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Seedbank Dynamics, Seedling Emergence and Survival of Herbaceous Species in Successional Plots in Ile-Ife, Southwestern Nigeria

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Abstract: Seedbank dynamics, seedling emergence and survival of herbaceous species were studied in four successional plots each of dimension 25×25 m in Ile-Ife, Southwestern Nigeria between 1999 and 2001 using seedling emergence method in the screenhouse. The result of the study shows that, species belonging to the families: Euphorbiacea, Poaceae, Asteraceae and Urticaceae dominated the seed bank of the study plots. Total Seedbank density ranged from 1986 seedlings (14115 seed m^{-2}) in older secondary forest plot to 3650 (21420 seed m^{-2}) in managed plots. The mean seedling density also ranged from 8.95±8.03 to 71.72±3.42 seedling m^{-2}. Seedbank density of the herbaceous species reduced significantly as the successional age of the plots increases and also across the 3 seasons in which soil was sampled: March, June and October. Two pattern of seedbanking were shown by the herbaceous species: transient and persistent. There was however no significant difference in species composition among the plots and across the seasons.

Key words: Seedbank, seedling emergence, herbaceous species, succession

INTRODUCTION

Seedbank in nature is an important determinant of plant community dynamics as it shows the potential of a community to regenerate after disturbance (Hopkins and Graham, 1983; Mitchel *et al*., 1998). Baker (1989) describes seedbank as an aggregation of ungerminated seeds potentially capable of replacing adult plants. Various workers have carried out researches on the dynamics of the seedbank and factors affecting the density and species composition of the seedbank. Information from the study of seedbank could be vital for the control of weeds and also to predict compositional changes under various intensities of management. Moreover, seedbank data could provide valuable information for successful forecasting of germination trends, as well as for the development of an effective integrated control program for weed species (Rawnsley and Groom, 2002).

Studies of the role of seedbank in the regeneration of disturbed vegetation especially arable fields dates back to the early 19th Century (Brenchley, 1918; Champness and Morris, 1948), however a number of work have also been carried out in the recent past on seedbank both at population and community levels e.g., (Thompson and Grime, 1979; Rawnsley and Groom, 2002; Funes *et al*., 2003). Thompson and Grime (1979) studied seasonal variation in the seedbank of herbaceous species in ten contrasting habitats using soil samples taken from 0-3 cm depth. Their study aimed at classifying the seedbank of the herbaceous species in the habitat considered.. It has been reported that seedbanks are usually diverse and dense in early succession and also declines with time (Picket and Mcdonnel, 1989). In recent times, efforts have been directed at quantifying the density as well as identifying the species composition of the seedbank of forested lands (Buckley *et al*., 1997; Douglas and Diodd, 1997; Kalamees and Zobel, 1998; Mitchel *et al*., 1998; Bossuyt and Hermy, 2001), but little attention has been directed towards identifying the seasonal variation in the seedbank density and species composition especially of herbaceous species for the depth 0-15 cm as well as in successional plots

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and these are the major focus of this present study. In this present study, the seedbank of herbaceous species was studied with a view to determining the seasonal variation in seedbank density along a successional gradient and to have an overview of the way the species composition of the plots changes with age.

MATERIALS AND METHODS

The study site is in the Obafemi Awolowo University Campus, Ile-Ife within latitudes 7° 30^1 to 7° 35^1 N and longitudes 4° 30^1 to 4° 35^{1}E. Four plots (each 25 m by 25 m) designated as MP_1, MP_2, SF_1 and SF_2, respectively were used for the study. These plots represent different stages of succession. Plots MP_1 and MP_2 are managed plots (periodically cleared) while SF_1 and SF_2 are secondary forest plots consumed by ground fire in 1983. The mean annual rainfall for the area is 1400 mm (five year mean) while the mean annual temperature ranges from 27 to 34°C (Oke and Isichei, 1997) with the highest range normally experienced in the dry season. To characterize the germinable seed bank of the area, 10 soil cores were taken randomly to depth of 15 cm on each of the 3 occasions that soil samples were taken (March, June and October or MS, JS and OS) in 1999. The auger used has a diameter of 8.5 cm. The density, species composition and seasonal dynamics of the seedbank of the plots were determined by screenhouse germination over a period of 20 months. Each soil sample was spread in a porous plate (after being air dried in the laboratory environment). The soil was turned over regularly (to mimick disturbance and to also allow for the germination of deeply buried seeds).

Seedlings were identified, counted and uprooted regularly and identification followed Hutchinson and Daziel (1954-1972) flora of west tropical Africa. The species whose identity was in doubt was collected and taken to the IFE Herbarium for proper identification. The number of seedlings that emerged per cm^{-2} area was transformed to per m^2 basis using the method of Major and Pyott (1966). The percentage number of seedlings per plot on each sampling occasion, the mean standard error were calculated. Also comparison of seedling emergence seasonally, total seedbank in all the plots were performed using two way ANOVA.

RESULTS

More seedlings germinated during the early rainy season (March soil collection or MS) (5280 seedlings cm^{-2}) while the least density was observed in the October soil collection or OS (2060 seedlings cm^{-2}). There was a general spatial and temporal variation in the total seedback density of the plots across the seasons. The total seedbank density ranged from 1986 (14115 seed m^{-2}) to 3650 (21420 seeds m^{-2}) with the older successional plots (SF_1 and SF_2) having lower seedbank density compared to the younger plots (MP_1 and MP_2). The mean seedbank density also ranged from 8.95±8.03 seedlings in SF_1 to 71.72±3.42 seedlings in SF_2 while other plots had intermediate values (Table 1). The total seedbank densities of the successional plot. For the three seasons were subjected to two way analysis of variance. The result shows that variations in seedbank density were highly significant both across the plots and in the three seasons.

There was a general reduction in the number of species that emerged in plots SF_2 and MP_2 across the seasons and a fluctuating trend in species number was observed in plots SF_1 and MP_1. Generally,

Table 1: Seasonal variation in the total density of seedbank of the four successional plots

Plot	MS	JS	OS
SF1	803	986	197
SF2	784	1793	250
MP1	1812	634	1206
MP2	1994	793	407
	5393	4206	2060

Table 2: Seasonal variation in number of species in the four successional plots

PLOT	MS	JS	OS
SF_1	22	24	22
SF_2	29	25	19
MP_1	32	22	25
MP_2	36	22	18

the highest number of species emerged from the March soil collection in the two younger plots (MP_1 and MP_2). The number of species that emerged across the seasons and among the plots when subjected to two way ANOVA did not show significant difference. The older successional (SF_1 and SF_2) plots recorded fewer number of species compared to the younger plots (MP_1 and MP_2) (Table 2).

The seasonal variation in species composition in plot SF_1 is presented in Table 3. A total of 34 herbaceous species belonging to twenty (20) families emerged from the seed bank of plot SF1. Thirteen (13) species: *Ageratum conyzoides*, *Amaranthus spinosus*, *Chromolaena odorata*, *Cynodon dactylon*, *Eragrostis tenella*, *Euphorbia prostata*, *Leptochloa carulescens*, *Oldenlandia corymbosa*, *Pergularia daemia*, *Phyllanthus amarus*, *Solanum torvum*, *Talinum triangulare* and *Urera repens* had fluctuating densities across the seasons. Fifteen species: *Adenia lobata*, *Aspilia africana*, *Brachiraria deflexa*, *Eragrostis tenella*, *Euphorbia heterophylla*, *Euphorbia hysopifolia*, *Laportea aestuans*, *Lepistome* sp. *Lindernia muemularifolia*, *Musaenda elegans*, *Nelsonia cinensis*, *Pergularia daemia*, *Pityrogammia* sp., *Smilax kraussiana* and *Spilanthis filicaulis* had a progressive reduction in their densities across the seasons. It was also observed that twelve species: *Brachiraria deflexa*, *Cleome ciliata*, *Corchorus tridens*, *Cyperus dactatylon*, *Desmodium scoparius*, *Euphorbia heterophylla*, *Euphorbia hysopifolia*, *Peperomia pellucida*, *Pergularia daemia*, *Phyllanthus muemularius*, *Smilax kraussiana* and *Urera repens* showed no seedling emergence in the March soil collection only to appear (emerge) in either the June soil collection (JS) or October soil collection (0S) or both. Similarly 4 species: *Cleome ciliata*, *Corchorus tridens*, *Cyperus dactatylon* and *Desmodium scoparious* emerged only in the October soil collection. Families Euphorbiaceae, Poaceae and Asteraceae were the dominant families with 5 species of family Euphorbiaceae while the other 2 families had 4 species each in the seedbank.

The seasonal emergence of herbaceous species in plot SF_2 is shown in Table 4. The result indicates that a total of 37 herbaceous species belonging to 19 families emerged in this plot. Species belonging to families Poaceae (6), Euphorbiaceae (4) and Asteraceae (4) dominated the seedbank.

There were 10 species with fluctuating seedling emergence across the seasons: *Dioscorea bulbifera*, *Eragrostis tenella*, *Laportea aestuan*, *Leptochloa carulescens*, *Oldenlandia corymbosa*, *Peperomia pellucida*, *Pityrogammia* sp. *Setaria barbata*, *Solanum torvum* and *Musaenda elegans*. Eleven species (*Aspilia africana*, *Brachiraria deflexa*, *Cissus* sp. Mucuna sp. *Nelsonia cinensis*, *Panicum maximum*, *Phyllanthus muemularius*, *Physalis* sp. *Sida pilosa*, *Spilanthis filicaulis*, *Sporobolus festivus* and *Zehrean capillacea*) emerged only in one of the three seasons while 3 species (*Ageratum conyzoides*, *Laportea aestuans* and *Oxalis corniculata*) had uniform level of seedling emergence across the seasons 4 species: *Euphorbia heterophylla*, *Euphorbia prostata*, *Solanum nigrum* and *Talinum triangulare* had increased seedling emergence across the seasons.

A total of 37 species belonging to 18 families emerged in the MP_1 (Table 5). The result of seedling emergence in plot MP1 showed that there was a reduction in seedling density across the seasons in 17 species out of the 37 species that emerged. The species were: *Aspilia africana*, *Borreria ocymo*, *Chromolaena odorata*, *Commelina nodiflora*, *Cyperus dactatylon*, *Drymaria kaudata*, *Elytraria lyrata*, *Euphorbia heterophylla*, *Fern* sp. *Gloriosa superba*, *Laportea aestuans*, *Lindernia* sp. *Mariscus* sp. *Peperomia pellucida*, *Pityrogammia* sp. *Scoparia dulcis* and *Solanum torvum*. Also 14 species: *Brachiraria deflexa*, *Cissus* sp. *Cynodon dactylon*, *Eragrostis tenella*, *Euphorbia hysopifolia*,

Table 3: Seasonal density and herbaceous species composition of the seedbank of plot SF_1

		March soil		
S/N	Name of species	No. of seedlings/cm^2	Seed/m^2	% of SB
1	*Adenia lobata*	1	18	0.124533
2	*Ageratum conyzoidis*	3	53	0.373599
3	*Amaranthus spinosus*	6	106	0.747198
4	*Aspilia africana*	1	18	0.124533
5	*Brachiraria deflexa*			0
6	*Chromolaena odorata*	31	546	3.860523
7	*Cleome ciliata*			0
8	*Corchorus tridens*			0
9	*Cynodon dactylon*	11	194	1.369863
10	*Cyperus dactatylon*			0
11	*Desmodium scoparious*			0
12	*Drymaria kaudata*	379	6672	47.19801
13	*Eragrostis tenella*	6	106	0.747198
14	*Euphorbia prostata*	2	35	0.249066
15	*Euphobia heterophylla*			0
16	*Euphorbia hysopifolia*			0
17	*Laportea aestuans*	103	1813	12.8269
18	*Lepistome* sp.	1	118	0.124533
19	*Leptochloa carulescens*	46	810	5.728518
20	*Lindernian muemularifolia*	3	53	0.373599
21	*Musaenda elegans*	3	53	0.373599
22	*Nelsonia cinensis*	11	194	1.369863
23	*Oldenlandia corymbosa*	31	546	3.860523
24	*Peperomia pellucida*			0
25	*Pergularia daemia*			0
26	*Phyllanthus muemularius*			0
27	*Phyllarithus amarus*	1	18	0.124533
28	*Pityrogrammia* sp.	124	2182	15.44209
29	*Setaria barbata*	1	18	0.124533
30	*Smilax kraussiana*			0
31	*Solanum trovum*	26	458	3.237858
32	*Spilanthes filicaulis*	2	35	0.249066
33	*Talinum triangulare*	11	194	1.369863
34	*Urera repens*			0
35		803	14240	100

		June soil			October soil		
S/N	Name of species	No. of seedlings/cm^2	Seed/m^2	% of SB	No. of seedlings/cm^2	Seed/m^2	% of SB
1	*Adenia lobata*						
2	*Ageratum conyzoidis*	7	123	0.709939	1	18	0.507614
3	*Amaranthus spinosus*	33	581	3.346856	1	18	0.507614
4	*Aspilia africana*			0			0
5	*Brachiraria deflexa*	31	546	3.144016			0
6	*Chromolaena odorata*	35	616	3.549696	28	495	14.2132
7	*Cleome ciliata*			0	12	211	6.091371
8	*Corchorus tridens*			0	1	18	0.507614
9	*Cynodon dactylon*	1	18	0.10142	1	18	0.507614
10	*Cyperus dactatylon*			0	2	35	1.015228
11	*Desmodium scoparious*			0	1	18	0.507614
12	*Drymaria kaudata*			0	4	70	2.030457
13	*Eragrostis tenella*	2	35	0.20284	3	35	1.522843
14	*Euphorbia prostata*	582	10,246	59.02637			0
15	*Euphobia heterophylla*	6	106	0.608519			0
16	*Euphorbia hysopifolia*	23	405	2.332657			0
17	*Laportea aestuans*	35	616	3.549696	3	53	1.522843
18	*Lepistome* sp.			0			0
19	*Leptochloa carulescens*	74	1302	7.505071	29	511	14.72081
20	*Lindernian muemularifolia*			0	1	18	0.507614

Table 3: Continued

		June soil			October soil		
S/N	Name of species	No. of seedlings/cm^2	Seed/m^2	% of SB	No. of seedlings/cm^2	Seed/m^2	% of SB
21	*Musaenda elegans*	2	35	0.20284	1	18	0.507614
22	*Nelsonia cinensis*	1	18	0.10142			0
23	*Oldenlandia corymbosa*	82	1444	8.31643	61	1074	30.96447
24	*Peperomia pellucida*	1	18	0.10142	3	53	1.522843
25	*Pergularia daemia*	3	53	0.30426	1	18	0.507614
26	*Phyllanthus muemularius*	2	352	0.20284			0
27	*Phyllarithus amarus*	2	35	0.20284	1	18	0.507614
28	*Pityrogrammia* sp	25	440	2.535497			0
29	*Setaria barbata*	9	158	0.912779	19	334	9.64467
30	*Smilax kraussiana*	4	70	0.40568			0
31	*Solanum trovum*	11	194	1.115619	15	264	7.614213
32	*Spilanthes filicaulis*			0			0
33	*Talinum triangulare*	10	176	1.014199	7	123	3.553299
34	*Urera repens*	5	88	0.507099	2	35	1.015228
35		986	17675	100	197	3455	100

Table 4: Seasonal density and herbaceous species composition of the seedbank of plot SF_2

		March soil		
S/N	Name of species	No. of seedlings/cm^2	Seeds/m^2	% of SB
1	*Ageratum conyzoides*	2	35	0.258732
2	*Amaranthus spinosus*	159	2799	20.56921
3	*Aspilia africana*	3	53	0.388098
4	*Brachiraria deflexa*			0
5	*Chromolaena odorata*	43	757	5.562743
6	*Cissus* sp.			0
7	*Cyperus dacatylon*		194	0
8	*Dioscorea bulbifera*	7	123	0.905563
9	*Drymaria kaudata*	6	106	0.776197
10	*Elytraria lyrata*	402	7077	52.00517
11	*Eragrostis tenella*	4	70	1
12	*Euphorbia heterophylla*	2	35	0.258732
13	*Euphorbia prostata*	8	141	3.2
14	*Laportea aestuans*	7	123	0.905563
15	*Leptochloa carulescens*	11	194	1.423027
16	*Lindernia muemularifolia*	15	264	1.940492
17	*Mucuna* sp.	1	18	0.129366
18	*Musaenda elegans*	2	35	0.258732
19	*Nelsonia cinensis*			0
20	*Oldenlandia corynbosa*	54	951	6.98577
21	*Oxalis corniculata*	1	18	0.129366
22	*Panicum* sp.			0
23	*Peperomia pellucida*	4	70	0.517464
24	*Phyllanthus amarus*	3	53	0.388098
25	*Phyllanthus muellerianus*			0
26	*Physalis* sp.	4	70	0.517464
27	*Pityrogrammia* sp.	1	18	0.129366
28	*Setaria barbata*	2	35	0.258732
29	*Sida pilosa*			0
30	*Smilax kraussiana*	2	35	0.258732
31	*Solanum nignum*			0
32	*Solanum torvum*	14	246	1.811125
33	*Spilanthes filicaulis*	6	106	0.776197
34	*Sporobolus festivus*			0
35	*Talinum triangulare*	3	53	0.388098
36	*Urera repens*	6	106	0.776197
37	*Zehrean capillacea*	1	18	0.129366
38		784	13803	100

Table 4: Continued

S/N	Name of species	June soil			October soil		
		No. of seedlings/cm^2	Seed/m^2	% of SB	No. of seedlings/cm^2	Seed/m^2	% of SB
1	*Ageratum conyzoides*	2	35	0.111545			
2	*Amaranthus spinosus*	1	18	0.055772	1	18	0.4
3	*Aspilia africana*			0			0.0
4	*Brachiraria deflexa*	10	176	0.557724			0.0
5	*Chromolaena odorata*	34	599	1.896263	10	176	4.0
6	*Cissus* sp.			0	1	18	0.4
7	*Cyperus dacatylon*	4	70	0.22309	3	53	1.2
8	*Dioscorea bulbifera*			0	1	18	0.4
9	*Drymaria kaudata*	2	35	0.111545			0.0
10	*Elytraria lyrata*	4	70	0.22309			0.0
11	*Eragrostis tenella*	2	35	0.111545	8	141	3.2
12	*Euphorbia heterophylla*	4	70	0.22309			0.0
13	*Euphorbia prostata*	1498	26373	83.54713			0.0
14	*Laportea aestuans*			0	7	123	2.8
15	*Leptochloa carulescens*	108	1901	6.023424	14	246	5.6
16	*Lindernia muemularifolia*	1	18	0.055772			0.0
17	*Mucuna* sp.			0			0.0
18	*Musaenda elegans*	7	123	0.390407			0.0
19	*Nelsonia cinensis*	3	53	0.167317			0.0
20	*Oldenlandia corynbosa*	2	35	0.111545	72	1267	28.8
21	*Oxalis corniculata*	1	118	0.055772			0.0
22	*Panicum* sp.			0	3	53	1.2
23	*Peperomia pellucida*	9	158	0.501952	9	158	3.6
24	*Phyllanthus amarus*	2	35	0.111545	2	35	0.8
25	*Phyllanthus muellerianus*	1	18	0.055772			0.0
26	*Physalis* sp.			0			0.0
27	*Pityrogrammia* sp.	21	370	1.171221			0.0
28	*Setaria barbata*	1	18	0.055772	12	211	4.8
29	*Sida pilosa*			0	1	18	0.4
30	*Smilax kraussiana*			0			0.0
31	*Solanum nignum*	18	317	1.003904	23	405	9.2
32	*Solanum torvum*	41	722	2.28667	14	246	5.6
33	*Spilanthes filicaulis*			0			0.0
34	*Sporobolus festivus*			0	1	18	0.4
35	*Talinum triangulare*	12	211	0.669269	66	1162	26.4
36	*Urera repens*	5	88	0.278862	2	35	0.8
37	*Zehrean capillacea*			0			0.0
38		1793	31666	100	250	4401	100.0

Table 5: Seasonal density and herbaceous species composition of the seedbank of plot MP_1

S/N	Name of species	March soil		
		No. of seedlings/cm^2	Seeds/m^2	% of SB
1	*Amaranthus spinosus*	4	70	0.2210
2	*Aspilia africana*	14	246	0.7739
3	*Borreria ocymo*	6	106	0.3315
4	*Brachiraria deflexa*			
5	*Chromolaena odorata*	18	334	0.9945
6	*Cissus* sp.			
7	*Commelina nodiflora*	2	35	0.1105
8	*Cynodon dactylon*	2	35	0.1105
9	*Cyperus dactatylon*	277	4875	15.3039
10	*Drymaria kaudata*	26	485	1.4365
11	*Elytraria lyrata*	300	5280	16.5746
12	*Eragrostis tenella*	9	158	0.4972
13	*Euphorbia heterophylla*	3	53	0.1657
14	*Euphorbia hysopifolia*	1	18	0.0552
15	*Euphorbia prostata*	4	70	0.2210
16	*Ferm* sp.	23	405	1.2707
17	*Gloriosa superba*	1	18	0.0552
18	*Laportea aestuans*	21	370	1.1602

Table 5: Countinued

		March soil		
S/N	Name of species	No. of seedlings/cm^2	Seeds/M 2	% of SB
19	*Leptochloa carulescens*	5	88	0.2762
20	*Lindernian* sp.	407	7163	22.4862
21	*Mariscus* sp.	4	70	0.221
22	*Nelsonia cinensis*	77	1355	4.2541
23	*Oldenlandia corymbosa*	36	634	1.989
24	*Olyra latiflora*	14	246	0.7739
25	*Oxalis corniculata*			
26	*Peperomia pellucida*	121	2341	6.6851
27	*Phyllanthus amarus*	2	35	0.1105
28	*Pityrogammia* sp.	159	2904	8.7845
29	*Platostome africanus*			
30	*Scoparia dulcis*	4	70	0.221
31	*Setaria barbata*	1	18	0.0552
32	*Sida pilosa*			
33	*Solanum torvum*	4	70	0.221
34	*Spilanthes filicaulis*	199	3502	10.9945
35	*Synedrella nodiflora*	5	88	0.2762
36	*Talinum triangulare*	61	1074	3.3702
37	*Urera repens*	1810	32189	100

		June soil			October soil		
S/N	Name of species	No. of seedlings/cm^2	Seed/m^2	% of SB	No. of seedlings/cm^2	Seed/m^2	% of SB
1	*Amaranthus spinosus*				5	88	0.4146
2	*Aspilia africana*	6	106	0.9464	6	106	0.4975
3	*Borreria ocymo*						
4	*Brachiraria deflexa*	3	53	0.4732			
5	*Chromolaena odorata*	12	211	1.8927	3	53	0.2488
6	*Cissus* sp.	1	18	0.1577			
7	*Commelina nodiflora*						
8	*Cynodon dactylon*	25	440	3.9432	18	317	1.4925
9	*Cyperus dactatylon*	158	2781	24.9211	107	1883	8.8723
10	*Drymaria kaudata*	7	123	1.1041	3	53	0.24898
11	*Elytraria lyrata*	56	986	8.8328	4	70	0.3317
12	*Eragrostis tenella*	41	722	6.4669	1	18	0.0829
13	*Euphorbia heterophylla*						
14	*Euphorbia hysopifolia*				1	18	0.0829
15	*Euphorbia prostata*				830	14608	68.8226
16	*Ferm* sp.				5	88	0.4146
17	*Gloriosa superba*						
18	*Laportea aestuans*				7	123	0.5804
19	*Leptochloa carulescens*	32	563	5.0473	4	70	0.3317
20	*Lindernian* sp.	150	2640	23.6593	22	387	1.8242
21	*Mariscus* sp.						
22	*Nelsonia cinensis*	3	53	0.4732	24	422	1.99
23	*Oldenlandia corymbosa*	15	264	2.3659	29	510	2.4046
24	*Olyra latiflora*	6	106	0.9464	11	194	0.9121
25	*Oxalis corniculata*				3	53	0.2488
26	*Peperomia pellucida*	70	1390	12.4606	20	352	1.6584
27	*Phyllanthus amarus*				7	123	0.5804
28	*Pityrogammia* sp.				1	18	0.0829
29	*Platostome africanus*	8	141	1.2618			
30	*Scoparia dulcis*						
31	*Setaria barbata*	13	229	2.0505	9	158	0.7463
32	*Sida pilosa*	4	70	0.6309			
33	*Solanum torvum*			1	18 0.	8229	
34	*Spilanthes filicaulis*	1	18	0.1577	54	950	4.4776
35	*Synedrella nodiflora*	2	35	0.3155	15	264	1.2438
36	*Talinum triangulare*	10	176	1.5773	19	334	1.5755
37	*Urera repens*	2	35	0.3155			
		634	11160	100	1206	21225	100

Euphorbia prostata, *Leptochloa carulescens*, *Nelsonia cinensis*, *Oldenlandia corymbosa*, *Olyra latiflora*, *Setaria barbata*, *Spilanthis filicaulis*, *Synedrella nodiflora* and *Talinum triangulare* recorded fluctuating densities across the seasons. Families Asteraceae, Euphorbiaceae and Poaceae dominated the seedbank with four (4) species each.

Thirty nine herbaceous species emerged from the seedbank of plot MP_2 belonging to 20 families. Families Poaceae, Asteraceae and Urticaceae dominated the seedbank with five, four and three species. Of the 39 species, 13 emerged in one season out of the 3 seasons in which soil was sampled. 11 species: *Commelina nodiflora*, *Cynodon dactylon*, *Cyperus dactatylon*, *Elytraria lyrata*, *Fern* sp. *Lindernia* sp. *Nelsonia cinensis*, *Olyra latiflora*, *Peperomia pellucida*, *Pityrogammia* sp., *Solanum torvum* had a general reduction in their level of seedling emergence as the seasons progressed. Ten species showed fluctuating seedling emergence while 3 species showed increasing trend in their seedling emergence across the seasons e.g., *Euphorbia prostata*, *Solanum erianthum* and *Spilanthis filic*aulis.

Generally, species belonging to the families Asteraceae, Euphorbiaceae and Poaceae dominated the seedbank of the four study plots (SF_1, SF_2, MP_1 and MP_2). However, there were individual species contributing immense number of seedlings to the seedbank of the plot in which they were found i.e. *Drymaria kaudata* (383 seedlings) and *Euphorbia prostata* (584 seedlings) both of SF_1. *Euphorbia prostata* (1506 seedlings) and *Elytraria lyrata* (406 seedlings) both found in SF_2. *Cyperus dactatylon* (542 seedlings) *Lindernia* sp., (579 seedlings) and *Elytraria lyrata* (360 seedlings) all found in MP_1 while in MP_2 species like *Cyperus dactatylon* contributed 573 seedlings, *Lindernia* sp., (571 seedlings), *Oldenlandia corymbosa* (418 seedlings) and *Peperomia pellucida* (573 seedlings).

DISCUSSION

The generally high density of herbaceous seedlings that emerged in the March soil may be due to the onset of rain which stimulated the germination of some of the seeds. The result agrees with the observation of Bartholoma (1979) Esperagos and Peco (1993) and Ortega *et al*. (1997). They observed that a temporal pattern in the number of viable seeds in the soil has been detected in annual Mediterranean pastures. They further observed that maximum emergence was recorded in the summer while the minimum was recorded in spring. Favourable weather has been observed as a critical factor in the germination of seeds stored in seed bank. In this study the older plots had lower seedbank density compared to younger plots and this could be attributed to the increased level of disturbance in the managed plots. This result is in agreement with the observation, of Ortega *et al*. (1997) who studied seedbank dynamics in Spanish mountain grassland and reported that the density of buried germinable seeds generally falls as altitude and successional age increase and also rises as intensities of disturbance in communities increases. Apart from density that reduced as successional age increased, floristic richness of herbaceous species also reduced in the plots used for this study. Falinska (1999) while studying seedbank dynamic in abandoned meadows reported that floristic richness decreased during succession. Furthermore Falinska (1999) discovered that seedbanks density fluctuates in the course of succession. In this study a significant variation in the total densites of seedbank was observed among the sucessional plots and in the seasons. In the older plots (SF_1 and SF_2) fewer herbaceous seedlings were recorded as against the figure recorded for the managed plots (MP_1 and MP_2). This could also be ascribed to the effect of the relatively closed canopy in the older plots which prevented global seedrain and this is in agreement with the result of Oke (1993). Oke (1993) reported that fewer herbaceous seedlings species were recorded in the older (forested) plot due to the effect of shading by the woody species. However, Edward and Young (1998) have reported a comparatively different result from the one reported for this study. Edward and Young (1998) reported little temporal variation in seedbank composition when 2 sites differing on soil age were compared in their study of spatio-temporal variation in shrub-thicket soil seedbank.

The dominant herbaceous species in this study e.g., *Chromolaena odorata*, *Pityrogrammia* sp. Oldenlandia corymbosa, *Laportea aestuans*, *Euphorbia prostata*, *Elytraria lyrata*, *Lindernia* sp. Peperomia pellucida, *Cyperus dactatylon*, *Spilanthes filicaulis* and *Solanum torvum*, have been reported by several authors like Oke (1993) and Oladipo (2003) as the dominant species in the soil seedbank of both disturbed and forested plots. This result also tallies very well with the result of Funes *et al.* (2003) who studied seedbanks dynamics in tall-tussock grasslands along an altitudinal gradient in Argentina. In that study, species belonging to families Asteraceae (19 species) and Poaceae (16 species) were dominant just like in the result of this present study in which species belonging to families Asteraceae, Euphorbraceae, Poaceae and Urticaceae were dominant in all the four plots. The pattern of seedling emergence of the herbaceous species in the plots and across the season also reveals the nature of their seedbank, for example species like *Chromolaena odorata*, *Mussaenda elegans*, *Laportea aestuans*, *Leptochloa carulescens*, *Solanum torvum* which consistently emerged from the seedbank of all the plots and across the seasons could be said to have transient seedbank while species with just a few emergence in one or two of the plots and in one of the 3 seasons like *Cissus* sp. Sida pilosa, *Sporobolus festivus*, *Physalis* sp. *Scoparia dulcis* may be said to exhibit persistent seedbank (Thompson and Grime, 1979). Moreover, the differences exhibited in the pattern of emergence of these species may be due to their differential germination requirements, those species that constantly, emerged in all the plots and across the seasons may have had all their seed germination requirements met. Cabin and Marshal (2000) have observed that persistent seedbank occur where environmental factors are unpredictable and there is a low probability of seedling survival. The trend of germination or seedling emergence observed in this study is consistent with the report of Cavieres and Arroyo (2001) that cold climate (an element of weather or environmental variable) promotes seed persistence in the soil. The assertion of Cavieres and Arroyo (2001) is further supported by the reports of Trillo and Carro (1993) as well as Baskin and Baskin (1998) who observed that the seedbank dynamics of a given species may be responsive to the modulating effect of the environment. However Thompson and Grime (1979) made it clear that in populations of the same species in different types of habitats, the seasonal variation in the number of seeds in the soil is more dependent on the species rather than the environment.

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