



Leaf epidermal appendages of desert plant: an ecological perspective

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Desert plant often have few, tiny or no leaves, which reduces transpiration. The epidermis of their leaves is often ornamented outgrowths called trichomes or hairs and a thick waxy cuticle. Hairs on the leaf surface trap humidity in dry climates and waxy leaf surfaces reduce water loss. Our present study is to investigate the characteristics of trichomes and waxy cuticle in leaf surface of desert plant, which in the long term acclimation in semi-humid, semi-arid and arid ecosystems of Northern China, from east (Zhangwu county, Liaoning province) to west (Korla city, Xinjiang Uygur Autonomous Region), passing through several provinces including the Inner Mongolia Autonomous Region, Shanxi province, the Ningxia Hui Autonomous Region and Gansu province. 68 shrubs and 7 trees were selected in the natural habitats which were artificial sand fixing vegetation and the adjacent natural vegetation in sandy areas. The leaf epidermis was observed by scanning electron microscopy (SEM) and the cuticle thickness was calculated in the leaf cross-section by transmission electron microscopy (TEM). The results indicated that the epidermis of selected materials was divided into five categories: (1) Trichomes with different forms covered completely on the adaxial and abaxial surfaces of leaf, and any other epidermal appendages could not been observed. (2) Epicuticular wax crystals with different forms almost completely covered in the epistomatal chambers as well as on the surrounding epidermis, and there were no other appendages on the leaf surface. (3) A lot of warty hairs arranged neatly on the surface and the stomatal index was too low. (4) Several or even dozens of papillary epidermal cells covered with waxy crystals enclosed a sunken stomata chamber, therefore the stomatal density is very low. (5) Like ordinary terrestrial plants, epidermal cells and cell outline are clear, with epidermal hairs or not, and the stomata and waxy crystals are visible. TEM showed that desert plants have different thickness of cuticle, from $0.2\ \mu\text{m}$, up to $5.4\ \mu\text{m}$ on the adaxial surface, excluding the data of soluble waxy. Even the same plant has a varied thickness of cuticle in different habitats. These features and data reflect the adaptation mode and the ability of different desert plants in response to extreme environment, and will provide a theoretical basis for the selection of plant species in artificial vegetation reconstruction in sandy areas of arid and semi-arid regions.

Key words: desert plant, leaf epidermal appendages, trichomes, waxy cuticle, vegetation reconstruction