Diet of the ant-eating chat *Myrmecocichla formicivora* in relation to terrestrial arthropod abundance

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During a survey of terrestrial arthropods in the central Orange Free State we collected a sample of ant-eating chats *Myrmecocichla formicivora* over a 12-month period to analyse the stomach contents. Throughout the year Hymenoptera (ants) were the most abundant arthropods in the pitfall traps with Isoptera common in winter. Although a wide variety of arthropod prey items was taken, there seemed to be some selection from the available prey. During winter a significantly higher number of prey items was taken than during summer. It is postulated that the different foraging methods employed during summer and winter, as well as the variation in the numbers and diversity of the prey, are responsible for the observed differences between the summer and winter diets of the ant-eating chat.

Tydens 'n opname van die grondlewende Arthropoda in die sentrale Oranje Vrystaat is 'n aantal swartpieke *Myrmecocichla formicivora* versamel en die maaginhoude geanaliseer. Reg deur die jaar was Hymenoptera (miere) die volopste insekorde wat in die putvalle beland het, terwyl Isoptera in die winter naas die Hymenoptera die volopste was. Alhoewel 'n groot verskeidenheid prooi deur die swartpieke gevreet is, wil dit tog voorkom asof daar 'n mate van prooiseleksie was. 'n Betekenisvolle groter hoeveelheid individuele prooi-items is gedurende die winter in vergelyking met die somer gevang. Die verskille in jagmetodes van swartpieke gedurende somer en winter, tesame met die verskille in die diversiteit en getalle van Arthropoda beskikbaar, is waarskynlik verantwoordelik vir die waargenome verskille tussen die somer- en winterdieet van die swartpiek.

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Despite its commonness in the grassland and open savanna of the southern third of Africa, the biology of the ant-eating chat *Myrmecocichla formicivora* is poorly known. No information is available on its diet except for that in general reference works such as Maclean (1985) in which the diet is given as 'insects (including ants, termites, beetles and caterpillars), millipedes, fruit'. Ant-eating chats forage from elevated perches by darting after prey into the surrounding vegetation or by running after and stalking prey on the ground (Herholdt 1987).

We examined in detail the diet of the ant-eating chat to determine to what extent this species selects its prey from the available terrestrial arthropods. We realize that the information content of this diet data is limited and therefore regard in-depth hypotheses and statistical analyses on the feeding stategies of ant-eating chats as unwarrented. However, certain basic facts on the diet of these birds are evident and are presented. This study formed part of a larger study of the general biology of this species (Earlé & Herholdt in press) and the dynamics of the terrestrial arthropod community of the area (Louw 1987).

Study area and methods

The study was undertaken in and around the Florisbad Research Station (28°46'S / 26°04'E), 40 km north-west of Bloemfontein, South Africa. The vegetation was dominated by various grass species mixed with low karoo shrubs, *Protasparagus africanum* shrubs and the occasional *Acacia karroo* tree. (For more detail of the physical environment of the Florisbad Research Station, see Louw 1987.)

A varying number of adult ant-eating chats was shot each month (see Appendix), the stomachs removed and stored in alcohol. All specimens were collected during the late morning hours between 10h00 and 12h00. In all, the contents of 33 stomachs collected over a 12-month period from April 1985 to March 1986 were examined and an attempt was made to identify all prey items to species level although some could only be identified to genus, family or order. The number of items in each taxon was determined and each item was measured to allow estimation of its dry weight by using the equation given by Rogers, Hinds & Buschbom (1976):

$$W = 0{,}0305L^{2{,}62}$$

where W is weight (mg) and L is the length (mm) of the arthoropod. Because of the fragmentary nature of some prey items, it was not always possible to measure a particular item directly. A similar-sized item in an entomological reference collection was then measured. All prey for which weight was estimated with the above formula fell within the 95% confidence interval of the double log plot of insect mass against length given by Rogers *et al.* (1976).

The availability of prey was sampled by operating five pitfall traps in the study area where ant-eating chats were often observed foraging actively. These traps comprised plastic buckets, 200 mm in diameter, filled with a preservative. The pitfalls were emptied monthly and all invertebrates larger than 1 mm were scored as available prey. It is realized that by using only pitfall traps to estimate prey availability some potentially available prey items (e.g. arboreal Hemiptera) will not be recorded. Nevertheless for the purpose of this study, this method was considered to provide the best results as ant-eating

chats were never observed to take prey from vegetation.

The five coldest months of the year, when the chats did not breed, namely April – August, will conveniently be called 'winter' whilst September – March will be referred to as 'summer'.

Results

Prey availability

During both summer and winter Hymenoptera (ants) dominated in the pitfall traps, with smaller numbers of Coleoptera, Isoptera, Orthoptera and Solifugae (Table 1). Within the Coleoptera it is clear that only the Tenebrionidae were available in some numbers during winter. Isoptera were significantly (t = 3,54; df = 10; P = 0,003) more common in the traps during the winter months than during the summer months (Figure 1). The weight of the available prey ranged from the *Aenictus* spp. ants, which weighed less than 0,1 mg, (about 1 mm in length) to the Solifugae which weighed up to 150 mg (about 60 mm in length). There was no significant difference in the number of prey available per month between summer [$\bar{x}$ = 232 ± 24,3 (s.d.)] and winter [($\bar{x}$ = 252,8 ± 47,3 (s.d.)](t = 1,0; df = 10; n.s.)

Diet

All prey identified from the ant-eating chat stomach samples are given in the Appendix. Numerically, Hymenoptera dominated the diet of the ant-eating chat during the summer months, while about equal proportions of Isoptera and Hymenoptera were taken during the winter (Table 1). During the winter a significantly higher number of prey items was taken per month for each individual bird [(summer: $\bar{x}$ = 93,5 ± 30,4 (s.e.); winter: $\bar{x}$ = 393,8 ± 188,1 (s.e.); t = 2,88; df = 10; P = 0,01)]. In all, 76,5% of the dry weight taken during winter was Isoptera and Orthoptera. Nearly equal numbers of Orthoptera and Coleoptera were taken during the summer (Table 1). Each prey taxon showed specific patterns of occurrence in the diet (Figure 2). Although Isoptera and Formicidae occurred in the diet during most months of the year, they were only common during summer and Orthoptera during late summer – early winter. Coleoptera were taken throughout the year (Figure 2). Fruit was taken during February, March and April (see Appendix).

Table 1 Percentage occurence (of all items collected), by numbers, of arthropod taxa in pitfall traps and the percentage occurrence by numbers and by dry mass of prey in the diet of the ant-eating chat

	Prey available (Numbers)		Prey in diet (Numbers)		Prey in diet (Dry mass)	
Taxon	Summer	Winter	Summer	Winter	Summer	Winter
Isoptera	5,4	16,8	18,1	47,5	11,5	54,1
Orthoptera	2,2	3,2	0,6	0,6	18,8	22,3
Hemiptera	0,0	0,0	3,1	0,2	3,7	0,4
Dermaptera	0,0	0,0	0,1	0,3	1,1	9,7
Hymenoptera	57,3	49,8	65,8	46,1	5,3	9,3
Coleoptera* (total)	30,7	29,9	10,8	5,3	19,0	4,2
Carabidae	**30,3**	**9,0**	**14,1**	**0,0**		
Tenebrionidae	**49,3**	**80,9**	**51,7**	**51,3**		
Curculionidae	**3,0**	**6,7**	**11,8**	**40,7**		
Scarabaeidae	**7,0**	**1,2**	**11,7**	**0,0**		
Other Coleoptera	**10,4**	**2,2**	**10,7**	**8,0**		
Solifugae	4,4	0,3	2,0	0,0	39,4	0,0
Diplopoda	0,0	0,0	0,8	0,0	1,2	0,0

Figures were corrected to represent five stomach samples per month as unequal numbers of birds were collected each month.

*The Coleoptera families are given as a percentage of the total number of Coleoptera.

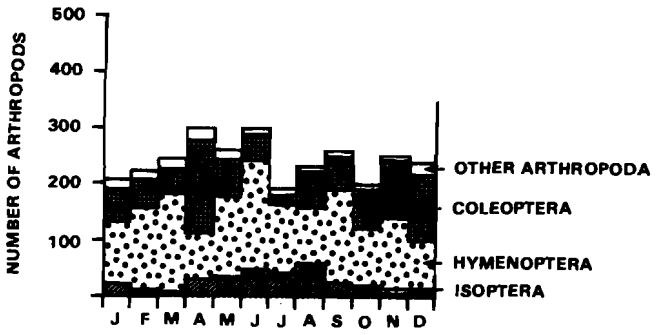

Figure 1 Monthly occurrence, by numbers, of terrestrial arthropods in five pitfall traps.

Discussion

This study documents two distinct features of the diet of the ant-eating chat. Firstly, the chats ate prey from all the taxa available to them and secondly, a significantly higher number of prey items were taken during winter than during summer.

Some taxa, such as Hymenoptera (ants) and Coleoptera, are available in relatively large numbers throughout the year. However, only the ants were taken in large numbers and constituted (by numbers) the largest proportion of the diet during summer. Isoptera constitute the major part of the winter diet probably because they are much more available during this period (Figure 1, Table 1). Although a significantly higher number of prey items was taken during winter than during summer, the individual items were small and their individual masses were low (see Appendix). By contrast, the summer diet is characterized by single items, each with a relatively high mass, such as the Solifugae, Scarabaeidae and Tenebrionidae.

The ease with which prey items can be spotted and subsequently taken, as well as differences in foraging strategy between summer and winter, probably affect the composition of the diet. During summer the chats mostly hunt from an elevated perch such as a fence (Herholdt 1987) and can thus easily spot fast-moving prey such as ants, solifugids and carabid beetles. During winter, the chats mostly search on the ground (Herholdt 1987) and are thus probably more likely to encounter the cryptic and

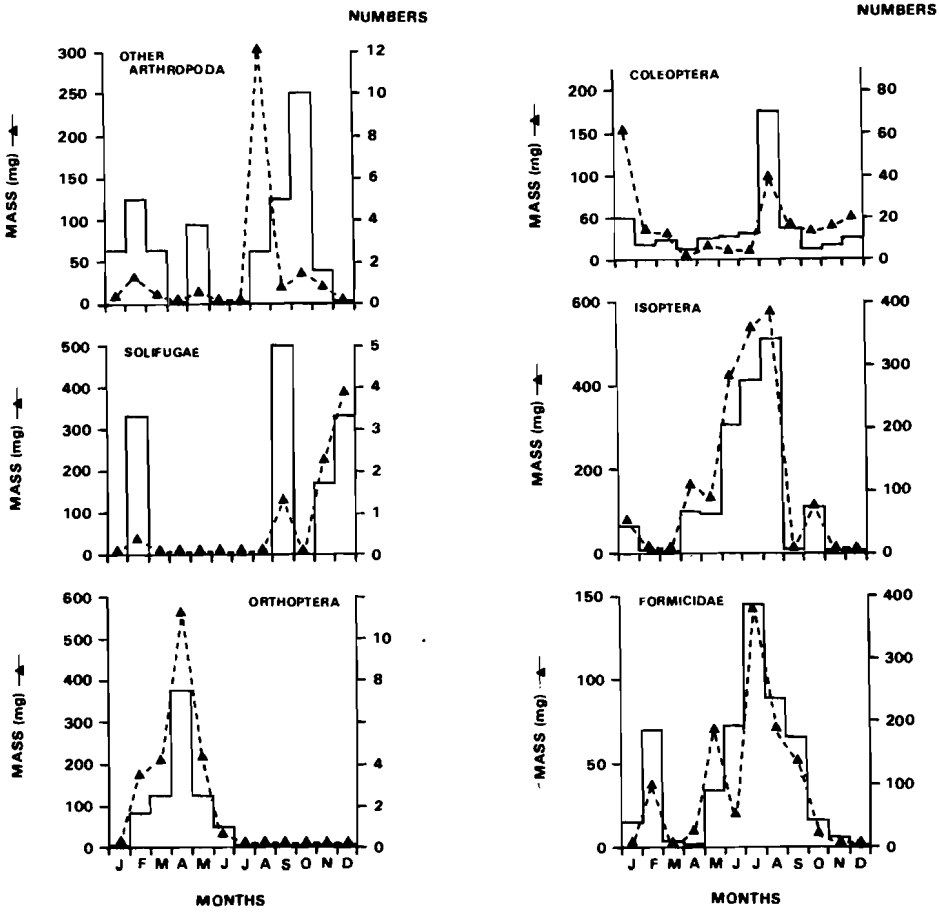

Figure 2 Monthly occurrence, by numbers and estimated dry mass, of arthropods in monthly samples of the diet of ant-eating chats. Figures were corrected to represent five stomach samples per month.

slow moving curculionid beetles. This argument is supported by the fact that the availability of the Curculionidae during winter is 223% more than during summer, but that it occurs 345% more frequently in the diet (Table 1).

Several members of the Turdidae are known to be opportunistically frugivorous (Oatley 1970). The presence of several berries in the stomachs of the ant-eating chats suggests that this could also be the case for this species. The berries found in their stomachs were 2–3 mm in diameter and fall from the small karoo bushes where they are especially sought-after by ants. If not actually feeding on the berries the chats might have swallowed the berries incidentally when foraging on ants. Only three stomachs contained a total of 15 berries and each also had ants.

Although the evidence is not at all conclusive with such a small sample, it would seem as if the ant-eating chat employs an opportunistic feeding strategy. This augments the statements by Fogden (1972), Holmes, Sherry & Bennett (1978) and Hutto (1981) that because of the change in the availability of prey items, both profitable and unprofitable ones, the diet of any bird species in a particular area may change diurnally, seasonally or even annually. However, in the present study there is some indication of prey selection from the available taxa. For instance, even though ants are the most abundant prey available throughout the year, they are only taken in small numbers during summer when larger and presumably more profitable items such as Orthoptera and Solifugae are available.

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References

EARLÉ, R.A. & HERHOLDT, J.J. in press. Breeding and moult of the ant-eating chat *Myrmecocichla formicivora*. *Ostrich*.

FOGDEN, M.P.L. 1972. The seasonality and population dynamics of equatorial forest birds in Sarawak. *Ibis* 114: 307–343.

HERHOLDT, J.J. 1987. Observations on the general behaviour of the ant-eating chat *Myrmecocichla formicivora*. *Mirafra* 4: 63–66.

HOLMES, R.T., SHERRY, T.W. & BENNETT, S.E. 1978. Diurnal and individual variability in the foraging behaviour of American redstarts (*Setophaga ruticilla*). *Oecologia* 36: 141–149.

HUTTO, R.L. 1981. Seasonal variation in the foraging behaviour of some migratory western wood warblers. *Auk* 98: 765–777.

LOUW, S. 1987. Species composition and seasonality of pitfall-trapped Coleoptera at a site in the central Orange Free State, South Africa. *Navors. nas. Mus., Bloemfontein* 5: 415–453.

MACLEAN, G.L. 1985. Roberts' birds of southern Africa. John Voelcker Bird Book Fund, Cape Town.

OATLEY, T.B. 1970. Observations on the food and feeding habits of some African robins (Aves: Turdinae). *Ann. Natal Mus.* 20: 293–327.

ROGERS, L.E., HINDS, W.I. & BUSCHBOM, R.L. 1976. A general weight vs. length relationship for insects. *Ann. Ent. Soc. Am.* 69: 387–389.

Appendix Arthropods identified from the stomachs of *Myrmecocichla formicivora* (total numbers as well as the estimated dry mass per month are given*

Taxon	Jan	Feb	Mrt	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Isoptera												
Hodotermitidae												
Hodotermes mossambicus	17	3	1	27	50	209	111	129	2	36	1	1
	33,3	5,9	2,2	66,7	103,4	421,7	217,7	233,3	3,9	70,6	2,0	2,0
Orthoptera												
Acrididae		1	1	3	2	1						
	104,0	83,4	202,5	171,1	43,6							
Hemiptera												
Pentatomidae		3			3				1			
		16,1			11,4				1,6			
Reduviidae									1	6		
									5,5	18,7		
Dermaptera												
Labiidae												
Labidura sp.								1			1	
								131,6			13,1	
Hymenoptera												
Formicidae												
Anoplolepis custodiens	6	15	2		64	43	108			23		
	1,1	6,5	0,5		14,5	9,2	36,3			4,9		
Anoplolepsis sp.							22				2	
							4,7				0,4	
Pheidole sp.	1	3					9	5		4	1	
	0,1	0,3					0,8	0,4		0,4	0,1	
Pheidole teruinodis								2				
								0,2				
Diplomorium longipenne		86										
		11,4										
Camponotus maculatus		1					5	5	2			
(major workers)		1,6					7,8	7,8	3,1			
Camponotus maculatus								55	61		1	
(minor workers)								14,9	15,6		0,3	
Camponotus sp. 1		1			10							
		1,3			13,9							
Camponotus sp. 2		1										
		1,4										
Messor capensis					1	16	5				3	1
					0,5	8,7	2,7				1,6	0,5
Aenictus rotundatus						1	3	1				
						0,1	0,1	0,1				
Aenictus eugeniae							1	9				
							0,1	0,3				
Solenopsis punctaticeps						132						
						4,6						
Ocymyrmex sp.						1		2	4			
						0,2		0,4	2,2			
Tetramorium sp.						1						
						0,1						
Crematogaster sp.						1	4					
						0,3	1,0					
Dorylus sp.								9				
								4,1				
Mesoponera sp.										1		
										0,2		
Scolioidea				1								
				3,3								
Apidae					1							
					27,9							

Appendix Continued

Taxon	Jan	Feb	Mrt	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Indet Fam	1 0,2											
Coleoptera												
Carabidae												
Graphipterus sp.	1 3,3											
Plagiopyga			1 7,3									
Cyrtotelus			1 0,9									
Harpalus			1 5,0									
Tenebrionidae												
Zophosis mellyi	2 4,6					1 0,8		11 15,3	1 1,9		1 4,0	3 5,0
Zophosis boei	1 3,9				1 3,4	1 2,0			1 6,5			1 9,6
Zophosis glabrata								6 5,6	2 1,7			
Somaticus aeneus	1 48,7											
Drosochrus sp.	2 2,3											
Echinotus spinicollis		1 13,1										1 12,9
Gonocephalum sp.					1 1,8			1 1,8				
Pterostichula calathoides								1 1,5				
Larvae							1 1,0					
Curculionidae												
Theates sp.					1 2,5	1 1,7						
Brachycerus sp.					1 2,1			1 4,5				
Episus echinatus						1 2,8						
Gronops postdentatus							2 1,1					
Ocladius sp.									1 0,1			
Microlarinus angustulus	1 0,3							3 1,0				
Protostrophus sp. 1		1 2,0			1 2,2	1 1,0						
Protostrophus sp. 2						3 1,0	1 0,5	2 1,1				
Tanymecini sp.				2 1,7	2 2,2	1 0,4		1 3,5				
Tanymecus sp.												1 3,5
Scarabaeidae												
Scarabaeus inquisitus		1 5,2										
Anoplochilus figuratus										2 18,5		
Gymnopleurus thalassinus											2 8,1	
Cetoniinae										1 2,3		
Meloidae												
Ceroctis groendalli											1 9,6	
Buprestidae												
Acmaeodera signifera		1 1,3										

Appendix Continued

Taxon	Jan	Feb	Mrt	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Chrysomelidae												
Chrysolina sp.						1		2				
						1,1		4,8				
Paussidae												
Paussus bohemani							1					
							0,4					
Coccenellidae												
Hippodamia variegata									1			
									3,9			
Solifugae		2							2		1	2
		28,9							55,8		133,0	233,4
Diplopoda												
Spirotreptoidea	1		1									
	5,0		5,0									
Plant material		X	X	X								
n = (number of samples) (33)	2	3	2	2	4	5	2	2	2	3	3	3
Total number of prey (1 436)	34	120	8	33	138	413	270	244	79	73	14	10

*e.g. 17 = numbers
33,3 = dry mass
X = plant material present.