

# The *Kurodaia* (Mallophaga: Menoponidae) Parasitic on the Strigiformes, with a Key to the Species of the Genus<sup>1</sup>

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## ABSTRACT

The 11 species of *Kurodaia* that occur on the Strigiformes are keyed and described. These include two new species, *K. acadicae* from *Cryptoglaux acadica* and *K.*

*flammei* from *Asio flammeus*. New synonymy: *K. magna* Emerson, 1960, (= *K. edwardsi* Emerson, 1961).

The lice of the amblyceran genus *Kurodaia* Uchida, 1926, are restricted in their known distribution to two bird orders, the Falconiformes (hawks) and the Strigiformes (owls). The species parasitic on the former order have been dealt with in a previous paper (Price and Beer 1963a). It is our purpose now to complete the survey of this genus by reviewing the status of the species currently considered to be found on the owls and to handle the undescribed species that we have obtained. By way of conclusion, we present a key to the known species of *Kurodaia* occurring on both the hawks and owls.

Eichler (1949) established the genus *Conciella*, with the type species *Colpocephalum painei* McGregor, to include the forms related to *Kurodaia* occurring on owls. His morphological separation of these two genera was so nebulous that this division in essence was based on the *Kurodaia* parasitizing hawks and the *Conciella*, the owls. Hopkins and Clay (1952) chose to synonymize *Conciella* with *Kurodaia*, stating that it is recognizable as a subgenus, thus leaving *Kurodaia* (*Kurodaia*) on hawks and *Kurodaia* (*Conciella*) on owls. Emerson (1960), in discussing the North American *Kurodaia* of owls, states that all known North American species of the subgenus *Kurodaia* possess three combs of short setae on the ventral surface of the third femora (misstated "coxae" in the paper) and that those of the subgenus *Conciella* possess four combs of such short setae. After our study of considerable material on a worldwide basis from both avian orders, we have failed to find that this premise consistently enables us to separate the species into these two subgenera; occasionally one finds an owl *Kurodaia* with three

rows (e.g., all specimens of *K. cryptostigmatia* and several other species show only three rows) and a hawk *Kurodaia* with two to three setae suggesting a fourth row. A character that may possibly prove to be the best means for separating this genus into two subgenera was called to our attention by Dr. Clay (in correspondence). It concerns the chaetotaxy, shape, and sclerotization of the gular plate. The *Kurodaia* from hawks usually have finer setae in more or less parallel rows; the plate itself is lightly sclerotized only across the anterior portion (Fig. 6). The *Kurodaia* from owls typically have stronger setae in rows that converge posteriorly; the plate is uniformly sclerotized (Fig. 5). On this basis, the subgenera *Kurodaia* and *Conciella* may be recognized from most specimens that we have seen.

There has also been a tendency for some workers to include among the *Kurodaia* of owls species that do not possess the characteristics attributed by Clay (1947) as well as by us (Price and Beer 1963a) to members of this genus. Eichler (1949) included "*brachysoma*" and "*pectinata*" among his *Conciella*. Emerson (1960) listed *K. brachysoma* (Kellogg and Chapman), *K. pectinata* (Osborn), and *K. menoponoides* (Ewing) among the owl *Kurodaia*. *K. keeleri* Emerson was later described by Emerson (1961) as occurring on *Bubo virginianus*. All four of these species are actually *Colpocephalum* sens. lat. and their status is discussed in another paper (Price and Beer 1963b). Reference to this paper will clarify our reasoning in so doing, and we shall not discuss it further here; we have mentioned these species now only to account for the absence of these names in the ensuing discussion.

The *Kurodaia* of owls for the most part represent such a homogeneous morphological type that, to avoid needless repetition, a general description may

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be given here and then only deviations from this description discussed with each species. A diagnosis of the genus has been given previously (Price and Beer 1963a) and will not be repeated.

Morphology and chaetotaxy for female much as in Fig. 1 and for male as in Fig. 2. Head widest at temples with expanded preocular region and distinct preocular notch. Preocular nodi well defined, with a very dark suboval central area and lighter peripheral zone. Sitophore with distinct posterior arms. Lateral head setae near preocular angle usually with a long stout seta and a finer seta half its length anterior to it; lateral temple margin with two very long setae. A short dorsal head seta usually situated well medially to the setal complex, this latter name given to the long seta, the medium seta, and the dorsal sensillus located in a cleared area above the anterior margin of the preocular nodus.

Margin of prothorax with a short, long, short, long, short, and three long setae on each side, numbered 1-8, respectively (Fig. 1). Margin of the metanotum with 10 long setae. Abdominal tergites usually possess only a marginal row of setae; *K. panjabensis* is the only species from owls known to have anterior tergal setae. On segments I-VIII this marginal row consists of 8-12 tergocentral setae flanked by a shorter seta and then a very long lateral postspiracular seta. Tergite IX with 3-5 marginal setae on each side, including a very long seta preceded and followed by one to two medium or short setae. We should explain that the character we refer to as tergite IX is probably the product of the fusion of abdominal segments IX and X; yet for the sake of simplicity, we shall continue to call it tergite IX.

Metasternal chaetotaxy variable, with 4-14 setae, depending on the species being considered. Sternites I-VII with marginal and anterior setae of such variable numbers that no significance is placed on them for species separation; total setal ranges as follows: I, 3-11; II, 13-32; III, 18-35; IV, 32-52; V, 30-53; VI, 20-44; VII, 25-37. Abdominal pleura with chaetotaxy as illustrated in Figs. 1 and 2. Chaetotaxy of terminal segments and morphology of the male genitalia are so important for each species that no generalizations will be made. There is no marked sexual dimorphism other than that associated with slightly larger female size and features associated with the terminal segments.

The characters found of most help in separating the species of *Kurodaia* from the owls are: (1) chaetotaxy of the vulva, postvulval plates, and anus of the female; (2) shape of male genitalia, especially the penis and genital sclerite; (3) comparative length of lateral marginal head setae on the preocular angle and the temples; (4) presence or absence and length of marginal prothoracic seta 5; (5) number of marginal tergal abdominal setae, especially on segment IX; (6) proximity of a dorsal head seta to the setal complex; (7) number of metasternal setae; (8) gross features of combs on sternite III; (9) number of setae on male genital plate; and (10) dimensions,

especially head width, prothorax width, and length of male genitalia.

All specimens studied and described were mounted on slides and the measurements, always given in millimeters, represent those of these slide-mounted lice. The classification of the hosts follows that of Peters (1940).

### *Kurodaia cryptostigmatia* (Nitzsch, 1861)

*Menopon cryptostigmatum* Nitzsch, 1861, Zeitschr. Ges. Naturwiss. 17: 529. Type-host: *Strix passerina* = *Athene noctua noctua* (Scopoli).

*Menopon minor* Piaget, 1880, Pediculines: 420. (*nec minor* Piaget, 1880: 418) Type-host: *Strix noctua* = *A. noctua*.

*Nosopoius xairido* Eichler, 1943, Zool. Anz. 141: 59. Nomen novum for *Menopon minor* Piaget.

Female as in Fig. 1. Femora III with only 3 comb rows. Abdominal tergites without anterior setae and with the following number of tergocentral setae: I, 8; II, 9-10; III, 10-12; IV, 12-13; V, 12-14; VI, 11-13; VII, 10-14; VIII, 5-8. Marginal setae of tergite IX on each side with 1 medium, 1 very long, and 1 short seta. Combs on sternite III usually of 2 rows, with anterior row quite reduced: row 1, 0-7; row 2, 9-14. Posterior row followed laterally only by a series of 2-4 short spiniform setae. Metasternal plate with 4-7 setae. Ventral terminal portion of abdomen as in Fig. 22. Vulva with 15-19 short evenly spaced marginal setae and 11-16 medium-length anterior setae. Postvulval plates each with 4-5 long setae. Setae around anus ventrally with 3-5 stout terminal setae flanking 8-10 short setae and dorsally with 19-26 fine medium setae all of similar length.

Male (Fig. 2) similar to female, except for the terminal segments and for slightly smaller size. Figs. 3 and 4 show variations from the usual marginal prothoracic setal arrangement. Approximately 50 setae on genital plate. Male genitalia 0.60-0.63 long, grossly as in Fig. 10A but with genital sclerite shaped as in Fig. 10B.

Measurements: preocular width, ♀ 0.45-0.47, ♂ 0.44-0.47; temple width, ♀ 0.54-0.60, ♂ 0.53-0.58; head length, ♀ 0.34-0.35, ♂ 0.33-0.34; prothorax width, ♀ 0.36-0.39, ♂ 0.35-0.40; metathorax width, ♀ 0.47-0.48, ♂ 0.42-0.45; total length, ♀ 1.50-1.80, ♂ 1.44-1.59.

MATERIAL EXAMINED.—11 ♀, 4 ♂ from *A. noctua* from England; 4 ♀, 4 ♂ from *Otus scops cyprius* (Madarász) from Cyprus; 2 ♀, 1 ♂ from *O. senegalensis* (Swainson) from N. Cameroon; 3 ♀, 2 ♂ from *Strix aluco* Linn. from England.

### *Kurodaia platyclypeatum* (Piaget, 1887)

*Colpocephalum platyclypeatum* Piaget, 1887, In Veth, Midden-Sumatra, Nat. Hist. Fauna 1, part 1: 55. Type-host: *Ketupa javanensis* = *K. ketupa ketupa* (Horsfield).

Both sexes close to *K. cryptostigmatia*, but possess 2 medium-length setae laterally before the long seta on tergite IX. The females, in addition, have the

marginal setae of the vulva grouped into a central portion of 5-8 setae which are longer than the lateral more widely spaced setae (Fig. 20). Genital sclerite of male same as for *K. cryptostigmatia* (Fig. 10B).

The status of this species has been discussed recently by Clay (1955); the presence of only 3 females representing the type-material and the absence of further specimens from *Ketupa* prevented detailed comparison with other species of *Kurodaia*. We had initially believed that our series from *Strix leptogrammica* Temminck represented an undescribed species. However, Dr. Clay later sent us a paratype of *K. platyclypeatum* and we can find no means of separating it from the females of the *S. leptogrammica* series. Therefore, for the present, we believe it best to consider the material from both these host species as *K. platyclypeatum*; moreover, it should be borne in mind that our descriptive details for this species are based almost completely on the specimens from *S. leptogrammica*.

MATERIAL EXAMINED.—1 ♀ paratype from *K. k. ketupa* from Sumatra expedition; 4 ♀, 2 ♂ from *S. leptogrammica* from Thailand.

#### *Kurodaia painei* (McGregor, 1912)

*Colpocephalum painei* McGregor, 1912, Entomol. News 23: 305. Type-host: *Otus asio mcallii* (Cassin).

Close to both *K. cryptostigmatia* and *K. platyclypeatum*. Resembles the former in the marginal chaetotaxy of the vulva (Fig. 21), although the median marginal setae are occasionally up to twice length of those of *K. cryptostigmatia*; resembles the latter in chaetotaxy of abdominal tergite IX. Differs from both in having 9-11 tergoventral setae on segment VIII, 16-20 anterior setae on vulva, and over 60 setae on the male genital plate. Occasionally 3 rows of sternal combs; first row, 0-5; second row, 7-11; third row, 9-13. Posterior row with at least one longer fine seta laterally (Fig. 8). Postvulval plates with more setae, each having 5-9. Metasternal plate also with more setae, having 7-10. Male genitalia as in Fig. 10A, with distinctively shaped genital sclerite. In addition to the above, shows a tendency toward a larger size: preocular width, ♀ 0.46-0.56, ♂ 0.50; temple width, ♀ 0.59-0.69, ♂ 0.62; head length, ♀ 0.35-0.42, ♂ 0.37; prothorax width, ♀ 0.39-0.47, ♂ 0.41; metathorax width, ♀ 0.48-0.57, ♂ 0.48; total length, ♀ 1.56-2.00, ♂ 1.56.

MATERIAL EXAMINED.—18 ♀, 5 ♂ from several subspecies of *O. asio* (Linn.) from the United States and Canada.

#### *Kurodaia acadicae*, new species

Type-host: *Cryptoglaux acadica* (Gmelin).

Closest to *K. painei*. Distinctly different from all other *Kurodaia* in its head chaetotaxy (Fig. 26). Both lateral head setae near preocular angle of equal length; 3 very long lateral temporal setae, the anterior one being shorter than the other two; dorsal seta usually near setal complex. Six to 7 meta-

sternal setae; vulva with 16-22 marginal setae and 14-19 anterior setae. Postvulval plates each with 3-5 setae. Sternite III with 2 comb rows, the first being very weak, with only 2-4 setae. Otherwise, similar in both chaetotaxy and dimensions to *K. painei*.

MATERIAL EXAMINED.—6 ♀, 1 ♂ from *C. acadica*, Grinrod, British Columbia, 3 March 1951, J. Wynne and G. J. Spencer; 7 ♀, 1 ♂ from *C. acadica*, Scarsdale, New York, 7 Dec. 1939, C. M. Herman. Holotype ♀, allotype ♂ on deposit at the United States National Museum; 4 ♀, 1 ♂ paratypes at University of British Columbia; 4 ♀ paratypes in the collection of Dr. K. C. Emerson; 4 ♀ paratypes at the University of Minnesota.

#### *Kurodaia deignani* Elbel and Emerson, 1960

*Kurodaia deignani* Elbel and Emerson, 1960, Proc. Biol. Soc. Washington 73: 119. Type-host: *Otus bakkamoena lettia* (Hodgson).

Close to *K. cryptostigmatia*. Dorsal head seta is near setal complex, much as with *K. acadicae*, but the other head setae mentioned earlier are different from that species (Fig. 27). The extent and shape of the preocular nodus coupled with the apparent absence of posterior arms of the sitophore is unusual, although we strongly suspect these may be the result of the mounting technique. Each abdominal tergite from II-VIII, with occasional minor variations of one seta either way, possesses only 8 tergoventral setae. Terminal segments of female as in Fig. 25. The inner posterior setae of tergite IX variable, being either rather long as illustrated or else shorter and more centrally located. Male genitalia with possible minor variations from those of *K. cryptostigmatia* (Fig. 11). All dimensions same as for *K. cryptostigmatia*.

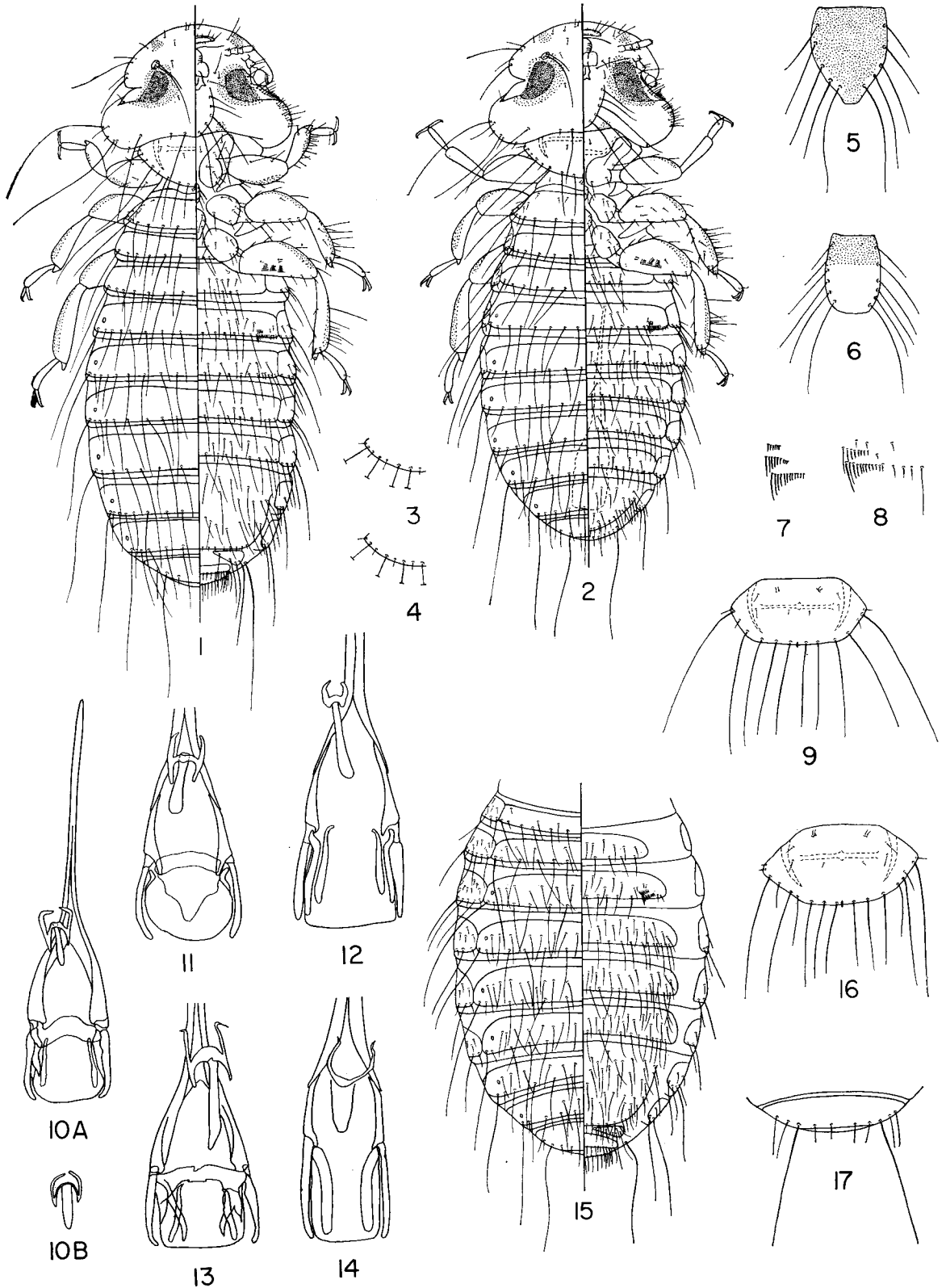
The two illustrations given by Elbel and Emerson (1960) in comparing the female terminalia of *K. deignani* with that of *K. painei* are somewhat misleading; no postvulval plates are shown for *K. painei* even though they are present on this species as well as all other species of *Kurodaia*. The male genital plates verify the fact that *K. deignani* has approximately 50 setae and *K. painei* over 60.

MATERIAL EXAMINED.—1 ♀, 1 ♂ (paratypes) from *O. bakkamoena lettia* from Thailand; 4 ♀, 4 ♂ from *Glaucidium cuculoides* (Vigors) from Thailand.

#### *Kurodaia flammei*, new species

Type-host: *Asio flammeus* (Pontoppidan).

Similar to *K. painei* in size, chaetotaxy of head, thorax, abdominal tergites I-VIII, sternites, vulva, genital plate, and setae around anus. Separated by marginal prothoracic seta 5 being long, attaining half the length of the adjacent setae (Fig. 16). Inner posterior setae on abdominal tergite IX usually of 4 or 3 medium setae, less often 2 (Fig. 17); all the other *Kurodaia* (except *K. panjabensis*) typically have only 2 setae in this position. Plates posterior to the vulva with 4-5 setae on each. Metasternum with 5-6 setae.



MATERIAL EXAMINED.—3 ♀, 1 ♂ from *A. flammeus*, Dallas, Texas, Nov. 14, 1912, F. C. Bishopp. Holotype ♀, allotype ♂, and paratype ♀ on deposit at the United States National Museum; 1 paratype ♀ at the University of Minnesota.

*Kurodaia longipes* (Giebel, 1874)

*Menopon longipes* Giebel, 1874, Insecta Epizoa: 280. Type-host: *Strix bubo* = *Bubo bubo bubo* (Linn.).

Margin of prothorax rounded toward lateral angle and often lacking seta 5 on one or both sides, thus giving arrangement of short, long, short, and 4 long setae on the side from which seta 5 is absent (Fig. 9). Marginal tergal setae as with *K. cryptostigmatia* except for 1-2 fewer setae on segments II-VI. Metasternum with 6 setae. Combs on sternite III of 2 or sometimes 3 distinct rows on each side (Fig. 7): row 1, 0-6; row 2, 5-9; row 3, 13-15. Male genitalia considerably longer than that of *K. cryptostigmatia* (length, 0.83); distinctive genital sclerite (Fig. 12). Female having vulva with 16-22 evenly spaced medium-length setae and more than 20 medium anterior setae; 7-8 setae on each postvulval plate (Fig. 19). In addition to all the above differences from *K. cryptostigmatia*, both sexes of *K. longipes* are considerably larger in all dimensions: preocular width, ♀ 0.50-0.53, ♂ 0.49-0.54; temple width, ♀ 0.64-0.67, ♂ 0.61-0.67; head length, ♀ 0.39-0.41, ♂ 0.38-0.39; prothorax width, ♀ 0.40-0.42, ♂ 0.38-0.42; metathorax width, ♀ 0.47-0.51, ♂ 0.44-0.49; total length, ♀ 2.00-2.12, ♂ 1.75-2.00.

MATERIAL EXAMINED.—5 ♀, 5 ♂ from *B. bubo* from England and Russia; 2 ♀, 2 ♂ from *B. a. africanus* (Temminck) from No. Rhodesia; 2 ♀ from *B. lacteus* (Temminck) from Cameroun.

*Kurodaia subpachygaster* (Piaget, 1880)

*Colpocephalum subpachygaster* Piaget, 1880, Pediculines: 517. Type-host: *Strix flammea* = *Tyto alba* (Scopoli).

Chaetotaxy and structure of head, thorax, abdominal tergites I-VIII, and sternal combs as for *K. cryptostigmatia*. Marginal setae of tergite IX as for *K. platyclypeatum*. Male genitalia of distinctive structure (Fig. 13) and in size intermediate between that of *K. cryptostigmatia* and *K. longipes* (length, 0.71). Female terminal segments different from all other observed *Kurodaia* (Fig. 23). Vulva with 14-16 marginal and 17-21 anterior setae. Each postvulval plate as illustrated, with 8-9 assorted long and medium setae. All setae surrounding anus essentially of same length and thickness (27-30 ventrally, 27-31 dorsally). Size of both sexes of same magnitude as *K. longipes*.

Emerson (1960) states in a couplet in his key to

the species of North American *Kurodaia* of owls that *K. subpachygaster* has "Abdominal tergites I-VI each with two rows of setae." Our findings are that this species, as well as all other owl *Kurodaia* but one, has only a single row of tergal setae. Dr. Emerson, in recent correspondence, concurs with our finding on this species.

MATERIAL EXAMINED.—7 ♀, 1 ♂ from *T. alba* from the United States and Chile.

*Kurodaia crassiceps* (Piaget, 1885)

*Menopon crassiceps* Piaget, 1885, Pediculines Supplement: 92. Type-host: *Pulsatrix torquata* = *P. perspicillata* (Latham).

*Menopon elongatum* Piaget, 1885, Pediculines Supplement: 93. Type-host: *P. torquata* = *P. perspicillata*.

As nearly as we could determine from the material available, *K. magna* is identical to *K. crassiceps* except for the latter being consistently smaller in all dimensions: preocular width, ♀ 0.50-0.53, ♂ 0.50; temple width, ♀ 0.67-0.71, ♂ 0.63-0.68; head length, ♀ 0.33-0.39, ♂ 0.37; prothorax width, ♀ 0.44-0.47, ♂ 0.42; metathorax width, ♀ 0.54-0.56, ♂ 0.53; total length, ♀ 1.70-1.79, ♂ 1.59. Further pertinent description may be found under the following discussion of *K. magna*. Dr. Clay has examined the type materials of *K. crassiceps*. She found that the marginal vulval setae numbered 18, 19, and 25. These numbers are fewer than those we have found for *K. magna* and, with the eventual availability of further material from *Pulsatrix*, may afford a means of separating these two closely related species.

It is unfortunate that our material of *K. crassiceps* was so highly cleared and in such fragmented condition that it was difficult to study. With resort to phase contrast microscopy we determined that this species is, as nearly as we could discern, identical to *K. magna* in shape and chaetotaxy. Reliance upon size as a sole means of separation is not to be encouraged, but in an instance such as this, where two species are already in the literature, we believe that this criterion is sufficient to maintain their separate identities at least for the present.

MATERIAL EXAMINED.—5 ♀, 2 ♂ from *P. perspicillata saturata* Ridgway from Guatemala.

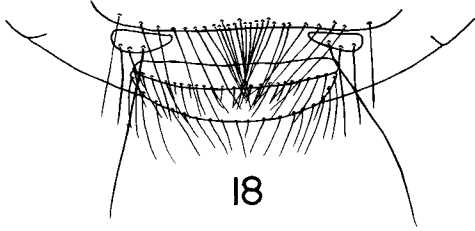
*Kurodaia magna* Emerson, 1960

*Kurodaia magna* Emerson, 1960, Entomol. News 71: 169. Type-host: *Strix varia* Barton.

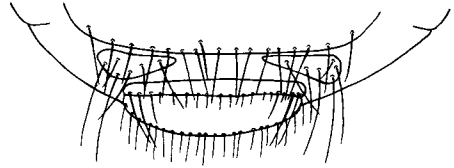
*Kurodaia edwardsi* Emerson, 1961, Proc. Biol. Soc. Washington 74: 190. Type-host: *Bubo virginianus* (Gmelin). NEW SYNONYMY.

The largest species of *Kurodaia* thus far known from the owls. Head (Fig. 28) with 3 very long marginal temporal setae. Most consistently 2, less

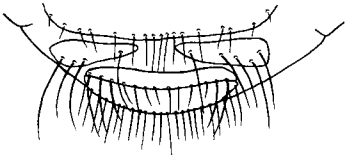
FIG. 1.—*Kurodaia cryptostigmatia*, female. FIG. 2.—Same, male. FIGS. 3-4.—Same, margin of prothorax of male. FIG. 5.—*K. painei*, gula. FIG. 6.—*K. fulvofasciata*, gula. FIG. 7.—*K. longipes*, combs on sternite III. FIG. 8.—*K. painei*, combs on sternite III. FIG. 9.—*K. longipes*, prothorax. FIG. 10A.—*K. painei*, male genitalia. FIG. 10B.—*K. cryptostigmatia*, male genital sclerite. FIG. 11.—*K. deignani*, male genitalia. FIG. 12.—*K. longipes*, male genitalia. FIG. 13.—*K. subpachygaster*, male genitalia. FIG. 14.—*K. magna*, male genitalia. FIG. 15.—*K. panjabensis*, female abdomen. FIG. 16.—*K. flammei*, prothorax. FIG. 17.—*K. flammei*, tergite IX.



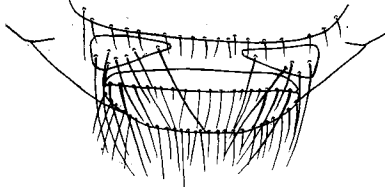
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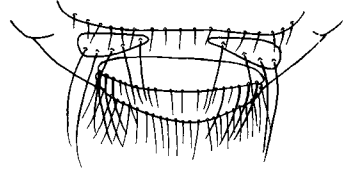
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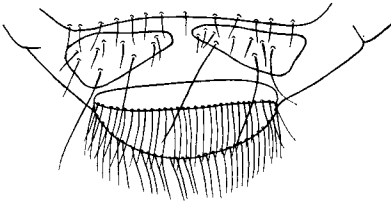
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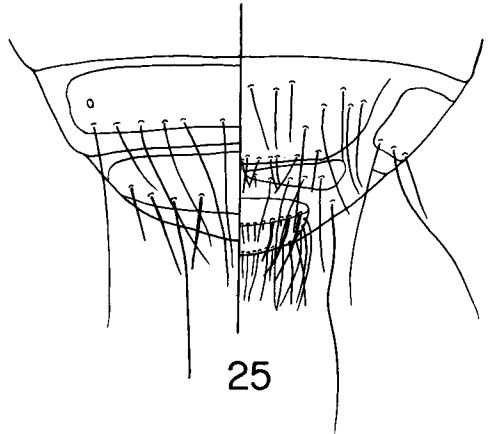
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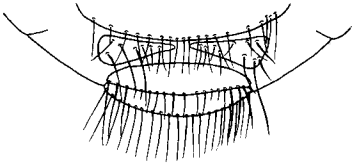
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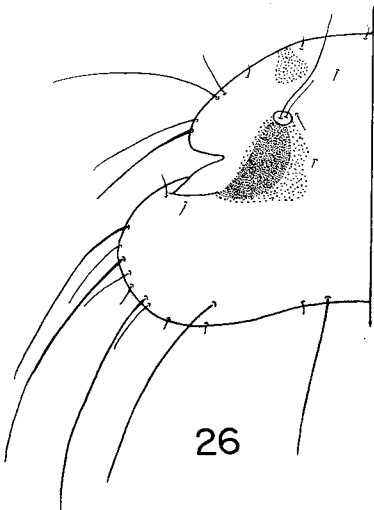
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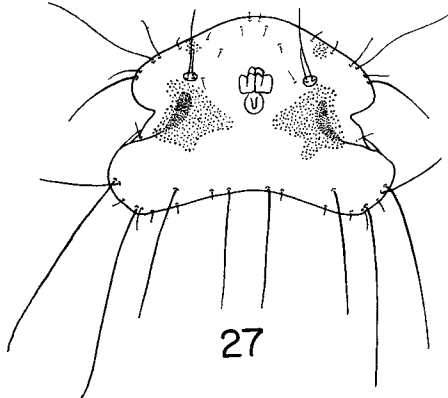
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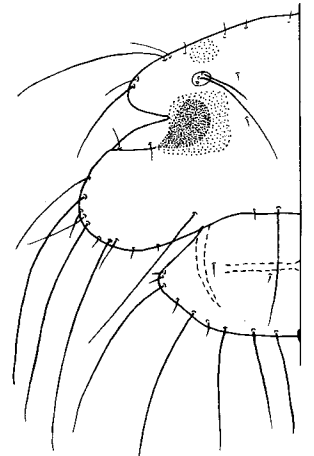
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often 3 or 1, setae at each lateral corner of the prothorax in the position of marginal prothoracic seta 1. Metasternal plate with 9-14 setae. Femora III often with 4 comb rows. Abdominal tergites I-VII with 8-11 tergo-central setae; tergite VIII with 6-8. Sternal combs of 2 or 3 rows (row 1, 0-4 setae; row 2, 4-9; row 3, 11-14). Male genitalia (length, 0.78-0.86) with poorly defined genital sclerite and penis (Fig. 14). Vulva of female (Fig. 18) with considerably more and longer marginal setae than on any other *Kurodaia* except possibly for *K. crassiceps*; 26-35 marginal setae, 24-33 anterior setae. Postvulval plates each with 2-7 setae, including at least one very long seta extending well beyond tip of abdomen. Ventrally 21-25 setae around anus, but otherwise the arrangement of the setae suggests that of *K. cryptostigmatia*. Measurements are as follows: preocular width, ♀ 0.57-0.65, ♂ 0.54-0.57; temple width, ♀ 0.74-0.84, ♂ 0.71-0.75; head length, ♀ 0.42-0.47, ♂ 0.35-0.44; prothorax width, ♀ 0.50-0.53, ♂ 0.47-0.48; metathorax width, ♀ 0.62-0.67, ♂ 0.57-0.62; total length, ♀ 1.96-2.38, ♂ 1.70-2.17.

Emerson (1960), in describing *K. magna*, states that it is closest to *K. painei*; he distinguishes between the two species on the basis of the number of marginal vulva setae, and we have confirmed the validity of this separation. We find, however, *K. magna* very close to *K. crassiceps* and separable only by a size differential.

We believe we have a sound basis for synonymizing *K. edwardsi* with *K. magna* even though their being on two such different hosts caused us some concern. Fortunately we had paratypes of each species generously sent to us by Dr. Emerson and, in addition, we had good series from each host in our own collection. Emerson (1961) presented the following for *K. edwardsi*: "This species is closely related to *K. magna* . . . Chaetotaxy, except for terminal abdominal segments, with two long setae per tergite and sternite less than *K. magna* . . . The male genitalia do not appear to be distinctive." Counts taken from 5 females and 3 males of each series were as follows: *magna*—tergo-central setae on I-VI, respectively, 8-9, 7-10, 8-9, 9-12, 9-11, 9-11, and sternal marginal setae on I-VI, 5-7, 12-15, 13-18, 26-34, 21-26, 18-22; *edwardsi*—tergo-central setae on I-VI, 8, 8-9, 8-10, 8-10, 8-12, 8-11, and sternal marginal setae on I-VI, 5-6, 9-13, 12-16, 25-35, 20-26, 17-22. This finding supports our belief that these may not be considered as separate species on the bases of tergal and sternal counts. Neither could we find any other means of separating the two series.

MATERIAL EXAMINED.—19 ♀, 10 ♂ (including pair of paratypes of *K. magna*) from *S. varia* from the United States and Canada; 21 ♀, 23 ♂ (in-

cluding pair of paratypes of *K. edwardsi*) from *B. virginianus* from the United States and Canada.

### *Kurodaia panjabensis* (Ansari, 1951)

*Cuculiphilus panjabensis* Ansari, 1951, Proc. Natl. Inst. Sci. India 17: 160. Type-host: *Athene brama indica* (Franklin).

Differs from all other known *Kurodaia* of owls by both sexes having a row of anterior setae on abdominal tergites I-VIII. Head similar to *K. cryptostigmatia* except for presence of 3 very long marginal temporal setae. Prothoracic seta 5 either absent or short. Abdomen of female as in Fig. 15, with ventral terminal segments as in Fig. 24. Tergite IX with 4 short fine inner posterior setae. Aside from anterior tergal setae, also more anterior sternal setae arranged in double row. Margin of vulva with 15-20 medium setae; postvulval plates each with around 10 setae of variable length. Male, unknown to Ansari at the time of description of this species, is similar in chaetotaxy to female, except for the ventral terminal segments. Tergite IX with 4 relatively long inner posterior setae. Genital plate similar to that of *K. cryptostigmatia*. Genitalia length, 0.71, in gross shape similar to other species; no discernible sclerites associated with the spiculated genital sac. Dimensions within range given for *K. cryptostigmatia*.

MATERIAL EXAMINED.—4 ♀, 2 ♂ (including a paratype ♀) from *A. brama indica* from India.

### KEY TO THE SPECIES OF *KURODAIA*

1. Abdominal tergites with row of anterior setae at least on I-IV..... 2  
Abdominal tergites lacking row of anterior setae on all segments..... 5
2. At least tergites II-VI with anterior row of 6 or more setae (♂ rarely may lack such setae on VI but has minimum of 6 on V)..... 3  
Females with not more than 5 anterior tergal setae on IV, 3 on V, or 1 on VI; ♂ unknown..... 4
3. Tergite IX with 4 inner posterior setae, fine and short with ♀, long with ♂; gula as in Fig. 5. Female with median setae of ventral anal fringe of uniform length, extending to or beyond tip of abdomen (Fig. 24). Male with genitalia larger, 0.71 mm. long and 0.17 mm. wide distally.....  
*panjabensis* (Ansari)
- Tergite IX with 2 inner posterior setae, relatively long in both sexes; gula as in Fig. 6. Female with median setae of ventral anal fringe having 10 or more minute setae among 4 or so longer ones. Male with smaller genitalia, 0.54-0.59 mm. long and not more than 0.10 mm. wide distally.....  
*fulvofasciata* (Piaget)
4. Not more than 4 anterior tergal setae on any abdominal segment; anal fringe ventrally of 8 short setae flanked at each end by a longer stout seta and dorsally of 13 setae.....  
*cheelae* Price and Beer

FIGS. 18-24.—Ventral female terminalia. FIG. 18.—*Kurodaia magna*. FIG. 19.—*K. longipes*. FIG. 20.—*K. platyclypeatum*. FIG. 21.—*K. painei*. FIG. 22.—*K. cryptostigmatia*. FIG. 23.—*K. subpachygaster*. FIG. 24.—*K. panjabensis*. FIG. 25.—*K. deignani*, dorsal-ventral female terminalia. FIGS. 26-28.—Head of female, dorsal view. FIG. 26.—*K. acadicae*. FIG. 27.—*K. deignani*. FIG. 28.—*K. magna*.

- At least 4 anterior tergal setae on segments I-IV; anal fringe ventrally with more than 20 setae and dorsally with more than 30.....  
*macroclybe* (Carriker)
5. Gula as in Fig. 6. Female having posterior margin of vulva with single row of 19-27 stout spiniform setae. Male with very fragile V-shaped genital sclerite.....  
*haliaëti* (Denny)
- Gula as in Fig. 5. Female with posterior margin of vulva without stout spiniform setae. Male with genital sclerite usually W-, U-, or H-shaped (Figs. 10-14)..... 6
6. Abdominal tergites II-VII usually each with 8 (range = 6-9) tergoventral setae; dorsal head hair always in close proximity to lateral setal complex; ♂ genitalia as in Fig. 11.....  
*deignani* Elbel and Emerson
- At least some of abdominal tergites II-VII typically with more than 9 tergoventral setae; dorsal head hair variable in position; ♂ genitalia as in Figs. 10, 12, 13, or 14..... 7
7. Prothoracic marginal seta 5 long, being half length of adjacent very long setae (Fig. 16); 2-4 medium inner posterior setae on tergite IX (Fig. 17).....  
*flammei* n. sp.
- Prothoracic marginal seta 5 short or absent; usually only 2 minute to medium inner posterior setae on tergite IX..... 8
8. Margin of vulva of ♀ with medium-length setae extending to or beyond ventral anal margin; postvulval plates each with at least one very long seta extending well beyond end of abdomen (Fig. 18); 2 short setae at one or both lateral corners of prothorax; genitalia of ♂ as in Fig. 14..... 9
- Margin of vulva with shorter setae, these usually not extending to ventral anal margin; postvulval plates perhaps with long, but lacking very long seta; lateral corners of prothorax normally with only single short seta; ♂ genitalia not as above..... 10
9. Smaller individuals (in mm.): temple width, ♀ 0.67-0.71, ♂ 0.63-0.68; prothorax width, ♀ 0.44-0.47, ♂ 0.42; ♂ genitalia length 0.69-0.71.....  
*crassiceps* (Piaget)
- Larger individuals (in mm.): temple width, ♀ 0.74-0.84, ♂ 0.71-0.75; prothorax width, ♀ 0.50-0.53, ♂ 0.47-0.48; ♂ genitalia length 0.78-0.86.....  
*magna* Emerson
10. The 2 lateral setae near preocular angle of equal length; 3 very long lateral temple setae; dorsal head seta usually close to setal complex (Fig. 26).....  
*acadicæ* n. sp.
- Without above combination of characters..... 11
11. Vulva of ♀ with evenly spaced, medium stout, setae (Fig. 19); ♂ genitalia as in Fig. 12; prothoracic seta 5 often absent on one or both sides (Fig. 9).....  
*longipes* (Giebel)
- Not as above..... 12
12. All hairs around ♀ anus similar (27-30 ventral, 27-31 dorsal) (Fig. 23); ♂ genitalia as in Fig. 13.....  
*subpachygaster* (Piaget)
- At least 3 different types of setae surrounding anus of ♀ (14-20 ventral, 19-29 dorsal); ♂ genitalia not as above..... 13
13. Segment VIII with 9-11 tergoventral setae; postvulval plates each with 5-9 setae; posterior comb row on sternite III with at least one longer, fine seta laterally (Fig. 8); tergite IX with 2 medium marginal setae lateral to very long seta; ♂ genital sclerite as in Fig. 10A; over 60 setae on ♂ genital plate.....  
*painei* (McGregor)
- Segment VIII with 5-8 tergoventral setae; postvulval plates each with 4-5 setae; posterior comb row on sternite III laterally only with few short spiniform setae; tergite IX either with 1 or 2 medium marginal setae lateral to very long seta; ♂ genital sclerite as in Fig. 10B; approximately 50 setae on ♂ genital plate..... 14
14. Tergite IX with one medium marginal seta lateral to very long seta; ♀ with vulva having 15-19 marginal setae very short, of essentially same length and evenly spaced (Fig. 22).....  
*cryptostigmatia* (Nitzsch)
- Tergite IX with 2 medium marginal setae lateral to very long seta at least on one side; 5-7 central setae of ♀ vulva longer than lateral marginal ones and grouped closer together (Fig. 20).....  
*platyclypeatum* (Piaget)

Species of *Kurodaia* Parasitic on the Falconiformes and Strigiformes.

Species	Type-host	Remarks
* <i>acadicæ</i> , n. sp.	<i>Cryptoglaux acadica</i>	
* <i>cheelae</i> Price and Beer, 1963	<i>Spilornis cheela</i>	
** <i>crassiceps</i> (Piaget, 1885)	<i>Pulsatrix perspicillata</i>	
** <i>cryptostigmatia</i> (Nitzsch, 1861)	<i>Athene noctua noctua</i>	
* <i>deignani</i> Elbel and Emerson, 1960	<i>Otus bakkamoena lettia</i>	
* <i>edwardsi</i> Emerson, 1961	<i>Bubo virginianus</i>	= <i>magna</i> Emerson
** <i>elongatum</i> (Piaget, 1885)	<i>Pulsatrix perspicillata</i>	= <i>crassiceps</i> (Piaget)
* <i>flammei</i> , n. sp.	<i>Asio flammeus</i>	
** <i>fulvofasciata</i> (Piaget, 1880)	<i>Buteo buteo</i>	
** <i>haliaëti</i> (Denny, 1842)	<i>Pandion h. haliaëtus</i>	
<i>koepckeii</i> Eichler, 1953	<i>Chondrohierax uncinatus</i>	Species sedis incertae
** <i>longipes</i> (Giebel, 1874)	<i>Bubo bubo bubo</i>	
** <i>macroclybe</i> (Carriker, 1903)	<i>Buteo p. platypterus</i>	
<i>macrura</i> Eichler, 1952	<i>Falco sparverius</i>	Species sedis incertae
* <i>magna</i> Emerson, 1960	<i>Strix varia</i>	
** <i>minor</i> (Piaget, 1880)	<i>Athene noctua</i>	= <i>cryptostigmatia</i> (Nitz.)
** <i>pachygaster</i> (Giebel, 1874)	<i>Pandion haliaëtus</i>	= <i>haliaëti</i> (Denny)
** <i>painei</i> (McGregor, 1912)	<i>Otus asio mcallii</i>	
* <i>panjabensis</i> (Ansari, 1951)	<i>Athene brama indica</i>	
* <i>platyclypeatum</i> (Piaget, 1887)	<i>Ketupa ketupa ketupa</i>	
** <i>subpachygaster</i> (Piaget, 1880)	<i>Tyto alba</i>	
* <i>taguatoii</i> Eichler, 1952	<i>Milvago c. chimango</i>	= <i>fulvofasciata</i> (Piaget)
** <i>xairido</i> (Eichler, 1943)	<i>Athene noctua</i>	= <i>cryptostigmatia</i> (Nitz.)

\* Denotes that type material has been seen.  
 \*\* Denotes that specimens from the type host have been seen.



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