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Contribution to the knowledge of ectoparasites of swallows in a semi arid region of Algeria

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ABSTRACT

An inventory of ectoparasites was carried out on 120 young House martin living (*Delichon urbica*) in 18 nests in Tebessa province (South-Eastern Algeria). A total of 104 samples were collected and identified, nine species of ectoparsites, belonging to two classes: Arachnida and Insecta with relative abundance of 21.14% and 78.86% respectively. The identified species are: *Ixodes lividus*, *Ixodes frontalis*, *Ceratophyllus gallinae*, *Ceratophyllus hirundinis*, *Callopsylla* sp., *Ceratophyllus* sp., *Xenopsylla* sp., *Stenepteryx hirundinis* and *Menacanthus* sp. The predominant species of total ectoparasites was *Ixodes lividus* in abundance 17.30% followed by *Ceratophyllus hirundinis* and *Xenopsylla* sp. with 15.38%, and other species whose abundance varies between 14.42% and 3.84%. The distribution of ectoparasite groups on the young body of *Delichonurbica* is irregular, the lice have a wide distribution, they are found on the belly feathers (61.16%). However, ticks are mainly localized on the wings (100%) and fleas are mainly found on the ears (54.84%) and nasal cavities (42.92%).

Key words : *Delichon urbica*, fleas, insecta, ticks, lice, tebessa.

INTRODUCTION

Parasitism is one of the major selective forces affecting the life history of birds (Clayton and Moore, 1997; Gupta *et al*., 2020), which are chiefly attacked by several kinds of ornithophilic, parasitic insects (Adler and Creadie, 2019). There are many kinds of lice, grinding insects, which inconvenience the animal by their bites or continual tugging on the hairs or downs. In addition to lice, bedbugs, fleas and some blood-sucking flies, sucking insects, and inflict multiple bites on the bird (Chu *et al*., 2019). Moreover, in the nests there are two dipteran insects belonging to the genera Neolliophilum and Prolocalliplwra, whose haemophagous larvae, adapted to the nesting life, gorge themselves on the birds' blood and weaken the often in a definitive manner. Generally, most parasites feed at the expense of their host (Bush *et al*., 2001). House martin whose nests are quilted, have specific fleas. The latter is a matter of larvae requirements (Rosza *et al*., 2000). In addition to host-specific factors, the parasite effect may depend on environmental and contextual factors such as habitat type, the season, or the year (Chapa-Vargas *et al*., 2020). These factors influence many parameters in both the host and the parasite. Thus, seasonal cooling causes the hosts to thermo regulate, to modify its resources and food behaviour, and may increase its vulnerability to infections (Nelson, 2004; Ham-Dueñas *et al*., 2017).

There is no specific flea for the house martin "*Delichonurbica*" and its nest is bare and dry, which is an environment where larvae could not survive. Nonetheless, house martin can be parasitized notably with *C. hirindinisand* with *C.gallinae* (Bouslama *et al*., 2002). These parasites belong to the order of Siphonapteara and are specific to mammals and birds (Clayton, 1997). However, the most numerous species are mammalian fleas: about 94% of the 3000 taxa listed (2005 species and 828 subspecies) (Krasnov, 2012). Bird fleas are distributed among four super families out of the five that we know. Of the five we know, bird fleas are distributed among four super families. Exploiting the resources of their hosts, ectoparasites can reduce the survival rate of these hosts and their reproduction success (Clayton and Moore, 1997; Fakhar *et al*., 2018). In addition to a change in the spawning cycle (Oppliger *et al*., 1994), the

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eggs size and parental investment (Tripet and Richner, 1999).

In the present work, we are interested in the study of the ectoparasite community of the house martin "*Delichon urbica*" of Mouldi Achouri colony, city of Tebessa, in an attempt to characterize the prevalence of parasites on these birds, the intensity of parasites' infestation and finally the distribution of the different groups of ectoparasites within young "*Delichon urbica*".

MATERIALS AND METHODS

Study area and sampling methods : Young swallows were captured in 2019 during April to July, in the Mouldi Achouri colony in Tebessa (Northeastern Algeria, GPS: 35° 28' N, 08° 07 E). The study was carried out on colonies of swallows (*Delichonurbica*) with an estimated number of 18 nests, 120 young birds were sampled during the study period (Fig. 1). Parts of the swallow's body such as: head, eyes, ears, beak, tail, body feathers and wings have been carefully examined for ectoparasites, are the most parasitic parts (Bush, 2001). All ectoparasite specimens were stored in 70% ethanol (Greiner and Ritchie, 1994). Depending on the species, the parasites from each individual are placed in a numbered petri dish.

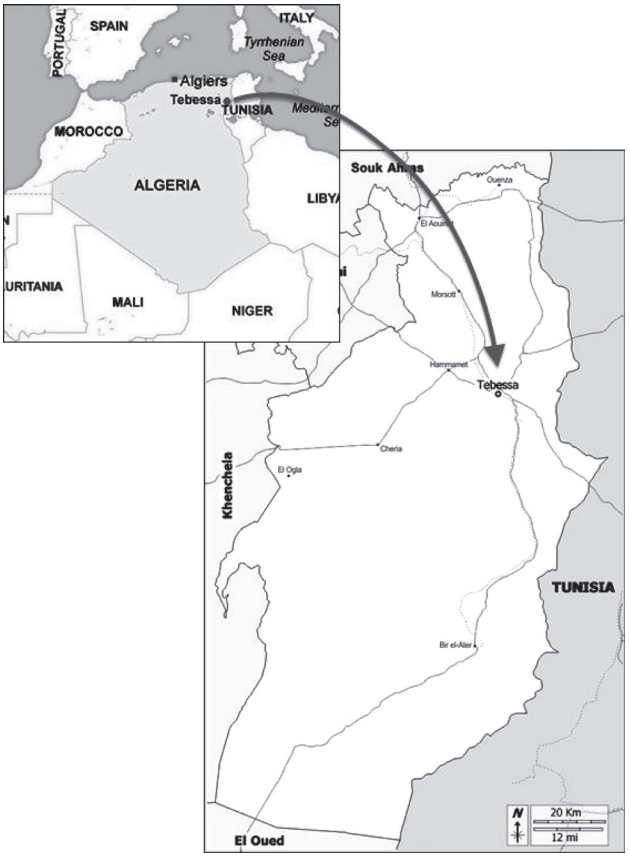

Fig. 1. Geographical position of the study area.

Identification of ectoparasites : The identification of ectoparasites based on the external morphology was carried out according to the following identification keys (Walker *et al*., 2000).

Data analysis : To express the diversity of ectoparasites identified in *Delichonurbica* of the Tebessa region, various statistical tools, graphs and indices were used in this study. The specific richness (Magurran, 2004) and the number of individuals, the relative abundance per cent of each species were recorded (Faurie *et al*., 2003) and the structure indices (Prevalence P%, Intensity I) according to Bush *et al*., 1997. Graphics were made using graph pad prism 7.

RESULTS AND DISCUSSION

Inventory of ectoparasitic species : Young house martins are infested with three types of ectoparasites: ticks, fleas and lice, which represent nine different species. The hematophagous ectoparasites found in young barn swallows are listed in Table 2. They are divided into two classes: Arachnida and Insecta, and on four orders and five families. The class Insecta is the most represented by families (fleas and lice) and nine species. While the Arachnids are represented by a single order, one family and two specie (Table 1). Semi-arid regions have difficult and stressful conditions that affect the biotic component negatively. However, very little information is available in semi-arid environments on ectoparasite-infested birds, including house martin (*Delichon urbica*) in the city of Tebessa. In the current study, the prevalence of ectoparasites is close to that recorded in other semi-arid regions (Moyer *et al*., 2002; Valera *et al*., 2003). As in many other species, mites are the most abundant of ectoparasites in the studied young house martin (Greiner and Ritchie, 1994), leading to the ease of their transmission by the least interaction between individuals (Tompkins, 1994).

Ecological indices : Collection carried out in the study area revealed the presence of 104 individuals attached to 9 species spread over two classes: Arachnida and insect. The insect class is quantitatively the most dominant with 7 species

Table 1. List of species isolated from young house martin *Delichon urbica*.

Branch	Class	Ordre	Family	Species
Arthropoda	Arachnida	Ixodida	Ixodidae	*Ixodes lividus* (Koch, 1844)
				Ixodes frontalis (Panzer, 1798)
	Insecta	Siphonaptera	Ceratophyllidae	*Ceratophyllusgallinae* (Schrank, 1803)
				Ceratophyllushirundinis (Curtis, 1826)
				Callopsyllasp (Wagner, 1934)
				Ceratophyllussp (Curtis, 1831)
		Ditera	Pulicidae	*Xenopsyllasp* (Glinkiewicz 1907)
			Hippoboscidae	*Stenepteryxhirundinis* (Linnaeus, 1758)
		Phthiraptera	Menoponidae	*Menacanthus sp* (Neumann, 1912)

Table 2. Classification of ectoparasite species.

Ectoparasites		
Ticks	Fleas	Lice
I. lividus, *I. frontalis*	*C. gallinae*, *C. hirundinis*, *Callopsylla* sp., *Ceratophyllus* sp., *Xenopsylla* sp., *S. hirundinis*	*Menacanthus* sp.

and 82 individuals (Tab. 01). *Ixodes lividus* is the most abundant species with a relative abundance of 17.30%, followed by *Ceratophyllus hirundinis* and *Xenopsylla sp* with 15.38%. Next come the species *Callopsylla sp, Ceratophyllus gallinae, Ceratophyllus sp, Stenepteryx hirundinis* and *Menacanthus sp* with 14.42%, 12.5%, 8.65%, 6.73%, 5.76% and 3.84% respectively (Table 3). Among the ectoparasites, Fleas presented the greatest number with 6 species and relative abundance of 66.33% followed by Ticks with a total of 2 species and a relative abundance of 21.14%, finally Lice with a single species and a relative abundance equal to 5.76% (Fig. 2).

Structural indices : The population of young house martin has a relatively high infestation rate of fleas

Table 3. Number of individuals and relative abundance (%) isolated from young house swallows *Delichonurbica*.

Species	Number of individuals	Relative abundance (%)
Ixodes lividus	18	17.30
Ixodes frontalis	4	3.84
Ceratophyllus hirundinis	16	15.38
Callopsylla sp.	15	14.42
Ceratophyllus gallinae	13	12.5
Ceratophyllus sp.	9	8.65
Xenopsylla sp.	16	15.38
Stenepteryx hirundinis	7	6.73
Menacanthus sp.	6	5.76

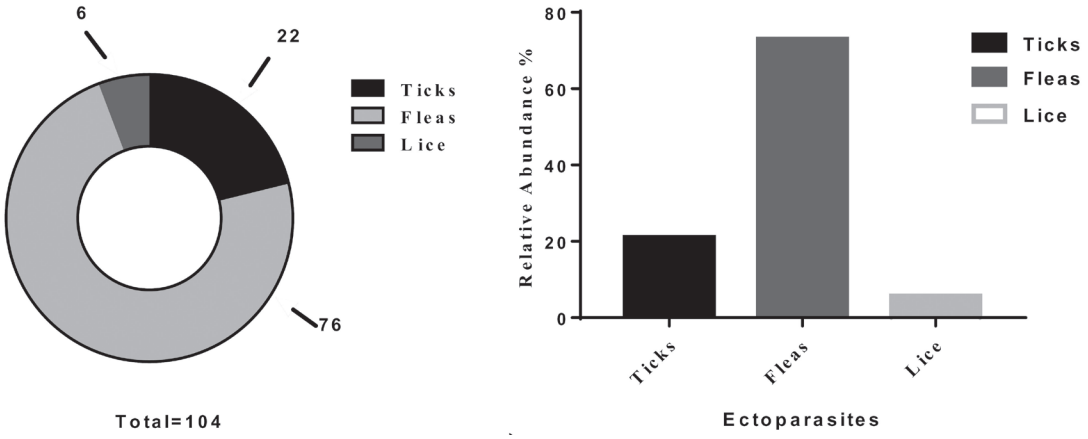

Fig. 2. Number of individuals of ectoparasite and relative abundance (%).

Table 4. Structural indices of ectoparasites of house martin *Delichonurbica* from the Tebessa region.

Species	Intensity (I)	Intensity%
Ixodes lividus	0.22	7.11
Ixodes frontalis	0.75	24.27
Ceratophyllus hirundinis	0.30	9.70
Callopsylla sp.	0.31	10.03
Ceratophyllus gallinae	0.20	6.47
Ceratophyllus sp.	0.12	3.88
Xenopsylla sp.	0.44	14.23
Stenepteryx hirundinis	0.42	13.59
Menacanthus sp.	0.33	10.67

(73.07%) and an intensity of 57.90% followed by ticks (21.15%) with an intensity of 31.38% and finally a low prevalence of lice (5.76%) and an intensity of 10.67%. Regarding fleas, we have noticed the dominance of Ceratophyllidae with a prevalence of 50.96% followed by the Pulicidae with 15.38% and finally Hippoboscidae with 6.73%. The ticks are represented by 2 species with a dominance of *Ixodes lividus* with a prevalence of 17.31% followed by *Ixodes frontalis* with 3.85%. As for lice, they are represented only by *Menacanthus* sp. With a prevalence of 5.77% or six individuals. However, the ticks described by the Ioxodidae family are very low in prevalence (3.84%) (Fig. 3). Based on the vegetation available in the region, particularly in woodlands, this type of mite is conditioned (Rosza *et al*., 1996). Wetlands are likely to be favoured (Heeb *et al*., 2000; Benoit *et al*., 2007) to compensate for the deficiency of body water (Krober and Guerrin, 1999) and to grow at ambient temperatures (Zakoveska *et al*., 2007). Menoponidae does exist among our young house martin in the city of Tebessa, and according to (Arthur, 1965) Menoponparasite. They can cause irritation and skin lesions with weight loss of their hosts along with a decreased egg size (Wall and Shearer, 2001) (Prelezov *et al*., 2006). These Phthiraptera show a strong correlation with temperature and photoperiodism, and they are abundant during warm seasons (Singh *et al*., 2009). As for the *Ceratophyllus* genus, it was separated from the house martin hosts of the city of Tebessa, and it was reported in the barn swallow in Clemont (Belgium) in 2014 as well. In Belgium, the house martin *Delichon urbica* has three specific fleas; *C. farreni, C. rusticus* and *C. hirundinis* that are found in nests. In Slovenia, the analysis of 145 house martin nests in 1998 helped isolating the parasites of the following species*: C. hirundinis* and *C. rusticus* (Bouslama *et al*., 2002). Several authors reviewing the Linnet (George, 1977; Loxdale, 1986) and the Greenfinch (George, 1977) have identified this type of parasite. The aforementioned parasite looks for the most irrigated parts of the body of its host (Boyd, 1951). In some species, it can reduce the reproduction success (Fitze *et al*., 2004a), it can also reduce the egg size and significantly increase the period of incubation significantly (Fitze *et al*., 2004a). Flies belonging to the Hippoboscidae family, that were isolated from the young house martin of the city of Tebessa, were also detected in the Greenfinch (Laghouat, Algeria) in 2013. These flies constitute a family of diptera, whose adult stage is ectoparasites of mammals and birds (Rahola *et al*., 2011). It could influence the demographic characteristics of its host (Hurtrez-Boussès *et al*., 1999). Ectoparasites of *Delichon urbica* found in Mouldi achouri colony were considered as healthy controls (Foronda *et al*., 2004). According to (Ash, 1960), the presence of lice in passerines should

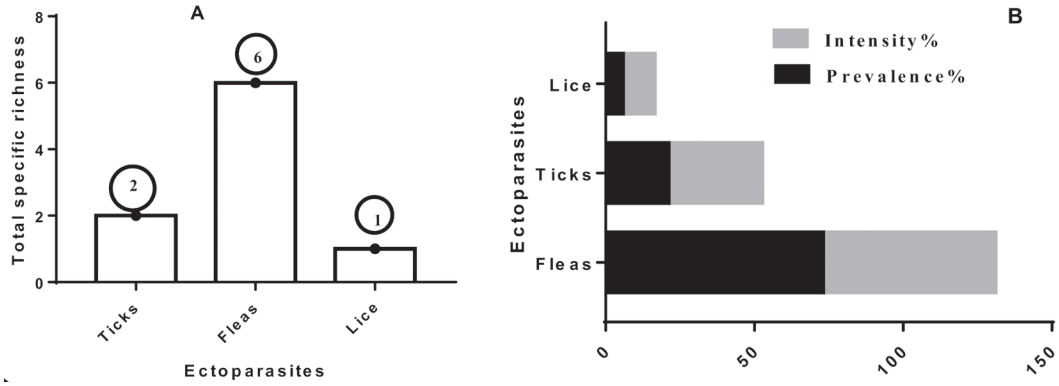

Fig. 3. Total specific richness (A) and intensity%, prevalence% (B) of ectoparasite.

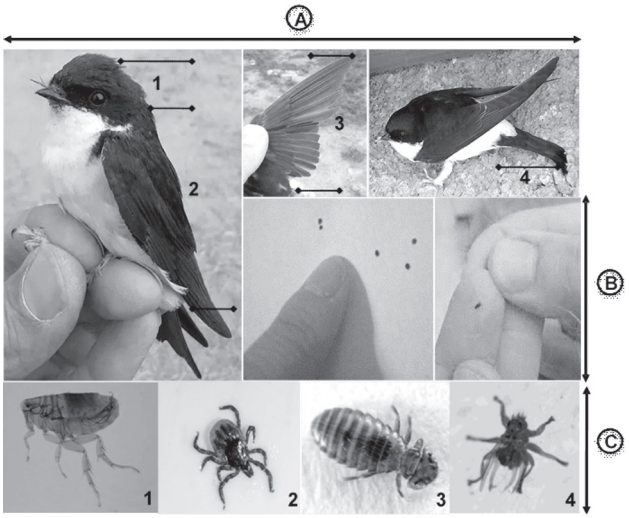

Fig. 4. Ectoparasites of young house martin (*Delichonurbica*). (A1) The head, (A2) The body feather, (A3) The wings, (A4) The tail; (B) collected ectoparasites; (C1) *Xenopsylla* sp., (C2) *Ixodeslividus*, (C3) *Menacenthus* sp., (C4) *Stenepteryx hirundinis*.

not be excluded. (Booth *et al*., 1993) have shown that lice parasitic load (Philopteridae) affects the metabolic rate. Indeed, if these parasites do not inflict direct mortality in the short term, the metabolic costs they generate are likely to strongly reduce the physical condition of their host, and therefore reduce its selective value through its effects on its survival in the long-term (Clayton, 1991).

The distribution of the different parasitic groups in Delichonurbica : The distribution of ectoparasite groups on the body of *Delichonurbica* is irregular. They are found on several parts of the bird's body: the back, the belly, the wings, the ears and the nasal cavities (Fig. 4). Lice have a wide distribution, they are found on belly feathers (61.16%), the back feathers (34.58%) and the wings (4.26%). Ticks, however, are mostly localized at the wings (100%). As for fleas, they are found mostly on the ears (54.84%) and the nasal cavities (42.92%).

AUTHORS' CONTRIBUTION

All authors performed data analysis and drafted the manuscript (FH, BH, DD, HM).

DECLARATION

The authors declare that they have no conflict of interests.

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