



## Review of the chewing louse fauna of the invasive common myna (*Acridotheres tristis*), with new records from Palestine and a redescription of *Brueelia chayanh* Ansari, 1955 (Phthiraptera, Ischnocera, *Brueelia*-complex)

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### Abstract

Palestine hosts a large diversity of birds, with 393 recorded species, but little data are available on the chewing lice fauna found on these birds. In this study, we surveyed the species of chewing lice found on the common myna, *Acridotheres tristis*, which is one of the most invasive bird species in the world. Forty-five mynas were examined to collect their ectoparasites, which were preserved and slide mounted. Among the 1004 chewing lice processed, we identified two species: *Menacanthus eurysternus* (Burmeister, 1838) (prevalence 100%) and *Brueelia chayanh* Ansari, 1955 (prevalence 82.2%). No other species of chewing louse known from *A. tristis* in its native range was found, showing a possible sorting event in the founding population of common myna in the region. Prevalence (100%) and abundance (22.3) were high compared to similar studies of the common myna. To contribute to future research on the lice of common mynas, we provide an annotated checklist of the louse species reported from this host globally. Also, we redescribe and illustrate *Brueelia chayanh*, and place *Sturnidoecus tristisae* Bughio *et al.*, 2018 as a new junior synonym of *Sturnidoecus bannoo* Ansari, 1968.

**Key words:** *Acridotheres tristis*, common myna, invasive species, Phthiraptera, chewing lice, *Brueelia chayanh*, *Menacanthus eurysternus*, *Sturnidoecus*, *Myrsidea*, sorting events, redescription, new synonymy

### Introduction

Chewing lice are small, wingless, dorsoventrally compressed insects belonging to the order Phthiraptera (Price *et al.* 2003). They are permanent obligate ectoparasites, i.e., complete their entire life cycle on the host's body, and most of them live on birds (Price *et al.* 2003), where they feed on feathers, blood, mucus, and skin scales (Marshall 1981; Johnson & Clayton 2003). Heavy chewing louse loads may have harmful effects on the host's health and may lead to a decrease in their reproduction (Johnson & Clayton 2003; Dik *et al.* 2011). Transmission among hosts occurs primarily during direct contact, such as copulation, parent and offspring in the nest, communal roosting, and other types of contact (e.g., Hillgarth 1996). However, transmission of lice may also happen through phoresy on hippoboscids flies (Bartlow *et al.* 2016; Lee *et al.* 2022), the effects of which may be substantial on the population structure of the lice (DiBlasi *et al.* 2018).

In the area of Palestine, few studies have been published on avian parasites, mainly focusing on helminths of residents and migratory birds (Awad *et al.* 2013; Awad & Rzaad 2015), but little research has been published on avian ectoparasites, particularly chewing lice. A total of 179 species of lice (60 species of Amblycera and 119 of Ischnocera) were recorded during a survey of ectoparasites of birds and mammals in Israel, between 1956 and 1962 (Theodor & Costa 1967). In addition, papers on mites (Rosen *et al.* 1985) and hippoboscids flies (Bear & Freidber 1995) are available. More recently, research on chewing lice has been published for some raptor species (Friedemann *et al.* 2013; Yosef *et al.* 2019).

Despite its small size, Palestine has 393 species of birds recorded from a variety of habitats and climate zones (Awad *et al.* 2022). However, in the last few decades, the native avifauna has been threatened by the spread of invasive bird species, which have had adverse effects on the native species and ecosystems (Holzapfel *et al.* 2006; Roll *et al.* 2008; Orchan *et al.* 2013; Colléony & Shwartz 2020). Among those invasive species, the common myna, *Acridotheres tristis*, is one of the most damaging species in the world (Birdlife International 2000; Lowe *et al.* 2000; Grarock *et al.* 2012). It has shown a remarkable versatility to establish itself in many parts of the world because of its omnivorous diet and the ability to adapt to different habitats (Ali & Ripley 1972; Feare & Craig 1999). Common mynas were introduced to Tel Aviv, Israel, in 1997, and they successfully established a breeding population (Holzapfel *et al.* 2006). Initially, they spread along the coastline northwards, but also southwards into less densely populated areas (Magory-Cohen & Dor 2019). Only later they spread to the West Bank, where it has been recorded in all governorates, mostly restricted to human communities (Handal & Qumsiyeh 2021). Common mynas are abundant in urbanized areas in the city of Bethlehem, but less common in rural and agricultural land; they live in proximity to humans, nest within cavities in buildings, feed on street food remains around trash containers, and also eat invertebrates and fruit.

The common myna displays very aggressive behaviour towards other birds, including displacing birds from nest sites and preying on their chicks, which reduces their breeding success (Orchan *et al.* 2013; Charter *et al.* 2016). Attacks on other birds in nests have been recorded against native species, such as the house sparrow *Passer domesticus*, the laughing dove, *Spilopelia senegalensis*, and the common swift, *Apus apus* (personal observations, B.J.).

Despite the wide native and introduced range of the common myna, studies on the prevalence and community structure of its chewing lice are few. However, as the myna thrives in diverse environments across the world and has been introduced to these areas through different colonisation events, it is an excellent model system to examine mechanisms of host associations in chewing lice. Three mechanisms are particularly involved: missing the boat (Paterson *et al.* 1999), the acquisition of new parasites, and the transfer of parasites from invasive birds to native birds.

In many studies, introduced host species have been shown to have depauperate louse faunas compared to those of the same hosts in their native ranges. For instance, louse populations of introduced starlings, *Sturnus vulgaris*, house sparrows and two species of parrots have all been found to be reduced compared to the same hosts in their native range (Boyd 1951; Fairn *et al.* 2014; Mori *et al.* 2015; Ancillotto *et al.* 2018; Oyarzún-Ruiz *et al.* 2021). Overall, Paterson *et al.* (1999) found that introduced species of birds in New Zealand had reduced louse faunas in 15 of 18 cases, with an average loss of diversity of approximately 2 louse species per host species. Processes such as “missing the boat” and “drowning on arrival” may be the cause of the losses (Paterson *et al.* 1999; MacLeod *et al.* 2010). However, long-term studies of other invasive birds have shown that louse species believed to be absent may in fact, just be rare or geographically limited in the introduced range (Grossi & Proctor 2021).

A reduction in the louse fauna of introduced birds (i.e., drowning on arrival), may be due to environmental constraints that limit the geographical distribution of certain louse species. In particular, high or low ambient relative humidity have been suggested to limit the range of some louse species (Fabiya 1996; Carillo *et al.* 2007; Bush *et al.* 2009; Malenke *et al.* 2011; Barrientos *et al.* 2014; Takano *et al.* 2019), but other factors such as ambient temperature may also affect louse survival. Gustafsson *et al.* (2022) suspected that some louse groups may be adapted to living at high elevations, which may be a proxy for humidity, temperature, or even lower oxygen levels at higher elevations. If correct, this could also limit louse faunas dispersing from one elevation to another.

In parallel to the loss of louse diversity, birds introduced to novel environments may acquire new louse species, so-called “spill-back effects” (Mori *et al.* 2019). Examples of these effects are rare in the literature, but Fabiya (1972) reported some novel louse species associated locally with domestic chickens in Nigeria. The louse fauna of domestic chickens differs around the world, and may be influenced by a combination of management differences and acquisition of lice from other game birds (Gustafsson & Zou 2020).

Furthermore, invasive species may act as reservoirs for human and wildlife diseases (Jalas & Tavalla 2018; Mori *et al.* 2018). Although there are neither published examples for the louse fauna of common mynas, nor well-studied examples of other invasive louse-host systems showing spill-over patterns, common mynas may spread their parasites to local bird species through direct contact while foraging or aggressive behaviour (Mori *et al.* 2018, 2019), for example, to the three other starling species which live in Palestine (Svensson *et al.*, 2009). Moreover, the potential to establish populations on distally related hosts cannot be excluded (*e.g.*, Sychra *et al.*, 2014).

In this paper, we report the first collection of chewing lice from common myna, an introduced species in Palestine, and we review current knowledge of the louse fauna of these birds world-wide. We hope that other researchers working on this invasive species will fill the gaps we found in the data relating to the louse communities of this host, in its native range and in the many additional areas where it has been introduced. To that end, we redescribe *Brueelia chayanh* Ansari, 1955, one of the most frequently recorded species from common mynas, we place *Sturnidoecus tristisae* Bughio *et al.*, 2018, as a new junior synonym of *Sturnidoecus bannoo* Ansari, 1968, and discuss other species of lice known from these hosts.

## Materials and methods

Forty-five mynas were collected dead in a suburban area of Bethlehem City, West Bank, Palestine, during July 2021 to October 2022. The study area lies at an elevation of 650–750m above sea level, with a Mediterranean climate characterized by hot, dry summers and mild, wet winters, with average annual rainfall of 501mm, an average annual temperature of 16.3°C, and average annual humidity of about 60.4% (ARIJ 2009).

Ectoparasites were collected from the birds by ruffling their feathers above a tray lined with a sheet of white paper. Lice from each bird were preserved with 70% ethanol in separately numbered Eppendorf tubes. All the lice were cleared in 10% KOH heated to ~60°C for 30–60 minutes, followed by dehydration in 70% and 100% ethanol, respectively, and were permanently mounted on slides in Canada balsam. Lice were identified to species level using the key in Price (1977) for *Menacanthus* species, and by comparison with identified specimens deposited at the Natural History Museum, London, United Kingdom (NHML), and the Bernice P. Bishop Museum, Honolulu, Hawai'i, United States (BPBM), for *Brueelia chayanh*.

The identified lice were counted by species, sex and nymphal stages from each bird. Prevalence, mean abundance, mean intensity, range of infestation, male: female ratio and adult: nymph ratio were calculated for each louse species. All statistical analysis was done using IBM SPSS 25.

A literature search in Google Scholar and <https://phthiraptera.myspecies.info> was performed for key words: “common myna”, “*Acridotheres tristis*”, combined with “lice”, “Phthiraptera”, “Mallophaga”, “ectoparasites” and “parasites”, as well as for each of the louse species known from common mynas, except for *Menacanthus eurysternus* (Burmeister, 1838). This latter species parasitises over 200 host species worldwide (Price *et al.* 2003: 119).

The species listed as junior synonyms under each louse species recorded from the common myna are only those relevant to this host or where an additional host species was recorded. Definitions and abbreviations of morphological and setal characters follow Gustafsson & Bush (2017). The specimens collected for this paper in Palestine were deposited in the Environmental Education Centre, Natural History Museum, Beit Jala, Palestine (EECNHM). Also, specimens from the following museum collections were examined: BPBM, NHML, and the University of Minnesota, St. Paul, Minnesota, United States (UMSP).

## Results

A total of 1004 chewing lice were collected and identified as belonging to two species: *Menacanthus eurysternus* and *Brueelia chayanh*. Every one of the 45 birds examined was infested with at least one species of louse, and the intensity of infestation ranged from 3 to 106 lice per bird, with a mean of 22.3. Prevalence data, and detailed incidence and intensity for each louse species are shown in Table 1, together with a summary of published data.

In addition, a literature review and examination of museum specimens of the louse species reported from *Acridotheres tristis* worldwide revealed that 18 species have been recorded from this bird (Table 2). A summary of the known geographical ranges of valid louse species regarded as natural and regular parasites of *Acridotheres tristis* is given in Table 3.

**TABLE 1.** Infestation parameters of *Menacanthus eurysternus* and *Brueelia chayanah* collected from *Acridtheres tristis* (n=45) in Bethlehem City, West Bank, Palestine, during 2021–2022, including data of these and three other species taken from the literature.

Data from the literature are based on samples from the natural range of *A. tristis*. Age ratios include the three nymphal stages together. Data from Aslam *et al.* (2015) are not included, as it is not clear that their “percent presence” represents prevalence.

	Number of lice (% of total sample)	Sex ratio (male: female)	Age ratio (adult: nymph)	Prevalence (%)	Sample mean abundance (lice index)	Mean intensity ( $\bar{X}$ )	Range of infestation (lice/bird)	Variance to mean ratio ( $s^2$ )	Index of discrepancy (D)	Source
<b>New data</b>										
<i>Brueelia chayanah</i>	268 (26.7)	1:1.33	1:0.68	37/45 (82.2%)	6	7.2	1–46	15.17	0.64	This study
<i>Menacanthus eurysternus</i>	736 (73.3)	1:2.44	1:1.13	45/45 (100%)	16.4	16.4	3–66	7.61	0.33	This study
Total	1004	-	-	45/45 (100%)	22.3	-	3–106	-	-	This study
<b>Literature data</b>										
<i>Brueelia chayanah</i>	-	1:1.2	1:1.1	24/100 (24%)	6.9	28.9	3–82	41.9	0.86	India (Saxena <i>et al.</i> 2007)
	6	1:1	1:0.5	1/1 (100%)	6	6	6	-	-	Iran (Moodi <i>et al.</i> 2013)
	193	-	-	76/80 (95%)	-	-	-	-	-	Pakistan (Bugchio <i>et al.</i> 2018) <sup>1</sup>
	79 (40.1)	-	-	19/25 (76%)	-	-	-	-	-	Yilmaz <i>et al.</i> (2023)
<i>Menacanthus eurysternus</i>	35428	1:1.30	1:0.88	442/646 (68.4%)	-	80.15	1–460	-	-	India (Chandra <i>et al.</i> 1990)

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TABLE 1. (Continued)

	Number of lice (% of total sample)	Sex ratio (male: female)	Age ratio (adult: nymph)	Prevalence (%)	Sample mean abundance (lice index)	Mean intensity ( $\bar{X}$ )	Range of infestation (lice/bird)	Variance to mean ratio ( $s^2$ )	Index of discrepancy (D)	Source
	-	1:1.1	1:0.7	13/100 (13%)	2.3	17.5	2–32	20.8	0.90	India (Saxena <i>et al.</i> 2007)
	210	-	-	80/80 (100%)	-	-	-	-	-	Pakistan (Bughio <i>et al.</i> 2018)
<i>Myrsidea ahmedalii</i>	118 (59.9)	-	-	16/25 (64%)	-	-	-	-	-	Yilmaz <i>et al.</i> (2023)
	44	-	-	35/80 (43.8%)	-	-	-	-	-	Pakistan (Bughio <i>et al.</i> 2018)
<i>Myrsidea invadens</i>	-	1:1.5	1:1.3	31/100 (31%)	5.1	16.3	2–63	32.1	0.86	India (Saxena <i>et al.</i> 2007)
<i>Sturnidoecus bannoo</i>	-	1:1.3	1:1.0	42/100 (42%)	15.6	37.07	3–106	50.3	0.78	India (Saxena <i>et al.</i> 2007)
	56	-	-	30/80 (27.5%)	-	-	-	-	-	Pakistan (Bughio <i>et al.</i> 2018) <sup>2</sup>

<sup>1</sup> Bughio *et al.* (2018) also reported 146 specimens of “*Brueelia* sp. 1” from 40 birds (50%), and 263 specimens of “*Brueelia* sp. 2” from 65 birds (81.3%). It is unclear if these specimens represent: stragglers, nymphs, unidentifiable specimens, or new species.

<sup>2</sup> Bughio *et al.* (2018) reported these data under the name “*Sturnidoecus tristisae*”, which is here considered a junior synonym of *St. bannoo*. They also reported 14 specimens of “*Sturnidoecus* sp.” from 8 birds (10%). It is unclear what these specimens are: stragglers, nymphs, unidentifiable, or new species.

**TABLE 2.** List of species of Phthiraptera that have been reported from *Acridotheres tristis*, with their taxonomic and host-association status

For more detail, see the text. Species that are expected to occur on the native range of *A. tristis* are in **bold text**.

Louse species	Taxonomic status	Host-association status
<b>Amblycera: Menoponidae</b>		
<b><i>Menacanthus eurysternus</i> (Burmeister, 1838)</b>	Valid (Price <i>et al.</i> 2003)	Natural and regular
<i>Menacanthus spiniferus</i> (Piaget, 1885)	Junior synonym of <i>M. eurysternus</i> (see Price 1975)	-
<i>Menacanthus tristisi</i> (Qadri, 1935)	Junior synonym of <i>M. eurysternus</i> (see Price 1975)	-
<b><i>Myrsidea ahmedalii</i> Bughio <i>et al.</i>, 2018</b>	Tentatively valid (see text)	Natural and regular
<b><i>Myrsidea invadens</i> (Kellogg &amp; Chapman, 1902)</b>	Valid (Price <i>et al.</i> 2003)	Natural and regular (See text)
<i>Myrsidea lyallpurensis</i> Ansari, 1951	Junior synonym of <i>Myrsidea chilchil</i> Ansari, 1951 (Tandan & Clay 1971)	Straggler or contaminant
<b>Ischnocera: Philopteridae</b>		
<b><i>Brueelia chayanh</i> (Ansari, 1955)</b>	Valid (Gustafsson & Bush 2017)	Natural and regular
<i>Brueelia fuscopleura</i> (Blagoveshtchensky, 1951)	Valid (Gustafsson & Bush 2017)	Straggler or contaminant (see text)
<i>Brueelia iliaci</i> (Denny, 1842)	Valid (Gustafsson & Bush 2017)	Straggler or contaminant
<i>Brueelia nebulosa</i> (Burmeister, 1838)	Valid (Gustafsson & Bush 2017)	Straggler or contaminant
<i>Colinicola docophoroides minhaensis</i> (Kellogg & Chapman, 1902)	Junior synonym of <i>Colinicola Docophoroides</i> (Price <i>et al.</i> 2003)	Straggler or contaminant
<i>Rallicola minhaensis</i> (Kellogg & Chapman, 1902)	Possibly valid (see text)	Straggler or contaminant
<i>Sturnidoecus affinis</i> (Piaget, 1880)	Valid (Gustafsson & Bush 2017)	Straggler or contaminant
<b><i>Sturnidoecus bannoo</i> (Ansari, 1955)</b>	Valid; may be a junior synonym of <i>S. capensis</i> (Gustafsson & Bush 2017)	Natural and regular
<i>Sturnidoecus bannoo avinus</i> (Ansari, 1968)	Junior synonym of <i>S. bannoo</i> (Gustafsson & Bush 2017)	-
<b><i>Sturnidoecus capensis</i> (Giebel, 1874)</b>	Valid (Gustafsson & Bush 2017)	Natural and regular
<i>Sturnidoecus fragilis</i> (Ansari, 1968)	Junior synonym of <i>S. capensis</i> (Gustafsson & Bush 2017)	-
<i>Sturnidoecus sturni</i> (Schrank, 1776)	Valid (Gustafsson & Bush 2017)	Straggler or contaminant
<i>Sturnidoecus tristisae</i> Bughio <i>et al.</i> 2018	Junior synonym of <i>S. bannoo</i> ( <b>new synonymy</b> )	-

### Annotated checklist of the lice recorded from *Acridotheres tristis* worldwide

All species of lice that have been reported from *Acridotheres tristis*—including junior synonyms under the senior names—are listed in chronological order, and discussed regarding their status, where necessary. Also, the material we examined is listed under relevant species. In cases where we have not examined specimens of literature records, we assume that the louse species reported were correctly identified, unless there is evidence to the contrary.

**TABLE 3.** Known geographical range of valid species of chewing lice recorded from *Acridotheres tristis*.

Records of junior synonyms are listed under their senior synonyms, and species listed as “Straggler or contaminant” in Table 2 are not included because they do not contribute to knowledge of the louse natural fauna of the common myna. Localities outside the native range of *A. tristis* are marked with an asterisk (\*). In addition, specimens of louse species registered in the open access website of the Natural History Museum, London (data.nhm.ac.uk; accessioned January 2023) are listed as “NHML” in the Source column, except for those in the *Brueelia*-complex, published by Gustafsson & Bush (2017). Note that except for specimens of *B. chayanh*, *S. bannoo* and *S. capensis*, we have not examined any specimens from the NHML, and we assume that identities on slide labels are correct.

Louse species	Locality	Source	
<i>Brueelia chayanh</i>	India	Chandra <i>et al.</i> (1990); Srivastava <i>et al.</i> (2003)?; Saxena <i>et al.</i> (2007); Gustafsson & Bush (2017)	
	Iran	Moodi <i>et al.</i> (2013)	
	Nepal	Gustafsson & Bush (2017)	
	Pakistan	Ansari (1955); Aslam <i>et al.</i> (2015); Bughio <i>et al.</i> (2018)	
	Palestine*	This report	
	Panjab	Ansari (1956a)	
	Saint Helena*	Gustafsson & Bush (2017)	
	Thailand	Gustafsson & Bush (2017)	
	Turkey	Yilmaz <i>et al.</i> (2023)	
<i>Menacanthus eurysternus</i>	Bangladesh	Hossain <i>et al.</i> (2022)	
	Hawai’i*	Price (1975)	
	India	Qadri (1935); Price (1975); Chandra <i>et al.</i> (1990); Srivastava <i>et al.</i> (2003); Saxena <i>et al.</i> (2007)	
	Madagascar*	Price (1975)	
	Malaysia	Price (1975); NHML	
	Myanmar	Price (1975)	
	New Zealand*	Palma (2017) <sup>1</sup>	
	Pakistan	Naz <i>et al.</i> (2016); Bughio <i>et al.</i> (2018)	
	Palestine*	This report	
	Thailand	Price (1975)	
	Turkey	Yilmaz <i>et al.</i> (2023)	
	<i>Myrsidea ahmedalii</i>	Pakistan	Bughio <i>et al.</i> (2018)
		<i>Myrsidea invadens</i>	Diego Garcia*
<i>Myrsidea invadens</i>	Hawai’i*	Kellogg & Chapman (1902); NHML	
	India	Saxena <i>et al.</i> (2007); Kumar <i>et al.</i> (2018)?	
	Madagascar*	NHML	
	Pakistan	Aslam <i>et al.</i> (2015)	
	Sri Lanka	NHML	
	Saint Helena*	NHML	
	Thailand	NHML	
	<i>Sturnidoecus bannoo</i>	Bangladesh	Hossain <i>et al.</i> (2022) Possible misidentification (see text)
India		Ansari (1968); Srivastava <i>et al.</i> (2003); Saxena <i>et al.</i> (2007); Gustafsson & Bush (2017)	
Nepal		Ansari (1968); Gustafsson & Bush (2017)	
Pakistan		Ansari (1955, 1968); Bughio <i>et al.</i> (2018)	
Panjab		Ansari (1956a, 1958b)	
<i>Sturnidoecus capensis</i>		Sri Lanka	Ansari (1968); Gustafsson & Bush (2017)
	Thailand	Gustafsson & Bush (2017)	

<sup>1</sup> Palma (2017) listed unidentified females of *Sturnidoecus* sp. from New Zealand.

## **PHTHIRAPTERA Haeckel, 1896**

Phthiraptera Haeckel 1896: 703.

## **Amblycera Kellogg, 1896**

Amblycera Kellogg, 1896: 68.

## **Menoponidae Mjöberg, 1910**

Menoponidae Mjöberg, 1910: 26.

## ***Menacanthus* Neumann, 1912**

### ***Menacanthus eurysternus* (Burmeister, 1838)**

*Menopon eurysternum* Burmeister, 1838: 439.

*Menopon spiniferum* Piaget, 1885: 99.

*Menacanthus tristisi* Qadri, 1935: 226.

**Type host.** *Pica pica* (Linnaeus, 1758)—Eurasian magpie.

**Type locality.** None given.

### **Other hosts**

*Acridotheres tristis* (Linnaeus, 1766)—common myna. See Ansari (1951: 150) and Qadri, (1935: 226).

Over 200 species of Passeriformes and Piciformes (Price *et al.* 2003: 119).

**Remarks.** *Menacanthus eurysternus* is a morphologically variable taxon, known from a great number of hosts across the world, with populations from some of those hosts described as separate species (Price 1975). Martinů *et al.* (2015) showed that, despite some genetic variation among specimens of *M. eurysternus* from 13 host families, their results agreed with the taxonomy of Price (1975). For a detailed description and illustrations of *M. eurysternus*, see Price (1975).

Although Ansari (1951) stated that *Menacanthus spiniferus* had “frequently been recorded from the Indian Minor [sic], *Acridotheres t. tristis* (Linn.)”, this species is not mentioned in Ansari’s later works (*e.g.*, Ansari 1956a).

The original description of *M. tristisi* is lengthy but lacks details to identify the taxon unequivocally. Price (1975) synonymized *M. tristisi* under *M. eurysternus*, after having examined specimens of *Menacanthus* from *A. tristis* from Burma, Hawaii, India, Madagascar, Malaysia and Thailand, but he does not appear to have examined the two female syntypes of *M. tristisi* from India. We accept the synonymy established by Price (1975), pending an examination of the syntypes, which may still be extant at the Zoological Museum of Aligarh Muslim University, Uttar Pradesh, India.

Records of *M. eurysternus* from *A. tristis* are listed in Tables 1 and 3. Chandra *et al.* (1990) studied the fluctuations in the population of *M. eurysternus* collected from 646 common mynas during a year. Srivastava *et al.* (2003) analysed the correlation between breeding cycles of common mynas and their lice, including *M. eurysternus*, over a year; they found that host testicular weight had the greatest influence on *M. eurysternus* population sizes, whereas in female hosts, the photoperiod had the greatest effect on louse populations.

**Material examined (non-types):** Ex *Acridotheres tristis*: 100♂, 244♀, 392 nymphs, Bethlehem, Palestine, Jul. 2021–Sep. 2022, coll. B. Jayarseh & M. Amaya, A0001–A0015 and A0017–A0046 (EECNHM).



## ***Myrsidea* Waterston, 1915**

### ***Myrsidea invadens* (Kellogg & Chapman, 1902)**

*Menopon invadens* Kellogg & Chapman, 1902: 167.

**Type host.** *Acridothores tristis* (Linnaeus, 1766)—common myna.

**Type locality.** Lahaina and Kahului, Maui Island, Hawai'i, United States.

#### **Other hosts**

*Spilopelia chinensis* (Scopoli, 1768)—spotted dove. See Kellogg & Chapman (1902: 167). Stragglers or contaminants.

*Gracula religiosa intermedia* Hay, 1845—northern hill myna. See Archawaranon & Subinprasert (2005: 113, fig. 1). Uncertain identification.

*Gracula religiosa palawanensis* (Sharpe, 1890)—Palawan hill myna. See Eduardo & Villa (2011: 80). Uncertain identification.

*Contopus pertinax* Cabanis & Heine, 1860—greater pewee. See Zavaleta (1944: 203). Uncertain identification.

*Calocitta formosa azurea* Nelson, 1897—white-throated magpie-jay. See Zavaleta (1944: 203). Uncertain identification.

**Remarks.** The original description and illustration of *M. invadens* were based on females only, and no redescription and/or comparison with the type specimens has been published. Kumar *et al.* (2018) published a redescription of *M. invadens* from the type host, but neither their description of the tergopleurites nor the head shape in their illustration agree with those features as illustrated by Kellogg & Chapman (1902). Considering that many of the species described by Kellogg and his coauthors were based on stragglers or contaminants (Palma 1994), the type specimens of *M. invadens* need to be examined and redescribed to verify that the material examined by Kumar *et al.* (2018) are indeed conspecific. It is not inconceivable that the natural and regular host of *M. invadens* is not the common myna, possibly a native bird to Hawai'i.

In addition, there are several reports of *Myrsidea* lice identified as *M. invadens*, but these identifications are uncertain because all samples examined were from hosts different from the type host, some not even from the same host family, *e.g.*, Zavaleta (1944: 203) (see above under **Other hosts**). Considering that the reports of *Brueelia chayanh* from two subspecies of the hill myna by Eduardo & Villa (2011) and by Archawaranon & Subinprasert (2005) are incorrect (see below), and the high host specificity of *Myrsidea* species (Kolencik *et al.* 2022), it is likely that the two reports of *M. invadens* from the hill myna are misidentifications.

Two additional reports of lice from the common myna, identified as *Myrsidea invadens* need to be confirmed: one by Gupta *et al.* (2009) describing the eggs, and another by Aslam *et al.* (2015) finding that the primary microhabitat occupied by this louse is the dorsal side of the host body.

### ***Myrsidea chilchil* Ansari, 1951**

*Myrsidea chilchil* Ansari, 1951: 181.

*Myrsidea lyallpurensis* Ansari, 1951: 185.

**Type host.** *Argya caudata* (Dumont, 1823), the common babbler.

**Type locality.** Lyallpur [= Faisalabad, Punjab Province, Pakistan].

#### **Other host**

*Acridothores tristis tristis* (Linnaeus, 1766)—common myna. See Ansari (1951: 187). Stragglers or contaminants.

**Remarks.** Based on a comparison of holotypes, Tandan & Clay (1971) regarded *Myrsidea lyallpurensis* as a junior synonym of *Myrsidea chilchil*, a species regularly found on *Argya caudata* (Dumont, 1823), the common babbler. Therefore, the three type specimens of *M. lyallpurensis* were stragglers or contaminants on the common myna, and *M. chilchil* is not a regular and natural parasite of *A. tristis*.

## *Myrsidea ahmedalii* Bughio et al., 2018

*Myrsidea ahmedalii* Bughio et al., 2018: 94.

**Type host.** *Acridotheres tristis* (Linnaeus, 1766)—common myna.

**Type locality.** Sindh Province, Pakistan.

**Remarks.** The lack of a detailed redescription of the type series of *Myrsidea invadens* (see above) makes it difficult to evaluate whether *M. ahmedalii* is a different species or a junior synonym. The original description of *M. ahmedalii* includes a comparison with *M. invadens*, but the characters used are not those found in the original description of *M. invadens*, so it is difficult to know what Bughio et al. (2018) actually examined to compare against their new species (Table 4). The correct status of *Myrsidea ahmedalii* will be known only when the type series of these two species can be compared with each other.

**TABLE 4.** Comparison of morphological characters of *Myrsidea invadens* (Kellogg & Chapman, 1902) given in the original description, versus those of “*Myrsidea invadens*” sensu Bughio et al. (2018), and those of *Myrsidea ahmedalii* Bughio et al., 2018.

Characters are listed in the order used for “*M. invadens*” by Bughio et al. (2018), but characters given for only *M. ahmedalii* are excluded. Note that characters for *M. ahmedalii* are drawn both from the description and from the discussion.

Character	<i>Myrsidea invadens</i> (Kellogg & Chapman, 1902)	“ <i>Myrsidea invadens</i> ” sensu Bughio et al. (2018)	<i>Myrsidea ahmedalii</i> Bughio et al., 2018
Gular plate	Not mentioned or illustrated	“medianly sclerotized”	“highly sclerotized with medially weak patches”
Chaetotaxy of pronotum	“anterior angles with two spines and one long hair; posterior margin [...] with two long hairs near the lateral margin and two long hairs each side of the median lobe”	“one short, two long setae on each side”	“three stout thorn like lateral setae, posteriorly 3, 6 normal setae”
Chaetotaxy of metanotum	“lateral margins diverging with few short spines and one long hair in its posterior angles; posterior margin straight with four long marginal hairs”	“4 marginal setae, 3 short and one very long”	“bear[ing] 10–12 lateroposterior marginal setae”
Abdominal tergites	Not described in detail, but as illustrated (female only) tergopleurites III–VII modified, with II arched posteriorly and IV–VII arched anteriorly.	“all abdominal tergites of both male and female equal and undivided without anterior setae”	Male: “all tergites similar, undivided.”  Female: “tergite depressed at median, tergite I complete, tergite II–IV intermediate to median deeply convex, tergites V–VIII similar, equal”
Post-spiracular setae	Not mentioned and not clearly illustrated.	“in both male and female extremely long on tergites II, IV and VIII, very long on tergite I and VII, long on III, V and VI”	“in female fine normal on tergite III–IV, short on tergite V–VI, very long on tergite VII and VIII; in male post spiracle setae fine normal on tergite II–III, short on tergite IV and V, long on tergite VI–VIII”
Abdominal sternite II	Not illustrated and not mentioned.	“with thorn like setae in 2+1, 1+2 arrangement in both male and female”	Male: “bearing 3+1 fine stout, thick, robust setae at lateral corners (all male specimens with symmetrical arrangement of lateral stout setae)”  Female: “bearing 4+1 stout, thick, robust setae at lateral corners (one specimen showed asymmetrical arrangement of 4+1, 1+3)”

## **Ischnocera Kellogg, 1896**

Ischnocera Kellogg, 1896: 63.

## **Philopteridae Burmeister, 1838**

Philopteridae Burmeister, 1838: 422.

### ***Brueelia*-complex**

#### ***Brueelia* Kéler, 1936**

##### ***Brueelia nebulosa* (Burmeister, 1838)**

*Nirmus nebulosus* Burmeister, 1838: 429.

**Type host.** *Sturnus vulgaris* Linnaeus, 1758—common starling.

**Type locality.** None, likely Germany.

### **Other hosts**

*Sturnus vulgaris zetlandicus* Hartert, 1918—Shetland Islands starling. See Gustafsson & Bush (2017: 413).

*Acridotheres tristis tristis* (Linnaeus, 1766)—common myna. See Naz *et al.* (2016: 196). Misidentification or stragglers.

**Remarks:** Naz *et al.* (2016: 196) reported *B. nebulosa* from *A. tristis* without comment, description, illustration, or photo of the specimens. *Brueelia nebulosa* is regularly found on *Sturnus vulgaris*; therefore, this record is likely a misidentification of *B. chayanh*, or the lice were stragglers. As two host specimens were reported as infested with *B. nebulosa*, they might belong to a local population established on *A. tristis*.

##### ***Brueelia iliaci* (Denny, 1842)**

*Nirmus iliaci* Denny, 1842: 51.

*Painjunirmus iliaci* (Denny); Ansari 1947: 288.

*Brueelia iliaci indiensis* Ansari, 1956b: 111.

**Type host.** *Turdus iliacus* Linnaeus, 1758—redwing.

**Type locality.** None given, but in the British Isles.

### **Other hosts**

*Pastor roseus* (Linnaeus, 1758)—rosy starling. See Denny (1842: 131). Misidentification.

*Turdus atrogularis* Jarocki, 1819—black-throated thrush. See Ansari (1956b: 111).

*Acridotheres tristis tristis* (Linnaeus, 1766)—common myna. See Ansari (1947: 288). Misidentification.

**Remarks:** Although Ansari (1947: 288) reported *B. iliaci* (as *Painjunirmus*) from *A. tristis*, this louse is not a regular and natural parasite of the common myna. *Brueelia iliaci* is not included in Ansari's subsequent lists of lice from Pakistan (*e.g.*, Ansari 1951, 1955) and, presumably, the specimens misidentified by Ansari (1947) were used to describe *B. chayanh*.

## ***Brueelia fuscopleura* (Blagoveshtchensky, 1951)**

*Degeeriella cruciata fuscopleura* Blagoveshtchensky, 1951: 303.

*Brueelia gulabitylar* Ansari, 1955: 54.

### **Type hosts**

*Pastor roseus* (Linnaeus, 1758)—rosy starling.

*Acridotheres tristis tristis* (Linnaeus, 1766)—common myna.

**Type locality.** Tajikistan.

**Remarks:** Lice from the two type hosts of *B. fuscopleura* examined by Gustafsson & Bush (2017: 405, 409) represented two different species. Blagoveshtchensky's type series was not examined by Gustafsson & Bush (2017), who listed *P. roseus* as the only host of *B. fuscopleura*. Although it may be that the type specimens of *B. fuscopleura* from *A. tristis* were stragglers or contaminants, more *Brueelia* samples from *A. tristis* from Tajikistan are needed to confirm if *B. fuscopleura* occurs together with *B. chayanh*, or replaces it. Both species can be separated by the shape of the head and presence/absence of the *aps* on the male abdominal segment VI.

Gustafsson & Bush (2017: 41) placed *Brueelia gulabitylar* as a junior synonym of *B. fuscopleura*, based on specimens examined from the type host, *P. roseus*. A redescription of *B. fuscopleura* will be published elsewhere (D.R.G. *in prep.*).

## ***Brueelia chayanh* Ansari, 1955**

(Figs 1–7)

*Brueelia chayanh* Ansari, 1955: 55.

*Brueelia chayanh* Ansari, 1956a: 395.

*Brueelia chayanh* Ansari, 1958a: 54.

**Type host.** *Acridotheres tristis tristis* (Linnaeus, 1766).

**Type locality.** None given, but presumably the Punjab region of Pakistan.

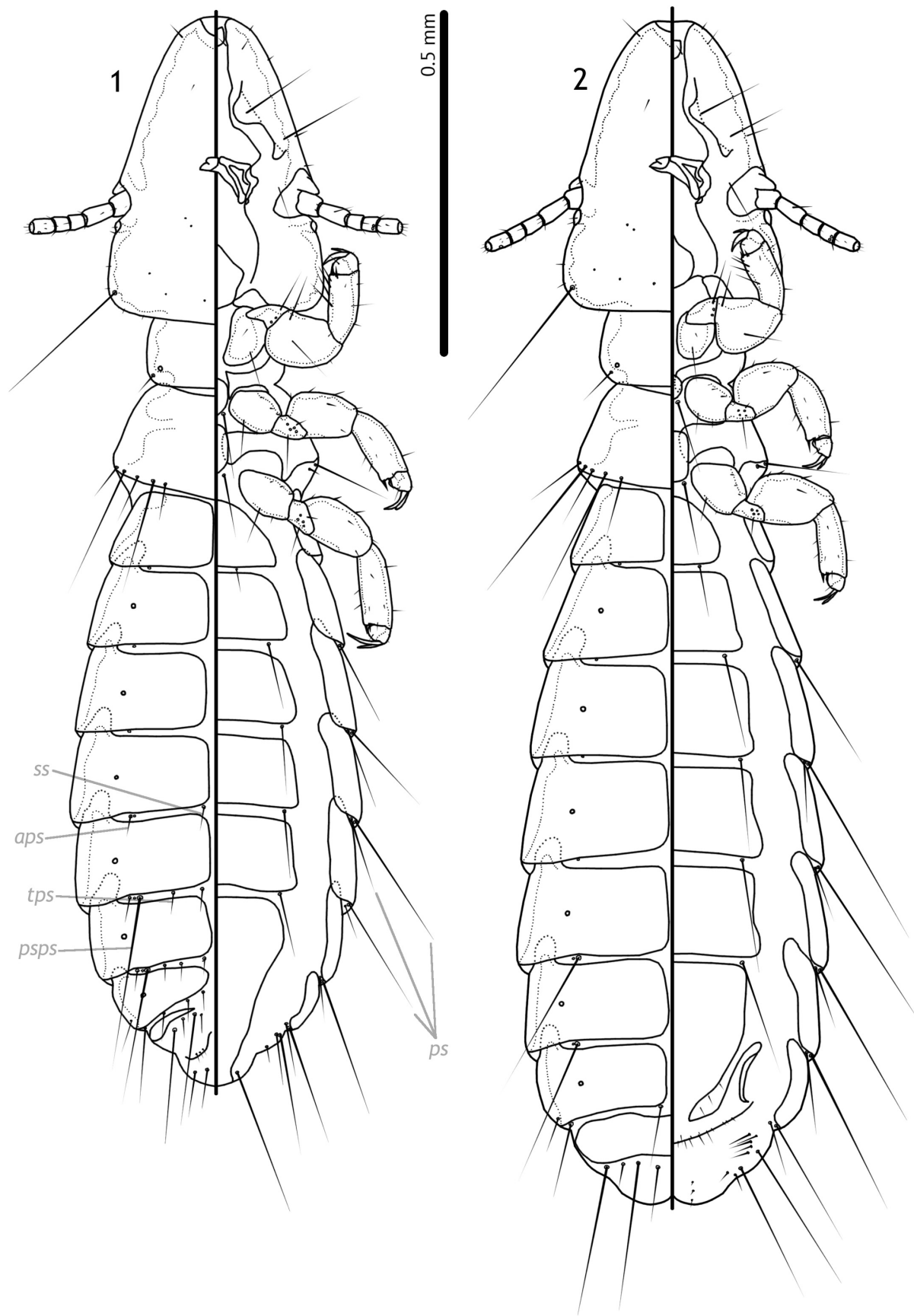
### **Other hosts**

*Gracula religiosa intermedia* Hay, 1845—northern hill myna. See Archawaranon & Subinprasert (2005: 113, fig. 2). Misidentification.

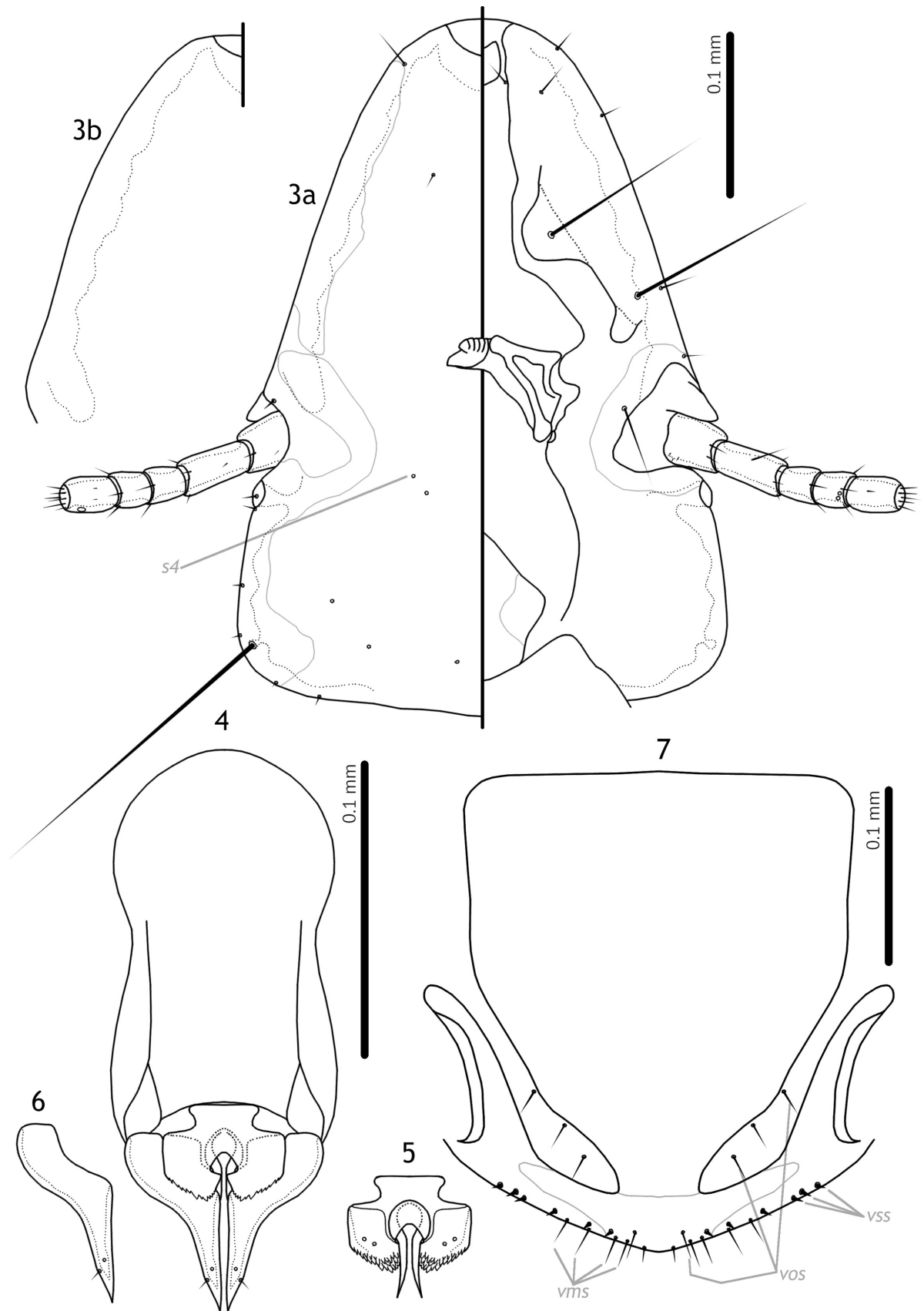
*Gracula religiosa palawanensis* (Sharpe, 1890)—Palawan hill myna. See Eduardo & Villa (2011: 82, figs 16–20). Misidentification.

### **Description**

Habitus as in Figs 1–2. Head slender, rounded dome-shaped, lateral margins of preantennal head slightly convex (Fig. 3a), but in specimens from Nepal and Thailand, the frons is more broadly blunted and lateral margins of preantennal head are more convex (Fig. 3b); head chaetotaxy as in Fig. 3a; head sensillum *s4* present; most of head lateral margins with darker pigmentation. Thoracic and abdominal segments as in Figs 1–2. Male abdominal chaetotaxy: *ss* present on tergopleurites V–VIII; *tps* present on tergopleurites VI–VIII; *psps* present on tergopleurites VI–VII; *aps* present on tergopleurites V–VII; *sts* present on sternites II–VI; *ps* present on segments III–VIII. Female abdominal chaetotaxy: *ss* present on tergopleurite VIII; *tps* and *aps* absent; *psps* present on tergopleurites VI–VII; *sts* present on sternites II–VI; *ps* present on segments III–VIII. Male genitalia as in Figs 4–6: basal apodeme broad, lateral margins concave (Fig. 4); proximal mesosome broadly flattened, narrowing distally (Fig. 5); mesosomal lobes broad, with parallel lateral margins and extensive distal fringes (Fig. 5); gonopore small, semioval; penile arms reach much beyond distal margin



**FIGURES 1–2.** *Brueelia chayanh* Ansari, 1955. **1**, male habitus, dorsal and ventral views. **2**, female habitus, dorsal and ventral views. Abbreviations: *aps* = accessory post-spiracular setae; *ps* = paratergal setae; *psps* = principal post-spiracular setae; *ss* = sutural setae; *tps* = tergal posterior setae.



**FIGURES 3–7.** *Brueelia chayanh* Ansari, 1955. **3a**, head, dorsal and ventral views of male from India. **3b**, lateral margin of preantennal head of male from Nepal, setae not shown. **4**, male genitalia, dorsal view. **5**, male mesosome, ventral view. **6**, male paramere, dorsal view. **7**, female subgenital plate and vulval margin, ventral view. Abbreviations: *s4* = *sensillus 4*; *vms* = *vulval marginal setae*; *vos* = *vulval oblique setae*; *vss* = *vulval submarginal setae*.

of mesosome (Fig. 5); parameres somewhat stout, elongated distally (Fig. 6). Female subgenital plate as in Fig. 7; connection to slender cross-piece narrow; cross-piece with dark pigmentation medianly; vulval margin convergent to median point, with 4–5 short, slender *vms*, 5–6 short, thorn-like *vss*, and 4 short, slender *vos* on each side; distal 1 *vos* on each side median to *vss*. Measurements: Male (n = 42; except TL where n = 40): TL = 1.38–1.76 (1.57); HL = 0.35–0.47 (0.41); HW = 0.25–0.32 (0.29); PRW = 0.19–0.24 (0.21); PTW = 0.26–0.35 (0.31); AW = 0.35–0.47 (0.41). Female (n = 80; except TL where n = 79, AW where n = 78): TL = 1.59–2.16 (1.88); HL = 0.38–0.52 (0.35); HW = 0.29–0.37 (0.33); PRW = 0.19–0.26 (0.23); PTW = 0.26–0.37 (0.31); AW = 0.39–0.56 (0.47).

**Material examined (non-types):** Ex *Acridotheres tristis tristis* [some labelled as *Sturnus tristis*]: 1♂, 21♀, Rajputana, India, Mar. 1937, coll. R. Meinertzhagen, 8975 (NHML). 5♂, 8♀, Nepal, May 1935, coll. R. Meinertzhagen, 3862 (NHML). 9♀, Nepal, Jul 1936, coll. R. Meinertzhagen, 4953–4 (NHML). 1♂, 1♀, St. Helena [South Atlantic], Oct. 1952, coll. E.L. Haydock, ML/64, Brit. Mus. 1952–595 (NHML). 1♂, 4♀, Ban Rai Dong, Lamphoon, Chiang Mai Province, Thailand, 8 Jul. 1963, coll. K. Thonglongya, SEATO 1067 (BPBM). 4♂, 4♀, Ban Bo Luang, Hot, Chiang Mai Province, Thailand, 7 Apr. 1962, coll. K. Thonglongya, 729 (NMHL). 3♂, 3♀, Ban Bo Luang, Hot, Chiang Mai Province, Thailand, 7 Apr. 1962, coll. K. Thonglongya, 729 (UMSP). 2♂, 2♀, Ban Bo Luang, Hot, Chiang Mai Province, Thailand, 7 Apr. 1962, coll. K. Thonglongya, 729 (BPBM). 3♂, Khon Kaen City [Khon Kaen Province], Thailand, 11 Oct. 1953, coll. R.E. Elbel & B. Lekagul, RE-3023, RT-B-22554 (BPBM). 1♀, Khlong Khlung, Kamphaeng Phet Province, Thailand, 19 Apr. 1953, coll. R.E. Elbel & H.G. Deignan, RE-2460, RT-B-21030 (BPBM). 8♂, 13♀, Thadinang, Pak Phayun District, Phattalung Province, Thailand, 28 Jul. 1962, coll. W. Songprakob, RE-6348 (BPBM). 68♂, 91♀, 109 nymphs, Bethlehem, Palestine, Jul. 2021–Sep. 2022, coll. B. Jarayseh & M. Amaya, A000–008, A0010, A0013–14, A0017–23, A0025–37, A0039, A0041–45 (EECNHM).

**Remarks.** *Brueelia chayanh* was described as a new species three times by Ansari (1955, 1956a, 1958a), but all three descriptions are inadequate to identify the species unequivocally, and only the third description included illustrations. Archawaranon & Subinprasert (2005: 113, fig. 2) identified a species of *Brueelia* from *Gracula religiosa intermedia* as *B. chayanh*, but it is likely a misidentification of *Brueelia acutangulata* (Piaget, 1880), a species identified by Gustafsson & Bush (2017: 392, 403) from the same host and belonging to a group not closely related to that containing *B. chayanh*. Also, the material identified as *B. chayanh* by Eduardo & Villa (2011: 82, figs 16–20) from *Gracula religiosa palawanensis* appears to be *B. acutangulata*. Aslam *et al.* (2015) found that the primary microhabitat occupied by *B. chayanh* on over 60 common mynas is the dorsal side of the host body.

Naz *et al.* (2020: 418) reported that the type material of *Brueelia chayanh* could not be found in any collection known to contain Ansari's type specimens and considered it to be lost. To facilitate the identification of *B. chayanh*, we provide a redescription based on samples from the type host from India, Nepal, and Thailand, as well as the recent collection from Palestine.

Specimens of *B. chayanh* from Nepal and Thailand are generally smaller than those from India, and have blunter preantennal areas (Fig. 3a vs Fig. 3b). As the impact of *e.g.*, elevation, on the morphology of *B. chayanh* is unknown, and grades in head shape and size are known in other *Brueelia* spp. from South and Southeast Asia (Gustafsson & Bush 2017), we do not consider these differences to be significant.

Considering that the exact type locality of *B. chayanh* is unknown—although it was described in papers dealing with the louse fauna of the Punjab region of Pakistan—and the morphological differences mentioned above, we do not designate a neotype because we have not examined any specimen from Pakistan. The illustrations of *B. chayanh* in this paper were taken from specimens from Thailand.

Srivastava *et al.* (2003) analysed the correlation between population fluctuations of an unidentified species of *Brueelia*, which may be *B. chayanh*, and several reproduction-related factors in the hosts. They found evidence of the influence of host hormone levels on the population sizes of this louse in male hosts, but greater effects of photoperiod on population sizes in female hosts.

## *Sturnidoecus* Eichler, 1944

### *Sturnidoecus sturni* (Schrank, 1776)

*Pediculus sturni* Schrank, 1776: 118.

*Philopterus sturni* (Schrank, 1776); Ansari 1947: 273.

*Sturnidoecus sturni* (Schrank, 1776); Hopkins & Clay 1952: 345.

**Type host.** *Sturnus vulgaris vulgaris* Linnaeus, 1758—common starling.

**Type locality.** Cornwall, United Kingdom (Clay & Hopkins (1954: 232).

### Other hosts

*Acridotheres tristis tristis* (Linnaeus, 1766)—common myna. See Ansari (1947: 273) and Blagoveshtchensky (1951: 290). Misidentifications.

*Acridotheres tristis ginginianus* (Latham, 1790)—bank myna. See Ansari (1947: 273). Misidentification.

*Sturnus vulgaris humii* Brooks, 1876—Himalayan starling. See Ansari (1947: 273, 1968: 35).

*Sturnus vulgaris zetlandicus* Hartert, 1918—Shetland Islands starling. See Ansari (1968: 35).

*Sturnus vulgaris nobilior* Hume, 1879—Afghan starling. See Gustafsson & Bush (2017: 243).

*Sturnus vulgaris poltaratskyi* Finsch, 1878—Siberian starling. See Gustafsson & Bush (2017: 243).

*Acridotheres fuscus fuscus* (Wagler, 1827)—jungle myna. See Hossain *et al.* (2022: 59). Misidentification.

*Gracupica contra* (Linnaeus, 1758)—Indian pied starling. See Hossain *et al.* (2022: 59). Misidentification.

**Remarks:** Ansari (1947: 273), Blagoveshtchensky (1951: 290) and Hossain *et al.* (2022: 59) reported *S. sturni* from *A. tristis*. However, Ansari did not include this host association in his later publications and, presumably, the specimens recorded in Ansari (1947) were later described as *S. bannoo avinus*. Blagoveshtchensky (1951) did not provide any illustrations, and his specimens have not been examined by us. In addition to *A. tristis*, Hossain *et al.* (2022) recorded *S. sturni* from *A. fuscus* and *G. contra*, providing a rudimentary description and two illustrations of their specimens, which could be either *S. capensis* or *S. bannoo*, but a correct identification can only be achieved by examining the specimens. *Sturnidoecus sturni* is not a natural and regular parasite of *A. tristis*.

### *Sturnidoecus capensis* (Giebel, 1874)

*Docophorus capensis* Giebel, 1874: 90.

*Sturnidoecus capensis fragilis* Ansari, 1968: 8.

**Type host.** *Gracupica contra* (Linnaeus, 1758)—Indian pied starling.

**Type locality.** None given.

### Other hosts

*Gracupica contra superciliaris* (Blyth, 1863)—Indian pied starling. See Ansari (1968: 32).

*Acridotheres tristis melanosternus* Legge, 1879—Sri Lankan common myna. See Ansari (1968: 32).

**Remarks:** Gustafsson & Bush (2017: 238, 438) regarded *S. capensis fragilis* as a junior synonym of the nominate subspecies based on the examination of the holotype of *S. c. fragilis* and extensive material from the type host of *S. capensis*. As noted above, Gustafsson & Bush (2017: 240) also expressed doubts that *S. bannoo* is different from *S. capensis*, but a larger-scale revision of the group is needed to establish species limits, synonymies, and host associations properly (see below under *S. bannoo*).

### *Sturnidoecus affinis* (Piaget, 1880)

*Docophorus affinis* Piaget, 1880: 67.

**Type host.** *Acridotheres javanicus* Cabanis, 1851—Javan myna.

**Type locality.** None given.



## Other hosts

*Acridotheres tristis tristis* (Linnaeus, 1766)—common myna. See Ansari (1955: 61, 1956a: 397, 1958b: 83).  
*Acridotheres fuscus fuscus* (Wagler, 1827)—jungle myna. See Ansari (1968: 30).

**Remarks:** *Sturnidoecus affinis* was listed from *A. tristis* by Ansari (1955, 1956a, 1958b), without comments or reference to specimens. To our knowledge, there are no subsequent reports of *S. affinis* from *A. tristis*, and Ansari (1968: 30, 37) did not list *A. tristis* as a host of *S. affinis*. It is also possible that *S. affinis* is a senior synonym of *S. bannoo* (see Gustafsson & Bush 2017: 240).

## *Sturnidoecus bannoo* Ansari, 1955

*Sturnidoecus bannoo* Ansari, 1955: 62.  
*Sturnidoecus bannoo* Ansari, 1956a: 397.  
*Sturnidoecus bannoo* Ansari, 1958b: 84.  
*Sturnidoecus bannoo laticephalum* Ansari, 1968: 9.  
*Sturnidoecus bannoo avinus* Ansari, 1968: 9.  
*Sturnidoecus bannoo bannoo* Ansari, 1968: 62: 9.  
*Sturnidoecus tristisae* Bughio *et al.*, 2018: 95. **New synonymy.**

**Type host.** *Acridotheres ginginianus* (Latham, 1790)—bank myna.

**Type locality.** None given, but in Punjab region of Pakistan.

## Other hosts

*Acridotheres tristis tristis* (Linnaeus, 1766)—common myna. See Ansari (1968: 37) and Bughio *et al.* (2018: 96).  
*Acridotheres cristatellus* (Linnaeus, 1758)—crested myna. See Price *et al.* (2003: 242).  
*Acridotheres fuscus fuscus* (Wagler, 1827)—jungle myna. See Gustafsson & Bush (2017: 437).

**Remarks:** Ansari described *Sturnidoecus bannoo* as a new species three times (Ansari 1955, 1956a, 1958b), but none of the descriptions or the illustrations provided by Ansari (1958b: 84) are sufficient to identify this species unequivocally. It is included in Ansari's (1968) key to the *Sturnidoecus*, but the characters used in this key are not reliable. Ansari (1968) described specimens from *A. tristis* as the subspecies, *Sturnidoecus bannoo avinus* Ansari, 1968. Gustafsson & Bush (2017: 437) examined the type specimens of *S. bannoo avinus* and *S. bannoo laticephalum*, as well as specimens from the type host of *S. bannoo bannoo* and considered them conspecific, in agreement with Price *et al.* (2003: 242). Rajput *et al.* (2010) described and illustrated the nymphal instars of *S. bannoo*, based on specimens from *A. ginginianus*.

Although *S. bannoo* was first described in a list of lice from Pakistan (Ansari 1955), other localities were given by Ansari (1968: 31), such as Rajputana and Manipur (India), Lyallpur (now Faisalabad, Pakistan) and Nepal. Ansari (1958b: 84) designated a holotype and an allotype for *S. bannoo*, but without referring to any locality, specimens, or slide. However, Ansari (1968: 31) marked a specimen from Rajputana with an asterisk, implying that it was the type of *S. bannoo*. In the collection of the NHML, there is a slide holding a male and female *S. bannoo* from Rajputana and identified by Ansari (NHML010709966), which Naz *et al.* (2020: 437) regarded as the holotype male and paratype female of *S. bannoo*. Gustafsson & Bush (2017: 437) listed these two specimens as “Non-types” because the slide did not have a “Type” label when they examined it.

Gustafsson & Bush (2017: 240) expressed doubt that *S. bannoo* is separable from *S. affinis*, *S. peguensis* (Mey, 1989) and *S. capensis* (Giebel, 1874), as their morphological differences are slight and appear to be correlated to a clinal geographical distribution rather than host associations. A revision of this group of species is needed (D.R.G. *in prep.*) and *S. bannoo* is not redescribed here because it is likely that only one species of *Sturnidoecus* parasitises most of the species of *Acridotheres* in South and Southeast Asia.

Srivastava *et al.* (2003) analysed the correlation between population fluctuations of *S. bannoo* and several reproduction-related factors in common mynas, finding that host hormone levels influenced population sizes of this

louse. Saxena *et al.* (2009) provided extensive data on the bionomics of *S. bannoo*, including incubation period, adult longevity and daily egg production to determine the intrinsic rate of natural increase.

*Sturnidoecus tristisae*—described by Bughio *et al.* (2018) from *A. tristis* collected in the Sindh Province of Pakistan—belongs to the *S. pastoris* species group (*sensu* Gustafsson & Bush 2017: 239), and is close to other species known from the same host species. Few of the species in this group have been illustrated or described in detail, and specimens examined from different host species are difficult to separate morphologically. Although some characters differ among specimens from different host species, there is evidence of clinal variation. For instance, regardless of host species, the number of setae on male tergopleurite II decreases towards the southeast in the specimens examined, with Indian and Nepalese material having 8 setae on each side, Myanmar samples having 7 setae on each side, and those from Thailand having 5–6 (rarely 7) setae on each side. Size also varies among populations from different host species, from larger specimens in India, intermediate in Myanmar and smaller in Thailand. The male genitalia are identical among samples, or show a similar clinal variation. No genetic data have been published for any species in the *S. pastoris* species group.

The characters used to separate *S. tristisae* from *S. bannoo* are listed in Table 5, together with an analysis of their validity. Bughio *et al.* (2018) have not given a single character which can reliably separate *St. tristisae* from *St. bannoo*. Therefore, we hereby place *Sturnidoecus tristisae* as a junior synonym of *St. bannoo* Ansari, 1955 **new synonymy**.

Gustafsson & Bush (2017: 437) reported specimens of *S. bannoo* from four species of *Acridotheres* in Northern India (Manipur, Gujarat, Rajputana) and Nepal. If *S. bannoo* is conspecific with *S. capensis* and *S. affinis*, as suggested by preliminary examinations of their morphology, the range of this species would extend into Myanmar, Thailand and Indonesia (Gustafsson & Bush 2017: 438). Blagoveshtchensky (1951) reported *Sturnidoecus sturni* from the *A. tristis* in Tajikistan, which may be a misidentification of *S. capensis*, but we have not examined Blagoveshtchensky’s specimens. Thus, *Sturnidoecus capensis* would have an extended range across southern Asia on at least 12 bird taxa.

**TABLE 5.** Characters used by Bughio *et al.* 2018 to separate *Sturnidoecus tristisae* from *S. bannoo*, with and analyses of their usefulness.

Other than the characters given by Bughio *et al.* (2018: 96, 99), no additional characters have been found that could be considered significant to separate these two species.

Character	Remarks	Usefulness for species separation
“preantennal region anteriorly narrow, projected, with thick hyaline margin, anteriorly concave, gradually become wider at preantennal region”	This is true for all species of <i>Sturnidoecus</i> and does not separate <i>S. tristisae</i> from <i>S. bannoo</i> .	None
“premarginal carina moderately sclerotized”	The illustration of the preantennal area (Bughio <i>et al.</i> 2018: fig. 18) mixes dorsal and ventral features together. It is therefore not clear how this character differs from <i>S. bannoo</i> ; the premarginal carina is moderately sclerotized in <i>S. bannoo</i> as well. In <i>Sturnidoecus</i> , this character often shows greater individual variation within samples than between species, and may be affected by mounting.	None
“dorsal anterior plate anteriorly deeply concave, laterally slightly convex”	This character is present in all <i>Sturnidoecus</i> , and the illustration (Bughio <i>et al.</i> 2018: fig. 19) is applicable to all other species in the <i>S. pastoris</i> group.	None
“gular plate short and cordate shape”	As illustrated (Bughio <i>et al.</i> 2018: fig. 20), this character differs from that of <i>S. bannoo</i> , which has deeply concave antero-lateral margins. However, it is clear from the photos provided (Bughio <i>et al.</i> 2018: figs 3–4) that only part of the gular plate was illustrated, and that the entire plate has the same shape as in <i>S. bannoo</i> , and for <i>Sturnidoecus</i> in general.	None

...Continued on the next page

TABLE 5. (Continued)

Character	Remarks	Usefulness for species separation
“female subgenital plate roughly triangular with 5 microsetae on lateral margins”	There is no significant difference in the shape of the subgenital plate between <i>S. tristisae</i> as illustrated (Bugchio <i>et al.</i> 2018: figs 22–23) and that of <i>S. bannoo</i> ; however, these figures show a somewhat different shape of the subgenital plate. The photo of the female (Bugchio <i>et al.</i> 2018: fig. 4) has a subgenital plate that is indistinguishable from that of <i>S. bannoo</i> . In our opinion, if there are differences, they represent individual variation. Notably, the shape of the subgenital plate is similar in all species of the <i>S. pastoris</i> species group, except in <i>S. stresemanni</i> (Mey 1989: fig. 6).	None
“vulva bearing 18 marginal to submarginal very short microsetae”	The setae along the vulval margin comprise two different sets: a marginal set of hair-like setae, and a submarginal set of thorn-like setae; this arrangement is conserved, with minor variations, throughout most of the <i>Brueelia</i> -complex (Gustafsson & Bush 2017). Bugchio <i>et al.</i> (2018) regarded these setae as one set, and the number in each set is thus not known. However, in the description (Bugchio <i>et al.</i> 2018: 95), it is stated that all 18 setae are thorn-like, which we assume are submarginal. In specimens we have examined of <i>S. bannoo</i> , this number is 16–18, so this character will not separate these species. However, in fig. 22, Bugchio <i>et al.</i> (2018) illustrated 12 setae on each side.	None
“male abdomen highly convex”	This character applies to all species of <i>Sturnidoecus</i> .	None
“posterior marginal setae on tergite also variable in number and attachment”	It is not clear how a “variable” character will separate <i>S. tristisae</i> from <i>S. bannoo</i> .	None
“endomeral plate elongated along the half length of parameres”	As illustrated (Bugchio <i>et al.</i> 2018: fig. 24a), the length of the “endomeral plate” (= mesosome) is indistinguishable from that of several other species in the <i>S. pastoris</i> species group, including <i>S. bannoo</i> and <i>S. pastoris</i> (Gustafsson & Bush 2017: fig. 390). The mesosome does not reach the distal parameres in <i>S. bannoo</i> as claimed by Bugchio <i>et al.</i> (2018: 96) but is similar in length to that illustrated for the <i>S. pastoris</i> species group by Gustafsson & Bush (2017: fig. 390).	None
Measurements	The measurements of <i>S. tristisae</i> given by Bugchio <i>et al.</i> (2018: table 2) are compared to four other species of <i>Sturnidoecus</i> from mynas. However, the measurements of <i>S. bannoo</i> are all from one specimen rather than ranges from a series. Several of the measurements of <i>S. bannoo</i> fall within the ranges of <i>S. tristisae</i> (eight out of 16, including both sexes). For another five measurements, the differences between those of <i>S. bannoo</i> and the ranges of <i>S. tristisae</i> are around 0.01 mm or less, with only three of 16 measurements differing by 0.02 mm or more. Therefore, these two species are closely similar in measurements. In one case (female total length of <i>S. tristisae</i> ), the maximum value given (5.33 mm) is evidently erroneous, as that specimen would be more than twice the size of any other species of the <i>Brueelia</i> -complex, and about 2.4 times as long as the smallest specimen measured by Bugchio <i>et al.</i> (2018). Furthermore, adding up the maximum length measurements of the individual body parts, the value would be 2.309 mm, not 5.33 mm.	None

### *Degeeriella*-complex *sensu lato*

#### *Colinicola* Carriker, 1945

#### *Colinicola docophoroides* (Piaget, 1880)

*Lipeurus docophoroides* Piaget, 1880: 357.

*Lipeurus docophoroides minhaensis* Kellogg & Chapman, 1902: 159.

*Lagopoecus docophoroides* (Piaget, 1880); Clay 1938: 195.  
*Colinicola docophoroides* (Piaget, 1880); Price *et al.* 2003: 163.

**Type host.** *Callipepla californica* (Shaw, 1798)—Californian quail.

**Type locality.** None given.

### Other host

*Acridotheres tristis* (Linnaeus, 1766)—common myna. See Kellogg & Chapman (1902: 159). Straggler or contaminant.

**Remarks:** *Lipeurus docophoroides minhaensis* was briefly described by Kellogg & Chapman (1902) based on a single female from *A. tristis*, collected in Lahaina, Maui Island, Hawai'i. Kellogg & Chapman (1902) regarded it as a “variety” based on the “disproportionate width of body when compared with typical specimens of the species”, but it was demoted to a junior synonym by Clay (1938). There is no doubt that the type of *L. docophoroides minhaensis* was a straggler or contaminant from a Californian quail; hence, *Colinicola docophoroides* is not a natural and regular parasite of *A. tristis*.

### *Rallicola*-complex

#### *Rallicola* Johnston & Harrison, 1911

#### *Rallicola minhaensis* (Kellogg & Chapman, 1902)

*Nirmus minhaensis* Kellogg & Chapman, 1902: 157.

**Type host.** *Acridotheres tristis* (Linnaeus, 1766)—common myna. In error.

**Type locality.** Lahaina, Maui Island, Hawai'i, United States.

**Remarks:** *Rallicola minhaensis* was described from a single female collected in Hawai'i. Hopkins & Clay (1952: 320) considered that the host record was probably an error, and the lack of subsequent reports of any species of *Rallicola* from *A. tristis* supports this statement. The natural and regular host of *R. minhaensis* is unknown, but Kellogg & Chapman (1902) also reported lice from *Fulica alai* Peale, 1848, and this coot may be the natural host of *R. minhaensis*. Kellogg & Chapman (1902: 160) reported *Rallicola advenus* (Kellogg, 1896) (as *Oncophorus advena*) from *F. alai*, but *R. advenus* is known from *Fulica americana* Gmelin, 1789 (Price *et al.* 2003: 228). Therefore, further louse collections from *F. alai* need to be compared with the type specimen of *R. minhaensis* to clarify its taxonomic status. Regardless of the identity of *R. minhaensis*, *Acridotheres tristis* is not a natural and regular host of any species of *Rallicola*.

### Discussion

Parasites can influence the physical condition of infested individuals and may be an element of selection pressure on migrant populations of birds, especially during long distance flights (Awad & Rzed 2015; Møller *et al.* 2004; Newton 2006).

The common myna, as a successful, invasive species, is a good example to understand the question of how host species lose or maintain their parasites as they colonise new areas. According to the “enemy release hypothesis” (Keane & Crawley 2002), the invasive success of many host species is sometimes attributed to its release from the regulatory effects of parasites in their native range (Shea & Chesson 2002). Such enemy release events may enable introduced hosts that lose their parasites to reach unnaturally high densities and to become pests in new locations, with extensive ecological consequences (Vitousek *et al.* 1997; Wilcove *et al.* 1998; Keane & Crawley 2002). In Palestine and adjacent countries, the common myna population is growing at an alarming rate: a study carried out during 2006 to 2018 found an increase of 843% in the population (Colléony & Shwartz 2020: 5). Besides studying

the obvious devastating ecological effects of this invasive bird, less obvious fields, such as parasite and disease transmission, should also be researched. Moreover, many parasite species can cause harm outside their native range (Daszak *et al.* 2000; Cleaveland *et al.* 2002) and understanding how parasites succeed in colonizing new regions is central to mitigating their spread and impact (MacLeod *et al.* 2010).

Three processes determine whether a parasite species successfully colonises a new region, following introduction of its host (MacLeod *et al.* 2010). Firstly, the parasite must be present on individuals of the host founder populations, as it may be absent from a newly invaded location simply because host individuals in the founding populations were not infested by the parasite (*i.e.*, “missing the boat”) (Dobson & May 1986; Paterson *et al.* 1999; Paterson & Gray 1997). Secondly, parasitised hosts must persist in the new region because, if infested hosts arrive but fail to establish, the parasite will also perish (*i.e.*, “sinking with the boat”) (MacLeod *et al.* 2010). In addition, if infested hosts arrive and persist, the parasite must also persist and not fail for other reasons (*i.e.*, “lost overboard” or “drowning on arrival”) (MacLeod *et al.* 2010).

In a survey of 25 common mynas in Turkey, Yilmaz *et al.* (2023) found the same two species of lice we have recorded in Palestine from the same host species: *Menacanthus eurysternus* and *Brueelia chayanh* (Table 1). In their native range, common mynas are parasitised by at least four, maybe six, different species of lice (Price *et al.* 2003: 355); hence, it is possible that the myna population introduced to Palestine has a reduced louse fauna. In this study, conducted long after the host introduction (1997 for the examined population), “missing the boat” and “drowning on arrival” events cannot be distinguished. It is therefore unknown whether any of the missing species of lice were ever present in this population of Palestinian mynas. Surveys are needed in areas where the myna is a more recent coloniser from its native range to examine whether “drowning on arrival” events ever happen, or if losses of louse associations are mainly driven by “missing the boat” events. Modelling suggests that there will be no shortage of such areas in the future (Magory-Cohen *et al.* 2019). MacLeod *et al.* (2010) suggested that “drowning on arrival” events would be more common than “missing the boat events”, although to our knowledge this has never been demonstrated based on actual collection data from recently introduced species.

Our knowledge of the louse fauna of *A. tristis* is patchy within both the native and the introduced ranges. More data are needed from throughout the native range and in areas of introduction, such as Australia, South Africa and Madagascar, before any general trends will become apparent. Data taken from specimens deposited at the NHML (Table 3) show that at least three of the species of lice found in the native range of *A. tristis* have also been reported from different parts of its introduced range: *B. chayanh*, *M. eurysternus*, and *M. invadens*. In addition, Palma (2017) reported *Sturnidoecus* sp. from *A. tristis* in New Zealand. Thus, at least four species of lice known from *A. tristis* in its native range have been introduced with their hosts to part of the novel range. Differences in local populations, such as the apparent absence of *Myrsidea* and *Sturnidoecus* in Palestine, could therefore be from “missing the boat” or “drowning on arrival” events.

Several mechanisms have been proposed to explain why parasites might drown on arrival, including insufficient parasite transmission due to small founding populations, high mortality rates and low host social interaction (Rózsa 1997; Rózsa *et al.* 1996; Rékási *et al.* 1997; Paterson *et al.* 1999, 2003). Moreover, chewing lice may be influenced by variation in abiotic factors such as ambient temperature and humidity (Janovy *et al.* 1997; Moyer *et al.* 2002; Møller 2010). There are contradictory results concerning this issue. For example, Fabiyi (1996) found that some chewing louse species thrived only in areas with a short, humid season, whereas other species were completely restricted to areas with a long, humid season. Moyer *et al.* (2002) found that humidity had a significantly positive impact on louse prevalence and abundance, and Bush *et al.* (2009) found that the impact may vary between different louse species on the same host. Local differences in *e.g.*, humidity in both the source locality and the introduced locality may have an impact on introduced lice and whether they thrive in the new range or not. In our study, *M. eurysternus* and *B. chayanh* have similar prevalences to at least parts of their native ranges (Table 1).

The introduced populations of *A. tristis* in various parts of the world derive from different introduction events at different times (*e.g.*, Eddinger 1967; Hone 1978; Baker & Moeed 1979; Holzapfel *et al.* 2006; Peacock *et al.* 2007). If all species of lice on a host follow population cycles throughout the year, like those shown for *M. eurysternus* by Chandra *et al.* (1990), introduction events at different times of the year could result in different founding populations of lice in their introduced ranges. The added effect of variable abiotic factors between the original sources and the introduced areas, would also have an influence on the introduced louse communities.

Invasive species such as the common myna offer unique opportunities to examine the way that louse faunas develop under natural settings. We encourage other researchers to survey the lice of invasive bird fauna in their areas to increase data about how they evolve.

## Acknowledgements

We thank Dr Sare Asli and Ms Abeer Shehadeh for their assistance in the logistic arrangement and supervision of the project. We are grateful to Bethlehem University, the Palestine Institution for Biodiversity and Sustainability, and the Environmental Education Center for allowing us to use their facilities and equipment. Also, we thank Aram Jarayseh, Jacob Muammar, and Ramiz Ibrahim for their assistance. This study was funded by the European Union Peacebuilding Initiative (EUPI) under the “Unity and Diversity in Nature and Society” project [contract #: ENI/2019/412-148], the Introduction of Full-Time High-Level Talent Fund of the Institute of Zoology, Guangdong Academy of Sciences (grant GIABR-GJRC201701), the National Natural Science Foundation of China (grant 31961123003), the Foreign Young Talent Plan (QN20200130012), and the Pearl River Talent Recruitment Program of Guangdong Province (grant 2019QN01N968). We are indebted to Terry D. Galloway (Department of Entomology, University of Manitoba, Winnipeg, Canada) for reviewing a draft of this paper and giving useful advice which improved the final version.

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