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Investigation of parasitic infection of *Merops apiaster* Bird

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ABSTRACT

The current study was conducted in Al-Hawija district, 60 km west of Kirkuk city, and extended from September 2019 to September 2020, where 104 birds of European bee-eaters (*Merops Apiaster*) were collected and the results were as follows: two species of lice were diagnosed, namely *Columbicola columbae* and *Hohorstiella lata* and one species of tapeworm *Rllietina tetragona*. The results of the diagnosis of ectoparasites showed that the overall infection rate was 41.34%, and 14.42%for endoparasites. The results showed significant differences in the infection rates according to the different months of the study, as the highest significant infection rates were 28.57% .The results showed that weight group 41-50 gm recorded the highest rates of significant infection, with rates of 48.05 and 15.58% for Ectoparasitic and endoparasitic, respectively.

Introduction

Birds are infected with a variety of ectoparasites that can have harmful effects on the growth and reproduction of the host, as birds, like other animals, are exposed to parasitic infections that lead to the appearance of pathological signs in them and it may lead to their death, as the effect of parasites ranges from a weak effect to an effect that leads to host death [1]. Birds with high mobility may be exposed to several vectors that may increase the potential risks of transmission of pathogens by new strains around the world [2]. Merops apiaster belongs to the bee-eaters family Meropidae and it breeds in southern Europe and in parts of North Africa and Western Asia, and is considered a permanent migratory bird, as it spends winter in tropical Africa [3]. Like other bee eaters, the Merops apiaster is a colorful and slender bird with brown and yellow upper parts while the wings are green and the bill is black, it can reach a length of 27-29 cm, including the central elongated tail feathers. Merops apiasters live in congregations, as they nest in a colonial way in sandy banks, preferably near the shores of rivers at the beginning of May. Males and females take care of eggs, where they remain in the brood for about three weeks [4]. It is increasingly believed that migratory birds play a major role in transmitting disease [5]. The many characteristics of migratory species make them seemingly ideal vectors for a wide variety of pathogens [6]. During the migration journey, migrants may encounter a wide range of parasite species and strains, which increases the likelihood of new parasites being transferred to the resident communities they encounter, [7]. Many immigrants also congregate in large numbers at so-called stop-over sites, which further enhances pathogen transmission [8].

Materials and methods

1. Collecting birds

The study was conducted in Kirkuk governorate/ Hawija district, and it extended from September 2019 to September 2020, 104 birds of European bee-eaters (*Merops Apiaster*), which were caught with a hunting rifle, and then they were marked and recorded on the date of collection, weight and sex.

2. Ectoparasites

The birds were visually examined by using a magnifying glass on all the areas of bird body, starting from the head area and then to bird face, nose, neck and wings, and then to the area around the anus in order to identify the extent of the bird's infection with ectoparasites. Then, parasites were taken with a forceps and stored in glass bottles and all information was recorded on them during the examination of the sample. Lice samples were diagnosed based on several previously developed classification keys [9] which depended on shape of

head, the number of antennae, the shape of the abdomen, and the number of hairs on the ventral side.

3. Isolation of endoparasites

The examination process was carried out by dissecting the birds by opening bird's body from the abdomen and chest area after removing the feathers from the area. The internal viscera was isolated and placed in water to relax, and the cavity was examined by using a hand magnifying glass to search for parasites or larval stages, and the gastrointestinal tract was divided into the pharynx, the retractile, the esophagus, small intestine, large intestine, caecal appendages and cloaca. After opening these organs longitudinally and coming out of their contents in a dish containing tap water, the worms were isolated by using a magnifying glass in a clean dish containing distilled water to get rid of the substances suspended on the parasite [10]. The worms were put in vial bottles containing formalin at a concentration of 10% in which the date, sex and weight and it was closed tightly to preserve the samples. [11]. The tapeworms were transferred to the prepared dye then they were left for 3-4 hours and transferred to glass dishes containing distilled water to remove the excess dye and attached to the worms, and then, it has been washed softly with distilled water, then they were dried by placing them in ascending concentrations of alcohol. After that, the samples were transferred to xylol for the purpose of leaching for five minutes to clarify the internal structures, then the worms were carried on glass slides containing Canada balsam.

4. Statistical analysis

Statistical analysis was conducted by using the Statistical Analysis System (SAS) (SAS, 2003), with the aim of comparing the different variables of the study according to the Least Significant Difference (LSD) test method at a probability level of 0.05 ($P \leq 0.05$), as reported by [12].

Results and Discussion

The results of Table (1) indicate that all the ectoparasites that were diagnosed were from the biting lice and belong to the two species: *C. columbae* and *H. lata*, as the results indicate that both types of lice on the *Merops apiaster* bird were recorded with infections amounting to 17 and 26 of the two species, respectively, out of a total of 104 birds, achieving infection rates of 16.34 and 25%, and infection severity of 4.47 and 4.65 for the two species respectively, and a total infection rate of 41.34 % as indicated by the results of Table (2), the infection place of type *C. columbae* was in the abdomen only, while the place of infection of *H. lata* was in the abdomen and wing areas.

Table 1: Species of ectoparasites isolated and the percentage of infection and its intensity in *merops apiaster*.

Species of bird	Parasite	Scientific name	Number of examined birds	Number of infected birds	Rate of infection %	Number of parasites in infected birds	Intensity of infection	Place of infection
Merops apiaster	**Lice**	***C. columbae***	**104**	**17**	**16.34 a**	**76**	**4.47 a**	abdomen
	Lice	***H. lata***	**104**	**26**	**25 c**	**21**	**4.65 a**	abdomen and wing

Values followed by the same letter are not significantly different from each other according to LSD test ($P \leq 0.05$).

Table 2: Numbers and rates of ectoparasite infection in the studied birds

Species of bird	Number of examined birds	Number of infected birds	Rate of infection %
Merops apiaster	**104**	**43**	**41.34**

These results are consistent with the results of study [13] in Mosul, which indicated that the studied birds were susceptible to ectoparasites, with a total infection rate of 37.6%, where the infection rate of *C. columbae* lice was 87.5%. It also agrees with [14] that found the rate of infection of pet pigeons with ectoparasites in the city of Baghdad, 46.3%. where[15] showed that 4 out of 12 are of *Merops apiaster* which were examined were infected with three types of lice. In Bangladesh, the rate of pigeon infection with lice was 33.3% [16]. Also, these results are not consistent with the results of study [17] that showed that the rate of infection of pigeons with ectoparasites in Basra governorate reached 64%. The reason for the difference in the rates of recorded infection may be due to a difference in the study areas, the size of the samples, and the climatic factors that directly affect the variation in the infection. [18] indicated that the nature of the ectoparasites' livelihoods have a choice in parasitism and that their bodies are adapted to withstand environmental conditions, making them have a higher prevalence than that of endoparasites.

The results of Table (3) show the distribution of ectoparasites among the studied birds during months of study, as the results of the statistical analysis showed that there were significant differences between the months of the study in the rates of infection of birds with ectoparasites. From that, for the bee-eater bird, during the months of the study, the highest moral infection rate was 54.05% during the month of July 2020, 20 of the 38 birds examined were infected, while the lowest significant rate of infection was 21.42% during the month of September 2019, as 3 birds were recorded out of the 14 examined.

Table 3: Distribution of cases of ectoparasites (lice) and the percentage according to the months of the study

Months of Study	***Merops apiaster***		
	Number of examined Birds	Number of infected birds	Rate of infection %
September / 2019	**14**	**3**	**21.42 d**
June / 2020	**16**	**7**	**43.75 b**
July / 2020	**38**	**20**	**54.05 a**
August / 2020	**36**	**13**	**37.14 c**
Total	**104**	**43**	
LSD			**1.819**

Values followed by the same letter are not significantly different from each other according to the LSD test (P≤0.05)

The results are consistent with the findings of [19] in India that the rate of infection of *menopon gallinae* lice reaches its highest in the summer compared to the winter season, and that there is a positive relationship between lice infection, temperature and day's length. It was also explained in [20] during the study of seasonal variations of a free-range chicken infection with parasites in selected areas of some villages in Zimbabwe, the highest infection rate of ectoparasite infection was recorded in the dry season, and the reason may be due to the different environmental conditions and the type of birds studied. It has been mentioned by [21] that there are several factors that affect the spread of lice in the dry seasons and thus affect the presence of lice on the host, including the age, season, ecosystem and the nature of the bird's life.

The results of Table (4) showed the existence of only one type of tapeworm, *R. tetragona*, as it was found that 15 of the 104 birds were infected, achieving infection rates of 14.42%, and an intensity of infection of 2.06, while the number of parasitic worms that were collected reached 31 tapeworms.

Table 4: Types of isolated internal parasites and the percentage of infection and its intensity

Species of bird	Scientific name	Number of examined birds	Number of infected birds	Rate of infection **%**	Number of parasites in infected birds	Intensity of infection
Merops apiaster	*R. tetragona*	**104**	**15**	**14.42**	**31**	**2.06**

The most vulnerable areas of the body to infection with parasitic worms are the alimentary tract through ingestion of food contaminated with the infective stages or ingestion of animal tissues that represent intermediate hosts for some parasitic worms [22].

The present results are consistent with findings from [23] in Wasit governorate and [24] in Basra that stated that the highest infection with endoparasites was due to tapeworms. In study [25], the intestines of 107 common starlings that were caught in Al-Sulaymaniyah region were examined during the period from 1/5/2012 to 5/7/2012To detect intestinal parasites, two species of parasitic worms were identified, one of them: *choanotaenia masculosa* and *acanthocephalan spp*. The prevalence rates for these worms were 8.56% and 13.91%, respectively. While these results do not agree with the results of study [26] that studied the infection of wild birds with parasites in the city of Tikrit. It pointed out that the rate of infection with endoparasites amounted to 48.82%. It also does not agree with the results of studies of [27] in Dhi-Qar governorate and [28] in Egypt that showed that the highest rate of infection with endoparasites in the birds they studied was with perforations and the lowest rates of infection were with tapeworms.

The results of Table (5) indicate the distribution of endoparasites among the studied birds during the months of the study, which showed significant differences in the rates of infection according to the different months of the study. From this, it is stated that the highest rate of infection significantly amounted 28.57 during September 2019 as 4 birds were recorded as infected out of a total of 14 birds that were examined, while the lowest rate of moral infection was 10.52% during July 2020, as 4 birds were recorded infected out of a total of 38 birds examined.

Table 5: percentage of endoparasites according to months study.

Months of Study	*Merops apiaster*		
	Number of examined Birds	Number of infected birds	Rate of infection %
September / 2019	**14**	**4**	**21.42 d**
June / 2020	**16**	**2**	**43.75 b**
July / 2020	**38**	**4**	**54.05 a**
August / 2020	**36**	**5**	**37.14 c**
Total	**104**	**15**	
LSD			**1.819**

Values followed by the same letter are not significantly different from each other according to LSD test (P≤0.05).

It is stated by [24] that the highest infection rate was recorded during the moderate and hot months in Basra, with a rate of 100%, while the lowest infection rate was 50% during the cold months. For [29], it stated that the highest rate of infection with endoparasites was recorded during the spring season in Nineveh governorate. It is stated by [30] that the high rate of infection in the temperate seasons may be due to birds devouring large quantities of animal species from insects and others, especially during the spring and summer seasons.

The availability of the host's larval roles throughout the year may be a reason for the high rates of infection with some worms or the appropriate environmental conditions for infection, and sometimes the birds provide a suitable environment for the presence of the parasite larvae, some parasitic worms have nearly similar infection rates in the host itself due to the fact that young birds are more susceptible to parasitic infections through eating copious amounts of food, as well as the weakening of their immune system [31]. It is also stated by [32] that when studying parasitic infections on domestic ducks in Baghdad and Al-Kut governorates that the high rates of infection in the temperate and hot months is the result of the appropriate temperatures and relative humidity and the availability of green herbs, which increases the presence of intermediate hosts such as crustaceans, insects and softeners that contain the infectious roles of these Parasites, as you notice the emergence of a clear seasonal cycle throughout the year.

The results of Table (6), which include the weight groups with ectoparasites and endoparasites according to these groups indicate that the average weight group is 41-50 grams. The highest rates of infection were recorded significantly with rates of 48.05 and 15.58% for ectoparasites and endoparasites, respectively, while the lowest rates of infection were significant, the weight group surpassed 51 gm or more by achieving a 0% infection rate for ectoparasites, while the lowest rate of infection with endoparasites was 11.11% for each weight group less than 40 and 51 grams and more.

Table 6: Results of the relationship between the weights of poultry in the wild and the proportion of birds in foreign and domestic species

Weighted aggregates (gm)	Examined number	Ectoparasites		Endoparasites	
		Infected number	Rate of infection%	Infected number	Rate of infection %
Less than 40	18	6	33.33 b	2	11.11 b
41-50	77	37	48.05 a	12	15.58 a
51 and more	9	0	0c	1	11.11 b
Total	104	43	41.34	15	14.42
(LSD= 1.998)					

Values followed by the same letter do not differ significantly according to LSD (P≤0.05).

These results are in agreement with [33] in Al-Qadisiyah governorate which showed that the rate of infection with ectoparasite decreased significantly with weight increase. It has been indicated by [34] that the bird's weight decreases when infected with *E. tenella*, and they attributed the weight loss to bleeding and secondary bacterial infections to the intestine as well as the occurrence of diarrhea, as the case of weight loss is one of the important pathological effects of infection with parasites that are proportional to the dose of infection, and the cause of this phenomenon is due to many factors, the most important of which is bleeding. In study [35], it was noticed that the rate of infection with ectoparasites increased significantly with the increase in weight in resident birds, while the rate of infection of endoparasites decreased significantly with the increase in weight in the birds themselves, while in migratory birds the incidence of ecoparasites decreased significantly with an increase in weight, which was matched by an increase in the incidence of endoparasites.

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التحري عن الطفيليات الداخلية والخارجية لطائر الورور

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الملخص

أجريت الدراسة الحالية في قضاء الحويجة 60 كم غرب مدينة كركوك، وامتدت من شهر أيلول 2019 لغاية شهر أيلول 2020، إذ تم جمع 104 طائر ورور *Merops apiaster* وكانت النتائج كما يلي: تم تشخيص نوعين من القمل هما *Columbicola columbae* و *Hohorstiella lata* ونوع واحد من الديدان الشريطية *Rllietina tetragona*. أظهرت نتائج تشخيص الطفيليات الخارجية أن نسبة الإصابة الكلية بالطفيليات الخارجية بلغت 41.34%، والداخلية14.42%. أظهرت النتائج وجود اختلافات معنوية في نسب الإصابة باختلاف أشهر الدراسة، إذ بلغت اعلى نسب الإصابة معنوياً 28.57% للورور خلال شهر أيلول 2019. أظهرت النتائج أن المجموعة الوزنية المتوسطة 41–50 غم قد سجلت اعلى نسب الإصابة معنوياً بمعدلات بلغت 48.05 و15.58% للطفيليات الخارجية والداخلية على التوالي.