

Host–Parasite Associations and New Records of Chewing Lice (Phthiraptera: Amblycera, Ischnocera) from Raptors (Accipitriformes, Falconiformes, Strigiformes) Encountered in Egypt¹

Eslam Adly², Daniel R. Gustafsson³, Mohamed Nasser, Rowida Baeshen⁴, and Mahmoud Kamal

Department of Entomology, Faculty of Science, Ain Shams University, Cairo 11566, Egypt

J. Entomol. Sci. 57(3): 394–410 (July 2022)

Abstract Compared to many other groups of parasitic insects, the chewing louse fauna of the Middle East remains poorly known. Our attempts to alleviate this data deficiency include this report of lice that we found on five species of raptors in Egypt. From a total of 12 birds, we recovered four new records of chewing lice for Egypt: *Colpocephalum milvi* Tendeiro, Restivo & Demartis; *Laemobothrion maximum* (Scopoli); *Colpocephalum percnopteri* Price & Beer; and *Laemobothrion vulturis* (F.). We also recovered additional records for Egypt of *Degeeriella regalis* (Giebel), *Colpocephalum turbinatum* Denny, and *Strigiphilus cursitans* (Nitzsch [in Giebel]). The record of *S. cursitans* constitutes a new host association, *Bubo ascalaphus* Savigny. We provide measurements, taxonomic and ecological notes for all identified chewing louse specimens.

Key Words birds of prey, Phthiraptera, *Colpocephalum*, *Degeeriella*, *Strigiphilus*, *Laemobothrion*

Raptors are considered an ecological parameter for a healthy environment. They are high-class predators that help in maintaining many pests (rodents and small mammals) below threshold levels (Olendorff 1992). These exceptional birds of prey have unique modifications that allow them to be predators, including a sharp vision, strong talons to catch prey, and a sharp upper bill to seize food. The birds of prey face many threats like overhunting, habitat loss, climate change, and pesticides (Dwyer et al. 2018). They harbor a number of ectoparasites, especially chewing lice, which also face the same destiny as the host bird due to the permanence of the host–parasite association. The study of chewing lice on raptors is important due to the importance of such intimate association (Nasser et al. 2020).

¹Received 28 October 2021; accepted for publication 20 December 2021.

²Corresponding author (email: eslam.saad5@gmail.com, Eslam.Adly@sci.asu.edu.eg).

³Guangdong Key Laboratory of Animal Conservation and Resources Utilization, Guangdong Public Laboratory of Wild Animal Conservation and Utilization, Institute of Zoology, Guangdong Academy of Sciences, Guangzhou, 510260, Guangdong Province, China.

⁴Faculty of Sciences, Biology Department, University of Tabuk, Tabuk, Kingdom of Saudi Arabia.

Chewing lice (Phthiraptera) are ectoparasitic insects that parasitize birds and mammals and they are classified into two suborders, Amblycera and Ischnocera. Approximately 5,000 species are known (Price et al. 2003), which is considerably lower than the number of potential hosts worldwide (e.g., 10,999 bird species [IUCN 2021] and 6,399 mammalian species [Burgin et al. 2018]). Moreover, the host distribution and geographical range of many species of lice are only partially known, as many species of lice are known from only a single collection event. Broad geographical surveys of chewing lice across the range of a host are rare (Grossi and Proctor 2020). More data are needed to understand the geographical and host range of most chewing lice groups, not least in order to form a better understanding of the cases where the louse and host ranges do not overlap completely.

In Egypt, no comprehensive study of chewing lice has been conducted since the 1960s (Hafez and Madbouly 1966a, b; 1968a, b). Recently, a description of one new species of a chewing louse from laughing dove, *Spilopelia senegalensis* (L.), and six new records were added to the Egyptian chewing louse fauna, increasing the known louse fauna of Egypt to 68 chewing louse species representing 31 genera (Adly et al. 2019). Exploration of ectoparasites, especially chewing lice of the birds of prey, is essential for the local and international interest due to the importance of the predators to the environment and the special position of Egypt in the migration routes (Adly et al. 2020, 2021). Many raptor species have been recorded in Egypt (Gill et al. 2021), but only four were examined for chewing lice by Hafez and Madbouly (1966b). Therefore, the present work was conducted to add additional records of chewing lice associated with the birds of prey to the Egyptian faunal data. Moreover, no lice have been previously recorded on the pharaoh eagle-owl (*Bubo ascalaphus* Savigny) internationally, and the chewing louse fauna of this host has thus been unknown. Congeneric species of owls are known to be parasitized by different species of lice in different parts of the range (Clayton 1990). Surveys of the fauna of pharaoh eagle-owls in Egypt may lay the foundation of comparative studies of louse faunas on this host in different parts of its range.

Materials and Methods

Eleven birds of prey representing three taxonomic orders (Accipitriformes, Falconiformes, Strigiformes) and five species were examined for chewing lice in Egypt during 2019–2021 (Fig. 1). These were one black kite, *Milvus migrans* (Boddaert); two Egyptian vultures, *Neophron percnopterus* (L.); one greater spotted eagle, *Clanga clanga* (Pallas); four common kestrel, *Falco tinnunculus* L.; and three pharaoh eagle-owls, *Bubo ascalaphus* Savigny (Strigiformes). All examined birds were released at the capturing location after inspection for lice.

Birds were caught using standard mist nets (mesh: 1.8 cm × 0.12 mm; net size: 2 m × 15 m) and visually inspected for chewing lice. Collected chewing lice were preserved in 70% ethyl alcohol, transported to the laboratory, and then cleared using lactic acid for 2 d. Finally, specimens were mounted by using Puri's media. Chewing lice species identifications were according to Giebel (1866), Price and Beer (1963), Nelson and Price (1965), Tendeiro et al. (1979), Clayton and Price

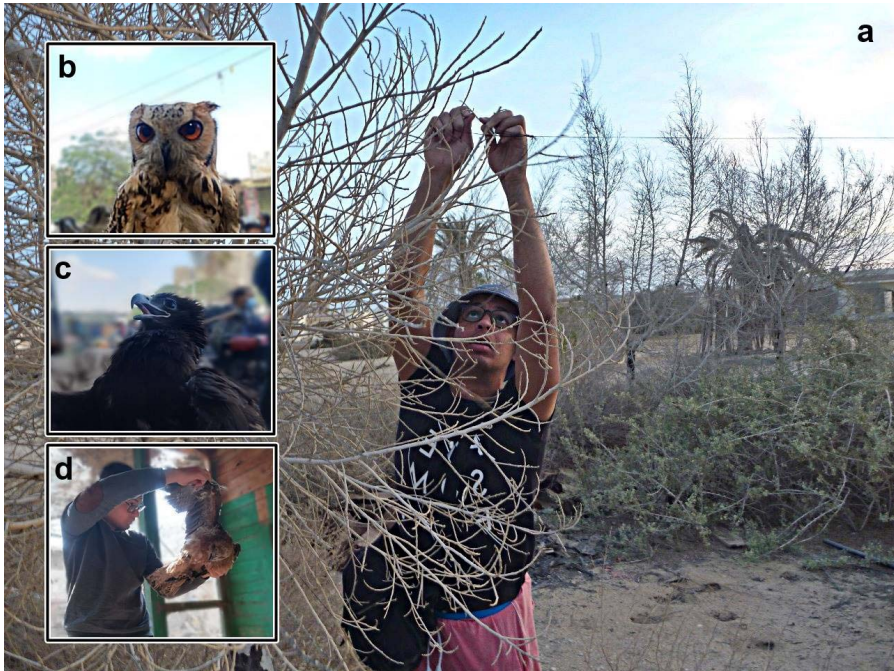


Fig. 1. (a) Mist nets were used to collect examined birds. (b) Pharaoh eagle-owl. (c) Greater spotted eagle. (d) Visual inspection of black kite for chewing lice by first author (E.A.).

(1984), Clayton (1990), Perez et al. (1995), Vikram et al. (2011), and Bilal et al. (2013). Louse taxonomy follows Price et al. (2003), and host taxonomy follows Porter and Aspinall 2013. The ecological notes, including the association of chewing lice with hosts, were revised from Price et al. (2003). Voucher specimens are kept in Ain Shams University Collection (ASUC).

All body parts (head length, head width, head index, thorax length, abdomen length, total length) of the examined specimens were measured under a microscope.

Results

We collected a total of 20 specimens of chewing lice representing seven species: *Colpocephalum milvi* Tendeiro, Restivo & Demartis; *Colpocephalum percnopteri* Price & Beer; *Colpocephalum turbinatum* Denny; *Laemobothrion maximum* (Scopoli); *Laemobothrion vulturis* (F.); *Degeeriella regalis* (Giebel); and *Strigiphilus cursitans* (Nitzsch [In Giebel]). Four of these species are new records for Egypt, and one is a previously unreported host–parasite association (Table 1).

Suborder Amblycera Kellogg
Family Menoponidae Mjöberg
***Colpocephalum* Nitzsch**

***Liotheum* Nitzsch, 1818: 298 [in partim] rejected name** (International Commission on Zoological Nomenclature Opinion 628 1962)

***Colpocephalum* Nitzsch, 1818: 298**

Ferrisia Uchida, 1926: 43

Cuculiphilus Uchida, 1926: 47 [in partim]

Kurodaia Uchida, 1926: 50 [in partim]

Neocolpocephalum Ewing, 1933: 65

Pseudocolpocephalum Qadri, 1936: 640

Allocolpocephalum Qadri, 1939: 66

Scalarisoma Kéler, 1939: 57

Corvocolpocephalum Conci, 1942: 30

Dimorphiventer Eichler, 1944: 60

Galligogus Eichler, 1947: 10

Liothella Eichler, 1947: 15

Pelecanigogus Eichler 1949: 12

Ratitiphagus Eichler, 1949: 13

Galliferrisia Ansari, 1951: 150

Picusphilus Ansari, 1951: 163

Cariamigogus Eichler, 1952: 76

Scopigogus Eichler, 1952: 77

Vulturigogus Eichler & Złotorzycka, 1963: 205

Gypsigogus Eichler & Złotorzycka, 1963: 212

Lanicephalum Złotorzycka, 1964: 187

Pricebeeria Eichler & Złotorzycka, 1971: 20

Aquiligogus Eichler & Złotorzycka, 1971: 30

Blagoveshtshenskyella Eichler, 1982: 82

Tendeiroella Eichler, 1982: 85

Talegalligogus Mey, 1982: 232

Falcocephalum Tendeiro, 1989: 150

Megacolpocephalum Mey 1999: 119

Type species. *Colpocephalum zebra* Burmeister, 1838: 438, by the plenary powers of the International Commission on Zoological Nomenclature, Opinion 342 (1955)

***Colpocephalum milvi* Tendeiro, Restivo & Demartis, 1979**

Colpocephalum milvi Tendeiro, Restivo & Demartis, 1979: 30

Colpocephalum mutabile Tendeiro, Restivo & Demartis, 1979: 34

Type host. *Milvus milvus milvus* (L.), red kite

Type locality. None given, possibly Asuni, Sardinia, Italy

Other hosts. *Hieraaetus pennatus* (Gmelin), booted eagle; *Milvus migrans* (Boddaert), black kite

Remarks. This report constitutes a new geographical record of *Colpocephalum milvi* from Egypt. The specimens were located on the abdomen of the host, near the

Table 2. Measurements (mm) of all examined chewing lice species collected from raptors in Egypt, 2020–2021.

Louse Taxon	HL*	HW	HI	TL	AL	TOL
<i>Colpocephalum milvi</i> ♀	0.40	0.46	0.87	0.50	1.06	1.96 ± 0.2**
<i>Colpocephalum percnopteri</i> ♀	0.40	0.44	0.91	0.30	0.90	1.60
<i>Colpocephalum percnopteri</i> ♂	0.39	0.40	0.98	0.30	0.80	1.49
<i>Colpocephalum turbinatum</i> ♀	0.31	0.48	0.65	0.35	1.18	1.84 ± 0.2**
<i>Strigiphilus cursitans</i> ♂	0.46	0.41	1.12	0.30	1.02	1.07 ± 0.2**
<i>Laemobothrion maximum</i> ♂	0.86	0.84	1.02	1.40	2.12	4.38 ± 0.3**
<i>Laemobothrion vulturis</i> ♀	1.51	1.80	0.84	2.54	6.35	10.40
<i>Degeeriella regalis</i> ♀	0.60	0.42	1.43	0.48	1.24	2.32
<i>Degeeriella regalis</i> ♂	0.55	0.39	1.41	0.44	1.10	2.09

* Abbreviations: HL = head length; HW = head width; HI = head index; TL = thorax length; AL = abdomen length; TOL = total length. **Mean ± SD.

skin. As several of the host species of *C. milvi* are common in Egypt (Gill et al. 2021, Price et al. 2003), this record was expected.

Colpocephalum milvi is characterized by a fine laterally enlarged prothorax with five marginal setae that vary in length, longer laterally, one external spine reaching near the posterior border, and one very short internal spine. Mesothorax can be detected with a pair of small spines. Metathorax trapezoid, with subconvex lateral margins bordered by six spines; Abdomen longitudinal oval, tergites of abdominal segments with patches and darker laterally, varied number of bristles (9 to 17) on tergites of abdominal segments; genital with rounded open, bordered by marginal bristles and with lateral marginal shape from curved bristles. Measurements as in Table 2.

Material. Ex Host: black kite, *Milvus migrans* (Boddaert)

2♀, Gabal El Ziet, Ras Gharib, City: Red Sea (N 28°00'20.8", E 33°25'42.0"), country: Egypt, exact date: (3 February 2019), collector: Eslam Adly, deposition data (ASUC)

***Colpocephalum percnopteri*, Price & Beer, 1963**

Colpocephalum percnopteri, Price & Beer, 1963: 758

Type host. *Neophron percnopterus* (L.), Egyptian vulture

Type locality. Deccan Plateau, India

Remarks. This is the first record of *Colpocephalum percnopteri* from Egypt. This species was found on the abdomen of the host, near the skin.

This species is characterized by middorsal head setae nearly as long as postocular setae; short median tergo-central setae at II, III tergites; pair of anterior tergal setae on median plate of III–IV tergites but fairly short. Abdominal tergite II longer than III, anus with inner setae. Measurements as in Table 2.

Material. Ex Host: Egyptian vulture, *Neophron percnopterus* (L.)

1 ♀, 1 ♂, Gabal El Ziet, Ras Gharib, City: Red Sea (N 28°00'20.8", E 33°25'42.0"), country: Egypt, exact date: (3 February 2019), collector: Eslam Adly, deposition data (ASUC)

***Colpocephalum turbinatum* Denny 1842:198**

- Colpocephalum turbinatum* Denny 1842:198
Colpocephalum oxyurum Nitzsch (in Giebel), 1861: 519
Colpocephalum ailurum Nitzsch (in Giebel), 1861: 522
Colpocephalum bicinctum Nitzsch (in Giebel), 1861: 524
Colpocephalum tricinctum Nitzsch (in Giebel), 1861: 524
Colpocephalum caudatum Giebel, 1874: 261
Colpocephalum caudatum var. *setosum* Piaget, 1880: 519
Colpocephalum dissimile Piaget, 1880: 520
Colpocephalum intermedium Piaget, 1880: 521
Colpocephalum subflavescens Piaget, 1880: 571
Colpocephalum dissimile var. *majus* Piaget, 1885: 119
Colpocephalum caudatum var. *longipes* Piaget, 1885: 125
Colpocephalum latifasciatum Piaget, 1885: 130
Colpocephalum osborni var. *costaricense* Carriker, 1903: 172
Colpocephalum abruptofasciatum Mjöberg, 1910b: 36
Neocolpocephalum gypae Qadri, 1935: 229
Neocolpocephalum tricinctum wetzeli Eichler, 1941: 374
Colpocephalum wernecki Orfila, 1959: 477
Vulturigogus eugenii Eichler & Złotorzycka, 1963: 207
Vulturigogus femellus Eichler & Złotorzycka, 1963: 209

Type host. *Columba livia* Gmelin, rock dove

Type locality. None given, but original description concerns lice of the British Isles

Other hosts. *Ducula bicolor* (Scopoli), pied imperial-pigeon; *Zenaida asiatica* (L.), white-winged dove; *Elanus leucurus* (Vieillot), white-tailed kite; *Haliastur indus* (Boddaert), brahmyn kite; *Haliastur sphenurus* (Vieillot), whistling kite; *Milvus migrans* (Boddaert), black kite; *Milvus milvus* (L.), red kite; *Terathopius ecaudatus* (Daudin), bateleur; *Circus aeruginosus* (L.), western marsh harrier; *Circus assimilis* Jardine & Selby, spotted harrier; *Circus approximans* Peale, swamp harrier; *Circus cyaneus* (L.), northern harrier/hen harrier; *Accipiter fasciatus* (Vigors & Horsfield), brown goshawk; *Accipiter tachiro* (Daudin), African goshawk; *Melierax metabates* Heuglin, dark chanting goshawk; *Buteo galapagoensis* (Gould), Galapagos hawk; *Buteo jamaicensis* (Gmelin), red-tailed hawk; *Buteo magnirostris* (Gmelin), roadside hawk; *Buteo swainsoni* Bonaparte, Swainson's hawk; *Falco mexicanus* Schlegel, prairie falcon; *Aquila audax* (Latham), wedge-tailed eagle; *Haliaeetus leucocephalus* (L.), bald eagle; *Haliaeetus leucogaster* Gmelin, white-bellied sea eagle; *Haliaeetus leucoryphus* (Pallas), Pallas's fish eagle; *Haliaeetus vocifer* (Daudin), African fish eagle; *Hieraaetus morphnoides* (Gould), little eagle; *Hieraaetus pennatus* (Gmelin), booted eagle; *Lophaetus occipitalis* (Daudin), long-crested eagle; *Polemaetus bellicosus* (Daudin), martial eagle; *Spizaetus nipalensis* Hodgson, mountain hawk-eagle; *Buteo buteo* (L.), Eurasian buzzard; *Buteo rufofuscus* (Forster), jackal buzzard; *Henicopernis longicauda* (Garnot), long-tailed buzzard; *Herpetotheres cachinnans* (L.), laughing falcon; *Pandion haliaetus* (L.),

osprey; *Pernis apivorus* (L.), European honey buzzard; *Pernis ptilorhyncus* (Temminck), Oriental honey buzzard; *Bubo sumatranus* (Raffles), barred eagle-owl; *Ketupa zeylonensis* (Gmelin), brown fish-owl; *Ninox connivens* (Latham), barking owl; *Tyto alba* (Scopoli), barn owl; *Aegyptius monachus* (L.), cinereous vulture; *Gyps africanus* Salvadori, African white-backed vulture; *Gyps bengalensis* (Gmelin), Indian white-backed vulture; *Gyps coprotheres* (Forster), cape griffon; *Gyps fulvus* (Hablizl), griffon vulture; *Gyps indicus* (Scopoli), Indian vulture; *Gyps rueppellii* (Brehm), Ruppell's griffon; *Necrosyrtes monachus* (Temminck), hooded vulture; *Neophron percnopterus* (L.), Egyptian vulture

Remarks. *Colpocephalum turbinatum* was previously recorded from pigeons in Egypt by Adly et al. (2019). *Colpocephalum turbinatum* were found on the abdomen of the host, near the skin.

Colpocephalum turbinatum is a well-known louse species described in many different publications due to the wide diversity of host associations of this louse, particularly with pigeons. It is characterized by six dark spots on the head, noncompletely covered antenna, apical segment of antenna protruded, rounded temple with some small seta; prothorax lozenge with two posterior setae on each side, marginal bands of legs paler; elongated abdomen in female and rounded in male, lateral seta on abdominal tergites, characterized segment IX with tuft-like lateral hairs and row of bristle-like setae on sternum, female with rounded abdominal tip, two long setae, two small spines; male genitalia have small parameres. Measurements as in Table 2.

Material. Ex Host: greater spotted eagle, *Clanga clanga* (Pallas)

2 ♀, Sharm el-Sheikh, City: South Sinai (N 27°47'21.5", E 34°13'29.9"), country: Egypt, exact date: (8 March 2019), collector: Eslam Adly, deposition data (ASUC)

Ex Host: Common kestrel, *Falco tinnunculus* L

1 ♀, Ain Shams University Botanical Garden, City: Cairo (N 30°04'40.3", E 31°16'56.7"), country: Egypt, exact date: (15 March 2020), collector: Eslam Adly, deposition data (ASUC)

Family Laemobothriidae Mjöberg *Laemobothrion* Nitzsch

Pediculus L., 1758: 601 [*in partim*]

Nirmus Nitzsch, 1818: 291 [*in partim*]

Laemobothrion Nitzsch, 1818: 301

Type species. *Laemobothrion maximum* (Scopoli, 1763), by subsequent designation (Johnston and Harrison 1911: 327)

Laemobothrion maximum (Scopoli, 1763)

Pediculus maximus Scopoli, 1763: 382

Pediculus buteonis J. C. Fabricius, 1776: 309

Pediculus circi Fourcroy, 1785: 518

Pediculus milvi Schrank, 1803: 193

Liotheum giganteum Nitzsch, 1818: 301

Nirmus buteonivorus Packard, 1872: 733

- Laemobothrium nigrolimbatum* Giebel, 1874: 252
Laemobothrium titan Piaget, 1880: 578
Laemobothrium loomisi Kellogg & Chapman, 1902: 23
Laemobothrium oligothrix Carriker, 1903: 161
Laemobothrium caracaraensis Kellogg, 1906: 48
Laemobothrium eidmanni Eichler, 1942: 14
Laemobothrium anaticum Eichler, 1942: 52
Laemobothrium hoeschi Eichler, 1942: 56
Laemobothrium niethammeri Eichler, 1942: 60
Laemobothrium indicum Sen, 1942: 169
Laemobothrium hieraeti Eichler, 1943: 209
Laemobothrium bureschi Eichler, 1943: 209
Laemobothrium mjobergi Eichler, 1944: 64
Laemobothrium chondrohieracis Eichler, 1953: 265
Laemobothrium mendesi Tendeiro, 1955: 521
Laemobothrium siddiqii Ansari, 1955: 57
Laemobothrium clayae Tuleshkov, 1957: 281
Laemobothrium lunai Tendeiro, 1958: 99
Laemobothrium tuleschkovi Bechet, 1961: 220
Laemobothrium grandiculus Tendeiro, 1964: 185

Type host. *Buteo buteo* (L., 1758), Eurasian buzzard

Neotype locality. Agna Manja, Tenerife, Canary Islands, Spain (Eichler 1942: 59)

Other hosts. *Accipiter badius* Gmelin, shikra; *Accipiter brevipes* (Severtsov), Levant sparrowhawk; *Accipiter cooperii* (Bonaparte), cooper's hawk; *Accipiter gentilis* (L.), northern goshawk; *Accipiter melanoleucus* Smith, black sparrowhawk; *Aquila chrysaetos* (L.), golden eagle; *Aquila fasciata* (Vieillot), Bonelli's eagle; *Aquila rapax* (Temminck), tawny eagle; *Aquila verreauxii* Lesson, Verreaux's eagle; *Aviceda subcristata* (Gould), Pacific baza; *Busarellus nigricollis* (Latham), black-collared hawk; *Butastur indicus* (Gmelin), grey-faced buzzard; *Butastur teesa* (Franklin), white-eyed buzzard; *Buteo augur* (Rüppell), augur buzzard; *Buteo jamaicensis* (Gmelin), red-tailed hawk; *Buteo lagopus* (Pontoppidan), rough-legged buzzard; *Buteo magnirostris* (Gmelin), roadside hawk; *Buteo regalis* (Gray), ferruginous hawk; *Buteo rufinus* (Cretzschmar), long-legged buzzard; *Buteo rufofuscus* (Forster), jackal buzzard; *Buteo swainsoni* Bonaparte, Swainson's hawk; *Chondrohierax uncinatus* (Temminck), hook-billed kite; *Circaetus cinereus* (Vieillot), brown snake eagle; *Circaetus gallicus* (Gmelin), short-toed snake eagle; *Circus aeruginosus* (L.), western marsh harrier; *Circus approximans* Peale, swamp harrier; *Circus cyaneus* (L.), northern harrier/hen harrier; *Circus pygargus* (L.), Montagu's harrier; *Haliaeetus ichthyaetus* (Horsfield), grey-headed fish eagle; *Haliaeetus leucogaster* Gmelin, white-bellied sea eagle; *Haliaeetus vocifer* (Daudin), African fish eagle; *Haliastur indus* (Boddaert), brahmyn kite; *Haliastur sphenurus* (Vieillot), whistling kite; *Hieraetus morphnoides* (Gould), little eagle; *Hieraetus pennatus* (Gmelin), booted eagle; *Hieraetus wahlbergi* (Sundevall), Wahlberg's eagle; *Ictinaetus malaiensis* (Temminck), black eagle; *Ictinia mississippiensis* (Wilson), Mississippi kite; *Melierax canorus* (Thunberg), southern pale chanting goshawk; *Melierax metabates* Heuglin, dark chanting goshawk; *Milvus*

migrans (Boddaert), black kite; *Milvus milvus* (L.), red kite; *Parabuteo unicinctus* (Temminck), Harris's hawk; *Fernis apivorus* (L.), European honey buzzard; *Polyboroides radiatus* (Scopoli), Madagascan harrier-hawk; *Polyboroides typus* Smith, African harrier-hawk; *Caracara plancus* (Miller), southern crested caracara; *Pandion haliaetus* (L.), osprey

Remarks. This is the first record of *L. maximum* from Egypt. All specimens of *L. maximum* were collected from the abdomen of the host.

Laemobothrion maximum is a cosmopolitan chewing louse species infesting many of birds of prey (Price et al. 2003). The genus is characterized by the large size compared to other groups of chewing lice. *Laemobothrion maximum* has very distinctive hypopharyngeal sclerite (Clay and Price 1965; Fig. 12), head broad with flatter margin anteriorly, distinguished lateral preocular swellings, temple with variable distance setae on lateral side, gula with five medium anterior setae on each side, antenna not extended flat anterior margin of head, crescent-shaped structure medio-anteriorly. sitophore sclerite of hypopharynx with a more reduced U-shaped structure than other *Laemobothrion* sp. (Clay and Price 1965; Fig. 12). Male has unique simple mace-shape genital structure. Measurements as in Table 2.

Material. Ex Host: black kite, *Milvus migrans* (Boddaert)

2♂, Gabal El Ziet, Ras Gharib, City: Red Sea (N 28°00'20.8", E 33°25'42.0"), country: Egypt, exact date: (3 February 2019), collector: Eslam Adly, deposition data (ASUC)

***Laemobothrion vulturis* (F. 1775)**

Pediculus vulturis F., 1775: 806

Liotheum percnopteri Gervais, 1844: 321

Laemobothrion gigas Nitzsch (in Giebel), 1861: 515

Laemobothrium pallidum Giebel, 1874: 250

Laemobothrium validum Giebel, 1874: 251

Laemobothrium gypsis Kellogg, 1906: 63

Laemobothrion setigerum africanum Kellogg, 1910: 43

Laemobothrion bulgaricum Eichler, 1943: 207

Laemobothrion grossei Eichler, 1943: 57

Laemobothrion romanicum Bechet, 1961: 217

Laemobothrion vulturis daneckii Zlotorzycza, 1969: 123

Type host. *Gyps bengalensis* (Gmelin), white-rumped vulture

Neotype locality. Deccan, India (Clay and Hopkins 1951): 34

Other hosts. *Aegyptius monachus* (L.), cinereous vulture; *Aegyptius occipitalis* (Burchell), white-headed vulture; *Aegyptius tracheliotos* (Forster), lappet-faced vulture; *Aquila audax* (Latham), wedge-tailed eagle; *Aquila chrysaetos* (L.), golden eagle; *Aquila heliaca* Savigny, eastern imperial eagle; *Aquila rapax* (Temminck), tawny eagle; *Clanga clanga* (Pallas), greater spotted eagle; *Clanga pomarina* Brehm, lesser spotted eagle; *Gypaetus barbatus* (L.), bearded vulture; *Gyps africanus* Salvadori, white-backed vulture; *Gyps bengalensis* (Gmelin), white-rumped vulture; *Gyps coprotheres* (Forster), cape vulture; *Gyps fulvus* (Hablitz), griffon vulture; *Gyps himalayensis* Hume, Himalayan vulture; *Gyps indicus* (Scopoli), Indian vulture; *Gyps rueppelli* (Brehm), Rüppell's vulture; *Haliaeetus*

albicilla (L.), white-tailed eagle; *Haliaeetus leucocephalus* (L.), bald eagle; *Haliaeetus pelagicus* (Pallas), Steller's sea eagle; *Haliastur sphenurus* (Vieillot), whistling kite; *Necrosyrtes monachus* (Temminck), hooded vulture; *Neophron percnopterus* (L.), Egyptian vulture; *Nisaetus nipalensis* Hodgson, mountain hawk-eagle; *Sagittarius serpentarius* (J. F. Miller), secretary bird; *Sarcogyps calvus* (Scopoli), red-headed vulture

Remarks. This report constitutes the first record of *L. vulturis* in Egypt. The specimen was collected from the abdomen of the host.

Laemobothrion vulturis can be distinguished from other species of the genus *Laemobothrion* by several characters. Head: preocular protruding, two large holes at sitophore sclerite of hypopharynx, very characteristic U shape at sclerite of hypopharynx (Clay and Price 1965: fig. 13); variable number of setae on each segment of body (I–VI = 11 to 16), (VII–VIII = more than 26), postvulval area has laterally pigmented spot (Clay and Price 1965: fig. 7). Measurements as in Table 2.

Material. Ex Host: greater spotted eagle, *Clanga clanga* (Pallas).

1 ♀, nymph with total length 5.5 mm, Sharm el-Sheikh, City: South Sinai (N 27°47'21.5", E 34°13'29.9"), country: Egypt, exact date: (5 January 2021), collector: Eslam Adly, deposition data (ASUC).

Suborder Ischnocera Kellogg Family Philopteridae Burmeister

***Degeeriella* Neumann, 1906:60**

Philopterus Nitzsch, 1818: 288 [*in partim*]

Nirmus Nitzsch, 1818: 291 [*in partim*] [*nec Nirmus* Hermann, 1804]

Degeeriella Neumann, 1906: 60

Kelerinirmus Eichler 1940: 101

Type species: *Nirmus discocephalus* Burmeister, 1838: 430, by subsequent designation (Johnston & Harrison, 1911: 326)

***Degeeriella regalis* (Giebel, 1866)**

Nirmus regalis Giebel, 1866: 364

Nirmus vittatus Giebel, 1874: 127

Nirmus appendiculatus Piaget, 1880: 132

Nirmus incertus Piaget, 1885: 20

Nirmus curvilineatus Kellogg & Kuwana, 1902: 470

Nirmus pseudophaeus Carriker, 1903: 142

Type host. *Milvus milvus milvus* (L., 1758), red kite

Neotype locality. "Czechoslovakia" Clay (1958): 189

Other hosts. *Buteo galapagoensis* (Gould), Galapagos hawk; *Buteo jamaicensis* (Gmelin), red-tailed hawk; *Buteo magnirostris* (Gmelin), roadside hawk; *Buteo swainsoni* Bonaparte, Swainson's hawk; *Haliaeetus leucogaster* Gmelin, white-bellied sea eagle; *Haliaeetus leucoryphus* (Pallas), Pallas's fish eagle; *Haliastur indus* (Boddaert), Brahminy kite; *Haliastur sphenurus* (Vieillot), whistling kite; *Milvus migrans* (Boddaert), black kite

Remarks. This species was previously recorded in Egypt by Hafez and Madbouly (1968b). All specimens were located on the wing feathers of the host.

Degeeriella regalis can be distinguished from other species of the genus *Degeeriella* by the following characters. Head: marginal carina with inner dorsal margin and deeply sharp indentation medially and laterally; thorax: anteriorly median indentation only on tergite I; female: genital plate with two genital sclerites medially inside, the genital plate looks the same from anterior and posterior position; male is best recognized by the unique male genitalia (Clay 1958: fig. 56).

Material. Ex Host: black kite, *Milvus migrans* (Boddaert)

1 ♀, 1 ♂, Gabal El Ziet, Ras Gharib, City: Red Sea (N 28°00'20.8", E 33°25'42.0"), country: Egypt, exact date: (9 January 2021), collector: Eslam Adly, deposition data (ASUC)

***Strigiphilus* Mjöberg, 1910**

Pediculus L., 1758: 601 [*in partim*]

Philopterus Nitzsch, 1818: 288 [*in partim*]

Docophorus Nitzsch, 1818: 289 [*in partim*]

Oncophorus Rudow, 1870: 475 [*in partim*]

Strigiphilus Mjöberg, 1910: 132

Eichlerius Złotorzycka, 1974: 328

Eustrigiphilus Ewing, 1926: 148

Neodocophorus Eichler, 1939: 53 *nomen nudum*

Tytoniella Eichler, 1949: 13

Type species. *Docophorus heterocerus* Grube, 1851: 469, by original designation

***Strigiphilus cursitans* (Nitzsch [in Giebel]), 1861 (Fig. 2a–c)**

Docophorus cursitans Nitzsch [in Giebel], 1861: 529

Docophorus brevimaculatus Piaget, 1880: 119

Docophorus athene Mjöberg, 1910: 115

Philopterus castaneus Fresca, 1923: 246

Type host. *Athene noctua* (Scopoli, 1769), little owl

Type locality. None given, likely Germany

Other hosts. *Strix butleri* (Hume), cape eagle-owl; *Bubo ascalaphus* Savigny, pharaoh eagle-owl, **new host association**

Remarks. *Strigiphilus cursitans* (Nitzsch [in Giebel]), was previously recorded in Egypt by Hafez and Madbouly (1968b) associated with *Athene noctua* (Scopoli), the little owl. Here, we recorded the same louse species from *Bubo ascalaphus* Savigny, the pharaoh eagle-owl. All specimens were located on the wing feathers of the host.

The genus *Strigiphilus* has been classified to many groups according to the morphological characters; (*crenulatus* group, *cursitans* group, *cursor* group, *heterocerus* group, *ketupae* group, *macrogenitalis* group, *rostratus* group, *siamensis* group, *strigis* group) according to Clay (1966).

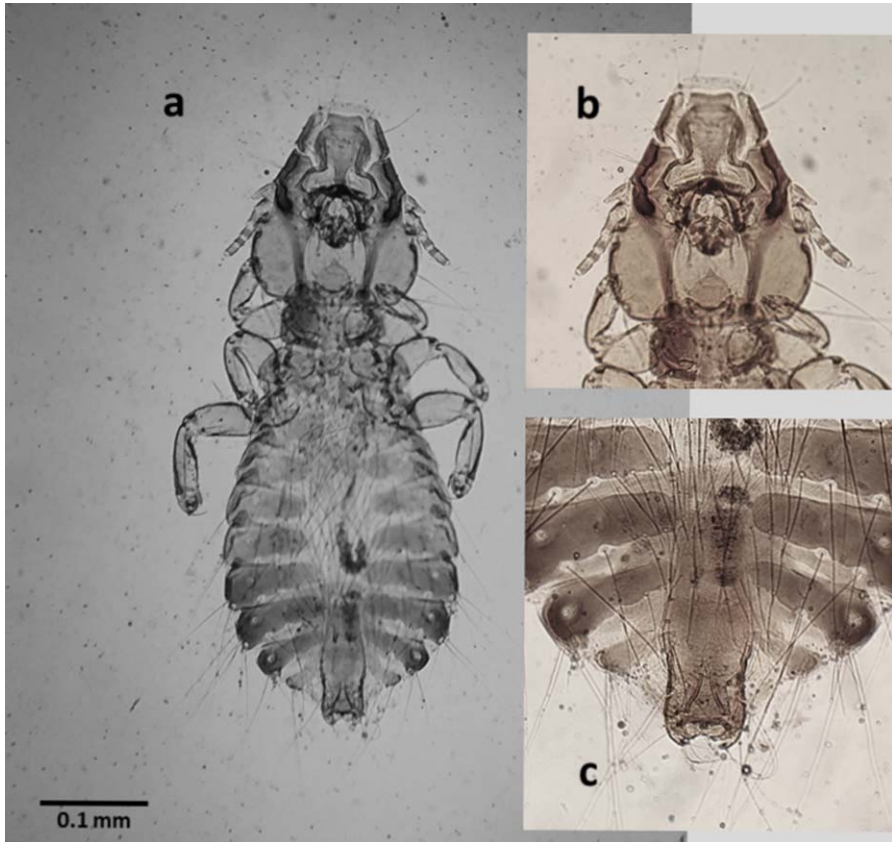


Fig. 2: New host association: *Strigiphilus cursitans*–pharaoh eagle-owl. (a) Male *Strigiphilus cursitans*. (b) Head of male *Strigiphilus cursitans*. (c) Genitalia of male *Strigiphilus cursitans*.

Our specimens were identified as *Strigiphilus cursitans* using the key to species groups of Clay (1966) and the key to species of Clayton and Price (1984). This constitutes the first record of *S. cursitans* from *Bubo ascalaphus*. The *cursitans* group is the most speciose and geographically widespread group of *Strigiphilus*. *Strigiphilus cursitans* is characterized by head longer than broad (Fig. 2b); large dorsal anterior head plate 1/3 of length of head, with posterior projection; dorsal submarginal and ocular setae long; prothorax well chitinized, smaller in size than pterothorax; meso- and metathorax fused with posterior row of long setae; tergites of each abdominal segment with single posterior row of long setae; sternites with two rows of setae, asymmetrical in number; pleura with long setae on postero-lateral corner; male genitalia is very characteristic with fork shape (Fig. 2c).

Material. Ex Host: pharaoh eagle-owl, *Bubo ascalaphus* Savigny (Strigiformes) 7♂, Qaroun, Ibsheaway, City: Faiyum (N 29°22'51.5", E 30°31'01.7"), country: Egypt, exact date: (15 March 2019), collector: Eslam Adly, deposition data (ASUC)

Discussion

Egypt is located in northern Africa, bordering both the Sahara and Arabian deserts and both the Red and Mediterranean seas; moreover, Egypt is in the middle of several migration routes for birds from northern Eurasia. As such, the Egyptian bird fauna is very rich, with 496 species of birds recorded until 2021 according to the Avibase website (Lepage 2021). Of these, a total of 56 species belong to the three orders of birds of prey that occur in Egypt. Few studies have reported on the chewing louse fauna of birds of prey (Accipitriformes, Falconiformes, Strigiformes) in Egypt and the wider Middle East region (Azizi et al. 2013, Dik et al. 2011, Hafez and Madbouly 1968b, Nasser et al. 2019, Nourani et al. 2020, Sultan Al-Ulama 1997, Yosef et al. 2019). Collectively, these publications have only recorded a fraction of the chewing louse species expected from raptors in the Middle East region (see Price et al. 2003). Data on the chewing louse fauna of this region is thus deficient.

Investigation of chewing lice on birds in Egypt and the Middle East is especially interesting, primarily for two reasons. First, many lice have been described from boreal (e.g., European) hosts that also occur in the Middle East. As ambient humidity may affect the distribution of chewing lice (Bush and Malenke 2008, Bush et al. 2009, Fabiyi 1996, Gustafsson and Zou 2020), Egyptian populations of birds may have different chewing louse fauna compared to conspecific bird populations in Europe. The apparently distantly related species of *Brueelia* on different populations of great tits, *Parus major* L., in Europe and North Africa may be one example of this effect (Gustafsson et al. 2018, 2019b). Investigation of the chewing louse fauna of Egyptian birds that also occur in more northern areas may thus give valuable data for the environmental factors that influence the geographical distribution of chewing lice.

Secondly, a large proportion of the birds known from Egypt are migrants from boreal habitats according to BirdLife International (2021). The effect of migration on the louse fauna of birds is poorly known, and recent research has given conflicting results (Chu et al. 2019, Gustafsson et al. 2019a). More data are needed to compare the effects of migration on the prevalence and composition of chewing louse communities on birds. For this, areas such as the Middle East that serve both as breeding grounds of migratory and resident birds, and wintering grounds of boreal migrants, are ideal for collecting data.

The new records reported here form a part of the work necessary to study the influence of these factors by systematically investigating the louse fauna of the birds of Egypt (Adly et al. 2019, 2021; Hafez and Madbouly 1966a, b, 1968a, b). Of the seven species of lice reported here, four represent new records for Egypt and one a new host association. These louse species were all expected from Egypt, given the prevalence of the hosts there. The new host association might also have been expected, given the presence of this louse species on other owl hosts in the Middle East and the known propensity for lice in the genus *Strigiphilus* to occur on multiple hosts in the same habitat (Clayton 1990, Clayton and Price 1984, Shimada and Yoshizawa 2020).

The louse species reported here have previously been reported from other regions with different climates, and the presence of these species on the small

number of hosts examined by us suggests that, at least for the louse groups studied here, external environment may not be a limiting factor in their distribution. However, other species of lice are known from almost all the hosts examined here, including genera *Craspedorrhynchus* and *Falcolipeurus*. Their absence from our samples may, for instance, be due to the small sample sizes, but may also be due to genuine absence of these lice in Egypt. More data are needed to establish the prevalence and abundance of chewing lice on raptors in Egypt and the Middle East.

Acknowledgments

We are grateful to Mohamed Amr Moharem (founder of the Egyptian Wild Animals Service Initiative, Cairo, Egypt) for helping in bird catching. Thanks also to Abubakr Mohammad for helping with bird identification. We thank Osama Mahmoud (the medical veterinary unit, Giza Zoo, Giza, Egypt). We greatly appreciated the help of Ricardo Palma from the Museum of New Zealand, for help in some confirmation of identification of chewing lice.

References Cited

- Adly, E., M. Nasser, S. Alfarraj, S.A. Alharbi and S. Al-Ashaal. 2021.** Parasites on the wing; two new records of marine chewing lice (Phthiraptera) on brown booby (Suliformes: Sulidae) from Egypt with notes on genus *Pectinopygus*/boobies phylogeny. J. King Saud Univ. Sci. 33(5): p.101451.
- Adly, E., M. Nasser, D.E. Soliman, S.A. AlAshaal, M.A. Kenawy, D.R. Gustafsson, K.M. Alghamdi and M. Shehata. 2020.** Analysis of phoretic relation between chewing lice and hippoboscoid flies of *Columba livia*. Vet. Parasitol.: Reg. Stud. Rep. 22: 100496. doi: 10.1016/j.vprsr.2020.100496.
- Adly, E., M. Nasser, D. Soliman, D.R. Gustafsson and M. Shehata. 2019.** New records of chewing lice (Phthiraptera: Amblycera, Ischnocera) from Egyptian pigeons and doves (Columbiformes), with description of one new species. Acta Trop. 190: 22–27. doi: 10.1016/j.actatropica.2018.10.016.
- Azizi, H.R., M. Adel, E. Sayahi, A.Z. Moghadam, A.E. Dehkordi and M. Hematzadeh. 2013.** *Laemobothrion maximum* (chewing lice) in Iranian golden eagles. J. Anim. Poult. Sci. 2(3): 85–90.
- Bilal, D., E. Yamaç and U.S.L.U. Uğur. 2013.** Studies on chewing lice (Phthiraptera: Amblycera, Ischnocera) species from domestic and wild birds in Turkey. Kafkas Üniversitesi Veteriner Fakültesi Dergisi 19(4): 553–560.
- BirdLife International. 2021.** Country profile: Egypt. 20 February 2021. (<http://www.birdlife.org/datazone/country/Egypt>).
- Burgin, C.J., J.P. Colella, P.L. Kahn and N.S. Upham. 2018.** How many species of mammals are there?. J. Mammal. 99: 1–14.
- Bush, S.E., C.W. Harbison, D.L. Slager, A.T. Peterson, R.D. Price and D.H. Clayton. 2009.** Geographic variation in the community structure of lice on western scrub-jays. J. Parasitol. 95: 10–13.
- Bush, S.E. and J.R. Malenke. 2008.** Host defence mediates interspecific competition in ectoparasites. J. Anim. Ecol. 77: 558–564.
- Chu, X., B. Dik, D.R. Gustafsson, X. Che, Q. Zhang and F. Zou. 2019.** The influence of host body size and food guild on prevalence and mean intensity of chewing lice (Phthiraptera) on birds in southern China. J. Parasitol. 105: 334–344.
- Clay, N.R. and R.D. Price. 1965.** The *Laemobothrion* (Mallophaga: Laemobothriidae) of the Falconiformes. J. Med. Entomol. 2: 249–257.
- Clay, T. 1958.** Revisions of Mallophaga genera. *Degeeriella* from the Falconiformes. Bull. British Mus. (Natural History) Entomol. 7: 123–207.

- Clay, T. 1966.** A new species of *Strigiphilus* (Phlopterae: Mallophaga). *Pac. Insects* 8: 835–847.
- Clay, T. and G.H.E. Hopkins. 1951.** The early literature on Mallophaga. Part II. 1763–1775. *Bull. British Mus. (Natural History) Entomol.* 2: 1–36.
- Clayton, D.H. 1990.** Host specificity of *Strigiphilus* owl lice (Ischnocera: Phlopterae), with the description of new species and host associations. *J. Med. Entomol.* 27: 257–265.
- Clayton, D.H. and R.D. Price. 1984.** Taxonomy of the *Strigiphilus cursitans* group (Ischnocera: Phlopterae), parasites of owls (Strigiformes). *Ann. Entomol. Soc. Am.* 77: 340–363.
- Dik, B., E.E. Yamaç and U. Uslu. 2011.** Chewing lice (Phthiraptera) found on wild birds in Turkey. *Kafkas Univ. Vet. Fak. Derg.* 17: 787–794.
- Dwyer, J.F., M.A. Landon and E.K. Mojica. 2018.** Impact of renewable energy sources on birds of prey, Pp. 303–321. *In* Sarasola J., J. Grande and J. Negro (eds.), *Birds of Prey*. Springer, Cham, Switzerland. doi: 10.1007/978-3-319-73745-4_13.
- Fabiyi, J.P. 1996.** Association between duration of humid season and geographical distribution patterns of different species of chewing lice (Mallophaga: Insecta) infesting domestic chickens in Nigeria. *J. Parasitol.* 82: 1034–1036.
- Giebel, C.G.A. 1866.** Die im zoologischen Museum der Universität Halle aufgestellten Eingeweidewürmer nebst Beobachtungen über dieselben. *Z. Ges. Nat.* 28: 253–278.
- Gill, F., D. Donser and P. Rasmussen. 2021.** IOC World Bird List (v 11.1). <https://www.worldbirdnames.org/new/ioc-lists/crossref/> 14 January 2021.
- Grossi, A. and H. Proctor. 2020.** Variation in ectosymbiont assemblages associated with rock pigeons (*Columba livia*) from coast to coast in Canada. *Diversity* 13: 9.
- Gustafsson, D.R., X. Chu, S.E. Bush and F. Zou. 2018.** Ten new species of *Brueelia* Kéler, 1936 (Phthiraptera: Ischnocera: Phlopterae) from nuthatches (Aves: Passeriformes: Sittidae), tits and chickadees (Paridae), and goldcrests (Regulidae). *Acta Parasitol.* 63: 527–557.
- Gustafsson, D.R., L. Lei, K. Luo, X. Chu, X. Zhao, Q. Zhang and F. Zou. 2019a.** Chewing lice from high-altitude and migrating birds in Yunnan, China, with descriptions of two new species of *Guimaraesiella*. *Med. Vet. Entomol.* 33: 407–419.
- Gustafsson, D.R., L. Oslejskova, T. Najer, O. Sychra and F. Zou. 2019b.** Redescriptions of thirteen species of chewing lice in the *Brueelia*-complex (Phthiraptera, Ischnocera, Phlopterae), with one new synonymy and a neotype designation for *Nirmus lais* Giebel, 1874. *Deutsche Entomologische Zeitschrift* 66: 17–39.
- Gustafsson, D.R. and F. Zou. 2020.** *Gallancyra* gen. nov. (Phthiraptera: Ischnocera), with an overview of the geographical distribution of lice parasitizing chicken. *Eur. J. Entomol.* 685: 1–36.
- Hafez, M. and M.H. Madbouly. 1966a.** Bird lice infested domestic birds in Egypt. *Bull. Entomol. Soc. Egypt* 10: 181–213.
- Hafez, M. and M.H. Madbouly. 1966b.** Survey of the Mallophaga (bird lice) encountered in Egypt, Pp. 351–360. *In* Third Ann. Vet. Congr. 1962, Cairo, Egypt.
- Hafez, M. and M.H. Madbouly. 1968a.** Mallophaga infesting migratory birds in Egypt. *Bull. Soc. Entomol. Egypt* 52: 113–154.
- Hafez, M. and M.H. Madbouly. 1968b.** Mallophaga infesting resident birds in Egypt. *Bull. Soc. Entomol. Egypt* 52: 53–111.
- International Commission on Zoological Nomenclature. 1955.** Designation, under the plenary powers, of type species for the nominal genera *Lipeurus* Nitzsch, 1818, *Colpocephalum* Nitzsch, 1818, and *Gyropus* Nitzsch, 1818 (Class Insecta, Order Mallophaga) in harmony with current nomenclatorial practice. *Opinions and Declarations Rendered by the International Commission on Zoological Nomenclature* 10(9): 271–298.
- International Commission on Zoological Nomenclature. 1962.** Opinion 628. *Menopon* Nitzsch, 1818 (Insecta, Mallophaga); added to the Official List. *Bull. Zool. Nomencl.* 19(2): 97–99.

- [IUCN] International Union for Conservation of Nature. 2021. The IUCN Red List of Threatened Species. Version 2021-1. <https://www.iucnredlist.org>, last accessed 15 February 2021.
- Johnston, T.H. and L. Harrison. 1911. Notes on some mallophagan generic names. Proc. Linnæan Soc. New South Wales 41: 321–328.
- Lepage, D. 2021. Avibase—Bird checklists of the world: Egypt. 20 May 2021. (<https://avibase.bsc-eoc.org/checklist.jsp?region=EG>).
- Nasser, M., E. Adly, A. AlAhmed and M. Shobrak. 2020. Host habitat and position on host affecting the evolution of chewing lice (Phthiraptera): Phylogenetic analysis of Ischnocera in Saudi Arabia. J. Insect Biodivers. Syst. 6: 101–112.
- Nasser, M., A. Alahmed, M. Ansari, E. Adly and M. Shobrak. 2019. An analysis of osprey/chewing lice interaction, with a new record for Saudi Arabia. Afr. Entomol. 27(1): 178–184. doi: 10.4001/003.027.0178.
- Nelson, R.C. and R.D. Price. 1965. The *Laemobothrion* (Mallophaga: Laemobothiidae) of the Falconiformes. J. Med. Entomol. 2: 249–257. doi 10.1093/jmedent/2.3.249.
- Nourani, L., M. Aliabadian, H. Amini and O. Mirshamsi. 2020. Prevalence of haemosporidian parasite infections in raptors of Iran. J. Raptor Res. 54: 455–462.
- Olendorff, R.R. 1992. Raptor habitat management on public lands: A strategy for the future. US Dept. Interior, Bureau of Land Management. Washington, D.C. 52 pp.
- Perez, T., T. Granados and I. Ruiz. 1995. The morphology of *Laemobothrion* (*Laemobothrion*) *maximum* (Phthiraptera: Laemobothiidae). Parasitology 37: 45–51.
- Porter, R. and S. Aspinall. 2013. Birds of the Middle East. Bloomsbury Publishing, London.
- Price, R.D. and J.R. Beer. 1963. Species of *Colpocephalum* (Mallophaga: Menoponidae) parasitic upon the Falconiformes. Can. Entomol. 95: 731–763.
- Price, R.D., R.A. Hellenenthal, R.L. Palma, K.P. Johnson and D.H. Clayton. 2003. The chewing lice: World checklist and biological overview. Illinois Natural History Survey Special Publication 24. X + 501 pp.
- Shimada, M. and K. Yoshizawa. 2020. A revision of *Strigiphilus* (Insecta: Phthiraptera: Philopteridae) from Japan. Zootaxa 4779: 501–521.
- Sultan Al-Ulama, M.I. 1997. Study on the parasites of falcons in the United Arab Emirates, MSc Thesis 665, United Arab Emirates University.
- Tendeiro, J., M.A. Miranda de Restivo and A. Mocci Demartes. 1979. Sur trois especes du genre *Colpocephalum* Nitzsch (Mallophaga: Menoponidae), Parasites de falconiformes de la Sardaigne. Garcia de Orta, Sér. Zool. Lisboa 8(1–2): 29–38.
- Vikram, K., B. Nayanci, A. Gaurav, A. Aftab and A.K. Saxena. 2011. Contribution to the morphology of *Degeeriella regalis* (Insecta, Phthiraptera, Ischnocera). J. Entomol. Res. 35: 93–96.
- Yosef, R., O. Strutzer, R. Tabibi and L. Rózsa. 2019. Infestations of lice of steppe buzzards (*Buteo buteo vulpinus*) differ from those of common buzzards (*Buteo buteo buteo*). J. Raptor Res. 53: 102–108.