Review:

TRADITIONAL INDIAN AYURVEDIC MEDICINES: SOME POTENTIAL PLANTS FOR BIOENERGY, MEDICINE FROM INDIA.

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Introduction:

Contribution of the traditional medicine to human health in the 21st Century is of paramount importance. A meeting of International Forum on Traditional Medicine held recently (1999) at Toyama Medical and Pharmaceutical University, Toyama, reviewed the potential of traditional medicines. WHO acting director Xhang emphasised that with the changing pattern of life style most of the diseases are now becoming life style diseases. Natural medicines improve the inner strength of the body. The use of traditional medical system has attracted so much attention that an International health Center has been opened in July in Toyama prefecture (Province) in Japan.

Some of the oldest traditional medical systems include Chinese, Ayurvedic, Unani, Japanese and recently added homeopathy and chiropathy which is also around 200 years old.The use of traditional medicine includes (i) medication by use of medicinal plants minerals, animal material and (ii) Non medication: acupuncture and yoga. Complementary medication includes acupuncture, herbal treatment, manual, spiritual and dietary treatments.

Toyama hospital utilizes vast amount of Chinese, Japanese and Ayurvedic medicine. Detailed studies in the areas of pharmacognosy and pharmacology are under progress. (Annual report, TMPU, Toyama)

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Besides this the Research Center for Ethnomedicines with its Museum of Materia Medica is one of its own kind in the world under Professor Watanabe. Dr. Komatsu provides wealth of information for all the scientists engaged in the field all over the world. This includes identification, molecular characterization at DNA sequence level , chemical characterization, biotransformations and studies on effects on microorganisms to direct application in the hospital.

To give entire description will be attempted in another paper. Here a brief attempt is made to identify common goals of research in India and Japan, with an object to attract attention of the workers to the great potential that the great bio-diversity of Indian subcontinent and wealth of Ayurvedic literature has to offer for future development of traditional medicines. However detailed future investigations are needed in this area to exploit the unexplored or poorly explored plant materials.

These traditional medicines have found practical application at clinical level in TMPU and over hundred cases of fissure have been cured in the hospital using a special thread prepared from latex of Euphorbia spp., thor of India (Euphorbia sp) , haldi powder *Curcuma longa* and some herbal ingredients. The *Euphorbia sp* is a plant of desertic region of India and different parts of the world. A large number of energy yielding desertic plants of India used in Ayurvedic system have great potential as Ayurvedic medicine. Negative environmental effects of current agricultural practices, such as emission of greenhouse gases, nutrient leaching, decreased soil fertility, and erosion, may be reduced when traditional annual food crops are replaced by dedicated perennial energy crops and medicinal plants. As they are able to grow and produce valuable products under dessert conditions they have great potential for covering the global desert areas into green belts leading to environmental improvement on one hand and providing valuable Ayurvedic crude drugs in addition to supplementing the bioenergy resources as renewable fuels. However detailed studies on their pharmacognostical characterization and determination of chemical products obtained from them are lacking. Some of the investigations indicated their potential use in Human immuno deficiency (HIV) diseases (Hattori et al 1995). Such bio-energy plants have not been explored in depth. Here attempt shall be made to provide brief out look of the Indian scene and highlight some of the work being carried out at our place in Rajasthan along with the possible impact assessment for desertic plants for future research strategies.

Among the desert plants the value of *Aloe vera* (L.) was recognized more than 3000 years ago when the Egyptian and Greek civilizations used its extract for skin burns, cut and wounds on the skin surface and found that it had a wonderful healing effects on skin. It is claimed that even 3rd degree burn can be cured and healed by *Aloe vera*. The chemical compounds like Aloein, resins, mixture of polysaccharides containing pectic acid are present.

Modern investigations indicate that extracts of *Aloe vera* act on the dead epithelial cells of skin, aiding their removal from the surface and stimulating the growth of new cells. Thus Aloe is providing to be a great gift of traditional medicine for protecting the smooth skin of human beings especially when radiation damage of human skin has assumed alarming situation due to stratospheric ozone depletion. Fresh juice of leaves are also used in liver and spleen troubles and also for eye troubles. Found useful in X-ray burns, dermatitis, cutaneous and other skin disorders.

In India, Egypt and Sudan around 70 percent of the rural people use traditional medicine. Similar situation exists in a large number of developing countries. In India and China 60 percent of the people affected with cholera and malaria are treated with herbal medicines. In these countries the market for traditional medicines is US $ 500 million while Western type medicine account for only US $ 300. In Singapore 50 percent and in Australia 60 percent of population uses alternative medicine. Around 17,000 herbal products are registered in these countries. In Belgium 40 percent contemporary and 84 percent home medicines and 74 percent acupuncture medicine is utilized. In France 50 percent of the people take

advantage of complementary medicine. In Germany 10,000 to 13,000 alternative medical practitioners are thriving well and 75 percent of them utilize complementary medicines. 77 percent of pain clinics utilize acupuncture. In UK 90 percent of the complementary medical practitioners utilize osteopathy and acupuncture. In US where in 1990 only 30 percent of the people were utilizing complementary medicines in 1997 it grew to 40 percent.

Ayurvedic system of Medicine:

Ayurveda is an offshoot of Atharva veda written over 3000 thousand years ago. The Charak and Sushruta describe a large number of crude drugs and a large part of them has origin to plants. However though some part of it has been translated from Sanskirt to Japanese and Japan Society of Ayurveda under Professor Dr. Namba is very active in this field but many of the crude drugs described remain to be identified to its plant source in botanical terms and Institute of Traditinal Medicine is the prime center for understanding the nature and morphology of crude drugs of Ayurvedic origin and their identification to the plant level. The personal communication with Professor Watanabe and Dr. Komatsu during my stay at Wakan Yaku as visiting Professor has contributed to the stimulation of such studies back home and some of the important findings are presented here. During my stay here I have worked on Nepalese crude drugs with support and guidance from Dr. Komatsu and other members of this institute.

The basic philosophy of Ayurveda considers that man is an inseparable part of the universe. The human body mind and spirit continuum is an integral whole and the individual is also linked to the family, society, environment and ultimately the universe.

The definition of health is that "it is state of complete psychosomatic equilibrium It does not mean only absence of diseases but a state in which the mind, senses and spirit are pleasant and active." That agrees with the definition of WHO "Health is a state of complete physical, mental and social well being and not merely the absence of disease or infirmity"

India with its varied climate soil and agro-ecology possess immense plant diversity, with over 15,000 species of higher plants. Both our Indian civilization as well as our diverse tribal heritage have gone a long way in conserving the wild weedy species, native land races and primitive cultivars (Fig.1). The Indian gene center is endowed with rich flora especially with regard to several less known yet economically important plants, ca 160 cultivar species of economic plants, plus 56 species of lesser known cultivated food plants. Further there are ca 320 species of wild and weedy economic types (Paroda 1979; Arora and Nayar, 1984 ; Kumar, 1998).

Utilization of biomass for bioenergy and medicine:

Use of biomass for energy, medicine and industry allows a significant quantity of hydrocarbons to be consumed without increasing the CO_2 content of the atmosphere and thus makes a positive contribution to the Greenhouse effect and to the problems of "global change" as occurs in both industrialized and developing countries. Further the advantages from utilization of biomass include: liquid fuels produced from biomass contain no sulfur, thus avoiding SO2 emissions and also reducing emission of N0x. Improved agronomic practices well managed biomass plantations will also provide a basis for environmental improvement by helping to stabilize certain soils, avoiding desertification which is already occurring rapidly in tropical countries, Modern bioenergy technologies and biofuels are relatively benign from environmental view point and produce very little pollution if burned correctly and completely. The creation of new employment opportunities within the community and particularly in rural areas is one of the major social benefits from the exploitation of biomass for energy, industry and environment.

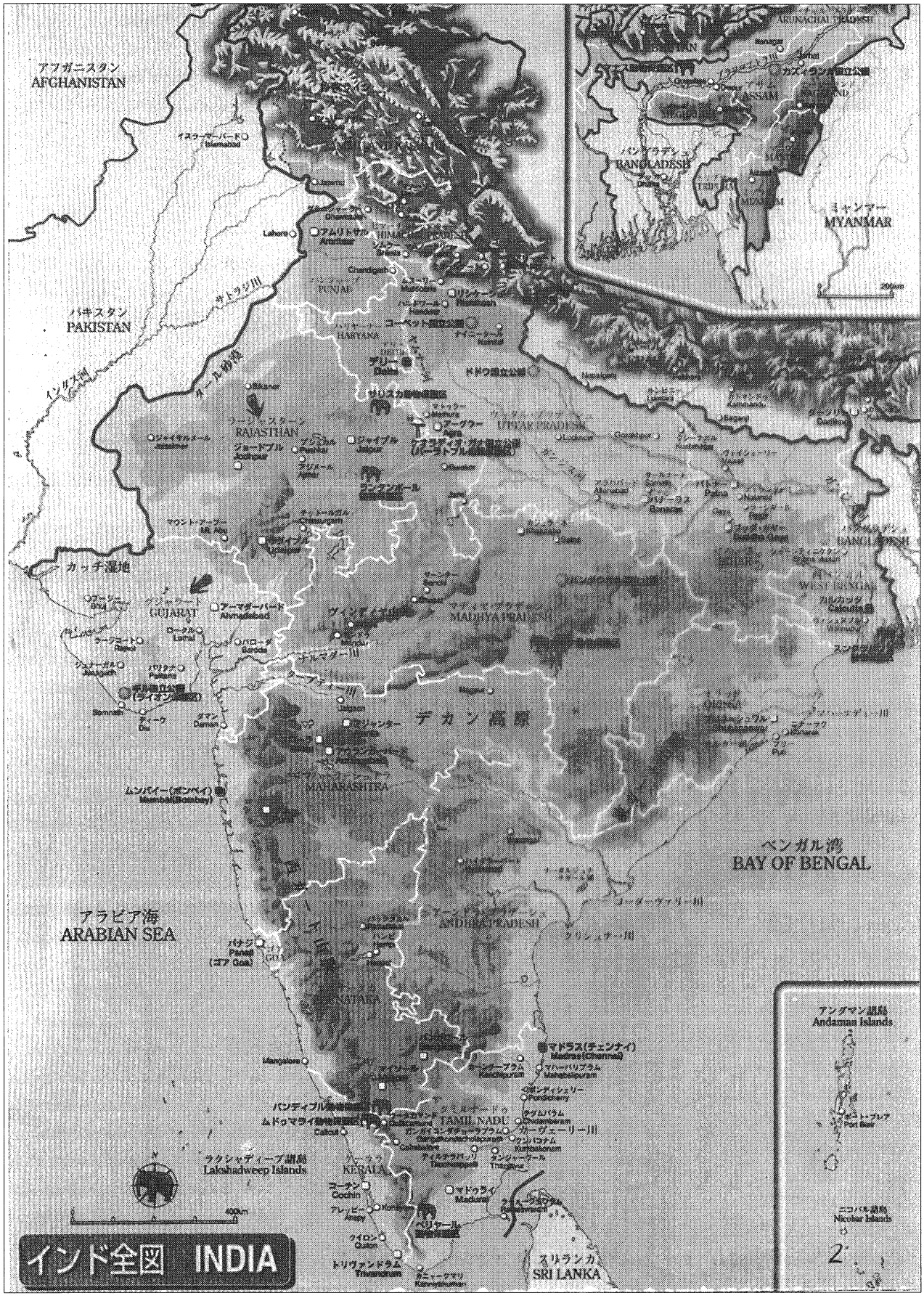

Fig.1. Map of India showing Rajasthan and Gujrat (see arrow).

Global scenario:

Out of 2,50,000 plant species only 10,000 or so have been exploited. At the global level, according to recent estimates by FAO the annual tropical deforestation rate for the decade 1981 to 1990 was about 15.4 million ha (Mha).

According to the latest data published in 1994, for the assessment period 1989-1991, the total area under forests is 64.01 Mha accounting for 19.5 percent of India's geographic area. At present there is hardly 0.4 percent forest below 25 cm rainfall zone and 1.3 percent above 30 cm rainfall zone. There is rapid depletion of forest products and in order to provide alternative energy sources a change is needed in conventional forestry management.

The fact that nearly 90 percent of the worlds population will reside in developing countries by about 2050 probably implies that biomass energy will be with us forever unless there are drastic changes in the world energy trading pattern. However if these plants could find additional use in medicines also besides providing the bio fuel, the entire economics of biofuel production shall become viable proposition in different parts of the globe.

Tropical deforestation and bio-diversity conservation:

Tropical deforestation is currently a significant environment and development issue. At the global level, according to recent estimates by FAO the annual tropical deforestation rate for the decade 1981 to 1990 was about 15.4 million ha (Mha). (Annonymous 1993). According to the latest data published in 1994, for the assessment period 1989-1991, the total area under forests is 64.01 Mha accounting for 19.5 percent of India's geographic area.

The possibilities for developing countries:

The specific research work carried out in the areas of biomass production and utilization in less fertile areas of the world will provide satisfactory answers to the double challenge of energy crisis and forest deforestation in the country in general and semi-arid and arid regions of Rajasthan in particular. The possibility of conversion of biomass into strategic liquid fuels, medicines and electricity will make if possible to supply part of the increasing demand for primary energy and medicinal plant resources.

Global Strategies:

Already European countries mainly Italy, Germany and Austria are leading in Bio-diesel production nearing 500,000 tons in 1997 out of which 2,50,000 was produced in France. The production capacity of bio-diesel in Germany was fully utilized in 1997, the sold quantity amounting to roughly 100,000 t (Groenen, 1998). The technologies for producing bio-oil are evolving rapidly with improving process performance, larger yield and better quality products. The present paper shall discuss problems and strategies for use of biomass in developing countries.

Arid and semi- arid regions:

Arid and semi arid lands occupy one third of the earth's surface. Indian arid zone occupies an area of about 0.3 million sq. km. 90 percent of which about 2,70,000 sq. km.) is confined to north west India covering most of Western Rajasthan, part of Gujrat and small portions of Punjab and Haryana (Fig 1). India with its vast expanse of wasteland unsuitable for agricultural production (nearly 180 million ha) could be considered for economically viable production of bio-fuels and medicinal plants.

Bio-diesel production:

A recent World Bank report concluded that "Energy policies will need to be as concerned about the supply and use of bio-fuels as they are about modern fuels.. (and) they must support ways to use bio-fuels more efficiently and in sustainable manner (World bank,1996) Although there is significant volume of

bio-diesel already produced in Europe there are remaining risks slowing down the further expansion to the target set by the European Commission to reach 5% market share in transportation fuels by the year 2000.

Bio-mass as potential resources:

Bio-mass resources are potentially the worlds largest and sustainable energy source a renewable resource comprising 220 billion oven dry tones (about 4500 EJ) of annual primary production. The annual bio-energy potential is about 2900 EJ though only 270 EJ could be considered available on sustainable basis and at competitive prices. Most major energy scenarios recognize bio-energy as an important component in the future worlds energy. Projections indicate the bio-mass energy use to the range of 85 EJ to 215 EJ in 2025 compared to current global energy use of about 400 EJ of which 55 EJ are derived from bio-mass (Hall and Rosillo-Calle. 1998).

Need for new strategies

At present there is hardly 0.4 percent forest below 25-cm rainfall zone and 1.3 percent above 30 cm rainfall zone. There is rapid depletion of forest products and in order to provide alternative energy sources a change is needed in conventional forestry management. Four broad categories of biomass use can be distinguished) basic needs e.g. food, fiber, etc.; b) energy e.g. domestic and industrial; c) materials e.g. construction and d) environmental and cultural e.g. the use of traditional medicines and fire. Bio-mass use through the course of history has varied considerably, greatly influenced by two main factors population size and resource availability.

The present paper presents the strategies for the semi- arid and arid regions of the word where wastelands could be utilized effectively for the development of Bio-fuels and medicinal plant resources on sustainable basis for the environmental benefit and rural health care based on traditional medicines.

The unutilized and underutilized resources:

Out of 2,50,000 plant species only 10,000 or so have been exploited during the course of human civilization. A large number of hydrocarbon yielding plants are able to grow under semi arid and arid conditions and they also produce valuable hydrocarbons (up to 30 percent of dry matter) which could be converted in to petroleum like substances and use as fossil fuel substitute. They are rich in triterpenoids which are constituent to important drugs against HIV.

Investigations:

During the last 15 years investigations have been carried out on the optimization of yield and production of hydrocarbons by such plants at the 50 ha Energy plantation demonstration project center. Their yield could be increased three fold making their commercial cultivation feasible. Several other countries are producing and selling bio-diesel on commercial basis. Such plants could also be exploited on commercial basis for production of medicinal compounds.

The potential plants:

Certain potential plants were selected and attempts were made to develop agro-technology for their large scale cultivation (Kumar et al, 1995, Kumar,1998, Kumar, 2000). A 50 ha bio-energy and medicinal plants cultivation demonstration center has been established in the campus of the University of Rajasthan to conduct the experiments on large scale cultivation of selected plants with the objective of developing optimal conditions for their growth and productivity, besides conserving the bio-diversity.

Plantation of laticiferous plants and desert plants can be carried out it could also lead to reclamation

of marginal land that has already been abandoned in developed as well as developing countries. India alone has over 144 million-hectare of marginal land which is about half of the total geographical area of the country. Touched only marginally by the green revolution Africa suffers not only a dramatic nutritional problem but also and equally serious and inter linked problem of energy. Increasing scarcity of fuelwood, desertification lack of water, food and medicines , excessive urbanization all are closely interdependent .

There are sure to be opportunities for Biomass in the south as well as in the North in wet climates and in dry ones but they will respond to very different schemes and strategies. There is not going to be a single unique recipe rather multiplicity of solutions depending on climate, soil, availability of land traditions social and economic conditions. Technological improvements should lower production costs but they are unlikely to obtain significantly higher yields, as chemical and energy inputs must be reduced. The transformation of Biomass into useful energy products and medicinal compounds may however involve on site industrial operations that could absorb at least part of the surplus man power.

Besides Bio-mass cycle must be fully integrated into the local and general context. Integration does not mean merely putting together several Bio-mass technologies so as to reach the maximum degree of self-sufficiency for a certain area. Neither does it mean integration of markets in the sense of finding uses for the different CO-products or by products of a certain Bio-mass crop. Integration means that above all that bio-mass projects must be able to co-exist in harmony with the rest of the world as it is or as it will be and in particular with local realities. Inputs must be available on the market products must compete in the market the utilization of land must be competitive with alternative utilization's. The implementation of bio-mass programs is favored by a certain pattern of land ownership the amount of labor and the skills required must be available the required investment must be feasible even when compared to competing needs and priorities.

How can we go from here to there from the present situation to a scenario in which Bio-mass has an important role to play for energy, medicine and for industry.

As far as research is concerned we are all aware of the important progress being made in agricultural biotechnology. Genetic engineering for example is increasingly applied to crop plants for improving resistance to pests and diseases, for providing more favorable crop composition.

There is a whole universe of possibilities in the use of advanced biotechnology to improve plants and processes. Bio-mass still calls for fundamental thinking and a of basic research.

Natural resource:

A detailed survey on the weeds on wastelands yielded valuable data about the first colonizers. Total land area of Rajasthan is 3,42,239 sq km out of which 45.25 percent is characterized as wasteland. Large portions of this land were productive at a given time and due to man made deforestation, cattle pressure, water and wind based soil erosion, improper water management, they have turned out to be wastelands. (Kotia and Kumar, 2001a). A large number of such weeds have the medicinal value. Out of the total weeds around 50 weeds having important medicinal values while other produce related compounds. These regions are rich in bio-diversity and weeds were collected from different regions of the developing wastelands. (Kotia and Kumar, 2001b)

A detailed survey was carried out in different parts of Rajasthan and some of the medicinally important plants of Rajasthan are listed by Ajanta and Kumar, (2001a) . Some of the Medicinal plants found in wild in the forests of Rajasthan include:

Table 1. List of Medicinal plants of Rajasthan.

Plant species	Local name	Plant species	Local name
1. *Asparagus racemosus*	satavari	26. *Colocynthes vulgaris*	Indrayan
2. *Chlorophytum arundinaceum*	Safedmusli	27. *Adhathoda vasica*	ardusta
3. *Curculigo orchioides*	Kali Musali	28. *Allangium salvifolium*	aankol
4. *Solanum surattense*	Kantkari	29. *Caesalpinnia bonducella*	tas
5. *Boerhaavia diffusa*	Santhi,	30. *Jatropha curcas*	ratanjot
6. *Hamidesmus indicus*	anantmool	31. *Eclipta alba*	bhringraj
7. *Sida cordifolia*	Bala	32. *Aloe barbadensis*	gwarpatha
8. *Holarrhena antidysenterica*	Indrajo	33. *Mucuna prutita*	Konch
9. *Curcuma aromatica*	Vanhaldi	34. *Terminalia bellerica*	baheda
10. *Oroxylum indicum*	Shyonaka	35. *Tamarindus indica*	imli
11. *Balanites aegyptiaca*	hingot	36. *Azadirachta indica*	neem
12. *Withania somnifera*	ashwagandha	37. *Achyranthes aspera*	aandhijhara
13. *Aegle marmelos*	Bael	38. *Barleria cacrulea*	bajrandanti s
14. *Cassia fistula*	Amaltas	39. *Barleria cristata.*	Badradanti p
15. *Gymnema sysvestre*	gudmar	40. *Barleria prinoitis*	bajradanti p.
16. *Terminalia arjuna*	arjuna	41. *Ocimum americanum*	bapchii
17. *Butea monosperma*	palas	42. *Centella asiatica*	brahmibuti
18. *Soymida febrifuga*	rohan	43. *Datura metel*	Dhatura
19. *Woodfordia fruticosa*	dhavri	44. *Convolvulus arvensis*	haranpadi
20. *Tribulus terrestris*	gokhru	45. *Evolvulus alsinoides*	shankhpushpi
21. *Pedalium murex*	badagokhru	46. *Cassia occidentalis*	kasaundi
22. *Vitex negundo*	negad	47. *Urginea indica*	Kolikanda
23. *Dyerophytum indicum*	chhitral	48. *Andrographis paniculata*	kalmegh
24. *Plumbago zeylanicum*	Chitrak	49. *Helicteres ispara*	marorphali
25. *Plantago ovata*	Isabgol	50. *Tinospora cordifolia*	nimgiloy

In addition to this some of the laticiferous with potential for bioenergy and ayurvedic use include the followings:

I) Hydrocarbon yielding plants included:

1. *Euphorbia lathyris* Linn.
2. *Euphorbia tirucalli.* Linn.
3. *Euphorbia antisyphilitica* Zucc.
4. *Euphorbia caducifolia* Haines.
5. *Euphorbia neriifolia* Linn
6. *Pedilanthus tithymalides* Linn.
7. *Calotropis procera* (Ait.)R.Br.
8. *Calotropis gigantea*(Linn)R.Br.

II) High molecular weight hydrocarbon yielding plants :

1. *Parthenium argentatum* Linn.

III) Non edible oil yielding plants

Jatropha curcas. Simmondsia chinenesis

IV) Short rotation energy plants :

Acacia tortilis; Holoptelia integrifolia; Parkinsonia aculeata; Cassia siamea; Albizzia lebbek;Acacia nilotica; Tecomella undulata; Prosopis juliflora; Pithocellobium dulce; Azadirachta indica;Dalbergia sisso; Anogiessus pendula; Boswellia serrata.

Increase in hexane extractable was recorded up to 6-7 months: thereafter percent hexane extractable (HE) did not increase significantly in E. *lathyris E.antisyphilitica*, and P. tithymaloides. Higher levels of HE were recorded in leaves as compared to the stem in *E.lathyris* and in fruits of *Calotropis procera.* Active phase of growth exhibited greater amounts of hexane extractable.

Calotropis procera (Ait.) R.Br. (Akanda, Alarka, Aak) : The plant is one of the important number of traditional herbal medicine in every home of India. Traditionally the leaves of aak are warmed and tied around any body organ in pain. It is practically useful in backache and in joint pains warm leaves also

relieve from stomachache if tied around. Inhalation of burnt leaf cures headache. The traditional folk healers use the milky latex of aak for several ailments. Leaf latex if applied on fresh cut, stops bleeding immediately. Recent investigations have found that the alkaloids calotropin, calotaxein and uskerin is stimulant to heart. Flowers and roots are used in Ayurvedic medicine. Plant is anthelmintic, the ashes act as an expectorant. The leaves are applied hot to the abdomen to cure the pain inside. Flower is tonic, antisialagogue, appetizer, and stomachache, cures piles and asthma. Flowers are believed to have detergent properties so they are given in cholera. The fresh roots are used as a toothbrush and are considered by pathans to cure toothache.. Alarka is an alternative, tonic and diaphoretic, in large dose emetic. Root bark useful for treating chronic cases of dyspepsia, flatulence, constipation, loss of appetite, indigestion and mucus in stools. Leaves used against guinea worms. Flowers useful in asthma. Seed oil is geriatric and tonic. Green copra given in asthma. Plant used in spleen complaints, rheumatism, epilepsy, hemiplegia, sores, and smallpox and protracted labor. Properties and uses of Alarka are the same as of *C.gigantea*

Calotropis gigantea R.Br. (Arka) : Arka is purgative, anthelmintic alexipharmic,; cures leprosy, ulcers, leucoderma, tumors, piles, diseases of spleen, liver and abdomen. Juice is anthelmintic and laxative; cures piles and kapha. Dried and powdered plant is taken with milk acts as a good tonic. Action is similar to Digitalis on the heart. Root bark and juice have emetic, diaphoretic, alternative and purgative properties. It is used in dysentery and as a substitute for Ipecauantha. It is regarded as a great remedy in syphilitic afflictions and is called "Vegetable mercury". In intermittent fevers it is used as antiperiodic and diaphoretic. It cures asthma and syphlis. In form of paste applied to elephantiasis. Tincture of leaves use in intermittent fevers. Latex is bitter, heating, oleagenous and irritant, used in combination with *Euphrobia neerifolia* as purgative. Flowers are sweet, bitter, digestive, tonic, stomachic, anthelmintic, analgesic, astringent; cure inflamations, tumours, kapha and are good in ascites.

Jatropha curcas Linn. (Vyagrairanda) : Juice of Vyagrairanda is a well known purgative and is useful in whitlow, convulsions, syphlis, neuralgia, dropsy, anasarca, pleurisy and pneumonia. Root bark is applied externally in rheumatism and is used in sores. Leaves are galactagogue, rubefacient, suppurative, insecticidal and are used in foul ulcers, tumors and scabies, given internally in jaundice. Leaves are locally applied to breasts to increase secretion of milk. Leaves warmed and rubbed with castor oil and applied to boils and abscesses have supportive effect. Decoction of leaves is antidiarrhoea useful in stomach-ache and cough also used for gargle to strengthen gums. Fresh stems are used as toothbrush. Fresh viscid juice flowing from stem is employed to arrest bleeding or hemorrhage from wounds. Stem bark is used for wound of animal bites. Fruit and seeds are anthelmintic, useful in chronic dysentery, urinary discharges, abdominal complaints, anaemia, biliousness, fistula, and diseases of heart. Seeds are acro-nacrotic, poisonous to human beings and cattle and used against warts and cancers, also to promote hair growth. Seed and oil are purgative, more drastic than castor oil. Wood causes dermatitis. Drug is bitter, acrid, astringent and anthelmintic. It serves to cleanse the entire system through its purgative property. It is useful in chronic dysentery, thirst, abdominal complaints, biliousness, anemia, fistula, ulcer, and diseases of the heart and skin.

Croton tiglium Linn. (Jamaalagotta, Jayapala) : Jayapala seeds and oil are drastic purgative, diaphoretic, vasicant, vermifuge irritant, rubefaceint and cathartic. Its action is prompt. Croton oil when rubbed on skin acts as a rubefaceint and counter-irritant and vesicant. When administered internally it operates as a powerful hydrogue cathartic. It is found to be very useful in ascites, anascara, cold, cough, fever, asthma, constipation, calculus, dropsy and enlargement of abdominal viscera. It is given only when a drastic purgative is required as in dropsy and cerebral affections like convulsions, insanity and other fevers, attended with high blood pressure. Wood is diphoretic in small doses and purgative and emetic in large

doses.

Euphorbia hirta Linn. (Dudhi, Cara) : Cara is demulcent, antispasmodic, anti-asthmatic pectoral, anthelmintic and local parasiticide. Plant is chiefly used in the affections of childhood, in worms, bowel complaints and cough, in postnatal complaints, failure of lactation, breast pain. Extract of plant has depressant action and action on cardiovascular system, a sedative effect on mucous membrane of respiratory and unino-genitory tract. Juice of plant is given in dysentery and colic, and milk applied to destroy warts. Plant alkaloid is effective in respiratory system and produces dilation of bronchi. Decoction of plant is used in bronchial affections and asthma. Latex is vermifuge and used in diseases of urinogenitory tract, also used in application for warts.

Euphorbia tirucalli Linn. (Vajraduhu, Satsala) :It is useful in biliousness, leucorrhoea, leprosy, dropsy, whooping asthma, enlargement of spleen, dyspepsia, jaundice, colic tumours, and stone in bladder. Milky juice is vesicant, rubifacient. In small doses a purgative but in large doses it is acrid, emetic and counter-irritant; application for warts, neuralgia,rheumatism, toothache, used in asthma, cough and earache, fish poison. Milky juice is applied to itch and scorpion bites. Decoction of tender branches and that of roots is administered in colic and gastralgia.

Anti-HIV agents among desert plants:

Around 40million people are affected due to Human Immunodeficiency Virus Globally. During the past decades, a large number of ani-tviral screening experiments on medicinal plant extracts have been reported and have led to the selection of several extracts active towards herpes viruses. A promising result of a naturally occurring antiherpetic agent was given by n docosanol (a natural 22 carbon saturated fatty alcohol) which is undergoing phase III clinical trials in patients. Clinical testing of the topical formulation, or systemic administration of drug suspensions has demonstrated a good therapeutic index, since high doses of n-docosanol do not elicit appreciable toxicity. The findings show that natural products are still potential sources in the search for new antiherpatic agents (Hattori et al. 1995, see also lab report).

Acquired immunodeficiency syndrome (AIDS), the great pandemic of the second half of the 20th Century, is still a threatening disease world wide. Many research approaches are currently aimed at developing novel agents to arrest the replication of HIV through various targets. These may include the inhibition of reverse transcriptase (RT), protease (PR), membrane fusion and integrase. HIV PR enzyme has been demonstrated to play an essential role in viral replication (Meek et al. 1990) It is considered as potential target for anti-AIDS therapy, as the inhibition of this enzyme produces immature, non-infectious virions (Mous et al. 1988; Huff, 1991; Robins and Platter, 1993). A range of HIV PR inhibitors have been designed and applied in clinical trials such as Sanqunavir, Ritonavir and Indinavir. However, the development of drug resistance by virus irrespective of the target, remains as an overwhelming problem in AIDS chemotherapy (El Farrash, et al. 1994). Thus there is great need to search for and develop new and different anti-HIV candidates from plants and natural products are considerable importance.

In search for anti-HIV active agents from natural products, many attempts at screening traditional medicines have been made (Chang and Yeung, 1989; Otake, et al. 1995; Wan et al. 1996). However Indian and other tropical region plants with their vast diversity, have not been investigated for their antiviral activity. Hussein et al (1999) investigated forty eight methanol extracts from Sudanese plants were screened for their inhibitory activity on viral replication. Nineteen extracts showed inhibitory effects on HIV -induced cytopathic effects (CPE) on MT-4 cells. The extracts were further screened against HIV-1 protease (PR) using an HPLC assay method. Of the tested extracts, the methanol extracts of desert plants *Acacia nilotica* (bark and pods), *Euphorbia granulata* (leaves), *Maytenus senegalensis* (stem - bark) and aqueous extracts of A.nilotica (pods) and M. senegalensis (stem-bark) showed considerable inhibitory

effects against HIV-1 PR (Hussain et al.1999). Some of the plants of Sudan are common with Indian dessert region of Rajasthan and generally they grow on the wastelands . They have potential use as bio-energy plantations (Kumar et al. 1995, Kumar, 1998). However a large number of them are used in the medicines of Ayurveda. They were also found effective against HIV-1. (Hussein, et. al. 1999). A list of potential plants of this region is given here in table no. 1. However these plants have not been studied in detail and there is need to study them for their medicinal properties including anti- HIV properties. Some of the active principles against anti-HIV are triterpenoids which are abundant in laticiferous plants of Rajasthan. Besides *Ganoderma sp* is very frequently met in Rajasthan attacking trees. *Ganoderma lucidum* has been described to contain triterpenes which have inhibitory effects against HIV-1 protease (Min et al. 1998) . Besides this several other plants commonly found in Rajasthan show anti HIV activity. Abrus precatorius L. (Leguminosae) is widely distributed in Rajasthan and allover India. Its seeds in China have been used as an insecticide and for skin diseases since ancient times.

A detailed survey of medicinally important plants have been carried out and important trees, shrubs herbs have been listed and their characters studied in the several publications from our laboratory. They included anti-depressant herbal drugs (Ajanta and Kumar, 2000b), medicines for skin diseases (Shivani and Kumar, 2000), anticancer drugs (Kant and Kumar, 2000); anti-diabetic drugs (Ritu and Kumar, 2000). Herbal drugs of Leguminosae from Rajasthan have been studied (Sapna and Kumar, 2000). Herbal crude drugs for anti-malaria (Anita and Kumar, 2001); anti-paralytic (Vandana and Kumar, 2001). Besides this herbal crude drugs for cure of hepatic diseases (Santosh and Kumar, 2001) and diseases of digestive system (Mamta and Kumar, 2001) have been studied for their characters and investigations on their morphological and pharmacognostical characterization is in progress.

Conclusion:

The sustainable land utilization in ecologically fragile climate of semi arid and arid regions, has to be guided by the principal of optimal utilization of resources. It is a matter of great interest that a large number of plants of the arid and semi-arid regions of the world are effective as anti-HIV agents. They are also used in variety to herbal and traditional medicines as lilted in this paper. Our previous work on their bio-energy production potential, if combined with their crude drug potential could yield bio-fuels on one hand and valuable crude drugs on the other hand. However a large number of tropical plants have not been studied in detail for their chemical constituents, pharmacological properties of the extracts, and their pharmacognostical characterization and DNA sequencing etc. If a joint collaboration could be established in this direction, valuable information could be generated with wide ranging practical applications. This could also provide alternative land use pattern for the rural poor thriving on marginal lands on one hand and help in eco-restoration on the other hand. The use of bio-energy plants in the herbal crude drugs has great potential and detailed investigations are planned with the help and cooperation from different agencies. This paper provided a brief outline the work in the area and is open to future suggestions and improvements.

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Literature cited:

Ajanta Mishra, and Ashwani Kumar. Medicinally important trees of Rajasthan. *Int. J. Mendel.* **18**: 37-38. 2001a

Ajanta Mishra, and Ashwnai Kumar. Studies on Ayurvedic crude drugs for the cure of urinary tract stones. *Int J. Mendel* **18** (1-2) : 41-42. 2001b

Ajanta Mishra and Ashwani Kumar. Searching for anti-depressant crude drugs in ayurvedic system of medicine. *Int. J. Mendel.* **17** (3-4) : 91-92. 2001c

Anita Yadav and Ashwani Kumar. Studies on anti-malarial drugs used in Ayurvedic system. *Int J. Mendel* Int. **18** (1-2) : 29-30. 2001

Ashwani Kumar, S, Johari, and S. Roy. Production and improvement of bioenergy sources. *J. Indian Bot.Soc.* **74A:** 233-244, 1995

Ashwani Kumar. Biomass energy crops of semi-arid regions of India and their energy potential. In: Biomass for Energy and Industry (eds. Kopetz H. et al.) CARMEN. Germany. pp 345-348. 1998.

Ashwani Kumar. Hydrocarbon yielding plants and future prospects: Biotechnological approach. In: Plant Biotechnology P C Trivedi. Eds. Panima. New Delhi. Pp 194-212. 2000.

A Kotia, and Ashwani Kumar. Characterization of weeds on wastelands and their role in eco-development. *Int. J. Mendel.* **18** : 7-8. 2001a

R.K. Arora, and E. R. Nayar, Wild relatives of crop plants of India. NBPGR. Science Monograph No. 9, New Delhi. 1984.

A. Kotia, and Ashwani Kumar. Some of the common weeds of medicinal value from Rajasthan. *Int. J. Mendel.* **18:** 17-20. 2001b

Byung-Sun. Min, Norio. Nakamura, Hirotsugu Miyashiro, et al. Triterpenes from the spores of Ganoderma lucidum and their inhibitory activity against HIV-protease. *Chem. Pharm. Bull.* **46** (10) : 1607-1612. 1998.

R.S. Chang, and H.W. Young, Inhibition of the growth of human immunodeficiency virus in vitro by crude extracts of Chinese medicinal herbs. *Antiviral Res.* **9** : 163-176. 1989.

Chao-mei Ma, Nario Nakamura and Masao Hattori. Saponins and C-Glycosyl Flavones from the seeds of Abrus precatorius. *Chem. Pharm. Bull.* **46** (6), 982-987. 1998.

T. Kawahata, T. Otake., H. Mori, M. Morimoto. N.Ueba, I.T. Kusumoto, S. El-Mekkawy., M.Hattori., T. Namba. *J. Trad. Med.* **13** : 59-65.1996

El M.A. Farrash, M.J. Kuroda, and T. Kitazaki, et. al.) Generation and characterization of a human immunodeficiency virus type -1 (HIV-1) mutant to an HIV-protease inhibitor. *J. Virol.* **68** : 233-239. 1994

M.Hattori, I.T. Kusumoto, M.Soga and T.Namba. Screening of various Ayurvedic medicines for their inhibitory activities on the reverse transcriptase and Identification of arecatanins an embelin as major inhibitory substances from Areca catechu and Embelia ribes. *J. Med. Pharm. Soc. Wakan-Yaku* **10** : 141-148. 1993.

M Hattori, T. Nabakayashi, and Y. Lim, et al Inhibitory effects of various Ayurvedic and Panamian medicinal plants on the infection of Herpes simplex virus 1 in vitro and in vivo. *Phythother. Res.* **9** : 270-276. 1995

J.R. Huff, HIV-1 protease: a novel chemotherapeutic target for AIDS. *J. Med. Chem.* **34** : 2305-2314. 1991.

G. Hussein, H.Miyashiva, N. Nakamura, M. Hattori et al. Inhibitory effects of Sudanese plant extract on HIV-1 replication and HIV-1 Protease. *Phytotherapy Res.* **13** : 31-36. 1999.

Kusumoto, T. Nakabayashi, and H. Kida, et al. Screening of various plant extracts used in Ayurvedic medicine for inhibitory effects on human immunodeficiency virus type 1 (HIV-1) protease. *Phytother. Res.* **9** : 180-184. 1995.

L. K. Sharma, and Ashwani Kumar. Searching for anti-cancer drugs in traditional medicines. *Int. J. Mendel.* **17** : 77-78. 2000.

Mamta Choudhary, and Ashwani Kumar. Ayurvedic crude drugs for cure of diseases of the digestive system. *Int. J. Mendel.* **18** : 27-28. 2001

J.Mous, E.P. Heimer, and S. F.J. Le Grice, Processing protease and reverse transcriptase from human immunodeficiency

virus type 1 polyprotein in Escherischia coli. *J. Virol.* **62** : 1433-1444. 1988.

T.D. Meek, D.M., Lambert, B.W Metcalf, , S.R Petterway,., and G.B Dreyer, HIV-1 protease as target for potential anti-AIDS drugs. In design of Anti-AIDS drugs ed. By E. DeClkercq, pp. 225-256. Elsevier Science Publishers B.V., The Netherlands. 1990.

T. Otake, H.Mori and M. Morimoto,.et al.Screening of Indonesian plant extracts for anti-human immunodeficiency virus type 1 (HIV-1) activity. *Phytother. Res.* **9** : 6-10. 1995.

R.S. Paroda. Plant resources of Indian arid zones for industrial uses. In: Arid land Plant resources, J.R.Goodin and D.K. Nottington(Eds), pp. 261-281. International Center for Arid and Semi-arid land studies, Lubbock, Texas. 1979.

T. Robbins, and J. Platter, HIV protease inhibitors their anti-HIV activity and potential role in treatment. *J. AIDS.* **6** : 162-170. 1993.

Ritu Gupta and Ashwnai Kumar. Ayurvedic crude drugs as potential cure of diabetes. *Int. J. Mendel.* **17** (3-4) : 127-128.2000

S. Roy and A. Kumar. Biodiversity of Rajasthan and its energy potentials. *J. Enviroment and pollution.* **2**(3) : 105-109. 1995

Santosh Sharma, and Ashwani Kumar. Ayurvedic plants for cure of hepatic diseases. *Int. J. Mendel.* **18** : 13-14. 2001

Sapna Sanghi, and Ashwani Kumar. Characterization of some of the medicinal plants of family Leguminosae used in Ayurvedic system of medicines. *Int J. Mendel.* **17** : 109-110. 2000

Shivani and Ashwani Kumar. Ayurvedic medicinal plants used for skin diseases. *Int. J. Mendel.* **17** : 105-106. 2000.

Vandana Sharma, and Ashwani Kumar (2001) Studies on anti-paralytic crude drugs used in Ayurvedic system. *Int. J. Mendel.* **18** : 33-34.2001

M. Wan , S. Bloor L, Foo, and B. Loh, Screening of New Zealand plant extracts for inhibitory activity against HIV-1 protease. *Phytother. Res.* **10** : 589-595. 1996.