This is a refereed journal and all articles are professionally screened and reviewed   **ORIGINAL ARTICLE**

Assessing the effect of Socio-economic factors on Agrobiodiversity in homegardens of Jajrood and Jamabrood in Tehran province(Iran).

[1]**Arash Ghalegolab behbahani,** [2]**Korous Khoshbakht,** [1]**Agrin Davari,** [1]**Leila Tabrizi,** [4]**Hadi veisi,** [1]**Ali Alipour**

[1]*M.Sc. Graduate, Department of Agroecology, Environmental sciences research institute (ESRI), Shahid Beheshti University, G.C. Tehran, Iran*
[2]*Associated Professor, Department of Agroecology, Environmental sciences research institute (ESRI), Shahid Beheshti University, G.C. Tehran, Iran*
[3]*Assistant Professor, Department of Horticulture, College of Agriculture and Environment, Tehran University, Tehran, Iran*
[4]*Assistant Professor, Department of Agroecology, Environmental sciences research institute (ESRI), Shahid Beheshti University, G.C. Tehran, Iran*

Arash Ghalegolab behbahani, Korous Khoshbakht, Agrin Davari, Leila Tabrizi, Hadi veisi, Ali Alipour: Assessing the effect of Socio-economic factors on Agrobiodiversity in homegardens of Jajrood and Jamabrood in Tehran province(Iran).

ABSTRACT

Due to Initiation of agriculture mechanization, utilization of supplementary energies (especially chemical fertilizers and pesticides), as well as applying improved varieties which have higher yield and more homogeneous genetics, the environment were altered to a more simple and specialized one. As a result, this circumstance, eventually, brought about simplification of agro-ecosystems, and sudden reduction in agro biodiversity. Therefore, Biodiversity conservation is one of the most crucial issues discussed in sustainable development during the last decades. Home gardens which are one of insitu conservation methods are production systems, producing crops and vegetables and are adjacent to household's location. This study was conducted to investigate the level of agro biodiversity in home garden systems as well as evaluating effective socio-economic factors on biodiversity indices (species richness and Shannon - Wiener indices) in East and Northeast areas of Tehran province through collecting questionnaire and direct interview. The results showed that, Home gardens as an insitue conservation, with high agro biodiversity in species, higher values for species richness indicator (minimum 9 and maximum 23) and Shannon index (minimum 1.9 and maximum 2.88), had more efficient in maintaining agro biodiversity, in comparison with agronomic and husbandry systems in 8 studied villages. In addition, these conservational systems were severely affected by socio-economic factors of household's life, in comparison with other systems.

Key words: Agro biodiversity, Homegarden, Sustainable Development, Species Richness Index, Shannon Index.

Introduction

Agriculture Revolution in 10 thousand years ago is considered as a turning point in human social evolution, and it seems man's contradictory interests with environment have been formed since that time. At first, because of the population balance and coordination between human functions and nature, this conflict was not obvious. However, current developments over the past two centuries particularly industrial and chemical revolution and also population explosion, led human into battle with nature, seriously [8]. Due to initiation of mechanization, agriculture along with industry went into area of mass production. On the other hand, after World War II, the use of supplementary energies, particularly chemical fertilizers developed rapidly, and afterward, the pesticides were emerged. Since the early 1950s to 1970, scientists started utilizing new technologies and management approaches in agroecosystems. In this regard, plant breeding and propagation in order to achieve proper characteristics in crops particularly in wheat, maize and rice were launched extensively. Therefore, plant breeders began to produce genetically high yield and homogenous crop varieties which were dependent noticeably on external inputs such as chemical fertilizers and pesticides. By evolution of intensified agricultural systems, merely target species were able to be survived. Consequently, it led to simplification

Corresponding Author

Arash Ghalegolab behbahani, M.Sc. Graduate, Department of Agroecology, Environmental sciences research institute (ESRI), Shahid Beheshti University, G.C. Tehran, Iran
E-mail: arash_ghalegolab@yahoo.com

of agro-ecosystems [10,6,5]. As a result, agrobiodiversity in agroecosystems started to diminish [20,4,23]. Nowadays, Biodiversity conservation is one of the most crucial issues discussed in sustainable development so that it could be considered as a prerequisite for sustainable agriculture. Moreover, Biodiversity is a vital part of a healthy and sustainable environment and so with loss of biodiversity in a region or an ecosystem, instability would be inevitable. Agrobiodiversity is the result of conscious activities of farmers, ranchers and fishermen over thousands of years. Conservation of agrobiodiversity is the assurance of its current and future existence and is a guarantee to its use by future generations [16,25,15,7,2]. Native and semi-domesticated plants play vital role in maintaining diversity in traditional agricultural systems [10]. Home gardens are considered as an important component of in-situ conservation since they contain high levels of diversity. Home gardens were defined in 2006 by Sharmila Sunwar et al as following: "production systems of different crops and vegetables which are adjacent to household location and accessible to them ". Home garden as one of the oldest land use management systems has a rich and valuable species diversity. Numerous varieties and native species as well as rare and endangered species are found in this system [24,14,18]. Over years, farmers have planted various species with suitable characteristics in Home gardens and have made it potential and actual sources for selection and domestication of plant species [9,1]. Richness of Home gardens and its sustainability have made it an appropriate approach for in-situ conservation; furthermore, it can promote household's income over time [22]. This study was conducted in Jajrood and Jamabrood county of Tehran province, in order to assess the situation of agrobiodiversity in Home gardens and investigate the importance of these systems in protecting of plant species. In this regard, socio-economic aspects of studied area were investigated then after the effect of these factors on agrobiodiversity indicators was evaluated. The aim of this study was estimation the biodiversity indices of Home gardens and investigating the significance of Home gardens on agrobiodiversity conservation as well as evaluating the effects of socio-economic factors on biodiversity in aforesaid systems.

Materials and Methods

Study area:

Eight villages with suitable geographic distribution were studied as the sample for regional evaluation during September 2009 until September 2010 (Figure 1). Two major regions were considered in the study: 1) The conservational area of Jajrood, 2) Region outside of the conservational area. The studied area was located at 25' and 35° to 5' and 36° North latitude and 45' to 51° and 5' to 52° east longitude. This area is affected by subtropical high pressure system during warm seasons and therefore, the amount of its rainfall is low and mainly is due to occasional passing of cold dynamic low pressure systems on the Northern slopes of the Alborz Mountains. Also in winters it is affected by Northern, Northwestern and Southwestern systems which come in Iran plateau. Arid cold, semi-arid cold and semi-wet cold climates are detectable in this area. In conservational area, two villages, Khosroabad and Siahsang, and in non-conservational area six other villages: Mara, Shamlabeh, Temisian, from Jajrood district and Maranak, Absard, and Ahran from jamabrood district were selected.
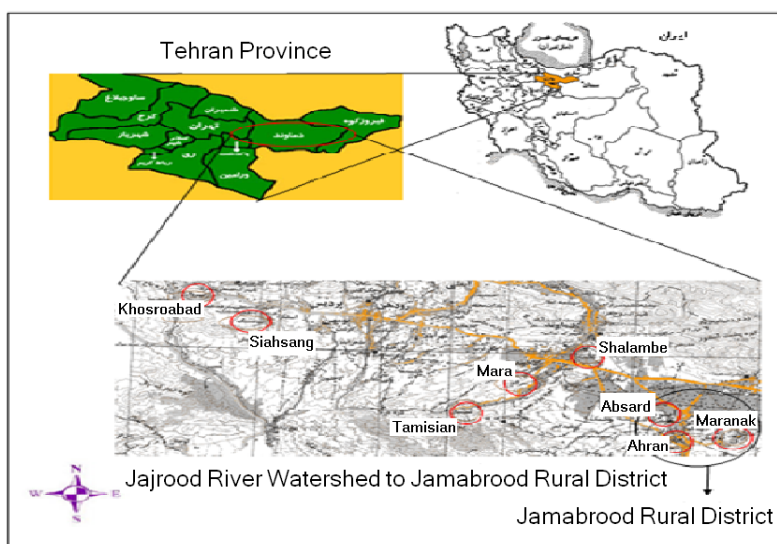

Fig. 1: Geographical status of the studied areas in the research

Data analyze:

According to literature review and related effective factors on biodiversity, the questionnaire was designed. The questionnaires were designed to assess two biodiversity indicators of Shannon-Wiener index and species richness indicator and also socioeconomic factors effective on them completed through direct interviews with farmers. Species richness degree of all Home gardens was computed after entering data on species and their area under cultivation into SPSS Version 18 and Excel version 2003, 2007. Also Shannon index for Home gardens was figured by specialized software called Ecological Methodology.

Then after using SPSS Version 18 software, the correlation of the average of every obtained factor (socioeconomic factors) from the questionnaire with agrobiodiversity indicators was calculated and its regression equation got fitted. Finally a cluster diagram was plotted to identify the difference between features of home gardens in studied villages.

Results and Discussion

Socioeconomic Situation of the Region:

In the first step of the study and data mining, social aspects of each village were studied. In this regard, results in relation to farmers' age and experience, number of household members, number of people employed in agriculture section and education level were estimated and subsequently compared. Average age in Siahsang village was 45.83 years which was the minimum value, and the largest was for Shamlabeh village by 60 years. Other important trait was the amount of farmers' experience. It was observed that farmers in Shamlabeh village had 37.7 years experience which was the most amount of experience and farmers in Absard village had 22.7 years experience which was the lowest. The average experience of farmers in Siahsang village was considered zero (0) due to lack of farmer population. Figure 2 shows farmers' level of experience and average age of them in the studied villages.
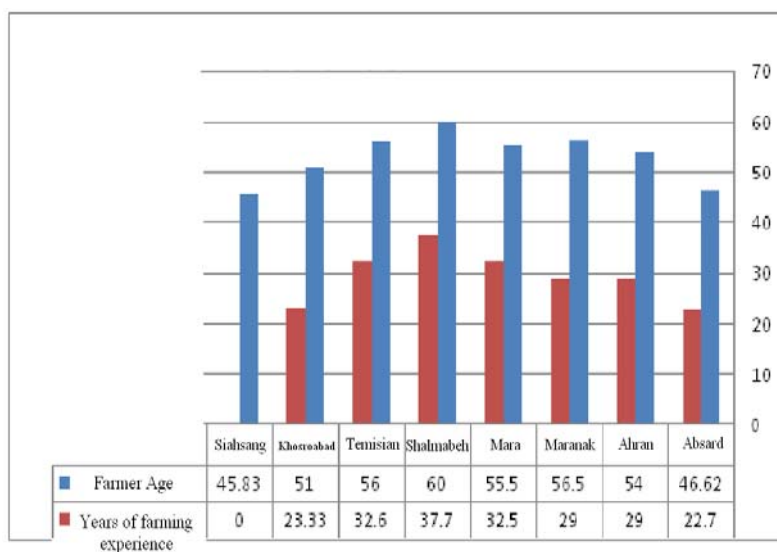

	Siahsang	Khosroabad	Temisian	Shalmabeh	Mara	Maranak	Ahran	Absard
■ Farmer Age	45.83	51	56	60	55.5	56.5	54	46.62
■ Years of farming experience	0	23.33	32.6	37.7	32.5	29	29	22.7

Fig. 2: Average age and experience of farmers

Factors such as the area of the home garden and income rate from home garden seemed to be necessary to report the situation of this small agricultural system. Average areas of 8 studied village Home gardens (Home gardens' area unit based on square meters has been measured) are demonstrated in Table (1).

Absard village and Temisian village having the average of 28 and 26 m^2 respectively, had the minimum area of Home gardens, on the other hand, the average size of Home gardens in Khosro Abad village as a representative of protected area was in fine condition compared with other villages. In

regard with vastness of Home gardens, It was just Khosro Abad village using Duncan mean comparison test at probability level of 95% had significant difference with other villages. The Average rate of income through Home gardens extracted from the questionnaires is depicted in Table (1).

In Khosro Abad village located in protected area in Jajrood there is the highest rate of home garden income. Average income from products sale has a significant correlation with home garden vastness which was significant at probability level of 99% (Table 2).

Table 1: Home gardens' average income (average for 1 year) and area

	Siahsang	khosroabad	Tamsian	Shalambeh	Mara	Maranak	Ahran	Absard
Homegarden earning	41.66$	692$	10$	41.66$	45$	19$	35$	42.23$
Homegarden area	58.33 m^2	690 m^2	26 m^2	90 m^2	39.9 m^2	68 m^2	44 m^2	28 m^2

Table 2: Regression coefficients of variables related to Home gardens

Evaluation Level	Simple Regression Variables	Regression Equation	Pearson Correlation Coefficient	Explanation Coefficient
6	Homegarden Size $\times$ Homegarden Income	$y = 1.061x - 15.718$	0.990	0.981

The number of household members and people employed in agriculture section per household is demonstrated in table 3. Low number of households' members employed in agriculture section indicates the lack of tendency in younger people to participate in this area.

Table 3: Average households' population and people employed in agriculture section

	Siahsang	Khosroabad	Temisian	Shalambeh	Mara	Maranak	Ahran	Absard
Household Population	5.33	6.17	4.6	6	5	6	5	4.23
Farmer Employed Population	0	1.67	1.2	1.5	2.5	2.5	2	1.54

Indices of Agro biodiversity in Home gardens:

Home gardens Species Richness index:

This index was calculated based on counting of the number of existing species in Home gardens for each village. It seems almost all species in farms and gardens (except species such as wheat) of studied villages are cultivated in home garden systems for consumptions of households, although it is possible that some of the products are sold. Species richness of gardens and farms in Siahsang village was almost zero, whereas in Home gardens of mentioned village high species richness was detected. It indicates that, Home gardens as a protection approach for agrobiodiversity has had an excellent performance in this area. Siahsang and Khosro Abad villages located in the protected area had high values of this index. In accordance with biodiversity The Western and Eastern studied regions of our research had better situations than the central region, i.e. Mara, Temisian and Shamlabeh villages. Home garden species richness in the studied villages is depicted in table 3.

Shannon - Wiener Index of Home gardens:

Index of species richness alone could not be an appropriate index to estimated biodiversity of an area. Several species may exist in a region system while extensive cultivation area might be allocated to the limited number of species. To resolve mentioned deficiency, in area under cultivation of Home gardens, another index called Shannon-Wiener was used, because in addition to frequency, distribution of existing species should be estimated. The rate of this index in the studied villages is shown in table 4. Shannon index of Khosro Abad village home garden in the protected area was very high that indicates in addition to high species richness, the existing species have appropriate distribution in cultivated area.

Table 4: Species richness indicator and Shannon - Wiener index of the studied villages' Home gardens

	Siahsang	Khosroabad	Temisian	Shalambeh	Mara	Maranak	Ahran	Absard
Species Richness	19	23	15	11	9	19	17	21
Shannon	2.55	2.81	1.85	1.9	1.18	2.52	2.26	2.28

At probability level of 99%, the rate of Home gardens' income has significant and positive correlation with the amount of work of women in Home gardens and also this income rate at this probability level has positive correlation with home garden age (Table 5). Also, there is a non-significant negative relationship between Shannon index in Home gardens and amount of working time in home garden. Similarly, there is a significant correlation at

level of 99% between Home gardens' income and home garden age.

Table 5: Regression coefficients of variables related to home garden

Explanation Coefficient	Pearson Coefficient	Regression Equation	Simple Regression Variables
0.752	0.867	$y = 460.6x - 988.5$	Homegarden Income × Time Working Time of Women
0.714	0.845	$y = 534.80x - 1431.7$	Homegarden Income × Homegarden Age

About Home gardens as it seemed species richness of these systems has a direct relationship with the Shannon index of Home gardens. This correlation is significant at probability level of 99%. Regarding the correlations (Table 6) it seems that younger farmers tend to use more of agrobiodiversity in home garden systems, although age of farmers and the Shannon index was not significant, but the negative correlation between age of farmers and Shannon index prove it.

Table 6: Correlation coefficients of variables related to home garden

1.Shannon	1								
2.Species Richness	0.915**	1							
3. Change of Use	0.230	0.376	1						
4.Distance from River	0.334	0.344	0.271	1					
5.Women's Work	0.082	0.173	-0.345	-0.615	1				
6. Oldness	0.577	0.602	-0.188	-0.93	0.691	1			
7.Working Time	-0.320	-0.140	-0.639	0.041	0.228	0.064	1		
8.Farmer Age	-0.487	-0.668	**-0.826	-0.023	-0.113	-0.323	0.506	1	
9.Size	0.518	0.502	-0.323	-0.253	**0.842	**0.854	0.080	-0.136	1
10.Income	0.495	0.513	-0.276	-0.275	**0.876	**0.845	0.081	-0.195	**0.995	1

Figure 4 shows difference of villages in indicators of agro biodiversity related to home garden by the cluster diagram. Despite of all differences in these villages according to their geographical location and also their location in and out of protected area, it can be seen that these villages are generally located in one cluster due to indicators of biodiversity, indicating that regardless of imposed environmental pressures and even changes and differences in management system of these systems, they have been able to be stable as a kind of in-situ conservation.
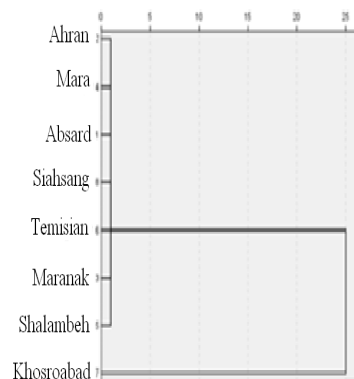

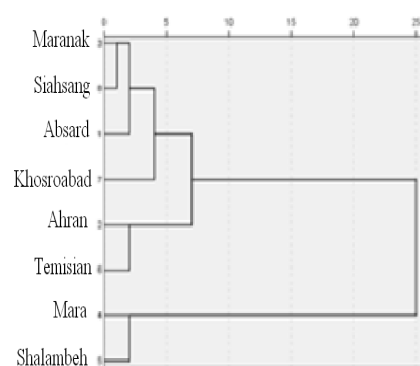Figure 3 Cluster Chart of Homegardens Overall Condition

Figure 4 Cluster Chart Variation Indicators

Existing species in Home gardens (in this study different species of vegetables have been considered as one kind of species) is shown in table 6.

	1	2	3	4	5	6	7	8
Solanum tuberosum	---	---	---	*	*	---	---	---
vegetables	*	*	*	*	*	*	*	*
Solanum lycopersicum	*	---	*	*	*	*	*	*
Cucumis sativus	*	---	*	*	*	*	*	*
Prunud domestica	*	---	*	*	---	---	---	*
Prunus Persica	---	*	---	---	*	---	---	*
Prunus armeniaca	*	*	*	*	*	*	*	*
Prunus cerasus	*	*	*	---	*	---	*	*
Pirus communis	*	*	---	---	---	---	*	*
Juglans regia	*	*	*	*	---	---	*	*
Malus domestica	*	*	*	*	---	*	*	*
Vitis vinifera	*	*	*	---	*	*	*	*
Diospyros lotus	*	---	---	---	---	---	*	*
Cerasus avium	*	*	*	*	---	---	*	*
Althaea officinalis	*	*	*	---	---	---	---	*
Capsicum annuum	---	---	---	*	*	---	*	*
Gladiolus hybreda	*	---	*	*	---	---	---	---
Syringa Vulgaris	*	*	---	---	---	---	---	*
portulaca grandiflora	*	*	*	---	---	---	*	*
Rosa Warm Welcome	*	*	*	*	*	*	*	*
Pelargonium species	*	*	*	*	---	*	*	*
Rosa damascena	*	*	*	---	---	*	*	---
Lilium longiflorum	---	*	---	---	---	---	---	---
Elaeagnus angustifolia	---	---	---	---	---	---	*	*
Chrysanthemum Indicum	*	---	*	---	---	---	---	---
Allium cepa	---	---	---	*	*	---	*	*
Lagenaria vulgaris	---	---	---	---	---	---	*	*
Solanum melongena	---	---	---	---	---	---	*	*

Table 6- Existing species in the studied villages' home garden
PLANTED (---).UNPLANTED (*).
(1)Abesard.(2)Ahran.(3)Maranak.(4)Tamisian.(5)Shalambe.(6)Mara.(7)siahsang(8)khosroabad

Conclusion:

In this study, the situation of agro biodiversity in home garden systems was determined to some extent in Tehran Northeast area, and the effect of socio-economic factors on biodiversity of these systems was evaluated, and consequently, the importance of Home gardens to agro biodiversity conservation, as a kind of in-situ protection, was determined.

In comparison with Home gardens in Western part of Nepal [19], it seems that diversity indices were higher than the area of our study. Average area of Home gardens were greater in their study, which in tropical section of Nepal was almost 470 m², and in semi-mountainous area it was 350 m², Moreover species richness index and Shannon index showed lower numbers in our study. Species richness in tropical and semi-mountainous area of Nepal showed 38 and 27 species, respectively, and Shannon index in these areas showed numbers 4 to 4.5 that was also higher than studied villages of this research. The noticeable point is that in the Nepal Home gardens which are different from the Iran's cultivation of cereals is common in these small systems that were not observed in our studied areas. There was not

significant relationship between species richness and home garden area in our study. This study reveals that the rate of household caretakers 'age and their working hours in Home gardens does not have significant relationship with species richness and Shannon indices, It was confirmed by Hashemi studies (2009), which were done on Basht county of Gachsaran city in Iran. Hashemi found that by increasing the percentage of women work in Home gardens the species diversity rate in these systems increases and also their functional role becomes more and further conspicuous. In this regard, there was no significant correlation between the time of women work in Home gardens and biodiversity indices, and on the other hand, the time of women work revealed a significant and positive correlation with the rate of income which represents the functional role of women Home gardens.

At the present, there is an urgent need to increase such studies in different parts of the country to complete information to start monitoring. Protection of the existing species is essential. Home gardens during many years have been excellent for in-situ conservation. But in areas such as Siahsang village in which farm and garden systems have been

destroyed, these small systems in addition to have functional role for households, also responsible for maintaining diversity and agricultural plant species in the area.

Home gardens due to proximity to households' location are affected by indigenous cultures of people and also could implicitly reflect the socioeconomic and cultural conditions of rural communities. These small systems with high species richness as a complement for farming and gardening systems that today have moved toward the simplified and intensified systems could protect old and valuable species which have been removed from agricultural land due to less commercial significance. Furthermore, by providing compatible and resistant native species as alternative plants, they would play an important functional role as genetic resources to support and maintain biodiversity in confronting with some problems such as pest and disease incidence or environmental stresses.

References

1. Blanckaert, I., R.L. Swennen, M.P. Flores, R.R. Lopez, amd R.L. Saade, 2004. Floristic composition, plant uses and management practices in home gardens of San Rafael Coxcatlan, Valley of Tehuacan-Cuicatlan, Mexico.Jour Arid Envir, 57: 39-62.
2. Brookfield, H. and M. Stocking, 1999. Agro biodiversity: definition, description and design. Journal of Global Environmental Change, 9: 77-80.
3. Environmental Management Plan in Jajrood Area, 2002. Environmental Protection Agency, Office of Habitat and Regions Affairs.
4. Faith, D.P., 2005. Global biodiversity assessment: Integrating global and local values and human dimensions. Global Environ. Change A., 15: 5-8.
5. FAO., 1999. REPORT: Sustainig agricultural Biodiversity and Agro-Ecosystem Functions. FAO ITALY.
6. FAO., 1998. the state of the world's plant genetic resources for food and agriculture. Food and Agriculture Organization of the united Nation. ROME
7. Harper, J., 2002 . Endangered Species: Health, Illness and Death among Madagascar's people of the forest. Carolina Academic press, Durham, NC.
8. Hilton- Taylor, C., 2000. IUCN red list of Threatened species, IUCN, Gland, Switzerland.
9. Hughes, A., and J. Stachowicz, 2004. Genetic diversity enhances the resistance of a seagrass ecosystem to disturbance, Proc. Natl. Acad. Sci., 101: 8998-9002.
10. Jackson, L.E., U. Pascual and T. Hodgkin, 2007. Utilizing and Conserving Agrobiodiversity in Agricultural Landscapes. Agriculture, Ecosystems & Environment, 121(3): 196-210.
11. Khoshbakht, K., V.H. Veisi, 2009. Protected Areas and Agro biodiversity of Plants (translated). Press and Publication Center of Shahid Beheshti University. First Edition., pp: 232.
12. Khoshbakht, K. and K. Hammer, 2005. Savadkouh (Iran)-an evolutionary centre for fruit trees and shrubs.Genet Resour Crop Evol., 00: 1-11.
13. Khoshbakht, K., K. Hammer and S. Amini, 2006. Interdisciplinary analysis of home gardens in Savadkouh/Iran: plant uses and socioeconomic aspects.Food Agri Envir, 4: 277-282.
14. Kumar, B.M. and P.K.R. Nair, 2004. The enigma of tropical home gardens. Agroforestry Systems. Kluwe academic publisher, 61: 135-152.
15. Long, J., E. Cromwell and K. Gold, 2000. On-farm management pf crop diversity: an introductory bibliography. The Schumacher center for technology and development. http://www.oneworld.org/odi/
16. Nassiri Mahalati, M.A., V.D. Koochaki, Mazaheri, 2006. Iran Agronomic Species Diversity. Biaban., 10(1): 39-42.
17. Soemarwoto, O., 1987. Home gardens: A traditional agroforestry system with a promising future. In: Steppler H.A. and Nait P.K.R. (eds), Agroforestry: A Decade of Development. ICRAF, Nairobi, Kenya, pp: 157-170.
18. Sthapit, B., R. Gautam and P. Eyzaguirre, 2004. The value of home gardens to small farmers. In: Gautam, R., B. Sthapit and P. Shrestha (2004). Home gardens in Nepal (8-17). [Proceedings of a national workshop], 6-7 August 2004, Pokhara, Nepal.
19. Sunwar, S., C.G. Thornstrom, A. subedi and M. Bystrom, 2006. home gardens in western Nepal: opportunities and challenges for on-farm management of agrobiodiversity.biodiversity and preservation, 15: 4211-4238.
20. Tilman, D. and C. Lehman, 2001. Human-caused environmental change: impacts on plant diversity and evolution. Proc. Natl. Acad. Sci. U.S.A. 98: 5433-5440.
21. Trinh, L.N., J.W. Watson, N.N. Hue, N.N. De, N.V. Minh, P. Chu, B.R. Sthapit and P.B. Eyzaguirre, 2003. Agro biodiversity preservation and development in Vietnamese home gardens. Agro Eco Environ, 97: 317-344.
22. Thomas, J.A., Telfer, M.G., Roy, D.B., Preston, C.D., Greenwood, J.J.D., Asher, J., Fox, R., Clarke, R.T., and J.H. Lawton, 2004. Comparative losses of British butterflies, birds and plants and the global extinction crisis. Science, 303: 1879-1881.

23. Watson, J.W. and P.B. Eyzaguirre. (2002). Home gardens and in situ preservation of plant genetic resources in farming systems. Proceeding of international home gardens workshop. 17-19 July 2001, Witzenhausen, Federal Republic of Germany.

24. Wilson, E.O., and Peter, F.M.(Eds.), 1998. Biodiversity. National Academy Press, Washington D.C.