The Journal of Animal & Plant Sciences, 28(1): 2018, Page: 321-326
ISSN: 1018-7081

TROPHIC ECOLOGY OF SHORT-TOED TREECREEPER'S *CERTHIA BRACHYDACTYLA* (BREHM, 1820) NESTLING IN THE SUBURBAN AREA OF ELHARRACH (ALGERIA)

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ABSTRACT

In this paper we are studing the diet composition of the short-toed treecreeper's *Certhia brachydactyla* (Brehm, 1820) nestling in the suburban area of El Harrach (Algeria). The diet analysis is based on examining fecal sacs which were carried out by parents and placed on the bark of *Washingtonia robusta* and *Jacaranda mimosifolia* near the nest during the breeding season 2014/2015. Fecal sacs were collected and treated separately in 70% alcohol to identify prey-species. In total, 277 items, representing 66 prey-species were identified from the collected fecal sacs of short-toed treecreeper nestling. The relative abundance index revealed that the insects were dominants with 67.15%, followed by arachnids 27.44%, Gastrapoda 3.61% and the other classes were poorly represented. Regarding the order of the different class-preys, the diet consisted predominantly of Araneae with (27.44%), followed by Coleoptera (24.91%) and Hymenoptera (18.05%). For the prey size, it varied from 1 mm to 15 mm with an average of 4.33±0.13 mm. And the most represented prey measuring was between [2,55-4,11 mm].

Key words: short-toed tree creeper, diet, fecal sac, nestling, prey size.

INTRODUCTION

The short-toed Treecreeper *Certhia brachydactyla* is present in center area of the Mediterranean. It can be spotted from North Africa to southern Scandinavia, east Ukrainian border to the west of the Atlantic Ocean (Harrap and Quinn, 1996). In Algeria, breeders usually take place in a great variety of woodland (oak, cedar...) in the Tell (densities of 4-5 pairs/10 ha in oakwood of Lesser Kabylie) and the Aures, up to the treeline, these species are more abundant in forest in the east than in the west of the country (Heim de Balsac and Mayaud, 1962; Isenmann and Moali, 2000).

Nestling passerines void their urine and feces encapsulated within a whitish mucosal structure called the fecal sac (Morton, 1979). Some studies have described the different aspects on the study of fecal sac and the analysis of those lead us to get information about the diet of nestling (Kleintjes and Dahlsten, 1992; Pechacek and Kristin, 2004; Michalski *et al.,* 2011; Gyug *et al.,* 2014).

Parents throw out the fecal sacs far from their nest to prevent predators from using it as olfactory indicator or visual clues and to avoid attracting ectoparasites (Lang *et al*. 2002; Ibáñez-Álamo *et al.,* 2014; Ibáñez-Álamo *et al*., 2016)

A few researches about the diet of the Short-toed Treecreeper have been realized in Europe (Madon, 1930; Orsini and Ponel, 1990), compared with the eurasian treecreper diet which is relatively known during his reproduction (Kuitunen and Törmälä, 1983; Kuitunen 1989, Suhonen and Kuitunen, 1991),

No study has been undertaken on the diet of the short toed treecreper in North Africa and particularly in Algeria. In the present study, our goal was the first to describe the diet of nestling Short-toed Treecreper by examining the fecal sacs during the breeding season in Algeria.

MATERIALS AND METHODS

Study area: The study area has been taking place in Algiers suburbs at national high school of agronomy in El Harrach (3°08' E, 36°43' N) which is located between Belfort (Hacen Badi) and the eastern part of Mitidja at 50 m a.s.l. This region contains parks arranged as building, parks and agricultural plots (Fig.1). The area of study belongs to the Mediterranean bioclimatic scale and the average monthly temperature ranges from a mean minimum of 10.5 °C in January to a mean maximum of 27.5 °C in August. The annual rainfall is 438.63 mm with a five-month drought period from May until September.

The vegetation is mainly dominated by trees such as *Phoenix canariensis, Washingtonia robusta, Jacaranda mimosifolia Pittosporum undulatum* and *Ficus retusa*.

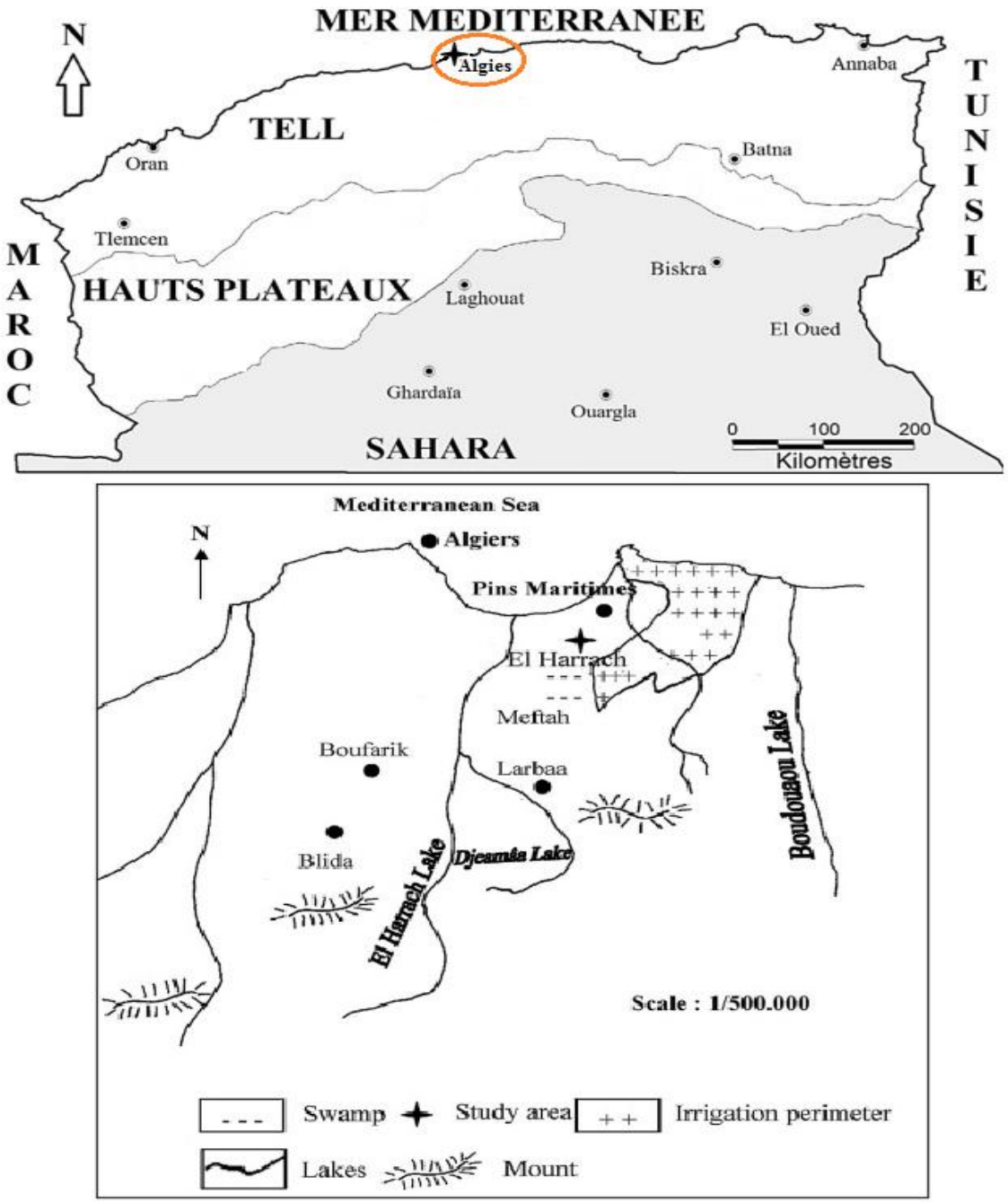

Fig.1. Geographic location of the study area.

Methods: The diet of nestling Short-toed treecreeper was investigated by identifying prey items from fecal sacs during breeding season (2014-2015).As a result of observation of three nests, a total of 48 fecal sacs, with 16 fecal sacs for each nest. They were collected near three nests which were carried out by parents and placed at the trunk *Washingtonia robusta* and *Jacaranda mimosifolia* near the nests (14.28±1,45m).

The fecal sacs were put separately in numbered sachets, marked with precise information such as the date and place of collection. Before examination each fecal sac, the sample was placed inside a Petri dish marked with a stylograph. And were analyzed with alcohol 70° which made it easy for us to separate the various fragments (sclerotinized parts and the inorganic contents). Prey species were identified using a zoom binocular microscope 20x.

Identification of species was not easy cause to its bad conditions and more particularly the thorough

fragmentation of the introduced chitinous parts (Boukhemza- Zemmouri *et al.,* 2013).

Once the prey was identified, we carried out an estimation of their size by spreading out the various fragments over graph paper and comparing with the collection of insects of the department of zoology on the national high school of agronomy in Algiers.

The number of individual prey items in each sample was determined based on the different parts found. Paired anatomical parts with the same features were counted as belonging to one individual. A head, thorax, abdomen, two cerci, two mandibles, two elytra, two wings, two of the same antennas, or six legs corresponded to one individual (Tergou *et al.*, 2014), Davies (1977) proved that there is a strong correlation between prey remains in the faeces and the composition of the true diet in other insectivorous passerines.

Two dietary indices were calculated, Relative frequency (RF; %), defined as the number of individuals of a species in relation to the total numbers of individuals of all species, Relative biomass (B %): The mass of the individuals of a prey species as a percentage of the total mass of prey and the prey size classes were determined using the percentage of number (n %) of each length class. The classes of sizes were given according to the rule of Sturge (Scherrer, 1984): Number of classes (NC) = 1 + (10log10 NR)/3, or NR = total number of specimens examined. With: I = (LSmax – LSmin)/NC. Where I = NC, class-interval = full number of classes, LSmax = maximum standard length, LSmin = minimal standard length.

RESULTS

In total, 277 items representing 66 prey-taxa; were identified in the collected fecal sacs of nestling Short-toed treecreeper (Appendix 1). These preys-taxa were distributed as followed: 55 Insecta, 6 Arachnida, 3 Gastrapoda, 1 Chilopoda and 1 Malacostraca (Tab.1). Insects were the dominant prey-taxa of items (n = 168, 67.15%), and Arachnida for the second one (n=76, 27.44%). Gastrapoda (n=10, 3.61%), Chilopoda and Malacostraca (1.44% and 0.3%, respectively) occurred rarely. The order of Araneae was the main preys (n=76; 27.44%), followed by Coleoptera (n=69, 24.91%), Hymenoptera (n=50, 18.05%), Homoptera (n=28, 10.11%), Hemiptera (n=20, 7.22%) and the other orders were rarely represented. The species best represented in the food spectrum of Aranea sp.1. Ind. , Homoptera sp. Ind., Formicidae sp. Ind. 2 and *Componotus barbatus* at 16.25%, 5.78%, 5.42% and 4.33 %, respectively.

However based on biomass, Arachnida were the dominant prey group (45.32%), followed by Insecta (41.40%), chilopoda (6.54%), Gastropoda (4.81%) and Malacostraca (1.92%). The highest biomass was represented by the dominant prey orders, Araneae (45.32%), it was followed by Coleoptera (14.19%), Hymenoptera (9.19%) and Chilopoda (6.54) with all the other prey species comprising less than 5% of the samples.

Table 1. Relative frequency and biomass of prey of nestling Short-toed treecreeper, by orders and systematic classes in the suburban area in El Harrach(Algeria). (n: number of specimens; n %: relative abundance of the taxon considered; NE: richness of species; NE%: frequency of the number of species).

Classes	Orders	N	n%	NE	NE%	B%
Mollusca	Gastropoda	10	3,61	3	4,55	4,81
Arachnida	Araneae	76	27,44	6	9,09	45,32
Chilopoda	Chilopoda ind	4	1,44	1	1,52	6,54
Malacostraca	Isopoda	1	0,36	1	1,52	1,92
Insecta	Dermaptera	4	1,44	4	6,06	4,33
	Psocoptera	1	0,36	1	1,52	0,10
	Homoptera	28	10,11	3	4,55	3,85
	Hemiptera	20	7,22	6	9,09	7,31
	Coleoptera	69	24,91	20	30,30	14,19
	Hymenoptera	50	18,05	14	21,21	9,19
	Lepidoptera	3	1,08	2	3,03	1,54
	Diptera	11	3,97	5	7,58	0,89
Total = 5	**12**	**277**	**100**	**66**	**100**	**100**

Prey size: The size of the prey found in the fecal sacs of nestling Short-toed treecreeper varied from 1 mm (*Coccus hesperidum*) to 15 mm (Chilopoda sp ind), with an average of 4.33±0.13 mm (Tab, 2). The Classe of Prey id measuring between 2,55 and 4,11 mm they were the most abundant with a rate of 54.15% represented for example, by Aranea sp1. , Formicidae sp 2 and Cercopidae sp ind. They are followed by those whose size was [4,11-5,66 mm] with 14.44%, and those was [1-2,55 mm] with 11.91%.

Table 2. Number frequency of valued prey size range (mm) of nestling Short-toed treecreeper in the suburban area in El Harrach(Algeria).

Prey size range (mm)	n	Percentage of number (%)	Arithmetic mean	Standard deviation
[1-2,55]	33	11,91	4.33	±0.13
[2,55-4,11]	150	54,15		
[4,11-5,66]	40	14,44		
[5,66-7,22]	29	10,47		
[7,22-8,77]	12	4,33		
[8,77-10,33]	8	2,89		
[10,33-11,88]	0	0,00		
[11,88-13,44]	3	1,08		
[13,44-15]	2	0,72		

DISCUSSION

Our results are the first attempt to describe the diet of Short toed-treecreper by examining the fecal sac in North Africa, especially Algeria. As mentioned before, the selected method for studying the diet of these species was the analysis of fecal sacs. The advantages of fecal sacs analysis are its simple field procedure, any disruption during handling, and no need for sophisticated equipment. This method is different from those of the authors who did study the diet of creeper family. Madon in 1930 and Williams (1979) analyzed the remainder of stomach content to identify the prey. The method used by Orsini and Ponel (1990) is to take photographs of adults trying to feed their nestling. The method used by Kuitunen and Törmälä (1983) is captured adulated in a plastic bag when an adult treecreeper went into the nesting boxes and the bird dropped from the food bill into the bag which will be analyzed, however this method must create a stress to the captured bird.

The prey-taxa found in the 48 fecal sacs collected in the suburban area in El Harrach enabled us to identify 66 prey-taxa, corresponding to 277 invertebrate preys. The majority were arthropods, with predominant of insect (n = 168, 67.15%), followed by Arachnida (n=76, 27.44%). This is in similar to what has been found by Madon (1930) and Orsini and Ponel (1990) who studied the diet of Short toed-treecreper. Kuitunen and Törmälä (1983) also found the dominance of insect followed by Arachnida consumed by common treecrepers.

Chilopoda, Malacostraca and Gastropoda also contributed to the diet composition of the Short toed-treecreper with 1, 4 and 10 individuals only, respectively.

Based on biomass, Arachnida were the dominant prey group (B= 45.32%), followed by Insecta (B= 41.40%). Kuitunen and Törmälä 1983 in Hauho, Southern Finland reported that Arachnida made up the greatest percentage of biomass with (B= 77%) consumed by common treecreepers. Similar results were recorded by Suhonen and Kuitunen (1991), where Arachnid were the most numerous prey by biomass (B= 65%), followed by insects.

The prey size varied between 1 mm and 15 mm with an average size of 4.33±0.13 mm. For absence of information on the prey size study of Short toed-treecreper, this aspect is compared with prey's size of common treecreepers. Similar results were recorded by Kuitunen (1989), Suhonen and Kuitunen 1991 in Finland, and it indicated that the size of prey consumed by common treecreepers varied between 1 mm and 15mm. In our study, preys measuring between [2,55-4.11 mm] in length made up 54.15% of the diet, followed by preys measuring [4,11-5.66 mm] in length (21.6%) and those of [1-2.55 mm] (11.91%). Kuitunen (1989) reported that small insects (2-3 mm) were the most abundant prey, with an average size 3.7 mm. Suhonen and Kuitunen (1991) reported that the prey measuring (3-4 mm) for female and (1-3 mm) for male are the most represent, the mean length of the prey taken by females (5 .4 mm) was a little greater than males (4 .6 mm).

When Comparing the Eurasian Treecreeper with Common Treecreeper diets and according to Kuitunen and Törmälä 1983 and Suhonen and Kuitunen (1991), the Common Treecreper does not use any ants for their food. In the other hand, the Short-toed Treecreeper uses ants in their food according to Madon 1930, Orsini and Ponel, 1990 and our study.

Appendix. Diet composition of nestling Short-toed treecreeper *Certhia brachydactyla* in the suburban area in El Harrach (Algiers, Algeria). (n: number of specimens; n%: relative abundance of the taxon considered).

Classes	Orders	Families	Species	N	n%
Gastropoda	Stylomatomorpha	Helicellidae	Helicellidae sp. ind.	5	1,81
		Hygromiidae	*Hellicela* sp. ind.	4	1,44

			Cochlicella barbara	1	0,36
		Gnaphosidae	Gnaphosidae sp. ind.	5	1,81
			Aranea sp.1 ind	45	16,25
			Aranea sp.2 ind	11	3,97
Arachnida	Aranea	Araneida F. ind.	Aranea sp.3 ind	5	1,81
			Aranea sp.4 ind.	4	1,44
			Aranea sp.5 ind.	6	2,17
Chilopoda	Chilopoda	Chilopoda F. ind.	Chilopoda sp. ind.	4	1,44
Malacostraca	Isopoda	Oniscidae	Oniscidae sp. ind.	1	0,36
		Anisolabididae	*Anisolabis mauritanicus*	1	0,36
		Spongiforidae	*Labia minor*	1	0,36
		Forficulidae	Forficulidae sp. ind.	1	0,36
	Dermaptera	Labiduridae	Labiduridae sp. ind.	1	0,36
	Psocoptera	Psocoptera F. ind.	Psocoptera sp. ind.	1	0,36
		Homoptera F. ind.	Homoptera sp. ind.	16	5,78
		Jassidae	Jassidae sp.2 ind.	1	0,36
	Homoptera		Jassidae sp.1 ind.	11	3,97
		Pentatomidae	Pentatomidae sp. ind.	1	0,36
		Heteroptera F.ind	Heteroptera sp. ind.	6	2,17
	Hemiptera	Cicadellidae	Cicadellidae sp ind.	1	0,36
		Cercopidae	Cercopidae sp. ind.	10	3,61
		Coccidae	*Coccus hesperidum*	1	0,36
		Coreidae	Coreidae sp. ind.	1	0,36
		Tenebrionidae	Tenebrionidae sp. ind.	2	0,72
		Lecanidae	Lecanidae sp. ind.	1	0,36
		Phalacridae	*Olibrus* sp.	1	0,36
		Cryptophagidae	Cryptophagidae sp. ind.	2	0,72
		Cerambycidae	Cerambycidae sp. ind.	1	0,36
		Lebeidae	Lebeidae sp. ind.	1	0,36
		Elatiridae	Elatiridae sp. ind.	1	0,36
		Scolytidae	Scolytidae sp. ind.	1	0,36
		Chrysomelidae	Chrysomelidae sp. ind.	2	0,72
Insecta			*Formicus* sp.	3	1,08
		Anthicidae	Anthicidae sp. ind.	2	0,72
			Anthicidae sp. ind.	12	4,33
		Curculionidae	Curculionidae sp.2 ind.	2	0,72
			Curculionidae sp.1 ind.	4	1,44
			Coleoptera sp.1 ind.	2	0,72
			Coleoptera sp.2 ind.	3	1,08
		Coleoptera F. ind.	Coleoptera sp.3 ind.	10	3,61
			Coleoptera sp.4 ind.	4	1,44
			Coleoptera sp.5 ind.	9	3,25
	Coleoptera		Coleoptera sp.6 ind.	6	2,17
			Formicidae sp.1 ind.	2	0,72
			Formicidae sp.2 ind.	15	5,42
			Messor sp.	1	0,36
			Componotus barbatus	12	4,33
		Formicidae	*Tetramorium biskrens*	1	0,36
			Pheidole pallidula	1	0,36
	Hymenoptera		*Plagiolepis* sp.	2	0,72
			Cataglyphus viaticus	4	1,44
			Crematogaster sp.	1	0,36
		Cynipidae	Cynipidae sp. ind.	1	0,36
		Aphelinidae	Aphelinidae sp. ind.	2	0,72
		Vespoidae	Vespoidae sp. ind.	2	0,72
		Chalcidae	Chalcidae sp. ind.	4	1,44

	Hymenoptera	Hymenoptera sp. ind.	2	0,72
Lepidoptera	Lepidoptera F. ind.	Lepidoptera sp. ind.	1	0,36
	Noctuidae	Noctuidae sp. ind.	2	0,72
	Cyclorrapha F. ind.	Cyclorrapha sp. ind.	5	1,81
	Calliphoridae	*Lucilia* sp.	2	0,72
Diptera	Brachycera F. ind.	Brachycera sp. ind.	1	0,36
	Diptera F. ind.	Diptera sp. 1 ind.	1	0,36
		Diptera sp. 2 ind.	2	0,72
	Totals		**277**	**100**

Acknowledgements: We thank all people for their contribution in field work.

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