

Micromorphology and anatomy of *Turbinicarpus* spines

Alessandro Mosco

Via Moreri 152, I-34135 Trieste, Italy.

Turbinicarpus Buxbaum & Backeberg is a small genus of Mexican cacti, which comprises about 30 entities of small-sized, globose, tuberculate plants. with variable spination, sometimes strongly mimetic. In this genus the spines are incredibly variable in number, shape and texture and are a key feature for its taxonomy.

Up to now only a survey of the micromorphology of the spines of Cactaceae along with a study on Opuntioideae has been done, while no study on spine anatomy has been carried out yet. This study was conducted to determine what are the anatomical features underlying the hard, rigid spines of most *Turbinicarpus* and the papery or corky spines of some species.

Turbinicarpus spine epidermis displays varied patterns of ornamentation due to the presence or lack of cell-trichomes. These lateral projections can be very long as in *T. valdezianus*, giving the spines a plumose appearance, short or absent. Spine-surface can be entire or the epidermis broken up or the epidermal and outmost sclerenchyma layers deeply fissured.

Transverse sections have shown that the mesophyll can be made up only of strongly sclerified or of wide-band tracheids or can be dimorphic, the outer layers composed of wide-band tracheids while the fibres are restricted to an inner core.

A strong relationship exists between the morphology and mechanical properties of the spines and their anatomy. The straight, stiff spines of most species have strongly sclerified fibres that make them hard and rigid. Their epidermis is usually entire or sometimes broken up and the presence of cell-trichomes is variable. These lateral projections can be very long as in *T. valdezianus*, short as in *T. horripilus*, sparse and small as in *T. knuthianus* or absent as in *T. ysabelae*.

Papery or corky spines have the outer layers made up of wide-band tracheids and a reduced number of fibres that form a hard core as in *T. macrochele* or may be completely absent and then the whole mesophyll is occupied by wide-band tracheids. Their epidermis is devoid of trichomes. These spines are usually deeply transversely fissured due to the weakness of the walls of wide-band tracheids. Also the shape of these spines, generally bent to tortuous, and flexibility is related to their anatomy.

Papery and corky spines are highly derived structures that are present in few unrelated genera of Cactaceae like *Leuchtenbergia*, *Pediocactus*, *Sclerocactus* and *Turbinicarpus*. Their function might be to give mimicry to the plants, as they resemble tufts of dried grass, but they may also play a role in water absorption, at least in *Turbinicarpus*, as proposed by Schill & Barthlott (1973).