

THE SPECIES GROUPS OF *PECTINOPYGUS* (PHTHIRAPTERA : PHILOPTERIDAE)

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SYNOPSIS

The *dispar* assemblage of species is defined with a key and four new species described. The species groups of *Pectinopygus* are defined with a key and the question discussed whether the *dispar* assemblage is a natural group equivalent to these other groups. The specialized setae found in *Pectinopygus* are described. The Piaget species of *Pectinopygus* are discussed, eight lectotypes designated and four names placed in synonymy.

INTRODUCTION

TIMMERMANN (1964, 1967) has discussed the species of *Pectinopygus* parasitic on 17 species included in the avian genus *Phalacrocorax* by Peters (1931) and arranged them in species groups. In 1967 he discussed, but did not describe, the species parasitic on *Phalacrocorax gaimardi*, pointing out that in the characters of the male genitalia it resembled the species found on those cormorants included by Peters in *Haliator*. Recently, through the kindness of Dr James E. Keirans, I received a series of a new species from *Phalacrocorax pelagicus*: this species, a new species from *P. penicillatus* and the species from *P. gaimardi* all have the same type of male genitalia. These, together with the species parasitic on the avian genus *Haliator* and the Old World species of *Anhinga*, are reviewed here as the *dispar* assemblage (hereafter called group). Whether in fact these are a natural group will also be considered. Synonymies, unless otherwise stated, are those given by Hopkins & Clay (1952); material, unless otherwise stated, is in the British Museum (Natural History).

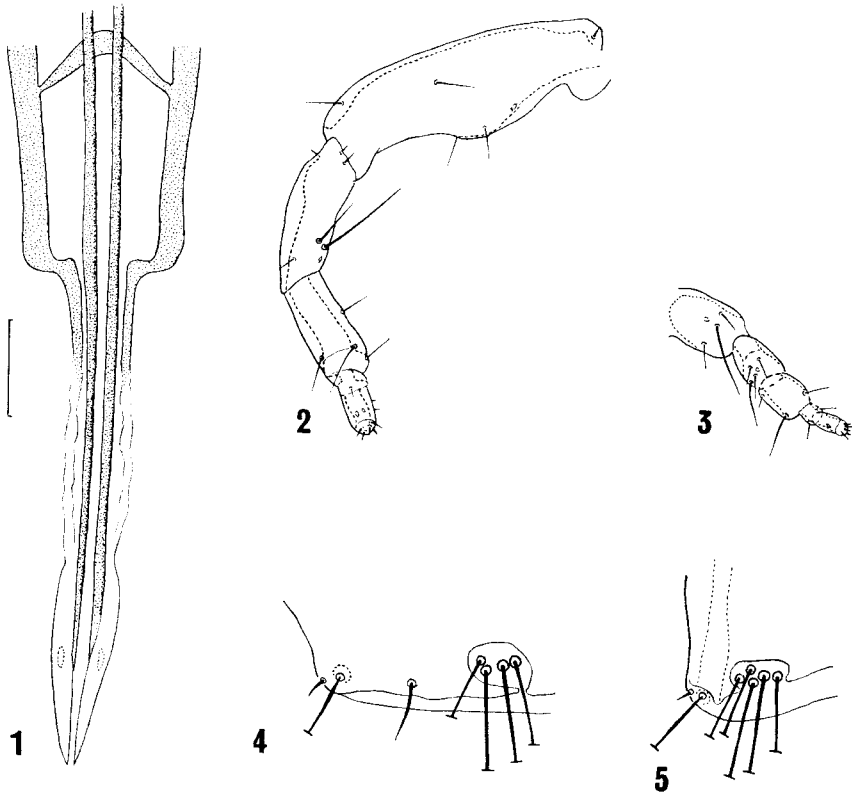
THE *DISPAR* GROUP

This group is distinguished from all other *Pectinopygus* by the characteristic male genitalia (Pl. 3, figs 18-19; Text-fig. 1), which differ interspecifically only in proportions and in the form of the cross-bar; there is no way of separating the females as a group. It comprises nine taxa having the following characters in common: antennal segment III without sexual dimorphism, segment I (scape) longer in the male, although in some species the difference between the sexes is slight; lens with ocular seta and temple with six setae each side, of which the fourth is always long, the remaining setae being short or spiniform, or of medium length or occasionally as long, or nearly as long as the fourth. The temple setal formula may show interspecific variation in the male but is similar throughout the group in the female, the ocular seta being spiniform and the temple setae usually short and spiniform (with the exception of the fourth) with the second and sixth sometimes longer. Pronotum with 2 + 2 marginal setae; pteronotum with postero-lateral group of five long setae each side (Text-fig. 5) with the occasional reduction in number on one side; trichobothrium and associated spiniform seta approximately level with marginal pteronotal setae, the spiniform seta being laterad to the trichobothrium. Mesosternum with two central setae, metasternum with 4, occasionally 5 or 6. In the male, abdominal tergites II-IV (that is the first three) and sternite II divided medially, sternum VIII varying interspecifically. Slightly mediad to the lateral edge of the abdomen there is an internal thickened buttress joining the dorsal and ventral surfaces, the junction of the buttress with the two surfaces producing the pattern characteristic of the species (Pl. 1, fig. 1). In mounted specimens there may be some individual variation in the shape of pattern due to slight distortion. As in other species of *Pectinopygus* the females may or may not have a central sclerite between the two widely divided tergal plates (Clay, 1955 : 171). In *P. dispar* and apparently in the other members of the group the vulval setae lie along the edge of the margin (Pl. 2, fig. 12), whereas in the rest of the *gyricornis* division the setae are submarginal, leaving a bare area below (Pl. 2, fig. 8), this area is greatly enlarged in the *turbinatus* group.

Abdominal chaetotaxy. Tergal setae, ♂: II-VIII, 2 central setae with 2 anterior on II and post-spiracular setae on VII and VIII. ♀: II-VI and VIII, 4 central setae with 2 anterior on II and post-spiracular on VII and VIII, number of central setae on VII varies. Sternal setae, ♂: II, VI, VII, 4 central setae; VIII, 2; other segments showing variation. ♀: II-VI, 4 central setae, VI with occasionally 1-2 extra setae; VII-VIII fused with 4 + 4. Pleural setae, ♂ and ♀: II, 0 + 0 (occasionally one on one side); III, 1 + 1 (occasionally 2 on one side); IV-V, 3 + 3; VI-VIII, 4 + 4 with 1 + 1 trichobothria on VIII. One of the lateral setae of IV-V and sometimes VI may be dorsal and rather similar in position to the 1 + 1 setae each side of VII and VIII here considered as the post-spiracular setae of those segments and not included in the count of the lateral setae. The post-spiracular setae are considered to be absent on segments IV-VI for the following reasons: (a) On segments II-V in the female there is a minute clear area in the usual position of the post-spiracular sensillum but without an adjacent seta, the dorso-lateral setae of IV and V not being associated with these areas. (b) This seta, which

is sometimes latero-dorsal on VI, is more usually positioned as one of the four pleural setae also found on segments VII and VIII in addition to the post-spiracular setae of those segments. It seems in a number of Ischnoceran genera that segments VI—VIII each have the same number of pleural setae (excluding the trichobothrium) and that the actual number may prove to be a supraspecific character in some cases (Tandan & Clay, in preparation). (c) Second instar nymphs, in which the tergal and pleural plates on segments III—VIII are still separated or partially separated, have a seta each side lying approximately between these plates on VII—VIII and on VII well separated from other setae of the segment; these are assumed to be the post-spiracular setae of those segments. The lateral setae are either marginal or dorso- or ventro-lateral or just below the pleural plates and presumed to be pleural.

The chaetotaxy of the terminal segments of the male abdomen provides important taxonomic characters. In the *dispar* group, as well as in the larger



FIGS 1-5. 1, *Pectinopygus acutofasciatus*, distal part of male genitalia (line = 0.01 mm.). 2-3, Male antenna: 2, *Pectinopygus varius*; 3, *P. brevicornis*. 4-5, Pteronotal margin and setae (trichobothrium and associated spiniform seta and the five marginal setae): 4, *Pectinopygus forficulatus*; 5, *P. afer*.

gyricornis division, the usual pattern is a single antero-lateral dorsal seta each side and ventrally a central arrangement of setae comprising a group of usually three setae each side, one usually having a smaller alveolus; posterior and central to these setae is another group, their number, position and size giving the main specific differences (Text-fig. 6). There are nine lateral setae each side of the last segment, of which marginal 2 may lie well on the ventral surface in some species (Text-fig. 9, c); the outer of the three anal setae in some specimens may appear marginal, giving the appearance of a tenth marginal seta. Towards the anterior part of the segment there are in most of the species 1 + 1 setae (the outer (a) and inner (b) anterior setae, Text-fig. 9).

The male genitalia. There is considerable diversity in the form of these structures in the species belonging to the *gyricornis* division (p. 217) and it is not always possible to interpret and homologize the different parts. In the *gyricornis* group sclerotized parameres (the term as used in the Phthiraptera) articulating with the distal end of the basal apodeme appear to be absent, their function probably being taken over by paramere-like sclerites of the genital sac; there are other sclerites of the sac lying dorsal to the base of the basal apodeme (Timmermann, 1964, figs 2-3). In the *dispar* group (Text-fig. 1) in which there is a reduction of the sac and the sclerites, the appearance is different: there are two long thin sclerites lying dorsal to the basal apodeme, each passing posteriorly to the inner side of a blade-like structure; arising from each end of the basal apodeme is a thin irregular sclerite, which passes posteriorly to form the outer side of this blade-like structure. The small size and lack of sclerotization make it uncertain whether the formation of these structures has been correctly interpreted. The genitalia of *setosus* and *punctatus* (Timmerman, 1964, fig. 5), although appearing distinct, can be interpreted in the same manner as those of the *dispar* group. In the *gyrocera*s group there is some connection between one of the paramere-like sclerites and the basal apodeme and in the *turbinatus* group (Timmermann, 1964, figs 6-7) true parameres seem to be present.

The *dispar* group can be further divided into three subgroups: the *afer* (including *dispar* but called *afer* to avoid confusion), the *acutofasciatus* and the *timmermanni*. The characters separating the first two subgroups and their included species are summarized below, the third, comprising three new species, is treated in more detail. Characters already given for the group are not repeated under the subgroups.

The *afer* subgroup

Head with hyaline margin developed and faint temporal carinae posteriorly. Tergum II in both sexes with height (antero-posteriorly) compared to width relatively longer than in the *timmermanni* group (Pl. 1, figs 2, 4). In the male internal lateral abdominal thickening as in Pl. 1, figs 1, 2; sternite VIII divided medially; sterna IV-V with 2 central setae; marginal seta 2 of IX on margin. Female subgenital plate and chaetotaxy of sterna VII and VIII as in Text-fig. 12, but the outline of the plate shows some intraspecific variation; shape of last abdominal sternite as in Text-fig. 13; tergum VII with 2 central setae. Genital

region laterally with two or more unmodified setae each side, modified setae with single elongated sclerite (Pl. 3, fig. 15 and see under Specialized Setae below); vulval setae on vulval margin. The species are not always distinguishable in the females, those of *dispar* vary in size (see below), the larger one with relatively large hypopharyngeal sclerites and a relatively broader anterior plate differ as much from the smaller ones of the same species as they do from smaller individuals of other species; the size and shape of the metasternal plates show intraspecific variation. Included species: *Pectinopygus dispar*, *P. afer*, *P. excornis* and *P. makundi*. Synonymy not given under the species is either given by Hopkins & Clay (1952) or on pp. 218 et seq.

1. *Pectinopygus dispar* (Piaget, 1880)

(Pl. 1, fig. 1; Pl. 2, fig. 7; Pl. 3, fig. 20; Text-fig. 6)

Type-host: '*Carbo sulcirostris*'. Error, probably *Haliator melanoleucos* (Vieillot).

The male is distinguished by having the characteristic lateral abdominal thickening on III as well as on IV-VIII (Pl. 1, fig. 1) and by the chaetotaxy of the terminal abdominal segment (Text-fig. 6). The cross-bar of the male genitalia is roof-shaped.

Dimensions (in mm). These are based on 18 males and 10 females taken from the localities listed below and parasitic on at least three subspecies of host. The rather larger range of certain measurements compared with those of some related species suggests that there may be a number of demes or local populations represented. However, there is insufficient material from most of the localities to make a statistical analysis. Head width: ♂ (18), 0.33-0.37, \bar{X} 0.36, lectotype, 0.36; ♀ (10), 0.42-0.47, \bar{X} 0.45, paratype, 0.45. Head length: ♂ (18), 0.45-0.52, \bar{X} 0.49, lectotype, 0.50; ♀ (10), 0.50-0.54, \bar{X} 0.52, paratype, 0.53. Head Index (C.I.): ♂, 0.71-0.74, \bar{X} 0.73, lectotype, 0.72; ♀, 0.82-0.89, \bar{X} 0.85, paratype, 0.85.

MATERIAL EXAMINED.

Holotype ♀ of *dispar*: syntypes 2 ♂, 3 ♀ of *subsetosus* (see below).

From *Haliator melanoleucos*. NEW ZEALAND: Otago, 2 ♂, 2 ♀, 27.ii.1950. TASMANIA: Green's Beach 1 ♂, 1 ♀, 23.x.1966 (*R. H. Green*); Fisher Island, 9 ♂, 1970 (*C. A. Nicholls*). AUSTRALIA: nr Perth, 6 ♂, 2 ♀, 1970 (*R. H. Stranger*). RENNELL IS.: Hatuana, 5 ♂, 4 ♀, 21.x.1953 and 3.iv.1965 (*T. Wolff*). NEW GUINEA: Skin (no locality), 7 ♂, 2 ♀; Moitaka, Papua, 1 ♂, 1 ♀, vii.1968 (*T. Wolff*).

2. *Pectinopygus afer* (Kellogg, 1910)

(Pl. 1, fig. 2; Pl. 3, figs 18-19; Text-figs 5, 7)

Type-host: *Haliator africanus africanus* (Gmelin)

This and the following two taxa resemble each other and differ from *dispar* in not having the characteristic male abdominal pattern on segment III. *P. afer* is distinguished by having the cross bar of the male genitalia centrally straight, not roof-shaped and in the arrangement of the ventral chaetotaxy of the terminal segment of the male abdomen (Text-fig. 7).

Dimensions. Head width: ♂ (11), 0.32-0.35, \bar{X} 0.34; ♀ (10), 0.41-0.43, \bar{X} 0.42. Head length: ♂, 0.46-0.48, \bar{X} 0.47; ♀, 0.47-0.50, \bar{X} 0.49. C.I.: ♂, 0.69-0.76, \bar{X} 0.73; ♀, 0.85-0.89, \bar{X} 0.87. Specimens measured taken from one host individual from S.W. Africa.

MATERIAL EXAMINED.

From *Halieter a. africanus*. Many males and females from ETHIOPIA, UGANDA, KENYA, BOTSWANA, SOUTH AFRICA, SOUTH WEST AFRICA.

3. *Pectinopygus excornis excornis* (Blagoveshtchensky, 1940)
(Text-fig. 8)

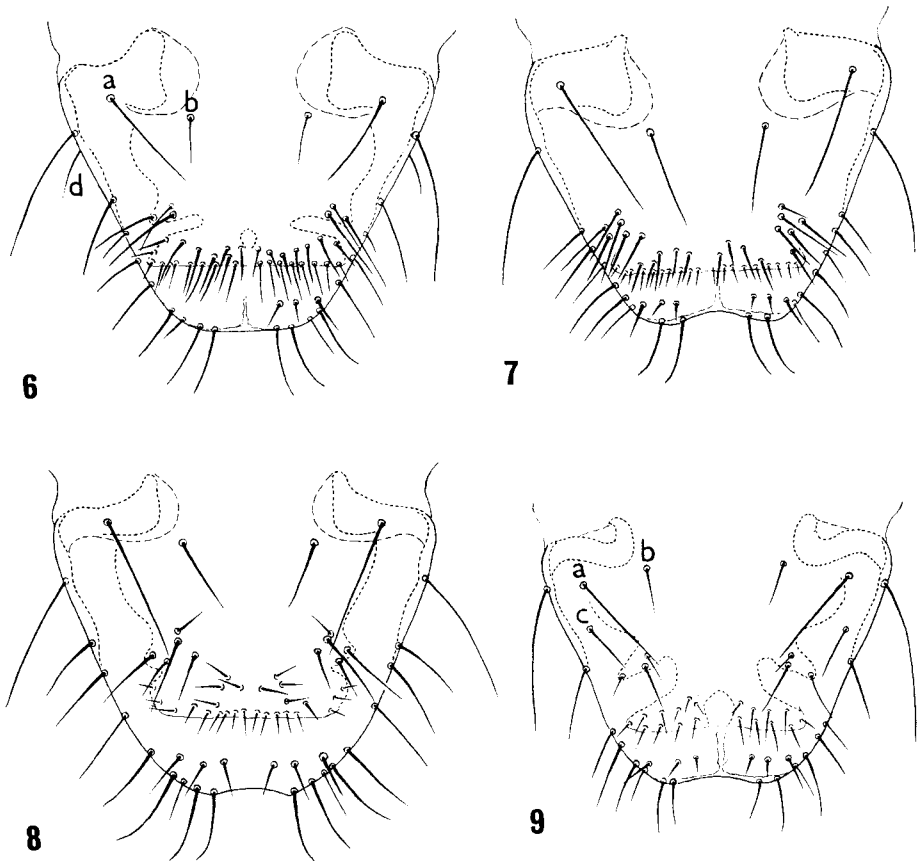
Type-host: *Halieter pygmeus* (Pallas)

The differences between this species and *afer* are given above under the latter species.

Dimensions (10). Head width: ♂, 0.33-0.35, \bar{X} 0.34; ♀, 0.42-0.44, \bar{X} 0.43. Head length: ♂, 0.44-0.46, \bar{X} 0.45; ♀, 0.47-0.49, \bar{X} 0.48. Head index: ♂, 0.74-0.77, \bar{X} 0.75; ♀, 0.89-0.92, \bar{X} 0.90.

MATERIAL EXAMINED.

From one individual of *Halieter pygmeus*. AFGHANISTAN: 31 ♂, 14 ♀, v.1937 (R. Meinertzhagen).



FIGS 6-9. Terminal sterna of male abdomen: 6, *Pectinopygus dispar* (anal setae omitted on left side); 7, *P. afer*; 8, *P. excornis*; 9, *P. acutofasciatus*. a, outer anterior seta; b, inner anterior seta; c, marginal seta 2; d, dorsal seta.

4. *Pectinopygus excornis makundi* Tandan, 1952 comb. n.

(Text-figs 12-13)

Type-host: *Halieter niger* (Vieillot)*Pectinopygus makundi* Tandan, 1952 : 300.

In general appearance and proportions this species resembles *afer* (see Pl. 1, fig. 2) and is distinguished from *excornis* only by size and proportions of various parts of the body, of which the head and abdominal tergite II appear to be the most marked. However, except for the head it is not possible to make any detailed measurements of the available specimens of *excornis* owing to their poor condition. Any apparent difference in ventral chaetotaxy of the last segment of the male are covered by the slight variation in number, length and position of the setae found in the populations from the type-hosts. It would appear from this that it is more satisfactory to treat *makundi* as a subspecies of *excornis*.

Dimensions. Head width: ♂ (20), 0.32-0.34, \bar{X} 0.33, holotype, 0.33; ♀ (10), 0.40-0.43, \bar{X} 0.42; allotype, 0.42. Head length: ♂ (10), 0.47-0.49, \bar{X} 0.48; holotype, 0.49; ♀ (10), 0.48-0.51, \bar{X} 0.50; allotype, 0.49. Head index: ♂ (10), 0.67-0.70, \bar{X} 0.69; holotype, 0.68; ♀, 0.82-0.86, \bar{X} 0.84; allotype, 0.86.

MATERIAL EXAMINED.

Holotype ♂ from *Halieter niger*, INDIA: Lucknow, 4.x.1947 (*B. K. Tandan*).

From *Halieter niger*. Many males and females including allotype ♀ and paratypes from INDIA: Manipur, West Bengal, Utter Pradesh, Hyderabad (now Andhra Pradesh), Rajasthan. PAKISTAN: Sind.

The *acutofasciatus* subgroup

This is similar to the *afer* subgroup except for a reduction in the size of the hyaline margin, the slight degree of sexual dimorphism of antennal segment I, the difference in the form of the lateral abdominal thickening of segments IV-VIII in the male (Pl. 1, fig. 6) and the shape of the last abdominal sternite in the female. In the male sterna IV-V each have 3-4 central setae, occasionally one of the segments with 2; marginal seta 2 of IX submarginal (Text-fig. 9). Female tergum VII with 4 central setae. Included species: *Pectinopygus acutofasciatus*; *P. aquaticus*.

5. *Pectinopygus acutofasciatus* (Piaget, 1880)

(Pl. 1, fig. 6; Pl. 3, fig. 15; Text-figs 1, 9, 14)

Type-host: *Anhinga melanogaster* Pennant

Posterior ventral setae of last segment of male as in Text-fig. 9: cross-bar of genitalia centrally roof-shaped. The female resembles those of the *afer* subgroup in having a number of lateral unmodified setae each side of the genital region and in the form of the modified setae (Pl. 3, fig. 15); one of the posterior of these setae each side is thick and spiniform. Shape of last female abdominal sternite as in Text-fig. 14.

Specimens have been seen from all the Old World species of *Anhinga* from the localities listed below. There are some differences in average size of specimens from some localities (see (a) and (b) below) but the ranges show that there is overlapping in all the cases. Concomitant with differences in size there may be

some variation in the shape of the anterior plate, but here again this may show intra-population variation. No constant differences are apparent in specimens from *Anhinga melanocephala* and *A. rufa*, those from *A. novaehollandiae* are separable on the characters given below and are considered to merit taxonomic recognition.

Dimensions. Holotype ♀, head width: 0.43; head length: 0.50; C.I.: 0.85.

Host	Head breadth		Head length		Head index	
	♂	♀	♂	♀	♂	♀
(a)	0.37-0.40 X̄ 0.39 (10)	0.45-0.47 X̄ 0.46 (8)	0.48-0.51 X̄ 0.49 (9)	0.49-0.54 X̄ 0.52 (8)	0.77-0.81 X̄ 0.80	0.85-0.94 X̄ 0.88
(b)	0.35-0.37 X̄ 0.36 (5)	0.40-0.43 X̄ 0.42 (8)	0.46-0.48 X̄ 0.47 (5)	0.49-0.52 X̄ 0.50 (8)	0.75-0.79 X̄ 0.77	0.82-0.85 X̄ 0.83
(c)	0.36 (2)	0.42-0.43 (3)	0.47-0.48 (2)	0.49-0.53 (3)	0.76	0.84-0.85 X̄ 0.85
(d)	0.36-0.39 X̄ 0.37	0.43-0.45 X̄ 0.44	0.46-0.50 X̄ 0.48 (4)	0.52-0.55 X̄ 0.53 (4)	0.76-0.78 X̄ 0.77	
(e)	0.38-0.39		0.49-0.51 (2)		0.77-0.78	
(f)	0.34-0.36	0.41-0.42	0.44-0.48 (2)	0.49-0.50 (2)	0.75-0.76	0.83-0.84

MATERIAL EXAMINED.

Holotype ♀ of *acutofasciatus* (see below).

From *Anhinga melanogaster* Pennant. INDIA: Lucknow (a), 10 ♂, 8 ♀ (*B. K. Tandan*); N. W. India (no further data), 1 ♀; Hyderabad (now Andhra Pradesh), 2 ♀, ii.1937 (*R. Meinertzhagen*); Rajasthan (b), 5 ♂, 8 ♀ iii.1937 (*R. Meinertzhagen*).

BURMA (c): Shingbuiyang, N. E. Burma, 2 ♂, 3 ♀, 27.x.1945 (*H. S. Fuller*).

From *Anhinga r. rufa* (Daudin). SUDAN (f): 2 ♂, 2 ♀, v.1936 (*R. Meinertzhagen*). UGANDA (e): 2 ♂, bird skin, vii.1906 (*R. Meinertzhagen*). KENYA (d): 1 ♂, 3 ♀, iv.1936 (no other data); Kisumu, 3 ♂, 1 ♀, ii.1956 (*R. Meinertzhagen*).

6. *Pectinopygus aquaticus* sp. n.

Type-host: *Anhinga novaehollandiae* (Gould)

This species is at once separable from *acutofasciatus* in the male by the form of the cross-bar of the genitalia, which is similar to that of *afer*, being flattened and not roof-shaped. It also differs in having temple setae 1-3 of the male longer than in *acutofasciatus*. There are difficulties in using the length of the long setae as a taxonomic character in the Phthiraptera, owing to the fine tips frequently being broken, and further the setae often do not lie in the same plane and seldom in a straight line. It is not therefore possible to give a series of comparative measurements of the temple setae of the specimens from various hosts. The comparison of approximate measurements and of specimens show that there is some variation

in the specimens from *A. melanogaster* and that the first seta tends to be shorter in specimens from *A. rufa*. Although the length of some of the setae of specimens from *A. melanogaster* may overlap with those from *novae-hollandiae*, seta 3 seems to be consistently longer in the specimens from the latter host. It would not be satisfactory to erect the new species on this character alone, but it is associated with the constant difference in the form of the cross-bar of the male genitalia.

Dimensions. Head width: ♂ (5), 0.37–0.40, \bar{X} 0.39; ♀ (3), 0.45–0.47, \bar{X} 0.46. Head length: ♂, 0.48–0.51, \bar{X} 0.49; ♀ (3), 0.53–0.54, \bar{X} 0.538. Head index: ♂, 0.76–0.79, \bar{X} 0.77; ♀, 0.85–0.88, \bar{X} 0.86.

MATERIAL EXAMINED.

Holotype ♂ from *Anhinga novae-hollandiae* (skin). AUSTRALIA: New South Wales (*Meinertzhagen*). BMNH (slide No. 4392).

Paratypes. 4 ♂, 3 ♀ with data as for holotype.

The *timmermanni* subgroup

Head without definite hyaline margin. Tergum II in both sexes with height to width relatively shorter than in the *afer* subgroup (Pl. 1, figs 3, 2). Male with internal lateral thickening of segments IV–VIII similar to that of *afer* group but differing in detail; sterna IV–V with 2 central setae; sternum IX with marginal seta 2 submarginal (Text-fig. 10). The female differs from the preceding subgroups and resembles the remaining species in Table I in having only one unmodified seta each side of the genital region and in having some of the modified setae with two internal sclerites (see below, p. 218; Pl. 3, fig. 16). The species of this subgroup resemble those of the *turbinatus* group in the absence of a hyaline margin and in *P. insularis* there is a superficial resemblance in the shape of the head and anterior plate, especially in the female. However, in the male the antenna, internal abdominal thickening and genitalia separate the two groups and in the female of the *turbinatus* group the inner ends of the internal sclerites of the modified setae bend inwards towards each other meeting in a small area and that part of the vulva below the setae is enlarged.

7. *Pectinopygus timmermanni* sp. n.

(Pl. 1, fig. 3; Pl. 3, fig. 17; Text-fig. 10)

Type-host: *Phalacrocorax gaimardi* (Lesson)

This species is distinguished from the two following by the shape of the anterior plate; in the male by the chaetotaxy of the last segment and in the female by the chaetotaxy of tergum VII.

♂. Characters as shown in Pl. 1, fig. 3 and as given under the *dispar* group and the *timmermanni* subgroup. First temple seta of medium length, not long as in the following species. Ventral chaetotaxy of terminal segment as in Text-fig. 10, marginal seta 2 submarginal.

♀. Characters as given for the *dispar* group and *timmermanni* subgroup. Tergum VII with 2–3 central setae (1 + 2–3 + 1); sternum VI with 6 (rarely 4 or 5) central setae. One of the modified setae each side of the genital region is stout and spiniform; chaetotaxy of this region as in Pl. 3, fig. 17.

Dimensions. Head width: ♂ (10), 0.32–0.34, \bar{X} 0.33; ♀ (7) 0.38–0.40, \bar{X} 0.39. Head length: ♂, 0.41–0.43, \bar{X} 0.42; ♀, 0.45–0.47, \bar{X} 0.46. Head index: ♂, 0.78–0.81, \bar{X} 0.79; ♀, 0.85–0.88, \bar{X} 0.86.

MATERIAL EXAMINED.

Holotype ♂ from *Phalacrocorax gaimardi* (skin). PERU: coast, viii.1875 (BMNH, slide No. 754).

Paratypes. 9 ♂, 7 ♀ with data as for holotype.

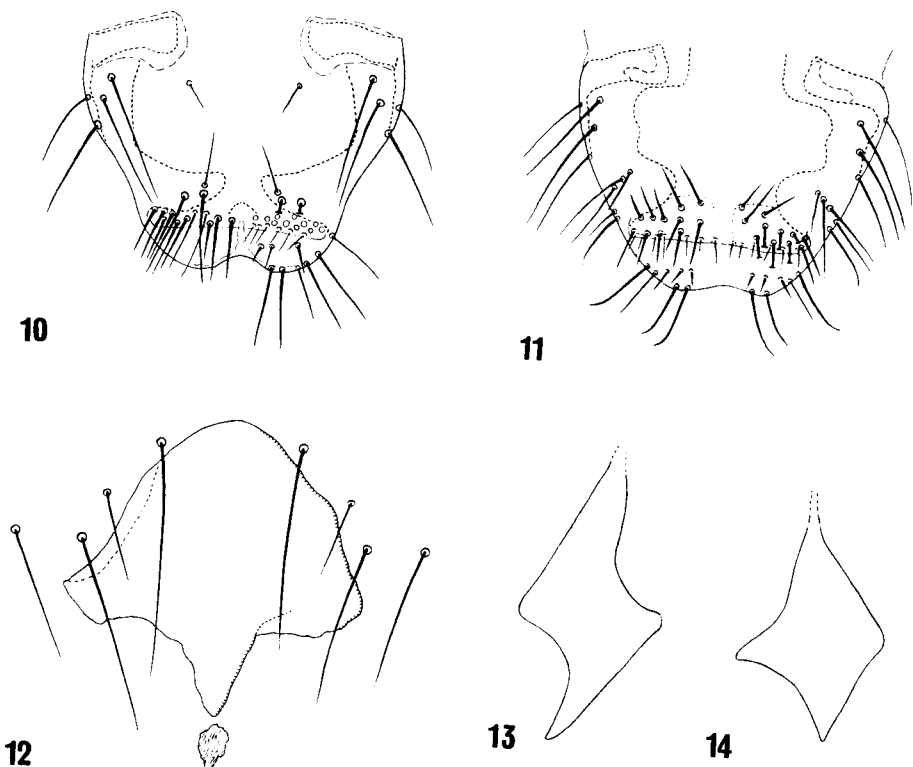
8. *Pectinopygus maritimus* sp. n.

(Pl. I, fig. 5; Text-fig. II)

Type-host: *Phalacrocorax penicillatus* (Brandt)

♂ and ♀. Characters as shown in Pl. I, fig. 5 and as given for the *dispar* group and *timmermanni* subgroup; differences from *timmermanni* and *insularis* as given under those species. In the male the first temple seta is long; ventral chaetotaxy of last segment as in Text-fig. II, marginal seta 2 submarginal, inner anterior seta absent. In the female tergum VII with 4 central setae (1 + 4 + 1); chaetotaxy of genital region as in Pl. 2, fig. II.

Dimensions. Head width: ♂ (9), 0.32-0.34, \bar{X} 0.33; ♀ (10), 0.38-0.40, \bar{X} 0.39. Head length: ♂, 0.39-0.42, \bar{X} 0.41; ♀, 0.44-0.46, \bar{X} 0.45. Head index: 0.79-0.83, \bar{X} 0.81; ♀, 0.84-0.89, \bar{X} 0.87.



FIGS 10-14. 10-11, Terminal sterna of male abdomen: 10, *Pectinopygus timmermanni* sp. n. (marginal setae 4-9 and anal setae omitted on left side); 11, *P. maritimus* sp. n. 12, Female genital plate, *Pectinopygus e. makundi*. 13-14, Female terminal sternite: 13, *P. e. makundi*; 14, *P. acutofasciatus*.

MATERIAL EXAMINED.

Holotype ♂ from *Phalacrocorax penicillatus*. U.S.A.: San Diego, California, 3.iii.1939 (*Clay*) (BMNH, slide No. 12883a).

Paratypes. 8 ♂, 17 ♀ with data as for holotype.

9. *Pectinopygus insularis* sp. n.

(Pl. 1, fig. 4, Pl. 2, figs 11-12; Pl. 3, fig. 16)

Type-host: *Phalacrocorax pelagicus resplendens* Audubon

♂ and ♀. Characters as given for *maritimus* above; the two species are separable on the proportions of the head (see dimensions below and Pl. 1, fig. 4).

Dimensions. Head width: ♂ (10), 0.34-0.37, \bar{X} 0.36; ♀ (10), 0.42-0.47, \bar{X} 0.44. Head length: ♂, 0.41-0.43, \bar{X} 0.42; ♀, 0.45-0.50, \bar{X} 0.48. Head index: ♂, 0.84-0.88, \bar{X} 0.86; ♀, 0.91-0.96, \bar{X} 0.93.

MATERIAL EXAMINED

Holotype ♂ from *Phalacrocorax pelagicus resplendens*. U.S.A.: Oregon, Curry County 7.ix.1969 (*Easton*) (USNM Washington).

Paratypes. 14 ♂, 17 ♀ with data as for holotype.

Note on host. The specimens on which this species is based were collected from unidentified nestling cormorants. However, as shown in Clifford *et al.* (1970: 442) there is no doubt that these were *P. pelagicus*, it being possible to eliminate other possible cormorants nesting in that area by a comparison of the species of *Pectinopygus* known to parasitize them.

KEY TO THE SPECIES OF THE *DISPAR* GROUP

Males

- | | | |
|---|---|--------------------------------|
| 1 | Internal abdominal thickening of V as in Pl. 1, fig. 6 | 2 |
| - | Internal abdominal thickening of V as in Pl. 1, figs 2-3 | 3 |
| 2 | (1) Cross-bar of genitalia centrally roof-shaped (Text-fig. 1) | <i>acutofasciatus</i> (p. 209) |
| - | Cross-bar of genitalia centrally flattened | <i>aquaticus</i> (p. 210) |
| 3 | (1) Anterior margin of head with hyaline area; ratio of height to width of segment II as in Pl. 1, fig. 2 | 4 |
| - | Anterior margin of head without hyaline area; ratio of height to width of segment II as in Pl. 1, fig. 4 | 7 |
| 4 | (3) Abdominal segment III with characteristic pattern of thickening | <i>dispar</i> (p. 207) |
| - | Abdominal segment III without characteristic pattern of thickening | 5 |
| 5 | (4) Cross-bar of genitalia centrally flattened | <i>afar</i> (p. 207) |
| - | Cross-bar of genitalia centrally roof-shaped | 6 |
| 6 | (5) Head Index: 0.74-0.77, \bar{X} 0.75 | <i>e. excornis</i> (p. 208) |
| - | Head Index: 0.67-0.70, \bar{X} 0.69 | <i>e. makundi</i> (p. 209) |
| 7 | (3) Inner anterior seta of sternum IX present | <i>timmermanni</i> (p. 211) |
| - | Inner anterior seta of sternum IX absent | 8 |
| 8 | (7) Head Index: 0.79-0.83, \bar{X} 0.81 (Pl. 1, fig. 5) | <i>maritimus</i> (p. 212) |
| - | Head Index: 0.84-0.88, \bar{X} 0.86 (Pl. 1, fig. 4) | <i>insularis</i> (p. 213) |

Females

- | | | |
|---|--|---|
| 1 | More than one unmodified seta each side of genital region; modified setae with one elongate internal sclerite (Pl. 3, fig. 15) | 2 |
| - | One unmodified seta each side of genital region; some modified setae with two elongate internal sclerites (Pl. 3, fig. 16) | 3 |
| 2 | (1) Tergum VII with 4 central setae <i>acutofasciatus</i> subgroup (p. 209) | |
| - | Tergum VII with 2 (occasionally 3) central setae <i>afer</i> subgroup (p. 207) | |
| 3 | (1) Tergum VII with 2-3 central setae <i>timmermanni</i> (p. 211) | |
| - | Tergum VII with 4 central setae | 4 |
| 4 | (3) Head Index: 0.84-0.89, \bar{X} 0.87; shape of anterior plate as in ♂ (Pl. 1, fig. 5) | |
| - | <i>maritimus</i> (p. 212) | |
| - | Head Index: 0.91-0.96, \bar{X} 0.93; shape of anterior plate as in ♂ (Pl. 1, fig. 4) | |
| - | <i>insularis</i> (p. 213) | |

THE SPECIES GROUPS OF *PECTINOPYGUS*

Pectinopygus is separated from the rest of the Philopteridae by a combination of the following characters: the form of the anterior carinae of the head (Pl. 1); the anterior plate which usually has an anterior striated region, but never crescentic markings (as in *Ardeicola*) and is never divided medianly by a narrow vertical suture (as in *Fulicoffula*); the fourth temple seta is always long. Pronotum without anterior central setae (present in *Ardeicola*); mesonotum without central setae (present in *Philoceanus* complex). Female with row or rows of long inwardly directed setae each side of the last sternum and at least two of the female anal setae sheathed; male genital opening terminal or ventro-terminal.

Harrison (1937: 31; see Thompson, 1935) recognized four subgenera parasitic respectively on the Pelecanidae (*Epiphelecanus*, *Pectinopygus forficulatus*), *Morus* (*Pectinopygus*, *P. bassani*), Fregatidae (*Eprifregata*, *P. gracilicornis*) and Phalacrocoracidae (*Philichthyophaga*, *P. gyricornis*). The species from *Sula* were placed in the subgenus *Pectinopygus* although the description was based solely on *Pectinopygus bassani* and does not apply to the species parasitic on *Sula*. These are rather a distinct group, resembling the species from the Fregatidae in the presence of two discrete projections each side of the posterior margin of the terminal segment of the female, but not fitting satisfactorily into any of the subgenera as now constituted. The species of *Pectinopygus* can be arranged in a number of species groups (see key below) but it does not seem useful to give them subgeneric names.

One of the objects of this communication is to consider whether the *dispar* group is a natural one comparable with other groups within the *gyricornis* division (see 5 and the following couplets in Key p. 217). For this comparison 11 characters have been scored for 25 species of the *gyricornis* division parasitic on *Phalacrocorax*, *Haliastur* and *Anhinga*. Where a number of species have all 11 characters in the same state they are placed together and given a number, 12 such groups emerge from this study (Table I). A number of other characters could be included, but they merely reinforce the present grouping and do not add any useful information.

Considering first the members of the *dispar* group (9-12 below the line in Table I) it will be seen that the males resemble each other and differ from other species

Table I
CHARACTER STATES

Species or Species groups	1	2	3	4	5	6	7	8	9	10	11
1	a	c	a	+	b	+	+	c	+	+	+
2	a	c	a	+	a	+	+	b	+	+	+
3	a	c	a	o	c	+	+	b	+	+	+
4	a	c	a	+	b	+	+	g	+	+	+
5	a	b	b	+	b	+	+	f	+	+	+
6	o	c	c	+	c	o	+	d	+	+	o
7	o	b	d	o	c	+	o	h	+	+	+
8	o	a	e	+	a	+	+	e	+	o	+
9	o	a	b	+	a-b	+	+	a	o	o	+
10	a	a	b	+	a	+	+	a	o	o	o
11	b	a	b	+	a	+	o	a	+	o	o
12	b	a	b	+	c	+	o	a	+	o	+

KEY TO TABLE I

SPECIES: 1. *gyricornis* group (*gyricornis*, *varius* Timmermann, 1964, *kosswigi* Timmermann, 1964, *socotranus* Timmermann, 1964). 2. *punctatus* Timmermann, 1964. 3. *setosus*. 4. *acutifrons*. 5. *brevicornis*. 6. *gyroceras* group (*gyroceras*, *farallonii*, *nannopteri*). 7. *turbinatus* group (*turbinatus*, *carunculatus* Timmermann, 1964, *magellanicus* Timmermann, 1967, *grubeni* Timmermann, 1967). 8. *anhingae*. 9. *acutofasciatus* group (*acutofasciatus*, *aquaticus* sp. n.). 10. *afer* group (*afer*, *dispar*, *excornis*, *makundi* Tandan, 1952). 11. *timmermanni* sp. n. 12. *maritimus* group (*maritimus* sp. n., *insularis* sp. n.).

CHARACTER STATES (Character present: +; character absent or different: o). 1. ♂ abdominal pattern: a. as in Pl. 1, fig. 2; b. as in Pl. 1, fig. 3. 2. Scape: a. little or no sexual dimorphism; b. enlarged and swollen (Text-fig. 3); c. enlarged with anterior margin convex medianly (Text-fig. 2). 3. ♂ tergites divided medianly: a. only II-III; b. only II-IV; c. only II-V. d. only II-VI; e. only II-VII. 4. ♂ ocular seta short to medium. 5. ♂ temple setae: a. only 4th long; b. one or more of medium length; c. 4th and one or more long. 6. II with o + o, III with 1 + 1 pleural setae. 7. Head with hyaline margin. 8. a-g distinct types of male genitalia. 9. ♀ with one unmodified seta each side of genital region (Pl. 3, fig. 17). 10. Vulval setae submarginal (Pl. 2, fig. 8): +; vulval setae marginal (Pl. 2, fig. 12): o. 11. ♀ tergum VII with 4 central setae.

(with the exception of those given in brackets) in the characters of the genitalia, form of the antenna (except *anhingae*) and the number of divided tergal plates (except *brevicornis*): and the female in the position of the vulval setae (except *anhingae*). The male abdominal thickening is of three types, that of the *afer* group being the same as that of groups 1-5. However, the characters of both sexes in which they differ from each other seem to be important. The three New World species (*timmermanni*, *maritimus* and *insularis* differ from the Old World species (*acutofasciatus* and *afer* subgroups) in a character of the female chaetotaxy (No. 9, Table I), the form of the modified setae and in the absence of a definite hyaline margin of the head. In considering groups 1-8 (above the line in Table I),

by definition the groups containing a number of species (1, 6, 7) are those in which all the character states, including those of the male genitalia, are the same; group 5 represented by a single species which, differing from group 1 in the form of the genitalia, also differs from the latter in other characters; *punctatus* Timmermann and *setosus* with a rather similar type of male genitalia differing from those of group 1, and *acutifrons* with distinct genitalia otherwise fit into this group except for the lengths of some of the head setae in *setosus* and *acutifrons*. The *dispar* group is the only one in which there is great similarity in the form of the genitalia associated with differences in other characters and cannot therefore be considered as equivalent to such groups as 1, 6, and 7. It seems unlikely, if it were not for the similarity of the genitalia, that groups 10 and 11-12 would be considered together. The genitalia, which may be a simplified form of those found in other groups, could be a primitive type which has persisted in certain species or species groups, their presence not necessarily implying relationships; the simple form of the antenna may also be primitive.

It seems reasonable to consider the *afēr* subgroup as a natural assemblage of species: they are all parasitic on the avian genus *Haliētor*, are similar in characters 1-11 and the females are separable from those of all others in the *gyricornis* division, with the exception of the *acutofasciatus* group, by the characters of the ventral chaetotaxy of the terminal segments. It is possible that the characters shared by the *acutofasciatus* and *afēr* subgroups, if not denoting relationships, are persistent primitive ones, or alternatively the *acutofasciatus* group is derived from an old established straggling population originating from a species of the Old World avian genus *Haliētor*, with or without hybridization. There is no particular resemblance between the species on the New and Old World *Anhinga*, except for the absence of sexually dimorphic antennae and in character 10 of the female; this suggests either a different origin for the two species groups or a long period of separation and divergence. Again, the more distant resemblance between the *timmermanni* and *afēr* subgroups suggests a different origin for the two. Alternatively, *Phalacrocorax pelagicus*, breeding as it does on both sides of the Bering Strait, might have at one time overlapped in distribution with one of the Old World *Haliētor* or the stock giving rise to these, and acquired a population of lice which was subsequently transferred to other west coast North American cormorants. The possibility of any relationships between these hosts is a subject which must be left to the ornithologists. The many characters separating the *turbinatus* and *timmermanni* groups show that these are not closely related in spite of the superficial resemblance of one of the species of the latter group to *turbinatus*.

KEY TO GROUPS IN *PECTINOPYGUS*

- 1 Posterior margin of pteronotum with lateral group of 3-6 long setae and one separate seta (in addition to trichobothrium and associated spiniform seta, Text-fig. 4); abdominal segment II with 2 + 2 and III with 3 + 3 lateral (pleural) setae **forficulatus** division
- Posterior margin of pteronotum with lateral group of 5 long setae (occasionally 3-6 on one side only) and no separate seta (Text-fig. 5); lateral setae of II and III otherwise 2

microscope, but with this microscope only it is not possible to say with certainty whether these pegs are present in all *Pectinopygus* or in other Ischnocera.

Modified genital setae. These setae are found in the female of the species comprising the *gyricornis* division (couplet 5 onwards in the key to Species Groups). They arise ventrally each side from a raised part of the last segment, the surface of this being ribbed (Pl. 2, fig. 9); this ribbing is not easily seen with transmitted light. The SEM shows that the bases of these setae are internal and with the light microscope it appears that they are extended inwards as a narrow sclerite of various lengths giving a characteristic and unique appearance to this part of the abdomen. In the *afer* and *acutofasciatus* subgroups there is only a single internal sclerite (Pl. 3, fig. 15), while in the remaining subgroups of the *dispar* assemblage and in the rest of the *gyricornis* division some of the setae have a second sclerite, sometimes set at an angle, at the end of the first sclerite (Pl. 3, figs 16-17). Those species in which there is only a single internal sclerite have two or more unmodified setae laterad to the rows of modified setae each side (Pl. 3, fig. 15); those with the double sclerites have only one seta each side (Pl. 3, fig. 17). Sections show the proximal sclerite having a wide lumen and the distal one being virtually solid. In addition to the setae with the elongate sclerite, some of the vulval setae have a short elongation of the base (Pl. 3, fig. 17), a condition also found in the lateral setae of the female genital region of *Colilipeurus* (see Clay, 1956, fig. 25).

SYNONYMY OF PIAGET'S SPECIES OF *PECTINOPYGUS*

The synonymy of most of the Piaget species of *Pectinopygus* as presently accepted was given by Hopkins & Clay (1952) without explanation. The opportunity is now taken to explain the interpretation of some of the names and hosts and to designate lectotypes from the Piaget collection in the British Museum (Natural History). The specimens now in the Rijksmuseum van Natuurlijke Historie, Leiden (RNH) have also been examined. Elsewhere (Clay, 1949), an account of the Piaget collection has been given and it was shown that most of the specimens were collected from skins in the Leiden Museum or from animals in the Rotterdam Zoological Gardens, and that there are many stragglers and erroneous host records. There are also obvious cases of mislabelling or omission of the specific name. A cause of confusion is what appears to be the labelling of specimens with an earlier specific name which were later described by Piaget as a new species, but without alteration being made to the original labels. Thus, these specimens have the correct type-host and agree with Piaget's figure and description but do not have the new specific name. In such cases, where the specimens can be identified, the designation of one as lectotype seems to be justified.

Pectinopygus acutofasciatus (Piaget)

Nirmus acutofasciatus Piaget, 1880 : 172. Holotype ♀ (slide No. 1018, BMNH) from *Plotus melanogaster* = *Anhinga melanogaster* Pennant, JAVA.
Pectinopygus acutofasciatus (Piaget) Hopkins & Clay, 1952 : 267.

The holotype female has more than one unmodified seta laterad to the modified genital setae and there is only the single internal sclerite arising from the base of the modified setae (Pl. 3, fig. 15). This places it either in the *acutofasciatus* or *afer* subgroup and the presence of four central setae on tergum VII shows that it belongs to the former and is the species described above under this name.

***Pectinopygus annulatus* (Piaget)**

Lipeurus annulatus Piaget, 1880 : 340. LECTOTYPE ♂ (slide No. 944, BMNH), here designated, from *Sula fusca* = *Sula leucogaster* (Boddaert), no locality.

Pectinopygus annulatus (Piaget); Hopkins & Clay, 1952 : 268.

There are no slides in the Piaget collections labelled *Lipeurus annulatus* and this is apparently one of those cases mentioned above, in which Piaget labelled the specimen with an earlier name and forgot to add his new name to the slide when he later described it as new. There are a number of specimens of *Pectinopygus* in the Piaget collection labelled *Lipeurus pullatus* (a synonym of *bassani*) from various species of *Sula*; these agree with Piaget's figure of that species with the exception of a male and female. The host of the male is given as *Sula fusca* (= *S. leucogaster*) and the specimen agrees with Piaget's figure of *annulatus* and with authenticated specimens from *Sula leucogaster*. There seems little doubt that the figure of *annulatus* was based on this specimen and it is here designated as lectotype.

***Pectinopygus bifasciatus* (Piaget)**

Lipeurus bifasciatus Piaget, 1880 : 342. Lectotype ♂ (BMNH); paralectotypes 5 ♂, 1 ♀ (BMNH, RNH) from *Pelecanus crispus* Bruch, no locality.

Pectinopygus bifasciatus (Piaget); Hopkins & Clay, 1952 : 268.

Pectinopygus bifasciatus (Piaget); Clay, 1961 : 56, fig. 17.

The terminal segments of the male abdomen were figured and a lectotype designated by Clay (1961).

***Pectinopygus dispar* (Piaget)**

Nirmus dispar Piaget, 1880 : 174. Lectotype ♀ (slide No. 1014) and 1 ♀ paralectotype (BMNH), here designated, from *Carbo sulcirostris* = *Phalacrocorax sulcirostris* (Brandt), no locality.

Lipeurus subsetosus Piaget, 1880 : 336. LECTOTYPE ♂ (slide No. 928, BMNH) and 1 ♂, 3 ♀ paralectotypes (1 ♀ in BMNH; 1 ♂, 2 ♀ in RNH), here designated, from '*Phalacrocorax (Graculus) melanotus*', no locality. **Syn. n.**

Lipeurus brevicornis Piaget, 1880 : 337 nec *brevicornis* Denny, 1842. LECTOTYPE ♂ (slide No. 799) and 6 ♂ paralectotypes (BMNH), here designated, from *Carbo sulcirostris* = *Phalacrocorax sulcirostris terretori* (Mathews), CELEBES. **Syn. n.**

Lipeurus confusus Bagnall & Hall, 1912 : 9. Replacement name for *brevicornis* Piaget. **Syn. n.**

Pectinopygus brevicornis (Piaget); Hopkins & Clay, 1952 : 268.

Pectinopygus confusus (Bagnall & Hall); Hopkins & Clay, 1952 : 268.

Pectinopygus dispar (Piaget); Hopkins & Clay, 1952 : 268.

Pectinopygus subsetosus (Piaget); Hopkins & Clay, 1952 : 270.

Although the syntypes of *dispar* are females, making exact identification difficult, there is no doubt that they agree with specimens of the *afer* group in the ventral chaetotaxy of the terminal segments, which is specific to this group; the presence of two central setae on tergum VII separate them from *acutofasciatus*. Measurements are not necessarily specific for individuals of the *afer* group, but those of the female head breadth, length and head index average more in specimens from the type-host of *subsetosus* than for those of the rest of the *afer* group. These measurements in the *dispar* type material fall within the range of the former specimens, the *dispar* and *subsetosus* paratypes having the same measurements. Further, among specimens in the Piaget collection labelled as from *Carbo sulcirostris*, the type-host of *dispar*, are identifiable males of *setosus* and *subsetosus* and it is reasonable to suppose that the two female *dispar* are the same as one of these species; if this is so they could only be *subsetosus*. The latter name, therefore, becomes a synonym of *dispar*. The true host was probably *Haliator melanoleucos* (see under *P. subsetosus* below).

The name given by Piaget to the type-host of *subsetosus* does not apply to any known bird. *Haliator melanoleucos melvillensis* (Mathews) was formerly known as *Phalacrocorax melanurus* and there are two skins so labelled in the Leiden Museum which Piaget could have examined. Authenticated specimens from *Haliator melanoleucos* are the same as Piaget's type material and it can be assumed that this species is the type-host of *subsetosus*, Piaget probably having misread the label on the skin. As already shown, the name becomes a synonym of *dispar*. There is also a male *setosus* on the same slide as the lectotype, a further indication of the mixing of the specimens from this group of hosts.

There are three slides in the Piaget collection (BMNH) labelled *brevicornis* with the host name and locality as given in the original description. The seven males on these slides are *Pectinopygus dispar* and do not entirely agree with Piaget's figure and description of *brevicornis*. These are rather confusing: the figure of the antenna shows one of a type similar to that of *P. longicornis* on the same plate and rather similar to that of *setosus* except that the second segment is somewhat longer; in the description Piaget states that the antenna is shorter than those of other species (presumably *setosus* and *brevisignatus*) and gives the length of the male antenna as nearer that of the length given for *subsetosus* than for *setosus*. It is obvious that the figure and the description are not based on the antenna of the same species. In the description of *brevicornis* the first three abdominal segments are said to have a median suture which agrees with the tergal divisions in *dispar* (= *subsetosus*); the dimensions are said to be similar to those of *setosus* which broadly covers those of *dispar*.

It must be presumed that the description of *brevicornis* is taken from more than one species and is not entirely accurate even for these. Piaget had a number of specimens labelled with the host name *Carbo sulcirostris* which he described under three different names (*dispar*, *setosus* and *brevicornis*) and which represent two species, *setosus* and *dispar*. Hopkins & Clay (1952) sank *brevicornis* as a synonym of *setosus* as the figure of the antenna seemed to be more like that of *setosus* than *dispar* and it was assumed that the type material was unrecognizably included

among the specimens labelled *setosus*. However, as the description may be based partly on the specimens of *dispar* labelled with the specific name *brevicornis* and the given host and locality, the only slides from that host on which the locality is given, it seems more satisfactory to designate one of these specimens as lectotype and sink *brevicornis* as a synonym of *dispar*. The matter is of no great importance as the syntypes had no valid name until 1912 and *brevicornis* was already a later name than either *dispar* or *setosus*.

***Pectinopygus gracilicornis* (Piaget)**

Lipeurus gracilicornis Piaget, 1880 : 309. LECTOTYPE ♂ (slide No. 824) and 2 ♀ paralectotypes (BMNH), here designated, from *Fregeta minor*, no locality.

Pectinopygus gracilicornis (Piaget); Hopkins & Clay, 1952 : 269.

The lectotype is conspecific with authenticated males from *Fregeta m. minor* (Gmelin).

***Pectinopygus gyricornis* (Denny)**

Lipeurus gyricornis Denny, 1842 : 58.

Lipeurus longicornis Piaget, 1880 : 334. LECTOTYPE ♂ (slide No. 460, BMNH) and 2 ♂, 2 ♀ paralectotypes (1 ♀ in BMNH; 2 ♂, 1 ♀ in RNH), here designated, all from *Phalacrocorax carbo*, no locality.

Pectinopygus longicornis (Piaget); Hopkins & Clay, 1952 : 269.

Although Piaget recorded this species from both *Phalacrocorax carbo* and *P. aristotelis*, the species occurring on these two hosts are quite distinct. The lectotype is the species found on *Phalacrocorax carbo* and is the same as the male holotype of *P. gyricornis* in the Denny collection (BMNH).

***Pectinopygus setosus* (Piaget)**

Lipeurus setosus Piaget, 1880 : 335. LECTOTYPE ♂ (slide No. 498) and 3 ♂, 2 ♀ paralectotypes (BMNH), here designated, from *Phalacrocorax (Graculus) sulcirostris* = *Phalacrocorax sulcirostris* (Brandt), no locality.

Lipeurus setosus var. *brevesignatus* Piaget, 1880 : 336. LECTOTYPE ♂ (slide No. 501, BMNH) and 3 ♂, 4 ♀ paralectotypes (2 ♂, 2 ♀♀ in BMNH; 1 ♂, 2 ♀ in RNH), from *Carbo javanicus* = *Haliator niger* (Vieillot), no locality.

Pectinopygus setosus (Piaget); Hopkins & Clay, 1952 : 270.

Pectinopygus brevisignatus (Piaget); Hopkins & Clay, 1952 : 268.

The lectotype of *setosus* is conspecific with authenticated material from the type host.

No differences could be found between the lectotypes of *setosus* and *brevesignatus*, the differences given by Piaget not being apparent. Authenticated specimens from *Haliator niger*, the type-host of *brevesignatus*, are *P. excornis makundi* and quite distinct from the lectotype of the former species. It is probable that Piaget's specimens labelled *brevesignatus* originated from *Phalacrocorax sulcirostris*, confusion having arisen during collecting or labelling.

Pectinopygus sulae (Rudow)

Lipeurus sulae Rudow, 1869 : 43. Neotype ♂ (slide no. 13438a, BMNH) from *Sula leucogaster plotus* Forster, JAVA.

Lipeurus tuberculatus Piaget, 1885 : 61. Holotype ♀ (slide No. 434, BMNH) from *Procellaria glacialis*, no locality. **Syn. n.**

Pectinopygus tuberculatus (Piaget): Hopkins & Clay, 1952 : 270.

The holotype female of *tuberculatus* belongs to the *sulae* division of species (see Key above) and does not appear to be separable from female 'neoparatypes' (see Clay & Hopkins, 1955 : 65) of *Pectinopygus sulae* (Rudow) from *Sula leucogaster plotus* Forster.

Pectinopygus turbinatus (Piaget)

Oncophorus turbinatus Piaget, 1890 : 233. Holotype ♂ (slide No. 344, BMNH) from *Mycteria senegalensis* (error), no locality.

Pectinopygus turbinatus (Piaget); Hopkins & Clay, 1952 : 270.

Pectinopygus macquariensis Harrison, 1937; Timmermann, 1964 : 280.

The holotype is the same as authenticated material from *Phalacrocorax atriceps* King.

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Synonyms are placed in *italics*

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afer (Kellogg), 207

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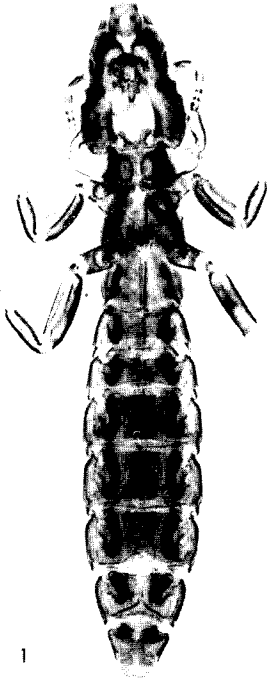
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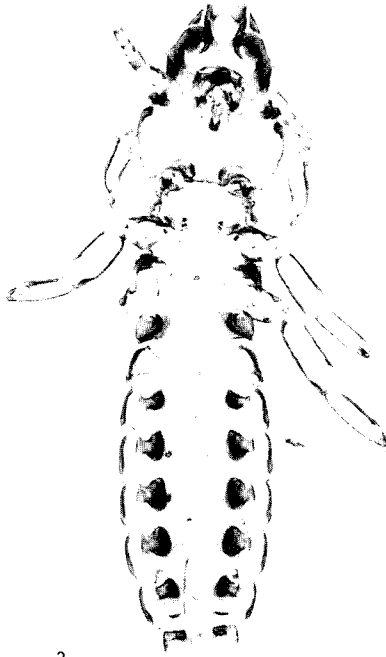
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PLATE I

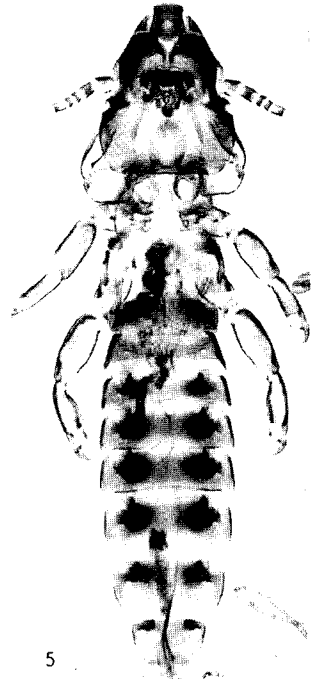
- FIG. 1. *Pectinopygus dispar* (Lectotype of *subsetosus*).
FIG. 2. *Pectinopygus afer*.
FIG. 3. *Pectinopygus timmermanni*.
FIG. 4. *Pectinopygus insularis*.
FIG. 5. *Pectinopygus maritimus*.
FIG. 6. *Pectinopygus acutofasciatus*.



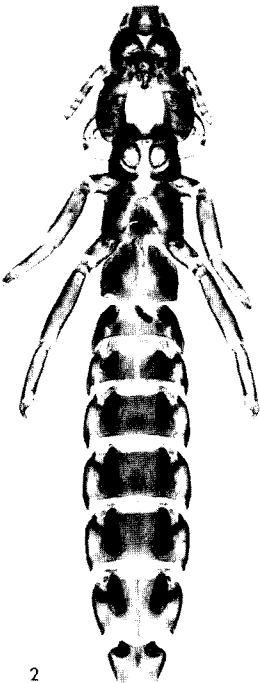
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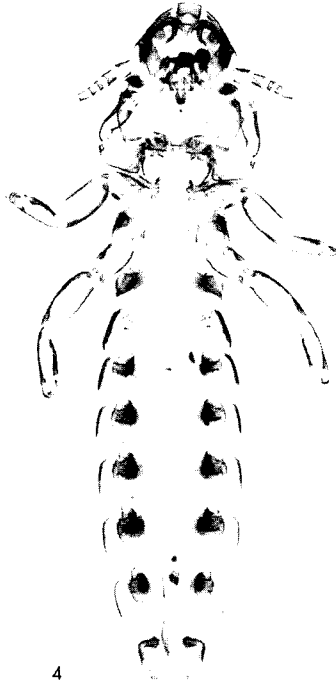
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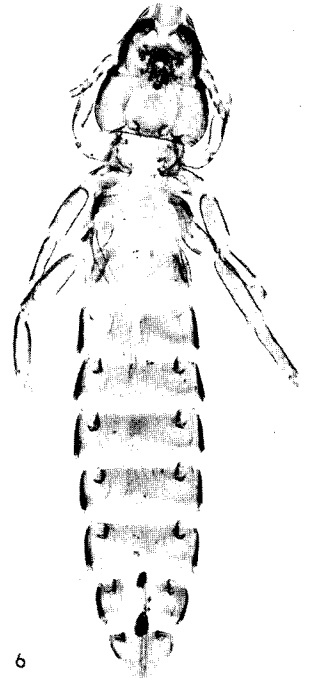
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6

PLATE 2

- FIG. 7. *Pectinopygus dispar*. Vulval edge.
FIG. 8. *Pectinopygus varius*. Vulval edge.
FIG. 9. *Pectinopygus varius*. Bases of ♀ modified lateral setae.
FIG. 10. *Pectinopygus brevicornis*. Base of ♀ modified lateral setae.
FIG. 11. *Pectinopygus insularis*. ♀ genital region.
FIG. 12. *Pectinopygus insularis*. Vulval edge
(SEM).

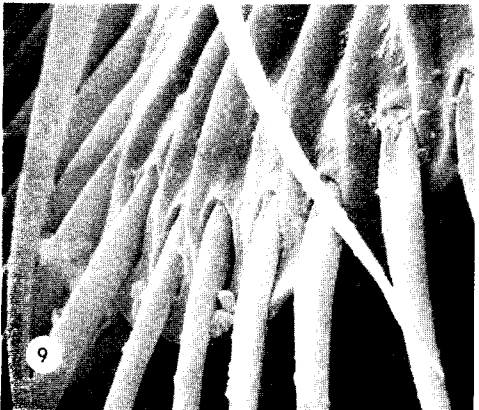
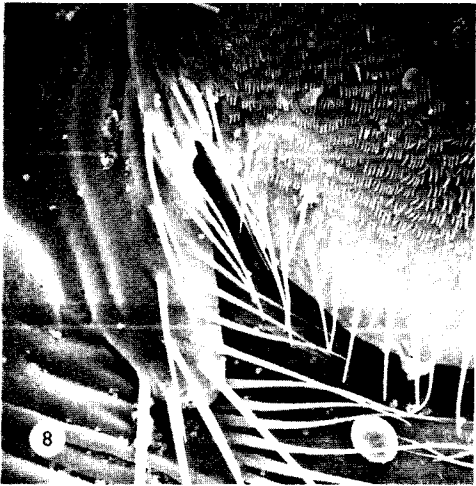
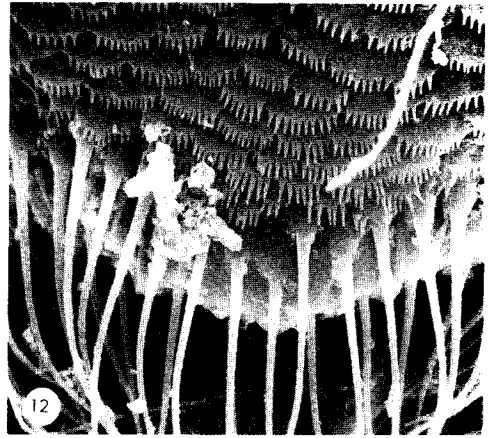
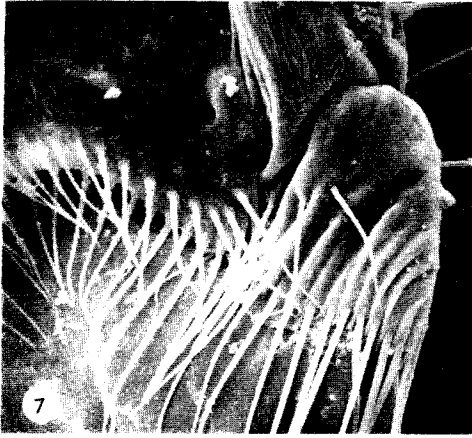


PLATE 3

- FIG. 13. *Pectinopygus varius*. ♀ sheathed anal seta and sense organ (SEM).
FIG. 14. *Pectinopygus varius*. Anal sense organ (SEM).
FIG. 15. *Pectinopygus acutofasciatus*. Part of ♀ terminal sternum. Arrow points to one of the unmodified lateral setae.
FIG. 16. *Pectinopygus insularis*. Lateral part ♀ terminal sterna.
FIG. 17. *Pectinopygus timmermanni*. ♀ terminal sterna. Arrow points to single unmodified lateral seta.
FIGS 18-19. *Pectinopygus afer*. ♂ genitalia.
FIG. 20. *Pectinopygus dispar*. ♀ sheathed anal setae (SEM).

