Plant species diversity and present structure of roof top garden in Dhaka city

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Abstract: The study was conducted within the DAE projected 4 metropolitan area to know the structure of roof top garden and diversity of plant species contributing to food security, socio-economic importance along with the problems of roof gardening practices. Both primary and secondary data were collected with reconnaissance survey, direct observation, key informant interview, questionnaire survey and group discussions. The collected data were analyzed by using SPSS and MS Excel. The roof top garden of Dhaka city posses high plant species diversity where Shannon-Weaver diversity index was 3.84. Mango, beli, brinjal, patabahar and pudina were found most prevalent in their respective category. Inter species diversity was the highest (0.799) in the vegetable species and lowest in medicinal species (0.795). Sixty two point five percent gardeners were interested in a rising roof top garden because they think that gardening products consumption are healthy. Garden owners faced pest attack problems during gardening practices which destroyed the products severely. Manpower seems to be a problem in some houses to look after the garden; in that cases paid services should be provided to continue the gardening activities. Adequate training, motivation and sustainable management are required to encourage the city people in practicing roof top garden to improve plant species diversity elsewhere in Bangladesh.
Key words: Plant species diversity, roof top garden, Dhaka city.

Introduction

Dhaka, the capital city of Bangladesh has experienced a higher rate of urban growth in recent decades and emerged as the world's fastest growing mega city. Due to unrestrained urban growth, it will be the fourth largest urban agglomeration of the world with a population of 160.4 million (World Population Prospects, 2016). The city is considered the largest in all of Bangladesh and the overall metropolitan area is the 9th largest city in the entire world. In urbanization process, it is found that about 20 percent vegetation cover that was present in 1989 has gradually decreased to 15.5 percent and 7.3 percent in the year 2002 and 2010, respectively. Vegetation was found in the Dhaka metropolitan area is only 1.87 percent. Diversity of life in all its forms and at all levels of organization has come under serious threat in many places in recent times. Several of the global hotspots of biodiversity are at the same time areas where human population density has increased tremendously, which has contributed to current global species extinction levels paralleling to previous mass extinction events (Myers *et al.,* 2001).

Roof top gardens (RTG) are man-made green spaces on the topmost levels of industrial, commercial, and residential structures. They may be designed to grow produce, provide play space, give shade and shelter, or simply be there as a living green area. Plants are grown for a variety of utilitarian and non-utilitarian purposes (Sajjaduzzaman *et al.,* 2005). Rooftop garden can supplement the diets of the community it feeds with fresh produce and provide a tangible benefits tie to food production. Plant species diversity is a resource, property and the characteristic of plant kingdom. We depend on it for our security and health; it strongly affects our social relations and gives us freedom and choice. In this case, RTG can be an effective method to rich biodiversity which is important in maintaining the balance of nature (Hoggerbrugge and Fresco, 1993). Roof top garden can be one of the best solutions against deforestation in the cities. City's gardeners and agriculturists, however, cite yet another reason why more house owners getting keens having a patch of greenery on their roofs, which is, they want vegetables and fruits fresh and free from poisonous chemicals.

The aim of this study is to furnish the knowledge of gardening practices for improving the diversity of plant species. This paper helps to assess the contribution of RTG to meet the needs of urban garden owners. As the roof top garden technique encompass a wide variety of system and diverse array of herb, shrub, climber and trees species, this paper will attempt to find out the contribution in the conservation of precious natural resources. The finding of the paper will be directly beneficial to the garden owners as they get feedback from the research findings. The findings will also useful to all garden owners that fall in similar ecological zones to get idea for the adoption of new alternatives as roof top gardening or improving the existing practices.

Materials and Methods

Description of study area: Dhaka city situated in the 23°42′0″N 90°22′30″E which experiences a hot, wet and humid tropical climate. The city has a distinct monsoonal season, with an annual average temperature of 25 °C (77 °F) and monthly means varying between 18 °C (64 °F) in January and 29 °C (84 °F) in August. Nearly 80 percent of the annual average rainfall of 1,854 millimeters (73.0 in) occurs during the monsoon season which lasts from May until the end of September.

The survey was conducted within the DAE projected 4 metropolitan area out of five metropolitan areas in Dhaka city. The metropolitan areas are Uttora, Kamrangichor, Mirpur, Mohammadpur and Gulshan of which Kamrangichor, Mirpur, Mohammadpur and Gulshan metro were selected purposively as the locale of the study. The study was conducted by face to face interviewing of the respondents' during period from April 19, 2013 to May 5, 2015.

Population and sampling procedure: Individual households represented the sampling units. Fifty eight percent of the population are proportionately randomly selected as the sample of the study. Thus, sample size of the study was 40 rooftop buildings. Responses to open questions were collected on a variety of demographic and

socioeconomic indicators: roof garden species, choice of species, consumption access of roof garden products, and so forth. On each topic, the respondents were free to express their views.

Data Collection and Data Analysis: Reconnaissance survey was carried out before conducting the detailed data collection. The pertinent information on the subject was collected from various primary sources. The questionnaires were pre-tested in some roof garden during the preliminary survey and were finalized by incorporating the feedbacks from garden owners. The feasibility of RTG was explored through a questionnaire survey of selected public and commercial buildings. After modifying questionnaire, out of 68 garden owners, 40 garden owners (58 percent) representing male and female respondents were selected. Moreover, a focus group discussion was also organized where stakeholders were invited to discuss the prospects and problems of rooftop gardening in the city.

Total tree species and their numbers were counted species-wise with the help of garden owners in their garden using checklist. Numbers of species were counted by observing the plants in the roof top garden. The main emphasis was given on the counting and identification of plant species.

Shannon's diversity index is simply the ecologist's name for the communication entropy introduced by Claude Shannon:

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Where pi is the fraction of individuals belonging to the i-th species.

The most commonly used formula of calculating inter species diversity "Simpson index (D)" suggested by Simpson (1949) was used in this study which was as:

$$D = 1 - Pi^2$$

Where, Pi is the proportional abundance of the ith species such that, Pi = Ni/N, Ni = Plant population of ith species and N = N1+N2+N3+…+Nn where n is the number of species.

Relative prevalence (RP) of species was calculated by using the following formula: RP = Population of the species per roof garden × % roof gardens with the species. These relative prevalence values were used to rank the species in different regions.

To measure Problem Faced Index (PFI), the following 10 (ten) items were selected: (i) Lack of capital, (ii) Adverse climate, (iii) Lack of high yielding varieties, (iv) Pest attack, (v) Diseases attack, (vi) Unavailability of pesticide in time, (vii) High price of seedling, (viii) High price of tools, (ix) Lack of training facilities about roof gardening, and (x) Theft flowers, fruits, vegetables by thief.

The Problem Faced Index (PFI) for each problem was computed by using the following formula: PFI = (Pvh × 4) + (Ph × 3) + (Pm × 2) + (Pl × 1) + (Pn × 0). Where, Pvh =Percentage of garden owners who faced very high problem, Ph = Percentage of garden owners who faced high problem, Pm =Percentage of garden owners who faced moderate problem, Pl =Percentage of garden owners who faced little problem, Pn =Percentage of garden owners who faced no problem at all.

To determine comparative importance of those ten problems, PFI was computed for each of the ten problems by summing up the scores of all the respondents. Problem Faced Index (PFI) of a specific problem could range from '0' to '160', where '0' indicated 'no problem faced' and '160' indicated 'very high problem faced'.

After completion of field survey all the data of the interview schedule were compiled. Local units were converted into standard unit. Appropriate coding and scoring technique was followed to convert the qualitative data into quantitative forms. The responses of the individual garden owner contained in the interview schedules were transferred to a master sheet for entering the data in the computer. The data were coded, categorized and fed in computer and analyzed using computer software packages MS Excel and SPSS 20 versions. Quantitative data were analyzed by simple statistical tools such as frequency, mean, percentage and standard deviation and qualitative data were analyzed by ordering, ranking with descriptive manner. The impacts of various socio-economic factors such as education status, family size, surface area of roof garden, spending time for gardening (hour), training for gardening (days), input availability for gardening, management for gardening, income of garden owners, problem faced by the garden owners and the diversification of plant species with comparison of percent of plants present in roof garden and diversification present in roof top garden were analyzed by using SPSS.

Results and Discussion

Shannon diversity index: Shannon's index accounts for both abundance and evenness of the species present. The proportion of species i relative to the total number of species (*pi*) is calculated, and then multiplied by the natural logarithm of this proportion (ln *pi*). The resulting product is summed across species, and multiplied by -1. But remember that the S-W index is usually expressed as *e*H'. The Shanon diversity index recorded in the present research is presented in Table 1.

Typically the value of the index ranges from 1.5 (low diversity) to 3.5 (high species diversity), though values beyond these limits may be encountered. The result revealed that Shannon-Weaver diversity index was very high in the study area which was 3.84. Sharmila (2003) reported species diversity in Bharsa 4.03, Baikunthapur 4.25, Terai overall 4.25 and Gulmi 4.418 in home gardens in western Nepal.

Table 1. Shannon diversity index in the study area

Categories of species	Grand total of each species	Relative abundance (Pi)	LN (Pi)	Pi*LN(Pi)
Fruit	2873	0.21	-1.57	-0.33
Vegetable	4390	0.34	-1.09	-0.37
Flower	2285	0.19	-1.66	-0.32
Ornamental	2169	0.17	-1.76	-0.30

Medicinal	1532	0.09	-2.36	0.01
Grand total	13249	1	ΣPiLn(Pi)	-1.33

H'= -ΣPiln(Pi) 1.33, e H' 3.84

Inter-species diversity: Simpson index of species diversity (D) varied among the different groups of plant species. Inter-species diversity was found higher for vegetable species (0.799) in the roof garden of the study area followed by fruit species (0.798), flower (0.797), ornamental species (0.796) and medicinal (0.795) species (Table 2).

Table 2. Inter-species diversity found in the study area

Metropolitan areas	Fruit	Vegetable	Flower	Ornamental	Medicinal	Average
Kamrangichor	0.967	0.960	0.961	0.954	0.968	0.961
Mirpur	0.968	0.963	0.967	0.946	0.954	0.967
Mohammadpur	0.952	0.954	0.971	0.968	0.961	0.952
Gulshan	0.948	0.952	0.946	0.961	0.946	0.959
Average	0.960	0.960	0.960	0.959	0.960	0.960
All	0.798	0.799	0.797	0.796	0.795	-

Table 3. Relative prevalence of species in roof top garden

Sl. No.	Species local name	Family	Genus	Species	Habit	Relative prevalence
Fruit Species						
1	Mango	Anacardiaceae	*Mangifera*	*indica*	Tree	127.1
2	Guava	Moraceae	*Psidium*	*guajava*	Tree	114.6
3	Papaya	Caricaceae	*Carica*	*papaya*	Herb	113.5
4	Straw berry	Rosaceae	*Fragaria*	*ananassa*	Herb	103.5
5	Kamrangha	Averrhoaceae	*Averrhoa*	*carambola*	Tree	99.67
6	Batabilebu	Rutaceae	*Citrus*	*grandis*	Shrub	76.44
7	Kagjilebu	Rutaceae	*Citrus*	*aurantifolia*	Tree	75.33
8	Alachilebu	Rutaceae	*Feronia*	*limon*	Shrub	70.8
9	Amloki	Euphorbiaceae	*Phyllanthus*	*embelica*	Tree	44.6
10	Billimbi	Averrhoaceae	*Averrhoa*	*bilimbi*	Tree	44.5
11	Kazipeyara	Moraceae	*Psidium*	*sp.*	Tree	38.7
12	Malta	Rutaceae	*Citrus*	*sinensis*	Tree	34.1
Flower Species						
13	Beli	Oleaceae	*Jasminum*	*sambac*	Shrub	115.7
14	Petunia	Solanaceae	*Petunia*	*hybrida*	Herb	113.7
15	Dianthas	Caryophyllaceae	*Dianthas*	*chinensis*	Herb	112.0
16	Jasmine	Oleaceae	*Jasminum*	*mauriculatum*	Shrub	111.7
17	Chondromollika	Oleaceae	*Jasminum*	*angustifolium*	Tree	109.1
18	Oleander	Apocynaceae	*Nerium*	*alba*	Shrub	108.7
19	Zinnia -yellow	Compositae	*Zinnia*	*elegans*	Herb	108.3
20	Hasnahena- red	Solanaceae	*Cestrum*	*elegans*	Shrub	105.7
Vegetable Species						
21	Brinjal	Solanaceae	*Solanum*	*melongena*	Shrub	130.8
22	Pipper	Solanaceae	*Capsicum*	*frutescens*	Herb	128.4
23	Tomato	Solanaceae	*Lucopersicon*	*esculentum*	Herb	125.7
24	Amaranth	Amaranthaceae	*Amaranthus*	*oleraceus*	Herb	120.3
25	Korola	Cucurbitaceae	*Momordica*	*acutangula*	Climber	116.5
26	Okra	Malvaceae	*Abelmoschus*	*esculentus*	Shrub	115.8
27	Green chili	Solanaceae	*Capsicum*	*annum*	Herb	115.2
28	Indian spinach	Basellaceae	*Basella*	*alba*	Herb	114.9
29	Lettuce	Compositae	*Lactuca*	*sativa*	Herb	102.3
30	Shim	Fabaceae	*Lablab*	*purpureus*	Climber	101.7
31	Ridged gourd	Cucurbitaceae	*Luffa*	*charantia*	Climber	88.5
32	Teasle gourd	Cucurbitaceae	*Momordica*	*dioica*	Climber	79.4
Ornamental Species						
33	Patabahar	Euphorbiaceae	*Codiaeum*	*craigii*	Shrub	112.3
34	Patharcuchi	Crassulaceae	*Kalanchae*	*pinnata*	Herb	110.9
35	Blood leaf	Amaranthaceae	*Lindenii*	*Iresine*	Shrub	109.7
36	Henna	Lythraceae	*Lawsonia*	*inermis*	Tree	99.0
37	Orchid	Orchidaceae	*Vanda*	*roxburghii*	Shrub	88.2
38	Cactus	Cactae	*Cactus*	*Sp.*	Herb	83.7
Medicinal Species						
39	Pudina	Labiatae	*Mentha*	*spicata*	Herb	112.9
40	Tulsi	Labiatae	*Ocimum*	*sactum*	Shrub	110.2
41	Alovera	Liliacieae	*Aloe*	*barbadensis*	Herb	107.3
42	Neem	Meliaceae	*Azadirachta*	*indica*	Tree	106.6
43	Kababchini	Piperaceae	*Piper*	*cubeba*	Tree	96.8
44	Lemon grass	Gramineae	*Andropogon*	*citratus*	Herb	91.7
45	Long pepper	Piperaceae	*Piper*	*longum*	Tree	59.8
46	Thankuni	Umbelliferae	*Centella*	*asiatica*	Herb	56.7
47	Tejpata	Lauraceae	*Cinnamomum*	*tamala*	Tree	44.3

It is showed that diversity index varied with different plant species in different metro areas. Higher average inter-species diversity (0.967) was found in Mirpur area followed by Kamrangichor (0.961) and Gulshan (0.959) area. However, the lowest inter-species diversity was found in Mohammadpur area (0.952) where study area showed the moderate to higher inter- species plant diversity. Mannan (2013) reported that the inter species diversity was highest (0.799) in the fruit species and lowest in summer vegetable. Among the fruit species coconut was found 80.67% in hoar homestead.

Relative prevalence of species in roof top garden: Different types of species were found in the study area. The relative prevalence of species found in the study is shown Table 3. The most common fruit species like mango (127.1), guava (114.6), papaya (113.5) and straw berry (103.5) were very high while prevalence of less common species like billimbi (44.5), kazipeyara (38.7) and malta (34.1) were found very low. The most common flower species like beli (115.7), petunia (113.7), dianthas (112.0) and jasmine (111.7) were very high while prevalence of less common species like zinnia –yellow (108.3) and hasnahena- red (105.7) were found medium. The common vegetable species like brinjal (130.8), pipper (128.4), tomato (125.7) and amaranth (120.3) were very high while prevalence of less common species like ridged gourd (88.5) and teasle gourd (79.4) were found low. The most common ornamental species like patabahar (112.3), patharcuchi (110.9) and blood leaf (109.7) were very high while prevalence of less common species like orchid (88.2) and cactus (83.7) were found medium. The most common medicinal species like pudina (112.9), tulsi (110.2), alovera (107.3) and neem (106.6) were very high while prevalence of less common species like tahankuni (56.7) and tejpata (44.3) were found low (Table 3).

Table 4. Age of the garden owners

Categories	Garden owners	
	Frequency Number	Percentage
Young aged (up to 31 years)	2	5.0
Middle aged (32 to 50 years)	13	32.5
Old aged (above 50 years)	25	62.5
Total	40	100

Demographic and Socio-Economic characteristics of the garden owners

Age of the garden owners: The age of the garden owners were ranged from 31 to 75 years. On the basis of their age, the garden owners were classified into three categories which was shown in Table 3.4.1. It is revealed that 62.5 percent of the garden owners were old age while 5.0 percent of them were young age (Table 4).

Family size of the garden owners: Family size of the garden owners were ranged from 3 to 7 where 3 to 4 members represented small family size, 5 to 6 members represented medium family size and above 7 members represented large family size. Based on their family size scores, the garden owner were classified into three categories (Table 5). It is revealed that 40.0 percent of the garden owners had small family size which was a representative of typical family size in Dhaka city while 22.5 percent of the garden owners had large family size.

Table 5. Family size of the garden owners

Categories	Garden owners		
	Family Members	Frequency	Percentage
Small	3-4	16	40.0
Medium	5-6	15	37.5
Large	>7	9	22.5
Total		40	100.0

Education level of the garden owners: The levels of education of the garden owners were ranged from 0 to 18. Based on their education scores, the garden owners were classified into four categories (Table 6). It is showed that 52.5% of the garden owners were higher educated while 47.5% had secondary level of education.

Table 6. Education level of the garden owners

Categories	Garden owners	
	Frequency	Percentage
Illiterate	0	0
Primary level (1 to 5)	0	0
Secondary level (6 to 10)	19	47.5
Higher level	21	52.5
Total	40	100

Area of the roof top garden: The area of the garden was categorized (sq. ft.) into three groups. Among them 1200 to 1600 sq. ft. was small area, 1700 to 2100 sq. ft. was medium area and above 2100 sq. ft. was large area (Table 7). It is showed that 50 percent was small garden area which was followed by large area (2100 sq. ft.) while 5 percent garden owners have medium garden area.

Table 7. Area of the roof top garden

Categories	Garden owners	
	Frequency	Percentage
Small area (1200 - 1600sq. ft.)	20	50.0
Medium area (1700 -2100sq. ft.)	2	5.0
Large area (Above 2100 sq. ft.)	18	45.0
Total	40	100

Training of gardeners owners on roof garden (days): Garden owners received training (days) from DAE (Department of Agricultural Extension) for gardening which was categorized into five (0 to 5 days) groups where 0 day indicated no training received for gardening and 5 days indicated better training received for gardening (Table 8). It is indicated that 25 percent garden owners received training for 1 day on the gardening while 5 percent garden owners received training 5 days for gardening.

Table 8. Training for roof gardening (days)

Categories (days)	Garden owners	
	Frequency	Percentage
No Training	7	17.5
1 day	10	25.0
2days	7	17.5
3 days	7	17.5
4 days	7	17.5
5 days	2	5
Total	40	100

Input availability for gardening: Input availability for gardening such as seedling, improved variety, fertilizer and pesticide which is important for gardening activities. It is revealed that 50.0 percent garden owners received medium

input availability while 30.0 percent gardeners received low input availability for gardening (Table 9).

Table 9. Input availability for gardening

Categories	Garden owners	
	Frequency	Percentage
Low input availability	12	30.0
Medium input availability	20	50.0
High input availability	8	20.0
Total	40	100

Purpose of roof gardening: Purpose of rooftop gardening was assessed using a semi-structured open questionnaire. Roof top gardening was the most accessible practiced for gardeners in the Dhaka city. Gardener's choice was given in Table 10.

Table 10. Purpose of rooftop gardening

Sl.	Purposes	Gardeners no.	Percentage
1.	Aesthetic value	5	12.5
2.	Environmental amelioration	4	10
3.	Leisure time activity	2	5
4.	Mental satisfaction	4	10
5.	Healthy product consume	25	62.5
	Total	40	100

It is showed that the garden owners were interested for rooftop gardening because they thought that gardening products were healthy for consumption (62.5%) while 5 percent garden owners were interested for rooftop gardening as leisure time activity where Mostafa (2013) found an article 'Present Status of Rooftop Gardening in Sylhet City Corporation of Bangladesh: an Assessment Based on Ecological and Economic Perspectives' that each gardener was interested in rising of rooftop garden because they think that home gardens could help them to income and save money (29.8 percent), respondents were also interested in environmental amelioration (54.9 percent), the percentage was in favor of mental satisfaction (95.3 percent), aesthetic value (82.5 percent) and leisure time activity (87.8 percent). Towle K. (1996) found an article "The role of ecological restoration in biodiversity conservation: basic issues and guidelines. The Evergreen Foundation, Toronto" that in favor of mental satisfaction (10 percent), aesthetic value (12.5 percent) and leisure time activity (5 percent) in the role of ecological restoration in biodiversity conservation: basic issues and guidelines. Matsuo E, Relf PD. (1995) found an article "Horticulture in Human Life, Culture, and Environment" that working with plants and in the outdoors benefits are the mental health, mental outlook, and personal wellness of individuals in having roof top gardening. Hynes HP. (1996) found an article "A Patch of Eden: America's Inner-City Gardeners" that sharing food with friends, families, neighbors, and/or needy members of their community in need are one of the important reasons that they grow produce. This also supported by various researchers in the world and Zabala (1990) found an article "Arboriculture, development of professional education in the forestry sector of Bangladesh" found that trees have a positive effect in ameliorating environmental conditions.

Problems faced by the garden owners in practicing roof top garden activities: The problem Faced Index (PFI) was calculated to find out major problems faced by the garden owners in practicing plant species diversity. The severity of problem faced of the garden owners is shown in Table 11.

Table 11. Problems Faced Index (PFI) for selected 10 problems with rank order

Sl. No.	Problems	Opinion on extent of problem					PFI	Rank order
		Very high	High	Moderate	Little	Not at all		
1	Pest attack	18	9	8	5	0	128	1
2	Diseases attack	14	10	9	2	5	115	2
3	Lack of capital	13	10	10	7	0	109	3
4	Adverse climate	12	10	8	10	0	104	4
5	High price of seedling	12	10	9	5	4	101	5
6	Unavailability of pesticides in time	11	10	6	6	7	92	6
7	High price of tools	12	10	4	5	9	91	7
8	Lack of high yielding varieties	10	9	5	4	10	81	8
9	Lack of training facilities	11	7	5	5	12	80	9
10	Theft flowers, fruits, vegetables by thief	10	4	6	10	10	74	10

The major problem faced by the garden owners in pest attack problem for gardening practices which destroyed the products in severe case. Lack of proper roof top gardening knowledge for practicing gardening, most of the garden owners faced diseases attack problem. Lack of sufficient investment, they could not invest enough money to participate in roof top gardening activities. Good seedlings were expensive and hard to manage; they could not arrange good seedlings timely. As the supply of pesticides in the market was insufficient and price was high during production season, most of the time the garden owners faced this problem. Drums and earthen pot (Tobs) for planting trees, gardening practices tools price was high with unavailability in the local market, most of the time the garden owners faced this problem. As high yielding varieties are not available and hard to manage, they could not arrange high yielding varieties timely. Some of the garden owners of the study area were unable to take training facilities due to the age because most of them are old aged people, they could not attend the DAE training program for gardening practices and lack of sufficient information about training facilities for gardening activities.

For higher conservation of diversity with better aesthetic, environmental and economic perspectives, plantation in the roof top is desirable. Roof top gardening plays a significant role in urban landscape planning and management. If there would be the sufficient roof top garden area, the more would be the plant species diversity to meet the high plant species diversity demand for food and nutrition. 62.5 percent gardener was interested in rising of rooftop garden because they think that gardening

products consumption are healthy which are chemical free than market products. So, more training facilities are needed for gardening activities which will get the better improvement of plant species.

Roof top gardening practices extended to all house owners, city dwellers and multistoried building owners under the city area. DAE provided the basic demands of incentives for the gardening activities but adequate training, motivation and sustainable management are required to encourage the city people in practicing roof top garden to improve plant species diversity elsewhere in Bangladesh based on residential and rental houses. Collection of different planting materials are not easy for them and manpower seems to be a problem, since no persons are available in some houses to look after the garden, in that cases paid services should be provided to continue the gardening activities. The research had only include the roof top garden but not the garden in "Balcony'', "Kitchen'', "Container'' and "Hydroponics" and "Aeroponics'' or "Air-dynaponics" etc. places which were found a large number. So, there is ample scope to conduct this type of research on that untouched area as well as other areas in Dhaka city

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