

**THE PIAGETIELLA (MALLOPHAGA: MENOPONIDAE)
OF THE PELECANIFORMES¹**

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Abstract

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Eight species of the genus *Piagetiella* are discussed and illustrated. There are two new synonymies: *P. africana* (Bedford) (= *Tetrophthalmus australis* Bedford) and *P. titan* (Piaget) (= *Tetrophthalmus subititan* Bedford). A key is given to the species.

In a continuation of the study of the known menoponids that bear femoral and(or) sternal ctenidia, I have undertaken a revision of the genus *Piagetiella* Neumann. This group of lice currently contains 16 specific names, 10 of which are recognized by Hopkins and Clay (1952) as representing valid species. However, since there has been no comprehensive work on these lice and since most of these species are unrecognizable from descriptions available in the literature, it is my purpose here to redescribe and illustrate the species and to provide a key for their identification.

The members of this genus of lice are interesting from an ecological standpoint, since they are principally found in the pouches of hosts within two families of the order Pelecaniformes—the pelicans (Pelecanidae: *Pelecanus*) and the cormorants (Phalacrocoracidae: *Phalacrocorax*). The lice themselves are among some of the larger forms, ranging in length from 4 to 6 mm.

All specimens I have studied were mounted on slides. Measurements are given in millimeters. Unless stated specifically to the contrary, data and illustrations are based on type-host material, data are for both sexes, and reference to tergites, pleurites, and sternites pertains to the abdomen. I would like to caution workers against taking quantitative data too literally, especially in this genus of lice where both dimensions and counts seem to vary considerably. The available material is generally of a limited nature and the data are intended only as an expression of the variation among these specimens; undoubtedly specimens exist that fall outside of the stated limits and allowance must be made for a reasonable amount of divergence. The nomenclature of the hosts follows that of Peters (1931).

In the following descriptions, the characteristics possessed by all known members of *Piagetiella* will be given first, then those for each of the two species-groups. For brevity, these will not be repeated in the subsequent species descriptions.

***Piagetiella* Neumann, 1906**

Tetrophthalmus Grosse, 1855 (nec Hope, 1845). *Z. Wiss. Zool.* 42: 534. Type-species: *T. chilensis* Grosse.

Piagetia Picaglia, 1884 (nec Ritsema, 1874). *Atti Soc. Nat. Mat. Modena* 2: 104. Type-species: *P. ragazzii* Picaglia.

Piagetiella Neumann, 1906. *Bull. Soc. Zool. France* 31: 60. Nomen novum for *Piagetia* Picaglia.

Little sexual dimorphism other than that associated with generally darker pigmentation and possession of apical tibial processes by the male, slight size differences, and terminalia. Large specimens, ranging from approximately 4-6 mm in total length.

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HEAD. Broadest across temples, front rounded; deep preocular slit; 2 pairs of middorsal setae, with inner medioposterior to outer; both pairs of occipital setae medium length; subocular comb row preceded anteriorly by about 10–12 evenly-spaced setae; antennae concealed beneath head, with segments shaped much as in Fig. 2; maxillary palpus as in Fig. 1, with 2 subterminal setae on last segment; sitophore sclerite of hypopharynx weakly developed (Fig. 5).

THORAX. Prosternal plate with at least 5 setae; 4 medioanterior mesothoracic setae, with each pair close together on a side; mesosternal plate irregularly oblong (Figs. 20–21); metasternal plate roughly triangular (Figs. 22–25).

ABDOMEN. Tergites undivided, without anterior setae, and of approximately same length, with I, II, and VIII sometimes appearing slightly shorter than III–VII; female tergites separate from pleurites, male usually with evident partial fusion at least on III–VI; postspiracular setae generally longest on VII–VIII, shorter on I–VI, but variable, especially on II, III, and VI; spiracles large. Female ventral terminalia (Figs. 9–13): sternites VII–VIII (or IX) fused; pair of submedian triangular plates lying between more darkly pigmented elongate lateral plates, each of these lateral plates with patch of 25–50 short spiniform and fine setae at posterior end; anus oval, without inner setae. Male ventral terminalia (Figs. 14–19) with sternites VIII–IX fused and setae of VIII clustered on each side. Male genitalia (Figs. 36–43) with slight posterior asymmetry, without usefully discernible parameres or other posterior sclerites, but with conspicuous genital sac of characteristic size and vestiture.

BURSAEPELECANI-group

Five species are included within this group; all of them occur on pelicans (*Pelecanus*) and share the following features.

HEAD. Dorsal anterior setal complex with adjacent seta distinctly mediad (Fig. 27); inner middorsal setae 0.06–0.08 long, outer 0.04–0.05; margin of temple with 4 very long setae on each side; gular plate distinct, variable in shape, close to Fig. 35, but with or without lateroposterior indentation for large seta.

THORAX. Pronotum with at least 25 marginal and submarginal setae of various lengths; both inner and outer dorsal prothoracic setae medium, 0.03 or more long; venter of each femur III with 3–5 well-developed ctenidia; posterior margin of each femur III with 2 short setae; tibiae II–III with 2 stout ventral subapical setae (Fig. 7); male with apical process on each of tibiae I–III.

ABDOMEN. Each spiracle with at least 1 associated seta (Fig. 3); sternite III with 2 well-developed ctenidia on each side, IV with 1 on each side; female ventral terminalia without conspicuous median plate between submedian triangular plates and with triangular plates distinctly shorter than elongate lateral plates; each side of last segment of female with 2 very long setae, 1–2 medium to long latero-anterior setae, and 1 short dorsal inner posterior seta; male genitalia with poorly organized vestiture in posterior, or endomeral, area.

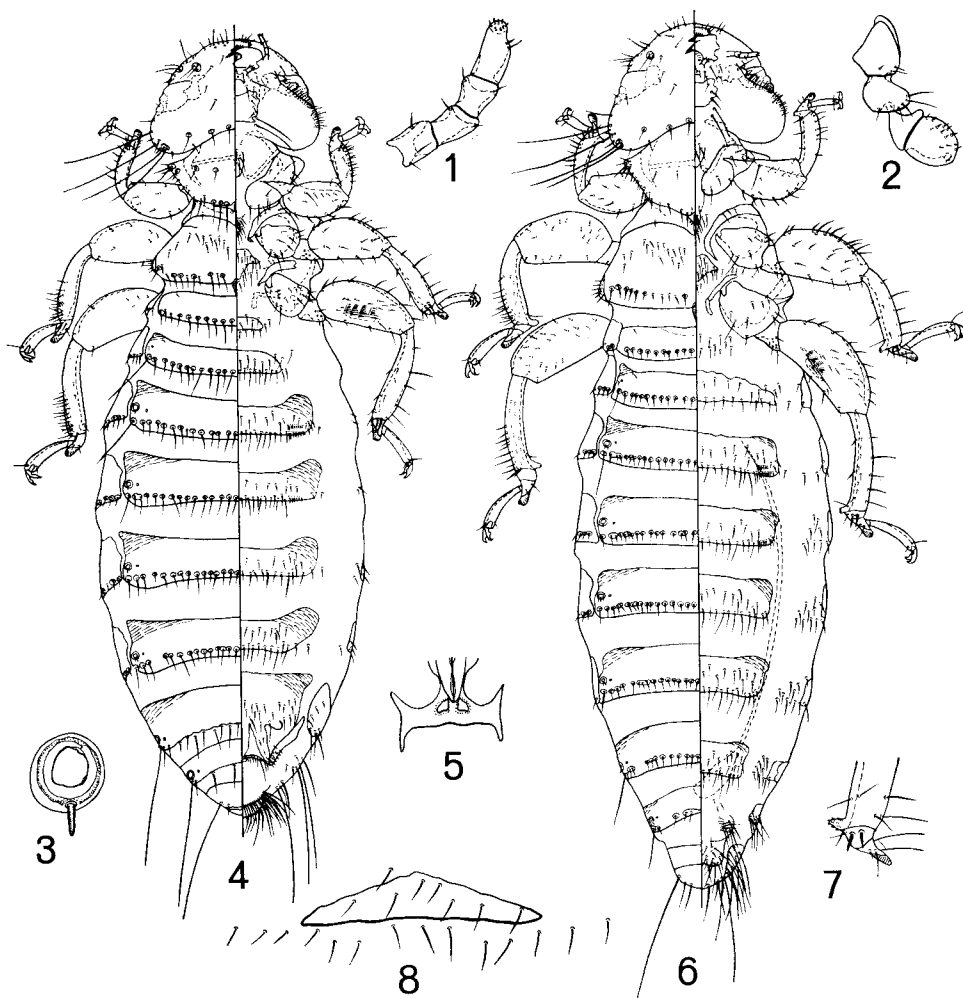
***Piagetiella bursaepelecani* (Perry)**

(Figs. 1–7, 11, 14, 20, 22, 32, 35, 37)

Trinotion bursaepelecani Perry, 1876, Proc. Lit. Phil. Soc. Liverpool 30: lxxx. Type-host: *Pelecanus fuscus* = *Pelecanus occidentalis* Linn.

Menopon titan var. *linearis* Kellogg, 1896, Proc. Calif. Acad. Sci. 6: 165. Type-host: *Pelecanus californicus* = *Pelecanus occidentalis californicus* Ridgway.

Female as in Fig. 4; male as in Fig. 6. Occipital setae 0.06–0.10 long; gula with 5–9 setae on each side. Pronotum with 30–43 marginal and submarginal



FIGS. 1-8. 1-7, *Piagetiella bursaepelecani*: 1, maxillary palpus; 2, antenna; 3, spiracle; 4, female; 5, sitophore sclerite of hypopharynx; 6, male; 7, male ventral tibia III. 8, *P. peralis*, male sternite I.

setae; dorsal prothoracic setae 0.04-0.05 long; prosternal plate moderately-developed (Fig. 32), with 5-9 setae. Mesosternum (Fig. 20) with 14-22 setae. Margin of metanotum with 18-24 short to medium setae, medioanteriorly with 15-30; metasternal plate (Fig. 22) with 26-37 setae; venter of each femur III with 3-4 ctenidia.

Marginal tergal setae, with bases mostly in clear areas on I-VI for female, on I-VIII for male: I, 19-24; II, 21-26; III, 24-32; IV, 26-34; V, 27-36; VI, female 25-31, male 31-36; VII, female 21-24, male 26-28; VIII, female 8-9, male 10-12. Tergal pigmentation of II-VII mostly dark, I and VIII-IX lighter. Each spiracle usually with 1-2 associated setae, less often 3. Sternal setae: I, 17-32; II, 38-50; III, 31-40 between ctenidia; IV, 38-56 including all but ctenidia; V, 40-51; VI, 37-46; VII, 34-46; male often with no discernible sternal sclerite on I.

Female ventral terminalia as in Fig. 11; relatively straight lateral plates; 9-12 posterior submedian marginal setae on each side, including longer lateral ones with

some extending halfway to ventral anal fringe; anal fringes of 55–77 setae ventrally, 40–57 dorsally. Internal genital chamber with fine spinules, much as in square in Fig. 11.

Male ventral terminalia as in Fig. 14; sternite VIII with 11–16 setae on each side; numerous longer setae on last pleurites; gross shape of terminal segment broadly rounded; genital plate with shallow indentation to occasional notch and with weak median division, with 13–17 setae on each side. Genitalia (Fig. 37) 2.06–2.22 long; genital sac large, much longer than basal apodeme, with coarse stout spinules anteriorly, dense long spinules medially resulting in very dark section often looped, and smaller sparse posterior spinules.

Dimensions of male slightly larger than for female: preocular width, female 0.73–0.76, male 0.77–0.79; temple width, female 0.98–1.00, male 1.02–1.03; prothorax width, female 0.75–0.81, male 0.82–0.85; metathorax width, female 0.97–1.01, male 1.07–1.13; total length, female 4.48–4.84, male 4.90–5.07.

REMARKS. Whereas females of *P. bursaepelecani* are difficult to separate from the following three species, the very large male genital sac and its associated vestiture easily separate the males of this species, enabling recognition even of relatively poorly-mounted material.

MATERIAL. 7 ♀♀, 16 ♂♂ (including ♀♂ “types” of *Menopon titan* var. *linearis* Kellogg), *Pelecanus occidentalis*, TRINIDAD and U.S.A. (California, Louisiana, Texas).

Piagetiella chilensis (Grosse)

(Figs. 15, 38)

Tetrophthalmus chilensis Grosse, 1885, Z. Wiss. Zool. 42: 534. Type-host: “Pelikan, in Chili” = *Pelecanus occidentalis thagus* Molina.

Both sexes close to those of *P. bursaepelecani*, differing as follows. Occipital setae 0.08–0.14 long. Prosternal plate with 10–15 setae. Margin of metanotum with 16–19 setae, medioanteriorly 13–18.

Fewer marginal tergal setae: I, 18–21; II, 20–23; III, 21–25; IV, 20–27; V, 22–27; VI, 21–25; VII, 18–21; VIII, 8–10. Sternal setae: I, 20–31; II, 35–49; III, 25–42; IV, 32–49; V, 38–46; VI, 37–51; VII, 30–45; male with well-developed sternal sclerite on I, close to that of Fig. 8.

Female internal genital chamber with possibly finer sparser spinules, but very little discernible in this area. Male ventral terminalia as in Fig. 15; sternite VIII with 6–15 setae clustered on each side; shorter setae on last pleurites; gross shape of terminal segment proportionately longer, truncate; genital plate with only slight indentation, 6–12 setae on each side. Genitalia (Fig. 38) 1.96–2.06 long; genital sac very slender, often anteriorly coiled, with uniformly dense slender spinules most of length.

Tendency for slightly smaller dimensions, with male being some larger than female: preocular width, female 0.67–0.75, male 0.72–0.74; temple width, female 0.87–0.94, male 0.96–1.01; prothorax width, female 0.69–0.76, male 0.77–0.84; metathorax width, female 0.93–1.00, male 1.00–1.09; total length, female 4.28–4.50, male 4.64–4.87.

REMARKS. The overall similarities of specimens of *P. chilensis* to those of *P. bursaepelecani*, added to the fact that both occur on the same species of pelican, have resulted in their being considered as conspecific by some workers (e.g., Hopkins and Clay 1952; Emerson 1964). However, the grossly different male genital sac, as well as other differences in the male terminalia, in quantitative tergal

chaetotaxy, and in dimensions, indicates that these are two distinct species and that *Pelecanus occidentalis thagus* carries a *Piagetiella* species different from that on the subspecies of *Pelecanus occidentalis* to the north.

In an illustration of the male genital apparatus of *P. chilensis*, Grosse (1885, fig. 15) clearly shows a slender coiled genital sac agreeing in excellent fashion with that in my Fig. 38, thereby confirming that his material and mine may be considered to be conspecific. Ferris (1928), in redescribing *P. chilensis*, provides 10 illustrations pertaining to this species; his fig. 8E, of the male genitalia, caused me concern since it was definitely not in agreement with either Grosse's illustration or my material from this host. I subsequently obtained the female and male Ferris used for his study and was surprised to learn that he could not have made the illustration from the genitalia of that male. In this same series of slides, also labelled with Ferris' handwriting, is a slide with two males and a female of *P. transitans* (Ewing) from *Phalacrocorax bougainvillii* (Lesson); one of these males has its genitalia partially dissected out and matches the fig. 8E as well as agreeing essentially with my Fig. 42. Ferris' fig. 8D, of the apex of the male tibia, also more closely represents that of *P. transitans*. So, apparently by some error, his two illustrations for the male are most probably those of *P. transitans* rather than *P. chilensis*.

MATERIAL. 3 ♀ ♀, 6 ♂ ♂, *Pelecanus occidentalis thagus*, Chile and Peru.

Piagetiella peralis (Leidy)

(Figs. 8, 43)

Menopon perale Leidy, 1878, Proc. Acad. Nat. Sci. Phila. 1878: 100. Type-host: *Pelecanus trachyrhynchus* = *Pelecanus erythrorhynchus* Gmelin.

Menopon consanguineum Piaget, 1884, Notes Leyden Museum 6: 111. Type-host: *Pelecanus erythrorhynchus*.

Piagetia ragazzii Picaglia, 1884, Atti Soc. Nat. Mat. Modena 2: 105. Type-host: *Pelecanus trachyrhynchus* = *Pelecanus erythrorhynchus*.

Menopon titan var. *impar* Kell'ogg, 1896 (nec *impar* Piaget, 1880), Proc. Calif. Acad. Sci. 6: 165. Type-host: *Pelecanus erythrorhynchus*.

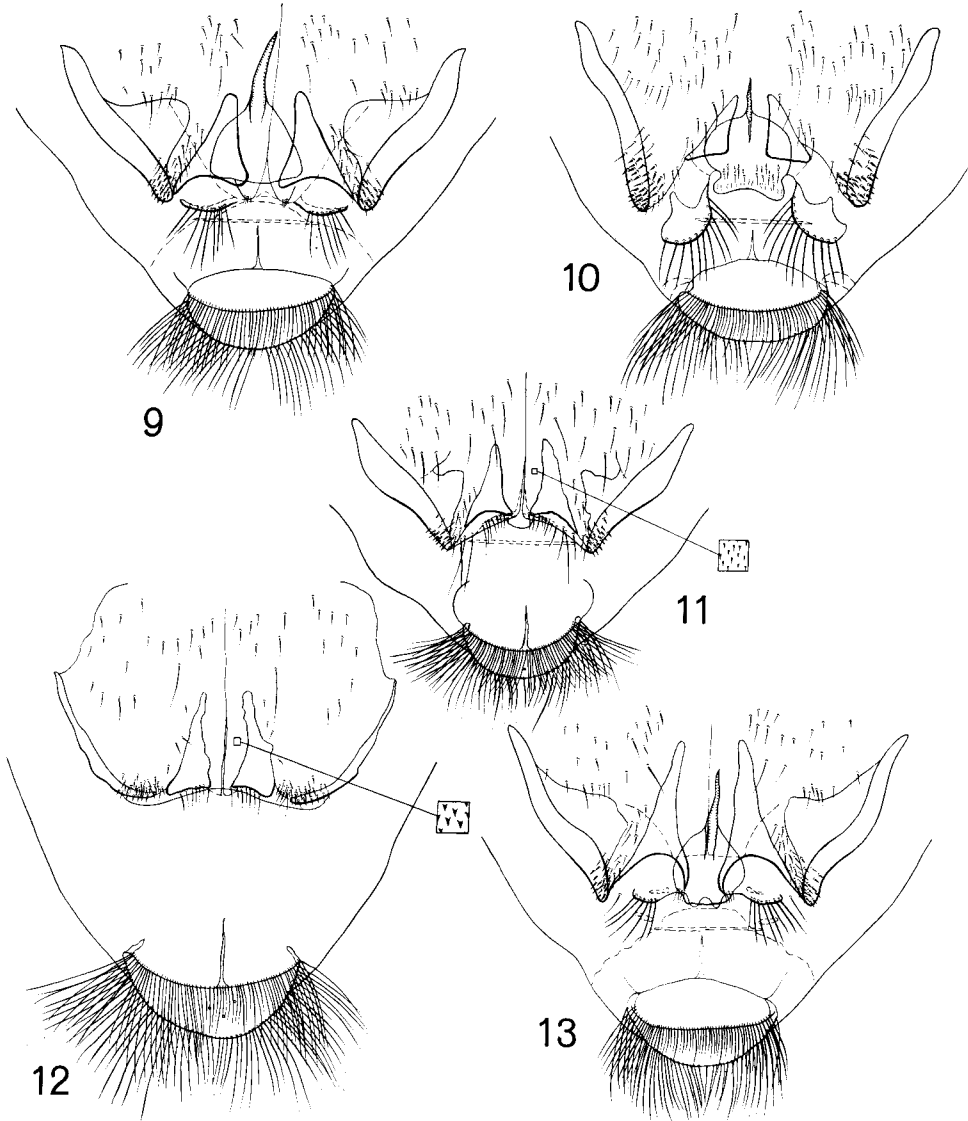
Close to the foregoing two species, differing from *P. bursaepelecani* as follows. Prosternal plate with 8–13 setae. Marginal tergal setae: I, 18–24; II, 20–24; III, female 21–24, male 25–29; IV, female 20–25, male 24–30; V, female 21–24, male 24–29; VI, female 18–22, male 23–30; VII, female 12–14, male 17–22; VIII, 8–10. Each spiracle usually with 2–3 associated setae, less often 1 or 4. Sternal setae: I, 16–24; II, 34–40; III, 30–40; IV, 33–50; V, 40–46; VI, 38–45; VII, 35–44; male usually with well-developed sternal sclerite on I (Fig. 8).

Male genitalia (Fig. 43) 1.66–2.58 long; genital sac shorter than basal apodeme, relatively broad, without evident vestiture anteriorly, with uniform short stout spinules over middle half and smaller spinules posteriorly.

Dimensions: preocular width, 0.76–0.81; temple width, 0.98–1.06; prothorax width, female 0.77–0.83, male 0.81–0.87; metathorax width, female 0.99–1.08, male 1.13–1.16; total length, female 4.67–5.55, male 4.97–5.90.

REMARKS. The female of *P. peralis* is very close to those of both *P. bursaepelecani* and *P. chilensis*. The tergal chaetotaxy is closer to that of the latter species, but differs from both in having only 12–14 marginal setae on tergite VII. The size and vestiture of the male genital sac afford good separation of the male of *P. peralis*, as evidenced by comparison of Fig. 43 with Figs. 37–38.

MATERIAL. 55 ♀ ♀, 86 ♂ ♂, *Pelecanus erythrorhynchus*, U.S.A. (Minnesota, Montana, Wyoming) and Canada (Manitoba).



FIGS. 9-13. Female ventral terminalia: 9, *Piagetiella incomposita*; 10, *P. transitans*; 11, *P. bursaepelecani*; 12, *P. titan*; 13, *P. caputincisa*.

***Piagetiella africana* (Bedford)**

(Figs. 16, 33, 36)

Tetrophthalmus africanus Bedford, 1931, Parasitology 23: 236. Type-host: *Neopelecanus rufescens* = *Pelecanus rufescens* Gmelin.

Tetrophthalmus australis Bedford, 1931, Parasitology 23: 236. Type-host: *Catoptropelecanus conspicillatus* = *Pelecanus conspicillatus conspicillatus* Temminck. **New Synonymy.**

Close to the foregoing three species, differing from *P. bursaepelecani* as follows. Pronotum with 43-54 marginal and submarginal setae of varying lengths; dorsal prothoracic setae 0.06-0.10 long; prosternal plate more strongly developed on posterior half (Fig. 33). Margin of metanotum with 24-45 setae, medio-anteriorly 21-36. Venter of each femur III with 4-5 well-developed ctenidia.

Marginal tergal setae: I, female 19–21, male 20–26; II, 18–21; III–IV, 20–23; V–VI, 18–24; VII, female 18–20, male 20–24; VIII, female 8–14, male 14–16; with female having bases of setae mostly posterior to pigmented tergal area, male with bases in clear areas within tergites. Each spiracle with highly variable number of associated setae, from 1–4 on material studied here, but Bedford (1931) reports up to 6–7, with totals on a side ranging from about 14 + 14 to 28 + 33. Sternal setae: I, 18–24; II, 45–52; III, 42–56; IV, 59–72; V, 46–54; VI, 38–52; VII, 35–53; male without discernible sternal sclerite on I.

Female ventral terminalia close to Fig. 11; with 7–10 posterior submedian marginal setae on each side, but lateral setae of these rows not as long, extending less than third of way to ventral anal margin; anus with 63–78 setae in dorsal fringe.

Male ventral terminalia as in Fig. 16; sternite VIII with 14–16 setae on each side on relatively broad short sclerite of variable shape; numerous longer setae on last pleurites; broadly rounded terminal segment; genital plate narrow, elongate, posteriorly rounded and extending to or slightly beyond end of abdomen, bearing 2 long slender submedian sclerites, and with estimated 30–40 setae. Genitalia (Fig. 36) 2.16–2.44 long; genital sac slender, shorter than basal apodeme, with anterior third having fine short spinules, remainder with sparse longer slender spinules.

Most dimensions larger than for any of previous three species: preocular width, 0.76–0.81; temple width, 1.06–1.14; prothorax width, female 0.86–0.89, male 0.87–0.95; metathorax width, female 1.05–1.15, male 1.15–1.24; total length, 4.70–5.21.

REMARKS. The larger number of marginal pronotal and metanotal setae, along with the structure of the prosternal plate, appears to afford a means of separating both sexes of *P. africana* from those of the preceding three species. The number of marginal tergal setae is nearest to that for *P. chilensis*. The shape of the male genital plate, with the associated chaetotaxy, distinguishes the male of *P. africana*; the male genital sac (Fig. 36) is closest to that of *P. chilensis* (Fig. 38), and grossly different from those of the other two species (Figs. 37, 43).

The specimens I have from *Pelecanus conspicillatus* are at to above the maximum given for the *P. africana* dimensions; however, Bedford (1931) gives measurements for *P. africana* and *P. australis* that overlap so completely, or even show *P. australis* as smaller, as to place serious doubt on the value of dimensional differences. Also, Bedford (1931) groups *P. africana* and *P. australis* together in separating them from *P. titan* (Piaget) and *P. subtitan* (Bedford). I agree that *P. africana* and *P. titan* are morphologically distinct species, but none of the features for justifying the other two as species holds up. The gular plates of all four have the "ear-shaped" structures associated with them and pustulation around the last seta is variable (Bedford 1931, fig. 1A–D). The mesosternal and metasternal plates of his fig. 2A–D and tergal pigmentation of his fig. 3B–C separate *P. titan* and *P. africana*, but not the other series. The same may be added for the terminal sternal plates of his figs. 4A–D and 5A–D; his fig. 4C, said to represent *P. africana*, and 4B, said to be of *P. subtitan*, are in error and should have the labelling reversed to 4B and 4C, respectively. In view of the absence of any known means for reliably separating the *Pelecanus conspicillatus* series from that from *P. rufescens*, they should now be considered as conspecific, in spite of the occurrence of one in Australia and the other in Africa.

MATERIAL. 6 ♀ ♀, 3 ♂ ♂ (including homotype ♀ ♂ of *T. africanus* Bedford), *Pelecanus rufescens*, **Belgian Congo, N. Cameroon, Kenya, Nyasaland, and Sudan**; 2 ♀ ♀, 3 ♂ ♂, *P. conspicillatus*, **Australia** (2 collections).

***Piagetiella titan* (Piaget)**

(Figs. 12, 19, 23, 31, 40)

Menopon titan Piaget, 1880, Pediculines: 503. Type-host: *Pelecanus onocrotalus* Linn.

Tetrophthalmus subtitan Bedford, 1931, Parasitology 23: 236. Type-host: *Metapelecanus roseus* = *Pelecanus roseus* Gmelin. **New Synonymy.**

Female dorsally as in Fig. 31. Occipital setae of female 0.16–0.17 long, male 0.07–0.13; gula with 5–7 setae on each side. Pronotum with 43–55 marginal and submarginal setae, including a number of longer ones; dorsal prothoracic setae 0.07–0.10 long; prosternal plate as in Fig. 32, with 7–8 setae. Mesosternum with 16–18 setae. Margin of metanotum of female with 22–25 setae, male 26–36, many of these fairly long; metanotum medioanteriorly with about 25 setae; metasternal plate (Fig. 23) proportionately longer than wide, with 27–34 setae; venter of each femur III usually with 5, less often 4, well-developed ctenidia.

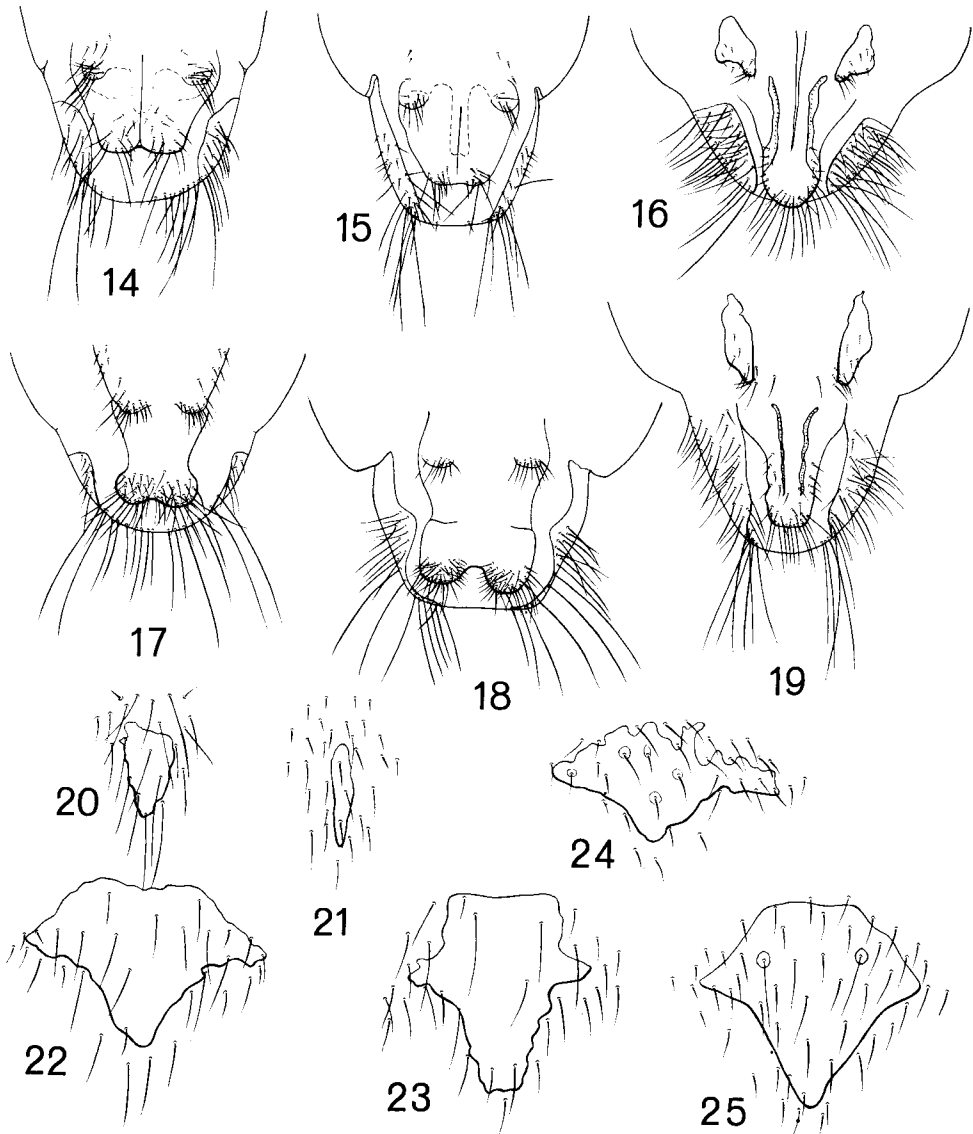
Marginal tergal setae, with bases of those of female generally not in clear areas probably due to lighter tergal pigmentation and with those of male virtually all with bases in clear areas: I, 22–24; II, 21–23; III, 22–27; IV, 23–29; V, 20–28; VI, 21–25; VII, 21–24; VIII, 16–19. Tergal pigmentation of female with III–VI dark medially and around spiracles, I–II and VII–IX uniformly lighter, of male with II–VII mostly dark, I and VIII–IX lighter. Each spiracle usually with 2–3, less often 1 or 4, associated setae. Sternal setae: I, 18–25; II, 49–56; III, 41–49; IV, 52–68; V, 44–57; VI, 37–48; VII, 29–38; male with or without evident sternal sclerite on I.

Female ventral terminalia as in Fig. 12; with slender lateral plates having posterior portion curving medially; 7–10 posterior submedian marginal setae on each side, including no longer ones; anus with 76–84 ventral fringe setae, 92–97 dorsal fringe setae. Internal genital chamber with conspicuous stout spinules, much as in square in Fig. 12.

Male ventral terminalia as in Fig. 19; sternite VIII with 14–18 setae on each side, on plate of variable shape, but usually longer than wide; many long setae on last pleurites; terminal segment apparently narrower, but genital plate with associated sclerites and 35 or so setae closest to that of *P. africana* (Fig. 16); however, plate not extending to end of abdomen. Genitalia (Fig. 40) very long, 3.28–3.70 long; genital sac large, anterior fourth with very fine short spinules, then an unornamented area, followed posteriorly by sparse slightly longer spinules grading into posterior half of dense long slender spinules.

Dimensions: preocular width, 0.85–0.88; temple width, 1.10–1.18; prothorax width, 0.90–0.94; metathorax width, 1.15–1.26; total length, 5.61–6.03.

REMARKS. The most distinguishing feature of the female of *P. titan* is the structure of the ventral terminalia (Fig. 12). All other known species of *Piagetiella* have the female with fairly straight stout lateral plates, whereas *P. titan* has these plates much thinner and the posterior end curved medially. Other features, such as the greater number of anal setae, the numerous longer pronotal setae, and the tergal pigmentation, reinforce this separation from other females of the *bursaepelacani*-group. The large size of the male genitalia (Fig. 40), in conjunction with the vestiture of the genital sac, separates *P. titan* from males of the other species of this group; the male ventral terminalia (Fig. 19) are closest



FIGS. 14-25. 14-19, male ventral terminalia: 14, *Piagetiella bursaepelecani*; 15, *P. chilensis*; 16, *P. africana*; 17, *P. transitans*; 18, *P. caputincisa*; 19, *P. titan*. 20-21, mesosternal plate: 20 *P. bursaepelecani*; 21, *P. transitans*. 22-25, metasternal plate: 22, *P. bursaepelecani*; 23, *P. titan*; 24, *P. caputincisa*; 25, *P. transitans*.

to those of *P. africana* (Fig. 16), but the gross shape of the terminal segment and the placement of the genital plate differ. In an illustration of the male genitalia of *P. titan*, Blagoveshtchensky (1956, fig. 4) shows the vestiture of the genital sac in agreement with that of my Fig. 40.

MATERIAL. 8 ♀♀, 9 ♂♂, *Pelecanus onocrotalus*, **Cyprus** and **Rajputana**; 6 ♀♀, 7 ♂♂ (including ♀♂ homotypes of *T. subtitan* Bedford), *P. roseus*, **Kenya**, **Ethiopia**, **Uganda**, and **N. Rhodesia**; 1 ♀, 1 ♂, *P. (?) crispus* Bruch, **Cyprus**; 1 ♂, *P. rufescens*, **Kenya**—probably a straggler or contaminant.

TRANSITANS-group

The three species recognized within this species-group all occur on cormorants (*Phalacrocorax*). They are separated from members of the *bursae-pelecani*-group by the following features.

HEAD. Dorsal anterior setal complex and adjacent seta either as in Fig. 26 or 27; inner middorsal setae 0.02–0.05 long, outer 0.01–0.03; margin of temple with 2 or 3 very long setae on each side; gular plate usually inconspicuous or at most weakly delineated.

THORAX. Pronotum with some microalveoli and not over 15 marginal and submarginal setae; both inner and outer dorsal prothoracic setae minute, less than 0.01 long; venter of each femur III with either a brush of 20 or so setae or up to 3–4 irregular to fairly compact ctenidia; posterior margin of each femur III with 2 or more short setae; tibiae II–III with 4 stout ventral subapical setae (Fig. 30); male with apical tibial process only on II–III.

ABDOMEN. Spiracles without associated setae; sternite III with 2 irregular ctenidia on each side, IV without any evidence of ctenidia; female ventral terminalia with conspicuous median plate between submedian triangular plates of varying size; each side of last segment of female with varying chaetotaxy; male genitalia with compact fine vestiture in posterior, or endomeral, area.

Piagetiella transitans (Ewing)

(Figs. 10, 17, 21, 25, 26, 28, 29, 34, 42)

Tetrophtalmus transitans Ewing, 1930, Proc. Biol. Soc. Wash. 43: 125. Type-host: "Cormorant, Chincha Island, Peru" = *Phalacrocorax bougainvillii*.

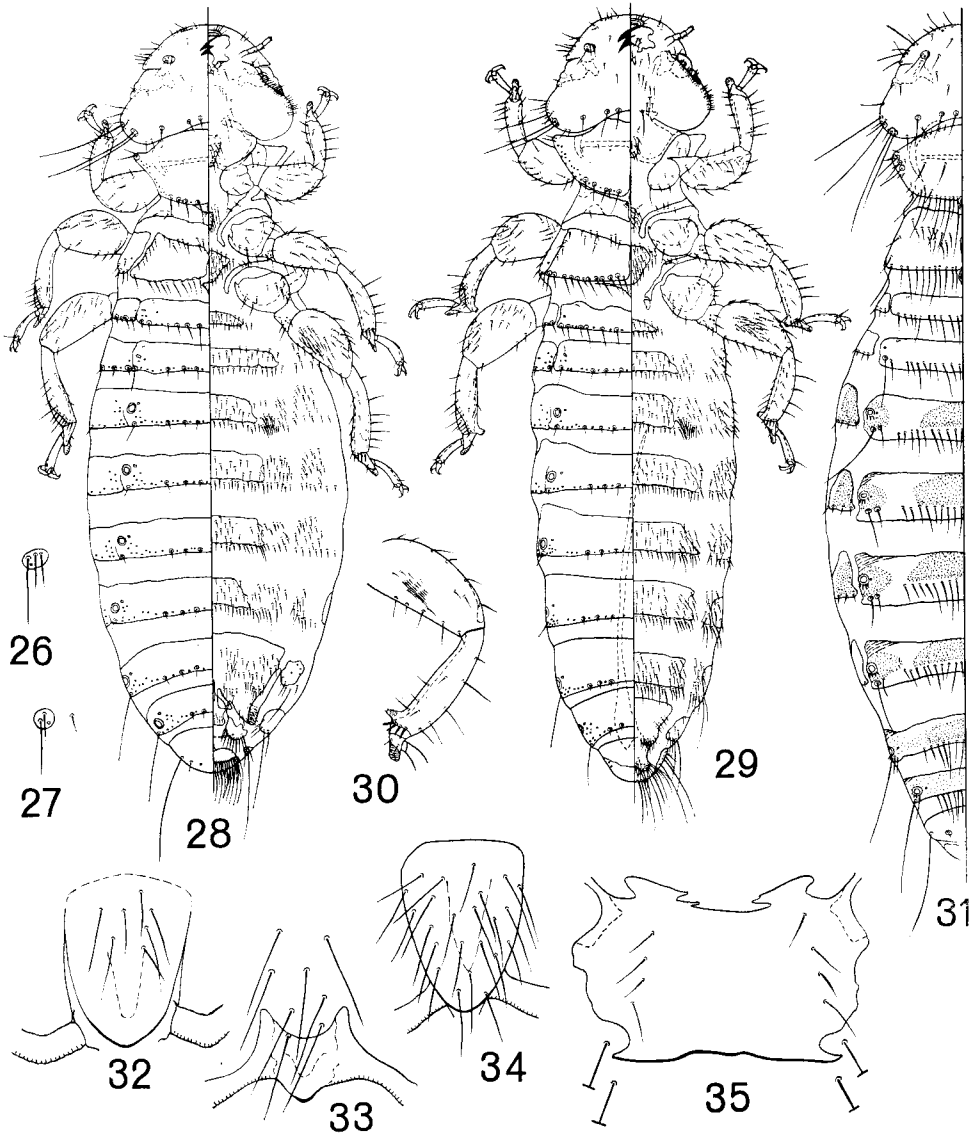
Tetrophtalmus titschaki Eichler, 1941, Arch. Naturgesch., N.F. 10: 361. Type-host: *Phalacrocorax bougainvillii*.

Female as in Fig. 28; male as in Fig. 29. Occipital setae 0.11–0.15 long; dorsal anterior setal complex with adjacent seta incorporated into complex (Fig. 26); margin of temple on each side with 3 very long setae; gular plate inconspicuous, with 8–13 setae on each side. Pronotum with 12–15 marginal setae; prosternal plate moderately-developed (Fig. 34), with 17–21 setae. Mesosternum (Fig. 21) with 22–40 setae. Margin of metanotum with 19–23 setae, medioanteriorly with 12–20; metasternal plate (Fig. 25) with 50–55 setae; venter of each femur III with brush of 20 or so setae, no indication of organization into even weak ctenidia; posterior margin of each femur III with 3–7 setae.

Marginal tergal setae, with bases in clear areas and with additional microalveoli: I, female 13–14, male 9–11; II–IV, 8–10; V–VII, 8–9; VIII, 6. Tergal pigmentation with I–VII mostly dark with lighter areas mediad to spiracles, VIII lighter, IX lightest, but male having IX with darker posterior area. Last segment of female on each side with 2 very long setae, 2 medium lateroanterior setae, and 1 short dorsal inner posterior seta; that of male as shown. Sternal setae: I, 30–40; II, 70–97; III, 55–70; IV, 95–110; V, 80–100; VI, 76–90; VII, 59–75.

Female ventral terminalia as in Fig. 10; relatively straight lateral plates; submedian pair of triangular plates much shorter than lateral plates, and with anterior process of median rounded plate extending anterior of triangular plates; 9–12 marginal setae on each well-developed posterior submedian plate extending about halfway between posterior limits of lateral plates and ventral anal fringe; anus with 56–59 ventral fringe setae, 52–57 dorsal fringe setae. Without discernible internal genital chamber structure.

Male ventral terminalia as in Fig. 17; sternite VIII with 18–24 setae on each side; terminal segment broadly rounded, fringed with long setae; genital plate



FIGS. 26-35. 26-27, dorsal anterior head setal complex: 26, *Piagetiella transitans*; 27, *P. caputincisa*. 28-29, *P. transitans*: 28, female; 29, male. 30, *P. caputincisa*, male ventral leg III. 31, *P. titan*, female dorsum. 32-34, prosternal plate: 32, *P. bursaepelecani*; 33, *P. africana*; 34, *P. transitans*. 35, *P. bursaepelecani*, gular plate.

darkly pigmented, medially concave giving bilobed appearance, with 15-30 setae on each side. Genitalia (Fig. 42) 1.55-2.00 long; genital sac with anterior third having short stout spinules, remainder having long slender dense spinules.

Dimensions of both sexes essentially similar: preocular width, 0.71-0.74; temple width, 0.94-1.00; prothorax width, 0.87-0.93; metathorax width, 1.06-1.13; total length, 3.99-4.51.

REMARKS. The female of *P. transitans* is differentiated from others of the group by the lobe-like plates associated with the ventral terminalia, the male by

the chaetotaxy and shape of the terminalia and the structure of the genital sac. Additionally, the presence of a setal brush on the venter of femur III and the composition of the dorsal anterior head setal complex assist in the characterizing of both sexes.

MATERIAL. 10 ♀ ♀, 8 ♂ ♂, *Phalacrocorax bougainvillii*, Peru (4 collections).

***Piagetiella incomposita* (Kellogg and Chapman)**

(Figs. 9, 41)

Menopon titan var. *incompositum* Kellogg and Chapman, 1899, Occ. Pap. Calif. Acad. Sci. 6: 123. Type-host: *Phalacrocorax penicillatus* (Brandt).

The data in the following description are for specimens from *Phalacrocorax auritus* (Lesson). Occipital setae 0.10–0.15 long; dorsal anterior setal complex with adjacent seta removed medially (Fig. 27); margin of temple on each side with only 2 very long setae; gular plate inconspicuous, with 7–10 setae on each side. Pronotum with 8–11 marginal setae; prosternal plate near to that of Fig. 33, with only 8–12 setae. Mesosternum with 14–27 setae. Margin of metanotum with 13–18 short to long setae, medioanteriorly with 9–16; metasternal plate variable, perhaps nearest to Fig. 24, with female having 42–49 setae, male 28–38; venter of each femur III with 3–4 irregular to fairly regular ctenidia plus adjacent setae; posterior margin of each femur III with 2 short setae.

Marginal tergal setae, with bases in clear areas and with additional microalveoli: I, 10–11; II, 8–9; III–V, 8; VI, 8–9; VII, 8; VIII, 5–6. Tergal pigmentation close to that of *P. transitans*, but with I and VII variably light to dark. Last segment of female with 4 long to very long setae on each side, in addition to 1–2 lateroanterior setae and 1 short dorsal inner posterior seta. Sternal setae: I, 11–18; II, 46–60; III, 48–55; IV, 80–95; V, 58–65; VI, 56–63; VII, 41–56.

Female ventral terminalia of "type" as in Fig. 9; relatively straight lateral plates; submedian pair of triangular plates much shorter than lateral plates, and with anterior process of median rounded plate extending well anterior of triangular plates to level of anterior end of lateral plates; 8–14 marginal setae on each submedian posterior side, not on large lobe-like plates as for *P. transitans*; anus with 50–64 ventral fringe setae, 56–63 dorsal fringe setae. Internal genital chamber with only weak spinules evident laterally.

Male ventral terminalia close to those of Fig. 18; sternite VIII with 15–17 setae on each side; shape of terminal segment more parallel-sided, without complete fringe of long setae, posterior margin truncate; genital plate bilobed, darkly pigmented, with 40 or so setae on each side. Genitalia (Fig. 41 of male ex *Phalacrocorax auritus*) 2.08–2.58 long; genital sac narrower than for *P. transitans*, especially anteriorly, with sparse spinules both anteriorly and posteriorly and denser longer spinules in middle portion.

Dimensions of both sexes essentially similar: preocular width, 0.72–0.79; temple width, 0.96–1.05; prothorax width, 0.74–0.82; metathorax width, 0.86–1.04; total length, 4.55–5.33.

REMARKS. The structure of the female ventral terminalia by lacking the prominent posterior submedian lobe-like plates bearing the marginal setae, the removal of the seta medially from the dorsal anterior head setal complex, the organization of the setae on the venter of femur III into some form of ctenidia, and the reduced sternal chaetotaxy, especially of sternite I, are among some of the features separating *P. incomposita* from *P. transitans*.

The application of the name *P. incomposita* to the series from *Phalacrocorax auritus* carries with it a certain hazard. With only the single "type" female of

P. incomposita from *Phalacrocorax penicillatus*, quite obviously no comparison could be made of the males. In lieu of finding no significant differences between the females, I see no justification now in assuming the *Phalacrocorax auritus* lice to represent any species other than *P. incomposita*. It is for this reason that I have designated this group of species the *transitans*-group, since it is conceivable that the above description may prove to represent a species different from *P. incomposita*.

Kellogg and Chapman (1899) state that their description is based on a single male, when they actually had a female and illustrate it clearly as such. The fact that until 1930 this species remained as the only *Piagetiella* that had been described from a cormorant prompted workers to conclude these lice were restricted to pelicans. Presumably this is why Harrison (1916) states that *P. incomposita* was a "Straggler from a pelican" and Thompson (1935) states that this louse ". . . is almost definitely a straggler from a pelican . . ."

MATERIAL. 1 ♀ ("type" of *Menopon titan* var. *incompositum* Kellogg and Chapman), *Phalacrocorax penicillatus*, **U.S.A.** (California); 11 ♀ ♀, 11 ♂ ♂, *P. auritus*, **U.S.A.** (Florida, Georgia, Illinois, Louisiana, Minnesota) and **Canada** (Quebec).

Piagetiella caputincisa Eichler

(Figs. 13, 18, 24, 27, 30, 39)

Piagetiella caputincisa Eichler, 1950, Riv. Parassitol. 11: 106. Type-host: *Phalacrocorax cirrhatus* = *Phalacrocorax atriceps atriceps* King.

Closest to *P. incomposita*, differing as follows. Gular plate weakly developed, faintly as for *P. bursaepelecani* (Fig. 35). Pronotum with 13–15 marginal setae; prosternal plate with 14–16 setae. Mesosternum with 24–34 setae. Metasternal plate proportionately broader than long (Fig. 24), with female having 27–34 setae, male 39–41; venter of each femur III with 2–3 fairly well-developed ctenidia.

Marginal tergal setae: I, 11–14; II–III, 8–10; IV–VII, 8; VIII, 6. Sternal setae: I, 17–23; II, 47–56; III, 40–49; IV, 62–76; V, 52–58; VI, 46–50; VII, 37–50.

Female ventral terminalia as in Fig. 13; anterior ends of submedian triangular plates and of lateral elongate plates at approximately same level, with anterior process of median rounded plate not extending this far; 7–9 setae on each posterior submedian side; anus with 65–69 ventral fringe setae, 63–65 dorsal fringe setae. Internal genital chamber with very weak spinules.

Male ventral terminalia as in Fig. 18; sternite VIII with 9–10 setae on each side. Genitalia (Fig. 39) 2.19–2.32 long; genital sac with broader anterior half of longer heavier spinules, posterior half with dense long slender spinules.

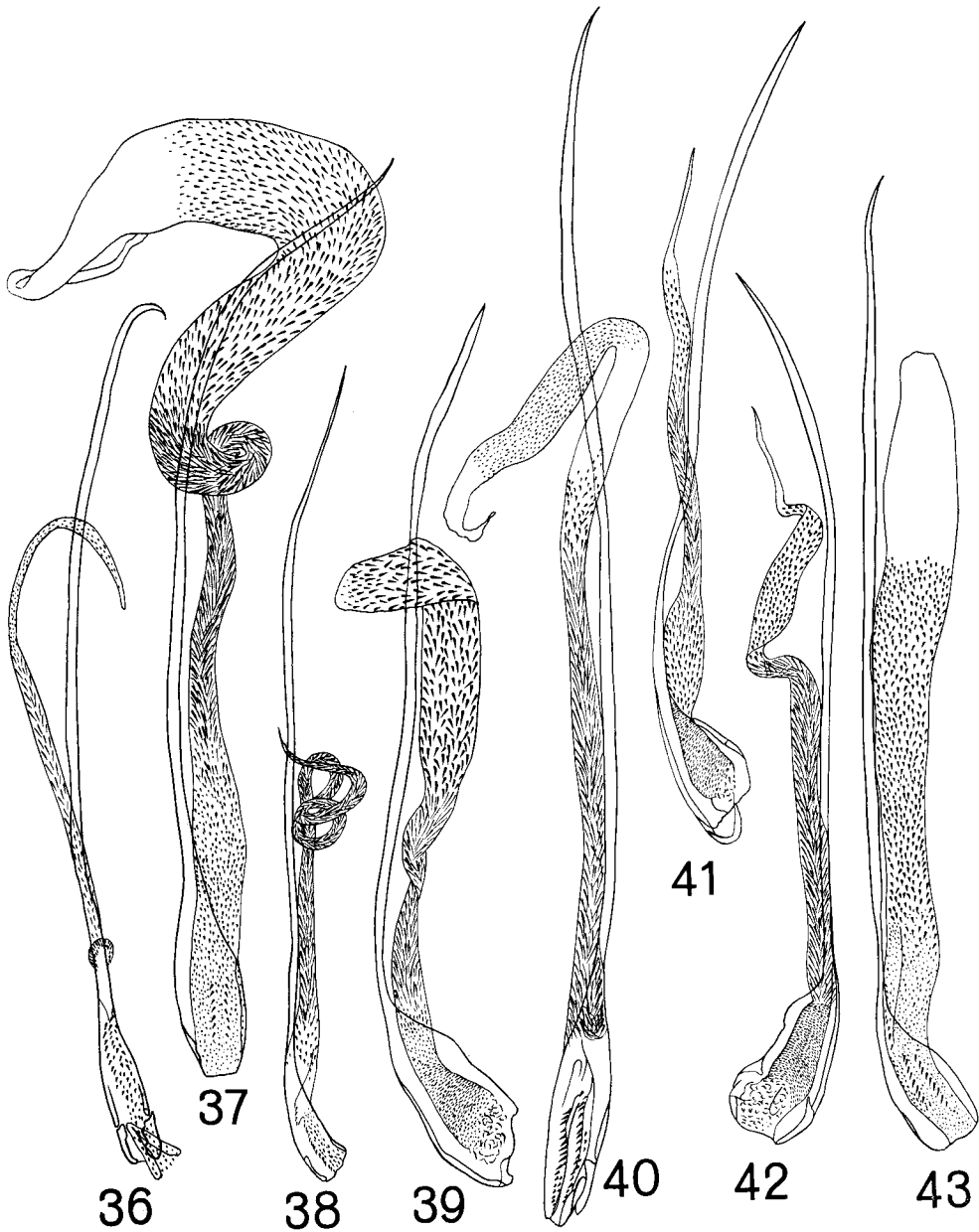
REMARKS. Although *P. caputincisa* is closest to *P. incomposita* in certain pertinent features of the ventral terminalia and overall chaetotaxy, thereby differing from *P. transitans* in the same ways as *P. incomposita*, *P. caputincisa* has a distinctive arrangement of the plates of the female ventral terminalia and the male has a markedly different structure of the genital sac.

MATERIAL. 3 ♀ ♀, 2 ♂ ♂, *Phalacrocorax atriceps*, **South Orkney Is.** and **Graham Land**; 2 ♂ ♂, *P. albiventer* (Lesson), **Falklands**.

Piagetiella vigua (Eichler)

Tetrophthalmus vigua Eichler, 1943, Zool. Anz. 141: 135. Type-host: *Phalacrocorax olivaceus olivaceus* (Humboldt).

I am unable to place this species due to the inadequacy of its description and my inability to obtain any specimens from this type-host. On the basis of the



FIGS. 36-43. Male genitalia: 36, *Piagetiella africana*; 37, *P. bursaepelecani*; 38, *P. chilensis*; 39, *P. caputincisa*; 40, *P. titan*; 41, *P. incomposita* (ex *Phalacrocorax auritus*); 42, *P. transitans*; 43, *P. peralis*.

host, assuming it is the correct one, *P. vigua* would probably be a member of the *transitans*-group. Whether it represents a fourth species of the group or is a synonym of one of the other names is uncertain.

Key to the Species of *Piagetiella*

1. Sternite IV with a short to well-developed ctenidium on each side; each tibia II-III with only 2 stout ventral subapical setae (Fig. 7); each spiracle with at least 1 associated seta (Fig. 3) 2
 Sternite IV without indication of ctenidia; each tibia II-III with 4 stout ventral subapical setae (Fig. 30); spiracles without associated setae 6
2. ♀ with ventral terminalia having slender curved lateral plates (Fig. 12). ♂ genitalia over 3.00 mm long, with vestiture of genital sac as in Fig. 40 *titan* (Piaget)
 ♀ with ventral terminalia having stouter relatively straight lateral plates (Fig. 11). ♂ genitalia shorter, not over 2.90 mm long, with vestiture of genital sac otherwise (Figs. 36-38, 43) 3
3. ♀ with not over 15 marginal setae on tergite VII. ♂ genital sac (Fig. 43) relatively broad, shorter than basal apodeme, and with uniform stout spinules *peralis* (Leidy)
 ♀ with 16 or more marginal setae on tergite VII. ♂ genital sac either broad and much longer than basal apodeme (Fig. 37) or narrow and with different vestiture (Figs. 36, 38) 4
4. ♀ with most to all of tergites III-VI with 24 or more marginal setae. ♂ with very large heavily spinulate genital sac (Fig. 37) *bursaepelecani* (Perry)
 ♀ with each of tergites III-VI typically with fewer than 24 marginal setae. ♂ with slender, more lightly spinulate genital sac (Figs. 36, 38) 5
5. Fewer than 20 marginal metanotal setae; prosternal plate as in Fig. 32. ♂ ventral terminalia (Fig. 15) with genital plate posteriorly concave to flattened, not extending to end of abdomen *chilensis* (Grosse)
 Over 20 marginal metanotal setae; prosternal plate as in Fig. 33. ♂ ventral terminalia (Fig. 16) with rounded genital plate extending to or beyond end of abdomen *africana* (Bedford)
6. Venter of each femur III with brush of setae, no indication of ctenidia. ♀ ventral terminalia with prominent pair of posterior submedian lobe-like plates bearing marginal setae (Fig. 10). ♂ terminal segment rounded, with continuous fringe of long setae (Fig. 17) *transitans* (Ewing)
 Venter of each femur III with at least several irregular to distinct ctenidia. ♀ ventral terminalia without prominent pair of posterior submedian plates bearing marginal setae (Figs. 9, 13). ♂ terminal segment flattened posteriorly, without continuous fringe of long setae (Fig. 18) 7
7. ♀ ventral terminalia (Fig. 9) with anterior process of median plate extending beyond anterior ends of submedian triangular plates. ♂ genital sac with size and vestiture as in Fig. 41 *incomposita* (Kellogg and Chapman)
 ♀ ventral terminalia (Fig. 13) with anterior process of median plate not extending beyond anterior ends of submedian triangular plates. ♂ genital sac with size and vestiture as in Fig. 39 *caputincisa* Eichler

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