

GENERAL INTRODUCTION

Rudraksh is a conjugate word related to Lord Shiva. The ancient Indian scriptures describe the importance of Rudraksh. "Rudra" means "Shiva" and "Aksh" means "Eyes" where the two words combine to form Rudraksh and literally it means "the eyes of Rudra". According to mythological story in Puranas, Rudra (Lord Shiva) had fought for a long time by keeping his eyes wide open in order to kill dangerous "Asur" named "Tripur" of Himalayas. In prolonged struggle the eyes of Lord Shiva got tired and tears rolled down on the earth and took the shape of a plant. Lord Brahma, the creator of Universe directed that this plant should be called Rudraksh as it was formed from Lord Shiva's flowing tears.

Many rare plants and their parts are used in Tantric (Hindu occult Science) system. Nature has created many things, which destroy negative planetary forces, get rid of evil auras in our homes, protect us from enemies or opposition around and create powerful friendly auras for health, wealth, success and happiness. The holy Rudraksh does this - a unique link between the material world and occult world. Its powerful presence keeps away all evil and negative forces. Rudraksh is the fruit stone of the Rudraksh tree (*Elaeocarpus ganitrus*). When fruit pulp is removed, the Rudraksh bead is found inside. The bead is rough in texture, with the surface divided into segments by ridges running from top to bottom. These form the faces of Rudraksh. The number of faces ('mukhi') ranges from 1 to 14, however, a major percentage of beads have 5 or 6 faces.

There are twin beads (beads joined together) called *Gaurishanker*, which are considered to be very auspicious. Natural beads have configurations on them. Such beads are extremely rare. Moreover one 'mukhi' Rudraksh is very rare while two to three and from nine to fourteen 'mukhi' Rudraksh are also difficult to find. One 'mukhi' Rudraksh has more importance, it is more effective and regarded as highly powerful. Quality of all other Rudraksh beads is cumulatively available in one 'mukhi' beads. It is believed that the person, who is lucky enough to get it, becomes wealthy in all respect. One 'mukhi' Rudraksh is related to the sun; by wearing it, a person can alleviate his bad effect to a large extent. According to Kalidas Vajpeyi, the author of *The Science of Mantara*, the five 'mukhi' Rudraksh is the best among all the other Rudraksh (cited in Hazarika 2001).

Rudraksh beads can be of the size of small peas or as large as marble. These beads can be worn around the neck, kept in the pocket or purse, in cash box or places of worship or at various points in home. Rudraksh brings good luck, health and many material comforts. When kept under pillow, it induces sound sleep, pleasant dreams, mental stability, better memory and happy feelings, stabilizes the blood pressure etc. (Hazarika 2001). Rudraksh should be worn after being fortified by specific mantras, which make it more effective. The Shiva Purana says that the Rudraksh protects a person from premature death, fulfill desire and bestows worldly pleasure and salvation forever. The Rudraksh improves health, protects from misfortune and planetary afflictions, brings purity and tranquility of mind; it also helps to relieve pain and is especially effective in high blood pressure, heart problems, epilepsy, cough, mental and

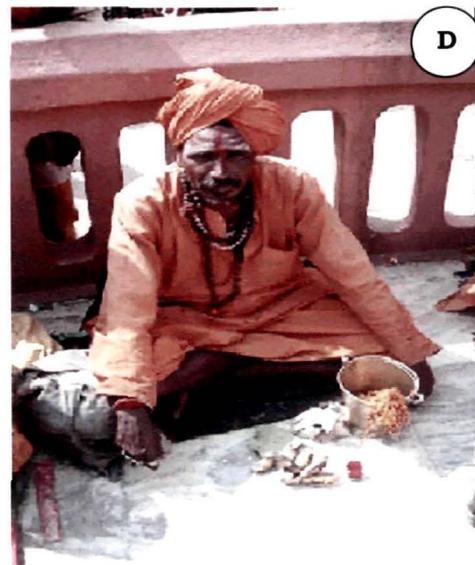
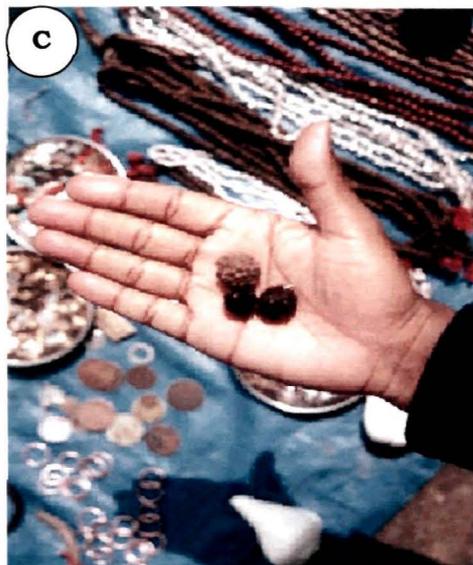
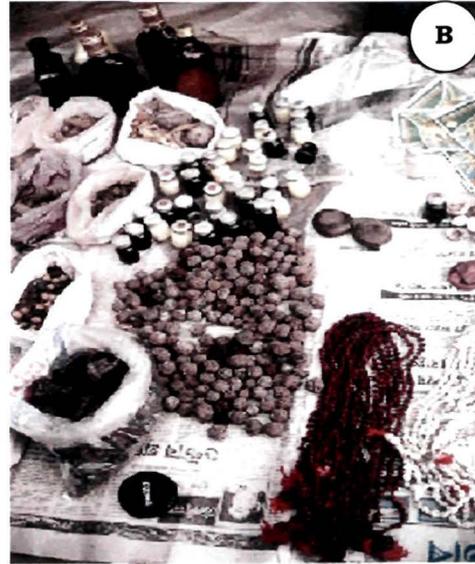
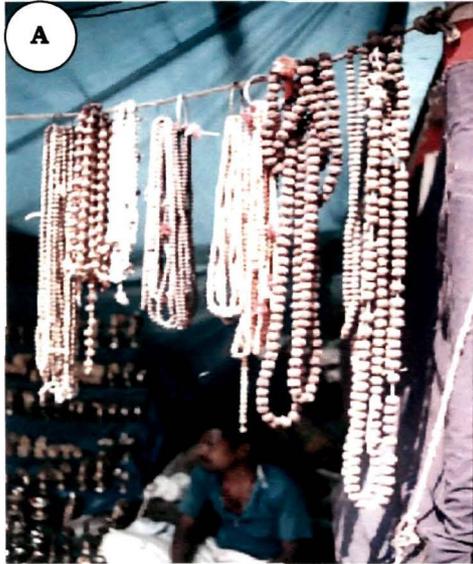
gynaecological problems. Ghosts and evil spirits cannot withstand the power of the Rudraksh.

As per modern psychology, mind in many ways is governed by the brain, its neurons, neurotransmitters, endocrine glands etc. For example, low level of serotonin causes depression, worry, lack of energy, low self esteem and higher level of it causes happiness, energy, higher level of confidence and self esteem etc. Dopamine causes over-activity of neurons resulting in mental agitation, restlessness, tension, fear, lack of control etc. Conversely, decreased level of dopamine results in peace, tranquility, stability etc. Psycho-pharmacological drugs like tranquilizers and antidepressants etc. control the activities of neurotransmitters to effectively soothe mental disturbances. According to Suhas Roy (unpublished), Rudraksh beads have certain electromagnetic and inductive properties and when worn over the heart, they send out corresponding signals differing for different 'mukhis' to the brain, acting or controlling certain brain chemicals and neurotransmitters, thereby influencing the status of mind. For example, the mental agitation and dopamine level of those who wore 5 mukhi Rudraksh was found to be less and the serotonin level of those who wore 1 mukhi and 12 mukhi Rudraksh beads was found to be high. The activity of neurons in the right part of the brain was found to be high among the wearers of 14 mukhi Rudraksh beads (right part of the brain controls abstract and lateral thinking as against logical and structural thinking controlled by left part of brain). This perhaps, is the reason behind the change in personality and attitude of the wearers of different types of Rudraksh beads. When the person gets a positive confident frame of mind, the impact goes deep into his subconscious mind sending out powerful vibrations thereby changing the way of nature and others

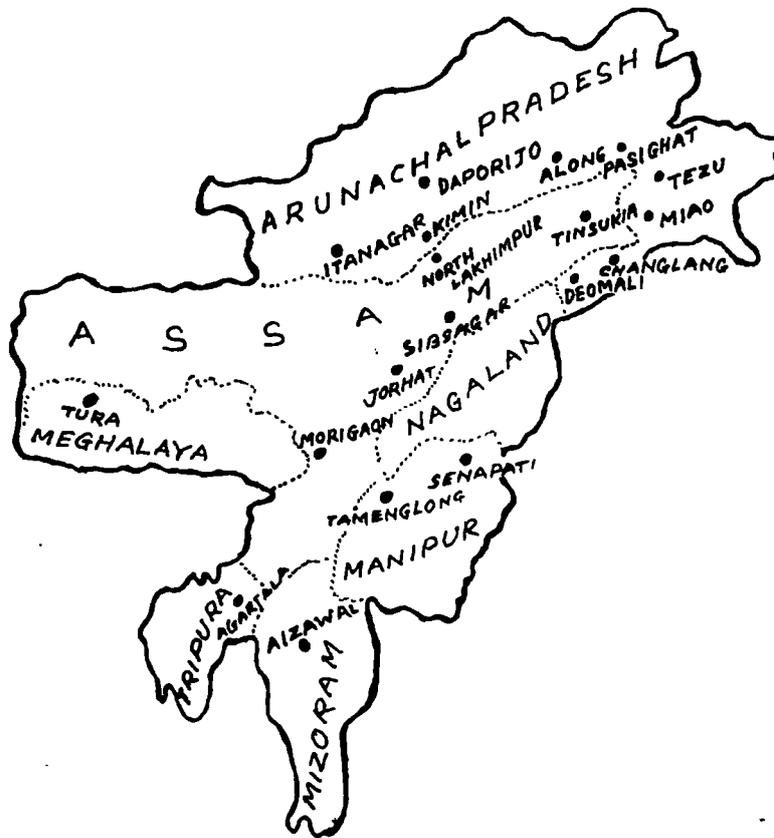
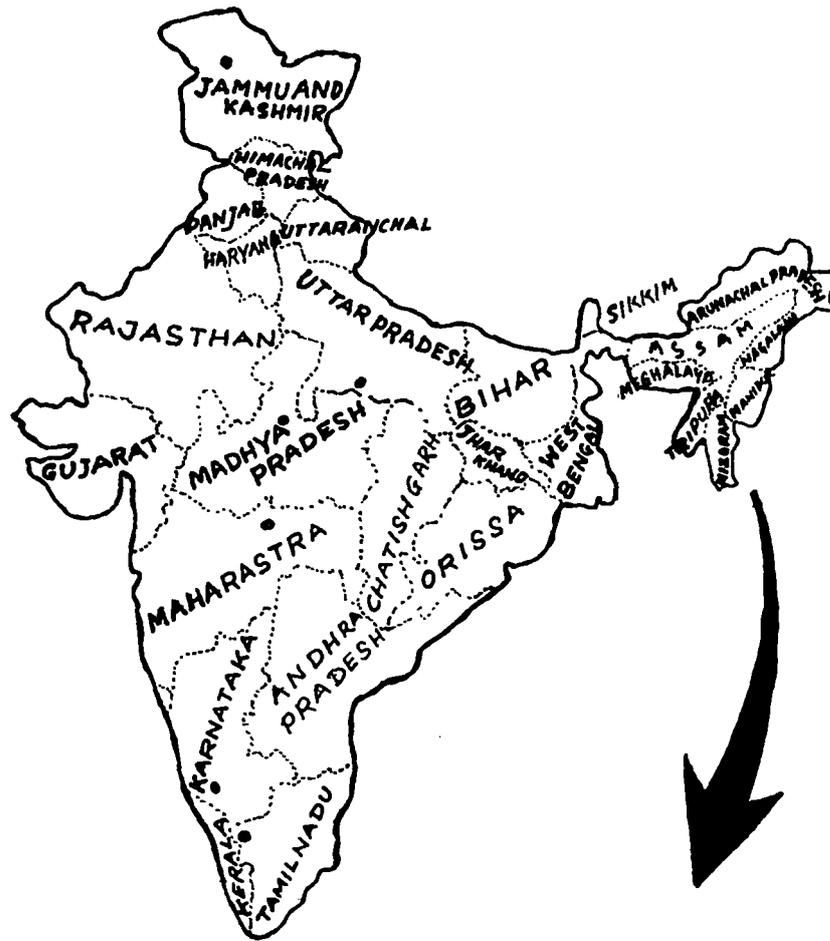
reaction to him. He also takes quick decisions and frequently finds himself in right place at the right time. This is perhaps called 'luck'. What have been said in Vedic scriptures is increasingly being proved almost with 100% precision scientifically (from unpublished literature).

Elaeocarpus, a genus with about 360 species of Elaeocarpaceae family, contains hard and highly ornamental stony endocarp commonly known as 'Rudraksh'. Stony endocarp (nut) is used as religious jewellery in the form of beads throughout India and Southeast Asia (plate1.1). The sculpturing of the stony endocarp surface appears as faces, commonly known as 'mukhi', associated with the locules of the ovary, normally five in number. Nuts with fewer or more locules are due to abnormalities. Each locule houses a seed. Out of about 120 species of *Elaeocarpus* reported from different parts of Asia including Nepal, Bhutan, Sikkim, Tibbet, Java, Indonesia, foot hill of Himalayas and various parts of India, 25 species are found in different parts of India, such as Uttar Pradesh, Maharastra, Bihar, Madhya Pradesh, Assam, Arunachal Pradesh, Meghalaya etc (Map1). The Rudraksh tree occurs sporadically in all districts of Assam but is more frequent in Arunachal Pradesh. In Assam, Rudraksh is found in places like Charaideu, Digboi, Margherita, Dibrugarh, Jorhat, Golaghat etc. In Arunachal Pradesh it is common along the foothill of all districts except Tawang and Upper Subansiri and some other high altitude areas (Map12).

Kaul & Haridasan (1987) have classified the forest vegetation of Arunachal Pradesh into five broad types. Rudraksh is found in tropical evergreen forest which is characterized by three-tier forest structure. The emergent top canopy trees are straight boled with an average girth of 2-5 m and height of 40-50 m. They do not form continuous close canopy. Second story is composed of



Plate].1. Nuts of Rudraksh collected from the forests being sold in market (A, B & C) in different forms, and the beads are worn as sacred jewellery (D).



Map 1. Showing (●) the distribution of Rudraksh (*Elaeocarpus ganitrus*) in India and North Eastern Region.



Map 2. Showing the distribution of natural (■) and planted (×) populations of Rudraksh (*Elaeocarpus ganitrus*) in Arunachal Pradesh.

other tree species, which occur gregariously to form a closed canopy ranging in height between 20-30 m. Rudraksh is usually present in this story. A few thin boled tree species occupy the lower level of the canopy as well.

However, tropical forests of Arunachal Pradesh are being modified and degraded due to increased anthropogenic pressure. The age-old practice of shifting agriculture is one of the potent factors changing the forest microenvironment and reducing the forest cover (Mishra & Ramakrishnan 1981, Ramakrishnan *et al.* 1981, Kushwaha & Ramakrishnan 1987). The 'jhum' cycle has been shortened as a result of population pressure, diversification and consequent shrinkage in available land area for agriculture due to logging activities (Ramakrishnan 1985). Accelerated search for new timber resource for industrial purposes is another cause of forest exploitation. Improved technology, pattern of forest resource use and infrastructure development have widely increased the effective wood harvesting and land clearing activities. It is believed that if the present trends continue and effective conservation measures are not implemented, most of the still existing forests will be destroyed or replaced by degraded communities (Thapliyal 1991, Beniwal & Haridasan 1992a, b, Menon *et al.* 2001). Rudraksh population in the natural as well as planted forest stands has been decreasing day by day due to household and other industrial uses. Moreover, nut collection for beads has caused the shrinkage of the seed bank in the soil, which has adversely affected the regeneration of the species. Thus the species is being pushed to the threatened category (Rao & Haridasan 1983). The species flowers during May to June and fruits ripe during November to December. The ripe fruits are blue in color. The fruits are consumed and dispersed by large birds. The fruits are consumed as a whole and the endocarp

is passed through the digestive tract. Sometimes small birds partly strip the fleshy exocarp. The exocarp is rich in carbohydrates and proteins and provides nutritious reward to consumers (Lee 1998). The species bears very low regeneration power and mainly reproduces through seeds.

Rudraksh is a fast growing species and has been included under the social forestry programme of Arunachal Pradesh and has been planted along roadside, in institutional premises, as small forest pockets etc. Many pockets of Rudraksh plantation can be noticed in various parts of the state. Many forest nurseries are engaged in raising the seedlings of this species to meet the requirement of various types. However, the germination of Rudraksh is very poor and erratic, and so it is a difficult task to raise the seedlings in nursery.

Although certain aspects of Rudraksh such as its biology (Lee 1998), chemical properties of nuts (Dutta & Mathur 1992), taxonomy of the species (Mitra *et al.* 1992), medicinal and aesthetic values (Sayani 1999, Hazarika 2001), and biochemical properties (Das *et al.* 2000) have been studied to some extent, there is a conspicuous lack of studies on fruit/nut production, dispersal and regeneration of the species. Thus a study on regeneration of Rudraksh (*Elaeocarpus ganitrus* Roxb.) was undertaken.

The present study focusing on the regeneration of Rudraksh (*Elaeocarpus ganitrus*) covers the following aspects:

1. Quantification of the population stock of Rudraksh in different forests of Arunachal Pradesh.
2. Study of the phenological events of Rudraksh in fragmented and undisturbed forests.

3. Investigations relating to the natural dispersal mechanism of Rudraksh (*Elaeocarpus ganitrus*) in fragmented and undisturbed forests and to find out as to how this dispersal mechanism has been changed/modified in response to human induced disturbances such as deforestation and harvest of nuts.
4. The determination of the nut bank in fragmented and undisturbed forests.
5. Evaluating the fitness components of the species (e.g. seed germination, seedling growth, seedling establishment and vegetative propagation etc.).

The '**General Introduction**' which sets out the objectives of the thesis is followed by the '**Review of Literature**' (**Chapter I**), which is followed by **Chapter II** on the climate, soil and vegetation of the study sites. The experimental data on various aspects mentioned above have been presented in **Chapters III – VIII**. Each chapter has been provided with a separate discussion. In addition to this, the results contained in various chapters have been discussed in an integrated manner under '**General Discussion**'.