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Ecophysiological Features of Acanthosicyos horridus (!Nara) to Survive the Namib Desert

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Abstract : The enigmatic melon species, Acanthosicyos horridus Welw. ex Hook. f., locally known as !nara, is endemic to the hyper-arid Namib Desert, where it thrives in sandy dune areas and dry river banks. The Namib Desert is characterized by extreme weather conditions which include high temperatures, very low rainfall, and extremely dry air. Plant and animals that have made the Namib Dessert their home are dependent on non-rainfall water inputs, like fog, dew and water vapor, for survival. Fog is believed to be the most important non-rainfall water input for most of the coastal Namib Desert and is a life line to many Namib plants and animals. It is commonly assumed that the !nara plant is adapted and dependent upon coastal fog events. The !nara plant shares many comparable adaptive features with other organisms that are known to exploit fog as a source of moisture. These include groove-like structures on the stems and the cone-like structures of thorns. These structures are believed to be the driving forces behind directional water flow that allow plants to take advantage of fog events. The !nara-fog interaction was investigated in this study to determine the dependence of !nara on these fog events, as it would illustrate strategies to benefit from non-rainfall water inputs. The direct water uptake capacity of !nara shoots was investigated through absorption tests. Furthermore, the movement and behavior of fluorescent water droplets on a !nara stem were investigated through time-lapse macrophotography. The shoot water potential was measured to investigate the effect of fog on the water status of !nara stems. These tests were used to determine whether the morphology of !nara has evolved to exploit fog as a non-rainfall water input and whether the !nara plant has adapted physiologically in response to fog. Chlorophyll a fluorescence was used to compare the photochemical efficiency of !nara plants on days with fog events to that on non-foggy days. The results indicate that !nara plants do have the ability to take advantage of fog events as commonly believed. However, the !nara plant did not exhibit visible signs of drought stress and this, together with the strong shoot water potential, indicates that these plants are reliant on permanent underground water sources. Chlorophyll a fluorescence data indicated that temperature stress and wind were some of the main abiotic factors influencing the plants' overall vitality.

Keywords : Acanthosicyos horridus, chlorophyll a fluorescence, fog, foliar absorption, !nara
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