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The prevalence and possible causes of contact dermatitis in farmworkers

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Introduction

The National Agricultural Workers Survey estimates that immigrants constitute approximately 78% of the migrant and seasonal farmworkers in the United States. Migrant farmworkers, defined as those traveling at least 75 miles and establishing a temporary abode within the previous year for work, made up 42% of the crop workers in 2001–2002.¹ Farmworkers are exposed to hazardous working conditions, such as exposure to pesticides, working long hours in hot climates, and working with dangerous machinery. These working conditions predispose agricultural workers to occupational skin disease, among other health problems.² Contact dermatitis, an irritating and inflammatory skin reaction to a foreign substance, is one of the most common skin problems among farmworkers. However, there is limited research involving the prevalence and specific etiologies of contact dermatitis in migrant farmworkers.

In many countries, occupational contact dermatitis is the most common reportable occupational disease, and makes up 30% of payable compensation.³ It is difficult to accurately compare data from different countries due to differences in the reporting of occupational diseases and the fact that national registries are often incomplete.⁴ In the United States, the Bureau of Labor Statistics acquires data regarding occupational disease from an annual survey that includes a representative random sample of business establishments in private industries. In the sector of agriculture, forestry, fishing, and hunting, the incidence of nonfatal occupational injuries/illnesses was 6.4 per 100 full time workers, second only to manufacturing in the goods producing industries.⁵ However, the incidence of occupational skin disease may actually be underreported of by 10 to 50 times, according to some estimates.⁴

Due to the paucity of data specific to skin disease in migrant farmworkers, we describe the existing knowledge on the prevalence of occupational contact dermatitis in any farmworker.

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Methods

The PubMed database was searched for the following terms in a variety of combinations: “occupational skin disease”, “contact dermatitis farmers”, “farmworkers”, “pesticide and contact dermatitis”, and “migrant farm workers.” Articles relevant to contact dermatitis in farmworkers were selected from the search results, excluding most case reports and publications that did not include the prevalence, incidence, or possible etiologies. All articles cited were published in English.

Prevalence of contact dermatitis in farmworkers

In the United States, Tennessee, North Carolina and California were the only 3 states found to have studies that examined occupational skin disease in agricultural workers. A North Carolina study examined the prevalence of occupational skin disease among Latino farmworkers. In a study of 54 men and 5 women in eastern North Carolina; 77.7% of men and 100% of women were diagnosed with skin disease, and contact dermatitis was diagnosed in 5.6% of the total sample.⁶

A longitudinal surveillance study evaluated the prevalence of occupational skin disease throughout one agricultural season as well as the associated risk factors in migrant farmworkers in eastern North Carolina. A total of 304 farmworkers were enrolled, and 12.2% of them were determined to have contact dermatitis during the study. Risk factors identified include younger age (18–24 years of age), exposure to pesticides, and poor housing conditions. The number of farmworkers with contact dermatitis steadily increased throughout the agricultural season, with an incidence of 2.1% in the period 29 May through 19 June, of 3.5% in the period 11 July to 31 July, and of 5.3 % in the period 11 September to 12 October.⁷

In California, a cross-sectional survey was conducted to examine the prevalence and risk factors of skin disease in grape, citrus and tomato farmworkers.⁸ Of the 759 farmworkers, 2% had contact dermatitis, and another 13% had a lichenified hand dermatitis (a form of chronic dermatitis of the hands often caused by chronic contact dermatitis). Compared to tomato and citrus, grape farmworkers were more likely to report skin rashes. Risk factors include amount of hours worked per week, not wearing gloves and male gender.⁸

Due to the paucity of studies within the United States, several studies from other countries were included to better characterize occupational skin disease in agricultural workers. An epidemiological study was conducted in Italy on the different types of skin disorders seen in agricultural workers associated with pesticide exposure. Contact dermatitis was the most common skin disorder seen in this population, and was present in 12% of 426 agricultural workers.⁹

In Poland, the specific incidence of contact dermatitis among all occupational skin diseases and the most common causes of contact dermatitis were evaluated in Polish farmers. Data were obtained from the compensation registers of the Agricultural Social Insurance Fund regarding all occupational skin diseases diagnosed during the years 1991 through 1999. The most common of all the skin diseases was allergic contact dermatitis (87 out of the 101 registered farmers), with 55 cases of hand dermatitis. The causative agents were divided into chemical substances and animal/plant allergens. The two most common animal/plant allergens identified were dust (38%, including hay dust, straw dust, grain dust, and threshing dust), and farm animals' antigens (36%, including animal dander and feathers). The most common chemical allergens identified were metals (29%), pesticides (18%), rubber additives (15%), fertilizers (5%), disinfectants (2%), and other agents (5%, such as ammonia).¹⁰

Forty-six New Zealand farmers with contact dermatitis were referred for patch testing over four years to identify the most common allergens in this population. Half of these farmers had one or more positive patch tests that were assessed as pertinent to the study. The most common allergens identified were pesticides (35%), rubber compounds (17%), sunscreens (9%), epoxy resin (9%), and plant materials (9%).¹¹

Another study from Belize examined chemical exposures of workers in the papaya industry. The cross-sectional study used an epidemiological survey, clinical dermatological examination, and a work setting evaluation. Of 45 reports of dermatitis, 22 were confirmed to be allergic contact dermatitis due to pesticide exposure. The estimated prevalence of allergic contact dermatitis due to pesticide was 36.7%.¹²

Possible etiologies of contact dermatitis in farmworkers

Pesticides—Pesticides are a common cause of occupational skin disease in farmworkers (Table 1). They are frequently used in agricultural work in an attempt to increase crop yields. However, pesticides negatively affect the health of farmworkers.^{13,14} Agricultural workers are exposed to pesticides while mixing the pesticide, spraying crops, sowing pesticide preserved seeds, and during harvesting of previously treated crops.^{14–16}

Several studies throughout the world have set out to determine the prevalence of contact dermatitis in agricultural workers that is associated with pesticide use, and to determine which allergens are responsible. In India, 30 fruit and vegetable farmers with contact dermatitis were patch tested with the ten most frequently used pesticides in the area, and 26.7% had a positive reaction to pesticides. The most common sensitizers were Captan [N-Trichloromethylmercapto-4-cyclohexene-1,2-dicarboximide], and Propargite [2-(p-tert-butylphenoxy)cyclohexyl 2-propynyl sulfite].¹⁵ In a similar study, 37 banana plantation workers in Panama with dermatitis were patch tested with the most commonly and recently used pesticides by these workers, and 41% had positive reactions to pesticides. The pesticides that most commonly caused a reaction were Carbaryl [1-Naphthyl-methylcarbamate], Benomyl [methyl N-[1-(butylcarbamoyl) benzoimidazol-2-yl]carbamate], and Ethoprophos [O-ethyl-S, S-dipropyl-phosphorodithioate].¹⁷

The prevalence of pesticide related contact dermatitis was studied in a group of 122 fruit farmers in Taiwan who frequently sprayed and prepared pesticides. Approximately 30% of the fruit farmers had hand dermatitis, and 40% of all the fruit farmers had positive patch tests to at least one common pesticide (two-fold higher than the control group). The most common sensitizers were captofol [N-((1,1,2,2-Tetrachloroethyl)thio)-4-cyclohexene-1,2-dicarboximide], Folpet [N-trichloromethylthiophthalimide], and Captan.¹⁸

In a cross-sectional survey of potato farmers in northern Ecuador, skin disorders were evaluated in sprayers of pesticides, farmworkers who had been exposed to pesticides, and consumers with the possibility of exposure. Contact dermatitis was observed in all three groups (55%, 68%, and 31%, respectively, $p < 0.001$). The patients with contact dermatitis and history of exposure to maneb [Manganese-N,N'-[1,2-¹⁴C]ethylene-bis-dithiocarbamate], the most commonly used fungicide in this population, were then patch tested with maneb, but only 35% had a positive patch test to this compound. Organophosphate pesticides, which were also commonly used in this population, were not commercially available for patch testing in this study.¹⁹

Fewer studies have been conducted on pesticide related contact dermatitis in the United States than in other parts of the world. In Tennessee, an outbreak of contact dermatitis from the pesticide, Dyrene [2,4-dichloro-6-(*o*-chloroanilino)-*s*-triazine] was reported in a group of migrant farmworkers on a tomato-strawberry farm. Out of the 26 farmworkers, 54%

developed contact dermatitis. Patch testing was performed on seven of the affected workers, and all seven had positive reactions, with six of the seven reacting to Dyrene. Patch testing with benomyl [methyl N-[1-(butylcarbamoyl)benzimidazol-2-yl]carbamate] also resulted in a positive reaction in two of the workers.²⁰ In California, 58% of 198 orange pickers were reported to develop contact dermatitis following the harvesting in Omite-CR treated fields.²¹

Disinfectants—Agricultural workers commonly use compounds such as formaldehyde, glutaraldehyde, glyoxal, and Lysol to disinfect machinery, storage containers, and livestock areas. These agents are common causes of contact dermatitis in the general population, especially in health care workers. Therefore, it is expected to see cases of contact dermatitis resulting from exposures to disinfectants in anyone exposed. Two farmers in Poland who suffered from chronic dermatitis both patch tested positive for glutaraldehyde and Lysol. One of the patients also had reactions to agents found in pesticides and rubber.²²

Rubber Compounds—Rubber compounds can also result in contact dermatitis, most commonly of the legs and feet from rubber boots worn in the fields. Patch testing with 19 rubber additives was performed on nine Japanese rice farmers with contact dermatitis of the legs and feet. All participants had a positive reaction to one or more of the following compounds found in the rubber: IPPD (N-isopropyl-N'-phenyl-p-phenylenediamine), DMBPPD (N-1,3-dimethylbutyl-N-phenyl p-phenylenediamine), and ETMDQ (6-ethoxy-2,2,4-trimethyl-1,2-dihydroquinoline). One subject had a positive reaction to MBT (2-mercaptobenzothiazole), and another to DMTT (dipentamethylenethiuram tetrasulfide), which are both commonly found in rubber. The patients did not have a recurrence of the dermatitis when they wore hypo-allergenic boots.²³

Tobacco—Tobacco farmworkers are exposed to several potential causes of contact dermatitis, with the tobacco leaf itself being one potential causative factor.^{24,25} In one case report from North Carolina five Latino male migrant tobacco farmworkers presented to health care clinics with contact dermatitis.²⁴ The distribution of the dermatitis (flexor and medial surfaces of the upper extremities, torso, and axilla) is consistent with the practice of holding the tobacco leaves under the arm while harvesting. Unfortunately patch testing was not performed, therefore we can only speculate as to the cause of contact dermatitis in these workers. However, another case report from Portugal described a patient with suspected tobacco leaf contact dermatitis that was patch tested. The patient had positive reactions against both green and dry tobacco leaf as well as several plant derived substances (wood tars, propolis, balsam of Peru, etc).²⁶ Furthermore, the patient tested negative against pesticides used on the farm, supporting that it was the plant itself causing the dermatitis.

Discussion

Agriculture is a vital part of both the economy and the health of consumers, and the health and productivity of farmworkers ultimately affects everyone. Lower productivity may result in lower crop yields and higher prices for consumers. It is important to understand the likely etiologies of occupational contact dermatitis, which can vary depending on the particular type of farm work and the region of the United States in which the work is being done.

Occupational skin disease is a common problem among agricultural workers, and contact dermatitis frequently affects the hands, which are vital to performing their work duties. Chemicals such as pesticides, disinfectants, and rubber have been identified as possible offending agents both in the U.S. and other countries; however, the low percentage of positive patch tests against these compounds indicates that farmworkers are coming in contact with other unidentified agents. Although, most of the pesticides found to be associated with contact dermatitis are fungicides, many other pesticides, including growth

regulators and organophosphorus insecticides, are known to irritate skin. Furthermore, other factors such as skin wetness can reduce barrier function and increase risk of exposure to antigens and infection. More research in this area can lead to better clinical care for farmworkers, as well as potentially increased productivity. The likelihood that this population of patients will actually see a physician for their skin disease is very low.²⁷ Therefore, prevention will be the best way to reduce the incidence of contact dermatitis for these patients. Knowledge of the most common causes of occupational contact dermatitis among farmworkers will allow physicians to determine the risk factors for developing skin disease, as well as provide the opportunity to investigate methods of prevention in addition to treatment.

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Table 1

Summary of Published Studies of Contact Dermatitis among Agricultural Workers.

	Study Population	Study size	Prevalence of CD	Suspected Allergen	Reference
Pesticides	India, fruit and vegetable farmers	30	26.7%	Captan Propargite	15
	Panama, banana plantation workers	37	41%	Carbaryl Ethoprophos	17
	Taiwan, fruit farmers	122	40%	Captan Captofol Folpet	18
	Ecuador, potato farmers		35%	Maneb	19
	Tennessee, tomato-strawberry farmworkers	26	54%	Dyrene	20
	California, orange pickers	198	58%	Omite-CR	21
Disinfectants	Poland, farmers	2	100%	glutaraldehyde Lysol	22
Rubber	Japan, rice farmers	9	100%	IPPD DMBPPD ETMDQ MBT DMTT	23
Tobacco	North Carolina, migrant tobacco farmworkers	5	100%	Tobacco leaf	24
	Portugal	1	100%	Tobacco leaf	26