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Assessment of soil seeds bank in uncultivated area (Shambat)

تقدير بنك بذور الحشائش في أرض غير مزروعة(شمبات)

A thesis submitted in partial fulfillment of the requirements for the degree of B.Sc. in plant Protection

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Inception

الآية

(هُوَ الَّذِي أَنزَلَ مِنَ السَّمَاءِ مَاءً ۖ لَّكُم مِّنْهُ شَرَابٌ وَمِنْهُ شَجَرٌ فِيهِ تُسِيمُونَ (10) يُنبِتُ لَكُم بِهِ
الزَّرْعَ وَالزَّيْتُونَ وَالنَّخِيلَ وَالْأَعْنَابَ وَمِن كُلِّ الثَّمَرَاتِ ۗ إِنَّ فِي ذَٰلِكَ لَآيَةً لِّقَوْمٍ يَتَفَكَّرُونَ (11))

النحل الآية 10-11

صدق الله العظيم

Dedication

To all those who encouraged and guided me in my life

To my family, my dear parents, brothers, sister, my teachers,

and to all my dear friends and colleagues

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ملخص البحث

أجريت هذه الدراسة في منطقة شمبات،الخرطوم بحري، جنوب كلية الدراسات الزراعية جامعة السودان للعلوم والتكنولوجيا خلال (ابريل – مايو 2016م)لتقدير بنك بذورالحشايش في التربه في هذه المنطقه، وتم اخذ العينات على مسافات متساوية في مساحة (10x10متر) على عمق (10) سم وقطر (8) سم ، وعدد العينات (25) عينة ووزن كل عينة (1) كيلو جرام ، وتم مزج العينات مع بعضها البعض وغربلتها بغربال (2) مش وتجزئتها الى (5) اجزاء بمعمل امراض النبات قسم وقاية النباتات، ثم تم استخلاص بذور الحشائش مباشرة عن طريق الغسيل بالماء في غرابيل متدرجة الأقطار(2- 0.2) مش، وتم اختبار حيوية بذور الحشائش عن طريق مركب كلوريد الكالسيوم .أظهرت النتائج ان اكثر انواع الحشايش سيادة هي الربعة *Trianthema portulacastrum*(34%), تليها النجيلة *Cynodon dactylon*(13.4%) تليها التبر *Ipomoea cordofana*(11.9%). عدد البذور الحية والميتة للحشائش النجيلية وعريضة الاوراق الموجودة في الأراضي غير المزروعة تساوت في كمياتها .

Abstract

This study was conducted in un cultivated Shambat area, Khartoum Bahri, south of college of Agricultural Studies, Sudan University of Science and Technology during(April to May, 2016),to estimate the soil seed bank in this area. The soil data were collected from area mention above. The distances between samples were equal (10x10 meters) at a depth of (10 cm) and a diameter (8 cm), and the number of samples (25), and the weight of each sample (1) kg. The samples were taken to plant pathology lab in department of plant protection, college of Agricultural Studies, Sudan University of Science and Technology, then the sample mixed with each other and screened sieve (2) Mesh and fragmentation to (5) parts, and then was extracted weed seeds directly by washing with water in sieves graded diameters (2 0.2) mesh, the vital weed seed was tested by calcium chloride. The results showed that, the most dominant species identified was *Trianthema portulacastrum*(34%), followed by *Cynodon dactylon*(13.4%), *Ipomoea cordofana*(11.9%). Also the number of live and dead seeds (grasses and broadleaves) in abandoned uncultivated land was equal.

CHAPTER ONE

INTRODUCTION

The weed seed bank is the reserve of viable weed seeds present on the soil surface and scattered throughout the soil profile (Singh *et al.*, 2012; Begum *et al.,* 2006). It consists of both new weed seeds recently shed, and older seeds that have persisted in the soil from previous years. In practice, the soil's weed seed bank also includes the tubers, bulbs, rhizomes, and other vegetative structures through which some of our most serious perennial weeds propagate themselves. Agricultural soils can contain thousands of weed seeds and a dozen or more vegetative weed propagules per square foot (Medalled, 2013).

The weed seed bank serves as a physical history of the past successes and failures of cropping systems and knowledge of its content (size and species composition) can help producers both anticipate and ameliorate potential impacts of crop weed competition on crop yield and quality. Eliminating "deposits" to the weed seed bank also called seed rain-is the best approach to ease future weed management (Medalled, 2008).

Weed seed banks are particularly critical in farming systems, which rely on cultivation as a primary means of weed control. Because a cultivation pass generally kills a fixed proportion of weed seedlings present, a high initial population will result in a high density of weeds surviving cultivation and competing with the crop. Initial weed population is directly related to the density of seeds in the seed bank (Brainerd,*et al.*, 2008; Teasdale *et al.,* 2004); thus, effective cultivation-based weed control requires either a low seed bank density or multiple cultivation passes to achieve adequate weed control(Forceless*et al.*, 2003). The main objective of this study to investigate the soil seed bank in un cultivated area in shambat.

CHAPTER TWO

LITERATURE REVIEW

2.1. The definition of a weed

Human desires values and most importantly economic needs are what drive a plant being defined as a weed. The qualities by which humans define plants as weeds include disturbance, aesthetics, utility or biological characteristics. All of these definitions are the consequence of interactions with humans. Many of these definitions are anthropomorphic, plant qualities as perceived by humans As such they reveal the plants' relationship to us, and tell us much of how we view nature the nature of weeds and weedness begins by understanding the basis on these types ofplantsaredefined.

1. Any plant that is objectionable or interferes with the activities or welfare of man (Anonymous, 1994).

2. A plant out of place, or growing where it is not wanted (Blatchley, 1912)

3. A plant growing where it is not desired (Buchholtz, 1967)

4. A very which unsightly plant of wild growth, often found in land that has been cultivated (Thomas, 1956).

5. Useless, unwanted, undesirable (Bailey and Bailey, 1941)

6. An herbaceous plant, not valued for use or beauty, growing wild and rank, and regarded as cumbering the ground or hindering growth of superior vegetation (Murray *et al.*, 1961).

7. A plant whose virtues have not yet been discovered (Emerson, 1878)

2.1.1. The origins of weeds

The reader should be warned that as yet there is no one to whom he can turn for an orderly history of weeds by a strange paradox these commonest of plants are comparatively unknown The vegetation of many a remote mountain range is better understood than the common flowers and weeds in your garden Weeds are adapted to habitats disturbed by man They may be useful in some respects and harmful in others They may be useful to some people and hated and despised by others Most of the most common and widespread weed species we now have come as a consequence of crop domestication, planting and cultivation These agricultural processes began about 12,000 years ago They occurred on different continents and involved different native species available for selection as crops Since those early origins both crops and their weeds have spread throughout the world These crop weed groups are the most successful invasive species in human history (Anderson, 1954).

2.1.2. Beneficial effects of weeds or economic uses of weeds

Several weeds have been put to certain economic uses since ages. *Typha* and *Saccharum* sp used for making ropes and that ch boards. *Cichoriumintybus roots are used for a*dding flavor to coffee powder. *Amaranthus viridis, Chenopodium album and Portulacasp.*used as *leafy* vegetable, in north India *Saccharum spontaneum* used in breeding programme for developing the noble canes. Incorporation of *Crotalaria*, *Parthenium*, *Calotropis* and *Eichornia*reduced root knot nematode population in the soil as they exhibited nematicidal properties, Hariyali grass (*Cynodon dactylon) Cenchru sciliaris, Dichanthium annulatum, Ecliptaalb* weeds of grass land serve as food for animals. People in china and Japan consume *Chlorella paranoids* (algae) as protein supplement. Weeds act as alternate host for predators and parasites of insect pests which feed on the weeds.

For example *Tricho grammachilonis* feed upon eggs of caster semi looper which damage the castor plants. Some weeds useful to identify the metals (Indicator geobotany) through satellite imageries Eg *Commelina*sp (Copper), *Eichornia crassipes* (Copper Zinc, lead and cadmium in water bodies several species of weeds *Tephorsia purpurea*and *Croton sparsiflora*in S. India used as green manures, Whereas *Eichornia crassipes* and *Pistiastratiotes*are used for composting. *Argemonemexicana* used for *r*eclamation of alkali soils NO_2 and SO_2 air pollutio*n* determined by wild mustard and chick weed respectively. Aquatic weeds are useful in Paper, pulp and fiber industry. *Chenopodium album* used as *m*ulch to reduce evaporation losses, where as *Agropyronrepens* (quack grass) used to control soil erosion because of its prolific root system. Weeds like *Lantana camera*, *Amaranthus viridis*, *Chenopodium album*, *Eichhornia crassipes used* for beautification. *Agropyronrepense* used for soil conservation, where as*Dicanthium annulatum s*tabilizing field bunds. *Opunti adellini* used as biological fence, some weeds have medicinal properties and used to cure snake bite (*Leucasaspera)*, gastric troubles (*Calotropisprocera)*, *skin* disorders (*Argemonemexicana) and jaundice* (*Phyllanthus nirur)* and *Striga orobanchioides*to control diabetes. In addition to the above agarbathis (*Cyperus rotundus),aromatic*oils, (*Andropogan sp& Simbopogon*sp) are prepared from weeds.

2.2. Soil seed bank

2.2.1. Types definitions of soil seed banks

Soil seed banks include all living seeds in a soil profile, including those on the soil surface. Soil seed banks are also composed of dispersal units, which are seeds or fruits surrounded by structures serving for dispersal and sometimes contain other plant parts such as bracts or stems. Over time, the dispersal structures, as well as seed coats, can decompose, leaving only germination units.

For example, Ranunculus arvensis has a thick seed coat and spikes which both decompose after burial in soil after a few years, leaving coatless seeds (Saatkamp, 2009). Soil seed banks resemble other biological reservoirs, such as invertebrate eggs, tubercles and bulb banks, spores of non-spermatophyte plants and fungi, or seeds retained on mother plants (serotiny). (Trudgill*et al*., 2005).Soil seed banks vary much according to seed proximity, seed persistence and physio- logical state. Living seeds have been found in or on the soil for different durations different seasons at different depths in different quantities (Thompson and Grime, 1979; Thompson *et al*., 1997) and in different states of dormancy or pro- cession to germination (Baskin and Baskin, 1998; Wicke*t al.*, 2005; Finch-Savage and Leubner-Metzger, 2006). Seeds in the soil seed bank may occur in or on the soil, but in many situations, there is continuity between seeds at the surface, partly buried and completely buried seeds (Thompson, 2000). In practice, it is rarely possible to properly separate buried seeds from the seeds in the litter. Seeds of several plant species hardly ever enter the soil but persist at its surface or in the litter for many years, prominent examples are the large and hard fruits of Medicago and Neurada, which contain dozens of seeds and can give rise to several plants over several years, Plants differ in the duration their seeds remain in the soil and even within a species and among seeds of the same cohort there is variability in the time they spend in the soil seed bank (Thompson and Grime,1979). proposed a system of soil seed bank types, based on the study of the seasonal dynamics and the duration of soil seed banks for the flora of Central England According to their data, they distinguished between transient seed banks for species that have viable seeds present for less than 1 year, and persistent seed banks for species with viable seeds that remain for more than 1 year.

Persistent soil seed banks can be subdivided further into short-term persistent for seeds that are detectable for more than 1 but less than 5 years, and long-term persistent seed banks that are present for more than 5 years (Bakker, 1989). A classification key for the three basic types can be found in Grime (1989), which is based on the abundance and depth distribution of seeds in the soil seed bank, their seed size, their seasonality and the presence/absence of a plant in the established vegetation around the seed bank sample. (Thompson and Grime, 1979) also used seasonality to separate winter and summer seed banks for plants with autumn and spring germination Since timing of seed dispersal and germination vary greatly among species and among climates (Baskin and Baskin, 1998; Boedeltje, *et al*., 2004), suggested that the time between dispersal and the first germination season should be used to distinguish transient from persistent seed banks, Some plants produce both transient and persistent seeds, in varying ratios And variation in the environment leads to vari- able seed exit by germination from the seed bank Whereas simple seed bank types are useful for multi- species comparisons, we need also to con- sider dynamic and quantitative aspects of seed banks if we want to predict more precisely the role of seed banks. For example, plants can build up seed banks when their seeds are buried during disturbance and stay ingeminated due to a light requirement but germinate nearly completely when they remain at the surface soil seed banks are a dynamic part of plant populations with a set of factors that quantitatively influence their entry, persistence and exit, all of which vary according to plant biology, time and their environment. Such an approach will improve our ability to predict ecological outcomes in response to community disturbance and/or community invasion. Research on soil seed banks differs in the type of data collected, sometimes consisting of (i) studying soil samples by identifying and counting seedlings, or sifting and identifying seeds, without any precise knowledge on seed ages and the size of the original seed rain; or (ii) burial experiments, which follow, in the best case, counted numbers of seeds over time under defined conditions of depth, soil type, moisture or fertility. We propose to distinguish 'persistence' of seeds in a general sense or with undefined numbers from 'survival' of individual seeds or precisely quantified seed populations. The difference between these data types needs attention, and potentially leads to contrasting conclusions with respect to the seed size–number trade-off. (Walck,*et al*. 2005).

2.2.2. Characteristics of the soil seed banks

The weed species have survived throughout time, because of their ability to resist to several adverse climatic conditions, tolerating high and low temperatures, dry and humid environments and variations in oxygen supply. The fundamental point in the success of weed survival is their persistence capacity in certain areas. This capacity is a consequence of a great number of seeds produced, long term viability, continuous germination, phenotypic and genetic plasticity (Hafliges&Scholz, cited by Freitas, 1990; Fernández-Quintanilla & Saavedra, 1989).

The composition of seed banks is variable, and is classified as temporary or persistent, when modifying the regeneration of the vegetation during different time of the year. Temporary banks are composed of seeds of short life, which do not present dormancy and are dispersed in time for short periods during the year Persistent seed banks are composed of seeds that have more than one year of age and reserves of seeds remain in the soil year after year, generally buried into the soil.the success of a seed bank depends on the seed density ready to germinate, when replacement of a plant is necessary and when the environmental conditions for establishment are favorable.(Garwood, 1989).

The longevity of seeds represents a major mechanism of survival of certain weed species, and this leads to a continuous source of emergency, the seed longevity in the soil varies among species, characteristics of the seeds, burial depth, and climatic conditions (Carmona, 1992). Freitas (1990) presents a study with weed species, buried and placed to germinate in different times of the year. After 40 years, the species, Amaranthus retroflexus, Ambrosia eliator, Lepidiumvirginucu, Plantago major, Portulaca oleracea and Rumexcrispus originated seedlings; the seed dormancy is another characteristic that affects the seed bank reservoir. The seed populations of several vegetable species behave in different ways with respect to germination; the weeds produce polymorphic seeds, with a certain proportion that is dormant and another not (Silvertown cited by Freitas 1990) several internal and external factors prevent seeds of germination. Among the internal factors, some important are: the presence of a seed coat, which is a barrier to the penetration of water and oxygen; presence of a biochemical inhibitor in the seed; and immature embryo. Among the external factors, the most common are soil water content and temperature (Quintanilla,*et al.*, 1991).

2.2.3. Evolution of soil seed banks

Soil seed banks are both the outcome of environmental or plant developmental contingencies and the result of evolutionary history. Climate, herb ivory and disturbances vary and lead directly to year-to-year changes in soil seed bank density and spatial heterogeneity. Some environments particularly favor the evolution of persistent soil seed banks, such as river mud flats or ephemeral ponds, forest gaps, pastures and arable fields since they are often or intensely disturbed (Bekker *et al*., 1998c) or have very variable habitat conditions (Brock, 2011).

2.2.4. Seed banks and the predictability of environment

Even predictable changes in the environment can lead to formation of soil seed banks, although lasting for a shorter time. Typically more predictable environmental factors include seasonal changes in temperature, moisture (Baskin and Baskin, 1998).Water level in some aquatic ecosystems such as flood plains of large rivers (Leck*et al.,* 1989) and the number of competing seeds from the same mother plant or environment (Cohen, 1967). When favorable environments for germination are predictable on shorter timescales, transient rather than persistent soil seed banks tend to form with germination time deter- mined by cues for dormancy loss and germination of non-dormant seeds (Thompson and Grime, 1979).

Sometimes disturbances are predictable at longer timescales only (10–20 years), such as fires with immediately following regeneration opportunities.

2.2.5. Evolution of persistent seed banks and density dependence competition and predation

Bet hedging explains evolution of persistent seed banks in the absence of density-dependent effects, such as competition or density-dependent seed predation. But, in many ecosystems, competition and density- dependent seed predation play an important role and this affects the evolution of soil seed banks. For example, competition can lead to deterministic fluctuations in otherwise constant environments due to high reproductive rate and deterministic growth.(Leck,*et al.*, 1989).

2.2.6. Methodology of studying soil seed bank

In order to development alternative weed systems, it is necessary to have information about the seed bank biology. However, in most agroecossystems little is known about weeds. The determination of seed banks of the soils is very difficult through the techniques that have been used lately, since they demand a lot of work and sometimes destruct seed viability (Buhler & Maxwell, 1993).

Roberts (1981), the best way to determine the presence and amount the seed in soil is to observe the seedlings emergence at the site. However, the most frequently used technique involves the determination of the number of seeds placing soil samples for germination in appropriate places, or using physical separation of seeds from the soil particles, based in differences in size and density.

When the soil samples are collected the main problems are related to the heterogeneity present in the soil profile. If there is no previous information in relation to the seed distribution, it is recommended to take the soil samples in "W", like it is normally used for soil chemical analyses (Roberts, 1981).The method of emergence of seedlings is simple and has the advantage of the easy identification of the species; however, it requires space in the greenhouse or growth chamber and the results can be influenced by seed dormancy (Buhler & Maxwell, 1993).The use of substances that promote the floatation is a good method for seed separation, but these substances can reduce the viability of the seeds. It is, therefore, desirable to reduce the seed exposition to the solution in order to reduce the losses in the seed viability (Buhler & Maxwell, 1993).Several chemical substances have been used for seed separation, mainly cheap salts not highly toxic to. Potassium and sodium carbonate and zinc calcium chlorine are examples. For soils with high clay content it is necessary to use a dispersant, like sodium hexametaphosphate sodium bicarbonate using a solution of potassium carbonate at 10,000 rpm centrifugation, recovered about 100% of the seeds of giant foxtail e *Abutilon theophrasti*. The germination of *Chenopodium album*, giant foxtail and *Abutilon theophrasti* was reduced by the exposition to carbonate.(Roberts, 1981,Buhler & Maxwell, 1993).

CHAPTER THREE

MATERIALS AND METHODS

3.1. Study area location

The study area shambat is located in Khartoum Bahri near the river Nile.The soil samples were collected from the area south of agricultural engineering department, near animal production department in College of Agricultural Studies, Sudan University of Science and Technology in April (2016) (shambat), to investigate and analyzed of soil seed bank in this area.

3.2. Soil seed bank sampling

Numbers of samples (25) were taken from the study area in Shambat using auger at a depth of (10 cm) and a diameter (8cm). Each sample was weighing one kilogram in size, collected from square area 2x2 meters (Fig. 1). Then, samples were brought to the laboratory plant pathology, Department plant protection, College of Agricultural studies, Sudan University of science and technology. The samples mixed with each other andthen sieved to remove course soil, plant fragments and

stones, then divided into five plastic bags, each bag containing(500 g) .the seeds were extracted directly washing by passing a stream of water in sieves graded diameters (2 - 0.2, mesh)respectively(Fig. 2). Then samples were dried in the laboratory at room temperature and separated seeds use a microscope (Fig. 3).

Fig. (1) Soil sample

Fig. (2). Sieves graded diameters

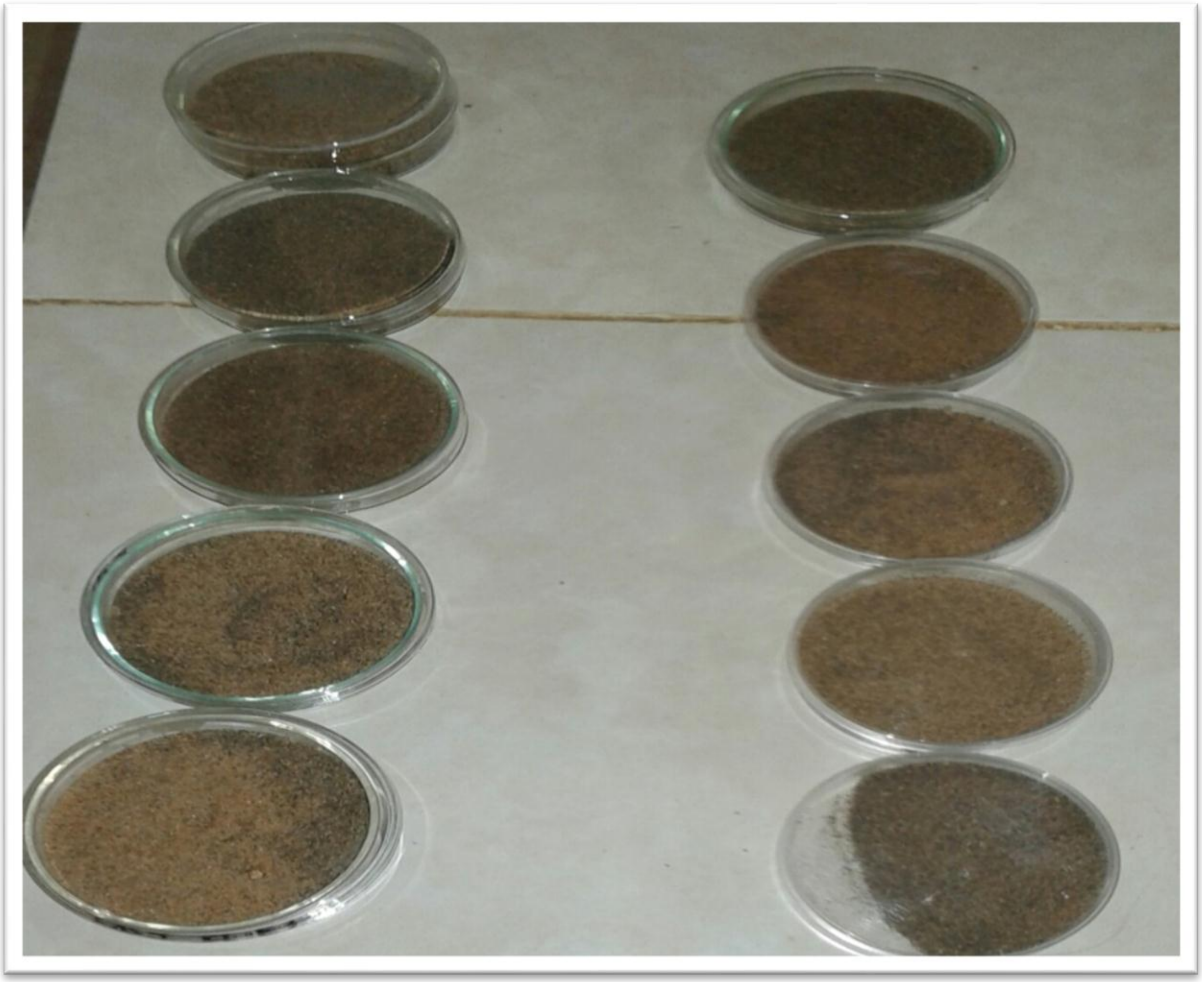

Fig. (3). Dried samples of seeds weed

3.3. Viability test

The viability of the seed was tested by calcium chloride compound. The seeds Mentioned above were transferred to a 500 ml beaker containing water. The dead seeds were observed to float and the water containing the floating dead seeds were immediately filtered in a flask .The residue (dead seeds) was air-dried. The live seeds at the bottom of the beaker were extracted as follows: A weight of1.5 g of $CaCl_2$ was accurately weighed and dissolved in (250 ml) of distilled water. The solution was added to the live seeds in the beaker and left for 40 min. The live seeds were observed to float in the $CaCl_2$ solution. These were then filtered in a flask and air-dried weighed (1.5 grams) melted in a liter of water was submerging seeds in the solution to The fifty minutes at room temperature in order to distinguish between the dead and the living tissue of seeds based on the relative rate of breathing wet tissue.

3.4. Germination test

The tested Seeds were planted in the sterilized soil in the pots and the weighting of the pots (500 grams), including (350silt) and (150sand), after germination we estimated and classified the germinating weeds.

3.5. Statistical analysis

The Statistical analysis was done by JMP package (programmer improved form SAS package) for analysis of variance; means were compared using tucky-kramer.

CHAPTERFOUR

RESULTS AND DISCUSSION

4.1. Species of weed in the study area

The result of the samples that collected from un cultivated area in shambat, were showed considerable different number of total seeds in the area. Eight species of seed weeds were found, classified into functional group grasses and broad leaved. The most dominant species identified was *Trianthema portulacastrum*(34%), followed by *Cynodon dactylon*(13.4%), *Ipomoea cordofana*(11.9%), *Brachiaria deflex*(10.4%),*Portulaca olearaceae*(10.4%),*Abutilon figarianum*(4,4%),*Tribulus terrestris*(4.4%) and *Corchorus depressus*(2.9%)(Table 1 and figure 4 and5). This finding is agree with Medalled (2013), he reported that ,soil seed bank consists of both new weed seeds recently shed, and older seeds that have persisted in the soil from previous years. In practice, the soil's weed seed bank also includes the tubers, bulbs, rhizomes, and other vegetative structures through which some of our most serious perennial weeds propagate themselves. Agricultural soils can contain thousands of weed seeds and a dozen or more vegetative weed propagules per square foot.

Table (1) Weed species of uncultivated area shambat

	Weed species		
Scientific name	English name	Weeds (%)	Classification of weed
Trianthema portulacastrum	Horse purslane	34.4%	Broad-leaved
Cynodon dactylon	Bermuda grass	13.4%	Grasses
Ipomoea cordofana		11.9%	Broad-leaved
Brachiaria deflexa		10.4%	Grasses
Portulaca olearaceae	Purslane	10.4%	Broad-leaved
Abutilon figarianum.		4.4%	Broad-leaved
Tribulus terrestris	Puncture vine	4.4%	Broad-leaved
Corchorus depressus	Suteb	2.9%	Broad-leaved

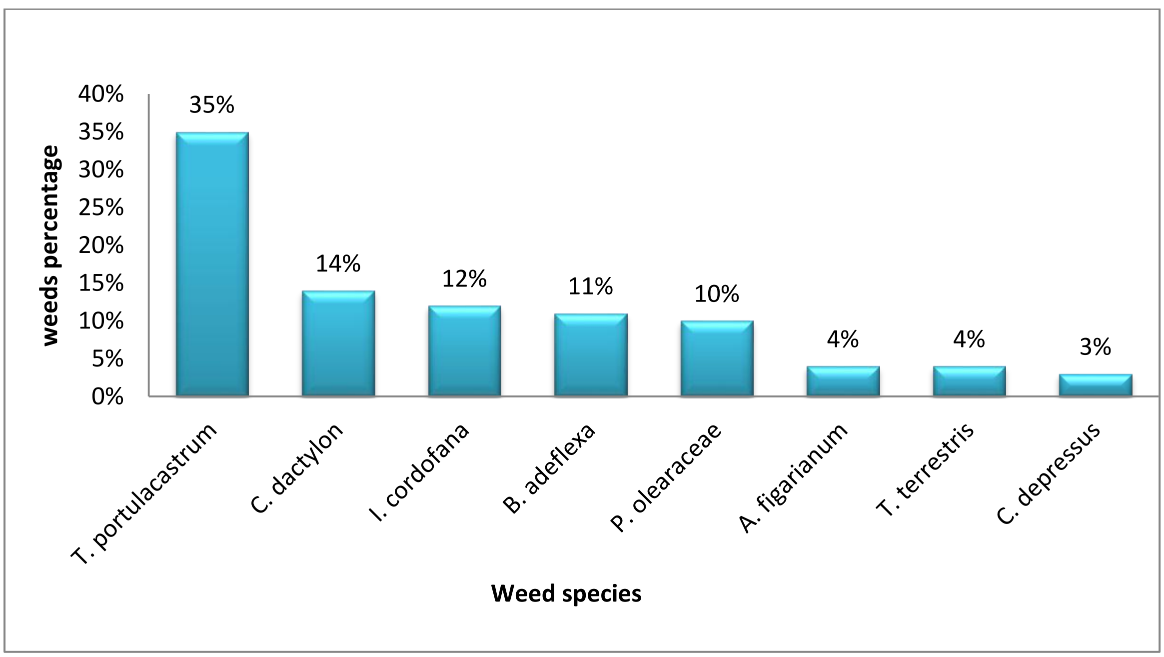

Figure (4) Weed species of uncultivated area shambat

4.2. Viability test

Table (2) showed the number of live seeds of grasses and broadleaved in uncultivated area. The maximum average number of living seeds recorded in broadleaved (7.6), while the grasses reported the lower number (5.8). The weed seed bank is the reserve of viable weed seeds present on the soil surface and scattered throughout the soil profile (Singh *et al.,* 2012; Begum *et al.,* 2006).

The number of dead seeds was equal in two types, which means they are affected by the same, circumstances that lead to the death of the seed was either harsh environmental conditions or corrupted by insects (Table 3).

Fig. (5). Germinating test of broadleaved seed weeds

Table (2). The number of live seeds (broad-leaved and grasses) of uncultivated area shambat

Number of live seeds	
Average No of seeds	Weeds classification
7.6	Seeds of Broadleaved
5.8	Seeds of Grasses
SE± 1.5	
CV= 51	

Table (3). The number of dead seeds (broad-leaved and grasses) of uncultivated area shambat

Number of dead seeds	
Average No of seeds	Weeds classification
2.6	Seeds of Broadleaved
2.6	Seeds of Grasses
SE± 0.9	
CV= 10	

Recommendation

This study is regarded as the base for future studies to show the change in plant cover and to know the flora in shambat area.

REFERENCES

Anderson, E. (1952). Plants, man and life.Little, Brown, Boston, MA. [Ch.1 quote: 1954?]

Anonymous. (1994). Herbicide handbook, 7th edition Weed Science Society of America, Champaign, IL.

Bailey, L.H. and E.Z. Bailey. (1941). Hortus the second. Macmillan, NY.

Baker H.G. (1989): Some aspects of the natural history of seed banks. – In: Leck M., Parker V. & Simpson R. (Eds), Ecology of soil seed banks, p. 9–21, Academic Press, San Diego.

Bakker J. D. & Wilson S. D. (2004): Using ecological restoration to constrain biological invasion. – J. Appl. Ecol. 41: 1058–1064.

Baskin, C. & Baskin, J. (1998). Seeds: ecology, biogeography, and evolution of dormancy and germination. Academic Press, San Diego, CA, US.

Blatchleys, W.S. (1912). The Indiana weed book. Nature Publications Company, Indianapolis, IN.

Brainard, D.C., Bellinder, R.R., Hahn, R.R. and Shah, D.A. (2008).Crop rotation, cover crop and weed management effects on weed seed banks and yields in snap bean, sweet corn and cabbage. Weed Science. 56: 434–441.

Brock J. (2003): Eleagnusangustifolia (Russian olive) seed banks from invaded riparian habitats in northeastern Arizona. – In: Child L., Brock J., Brundu G., Prach K., Pyšek P., Wade M. & Williamson M. (Eds), Plant inva- sions: ecological threats and management solutions, p. 267–76, Backhuys Publishers, Leiden.

Buchholtz, K.P. (1967). Report of the terminology committee of the Weed Science Society of America. Weeds 15:388-389.

Bulher, D.D.; Maxwell, B.D. Seed separation and enumeration from soil using K2CO3-centrifugation and image analyses. Weed Science, v.41, p.298-303, (1993).

Carmona, R. Problemática e manejo de bancos de sementes de invasorasem solos agrícolas. PlantaDaninha, v.10, n.1/2, p.5-16, (1992).

Cohen D. (1966): Optimizing reproduction in a randomly varying environment. J. Theor. Biol. 12: 119–29. Colautti R., Grigorovich I. &MacIsaac H. (2006): Propagule pressure: a null model for biological invasions. – Biol. Inv. 8: 1023–1037.

Emerson, R.W. (1878). Fortune of the republic. Houghton and good, Boston, MA.

Fernandez-Quintanilla, C.; Saavedra, M.S. Malashierbas: conceptosgenerales. In: Garcia Torre, L.; Fernandez-Quintanilla, C. Fundamentossobremalashierbas y herbicidas. Madrid: Mundi-Prensa, Madrid, (1991). P.26-48.

Fernandez-quintanilla, C.; Saavedra, M.S; Garcia Torre, I Ecologia de lasmalashierbas. In: garcia torre, I.; Fernandez- Quintanilla, C. Fundament to ssobremalashierbas y herbicidas. Mundi-Prensa, Madrid, (1991). P.49-69.

Forcella, F. (2003). Debiting the seed bank: Priorities and predictions. p. 151–162. *In* Bekker *et al.* (Eds.) Seed banks: Determination, dynamics and Management. Aspects of Applied Biology 69.Association of Applied Biologists, Welles Bourne, UK.

Freitas, R.R. Dinâmica do banco de sementesemumacomunidade de plantasdaninhas com aspectos da germinação e dormência de sementes de Capimmarmelada (Brachiariaplantaginea (Link) Hitc.). Lavras, (1990).118p. Dissertação (Mestrado) ¾ Escola Superior de Agricultura de Lavras.

Garwood, N.C. Tropical soil seed banks: a review. In: Leck, M.A.; Parker, V.T; Simpson, R.L. (Ed). Ecology of soil seed banks. London: Academic Press, (1989). P.149-209.

Grime J. (1989). The stress debate: symptom of impending synthesis? – Biol. J. Linn. Soc. 37: 3–17.

Leck, M.A., Parker, V.T. & Simpson, R.L. (Eds.). (1989). Ecology of soil seed banks. Academic Press, San Diego, CA, US.

Medalled, F.D. (2013). Manage the Weed Seed Bank—Minimize "Deposits" and Maximize "Withdrawals". Available at: extension.org http://www.extension.org/pages/18527/manage-the-weed-seed________bank minimize-deposits-and maximize-withdrawals. VkG6 Xl53C1t

Menalled, F.D. (2008). Weed Seed bank Dynamics & Integrated Management of Agricultural Weeds. Agriculture and Natural Resources (Weeds), 200-708SA

Murray, J.A.H, H. Bradley, W.A. Cragie, and C.T. Onions (Eds.). (1961). Oxford English dictionary. The Clarendon Press, Oxford.

Roberts, H.A. Seed banks in the soil.Advances in Applied Biology, Cambridge, Academic Press, (1981).v.6, 55p.

Teasdale, J.R., Magnum, R.W., Radhakrishnan, J. and Cavigelli, M.A. (2004). Weed seed bank dynamics in three organic farming crop rotations. *Agronomy J*. 96: 1429–1435.

Thomas, W.L. Jr. (Ed.). (1956). Man‘s role in changing the face of the earth. University of Chicago Press, Chicago, IL.

Thompson K. & Grime J. (1979): Seasonal variation in seed banks of herbaceous species in ten contrasting habi- tats. – J. Ecol. 67: 893–921.

Thompson K., Bakker J. & Bekker R. (1997): The soil seed banks of North West Europe: methodology, density and longevity. – Cambridge Univ. Press, Cambridge

Thompson, (2000). The functional ecology of seed banks. In: Fenner, M. (Ed.)

Walck J., Hidayati S. N., Dixon K. W., Thompson K. &Poschlod P. (2005): Climate change and plant regenera- tion from seed. – Glob. Change Biol. 17: 2145–2161