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Original Article

Biodiversity around Garbage area in Kannamwar nagar, Vikhroli Suburb, Mumbai.

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Abstract

The present study deals with the biodiversity studies of garbage area in Kannamwar nagar, Vikhroli, Mumbai, metropolis during the period of June 2012 to May 2013. The study includes the evaluation of types of Plants, Animals and Fungi developing and visiting to the garbage site. Kannamwar nagar is suburban area of Mumbai city and the largest organized colony of middle class peoples in India. It is also known as baggiest colony in the Asia in terms of population and organized structural built up. However, the colony is lacking adequate system for waste disposal. BMC (Bruhanmumbai Municipal Corporation) installed dustbins for the collection of garbage at certain sites of Kannamwar nagar. These are daily filled with domestic waste materials by residential people. Due to domestic waste various organisms are attracted towards the garbage and also some organisms develop on rotting garbage. It is necessary to study which organisms are visiting, which are developing and responsible for the transmission of diseases. Observations are carried out at day and night time at each site and the collected samples are analyzed in laboratory for organisms. Altogether, 32 animal species were observed from which 16 are visiting animals nourishing on that garbage waste and 16 species where developing on garbage. Animals are belonging to class Mammals (19%), Aves (16%), Amphibians (9%), Arthropods (34%) Molusca (13%) Reptilian (3%) and Annelids (6%). The number of plant species were 47 growing around the garbage area belongs to the various divisions such as Algae (2%), Bryophytes (4%), Pteridophyta (4%) and Angiosperms (Dicot 73% and Monocot 17%). Total of 10 fungal species reported from class Ascomycetes (40%), Basidiomycetes (30%), Deuteromycetes (10%) and Phycomycetes (20%). Thus the total biodiversity consist 52.80% of plants, 35.95% animalia and 11.23% of fungi. Angiospermic plant includes weeds, household plants and seedlings of tree species. Animalia includes scavengers, herbivores and carnivores. Species of arthropoda act as vector for the various diseases. All fungi reported were saprophytic and can develop allergic diseases through the spores.

Keywords: Biodiversity, Garbage, Kannamwar nagar, species.

Introduction

India having urban area based on the population of more than 5,000; density exceeding 400 persons per sq. km., and where 75 percent of the male workers are engaged in non-agricultural professions. However, this rapid growth in urban population leads to change in land use patterns, accentuates the demand for natural resources. Each family in the India throws away an average of 1 ton of garbage per year, Walsh and Bryan (2011). It causes pollution and alters hydro-geomorphology and loss of biodiversity. Studies suggest that substantial human-induced environmental changes are linked to urbanization on regional scale could become an important factor in biodiversity conservation (Haines-Young, 2009, McKee et al. 2003 and Cincotta et al., 2000). Connecting to the urbanization and biodiversity, it is to be stated that nearly 20 percent of the world's population lives in biodiversity hotspot regions. Therefore, predicting patterns of urbanization in the areas of high biodiversity are critical for conservation. In India, most the studies on urbanization focus on megacities like Mumbai, Delhi and Kolkata. However, the urbanization of smaller cities and towns, particularly those located in biodiversity rich areas are of serious concern to conservation. There are no studies carried out that enumerate the ground realities of urbanization and its impacts on biodiversity in India.

In the present study, the research was conducted to determine the biodiversity of garbage area in Kannamwar nagar, Vikhroli suburb, Mumbai. It is considered as one of the biggest organized housing colony in India and one of the biggest workers housing colony

in Asia. In Kannamwar Nagar there are more than 300 Buildings and it is one of the 56 Transit Camps developed by Maharashtra Housing and Area Development Authority (MHADA) in Mumbai. The climatic condition indicates the temperature range of 17.5 °C - 34.4 °C and annual Rainfall, 2567.5 mm. It is coming under ecologically sensitive zones within (15-km distance Coastal Regulation Zone (CRZ) – I & II). (Bruhanmumbai Municipal Corporation) installed dustbins for the collection of garbage at certain sites of Kannamwar nagar. Kannamwar nagar facing the problem of waste-management because of the presence of dump-site at every corner of the locality. People throw away leftover food, vegetable waste, food waste, paper, clothes, packaging material, wood, plastic bags, toys and the electrical equipments. The rotting rubbish also produces a rather unpleasant, poisonous liquid known as leachate which seeps into the earth and if it is not carefully managed, could be washed into rivers or even groundwater that is used for drinking supplies. The domestic waste is collected in low quality and open dust-bins which are always full of garbage and rest of the matter spreads along road side. The BMC activities which are carried out for the proper disposal of waste material, drainage are not sufficient. We find variety of garbage at dump-sites in Kannamwar nagar which remain over there, accumulate for several days and generate variety of health problems due to the growth of disease causing organisms, air pollution and soil pollution. The presence of food matter in that garbage attracts mosquitoes, honey bees, flies and stray dogs. They consume this food and transmitted with that pathogens, turn into vectors and spreads diseases to animals and healthy persons. The person can suffer from Malaria, Typhoid, and Chicken pox, Chickengunea, Dengue and Hepatitis. Some allergies can be produce in terms of bronchial allergies, nasal allergies and asthmatic bronchitis mainly because of the presence of fungal species in that garbage. The smell produce from this garbage spreads all over which posses harmful gases also. People get irritated by this smell and suffer from eye irritation, nausea, vomiting and headache. Some of this organic matter plays great role in increasing the fertility of soil. This gives rise to the production of bacteria, fungi, plants and animals which helps to maintain the ecological balance and biodegradation. This organic matter can be use in the form of manure, fertilizers to avoid its harmful effects. The garbage is generated by the people with no taking adequate precautions then the population is suffering with various illness problems but still it is neglected area.

Materials and Methods

The study adopted a suite of methodologies, which included literature review, field surveys, identification of species in laboratory and discussions with informants and interviews with individuals. Sampling Location was Kannamwar nagar a suburban part of Mumbai city with urban conditions located in north-western Mumbai. The area spreads around the Latitudes of 19° 7'19.89"N, and Longitude of 72°56'17.80"E. Total of 12 garbage sites were selected in Kannamwar nagar, to study the biodiversity aspect. Observations are carried out for a period of 12 months at day and night time. The study involved seasonal documentation of the flora and fauna developing on garbage and visiting to the garbage site. For visiting animal observations are carried out by sitting near the garbage site and for developing organisms, by analyzing garbage in the laboratory. Observation and identification of collection of specimen done in Department of Botany, Institute of Science, Mumbai. We does not follow quadrate method but specimens were randomly selected of each species of organism i.e. fungi, plant and animal. Fungi sampling was carried out at 12 locations of Kannamwar nagar, Vikhroli by considering the distance, altitude, population and traffic density. The sampling of aero microbes was done by the plate exposure method for a period of 12 months between June 2012 to May 2013. The petriplates of 9 cm diameter with 25 ml of nutrient agar media were used for the study. Three petriplates were used in each sampling locality at the heights of 3 meters. After the exposure, the plates were incubated at 25°C for 3 to 7 days. However the aero microbes were identified using lacto phenol cotton blue test and fungal identification chart (Achudume and Olawale 2010). The fungal colonies were identified by colony counting method. Fungi grown in the medium were identified according to their morphological and microscopic characteristics based on the lacto phenol cotton blue test as well as by following the identification keys (Barnet and Hunter, 1972; Booth, 1971; Nirenberg, 1981; Von Arx, 1981)

Result and Discussion

An observation made in the present study indicates the occurrence of Biodiversity of Plants, Animals and Fungi developing and visiting to the garbage site (Table- 1, 2 and 3). Altogether 32 animal species were found from which 16 are visiting animals which nourishing on that garbage waste and 16 species where developing on garbage. Animals are belonging to class Mammals 19%, Aves 16%, Amphibians 9%, Arthropods 34% Molusca 13% Reptilian 3% and Annelids 6% for animal kingdom (Table – 4, Fig-1). From animals 19 species i.e. 59.37% were visiting species (some are nocturnal) and 13 species i.e. 40.62% were developing in the garbage area. Crow, dogs and housefly like species are dominant at garbage sites throughout the year. Pila, frog, chiton like species observed for only five to six months during rainy season only. Mosquito species, dragonfly and earthworm like species were moderately dominant and observed for nine to ten months. Crow, dog, housefly and black ant species of animal were found to be predominant throughout the year around all the site while frog and lizard are rarely observed.

The number of plant species were 47 growing around the garbage area belongs to various divisions such as Algae 2%, Bryophytes 4% , Pteridophyta 4% and Angiosperms (Dicot 73% and Monocot 17%)for plant kingdom (Table – 4, Fig-2). From plants *Cynadon, Ziziphus, Tridex* like genera found to be all time dominant at all the garbage site throughout the year. The plant species of genera *Mimosa*, *Sida* and *Eclipta* were moderately dominant in occurrence for only seven to eight months during rainy season and after in winter at the studied sites. Total 26 species found dominant only during rainy season and not observed in winter and summer months.

Table 1. Observed data of 12 months with evaluation of 12 sites per month on Plant Biodiversity in garbage area, Vikhroli, Mumbai.

Sr. No	NAME OF PLANTS	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	TOTAL
1	*Spirogyra spp*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
2	*Anthoceros spp*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.699
3	*Funaria spp*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.080
4	*Citrus lemmon**	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
5	*Polyalthia longifolia**	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.173
6	*Ficus glomerata **	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.0
7	*Ficus religeosa**	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.0
8	*Ficus benghalensis**	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.0
9	*Mangifera indica**	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.328
10	*Artocarpous heterophylla**	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.699
11	*Annona squamosa**	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.595
12	*Pisidium gunjava**	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
13	*Manilkara zapota**	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.595
14	*Heliotropium ovalifolium*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.173
15	*Phyllanthus neruri*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
16	*Brassica napus*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.328
17	*Achyranthus aspera*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.699
18	*Mirabilis jalapa*	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 1.032
19	*Ricinus communis*	+	+	+	+	+	+	+	-	-	-	-	-	7.0 ± 0.333
20	*Portulaca oleraceae*	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.0
21	*Celosia argentea*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.080
22	*Ocimum sanctum*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.328
23	*Physalis minima*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.595
24	*Coriandrum sativum*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
25	*Cucurbita spp.*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.173
26	*Cyperus spp.*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.699
27	*Commelina spp.*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.328
28	*Eclipta alba*	+	+	+	+	+	+	+	+	-	-	-	-	8.0 ± 0.00
29	*Dhatura alba*	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.0
30	*Ziziphus jujuba* Ber*	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.0
31	*Adiatum spp*	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 1.032
32	*Eugenia jambolana **	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 0.971
33	*Terminalia cattapa**	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 0.918
34	*Colocasia spp*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.173
35	*Tagetes spp* Genda	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
36	*Ageratum conyzoides*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.595
37	*Pteris spp*	+	+	+	+	+	+	+	-	-	-	-	-	7.0 ± 1.164
38	*Allium cepa*	+	+	+	+	+	+	+	-	-	-	-	-	7.0 ± 1.100
39	*Sida cordifolia*	+	+	+	+	+	+	+	+	-	-	-	-	8.0 ± 1.074
40	*Mimosa pudica*	+	+	+	+	+	+	+	+	-	-	-	-	8.0 ± 0.918
41	*Ipomoea aquatica*	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 0.971
42	*Calotropis procera*	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.0
43	*Oryza sativa #*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.080
44	*Dactylotenium aegyptium #*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
45	*Elusine indica #*	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 1.173
46	*Cynadon dactylon #*	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.0
47	*Tridax procumbens*	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.0

(Average value indicated after evaluation of 12 garbage site per month.)

(* Tree species Seedling, # grass species)

Table 2. Biodiversity of Fungal species observed in garbage area of Vikhroli, Mumbai.

Sr. No	Name of Fungi	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	TOTAL
1	*Agaricus spp* +	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.699
2	*Pleurotus spp* +	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.646
3	*Schizophyllum* +	+	+	+	+	+	+	+	+	-	-	-	-	8.0 ± 1.100
4	*Mucor spp* *	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
5	*Rhizopus stolonifer* *	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.00
6	*Alternaria* €	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.849
7	*Penicillium spp* #	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.843
8	*Cladosporium* #	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.707
9	*Aspergillus spp.* #	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
10	*Fusarium spp.*	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00

+ - *Basideomycetes,* # - *Ascomycetes,* * -*Phycomycetes,* € - *Deuteromycetes*

Table 3. Biodiversity of Animal species observed in garbage area of Vikhroli, Mumbai.

Sr. No	NAME OF ANIMALS	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	TOTAL
1	*Rana tigrina* Frog ¥	+	+	+	+	+	-	-	-	-	-	-	-	5.0 ± 0.699
2	*Helix pomatia* Pila spp ¥	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 0.918
3	*Acanthopleura granulate* Chiton ¥	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 1.032
4	*Pila globusa* Pila ¥	+	+	+	+	+	+	-	-	-	-	-	-	6.0 ± 1.032
5	*Anisoptera spp* Dragonfly ¥	+	+	+	+	+	+	+	+	+	+	-	-	10.0 ± 1.00
6	*Bufo bufo* Toad ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.707
7	*Ambystoma spp.* Salamander ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
8	*Lithobius forficatus* Centipede	+	+	+	+	+	+	+	-	-	-	-	-	7.0 ± 1.164
9	*Coleoptera spp.* Beetle	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.707
10	*Heteropoda spp* Spider	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.00
11	*Hottentotta tumulus* Scorpion	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
12	*Telescopium spp.* Apple snail	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.00
13	*Lumbricus terrestris* Earthworm	+	+	+	+	+	+	+	+	+	+	-	-	10.0 ± 0.726
14	*Aedes aegypti* Mosquito	+	+	+	+	+	+	+	+	+	+	-	-	10.0 ± 0.927
15	*Anopheles stephensi* Mosuito	+	+	+	+	+	+	+	-	-	-	-	-	7.0 ± 0.971
16	*Musa domestica* Housefly	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.00
17	*Periplaneta americana* Cockroach	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
18	*Lasius niger* Black ants	+	+	+	+	+	+	+	+	+	+	+	+	12.0± 0.00
19	*Trigoniulus corallinus* Milipede	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.843
20	*Calotes versicolor* Lizard ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
21	*Milvus migrans* Kite ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
22	*Columba livia* Pigeon ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.843
23	*Corvus splendens* Crow ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
24	*Acridotheres tristis* Myna ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.843
25	*Passer domesticus* Sparrow ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.00
26	*Canis familiaris* Dog ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
27	*Felis catus* Cat ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
28	*Ratus ratus* Rat ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
29	*Bandicota bengalensis* Ghus ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.00
30	*Suncus murinus* Chichundri ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.00
31	*Herpestes javanicus* Mongoose ¥	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 0.849
32	*Camponotus spp.* Black ant	+	+	+	+	+	+	+	+	+	+	+	+	12.0 ± 1.00

¥ - Visiting animals

Table 4. Percent occurrence of animal, fungi and plant Biodiversity observed in garbage area of Vikhroli, Mumbai.

Animals	**Species**	**Occurrence in %**	**Fungi**	**Species**	**Occurrence in %**	**Plants**	**Species**	**Occurrence in %**	
Annelida	2	6%	Ascomycetes	4	40%	Algae	1	2%	
Molusca	4	13%	Basidiomycetes	3	30%	Bryophyta	2	4%	
Amhibian	3	9%	Deuteromycetes	1	10%	Pteridophyta	2	4%	
Arthropoda	11	34%	Phycomycetes	2	20%	Angio- Dicot tree saplings	13	27%	73%
Reptelia	1	3%	-	-	-				
Aves	5	16%	-	-	-	Angio- Dicot	21	47%	
Mammals	6	19%	-	-	-	Angio- Monocot	8	17%	
-	-	100%	-	-	100%	-	-	100%	
Total Animal species	**32**	**35.95 %**	**Total Fungal species**	**10**	**11.23 %**	**Total Plant species**	**47**	**52.80%**	

Total 10 fungal species reported belongs to the class Ascomycetes 40%, Basidiomycetes 30%, Deuteromycetes 10% and Phycomycetes 20% (Table – 4, Fig-3). In total biodiversity animalia was recorded as 35.95%, plants 11.23% and fungi 52.80%. Angiosperm plant includes weeds, household plants and seedlings of tree species. The fungal species *Alternaria*, *Aspergillus*, *Cladosporium*, *Mucor*, *Penicillium*, *Rhizopus* were found from which *Alternaria*, *Rhizopus*, *Aspergillus and Cladosporium* are the dominant fungi in the atmospheric air for all year. The fruiting bodies of *Pleurotus and Schizophyllum* were also dominantly observed on the woody rotting garbage. *Pleurotus* species found only for five months in rainy season and *Schizophyllum* found in rainy and winter season which was moderately dominant. Thirumala et al. (2012) found same species predominant around solid waste in Karnataka. Menezes et al., (2004) and Agrios, et al., (2005) also found similar results. Ejaz et al. (2010) found miserable solid waste management crises due to an inefficient municipal solid waste management system and creating serious negative environmental impacts like infectious diseases, land and water pollution, obstruction of drains and loss of biodiversity in Rawalpindi city of Pakistan. Plants are producers in this ecosystem but garbage also source of food for mosquito, snail, earthworm and rat like primary consumers. The secondary consumers like frog, toad, myna, crow feeds on primary consumers and also on garbage waste. The tertiary consumers like dog, kites are feeding on secondary consumers and garbage waste. Crow and Fungal group is also acting as a scavenger responsible for spreading of diseases. This energy flow in the garbage ecosystem become one of the artificial ecosystem but due to the negligence of the human being.

Conclusions

Proper method of garbage disposal and its management is a matter of high concerned to maintain clean society. Studies proves higher percentage of plant diversity (54%) in which (27%) species were of tree species due to which such sites can be use to grow saplings of tree species for the plantation purpose for the development of forest. Plant diversity followed by the animal diversity that includes mammals like stray dogs which are responsible for spreading rabbis and attacking to the pedestrian. Bandicoots like rat are transmitters of diseases like plague to human beings. Insects like housefly can spread typhoid bacteria and mosquitoes causing malaria and dengue like diseases. It becomes breeding houses for the stray dogs, mosquito, housefly and many other organisms. The surroundings and conditions are most favorable for the growth and proliferation of such organisms. The present study indicated 11.23% population of fungi. The greater diversity was received for various groups of the fungi Basidiomycetes 33%, Ascomycetes 34% and Phycomycetes 22%. These fungal organisms are causal organisms for the various health diseases, allergies, respiratory illness etc. To the context it is a need of hours to meticulously record the diversity of flora and fauna around the garbage area so as to study their propagation, proliferation and infection role in order to generate awareness about spreading diseases in the society and to take necessary precaution.

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