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PLANTS AS DETECTING AGENTS OF UNDERGROUND WATER (DUG-WELLS) AS ENVISAGED BY ACHARYA VARAHMIHIRA

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ABSTRACT:

The art of ground water detection in relation to plants and termites was versioned by Acharya Varahmihira. He was a veteran and versatile genius in astronomy, astrology and mathematics. His contribution includes multifarious facets, one of which is Brihat-Samhita. It extensively deals with his personal experimental experiences combined with the eternal truth lying in the Vedas. The Latin enumeration with his Sanskrit version of 82 plants has been identified from his magnum opus as bio-indicators of underground water. In the present paper we have given the plant name in Sanskrit, Hindi, Gujarati, English, Latin name, family and habit. Geological survey of India is translating his experiments at Balaram, Iqbalgadh, Kankarej, Deesa, Tharad, Diyodar, Danta, Dhanera, Palanpur, Radhanpur, Vadgam, Vav, Santalpur of Banaskanta District of Gujarat. It may help to pinpoint the plant and explore ground water.

KEY WORDS: *Plant, Ground Water, Acharya Varahmihira.*

INTRODUCTION:

The water is major problem of the earth. It is requirement of all living organism in the world. But human mankind are more important whenever shortage of water and scarcity. A dominance of relatively tall and robust, adventives species or their hybrids, as opposed to shorter emergent species, is one possible sign of a lack of periodic disturbance from livestock, burning, mowing, or cultivation. A relative scarcity of highly palatable (to cattle) plant species can also signify that intensified grazing has occurred during drier years. Plants that are annuals tend to be the most affected by early-season mowing. Other during this type of condition required the some other source of the water find out in the nature and surrounding areas. The ground water detection in relation to plants and termites was versioned by Acharya Varahmihira. His monumental work embraces the scientific details involved in 125 shlokas which constitute the 54th chapter entitled

'Dakargalam' means ground water exploration. It is treated as an ancillary topic to Jyossatra or astrology. The word 'dakargala' is made up of two words, viz.'udaka' + 'argala', where 'udaka' means 'water' and the word 'argala' is derived from the root 'arj' means 'to gain' or 'to earn'. Hence the word can be translated as either 'key to water' or 'winning water'. Further 'argalam' means 'place of existence' and 'dakargalam' means water's place of existence. Thus the title is translated as exploration of underground water springs.

He provided an integrated account of the ground water environment dealing with the interrelations of the plants, animal and their physical environment (Prasad, 1980). Termite mound commonly associated with vegetation is an important bio-indicator for both ground water and metalliferous ore deposits. He described the methods of ground water exploration applicable to different environments, viz.'anupa' and 'jangala' regions and to 'marudesa' –the desert regions.

All the plants pointed out as hydrologic indicators are called Phreatophytes which are also known as well plants. Their roots extend to a great depth reaching the water table. The depth of the ground can be estimated from the known depth of the root penetration of the species present (Pisharoty, 1986). The extent of root system in modern times is determined:

i. Directly.
ii. By analysing the shoots for lithium or radio isotopes that have been placed in the soil at definite points.
iii. By following the course of depletion of soil moisture.

He employed more than 100 plant species occurring

i. individually
ii. in association with termite mounds
iii. as a combined form of two or three different species
iv. With conspicuous morphologic and physiologic features.

With the aid of these plants, sources of ground water were located at depths varying from 2.29m to as much as 160m in different environments in arid and semi-arid regions.

MATERIALS AND METHODS:

Frequent exploration trips (July 2002 to December 2009) were conducted to study the vegetation and different local tribes and local people were interviewed for hydrologic indicator plants. During the survey the villages covered are Balaram, Iqbalgadh, Kankarej, Deesa, Tharad, Diyodar, Danta, Dhanera, Palanpur, Radhanpur, Vadgam, Vav, Santalpur of Banaskanta District of Gujarat. During the survey we collected the information on plants and their synoptic account as hydrological indicator. The details are presented in the form of Table and Figure.

RESULT AND DISCUSSION:

The total 82 plants are found out the hydrological indicator plants presented in the study area (Table.1). Total of 82 plants belongs to 41 families act as hydrological indicator plants found in the area. The top five families are Gramineae, Cyperaceae, Rubiaceae, Verbenaceae and Cesalpinaceae (Figure.1). The maximum species present in the Gramineae (06). This data compared with the Sanskrit version from His Magnum Opus as bio-indicators of underground water. The Latin enumeration with his Sanskrit version of 82 plants has been identified from His Magnum Opus as bio-indicators of underground water. In the present paper we have given the plant name in Sanskrit, Hindi, Gujarati, English, Latin name, family and habit (Shah, 1978). Geological survey of India is translating his experiments at Balaram, Iqbalgadh, Kankarej, Deesa, Tharad, Diyodar, Danta, Dhanera, Palanpur, Radhanpur, Vadgam, Vav, and Santalpur of Banaskanta District of Gujarat (Sexton, 1918). It needs the combined efforts of a Geologist, Zoologist and a Botanist. It may help to pinpoint the plant and explore ground water.

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Table 1: ENUMERATION OF HYDEOLOGIC INDICATOR PLANTS

Sr. No.	Sanskrit Name	Hindi Name	Gujarati Name	English Name	Latin Name with family in bracket	Habit of The plant
1.	Kankati	Kanghi	Kapat	Indian mallow	*Abutilon indicum* (Malvaceae)	1-2 m tall shrub
2.	Gorakshi	Gorakshmli	Gorakshmli	Monkey bread tree	*Adansonia digitata* (Bombacaceae)	A tall palm
3.	Bilva	Bel	Bili	The Bael tree	*Aegle marmelos* (Rutaceae)	Tree
4.	Kalo, Saras	Siris	Siris	Siris	*Albizzia lebbeck* (Mimosae)	8-20m tall tree
5.	Ankota	Akola	Ankol	Sage-leaved alangium	*Alangium salvifolium* (Alangiaceae)	3-10m tall thorny tree
6.	Sapta parna	Chatium	Satwan	Ditta bark	*Alstonia cholaris* (Apocynaceae)	Huge tree
7.	Rihitaka	Harinhara	Rohido	Rohitak, Pithraj	*Amoora rohituka* (Meliaceae)	A big tree
8.	Baru	Baru	Baru	Aleppo grass	*Andropogon halepensis* (Cyperaceae)	A tall perennial grass
9.	Dhava	Bakla Dhaura	Dhavdo	Axle wood	*Anogeissus latifolia* (Combretaceae)	A small tree
10.	Kadamba	Kadamba	Kadam	Common bur-flower, NewGuinea labula	*Anthocephalus cadamba* (Rubiaceae)	A small tree
11.	Vanaraja	Kachnal	Kachnal	Gold sen	*Bauhinia purpurea* (Caesalpiniaceae)	Moderate sized evergreen tree
12.	Chio	Chio	Chio	Rat's beard	*Bulbostylis barbata* (Cyperaceae)	A small herb
13.	Palasha	Dhakpalas	Kesudo	The flame of the forest	*Butea monosperma* (Papilionaceae)	A medium sized tree
14.	Karira	Karer, Karil	Kerdo	Caper bush	*Capparis decidua* (Capparidaceae)	A densely branched shrub
15.	Sedge	Sedge	Devrat	Sedge grass	*Carex fedia* (Cyperaceae)	A small herb
16.	Suvarnaka	Amaltas	Garmalo	Indian laburnum	*Cassia fistula* (Caesalpiniaceae)	A moderate sized deciduous tree
17.	Nandi vriksha	Tun	Tun	Indian Mahogany	*Cedrela toona* (Meliaceae)	A large handsome tree
18.	Jyotish-mati	Malkangni	Kangani	Black oil plant	*Celastrus paniculata* (Celastraceae)	A large climbing shrub

19.	Anjan	Anjan	Anjan		*Cenchrus ciliaris* (Gramineae)	Annual herb
20.	Laghu-parnika	Murhari	Morvel	Traveller's joy	*Clematis triloba (Ranunculaceae)*	Climbing twinner
21.	Bharangi	Barangi	Barangi	Bharanghi	*Clerodendron serratum* (Verbenaceae)	Hedge plant
22.	Narikela	Nariyal	Nariyal	Coconut	*Cocos nucifera* (Arecaceae)	A tall stately palm
23.	Gavedhu, Jargadi	Gurlu, Sankru	Manka	Job's tears	*Coix lachrymajobi* (Gramineae)	A tall annual grass
24.	Lasor	Lasora , Chotalasora	Gundo	Assyrian plum	*Cordia myxa* (Boraginaceae)	A big deciduous tree
25.	Lasor	Lasora	Gundi	clammy cherry	*Cordia oblique* (Boraginaceae)	A small deciduous tree
26.	Laghu shlesh	Gondi	Gundadi	Grey-leaved cordia	*Cordia rothii* (Boraginaceae)	A small deciduous tree
27.	Varuna	Barun	Varno	The sacred Barna	*Crataeva religiosa* (Capparidaceae)	A moderate sized deciduous tree
28.	Rohisa	Gandh bel	Rocha	Palmarosa	*Cymbapogon schoenanthus* (Gramineae)	A perennial grass
29.	Adrue	Piri Piri	Vadachio	Sedge-grass	*Cyperus articulatus* (Cyperaceae)	A small herb
30.	Mustak	Motha, Nagarmotha	Chiyo	Snow white sedge	*Cyperus niveus* (Cyperaceae)	A small herb
31.	Shishapa	Shisham	Shisham	Rose wood	*Dalbergia latifolia* (Paplinionaceae)	A big tree
32.	Gulmor	Gulmohar	Gulmohar	Royal Poinciana	*Delonix regia* (Caesalpiniaceae)	A deciduous tree
33.	Dirgha-patraka	Tendu	Timro	Coromandal Ebony	*Diospyros melanoxylon* (Ebenaceae)	A large tree attaining a height of 60-80 feet
34.	Adiphala, Amalaka	Amla, Aonla	Amla	Emblic myrobalan	*Emblica officinalis* (Euphorbiaceae)	A small deciduous tree
35.	Darbha	Dab	Darbh	Dabh	*Erogrostis cynosuroides* (Gramineae)	A tall perennial grass
36.	Kapittha	Kavitha, Beli	Kothi	Wood apple, Elephant apple	*Feronia elephantum* (Rutaceae)	A tall tree
37.	Vata	Bor	Vad	The Banyan	*Ficus benghalensis*	A very large tree

					(Moraceae)	
38.	Udumbara	Gular	Guler	Fig	*Ficus glomerata* (Moraceae)	A large spreading tree
39.	Pippal	Pipal	Pipado	Peepal tree	*Ficus religiosa* (Moraceae)	A large tree
40.	Gumbhari	Gumari	Sivan	Gumhar	*Gmelina arborea* (Verbanaceae)	An unarmed tree
41.	Parusha	Phalsa	Falsa	Phalsa	*Grewia asiatica* (Tiliaceae)	A small tree
42.	Ananta	Magrabu	Usno	Indian sarasaparilla	*Hemidesmus indicus* (Asclepiadaceae)	A perennial twinner
43.	Nali	Patson	Ambdi	Deccan hemp	*Hibiscus cannabinus* (Malvaceae)	1-3 m tall hairy under shrub
44.	Kutaja	Kurchi	Jav	The easter tree	*Holarrhena antidysenterica* (Apocynaceae)	A large deciduous shrub
45.	Chirabilva	Papri	Kanji	Indian Elm	*Holoptelia integrifolia* (Ulmaceae)	A deciduous tree
46.	Abhiru	Abhaya	Nir	Toad rush	*Juncus bufonius* (Juncaceae)	A thick herb
47.	Madhuka	Mahua	Mahudo	Butter tree	*Madhuca indica* (Sapotaceae)	A grace full tree
48.	Rechanaka	Kamala, Kamilp	Kapilo	Monkey face tree	*Mallotus philippensis* (Euphorbiaceae)	A much branched evergreen tree
49.	Amra	Am,Amb	Am,Kheri	Mango	*Mangifera indica* (Anacardiaceae)	A large tree
50.	Vikankata	Baikal	Viklo	Red spike thorn	*Maytenus emarginata* (Celastraceae)	A spinous tree
51.	Triputa	Nisoth	Nasotar	Indian Jalap	*Merremia turpethum* (Convolvulaceae)	A spreading herb
52.	Champaka	Champa Chmpaka	Champo	Yellow Champa	*Michelia champaca* (Magnoliaceae)	A handsome evergreen tree
53.	Ashyuka	Ach	Jungle ach	Great Morinda	*Morinda citrifolia* (Rubiaceae)	A small shrub
54.	Achchhuka	Ach	Kadvi	Indian Mulberry	*Morinda tinctiria* (Rubiaceae)	A small tree
55.	Svetashigr	Sajana	Sarguva	Drum-stick tree	*Moringa concanensis* (Moringaceae)	A tree with small pinnate leaves
56.	Surangi	Surangi	Kesar	Surangi	*Ochrocarpus longifolius* (Guttiferae)	A large tree
57.	Shyonaka	Arlu	Tetu	Tiutum	*Oroxylum indicum*	A small tree

					(Bignoniaceae)	
58.	Amllka	Amrul	Neveri	Wood sorrel	*Oxalis corniculata* (Oxalidaceae)	Annual or perennial herbs with radially spreading branches
59.	Kharjuri	Khajur	Khajuri	Date palm	*Phoenix sylvestris* (Arecaeae)	Unbranched palm
60.	Shami	Jhand	Shami	Shemi	*Prosopis spicigera* (Mimosaceae)	An armed small tree
61.	Madana	Mainphal	Mindal	Emetic nut	*Randia dumetorum* (Rubiaceae)	A large shrub
62.	Gangati	Pindalu	Gangeti	Divine Jasmine	*Randia uliginosa* (Rubiaceae)	A large shrub
63.	Munja	Sarkanda	Munj	Munj Sarkanda	*Saccharum bengalense* (Gramineae)	Tickly rhizomatous perennial shout herbs
64.	Salmali	Simul	Shimdo	Silk Cotton	*Salmalia malabarica* (Bombacace)	A prickly tree.
65.	Brihatpilu	Chotapilu	Piludi	Tooth brush tree	*Salvadora persica* (Salvadoraceae)	An evergreen tree
66.	Arista / Pheila	Aritha	Aritha	Soap nut	*Sapindus laurifolius* (Sapindaceae)	A medium sized tree with abruptly pinnate leaves.
67.	Ashoka	Ashok tree	Ashok	Sita Ashok	*Saraca indica* (Caesalpiniaceae)	A small evergreen tree.
68.	Soma	Somlata	Somvel	Creeping Milk-Hedge	*Sarcostemma brevistigma* (Asclepiadaceae)	A jointed succulent shrub-twinner.
69.	Bhallica	Bhilawa	Biba	Marking nut tree	*Semecarpus anacardium* (Anacardiaceae)	A deciduous tree.
70.	Jujube	Jojoba	Jojoba	Jojoba	*Simmondsia chinensis* (Buxaceae)	A spiny tree.
71.	Kantakari	Kateli	Ringni	Thorny night shade	*Solanum xanthocarpum* (Solanaceae)	A very spiny herb.
72.	Rohini	Rohun	Rohido	Indian red wood	*Soymida febrifuga* (Meliaceae)	5 to 12m tall deciduous tree.
73.	Jambu	Jamun	Jamu	Black plum	*Syzygium cumini* (Myrtaceae)	Big trees with white

						exfoliate bark.
74.	Rohi	Rugtroro	Pitraj	Lohera / Roheda	*Tecomella undulate* (Bignoniaceae)	A small tree.
75.	Saka	Sagwan	Sag	Teak	*Tectona grandis* (Verbanaceae)	A perennial deciduous tree
76.	Arjuna	Arjun	Sadad	Arjun tree	*Terminalia arjuna* (Combretaceae)	A large spreading tree.
77.	Bahira	Bahera	Baheda	Belleric mirobalan	*Terminalia bellarica* (Combretaceae)	A large spreading tree.
78.	Gokshura	Chota gokhru	Bethu	Bur weed/ Cocklebur	*Tribulus terrestris* (Zygophyllaceae)	A small annual herb.
79.	Ushira	Khas	Khas	Vetiver	*Vetivera zizaniodes* (Gramineae)	Herb.
80.	Nirgundi/ Surasa	Nirgandi	Nagod	Sheras	*Vitex negundo* (Verbanaceae)	A small tree.
81.	Ashvakand-ika	Asgand	Ashvaganda	Rape seeds	*Withania somniferum* (Solanaceae)	A herb of 3 to 4 feet height.
82.	Badari	Ber	Bordi	Jagged jujube	*Zizyphus jujube* (Rhamnaceae)	A small spiny tree.

Figure-1: MAJOR TOP SIX FAMILIES OF HYDEOLOGIC INDICATOR PLANTS