The Genus *Kurodaia* (Mallophaga: Menoponidae) from the Falconiformes, with Elevation of the Subgenus *Falcomenopon* to Generic Rank

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ABSTRACT

Descriptions and illustrations are given for four species of *Kurodaia* that occur on the Falconiformes: *K. haliætii* (Denny) from *Pandion haliætus*, *K. fulvofasciata* (Piaget) (= *K. taguatoi* Eichler, n. syn.) from 15 species of hawks including 6 *Buteo* species, *K. macrocybe* (Carriker) from *Buteo platypterus*, and *K. cheela* from *Spilornis cheela*. *K. macrura* Eichler and *K. kocepekii* Eichler are considered species sedis incertae. *Falcomenopon* Emerson and Elber, formerly regarded as a subgenus of *Kurodaia*, contains the single species *boonsongi* Emerson and Elber.

The lice of the genus *Kurodaia* are restricted in their known distribution to birds of the orders Falconiformes and Strigiformes. Although the *Kurodaia* of hawks have been reviewed relatively recently by Eichler (1952), the inadequacy of both the illustrations and the written descriptions has made it impractical to utilize this work for identification of material; thus, we find it necessary to re-examine critically this genus. It is our intent here to review not only the status of the seven species of *Kurodaia* currently recognized as occurring on the Falconiformes but also the specimens which we have been able to obtain from 14 additional host species. The *Kurodaia* of owls will be dealt with in a subsequent paper. The host nomenclature throughout this paper follows that of Peters (1931).

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Genus *Kurodaia* Uchida, 1926


Type species: *Colpocephalum haliaeeti* Denny.


Type species: *Menopon falcofasciatum* Plagget.

*Causiella* Eichler, 1940, Boll. Soc. Entomol. Ital. 79: 11.

Type species: *Colpocephalum pannae* McGregor.


The genus *Kurodaia* was defined by Uchida (1926) as follows: “A genus of Colpocephalidae, somewhat resembles genus *Cuculiphius*. Three combs of short spines upon ventral surface of the posterior femora and two or three combs of short spines upon each side of the third abdominal sternites. Mesothorax very small, but distinctly separated from metathorax by a suture. Head broad, the forehead large, rounded; ocular emargnation very narrow, forming a kind of slit in the lateral margin just in front of the eye. Oesophageal gland present but very indistinct. Gastric teeth absent. Genitalia in the male characteristic stout, moderately long. The basal plate is composed of a rod, bifurcated near its median portion, in the form of an inverted Y. Basal plate contiguous distally with a broad lamina, each side comes in contact with stout, slightly curved paramere.”

Clay (1947) has amended this generic characterization by adding that the head is without ventral sclerotized processes arising near the palpal bases, the terminal segment of the antenna is without definite signs of division, and the prosternum has only two median setae. Gastric teeth are present, not absent as stated by Uchida. The females are further described as possessing a ventral sclerite between the vulva and anus bearing marginal and surface setae, having the abdomen ovoid and widest at segment IV, lacking dorsal bands joining occipital and precocoon sclerotized areas, and having sternite IV with group of one to six lateral setae on each side similar to those in combs on sternite III. The males share these last two points and in addition have a characteristic genitalia (see fig. 2), especially the sclerotized structures associated with the genital sac.

We can add little to this generic diagnosis but to stress certain of these features. The very poorly developed occipital nodi and absence of carinae connecting the occipital nodi either to each other or to the preoccipital nodi is a constant feature of both sexes, as is also the presence of a pair of lateroventral sclerites and their associated setae between the vulva and anus of the female. All *Kurodaia* have a row of four to six medium-length setae anterior to the comb row along the lateroventral head margin.

Unfortunately, confusion has existed, and still exists, in distinguishing between the *Kurodaia* and *Colpocephalum* found on Falconiformes. Upon examination of abundant menoponid material from genitalia as in figure 2; quite distinctive and large many species of these birds, we have found that these lice (aside from *Cuculiphius* and possibly *Nosopoio*) consistently are separable either into *Kurodaia* as defined above or into *Colpocephalum*.

The latter genus today consists of a heterogeneous mixture of forms found on a number of bird orders. However, of the over 1000 *Colpocephalum* examined from 53 hawk species, all material has shown uniformity in the possession of the following features: (1) prominent preoccipital and occipital nodi with carinae connecting the occipital nodi to each other and to the respective preoccipital nodus on each side, (2) absence of ventral sclerites and setae between the vulva and margin of the anus of the females, (3) a distinctly shaped sclerotized plate associated with the genital sac, and (4) at most two widely spaced medium length setae anterior to the comb row on the lateroventral head margin, never a row of four to six evenly spaced setae. Other features such as head shape and general chaetotaxy also support this separation. The over 300 specimens of *Kurodaia* from 18 hawk species all consistently demonstrated the generic characters and none could be confused with the *Colpocephalum* group.

**Kurodaia haliaeeti** (Denny, 1842)

*Colpocephalum haliaeeti* Denny, 1842, Monogr. Anopl. Brit.: 199, 216. Type host: *Pandion haliaeetus haliaeetus* (Linn.).

*Colpocephalum pachygaster* Giebel, 1874, Insecta Epizoae: 264. Type host: *Pandion h. haliaeetus*.

All of the following counts and measurements for *K. haliaeeti* are based on 10 individuals of each sex; where quantitative data are given, the numbers represent mean, standard deviation, and range, in that order. All specimens of this as well as subsequent species were studied from materials mounted on slides and all measurements are given in millimeters.

**Male.**—As in figure 1. Setae on head and thorax stable in both position and length. Hypopharynx poorly developed. Usually 3 comb rows on venter of third femora: first row, 5.7±1.1, 3-8; second row, 6.4±1.2, 4-8; third row, 6.8±1.4, 5-9; with scattered spiniform setae proximally, occasionally aligned into additional row of 2-5 setae. Abdominal tergites I-VII marginally each with 8 long tergo-central setae flanked at each side by a shorter seta and a very long postspiracular seta; marginal setae of tergite VIII variable in length and number, with maximum of 10. The only submarginal setae on abdominal tergites consist of irregularly placed short setae, especially on segments I-II, where 5-10 occur. Abdominal sternites I-VII with marginal row of medium setae and irregularly placed slightly shorter submarginal setae: sternite I, 7.3±1.2, 5-10; sternites II-III, 27.7±3.3, 21-33; sternites IV-VII, 48.2±5.0, 30-58. Usually two rows of combs on third sternite with scattering of other spiniform setae about area: anterior comb row with fewer such setae (4.8±1.1, 3-7) than posterior row (12.3±1.3, 10-14). Genital plate as illustrated with 70-80 medium setae. Male in proportion to body size, length being 0.80±0.04, 0.74–0.86. Measurements: preoccipital head width, 0.44±0.01, 0.43–0.46; temple width, 0.59±0.01, 0.57–0.60; head length, 0.32±0.01, 0.29–0.33; pro-
thorax width, 0.42±0.01, 0.41–0.43; metathorax width, 0.52±0.02, 0.49–0.54; total length, 1.79±0.06, 1.70–1.86.

**Female.**—Similar to male except for increased number of setae on certain abdominal sternites, larger size, and terminal segments as shown in figure 3. Sternites II–VI with means of 8-15 more setae per segment, with standard deviation and range of same degree as with male. Posterior margin of vulva with single row of stout spiniform setae (2.0±0.25, 19-27); mixture of medium to long hairs and few stout setae submarginally (39.9±4.5, 33-45). Pair of wide sclerotized plates between vulva and anus, each with several medium setae and about twice as many shorter stout setae; total setal counts per plate: 11.9±2.1, 10-16. Setae around anus ventrally with series of short slender setae among staggered longer setae (33.3±1.6, 30-35), dorsally with uniform medium slender setae (37.5±0.6, 24-47). Measurements: proecular head width, 0.49±0.01, 0.47–0.50; temple width, 0.66±0.01, 0.64–0.67; head length, 0.35±0.02, 0.33–0.38; prothorax width, 0.46±0.01, 0.46–0.47; metathorax width, 0.60±0.01, 0.59–0.61; total length, 2.23±0.04, 2.15–2.27.

This species is easily distinguished from all other known *Kurodaia* by the poorly developed hypopharynx, the chaetotaxy and structure of the female terminalia, and the male genitalia. *K. haliætis* is known only from the osprey, *P. haliætus*, but is apparently very commonly found on this bird. Virtually everyone who contacted for loan of materials had ample representatives of this species, but very few, if any, *Kurodaia* from other hosts.

**Material Examined.**—147 females, 56 males from *P. haliætus* from U.S.A. and Canada.

*Kurodaia fulvofasciata* (Piaget, 1880) sensu lato


**Male.**—As in figure 4. Ten to thirteen males from the type host were used in the analysis of characters. Chaetotaxy of head and thorax similar to *K. haliætis*, but with hypopharynx considerably more developed and of different shape. Metasternum with scattered medium setae (11.6±1.4, 8-13). Spiniform setae in femoral combs: first row, 5.6±1.3, 2-8; second row, 7.3±1.1, 5-9; third row, 6.7±1.4, 4-9. Abdominal tergites with marginal row of setae as in *K. haliætis*; single submarginal row of medium setae also present on segments I-IV (11.3±1.8, 7-15), with fewer such setae on segments V (7.2±1.9, 6-11) and VI (3.3±1.7, 0-6), none or only 1-2 on VII, and none on VIII or IX. Spiniform setae in combs on sternite III: first row, 7.1±1.4, 5-10; second row, 11.3±1.5, 9-15. Sternites with medium marginal and submarginal setae; greatest number on sternite IV (42.2±4.2, 37-51); decreasing in each direction such that sternite II has 17.9±1.9, 15-22; sternite I, 6.0±0.9, 5-7; and sternite VII, 26.6±4.1, 19-36. Genital plate with many medium and 2-4 long setae (63.1±3.6, 58-69). Genitalia as in figure 5; length, 0.56±0.02, 0.54–0.59. Preecular width and head length as for *K. haliætis*; considerably smaller in other dimensions; temple width, 0.54±0.01, 0.52–0.55; prothorax width, 0.36±0.01, 0.34–0.37; metathorax width, 0.44±0.02, 0.42–0.47; total length, 1.58±0.04, 1.52–1.64.

**Female.**—Of larger size than male, with more sternal setae on all abdominal segments, with more submarginal tergal setae on V–VII, and with terminal segments as in figure 6. Eighteen to twenty-four females from the type host were examined for the characters analyzed. Spiniform setae in combs on third femora: first row, 5.6±1.9, 2-9; second row, 7.6±1.7, 2-11; third row, 7.1±1.9, 3-11. Setae in combs of sternite III: first row, 7.5±1.4, 4-10; second row, 11.6±1.8, 7-15. Submarginal abdominal tergal setae as follows: tergite V, 10.4±1.6, 7-15; tergite VI, 6.0±1.9, 3-9; tergite VII, 1.7±1.4, 0-4. Greatest number of sternal setae on sternite IV (48.9±3.1, 45-55), reducing anteriorly to 20.1±2.5, 16-25, on sternite II; to 8.2±1.2, 5-10, on sternite I; and posteriorly to 42.1±2.8, 38-48, on sternite V: to 38.3±2.6, 32-41, on sternite VI; and to 31.2±2.7, 26-37, on sternite VII. Vulva finely rounded with medium marginal setae (15.7±1.9, 13-20) and medium scattered submarginal setae (21.6±2.3, 19-27). Each ventral plate posterior to vulva with 2-5 medium and 3-5 very short setae. Ventral row of setae around anus centrally with 4 fine medium setae among 11-14 very short setae, and laterally terminated by a medium spinelike seta and 1-3 longer hairs: dorsal anal hairs of uniform medium length (32.1±3.4, 26-38). Measurements: proecular width, 0.48±0.01, 0.44–0.49; temple width, 0.60±0.01, 0.50–0.61; head length, 0.35±0.01, 0.34–0.36; prothorax width, 0.39±0.01, 0.35–0.40; metathorax width, 0.50±0.01, 0.49–0.53; total length, 1.97±0.06, 1.75–2.01.

*K. fulvofasciata* is readily separable from *K. haliætis* by its smaller size, its well developed hypopharynx, the possession of two tergal rows on most of the abdominal segments, the chaetotaxy of the female terminal segments, and the much smaller and simpler male genitalia.

*K. tognatii* was described from two females taken from *Milvago c. chimango* by Eichler (1952); Dr. Kéler sent us the holotype for examination. It was a poorly cleared specimen, but obviously the one Eichler used for his microphotograph. Eichler provided no particular differential characters for this species other than the mention and abbreviated sketches of the femoral and sternal comb rows and some setae on the fourth abdominal sternite. The chaetotaxy of these particular areas is so variable that this proves to be an unsatisfactory character. We could find no means of separating this from *K. fulvofasciata*. It might be added that these two specimens represent the only collection of *Kurodaia* we are aware of from a member of the Falconidae.
Aside from the series of lice described above from the type host, B. buteo, we also had similar-appearing lice from 15 other species of Falcnotornis. As the condition of the specimens allowed, over 40 characters were quantitatively evaluated for each sex in all of these series; in addition, setal positions and lengths were compared to those of K. fulvojaciata as illustrated from the type host. An excellent degree of agreement on the more stable characters (e.g., head chaetotaxy; widths of head and prothorax; marginal setae of prothorax, metathorax, and abdominal tergites; setae on vula, postvulval plates, and surrounding anus) was found among all of these lice except for those from Buteo platypterus (Vieillot). This statistical treatment did indicate, moreover, the wide variation encountered in such features as numbers of sternal setae and of spiniform setae in the femoral and sternal combs. These comb rows are actually used for little more than generic characters afforded by their presence or absence.

Our series from B. swainsoni Bonaparte most consistently showed setal counts on certain of the sternum and submarginal tergal areas that were near or beyond the upper limits given for material from the type host of K. fulvojaciata. An analysis of 24 females revealed the following setal counts: submarginal tergite V, 14.5 ± 2.1, 11-19; tergite VI, 12.8 ± 2.3, 8-16; tergite VII, 7.9 ± 3.1, 1-13; tergite VIII, 1.2 ± 1.2, 0-4; sternite IV, 56.1 ± 5.1, 46-67; sternite V, 50.0 ± 4.2, 42-57; sternite VI, 46.6 ± 3.6, 39-52; sternite VII, 38.8 ± 3.3, 32-45. The setal counts of lice from B. jamaicensis (Gmelin) tended to be intermediate between those from B. buteo and B. swainsoni. It can be seen by comparison with the B. buteo material that the means are consistently different. However, in our opinion the overlap shown between the ranges of these series prevents their treatment as separate species, especially in the absence of any other confirmatory characters. For this reason it should be borne in mind that we have based our description of K. fulvojaciata on material only from the type host and have included within the same species material from 14 other host species even though certain quantitative aspects of variable characters may be beyond the ranges given. This is a conservative approach but the one most justified by our present state of knowledge. Our designation of K. fulvojaciata as "sensu lato" further emphasizes that this species is composed of populations from a number of different hosts and recognizes that more refined morphological or biological information may ultimately enable separation into a number of species.

Material examined.—23 females, 14 males from Buteo buteo from Israel, Estonia, Kenya, and India: 15 females, 12 males from B. jamaicensis from U.S.A. and Canada; 31 females, 5 males from B. swainsoni from U.S.A. and Canada; 2 females from B. lagopus (Pendopipad) from Canada; 3 females, 3 males from B. lineatus (Gmelin) from U.S.A.; 1 female, 1 male from B. rufofuscus (J. R. Forster) from Kenya; 1 female, 1 male from Hieracium fasciatum spilogaster (Bonaparte) from South Africa; 1 female, 1 male from Helicolestes hamatus (Tenninick) from Surinam; 1 female from Elnaoides forficatus (Linn.) from U.S.A. (dubious host record since slide labelled from "skin"); 1 female, 2 males from Circaetus gallicus pectoralis A. Smith from South Africa; 1 female (holotype: K. tagouiti) from Milvago c. chimango from Paraguay; 5 females from Circus cyanus (Linn.) from U.S.A.; 2 females from Cathartes aura (Linn.) from U.S.A. (questionable host record); 4 females, 2 males from Accipiter badius poliopsis (Hume) from Thailand; 2 females, 1 male from Ictinia plumbea (Gmelin) from Brazil.

Kurodapia macrocybe (Carriker, 1903)

Micropteron macrocybe Carriker, 1903, Nebraska Univ. Studies 3: 181. Type host: Buteo p. platypterus (Vieillot).

Female.—Similar to K. fulvojaciata except for fewer submarginal setae on certain abdominal segments (III, 7-10; IV, 5; V, 1-3; VI and VII, none) and narrower temple width (0.53—0.57).

Carriker (1903) described K. macrocybe from a single female; although we were unable to view the holotype, Mr. Carriker supplied us with two females subsequently collected by him in Colombia from the type host of his species. Males of K. macrocybe apparently are still unknown.

We do not feel a strong separation has been accomplished between K. macrocybe and K. fulvojaciata s.l. The narrow temples of the former are matched only by the series from A. bodin (0.53—0.55) and I. plumbea (0.57); these lice, though, as well as all others from the other hosts of K. fulvojaciata, have consistently more submarginal tergal setae on abdominal segments III-VII. Whether further collections of K. macrocybe will bear out this difference is uncertain, but we feel it best to retain the identity of this species for the present.

Kurodapia cheelae, new species

Female.—This species is based on the single female illustrated in figure 7. Head peculiarly shaped; preocellar width, 0.50, temple width, 0.55, and length, 0.32. Orientation of lateroventral setae unusual in being situated well within the lateral head margin, and the maxillary palpi are set closer to mid line. How much of this head shape

Figs. 1-3.—Kurodapia heliaca (Denny).
Fig. 1.—Dorsal-ventral view of male. Fig. 2.—Male genitalia. Fig. 3.—Dorsal-ventral view of terminal segments of female.

Figs. 4-6.—Kurodapia fulvojaciata (Piaget).
Fig. 4.—Dorsal-ventral view of male. Fig. 5.—Male genitalia. Fig. 6.—Dorsal-ventral view of terminal segments of female.
may be due to mounting technique is uncertain. The terminal antennal segments were broken off and thus are not illustrated. Dorsal head chaetotaxy could not be observed in detail. Dorsal thoracic and marginal abdominal tergal chaetotaxy as with the other Kurodaia. Metasternum with 2 short anterior and 5 medium posterior setae. Submarginal medium setae of abdominal tergites I-VIII, 0, 4, 4, 2, 2, 1, 0, and 0, respectively. Stermites I-VII with 4, 20, 22, 35, 32, 29, and 23 setae, respectively. Vulva with 12 marginal and 16 submarginal setae; marginal setae rather evenly spaced but slightly closer together laterally instead of ventrally. Each ventral plate suboval, with 3 medium setae. Ventral row of setae around anus of 8 short setae flanked at each end by a longer stout seta; dorsal row with 13 sparse medium-
short, weak setae. Prothoracic width, 0.35; metathoracic width, 0.45; total length, 1.81.

Had we not observed such a large group of Kurodaia from a number of different hosts, we would have been reluctant to consider describing a species from a single individual. However, this specimen showed a number of distinguishing morphological features setting it apart from other members of the genus. The head shape seems unusual but we would not emphasize this. Chaetotaxy associated with the metasternum, vulva, ventral postvulval plates, and the anus, as well as the paucity of submarginal abdominal tergal setae, all easily distinguish this species.

Holotype.—Female from Spilornis cheela burnmanicus Swann, Shingbwiyang, 20 miles south, 27-x-1945, H. S. Fuller, Slide BM 1947-321 (167). Deposited in the British Museum (Natural History).

Species Sedis Incertae

Kurodaia macrura Eichler, 1952

Type host: Falco sparverius Linn.

This species was described from specimens on two slides obtained by Eichler from the Zoological Museum at Hamburg. In correspondence with Dr. H. Weidner of that museum, we learned Eichler has not returned these specimens. We, in turn, have been unable to procure these specimens from Eichler. His description is most inadequate; the only illustration is a meagre outline of the head lacking any detail. Eichler himself held as uncertain whether this species actually could remain in the genus Kurodaia. The unavailability of type materials plus the absence of other Kurodaia specimens from *F. sparverius* makes the position of this species of a dubious nature. All mesopodium specimens we have obtained from this falcon have proven to be either a Colpocephalum or another form lacking characters of either of these genera.

Kurodaia koepckeii Eichler, 1953


*K. koepckeii*, erected from a single, poorly cleared female taken from *Chondrohierax uncinnatus*, was, as with *K. taguatoi*, inadequately illustrated by means of a microphotograph (Eichler 1953). Few details beyond general body outline are recognizable. We agree with Eichler that the form corresponds nearly to the shape of *K. taguatoi*, thus making it also similar to *K. fulvofasciata*. The written description was brief and included counts of the highly variable femoral and sternal combs, all of which fell within the range for *K. fulvofasciata*. Reference was made that the bristles on sternite IV did not suggest the spine combs as in *K. taguatoi*. Even within *K. fulvofasciata* there may be from none to 3-5 spiniform setae in this area. Although this form is un-

![Fig. 7.—Kurodaia cheela, new species. Dorsal-ventral view of holotype female.](image)
doubtedly close to, and possibly indistinguishable from, *K. fulvofasciata*, our inability to obtain any material leaves us with little choice but to include it in this category.

Genus *Falcomenopon* Emerson and Elbel, 1958

Initially established by Emerson and Elbel (1958) as a subgenus of *Kurodaia*, sufficient differences exist between this subgenus and the remainder of the *Kurodaia* to justify elevation to a genus containing the single species *Falcomenopon boonsongi* Emerson and Elbel from *Microhierax caeruleus* *burnanicus* Swann. Emerson states for *Falcomenopon*: “Large stout Menoponidae distinguished from the known species of the genus *Kurodaia* by the following diagnostic characters: a comb of short setae in the lateral posterior angles of the fourth abdominal sternite, the absence of prominent setae on the median posterior margin of the abdominal tergites, the expanded lateral margins of the forehead, the large prominent male genitalia, and the presence of a row of medium-length setae on the posterior margin of the female vulva.”

Inspection of a paratype female and male provided by Dr. Emerson has confirmed the above points. The head shape approaches that of *K. cheelea*, but the other features are most distinctive (see illustrations by Emerson and Elbel 1958). In addition to the above, the female lacks the ventral plates and setae between the vulva and anus, a feature possessed by all *Kurodaia*.

**Discussion**

In light of the above findings, there are now four recognized species of *Kurodaia* from the Falconiformes. *K. haliæti* is limited to the family Pandionidae, more specifically to the osprey, *P. haliaetus*, and represents presumably the most abundant species of the *Kurodaia*. *K. fulvofasciata* is apparently not so commonly found, but has a rather wide host distribution, primarily among species of several subfamilies of the Accipitridae; we have recorded it from six *Buteo* species and seven other genera of this family. Two females each have been recorded from *Milvago* (Falconidae) and from *Cathartes* (Cathartidae), but, until further collections are made from these or related hosts, we hesitate to emphasize these findings. *K. macrocybe* is morphologically quite similar to *K. fulvofasciata* and has been taken only from *B. platypterus*. *K. cheelea* is known only from *Spilornis cheela* (Accipitridae).

It is interesting to compare these findings with those of Clay (1958) on the *Degeeriella*, another genus of lice from hawks. No *Degeeriella* are known from the Pandionidae, which contains the host of the most common *Kurodaia*. We note that *Buteo* (aside from *B. swainsoni* and *B. galapagoensis*), *Hieraætus*, *Circus*, and *Circæætus* contain species Clay places in her *fulva* species group. She further notes that “The *Degeeriella* of the Accipitrinae suggest a fairly close relationship between the members of this subfamily, especially between *Aquila* and *Buteo*; further that there is little difference between this subfamily and the Cincidae, and that *Terathoptix* and *Circæætus* (but not *Spilornis*) of the subfamily Circinae are similar but rather more distinct.” *B. swainsoni*, whose lice in our material came close to having certain chaetotaxal features beyond the range of *K. fulvofasciata*, contains a species in Clay’s *regalis* group. Although Clay did place her *Degeeriella* from *Spilornis cheela* in the *fulva* group, she could not identify it to species.

Unfortunately, even through extensive canvassing of many collections for *Kurodaia* material, we have been able to obtain these lice from only 18 hawk species, with many of these represented by very short series. This further substantiates the observations of other workers that, aside from *K. haliæti*, lice of this genus are not very common on the hawks. Perhaps this paper will serve the purpose of stimulating others who have access to hawks to collect lice from them. As the other genera, besides the *Kurodaia* and *Degeeriella*, are worked up, we hope that observations can be made on the relationships of the hawk species.

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