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PARASITIC ARTHROPODS OF RODENTS IN KHORAMABAD-LORESTAN, IRAN

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Abstract Nine species, 168 individuals of rodents were live trapped and examined for parasitic arthropods in 24 localities in khoramabad from July 2002 through May 2003. Seven species of ectoparasites were collected: 1 species of sucking lice (Anoplura), 3 species of fleas (Siphonaptera), immature stages of 1 species of hard ticks (Ixodidae) and 2 species of mesostigmatid mites (Mesostigmatidae). Iranian jird (*Meriones persicus*) was the most abundant species of rodents and harbored the most species of ectoparasitic arthropods, followed by the *Microtus socialis*, and the *Mus musculus*.
Key Words Arthropods, ectoparasites, fleas, lice, rodents, Khorramabad, mites, ticks

INTRODUCTION

No study has been completed on the parasitic arthropods of rodents in Khoramaba – Lorestan, Iran. But few studies in which ectoparasites of rodents and other small mammals in adjacent regions have been documented. These include Maghami (1968) for domestic animals in Iran, Eghbali (1991) for ectoparasites of rodents in Ardestan, Arbabi et al (1999) for new species of myocoptid mites on *Calomyscus* sp. in Iran, Arbabi et al. (2000) for description of the Myobiidae, and Moniri et al. (2000) for study of ectoparasites of *Nesokia indica* and *Meriones* spp. in Ardestan.

To determine the species composition and infestation parameters for parasitic arthropods associated with certain rodent species and to determine the presence of known vector species, mammals from 24 different locations in Khorramabad were live-trapped and examined for ectoparasites.

MATERIALS AND METHODS

Rodents were live-trapped at 24 localities in five major land-resource areas in Khorramabad (Fig. 2) on various dates during each moth from July 2002 through May 2003. Because study localities were so numerous, a detailed description of vegetation at each collection site would be lengthy. Therefore, the dominant vegetation of each locality is presented according to 7 general categories; rich prairie, middle prairie, poor prairie, mixed sparse woods and poor prairie, mixed bushy woods and middle prairie, agricultural farms, residential quarters. Dominant over-story species of trees at sites described as sparse woods were oak, *Quercus persicus*, myrtle, *Myrtus communis*, wild pistachio, *Pistachia atlantica* sub species *mutica*, bitter almond, *Amygdalus amara*, wild plum, *Crategus melanocrapus*. Typical mid-story species were wild strawberry, *Fragaria viridis*, and oak, *Quercus libanii*, and *Q. infectoria*.

Bushy wood habitats consisted of pistachio, *Pistachia vera*, wild pistachio, *P. atlantica* sb spp *mutica*, evergreen cypress, *Cupressus sempervirens*, wild pear, *Pyrus communis*, oaks, *Quercus persica*, *Q. branti*, *Q. libanii*, *Q. infectoria*, wild plum, *Crategus melanocrapus*, willow, *Salix alba*, large wild thyme, *Thymus pulegioides*, common ash, *Fraxinus excelsior*, bitter almond, *Amygdalus amara*, walnut tree, *Juglans regia*, wild strawberry, *Fragaria viridis*, medlar tree, *Mespillus germanica*, and myrtle, *Myrtus communis*. Representative under-story species included pomegranate tree, *Punica granatum*, elm tree, *Ulmus campestris*, and wild apple, *Malus sylvestris*.

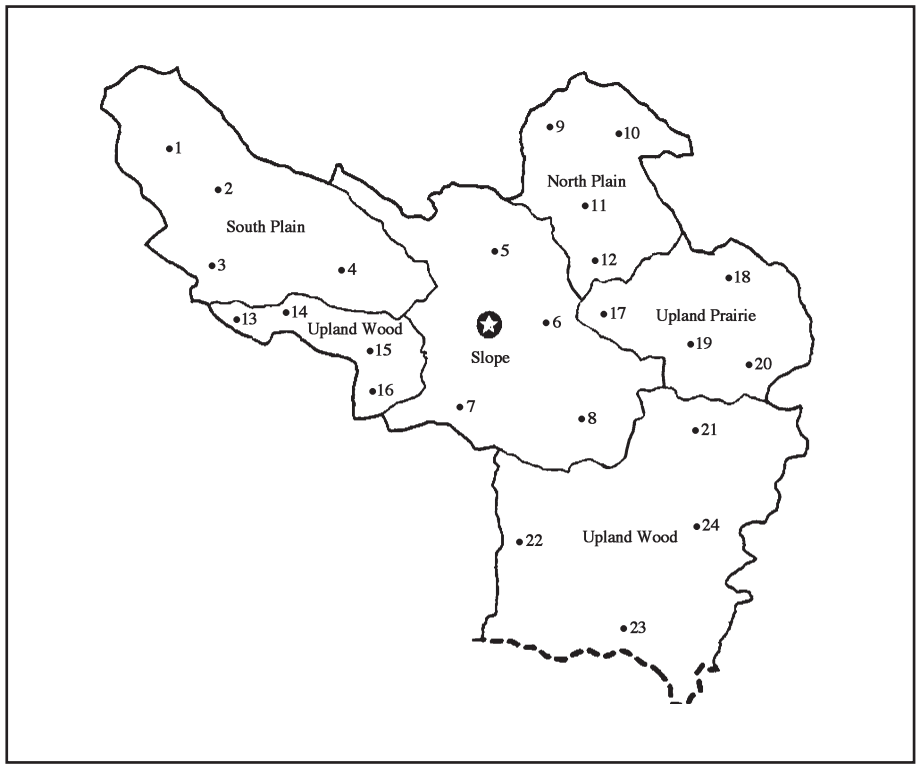

Figure 1. Map of study localities for rodent collection in Khorramabad in 2003-2002, including major land-resource areas; 1 = Doureh Wild life.; 2 = Sarab-e-Changaii Recreation Area.; 3 = Tashkan Wild life.; 4 = Pol-e-Kashkan Recreation Area.; 5 = Azna Mamil Wild life.; 6 = Makhmal Kouh State Park.; 7 = West Koregah Urban Area.; 8 = Kakasharaf Wild life.; 9 = Chagalvandi Wild life.; 10 = North Beiranvand Wild life.; 11 = South Beiranvand Wild life.; 12 = Dera Zari Wild life.; 13 = Tel-e-Komas Wild life.; 14 = Chambagh Wild life.; 15 = Weisian Wild life.; 16 = Shurab State Park.; 17 = Zagheh Wild life.; 18 = Razan Wild life.; 19 = Pol-e-Horou Wild life.; 20 = Ghaedrahmat Wild life.; 21 = Chamsangar Wild life.; 22 = Keshvar Wild life.; 23 = Nogian Recreation Area.; 24 = Taf Recreation Area.

A combination of three sizes of Sherman® live traps were randomly set in differents habitats: woodland transects, woodland ecoton, old fields, refuse heaps, beside dumpsters, in and around decrepit buildings. Traps were baited with wheat and other cereal together with other baits as mixed bread and butter, during autumn and winter, cucumber, walnut, almond, apple, sunflower seeds, corn, during spring and summer, and sausage, salami, bread, biscuit mixed with almond oil, and pop walnut with oil, in urban localities during the year. Captured animals were anesthetized with chloroform, placed in a white tray, and examined for ectoparasites. Ectoparasites were located with the naked eye by combing the hosts' pelage with fine-tipped forceps. Some dropped off hosts after they were euthanized. These were also collected. All ticks and larger mites that were found were collected, but only samples of lice were removed. Ectoparasite samples were stored in 70% ethanol until they could be identified. All animals were handled in accordance with institutional care and guidelines for animal welfare. Rodent specimens were identified to species at the Museum of Hygiene Faculty and Hygienic Investigations Institute, Tehran University of Medical Sciences and ectoparasite specimens at Iran Pasteur Institute.

RESULTS

A total of 168 individuals and 9 species of rodents were live-trapped and examined for parasitic arthropods (Table 1). These included 1 species of sciurid rodents, the Iranian squirrel (*Sciurus anomalus*); 3 species of murine rodent, the house mouse (*Mus musculus*), black rat (*Rattus rattus*), and plantation mouse (*Apodemus sylvaticus*); 1 species of gerbil rodent, the Iranian jird (*Meriones persicus*); 2 species of hamster rodents, the gray hamster (*Cricetulus migratorius*) and mouse-like hamster (*Calomyscus bailwardi*); 2 species of vole rodents, the southern mole-vole (*Ellobius foscocapillus*) and social vole (*Microtus socialis*). The most abundant species were Iranian gerbil (n = 64; 38.09 %) and Plantation mouse (n = 28; 16.6 %). Iranian squirrel constituted1.19 % of captures.

Table 1. Rodents trapped in 24 localities in Khorramabad in 2002-2003, including wild life management areas (WMA), state parks (SP), recreation areas (RA) and urban areas (UA).

Locality	Number of Rodents in each species[a]									
	M.p.	*M.m.*	*M.s.*	*A.s.*	*C.b.*	*C.m.*	*E.f.*	*S.a.*	*R.r.*	Total
Azna mamil WMA		3					2		1	6
West koregah UA		1							4	5
Makhmal kouh SP							1		3	4
Kakasharaf WMA		2					1			3
Zagheh WMA	14	1	6	4	3	2	6			36
Razan WMA	8		3	4		2				17
Ghaedrahmat WMA	4			3		3				10
Pol-e-horou WMA	5		2	1	1		2			11
Doureh WMA		1							1	2
Pol-e-kashkan RA										0
Tashkan WMA									1	1
Sarab-e-changaii RA		1							2	3
Shurab SP	3	1								4
Weisian WMA	2									2
Chambagh WMA		1								1
Tel-e-komas WMA	1	1								2
Chamsangar WMA	6	2		1						9
Taf RA	4			3				1		8
Nogian RA	6		5	11				1		23
Keshvar WMA	2			1						3
North-beiranvand WMA	3						1			4
South-beiranvand WMA	1				3					4
Derazari WMA					1					1
Chaghalvandi WMA	5	1			1		2			9
Total	64	15	16	28	9	7	13	2	12	168

[a] *M.p.= Meriones persicus*; *M.m.= Mus musculus*; *M.s.= Microtus socialis*; *A.s.= Apodemus sylvaticus*; *C.b.= Calomyscus bailwardi*; *C.m.= Cricetulus migratorius*; *E.f.= Ellobius foscocapillus*; *S.a.= Sciurus anomalus*; *R.r.= Rattus rattus*.

Data for the number of trap-nights and trap success by major land-resource area and general habitat category are shown in Table 2. Approximately 57% trapping was conducted at localities within the upland-prairie and upland-wood areas, resulting in 77% of the total number of captures. Trap success at localities in the upland-prairie (34.6%), where most sites were dominated by rich-prairies, was approximately twice that at localities in the upland-wood, which were dominated by bushy and sparse woods. Trap success at localities characterized as mixed bushy wood and middle prairie (23.6), was significantly different from that at mixed sparse wood and poor prairie localities (9.1). Also, trap success at localities dominated by rich prairies (37%) approximately threefold and sevenfold that at those described as middle (14%) and poor prairies (5%), respectively.

Table 2. Trapping success for rodents in Khoramabad in 2002-2003 by major land-resource, area, site, and habitat.

Land-resource Area	Site[a]	Number of trap-nights	Number of captures	Success (%)	Habitat[b]
Upland Prairie	Zagheh WMA	50	26	52	RP
	Razan WMA	50	17	34	RP
	Pol-e-Houru WMA	50	15	30	RP
	Ghaedrahmat WMA	50	16	32	RP
	Makhmal Kouh SP	25	4	16	MP
Area total		225	78	34.6	
Upland Wood	Chamsangar WMA	50	9	18	BW/MP
	Keshvar WMA	45	3	6.6	BW/MP
	Nogian RA	50	23	46	BW/MP
	Taf RA	37	8	21.6	BW/MP
	Kakasharaf WMA	34	3	8.8	SW/PP
	Shurab SP	25	4	16	SW/PP
	Tel-e-komas WMA	20	2	10	SW/PP
Area total		261	52	19.	
South Plain	Doureh WMA	25	2	8	PP
	Sarab-e- Changaii RA	30	3	10	MP
	Tashkan WMA	20	1	5	PP
	Pol-e-Kashkan RA	15	0	0	PP
Area total		90	6	6.6	
North Plain	Chagalvandi WMA	35	9	25.7	MP
	North Beiranvand WMA	40	4	10	AF
	South Beiranvand WMA	45	4	8.8	AF
	Dera Zari WMA	30	1	3.3	MP
Area total		150	18	12	
Slope	Azna Mamil WMA	40	6	15	MP
	West Koregah UA	35	5	14.2	RQ
	Weisian WMA	30	2	6.6	SW/PP
	Chambagh WMA	22	1	4.5	SW/PP
Area total		127	14	11.2	

[a] WMA = wild life management area; SP = state park; RA = recreation area; UA = urban area.
[b] RP = rich prairie; MP = middle prairie; PP = poor prairie; RQ = residential quarter; AF = agriculture farm
BW/MP = bushy wood and middle prairie; SW/PP = sparse wood and poor prairie.

In total, 7 species of parasitic arthropods were collected from 8 of 9 host species trapped (Table 3; no parasites were recovered from the sciurid). No small mites (e.g., glycyphagids, myobiids, listrophorids, and trombiculids) were recorded.

Table 3. Parasitic arthropods removed from rodents in Khoramabad in 2002-2003, as shown by number of rodents of each species and localities, and numbers and life stages of infesting arthropod. M, male; F, female; L, larva; N

Host species (n), Taxonomy, and parasite species	Host/parasite data	
	Numbers and stages	Localities
Meriones persicus (64)		
Fleas (Insecta: Siphonaptera)		
Xenopsylla baxtoni	1F	ZA
Nosopsyllus fasciatus	1F	ZA
Mites (Acari: Mesostigmata)		
Haemolaelaps glasgowi	14F, 5N	ZA, RA, NO, TA, SB, NB
Ornithonyssus sylviarum	4M, 27F, 7N	ZA, PH, SH, CH, KE, WS
Ticks (Acari: Ixodidae)		
Haemaphysalis sp	32L	ZA, RA, DO, TA
Lice (Insecta: Anoplura)		
Neohaematopins laeviusulus	3F	ZA, PH
Apodemus sylvaticus (28)		
Fleas (Insecta: Siphonaptera)		
Xenopsylla baxtoni	1M, 4F	GA, NO
Nosopsyllus fasciatus	1F	ZA
Mites (Acari: Mesostigmata)		
Haemolaelaps glasgowi	6M, 24F, 16N	ZA, RA, TA, CH, PH, NO, KE
Lice (Insecta: Anoplura)		
Neohaematopins laeviusulus	2F	ZA, CH
Mus musculus (15)		
Fleas (Insecta: Siphonaptera)		
Nosopsyllus fasciatus	1M	KK
Nosopsyllus iranus	1F	AM
Mites (Acari: Mesostigmata)		
Haemolaelaps glasgowi	8N	WK, SC
Ticks (Acari: Ixodidae)		
Haemaphysalis sp	8L	TK, SH, ZA
Microtus socialis (16)		
Fleas (Insecta: Siphonaptera)		
Xenopsylla baxtoni	1F	KE
Nosopsyllus fasciatus	1F	ZA
Mites (Acari: Mesostigmata)		
Haemolaelaps glasgowi	3F, 7N	RA,PH
Ticks (Acari: Ixodidae)		
Haemaphysalis sp	6L	ZA, NO, RA
Lice (Insecta: Anoplura)		
Neohaematopins laeviusulus	1M,1F	KE, ZA
Calomyscus bailwardi (9)		
Fleas (Insecta: Siphonaptera)		
Xenopsylla baxtoni	1F	DZ
Mites (Acari: Mesostigmata)		
Ornithonyssus sylviarum	3F,1N	CV, SB
Ticks (Acari: Ixodidae)		
Haemaphysalis sp	5L	ZA, DZ

Host species (n), Taxonomy, and parasite species	Host/parasite data: Numbers and stages	Host/parasite data: Localities[a]
Cricetulus migratorius (7)		
Fleas (Insecta: Siphonaptera)		
Xenopsylla baxtoni	1M	ZA
Nosopsyllus iranus	1F	GA
Mites (Acari: Mesostigmata)		
Haemolaelaps glasgowi	6N	RA, GA
Ornithonyssus sylviarum	2F,4N	RA
Ellobius foscocapillus (15)		
Mites (Acari: Mesostigmata)		
Haemolaelaps glasgowi	1F	ZA
Rattus rattus (12)		
Fleas (Insecta: Siphonaptera)		
Xenopsylla baxtoni	1M	WK
Mites (Acari: Mesostigmata)		
Haemolaelaps glasgowi	2F, 1N	TS, MM
Ornithonyssus sylviarum	1F	TA
Ticks (Acari: Ixodidae)		
Haemaphysalis sp	2L	SC
Sciurus anomalus (2)		

[a] ZA= Zagheh.; RA= Razan.; NO = Nogian.; TA = Taf.; SB = South Beiranvand.; NB = North Beiranvand.; PH = Pol-e-Horou.; SH = Shurab.; CH = Chamsangar.; KE = Keshvar.; WS = Weisian.; DO = Doureh.; GA = Gaedrahmat.; KK = Kakasheraf.; TS = Tashkan.; WK = West koregah.; SC = Sarab-e- Changaii.; TK = Tel-e-komas.; DZ = Dera zari.; CV= Chaghalvandi.; MM = Makhmal Kouh. ; AM = Azna Mamil.

DISCUSSION

The most common rodents captured during this study were *Meriones*. Various species of this genus are distributed widely throughout Iran and are known to inhabit most habitats (Nazari, 1981). They were also the most commonly collected rodent species in recent studies conducted in other states (Eghbali, 1991). The abundance of *Meriones* in our sample may explain why trapping success was higher than other species in different areas. The differences we observed in trap success by major land-resource area and habitat category were likely due to variation among localities in quality and quantity of mass production. Most of the upland-wood collection localities were dominated by hard wood trees, particularly mass-producing species such as oak, whereas upland-prairie localities were dominated by rich prairie. This is probably the main reason why our trap success at upland-prairie was approximately twice, three fold and six fold that at upland-wood, north plain and slope, and south plain respectively. Higher trap success rates at a few localities that were generally characterized as being dominated by bushy oaks (Nogian, Taf) and middle prairies (Chaghalvandi) were actually due to setting of many of the traps in wildlife food plots consisting of numerous grains and other high-quality fodder, which resulted in the capture of more Iranian gerbil at those site (Table 1).

We identified only 7 arthropod species, based on information for the same host species in other states (Eghbali, 1991). We did not recover small mites; probably our recovery technique was unsuitable for collecting them. Small parasitic mites specially Myobiidae (Acari: Prostigmata) parasailing rodents in Iran described by Arbabi et al. (2000). If the low number is not an artifact of the collection techniques, it might be due to prey techniques in different species of rodents, such as squirrel and the southern mole-vole specimens. In the south plain, trap success was lowest, but we observed rodent tracks during the day. Some of the specimens in our survey had died in the traps, and few ectoparasites would have been expected to remain on them. There were insufficient data to reliably determine seasonal abundance of the ectoparasite species collected, but most of the ectoparasites were collected during the spring and autumn seasons.

We found 1 species of widely distributed ectoparasites from most of the host species: the mite *Haemolaelaps glasgowi* (Table 3). Arbabi et al. (1999) reported a new mite species from Iran: *Trichoecius calomysci* (Acari: Myocoptidae). Only 2 Iranian squirrels were examined in this study. But none was parasitized by ectoparasites, because they had died in the traps. Iranian squirrel has not been recorded in western regions. This species (*Sciurus anomalus*) established as a new state record for western regions of Iran. One ectoparasite species, *Haemaphysalis* sp., (tick) was found only in larval stage. Overall, we have documented the presence of several species of wide-ranging parasitic arthropods from rodents in Khoramabad.

Ectoparasite species recorded in this survey that are known vectors of zoonotic pathogen include the flea *Xenopsylla baxtoni*, which is a vector of the bacterial agent that causes plague (Service, 1980). The tick *Haemaphysalis* sp. can be a pest of livestock (Arthur, 1962), mite *Ornithonyssus sylviarum*. This is a serious pest of domestic and wild birds (Vatandoost, 2002).

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