

Occupational dermatoses: An Asian perspective

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Abstract

Occupational dermatoses contribute to a significant portion of work-related diseases, especially in Asia, where a major portion of the workforce is in the unorganized sector. This review article is focussed on the frequency and pattern of occupational skin diseases reported across Asian countries and type of allergens implicated in different occupations. The literature was searched systematically using key words 'occupational dermatoses,' 'occupational skin disease' and name of each Asian country. Ninety five full-text articles were considered relevant and evaluated. Some of the dermatoses seen in industrial workers in Asian countries are similar to those in Western countries, including dermatoses due to chromate in construction and electroplating workers, epoxy resin, and chromate in painters, wood dust in workers in the furniture industry, azo dyes in textile workers and formaldehyde and chromates in those working in the leather and dyeing industries, dermatoses in domestic workers, chefs and health-care workers. Dermatoses in workers engaged in agriculture, beedi (tiny cigars) manufacture, agarbatti (incense sticks) production, fish processing, carpet weaving, sanitation and those working in coffee plantations and coal mines appear to be unique to Asian countries. Recognition of clinical patterns and geographic variations in occupational skin diseases will provide an impetus to further strengthen future research in these areas, as well as improving their management.

Key words: Asia, occupational dermatoses, patch test

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Introduction

Occupational disease is any disease developing primarily as a result of exposure to risk factors arising from work activity. Occupational dermatoses account for approximately 30%–45% of all occupational diseases and are responsible for an estimated 25% of all lost workdays in the United States.¹ In Asia, the statistics regarding the magnitude of the problem are not available. Dermatoses in Asian workers are similar to those seen in western countries in occupations such as health-care, hairdressing manufacturing industries, food production, construction, machine tool operation, printing, metal plating, leather work, engine service and forestry. On the other hand, there are certain small-scale industries such as carpet weaving, silk industry, beedi manufacturing and coffee plantation which are unique to Asia. Workers engaged in these are at a risk of developing unique, albeit recognizable, work-related dermatoses. In light of the paucity of focused reviews on occupational dermatoses in Asian countries, we reviewed the available data on this subject with an emphasis on the causative agents/allergens. Knowledge about the prevalence of occupational dermatoses in Asia along with their causative agents will help in the early diagnosis and appropriate

counseling of patients and has implications for future research on, and management of, these conditions.

Methods

The literature was searched systematically using PubMed and EMBASE databases for English language articles published up to the end of September 2015 using the following key words: "Occupational skin disease," "occupational dermatoses" and name of each Asian country. Relevant studies in which skin diseases were attributed to occupation were included. Details which were specifically looked for included sample size, clinical features, patch test results (if mentioned) and impact on the quality of life. This review is focused on relevant data on occupational dermatoses obtained only from online databases.

Results

Two hundred and thirty abstracts were identified and screened. From these, 95 full-text articles considered relevant were evaluated. The important aspects of occupational dermatoses in Asians are summarized and presented.

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Epidemiology: Recent trends

Occupational dermatoses is one of the major health problems with an estimated annual incidence of 1.89 million/year.² Unlike the West, where notification systems exist for occupational dermatoses, Asian countries do not have an established system of reporting these diseases; hence data regarding epidemiology is scant. The incidence of various occupational dermatoses is determined by the degree of socioeconomic and industrial development in an area, resulting in a lot of geographical variation. In Singapore and China, only 56 and 141 new cases, respectively, were reported in the Workplace Safety and Health Statistics Report in 2013.^{3,4} The prevalence rate of occupational dermatoses in Korea was 0.19/100,000 workers.⁵ Skin diseases constitute 2.5% of all occupational diseases in Vietnam and 11% in Thailand, compared to 7.1% in Europe.⁶⁻⁸ Self-reporting has been shown to be associated with higher incidence rates, as shown in a study from Taiwan in 1994, in which 84% of 18,942 Taiwanese workers responded to a postal questionnaire; the 12-month prevalence rate was 8.2% for upper extremity skin conditions and 56.7% of these dermatoses were considered by the respondents to be work related. Almost 45% reported that they did not seek a definitive diagnosis or therapy from a physician.⁹ In a cross-sectional survey of small-scale industries in Nepal, 26% of workers had skin problems, the nature of which was not reported.¹⁰ No concrete data is available from the Indian subcontinent, where occupational research is a more complex issue, due to issues such as child labor, poor industrial legislation, vast informal, unorganized sector, less attention to industrial hygiene and poor surveillance standards.

Occupational contact dermatitis is the most common type of occupational dermatoses. Mathias' criteria are validated for occupational contact dermatitis but have not been adopted uniformly.¹¹ It has been reported to be the second most common (20%) occupational disease in Singapore and fifth most common (8%) occupational disease in Hong Kong.^{12,13} The incidence of occupational contact dermatitis reported by factory workers in Singapore was 2.5/10,000 workers in 2002. In the Republic of Mauritius, 223 (1.5%) cases of occupational contact dermatitis were found from a total of 14,670 patients presenting to dermatology specialty clinics in the year 2000.¹⁴ A Taiwanese tertiary referral clinic reported occupational hand dermatitis in 36.6% of the patients for the period 1987–1993 and none applied for workers' compensation.¹⁵ The Contact and Occupational Dermatoses Clinic in Singapore has reported a steady decline in the incidence of occupational contact dermatitis, from 262.5 cases/year in 1984–1985 to 93.8 cases/year in 1989–1998 and 62.5 cases/year in 2003–2004. Occupational contact dermatitis constitutes 97.2% of cases of occupational dermatoses.¹² In Malaysia, occupational contact dermatitis comprised 87% of all the cases of occupational dermatoses (108) reported to the Ministry of Health between June 1997 and November 1998.¹⁶

Like in Western literature, irritant contact dermatitis has been reported to be more common than allergic contact dermatitis in Singapore (62% vs. 37%), Taipei (58.5% vs. 41.5%) and Taiwan (59% vs. 42%).^{12,15} In India, Pakistan and Thailand, occupational allergic contact dermatitis was found to be more common than occupational irritant contact dermatitis (57% vs. 24%, 50% vs. 49% and 76.3% vs. 24.2%, respectively).¹⁷⁻¹⁹

The impact of occupational contact dermatitis on daily living activities, interpersonal relationships and self-image was found to be significant in studies from India ($n = 117$) and Israel ($n = 70$).^{17,20}

Occupational dermatoses: Classification

Of all the occupational dermatoses, occupational contact dermatitis is the most common, accounting for 79%–95% of cases.¹¹ Contact urticaria, occupational marks, infectious dermatoses and neoplasia are other described causes. Occupational dermatoses in various occupations are discussed below.

Occupational dermatoses in agricultural workers

Majority of the Asian workforce is engaged in agriculture, which is considered to be one of the most hazardous industries by International Labour Organization but with no legal protection. Further, being largely uneducated, the working population, is unaware of the hazards associated with their occupation.

Plant-related dermatitis

Agriculture, horticulture, olericulture, floriculture, fruit packaging, hobby gardening and forestry are the various forms of farming.

Parthenium dermatitis is one of the most common causes of occupational dermatoses in India.¹⁷ *Parthenium hysterophorus* is a weed found abundantly along roads and in fields. The incriminated allergen is a sesquiterpene lactone called parthenin. Exposure may be due to direct contact, or airborne. It causes itchy scaly plaques on the exposed sites involving the folds in airborne contact dermatitis, while in some cases, the pattern may change to lichenified plaques over sun-exposed distribution (chronic actinic dermatitis-like) or a mixed pattern [Figure 1a and b].²⁰ Other plants in Compositae family reported to cause allergic contact dermatitis are chrysanthemums, namely *Helianthus annuus* (sunflower), *Dahlia pinnata* (pinnate dahlia), *Mikania scandens* and *Holigarna ferruginea*.²¹⁻²³ Occupational allergic contact dermatitis from the flowers of *Walidida antidysenterica* has been reported in florists.²⁴ In Sri Lanka, Compositae plants such as *Tithonia diversifolia* mainly cause allergic contact dermatitis, clinically manifesting as parthenium dermatitis.²⁵

In Japan, occupational allergic contact dermatitis is reported in farm workers secondary to tobacco leaves, mitsuba (*Cryptotaemia japonica* Makino) vegetable leaves and its stalks and okra (or lady's fingers, *Hibiscus esculentus*) leaves.²⁶⁻²⁸ There is a recent report of airborne contact dermatitis due to Japanese cedar pollen.²⁸ In Taiwan, dermatitis is reported in 30% of fruit farmers.²⁹

In the Philippines, tropical plants are found in abundance. Irritant contact dermatitis has been reported to develop as a result of contact with chemicals released (alkaloids, silicates) or mechanical irritation by trichomes and glochidia of plants such as *Arena pinnata*, *Calotropis gigantea*, *Mangifera caesia*, *Capsicum annuum*, Hierba mala, Dieffenbachia and *Fleurya interrupta*. Allergic contact dermatitis involving the perioral area has been reported with *M. caesia*.³⁰

In Vietnam, workers involved in agriculture, farming and flower cultivation were found to suffer from dermatitis secondary to wastewater. In a nested case-control study in Vietnam, work involving wastewater exposure was associated with a significant increase in skin diseases (32 episodes/100 person-years at risk). In Cambodia, dermatitis was found in 6.1% of aquatic plant culture workers. However, unlike in Vietnam, a consistent association between occupation and skin diseases could not be established.^{31,32}

In Thailand, allergen thitsiol in the lacquer tree (*Melanorrhoea usitata*, *Anacardiaceae* family) is a common cause of allergic phytocontact dermatitis.³³



Figure 1a: Lichenified plaques involving face and neck (mixed pattern of parthenium dermatitis)

Pesticide-related dermatoses

Pesticides are perhaps underreported as a cause of occupational dermatitis. Prevalence reported in a large study from Japan was 39 per cent³⁴ The exact prevalence of pesticide dermatitis in India is not known, but 26.7%–36.6% of farmers with dermatitis had a positive pesticide patch test.^{35,36} Pesticide dermatitis can occur due to solvents, impurities or the chemical itself. Contact with pesticides may occur during sowing of previously sprayed crops or during spraying itself, especially when protective measures are not followed. Sweating and use of leaky spray equipment are the additional risk factors. Diagnosis is often difficult because of constant changes in the pesticides used at a given time and place. Pesticides frequently identified in causing contact dermatitis are dithiocarbamates, propargite, benomyl, sulfur, captan, chlorothalonil, pyrethroids and chlorophenoxy and organophosphorus compounds. Alachlor is a rarely reported cause of occupational allergic contact dermatitis in agricultural workers in Korea.³⁷ However, depending on the type of crops, results of patch testing vary across regions as a number of pesticides are used in different parts of the world [Table 1].^{27,30,35,36,38,39}



Figure 1b: Positive patch test to parthenium extract (1:100, 1:200 in acetone) in the same patient

Cashew nut-related dermatoses

Anacardium occidentale, belonging to *Anacardiaceae* family, has been shown to contain a highly irritating chemical, anacardic acid in its fruit shells.⁴⁰ The phenols of this plant are also potentially allergenic. A cashew nut factory worker from India with fissuring and exudative hand dermatitis was patch test positive with 0.1% cashew nut shell oil as well as pericarp and kernel as such.⁴¹ Miliaria, intertrigo and keratosis were commonly found in cashew nut workers in India.⁴² There are reports of allergic contact dermatitis in cashew nut workers in Sri Lanka and the Philippines.^{27,31} Barrier creams and castor oil have been used effectively to protect workers from developing dermatitis.

Paddy field work-related dermatoses

Paddy (*Oryza sativa*) belongs to the grass (Gramineae) family. Paddy field workers are exposed to various irritants (mud, cow dung or other manure, fertilizers, pesticides and dust from the dried plant and grains during thrashing). In a study done in South India, out of 341 paddy field workers examined for skin diseases, 73%

complained of itching that correlated with the work. Involvement of hands was as hyperkeratosis (26.4%), nail dystrophy (15.2%) and paronychia (8.8%). A positive patch test to *O. sativa* was reported to 10% paddy extract in four patients.⁴³

Occupational dermatoses in industrial workers

Progressive industrialization has led to an increased exposure to various chemicals, thus posing occupational hazards. The metal, engineering, construction, electronics and transport industries are the major sources of occupational dermatoses.¹² Chromate was found to be the most common allergen while cutting fluid was the most common irritant leading to occupational contact dermatitis.¹² In a survey on 25,050 employees working in ten industrial units (manufacturing rotating machines, tractors, leaf spring, footwear, antibiotics and dashboard instruments, gaskets; units involved in printing synthetic cloth and cotton and books and copper mines) around New Delhi by Mathur *et al.*,⁴⁴ the incidence of occupational dermatoses was very low [Table 2⁴⁴].

Dermatoses in construction industry workers

The construction industry employs 7.5% of the world's labor force.⁴⁵ In India, it is the second largest industry, after agriculture and consists of 44% of all urban unorganized workers.⁴⁵ In a study by Bhatia *et al.*, construction workers included masons (27/32), laborers (2/32), plumbers (1/32) and tile layers (2/32).¹⁷ Construction workers are exposed to multiple irritants and potential sensitizers such as cement, chalk, fly ash, hydrochloric acids, epoxy resin, rubber, leather gloves, adhesives, wood preservatives and phenol-formaldehyde-impregnated fiberglass. Most commonly, there is involvement of fingers and toes as oozy itchy scaly plaques [Figure 2a and b].¹⁷ Acute irritant reaction manifests clinically as cement burns [Figure 2c].

In Singapore, allergic contact dermatitis was more common than irritant contact dermatitis among construction workers, the common allergens being chrome (94.5%), cobalt and rubber chemicals.¹²

The prevalence rate of chromium sensitivity has been found to be 87.5% in India, 24.5% in Taiwan and 40% in Singapore.^{17,46,47} In a study done in Kuwait, 112 construction workers with allergic contact dermatitis to cement were followed up for 2 years. Of these, 75% of the patients showed an exacerbation in clinical features during the humid months due to leaching of chromate ions.⁴⁸

Addition of iron sulfate is known to decrease allergenicity of cement. However, it has not been implemented in most of the Asian countries.

Dermatoses in electroplating industry workers

In a study from Singapore, 38% of the chrome platers working in 17 chrome electroplating factories had occupational dermatoses. However, only two workers were found to be allergic to chromate and one to nickel.⁴⁹ Subacute hand and forearm eczema was seen in an isolated case who was sensitized to gold chloride in the course of gold plating.⁵⁰

Dermatoses in plastic factory workers

Fiberglass, unsaturated polyester resin and hardeners are the usually implicated agents. Studies have reported skin problems in as many as 58.8% workers, mainly as dermatitis, developing mostly during lamination followed by grinding and cutting of glass fibre.⁵¹ Allergens incriminated in development of allergic contact dermatitis in fiberglass plastic factory workers are unsaturated polyester resin, benzoyl peroxide, methyl ethyl ketone peroxide, styrene, formaldehyde, cobalt chloride and para-tertiary butylcatechol.⁵¹ Significantly high risk of work related skin diseases has been found in cross-sectional studies done in Japan with (sample size = 148; odds ratio = 4.10–4.69) and Thailand (sample size = 178; odds ratio = 3.89).^{51,52}

Dermatoses in leather industry workers

A wide range of prevalence for occupational dermatoses has been reported among tannery workers in India, Korea, Bangladesh

Table 1: Pesticide contact dermatitis across various countries in Asia

Author, place, year	Patient number	Clinical features	Patch test (%)	Allergens
Matsushita <i>et al.</i> , Japan, 1980 ³⁴	Patients - 815	Contact dermatitis (216)	NA	Captafol/difoltan, sulfurs (18.5%), organophosphate, chlorinated hydrocarbons
Sharma and Kaur, North India, 1990 ³⁶	Farmers - patients (30), controls (20)		36.6	Carbamates (23.3%), organic phosphorus compounds (13.3%), dichlorophenoxy 2,4-D acetic acid, fenvalerate-a synthetic pyrethroid (10% each) and antibiotic streptomycin (6.6%)
Guo <i>et al.</i> , Taiwan, 1996 ²⁹	Fruit farmers - 122, 63 nonfarmer participants screened	Hand dermatitis (30%)	40	Captafol, folpet and captan
Horiuchi <i>et al.</i> , Japan, 1975-2000 ³⁸	Patients 394; during pesticide-related work (98%), accidental exposure (2%)	Acute dermatitis (54%), chronic dermatitis (21%)	NA	Organophosphorus, sulfur, fungicides, organochlorines, soil fumigants, herbicides, carbamates
Verma <i>et al.</i> , India, 2007 ³⁵	Fruit and vegetable farmers - patients (30), controls (20)	Hand dermatitis, ABCD pattern of dermatitis	26.66	Captan (16.7%), propargite (6.7%) chlorpyrifos, tree spray oil and thiram-mix (3.3%)
Del Prado-Lu, Philippines, 2015 ³⁹	Eggplant (<i>Solanum melongena</i> L.) farmers and farm workers	Itching as a manifestation of pesticide poisoning	63.8	Profenofos, triazophos, chlorpyrifos, cypermethrin and malathion

NA: Not available, ABCD: Airborne contact dermatitis



Figure 2a: Cement dermatitis on the dorsa of fingers distally

Table 2: The common dermatoses in manufacturing industries in India

Occupational dermatoses	Number of patients/1000 workers
Callosities	4.3
Contact dermatitis	1.43
Traumatic nail dystrophy	0.55
Frictional dermatitis of fingertips	0.399
Oil acne	0.399
Stasis dermatitis	0.119
Traumatic leukoderma	0.0798
Keloid	0.0798

and Indonesia (2.6%–26.4%).⁵³⁻⁵⁶ Clinical manifestations found were dermatitis, calluses, paronychia, burn, physical trauma, vitiligo, joint deformity and oil acne.⁵⁶ Sensitizers found to be occupationally relevant were potassium dichromate (9.2%), *N,N*-diphenylguanidine (5.3%), benzidine (3.9%) and sodium metabisulfite (2.6%).⁵⁶

Dermatoses in shoe manufacturing industry workers

In shoe production, there are many possible occupational exposures to a broad spectrum of allergens and irritants contained in adhesives, preservatives, acrylic resins, leather, rubber, dyes and glues. Occupational dermatoses in shoe manufacturing workers are rarely reported in Asia. Prevalence of occupational dermatoses in shoe manufacturing workers ranges from 13.6% (Thailand) to 29% (Indonesia) as callosities (9.5%) and occupational contact dermatitis (7.6%).^{57,58} Overall prevalence of occupational allergic contact dermatitis was 3%, incriminated allergens being dodecyl mercaptan, polyurethane-based adhesives, p-tert-butylphenol formaldehyde resin, triethylenediamine, epoxy resin, diphenylmethane diisocyanate, colophony, formaldehyde, phenyl glycidyl ether, ethylenediamine dihydrochloride and 2-mercaptobenzothiazole.⁵⁸

Dermatoses in electronics industry workers

The electronics industry is the most established industry in Singapore and Taiwan. A study on 3070 electronics workers in Taiwan reported contact dermatitis of hands in 302 (9.8%) patients, associated with a personal history of atopy and metal allergy. Working in wafer bonding, cutting, printing, softening/degluing, impregnation and tin plating was associated with the development of occupational contact



Figure 2b: Irritant reaction leading to ulceration in a cement worker

dermatitis. Irritant contact dermatitis was more common (35.5%) than allergic contact dermatitis (3.8%). The causative allergens were nickel, cobalt and phenylenediamine.⁵⁹ Tan *et al.* reviewed 149 workers from the electronics industry with occupational dermatoses and found that 40.9% had occupational allergic contact dermatitis. Allergens implicated were nickel and resins, followed by rubber chemicals and the constituents of flux and epoxy resin.⁶⁰ Flux is also a common irritant and is required to facilitate proper soldering.

Dermatoses in paint industry workers

Unlike the Western literature, data regarding occupational dermatoses in painters is scant in Asia, probably due to underreporting. Recently, in a series reported from India, seven painters were found to have occupational contact dermatitis presenting as crusted, oozy plaques predominantly involving the dorsa of hands.¹⁷ Occupational allergic contact dermatitis was seen in 85% of the painters in varying proportions to epoxy resin, potassium dichromate, glue and colophony.¹⁷ An epidemic outbreak of irritant contact dermatitis to tri-*N*-butyl tin oxide in paint was reported in Singapore.⁶¹ In China, cases of occupational contact dermatitis to toluene diisocyanate were reported to develop at a concentration of 0.11 mg/m³ in paint.⁶²

Dermatoses in furniture industry workers

Working in a furniture industry places the workers at a risk of dermatitis secondary to wood dust and resins. Synthetic and natural resins, quinones, other ingredients in sawdust, preservatives in glues, acrylates and adhesives are the common allergens. The prevalence of occupational dermatoses was 3.8% in a study of 479 sanders in the furniture-making industry in Singapore.⁶³ Dimethylfumarate was recently found to be responsible for the epidemic of Chinese sofa dermatitis.⁶⁴ Reactions have been reported to Rengas wood in Singapore, Malaysia and Indonesia (belongs to *Anacardiaceae* family).⁶⁵

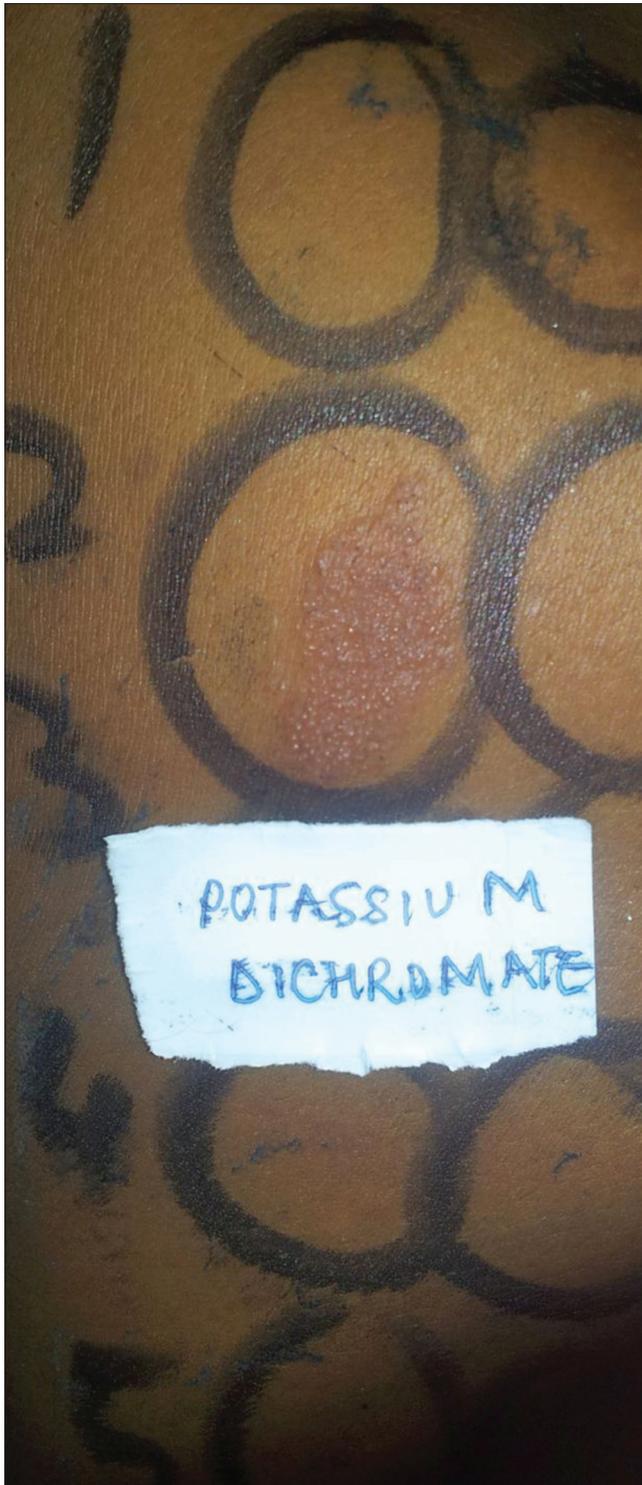


Figure 2c: Patch test positive to potassium dichromate 0.5%

Urushiol is another allergen, found in the Japanese lacquer tree (*Toxicodendron vernicifluum*) of the *Anacardiaceae* family which can lead to occupational allergic contact dermatitis in carpenters, furniture makers and polishers.⁶⁶

Dermatoses in automobile industry workers

It has been estimated that 50% of this sector is unorganized in India. Allergic or irritant dermatitis may develop depending on the type

of work (molding and production of large engine blocks, etc., in ferrous foundries or vehicle parts' assembly or vehicle finishing). Oil acne/folliculitis, leukonychia and callosities may develop due to irritant oils/mechanical causes. Allergens to which these workers are commonly exposed are chromium, cobalt, nickel, epoxy resins and rubber allergens, while cutting oil is the major irritant incriminated. In a survey of 106 automobile repair workers in Vellore, India, 11 (10.6%) were found to have features of contact dermatitis.⁶⁷

Dermatoses in textile industry workers

A large portion of India's earnings come from textile industries. A study involving 1300 textile industry workers in India reported occupational dermatitis in 100 (7.6%) workers, primarily involving the dorsa of hands. Patch test was positive in 81/100 patients. The most common causative allergens were azo dyes Red RC Base (48%) and naphthol (29%).⁶⁸ In textile dermatitis, disperse dyes are most often implicated. These are present in clothing including undergarments and occurrence of dermatitis is more common in the areas of friction and sweating, such as, suprapubic area, axillae and inframammary areas [Figure 3].

Dermatoses in silk industry workers

Dermatitis has been reported commonly in silk reeling industry in Korea and India as fissuring and erosions on fingers (2.6%–51.8%).^{69,70} Silk workers are exposed to various allergens and irritants at different steps of silk manufacturing. While cocoons are immersed in hot water to loosen fibers, workers tend to put their bare hands in hot water to see whether the fibers are loosened to pick silk thread for unwinding. Acid/azo dyes used on the proteinaceous fibers of silk can also cause allergic contact dermatitis. Other potential allergens to which workers are exposed are chromium, formaldehyde and pesticides.

Occupational dermatoses in hairdressers/beauticians/masseurs

Hairdressers are exposed to diverse irritants and allergens. Dermatitis has been reported in 83% of hairdressers in Taiwan.⁷¹ Positive patch test reactions were observed with para-phenylene diamine, shampoos, rubber allergens, nickel, ammonium thioglycolate, ammonium persulfate and detergents. Beauticians with atopic dermatitis were found to develop hand eczema more than nonatopics ($P < 0.05$).⁷²

Occupational dermatoses in domestic workers/kitchen workers

Homemakers have been reported to be the common occupational group (68.2%) affected by dermatitis due to contact with irritants and allergens in addition to the trauma of rubbing and scrubbing.⁷³ Fingertip dermatitis, cumulative insult dermatitis and paronychia may be seen [Figure 4]. Occupational irritant contact dermatitis has been found to be more common than occupational allergic contact dermatitis. Allergens implicated in a study from India were vegetables (48%).¹⁷ In a study on 110 patients of chronic paronychia in Singapore, 48% of the patients were homemakers and the cause was found to be repeated mechanical insult due to domestic chores.⁷⁴ However, whether patch testing was done is not mentioned, hence any allergic component cannot be ruled out.

Dermatoses in kitchen workers/chefs

In a study on 457 chefs in Singapore, the 12-month prevalence of contact dermatitis was 10%, all cases being irritant contact

dermatitis.⁷⁵ Workers involved in catering in Malaysia were reported to have fingertip dermatitis to onions.⁷⁶ In India, a study screened 273 workers, of which 206 had work-related dermatoses (callosities, pitted keratolysis, scalloped nails and paronychia).⁷⁷ Food-related contact urticaria and protein contact dermatitis are known secondary to a variety of allergens such as crustacea, shellfish, fruits and vegetables (red-leaved chicory), rice, wheat, eggs, cow's milk, buckwheat and gelatin.⁷⁸ *Curcuma longa* rhizome (turmeric) powder-induced allergic contact dermatitis has been reported in a miller in a spice shop in Singapore.⁷⁹

Occupational dermatoses in paramedical workers

Dermatoses in pharmaceutical industry workers

Allergic and photoallergic contact dermatitis has been reported in workers in contact with ranitidine base powder and carbimazole, respectively.⁸⁰

Dermatoses in health-care workers

Working in health care involves regular exposure to a wide variety of contact irritants and allergens. One-fifth (23%) of dentists are reported to develop occupational contact dermatitis in Thailand.⁸¹ The prevalence of contact dermatitis among nursing staff is reported to be 8% (Taiwan), 11.8% (Korea), 27.6% (Japan) and 70% (India).⁸²⁻⁸⁴ Usually, there is an involvement of the dorsa of hands as erythematous scaly plaques with a sharp cutoff at the wrist [Figure 5a and b]. Positive patch test reactions are reported with rubber gloves (50%), nickel (40%), cobalt chloride, fragrance mix and gentamycin (15% each), formaldehyde (12.5%), neomycin sulfate, epoxy resin and mercaptobenzothiazole (10% each), colophony, thiuram mix, nitrofurazone and *p*-tertiary butylphenol formaldehyde resin (7.5% each), polyethylene glycol 400 (7.5%), benzocaine, chinosin and paraben (5% each) and mercapto mix, woods alcohols and balsam of Peru (2.5% each).⁸⁴

Miscellaneous

Dermatoses in beedi rollers

Beedis are tiny cigarettes filled with tobacco and tied with tendu leaves/*Piliostigma racemosum* leaves. In the traditional method of beedi rolling, the leaves are cut to size using scissors. Then, a metallic nail or bamboo stick with or without glue is used to roll the leaf after which the beedi is filled with tobacco. In a study

from India, out of 91 beedi workers, callosities were seen in 51 (56.1%) on fingers and feet, and dermatitis in 29 workers. Use of scissors for cutting leaves and gum and artificial metallic nails for rolling beedis was found to cause callosities and localized nail changes which are considered to be occupational marks in beedi rollers.⁸⁵

Dermatoses in agarbatti workers

The manufacture of agarbattis (incense sticks) is a traditional cottage industry in India. It involves raw materials comprising bamboo sticks, jigat powder and charcoal. Skin problems have been described due to exposure to phthalic acid esters used in the production of agarbattis, leading to blisters on hands.⁸⁶

Dermatoses in carpet weaving industry workers

Informal small-scale industries involved in producing hand-woven carpets are an important sector in India, China, Turkey, Iran and Pakistan. Noorbala found hyperkeratotic nodules and plaques on the hands and fingers among carpet handweavers.⁸⁷

Dermatoses in laundry workers

Laundry workers in India and Sri Lanka have been reported to develop allergic contact dermatitis with an urushiol-containing black oleoresin extracted from the nut of *Semecarpus anacardium* on the nape of the neck.^{26,88} This is also known as "dhobie mark dermatitis."

Dermatoses in betel sellers

Betel quid (seeds of the *Areca catechu*) chewing is widely prevalent in Asia. Betel sellers have been reported to have irritant finger dermatitis. Betel leaf contains eugenol, an irritant chemical that can cause perleche and cheilitis granulomatosa.⁸⁹

Dermatoses in fishery workers

Traditional fishery is one of the main occupations in Maldives placing the workers at a risk of contact dermatitis to fish proteins as well as rubber gloves. A study on fishermen in Basrah, Iraq, showed significantly increased prevalence of marine stings, infections (bacterial, fungal and warts), photodamage (wrinkles, freckles) and contact dermatitis as compared to controls.⁹⁰

Dermatoses in coffee plantation workers

In a study of 34 coffee plantation workers, 19 had erythema on photo-exposed areas. Nail changes as periungual telangiectasia,



Figure 3: Contact dermatitis to textile dye in undergarments



Figure 4: Cumulative insult dermatitis in a homemaker



Figure 5a: Rubber glove dermatitis in a nurse

distal onycholysis, splinter hemorrhages and distal nicking were seen in some of the patients. The workers were exposed to chemicals such as paraquat, benzene hexachloride and Bordeaux, during the process of spraying pesticides.⁹¹ However, the exact cause of such manifestations remains unknown.

Table 3 presents an overview of the various studies done involving different occupations from Asia.

Dermatoses in coconut tree climbers

Callosities and irritant dermatitis are reported in coconut tree climbers in India. It develops as a result of friction involved in gripping the tree while climbing.⁹²

Dermatoses in sanitation workers

In a descriptive study involving 294 sanitation workers in China, it was observed that there was a significantly higher prevalence of certain dermatoses such as large pores, telangiectasias, senile warts, deep wrinkles and hair loss ($P < 0.05$) in sanitation workers compared with control population (administrative staff, $n = 113$).⁹³

Dermatoses in coal miners

In a descriptive study in Pakistan, 41% of coal miners were found to have skin and nail dermatoses attributed to chemicals in the coal and rock. However, the nature of these was not further described.⁹⁴

Dermatoses in photographers

Developing and fixation of photographs involves contact with chemicals such as hydroquinone, chromate, *p*-phenylendiamine, formaldehyde and acids as well as alkalis. In a cross-sectional study in Tehran involving 100 photographers, 37% were found to have



Figure 5b: Patch test positive to rubber glove

skin diseases (contact dermatitis in 24%, nail hyperpigmentation in 3% and leukoderma in 2%). Skin disorders were more frequent in workers involved in manual printing than those whose occupation involved working with computerized printers.⁹⁵

Occupational marks

Occupational marks are not a disease but develop as a result of mechanical contact which occurs in a peculiar way in different occupations leading to skin changes which are characteristic of that occupation. These are seen in plumbers, coconut tree climbers, musicians and tailors.

Conclusions

Dermatoses seen in industrial workers from Asia are similar to those in Western countries, albeit more common due to a lesser emphasis on preventive measures. These include dermatoses due to chromate in construction and electroplating workers; epoxy resin; chromate in painters; wood dust in furniture workers; azo dyes in textile workers; formaldehyde and chromates in leather workers; dyes, chromates, formaldehyde and pesticides in silk industry workers. Occupational dermatoses in domestic workers, chefs and health-care workers are similar to those seen in Western countries. In Asia, farmers very commonly suffer from contact dermatitis which has been attributed to parthenium and other plants, as well as to pesticides, with allergic contact dermatitis seen more frequently than irritant contact dermatitis. Dermatoses in the workers engaged in agriculture, beedi work, agarbatti manufacturing, coffee plantation, fish processing, carpet weaving, sanitation and coal mining are unique to the Asian countries.

Delineation of various dermatoses in these sectors and knowing the clinical patterns and geographic variation will further strengthen future research and management of occupational dermatoses.

Table 3: Allergens incriminated in different occupations in various studies in Asia

Occupation	Number of cases	Allergen/irritant	References
Agricultural workers			
Farmers	30	Pesticides	Sharma and Kaur ³⁶
Farmers, gardeners, laborers	80	Compositae plants	Sharma and Kaur ²²
Food handlers	33	Prawn, fish, pineapple	Lim and Goon ¹²
Caterers, restaurant workers	335	65 (19%) had occupational dermatoses (ICD), no allergens identified	Teo <i>et al.</i> ⁷⁵
Beauticians	161	Paraphenylene diamine (35.5%) rubber antigens (22.6%), nickel (22.6%)	Khanna ⁷²
Hairdressers	98	83% had occupational dermatoses, 44% were patch test positive, common allergens were nickel, thimerosal, Captan, Kathon CG and fragrance mix and sensitivity to hair dye and permanent wave ingredients was low	Guo <i>et al.</i> ⁷¹
Health-care workers	75	Xerosis (13%), dermatitis (8%), scabies (10%), fungal infections (21%)	Smith <i>et al.</i> ⁸²
Construction workers	87	Chromate (61%), cobalt (28%), rubber chemicals (21%) and nickel (18%)	Goh <i>et al.</i> ⁴⁷
Plastic industry worker	87	Unsaturated polyester, rubber chemicals, cobalt chloride, PTBC, MEKPO, BPO	Minamoto <i>et al.</i> ⁵¹
Factory worker, medical personnel, food server, engineer, army, rubber tapper, carpenter, cobbler, gardener, cleaner, laborer, lorry driver	48	Rubber additives, nickel, chromium, fragrance mix, cobalt, epoxy resin	Rohna <i>et al.</i> ⁷⁶

PTBC: Para-tertiary-butyl catechol, MEKPO: Methyl ethyl ketone peroxide, BPO: Benzoyl peroxide, ICD: Irritant contact dermatitis

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

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