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A survey of plants responsible for causing irritant contact dermatitis in the Amathole district, eastern cape, South Africa



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ABSTRACT

Ethnopharmacological relevance: Potentially harmful plants grow almost everywhere, hence, it is not practical to eradicate them all. However, a basic understanding of adverse cutaneous reactions and the common plants that cause each type can enable vulnerable individuals to discover the source of their dermatitis and thus prevent re-exposure. The aim of this study therefore, was to document the plants responsible for irritant contact dermatitis (ICD) in the Eastern Cape, along with their respective irritants and clinical presentations.

Materials and methods: Study participants (161) in 12 locations were selected by convenient sampling with particular focus on local people who regularly interact with plants or plant products. Interview questions were focused on the local names of plants that contain irritating chemicals and physical characteristics that cause ICD.

Results: Forty four plant species distributed in 24 families and 34 genera were reported as causative agents of irritant contact dermatitis. Herbs constituted 67.35%, trees 24.49% and shrubs 8.16%. Mechanical ICD was reported to be caused by 23 species, closely followed by chemical ICD (20 species) and mechanico-chemical ICD (6 species). Species with the highest frequency of citations were *Allium cepa*, *Acacia karroo*, *Capsicum annuum*, *Citrus limon* and *Zea mays*. The most representative families were Euphorbiaceae (for chemical ICD), Urticaceae (for mechanico-chemical ICD), Fabaceae and Rutaceae for mechanical ICD. Most of the classes of chemical compounds identified as being responsible for chemical ICD were restricted to plants of specific genera such as the diterpenes in *Euphorbia* spp., disulphides in *Allium* spp., terpenes in *Citrus* spp. and isothiocyanates in *Brassica* spp.

Thorns and hairs were reported for causing Mechanical ICD in 6 plant species each, including widely cultivated plants such as *Acacia karroo* and *Citrus reticulata*.

Conclusion: Irritant contact dermatitis is a common cutaneous disorder in individuals exposed to plants in the Eastern Cape, especially among workers of the food and flower industries. Health practitioners should therefore consider the possible work-related causes of dermatitis, especially in cases associated with a clear history of symptoms.

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1. Introduction

Plants are of relevance to dermatology both for their adverse and beneficial effects on the skin. Beneficial aspects of medicinal plants on the skin include: healing of wounds and treatment of skin infections such as acne, herpes and scabies and against inflammatory disorders affecting the skin such as psoriasis (Mantle et al., 2001). Adverse effects due to plants are common in South Africa since harmful plants grow in almost every garden and form part of the indigenous flora. Cutaneous adverse effects induced by plants

include: irritant contact dermatitis due to mechanical injury or by irritant chemicals in the plant sap, phytophotodermatitis resulting from skin contamination by plants containing furocoumarins following subsequent exposure to UV light and immediate (type I) or delayed hypersensitivity contact reactions mediated by the immune system in individuals sensitised to plants or plant products e.g. peanut (*Arachis hypogaea*) allergy and poison ivy (*Toxicodendron radicans*) poisoning.

Touching certain plant species can be a serious health hazard. Hence, numerous occupations such as food handlers, caterers, gardeners, farmers, agricultural workers, florists, nursery workers, landscapers, forestry workers and loggers are associated with the risk of developing adverse cutaneous reactions to plants and woods. For example, it is estimated that 50% of all occupational skin diseases among agricultural workers is due to plants (Modi et al., 2009) while reactions to pesticides and chemicals account

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for less than 20%. Poison control centres, physicians, botanists, and toxicologists are frequently confronted by situations in which a plant is implicated in the formation of a rash, suggesting that the ability to recognise plant-induced dermatitis is important for all.

Skin-associated complaints are the most frequent type of plant poisoning reported to poison control centres and are managed by primary care physician or dermatologists. However, South Africa suffers from a scarcity of dermatologists, compounded by the fact that most dermatologists are centred near urban areas, not accessible to 70% of the rural population (Carruthers (2013)). The majority of specialist care, including dermatology, is only available in the major hospitals. There are currently 167 members in the Dermatology Society of South Africa (110 of whom are exclusively in the private sector) serving a population of about 50 million (Carruthers (2013)). Many health care centres in the Eastern Cape are often run by clinical officers or nurses, rather than physicians, who act as the primary care workers but have very limited training in diagnosing dermatologic conditions (Hay and Marks, 2004). Hence, skin diseases such as dermatitis, prurigo, scabies, and papular urticaria are either untreated or over-treated with strong topical steroids or antibiotics which have been found to cause considerable disability (Njoronge and Bussmann, 2007).

The Eastern Cape is one of the poorest regions of South Africa and it is particularly known for its richness in plant species (Phillipson, 1987). The Xhosas are the major inhabitants of this province and they live primarily in the areas called Ciskei and Transkei. They are divided into a number of subgroups with their own distinct but related heritages. One of these subgroups is called Xhosa as well. The other main subgroups are the Bhaca, Bomvana, Mfengu, Mpondo, Mpondomise, Xesibe and Thembu.

In the Eastern Cape, various floral habitats meet. Rolling grasslands dominate the eastern interior of the province, while the western central plateau is savanna bushveld. The northern inland is home to the aromatic, succulent-rich Karoo habitat (Phillipson, 1987). As a result of the myriad of previous ethnobotanical studies carried out in the Eastern Cape, many plants have been grouped according to their use-categories and/or use-values and some of the phytochemicals responsible for their curative and nutritional values have been elucidated. However, because of the relatively little data available in the scientific literature with regard to the adverse effects of plants in the Eastern Cape, the aim of this study therefore, was to document the plants responsible for irritant contact dermatitis (ICD) in the Eastern Cape, along with their respective irritants and to describe the clinical presentations observed in plant-induced ICD.

Since harmful plants grow everywhere, it is not practical to eradicate them all. The most we can do is to learn to identify them and to raise awareness in the general public on the dangers of

these plants. With a basic understanding of the types of reaction and the common plants that cause each type, physicians can help patients discover the source of the dermatitis and thus prevent re-exposure.

1.1. The skin

The skin is our primary interface with the external environment and in general, performs quite efficiently as a barrier against noxious chemicals or living organisms. Other functions of the skin include protection, percutaneous absorption, temperature regulation, fluid maintenance, sensory and disease control (Abbasi et al., 2010). However, since the range of human activities is extremely diversified, numerous occupations can lead to break down of the epidermal barrier, with subsequent development of work-related dermatoses (Mathias 1988). Although mortality rates for skin disorders are relatively low (Njoronge and Bussmann, 2007), skin ailments present a major health concern because they occur worldwide and amount to approximately 34% of all occupational diseases encountered (Spiewak, 2000) and because of their highly visible symptoms, they impact significantly on the quality of life, are often persistent and difficult to treat.

1.2. Irritant contact dermatitis (ICD)

The term “irritant contact dermatitis” (ICD) is used to describe a cutaneous inflammatory response to physical or chemical injury, characterised by the absence of antigen-specific immunoglobulins. Only innate immune response mechanisms are involved in ICD and unlike in the case of allergic contact dermatitis, anyone exposed to a cutaneous irritant can potentially be affected and the effect is usually restricted to areas of skin contact (Modi et al., 2009). Irritant contact dermatitis is caused by the direct cytotoxic action of the offending agent on the cells of the epidermis and dermis. Visible skin changes are the result of alterations in the epidermal barrier, cellular destruction, trans-epidermal water loss, and inflammation secondary to non-immunologic release of vasoactive peptides and pro-inflammatory cytokines (Adams, 1988). Although itch is a frequent complaint, the main symptoms are pain or a burning sensation, and the dermatitis presents as subacute to chronic eczema. ICD is the most common type of occupational skin disorder, traditionally held accountable for approximately 80% of all contact dermatitis reactions and the majority of occupational and plant dermatoses (Adams, 1988, Ricks et al., 1994).

Table 1

Physical structures in plants responsible for mechanical irritant contact dermatitis (Adapted from Modi et al. (2009)).

Type of irritant	Characteristics	Mode of action	Clinical presentation/effect on skin	Example of plants
Spinose apical process	Sharp, stiff, and spinelike leaf apex, generally an extension of the mid-vein	Scratch, impale, or lacerate the skin	Vesicular, pruritic, pains, wounds and excoriations	<i>Agave</i> and <i>Aloe</i> spp.
Thorns	A branch with a sharp tip	Scratch, impale, or lacerate the skin	Vesicular, pruritic, pains, wounds and excoriations	<i>Citrus</i> and <i>Acacia</i> spp.
Spines	Modified leaves, stipules, or parts of leaves, such as extensions of leaf veins	Scratch, impale, or lacerate the skin	Vesicular, pruritic, pains, wounds and excoriations	<i>Opuntia</i> spp.
Glochids	Hair-like spines or short prickles, generally barbed, found on the areoles of cacti	Easily detach from the plant and lodge in the skin	Cause irritation upon contact. extremely pruritic, papular eruption called sabra dermatitis	<i>Opuntia</i> spp.
Trichomes	Very fine outgrowths (hairs) on plants	Rub against the skin	Skin irritation, rashes	<i>Capsicum pubescens</i>
Prickles	Spinose structure with sharp end derived from the epidermis and don't have vascular bundles	Scratch, impale, or lacerate the skin	Vesicular, pruritic, pains, wounds and excoriations	<i>Rosa</i> spp.

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