Indian Journal of Science and Technology http://www.indjst.org Vol.1 No.1 (Nov. 2007)

Learn the language of plants

Natarajan Gajendran
Email:gajend6an@yahoo.com
Department of Biology, Director, Curriculum Development & Review, Eritrea Institute of Technology, Eritrea

Abstract: Language is the expression of mind and a channel for communication. Language is the baby of intelligence. Do plants have intelligence? If so, what is their language of expression? The biological clock of the plant to comprehend the surrounding climate is no way inferior to the weather forecast by human intelligence.

Keywords: plant, intelligence, response

Intelligence is not a term commonly used when plants are referred to. However, such an omission is solely borne out of sessile lifestyle of plants, and certainly not reflecting their ability that we are going to understand now. If the term 'behaviour' can reflect the level of intelligence, then we should certainly acknowledge the intelligence in plants as they show a variety of behavioral response. Plants make their own way of GIS (Geographical Information System) and understand the topology, property of the terrace, climatic and seasonal changes. Such understanding helps the plant whether to go for vegetative growth, seeding or for generating morpho-physiological changes (we call adaptation) to cope up with the situation. It is the common fact that for any tourist who considers the face of a semi-arid place like Eritrea in summer as barren rocks and battered soil, become astonished at the sight of the panoramic scenario that are thrown all over Eritrea at all times after a rain. Marvelous weeds disappear in the form of seeds at times or become hidden as underground roots during scorching summer, but all to surface suddenly after a brief rain. They have special sensors in the form of chemical pigments (phytochrome) in the leaves, which can sense the light and heat. Accordingly they seed or they germinate.

The biological clock of the plant to comprehend the surrounding climate is no way inferior to the weather forecast by human intelligence.

Man is known for his intelligence to hunt for food. The ability of certain plants to outwit the prey only reflects the unnoticed skill and knack in them.

Insectivorous plants (plants that catch and digest insects as nitrogen rich food source) such as Nepenthes and *Drosera* catches the insects in their own ways. The leaves of Venus fly trap folds swiftly to trap the insects within its fold in a fraction of second, giving no chance for the fly to escape. The touch-me- not plants shy away from your prank. Sometimes, intelligence is defined as 'adaptively variable behaviour within the lifetime of the individual'. The more intelligence of the organism is, greater the degree of adaptively variable behaviour! However, in animal the terms 'behaviour' is equated with movement.

Although some plants exhibit rapid movements (e.g. touch-me-not or venus fly trap), most plants elude from our attention as they move on a slower time scale compared to that of ours. Mimosa plant captures our attention because it operates on a time scale similar to that of our own. The folding and unfolding of flowers, leaves and growth of plants towards sunlight all tell about the movement behaviour of plants for a defined purpose. Certainly, it is the difference in time scales that frequently makes plants seem unmoving.

We communicate by signs, vocal sounds and body language. The communication among insects is mostly by chemical signals. Plants intelligently exploit some of these communication systems in order to fulfill their own needs. For example, plants utilize the service of the insects by mimicking the chemical signals used by insects. The chemical mimicry employed by plants is to attract insect pollinators.

Indian Journal of Science and Technology http://www.indjst.org Vol.1 No.1 (Nov. 2007)

Language is the expression of mind and a channel for communication. Language is the baby of intelligence. Do plants have intelligence? If so, what is their language of expression?

Man competes and succeeds in every deed, marking his intelligence. Plants do compete among themselves for food and substratum. Banyan tree produces millions of seeds but none of its own seed is allowed to germinate its underneath. Nevertheless, you find them mostly growing in cracks of the walls, in the crevices of the rock or perching over the *Borassus* trees.

Civilization marks the intelligence of mankind and the marital relationship plays an important role in it. In-breeding is commonly seen in animals and it is prohibited in human society for its own advantage. Plants too intelligently avoid self-pollination and in some cases ensure for cross-pollination.

Plants do have an internal memory that specifies the optimal ecological niche in which maximal fitness, usually regarded as the greatest number of viable seeds or growth pattern can be achieved. Plants that are growing in arid region seed with high protective coat to ensure the ecological stress. They also develop thick boundary around their body in the form of mucilage and wax to insulate them from the scorching sun. When the same plant is grown in an ideal condition elsewhere, they tend to loose the additional protection periodically. The ability of plants to specify the necessary extent of plasticity in growth and development reflects their intelligence.

'Learning' and 'memory' are the two major properties of neural networks that involve large numbers of neural cells in communication. But, both properties originate from signal transduction processes in individual neural cells. Quite remarkably, the molecules used in signal transduction are almost similar for nerve cells and plant cells. Most decisions made by plants about growth and flowering are an outcome of the communication among different parts of the plant. For an example, in flowering, the signals are produced in leaf and transported to apical meristem of shoot apex, so that the tip of the plant grows to produce flower parts instead of leaf and stem. Now we know that it is carried out by means of chemical signals called 'phytohormones'. The neural network is phenotypically plastic and intelligent behaviour, which requires plasticity. **Plant development is plastic too and is reversible.**

Two kinds of chemical transmission are recognized in neural network. Fast transmission completes in milliseconds. Slow transmission can take many minutes and is enormously more complex, involving at least 100 different chemicals falling into four classes: biogenic amines, peptides, amino acids and nitric oxide. Quite remarkably, glutamate and nitric oxide are the recognized messengers in plant cells too.

When the informative communication is the expression of intelligence, then it is better to look for the chemical base that involved in the process. In plants, the communication involves nucleic acids, growth regulators, oligonucleotides, proteins and peptides, minerals, oxidative signals, gases, osmotic and other mechanical signals, electrical signals, lipids, wall fragments (oligosaccharides), amino acids, secondary products of many kinds, minerals and simple sugars. Transcripts can even move between graft unions. Plasmodesmata (connecting cells through cytoplasmic bridge) control the information flow. From the available information, it looks as though plant communication is likely to be as complex as that of a brain.

How plant gauges the environment?

We understand the climatic condition by means of perception through skin and eyes. Light and temperature forms the important media in sensory mode. Same way plants do assess the climate/season by measuring the prevailing length of the day light and the temperature. The duration of light and temperature are unique to seasons. Plants use these parameters and predict the forthcoming seasons. They employ such predictions to decide about their option for vegetative growth or resting mode to carry over the harsh climate.

The growing tip of the stem is sensitive to sunlight light. Since the sunlight falls at certain angle, it creates the differential distribution of certain hormone (auxin) which leads to uneven growth of the cells at one side of the stem tip. Thus, the plant bends towards the sunlight. Since the sunlight is the primary source of food energy, plants

Indian Journal of Science and Technology http://www.indjst.org Vol.1 No.1 (Nov. 2007)

intelligently seek for sunlight and grow towards it. Same way, certain plants prefer to form flower and produce seed during summer season so that in the event of the fragile vegetative part die away, leaving the hard reproductive parts preserved until a favourable season to come. Plants measure the available length of day light and night period by means of 'phytochromepigment'. Thus, some long-lived memory has obviously been instituted.

In another set of behaviour, the seeds of the plant need the experience of low temperature-exposure in order to germinate. Generally winter is followed by spring and summer during which the plants can get sufficient food and water for growth. Hence, the experience of plant is transferred into the memory of seed, so that until the seed encounter the winter, the germination will not occur. Until such experience happen the seeds undergo resting stage called 'dormancy'. Now we forcibly germinate the seed or break its dormancy by subjecting them under 'vernalization' (cold treatment).

Drought avoidance/tolerance behaviour by plants is well established. The *Opuntia* (Beles) is considered to be an intelligent plant to survive profusely when other plants struggle to exist. It drops away all leaves to conserve water (water generally escapes out through stomata of leaves) and the photosynthetic function is delegated to stem, which is enriched with green pigment. In addition, it also equipped with thorns and acids to ward off the grazing animals. Such morphological changes in plants do act like long-term memory, because they will influence subsequent behaviour by the individual plant when other environmental signals are imposed.

Morphological or phenotypic plasticity in plants indicate their sensitivity over the surroundings. For an example, the recorded pumpkin of 481 kg (Guinness Book of Records, 1998) was possible apparently due to the instinct behaviour of plants to sense the nutritional availability in the surroundings. Because plants lack an obvious specific tissue for computation, their intelligence is often doubted. Certainly, phenotypic plasticity is a witness to the complex computational capability plants can bring to finely scrutinize the local environment and act upon it.

Hence, forget not that the green eyes, which always aspire for your love, affection and care, are observing you.

Plant is an essential organ of Nature.

Under its canopy lie the human breath and the cooked food of sunlight.