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RESEARCH ARTICLE

Studies on Chewing Lice (Phthiraptera) Species Found on Some Duck (Anseriformes: Anatidae) Species at Lake Akşehir, Turkey

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Summary

The present study was conducted between September 2010 and November 2011 to identify louse species parasitizing ducks at Lake Akşehir. Within the study period, 54 ducks, which belonged to seven different avian species (teal, garganey, shoveler, northern pintail, mallard, ruddy shelduck, common shelduck) and were found either alive or wounded or had been shot by hunters, were examined for the presence of lice. After examined macroscopically for the presence of ectoparasites, all ducks were placed into a white tub and medicated with propoxur or tetramethrin. The louse specimens collected from the animals were preserved in 70% alcohol, cleared in 10% KOH, passed through a graded series of alcohol, and mounted in Canada balsam for species identification by light microscopy. Of the 54 ducks examined, 29 (53.70%) were found to have been infested with lice. In total, eight louse species were identified, 4 *(Anatoecus regina, Anaticola magnificus, Holomenopon tadornae, Trinoton querquedulae)* of which had infested the ruddy shelduck *(Tadorna ferruginea)*, 2 *(Anaticola crassicornis, Trinoton* sp.) of which had infested the common shelduck *(Tadorna tadorna)*, 4 *(A. crassicornis, Anatoecus dentatus, Anatoecus icterodes, Trinoton querquedulae)* of which had infested the teal *(Anas crecca)*, 1 *(T. querquedulae*) of which had infested the garganey (*Anas querquedula*), 3 (*A. crassicornis, T. querquedulae* and *Holomenopon* sp.) of which had infested the shoveler (*Anas clypeata*), and 4 (*Anaticola crassicornis, Anatoecus icterodes, Trinoton querquedulae, Holomenopon clypeilargum)* of which had infested the northern pintail *(Anas acuta)*. Of the identified louse species listed above, *A. regina, A. magnificus, H. tadornae* and *H. clypeilargum* are reported for the first time from avian species in Turkey. On the global scene, *Trinoton querquedulae* is reported for the first time from the ruddy shelduck and *Trinoton* sp. is reported for the first time from the common shelduck.

Keywords: *Anaticola, Anatoecus, Holomenopon, Trinoton, Turkey*

Akşehir Gölündeki Ördeklerde (Anseriformes: Anatidae) Bulunan Bit (Phthiraptera) Türleri Üzerine Araştırmalar

Özet

Bu araştırma Akşehir Gölü'ndeki ördekler üzerindeki bit türlerini belirlemek amacıyla Eylül 2010-Kasım 2011 tarihleri arasında yapılmıştır. Bu süre içerisinde canlı, yaralı veya ölü olarak bulunan ya da av sezonunda avcılar tarafından avlanan yedi kuş türüne (Çamurcun, Çıkrıkçın, Kaşıkkaga, Kılkuyruk, Yeşilbaş, Angıt, Suna) ait 54 ördek bit yönünden incelenmiştir. Ördeklerin tamamı ektoparazitler yönünden çıplak gözle incelenmiş, sonra da beyaz bir küvet içerisine alınarak propoxur veya tetrametrin ile ilaçlanmıştır. Toplanan bitler % 70 alkol içerisine alınmış, %10'luk KOH ile saydamlaştırıldıktan sonra alkol serilerinden geçirilerek Kanada balsamı ile lam üzerine yapıştırılmışlar ve ışık mikroskobunda incelenerek teşhis edilmişlerdir. İncelenen 54 ördeğin 29 (%53.70)'u bitlerle enfeste bulunmuş, Angıt (*Tadorna ferruginea*)'dan dört *(Anatoecus regina, Anaticola magnificus, Holomenopon tadornae, Trinoton querquedulae),* Suna *(Tadorna tadorna)*'dan iki *(Anaticola crassicornis, Trinoton* sp.), Çamurcun *(Anas crecca)*'dan dört *(A. crassicornis, Anatoecus dentatus, Anatoecus icterodes, Trinoton querquedulae)*, Çıkrıkçın *(Anas querquedula)*'dan bir *(T. querquedulae)*, Kaşıkgaga *(Anas clypeata)*'dan üç *(A. crassicornis, T. querquedulae ve Holomenopon* sp.) ve Kılkuyruk *(Anas acuta)*'dan dört *(Anaticola crassicornis, Anatoecus icterodes, Trinoton querquedulae, Holomenopon clypeilargum)* olmak üzere toplam dokuz tür tespit edilmiştir. Bu türlerden *A. regina, A. magnificus* ve *H. tadornae, H. clypeilargum* Türkiye'deki kanatlı hayvanlardan ilk kez bildirilmektedir. *Trinoton querquedulae* tüm dünyada Angıt'ta ilk kez saptanmış, yine tüm dünyada Suna'dan ilk kez *Trinoton* sp. kaydedilmiştir.

Anahtar sözcükler: *Anaticola, Anatoecus, Holomenopon, Trinoton, Türkiye*

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INTRODUCTION

Chewing lice (Phthiraptera: Ishnocera, Amblycera) are obligate ectoparasites, which in general parasitize avian species and mostly feed on the hair, feathers and skin debris of their hosts. Out of the 5000 louse species described on earth to date, approximately 4000 parasitize avian species [1].

By the publication date of their manuscript, İnci et al.[2] had reported that 79 louse species had been identified from avian species in Turkey, which belonged to three families, including the Philopteridae (22 genera, 43 species), Menoponidae (14 genera, 35 species) and Laemobothridae (1 genus, 1 species). However, taking into account the species identified in subsequent studies [3,4] this number has almost reached 100. Only a very limited number of studies are available on the louse species parasitizing ducks (Anatidae) in Turkey. Merdivenci [5] reported to have encountered *Anatoecus dentatus* (Scopoli, 1763) (referred to in the text as *Philopterus dentatus*) and *Anaticola crassicornis* (Scopoli, 1763) *(*referred to in the text as *Estiopterum crassicorne)* on domestic ducks, the species of which he did not indicate. Dik and Uslu [6] reported not to have encountered any lice on a ruddy shelduck *(Tadorna ferruginea)*, a mallard *(Anas platyrhynchos)* and two American wigeons *(Anas americana)*, which they had examined at the Zoo of Konya province. In subsequent studies; *Anatoecus icterodes* (Nitzsch, 1818) was identified from the marbled teal *(Marmaronetta angustirostris)* [7], and *Anaticola crassicornis* (Scopoli, 1763), *Holomenopon* sp. and *Trinoton querquedulae* (Linnaeus, 1758) from the northern pintail *(Anas acuta)* [3]. In another study, 6 out of 12 mallards hunted in the vicinity of Elazığ province were determined to have been infested with lice, and three louse species, namely, *Anaticola crassicornis, Anatoecus* sp. and *Trinoton querquedulae*, were identified from the infested ducks [8].

The present study was aimed at identifying the louse species parasitizing ducks at Lake Akşehir.

MATERIAL and METHODS

Akşehir Lake is a lake in the Central Anatolia Region. Area of the lake is 353 km^2. Lake is located within the boundaries of the provinces of Konya and Afyonkarahisar. Akşehir Lake is Turkey's 5th largest lake. Location: latitude 38.5309, longitude 31.4181. Lake water level is approximately 1.5 to 2 m in depth were measured in May of 2010.

The present study was conducted between September 2010 and November 2011 with an aim to identify the louse species parasitizing ducks at Lake Akşehir. For this purpose, in total 54 birds, belonging to seven species, including the teal, garganey, shoveler, northern pintail, mallard, ruddy shelduck and common shelduck were examined for the presence of lice. It was determined that, during late summer and early autumn in 2010, many birds belonging to various duck species had either died or suffered from disease at Lake Akşehir. The lake was visited in September and October 2010 and 19 ducks found either dead or ill were collected. In October and November 2011 a further 35 birds, which had been shot by hunters, were collected. These 54 birds were transferred to the laboratory separately in either boxes or plastic bags. Firstly, the ducks were examined macroscopically and were later placed in a white tub and medicated with propoxur or tetramethrin. Following medication, the birds were kept in the tub for 20-30 min. The louse specimens collected from the body of the ducks and from the inside of the tub were transferred into labelled Eppendorf tubes containing 70% alcohol. After cleared in 10% KOH, the specimens were washed in distilled water for 24 h, and passed through a graded series of 70%, 80%, 90% and 96% alcohol, and mounted in Canada balsam on the slides. The slides were dried in an incubator at 50-60°C for 2-3 weeks and examined by light microscopy for species identification in compliance with descriptions made in relevant literatures [9-16].

Data was analyzed by chi-square test. $P<0.005$ value was accepted statistically significance level.

RESULTS

Of the 54 birds examined, which belonged to seven duck species, 29 (53.70%) were infested with lice. In total, 8 louse species belonging to 5 genera were identified from these infested ducks, four *(Anatoecus regina* Ansari, 1955 (*Fig. 1* and *2*), *Anaticola magnificus* Ansari, 1955 *(Fig. 3), Holomenopon tadornae* (Gervais, 1844) *(Fig. 4), Trinoton querquedulae (Fig. 5)* of which had infested the ruddy shelduck *(Tadorna ferruginea)*, two *(Anaticola crassicornis* (Scopoli, 1763) *(Fig. 6), Trinoton* sp.) of which had infested the common shelduck *(Tadorna tadorna)*, four *(A. crassicornis* (Scopoli, 1763), *Anatoecus dentatus* (Scopoli, 1763) *(Fig. 7)*, *Anatoecus icterodes* (Nitzsch, 1818) *(Fig. 8), Trinoton querquedulae* (Linnaeus, 1758)) of which had infested the teal *(Anas crecca),* one *(T. querquedulae* (Linnaeus, 1758)) of which had infested the garganey *(Anas querquedula)*, three *(A.crassicornis* (Scopoli, 1763), *T. querquedulae* (Linnaeus, 1758) and *Holomenopon* sp.) of which had infested the shoveler *(Anas clypeata)* and four *(Anaticola crassicornis* (Scopoli, 1763), *Anatoecus icterodes* (Nitzsch, 1818), *Trinoton querquedulae* (Linnaeus, 1758), *Holomenopon clypeilargum* Eichler, 1943 *(Fig. 9)* of which had infested the northern pintail *(Anas acuta) (Table 1)*. No louse specimen was encountered on the mallard *(Anas platyrhynchos)*. Of the ducks examined for the presence of lice, 15 were infested with one, seven were infested with two, six were infested with three, and one was infested with four louse species *(Table 2)*.

Species

Anaticola crassicornis: 3 ♀ 3 ♂ 4 Nymphs, September 13th, 2010, *Anas crecca*; 2 ♀ October 6th, 2010, *A.crecca*; 6 ♀, 2 ♂, September 13th, 2010, *Tadorna tadorna*; 3 ♀ 3 ♂ 6 N,

Table 1. *Duck species studied, infestation rates, and louse species found on the ducks*
Tablo 1. *Ördeklerde bulunan bit türleri ve infestasyon oranları*

Bird Species	Number of Examined Birds	Number of Infested Birds (%)	Louse Species
Ruddy shelduck *(Tadorna ferruginea)*	4	3 (75)[B]	*Anaticola magnificus* *Anatoecus regina* *Holomenopon tadornae* *Trinoton querquedulae*
Shelduck *(Tadorna tadorna)*	2	1 (50)[B]	*Anaticola crassicornis* *Trinoton sp.*
Teal *(Anas crecca)*	30	17 (56.66)[A]	*Anaticola crassicornis* *Anatoecus dentatus* *Anatoecus icterodes* *Trinoton querquedulae*
Garganey *(Anas querquedula)*	3	1 (33.33)[B]	*Trinoton querquedulae*
Shoveler *(Anas clypeata)*	4	2 (50)[B]	*Anaticola crassicornis* *Holomenopon sp* *Trinoton querquedulae*
Pintail *(Anas acuta)*	10	5 (50)[B]	*Anaticola crassicornis* *Anatoecus icterodes* *Holomenopon clypeilargum* *Trinoton querquedulae*
Mallard *(Anas platyrhynchos)*	1	-	-
Total	54	29 (53.70)	

A, B: *Different letters in the same column are statistically sinificant (P<0.05)*

Table 2. *Concurrent infestation of the ducks examined with the different louse species identified*
Tablo 2. *İncelenen ördek türlerinde saptanan bit türlerinin birlikte görülme durumları*

Infestation Forms	Total Case Number (n)	Lice Species	Case Number (n)
Infestation with one species	15[A]	*Trinoton querquedulae*	11
		Anaticola crassicornis	2
		Anaticola magnificus	1
		Anatoecus icterodes	1
Infestation with two species	7[B]	*A. crassicornis + T. querquedulae*	4
		A. crassicornis + Trinoton sp.	1
		A. icterodes + T. querquedulae	1
		H. clypeilargum + T. querquedulae	1
Infestation with three species	6[B]	*A. crassicornis + A. icterodes + T. querquedulae*	3
		A. crassicornis + A. dentatus + T. querquedulae	1
		A. crassicornis + Holomenopon sp. + T. querquedulae	1
		A. magnificus + H. tadornae + Trinoton sp.	1
Infestation with four species	1[C]	*A. magnificus + A. Regina + H. Tadornae + T. querquedulae*	1

A, B, C: *Different letters in the same column are statistically sinificant (P<0.05)*

September 13th, 2010, *Anas clypeata*; 2 ♀ 1 ♂, October 24th, 2011, *Anas crecca*; 1♀ 1 ♂ 1 N, October 24 13th, 2011, *A. clypeata*; 1 ♀ 1 ♂ 1 N, October 24th, 2011, *A. crecca*; 1 ♀, October 24th, 2011, *A. crecca;* 1♀ 1 ♂, October 24th, 2011, *Anas acuta*; 1 ♀, October 24 13th, 2011, *A. crecca,* 1 ♂, October 24th, 2011, *A. crecca*, 1 ♀, October 24th, 2011, *A. crecca.*

Anaticola magnificus: 3 ♀ 5 ♂, September 13th, 2010, *Tadorna ferruginea*; 5 ♀, September 13th, 2010, *T. ferruginea*; 8 ♀ 15 ♂ 6 N, October 6th, 2010, *T. ferruginea*.

Anatoecus dentatus: 1 ♂, September 13th, 2010, *Anas crecca.*

Anatoecus icterodes: 1 ♀ 1 N, September 13th, 2010, *Anas crecca;* 1 ♀, October 24th, 2011, *A. acuta*; 1 ♀, October 24th, 2011, *A. crecca;* 1 ♀, October 24th, 2011, *A. crecca;* 1 ♂, October 24th, 2011, *A. crecca.*

Anatoecus regina: 8 ♀ 6 ♂ 1 N, October 6th, 2010, *T. ferruginea*.

Holomenopon sp.: 1 N, September 13th, 2010, *A. clypeata*.

Holomenopon tadornae: 17 ♀ 9 ♂ 1 N, September 13th, 2010, *T. ferruginea*; 7 ♀ 3 ♂ 3 N, October 6th, 2010, *T. ferruginea*.

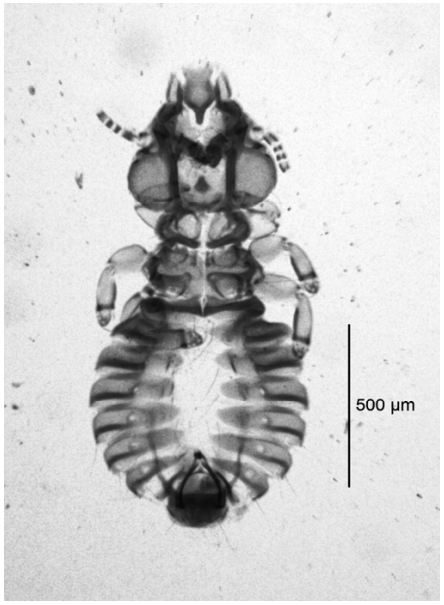

Fig 1. *Anatoecus regina*, male, original
Şekil 1. *Anatoecus regina*, erkek, orijinal

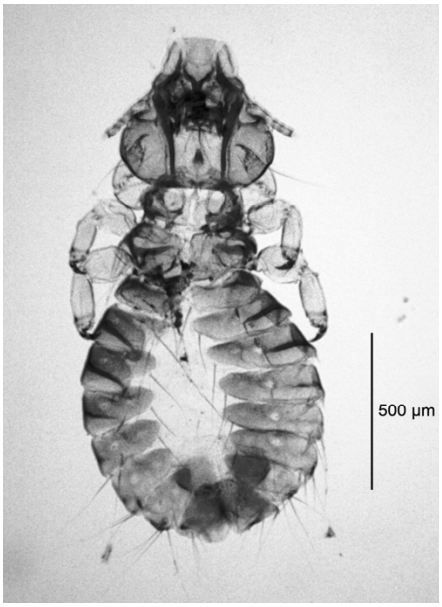

Fig 2. *Anatoecus regina*, female, original
Şekil 2. *Anatoecus regina*, dişi, orijinal

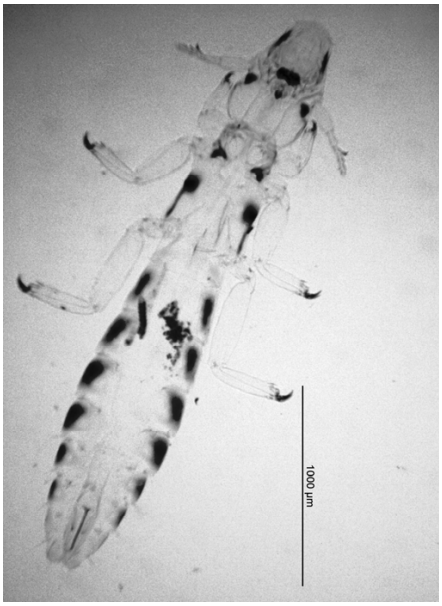

Fig 3. *Anaticola magnificus*, male, original
Şekil 3. *Anaticola magnificus*, erkek, orijinal

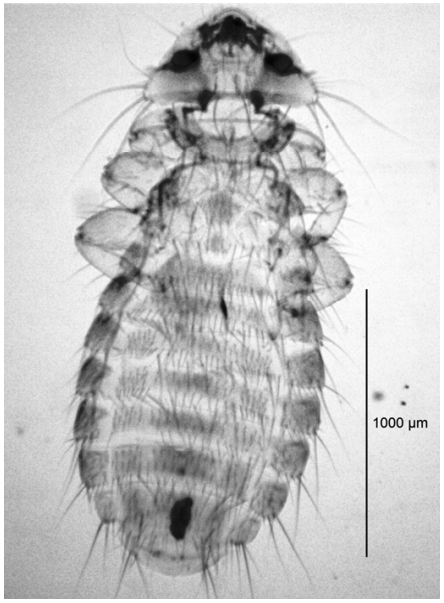

Fig 4. *Holomenopon tadornae,* female, original
Şekil 4. *Holomenopon tadornae*, dişi, orijinal

Fig 5. *Trinoton querquedulae*, original
Şekil 5. *Trinoton querquedulae*, orijinal

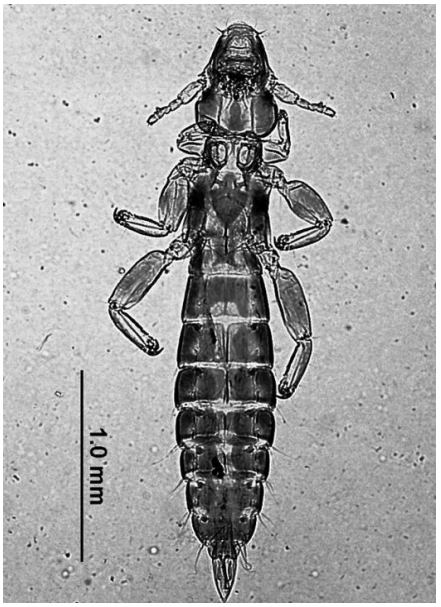

Fig 6. *Anaticola crassicornis*, male, original
Şekil 6. *Anaticola crassicornis*, erkek, orijinal

Note. *It was not shown sex of Trinoton querquedulae in explanation of the photo due to the photo was taken before clearing*

Trinoton querquedulae: 1 N, September 13th, 2010, *A. crecca*; 2 ♀ 5 ♂ 7 N, September 13th, 2010, *A. crecca*; 1 ♀, September 13th, 2010, *A. crecca*; 1 ♀ 1 N, September 13th, 2010, *A. crecca*; 5 ♀ 3 ♂ 12 N, October 6th, 2010, *Tadorna ferruginea*; 3 ♀ 2 ♂, September 13th, 2010, *Anas querquedulae*; 3 ♂, September 13th, 2010, *A. clypeata*; 3 ♀ 1 ♂ 1 N, October 24th, 2011, *A. acuta*; 1 ♂, October 24th, 2011, *A. acuta*; 2 ♀ 1 ♂, October 24th, 2011, *A. crecca*; 1♀ 1 N, October 24th, 2011, *A. crecca*; 1 ♀, October 24th, 2011, *A.crecca*; 1 ♀, October 24th, 2011, *A. crecca*; 1 ♀, October 24th, 2011, *A. crecca*; 2 ♀, October 24th, 2011, *A. crecca*; 1 ♀ 1 N, October 24th, 2011, *A. crecca*; 1 ♀, October 24th, 2011, *A. crecca*; 1 ♀, October 24th, 2011, *A. crecca*; 1 ♀, October 24th, 2011, *A. crecca*; 1 ♀, October 24th, 2011, *A. crecca*; 1 ♂, October 24th, 2011, *A. clypeata*.

Trinoton sp.: 1 N, September 13th, 2010, *T. ferruginea;* 2 N, September 13th, 2010, *T. tadorna.*

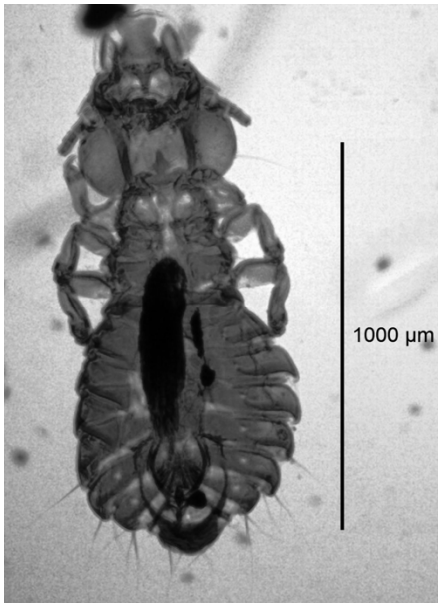

Fig 7. *Anatoecus dentatus*, male, original
Şekil 7. *Anatoecus dentatus*, erkek, orijinal

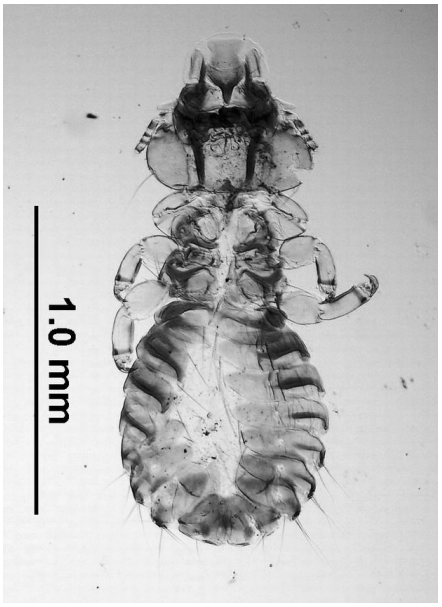

Fig 8. *Anatoecus icterodes,* female, original
Şekil 8. *Anatoecus icterodes,* dişi, orijinal

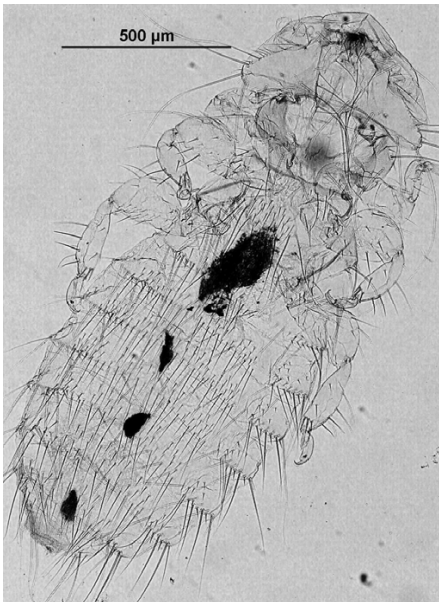

Fig 9. *Holomenopon clypeilargum*, female, original
Şekil 9. *Holomenopon clypeilargum*, dişi orijinal

DISCUSSION

The louse species parasitizing ducks in Turkey have been studied only to a limited extent. Merdivenci [5] reported that *Anatoecus dentatus* and *Anaticola crassicornis* were encountered on domestic ducks, but did not indicate the duck species examined. In subsequent studies, *Anatoecus icterodes* was identified from the marbled teal [7], and *Anaticola crassicornis, Holomenopon* sp. and *Trinoton querquedulae* were identified from the northern pintail[3]. In the present study, in which 8 louse species were identified from the ducks examined, the species reported in previous studies conducted in Turkey were encountered and also four new records novel to the Turkish fauna were detected. The *Trinoton* specimens collected from the common shelduck and the *Holomenopon* specimen collected from the shoveler were not able to be identified at species level as they were in the nymphal stage.

In the present study, the most extensively examined duck species was the teal (30 specimens) followed by the northern pintail (10 specimens), shoveler (4 specimens) and the ruddy shelduck (4 specimens). Although the data obtained from the duck species examined in the present study did not display a homogenous distribution and were inadequate to reach definite results, the highest infestation rate was determined in the ruddy shelduck (75%), followed by the teal (56.66%), common shelduck (50%) and northern pintail (50%).

The most common louse species identified from the infested ducks was *T. querquedulae* (70 specimens) followed by *A. crassicornis* (48 specimens), *A. magnificus* (42 specimens) and *H. tadornae* (40 specimens). Only one specimen of *A. dentatus* and only two specimens of *H. clypeilargum* were encountered. As regards the number of lice per duck, the highest number was determined for *A. magnificus* and 3 out of the 4 ruddy shelducks examined were determined to have been infested by this species with 14 lice per animal. This species was followed by *H. tadornae* with 13.33 lice per duck and *T. querquedulae* with 3.5 lice per duck. The louse species observed at the lowest rates on the infested ducks were *A. dentatus, H. clypeilargum* and *A. icterodes*. The louse species most frequently observed on the infested ducks were *T. querquedulae* (23 cases), *A. crassicornis* (12 cases) and *A. icterodes* (5 cases).

Of the 54 ducks examined in the present study, 10 were transferred to the laboratory alive and 44 were transferred dead. Nine out of the 10 ducks transferred alive were found to have been infested with lice, whilst no lice were encountered on one (a northern pintail). Of the ducks found dead in 2010, one (ruddy shelduck) presented with lice, whilst eight were not infested with lice. Of the 27 hunted ducks collected in October 2011, which were mostly comprised of teals and were examined one day after they were shot, 17 were determined to have been infested with lice, whilst no lice was encountered on 10. Of the 8 ducks hunted in November 2011, 2 were determined to have been infested with lice and 6 did not present with any lice infestation. As lice are obligate parasites, spend their entire life cycle on their host and can survive only a few days apart from their host, they leave their host within a few days after its death. In the present study, no lice having been detected on any of the dead birds, excluding one, which were examined in September 2010, was attributed to lice being obligate parasites. Almost half of the ducks hunted in 2011 having been determined to be infested with lice further supported this view. The majority of the infested ducks were determined to have been infested with a single louse species (51.72%), and of

the ducks infested with a single louse species, the majority were infested with *T. quarquedulae*. The most commonly observed species in cases of infestation with two louse species were *T. querquedulae* and *A. crassicornis*, whilst in the majority of the cases of infestation with three louse species *T. querquedulae, A. crassicornis* and *A. icterodes* were identified. Infestation with four louse species was observed in only the ruddy shelduck.

Despite some exceptions and the increase observed in such exceptions over the course of time, in general, each louse species has a specific host. Merdivenci [5] reported to have encountered *Anatoecus dentatus* and *Anaticola crassicornis* on domestic ducks, but did not indicate the duck species examined. Due to the host(s) of these species having not been indicated in the literature report referred to above, it remains unclear whether *A. dentatus* and *A. crassicornis* have been identified for the first time from the particular duck species they were collected from in the present study. In further studies conducted in Turkey, *Anatoecus icterodes* was identified from the marbled teal [7], *Anaticola crassicornis, Holomenopon sp* and *Trinoton querquedulae* were identified from the northern pintail [3], and *A. crassicornis, Anatoecus* sp and *T. querquedulae* were identified from mallards [8].

Eichler and Vasjukova [11], in their manuscript on the general features of the genus *Trinoton* and the species belonging to this genus, have indicated the specific hosts of the different *Trinoton* species. These researchers [11] have not reported any *Trinoton* species parasitizing the common shelduck or the ruddy shelduck. Similarly, Price et al.[15] have not reported any *Trinoton* species from the common shelduck or the ruddy shelduck. Clay and Hopkins [9] indicated that, when identifying *Trinoton querquedulae* and *Trinoton anserinum,* the major differentiating features that should be sought are the spine-like setae on the 4th and 5th sternites and the differences observed in the genital chamber of female lice; and also pointed out to the fact that the genital chamber of female lice could be better observed under a phase-contrast microscope. In the present study, *Trinoton* specimens were encountered on two ruddy shelducks and one common shelduck. As the specimens collected from the common shelduck and one of ruddy shelducks were in the nymphal stage, species identification could not be performed and these lice were referred to as *Trinoton* sp. The adult lice collected from the other ruddy shelduck were examined under a phase-contrast microscope, and it was observed that both the spine-like setae on the 4th and 5th sternites and the morphology of the wall of the female genital chamber displayed similarity to that previously described for *T. querquedulae*. Therefore, these specimens were identified as *T. querquedulae*.

In conclusion, of the 19 ducks examined, 10 (52.63%) were found to have been infested with lice, and 8 louse species were identified, 4 *(Anatoecus regina, Anaticola magnificus, Holomenopon tadornae, Trinoton querquedulae)* of which were found on the ruddy shelduck *(Tadorna ferruginea)*, 2 *(Anaticola crassicornis, Trinoton* sp.) of which were found on the common shelduck *(Tadorna tadorna)*, 4 *(Anaticola crassicornis, Anatoecus dentatus, Anatoecus icterodes, Trinoton querquedulae)* of which were found on the teal *(Anas crecca)*, 1 *(Trinoton querquedulae)* of which was found on the garganey *(Anas querquedula)*, and 3 *(Anaticola crassicornis, Trinoton querquedulae* and *Holomenopon clypeilargum)* of which were found on the shoveler *(Anas clypeata)*.

Of these species, *Anatoecus regina, Anaticola magnificus, Holomenopon tadornae* and *Holomenopon clypeilargum* are reported from Turkey for the first time, whilst *Trinoton querquedulae* is reported for the first time from the ruddy shelduck worldwide. This study also reports for the first time *Trinoton* sp. from the common shelduck worldwide.

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