

REVIEW ARTICLE

GIANT HOGWEED AND PHOTODERMATITIS

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Summary

Giant hogweed (*Heracleum mantegazzianum*) is a member of the parsley or carrot family (*Apiaceae*). As its name indicates it is characterized by its size and may grow up to 4 meters in height. Giant hogweed is native to the Caucasus mountains and southwestern Asia and has been introduced to Europe, the United Kingdom, Canada and the United States as a garden curiosity. Because of its tenacious and invasive nature it soon becomes a pest within the ornamental garden and readily escapes. It has naturalized in many of the places where it was first introduced. All parts of the plant are poisonous and giant hogweed is toxic to livestock and humans. The danger of this contact-poisonous plant lies in the presence of phototoxic furocoumarins (psoralens). These substances cause disagreeable dermatitis with poorly healed blisters. Giant hogweed is dangerous for children and mainly if its juice penetrates the eyes.

Key words: Giant hogweed; Invasive plant; Weed; Furocoumarins; Psoralens; Health risk; Phototoxicity; Phyto-photodermatitis; Eye irritation

INTRODUCTION

The mission of this article is to inform readers about the health risks of giant hogweed (*Heracleum mantegazzianum* Sommier & Levier), a poisonous invasive plant that has a negative impact on various ecosystems and poses a serious health risk to humans (Drever and Hunter, 1970a,b). Hogweed's original home is Western Caucasus, where the plant reaches height of about 1 m and behaves quite harmless. In Europe, the plant was brought in the first half of the 19th century and in Bohemia it was first planted in 1862 by Gardener Prince Metternich in Kynžvart Spa park as an ornamental plant. Local conditions caused hogweed to flourish and it began to spread into the environment. Its expansion was also helped by its attractive appearance. Today, in the Czech Republic, it is mainly found in the Slavkov Forest, along the river Mze, in the foothills of the Ore Mountains, in the Giant Mountains, and in the Czech Karst (Pergl et al., 2006).

BIOLOGY

Giant Hogweed (*Heracleum mantegazzianum* Sommier et Levier) is a multi-year and two to four meters high plant of the family *Apiaceae* (Fig. 1). In the first year it only creates a sharp trim with leaves, reaching lengths of up to 1.7 m. The hollow fluted stems reach a diameter of 5-10 cm. Plants bloom for the first time in the second year

after germination in the period from mid-June to late July. White to pink flowers in umbels are in orderly arrangement, whose diameter can reach up to 1 m (McGovern and Barkley, 2000). From one plant average 20,000 seeds arise. Giant creates a massive root system, leading to its rapid spread and difficult disposal. In the Czech Republic and many other countries of the Northern Hemisphere this plant is listed as particularly dangerous invasive species that disrupts until the natural ecosystem is disrupted and may also endanger human health (Drever and Hunter, 1970a,b).



Figure 1. Giant hogweed (*Heracleum mantegazzianum*).

DANGER FOR HUMANS

Giant Hogweed presents a serious risk to human health (Drever and Hunter, 1970b). Whole plant exudes a clear liquid which contains a chemical compound from the group of furanocoumarins (Beyrich, 1965; Pira et al., 1985; Walasek et al., 2015): phellopterin, pimpinellin, isopimpinellin, bergapten, isobergapten, sphondin, imperatorin, psoralen (Fig. 2). The most dangerous are the unripe fruits. Furanocoumarins concentration fluctuates during the growing season and the highest concentration is achieved in June and lowest in November (Pira et al., 1989).

A particular manifestation of toxicity of photosensitization giant hogweed is, i.e. sensitization of organism to sunlight after contact with furanocoumarins which are in the plant tissues (Lagey et al., 1995). Photosensitization mechanism lies in the ability to absorb and retain short time quanta of light energy which arises activated molecule phototoxic agents. Destructive UV radiation has wavelengths shorter than 330 nm. If the phototoxic material is irradiated in the skin, it is activated by sunlight. These activated molecules transfer their energy to the surrounding tissue and damage it by forming highly reactive forms of oxygen. These activated molecules transmit its energy to the surroundings and damage tissues, form highly active oxygen species. This can result in disturbances of cell division, changes in membrane permeability, violation of protein synthesis. Based on the interactions with DNA and RNA, it is believed that they could also have mutagenic and carcinogenic effects (Walker et al., 2003).

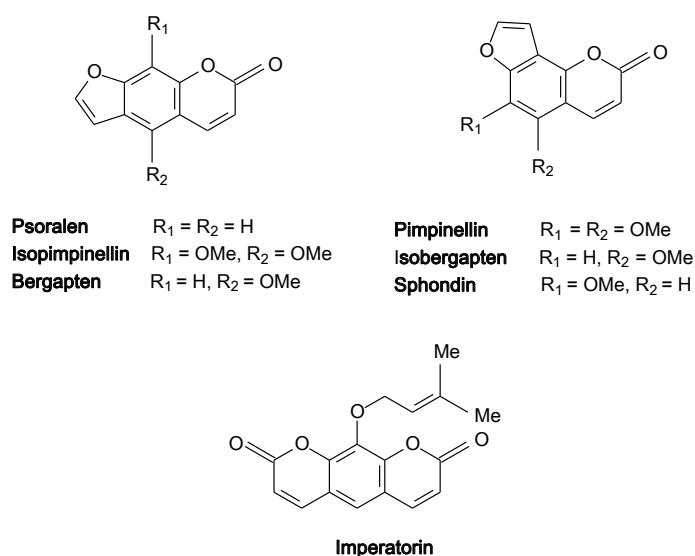


Figure 2. Chemical structures of furanocoumarins from the giant hogweed.

CLINICAL PICTURE OF POISONING

When contacting a giant hogweed with human skin and subsequent exposure to the sun, phytophotodermatitis may occur. Phototoxic reaction can be activated by UV radiation only 15 minutes after exposure, with a sensitivity peak between half and two hours after exposure (Nielsen et al., 2005). The intensity of the reaction depends on the sensitivity of the individual, however, the mucous membranes are sensitive in the reaction. In the acute stage of intoxication, erythema, blisters, and blisters on contact points arranged in stripes arise (Moravcova, 2003). Chronically it may annoy residual hyperpigmentation lasting weeks to months, and can increase sensitivity to UV light for several years. It can be said that the reaction of the organism is similar to that in contact with the mustard. The literature describes a number of phyto dermatitis cases caused by Giant Hogweed [see, e.g. Camm et al., 1976; Prinz and Koster, 1976).

FIRST AID

First aid consists of thorough washing with soap and water and subsequent avoidance of UV radiation (eg. Overlay clothing). To mitigate the reaction in the early stages, the physician may recommend a medication with steroids. Eye contact is necessary to rinse with plenty of clean water and use sunglasses. For larger spill it is recommended to seek professional medical help. In any case, we should not underestimate the burns caused by the plant (Dissemond, 2005).

IMPORTANCE OF AWARENESS TO WORK WITH GIANT HOGWEED

The most vulnerable group of people are people exposed to hogweed as a result of their employment. When manually removing the plants without the use of mechanization and suitable protective equipment such as gloves, face shield and protective clothing it can cause painful phyto dermatitis. Another vulnerable group are children who are in the vicinity of these plants, or even use the hollow stems for games, eg. as pea shooters or telescopes. The big danger is that your own contact with the plant is completely painless and disabled persons are not warned, and continue their activities without realizing the harm (Rzymiski et al., 2015).

Everyone operating in areas infested by invasive hogweed should be informed about the health risks associated with these plants. It is necessary to avoid touching the plant by bare skin and in case of contact to prevent UV rays

to the affected area. Skin reactions may occur only after contact with injured parts of the plants, secreting toxic state but also after the mere touch of sheets. When working with Giant Hogweed or in case of possible contact with the plants, all body parts must be covered with protective clothing. The best are synthetic water-resistant materials, since cotton and linen fibers soak up the plant sap and can be penetrated by plant hairs. When working, it is recommended to use gloves with long cuffs and a face shield or goggles at least - particularly when moving to prevent drops of juice in the face. When disposing of giant hogweed stands, it is important to avoid contact with contaminated parts of clothing and tools with unprotected skin. When using mechanization (hedge trimmer, lawn mower), the plant material sprays into the environment, so it is important to wear additional protective goggles and protect the airway with a suitable mask (Nielsen et al., 2005).

CONCLUSION

Acute photodermatitis caused by skin contact with giant hogweed and exposure to ultraviolet radiation is a rare but very dangerous cause of phytophotodermatitis, especially in children. Initially, skin changes are signaled by a burning sensation, followed by a vesicubullous rash and long-term hyperpigmentation. Usually, skin disorders improve after the application of topical and oral corticosteroids. In extremely rare instances, full skin thickness burns or epidermal necrosis occur. However, as Baker and co-authors (2016) pointed out, they treated more cases of burns caused by giant hogweed in the summer of 2015 at paediatric and adult burns centres, than was seen cumulatively over the previous 10 years and this has been accompanied by widespread local and national reports of cases in the media.

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