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Sensitization risk of pyrethroid insecticides

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Although the true incidence of contact dermatitis from pesticides (1, 2) is unknown, the main causes are now fungicides, particularly thiophthalimides (captan, difolatan and folpet), bis-dithiocarbamates (maneb, zineb and mancozeb) and benomyl (3, 4), instead of organophosphates and chlorinated hydrocarbons (5-7). Sensitization to those derived from plants (pyrethrum, nicotine, rotenone and quassia) is rare and to pyrethroids unknown.

Pyrethroids are neurotoxic synthetic compounds with broad-spectrum insecticidal activity and less toxicity to mammals than organophosphates (8). They are rapidly metabolized and only partially absorbed from the GI tract (9). They have largely been used since 1973 to control agricultural pests and to protect stored products. Over 1,000 pyrethroids have been synthesized and some (e.g., cypermethrin, deltamethrin, fenpropathrin and fenvalerate) have an  $\alpha$ -cyano group attached to the 3-phenoxybenzyl alcohol of the molecule (10). These possess greater photostability, less volatility and higher insecticidal activity than those pyrethroids lacking an  $\alpha$ -cyano group (e.g., allethrin, bioresmethrin, cismethrin, fenothrin, permethrin and resmethrin).

The aim of the present study was to establish the irritation and sensitization risks of the most widely used pyrethroids.

Patients and Methods

230 volunteer subjects, 162 male and 68 female, aged between 19 and 78 years, were patch tested with pyrethroids; 82 were agricultural workers and 28 had worked on the land in the past. 54 subjects had irritant (20) or allergic (34) contact dermatitis of the hands, which was correlated with agricultural activities in 18. The other 176 had been admitted for non-allergic skin disorders; 16 were atopics.

Patch tests were performed on the upper back and read after 2 and 3 days, according to ICDRG criteria. The 7 pyrethroids tested (allethrin, cypermethrin, deltamethrin, fenothrin, fenvalerate, permethrin and resmethrin) (FIRMA, Florence) were dispersed in petrol at 3 different test concentrations (5%, 2% and 1%).

Results

The results are shown in Table 1. Only 2 irritant reactions, both to resmethrin, were observed. These were seen in 2 non-atopic patients, who both had venous leg ulcers. There were positive allergic reactions to pyrethroids in 3 subjects, though that to cypermethrin was not clinically relevant. The 2 fenvalerate-positive patients had chronic contact derma-

Table 1. Patch test results in 230 subjects examined.

Pyrethroids	Total subjects		Agricultural workers (n=82)		Ex-agricultural workers (n=28)		Others (n=120)	
	I	A	I	A	I	A	I	A
allethrin	-	-	-	-	-	-	-	-
cypermethrin	-	1	-	-	-	-	-	1
deltamethrin	-	-	-	-	-	-	-	-
fenothrin	-	-	-	-	-	-	-	-
fenvalerate	-	2	-	1	-	-	-	1
permethrin	-	-	-	-	-	-	-	-
resmethrin	2	-	-	-	-	-	2	-

I = irritant reactions; A = allergic reactions.

Allergic reactions were observed to all 3 test concentrations used (5%, 2% and 1%), irritant reactions only to the 5% test concentration.

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titis of the hands. One was a farmer, also sensitized to potassium dichromate and mercaptobenzothiazole; the latter had gardening as a hobby.

No cross-reactions among the pyrethroids were found.

**Discussion**

Our results demonstrate that pyrethroids are only very slight cutaneous irritants or sensitizers, as suggested by the lack of reports in the literature (11), though He et al. (12) did report dermatitis with vesiculation and red miliary papules in Chinese farmers exposed to deltamethrin.

However, deltamethrin, as well as fenvalerate, cypermethrin and permethrin, frequently causes temporary paraesthesias, unassociated with erythema, oedema, vesicles or other signs of cutaneous irritation, and without neurological or electrophysiological abnormalities in the arms and legs (13). These cutaneous paraesthesias (13-17) mainly include feelings of burning, tingling and warmth, usually symmetrically distributed over the cheeks, particularly under the eyes, and sometimes on the nose. These sensations develop within 4 h of pyrethroid exposure and disperse within 24 h. Systemic symptoms (e.g., cough, dyspnoea, headache, dizziness, nausea, muscular fasciculation) are also common, but minimal in intensity. Facial paraesthesias are thought to be due to a transient lowering of the threshold of sensation of skin sensory nerve endings (13).

In conclusion, pyrethroids have a relatively low toxicity for humans, even if the occurrence of paraesthesia leads to a decrease in the usefulness of this class of insecticides, which have an excellent cost/benefit ratio for agricultural and domestic pest control.

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Table 2. Patch

pos.
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