

Acarex test correlates with monoclonal antibody test for dust mites

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Forty-two dust samples from the homes of patients having positive mite skin tests were tested by both monoclonal antibody and Acarex techniques. A Spearman's correlation coefficient of 0.85 ($p = 0.0001$) was found. The Acarex test is simple to use and is much less expensive than the monoclonal antibody method. The use of either method may enhance patient compliance with mite-control instructions and may prove crucial to the effective use of miticides in infested homes. (J ALLERGY CLIN IMMUNOL 1991;87:886-8.)

Mites of the genus *Dermatophagoides* are well established as an important cause of allergic asthma, eczema, and rhinitis.¹ Research initiatives in Europe, North America, and elsewhere aimed at determining what constitutes sufficient mite exposure to trigger disease symptoms depended initially on the use of mite counts, a technically demanding method.² More recently, elegant MAb-based assays have been widely used. Such studies have led to a consensus on what are clinically significant mite levels, so that levels $<2 \mu\text{g/gm}$ of crude dust (*Der f I* or *Der p I* antigens) are believed to be low; levels between 2 and $10 \mu\text{g/gm}$ are intermediate; levels $> 10 \mu\text{g/gm}$ are high and are believed to be associated with symptoms in most mite-allergic subjects.³ MAb techniques with ELISA or radioimmunoassay technology are accurate, but now are only available from two commercial sources (Alk America, Milford, Conn., and DACI Laboratories, Baltimore, Md.). Such assays are time consuming and relatively expensive.

A new, semiquantitative assay for mites, Acarex, is now commercially available in the United States (distributed by Fisons Corp., Bedford, Mass.). Since this test offers the advantage of low cost and claims to elicit rapid, on-site results, we compared it with the MAb assay to determine if it is sufficiently accurate to have clinical use.

Abbreviations used

MAb:	Monoclonal antibody
<i>Der f I</i> :	<i>Dermatophagoides farinae</i> , group I antigen
<i>Der p I</i> :	<i>Dermatophagoides pteronysinus</i> , group I antigen

MATERIAL AND METHODS

Acarex test kits obtained from commercial European sources in early 1989 were used for our studies. The tests were performed according to manufacturers' directions, except that dust samples used had previously been sieved, a step not required by directions. Acarex is a dipstick technique with litmus activated with methanol and a diazo compound. Guanine is extracted from raw dust by potassium hydroxide, and the amount present is estimated according to the intensity of color change on the test strip. For the purposes of the test, it is presumed that the guanine thus identified comes from mite feces and that guanine levels relate to the antigenicity of the dust.¹² The tests were not done in duplicate, again to conform to clinical usage. MAb assays were done in our laboratory with an ELISA technique according to the method of Chapman et al.⁴ with MAbs supplied by Dr. M. D. Chapman. Dust samples were collected by us from the homes of patients with positive mite skin tests and were sieved and stored in the refrigerator at 4°C until use. Based on MAb results, approximately equal numbers of samples with low, intermediate, and high *Der f I* levels were selected for Acarex testing. Samples were blinded during the Acarex test procedure so that the technician performing the test did not know the previously de-

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TABLE I. Data summary: MAb/Acarex comparison

MAb assay values ($\mu\text{g/gm}$)	42 samples: Acarex test values			
	O	L	M	H
>10		17.3	27.6	74.2
			14.6	77.6
			11.6	250.0
			46.6	30.2*
			53.0	29.9*
2 to 10		3.1	4.2	
		4.5	9.0	
		4.6	2.6	8.6*
		8.4	2.0	2.0*
		5.5	3.6	
<2			0.4	
	0.0	0.6	1.2	
	0.3	0.3	0.4	
	0.3	0.2	0.1	
	0.2	0.1	1.7*	
			1.9	
			0.2	

L, Low; M, medium; H, high.

*Bold-faced data points identify samples in which the color change did not distinguish between contiguous classes.

terminated antibody level for the sample at the time of the Acares testing.

RESULTS

Forty-two samples were analyzed by Acares and compared to MAb values. Results are summarized in Table I. Spearman's test was chosen to analyze the results, since the Acares readings are ordinal in nature, and can be compared to the MAb numerical results most appropriately by this method. Statistical analysis with Spearman's test yields a correlation coefficient of 0.85 ($p = 0.0001$), suggesting a strong positive correlation between the two methods. Acares may elicit false-positive results in the low range, if a MAb value of 2 $\mu\text{g/gm}$ or higher is accepted as the proper cutoff point for clinical significance, as we did. Some investigators have suggested that the level of significance be lowered to 1 $\mu\text{g/gm}$.⁵ Even at this lower level, there are still four samples, reading low by Acares, that may be false positives.

All Acares values reading "medium" scored >2 $\mu\text{g/gm}$ by MAb assay, and all samples reading "high" were >20 $\mu\text{g/gm}$, suggesting that medium and high range readings by Acares can provide useful estimates of exposure.

At times, the Acares color change is sufficiently subtle so that it is not always possible to decide in which category a result should be placed. Bold-faced data points in Table I identify five samples in which

the Acares category was problematic. Four of these samples are positive, no matter which contiguous category is chosen; therefore, differences may have little clinical relevance.

To test the reproducibility of the Acares method, 15 months after the original Acares testing on which our data are based, we retested 20 dust samples with Acares kits newly acquired from commercial sources. In all cases, the results were unchanged; each retested sample elicited the same response as previously. The same technician performed the tests both times.

DISCUSSION

If the presence of a positive in vivo or in vitro mite-test response of patients always correlated with contemporaneous exposure to high mite levels, the importance of environmental mite determinations would be limited to research interest only. However, increasing evidence suggests that not all patients who test positive for mites have enough exposure in their present environments to cause symptoms. For example, a survey done by us in Topeka, Kan., demonstrated that only 40% of mattress samples, 60% of carpet samples, and 45% of furniture samples actually had levels of mite antigen high enough to be considered positive by present MAb correlates.⁶ Thus, assaying the environments of patients with suspected mite sensitivity may be a critical step in determining relevant diagnosis and management.

It appears to us that the presence or absence of mites should be routinely determined in such patients, since avoidance strategies, already demonstrated to be effective,⁷ may be enhanced by this knowledge.

We have recently demonstrated that patient compliance with dust-control advice is better when mite antigens are identified in patients' homes.⁸ Ninety-two percent (24/26) of mite-allergic patients who had home mite assays performed (MAb method) reported that they instituted one or more mite-control measures, but only 52% (11/21) of control patients, who were skin test positive for mites but had no home mite assays, instituted these measures.

A miticide for treating mite-infested carpets is now available (Acarosan; Fisons Corp.). This product has been carefully studied in Europe,⁹ but effective use of it depends on identifying the presence of mites and on occasional retesting to determine when and if reapplication is needed.

It has been demonstrated that patients' sera may react to several species of storage-mite antigens and that there are antigens in *Blomia tropicalis*, *Glycyphagus destructor*, *Acarus siro*, and *Tyrophagus longior* that cross-react with some antigens of *Dermatophagoides* mites.^{10, 11} Thus, it is possible that some "false positive" tests as defined in our study represent positive responses to the excreta of mite species not identified by the MAb method. Le Mao et al.,¹² with a quantitative guanine assay, obtained a positive correlation between the guanine content and *Der p* I potencies of house dust samples very similar to our own correlation ($r = 0.86$). These authors suggest some additional reasons for occasional discrepancies between MAb and guanine content readings, including heterogeneous content of some dust samples and the possibility that guanine may be used up by microorganisms living in mattresses, although these explanations are, at this time, speculative.

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REFERENCES

1. Platts-Mills TAE, de Weck AL. Dust mite allergens and asthma—a worldwide problem [International workshop] J ALLERGY CLIN IMMUNOL 1989;83:416-27.
2. Voorhorst R, Spieksma FThM, Varekamp H, Leupen MJ, Lykema AW. The house dust mite (*Dermatophagoides pteronyssinus*) and the allergies it produces: identity with the house dust allergen. J ALLERGY CLIN IMMUNOL ALLERGY 1967;39:325-39.
3. Smith TF, Kelly LB, Heymann PW, Wilkins SR, Platts-Mills TAE. Natural exposure and serum antibodies to house dust mites of mite-allergic children with asthma in Atlanta. J ALLERGY CLIN IMMUNOL 1985;76:783-8.
4. Chapman MD, Heymann PW, Wilkins SR, Brown MB, Platts-Mills TAE. Monoclonal immunoassays for major dust mite (*Dermatophagoides*) allergens, *Der p* I and *Der f* I, and quantitative analysis of the allergen content of mite and house dust extracts. J ALLERGY CLIN IMMUNOL 1987;80:184-94.
5. Wood RA, Eggleston PA, Mudd KE, Adkinson NF. Indoor allergen levels as a risk factor for allergic sensitization [Abstract]. J ALLERGY CLIN IMMUNOL 1989;83:199.
6. Ransom JH, Leonard J. Dust mite assays in clinical allergy practice: mite antigen exposures among skin test-positive patients in Kansas. Ann Allergy 1990;65:292-6.
7. Murray AB, Ferguson AC. Dust-free bedrooms in the treatment of asthmatic children with house dust or house dust mite allergy: a controlled trial. Pediatrics 1983;71:418-22.
8. Ransom JH, Leonard J, Wasserstein RL. Home mite assays improve patient compliance with dust control instructions [Abstract]. J ALLERGY CLIN IMMUNOL 1990;85:239.
9. Kersten W, Stollewerk D, Musken H. A clinical study on the effectiveness of Acarosan in treating house dust mite allergy. Allergologie 1988;11:371-90.
10. Fernandez-Caldas E, Trudeau W, Sanchez Medina M, et al. Demonstration of allergenic components in extracts of mite *Blomia tropicalis* [Abstract]. J ALLERGY CLIN IMMUNOL 1989;83:292.
11. Griffin P, Ford AW, Alterman L, et al. Allergenic and antigenic relationship between three species of storage mite and the house dust mite, *Dermatophagoides pteronyssinus*. J ALLERGY CLIN IMMUNOL 1989;84:108-17.
12. Le Mao J, Pauli G, Tekcia F, Hoyet C, Bischoff E, David B. Guanine content and *Dermatophagoides pteronyssinus* allergens in house dust samples. J ALLERGY CLIN IMMUNOL 1989;83:926-33.