INTRODUCTION
CHAPTER – 1
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Homegardens can be considered an integral part of human civilization, right from the stage humanity learnt agriculture, and human beings transformed from the hunters and food gatherers to the status of permanent settlers. Practice of home gardening may be as old as that time and in later period homegardens might have become a regular feature of rural landscape due to their potential for local subsistence, food security and nutrition, for providing much needed variety in daily food, and their contribution to household income in some cases.

In ancient Indian literature, frequent references can be found regarding presence of gardens surrounding homes full of fruits and flowers bearing plants. Various visitors to India, such as Ibn Batuta, have also mentioned about the elaborate presence of homegardens in rural areas (Randhawa, 1980). Classical literature like Abhijan Shakuntalam, Geet Govindam, Ramayana, and Mahabharata and several other religious and classical texts depict frequent references to homegardens.

Systemic research interest in homegardens started somewhere in late forties with some studies on Javanese homegardens in Indonesia but these efforts remained relatively unnoticed till late seventies, when many studies on homegardens in Java drew attention of researchers towards their role in increasing food production and reducing malnutrition in tropical countries. This international interest in study of homegardens was further accentuated in eighties by their being recognized as a typical example of multi-storeyed agroforestry systems (Kumar and Nair, 2006).

Homegardens appear to have developed independently in the Indian subcontinent, Indonesia and other parts of Southeast Asia, the tropical Pacific islands, the Caribbean, various parts of tropical Latin America and Africa (Brownrigg, 1985 and Landauer and Brazil, 1990), and “can be found in almost all tropical and subtropical eco-zones where subsistence land use systems
predominate” (Nair, 1993). Homegarden forms a dominant and promising land use system in many parts of the tropics. Though exist widely, particularly in rural areas, homegarden is not a well understood traditional ecosystem in the world.

Homegardens have been defined by several workers from time to time; however some of the important definitions are described here to understand the central meaning of the word.

Homegardens have been defined as an assemblage of plants, which may include trees, shrubs and herbaceous plants, growing in or adjacent to a homestead or home compound, planted and maintained by members of the household, and their products are intended primarily for household consumption, and ornamental value (Michon et al., 1983; Singh, 1987; Soemarwoto, 1987; and Landon-Lane, 2011). Homegardens have also been called homestead farms, maintaining high level of productivity and stability (Michon et al., 1983; Thaman, 1988, and Soemarwoto and Conway, 1992). Homegardens have also been identified as species-rich agroforestry systems maintained on the basis of choice, needs and importance of plants, these represent a traditional land use practice around a homestead where several plant species are maintained by the members of the household and their products are intended primarily for household consumption (Shrestha et al., 2001). Within a very small area one can find a combination of trees, shrubs, vegetables, root crops, climbers, grasses and herbs that provide food, spices, medicines and construction materials. Physiognomically, homegardens exhibit a multi-tiered canopy structure somewhat similar to that of tropical evergreen forests. Domestic animals are often integrated into the system too (Reinhardt, 2005). Homegarden is a place of agricultural experimentation in which all the family participates (Chavero and Roces, 1988).

Another way of looking at the homegardens is as “a small scale, supplementary food production system by and for household members that mimics the natural, multi-layered ecosystem” (Hoogerbrugge and Fresco,
Two basic components of traditional homegardens are proximity to houses and a diversity of plants, the latter well adapted to the local environment and serving multiple purposes (Ninez, 1987).

The homegarden definition developed at the workshop organized by IPGRI (International plant genetic research institute) in October 1998, on ‘Contribution of homegardens to in-situ conservation of plant genetic resources in farming systems’, was: ‘A multi-story, multi-species, multi-use small scale land-use systems, in particular ecosystems, that are for the immediate needs of household members primarily as regards their food, health, fuel and spiritual requirements.’

Homegardens, including the domestic, kitchen and dooryard gardens, have a long tradition in many countries, although their structure, function, species composition and management vary throughout different regions of the world (Fernandes and Nair, 1986).

The traditional homegardens as a climax ecosystem, where ecological succession is consciously manipulated by human beings, with high intensity of vertical and horizontal space use, and with the highly dynamic chronological structure and the capacity to perform essential ecological processes make this ecosystem relatively sustainable (Jose and Shanmugaratnam, 1993).

Studying and analysing various homegarden definitions, an elaborate definition of homegardens was suggested as ‘integrated tree-crop-animal production systems, often in small parcels of land surrounding homesteads, and primarily found in tropical environments’ (Kumar and Nair, 2006). These agro-forestry systems, developed and nurtured by farmers through generations of innovation and experiment, are often cited as the epitome of sustainability, yet have been long neglected by the scientific community. Today, however, these age-old systems are receiving increasing attention owing to their perceived potential to mitigate environmental problems such as loss of biodiversity and rising levels of atmospheric CO₂, while providing significant economic gains, as well as food and nutritional security to their owners. There are several
definitions for homegardens but the most appropriate for tropical regions is that it is a multi-layered species rich agro-forestry system (Christanty, 1990).

The structure, composition, function and species diversity of homegardens have been greatly influenced by the changes in socio-economic circumstances and cultural values of the users of these homegardens. The understanding, of these factors and the ways they change according to the behaviour and decision making patterns of the users of the homegardens, is important for conservation of plant diversity. Deliberate management of multipurpose plants species including annual and perennial varieties give economic viability to rural homegardens. The plants are intensively managed by family labour (Fernandes and Nair, 1986).

Some studies on the role of family members in homestead agriculture pointed to women being the main participants in homegardens. Home gardening is a respectable way for women to contribute to subsistence production and manifest specialized knowledge and skill without competing with man (Howard, 2006).

Rural homegardens have a strong role in women emancipation and empowerment as these provide an excellent opportunity to women folk of the rural households to effectively contribute to family income and food and nutrition sustenance, increasing their importance in family and resultant improvement in their status. An understanding of the role of women in homegarden management within a traditional farming system is important in expanding and improving the practice. Participation of women in homegarden management activities may result in improvement in women’s income and livelihoods, further improving women’s awareness of homegarden-oriented activities that support conservation of natural resources.

Women may be naturally involved in homegarden management-related activities and interested in conserving homegardens because they obtain such substantial benefits as food security, income, health care, and environmental benefits. Realising the need of homegardens due to all these benefits the
women folk can be a motivator for homegarden conservation, motivating husbands, children, and neighbours to conserve the agro-biodiversity of homegardens. Increased involvement of women in a broad range of homegarden management activities is not only beneficial for their own socio-economic well-being, but also imperative for sustaining the livelihoods of their communities and for preserving the agro-biodiversity in homegardens.

In tropics, agricultural practices are seasonal, particularly in India, where monsoon rains decide the duration of cultivation of crops, homegardens help in spreading the need for labour inputs more evenly seasonally, thus enabling fruitful utilisation and retention of labour throughout the year. They can also be a potential solution to prevent migration of rural labour in search of employment to urban areas. Family members can be gainfully employed in homegardens during their spare times without change in their main occupation, if any. The technology involved in homegardens is simple, labour intensive, and requires little outside technical or financial support. Trees in homegardens are important assets for the marginal farmer because of their low investment cost, rapid growth and appreciation, economic viability, flexible harvesting time and are an important source of income during unforeseen contingencies.

Homegardens have been claimed as land-use options that increase resilience and reduce vulnerability of contemporary rural societies and are fundamental to livelihoods improvement and adaptation to climate change. Homegardens may have better resilience to climate change and continued contribution to household food security under adverse conditions as well, due to their characteristic micro-management dynamics. The type of employment, age, sex, education level of household head, experience in farming, homegarden size, diversity of homegardens, and perceptions towards climate change alongwith manageable size of homegardens may influence the decision of homegardeners to adopt different strategies such as, changes in— planting dates, agronomic practices, and technology (use of new varieties and irrigation equipment, use of soil and water conservation measures), to cope up with
climate change. Their wide-spread adaptation in rural areas may potentially support livelihoods improvement through simultaneous production of food, fodder and firewood as well as mitigation and adaptation to climate change. Apart from this, rural homegardens also contribute to biodiversity conservation; yield of goods and services to society; augmentation of the carbon storage in agro-ecosystems; enhancing the fertility of the soils; and providing social and economic well-being to people.

Burgeoning population, necessitating expansion and intensification in agriculture practices, is resulting in further depletion of the natural resources, such as forests, soil etc., already at the precarious situation. Homegardens save agricultural lands from degradation resulting from intensive agriculture and maintain or increase site productivity through nutrient recycling and soil protection. Besides providing food, nutrition and other benefits discussed above, homegardens are good source of raw materials, like compost etc., to traditional agriculture. A well-managed homegarden practice can be vital for reversing the trend and promoting the ecological balance of the country.

The homegarden agro-ecosystem is closer to the natural ecosystem in structure and functions due to its species composition and diversity, garden architecture in time and space, recycling of natural resources like nutrients and water, and low dependence on energy subsidies.

Homegardens have numerous varieties of plant species in a unique multi-storey vertical structure composed of usually four to five layers of canopies, right from herbs, shrubs, climbers, and small and large trees. In their horizontal expanse also they have myriad variety of diverse species spread out strategically, taking maximum advantage of natural resources like sunshine, soil nutrients, and moisture. Also, wide variety of plant species suitable to various weather and climate conditions can be grown and harvested throughout the year. All this may result in more output value from land than other methods of agriculture, if various management practices in vogue in various agro-climatic conditions can be studied and optimised locally. Structure of
homegardens varies from place to place depending upon the socioeconomic and ecological conditions (Soemarwoto, 1987). Species diversity in tropical homegarden is reported to be very high due to species having different life forms, height and canopy structure (Babu et al., 1982 and Soemarwoto and Conway, 1992). Distribution of species in home garden creates a multi-storey structure (Singh, 1987).

Homegardens can also be considered as mini-ecosystems supporting a variety of species and genetic diversity. These gardens in villages are economically viable as they are not only an important sources of flowers, fruits, vegetables and medicines but are also an important means for ex-situ conservation of a wide range of plant genetic resources.

As traditional agro-forestry systems that are ecologically and sociologically sustainable, the structure and composition of homegardens depend both on their position in the overall farming system and on livelihood strategies of the managers. Rural transformations result in changes in livelihoods and systems, and have impacts on homegarden function and composition (Wiersum, 2006).

Considerable research attention during the past three decades (Wojtkowski, 1993), has been drawn towards homegardens mainly due to the following reasons: (i) they contain characteristics which make them an interesting model for research and the design of sustainable ecosystem including efficient nutrient cycling, high biodiversity, low use of external inputs and soil conservation potential (Torquebiau, 1992 and Jose and Shanmugaratnam, 1993), and (ii) homegardens have been shown to provide a diverse and stable supply of socio-economic products and benefits to the families that maintain them (Christanty, 1990).

Over 6000 species of medicinal plants are found in India and form the basis for traditional medicine that is a major source of health care for 65 percent of the population (WHO, 2002). Nearly 90% of the medicinal plants are sourced from forests. At present, the farming of medicinal plants is small
scale, scattered, and largely informal. Given the increasing global population and consequent rise in demand for medicinal plants, one strategy option is to regard medicinally important species as underutilized crops. However, unsustainable collection is becoming a growing trend primarily because of increased market pressures. Therefore, medicinal plant conservation is vital not only for the health of ecosystem, but also for India’s 4635 ethnic communities, history, and culture (UNU-IAS, 2012).

Recognising the potential of homegardens in the conservation of fast diminishing population of medicinal plant species, United Nations Development Project in association with Ministry of Environment and Forest, Government of India, has launched a project under which over 12000 home-herbal-gardens are to be set up in Chhattisgarh with the help of Traditional Healers Association to reduce health expenditure, promote traditional knowledge, and also demonstrate an exemplary model of ex-situ conservation. Traditional rural homegardens can be a promising opportunity for conservation and propagation of medicinal and endangered plant species.

Dual role of production and ex-situ conservation of medicinal plants to overcome their dwindling supplies and threat of extinction from natural sources is possible by the homegardens. Medicinal plants in homegardens are either deliberately cultivated or they come up spontaneously. Homegardens offer an economically and socially viable option for large-scale production of phyto-chemicals from important medicinal plants under organic cultivation (Rao and Rao, 2006).

Homegardens are important sites of ex-situ conservation as well as places for introduction and maintenance of many of the exotic plants and in accordance with the convention of biological diversity, investigation of such areas can help in the identification and conservation of plant diversity, while assessing the sustainability of the system.

The state of Chhattisgarh is endowed with about 22 varied forest sub-types existing in the state. In view of extremely rich bio-cultural diversity in the
state and dependence of forest dwellers for their health requirements on medicinal plants the Government has declared Chhattisgarh as an ‘Herbal State’ in July 2001.

Accordingly the Chhattisgarh Forest Policy has specially provided for evolving a feasible mechanism for in-situ/ ex-situ conservation, domestication, propagation and non-destructive harvest of medicinal plants with the active help and support from local people including traditional healers and vaidyas. Role of homegardens in cultivation and conservation of local medicinal plants can be important and must be systematically studied to take maximum advantage of rural homegardens.

About 10% of world plant species have been estimated under threatened categories of plants including the endangered, vulnerable and rare by the International Union for Conservation of Nature (IUCN). Botanical Survey of India has undertaken an extensive survey of the flowering plants in many states and many plant species have been listed in the red data book. In the Conservation Assessment and Management Prioritization (CAMP) workshop held at Bhopal (2003) to assess the threat status of prioritized medicinal plants of Chhattisgarh, 47 medicinal plant species were assigned the Red List status of near threatened and above. Rural homegardens can be a viable site for conservation of endangered plant species. In fact, many studies have reported existence of such plant species in homegardens. However, systematic efforts to create awareness about the possible extinction of species and some incentives to their cultivation in homegardens will be required before increasing land costs, allure of cash crops, and rapid urbanisation of remaining rural habitats take their toll.

Thus, to protect and propagate the existing individuals of the red listed species, efforts to improve awareness about the status and importance of red listed species are urgently required.

Despite various reported advantages, homegardens rank quite low in the economic calculations as the marketable surplus produced by them is quite low.
Lower economic returns are forcing many farmers to shrink their homegardens and make space available for more remunerative mono-crops. The process of modernisation includes a decrease in tree/shrub diversity, gradual concentration on a limited number of cash-crop species, an increase in ornamental plants, gradual homogenization of the homegarden structure and an increase in use of external inputs (Peyre et al., 2006a). Traditional homegardens are subject to different conversion processes linked to socioeconomic changes to the point of them becoming irrelevant or even extinct (Kumar and Nair, 2004). This change is principally attributed to an increase in the importance of socio-economic factors (e.g., commercialisation) over time, with a decrease in the importance of agro-ecological characteristics (Kehlenbeck et al., 2007). For example, many agro-ecological characteristics, such as low fertility, can be altered with technologies, such as the application of fertilizer. Various scientists have voiced concerns that socioeconomic changes and related adoption of modernised managerial systems cause a negative conversion process of homegardens (Jose and Shanmugaratnam, 1993; Santhakumar, 1996, John and Nair, 1999a). Studies reinforce the general fear of the loss of traditional characteristics of homegardens and their gradual demise into cash crop production systems (Peyre et al., 2006b).

Species composition, structure and function of homegardens may be influenced by ecological, socio-economic and cultural factors such as distance from the urban market, household size and composition, environmental degradation, family tradition and the influence of tourism (Lamont et al., 1999).

Rural homegardens are also facing challenges due to pressure of market demand and commercialization. Recent trends in agrarian structure and the high market orientation are exerting pressures on the homegarden, and continuation of its sustainability as a human ecosystem (Jose and Shanmugaratnam, 1993). Even the government policies to promote cash crops like rubber monoculture by offering special price and other incentives are a major factor threatening the
sustainability of the homegarden as a climax system with high species diversity.

Spread of urban areas into village areas is also putting pressure on the ecology of homegardens. A study of multistoried village gardens in the vicinity of Bogor (West Java, Indonesia), showed their being affected by effects of urban growth and resultant high population increase and the rise of a market economy (Michon and Mary, 1994). Some gardens tend to specialize in commercial growing of fruits or of export crops; others are colonized by houses and associated homegardens, completely changing the ecology of homegardens (Hoogerbrugge and Fresco, 1993).

Kumar and Nair (2004) in a review of research of last 25 years on homegardens commented that the tropical homegardens, one of the oldest forms of managed land-use systems, are considered to be an epitome of sustainability. Although these multispecies production systems have fascinated many and provided sustenance to millions, they have received relatively little scientific attention. The objective of their review was to summarize the then state of knowledge on homegardens with a view to using it as a basis for improving the homegardens as well as similar agro-forestry systems. Description and inventory of local systems dominated the ‘research’ efforts on homegardens during the past 25 or more years. The main attributes that have been identified as contributing to the sustainability of these systems are biophysical advantages such as efficient nutrient cycling offered by multispecies composition, conservation of bio-cultural diversity, product diversification as well as non-market values of products and services, and social and cultural values including the opportunity for gender equality in managing the systems.

With increasing emphasis on industrial models of agricultural development, fragmentation of land holdings due to demographic pressures, and, to some extent, the neglect or lack of appreciation of traditional values, questions have been raised about the future of homegardens, but such concerns
seem to be unfounded. Quite to the contrary, it is increasingly being recognized that understanding the scientific principles of these multispecies systems will have much to offer in the development of sustainable agro-ecosystems. Research on economic valuation of the tangible as well as intangible products and services, principles and mechanisms of resource sharing in mixed plant communities, and realistic valuation and appreciation of hitherto unrecognized benefits such as carbon sequestration will provide a sound basis for formulating appropriate policies for better realization and exploitation of the benefits of homegardens.

Review of homegardens of Southeast Asia has emphasized need for necessary interdisciplinary research (Anderson, 1979). The ecology of the homegarden (size, composition and spatial distribution, food-web, and functions) should be investigated. The work on Socio-economic status of the homegarden and evaluation of the energetic efficiencies, ecological/economic effectiveness, production and utilization of homegarden products should also be carried out.

Several researchers (Kumar and Nair, 2006; Kabir and Webb, 2008a and 2008b, and Huai and Hamilton, 2009) have emphasized on the need of extensive research on homegardens due to their potential for natural-resource use in perpetuity, biodiversity conservation, gender equity, social justice, environmental integrity, appreciation of indigenous knowledge, preservation of cultural heritage, and so on. While systematic studies on the role of homegardens in many of these contemporary issues have not been done, there is a long-held belief and intuition that homegardens score very high on most, perhaps all of these so-called “intangible” benefits. Logic, circumstantial evidences, and limited empirical results that are available support these conjectures; but certainly more convincing evidence based on rigorous research is needed (Kumar and Nair, 2006).

Although homegardens provide sustenance to millions of households in the tropics, their underlying scientific foundations have not been fully explored
and therefore they are not a part of development agendas. In the wake of recent trend towards commercialisation and consequent conversion of homegardens to produce market oriented crops, concerns have been raised about the future of traditional homegardens (Nair, 2006).

In India homegardens have been studied in Kerala (Jose and Shanmugaratnam, 1993; Mohan et al., 2006, and Peyre et al., 2006a), Karnataka (Shastri et al., 2002), Port Blair (Bandhopadhyay, 1998), Andaman and Nicobar (Pandey et al., 2002, 2006 and 2007), Assam (Saikia and Khan, 2011; Saikia et al., 2012), Das and Das, 2005, 2013 and Devi and Das, 2010 2013), Northeast (Sahoo, 2009; Sahoo et al. 2010; Tangjang and Arunachalam, 2009; Tynsong and Tiwari, 2010; and Zimik et al., 2012), Pachmarhi, Madhya Pradesh (Kala, 2010).

However, no reference to any study or research on homegardens in Chhattisgarh could be located by the author. In Chhattisgarh, most of the houses in the villages have homegardens, locally known as Badi. A large variety of plants are grown in these homegardens even though no systematic studies have been made to understand these homegardens and to investigate the diversity of plants in these homegardens. Homegardens are a treasure trove of plants species used in traditional home remedies and herbal medicines all over the world and this can be very well true for Chhattisgarh as well.

Rural homegardens also act as repository for medicinal and endangered plants but no data is available for medicinal and endangered plants species diversity in the homegardens of villages of Raipur district of Chhattisgarh and their traditional medicinal uses. There is a risk of losing this treasure of traditional knowledge with erosion of traditional culture and values and hence there is urgent need to study and put on record the diversity of plant species found in rural homegardens of this area and their various use values.

Kumar and Nair (2006) have studied the global distribution of homegardens. Their attempt is based on the geographical distribution of 135 selected studies based on the specific geographical locations; and not
surprisingly in India, homegarden studies have been shown only to be mainly undertaken in Kerala and Northeast India. So far, not many investigations have been made in central India including the Chhattisgarh region. Looking to the rich tradition of homegardens in Chhattisgarh, it is imperative that research studies should be undertaken to discover various intricacies of practice of home gardening in this resource rich region. Rural homegardens in Chhattisgarh are a common feature of village households and have an important place in rural economy and culture. However, no systematic studies on the rural homegardens of Chhattisgarh could be located in the various research references.

Looking to the widespread presence of Badi (homegarden in local parlance), a common feature of rural household in Chhattisgarh and their important role in providing food, nutrition, home remedies for various ailments, rich plant diversity, socio-economic benefits, it is high time that a systematic study on various aspects of rural homegardens in Chhattisgarh should be undertaken to further understand and optimize these functions. Possibility of these homegardens as the important host to endangered plant species should also be investigated and explored.

In order to understand the structure and function of these homegardens, it is necessary to study the socio economic and biophysical aspects of these systems. As a step in this direction, present study was planned to study the diversity and species composition, various use values of the plants species, including their medicinal values, possible presence of endangered plant species, and their role in conservation and protection of ecology in homegardens of some villages of Raipur district with special reference to medicinal and endangered plants.

The present study has recorded the contemporary status of rural homegardens in Chhattisgarh, their layout and structure, the plant diversity and use value, presence and use of medicinal plants, presence of endangered plants. The outcome of this study will help in generating an understanding about the
home gardening systems as practiced by rural people in Raipur district as well as in the country and its various advantages, it will also provide a baseline data for further scientific studies.

**Objectives of the present study:**

The main objectives that the proposed study aimed to undertake were:

1. To study the socio-economic status of homegarden owners.
2. To study the socio-economic and environmental benefits out of homegardens to the rural people.
3. Documentation of practices adopted by homegarden owners in homegardens.
4. Documentation of use value of plants species for homegarden owners.
5. Analysis of structure and species composition of the homegardens to understand the home gardening system.
6. To study the diversity of plants in homegardens.
7. To evaluate the diversity of medicinal plants growing in the homegardens.
8. To identify the endangered plants growing in homegardens, with reference to Red Data Book.
9. To study the distribution of plants species in homegardens.
10. To analyse the environmental factors including soil of homegardens.