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MESOSTIGMATIC MITES (ACARI: MESOSTIGMATA) IN WHITE-TAILED SEA EAGLE NESTS (*HALIAEETUS ALBICILLA*)

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KEY WORDS: *White-tailed Sea Eagle;* Haliaeetus albicilla; *nest biology; mites; Mesostigmata; Poland.*

Although studies on mites living in bird nests were first carried out 70 yr ago (Nordberg 1936), knowledge on mite communities in this microhabitat is largely inadequate. Recently, the acarofauna of small passerine nests have been studied including detailed studies on Great Reed Warbler (*Acrocephalus arundinaceus*), Reed Warbler (*A. scirpaceus*), Penduline Tit (*Remiz pendulinus*), and Red-backed Shrike (*Lanius collurio*; Mašan and Krištofik 1995, Krištofik et al. 2001, Tryjanowski et al. 2001). However, information about mites occurring in bird nests is still fragmentary, especially in reference to the acarofauna of raptor nests (e.g., Philips 1981, 2000, Philips et al. 1983,

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Gwiazdowicz et al. 1999, 2000, Gwiazdowicz and Mizera 2002).

In contrast to passerines, many raptor species use their nests for several successive years, which allow communities of invertebrates to develop. In addition, the relatively long period over which raptor nests are used allows for temporal changes in acarofauna composition and population dynamics to be observed. Here, we compared the composition of the mite community of the order Mesostigmata occurring in two different nests of White-tailed Sea Eagle (*Haliaeetus albicilla*) in Poland over 6 yr (1997–2002). Our work represents the first multi-year observations of mites using raptor nests.

MATERIALS AND METHODS

Nest material was collected during visits to occupied nests within the ranges of two pairs of White-tailed Sea-Eagle between 9 May and 2 June 1999–2002. Unlike the nests of passerines, in which the entire nest is collected and analyzed after fledging, we collected only ca. 250–330 g of the lining material from the nest cup (<0.1% of the entire nest mass).

The samples were collected from both nests. One was built in a Scotch pine (*Pinus sylvestris*) in a forest cluster of about 120 yr of age in the Bytnica forest district (52°00′N, 15°10′E). The nest was 1.5 m high, 1.8 m in diameter and weighed ca. 500 kg. The area around the nest comprised moss and boggy ground on the northwest side and a large pine forest in other directions. Samples from this nest were collected for 6 yr on the following dates: 21 May 1997, 22 May 1998, 6 May 1999, 2 June 2000, 28 May 2001, and 29 May 2002. The nest was occupied in all years by a pair of White-tailed Sea Eagles, and broods fledged successfully with the exception of the year 2000, when eggs were laid but did not hatch.

The second nest was located in Podanin forest district (53°00′N, 16°50′E) and was built in an oak (*Quercus* sp.) within a beech-dominated forest (*Fagus sylvatica*). This nest was one of the largest sea eagle nests in western Poland (ca. 2.30 m deep and 2.0 m wide, weighing ca. 700 kg), and was built from mostly beech boughs with some pine and oak branches (Mizera 1999). The cup-lining material was comprised of dry grass that probably had been collected from within the forest. Samples from this nest were collected during 3 yr on the following dates: 9 May 1998, 11 May 1999, and 20 May 2000. In all years, fledglings were produced.

The mites were extracted in a Tullgren funnel (Karg 1993) and preserved in 75% ethanol. Prior to identification the specimens were kept in lactophenol. Mites were identified with Axioscop 2 Zeiss microscope equipped with Nomarsky contrast (Zeiss, Oberkochen, Germany).

The species compositions between the two nests and among the different years were compared. Zoocenological analysis of the mite community was based on numerical species percentage dominance (dominancy = D) and frequency in samples. Dominant species were taken as those with proportions over 10% of the mite community. The most frequently occurred species were divided into two groups; 30–50% and >50%. The Sørensen similarity index and the Shannon diversity index (H') of the mite assemblage were calculated and tested according to Maguran (1988). The collected mites were deposited in the Invertebrates Databank (Department of Animal Taxonomy and Ecology, Adam Mickiewicz University, Poznan, Poland).

RESULTS AND DISCUSSION

Mite communities recorded in the two nests differed from one another both in generic composition and relative abundance of mite species (Table 1). Those differences were clearly visible in samples from both nests and in the subsequent years of the survey. Even within one nest, there was wide variation in the apparent abundance of mites and the variety of species that were represented between samples. Samples collected from the Bytnica nest included 11 (2001) to 419 (2002) mite specimens, and 5 (2000) to 15 (2002) species. The Podanin nests contained 11 (2000) to 334 (1998) specimens, and 4 (2000) to 10 (1998) species. The total number of species of Mesostigmata mites in the Bytnica nest was 29 (696 specimens), while the number of species in the Podanin nests was only 15 (364 specimes).

Out of 35 mite species identified, only 9 (25.7%) were found in both nests. The Sørensen similarity index (calculated from paired samples collected in 1998–2000) was very low (similarity = 25%), suggesting that the mite communities in these two nests were distinct from one another. *Uroseius infirmus* was the most common species in the Bytnica nest in 1997 (D = 53%) and 1999 (D = 34%). In 1998 *Macrocheles merdarius* was most common (78%); in 2000 *Androlaelaps casalis* was most dominant (74%); while in 2001 there were no dominants; and in 2002 three species were dominant: *Parasitus fimetorum* (32%), *Alliphis siculus* (20%), and *Macrocheles ancyleus* (12%). *Alliphis siculus* (87%) was dominant in the Podanin nest in 1998, *Nenteria pandioni* (53%) in 1999, and in 2000 there were no dominants. Over the 6 yr of survey, the most commonly identified species in the Bytnica nest was *Parasitus fimetorum,* which was also one of the most common in the Podanin nest (examined for 3 yr). The second most numerous species in the Bytnica nest was *Alliphis siculus,* which appeared "super-dominant" in the Podanin nest, comprising 80% of all mites. However, the third and fourth most numerous species in the Bytnica nest (i.e., *Uroseius infirmus* and *Macrocheles merdarius*) were totally absent from the Podanin nest (Table 1).

Zoocenologic analysis was also based on frequency calculations. It appeared that *Uroseius infirmus* (100%) and *Trichouropoda ovalis* (83%), classified as euconstants, were the most frequent mites in the Bytnica nest. We classified *Alliphis siculus* (67%) and *Asca nova* (67%) as constants. *Nenteria pandioni* (100%) was the most frequent in the Podanin nest. We noted that only two species of Uropodina suborder (*Nenteria pandioni, Trichouropoda ovalis*), were commonly found in both nests (56–78%) and occurred regularly in all years. Apart from the two Uropodina species, the lack of a pattern in species composition

Table 1. List of mite species in two nests of the White-tailed Sea Eagle from Poland. F = female, M = male, D = deutonymph, P = protonymph, and L = larva.

	Nest from Bytnica Forest District				
Species	1997	1998	1999	2000[a]	2001
Sejina					
Sejus togatus					
Gamasina					
Alliphis siculus		7F, 2M	5F, 1M		1F
Androlaelaps casalis				18F, 8M	
Amblyseius sp.	1F	1F, 1M			
Ameroseius corbiculus					
Ameroseius elegans					
Asca nova	3F	1F		1F	
Cornigamasus lunaris					
Dendrolaelaps latior	11F, 1M				1F, 1D
Dendrolaelaps wengrisae		1F, 1M			
Dendrolaelaps sp.			1D		
Gamasellodes bicolor				1F	1F
Halolaelaps sp.	5F, 4D	1F	1D		
Iphidozercon gibbus					
Lasioseius sp.					
Leioseius sp.					
Macrocheles ancyleus					
Macrocheles glaber					
Macrocheles merdarius		55F, 25M			
Macrocheles tridentinus					1F
Neojordensia sinuata					
Paragamasus vagabundus	1F		1F		1F
Parasitus coleoptratorum					
Parasitus fimetorum					
Pergamasus mediocris			3F, 2M		
Proctolaelaps pygmaeus					
Prozercon kochi			1F		
Typhlodromus pyri			1F		
Vulgarogamasus kreaepelini	1D		1F, 1M, 16D		
Zercon curiosus					
Zercon triangularis					
Zercon zelavaiensis		1F, 1M			
Uropodina					
Nenteria pandioni	1F, 1M, 1D	1F, 2D			
Trichouropoda ovalis	4M		1M	3M, 2D, 1L	2D
Uroobovella marginata	1D				
Uroseius infirmus	24F, 13M, 1D, 2P	2M, 1D	4F, 10M, 3D, 1P	1F	1F, 1D, 1P
Number of species	10	9	10	5	7
Number of specimens	75	103	53	35	11

[a] No nestlings produced in 2000.

Table 1. Extended.

Nest from Bytnica Forest District			Nest from Podanin Forest District				
2002	Total Speci-mens	Domi-nancy [%]	1998	1999	2000	Total Speci-mens	Domi-nancy (%)
1F	1	0.14					
43F, 14M, 27D	100	14.37	152F, 87M, 51D	1M		291	79.95
13F, 2M	41	5.89			1F, 1D	2	0.55
			1F			1	0.27
	3	0.43					
				3F		3	0.82
1F	6	0.86					
2F, 18D	20	2.87	1D			1	0.27
	14	2.01					
	2	0.29					
	1	0.14	2M			2	0.55
	2	0.29					
	11	1.58					
3F, 1M	4	0.57					
			1F			1	0.27
1M	1	0.14					
46F, 4M	50	7.18					
35F, 11M, 2D	48	6.90					
6F	86	12.36					
	1	0.14					
			1F			1	0.27
	3	0.43					
				1F, 1M, 1D		3	0.82
6F, 2M, 128D	136	19.54	3F, 16D		1F, 1D	21	5.77
1F	6	0.86					
1F	1	0.14					
	1	0.14					
	1	0.14					
	19	2.73	1D			1	0.27
					2F	2	0.55
				1F		1	0.27
	2	0.29					
	6	0.86	4F, 1M, 4D, 8P	6F, 3M, 1D	1F, 1M, 3D	32	8.79
17F, 9M	39	5.60	1M	1D		2	0.55
	1	0.14					
7F, 5M, 13D	90	12.93					
15	29		10	6	4	15	
419	696		334	19	11	364	

suggests that the occurrence and abundance of mite species may be influenced by stochastic factors. We suggest that the mite communities in these nests were highly instable, and that the generic compositions were the result of random factors. Changes in the number of genera observed over the years were clearly correlated with the changes of mite numbers ($r = 0.81$; $P < 0.01$).

The Shannon diversity index differed between years in both nests (Bytnica nest, $H' = 1.709 \pm 0.816$; Podanin nest $H' = 1.082 \pm 0.444$) and probably was related upon whether or not the nest was successful, because the lowest species diversity ($H' = 0.828$) was recorded in the nest with no nestlings. The generic diversity recorded in the nest when no nestling was reared differed significantly ($t = 2.42$, df $= 5$, $P = 0.05$) from that recorded in the same nest in successful years.

Variation in the number of mite species and abundance during this survey support the hypothesis of high variability of the Mesostigmata community in the unstable microhabitat of White-tailed Sea Eagle nests. However, our results were based on only two nests. Also, we do not know whether our removing of samples each year may have affected the mite community that was present the following year.

Three species of the Uropodina suborder, *Nenteria pandioni, Uroseius infirmus,* and *Trichouropoda orbicularis,* seemed to be typical nidicoles associated with White-tailed Sea Eagle nests. All three species are phoretically transferred by insects. However, the most consistently-occurring species in the microhabitat of the eagle nests among Gamasina were *Alliphis siculus, Asca nova, Pergamasus vagabundus,* and *Parasitus fimetorum.*

Because eagle nests are reused year after year and mite species can persist from one year to the next, the year to year variety of mites that might be available to populate a nest may be masked. The eagle nest mite populations did not show regular, seasonal changes, but rather changes were irregular with no distinct trends. We suggest that eagle nest mite occurrence and abundance depends mainly on changes in climatic conditions throughout the year and the microclimate inside the nest, and is related to nest specific differences (e.g., nest success, nest-lining composition, amount and type of prey remains, and the amount of excrement). Importantly, the availability of potential prey for the mites depends on the presence of decaying flesh (mainly fish and water birds) in the nest, and the amount of eagle excrement. Fluctuation in raptorial-mite numbers may also be influenced by the occurrence of nematodes, and the eggs and larvae of some insects upon which the mites feed.

Our results on the species structure of mesostigmatic mites recorded in White-tailed Sea Eagle nests were similar to results on acarofauna found in other raptor nests, including the Spotted Eagle (*Aquila clanga*), Lesser Spotted Eagle (*A. pomarina*), Osprey (*Pandion haliaetus*), Red Kite (*Milvus milvus*), Black Kite (*M. migrans*), and Common Buzzard (*Buteo buteo*) (Gwiazdowicz et al. 1999, 2000, Gwiazdowicz 2003). However, preliminary comparisons with White Stork (*Ciconia ciconia*) and small passerines from nest boxes (Gwiazdowicz 2003, J. Bloszyk unpubl. data) suggest differences from these kinds of nests For example, in White Stork nests *Alliphis siculus* (a dominant species in White-tailed Sea Eagle nests), was not found. In contrast *Androlaelaps casalis* was detected as a dominant species in nest boxes but was rare and uncommon in White-tailed Sea Eagle nests.

The results presented here are preliminary and further research is needed, especially to examine potential relationships between mite fluctuations and features of the nest.

ÁCAROS (ACARI: MESOSTIGMATA) PRESENTES EN DOS NIDOS DE *HALIAEETUS ALBICILLA*

RESUMEN.—Se estudiaron los ácaros del suborden Mesostigmata en dos nidos de *Haliaeetus albicilla.* Las muestras del primer nido fueron colectadas a lo largo de seis años y las del segundo a lo largo de tres años. Los grupos de ácaros de los dos nidos presentaron diferencias marcadas en cuanto a composición genérica y abundancia relativa. En el primer nido se registraron 29 especies y 696 especímenes, mientras que en el segundo sólo se encontraron 15 especies y 364 especímenes. En total, en los dos nidos se encontraron 35 especies, de las cuales sólo nueve fueron abundantes en ambos nidos. Las especies dominantes en el primer nido fueron *Parasitus fimetorum* (19.54%), *Alliphis siculus* (14.37%) y *Uroseius infirmus* (12.93%), y en el segundo dominaron *Alliphis siculus* (79.95%) y *Nenteria pandioni* (8.79%).

[Traducción del equipo editorial]

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VERTEBRATE PREY OF THE BARN OWL (*TYTO ALBA*) IN SUBTROPICAL WETLANDS OF NORTHEASTERN ARGENTINA AND EASTERN PARAGUAY

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KEY WORDS: *Barn Owl;* Tyto alba; *Iberá-Ñeembucú Wetlands; diet; prey biomass; Argentina; Paraguay.*

In South America, the diet of the Barn Owl (*Tyto alba*) has been studied primarily in temperate and arid regions of Argentina and Chile (Jaksic 1996, Pardiñas and Cirignoli 2002). In the vast tropical and subtropical-humid areas this owl is poorly known (e.g., Motta-Junior 1996, Bellocq 2000, Vargas et al. 2002). Here, we describe the vertebrate prey consumed by Barn Owls in the subtropical wetlands of the Iberá-Ñeembucú system (Argentina and Paraguay).

STUDY AREA

The Esteros del Iberá (Corrientes Province, Argentina) is a Ramsar site of 13 000 km^2, making it one of the largest wetlands in South America. The Esteros del Ñeembucú (Ñeembucú Department, Paraguay), with ca. 4000 km^2, cover an extensive region on the left bank of Paraguay River. Both wetlands (Fig. 1A) display a complex mosaic of marshes, "*embalsados*" (massive carpet of floating vegetation, mostly composed of accumulated, dead, and decomposing plant material). These wetlands are intermixed with extensive palms of *Copernicia alba* and gallery forest, and have remained mostly unmodified by human activities (Carnevali 1994). The climate is humid subtropical (according to Köppen's [1931] classification scheme), with a mean annual temperature of 23ºC and mean annual precipitation of nearly 1350 mm (Carnevali 1994).

METHODS

The owl-pellet samples ($N = 14$) were collected during the breeding seasons of 2001–02 and 2002–03 (September–December) from human buildings at 11 localities in the Iberá-Ñeembucú wetlands (Fig. 1A). Because of the humid environment, pellets rapidly disintegrated (<1 mo). Therefore, the precise number of pellets included was undetermined. We also included two samples of pellet debris (localities of Ensenadita and Desaguadero) from the west border of Iberá, at a site previously studied by Massoia et al. (1988, 1990).

Only vertebrates were considered in this study; invertebrates (mainly insects) were also present in some sam-

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