and 3 with two, 4 with three, 5 and 6 with four and 7 with five moderately long setae; posterior margin

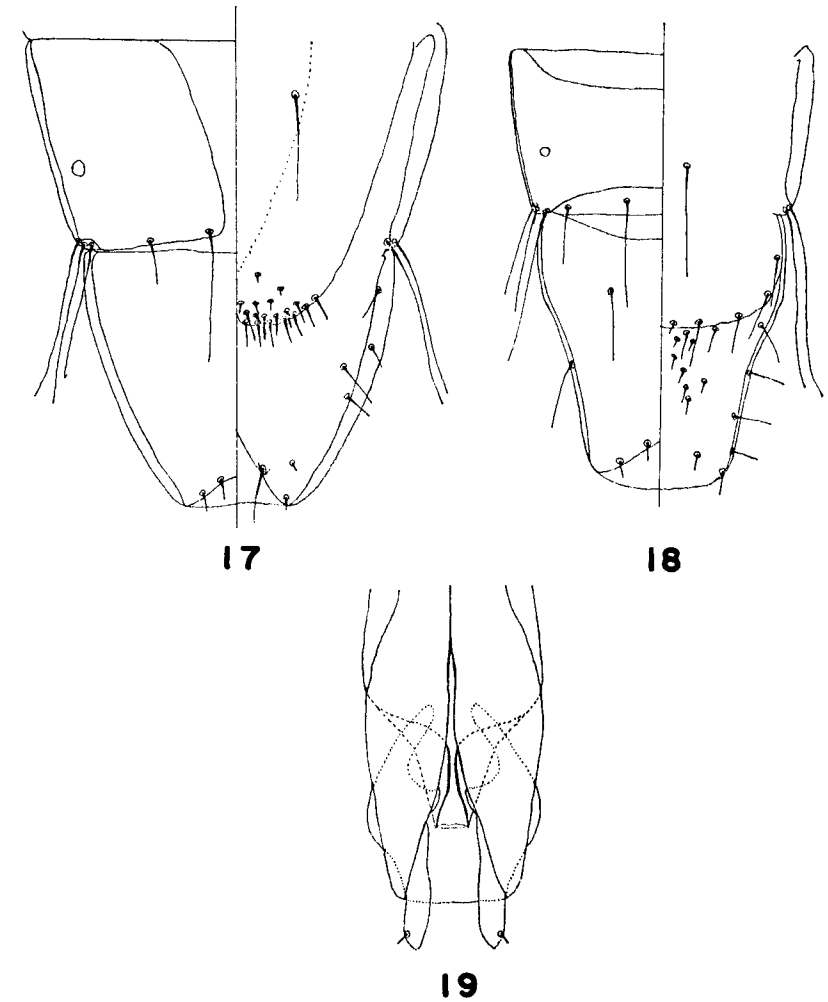


FIG. 17, *Ardeicola gaibagla* Ansari, dorsal-ventral view of terminal abdominal segments of male. FIG. 18, *Ardeicola gaibagla* Ansari, dorsal-ventral view of terminal abdominal segments of male. FIG. 19, *Ardeicola gaibagla* Ansari, ventral view of male genitalia.

of sternites 1, 2, 5 and 6 with four setae, sternites 3, 4 and 7 with two medial setae; terminal abdominal segment conical, chaetotaxy characteristic; apical margin of terminal segment emarginate, dorsal and ventral lobes truncate, dorsal lobes shorter than and overlapped by

narrow ventral lobes; genitalia well developed, characteristic of the species.

Allotype female with anterior margin of clypeus emarginate; occipital setae absent; dorsal premandibular setae extremely short; conical small; width across rounded preantennal nodus less than width across straight parallel-sided temporal margins; antennae normal.

Prothorax, pterothorax and legs similar to those of male.

Abdomen elongate, parallel sided; width of base of terminal segment much less than width at apex of segment 7; tergites divided medially, chaetotaxy as in male; terminal conical segment with acutely emarginate apex, lobes slightly angulate; anterolateral margin of terminal segment with a single long seta; chaetotaxy of terminal segment as in Figure 10.

Measurements:

	Holotype Male		Allotype Female	
	Length	Width	Length	Width
Head	.72	—	.68	—
preantennal	.41	.48	.41	.41
temples	—	.44	—	.43
Prothorax	.27	.34	.20	.30
Pterothorax	.44	.47	.37	.41
Abdomen	1.75	.56	1.72	.54
Total	3.18	—	2.97	—

Diagnosis: Both sexes have slightly flattened clypeal papillae; anterior clypeal margin is also distinctly emarginate. The females can be most easily separated from all other North American *Ardeicola* by the conical terminal abdominal segment being considerably narrower than segment 7. The robust basal antennal segment of the male (for which the species was named) represented in Figure 9 is unmistakable. The male antennae also have an unusual third segment, claw-like rather than with the normal anterolateral projection as in other species. The male genitalia appears to be the most complex of any of the *Ardeicola* known from the American continent.

Discussion: *Ardeicola robusta* and *Ardeicola elongata* are normal parasites of *Eudocimus albus*, the White Ibis. In no instance should the two species be confused. This is the first record where more than one species of *Ardeicola* has been found on the same host.

The *Ardeicola* of the Ardeidae

With the exception of *Ardeicola gaibagla* Ansari, the remaining species of *Ardeicola* on the Ardeidae appear to be very closely related. There is some variation in degree of pigmentation and size of individuals. The chaetotaxy of these species, including *A. gaibagla*, does not appear to offer a reliable means of separation. The method of separa-

tion employed may not be the most acceptable because degrees of pigmentation are considered. For want of a more tangible and reliable method the author chooses to use pigmentation for distinguishing species. However, in this complex of species from the ardeids, the male genitalia seem to be the most characteristic structure for a given species. Further study should determine if the differences noted are really of specific or subspecific significance.

The differences between the various carinae of the head have been found inadequate because the differences are less apparent than coloration. The chaetotaxy of the terminal abdominal segments was examined and compared but again few differences were found due to the degree of individual variation.

The majority of the Ardeidae occurring in North America are colony breeders. This gregarious habit could, and does occasionally, lead to straggling of parasites. Three hosts are known to be solitary in habit: *Ixobrychus exilis* (Least Bittern); *Botaurus lentiginosus* (American Bittern); and *Butorides virescens* (Green Heron).

There is a considerable degree of host specificity in the Mallophaga. Occasionally a given parasite may be widely distributed on different hosts partially due to the adaptability of the parasite to a host and without the appearance of variation due to isolation. The name of the host species is an excellent aid when used with structural illustrations to identify a given species of parasite. The extent of similarity between parasites is probably related to the close relationship of the hosts. It is again worth noting that these gross similarities can also be explained by isolation of the same species on different hosts. The minor differences in genitalia are a product of this isolation.

The following descriptions are rather general. Of primary concern in the identification of the species, as shown in the associated illustrations, is the shape and extent of pigmentation of the abdominal tergites.

Ardeicola gaibagla Ansari
(Figs. 17, 18, 19)

Ardeicola gaibagla Ansari, 1947. Proc. Nat. Inst. Sci. India, 12(6):256, fig. 1.
Host: *Bubulcus ibis coromandus* (Boddaert).

Ardeicola albulus Eichler, 1948. Vögel der Heimat, No. 6:107, figs. 2 and 3. Host: *Casmerodius a. albus* (Linn.) (NEW SYNONYMY).

Ardeicola albulus Eichler is placed in synonymy with *A. gaibagla* after comparing the descriptions of both species with numerous specimens from *Bubulcus ibis* and *Casmerodius albus*. In addition to the above-mentioned hosts, numerous specimens obtained on *Florida thula* are considered conspecific with *A. gaibagla*. The minor differences in the number of marginal setae on the median ventral area of the terminal abdominal segment in the females and the width of the median lobe of the male genitalia may be characters of subspecific value. Subspecies should not be erected until more hosts are examined.

It is most interesting to note that this species of *Ardeicola* has been

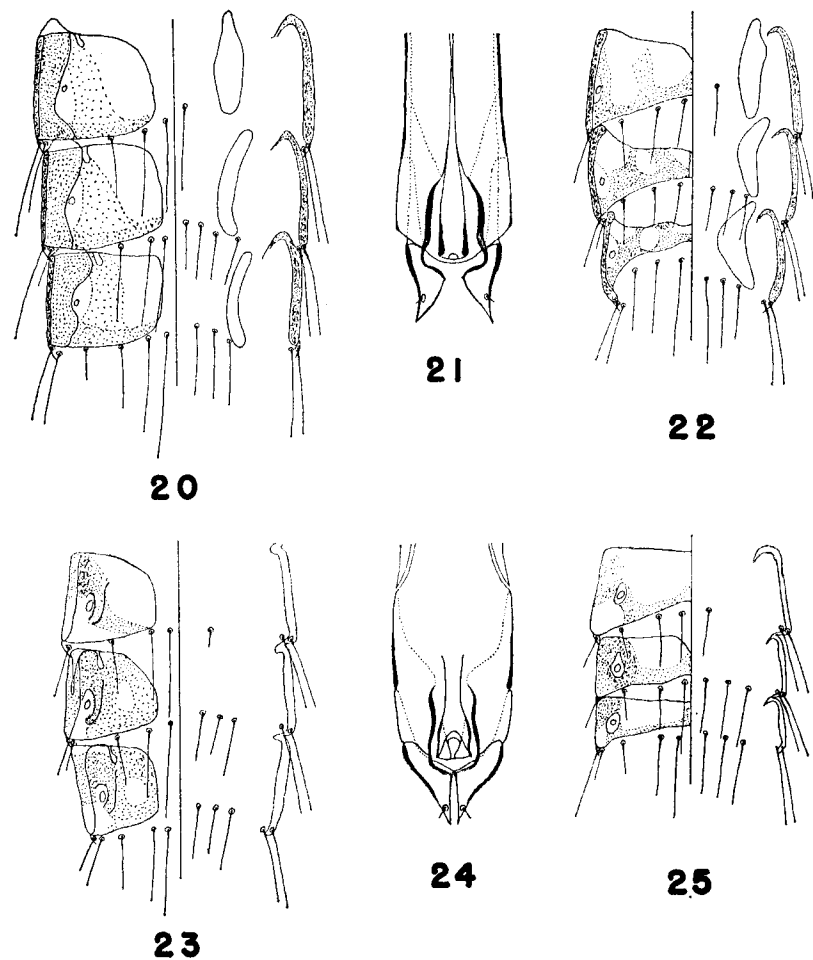


FIG. 20, *Ardeicola botauri* (Osborn), dorsal-ventral view of abdominal segments 4, 5 and 6 of female. FIG. 21, *Ardeicola botauri* (Osborn), ventral view of male genitalia. FIG. 22, *Ardeicola botauri* (Osborn), dorsal-ventral view of abdominal segments 4, 5 and 6 of male. FIG. 23, *Ardeicola celeris*, sp.n., dorsal-ventral view of abdominal segments 4, 5 and 6 of female allotype. FIG. 24, *Ardeicola celeris*, sp.n., ventral view of genitalia of holotype male. FIG. 25, *Ardeicola celeris*, sp.n., dorsal-ventral view of abdominal segments 4, 5 and 6 of holotype male.

found on three North American hosts that have exclusively white plumage.

Material examined: Twelve males and 16 females from *Bubulcus ibis* (Linn.), Mona Island, Puerto Rico, 1 Sept. 1955, Warren F. Pippin, No. 439; Thailand, Lop Buri, Khao Oerawan Mt., 9 Aug. 1953, R. E. Elbel, RE No. 2868, Traub No. B-21687; Thailand, Chaiyophum, Phukhieo, Ban Kaeng, Ban Lat, 9 Jan. 1952, R. E. Elbel, RE No. 338, RT-B-9891; Waller Co., Texas, 25 May, 26 July, 12 Aug. 1960, and 2 Aug. 1961, D. W. Tuff; and Aransas Co., Texas, 10 Dec. 1960, D. W. Tuff. Eleven males and 29 females from *Casmerodius albus* (Linn.), skin of host; Hartstown, Penna., 8-5-1933, W. E. C. Todd, Bish. No. 22540; Waller Co., Texas, 17 May, 29 June, 13 and 26 July 1960, D. W. Tuff. Eight males and 14 females from *Florida thula* (Molina), Waller Co., Texas, 17 May, 4 June, and 12 Aug. 1960, D. W. Tuff; and Sewerline, Dugway Prov. Ground, Touele Co., Utah, 20 May 1953, W. G. Denzer, No. 31:B-261.

Ardeicola botauri (Osborn)

(Figs. 20, 21, 22)

Lipeurus botauri Osborn, 1896. Bull. U. S. Bur. Entomol. (n.s.), 5:234, Host: *Botaurus lentiginosus* (Montagu).

Esthiopterum botauri (Osborn) Harrison, 1916. Parasitology, 9(1):131.

Ardeicola botauri (Osborn) Thompson, 1940. Ann. Mag. Nat. Hist., (11), 5:300; Emerson, 1960. Proc. Biol. Soc. Washington, 73:159.

Hopkins and Clay (1952) placed *A. botauri* as a synonym of *A. stellaris* (Denny). Emerson (1960), upon examination of Osborn's types, considered *A. botauri* to be a valid species. I agree with Emerson since the dark spots mentioned and figured in the male of *A. stellaris* by Denny (1842) are absent in *A. botauri*.

Material examined: Five males and 11 females from *Botaurus lentiginosus* (Rackett), Fairhope, Alabama, 10-5-1931, Mrs. W. H. Edwards, Bish. No. 18126; Bainbridge, Ga., 9 March 1956; Manhattan, Kansas, 1 Nov. 1935, J. E. Ackert; and Creole, La., 20 Nov. 1940, W. W. Wirth.

Ardeicola celeris, sp.n.

(Figs. 23, 24, 25)

Type material: Holotype male and allotype female from *Ixobrychus exilis* (Gmelin), Chambers Co., Texas, 13 May 1961, D. W. Tuff, U.S.N.M. No. 69352. Four male and four female paratypes with same data as holotype.

Description: Holotype male. The overall length of the male of this species is somewhat shorter than males of closely related species; fifth abdominal tergite with a distinct anterior median emargination; posterior margin of tergite 5 sinuous; tergite 6 narrow; pigmentation greatly reduced; abdominal segments 1 and 2 without pigmentation, faint on tergite 3, most pronounced on 4, 5 and 6; chaetotaxy reduced as in related species. Male genitalia characteristic of the species (Fig. 24).

Allotype female similar to male; pigmentation of tergites as in male; tergites divided medially and not entire as in the male; characteristic form of pigmentation of tergites 4, 5 and 6 as in Figure 23.

The pattern of darkest pigmentation is confined generally to the anterolateral portion of the tergite, proceeding mesad of the spiracle and along the posterior margin of the tergite; additional pigmentation of tergites 5 and 6 is seen surrounding a clear spot on the central portion of the tergite.

Diagnosis: The male of this species is most easily recognized by the (1) greatly reduced projection of the anterolateral margin of the third antennal segment; (2) deep median emargination on anterior border of tergite 2, also the sinuous posterior margin of the tergite; (3) tergal pigmentation (Fig. 25); and (4) the male genitalia (Fig. 24). The form of pigmented areas on the 4, 5 and 6 abdominal tergites, as earlier mentioned, is the unique feature of the female.

Measurements:

	Holotype Male		Allotype Female	
	Length	Width	Length	Width
Head	.61	—	.66	—
preantennal	.35	.30	.35	.34
temples	—	.35	—	.41
Prothorax	.17	.25	.27	.30
Pterothorax	.27	.34	.27	.41
Abdomen	1.15	.41	1.63	.51
Total	2.20	—	2.83	—

Discussion: The type material was obtained from a single host specimen. No other material has been seen. The host was immature but was easily determined as the Least Bittern, *Ixobrychus exilis* (Gmelin).

Ardeicola cruscula Carriker
(Figs. 26, 27, 28)

Ardeicola cruscula Carriker, 1960. Novedades Colombianas, 1(5):318, fig. 1, Host: *Ardea herodias* Linnaeus.

It is interesting to speculate as to what type of *Ardeicola* will be found on *Ardea occidentalis* Audubon, the Great White Heron. This species and *Ardea herodias*, the host of *A. cruscula*, appear to be rather closely related since hybrids between the two species have been observed (Brodkorb, in Blair, p. 387). On the basis of the host color, one would expect to find a form of *Ardeicola gaibagla* Ansari. However, when the close relationship of the hosts is considered, an *Ardeicola* with male genitalia similar to that of *A. cruscula* Carriker might be found.

Carriker (1960) noted the similarity of *A. cruscula* with *A. ardeae* (Linn.), the type of the genus. Carriker had only the female holotype.

The male genitalia of *A. cruscula* and *A. ardeae* are of the same basic pattern as in the *A. botauri* group. A comparison of the male

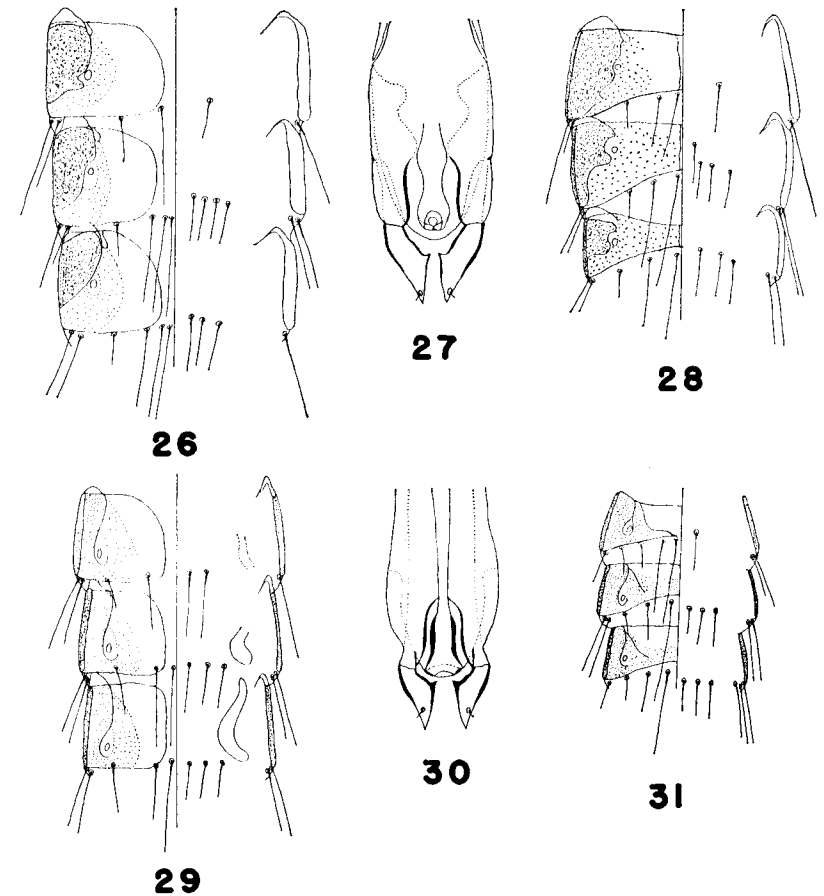


FIG. 26, *Ardeicola cruscula* Carriker, dorsal-ventral view of abdominal segments 4, 5 and 6 of female. FIG. 27, *Ardeicola cruscula* Carriker, ventral view of male genitalia. FIG. 28, *Ardeicola cruscula* Carriker, dorsal-ventral view of abdominal segments 4, 5 and 6 of male. FIG. 29, *Ardeicola florida florida* Carriker, dorsal-ventral view of abdominal segments 4, 5 and 6 of female. FIG. 30, *Ardeicola florida florida* Carriker, ventral view of male genitalia. FIG. 31, *Ardeicola florida florida* Carriker, dorsal-ventral view of abdominal segments 4, 5 and 6 of male.

genitalia of *A. cruscula* with Clay and Hopkins' (1950) figure of *A. ardeae*, as well as with specimens of *A. ardeae*, shows the two forms to be distinct.

Carriker's figure of *A. cruscula* has a series of five submarginal setae on the dorsal surface of the pterothorax at the posterolateral angle. Actually there are only three long setae in this group but there

is a non-associated short seta under the middle long seta as well as a long marginal seta at the posterolateral angle. This is true in both males and females.

Material examined: Seven males and five females from *Ardea herodias* Linn. Mariguana Island, 20 July 1930, H. S. Peters, Bish. No. 15131; and Aransas Co., Texas, 19 July 1960, D. W. Tuff.

Ardeicola florida florida Carriker
(Figs. 29, 30, 31)

Ardeicola florida Carriker, 1960. *Novedades Colombianas*, 1(5):318, fig. 2, Host: *Florida caerulea* (Linnaeus).

This species was described from a single female. The material I examined agrees with Carriker's figure and measurements. The pigmentation of the specimens examined was not as distinctly outlined as shown in his figure. The subspecies in the following description has a color pattern similar to that illustrated by Carriker.

Material examined: Twenty-one males and 19 females from *Florida caerulea* (Linn.), skin of host, Antigua, B.W.I., 6 August 1933, S. T. Danforth, Bish. No. 22019; and Waller Co., Texas, 27 April, 17 May, 4 June, and 12 Aug., 1960, D. W. Tuff.

Ardeicola florida nigra, ssp.n.
(Figs. 32, 33)

Type material: Holotype female and allotype male from *Dichromanassa rufescens* (Gmelin), Galveston Co., Texas, 13 May 1961, D. W. Tuff, U.S.N.M. No. 69354. Nineteen male and 19 female paratypes with same data as holotype. Six male and six female paratypes from type host, Aransas Co., Texas, 19 July 1960, D. W. Tuff; and two male and four female paratypes from type host, Aransas Co., Texas, 18 July 1961, D. W. Tuff.

Additional material examined: Three males and three females from type host, Providenciales, Caicos Isl., Bahama Islands, 4 August 1930, H. S. Peters, Bish. No. 15227; and Galveston, Texas, K. C. Emerson, K. C. E. No. 15. Thirteen males and 11 females from *Hydranassa tricolor* (Muller), West Plana Cay, Bahama Islands, 17 July 1930, H. S. Peters, Bish. No. 15118; Galveston Co., Texas, 14 June 1946, K. C. Emerson, K. C. E. No. 12; and Waller Co., Texas, 25 May and 29 June 1960, D. W. Tuff. Three males and one female from *Butorides virescens* (Linn.), Cayman Brac, Cayman Islands, B.W.I., 11 Sept. 1960, H. S. Peters, Bish. No. 15392.

Description: Holotype female. Head triangular; clypeus rugose; conical small; antennae filiform; temporal lobes rounded; eyes well developed.

Prothorax wider than long; postspiracular seta small.

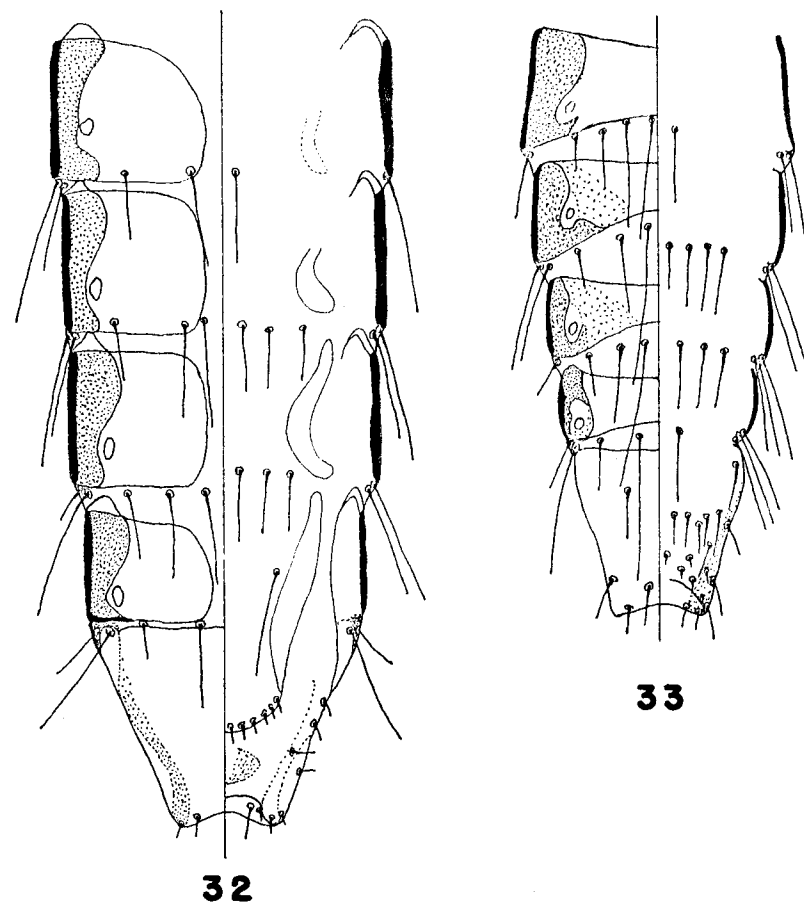


FIG. 32, *Ardeicola florida nigra*, ssp.n., dorsal-ventral view of abdominal segments 4 to 8 of holotype female. FIG. 33, *Ardeicola florida nigra*, ssp.n., dorsal-ventral view of abdominal segments 4 to 8 of allotype male.

Pterothorax wider than long; setae on posterolateral angle as in related species.

Abdomen elongate, slightly fusiform; widest at segment 4; tergites separated medially; tergal pigmentation confined to lateral regions of segments, not surrounding spiracles; small sternal sclerites on segments 5, 6 and 7.

Allotype male similar to female except for antennae, smaller overall size and degree of pigmentation on abdominal tergites. The male genitalia are identical with *Ardeicola florida florida* Carriker.

Measurements:

	Holotype Female		Allotype Male	
	Length	Width	Length	Width
Head	.69	—	.61	—
preantennal	.39	.37	.34	.34
temples	—	.41	—	.36
Prothorax	.20	.30	.18	.27
Pterothorax	.30	.38	.30	.31
Abdomen	1.90	.54	1.34	.42
Total	3.09	—	2.43	—

Diagnosis: The males and females of this subspecies are easily recognized by the dark brown to black pigmentation on the abdominal tergites. The margins of the pigmented areas are well defined, with little gradation in color, except on tergites 5 and 6 of the male.

Discussion: Specimens from the type host cannot be separated from specimens from two other hosts, *Hydranassa tricolor* (Müller) and *Butorides virescens* (Linn.). The male genitalia in all specimens are identical. I do not believe the differences noted to be of specific value.

Ardeicola goisagi Uchida
(Figs. 34, 35, 36)

Ardeicola goisagi Uchida, 1953. Iconographia Insectorum Japonicorum, Tokyo, 109, fig. 269, Host: *Nycticorax n. nycticorax* (Linn.).

Numerous specimens of *A. goisagi* were obtained and examined from eight host specimens. All males were identical with Uchida's figure.

Material examined: Eighteen males and 22 females from *Nycticorax nycticorax* (Linn.), Thailand: Khon Kaen Chumphae, Non Han, Ban Na Noug Thum, 5 Nov. 1953, R. E. Elbel and B. Lekagul, R. E. No. 3127, Traub No. B-22587; Aransas Co., Texas, 19 July 1960, D. W. Tuff; San Patricio Co., Texas, 9 Dec. 1960, D. W. Tuff; and Waller Co., Texas, 29 June and 12 Aug. 1960, D. W. Tuff.

Ardeicola nyctanassa, sp.n.
(Figs. 37, 38, 39)

Type material: Holotype male and allotype female from *Nyctanassa violacea* (Linn.), Cameron Co., Texas, 2 May 1960, H. A. Trevino, U.S.N.M. No. 69355. Three male and seven female paratypes with same data as holotype.

Additional material examined: Seven males and ten females from type host, skin of host; Doce Leques Cayos, Cuba, 9 Sept. 1930, H. W. Peters, Bish. No. 15383; and Laguna de la Costa, Tampico, Tamaulipas, Mexico, 30 Jan. 1962, M. A. Price and O. H. Graham.

Description: Holotype male. Head with shape similar to other species; eyes small; basal antennal segment large, third segment later-

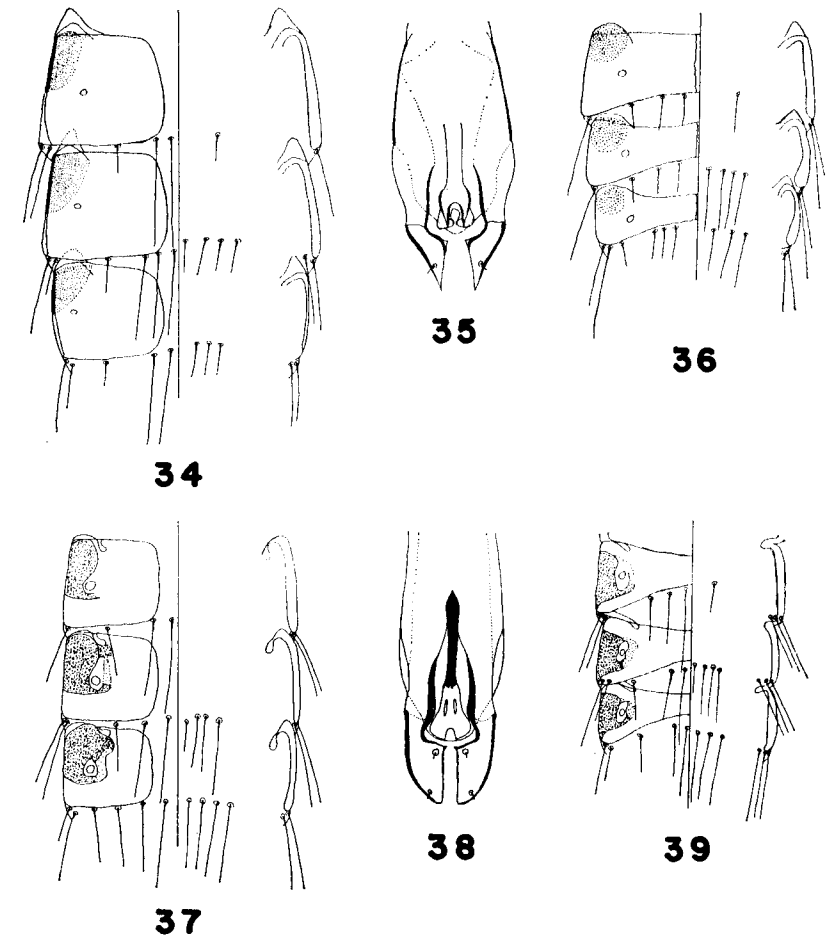


FIG. 34, *Ardeicola goisagi* Uchida, dorsal-ventral view of abdominal segments 4, 5 and 6 of female. FIG. 35, *Ardeicola goisagi* Uchida, ventral view of male genitalia. FIG. 36, *Ardeicola goisagi* Uchida, dorsal-ventral view of abdominal segments 4, 5 and 6 of male. FIG. 37, *Ardeicola nyctanassa*, sp.n., dorsal-ventral view of abdominal segments 4, 5 and 6 of female. FIG. 38, *Ardeicola nyctanassa*, sp.n., ventral view of genitalia of holotype male. FIG. 39, *Ardeicola nyctanassa*, sp.n., dorsal-ventral view of abdominal segments 4, 5 and 6 of holotype male.

ally produced; temporal lobes rounded with medium length setae at posterolateral margin.

Prothorax wider than long, with lateral margins converging anteriorly, not parallel; dorsoposterior margin with a pair of medium length setae.

Pterothorax wider than long with a pair of long meso- and metasternal setae.

Legs and chaetotaxy resembling related species.

Abdomen elongate, widest at segment 4; pigmentation absent on tergite 1, gradually increasing in depth of color and extent to tergite 5, decreasing again on 6 and nearly absent on 7.

The male genitalia of *A. nyctanassa* differ from other species in that the parameres appear blade-like with the lateral margins convex rather than concave as in other species. The internal margins of the parameres are parallel.

Allotype female larger than male, but otherwise similar in most respects; antennae filiform as in other species; abdomen elongate, widest at fourth segment; tergites progressively darker and more extensively pigmented to segment 6; tergite 7 with reduced area of pigmentation, tergite 1 without color; pigmentation confined to lateral area of tergites and generally on the anterior half, circumspiracular on tergites 5 and 6.

Measurements:

	Holotype Male		Allotype Female	
	Length	Width	Length	Width
Head	.66	—	.68	—
preantennal	.34	.39	.37	.38
temples	—	.41	—	.45
Prothorax	.20	.30	.19	.32
Pterothorax	.27	.44	.27	.49
Abdomen	1.45	.52	1.70	.57
Total	2.58	—	2.84	—

Diagnosis: The form of abdominal pigmentation is characteristic of the species. The male genitalia offer the best characters for identification.

Discussion: The specimens of the type series were taken from an adult Yellow-crowned Night Heron whereas the examples from the Mexican hosts were all from immature birds. Few specimens from North American birds have been collected, primarily due to the relative infrequency with which the Yellow-crowned Night Heron is encountered.

KEY TO THE SPECIES OF *ARDEICOLA* CLAY

Males:

- 1 Posterior lateral angles of pterothorax each with a row of three long setae dorsally (on Ardeidae) 6
- 1' Posterior lateral angles of pterothorax each with four or five long closely grouped setae dorsally (on Threskornithidae and Ciconiidae) 2
- 2(1') Five closely grouped setae on each side of dorsal posterior margin of pterothorax *A. loculator*
- 2' Four closely grouped setae on each side of dorsal posterior margin of

- pterothorax 3
- 3(2') Posterior margin of tergites 1 to 6 with four setae of equal length, distance between setae subequal; clypeus distinctly carinate *A. raphidius*
- 3' Posterior margin of tergites 1 to 6 not as above; clypeus with crescentic papillae 4
- 4(3') Posterior margin of tergite 1 with four setae; two long setae on dorsal-medial surface of head slightly anterior to mandibles *A. ajajae*
- 4' Posterior margin of tergite 1 with two setae; two short setae on dorsal-medial surface of head anterior to mandibles 5
- 5(4') Posterior margin of tergite 7 with two medial setae; tip of abdomen truncate; posterior margin of ventral lobes each with four short spines *A. robusta*, sp.n.
- 5' Posterior margin of tergite 7 with four setae; terminal abdominal segment conical *A. elongata*
- 6(1) Pigmentation absent except on tarsal claws, mandibles and genitalia *A. gaibaglia*
- 6' Pigmentation well developed 7
- 7(6') First abdominal segment with a lateral pigmented area 8
- 7' First abdominal segment without pigmentation 11
- 8(7) Tergite 3 constricted medially; tergites 4 to 7 with circular unpigmented area mesad of spiracle *A. botauri*
- 8' Tergite 3 not constricted medially; tergites 4 to 7 not as above 9
- 9(8') Tergites 4 and 5 divided medially and with pigmentation limited to a triangular area distad of spiracle with base along anterior margin *A. cruscula*
- 9' Tergites 4 and 5 not as above 10
- 10(9') Dark pigmentation "C"-shaped on margins of tergites 2 and 3; tergite 4, "L"-shaped marking on margin and lateral one-third of posterior margin *A. florida florida*
- 10' Pigmentation similar to above except lateral markings of tergites 2 and 3 nearly straight; all pigmentation on margins of remaining tergites nearly black *A. florida nigra*, ssp.n.
- 11(7') Tergite 5 with deep medial emargination; abdominal segment 2 without pigmentation *A. celeris*, sp.n.
- 11' Tergite 5 without emargination; abdominal segment 2 with lateral margin pigmented 12
- 12(11') Pigmentation of tergites 4, 5 and 6 limited to a small circular spot on anterolateral angle anterior to spiracle *A. goisagi*
- 12' Pigmentation of tergites 4, 5 and 6 on lateral margins nearly circumspiracular *A. nyctanassa*, sp.n.

Females:

- 1 Posterolateral angles of pterothorax each with a row of three long setae dorsally (on Ardeidae) 6
- 1' Posterolateral angles of pterothorax each with four or five long closely grouped setae dorsally (on Threskornithidae and Ciconiidae) 2
- 2(1') Five closely grouped setae on each side of dorsoposterior margin of pterothorax; tergites 5 and 6 with a dark spot at lateral anterior angle *A. loculator*
- 2' Four closely grouped setae on each side of dorsoposterior margin of pterothorax; tergal pigmentation other than above 3
- 3(2') First abdominal segment much wider than long 4
- 3' First abdominal segment as long as or longer than wide 5
- 4(3) Terminal abdominal segment conical, longer than wide; lateral margins of terminal segments gradually tapering; length 3.9 mm *A. elongata*
- 4' Terminal abdominal segment wider than long; lateral margin of terminal segment not continuous with margin of preceding segment, giving a stepped appearance; length 3.5 mm *A. robusta*, sp.n.
- 5(3') Second abdominal segment with lateral margins straight, diverging

- posteriorly; abdominal segment 3 well developed, as long as segment 4; length 4.0 mm *A. rhapsidius*
- 5' Second abdominal segment with lateral margins sigmoid, broad anteriorly, constricted posteriorly; segment 3 greatly reduced, half as long as segment 4; length 3.4 mm *A. ajajae*
- 6(1) Pigmentation absent except on tarsal claws and mandibles *A. gaibagla*
- 6' Pigmentation well developed, never entirely absent 7
- 7(6') First abdominal segment with at least some pigmentation on lateral margins 8
- 7' First abdominal segment without pigmentation 11
- 8(7) Abdominal segment 6 with six long setae on dorso-medial margin; dark pigmentation of tergites 4, 5 and 6 confined to a triangular area in lateral anterior portion of segment; spiracle not encircled by pigmentation *A. cruscula*
- 8' Abdominal segment 6 with four long setae on dorso-medial margin; dark pigmentation of tergites 4, 5 and 6 on entire lateral margin, spiracle generally completely encircled by pigmentation 9
- 9(8') Elongate reniform thickening on each side of abdominal segments 2 to 8 distinct *A. botauri*
- 9' Thickenings distinct only on segments 5 to 8 10
- 10(9') Pigmentation dark brown on lateral margins of tergites; spiracle surrounded by faint pigmentation on segments 3 to 7 *A. florida florida*
- 10' Pigmented area confined primarily to lateral margins of tergites 1 to 7, dark brown to black; spiracles not surrounded by pigmentation *A. florida nigra*, ssp.n.
- 11(7') Pigmented area of tergites 4, 5 and 6 limited to anterior lateral angle; spiracle not associated with pigmentation *A. goisagi*
- 11' Pigmented area more extensive than above; spiracle directly associated with pigmented area 12
- 12(11') Tergites 5 and 6 with a clear circular unpigmented area; spiracular pigmentation generally along anteromedial side *A. celeris*, sp.n.
- 12' Tergites 5 and 6 without circular area; spiracles completely ringed by pigmentation *A. nyctanassa*, sp.n.

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