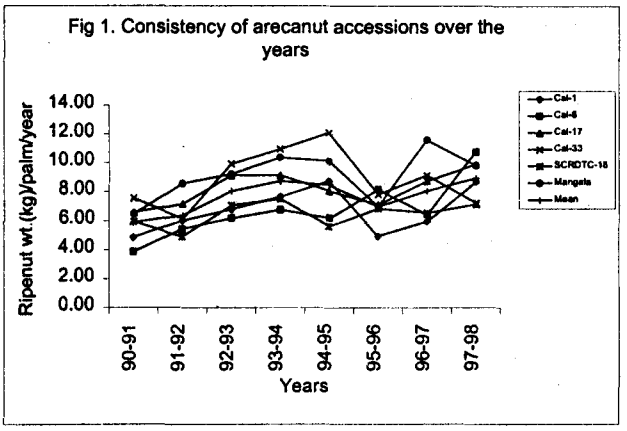

Fig. 1. Consistency in field of arecanut accessions over the years

(Table 4). The fresh weight of nuts ranged between 19.08 g (Cal-27) and 41.50 g (Cal-2) with a mean of 34.64 g, while for the dry kernel weight minimum weight of 4.85 g and maximum of 12.67 g were observed in Cal-27 and Cal-2, respectively with a mean being the 7.80 g/nut. The maximum fruit length of 5.94 cm was measured in accession Cal-35 while the accession Cal-6 recorded highest fruit breadth (4.60 cm). The maximum kernel length (2.74 cm) was noticed in Cal-5, while maximum kernel breadth (3.08 cm) was observed in Cal-2 accession. Accessions Cal-17 (27.73%), Cal-4 (26.85%), Cal-2 (26.55%), Cal-21 (27.11%) and Cal-33 (26.46%) showed significantly higher recovery of chali/dry kernel from the fresh fruit compared to other accessions. The high recovery may be due to low content of husk in the nuts of these accessions and similar results were obtained for fruit component traits in dwarf arecanut hybrids by Ananda (2000). Overall the accession Cal-2 was found to be superior for most of the fruit component characters studied in the present collections. Thus, nuts with less husk is a desirable trait and such accessions could be utilized as donor parents for improvement of arecanut.

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Plant Genetic Resources of Spiti – a Cold Desert in the Western Himalaya

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Key Words: PGR, Medicinal Plants, Himalayas

For centuries a mystic area surrounded the trans-Himalayan tracts of Tibet, Lahaul and Spiti. Spiti is an introversive culture of life focussed around its several monasteries and faith as deep as the river swift. Spiti a sub division of Lahaul and Spiti district of Himachal Pradesh is lying at the extreme North-East corner between 31°49' and 33°00' N latitude, and 77°37' and 78°35' E longitude. It is bordered by Ladakh on the west, Lahaul on the south and Kinnaur on South-East, covering an area of 7,460 Km^2. Mountain ranges belong to the great and middle Himalayas. The sub-division lies at a mean elevation of about 4,570 m and average elevation of mountain ranges is over 5,485 m above mean sea level (msl). The whole area is drained by Spiti river and its tributaries and finally merges into Sutlej at Khab in Kinnaur. Villages are established on flat pieces of land

along springs and streams. Gete, the highest village in the World, has only 8 houses and recently connected with road. The area is mostly dominated by mountains of brown and grey rocks, steppes and pasture lands with flat plateaus along the banks of river Spiti at Rangrik, Kee, Kiamo, Kiato *etc.* The climate of this valley is predominantly cool and dry throughout the year, except the months of May to September, when it receives very little showers. For rest of the year valley remains covered under snow.

During investigations in the entire Spiti division, field trips of one to one and half months duration were undertaken in different seasons of the years between 1988-94 and the area covered ranges from 3200-5500 m above msl. The areas explored during these surveys include Kaza, (Kewang, Kwaling, Langza, Hikkim, Gete, Tashigang, Shego, Maran, Ledang, Lingti, Shoulochouk, Cubhrung, Talung and Demul), Kibber area (Kee, Kee Gompa, Chicham, Ladarcha); Gue area (Hurling, Sumdo, Gue and Kaurik), Kunzum Pass, Demul Pass; Rongtong area (Rangrik, Khurik, Sichling, Maran, Hull, Pangmo, Chisighar, Kiato, Hansa, Lossar and Kiamo); Pin valley area (Senling, Gulling, Bhar, Chud, Kungri, Hikkim, Sagnam, Attargu, Sagnam glaciers, Tialing, Mud, Khar, Todan, Lingti Gompa and Chhidang) and Sichling area (Sichiling, Dankhar, Mane, Gogma, Mane Yogma, Lundupdin, Poh, Morang, Kurith, Tabo and Lari). The main objective of these field trips was to inventorise the floristic composition of the area for preparing an account of different vegetation types. The information on local/common names, uses to which various plants are put by the local inhabitants for their domestic use, edible plants, plants used in household medicines and other related information about the plant species along with their product was collected during these field investigations.

To record morphological variations, attempts were made to collect same species from different habitats/ localities. Depending upon the availability, at least 4-6 voucher specimens were collected under one collection number. Specimens were usually collected in both flowering and fruiting periods. Complete field notes regarding habit, habitat, height, subterranean organs, flowering and fruiting season(s), flower colour, abundance, associations, types of soil and other interesting features which can not be observed in pressed specimens were entered in the field notebook along with other related information. The voucher specimens are deposited in the UHF herbarium in the Department of Forest Products.

Spiti has only two seasons – short lived summer and a long freezing winter. As a result of survey and exploratory studies conducted in Spiti, the vegetation was found to be sparse, discontinuous and scattered, clearly showing the rugged landscape with brown and barren rocks, but at the same time most varied and attractive owing to the dry alpine nature. The vegetation is dominated by coarsely shaped bushes majority of which form spinescent cushions. The stunted forms, twisted and bent nature of stem, succulence, wooliness, perennation, by underground parts, cushiony and matted habit and strong root systems are the characteristic features of the vegetation of this cold desert area.

A total of 477 species covering 218 genera belonging to 50 families were recorded. Asteraceae is the most cosmopolitan and largest family (72 species) followed by Fabaceae (43) and Poaceae is placed third with (34 species). Of these, 23 families are monogeneric and 11 families are monospecific. Various ecological niches revealed that tree species account for only 1.89%. Most important ones are: *Juniperus macropoda, Populus balsamifera, P. nigra, Salix viminalis, S. elegans, Betula utilis* and *Hippophae* at places. Shrubs account for 49 species (10.27%). Important species are *Rosa webbiana, Hippophae rhamnoides, Myricaria germanica, Salix flabellaris, S. fragilis, S. hastata, S. lindeleyna, Juniperus recurva, J. communis, Ribes orientale, Lonicera obovalata, Rhododendron lepidotum, Ephedra gerardiana, Colutea nepalensis, Capparis spinosa etc.* The herbaceous elements (both annual and perennials) account for 431 species (86.58%). Herbaceous element is dominated by members of pea family *i.e.* Leguminosae followed by Asteraceae and Boraginaceae. Among monocots members of Liliaceae are prominent and grasses are sparse and scattered. Plants prominently found include *Cicer microphyllum, Lindelophia stylosa, Allium carollianum, Hyoscyamus niger, Cousinia thomsonii, Caltha palustris, Thermopsis inflata, Rumex nepalensis, Oxyris digyna, Crepis flexuosus, Aconogonum tortuosum, Lepidium latifolium, Nepeta podostachya, Plantago depressa, Eriophyton wallichii, Lamium rhomboideum, Aquilegia fragrans, Codonopsis ovata, Chenopodium foliosum, Bistorta affinis, Taraxacum officinale, Geranium wallichianum, Lactuca macrorrhiza, Hyssopus officinalis, Cymbopogon jwarankusha*, several species of *Artemisia, Potentilla, Chaerophyllum, Astragalus, Chesneya, Oxytropis,*

Gentianella, Gentiana, Pedicularis etc. The parasites and saprophytes were only 6 (1.26%) and mainly include *Orobanche, Cuscuta* and *Boschniakia.*

Out of the identified species, 74 have been categorized as medicinal and aromatic plants. Among the plants of commerce and known medicinal importance mention can be made of *Ephedra gerardiana, Artemisia brevifolia, Arnebia euchroma, Onosma hispidum, Rheum australe, R. moorcroftianum, Hyoscyamus niger, Corydalis govaniana, Gentiana tianschanica, Thymus serpyllum, Dactylorhiza hatagirea, Heracleum candicans, Allium carolinianum, A. rubellum, Bergenia stracheyi, Malva rotundifolia, Tanacetum nubigenum, Hyssopus officinalis, Achillea millefolium, Traxacum officinale, Betula jacquemontii, Juniperus communis, Rhododendron lepidotum* and *Physochlaina praealta.* All these can be commercially exploited on systematic basis for pharmaceutical industry. Salix trees and shrubs (Changma, Lagma and Goo) form the main fodders for the cattle. *Lonicera spinosa, Caragana gerardiana* and *Ephedra gerardiana etc.* along with roots of perennial herbs are used as fuel wood and heaps of these shrubby species can be seen piled on the thatched house roof in each household.

During the study, it was revealed that 103 plant species are of ethnobotanical importance *i.e.* used by local inhabitants in their daily life for curing of various ailments. *Thermopsis inflata* (Lamo) is used in ascites-to remove water from the body. The flowers of *Astragalus grhahaminus* (Chhichhar, Khilla) are used in fevers and insanity. *Convolvulus arvensis* (Marshi) is used as detergent to wash clothes. *Saussurea obvallata* (Pangchi) bracts are used in cough and respiratory problems. The twigs of *Cassiope fastigiata* (Gangachu) are used for inducing suppuration (Puss formation) in boils. *Delphinium vestitum* (Changuathpa) is used in diabetes in combination with other herbs. The roots of *Bergenia stracheyi* (Gatikpa) are used as massage to cure joint pains and body swellings. Flowers of *Aquilegia fragrans* (Lundud dorje) are used in leucorrhoea and diabetes. *Thymus serpyllum* (Pangdum, Padumba) is used in stomach problems and as flea repellent. Its dried leaves and flowers are used as condiments. The floral parts of *Hyssopus officinalis* (Tengu) are used as substitute for saffron in Tibetan medicines useful for fevers and blood related diseases. The extract of the wood of *Fraxinus xanthoxyloides* (Pipjul) quite bitter in taste is given orally in bone feature after tying the affected organ with wooden pieces in proper position. *Ferula jaeschkeana* (Kati) is reported to labour mushrooms under it in Pin Valley. The plant is used as a mulch and organic manure in the fields. It is also utilized as mulching with *Lindelophia stylosa* (Shuara) and Khamet (*Arnbeia euchroma*) in cattle shed to produce organic manure for the agricultural field in crops like wheat, barley (2 types), buckwheat, peas, potatoes, mustard and off season vegetables. Recently introduced fruit crops are apple and apricot.

As a result of survey and exploratory studies conducted in Spiti, the vegetation was found to be sparse, discontinuous and scattered, clearly showing the rugged landscape with brown and barren rocks, but at the same time most varied and attractive owing to the dry alpine nature. Pin valley is comparatively greener and richer in vegetation. The main cultivated crops include wheat, barley (2 types), buckwheat, peas, potatoes, mustard and off season vegetables. Recently introduced fruit crops are apple and apricot only. The only green patches soothing to the eyes are available around the villages with cultivated fields and hay lands. Thick forest patch of *Hippophae* existing in Mane village, a tree size *Myricaria* in Gue and dilapidated *Juniper* patch near Gue and Kaa loops reminds us of the past forests and the present day destruction by biotic interference.

Spiti provides ample water and land resources in a typical environment. If these are properly harnessed and plantation programmes judiciously executed with the close co-operation of the people, time is not far off when the valley can boast itself as the unique biosphere reserve on the land. Being close to nature, people make maximum use of herbs for meeting their daily needs and curing themselves from various diseases. Their system is very close to the Tibetan Medical System.

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Collection of Plant Genetic Resources from Parts of Arid and Semi-Arid Regions in India

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Between 1980 to May 2001, 68 major explorations comprising 48 crop/region specific and 20 multicrops, were carried besides 13 minor ones in the states – Gujarat, Haryana, Rajasthan and adjoining areas of Madhya Pradesh, Punjab and Uttar Pradesh (Chandel and Bhandari, 1989; Chopra and Bhandari, 1989; Dwivedi and Bhandari, 1995, 1996, 1999; Dwivedi *et al.,* 1994, 1997, 1998). Of these collection trips, 25 major explorations were jointly carried out with National/International Institutes (Central Arid Zone Research Institute, Jodhpur; Central Institute for Jute and Allied Fibres, Barrackpore, W.B.; CCS Haryana Agricultural University, Hisar and its Agricultural Research Station, Bawal, Directorate of Pulse Research, Kanpur; ISCRISAT, Hyderabad; University of Hyderabad; Indian Institute of Horticulture Research, Bangalore; Gujarat Agricultural University, Main Rice Research Station Navagaon; Kheda, Wheat Research Staton Vijapur, Mehsana; National Research Centre for Arid Horticulture, Bikaner and Rajasthan Agriculture University, Agriculture College, Jobner. Six

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