GRAIN AMARANTHS IN THE HIMALAYAS

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Periodic attempts have been made to trace the history and origin of grain amaranth by different research workers but still very little is known. Some more information on Amaranthus hypochondriacus L., A. cruentus L. and A. caudatus L. has been added based on published work and folklore information gathered in India. There are approximately 25 species of Amaranthus available in the Asian region. Four Sanskrit names (Rahadri, Rajagiri, Rajashakini and Tandulya) are available in the old literature. The fossil records of pollen have been documented in several excavations in India from Holocene and late Pliestocene periods. Enormous genetic diversity and concentrations of the crop in the Himalayan region unlike peninsular India, its uses and prohibition in different rituals, large number of vernacular names of medicinal and culinary preparations and the amount of genetic diversity in grain amaranths as observed in Himalayas would indicate the greater likelihood of spread of the crop in India from that region in eighth century. Their direct and indirect evidences of the antiquity of the crop in India suggested that possibly grain amaranths were prevelent in south Asia from time immemorial.

Amaranth is one of a few economic plants of great food value bestowed by nature, with multiple uses. This is a favourite of poor masses who sustain for their food on marginal lands. It is highly nutritious and has a capacity to wipe out malnutrition in the third world (Anon. 1984). The organoleptic taste of leaves and grain food products has been found to be excellent (Grubben and Sloten, 1981). Grain amaranth can withstand adverse weather changes particularly severe moisture stress, thereby showing better potential (Joshi and Rana, 1991). It can be grown in diverse agro-climatic conditions, high rainfall areas to as low as 400 mm per year from sea shore to high altitudes and is most suitable crop for sustainable agriculture (Joshi, 1991).

In view of its great economic and nutritional importance coupled with wide adaptability, the National Bureau of Plant Genetic Resources, Regional Station, Shimla initiated collection, evaluation during the past two decades and consequently over 3,000, collections were made from wide agro-ecological regions of Himalayas as well as from exotic sources. Based on studies carried out on the germplasm survey and collections from Himalayan region from 1979 to 1991, some more information on history of grain amaranth and their ethnobotany has been discussed.

DOMESTICATION OF THE SPECIES

The origin of various species of cultivated amaranths is not easy to trace because the wild ancestors are pantropical consmopolitan weeds. Amaranths are presently cultivated as pseudocereals in both old and new world. The regions of origin and domestication of the grain amaranths were once controversial. However, Sauer (1950, 1967) has presented several lines of evidence, pointing to the New World as the Centre of origin and domestication. Working independently, Hungiker (1952) arrived at the same conclusion. The three grain amaranth species, i.e., Amaranthus hypochondricus, A. cruentus and A. caudatus were domesticated prehistorically in the highlands of tropical and sub-tropical America. However, the crop has declined to a vanishing relic in its home land as more amaranth grain is now produced in Asia, especially in India, than in the Americas. According to Sauer (1967), amaranths were widely distributed through the temperate and tropical regions of the world before man domesticated them or converted some of them into cosmopolitan weeds. Sixty species were native to the New World and about 15 to the Old World and Australia. Most of them were pioneer annuals of naturally open habitats; mountain and desert canyons, river banks, lake shoes, tidal marshes, and ocean beaches. Producing abundant seed, widely dispersed by water and birds, they survived by constant colonization of sites with disturbed soil, full sun and little competition, long natural selection for such a way of life; preadapted certain of the species for survival in habitats which were drastically disturbed by man. The domestication of amaranths for use as pot herb took place only in Asia (Sauer, 1967). A variety of cultivated races assigned to A. lividus and A. tricolor which are common pot herb in eastern and southern Asia have been subsequently introduced into New World. A. tricolor might have originated in India and have spread to neighbouring countries, by traders, Buddhist monks and Muslim invaders.

In his 1950 survey of the history and classification of grain amaranth Johanathan Sauer suggests a number of areas in the ancient literature of the old world which have not been searched for evidence of grain amaranths. Ames (1939), Vavilov (1949), Darlington & Janaki-Ammal (1945), Merril (1950), De Candolle (1983) and Hooker (1985), based on several observations, concluded that grain amaranths have been cultivated in South Asia from time immemorial and probably originated there. A. hypochondriacus and A.caudatus are the two main species grown throughout the prevalent regions of Asia stretching from Manchuria, interior of China and across the Himalavas upto Afghanistan and Persia (Atkinson, 1891). The 10th Century records of grain amaranth in China (Sauer, 1950) provide some evidence of its great antiquity in Asia. Grain amaranths have been introduced to India's Malabar Coast by early Portuguese traders from Brazil (Merril, 1945) after 1500 A.D or probably may have been introduced from China through land route. However, observations on the history, distribution, crop diversity, fossil records, Sanskrit names, large number of vernacular names, a variety of uses and ethnobotanical evidences etc. suggested that grain amaranths have probably originated the Himalayas, may have co-evolved as in maize, or simultaneously originated at more than one sites.

TAXONOMY

In India, ten species of Amaranths i.e. Amaranthus tricolor, A. dubius, A. melancholicus, A. gangiticus, A. hypochondriacus, A. cruentus, A.caudatus, A. spinosus, A. hybridus and A.retroflexus are found. Including Australia, there are 25 species occurring in this region of Old World as against a total of 60 species found in the New World (Willis, 1973). Taxonomically all the grain amaranths cultivated in the Old World are indistinguishable from those cultivated in the New World. Not only in terms of species but also in terms of sub-specific entities, the available Old World specimens represent nothing but a small sample of diversity present in the American grain amaranths. The entire Asiatic pot-herb group is easily distinguishable from the grain group by a few important characters, such as number of stamens, number of tapels, and shape of the tapels. Few of these Asiatic species are even superficially similar to the grain amaranths, for one thing none of them has a branched terminal inflorescene (Sauer, 1950).

While classifying the germplams collected from wide agro-ecological regions of Himalayas, Joshi (1981) observed that the present taxonomical grouping is inadequate. It needs further detailed studies because introgression and aneuploidy in the natural populations have played a crucial role to generate a taxonomic complexities in the genus.

DIALECTUAL NOMENCLATURE

There are atleast twenty vernacular names given to grain amaranths in different parts of India, viz, ramdana in Bihar; rajgira in Deccan; rajgara in Gujarat; anardana in Eastern Uttar Pradesh; chuka in Bengal; kalaghesa, chumera and ganhar in Central India; kelabagi and rajagira in Maharashtra; kiyan in Kerala; bustanfrej in Kashmir; seol, chaulai and sil in Northern plains; bathu in Shimla; siriara in Kullu; tulsi, dankar and kalji in Kinnaur; chua in Kumaon hills and marchu in Garwhal Himalayas (Singh and Thomas, 1978; Joshi, 1983) indicating its great antiquity, ancient association and popularity in the tribal culture of India. The grain amaranth is locally known as Siriara in Kullu valley of Himachal Pradesh. This may have a similarity with the word Sierra Madra Occidentale of Mexico or from Sierra Norte of Peru which is abundantly found in the tropical highland of Mexico and in the Andean region of Peru (Hauptli, 1979 and Nabhan, 1979) or vice-versa. Likewise the vernacular name chua in the Kumaon hills of Himalayas has got a similarity with the word Chihuhaa of Mexico where roughly 65 per cent of the northern Tephnan families are still cultivating A. hypochondriacus (Nabhan 1979) or *Quecha*, the name applied to cultivated amaranth in Peru (Kalinowski, 1987). In some parts of Nepal, it is called murcha, similar to marchu in Garwhal Himalayas in India.

In Chinese and Manchurian mountain regions, amaranth seeds are locally called *Tien-Shu-Tzi*, i.e, millet from heaven.Likewise in India the grain amaranth is locally called *ramdana* i.e, seed sent by God (Anon., 1984). This indicates its very ancient associaton with the culture of the Asian people.

ANCIENT MIGRATIONS AND RECORDS

Fossil records of amaranth/chenopod group of pollen have been observed from several areas in India (Sukko-tada in Gujarat and Diamabad in Maharashtra) from Holocene and late Pleistocene period. *Amaranthus* spp* recorded in Harappan civilization (Posschlo, 1982) also confirms its antiquity in the Indian subcontinent. On certain religious occasions and on fast days, grain amaranth was the only permitted food for consumption by the people (Singh, 1961; Joshi, 1981). Its use during *Shradha* (ritual ceremony to mark death anniversary) is prohibited in India; the custom is usually practiced by higher castes.

Johannessen and Anni (1985) discovered that grain amaranth being used in Bhutan as the main ingradients in *tormas* (ceremonial conical shaped figures of dough) which are made once a year on the celebration

^{*}The fossil records of pollen as evidence of antiquity of grain amaranth cultivation appear to rather indirect in view of the difficulty in distinguishing grain amaranth pollen from vegetable amaranths and also from chenopods.

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of Guru Pamasambhava (who is thought to have introduced Buddhism to Bhutan from India in the 8th Century at a monastery called Gomkhora in eastern Bhutan) can be considered as an indication of the introduction of amaranth from India to Bhutan.

USES

The green leaves when tender are used as vegetable. The tender stem is used in vegetable curry like drumstick. The grains after roasting and sometime grinding are used in different culinary preparations, such as sweet porriadge (kheer), pudding, chappati, sweet ball (Ladoo), Parantha and crisp Pakora in Himalayas, Alcoholic drinks is also prepared from fermented seeds. The crop is grown on the border of maize field to ward-off bird damage to maize cob (due to colour effect of red inflorescence types). When rock boulders are heated with the smoke of dried stem of amarnath and the decoction of horsegram, it is considered to break big rocks just like explosives. In certain areas of Himachal Pradesh (Radhu, Khanag, Kullu, and Pangi), the grain stocks are used for meat and apple fruit preservation for 4-6 months. It is reported by them that the meat remain fresh for one and half month and becomes more tastey whereas apples remain farm fresh for 4-6 months when merged in grainbins of amaranth. Amaranth is considered delicious, nutrititous and sumptuous food when mixed with finger millet flour in Uttrakhand Himalayas.

Its food and medicinal uses were indicated since the ancient vedic civilisation (Shastri, 1961). It has been mentioned that the grain amaranth leaves and seeds are laxative, soporfic and narcotic, and improve appetite, useful in biliousness, kapha. The plant is used for purifying the blood, and in piles, and also diuretic in strangury. It is given in scrofula and applied topically on scrofulous sores. Behari et al. (1986) reported that the species A. viridis is used as a pot herb and in treating snake bites. In Tamil Nadu and Kerala hills, the tribals use stem and leaf juice of A. spinosus in the treatment of kidney stones. In Uttarakhand Himalayas, people consider that the grain helps in curing the measels in children by bringing down the body temperature when they sleep over the spreaded grains on the bed. In Himachal Pradesh, it is considered that the decoction of grains is very effective in treatment of foot and mouth diseases of animals. However, excessive feeding of amaranth green to the cattle is crusidered to cause mouth and tongue ailment.

MIGRATION TO HIMALAYAS AND OTHER REGIONS IN INDIA

In the 6th Century A.D when Arab started invading India via Kashmir and Gujarat state, the simple, religious and non-violent people

from Gujarat, Rajasthan, Maharashtra and Madhya Pradesh started migrating to the safer and holy places and eventually took refuge in the Himalayas where they permanently settled. It may be emphasized that the present set-up of Kumaon including Carhwal Himalayas is a result of immigration of different people during the mediaeval period (Atkinson, 1974). The Chamba region of the Himachal Pradesh is the richest of all the epigraphical remain beginning from the 6th century A.D down to the last century (Ahluwalia, 1988). Another important copper plate has been found in Nirmand (Kullu) dating 6th century which was issued by Maharaja Samudrasen of Kullu (Hutchisen and Vogal, 1933). While some of the people returned to their native place and probably they must have brought with them the seeds of grain amarnath as food from Himalayas. In Mehsana area of Gujarat state, it is still cultivated as one of the staple food crop and grown extensively. Since amaranths grow vigourously, resist drought, heat and pests and have a high reproduction rate (one plant produces more than 50,000 to 1,00,000 seeds and adapts readily to new environment), they got established in rest of the Indian region by way of pilgrimage. In the 9th century with the establishment of the holy shrine in North-west Himalayas by Adi Guru Shankaracharya, regular pilgrimage to these remote inaccessible areas increased. A large number of devotees visiting holy places from different parts of India needed food for long period of time and journey on foot which sometime took more than a year to and frd. People took amaranth seeds with them while returning. Since it is easy to carry and process, and a dual purpose crop used both the green and grain and the only permitted food for those who observe fast, its demand by devotees increased which probably promoted its intensive cultivation in the Himalayas and its marginal diffusion in rest of the country.

VARIABILITY AND CONCENTRATION IN HIMALAYAS

A great deal of variability and concentration of the crop is found in the Himalayas (Jain *et al.*, 1979; Joshi, 1981) unlike in peninsular India, particularly the coastal regions. This does not support the views of its sea route introduction by Portugueese, (Merril, 1954). The amount of diversity in the crop with regards to plant height, branching behaviour, inflorescene shape, size and colour spiny and glabrous nature of bracts, lateral and terminal spiklet, branching pattern and their size, seed shape, size and color (7 forms) generated in the crops in Himalayas itself speaks of its long and ancient cultivation, (Joshi, 1983). The occurrence of 15 species of amaranth in Asia and 10 species particularly in the Himalayas together with the amount of genetic diversity observed in the Himalayas would indicate the origin, and the greater likelihood of spread of the crop in India and other Asian countries, from this region rather from coastal part of India and from New World.

COMPARISON OF COLLECTION AND EVALUATION

A comparison of grain amaranth in India (Joshi, 1981, 1991) and in Central America (Hauptli *et al.*, 1979; Nabhan, 1979) indicate close similarity in the cultivated species distribution, evolution, variation pattern, cultivation practices and grain uses in two widely seperated geographical regions of the world (Table 1). It has already been mentioned that grain amaranths (*A. hypochondriacus* and *A. caudatus*) were under cultivation in Old World before 1500 A.D (Singh, 1961; Joshi, 1983). This may indicate the independent and parallel origin and evolution of grain amaranth in Himalayas as well as in Central America in ancient time.

CONCLUSION

On reviewing the history of grain amaranths in Old World, it was observed that there are four Sanskrit names available in the literature (Kirtikar and Basu, 1918; Shastri, 1941). The fossil records of pollen have been found in several digs in India from Holocence and late Pleistocene period (Posschlo, 1982). There are approximately 25 species of *Amaranthus* available in the Asian region (Willis, 1973) with great deal genetic diversity in the Himalayas (Joshi, 1983). Its uses and prohibition in different rituals in India and Bhutan indicate its ancient association with culture of the people of Asia. Twenty vernacular names given to the crop in the Indian region, association with large number of uses of various culinary preparations and in medicines confirms ancient existence of the crop in this region. The migration and settlement of simple and religious people in the Himalayas in 6th century (The Malana village in Kullu district)* from the west coastal region and central part of India are the indirect evidences throwing a great deal of light on its independent origin than of pre 1500 A.D. introduction in Old World. Parker (1986) studied the ancient Hindu, Arabic, Chinese and Persian literature in order to find pre 1500 A.D. written evidence of grain amaranths in the Old World. In China, a book called Ku Chin T'u Shu Chi Ch'en, Vol. 65 by Ting-hsi Chiang in 1964 cites the historical reference which list

^{&#}x27;An old villager of a remote village Malana in Kullu (Himachal Pradesh) revealed to the author that his ancestors led a nomadic life and carried with them the roasted seeds of grain amaranth locally collected from wild habitat. Some of the seeds undoubtedly were scattered and amaranth became established as a crop in one locality, now called Malana. Considering the place a holy one, where the roasted seed lot germinated, they permanently settled (probably in 7th century) and gave up their nomadic life style. It appears that some of the unpopped seeds (which were not damaged) got germinated. Grain amaranth in the village has remained till today as their most chrished staple food.

	parison of distribution pattern and crop characteristics in grain amaranth from Himalayas and central America	New World Old World & South America Himalayas	Distributed all the way from foot to Distributed all the way from foot to high hills high hills	Distributed in foot hills to mid hills Distributed in foot hills to mid hills comparatively less adaptable to that of A humohmdriacus	Confined to high hills indicating confined to high hills succific physiological adaptation	Found in the population of amaranth Found in Himalayan region in rare frequency field, rarely distributed (Hauptli, 1979) (Joshi 1981) showing similar evolutionary trends.	Seven seed colour types were collected seven seed colour types were collected from by Hauptli, (1979) from Central and Himalayas (Joshi, 1981) South America	Similarity in inflorescence colour Variation in inflorescence and other plant parts	variation and other plant parts quite comparable (Joshi, 1983) (Nabhan, 1979 and Hauptli, 1979).	Rare occurrence of non-circumscissile Rare occurrence of non-circumscissile utricles in the utricle in the population collocted by Joshi, 1981 from Hauptli, 1979 from Central and Himalayas	Mixed cropping with maize and French Mixed cropping with maize and French bean bean which may have close ecological common practice in Himalayas indicating relationship generally follwed in ecological relationship Central and South America
•••	Table 1. Com	Distribution pattern, crop characteristic & cultivation	I. Species A. hypochondriacus	A. cruentus	A. caudatus	<i>Sp. novo</i> (A new genotype close to <i>A. edulis</i>	II Crop characteristics Seed colour	Inflorescence colour were		Hard threshability	III Cultivation pattern

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uses of amaranths (Xian/Jian). The Yiching a book on geometry written in the 1st century B.C. uses the term Xian/Jian (amaranth). During Sung Dynasty (1101 A.D.), a book called the *Tu-ching pent t'sao* written by Shong Su about herbs mentions medicinal uses of herbs and the amaranth is cited in it. The Chinese sources clearly need further search and the reference cited by Sauer for the 10th century is very significant.

In India, *Garuda Purana* (roughly dated at around the 5th B.C) refers to *Tanduliya* and *Palankya* amaranth types which are anti-toxic and the *Brahmanda Purana* (which can be dated around 700-1000 A.D) states that 'all flowers equipped with sweet scent and beautiful fragrance are excellent. So also with *nadis* (Long tubes) as well as the yellow amaranth flowers.' In the *Sushrata Samhita* (5th B.C.) and Indian medicinal text which was originally written about two centuries before the birth of Buddha lists *Tandula* and *Tanduliyaka* as names for *Amaranthus* species. This book also lists *marisha* as the name of amaranth. Thus, the views of Merrill (1954) may not be tenable keeping in view the aforesaid observations and support. The views of the De Candolle (1833), Hooker(1985), Ames (1939), Vavilov (1949), Darlington and Janki Ammal (1945) that the grain amaranths have been cultivated in the South Asia from time immemorial and probably would have originated in the Himalayas may have to be upheld after further studies.

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