

Ultrastructural alterations of tracheal cilia in wild rodents exposed to urban pollution

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The main aim of this study is to quantified interspecific differences in ultrastructural alterations of cilia in small mammals exposed to urban pollution (Mexico DF). In Cumbres de Ajusco National Park, n=65 adult rodents from four species were collected: *Peromyscus melanotis* (20), *Peromyscus difficilis* (20), *Reithrodontomys chrysopsis chrysopsis* (10), and *Microtus mexicanus* (15). All specimens were sexed and samples of tracheal epithelium were processed following conventional fixative and embedding techniques for electron microscopy. Ultrathin sections were observed in TEM and images of 500 cilia were collected for each specimen. Three different alterations: ciliary vesiculate distensions (VD), globet cilia (GC) and attached cilia (AC) were quantified. Also, to measure globally the ciliary alterations, two different semiquantitative indexes were used. The effect of species and sex was analysed for the three alteration kinds and the indexes. The results showed that the frequency of alterations was VD>AC>GC (**Table 1**). In contrast with the other three especies, *P. difficilis* showed highest VD and lowest AC mean values. The MANOVA analyses showed differences in number and kind of ciliary alterations among species ($F=1.591$, $p=0.037$). Among all the specimens, percentage of individuals presenting ciliary alteration was 60% for *P. melanotis*, 35% for *P. difficilis*, 90% for *R. c. chrysopsis*, and 60% for *M. mexicanus*. Also, these two last species showed highest values of semiquantitative indexes. Finally, not significant differences were detected between sexes, but mean values of AC and VD showed a general tendency to be higher in males than in females for all species, whereas GC were higher in males in both *Peromyscus* species and *M. mexicanus*. Some examples of the most common alterations are showed in **Figure 1**. We concluded that the *Microtus* and *Reithrodontomys* seem to demonstrate more sensitivity to environmental changes than *Peromyscus* species. Therefore, *M. mexicanus* and *R. c. chrysopsis* could be used to assess atmospheric pollution and its effect on the respiratory tract. However, further studies are necessary to compare these results with other polluted and reference sites.

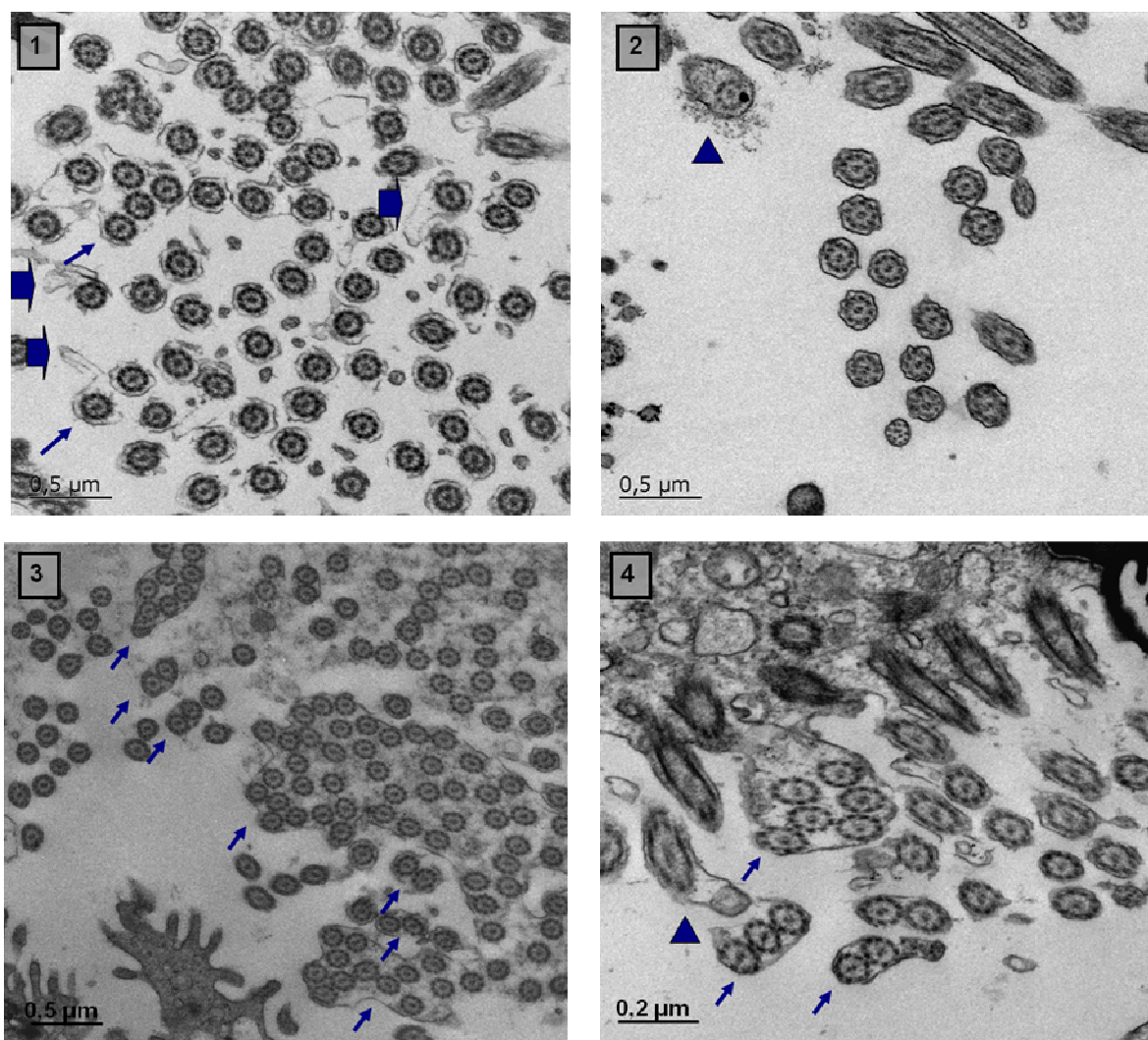


Figure 1: Representative electromicrographs of ciliary alterations (Vesiculate Distensions: 1; Globet cilium: 2, 4; Attached cilia: 1, 3, 4) observed in specimens of *R. c. chrysoptis* (1, 2) and *M. mexicanus* (3-4).

			<i>P. melanotis</i>	<i>M. mexicanus</i>	<i>P. difficilis</i>	<i>R. c. chrysoptis</i>	
			20	15	20	10	
Ciliary alterations	Vesiculate distensions	M	68,80	40,80	123,80	22,44	$p < 0.05$
		Sd	52,53	42,91	159,28	31,09	
	Globet cilia	M	0,90	0,73	0,80	0,33	
		Sd	2,71	2,84	3,35	0,71	
	Attached cilia	M	0,60	0,60	0,30	0,89	$p < 0.05$
		Sd	0,50	0,51	0,47	0,33	
	Microtubule deviation	M	1,00	1,00	0,80	0,89	
		Sd	0,00	0,00	0,41	0,33	
Indexes	ISD	M	73,30	45,27	125,40	28,56	
		Sd	51,43	39,86	158,60	37,62	
	IQD	M	42,45	32,77	64,55	25,06	$p < 0.05$
		Sd	25,74	27,65	79,01	32,16	

Table 1. Basic descriptives statistics in the four species of wild rodents.