

## PERMETHRIN RESISTANCE IN ISRAELI HEAD LICE

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Over the last decade control head louse control strategies in Israel have focussed on the use of pyrethroids. Permethrin was introduced in 1991 and accounted for ~80% of pediculicides used between 1991 and 1995. First reports of permethrin control failure in this country occurred in early 1993. Permethrin resistance was confirmed by bioassay testing of head lice collected from schoolchildren before (1989) and after the introduction (1994) of this pediculicide. Exposure of permethrin-resistant lice to 0.2% phenothrin impregnated filter paper showed that the lice in Israel also were resistant to this pyrethroid, which had not been used for the treatment of lice in this country. A glutathione S-transferase (GST)-based mechanism of DDT resistance in the Israeli head lice was identified. This GST mechanism occurred before 1989, while permethrin resistance in local head lice developed after 1994, suggesting that the main GST resistance mechanism selected by DDT use does not confer any pyrethroid cross-resistance. Esterase activity levels were equivalent in pyrethroid resistant and susceptible field collected lice, and in a susceptible strain of body louse, indicating no involvement of any esterase-based mechanism of resistance. A weak monooxygenase-based permethrin metabolism resistance mechanism was the only factor identified which could account for any of the observed pyrethroid resistance in local head lice. The two major mechanisms by which insects acquire resistance to insecticides are by an increase in the rate of insecticide detoxification (primarily increased cytochrome P450 activity) and target site (nerve) insensitivity. The voltage-gated sodium channel is the target site for pyrethroids and DDT. Mutations that occur in the *para*-orthologous sodium channel  $\alpha$ -subunit fragment that spans the IIS4-IIS6 region was amplified from lice collected in Jerusalem using PCR. Sequence analysis confirmed the presence of two functional point mutations, and two silent mutations, previously found in resistant louse samples from Florida (USA) and Bristol (UK). We developed a simple PCR-based diagnostic assay, which could be used to quickly monitor the frequency of pyrethroid resistance in human lice.