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Contributions to Research on Native Mexican Plants of Economic Importance in Northeast Mexico

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Abstract

The author states a salient out lines of research advances on various aspects of native plants in Northeast of Mexico and high land of Puebla. The native plants studied are Cactus, Mexican plant fibres, medicinal plants, wild fruit tree, wild edible plants such as chile piquin, wild species of Brassica, and Phaseolus, wild maize, and timber yielding plants. The investigation gives the comprehensive idea not only on the composition of the plants, but also information on the individual characteristics distinctly different.

1. Introduction

Native plants, since remote times, play an important role in our society for its utility for various uses such as food, medicine, edible plants, fruits, timber, sources of fibres and other uses. Researchers have been directed mostly on the ethnobotany and utility of various native plants. During 25 years of working as professor and research scientist in 3 universities, the author undertook researches on several native plants in various aspects which mentioned below in brief. The present article summarises salient research results on various native plants of Mexico and giving references on each aspect separately at the end.

2. Cactus

Cactus is a dominant flora in desertic environment with beautiful flower. In Mexico many cactus species are endangered now having more or less 850 species. Research on cactus species is rare. We undertook research on few aspects such as morphology, dermal anatomy, floral morphology, phenology, seed structure and propagation of many species of cactus from seeds using novel technique.

Stuies have been undertaken morphology and anatomy of some cactus species adapted in high land valley of Puebla, Mexico and on comparative morphology and anatomy of six species of Astrophytum (Maiti et al., 2003), dermal surface comparison between some species of Cactaceae and its possible relation with adaptation to arid conditions (Maiti et al., 2002), floral biology of three species of *Mammillaria* (Maiti et al., 2002), floral morphology and phenology of few species of Cacyaceae (Maiti et al., 2003), studied variability in seed viability of seven species of Cactaceae in reserve biosphere of Tehuácan-Cuítlan, MexicoA novel technique for the germination and propagation of four species of *Astrophytum* (Cactacae) (Maiti et al., 2002).

We studied Visnaga (*Echinocactus platyacanthus* Link and Otto)-an endangered gigantic cactus: morphology, distribution, germination and crop management. (Maiti et al., 2002). Propagation and conservation of cacti (including endangered, rare and vulnerable) in high land valleys of Mexico (Maiti et al., 2002), studied propagation, conservation and creation of a germplasm bank of Cactaceae at the seedling stage in a green house nursery (Maiti et al., 2002). The nvel technique used to induce seed germination is described in different publications. It includes sowing the seeds on soil surface in tray covered with organic matter and moist soil and exposing the seeds with 16 hours light by fixing the incandescent tube

light on the top of the trays covered with polythin sheet. Cactus seeds requires 16 hours continuos light for inducing seed germination, light induces phytochrome on seed testa to convert to green cour. This technique is being efficiently used in the propagation of large number of cactus species in a cactus green house in high land of Puebla green house (Maiti, R.K., Baquie-Leal, A., Olguin-Tellez, L.P., Sanchez-Arreola, E., Wesche-Ebeling, P., Lorenzo-Tovia, J.L., 2002). Using the simple technique in a growth chamber we propagated 200 cactus species. This technique can be efficiently utilized in the propagation ofr endangered cactus species in desertitic regions of many countries. We presented varius references to support our claim. Most of the papers are published in Crop Rsearch, Rsearch on Crops. Besides we published a book on cactus biology, propagation and conservation (Maiti et al., 2003). To our knowledge, such a comprehensive study on various aspects of Cactaceae is not available in the literature.

3. Mexican Fibre Plants

In arid and semiarid regions of Mexico, *Agave lechuguilla* and *Yucca carnerosana* are the main sources of fibres for various domestic and industrial uses such as rope, baskets, mattres, etc. baand source of income for arid land farmers of Mexico. In the case of *Agave lechuguilla,* the poor arid land farmers work whole day with his family to harvest the central "cogollo" (central whole of young leaves with the help of sharp curved knife, they collect the central cones in a bag and store them under trees. Then they extract the fibres by hammering with stone and knife finally to liberate bunch of fibres from the leaf tissue. At present some farmers use machine to scrape off the fibres from the leaves. Working whole day one can harvest about 5 kg fibres which can sell at a price of 20 Mexican peso, a low price. This is the main source of income apart from rearing goats and cattle. After cutting off the central cone, the plant cannot grow and die in the long run. Thereby over-exploitation of *Agave lechuguilla* could leaf to extinction in the long run if proper care in the propagation and management practice is adopted. Ecept few dasonomic, distribution of this species in arid lands of Mexico, little research inputs is given on this over-exploited species of great economic importance.

Besides *Agave lechuguilla, Youca carnorosana* is another important source of fibres. The farmers cut of the top of the tree completely and extract the fibres by hammering with stones and sharp knife. After cutting off the top the plant loses its capacity to regenerate and killed ultimately, thereby over-exploitation of this fibre called ixtke could lead to extinction in the long run. No attempt is made for efficient management and propagation of this species is undertaken, although the seeds are easy to germinate (in our study). Similar to that of *Agave lechuguilla*, very little research is undertaken on this plant except dasonomic and distribution aspects.

In Northeast of Mexico we undertook a number of research inputs on various aspect on *Agave lechuguilla* and *Yucca carnerosana* and few minor fibre such as *Agagave asperima*. This has been accomplished through theses at bachelor, masters and doctorate levels and publication of research papers in journals. Barron Razo (1987) in his bachelor theisis studied the growth and development of the fibre of *Agave lechuguilla* and *Agave asperima*, (Trel) Mckelvey (Yucca), in Mina Nuevo Leon, Mexico. Biolgy Faculty, UANL, Mexico. A study has been made on quantitative description of morphoanatomical characters and productivity of lechuguilla (*Agave lecheguilla* torr.) (Agavaceae), Villa de Garcia, Nuevo Leon, Mexico. (Maiti et al., 1990). Maiti et al. (2004) studied germination and seedling development of *Agave potatorum* Zucc.

Maiti et al. (2002) studied distribution, ecology and botany of Agave spp. Maiti et al. (2004) n undertook a review on. *In vitro* micropropagation of Agave and a few plants of economic importance Studies have been undertaken on distribution and biometrical analysis in seven localities in Mina by Lozano Maldonado (1988), general morphology, growing condition and development of fibre filaments in Agave lechuguillla (Maiti and de la Riba, 1995). Maiti et al. (2005) described fibre cell characteristics of some *Agave* and other species of arid zones in Mexico Maiti et al. (2005) studied the effects of different light-temperature treatments over germination responses and seedling development of some *Agave* spp. Villareeal made exhaustive studies in her Master and doctoral thesis and published papers on the distribution, biometry, productivity and growth and development of fibre filaments in *Agave lechuguilla* and also in *Yuca carnerosana*, mentioned below:

Villarreal Rivera (1988) studied in her Master theis on the actual use, biometry of vegetable of vegetable fibres with special reference to Agave lechuguilla, the development and structure and productivity in Mina. Subsequently Villarreal, and Maiti (1991) undertook study on morpho-anatomical characteristics and productivity of *Agave lecheguilla* Torr., en Nuevo Leon, Mexico.

Villarreal et al. (1991) estimated the productivity of the fibre of Agave lecheguilla Torrey, in seven localities of Mina, Nuevo Léon, Mexico Later Villarreal-Rivera et al. (1994) studied the growth and dvelopment of the fibre filaments in the leaves of *Yucca carnerosano* (Trel.) McKelvey. It has been reported that the young fibre cells are derived from procambial cells situated at the base of Agave lechuguilla which grow longitudinally and join end to end through leaf mesophyll and finally joined to together to form strong spine at the tip of the leaf No such detailed studies on Agave lechuguilla and Yuca carnerosana are available in the literature.

4. Medicinal Plants

Since remote times medicinal plants play an important role to alleviate various diseases in rural villages as well as in urban cities in Mexico. The knowledge on ethnomedicine is inherited from generation to generation. There is great necessity to recover the ethnic knowledge which is disappearing gradually. Significan research advances have been attained on ethnobotany, medicinal uses, anatomical characterization, pharmacognosy and phytochemistry of Mexican medicinal plants. We have undertaken similar studies through thesis students and published several papers.

Several studies have been undertaken on ethnobotany and medicinal usesof plants, Olivares Ipiña (1990) studied medicinal used of 12 species of medicinal plants (Compositae) in Nuevo León: selected medicinal plants (Maiti et al., 2003), and Ethnomedicine of Cuetzalan, Puebla (´Mexico) (Sánchez-Arreola et al., 2003); (Maiti et al., 2003) studied ethnobotanical study of 17 medicinal plants in Puebla city and Cholula.

Phramacognosy deals with morphological, anatomical and histochemical characterization of medicinal plants. Few studies have been undertaken on ethnobotany and pharmacognosy of several medicinal plants. such as Oliveres Ipina (1990) on 12 medicinal plants of the family Compositae of Nuevo Leon, Castillo Velazquez (1990) studied ethnobotany, pharmacognosy of medicinal plants used in diabetes in Cadeyryta, Nuevo Leon. Plantas con valor potencial hipoglucemico de uso tradicional en Nuevo Leon: Maiti et al. (2000) studied on pharmacognosy, histochemistry of 17 medicinal plants. Later (Maiti et al., 2002) studied on on pharmacognosy of ten species of the faqmily Solanaceae utilized in traditional medicine. Sánchez-Arreola et al. (2002) studied on pharmacognosy and phytochemistry of two Mexican plants, "Gordolobo" (*Bocconia frutescens* L.) (Papavaraceae) and "Candelaria" (*Ipomoea bracteata* Cav.) (Convulacae). Subsequently Sánchez-Arreola and Maiti (2002) reported therapeutic properties, botany and chemistry of Mexican arnica (*Heterotheca inuloides*). Sanchez-Arreola et al. (2002) made a review on medicinal uses and chemistry of some species of *Agave*: In addition Sanchez-Arreola, and Maiti, (2003.) made a review on therapeutic properties, botany and chemistry of *Origanum majorana*.

In another study, Sanchez-Arreola et al. (2003) undertook morpho-anatomical characters and secondary metabolites of agave "mezcalero" (*Agave potatorum*). Subsequently in another study Sanchez-Arreola et al. (2003) made a comparative preliminary study on the phytochemistry of *Ipomoea murucoides* and *Ipomoea arborescence* (Family Convulaceae) of common use in Cholula, Puebla and other region of Tehuacan, Puebla, México. Later Sánchez-Arreola et al. (2005) reported traditional Uses and the phytochemistry of nine medicinal plant species of common use In high land of Puebla and Tlaxcala, Mexico.

5. Wild Fruits

Crataegus spp. (Hawthorn), called as "Tejocote" is an edible fruit eaten specially during christmass ceremony in Mexico. It is also a timber yielding plant. Rsearch on this wild edible fruit plant is rare. Gutiérrez-Lobatos (1996) in his doctoral thesis is worked on varaibility in the morphological and anatomical characteristics of diverse accessions of *Crataegus pubescens* (HBK) Steud. Rosaceae and its probable adaptation to diverse environmental conditions.

Gutierrez-Lobatos et al. (1999.) made a review on *Crataegus* spp. (Hawthorn). Gutttierrez-Lobatos et al. (1998) reported that there exist variability of leaf surface ultrastructure in *Crataegus pubescens* accessions and its probablee relation to the mechanisms of adaptation to diverse environmental condition. There exists a large variability in morphological characteristics of leaves and fruits among accessions of *Crataegus pubescens* (HBK) Steud (Foroughbakhch et al., 1999).

6. Wild Edible/Potential Crop Plant

During more tan 25 years stay as professor and research scientists in 3 universities in Mexico I directed my research on various wild edible plants of potential crop such as wild chilli,: Chile piquin: sunflower, *Brassica, Sysibrium, Amaranthus* spp. mentioned below in brief.

6.1. Wild chilli: Chile piquin

Gonzalez, C.O. et al. (1991) reported edible plants in the Municipality of Matehuala, S.L.P., Mexico. Chile piquin (*Capsicum annuum* var. *aviculare*). Chile piquin is an edible condiment of high comercial and medicinal values in Mexico. It has high demand and expoeted with high Price to the neighbouring country, U.S.A., Canada and other countries/ Oeing to the presence of dormancy this cannot be grown in the fields. The local farmers collect the chillies from their wild habitat in the forest grown undern tree shades. We worked on different aspects of chile piquin starting from distribution, botany, anatomy, dormancy breaking germination, nutritional anf few aspects of physiology.

Almanza et al. (1994) reported Chile piquin (*Capsicum annuum* var. *aviculare* of high food value. Almanza (1994) studied in his bachelor theisis on ethnobotany, morphology, anatomy and productivity of chile piquin. Maiti et al. (1999) studied the morphology and anatomy of the wild chili chile piquin (*Capsicum annuum* L.) var aviculare. Maiti et al. (1997) investigated seed coat ultrastructure and a method for inducing rapid germination of the wild chili "Chile piquin" (*Capsicum annuum* var. *aviculare* D And E., Solanaceae). Keeping the

seeds in the refrigerators at 4 °C mixed with the extracts of cowdung for 7 days following by sowing on soil at lower depth break seed dormancy and induce germination of chile piquin. This technique is utilized to propagate chile piquin and grow in the field. Teran et al. (1994) studied photosynthesis of chile piquin. Cárdenas et al. (1997) made in vitro tissue culture of wild chili "chile piquin" (*Capsicum annuum* var. *aviculare* (Dierb.) D'Arcy and Esbaugh): an alternative method for propagation.

Sánchez-Arreola et al. (2003) investigated some aspects on nutritional values and preliminary phytochemistry of Mexican wild chilli "Cile Piquin" (*Capsicum annuum* var *aviculare* Dierb.) (D and E). Recently we studied various aspects of physiology of chile piquin starting from ecology, distribution, pigments, water potential, few micro and macronutrients of chile piquin (IJBSM in press).

6.2. Amaranthus spp.

In Nuevo Leonm Northeat of Mexico, few species of Amaranthus such ad Amaranthus viridis, A. retroflexus, A, palmerigro in wild condition but not consumed by Mexican although these species are cultivated in Asian countries as nutritious vegetables. We investigated different aspects of these *Amaranthus* sp. Such as ecological conditions, distribution, taxonomy, morphology, anatomy, microsporogenesis, growth and nutritional values for their potential values ad edible plants. Gonzalez A., M. (1991) in his Master thesis in Botany studied taxonomy and epidermal tissues of few species of the family Amaranthaceae. de La Cruz, F (1990) in his bachelor thesis studied floral structure and microsporogenesis of of 5 species of Amaranthus. enesis de 5 especies de amaranthus del centro de Nuevo Leon. Biologo, 1990.

Sosa Alvarado (1989) in his bachelor theisis studied growth and development of wild *Amaranthus* spp. Iof Nuevo Leon. Subsequently Maiti et al. (1991) on three papers described few aspects of Amarantus spp. In Nuevo Leon. 1), (ecology and botany, 2) growth pattern and distribution, description and morpho-anatomy. Gonzalez, D.I. et al. (1992) estimated antinutritional factors such as nitrate, oxalates of 4 species of *Amaranthus* and found no antinutritional factors in these species and therefore recommended as edible vegetables. Finally Wesche P. Ebeling and Maiti, R.K. (1995) reported the botany and nutritional value of some wild Amaranthus species (Amaranthaceae)

6.3. Wild sunflower (Helianthus sp) sunflower

Maiti et al. (1991) reported wild species of sunflower (*Helianthus annus* L.) as an alternative of Green fodder for cattle.

6.4. Wild Brassica

In Nuevo Leon, wild species of *Brassica* (*B. campestris, B. juncea*) grow, We undertook few studies on these two species. Alanís-Guzman et al. (1995) undertook chemical, nutritional and functional characterization of proteins extracted from wild mustard (*Brassica campestris*, Brassicaceae) seeds from Nuevo Leon, Mexico. Garza Saenz, O.G., 1991. Studied some aspects on ecology, methods of domestication and effects of photoperiods of *Brassica juncea*.

Besides Flores Sifuentes (1998) in his bachelor thesis studied morpho-anatomy, phenology of *Brassica campestris* L. And *Sisybrium irio* L. (Cruciferae) in urban áreas of Monterrey, N.L. Later, Maiti et al. (2003) investigated phenology and nutritional values of wild species of *Brassica campestris* L. and *Sisumbrium irio* L. (Cruciferae) in the semiarid regions of Monterrey, N.L., Mexico.

6.5. Wild Phaseolus

Few species of Phaseolus grow in semiarid regions of Monterrey, Nuevo Leon. Moreno Limón undertook few studies on some aspects of wild species of Phaseolus. Moreno Limó (1993) in his bachelor theiss is studied morpho-anatomy, ecophysiology and few aspects of biochemistry of wild Phaseolus. Subsequently Moreno et al. (1994) investigated morphology, ultrastructure and mineral contents of the sedes and seedling development of 5 wild species, one semi-cultivated and one cultivated Phaseolus species. Wild species contained high amounts of proteins compared to those of cultivated species, the later contained high amount of strch grains. Moreno et al. (1994) undertook a review on morpho-anatomy, physiology and biochemistry of wild and cultivated species of Phaseolus.

6.6. Wild maize

Maiti et al. (2002) investigated differential response among native "criollo" and hybrid maize cultivars for tolerance to SALT stress at the germination stage: Later Maiti et al. (2003) studied variability in nutritional values of grains of maize "Criollo" Compared to those of maize hybrids.

6.7. Timber yielding plants

Maiti et al. (2001) reported utilisation of non-timber forest resources in Mexico. Foroughbakhch et al. (2000) described seed morphology and ultrastructure of eight native shrubs and trees of northeastern Mexico. Foroughbakhch et al. (2000) developed techniques of germination and growth potential of some fuel wood species in northeastern Mexico Rodriguez Gonzalez, (1989) made a comparative study of secondary xylem of 15 species of the family Leguminosae, M. Estudio comparativo del xilema secundario de 15 especies de la familia Leguminosae. Saenz Montemayor (1999) in his bachelor thesis

studied Wood anatomy of 12 species of Pinus. Seel-Ruiz (1995) in his Master theisis studied variability in morpho-anatomy of the leaves and wood anatomy of nine species of Eucalyptusin South of Nuevo Leon. Later Steel Ruiz et al. (1999) undertook microscopic and ultrastructural variability of leaf surface of *Eucalyptus* spp. and its possible relation to the semiarid environments. Subsequently Steel-Ruiz et al. (1999) made a comparative anatomy of the secondary xylem of Eucalyptus spp. and its possible relation to wood quality.

7. Bioliography

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