



A new host record of *Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) (Phthiraptera: Menoponidae) in Iran with a taxonomic note and a checklist of the lice of Guilan Province

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ABSTRACT. There is little information about the lice infesting birds and mammals in Guilan Province of northern Iran besides their importance in medicine and veterinary medicine. A good series of lice were collected from a road-killed great egret, *Ardea alba* (Ciconiiformes: Ardeidae), in Rasht City of Guilan Province in the summer of 2023. The collected lice were preserved in 80% ethanol and cleared in 10% KOH. The microscope slides of specimens were prepared using Berlese's fluid. The chewing lice were morphologically identified as *Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) (Phthiraptera: Menoponidae) from the great egret, as a new host record for Iran. A taxonomic note was presented for the species. Also, a checklist of the Phthiraptera of Guilan Province as well as their hosts and distribution were presented including three suborders, four families, ten genera and 12 species. This checklist is considered preliminary for further investigation.

Keywords: Amblycera, avian lice, bird lice, biting lice, chewing lice

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INTRODUCTION

The order Phthiraptera (Insecta: Hemimetabola) includes four suborders: Anoplura (sucking lice), Amblycera, Ischnocera and Rhynchophthirina (collectively known as avian, biting or chewing lice). The sucking lice are obligate, hematophagous ectoparasites of placental mammals, however the chewing lice are obligate ectoparasites of birds and marsupial or placental mammals (Durden, 2019). The order composes approximately 5000 species including more than 550 species of sucking lice (Light et al., 2010) and more than 4400 species of chewing lice (Price et al., 2003). A few species of sucking lice are important in medicine and veterinary medicine. Three or two species, depending on their classification, of the head louse *Pediculus capitis* De Geer, 1778 (or the subspecies *Pediculus humanus capitis* De Geer, 1778) and the body louse *P. humanus* Linnaeus, 1758 (or the subspecies *P. humanus humanus* Linnaeus, 1758, synonym: *P. humanus corporis* De Geer, 1778) (Phthiraptera: Pediculidae) and the crab (pubic) louse *Phthirus pubis* (Linnaeus, 1758) (Phthiraptera: Phthiridae) are important in public health (Service, 2001; Durden, 2019). The main important human pathogens, which are mainly, naturally and biologically

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transmitted by the body louse, are: the epidemic (louse-borne) relapsing fever agent *Borrelia recurrentis*, the epidemic (louse-borne or exanthematic) typhus pathogen *Rickettsia prowazekii* and the causing agent of trench fever *Bartonella quintana* (Durden, 2019). Some pathogenic bacteria such as *Acinetobacter baumannii*, *Coxiella burnetii* (the agent of Q fever), *R. conori* (the pathogen of Boutenense), *R. rickettsia* (the agent of Rocky Mountain spotted fever), *Salmonella typhi* (the pathogen of typhoid or salmonellosis), *Staphylococcus aureus*, *Streptococcus pyogenes* and *Yersinia pestis* (the agent of plague) have been detected in the head and/or body lice (Durden, 2019; Fu et al., 2022; Deng et al., 2023).

Other than human-specific louse species some other sucking lice are known to be associated with human health via their role in the epidemiology of some diseases. *Pedicinus obtusus* (Rudow, 1869) (Phthiraptera: Pedicinidae), infesting macaques, has been reported to be infected with the trench fever agent (Durden, 2019). The sucking louse *Neohaematopinus sciuropteri* (Osborn, 1891) (Phthiraptera: Polyplacidae) is a vector of *R. prowazekii* to flying squirrels (Service, 2001; Durden, 2019). Some sucking lice of rodents such as *Hoplopleura oenomydis* Ferris, 1921 (Phthiraptera: Hoplopleuridae) and *Polplax spinulosa* (Burmeister, 1839) (Phthiraptera: Polyplacidae) are known vectors of the murine typhus agent *R. typhi* in rodents (Azad, 1990). Some species of *Polyplax*, such as *P. spinulosa* and *P. serrata* (Burmeister, 1839), are vectors of pathogens causing haemotropic mycoplasmas (Service, 2001; Durden, 2019). The dog-chewing louse *Trichodectes canis* (De Geer, 1778) (Phthiraptera: Trichodectidae) is known intermediate host of the double-pored tapeworm *Dipylidium caninum* (Durden, 2019). Although canids and felids are the normal hosts for this globally distributed tapeworm, rare human cases have been reported from different countries (Beugnet et al., 2018). Although several species of lice affect their hosts severely through causing anaemia, weight loss, damage to hides and fur, general irritability, transmitting some pathogens and parasites and costing very much for some livestock industries, most species of lice are not important in medicine or veterinary medicine, because they mostly infest wild birds and mammals (Durden, 2019). Relapsing fever and typhus were historically reported in Iran, especially the epidemics of typhus during the First and Second World War (Külz, 1917; Fry, 1920; Sinton, 1921; van Rooyen et al., 1944; Snyder, 1947; Bayne-Jones, 1948; Moulton, 1948; Golshani et al., 2022); however, there is no record of the aforementioned diseases during recent decades in the country. There are many published data about pediculosis capitis, including some recent useful systematic reviews and meta-analyses which the readers may refer to for further references (Sohrabivafa et al., 2020; Khosravani et al., 2021; Akbari et al., 2022). Also, there is some data on the body louse (Ghorbani et al., 2024) and the pubic louse (Dehghani et al., 2013; Garedaghi, 2015).

There is a substantial amount of published data in Iran, specifically about lice-infesting birds (Rafiyi et al., 1969a; Bahiraei et al., 2024). Bahiraei et al. (2024) have reviewed further references that are not cited herein. However, there is not much information about the lice infesting mammals in the country (Rafiyi et al., 1969b; Kim & Emerson, 1971; Kaneko, 1972; Mostaghni & Ahmadnezhad, 1979; Seydigazafi et al., 2022). Some data also become available due to the investigation of different endoparasites and/or ectoparasites, including ticks, mites, fleas as well as lice in different hosts (i.e. Maghami, 1968; Anwar et al., 1971a, 1971b; Rak, 1972; Hosseini et al., 2001; Ebrahimzade et al., 2016; Rassouli et al., 2016; Hosseinzadeh Marzenaki, 2017; Hosseinzadeh Marzenaki & Shojaee, 2017; Chaechi-Nosrati et al., 2018).

In the summer of 2023, a road-killed great egret, *Ardea alba* (Ciconiiformes: Ardeidae) was found infested with many lice just outside Rasht City, capital of Guilan Province, Caspian Sea littoral, northern Iran. This article presents the result of the identification of those lice with a taxonomic note as well as a checklist of the lice of Guilan Province, their hosts and geographical distribution.

MATERIAL AND METHODS

The collected lice were preserved in 80% ethanol and cleared in 10% KOH. The microscope slides of specimens were prepared using Berlese's fluid. The specimens were morphologically identified using available keys (Price & Beer, 1965; Clay, 1969; Price et al., 2003). Photographs were captured by the first author using a Canon® EOS 600D camera attached to a Nikon® E200 Microscope with a trinocular head. The specimens are deposited in the Museum of Medical and Veterinary Entomology, the School of

Health, Guilan University of Medical Sciences, Rasht, Iran. Valid names of the species of lice were adopted from Durden & Musser (1994), Price et al. (2003) and Smith et al. (2024). The morphological terminology recommended by Price et al. (2003) is used.

Regarding the checklist of Phthiraptera of Guilan Province, the scanty available data about the fauna of lice of birds and mammals in Guilan Province (Hosseini et al., 2001; Dik & Halajian, 2013; Ebrahimzade et al., 2016; Rassouli et al., 2016; Hosseinzadeh Marzenaki, 2017; Hosseinzadeh Marzenaki & Shojaee, 2017; Chaichi-Nosrati et al., 2018) were compiled. In some published records, only the hosts of collected lice have been mentioned without the exact locality of collection (Maghami, 1968; Rafyi et al., 1969a, 1969b; Anwar et al., 1971a, 1971b). Thus, it is not possible to retrieve the possible detection of recorded lice in Guilan Province from the literature, though their hosts occur in the province.

RESULTS

Taxonomic hierarchy

Class Insecta Linnaeus, 1785

Order Phthiraptera Haeckel, 1896

Suborder Amblycera Kellogg, 1896

Family Menoponidae Mjöberg, 1910

Genus *Ciconiphilus* Bedford, 1939

***Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) (Fig. 1A–H)**

Material examined. A total of 140 microscope slides (71 females and 69 males) were provided from the collected lice on the great egret *Ardea alba*. The specimens were collected by Meysam Sharifdini just outside Rasht City (37°16'28"N, 49°35'20"E) in September 2023. The lice specimens were identified as *Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) (Phthiraptera: Menoponidae) based on morphological characters (Fig. 1). The number of anterior setae (or their alveoli if setae are missing) on abdominal tergites in 20 females of *C. decimfasciatus* were presented in Table 1 (see Taxonomic note). The lice were collected from different parts of the host body including the neck, wings, back and abdomen. This is the first record of this louse species from the great egret in Iran. No other ectoparasite was observed on the host.

Taxonomic note. *Ciconiphilus decimfasciatus* is a very similar species to *Ciconiphilus butoridiphagus* Carriker, 1964 (synonym: *C. melanolophi* Price & Beer, 1965) (Price & Beer, 1965). They are differentiated using the number of anterior setae on abdominal tergites in females and minor differences in the shape of the penis of the male genitalia (Price & Beer, 1965). In *C. butoridiphagus*, the penis is deeply concave in basal margin and with heel-like projection at apical portion, best seen in lateral view, whereas, in *C. decimfasciatus*, the penis is elongate, slender, with almost straight basal margin and evenly rounded apical bend (Price & Beer, 1965). The male genitalia of the specimens of this investigation (Fig. 1H) shows exact similarity with the illustration of *C. decimfasciatus* provided by Price & Beer (1965) and similar to the photo provided by Amina et al. (2014). The figure of the penis for *C. decimfasciatus* in Carriker et al. (1964) is slightly different from the figure provided by Price & Beer (1965). Also, Carriker et al. (1964) described *C. butoridiphagus* based on just female specimens. Price & Beer (1965) described the male and female of *C. melanolophi* that later became a junior synonym of *C. butoridiphagus* because they shared the same type-host species (Price & Emerson, 1966). Except for the figure provided by Price & Beer (1965), there is not any figure or specimen of *C. butoridiphagus* (or *C. melanolophi*) available to the authors to compare the penis shape. Price & Beer (1965), in their key, mentioned that abdominal tergites II–VI have a total of 0–3 anterior setae in *C. butoridiphagus* and over 3 anterior setae in *C. decimfasciatus* in females. They added the numbers of anterior setae that were 2–6 on abdominal tergites II–IV, 1–2 on V and 0–2 on VI, and total number of anterior setae on II–VI of 7–18 (average 12.3).

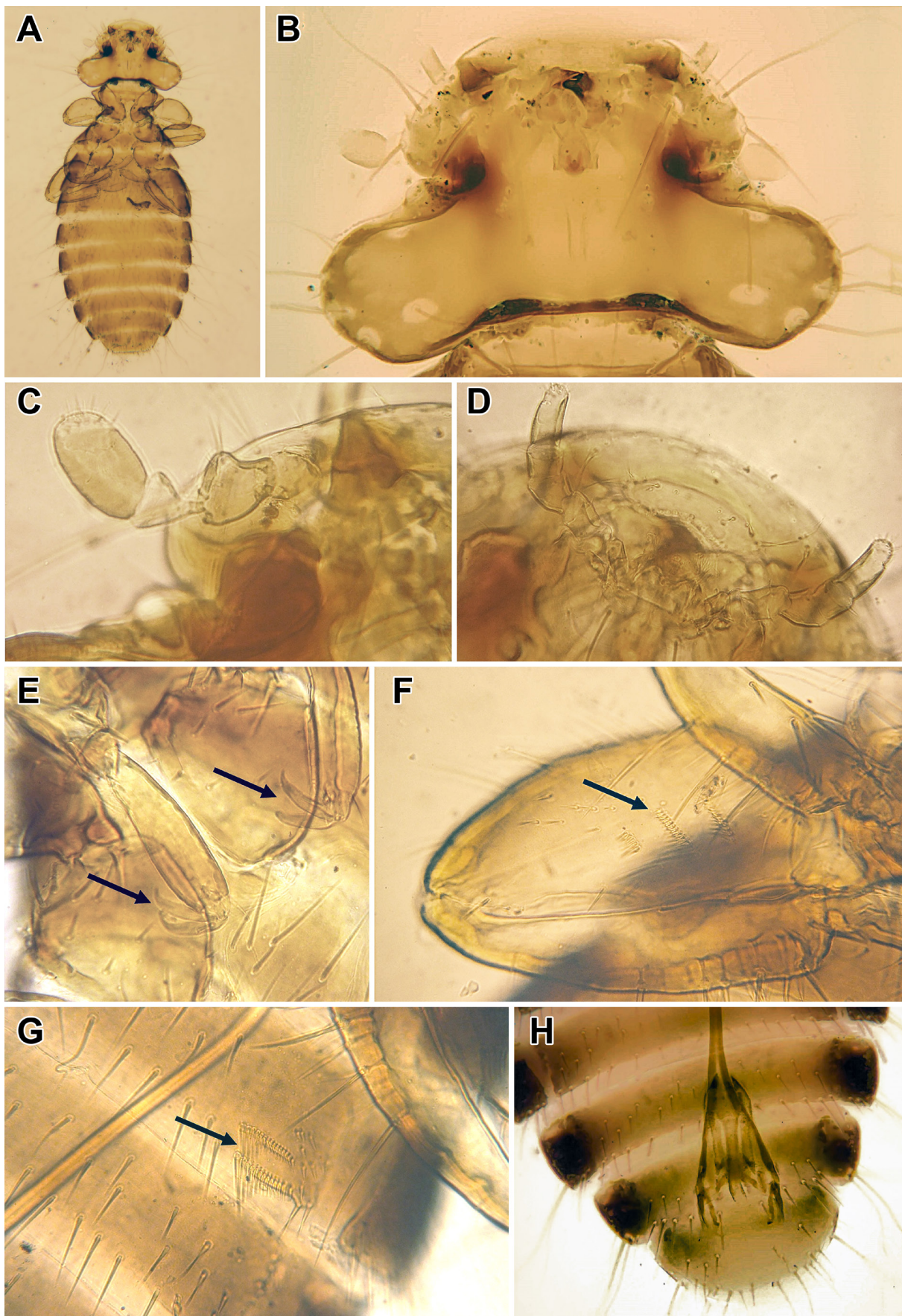


Figure 1. *Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) collected from the great egret in Guilan Province of northern Iran, 2023. **A.** General habitus; **B.** Head, dorsal view; **C.** Antenna; **D.** Maxillary palpus; **E.** Claws; **F.** Hindfemur ctenidia; **G.** Sternal ctenidia; **H.** Male genitalia.

Table 1. The number of anterior setae (or their alveoli if setae are missing) on abdominal tergites II–VI in 20 females of *Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) collected from the great egret in Guilan Province of northern Iran, 2023.

Abdominal tergites	The number of anterior setae (or their alveoli if setae are missing) in female individuals																			
II	5	5	5	5	3	6	4	3	6	6	5	5	4	5	5	2	6	3	4	3
III	4	4	5	4	4	6	4	3	4	6	4	3	5	3	6	6	6	4	4	5
IV	3	3	4	3	4	4	4	2	4	3	2	3	5	3	4	5	2	3	3	2
V	0	2	1	1	4	4	1	0	2	3	0	1	4	1	4	6	3	1	0	1
VI	1	0	1	0	0	0	0	0	0	2	1	0	0	0	1	3	3	0	1	1
Total number	13	14	16	13	15	20	13	8	16	20	12	12	18	12	20	22	20	11	12	12

Also, Price & Beer (1965) noted, “Specimens from hosts other than the type-host [*Ardea cinerea*] show occasional departures from the above-cited ranges; however, none of these is consistent enough to enable specific or sub-specific differentiation”. This phenomenon was observed in this investigation, either. The numbers of anterior setae were 2–6 on abdominal tergite II (just one specimen 2, others 3 or more), 3–6 on III, 2–5 on IV (four specimens 2, others 3 or more), 0–6 (13 specimens 0–2 setae, others 3 or more) on V, 0–3 on VI (18 specimens 0–2 setae, others 3) and total number of anterior setae on II–VI of 8–22 (average 14.9) (Table 1). Kumar et al. (2019) mentioned that the numbers of anterior setae of abdominal tergites are 4 on II, 5 on III, 3 on IV, 3 on V and 2 on VI for each side in a female collected from *Bubulcus ibis* (cattle egret) in India (Total number = 34). It seems that the numbers are much higher than those of the present study and Price & Beer (1965)’s work. As the authors know, there is no more data about the chaetotaxy of the species. In this regard, Price & Beer (1965) noted, “Only a study of good series of these closely related species from a number of hosts has enabled us to observe these differences and to verify their stability”. It is noteworthy that Ledger (1980) reported *C. decimfasciatus* from *Butorides striatus* from the Transvaal of Africa, whereas Price & Beer (1965) recorded *C. butoridiphagus* (as *C. melanophi*) from the same host in Cuba and Thailand. Ledger (1980) explained, “It is possible that geographical distribution plays a role in this case, or else the species of lice may sometime prove to be inseparable” and the author did not include *C. butoridiphagus* in the checklist of Afrotropical *Ciconiphilus*, even though the host genera *Butorides* and *Ixobrychus* were present in the region. Moreover, Zlotorzycza et al. (1999) mentioned the subspecies *C. decimfasciatus minor* (Piaget, 1885) (synonym: *Colpocephalum trchioxum* var. *minor* Piaget, 1885) for the species using body measurements, but it is now considered a synonym of *C. decimfasciatus* (Price et al., 2003; Smith et al., 2024). It seems that body measurements have not made enough reliable and consistent characters to use in the taxonomy of this species (Carriker, 1964; Price & Beer, 1965; Zlotorzycza, et al., 1999; Amina et al., 2014; Kumar et al., 2019). It is believed that the body size of lice, and also other parasites, may be influenced by the host body size, the population density of lice, differences in selection pressure exerted by each host, inter and intraspecific competition, microhabitats within the host body, which lice occupy and different community-level interactions (Johnson et al., 2005; Tryjanowski et al., 2007; Harnos et al., 2017).

Checklist of Phthiraptera of Guilan Province. The checklist of species as well as their hosts, distribution in the province (if it is available) and references, including three suborders, four families, ten genera and 12 species, is presented here. This checklist is regarded as preliminary because few collections and specimens are available for the province.

Suborder Amblycera Kellogg, 1896

Family Menoponidae Mjöberg, 1910

Ciconiphilus decimfasciatus (Boisduval & Lacordaire, 1835)

Host association. *Egretta garzetta* (little egret), Talesh (Dik & Halajian, 2013); *Ardea alba* (great egret), Rasht (present work).

***Menacanthus stramineus* (Nitzsch, 1818)**

Host association. *Gallus gallus* (fowl), Rudsar (Hosseinzadeh Marzenaki & Shojaee, 2017); *Columba livia* (pigeon), Lahijan (Chaechi-Nosrati et al., 2018)*.

***Menopon gallinae* (Linnaeus, 1758)**

Host association. *Anser anser* (greylag goose), Guilan (Hosseini et al., 2001)*; *Gallus gallus* (fowl), Langroud (Hosseinzadeh Marzenaki, 2017), Rudsar (Hosseinzadeh Marzenaki & Shojaee, 2017); *Columba livia* (pigeon), Lahijan (Chaechi-Nosrati et al., 2018)*.

Suborder Anoplura**Family Pediculidae Leach, 1817*****Pediculus humanus* Linnaeus, 1758**

Host association. *Homo sapiens* (human), Rasht (Golchie & Ahmadi Ghajari, 2002; Golchie & Ramezanpoor, 2003), Astara, Rudbar, Siahkal, Fuman, Lashtenesha (Pourbaba et al., 2005), Amlash (Rafinejad et al., 2006).

Suborder Ischnocera**Family Philopteridae Nitzsch, 1818*****Ardeicola* sp. nr *expallidus* (Blagoveshtchensky, 1940)**

Host association. *Egretta garzetta* (little egret), Talesh (Dik & Halajian, 2013).

***Columbicola columbae* (Linnaeus, 1758)**

Host association. *Columba livia* (pigeon), Lahijan (Chaechi-Nosrati et al., 2018).

***Goniocotes gallinae* (De Geer, 1778)**

Host association. *Meleagris gallopavo* (turkey), Rasht (Rassouli et al., 2016).

***Goniodes dissimilis* Denny, 1842**

Host association. *Gallus gallus* (fowl), Langroud (Hosseinzadeh Marzenaki, 2017), Rudsar (Hosseinzadeh Marzenaki & Shojaee, 2017).

***Goniodes gigas* (Taschenberg, 1879)**

Host association. *Meleagris gallopavo* (turkey), Rasht (Rassouli et al., 2016).

***Goniodes* sp.**

Host association. *Columba livia* (pigeon), Lahijan (Chaechi-Nosrati et al., 2018)*.

***Lipeurus caponis* (Linnaeus, 1758)**

Host association. *Anser anser* (greylag goose), Guilan (Hosseini et al., 2001).

Family Trichodectidae Kellogg, 1896***Trichoidectes canis* (De Geer, 1778)**

Host association. *Canis familiaris* (dog), Guilan (Ebrahimzade et al., 2016).

Remarks. The bird hosts, indicated by an asterisk, are not normally the hosts of the louse species. These records are probably due to contamination or misidentification.

DISCUSSION

Ciconiphilus decimfasciatus was reported to infest the little egret *Egretta garzetta* (Ciconiiformes: Ardeidae) in Talesh of Guilan Province, for the first time in 2013 (Dik & Halajian, 2013). This is the second report of this species with a new host record in Iran. The fact that this louse has been found on two bird species in Guilan Province, means there is the possibility of finding the louse in other known hosts which occur in the province. The genus *Ciconiphilus* is cosmopolitan and includes nine species, and its hosts are limited to certain members of the bird orders Anseriformes and Ciconiiformes (Carriker, 1964; Price & Beer, 1965; Palma, 1978; Price et al., 2003; Smith et al., 2024). In the genus, only two species, *C. butoridiphagus* and *C. decimfasciatus*, infest the bird family Ardeidae, the bitterns and herons. *Ciconiphilus decimfasciatus* has a cosmopolitan distribution and infests at least 16 genera and 22 species of the family Ardeidae (Price & Beer, 1965; Price & Emerson, 1966; Ledger, 1980). Price et al. (2003) prepared keys to the lice suborders, families and genera that infest Ciconiiformes. In the family Menoponidae, the genus *Ciconiphilus* is characterized by having both ctenidia on the hindfemur and the third abdominal sternite and lateral slit, not notch, on the head (Clay, 1969; Price et al., 2003) (Fig. 1). The genus is included in the *Colpocephalum* complex (Clay, 1969; Ledger, 1980).

Ciconiphilus butoridiphagus is a very close and similar species to *C. decimfasciatus* (Price & Beer, 1965). It has also been collected from the bird hosts of five genera representing six species of the family Ardeidae in British West Indies, Cuba, Thailand, Trinidad and USA and is the only representative of the genus *Ciconiphilus* found on the bird genera *Butorides*, *Gorsachius* and *Ixobrychus*, but this species has not been collected from the genera *Ardea* and *Egretta* (Price & Beer, 1965; Price et al., 2003). On the other hand, Ledger (1980) reported a series of *C. decimfasciatus* from *Butorides striatus* from the Transvaal of Africa, whereas Price & Beer (1965) recorded *C. butoridiphagus* (as *C. melanolophi*) from the same host in Cuba and Thailand. It seems that more material from different hosts and geographical distributions for these two very close species is needed for a better analysis of their variation.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: S. Azari-Hamidian: conceptualization, methodology, investigation, data curation, writing original draft; M. Sharifdini: investigation, data curation, writing original draft; A. Sazmand: investigation, data curation, writing original draft. All authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens mentioned in this article are deposited in the Museum of Medical and Veterinary Entomology, the School of Health, Guilan University of Medical Sciences. All other data are provided within the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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گزارش میزبان جدید شپش *Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) (Phthiraptera: Menoponidae) در ایران همراه با یک یادداشت تاکسونومیک و فهرست شپش‌های استان گیلان

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چکیده: داده‌های اندکی در مورد شپش‌های پرندگان و پستانداران در استان گیلان در شمال ایران وجود دارد، با وجود اهمیتی که آنها در پزشکی و دامپزشکی دارند. مجموعه‌ی خوبی از شپش‌ها از یک نمونه حواصیل بزرگ، *Ardea alba* (Ciconiiformes: Ardeidae)، کشته شده ناشی از تصادف جاده‌ای در رشت، استان گیلان، در تابستان ۱۴۰۲ جمع‌آوری شد. شپش‌های جمع‌آوری شده در اتانول ۸۰٪ نگهداری و با پتاس ۱۰٪ شفاف شدند. لام‌های میکروسکوپی با استفاده از محیط برلیز تهیه شد. شپش‌ها بر اساس ریخت‌شناختی *Ciconiphilus decimfasciatus* (Boisduval & Lacordaire, 1835) (Phthiraptera: Menoponidae) از روی حواصیل بزرگ به عنوان میزبان جدید تشخیص داده شدند. یک یادداشت تاکسونومیک برای این گونه ارائه شد. همچنین فهرستی از شپش‌های استان گیلان همراه با میزبان و انتشار آنها شامل سه زیرراسته، چهار خانواده، ده جنس و دوازده گونه ارائه شد. این فهرست بنیانی مقدماتی برای پژوهش‌های آینده است.

واژگان کلیدی: Amblycera، شپش‌های پرندگان، شپش‌های طیور، شپش‌های جونده، شپش‌های ساینده