



**Figure 2.** Force–distance curve obtained on gold thin film showing various regions of interaction: *a*, Non-contact region; *b*, Maximum attractive force; *c*, Contact region; *d*, Maximum load, and *e*, Maximum adhesive force. (Inset) Calibration of optical stage without optical lever.

bring the cantilever in contact with the sample and measure the standard deviation of the fluctuation in voltage around this fixed point. For our case the rms fluctuation about the set value is  $\sim 10 \mu\text{V}$ . The calibration of the optical stage without the optical leverage factor gives a sensitivity of  $33 \mu\text{V}/\text{nm}$ . Taking into consideration the optical lever factor

of 500 (for the present case, cantilever length =  $100 \mu\text{m}$ ), we get the sensitivity  $\sim 17 \text{mV}/\text{nm}$ . This gives a displacement resolution of  $\sim 0.5 \text{pm}$ . This for our case (cantilever with force constant =  $20 \text{N}/\text{m}$ ) gives the noise limited force resolution of  $\sim 10 \text{pN}$ .

For the calibration of the  $x$ - $y$  scan piezo, we have imaged a 2D commercial calibration-grating replica (Pelco International, USA) having  $2.16 \text{lines}/\mu\text{m}$  in contact mode (Figure 1*b*). We have obtained a calibration of  $40 \text{nm}/\text{V}$  and scan range up to  $5 \mu\text{m} \times 5 \mu\text{m}$ . The SFM has been used to characterize copper thin films grown using atomic layer chemical vapour deposition technique on Si (100) (Figure 1*c*). The typical scan time was 50 s.

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## A halophyte in the Himalaya

The plant *Acanthus ilicifolius* L. (family Acanthaceae) commonly known as sea holly (Figure 1) is found along the sea coasts of India, Sri Lanka, Philippines, Malaysia, Australia and South Africa<sup>1</sup>. In India, it is found along the sea coast spanning several states from West Bengal to Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Maharashtra. It is known as ‘Hergoza’ in West



**Figure 1.** *Acanthus ilicifolius*.

Bengal, ‘Kilichiri’ in Orissa, ‘Etichilla in Andhra Pradesh, ‘Atumulli’ in Tamil Nadu, ‘Payinachulli’ in Kerala, ‘Holechulli’ in Karnataka and ‘Marandi’ in Maharashtra.

So far this plant is known to be an obligate halophyte; however, two bushes of the plant are strangely found to occur in Darjeeling, in the Government College compound just behind the Department of Botany. How this halophytic plant came into existence here and is managing to survive in a temperate climate at an altitude of 2034 m asl, is an open question. The soil conditions in the vicinity of the present habitat of the plant are far from halophytic, with the soil type being acidic in nature (pH 5.8–6.0). The soil is sandy in texture and contains 21% gravel, 33% coarse sand, 40% fine sand and 6% silt and clay. It contains 26% moisture and is abundant in nitrates and chlorides, deficient in sulphates and car-

bonates, while containing traces of phosphate salts<sup>2</sup>. *A. ilicifolius* not only shows some peculiar botanical characters, but also has some important medicinal uses.

The plant is a short (3–4 ft), bushy shrub having a much dissected leaf with sharp spinous teeth on the margins at the endings of the nerves and midrib. The flowers occur in terminal strobilate spikes (10–20 cm long). Sepals are four in number, spiny, and occur as an outer and an inner pair. Corolla forms a short, two-lipped tube, the upper lip of which is obsolete and the lower lip elongated forming a protective covering to the essential whorls of the flower. Anthers four (plus one vestigial) didynamous with one-celled, bearded (hairy) anthers. The base of the filaments forms a hairy cup for trapping the pollen grains for insect pollination. Capsules are compressed with four compressed seeds having a lax, white testa<sup>3</sup>. Though a shrub, the stems

are very stout and woody showing a tendency towards a tree habit. One interesting feature of the plant growing in Darjeeling is that there is no development of pneumatophore roots, however, prop roots are found to develop from the base and the middle of the stems.

The anatomy of the leaf shows Caryophyllaceous-type of stomata. Cystoliths of different size and shape are present in the parenchyma cells of leaves and stems<sup>4</sup>. Phloems are both inter-xylery and intra-xylery type. Inter-vascular pits are alternate and minute. Wood parenchyma are sparse and paratracheal. Vessels are small in diameter with simple perforations. Fibres are septate and simple-pitted<sup>5</sup>.

Several ethnomedicinal uses of the plant are recorded in different parts of the country. In Maharashtra, the extract of the young twigs and leaves of the plant is mixed with cumin powder and sugar candy for the treatment of dyspepsia and acidity. In Goa, the leaf paste is applied externally for relieving rheumatic pain. In Kerala, the plant juice is taken orally for curing asthma<sup>1</sup>. The juice is also used for its analgesic and anti-inflammatory properties in other parts of the country.

On phytochemical screening, the plant gave a positive test for the presence of flavonoids and terpenes<sup>6-8</sup>. 2-Benzoxazolinone isolated from this plant showed leismanicidal activity. One important use of *A. ilicifolius* may be as an antioxidant. The ethanolic extract of the plant was found to scavenge superoxide and hydroxyl radicals. The extract was also

found to inhibit the generation of nitric oxide radical and lipid peroxides. Recent studies have shown that the plant extract has a remarkable hepatoprotective effect. The CCl<sub>4</sub>-induced increase in the activities of alkaline phosphatase (ALP), glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT) enzymes having damaging effects on liver was found to be controlled to a large extent in rats treated with the extract of *A. ilicifolius*. The flavonoids present in the plant were found to have hepatoprotective and antioxidant activities<sup>9</sup>.

How the plant came to Darjeeling is not clearly understood. It may have been brought by some students during an excursion and thrown in the backyard where it thrived. The seed of the plant may also have arrived inadvertently with other supplies and germinated. Whatever may be the reason of its migration, such a useful plant is most welcome here. At least it is adding to the biodiversity of the place. This plant is proliferating successfully and may soon be recognized as an ecotype. Survival of this plant in the Himalayan environment proves that such other plants may also survive here. Since the plant is medicinally important both in terms of traditional and modern medicine, it should be domesticated, studied, conserved and exploited for medicinal and economic purposes. Whether the plant shows any difference with those from the coastal areas in its chromosomal characters and the active principle content, will be an interesting topic for research.

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