

THE *LAEMOBOTHRION* (MALLOPHAGA: LAEMOBOTHRIIDAE) OF THE FALCONIFORMES¹

By Richard Clay Nelson² and Roger D. Price²

Abstract: A study of over 435 adult *Laemobothrion* from 74 different species of Falconiformes has revealed only 4 morphologically separable species—*L. tinunculi*, *L. maximum*, *L. vulturis*, and *L. glutinosus*. These species are redescribed and illustrated; there are 32 new synonymies.

To date there have been 70 specific names applied to lice of the genus *Laemobothrion* Nitzsch, 1818, with 46 of these recorded from hosts within the Falconiformes, 20 from hosts outside of this order, and 4 unassociated with a correctly designated host. Following the classification proposed by Hopkins & Clay (1952), we recognize the subgenus *Laemobothrion* as including those species of *Laemobothrion* restricted to the Falconiformes and the subgenus *Eulaemobothrion* Ewing, 1929, as including the *Laemobothrion* parasitic on birds other than the Falconiformes. A key to some of the species of *Eulaemobothrion* and a discussion of this subgenus is given by Clay & Hopkins (1960); this group will not be considered further in this paper.

A revisional study of the subgenus *Laemobothrion* is needed since the literature contains few descriptions of such quality as to allow the specific recognition of the included forms. Eichler (1942a) does give a synopsis of what he considers 27 species of *Laemobothrion*, but he neither critically examined material from a large number of host species nor gives adequate descriptions for the lice. In a series of papers dealing with the early literature of Mallophaga through 1818, Clay & Hopkins (1950, 1951, 1954, 1960) include several portions concerning early *Laemobothrion* descriptions. Their conclusion (1954) that the described species represent only four recognizable species or species groups is, as far as it goes, in agreement with our findings. However, since most *Laemobothrion* names have been applied since 1818, a purpose of the present study is to determine their status.

An examination of *Laemobothrion* descriptions reveals an almost universal absence of series differentiation

by any reliable means, morphological or biological, and an absence even in the recent descriptions of a serious attempt to compare the "new species" with the related forms. Descriptions often are simply based on a specimen or specimens found on a previously unrecorded host species and therefore regarded as new, with emphasis placed at most only on minor aspects of the shape of the head or shape and chaetotaxy of the prosternal and meso-metasternal plates. In other words, there has not been a single *Laemobothrion* species described from a falconiform host since 1861 which we found to be morphologically separable from one of the four previously described and recognizable species. This necessitates the recognition of only four species and the synonymy of many currently recognized names.

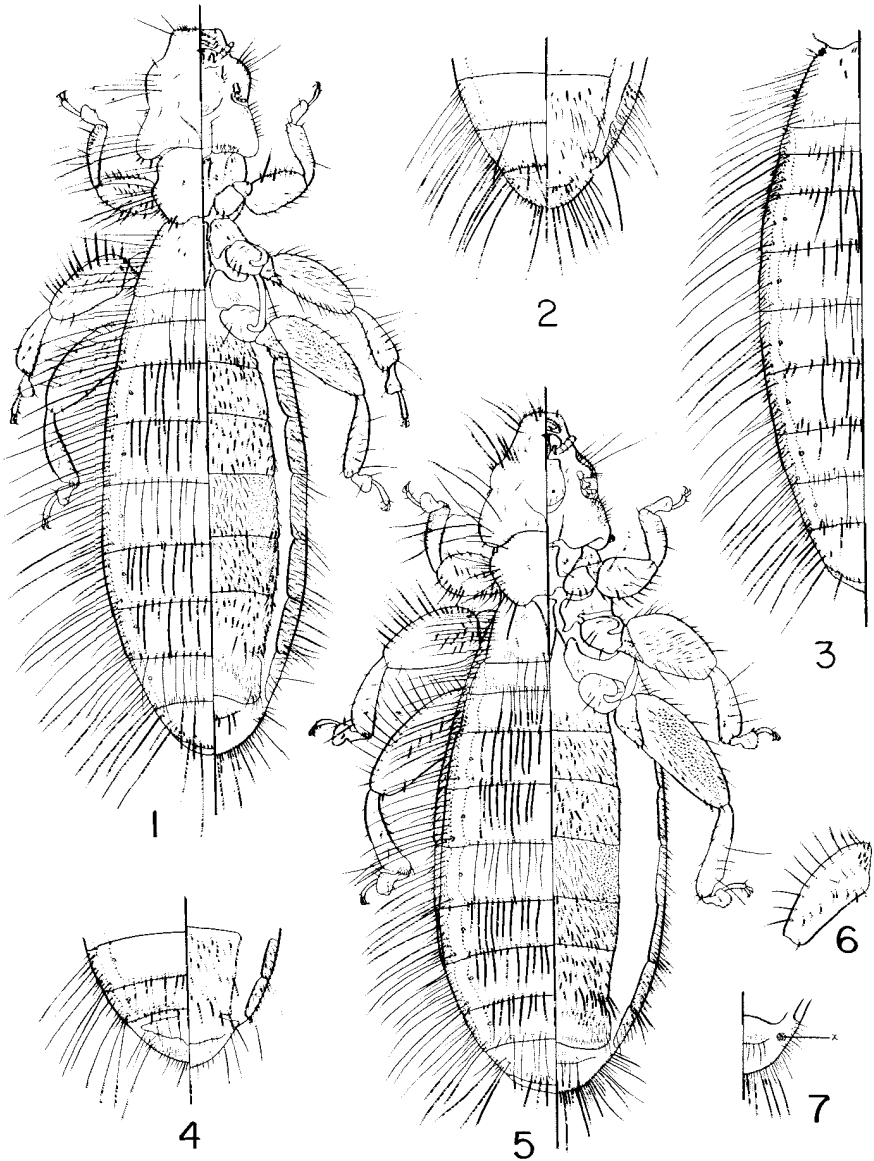
An attempt to anticipate a high degree of host-parasite specificity, thereby describing each series of lice from a different species of host as a distinct species, is unjustified on the basis of our present knowledge. It is precisely activity like this that has led to much of the chaos in mallophagan taxonomy. The *Laemobothrion* represents but one facet of a condition that prevails throughout many taxa of bird lice. Taxonomic procedure should be based on current knowledge, and while we must always recognize that structural or biological evidence may subsequently be found for further separation, this is no justification for the present support of "species" through the use of nebulous characters that reflect individual variation or at the most infraspecific variation.

During this study we have examined over 435 adult specimens of *Laemobothrion* representing lice from 74 falconiform species distributed among 33 genera. Although only small samples were available from a number of these hosts, thereby limiting quantitative analysis, and although some specimens were other than in optimum condition, each feature studied was explored as thoroughly as feasible. This study represents the most comprehensive survey of known *Laemobothrion* material, and the conclusions reached represent the ones we feel most logical.

Since many of the *Laemobothrion* descriptions are not adequate for species identification and since type-material often has been lost or is unavailable for study, it has been necessary to rely upon specimens from the

1. Paper No. 5657, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota 55101.

2. Department of Entomology, Fisheries, and Wildlife, University of Minnesota, St. Paul.



Figs. 1-7. Figs. 1-2, *Laenobothrion maximum*: 1, ♀; 2, ♂ terminalia. Fig. 3, *L. glutinosus*, ♀ dorsal pterothorax and abdomen (ex *Cathartes aura*). Figs. 4-5, *L. tinnunculi*: 4, ♂ terminalia; 5, ♀. Figs. 6-7, *L. tinnunculi*: 6, ♀ dorsal femur II; 7, ♀ ventral terminalia.

type-host in a some instances and to assume without evidence to the contrary, that these are conspecific with the original material. In a few instances, even in the absence of material from the type-host, we have exercised our best judgment in the disposition of the name for the sake of nomenclatorial stability. Although such practices occasionally may be subject to error, there is little other choice for the modern worker in Mallophaga.

All lice studied were ones that had been cleared and mounted on microscope slides. Measurements, made with an ocular micrometer, are given in millimeters. The value in parentheses following a statement of range represents the mean. The host nomenclature follows that of Peters (1931). Where the type-host for a species was originally given as a common name, the interpretation of this name by Hopkins & Clay (1952) is followed.

For the description of each of the following *Laemobothrion* species, the material providing the longest and best series of both sexes from a single host species was utilized for quantitative details since these are believed to give the best indication of expected infraspecific variability. Illustrations, except where stated, are from type-host material. Data from all other series considered to be conspecific either fell completely within the given ranges or else overlapped them significantly. Individual specimens most certainly do exist that show setal counts, dimensions, or other morphological features differing to a degree from those given, but we have seen none consistent enough to merit specific separation. Future workers are encouraged to study a series of specimens from the same host and to compare them critically with specimens from other hosts before undertaking a description of a new *Laemobothrion* species. It is only in this way that we can avoid the pitfalls that arise from the lack of appreciation of infraspecific variation.

Subgenus *Laemobothrion* Nitzsch

Laemobothrion Nitzsch, 1818. *Germer's Mag. Ent.* 3: 301. Type-species: *Liotheum* (*Laemobothrion*) *giganteum* Nitzsch.

Laemobothrion Burmeister, 1838. *Handb. Ent.* 2: 441. Emendation.

The following features are common to all known species of this subgenus and will not be repeated in subsequent descriptions. Head (figs. 1, 5) not greatly expanded across temples, but with strong lateral swelling in front of the eyes; anterior margin with series of short to medium setae; temple margin with row of evenly spaced medium setae anteriorly, several very long setae dorsoposterior to these, and ventrally 4-5 closely appressed rows of comb-like sculpturing. Occiput concave, with 1-3 short submarginal setae on each

side.

Pronotum concave posteriorly, with medium to very long lateral setae; pterothorax laterally with number of long to very long setae, with few short anterior setae, and with row of short to long marginal setae. Well developed prosternal and meso-metasternal plates with characteristic shape and chaetotaxy. Femur III with ventral area of microtrichia.

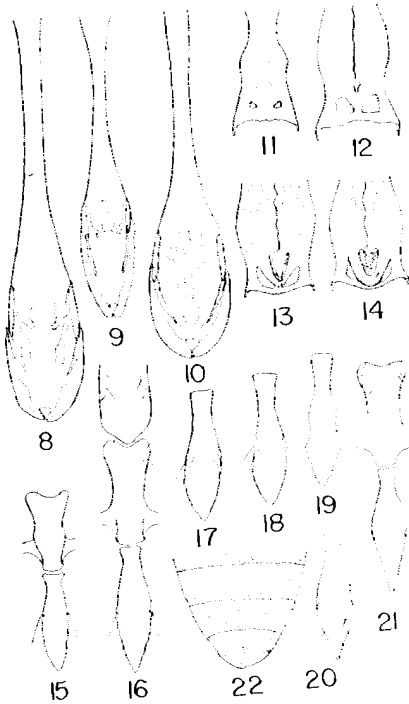
Abdominal tergite I shortest, others of essentially equal length and undivided except for weak median division suggested for anterior segments; with marginal but without anterior setae. Postspiracular setae very long on I-VIII. Tergites laterally and pleura with medium to very long setae. Posterior margin of abdomen evenly rounded, with fringe of variable length setae. Sternite I apparently absent, never indicated by bearing setae; sternites II-VII with many relatively uniform length marginal and anterior setae; lateral portions of sternites V-VI with patch of short microtrichia grouped 2-7 on common base. ♀ terminalia much as in figs. 1, 5; ♂ terminalia as in figs. 2, 4. ♂ genitalia large, relatively simple (figs. 8-10).

Very large specimens, representing the largest known bird lice; approximate total length of ♀ from 7.5-11.0, ♂ from 6.5-10.0. Slight sexual dimorphism, with ♂ differing from ♀ in size, certain aspects of abdominal chaetotaxy, and structure of the terminalia.

KEY TO SPECIES OF THE SUBGENUS

Laemobothrion

1. Head shape as in fig. 5, with reduced swellings anterior to eyes; prosternal plate somewhat flattened anteriorly, with only 2 minute setae (fig. 15); sitophore sclerite of hypopharynx simple, with 2 small holes in posterior portion (fig. 11); limited to *Falco* species. *tinnunculi* (L.)
Head shape close to fig. 1, with swellings anterior to eyes not reduced; prosternal plate with deeper indentation anteriorly and with more setae (figs. 16, 21); sitophore sclerite of hypopharynx with either a heavy medioposterior U-shaped structure and/or 2 large lateroposterior holes (figs. 12-14); on members of genera other than *Falco* 2
2. Lateral margins of meso-metathorax and anterior abdominal segments with several stout spiniform setae (fig. 3); sitophore sclerite with a heavily sclerotized medioposterior U-shaped structure (fig. 14); posterior end of meso-metasternal plate with single seta (figs. 20, 21); on members of the Cathartidae *glutinans* Nitzsch
Lateral margins of meso-metathorax and anterior abdominal segments without stout



Figs. 8-22. Figs. 8-10, ♂ genitalia: 8, *Laemobothrion maximum*; 9, *L. tinnunculi*; 10, *L. glutinosus* (ex *Cathartes aura*). Figs. 11-14, ♂ sitophore sclerite of hypopharynx: 11, *L. tinnunculi*; 12, *L. maximum*; 13, *L. vulturis*; 14, *L. glutinosus* (ex *C. aura*). Fig. 15, *L. tinnunculi*, ♀ pro- and meso-metasternal plates. Fig. 16, *L. maximum*, ♀ gular, pro-, and meso-metasternal plates. Figs. 17-20, Meso-metasternal plate: 17-18, *L. maximum* (♀ ex *Circocetus gallicus*); 19, *L. vulturis* (♂ ex *Aquila pomarina*); 20, *L. glutinosus* (♀ ex *C. aura*). Fig. 21, *L. glutinosus*, pro- and meso-metasternal plates (♀ ex *C. aura*). Fig. 22, *L. vulturis*, pigmentation of ♀ dorsal terminalia.

spiniform setae; sitophore sclerite with U-shaped structure absent to less developed (figs. 12, 13); posterior end of meso-metasternal plate without a seta; not on members of the Cathartidae 3

3. Proximodorsal aspect of femur II with group of 5 or more stout spiniform setae (fig. 6); sitophore sclerite with conspicuous U-shaped structure (fig. 13); large unpigmented areas along median line of most abdominal tergites (fig. 22); postvulval area

of ♀ with lateral pigmented spot (fig. 7: x) *vulturis* (J. C. Fabricius)

- Proximodorsal aspect of femur II with no more than 4 stout spiniform setae (fig. 1); sitophore sclerite with U-shaped structure much reduced in size (fig. 12); lacking large unpigmented areas along the median line of abdominal tergites; postvulval area of ♀ without lateral pigmented spot. *maximum* (Scopoli)

***Laemobothrion tinnunculi* (Linnaeus) Figs. 4, 5, 9, 11, 15.**

Pediculus tinnunculi Linnaeus, 1758, Syst. Nat., ed.

10: 612. Type-host: *Falco tinnunculus* L.

Nirmus hasticeps Olfers, 1816, De Veget. et Anim.

Corp. in Corp. Anim. Reper. Comment.: 87.

Type-host: *Falco tinnunculus* L.

Liotheum hasticeps Nitzsch, 1818, Germa's Mag. Ent.

3: 302. Nom. nov. for *P. tinnunculi* L.

Laemobothrion hastipes Burmeister, 1838, Handb. Ent.

2: 442. Type-host: *Falco tinnunculus* L.

Laemobothrion laticolle Denny, 1842, Mon. Anopl.

Brit.: 203, 239. Type-host: *Falco subbuteo* L.

New synonymy.

Nirmus albicillae Denny, 1852, List Brit. Animals in Brit. Mus., pt. II, Anopl.: 39. Nom. nov. for *L. laticolle* Denny.

Physotomum Lougetarsatum Piaget, 1895, Tijdschr.

Ent. 38: 101. Type-host: "... vraisemblablement d'un *Lamprotermis*."—Error. **New synonymy.**

Laemobothrion intermedium McGregor, 1917, Entomol.

News 28: 434. Type-host: *Falco sparverius* L. **New synonymy.**

Laemobothrion aquab Ansari, ?1955, Proc. 7th Pak.

Sci. Conf. (Sect. Biol.): 57. (Also described as n. sp. in Ind. J. Ent. 17: 400 and 18: 437) Type-host:

Falco jugger J. E. Gray. **New synonymy.**

Laemobothrion semicirculus Carriker, 1961, Nov. Cien.

Mus. Hist. Nat. LaSalle 28: 39. Type-host:

Falco columbarius L. **New synonymy.**

♀. As in fig. 5. Quantitative data for specimens from *Falco tinnunculus*. Head with somewhat rounded anterior margin; reduced lateral preocular swellings. Pair of adjacent long setae on laterodorsal temple region. No gular setae. Sitophore sclerite of hypopharynx (fig. 11) with 2 small holes; no evidence of heavily pigmented U-shaped structure. Prothorax with only few short setae along anterior margin; inner dorsal pronotal seta minute to absent; prosternal plate (fig. 15) somewhat flattened anteriorly, with only 1 short seta on each side. Metanotal margin with 15-22 (18.8) median setae, 6-11 of these long, 7-13

short; meso-metasternal plate as in fig. 15. Abdominal segment I with 17-25 (21.4) tergo-central setae, with 13-19 long, 3-9 short; II-VI with 17-27 (21.8) tergo-central setae, predominantly long to very long, but with occasionally up to 5 short fine setae, especially laterally; VII with 19-26 (21.8), including 3-7 short setae; VIII with 14-20 (17.7), including 8-12 long, 6-12 short setae. Abdominal tergites without large unpigmented median area. Abdominal sternal setae: II, 27-44 (33.3); III, 57-92 (75.4); IV, 72-120 (95.2); V, 92-136 (109.8); VI, 87-121 (102.0); VII, 54-86 (70.4). Without longitudinal line of setae on lateral margin of sternites V-VI, outside of microtrichial area. Vulva fringed with microtrichia; with 43-60 (51.3) short submarginal spiniform setae and 42-75 (61.3) other longer setae running mostly diagonally inward from lateroposterior corner.

♂. Much as for ♀ (fig. 5), except for details of abdominal chaetotaxy, terminal abdominal segments, and smaller size. Somewhat fewer long and more short tergo-central setae; total tergo-central setae on I, 16-23 (19.7); II-IV, 19-29 (23.9); V, 22-33 (26.8); VI, 27-36 (31.8); VII, 31-40 (34.3); VIII, 32-47 (38.2). Of these totals, short setae account for 4-18 on I-V, 14-24 on VI, 20-27 on VII, and 26-41 on VIII. Fewer sternal setae: II, 26-29 (27.3); III, 49-62 (55.3); IV, 48-77 (61.8); V-VI, 77-93 (84.0); VII, 44-58 (50.0). Terminalia as in fig. 4. Genitalia as in fig. 9.

Dimensions. Preocular width, ♀ 1.20-1.33 (1.27), ♂ 1.13-1.20 (1.14); temple width, ♀ 1.53-1.67 (1.59), ♂ 1.37-1.47 (1.41); head length, ♂ 1.27-1.40 (1.34), ♀ 1.20-1.30 (1.25); prothorax width, ♀ 1.23-1.43 (1.32), ♂ 1.10-1.20 (1.14); metathorax width, ♀ 1.67-2.07 (1.89), ♂ 1.43-1.73 (1.52); abdomen width, ♀ 2.37-2.90 (2.66), ♂ 2.00-2.33 (2.16); total length, ♀ 7.73-8.50 (8.07), ♂ 6.43-6.83 (6.59); ♂ genitalia width, 0.30-0.37 (0.34).

Laemobothrion tinunculi is restricted in its known distribution to birds of the genus *Falco* (Falconidae: Falconinae) and probably represents the only locus of this genus to occur normally on these hosts. We have examined lice from 13 species of *Falco*, including the type-hosts of all described species, and have been unable to find any means for morphological separation.

Dr Clay has examined type-material of *L. longitarsatum* (Piaget) and found it to be conspecific with *L. tinunculi*. The type-host as given must represent an error and is probably a species of *Falco*.

MATERIAL EXAMINED. 4 ♀♀, 3 ♂♂, *Falco biarmicus* Temminck, Somaliland, Israel; 3 ♀♀, 1 ♂, *F. mexicanus* Schlegel, USA; 3 ♀♀, 3 ♂♂, *F. jugger*, India; 7 ♀♀, 5 ♂♂, *F. peregrinus* Tunstall, Sudan; 1 ♀, 2 ♂♂, *F. albicollis* Daudin, Nicaragua; 4 ♀♀, 1 ♂, *F. subbuteo*, Belgian Congo, Kenya; 1 ♂, *F. longipennis* Swainson, Queensland; 2 ♀♀, 2 ♂♂, *F. eleonorae* Géné, Algeria;

1 ♂, *F. fuscocaeulescens* Vieillot, Venezuela; 1 ♀, *F. columbarius*, Colombia; 3 ♀♀, 1 ♂, *F. ardosiaceus* Vieillot, W Africa (London Zoo); 22 ♀♀, 6 ♂♂ (including 6 ♀, 2 ♂ neoparatypes of *L. tinunculi*), *F. tinunculus*, Sweden, Formosa, Tanganyika, Philippine Is., Vietnam, S Africa, India, Ireland; 11 ♀♀, 6 ♂♂, *F. sparverius*, USA.

***Laemobothrion maximum* (Scopoli)** Figs. 1, 2, 8, 12, 16, 17, 18.

Pediculus maximus Scopoli, 1763, Ent. Carniolica: 382. Type-host: *Falco Buteo*=*Buteo buteo* (L.).

Pediculus Buteonis J. C. Fabricius, 1776, Gen. Ins.: 309. Nom. nov. for *P. maximus* Scopoli.

Pediculus circi Fourcroy, 1785, Entomol. Paris.: 518. Nom. nov. for Geoffroy's *Pediculus circi, fuscus oblongus* Type-host: "Busard des marais, *circus* Bellon"—*Circus aeruginosus* (L.) **New synonymy.**

Pediculus milei Schrank, 1803, Fauna Boica: 193. Nom. nov. for Frisch's "Huhnergeyerlaus". Type-host: "Huhnergeyer"—*Circus aeruginosus aeruginosus* (L.).

Liotheum (Laemobothrion) giganteum Nitzsch, 1818, Germar's Mag. Ent. 3: 301. Nom. nov. for *maximum* Scopoli, *buteonis* Fabricius, and *circi* Geoffroy.

Nirurus buteonivorus Packard, 1872, Rep. U.S. Geol. Surv. 6: 733. Type-host: *Buteo swainsoni* Bonaparte. **New synonymy.**

Laemobothrion nigrolimbatum Giebel, 1874, Insecta Epizoa: 252. Type-hosts: *Circus cinereaceus*—*C. pygargus* (L.) and *C. aeruginosus* (L.).

Laemobothrion titan Piaget, 1880, Pediculi: 578. Type-host: *Milvus aetolius (ater)*—*M. migrans migrans* (Boddaert). **New synonymy.**

Laemobothrion loomisi Kellogg and Chapman, 1902, J. New York Entomol. Soc. 10: 23. Type-host: *Anser albifrons gambeli*—Error. Some member of the Falconiformes. **New synonymy.**

Laemobothrion oligothrix Carriker, 1903, Univ. Stud. Nebraska 3: 161. Type-host: *Buteo borealis costaricensis*—Error. Actually, *Buteo swainsoni* Bonaparte.

Laemobothrion caracaraensis Kellogg, 1906, J. New York Entomol. Soc. 14: 48. Type-host: *Polyborus tharos*—*P. plancus plancus* (J. F. Miller). **New synonymy.**

Laemobothrion eidmanni Eichler, 1942, Mitt. Dtsch. Ent. Ges. 11: 14. Type-host: *Gymnogyps typicus pectoralis* (Sharpe). **New synonymy.**

Laemobothrion anatolicum Eichler, 1942, Zool. Anz. 137: 52. Type-host: *Falco subbuteo subbuteo* L.—Error. Perhaps *Buteo rufinus rufinus* (Cretzschmar). **New synonymy.**

Laemobothrion hoeschi Eichler, 1942, Zool. Anz. 137:

56. Type-host: *Aquila verreauxi* Lesson. **New synonymy.**

Laemobothrion niethammeri Eichler, 1942, Zool. Anz. **137**: 60. Type-host: *Buteo rufinus rufinus* (Cretzschmar). **New synonymy.**

Laemobothrion indica Sen, 1942, Ind. J. Vet. Sci. Anim. Husb. **12**: 169. Type-host: *Mikous migrans goevinda* Sykes.

Laemobothrion hieraeti Eichler, 1943, Mitt. Königl. Naturwiss. Inst. Sofia **16**: 209. Type-host: *Hieraetus pennatus* (Gmelin). **New synonymy.**

Laemobothrion bureschi Eichler, 1943, Mitt. Königl. Naturwiss. Inst. Sofia **16**: 209. Type-host: *Pandion haliaetus* (L.). **New synonymy.**

Laemobothrion nyjobergi Eichler, 1944, Dtsch. Ent. Z. **1943**: 64. Type-host: *Haliastur indus intermedius* Blyth. **New synonymy.**

Laemobothrion chondrohieracis Eichler, 1953, Bonn. Zool. Beitr. **4**: 265. Type-host: *Chondrohierax uncinatus* Temminck. **New synonymy.**

Laemobothrion mendesi Tendeiro, 1955, Bol. Cult. Guine Port. **9**: 521. Type-host: *Aquila chrysaetos* (L.). **New synonymy.**

Laemobothrion siddiqii Ansari, ?1955, Proc. 7th Pak. Sci. Conf. (Sect. Biol.): 57. (Also described as n. sp. in Ind. J. Ent. **17**: 400) Type-host: *Circaetus ferox* = *C. gallicus* (Gmelin). **New synonymy.**

Laemobothrion clayi Tuleschkov, 1957, Izv. Zool. Inst. Bulg. Akad. Nauk. (Otd. Biol.) **6**: 281. Type-host: *Circaetus gallicus* (Gmelin). **New synonymy.**

Laemobothrion lunai Tendeiro, 1958, Publ. Cult. da Diam. Comp. Angola **40**: 99. Type-host: *Pernis apivorus apivorus* (L.). **New synonymy.**

Laemobothrion tuleschkovi Bechet, 1961, Stud. Cerc. Biol. **12**: 220. Type-host: *Circaetus gallicus* (Gmelin). **New synonymy.**

♀. As in fig. 1. Quantitative data for specimens from *Buteo swainsoni*. Differs from *L. tinnunculi* as follows. Head with flatter anterior margin; prominent lateral preocular swellings; fine short seta adjacent to very long seta on laterodorsal temple region. Gula (fig. 16) anteriorly with 2-6 short to medium setae on each side. Sitophore sclerite of hypopharynx (fig. 12) with 2 large holes; slight evidence of medioanterior U- or V-shaped structure. Prothorax with patch of short setae along anteroventral margin; longer median dorsal pronotal seta; prosternal plate (fig. 16) with 1-6 (3.2) short setae on each lateroanterior portion, in addition to minute anterior seta. Only 2-5 long marginal metanotal setae, 10-13 short. Femur II with up to 4 short spiniform setae on proximodorsal area. Fewer total tergoventral setae: I, 16-18 (17.0); II-VIII, 13-22 (17.9). Indefinite faint median area on most of abdominal tergites I-VIII. More sternal setae: II, 55-63 (59.3); III, 84-110 (94.7); IV, 112-

124 (116.7); V, 120-145 (129.3); VI, 123-152 (139.3); VII, 74-107 (90.0). Longitudinal series of setae on lateral margin of sternites V-VI, outside of microtrichial area. Vulva with 82-92 (87.2) longer setae.

♂. Much like ♀, except for terminalia (fig. 2) and smaller size. More tergoventral setae on VII, 25-30 (27.8), and VIII, 29-37 (33.8), with larger number related to more short setae, as for *L. tinnunculi*. Genitalia as in fig. 8.

Dimensions. Consistently larger than *L. tinnunculi*. Preocular width, ♀ 1.30-1.53 (1.47), ♂ 1.37-1.47 (1.41); temple width, ♀ 1.60-1.83 (1.73), ♂ 1.60-1.67 (1.63); head length, ♀ 1.40-1.60 (1.52), ♂ 1.37-1.50 (1.44); prothorax width, ♀ 1.30-1.50 (1.38), ♂ 1.23-1.30 (1.26); metathorax width, ♀ 1.60-2.07 (1.83), ♂ 1.43-1.73 (1.55); abdomen width, ♀ 2.50-2.87 (2.76), ♂ 2.20-2.50 (2.31); total length, ♀ 8.90-10.03 (9.56), ♂ 8.03-8.43 (8.25); ♂ genitalia width, 0.43-0.47 (0.44).

Material from the type-hosts of *L. circi*, *L. buteonivorum*, *L. titan*, *L. eidmanni*, and *L. nyjobergi* is all apparently in agreement with the descriptions and is conspecific with *L. maximum*.

The type-host (*Anser albifrons*) of *L. loomisi* must be in error, since the type-specimen is inseparable from *L. maximum* and probably was collected from a falconiform host. We have also seen 2 "types" that were used for the description of *L. caracaraensis*. They both are nymphs, one of which is the specimen illustrated by Kellogg (1906a) as a ♀ with a unique pointed abdomen; this unusual abdominal attenuation proved to be mainly illusionary, rounding out to a more normal appearance after being cleared and remounted. The smaller sizes given by Kellogg, with ♀ 6.5 and ♂ 5.5, are also both indicative of nymphs.

A single ♀ was used for the description of *L. anatolicum* by Eichler (1942a), this specimen is said to be from *Falco subbuteo*. The illustration of the sternal plates is definitely not of *L. tinnunculi*, but rather of *L. maximum* or *L. vulturis*. In the same paper, Eichler describes *L. niethammeri* from *Buteo rufinus*. Since the specimens for both were taken by the same collectors and on the same expedition in 1933, we concluded that the *Falco* specimen must be a straggler and most probably represents one from *Buteo rufinus*; hence it is also a synonym of *L. maximum*.

Eichler (1943) recognizes a *validum* group (equivalent to our *L. vulturis*) and a *giganteum* group (equivalent to our *L. maximum*); in so doing, he generally indicates to which his "new species" belong. Unfortunately, we have been unable to procure type-specimens of most of his "species" and the descriptions are virtually useless for identification purposes. Although no type-host material has been available for *L. hoeschi*, *L. hieraeti*, *L. bureschi*, or *L. chondrohieracis*, these are

indicated to be within the *giganteum* group and we have accordingly synonymized them with *L. maximum*; we believe that these do not represent recognizable species, that they were inadequately described from material now unobtainable, and that we should make a disposition of the names here to the best of our judgment. The only possible error in our action might be that one perhaps will prove to be *L. vulturis* instead of *L. maximum*. The great emphasis by Eichler on the sternal thoracic plates to the exclusion of more thorough analysis of characters is unjustified since he fails to recognize their variable chaetotaxy and shape within a single series of specimens.

The discussion of *L. mendesi*, as well as interpretation of paratype material of *L. mendesi* by Dr Clay, clearly places this name with *L. maximum* even though the only lice we have seen from *Aquila chrysaetos* represent *L. vulturis*. This is not unusual since we have records of both louse species distributed among *Aquila* species. We could find no differences of note between *L. mendesi* and *L. lunai*.

Three recent descriptions have been based on lice from *Circaetus gallicus*. *Laemobothrion siddiqii* was very inadequately described, with only a statement that it resembles *L. aquab* [now a synonym of *L. tinunculi*] but differs in chaetotaxy and tergal plates, without saying how or without any comparison with *L. maximum* or related forms. Shortly thereafter, *L. clayae* (*L. clayi* represents an incorrect spelling) was described, with the author apparently unaware of the description of *L. siddiqii*; obvious differences from *L. circi* are supposedly given, but we could detect no differences from *L. maximum* (= *L. circi*) in either the illustrations or descriptive details. The description of *L. tuleschkovi*, from a single ♀, emphasizes the presence of 2 setae on each side of the meso-metasternal plate; figs. 16–18 show the variation we encountered with this for 3 ♀♀ (1+1, 2+2, 2+1); the ♂ we studied has a 3+1 setal pattern.

The known hosts of *L. maximum* fall chiefly within the subfamilies Perninae, Milvinae, Accipitrinae, Buteoninae, Circinae, and Circaetinae, all of the Accipitridae. It is also known from *Polyborus*, with probable stragglers from *Falco*. This louse seems to be most commonly collected from various *Buteo* species. It overlaps the distribution of *L. vulturis* on *Aquila* and *Haliaeetus*.

MATERIAL EXAMINED. 4 ♀♀, 9 ♂♂, *Ariceda sub-cristata* (GoULD), New Guinea; 1 ♀, 1 ♂, *Pernis apivorus*, Jugoslavia; 4 ♀♀, 5 ♂♂, *Ictinia mississippiensis* (Wilson), USA; 5 ♀♀, 5 ♂♂, *Milvus migrans*, Africa, New Guinea; 2 ♀♀, 3 ♂♂, *M. lineatus* (J. E. Gray), Thailand, Burma; 10 ♀♀, 8 ♂♂, *Haliastur indus*, Ceylon, Philippine Islands, New Guinea, India (Zoo); 1 ♀, 1 ♂, *H. sphenurus* (Vieillot), Australia; 1 ♀, *Ac-*

cipiter gentilis (L.), Korea; 1 ♀, *A. badius* (Gmelin), India; 1 ♀, *Melierax metabates* Heuglin, Yemen; 2 ♀♀, 3 ♂♂, *Buteo rufinus*, India, Israel; 2 ♀♀, 1 ♂, *B. rufocinctus* (J. R. Forster), Belgian Congo, E Africa; 5 ♀♀, 6 ♂♂, *B. regalis* (G. R. Gray), USA; 17 ♀♀, 11 ♂♂, *B. jamaicensis* (Gmelin), USA, Canada, Mexico; 2 ♀♀, 1 ♂, *B. harlani* (Audubon), USA; 13 ♀♀, 10 ♂♂, *B. swainsoni*, USA, Canada; 2 ♀♀, 2 ♂♂, *B. buteo*, Israel; 2 ♀♀, *B. vulpinus* (Gloger), Yemen; 4 ♀♀, 6 ♂♂, *B. lagopus* (Pontoppidan), USA; 2 ♀♀, 2 ♂♂, *B. magnirostris* (Gmelin), Panama; 1 ♂, *Parabuteo unicinctus* (Temminck), Mexico; 1 ♀, 1 ♂, *Butastur teesa* (Franklin), India; 5 ♀♀, 3 ♂♂, *B. indicus* (Gmelin), Formosa, Thailand; 3 ♂♂, *Polemaetus bellicosus* (Daudin), Mozambique; 1 ♀, 2 ♂♂, *Hieraetus fasciatus* (Vieillot), Congo; 1 ♀, *Aquila rapax* (Temminck), Belgian Congo; 1 ♀, *A. Wahlbergi* Sundevall, Sierra Leone; 1 ♂, *Haliaeetus vocifer* (Daudin), Kenya; 1 ♀, 2 ♂♂, *Circus cyaneus* (L.), USA; 6 ♀♀, 6 ♂♂ (including 5 ♀, 5 ♂ neoparatypes of *L. circi*), *C. aeruginosus*, Kenya, France; 1 ♀, *Gymnogonyx typicus*, Uganda; 3 ♀♀, 1 ♂, *Circaetus gallicus*, Africa; 1 ♀, 1 ♂, *C. cinereus* Vieillot, Ethiopia; 3 ♀♀, 5 ♂♂, *Polyborus cheriway* (Jacquin), USA, British Guiana, Mexico; 1 ♂, *Falco mexicanus*, USA; 1 ♀, 1 ♂, *F. tinunculus*, France (the last 2 probably host errors); 1 ♀ (type-specimen of *L. loomisi*), *Anser albifrons gambeli*—error.

Laemobothrion vulturis (J. C. Fabricius) Figs. 6, 7, 13, 19, 22.

Pedicular vulturis J. C. Fabricius, 1775, Syst. Entomol.: 806. Type-host: "in Indiae orientalis vulturibus" = *Pseudogypsy bengalensis* (Gmelin).

Liotheum percnopteri Gervais, 1844, Hist. Nat. Ins. 3: 321. Type-host: *Vultur percnopterus* = *Neophron percnopterus percnopterus* (L.). **New synonymy.**

Laemobothrion pallidum Giebel, 1874, Insecta Epizoa: 250. Type-host: *Neophron percnopterus* (L.).

Laemobothrion validum Giebel, 1874, Insecta Epizoa: 251. Type-host: *Neophron monachus* = *Necrosyrtes monachus* (Temminck). **New synonymy.**

Laemobothrion gypsis Kellogg, 1906, Entomol. News 17: 63. Type-host: *Gyps kolbi* = *G. coprotheres* (J. R. Forster). **New synonymy.**

Laemobothrion africanum Kellogg, 1910, Wiss. Ergebn. Schwed. Zool. Exped. Kilimandjaro 3 (15): 49. Type-host: *Ardea purpurea*—(Error)—and *Pseudogyps africanus* (Salvadori). **New synonymy.**

Laemobothrion grassii Eichler, 1943, Zool. Anz. 141: 59. Nom. nov. for "*Laemobothrion* von *Gypogeryanus serpentarius*" Grosse, 1885, Z. Wiss. Zool. 42: 557. Type-host: *Sagittarius serpentarius* J. F. Miller). **New synonymy.**

Laemobothrion bulgaricum Eichler, 1943, Mitt. Königl. Naturwiss. Inst. Sofia 16: 210. Type-host: *Gyps*

fulves (Hablizl). **New synonymy.**
Laemobothrion romanicum Becher, 1961, Stud. Cerc. Biol. 12: 218. Type-host: *Aquila pomarina* C. L. Brehm. **New synonymy.**

♀. Quantitative data for lice from *Haliaeetus leucocephalus*. Close to *L. maximum*, but differing as follows. Head occasionally with slightly more protruding preocular expansion. Sitophore sclerite of hypopharynx (fig. 13) with 2 large, but somewhat compressed, holes; with well defined U-shaped structure medioanterior to holes. Femur II (fig. 6) with 5 or more short spiniform setae on proximodorsal area. Tendency for fewer tergoventral setae on I-VI: I, 11-13 (12.2); II-VI, 12-18 (14.7); and for up to 25 on VII and 29 on VIII. Large unpigmented median area on tergites II-VIII (fig. 22). Sternal setae much as for *L. maximum*, but with II up to 79, IV down to 77, V down to 104, VI up to 163, and VII up to 118. Longer vulval setae 62-90 (81.0). Pigmented spot laterally on postvulval area (fig. 7: x).

♂. Much as for ♀, except for terminalia and smaller size. More tergoventral setae on VI, 15-22 (18.8); VII, 24-30 (27.2); and VIII, 23-39 (32.4); due to increased number of short setae. Genitalia essentially as for *L. maximum* (fig. 8).

Dimensions. Slightly larger than *L. maximum*. Preocular width, ♀ 1.47-1.60 (1.55), ♂ 1.47-1.53 (1.50); temple width, ♀ 1.80-1.90 (1.86), ♂ 1.60-1.80 (1.73); head length, ♀ 1.50-1.63 (1.56), ♂ 1.43-1.57 (1.49); prothorax width, ♀ 1.40-1.57 (1.48), ♂ 1.23-1.40 (1.33); metathorax width, ♀ 1.90-2.07 (2.02), ♂ 1.67-1.80 (1.72); abdomen width, ♀ 3.07-3.30 (3.21), ♂ 2.40-2.70 (2.59); total length, ♀ 10.43-10.90 (10.61), ♂ 9.00-9.67 (9.28); ♂ genitalia width, 0.50-0.53 (0.51).

We have seen specimens representing lice from the type-hosts of all names we consider conspecific with *L. vulturis* and have found no features suggestive of species differentiation. An example of variation of shape and chaetotaxy of the meso-metasternal plate is shown by 2 ♂♂ from *Aquila pomarina*, one without any setae and shaped as in fig. 19, the other with 1±1 setae and shaped as in fig. 16.

We obtained a ♀ and 2 ♂♂ of *L. gypsis* bearing the "type" data; Kellogg (1906b), however, in describing *L. gypsis* said it was based on 3 ♀♀, and then proceeded to give an illustration of a ♂. A similar situation involves *L. africanum*, which was undoubtedly described from 3 nymphs instead of the stated 3 ♂♂; we have seen 1 specimen of the "type"-series and its morphology and small size, as well as the 5-6 mm range given for the type-specimens, further bear out this error. The illustration and small size for *L. romanicum* indicate that the single specimen upon which this was based is actually a nymph instead of a ♀.

The known distribution of *L. vulturis* lies principally within birds of the subfamily *Agypiiinae* and on *Aquila*, *Uroaetus*, and *Haliaeetus* of the subfamily *Butorinae*. Specimens have also been seen from the *Sagittariidae* and from *Haliastur* of the *Milvinae*, but their significance must await further collecting.

MATERIAL EXAMINED. 1 ♀, 1 ♂, *Sagittarius serpentarius*, no data; 1 ♀, 1 ♂, *Haliastur sphenurus*, Australia; 4 ♀♀, 1 ♂, *Aquila chrysaetos*, Canada, Washington DC (Zoo); 2 ♀♀, 2 ♂♂, *A. heliaca* Savigny, India; 1 ♂, *A. rapax*, Sudan; 1 ♀, 2 ♂♂, *A. clanga* Pallas, Afghanistan; 2 ♀♀, 3 ♂♂, *A. pomarina*, India; 2 ♀♀, 2 ♂♂, *Uroaetus audax* (Latham), Washington DC (Zoo); 3 ♀♀, 4 ♂♂, *Haliaeetus leucorhynchus* (Pallas), Manchukuo, India; 22 ♀♀, 17 ♂♂, *H. leucocephalus* (L.), USA, Canada; 1 ♀, *H. albicilla* (L.), Russia; 1 ♀, 1 ♂, *Sarcogyps calvus* (Scopoli), India; 1 ♀, *Aegypius monachus* (L.), Washington DC (Zoo); 1 ♂, *Trigoniceps occipitalis* (Burchell), Bechuanaland; 2 ♀♀, 3 ♂♂, *Gyps fulvus*, Serbia, India; 2 ♀♀, 4 ♂♂, *G. coprotheres*, Transvaal, S Africa; 1 ♂, *G. himalayensis* Hume, India; 2 ♀♀, 1 ♂, *G. ruppellii* (A. E. Brehm), Arabia; 1 ♂, *G. indicus* (Scopoli), India; 3 ♀♀, 1 ♂ (including 1 ♀ neoparatype of *L. vulturis*), *Pseudogyps bengalensis*, India; 1 ♂, *P. africanus*, Kenya; 1 ♀, 1 ♂, *Necrosyrtes monachus*, Sudan; 1 ♀, 4 ♂♂, *Neophron percnopterus*, Israel, Cape Verde Is.; 2 ♀♀, 2 ♂♂, *Gypaetus barbatus* (L.), Ethiopia, Arabia, India.

Laemobothrion glutinans Nitzsch Figs. 3, 10, 14, 20, 21.

Laemobothrion glutinans Nitzsch, 1861, In Giebel, Z. Ges. Naturwiss. 17: 518. Type-host: *Sarcoramphus papa* (L.).

Laemobothrium delogramma Carriker, 1903, Univ. Stud. Nebraska 3: 159. Type-host: *Gypagys papa* = *Sarcoramphus papa* (L.).

Laemobothrium delogramma Kellogg & Paine, 1910 (nec Carriker, 1903), Ent. News 21: 460. Type-host: *Cathartes aura* (L.).

Laemobothrion canalense Eichler, 1942, Zool. Anz. 139: 31. Nom. nov. for *L. delogramma* Kellogg & Paine, 1910 (nec Carriker, 1903). **New synonymy.**

Laemobothrion museihamburgi Eichler, 1954, Beitr. Fauna Perus 4: 34. Type-host: *Coragyps atratus* (Bechstein). **New synonymy.**

♀. Description and illustrations for lice from *Cathartes aura*. Differs from other species as follows. Distinctive sitophore sclerite of hypopharynx (fig. 14), with large darkly pigmented U-shaped median structure; compressed lateroposterior holes. Meso-metanotum (fig. 3) with several short spiniform setae laterally; metanotal margin with only 2-3 long setae among 8-14 much shorter ones. Prosternal plate (fig. 21) with 4-7 lateroanterior setae on each side, in addi-

tion to minute anterior one; meso-metasternal plate with from 2 mediolateral setae on each side (fig. 21) to 5-6 (fig. 20), but apparently always with single seta at posterior apex. Dorsal abdominal chaetotaxy as in fig. 3. Few stout spiniform setae along lateral margin of anterior segments. Fewer tergoventral setae: I, 12-14 (13.5); II, 9-15 (12.6); III-VIII, 11-19 (15.7); majority of these setae short, especially on more posterior tergites. Narrow unpigmented median area on tergites II-VII or III-VII. Sternal setae: II, 75-103 (86.2); III-IV, 129-167 (145.5); V-VI, 88-130 (111.2); VII, 115-146 (126.2). Vulva with 51-76 (61.0) short submarginal spiniform setae, 104-125 (116.2) longer setae.

♂. Much as for ♀, except for terminal abdominal segments and smaller size. Tergoventral setae: V-VI, 17-23 (20.1); VII, 24-29 (26.3); VIII, 31-34 (32.2); increased number due to more short setae. Genitalia as in fig. 10.

Dimensions. All within ranges for *L. maximum*.

Eichler (1942b) established *L. canalense* as a nomen novum for specimens that had been identified earlier in the literature as *L. delogramma* from *Cathartes aura*. He apparently believed this identification to be in error, but gave no reason for his thinking so. After comparing specimens from *Cathartes aura* as well as from *Coragyps atratus* with specimens from *Sarcoramphus papa*, we could not differentiate between them and believe all to be conspecific with *L. glutinans*. Thus, *L. glutinans* has its known distribution restricted to the species of the Cathartidae, with specimens known from all genera and 5 of the 6 species of this family.

MATERIAL EXAMINED. 1 ♀, *Falco gryphus* L., Colombia; 1 ♀, 2 ♂♂ (including 1 ♀, 1 ♂ paratypes of *L. delogramma* Carriker), *Sarcoramphus papa*, Colombia, Costa Rica; 4 ♀♀ (including holotype of *L. musci-hamburgi*), 2 ♂♂, *Coragyps atratus*, USA, Mexico, Brazil, Venezuela; 8 ♀♀, 5 ♂♂, *Cathartes aura*, USA, Panama, Brazil, Colombia; 1 ♂, *C. urubitinga* Pelzeln, Venezuela; 1 ♀, *Polyborus cheriway*, British Guiana (probably host error).

Acknowledgements: We wish to thank Dr Theresa Clay, British Museum (Natural History), and Dr K. C. Emerson, Arlington, Virginia, for their generous

cooperation in this study, including the loan of many valuable specimens and the critical examination of this manuscript. In addition, we thank the following for loan of specimens: Dr George W. Byers, University of Kansas; Mr M. A. Carriker, Jr., Bucaramanga, Colombia; Dr J. F. Gates Clarke, United States National Museum; Dr Robert E. Elbel, Dugway, Utah; Dr C. Don MacNeill, California Academy of Sciences; Dr J. E. H. Martin, Ottawa, Canada; Miss Martha L. Noller, University of Arizona; Dr L. L. Pechuman, Cornell University; Dr Jerry A. Powell, University of California; Dr H. Weidner, Zoologisches Museum, Hamburg; Dr Nixon Wilson, Bishop Museum, Honolulu; Dr J. Porter Woodring, Louisiana State University; and the Director, Zoological Survey of India, Calcutta.

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