



An annotated checklist of the chewing lice (Phthiraptera: Ischnocera, Amblycera, Rhynchophthirina) from domestic and wild mammals in Malaysia

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Abstract

Literature records of chewing lice (Phthiraptera) from mammals in Malaysia were checked and reviewed, resulting in a list of 13 confirmed species belonging to eight genera (*Bovicola*, *Felicola*, *Gliricola*, *Gyropus*, *Haematomyzus*, *Heterodoxus*, *Loricicola*, *Trichodectes*) from four families (Boopidae, Gyropidae, Haematomyzidae, Trichodectidae) in three suborders (Amblycera, Ischnocera, Rhynchophthirina). We present a checklist of those 13 chewing lice recorded from Peninsular Malaysia and Malaysian Borneo, including hosts, localities, and literature references. An additional 12 species are listed and discussed as possibly occurring in this country. A host-lice list is also given.

Key words: chewing lice, Phthiraptera, Ischnocera, Amblycera, Rhynchophthirina, checklist, mammal hosts, Malaysia, localities, references

Introduction

Following the publication of a list of sucking lice from domestic and wild mammals in Malaysia (Kazim *et al.* 2022), we have done a similar analysis of the chewing lice from mammals recorded in this country. Research on chewing lice from mammals in Malaysia has been even more limited than on sucking lice. Consequently, very little is known about which species are present in the country, their importance in regard to their host relationships, pathogen transmission and biodiversity. We believe a summary of available data may be useful to stimulate future research in this topic, and to highlight gaps of knowledge on Malaysian chewing lice. Therefore, we present a list of species of chewing lice recorded from mammals in Malaysia. The list includes 13 confirmed species belonging to eight genera (*Bovicola*, *Felicola*, *Gliricola*, *Gyropus*, *Haematomyzus*, *Heterodoxus*, *Loricicola* and *Trichodectes*) from four families (Boopidae, Gyropidae, Haematomyzidae and Trichodectidae) in three suborders (Table 1). Also, we have listed 12 species which possibly occur in Malaysia, because their mammalian hosts are present. We report a new record of the slender guinea pig louse, *Gliricola porcelli* (Schrank, 1781), collected from a pet guinea pig (*Cavia porcellus* (Linnaeus, 1758)) in Peninsular Malaysia. We include a host-lice-list, two distribution maps, and two tables: one listing actual louse records from Malaysia, and another listing mammalian hosts which we recommend to be searched for lice in Malaysia, with louse genera known from them in other countries.

Materials and methods

Tables listing known and potential mammal hosts of Malaysian chewing lice were taken from Price & Graham (1997), Price *et al.* (2003) and other relevant sources. Then, the list was checked against a thorough review of the literature with the aid of Google Scholar. Articles including Malaysian louse species were searched using specific keywords on the web's search engine (*e.g.* “*Heterodoxus spiniger*” + “Malaysia”).

TABLE 1. List of chewing lice recorded from mammals in Malaysia.

Louse suborder & family	Louse species	Peninsular Malaysia	Malaysian Borneo
Amblycera Boopiidae	<i>Heterodoxus spiniger</i>	x	x
Gyropidae	<i>Gliricola porcelli</i>	x	
	<i>Gyropus ovalis</i>	x	
Rhynchophthirina Haematomyzidae	<i>Haematomyzus elephantis</i>	x	
Ischnocera Trichodectidae	<i>Bovicola bovis</i>	x	
	<i>Bovicola caprae</i>	x	
	<i>Bovicola limbatus</i>	x	
	<i>Bovicola ovis</i>	x	
	<i>Felicola siamensis</i>	x	
	<i>Felicola subrostratus</i>	x	x
	<i>Loriscicola mjoebergi</i>	x	x
	<i>Trichodectes canis</i>		x
	<i>Trichodectes emersoni</i>		x

The geographical distribution of the chewing lice was prepared from locality records found in the literature. Species of lice lacking locality information were excluded from the maps (Figures 1 & 2), which were created using the open-source geographical information software: Quantum Geographical Information System (QGIS), and with Malaysian data obtained from the website <https://gadm.org>. Additional legends and visual cues were made using the open-source vector software: Inkscape.

In the following list, the sequence of families, genera and species of lice follows that used by Price *et al.* (2003).

Pattern used for species entries

Name of species author/s, date of publication.

Original genus and species author/s, date: page number, figs

Combinations of species with other genera, date: page number, figs

Current genus and species date: page number, figs

Relevant synonymies, date: page number, figs

Type host:

Malaysian host/s:

Malaysian locality/ies (references): [as in Figs 1–2].

Geographical distribution: [based on host/s]

Remarks: [Additional data on louse taxonomy, host status, host distribution, misidentifications, new records, biology, etc.]

List of chewing louse species from mammals with confirmed records in Malaysia

Suborder AMBLYCERA Kellogg, 1896

Family Boopiidae Mjöberg, 1910

Genus *Heterodoxus* Le Souëf & Bullen, 1902

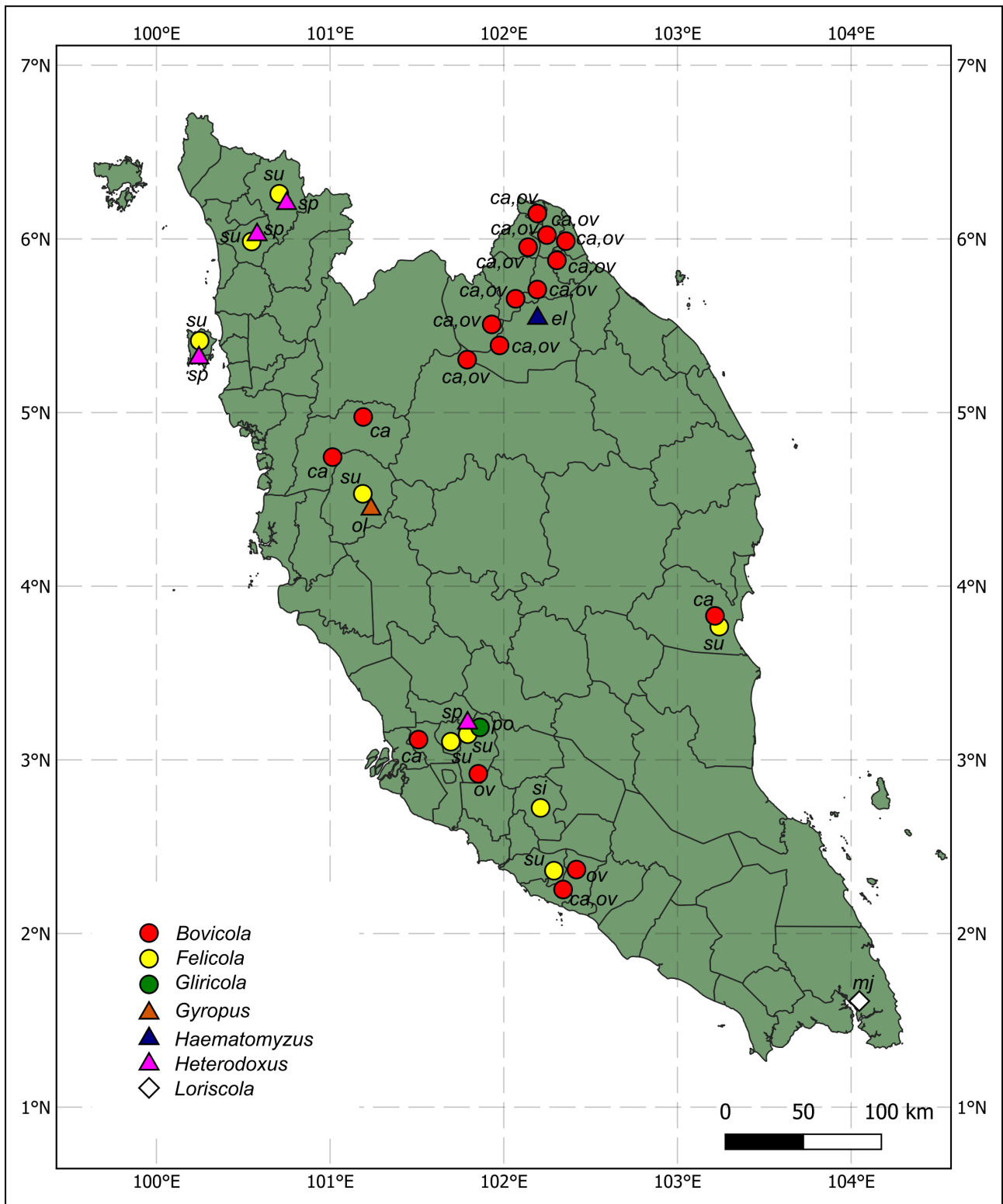


FIGURE 1. Map of Peninsular Malaysia showing the geographical distribution of mammalian chewing lice. Some species were excluded from the map due to the absence of locality information. Abbreviations of louse species: *ca*, *caprae*; *el*, *elephantis*; *mj*, *mjoebergi*; *ol*, *ovalis*; *ov*, *ovis*; *po*, *porcelli*; *si*, *siamensis*; *sp*, *spiniger*; *su*, *subrostratus*. Malaysian map data obtained from the website <https://gadm.org>

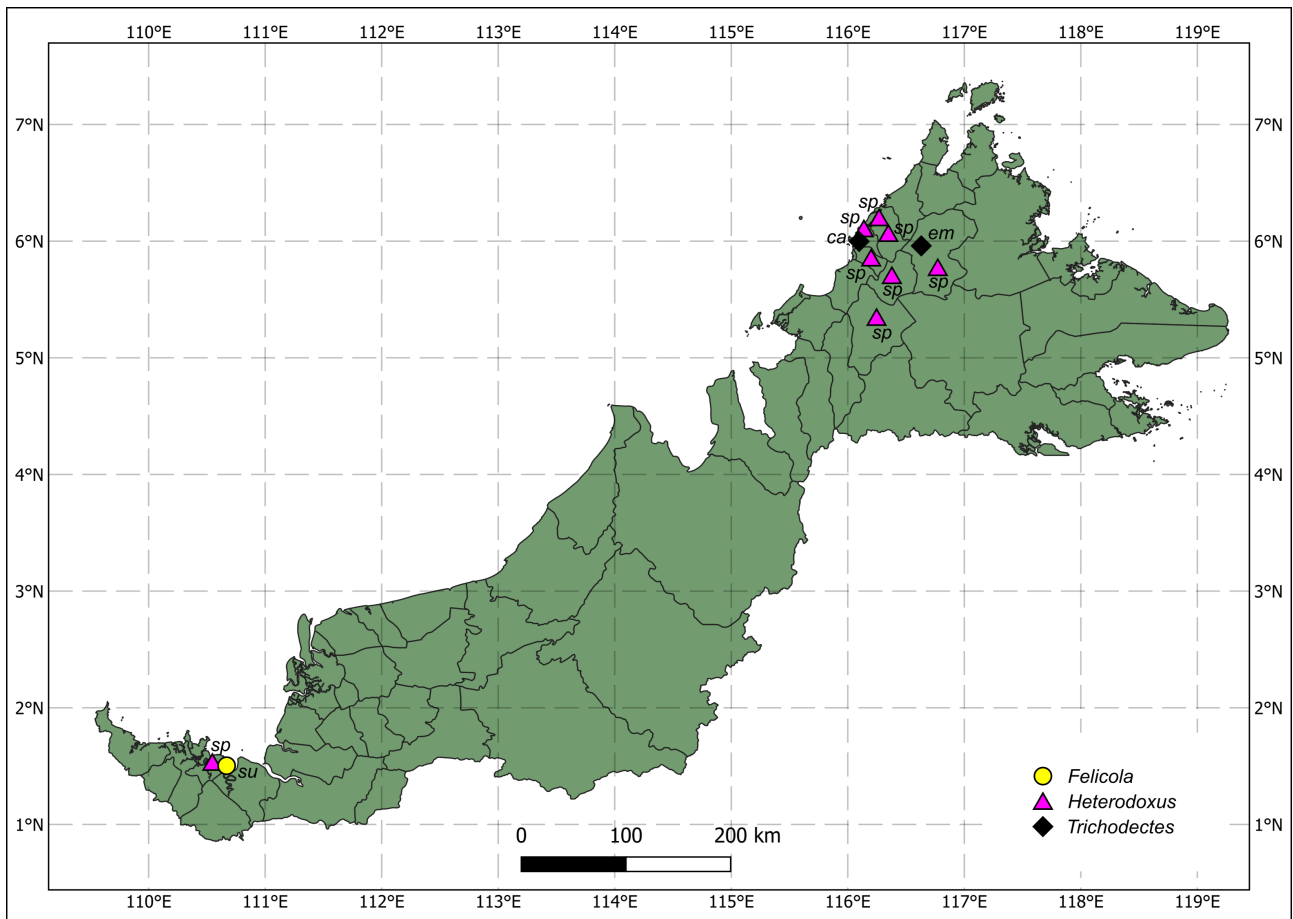


FIGURE 2. Map of Malaysian Borneo showing the geographical distribution of mammalian chewing lice. Some species were excluded from the map due to the absence of locality information. Abbreviations of louse species: *ca*, *canis*; *em*, *emersoni*; *sp*, *spiniger*; *su*, *subrostratus*. Malaysian map data obtained from the website <https://gadm.org>

***Heterodoxus spiniger* (Enderlein, 1909)**

Menopon spiniger Enderlein, 1909: 80, pl. 8: figs 4, 5.

Menopon (Menacanthus) spinigerum Neumann, 1912a: 364, fig. 12.

Heterodoxus armiferus Paine, 1912a: 362, figs A–D.

“*Heterodoxus longitarsus* Werneck, 1936”: 492, figs 126–129. Not *Menopon longitarsus* Piaget, 1880.

Heterodoxus spiniger (Enderlein, 1909); Plomley 1940: 19, pl. 3: figs A–J, pl. 4: figs A–B, D–K, pl. 5: figs A, C–G, pl. 6: figs B–C.

Heterodoxus spiniger (Enderlein, 1909); Werneck 1948: 21, figs 4–5.

Heterodoxus spiniger (Enderlein, 1909); Mustaffa-Babjee, 1969: 37.

Heterodoxus spiniger; Macadam *et al.* 1984: 37.

Heterodoxus spiniger (Enderlein, 1909); Price *et al.* 2003: 74.

Heterodoxus spiniger; Wells *et al.* 2012: 912.

Heterodoxus spiniger; Norhidayu *et al.* 2012: 301.

Type host: “House dog”, presumably *Canis lupus familiaris* Linnaeus, 1758—Domestic dog.

Type locality: Kalahari Desert, Southern Africa.

Malaysian hosts: *Canis lupus familiaris*, *Felis catus* Linnaeus, 1758.

Malaysian localities: Kuala Nerang, Pendang (Kedah) Peninsular Malaysia (Tay *et al.* 2014); Georgetown (Pulau Pinang) Peninsular Malaysia (Norhidayu *et al.* 2012); Keningau, Kota Kinabalu, Penampang, Tambunan, Tamparuli, Tuaran & Ranau (Sabah) Malaysian Borneo (Wells *et al.* 2012); Samarahan (Sarawak) Malaysian Borneo (Ahmad 2013); Ampang (Selangor) Peninsular Malaysia (Tay *et al.* 2014); “West Malaysia”, Peninsular Malaysia (Mustaffa-Babjee 1969).

Geographical distribution: Worldwide except Europe, New Zealand and Antarctica; more prevalent in tropical and subtropical regions.

Remarks: *Heterodoxus spiniger* is a species from an Australian marsupial (Kéler 1971), which has widely transferred to dogs, other canids and civets (Price & Graham 1997; Price *et al.* 2003; Durden 2019). However, a number of studies in Singapore and Peninsular Malaysia have reported infestations of this louse species on domestic cats (Colless 1959; Norhidayu *et al.* 2012; Mohd-Zain *et al.* 2013). Colless (1959) concluded that the transmission of *H. spiniger* to cats was a result of their close contact with dogs, but not due to change of host preference or host adaptation. This statement was further supported by Norhidayu *et al.* (2012), commenting that the long time gap between their discovery and Colless's (1959) report implied that it was a rare occurrence. However, Price & Graham (1997) argued that the infestation of *H. spiniger* on cats was well-established instead of accidental.

Heterodoxus spiniger is known as the intermediate host of several helminthes, most notably the double-pored tapeworm *Dipylidium caninum* (Linnaeus, 1758) (see Norhidayu *et al.* 2012), and the filarial nematode *Acanthocheilonema reconditum* (Grassi, 1889) (see Nelson 1962), although the latter is not known to injure its canine hosts seriously (Price & Graham 1997). Mokhtar *et al.* (2011) reported *Bartonella henselae* (Regnery *et al.*, 1992) from *H. spiniger* using PCR assays. Conversely, Tay *et al.* (2014) detected no rickettsial pathogens from field collected *H. spiniger* in multiple locations in Peninsular Malaysia.

Family Gyropidae Kellogg, 1896

Genus *Gliricola* Mjöberg, 1910

Gliricola porcelli (Schrank, 1781)

Pediculus porcelli Schrank, 1781: 500, pl. 1: fig.1.

Pediculus saviae Schrank, 1803: 186. Unnecessary *nomen novum* for *Pediculus porcelli* Schrank, 1781.

Pediculus bifurcatus Olfers, 1816: 83. Unnecessary *nomen novum* for *Pediculus porcelli* Schrank, 1781.

Gyropus gracilis Nitzsch, 1818: 304. Unnecessary *nomen novum* for *Pediculus porcelli* Schrank, 1781.

Gyropus porcelli perfoliatus Neumann, 1912b: 216.

Gyropus bicaudatus Paine, 1912b: 441, pl. 20: fig. 3.

Gliricola mexicana Zavaleta, 1946: 435, figs 1A–F.

Gliricola porcelli (Schrank, 1781); Werneck 1948: 38.

Gliricola porcelli (Schrank, 1781); Price *et al.* 2003: 76.

Type host: *Cavia porcellus* (Linnaeus, 1758)—Guinea pig.

Type locality: Not given in the original description.

Malaysian host: *Cavia porcellus*.

Malaysian locality: Ampang (Selangor) Peninsular Malaysia (this paper).

Geographical distribution: Worldwide, except Antarctica.

Remarks: *Gliricola porcelli* was collected from a pet guinea pig in a veterinary clinic located in Ampang, Selangor, and identified by the first author (A.-R.K.). This is the first record of *G. porcelli* from Malaysia.

Genus *Gyropus* Nitzsch, 1818

Gyropus ovalis Burmeister, 1838

Gyropus ovalis Burmeister, 1838: 443.

Gyropus turbinatus Piaget, 1880: 612, pl. 50: fig. 7.

Allogyropus turbinatus (Piaget); Ewing, 1924: 20.

Gyropus recifensis Torres, 1938: 279, figs 1–4.

Macrogyropus mexicanus Zavaleta, 1946: 438, figs 2G–L.

Gyropus ovalis Burmeister, 1838; Werneck 1948: 53.

Gyropus ovalis Burmeister, 1838; Cheah 1988: 25.

Gyropus ovalis Burmeister, 1838; Price *et al.* 2003: 77.

Type host: “*Savia* [sic] *cobaya*” = *Cavia porcellus* (Linnaeus, 1758)—Guinea pig.

Type locality: Not given in the original description.

Malaysian host: *Cavia porcellus*.

Malaysian locality: Ipoh (Perak) Peninsular Malaysia (Cheah 1988).

Geographical distribution: Worldwide, except Antarctica.

Remarks: Commonly known as the oval guinea pig louse, *Gyropus ovalis* was reported from laboratory guinea pigs in the Veterinary Research Institute, Ipoh, by Cheah (1988). This is the only record of *G. ovalis* in Malaysia.

Suborder ISCHNOCERA Kellogg, 1896

Family Trichodectidae Kellogg, 1896

Genus *Bovicola* Ewing, 1929

Bovicola bovis (Linnaeus, 1758)

Pediculus bovis Linnaeus, 1758: 611.

Pediculus tauri Linnaeus, 1761: 476. Unnecessary *nomen novum* for *Pediculus bovis* Linnaeus, 1758.

Trichodectes scalaris Nitzsch, 1818: 296. Unnecessary *nomen novum* for *Pediculus bovis* Linnaeus, 1758.

Trichodectes bovis Linnaeus, 1758 [sic]; Harrison 1916: 69.

Bovicola bovis (Linnaeus, 1758); Ewing, 1929: 123.

Bovidoecus bovis (Linnaeus, 1758); Bedford 1929: 519.

Damalinia (Bovicola) bovis (Linnaeus, 1758); Hopkins 1949: 527.

Bovicola bovis (Linnaeus, 1758); Werneck 1950: 63.

Damalinia bovis (Linnaeus, 1758); Mustaffa-Babjee 1969: 37.

Bovicola (Bovicola) bovis (Linnaeus, 1758); Price *et al.* 2003: 253.

Type host: *Bos taurus* Linnaeus, 1758—Domestic cattle.

Type locality: Not given, but Emerson & Price (1975) noted it was in Europe.

Malaysian host: *Bos taurus*.

Malaysian locality “West Malaysia”, Peninsular Malaysia (Mustaffa-Babjee 1969).

Geographical distribution: Worldwide, except Antarctica.

Remarks: *Bovicola bovis* is the only chewing louse parasitic on domestic cattle. Mustaffa-Babjee (1969) recorded *B. bovis* from cattle in Peninsular Malaysia, but without specifying the actual locality. Considering that studies of *B. bovis* in Malaysia are scarce, it is imperative to investigate the prevalence of this species from livestock, as *B. bovis* is known to affect cattle hide quality and cause a number of deteriorating symptoms, such as anemia and malnutrition (Durden 2019).

Bovicola caprae (Gurlt, 1843)

Trichodectes caprae Gurlt, 1843: 3, pl. 1; fig. 2.

Trichodectes climax Nitzsch [in Giebel], 1861a: 81, pl. 1: figs 1–2.

Trichodectes climacium Giebel, 1861b: 292. Unnecessary *nomen novum* for *Trichodectes climax* Nitzsch [in Giebel], 1861a.

Trichodectes mambricus Rudow, 1866: 111, pl. 6: fig. 2.

Trichodectes solidus Rudow, 1866: 112, pl. 7: fig. 2.

Trichodectes caprae (Gurlt, 1843); Packard 1870: 96, fig. 28.

Trichodectes climax truncata Piaget, 1880: 393.

Trichodectes peregrinus Taschenberg, 1882: 218, pl. 7: fig. 10.

Bovicola caprae (Gurlt, 1843); Ewing 1929: 123, 193.

Bovidoecus caprae (Gurlt, 1843); Bedford 1929: 519.

Bovicola climax Nitzsch [sic]; Kéler 1937: 317.

Damalinia (Bovicola) caprae (Gurlt, 1843); Hopkins 1949: 532.

Damalinea caprae (Gurlt, 1843); Mustaffa-Babjee 1969: 37.
Bovicola (Bovicola) caprae (Gurlt, 1843); Price *et al.* 2003: 253.
Bovicola caprae (Gurlt, 1843); Syamsul *et al.* 2020: 51, fig. 2A.
Type host: *Capra hircus* Linnaeus, 1758—Domestic goat.
Type locality: Not given, but Emerson & Price (1975) noted it was in Europe.
Malaysian host: *Capra hircus*.

Malaysian localities: Bachok, Gua Musang, Jeli, Kota Bharu, Kuala Krai, Machang, Pasir Mas, Pasir Puteh, Tanah Merah, Tumpat (Kelantan) Peninsular Malaysia (Syamsul *et al.* 2020); Ayer Keroh (Melaka) Peninsular Malaysia (this paper); Kuantan (Pahang) Peninsular Malaysia (this paper); Chemor, Kuala Kangsar (Perak) Peninsular Malaysia (this paper), Shah Alam (Selangor) Peninsular Malaysia (this paper).

Geographical distribution: Worldwide except Antarctica.

Remarks: Although *Bovicola caprae* is well known for its worldwide distribution, studies of this species in Malaysia are scarce, particularly in Malaysian Borneo (Mustaffa-Babjee, 1969). Syamsul *et al.* (2020) collected and identified *B. caprae* from farmed goats in multiple districts in Kelantan. Here, we report several new records of this species in four states of Peninsular Malaysia, namely Melaka, Pahang, Perak and Selangor.

***Bovicola limbatus* (Gervais, 1844)**

Trichodectes limbatus Gervais, 1844: 313, pl. 48: fig. 4.
Trichodectes climax major Piaget, 1885: 86, pl. 9: fig. 5.
Trichodectes madagascariensis Mjöberg, 1910: 64, figs 38–39.
Trichodectes painei Kellogg & Nakayama, 1914: 90, figs 1A–D.
Bovicola limbatus (Gervais, 1844); Ewing, 1929: 123.
Bovidoecus painei (Kellogg & Nakayama, 1914); Bedford 1929: 519.
Bovicola painei (Kellogg & Nakayama, 1914); Bedford 1932b: 362.
Bovicola major (Piaget); Emerson 1940: 105.
Bovicola sachtlebeni Kéler, 1937: 314, figs 1–2.
Bovicola wernecki Kéler, 1937: 317.
Damalinea (Bovicola) limbata (Gervais, 1844); Hopkins 1949: 504, 533.
Bovicola limbatus (Gervais, 1844); Werneck 1950: 62.
Damalinea limbata (Gervais, 1844); Mustaffa-Babjee 1969: 37.
Bovicola (Bovicola) limbatus (Gervais, 1844); Price *et al.* 2003: 253.
Type host: *Capra hircus angorensis* (Shaw, 1800)—Angora goat.
Type locality: Not given in the original description.

Malaysian host: *Capra hircus* Linnaeus, 1758.

Malaysian locality: “West Malaysia”, Peninsular Malaysia (Mustaffa-Babjee 1969).

Geographical distribution: Worldwide, except Antarctica.

Remarks: *Bovicola limbatus* and *B. caprae* and both common parasites of goats (Durden, 2019) and morphologically similar. Sebei *et al.* (2004) separated the males of *Bovicola limbatus* and *B. caprae* by the morphology of their gonopods (*e.g.* presence of terminal flaps in *B. caprae*, but absent in *B. limbatus*). In Peninsular Malaysia, only one record of *B. limbatus* has been reported by Mustaffa-Babjee (1969); however, considering that there are no figures and no mention of genitalia or gonopods of the male, it is not possible to determine with certainty the species that Mustaffa-Babjee (1969) examined. Further studies are needed to investigate the occurrence and prevalence of *B. limbatus* and *B. caprae* in Malaysia.

***Bovicola ovis* (Schrank, 1781)**

Pediculus ovis Schrank, 1781: 502, pl. 1: figs 8–9.
Pediculus ovisarietis Schrank, 1803: 187. Unnecessary *nomen novum* for *Pediculus ovis* Schrank, 1781.
Pediculus sphaerocephalus Olfers, 1816: 85. Unnecessary *nomen novum* for *Pediculus ovis* Schrank, 1781.
Trichodectes sphaerocephalus (Olfers, 1816); Nitzsch 1818: 296.
Trichodectes ovis Schrank, 1781 [sic]; Harrison 1916: 71.
Bovicola ovis (Schrank, 1781); Werneck 1950: 73, figs 54–56.
Bovicola (Bovicola) ovis (Schrank, 1781); Price *et al.* 2003: 66, 253, fig. 248.

Bovicola ovis (Schrank, 1781); Syamsul *et al.* 2020: 51, fig. 2C.

Type host: “Ove ariete” = *Ovis aries* Linnaeus, 1758—Sheep.

Type locality: Not given, but Emerson & Price (1975) noted it was in Europe.

Malaysian host: *Ovis aries*.

Malaysian localities: Bachok, Gua Musang, Jeli, Kota Bharu, Kuala Krai, Machang, Pasir Mas, Pasir Puteh, Tanah Merah, Tumpat (Kelantan) Peninsular Malaysia (Syamsul *et al.* 2020); Ayer Keroh, Jasin (Melaka) Peninsular Malaysia (this paper); Beranang (Selangor) Peninsular Malaysia (this paper).

Geographical distribution: Worldwide except Antarctica.

Remarks: Here, we report two new records of *Bovicola ovis* from farmed sheep in the state of Selangor and in southern Melaka.

Genus *Felicola* Ewing, 1929

Felicola siamensis Emerson, 1964

Felicola siamensis Emerson, 1964a: 4, figs 1–3.

Felicola (Loriscicola) siamensis Emerson, 1964a; Price *et al.* 2003: 258.

Felicola (Lyalicola) siamensis Emerson, 1964a; Mey 2021: 199.

Type host: *Prionailurus bengalensis* (Kerr, 1792)—Leopard cat.

Type locality: Kuala Pilah, Negeri Sembilan, Peninsular Malaysia.

Malaysian host: *Prionailurus bengalensis*.

Malaysian locality: Kuala Pilah (Negeri Sembilan) Peninsular Malaysia (Emerson 1964a).

Geographical distribution: Peninsular Malaysia.

Remarks: The adult male and female of *Felicola siamensis* were described by Emerson (1964a), noting that they were morphologically similar to *Felicola hercynianus* Kéler, 1957, with the former species easily distinguished by the fewer number of setae on abdominal sternites and tergites IV–VII in the females, and the narrower basal junction between the endomera in the male genitalia (Emerson 1964a). There is no information on the ecology of *F. siamensis*.

Felicola subrostratus (Burmeister, 1838)

Trichodectes subrostratus Burmeister, 1838: 438, Species 4.

Felicola subrostrata (Nitzsch, 1818); Ewing 1929: 122.

Felicinia subrostrata (Nitzsch, 1818); Bedford 1929: 519.

Felicola rostrata Bedford, 1932a: 360, figs 6A, 6B, a, 6C.

Felicola subrostratus (Burmeister, 1838); Werneck 1950: 194, figs 317.

Felicola subrostratus (Burmeister, 1838); Mustaffa-Babjee 1969: 37.

Felicola subrostratus (Burmeister, 1838); Amin-Babjee 1978: 107.

Felicola subrostratus (Burmeister, 1838); Shanta *et al.* 1980: 17–27.

Felicola (Felicola) subrostratus (Burmeister, 1838); Price *et al.* 2003: 258.

Felicola subrostrata [sic]; Norhidayu 2012: 69, 71, 75, tables 3.1, 3.6–3.9.

Felicola subrostratus; Norhidayu 2012: 31, figs 1.3, 3.2.

Felicola subrostratus (Burmeister, 1838); Che Kamaruddin *et al.* 2020: 1212, fig. 2A.

Type host: “Hauskatze” = *Felis catus* Linnaeus, 1758—Domestic cat.

Type locality: Not given in the original description.

Malaysian host: *Felis catus*.

Malaysian localities: Kuala Nerang, Pendang (Kedah) Peninsular Malaysia (Tay *et al.* 2014); Kuala Lumpur, Peninsular Malaysia (Norhidayu 2012; Mohd-Zain *et al.* 2013); Melaka, Peninsular Malaysia (Mohd-Zain *et al.* 2013); Kuantan (Pahang) Peninsular Malaysia (Norhidayu 2012; Mohd-Zain *et al.* 2013); Ipoh (Perak) Peninsular Malaysia (Shanta *et al.* 1980; Norhidayu 2012); Georgetown (Pulau Pinang) Peninsular Malaysia (Norhidayu 2012; Mohd-Zain *et al.* 2013; Tay *et al.* 2014); Samarahan (Sarawak) Malaysian Borneo (Ahmad 2013; Che Kamaruddin *et al.* 2020); Ampang (Selangor) Peninsular Malaysia (Tay *et al.* 2014); Selangor, Peninsular Malaysia (Amin-Babjee 1987); “West Malaysia”, Peninsular Malaysia (Mustaffa-Babjee 1969).

Geographical distribution: Worldwide except Antarctica.

Remarks: Reports of *Felicola subrostratus* in Malaysia are abundant, albeit mostly in prevalence studies rather than experimental vector transmission or phylogenetic analyses (Amin-Babjee 1978; Shanta *et al.* 1980; Norhidayu *et al.* 2012; Mohd-Zain *et al.* 2013; Colella *et al.* 2020). The cat louse was first reported from cats in Peninsular Malaysia by Mustaffa-Babjee (1969). Norhidayu (2012) recorded *F. subrostratus* from stray cats in four main cities in Peninsular Malaysia, this species being the second most prevalent ectoparasite collected in that survey. Tay *et al.* (2014) attempted to isolate and molecularly identify rickettsial pathogens from *F. subrostratus* collected in Pulau Pinang, Selangor and Terengganu, but the results showed no rickettsial *omp* genes. Low *et al.* (2017) reported a potentially new species of tapeworm of the genus *Dipylidium* from *F. subrostratus*.

Genus *Loriscicola* Bedford, 1936

Loriscicola mjobergi (Stobbe, 1913)

Trichodectes mjobergi Stobbe, 1913: 379, figs 8a–b.

Trichodectes brachycephalus Ewing, 1930: 120.

Loriscicola mjobergi (Stobbe, 1913); Bedford 1936: 52.

Meganarion mjobergi (Stobbe, 1913); Kéler 1938: 465.

Meganarion brachycephalus (Ewing, 1930); Kéler 1938: 465.

Loriscicola mjobergi (Stobbe, 1913); Werneck 1950: 3, figs 2–8, 8A.

Felicola (*Loriscicola*) *mjobergi* (Stobbe, 1913); Price *et al.* 2003: 258.

Loriscicola mjobergi [sic] (Stobbe, 1913); Mey 2021: 194, figs 1–5, 7–17, tables 1–2.

Type host: *Nycticebus borneanus* (Lyon, 1906)—Bornean slow loris [see Mey 2021: 184].

Type locality: “Nord-Borneo” = Sabah, Malaysian Borneo.

Malaysian hosts: *Nycticebus borneanus*, *Nycticebus coucang* (Boddaert, 1785) [see Mey 2021: 184].

Malaysian localities: Kota Tinggi (Johor) Peninsular Malaysia (Ewing 1930); Sabah, Malaysian Borneo (Stobbe 1913).

Geographical distribution: Southeast Asia.

Remarks: Mey (2021) discussed the taxonomic status of *Loriscicola mjobergi* in great detail, including a complete morphological description and a discussion about its hosts. Also, Mey (2021) questioned the validity of the two hosts listed above, based on their known geographical distribution.

Genus *Trichodectes* Nitzsch, 1818

Trichodectes canis (De Geer, 1778)

Ricinus canis De Geer, 1778: 81, pl. 4: fig. 16.

Pediculus canis O. Fabricius, 1780: 215.

Trichodectes latus Nitzsch, 1818: 296.

Trichodectes octopunctatus Denny, 1852: 29. Unnecessary *nomen novum* for *Trichodectes latus* Nitzsch, 1818.

Trichodectes Riveti [sic] Neumann, 1913: 614, figs 7–8.

Trichodectes floridanus McGregor, 1917: 168, pl. 16: figs 3, 5.

Trichodectes latifrons Fahrenholz, 1919: 363.

Trichodectes canis (De Geer, 1778); Werneck 1948: 111.

Trichodectes canis; Macadam *et al.* 1984: 37.

Trichodectes canis (De Geer, 1778); Price *et al.* 2003: 274, fig. 264.

Type host: *Canis lupus familiaris* Linnaeus, 1758—Domestic dog.

Type locality: Europe.

Malaysian host: *Canis lupus familiaris*.

Malaysian locality: Kota Kinabalu (Sabah) Malaysian Borneo (Macadam *et al.* 1984).

Geographical distribution: Worldwide, except Antarctica.

Remarks: *Trichodectes canis* is a prevalent parasite of dogs (Durden 2019), that also parasitises several other hosts (Price *et al.* 2003: 274). The only record of *T. canis* in Malaysia is from domestic dogs in multiple locations of Sabah, Malaysian Borneo (Macadam *et al.* 1984). Whether *T. canis* in Malaysia is more prevalent on hosts in forest areas, as shown by Macadam *et al.* (1984), needs to be confirmed.

***Trichodectes emersoni* Hopkins, 1960**

Trichodectes (Trichodectes) emersoni Hopkins, 1960: 93, figs 11–13; pl. 1: fig. 4; pl. 2: figs 5–6.

Trichodectes emersoni Hopkins, 1960; Price *et al.* 2003: 274.

Type host: “*Helictis orientalis everetti*” = *Melogale everetti* (Thomas, 1895)—Bornean ferret badger.

Type locality: Gunung Kinabalu (Sabah) Malaysian Borneo.

Malaysian host: *Melogale everetti*.

Malaysian locality: Gunung Kinabalu (Sabah) Malaysian Borneo (Hopkins 1960).

Geographical distribution: Malaysian Borneo.

Remarks: As there are no other records of *T. emersoni*, it appears the geographical distribution of this louse is restricted to the northern region of the Malaysian Borneo.

Suborder Rhynchophthirina Ferris, 1931

Family Haematomyzidae Enderlein, 1904

Genus *Haematomyzus* Piaget, 1869

***Haematomyzus elephantis* Piaget, 1869**

Haematomyzus elephantis Piaget, 1869: 254.

Haematomyzus longirostris Piaget, 1869: 254.

Idolocoris elephantis Walker, 1872: 132, fig. 67.

Phantasmocoris elephantis (Walker, 1872); White 1872: 234.

Haematomyzus proboscideus Piaget, 1880: 658, pl. 49: figs 2, 2h.

Haematomyzus paradoxus Lahille, 1908: 189, figs 1–9.

Haematomyzus elephantis sumatranus Fahrenholz, 1910: 714.

Haematomyzus elephantis elephantis Piaget, 1869; Hopkins 1949: 521.

Haematomyzus elephantis Piaget, 1869; Werneck 1950: 199, figs 306–315.

Haematomyzus elephantis Piaget, 1869; Jeffery *et al.* 1999: 51.

Haematomyzus elephantis Piaget, 1869; Price *et al.* 2003: 79.

Type host: *Loxodonta africana* (Blumenbach, 1797)—Bush African elephant.

Type locality: Rotterdam Zoo, Netherlands.

Malaysian host: *Elephas maximus indicus* Cuvier, 1798.

Malaysian locality: Kuala Krai (Kelantan) Peninsular Malaysia (Jeffery *et al.* 1999).

Geographical distribution: Central and southern Africa, and Southeast Asia.

Remarks: Jeffery *et al.* (1999) collected *Haematomyzus elephantis* from a captive Indian elephant in the Kuala Krai Mini Zoo. As Indian elephants are native in both Peninsular Malaysia and Malaysian Borneo, it is likely that *H. elephantis* will be found parasitising free-living elephants in Malaysia.

Chewing lice not recorded from Malaysia, but known elsewhere from mammalian hosts present in this country

***Bovicola equi* (Denny, 1842)**

Bovicola equi is the only chewing louse known to infest horses (Price & Graham 1997; Price *et al.* 2003). Although horses are not native in Malaysia, the importation of these animals for recreational purposes implies that *B. equi* may be present in the country. Further research is needed to determine the presence and prevalence of *B. equi* in both Peninsular Malaysia and Malaysian Borneo.

***Damalinia muntiaca* (Séguy, 1948)**

The detailed type locality of *Damalinia muntiaca* is uncertain, as Séguy (1948) wrote that the type specimens were from a captive red muntjac (*Muntiacus muntjak* (Zimmermann, 1780)) originally from “d’Indo-Malaise” (= Indo-Malaya). The red muntjac is distributed in Southeast Asia, including Malaysia, where it has been listed as a non-endangered species by the Malaysian Department of Wildlife and National Parks (PERHILITAN 2010, 2017). Hence, it is possible that *D. muntiaca* occurs in Malaysia.

***Damalinia thompsoni* (Bedford, 1936)**

Bedford (1936) described *Damalinia thompsoni* based on females collected from the Sumatran serow (*Capricornis sumatraensis* (Bechstein, 1799)) in Sumatra, Indonesia. Emerson (1964b) identified a male and females from the Formosan serow (*Capricornis swinhoei* Gray, 1862) in Taiwan as *D. thompsoni*, but the male from the type host was still unknown (Emerson, 1964b). *Capricornis sumatraensis* is distributed from the Himalayas to Southeast Asia, including Malaysia, and is listed as a vulnerable species by the *International Union for Conservation of Nature* (IUCN) (Phan *et al.* 2020). However, it is still possible that *D. thompsoni* will be found in Malaysia.

***Damalinia traguli* Werneck, 1950**

Werneck (1950) described the adult male and female of *Damalinia traguli* from the greater mousedeer (*Tragulus napu borneanus* Miller, 1902) collected in Kendawangan, West Kalimantan, Indonesian Borneo, as well as on other *Tragulus* species from Sumatra, Indonesia. Also, *Damalinia traguli* was reported from the Javan mousedeer (*Tragulus javanicus* (Osbeck, 1765)) in Sumatra (Emerson & Price 1981). *Tragulus javanicus* and *T. napu borneanus* are both native in Malaysia (Abdullah & Mammalian Research Group 2013; Duckworth *et al.* 2015; Timmins & Duckworth 2015), therefore there is a possibility that *D. traguli* is also present in this country.

***Felicola aspidorhynchus* (Werneck, 1948)**

Werneck (1948) described the adult male and female of *Felicola aspidorhynchus* from the banded linsang (*Prionodon linsang* (Hardwicke, 1821)) collected in eastern Sumatra, Indonesia. This host is distributed in Southeast Asia, particularly southern Myanmar, Thailand, Peninsular Malaysia, the Sumatran region of Indonesia and Borneo (Duckworth *et al.* 2016a). Given that *P. linsang* is native in Malaysia (Abdullah & Mammalian Research Group 2013), it is possible that *F. aspidorhynchus* occurs in this country.

***Felicola bengalensis* (Werneck, 1948)**

The type host of *Felicola bengalensis* is the Asian palm civet (*Paradoxurus hermaphroditus* (Pallas, 1777)), with a wide distribution from India to Southeast Asia. Werneck (1948) gave the type locality as “*de Pulo Terutan, na costa ocidental da peninsula de Malaca, Sião*” = “from Pulo Terutan, on the western coast of the Malacca Peninsula, Siam”. The name “Pulo Terutan” refers to the Ko Tarutao Island in Thailand, located approximately 10 kilometers north of Pulau Langkawi in Peninsular Malaysia. Furthermore, Changbunjong *et al.* (2010, 2011) did not mention any material of *F. bengalensis* from Malaysia. However, considering that the type host does occur in Malaysia, this louse species may be found in this country.

***Felicola juccii* (Conci, 1942)**

Conci (1942) described the adult male and female of *Felicola juccii* from *Paguma larvata grayi* (Bennett, 1835), a subspecies of the masked palm civet collected in Myanmar. Emerson (1964b) reported *F. juccii* from the Formosan masked palm civet (*Paguma larvata taivana* Swinhoe, 1862) in Taiwan. Several subspecies of the masked palm civet are widely distributed in the Oriental region (Duckworth *et al.* 2016b). More studies are needed to determine the actual geographical distribution of *F. juccii*, especially if it parasitises any of the two subspecies living in Malaysia.

***Felicola malaysianus* (Werneck, 1948)**

Werneck (1948) described the adult male and female of *Felicola malaysianus* collected from the otter-civet, *Cynogale bennettii* Gray, 1836 in Sumatra, Indonesia. *Cynogale bennettii* is an endangered species distributed in Peninsular Malaysia, Borneo and Sumatra (Indonesia) (Ross *et al.* 2015). More parasite surveys are needed to determine if this louse species is present in Peninsular Malaysia and/or Malaysian Borneo.

***Felicola rohani* Werneck, 1956**

Werneck (1956) described the adult male and female of *Felicola rohani* from the Indian grey mongoose *Herpestes edwardsii* (Geoffroy Saint-Hilaire, 1818) introduced into the island of Mauritius by human agency. The natural distribution of *H. edwardsii* is in the eastern part of Saudi Arabia and the Indian subcontinent (Mudappa & Choudhury 2016). Other host species for *F. rohani* include the Javan mongoose (*Herpestes javanicus* (Geoffroy Saint-Hilaire, 1818)) and the crab-eating mongoose (*Herpestes urva* Hodgson, 1836) (Price *et. al.* 2003). These two *Herpestes* species are native in Malaysia (Abdullah & Mammalian Research Group 2013; PERHILITAN 2010, 2017), therefore we hypothesize that *F. rohani* occurs in Malaysia.

***Felicola sumatrensis* (Werneck, 1948)**

The type host of *Felicola sumatrensis* is the banded linsang (*Prionodon linsang*), which is also the type host of *Felicola aspidorhynchus*. Similarly, *Felicola sumatrensis* has been reported only from Sumatra, Indonesia (Werneck 1948). Given that *P. linsang* is distributed across a large part of Southeast Asia, it is possible that *F. sumatrensis* occurs in Malaysia.

***Tricholipeurus indicus* Werneck, 1950**

Werneck (1950) described the adult male and female of *Tricholipeurus indicus* from the Indian muntjac (*Muntiacus muntjak*, but expressed doubt about the identity of the type host because *T. indicus* belonged in a group of species from the Americas. However, Price *et al.* (2003) listed Reeve's muntjac (*Muntiacus reevesi* Ogilby, 1839) as an additional host of *T. indicus*, a mammal which also occurs in eastern Asia. As stated above under *Damalinia muntiaci*, the red muntjac is distributed in Southeast Asia, including Malaysia. Considering that Malaysian researchers have frequently studied the ectoparasites of small mammals (Mariana *et al.* 2005, 2008; Madinah *et al.* 2011, 2013, 2014; Mohd-Taib *et al.* 2021), it is highly recommended that future parasite surveys should focus on large mammals, such as muntjacs, to determine whether *Tricholipeurus indicus* is present in Malaysia.

***Trimenopon hispidum* (Burmeister, 1838)**

Trimenopon hispidum is a widely distributed species recorded on domestic and wild guinea pigs (*Cavia porcellus*) (Emerson & Price 1981; Price & Graham 1997). More parasite surveys of guinea pigs are needed in Malaysia to determine whether *T. hispidum* is present in the country.

Discussion

As discussed in our paper on sucking lice of Malaysian mammals (Kazim *et al.* 2022), surveys of ectoparasites in this country often dealt with small mammals, mainly recording ticks and mites rather than lice (Shabrina 1990; Mariana *et al.* 2008; Madinah *et al.* 2014). Considering that among the 13 species of chewing lice recorded in Malaysia, nine species were introduced by humans, gives a clear picture of the dearth of data on chewing lice from native mammals in this country. Figures 1 and 2 show the patchy distribution of the louse genera and species in Peninsular Malaysia and Malaysian Borneo, respectively. Even in the case of introduced species of chewing lice, considering that they are all of veterinary importance, our knowledge is scarce for most of them.

One important factor contributing to the scarce research on mammalian chewing lice in Malaysia is the lack of dedicated louse taxonomists. Published surveys and other research which we have included in this checklist have mostly been made by general parasitologists or biodiversity experts researching the prevalence of endo- and ectoparasites from companion animals, livestock and some small mammals.

Lack of interest on studying chewing lice may be another cause for the scarce knowledge about this group of ectoparasites in Malaysia, probably because of the public stigma that lice carry as vectors of diseases, even though chewing lice do not affect humans (Nelson 1962; Mokhtar *et al.* 2011).

The large areas without louse records shown in both maps (Figs 1 and 2) have not been explored for louse studies, not only for lack of interest but, also, because of lack of funding. These uncharted areas, where most wild mammals roam and reproduce, are montane and forested, hence more difficult to access. Research on the lice of Malaysian wild mammals would be beneficial, as some of them are already vulnerable or endangered, such as the

Malayan tiger (*Panthera tigris*), the mainland serow (*Capricornis sumatraensis*) and the sambar (*Cervus unicolor*) (PERHILITAN 2010, 2017).

We included a list of chewing louse species which possibly occur in Malaysia—based on the occurrence of their hosts, all native in this country—in the hope that it will stimulate more research, especially on those hosts. Furthermore, Table 2 includes all other mammalian hosts still without records of lice in Malaysia, with the genera of lice known to occur in other countries. This list shows great gaps of knowledge indicative of a lack of targeted research in this country. According to the list of mammals by Abdullah & Mammalian Research Group (2013), the majority of mammal species in Malaysia are murine rodents, but most of these species are not known to harbour chewing lice, in particular those in speciose genera—such as *Rattus* and *Mus*—which have been thoroughly searched for ectoparasites in many countries (Price *et al.* 2003). Currently, only four species in two genera of murine rodents (*Kunsia* and *Thomasomys*) are known to be infested by chewing lice, in contrast to other rodent families, such as the Geomyidae (see Price *et al.* 2003). However, even if the rodents are not included, there are 40 species of potential hosts of chewing lice in Malaysia (Table 2).

TABLE 2. List of mammalian host species without records of lice in Malaysia, and chewing louse genera known from other countries.

Host family	Host species	Louse genus
Bovidae	<i>Bos gaurus</i> (Gaur)	<i>Bovicola</i> Ewing, 1929
	<i>Bos javanicus</i> (Banteng)	
	<i>Bubalus bubalis</i> (Water buffalo)	
Equidae	<i>Capricornis sumatraensis</i> (Sumatran serow)	<i>Damalinia</i> Mjöberg, 1910
	<i>Equus caballus</i> (Horse)*	<i>Werneckiella</i> Eichler, 1940
	<i>Equus asinus</i> (Donkey)*	
Muridae	<i>Bandicota bengalensis</i> (Lesser bandicoot rat)	<i>Cummingsia</i> Ferris, 1922
	<i>Bandicota indica</i> (Greater bandicoot rat)	
	<i>Berylmys bowersi</i> (Bower's white-toothed rat)	
	<i>Chiropodomys gliroides</i> (Pencil-tailed tree-mouse)	
	<i>Chiropodomys major</i> (Large pencil-tailed tree-mouse)	
	<i>Chiropodomys muroides</i> (Grey-bellied pencil-tailed tree-mouse)	
	<i>Chiropodomys pusillus</i> (Lesser pencil-tailed tree-mouse)	
	<i>Haeromys margarettae</i> (Ranee mouse)	
	<i>Hapalomys longicaudatus</i> (Marmoset rat)	
	<i>Lenothrix canus</i> (Grey tree rat)	
	<i>Leopoldamys edwardsi</i> (Edwards's long-tailed giant rat)	
	<i>Leopoldamys sabanus</i> (Long-tailed giant rat)	
	<i>Maxomys alticola</i> (Mountain spiny rat)	
	<i>Maxomys baeodon</i> (Small spiny rat)	
	<i>Maxomys inas</i> (Malayan mountain spiny rat)	
	<i>Maxomys ochraceiventer</i> (Chestnut-bellied spiny rat)	
	<i>Maxomys rajah</i> (Brown spiny rat)	
	<i>Maxomys surifer</i> (Red spiny rat)	
	<i>Maxomys tajuddini</i> (Tajuddin's spiny rat)	
	<i>Maxomys whiteheadi</i> (Whitehead's spiny rat)	
<i>Mus caroli</i> (Ricefield mouse)		
<i>Mus musculus</i> (House mouse)		
<i>Niviventer cameroni</i> (Cameron Highlands white-bellied rat)		
<i>Niviventer cremoriventer</i> (Dark-tailed tree rat)		

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TABLE 2. (Continued)

Host family	Host species	Louse genus
Muridae	<i>Niviventer niviventer</i> (White-bellied rat)	<i>Cummingsia</i> Ferris, 1922
	<i>Niviventer rapit</i> (Long-tailed mountain rat)	
	<i>Pithecheir melanura</i> (Monkey-footed rat)	
	<i>Rattus annandalei</i> (Annandale's rat)	
	<i>Rattus argentiventer</i> (Ricefield rat)	
	<i>Rattus baluensis</i> (Summit rat)	
	<i>Rattus exulans</i> (Polynesian rat)	
	<i>Rattus norvegicus</i> (Brown rat)	
	<i>Rattus rattus</i> (Black rat)	
	<i>Rattus tiomanicus</i> (Malayan field rat)	
	<i>Rhizomys pruinosus</i> (Hoary bamboo rat)	
	<i>Rhizomys sumatrensis</i> (Large bamboo rat)	
	<i>Sundamys infraluteus</i> (Mountain giant Sunda rat)	
<i>Sundamys muelleri</i> (Müller's giant Sunda rat)		
Cervidae	<i>Cervus timorensis</i> (Javan rusa)*	<i>Bovicola</i> Ewing, 1929
	<i>Cervus unicolor</i> (Sambar deer)	<i>Damalinia</i> Mjöberg, 1910
	<i>Muntiacus atherodes</i> (Bornean yellow muntjac)	<i>Tricholipeurus</i> Bedford, 1929
	<i>Muntiacus muntjak</i> (Red muntjac)	
Tragulidae	<i>Tragulus javanicus</i> (Javan mousedeer)	<i>Damalinia</i> Mjöberg, 1910
	<i>Tragulus kanchili</i> (Lesser mousedeer)	
	<i>Tragulus napu</i> (Greater mousedeer)	
Hystriidae	<i>Hystrix brachyuran</i> (Common porcupine)	<i>Eutrichophilus</i> Mjöberg, 1910
	<i>Hystrix crassispinis</i> (Thick-spined porcupine)	
	<i>Trichys fasciculata</i> (Long-tailed porcupine)	
Felidae	<i>Panthera pardus</i> (Clouded leopard)	<i>Felicola</i> Ewing, 1929
	<i>Panthera tigris</i> (Malayan tiger)	
	<i>Pardofelis badia</i> (Bay cat)	
	<i>Pardofelis marmorata</i> (Marbled cat)	
	<i>Pardofelis temminckii</i> (Golden cat)	
Mustelidae & Mephitidae	<i>Arctonyx collaris</i> (Hog badger)	
	<i>Amblonyx cinereus</i> (Oriental small-clawed otter)	<i>Neotrichodectes</i> Ewing, 1929
	<i>Lutra lutra</i> (Eurasian otter)	<i>Lutridia</i> Kéler, 1938
	<i>Lutra sumatrana</i> (Hairy-nosed otter)	<i>Paratrichodectes</i> Lyal, 1985
	<i>Lutrogale perspicillata</i> (Smooth-coated otter)	<i>Stachiella</i> Kéler, 1938
		<i>Trichodectes</i> Nitzsch, 1818
	<i>Mydaus javanensis</i> (Malayan stink badger)	
<i>Mustela nudipes</i> (Malay weasel)		

.....continued on the next page

TABLE 2. (Continued)

Host family	Host species	Louse genus
Viverridae	<i>Arctogalidia trivirgata</i> (Small-toothed palm civet)	<i>Neofelicola</i> Werneck, 1948
	<i>Cynogale bennettii</i> (Otter civet)	<i>Felicola</i> Ewing, 1929
	<i>Diplogale hosei</i> (Hose's civet)	<i>Trichodectes</i> Nitzsch, 1818
	<i>Hemigalus derbyanus</i> (Banded palm civet)	
	<i>Paguma larvata</i> (Masked palm civet)	
	<i>Paradoxurus hermaphroditus</i> (Common palm civet)	
	<i>Viverra megaspila</i> (Large spotted civet)	
	<i>Viverra tangalunga</i> (Malay civet)	
	<i>Viverra zibetha</i> (Large Indian civet)	
	<i>Viverricula indica</i> (Small Indian civet)	
Prionodontidae	<i>Prionodon linsang</i> (Banded linsang)	<i>Felicola</i> Ewing, 1929
Herpestidae	<i>Herpestes brachyurus</i> (Short-tailed mongoose)	<i>Felicola</i> Ewing, 1929
	<i>Herpestes edwardsii</i> (Indian grey mongoose)	
	<i>Herpestes hosei</i> (Hose's mongoose)	
	<i>Herpestes javanicus</i> (Javan mongoose)	
	<i>Herpestes semitorquatus</i> (Collared mongoose)	
	<i>Herpestes urva</i> (Crab-eating mongoose)	
Ursidae	<i>Helarctos malayanus</i> (Malayan sun bear)	<i>Trichodectes</i> Nitzsch, 1818

* Introduced by human agency

In conclusion, targeted studies on chewing lice from mammals would be beneficial, not only to improve our knowledge of the Malaysian biodiversity but, also, to study host-parasite ecology and to find any pathological risk that these lice may impose on host health and fitness, especially on domestic and endangered species.

Host-lice list

Host taxa are listed in alphabetical order according to order and family. Louse taxa are listed under each host in alphabetical order according to genera. Vernacular names of host species are given in English and Malay.

ORDER ARTIODACTYLA

FAMILY BOVIDAE

Bos taurus Linnaeus, 1758

Bovicola bovis (Linnaeus, 1758)

Domestic cattle—Lembu

Capra hircus Linnaeus, 1758

Bovicola caprae (Gurlt, 1843)

Bovicola limbatus (Gervais, 1844)

Domestic goat—Kambing

Ovis aries Linnaeus, 1758

Bovicola ovis (Schränk, 1781)

Sheep—Biri-biri

ORDER CARNIVORA

FAMILY CANIDAE

Canis lupus familiaris Linnaeus, 1758

Heterodoxus spiniger (Enderlein, 1909)

Trichodectes canis (De Geer, 1778)

Domestic dog—Anjing

FAMILY FELIDAE

Felis catus Linnaeus, 1758

Felicola subrostratus (Burmeister, 1838)

Heterodoxus spiniger (Enderlein, 1909)

Domestic cat—Kucing

Prionailurus bengalensis (Kerr, 1792)

Felicola siamensis Emerson, 1964

Leopard cat—Kucing batu

FAMILY MUSTELIDAE

Melogale everetti (Thomas, 1895)

Trichodectes emersoni Hopkins, 1960

Bornean ferret badger—Pulasan lamri

ORDER PRIMATES

FAMILY LORISIDAE

Nycticebus borneanus (Lyon, 1906)

Loriscicola mjoebergi (Stobbe, 1913)

Bornean slow loris—Konkang

Nycticebus coucang (Boddaert, 1785)

Loriscicola mjoebergi (Stobbe, 1913)

Slow loris—Kera duku

ORDER PROBOSCIDEA

FAMILY ELEPHANTIDAE

Elephas maximus indicus Cuvier, 1798

Haematomyzus elephantis Piaget, 1869

Asian elephant—Gajah

ORDER RODENTIA

FAMILY CAVIIDAE

Cavia porcellus (Linnaeus, 1758)

Gliricola porcelli (Schrank, 1781)

Gyropus ovalis Burmeister, 1838

Guinea pig—Tikus Belanda

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References

Abdullah, M.T. & Mammalian Research Group (2013) *List of 361 species of mammals in Malaysia*. Available from: <http://ir.unimas.my/id/eprint/1554> (Accessed 2 July 2022)

- Ahmad, N.I.I. (2013) *A survey of ectoparasites on domestic cat (Felis catus Linnaeus, 1758) from rural and urban areas*. Bachelor of Science Degree. Universiti Malaysia Sarawak, Kota Samarahan. 30 pp.
- Amin-Babjee, S.M. (1978) Parasites of the domestic cat in Selangor, Malaysia. *Kajian Veterinaire*, 10, 107–114.
- Bedford, G.A.H. (1929) Anoplura (Siphunculata and Mallophaga) from South African hosts. *15th Annual report of the Director of Veterinary Services, Union of South Africa*, 501–549.
- Bedford, G.A.H. (1932a) *Trichodectes* (Mallophaga) found on African Carnivora. *Parasitology*, 24 (3), 350–364.
<https://doi.org/10.1017/S003118200002076X>
- Bedford, G.A.H. (1932b) A synoptic check-list and host list of the ectoparasites found on South African Mammalia, Aves, Reptilia. Part II. *Report of the Director of Veterinary Services and Animal Industry, Union of South Africa*, 18, 223–523.
- Bedford, G.A.H. (1936) Notes on species of Trichodectidae with descriptions of new genera and species. *Onderstepoort Journal Veterinary Science and Animal Industry*, 7, 33–58.
- Burmeister, H. (1838) Mallophaga. In: *Handbuch der Entomologie*. Enslin, Berlin, 2 (1), 418–443.
- Changbunjong, T., Prompiram, P., Weluwanarak, T. & Buddhironawat, R. (2011) A redescription of *Felicola (Paradoxuroecus) bengalensis* (Werneck, 1948) (Phthiraptera: Trichodectidae) from a common palm civet (*Paradoxurus hermaphroditus*) in Thailand. *Kasetsart Journal (Natural Science)*, 45, 1020–1027.
- Changbunjong, T., Jirapatharasate, C., Buddhironawat, R., Chewajon, K., Charoenyongyoo, P., Suwanapakdee, S., Waengsothorn, S., Triwitayakorn, K., Chaichoun, K. & Ratanakorn, P. (2010) Ectoparasitic fauna of birds, and volant and non-volant small mammals captured at Srinakarin Dam, Kanchanaburi, Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health*, 41, 526–535.
- Che Kamaruddin, N., Adrus, M. & Ismail, W.N.M. (2020) Prevalence of ectoparasites on a stray cat population from “Town of Knowledge” Kota Samarahan, Sarawak, Malaysian Borneo. *Turkish Journal of Veterinary and Animal Sciences*, 44, 1212–1221.
<https://doi.org/10.3906/vet-2005-24>
- Cheah, T.S. (1988) A record of the finding of the Mallophagan (biting louse) *Gyropus ovalis* on guinea pigs. *Journal Sekolah Teknologi Makmal Veterinar (Malaysia)*, 5: 25–28.
- Colella, V., Nguyen, V.L., Tan, D.Y., Lu, N., Fang, F., Zhijuan, Y., Wang, J., Liu, X., Chen, X., Dong, J., Nurcahyo, W., Hadi, U.K., Venturina, V., Tong, K.B.Y., Tsai, Y.L., Taweethavonsawat, P., Tiwananthagorn, S., Le, T.Q., Bui, K.L., Watanabe, M., Rani, P.A.M.A., Annoscia, G., Beugnet, F., Otranto, D. & Halos, L. (2020) Zoonotic vectorborne pathogens and ectoparasites of dogs and cats in Eastern and Southeast Asia. *Emerging Infectious Diseases*, 26 (6), 1221–1233.
<https://doi.org/10.3201/eid2606.191832>
- Colless, D.H. (1959) *Heterodoxus spiniger* (Mallophaga: Boopiidae) from cats in Singapore. *Journal of Parasitology*, 45, 248.
<https://doi.org/10.2307/3274490>
- Conci, C. (1942) Diagnosi preliminare di tre nuovi generi e di una nuova specie di Trichodectinae (Mallophaga). *Bollettino della Società Entomologica Italiana*, 74, 140–142.
- De Geer, C. (1778) Des Ricins. Pp. 69–82, pl. 4. In: *Mémoires pour servir à l'histoire des insectes*. Volume 7. Pierre Hesselberg, Stockholm. xii + 950 pp., 49 pls.
- Denny, H. (1842) *Monographia Anoplurorum Britanniae or, an essay on the British species of parasitic insects belonging to the order of Anoplura of Leach, with the modern divisions of the genera according to the views of Leach, Nitzsch, and Burmeister, with highly magnified figures of each species*. Henry G. Bohn, London, xxiv + 262 pp., 26 pls.
<https://doi.org/10.5962/bhl.title.137104>
- Denny, H. (1852) *List of the specimens of British animals in the collection of the British Museum. Part XI. Anoplura, or parasitic insects*. Trustees of the British Museum, London. iv + 51 pp.
- Deplazes, P., Eckert, J., Mathis, A., von Samson-Himmelstjerna, G. & Zahner, H. (2016) *Parasitology in veterinary medicine*. Wageningen Academic Publishers, Wageningen, 653 pp.
- Duckworth, J.W., Mathai, J., Chutipong, W., Brodie, J. & Wilting, A. (2016a) *Prionodon linsang*. *The IUCN Red List of Threatened Species 2016*. e.T41705A45219711.
<https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T41705A45219711.en>
- Duckworth, J.W., Timmins, R. & Semiadi, G. (2015) *Tragulus javanicus*. *The IUCN Red List of Threatened Species 2015*. e.T41780A61978138. (Accessed 23 August 2022)
<https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T41780A61978138.en>
- Duckworth, J.W., Timmins, R.J., Chutipong, W., Choudhury, A., Mathai, J., Willcox, D.H.A., Ghimirey, Y., Chan, B. & Ross, J. (2016b) *Paguma larvata*. *The IUCN Red List of Threatened Species 2016*. e.T41692A45217601.
<https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T41692A45217601.en>
- Durden, L.A. (2019) Chapter 7. Lice (Phthiraptera). In: Mullen, G.R. & Durden, L.A. (Eds.), *Medical and Veterinary Entomology. 3rd Edition*. Academic Press Inc., Cambridge, Massachusetts, pp. 79–106.
<https://doi.org/10.1016/B978-0-12-814043-7.00007-8>
- Eichler, W. (1940) Notulae Mallophagologicae. — I. Neue Gattungen und Subfamilien von Haarlingen. *Zoologischer Anzeiger*, 129 (5/6), 158–162.
- Emerson, K.C. (1940) Records of Mallophaga from Oklahoma hosts. *Canadian Entomologist*, 72, 104–108.
<https://doi.org/10.4039/Ent72104-5>
- Emerson, K.C. (1964a) A new species of Mallophaga from Malaya. *Journal of Kansas Entomological Society*, 37, 4–5.

- Emerson, K.C. (1964b) Notes on some Mallophaga from Formosan mammals. *Proceedings of the Biological Society of Washington*, 77, 195–198.
- Emerson, K.C. & Price, R.D. (1975) Mallophaga of Venezuelan mammals. *Brigham Young University Science Bulletin. Biological Series*, 20 (3), 1–77.
<https://doi.org/10.5962/bhl.part.5667>
- Emerson, K.C. & Price, R.D. (1981) A host-parasite list of the Mallophaga on mammals. *Miscellaneous Publications of the Entomological Society of America*, 12 (1), 1–72.
- Enderlein, G. (1904) Läusestudien. I. Über die Morphologie, Klassifikation und systematische Stellung der Anopluren nebst Bemerkungen zur Systematik der Insektenordnungen. *Zoologischer Anzeiger*, 28 (4), 121–147.
- Enderlein, G. (1909) Anopluren (Siphunculaten) und Mallophagen. In: Schultze, L. (Ed.) *Zoologisch und Anthropologische Ergebnisse einer Forschungsreise in Südafrika* 2 (2). *Denkschriften der medizinisch-naturwissenschaftlichen Gessellschaft*, 14, 79–81, pl. 8.
- Ewing, H.E. (1924) On the taxonomy, biology, and distribution of the biting lice of the family Gyropidae. *Proceedings of the United States National Museum*, 63 (20), 1–42.
<https://doi.org/10.5479/si.00963801.63-2489.1>
- Ewing, H.E. (1929) *A manual of external parasites*. Baillière Tindall & Cox, London. xvi + 225 pp.
<https://doi.org/10.2307/3271887>
- Ewing, H.E. (1930) Six new species of Mallophaga. *Proceedings of the Entomological Society of Washington*, 32 (7), 117–121.
- Fabricius, O. (1780) *Fauna Groenlandica systematice sistens animalia Groenlandiae occidentalis hactenus indagata*. J.G. Rothe, Hafniae et Lipsiae. xvi + 452 pp., pl. 1.
- Fahrenholz, H. (1910) Diagnosen neuer Anopluren. *Zoologischer Anzeiger*, 35 (23), 714–715.
- Fahrenholz, H. (1919) Bemerkungen zu der Arbeit. In: Schwalbe, G. “Über die Bedeutung der ausseren Parasiten für die Phylogenie der Säugetiere und des Menschen”. *Zeitschrift für Morphologie und Anthropologie*, 21, 361–364.
- Ferris, G.F. (1922) The mallophagan family Trimenoponidae. *Parasitology*, 14 (1), 75–86.
<https://doi.org/10.1017/S0031182000009999>
- Ferris, G.F. (1931) *The louse of elephants, Haematomyzus elephantis Piaget (Mallophaga: Haematomyzidae)*. *Parasitology*, 23 (1), 112–127, 2 pls.
<https://doi.org/10.1017/S0031182000013494>
- Gervais, F.L.P. (1844) Dicères épizoïques. Pp. 290–361, pls 48–49. In: Walckenaer, C.A. (Ed.) *Histoire Naturelle des Insectes. Aptères*. Tome 3. Librairie Encyclopédique de Roret, Paris. viii + 476 pp.
- Giebel, C.G.A. (1861a) Die Haarlinge der Gattungen *Trichodectes* und *Gyropus* nach Chr. L. Nitzsch’s Untersuchungen. *Zeitschrift für die gesammten Naturwissenschaften (Halle)*, 18, 81–93, 2 pls.
- Giebel, C.G.A. (1861b) Die Verzeichniss der von Chr. L. Nitzsch untersuchten Epizoen nach den Wohnthieren geordnet. *Zeitschrift für die gesammten Naturwissenschaften (Halle)*, 18, 289–
- Gurlt, E.F. (1843) Über die auf den Haus-Säugetieren und Haus-Vögeln lebenden Schmarotzer – Insekten und Arachniden. *Magazin für die gesammte Thierheilkunde*, 9, 1–24, 1 pl.
- Harrison, L. (1916) The genera and species of Mallophaga. *Parasitology*, 9 (1), 1–156.
<https://doi.org/10.5962/bhl.title.102856>
- Hopkins, G.H.E. (1949) The host-associations of the lice of mammals. *Proceedings of the Zoological Society of London*, 119 (2), 387–604.
<https://doi.org/10.1111/j.1096-3642.1949.tb00888.x>
- Hopkins, G.H.E. (1960) Notes on some Mallophaga from mammals. *Bulletin of the British Museum (Natural History), Entomology*, 10 (2), 77–95, 2 pls.
<https://doi.org/10.5962/bhl.part.16257>
- Jeffery, J., Vellayan, S., Sulaiman, S., Oothuman, P., Zahedi, M. & Krishnasamy, M. (1999) The occurrence of *Haematomyzus elephantis*, Piaget (Mallophaga: Haematomyzidae) on the Asian elephant *Elephas maximus indicus* Cuvier. *A new record for Peninsular Malaysia. Tropical Biomedicine*, 16 (2), 51–52
- Kazim, A.-R., Houssaini, J., Tappe, D. & Heo, C.-C. (2022) An annotated checklist of sucking lice (Phthiraptera: Anoplura) from domestic and wild mammals in Malaysia, with lists of hosts and pathogens. *Zootaxa*, 5214 (3), 301–336.
<https://doi.org/10.11646/zootaxa.5214.3.1>
- Kéler, S. von (1937) Über einige neue und interessantere Mallophagen des Deutschen Entomologischen Instituts in Berlin-Dahlem. *Arbeiten über Morphologische und Taxonomische Entomologie aus Berlin-Dahlem*, 4 (4), 312–324.
- Kéler, S. von (1938) Baustoffe zu einer Monographie der Mallophagen. I. Teil: Überfamilie Trichodectoidea. *Nova Acta Leopoldina Abhandlungen der Kaiserlich Leopoldinisch-Carolinisch Deutschen Akademie der Naturforscher (Neue Folge)*, 5 (32), 393–467.
- Kéler, S. von (1957) *Der Haarling der Wildkatze (Felicola hercynianus n. sp.) (Mallophaga, Trichodectidae)*. *Deutsche Entomologische Zeitschrift, N.F.*, 4, 172–178.
<https://doi.org/10.1002/mmnd.4800040306>
- Kéler, S. von (1971) A revision of the Australasian Boopiidae (Insecta: Phthiraptera), with notes on the Trimenoponidae. *Australian Journal of Zoology, Supplement*, 6, 1–126.

- <https://doi.org/10.1071/AJZS006>
- Kellogg, V.L. (1896) New Mallophaga, I, — with special reference to a collection made from maritime birds of the Bay of Monterey, California. *Proceedings of the California Academy of Sciences (Series 2)*, 6, 31–168, 14 pls.
- Kellogg, V.L. & Nakayama, S. (1914) A new *Trichodectes* from Baja California. *Psyche*, 21, 90–92.
<https://doi.org/10.1155/1914/56086>
- Lahille, (1908) El piojo y la elefantita, *Haematomyzus paradoxus* Lahille. *Revista del Jardín Zoológico de Buenos Aires (Series 2)*, 1, 187–189.
- Lee, H.L., Krishnasamy, M., Jeffery, J. & Paramasvaran, S. (2006) Notes on some ectoparasites received by the Medical Entomology Unit, Institute for Medical Research. *Tropical Biomedicine*, 23, 131–132.
- Le Souëf, S.A. & Bullen, H. (1902) Description of a mallophagous parasite from the kangaroo. *The Victorian Naturalist*, 18, 159.
<https://doi.org/10.5962/bhl.part.27549>
- Linnaeus, C. (1758) *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Volume 1. 10th Edition. Laurentii Salvii, Holmiae, iv + 824 pp.
<https://doi.org/10.5962/bhl.title.542>
- Linnaeus, C. (1761) Pediculi. In: *Fauna Suecica Sistens Animalia Sueciae Regni: Mammalia, Aves, Amphibia, Pisces, Insecta, Vermes*. Laurentii Salvii, Stockholmiae. Pp. 475–479.
- Low, V.L., Prakash, B.K., Tan, T.K., Sofian-Azirun, M., Anwar, F.H.K., Vinnie-Siow, W.Y. & Abu-Bakar, S. (2017) Pathogens in ectoparasites from free-ranging animals: infection with *Rickettsia asembonensis* in ticks, and a potentially new species of *Dipylidium* in fleas and lice. *Veterinary Parasitology*, 245, 102–105.
<https://doi.org/10.1016/j.vetpar.2017.08.015>
- Lyal, C.H.C. (1985) A cladistic analysis and classification of trichodectid mammal lice (Phthiraptera: Ischnocera). *Bulletin of the British Museum (Natural History)*, 51 (3), 187–346.
- Macadam, I., Gudan, D., Timbs, D.V., Urquhart, H.R. & Sewell, M.M.H. (1984) Metazoan parasites of dogs in Sabah, Malaysia. *Tropical Animal Health and Production*, 16, 34–38.
<https://doi.org/10.1007/BF02248927>
- Madinah, A., Fatimah, A., Mariana, A. & Abdullah, M.T. (2011) Ectoparasites of small mammals in four localities of wildlife reserves in Peninsular Malaysia. *The Southeast Asian Journal of Tropical Medicine and Public Health*, 42, 803–813.
- Madinah, A., Mariana, A., Fatimah, A. & Abdullah, M.T. (2013) A preliminary field survey of ectoparasites of rodents in urban park, Sarawak, Malaysian Borneo. *Tropical Biomedicine*, 30, 547–551.
- Madinah, A., Abang, F., Mariana, A., Abdullah, M.T. & Mohd-Azlan, J. (2014) Interaction of ectoparasites-small mammals in tropical rainforest of Malaysia. *Community Ecology*, 15, 113–120. <https://doi.org/10.1556/ComEc.15.2014.1.12>
- Mariana, A., Zuraidawati, Z., Ho, T.M., Mohd-Kulaimi, B., Saleh, I., Shukor, M.N. & Shahrul-Anuar, M.S. (2005) A survey of ectoparasites in Gunung Stong Forest Reserve, Kelantan, Malaysia. *The Southeast Asian Journal of Tropical Medicine and Public Health*, 36 (5), 1125–1131.
- Mariana, A., Zuraidawati, Z., Ho, T.M., Mohd-Kulaimi, B., Saleh, I., Shukor, M.N. & Shahrul-Anuar, M.S. (2008) Ticks (Ixodidae) and other ectoparasites in Ulu Muda Forest Reserve, Kedah, Malaysia. *The Southeast Asian Journal of Tropical Medicine and Public Health*, 39, 496–506.
- McGregor, E.A. (1917) Six new species of Mallophaga from North American mammals. *Annals of the Entomological Society of America*, 10 (1), 167–175.
<https://doi.org/10.1093/aesa/10.2.167>
- Mey, E. (2021) *Loricicola mjobergi* [sic] (Stobbe, 1913) sensu lato (Insecta, Psocodea, Phthiraptera, Ischnocera, Trichodectidae) from two *Nycticebus* species (Mammalia, Primates) from Vietnam, with notes on the genus *Loricicola* Bedford. *Vietnamese Journal of Primatology*, 3, 179–201.
- Mjöberg, E. (1910) Studien über Mallophagen und Anopluren. *Arkiv för Zoologi*, 6 (13), 1–296, 5 pls. <https://doi.org/10.5962/bhl.part.26907>
- Mohd-Taib, F.S., Asyikha, R. & Md-Nor, S. (2021) Small mammal assemblages and their ectoparasite prevalence (Acarina) in mangrove forests of Peninsular Malaysia. *Tropical Zoology*, 34, 24–43.
<https://doi.org/10.4081/tz.2021.78>
- Mohd-Zain S.N., Norhidayu, S., Pal, P. & Lewis, J.W. (2013) Macroparasite communities in stray cat populations from urban cities in Peninsular Malaysia. *Veterinary Parasitology*, 196, 469–477.
<https://doi.org/10.1016/j.vetpar.2013.03.030>
- Mokhtar, A.S., Jeffery, J., Noraisah-Mydin, A.A. & Tay, S.T. (2011) Molecular detection of *Bartonella henselae* and *B. clarridgeiae* (causative agents of cat scratch disease) from animal ectoparasites in Malaysia. *47th Annual Conference of the Malaysian Society of Parasitology and Tropical Medicine, Kuala Lumpur, Malaysia, 3–4 March 2011*. Malaysian Society of Parasitology and Tropical Medicine, Malaysia, p. 62.
- Mudappa, D. & Choudhury, A. (2016) *Herpestes edwardsii*. *The IUCN Red List of Threatened Species 2016*. e.T41611A45206787. (Accessed 23 August 2022)
<https://doi.org/10.2305/IUCN.UK.2016-1.RLTS.T41611A45206787.en>
- Mustaffa-Babjee, A. (1969) Lice and fleas of animals in Malaysia. *Kajian Veterinaire*, 2, 37.
- Nelson, G.S. (1962) *Dipetalonema reconditum* (Grassi, 1889) from the dog with a note on its development in the flea, *Ctenocephalides immitis* (Wolfe, 1908).

- phalides felis*, and the louse, *Heterodoxus spiniger*. *Journal of Helminthology*, 36, 297–308.
<https://doi.org/10.1017/S0022149X00023968>
- Neumann, L.G. (1912a) Notes sur les Mallophages. – II. I. – Sur le genre *Menopon* (sous-genre *Menacanthus* n. subgen.). *Archives de Parasitologie*, Paris, 15 (3) 353–368.
- Neumann, L.G. (1912b) Sur le genre *Gyropus* Nitzsch. *Bulletin de la Société Zoologique de France*, 37, 212–228.
- Neumann, L.G. (1913) Notes sur les Mallophages – III. *Archives de Parasitologie*, Paris, 15 (4), 608–634
- Nitzsch, C.L. (1818) Die Familien und Gattungen der Theierinsekten (Insecta epizoica); als ein Prodrömus einer Naturgeschichte derselben. *E.F. Germar's Magazin der Entomologie*, 3, 261–318.
- Norhidayu, S. (2012) *Biodiversity and epidemiology study of macroparasites from stray cats in Peninsular Malaysia*. Thesis, Master in Science. Universiti Malaya, Kuala Lumpur, 270 pp.
- Norhidayu, S., Mohd-Zain, S.N., Jeffery, J. & Lewis JW (2012) The dog louse *Heterodoxus spiniger* from stray cats in Penang, Malaysia. *Tropical Biomedicine*, 29, 301–303.
- Olfers, I.F.J.M. von (1816) *De vegetativis et animatis corporibus in corporibus animatis reperiundis commentarius*. Taberna Libraria Maureriana, Berolini. vi + 113 pp., 1 pl.
- Packard, A.S. (1870) Certain parasitic insects. *American Naturalist*, 4, 83–99, pl. 1.
<https://doi.org/10.1086/270541>
- Paine, J.H. (1912a) The mallophagan genus *Heterodoxus* Le Souëf and Bullen. *Entomological News*, 23, 359–362.
- Paine, J.H. (1912b) Notes on a miscellaneous collection of Mallophaga from mammals. *Entomological News*, 23, 437–442.
- PERHILITAN – Jabatan Perlindungan Hidupan Liar dan Taman Negara Semenanjung Malaysia (2010) *Red list of mammals for Peninsular Malaysia*. Department of Wildlife and National Parks of Peninsular Malaysia, Kuala Lumpur. 150 pp.
- PERHILITAN – Jabatan Perlindungan Hidupan Liar dan Taman Negara Semenanjung Malaysia (2017) *Red list of mammals for Peninsular Malaysia. Version 2.0*. Department of Wildlife and National Parks of Peninsular Malaysia, Kuala Lumpur, 216 pp.
- Phan, T.D., Nijhawan, S., Li, S. & Xiao, L. (2020) *Capricornis sumatraensis*. *The IUCN Red List of Threatened Species 2020*. e.T162916735A162916910. (Accessed 23 August 2022)
<https://doi.org/10.2305/IUCN.UK.2020-2.RLTS.T162916735A162916910.en>
- Piaget, E. (1869) Description d'un parasite de l'éléphant, *Haematomyzys elephantis*. *Tijdschrift voor Entomologie*, 12, 249–254.
- Piaget, E. (1880) *Les Pédiculines. Essai Monographique*. Volumes 1–2. E.J. Brill, Leide, xxxix + 714 pp., 56 pls.
- Piaget, E. (1885) *Les Pédiculines. Essai Monographique. Supplément*. E.J. Brill, Leide. xvi + 200 pp., 17 pls.
- Plomley, N.J.B. (1940) Notes on the systematics of two species of *Heterodoxus* (Mallophaga, Boopiidae). *Papers and Proceedings of Royal Society of Tasmania*, 1939, 19–36.
- Price, M.A. & Graham, O.H. (1997) Chewing and sucking lice as parasites of mammals and birds. *United States Department of Agriculture, Agricultural Research Service, Technical Bulletin*, 1849, vi + 257 pp., 2 appendices.
- Price, R.D., Hellenthal, R.A. & Palma, R.L. (2003) *World checklist of chewing lice with host associations and keys to families and genera*. Pp. 1–448. In: Price, R.D., Hellenthal, R.A., Palma, R.L., Johnson, K.P. & Clayton, D.H. *The chewing lice: world checklist and biological overview*. Illinois Natural History Survey Special Publication 24. x + 501 pp.
- Ross, J., Wilting, A., Ngoprasert, D., Loken, B., Hedges, L., Duckworth, J.W., Cheyne, S., Brodie, J., Chutipong, W., Hearn, A., Linkie, M., McCarthy, J., Tantipisanuh, N. & Haidir, I.A. (2015) *Cynogale bennettii*. *The IUCN Red List of Threatened Species 2015*. e.T6082A45197343. (Accessed 23 August 2022)
<https://doi.org/10.2305/IUCN.UK.2015-4.RLTS.T6082A45197343.en>
- Rudow, F. (1866) Sechs neue Haarlinge. *Zeitschrift für die gesammten Naturwissenschaften (Halle) (N.F. 2)*, 27 (2), 109–112, 3 pls.
- Schrank, F. von P. (1781) *Enumeratio insectorum Austriae indigenorum*. Eberhardi Klett et Franck, Viduam Augustae Vindelicorum. ix + 548 pp., 4 pls.
- Schrank, F. von P. (1803) *Fauna Boica*. Landshut, 3 (1), 186–194.
- Sebei, P.J., McCrindle, C.M.E., Green, E.D. & Turner, M.L. (2004) Use of scanning electron microscopy to confirm the identity of lice infesting communally grazed goat herds. *Onderstepoort Journal of Veterinary Research*, 71, 87–92.
<https://doi.org/10.4102/ojvr.v71i2.269>
- Séguy, E. (1948) Le trichodecte du muntjac (Mallophage). *Musée Heude. Notes d'Entomologie Chinoise*, 12 (13), 149–152.
- Shabrina, S.M. (1990) Ectoparasites of small mammals trapped at the Ulu Gombak Forest, Selangor Darul Ehsan. *Journal of Wildlife and Parks*, 9, 9–17.
- Shanta, C.S., Wan, S.P. & Kwong, K.H. (1980) A survey of the endo- and ectoparasites of cats in and around Ipoh, West Malaysia. *Malaysian Veterinary Journal*, 7, 17–27.
- Stobbe, R. (1913) Mallophagen. 3. Beitrag: Die Trichodectiden des Berliner Museums für Naturkunde. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin*, 1913 (8), 365–383.
- Syamsul, V.S., Okene, I.A.A., Che-Yahya, S.N., Hamdan, R.H., Lee, S.H. & Tan, L.P. (2020) Prevalence of ectoparasitism on small ruminants in Kelantan, Malaysia. *Tropical Life Sciences Research*, 31, 45–56.
<https://doi.org/10.21315/tlsr2020.31.1.3>
- Taschenberg, O. (1882) Die mallophagen mit besonderer Berücksichtigung der von Dr. Meyer gesammelten Arten systematisch bearbeitet. *Nova Acta der Kaiserlich Leopoldinisch-Carolinisch Deutschen Akademie der Naturforscher*, 44 (1), 1–244, 7

pls.

<https://doi.org/10.5962/bhl.title.82513>

- Tay, S.T., Mokhtar, A.S., Low, K.C., Mohd-Zain, S.N., Jeffery, J., Abdul-Aziz, N.A. & Kho, K.L. (2014) Identification of rickettsiae from wild rats and cat fleas in Malaysia. *Medical and Veterinary Entomology*, 28, 104–108.
<https://doi.org/10.1111/mve.12075>
- Timmins, R. & Duckworth, J.W. (2015) *Tragulus napu*. *The IUCN Red List of Threatened Species 2015*. e.T41781A61978315 (Accessed 23 August 2022)
<https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T41781A61978315.en>.
- Torres, J. (1938) Sobre um parasito (Mallaphaga [sic!] – Gyropidae) de *Cavia cobaya* (*Gyropus recifensis* n. sp. ou *G. ovalis* N.2). *Boletim da Sociedade Brasileira de Medicina Veterinaria*, 8, 279–288.
- Walker, F. (1872) A new form of parasite. In: Richter, H.C. (Ed.) *Hardwicke's Science Gossip*, 1871, 131–132, fig. 67.
- Wells, K., Beaucournu, J.C., Durden, L.A., Petney, T.N., Lakim, M.B. & O'Hara, R.B. (2012) Ectoparasite infestation patterns of domestic dogs in suburban and rural areas in Borneo. *Parasitology Research*, 111, 909–919.
<https://doi.org/10.1007/s00436-012-2917-7>
- Werneck, F.L. (1936) Contribuição ao conhecimento dos mallophagos encontrados nos mamíferos sul-americanos. *Memórias do Instituto Oswaldo Cruz*, Rio de Janeiro, 31 (3), 391–590, 1 pl.
<https://doi.org/10.1590/S0074-02761936000300001>
- Werneck, F.L. (1948) Os malófagos de mamíferos. Parte I: Amblycera e Ischnocera (Phlopterae e parte de Trichodectidae). *Revista Brasileira de Biologia*, Special Volume, 1–243 pp.
- Werneck, F.L. (1950) Os Malófagos de Mamíferos. Parte II: Ischnocera (continuação de Trichodectidae) e Rhyncophthirina. *Memórias do Instituto Oswaldo Cruz*, Rio de Janeiro, 207 pp.
- Werneck, F.L. (1956) A respeito de alguns Malófagos de mamíferos. *Revista Brasileira de Biologia*, 16, (1) 25–32.
- White, F.B. (1872) The new elephant parasite. In: Richter, H.C. (Ed.), *Hardwicke's Science Gossip*, 1871, 234.
- Zavaleta, D. (1946) Dos nuevas especies de la familia Gyropidae encontradas en los cuyes de México. *Anales del Instituto de Biología, Universidad Nacional de México*, 16, 435–444.