SJ IMPACT FACTOR: 2.912 CRDEEP Journals
Global Journal of Current Research Handiso et. al., Vol. 5 No. 4 ISSN: 2320-2920
Global Journal of Current Research Vol. 5 No. 4. 2017. Pp. 152-158

Full Length Research Paper

Efficacy of Cultural and Botanical Control on Germination and Emergence of *Parthenium hysterophorus* (L.) and *Argemone Mexicana* (L.)

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Article history
Received: 16-10-2017
Revised: 19-10-2017
Accepted: 02-11-2017

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Abstract
Parthenium and Argemone seeds had been primed in a solution containing 10% w/v of Ricinus communis and Senna occidentalis root extracts and sown in organic-mulch, plastic-mulch and non-mulch conditions to evaluate the germination and emergence rate. The treatments were laid out in CRD with factorial arrangement with three replications. Data collected on percent and date of germination and emergence was analyzed by using ANOVA. The extracts were proved to be superior over check (control). Synthetic mulch with Ricinus communis and Senna occidentalis had shown significant effects on Parthenium seed germination whereas Senna occidentalis in both synthetic-mulch and organic-mulch conditions gave superior result on Argemone, with 45 and 52% of germination and emergence. This suggested that Senna occidentalis had pre-emergence chemicals that inhibited the germination of Parthenium and Argemone seeds. Further researches are needed to be initiated weed competition at pre-emergence stage and these botanicals must be evaluated under field condition.

Key words: - *Cultural Control, Plant Extract, Weed Species, Germination, Emergence*

Cite this article as: Handiso, S., Shiferaw, D., Mekonnen, E., & Teshome, I. (2017). Efficacy of Cultural and Botanical Control on Germination and Emergence of Parthenium hysterophorus (L.) and Argemone Mexicana (L.). *Global Journal of Current Research*, 5(4), 152-158. Retrieved, from www.crdeepjournal.org/gjcr

Introduction

Cultural weed management is the manipulation of practices normally undertaken to suppress weed growth and seed production, while promoting the growth and development of the desired plant species. Cultural practice include preventing the spread of weeds between field rotating crops and posture enhancing the competitive ability of crops in a posture delaying sowing and using living mulches plastic mulches and crop residues. Cultural control of methods have become before. In recent years, in an attempt to reduce dependence on herbicides, to retard the developments of herbicide resistance and reduce chemical pollution levels in the environment (Sidel, 1968).

The increasing movement of different invasive alien species (IAS) through the aid of human and animals from place to place is having a negative impact on socio healthy and several aspects of the welfare human population and subsequent pressure that exert on the natural. Resource of the country accelerates the changes in land also patterns and ended up with conversion of a large mass of land to agriculture, mining and construction purposes. These all result in making of the natural ecosystem in suitable for native biodiversity while at the time provided on ideal opportunity for IAS to aggressively invaded once in an ecosystem and expand their geographical dimension (Taye, 2004)

As in many other countries in the tropical invasive alien plant species (IAS) introduce to Ethiopia internationally and unintentionally .In the absence detailed back ground studies prioritization of IAS was done by considering facts such as the magnitude of the invasiveness threats to local biodiversity socio economic and human health impacts several alien species are reported to be spreading at alarming rates threatening natural and agricultural ecosystem of the country. Culturally, IAS is a great concern posing serious problem to development as well as big threat to biodiversity conservation of country.The environmental policy of Ethiopia (EPE),Ethiopia institute of agricultural research (EIAR) and then policy and strategy documents acknowledge the eminent threat posed by IAS on the countries biodiversity and ecosystem at large (Abdu,2004). Among several IAS in the country *Parthenium hystrophorus* and*Argemone mexicana* were considered as emerging issues for the country (Kassahun,1996; Hailu *et a1*.,2004).

Parthenium hysterophorus L. belongs to the family asteraceae an extremely diverse family with cosmopolitan distribution. The centre of the origin is thought to be centralSouth America. In Ethiopia Parthenium has become the worst weed seenis its discovery as exotic invasive weed in the 1980, when and how it is introduce in to country with a matter of speculation. The seed can germinate any life of the year oven a wide range of both constant (10^0 and 25^0c) temperature provided moisture is not lifitthe maximum emergence of Parthenium occurred from shallow buried (0.5cm)seeds and emerges decrease with the decrease depth burial (Tamado,2001). *Argemone mexicana* L. is described as annual herb which is drought tolerant and conserve through dry period because of its tap-root. Commoly germinated quite late in the phenology and persist through the dry season. (FAO, 1987). Parthenium also produce a long tap root system that enable it to obtain water from deep with on the soil profile and stores energy reserves for rapid re-growth of the plant is the slashed or grazed (Navice, *et al*.,1996, Evans,1997).The seeds can germinate during any type of the year over a wide range of both constant (10^0c) temperature provided in posture is not limiting .Seeds germinated both to a higher temperatures. On the other hand, Parthenium seeds are should lower percentage and rate of germination to a moisture stress than sorghum grain and the effect of moisture stress were before severe at higher temperature (27^0c). This implies the earlier emergency sorghum in the field than Parhenium in response to lower precipitation (Tomado, 2001). Parthenium and Argemone are major emerging agricultural weeds in Ethiopia. They are spreading rapids and having substantial impacts in arable land, punctures and grazing land. The occurrence of weed in grass land is reported to reduce larger production up to 90%. Besides making landless productive affecting grazing land, animal health and milk and milk qualities (Navie *et al,* 1996; Evans,1997). Furthermore, the problem of invasive alien plant species (IAPS) constitutes major constraints to biodiversity, agriculture, as well as animals and human health and competes the desired plant species. So increased effort are being carried out so far against these species and several innovative control strategies that are efficient and easy to use were undertaken in Ethiopia (Senayit *et al*, 2004). Cultural control through mulches mulches may inhibit germination of weeds from seed rain in the short term by preventing seeds from entering the soil. Synthetic mulches and course of grades bark and wood chips would appear to be most effective in this context, although, at the break down, they may eventually provide conditions to weed germination (Appleton *et al.,* 1990; Felfon *et al.,* 1987). Further the seeds that do not germinate will exhaust seed reserves before reaching light where synthetic mulches are non-penetrable or the mulch layer is sufficient depth (Haudreck *et al*., 1994; Sindel, 1968).

More recently plant extracts of *Ricinus communis* and *Senna occidentalis* were produced using aceton or per-ether. The repulsion of the stored products of weed Species to the extracts was tasted using a s shaped lactometer (Dwivedi, 2000). *Ricinus comminus* extracts in both solvent exhibited the highest inhibiting action against insects, and weed, although *Senna occidentalis* has greater inhibiting ability of the weed and insects (Dwivedi, 2000). Castor (*Ricinus communis*) seeds, which are rarely available by products, were assessed for their suitability as a feed stocks (Grgonou,2001). It also has hydroscopic character in the seed apart from insecticidal and herbicidal properties (Gergorou, 2001). *Coffee senna* is also known as stinking weed. The species varies from semi-woody annual herb in warm temperature areas to a woody annual shrub or times a short –lived perennials shrub in forest areas (Haseswood, 1966). The seed of coffee Senna are roasted and use as a coffee. The plan tissue contain a host of photoactive chemicals that may support its numerous application in a folk medicine as well as insecticidal properties (Guzman, 1975). Extracts of *Senna occidentalis* are have an analgesic, antibacterial, antipathic, antifungal, anti-inflammatory, antiseptic, antispasmodic, febrifuge, and insecticidal properties (Rainfree, 2002).

Thus this paper was initiated with the aim to evaluate and compare the efficacy of cultural and botanical control on emergence and germination of *Parthenium hysterophorus* and *Argemone mexicana*

Materials and methods

Description of the Study Area

The experiment was conducted in Wolaita Sodo University practices site which located about 390 km south of Addis Ababa. Geographically it is located at latitude of 1800m 649'Nand longitude of 37 45 E with annual average temperature of 20^{o}C and rainfall 1212mm (WSU student hand book, 2009)

Method of extraction

Leaves and seed of *Ricinus comminus* and *Senna occidentalis* were collected (l kg from each weed) from wolaita sodo university campus. They were powdered manually with mortar and pestle which soaked in three pots for 6 hrs, thoroughly mixed by shaking the pot with back and forth movement until uniform mix of the leaf, bark and seed of *Ricinus comminus* and *Senna occidentals were maintained*. After that, little amount of water was added and thoroughly mixed in order to facilitate dormancy of weed seed during sowing, Parthenium and Argemone seed were soaked with the petridish /syringe of from mixed parts for six minute.

Treatments and experimental Design

The plate experiment was conducted in Complete Randomized Design (CRD) where the treatments were replicated three times. The treatments were aqueous extracts of *Ricinus comminis, senna occidentalis* and control. Data Collected included days of germination and percentage germination. For the Pot experiment, experimental Design the completely randomized block design. The aqueous extracts of *Ricinus communis* and *Senna occidentalis* under no mulch, organic mulch and synthetic mulch regimes were applied on a pot sown with Argemone and Parthenium weed seed which were obtained from around Wolaita Sodo university. Sowing was done after repeated depletion of weed seed bank that was carried out by exposing it to concurrent sun light and watering through flushing

method (two flushing). The parameters were examined in terms of their emergence percentage and days of emergence on Parthenium and Argemone. The seedling was appeared above the soil surface counted as emerged. The nine (9) treatment combinations are presented in Table 1 as follows:

Table 1. Arrangement of treatment combination

No	Treatment combination	No.	Treatment combination
1	Dry mulch	6	Synthetic mulch with *Senna occidentalis*
2	Dry mulch with *Ricinus comminus*	7	*Ricinus communis*
3	Dry mulch with *Senna occidentalis*	8	*Senna occidentalis*
4	Synthetic mulch	9	Control
5	Synthetic mulch *Ricinus conmunis*		

Furthermore, the agronomic crop husbandry like irrigation was performed.

Statistical Analysis

All the data at end of experiment were subjected to analysis of variance (ANOVA) and critical difference (CD 5%)

Results

When concerned with the experimental results of Parthenium and Argemone weed, were observed that move or less similar results. The analyzed data revealed that cultural practices and plant extract have significant effect on days of emergence and percentage as well as days of germination for Argemone and Parthenium. This implies that cultural control method could be attributed to better inhibiting of weed see after germinated due to free venation of sun light.

Plant extracts on germination of Parthenium and Argemone weed species Petri dish experiment

Days of Germination

Pots treated with *Ricinus Comminis* and *Senna occidentals* had significant effect on days of germination of Parthenium and Argemone weed seed than control treatments (Table 2). However, the earliest day of germination attributing traits were recorded in plant extract of *Senna occidentalis* treatment at 5(five) days of germination on Parthenium seed rather than *Ricinus communis* and control treatment. Besides, in Argemone seed which become fastest germination was recorded in plant extracts of *Senna occedentalis* at sixteen days of germination. This implies that plant extracts of *Senna occidentalis* seed have herbicidal properties similar observation were also obtains by Grigorius (2001).

Table 2. The effects of plant extract on days of germination of Parthenium and Argemone seed

Treatment	Parthenium	Argemone
	Main value of five day of germination	Mean value at sixteen day of germination
R.comminus	6.33	6
S.occidentalis	7	6.66
control	4.33	4.33

Germination Percentage

The plant extracts of *Ricinus comminis* and *Senna accidentals* treatments were resulting in significant effect on germination of Parthenium and Argemone than control treatments. However the maximum germination value obtained in *Ricinus comminus* (86.6%) than *Senna occidentalis*(83.3%) extract on Parthenium whereas Argemone seed were resulted maximum value on *Senna occidentalis* (90%) than *Ricinus comminus* (80%) table 3. In the other land parthenium seed germination had significant effect on germination had significant effect on *Senna occidentalis* rather than *Ricinus comminis*. This implies that the influences of plant extract to break dormancy of a particular weed seed species were specific.

Table 3. The effect of plant extracts on germination percentage of Argomone and Parthenium seed

Species	Treatments		
	Ricinus comminus	***Senna accidentalis***	**Control**
Parthenium	86.6%	83.3%	60%
Argemone	80%	90%	50%

Cultural controls on Emergency of Parthenium and Argemone weeds in pot Experiments

Days of Emergency

The seedlings of parthenium weed shown more variation at starting from 5th day of emergence which indicated that synthetic much with *Senna occidentalis* and *Ricinus comminus* resulted to have a significant effect on seedling (Table 4). On the other hand, the seeds were promoted to germination emerged at a short time but the emerged seedling were inhibited in 3-5 days interval. Similarly, Grigorius (2001) reported that *Senna occidentalis* and *Ricinus comminus* have hydroscopic properties in the seed which implies that

insecticidal and herbicidal properties were inhibites the seedling at the emergency due to trap water from seedling also on the seedling argemone seeds there were existed the variation at sixteen day of emergency (Table 5) when seedling becomes significant difference due to similarity that parthenium seed at given day of emergence. The result showed that there was significant difference in both synthetic much with *Ricinus commnius* and *Senna accidentalis* as compare to other treatments of parthenium seed emergency (Table 4).

Table 4: Comparison of treatments at fifth date of emergence on Parthenium seed when smallest mean used as check

	Treatments								
	DM	**MXRC**	**DMXSO**	**SM**	**SMXRC**	**SMSO**	**RC**	**SO**	**Control**
Mean	14.67	14	12	10.3	24.66	21.66	13.66	10	8.33
Check	8.33	8.33	8.33	8.33	8.33	8.33	8.33	8.33	8.33
Difference	6.33	5.67	3.67	1.97	16.3	13.33	5.33	1.67	–
Significance	--	--	--	--	--	--	--	--	--
Rank	1	2	3	4	5	6	7	8	9

CD 0.05= 9.64, CV =22.39 %, Grand mean =15.04
***(Key** :- DM= Dry mulch only MXRC= mulch with Ricinus comminis, DMXSO= Dry mulch with Senna occidentalis, SM= Synthetic mulch only, SMXRC = Synthetic mulch with Ricinus comminis SMSO= Synthetic mulch Senna occidentalis, RC= Ricinus comminis only, SO = Senna occidentalis alone, control= no treatment)*

Table 5. Comparison of significant difference between treatments at the sixteenth date of emergence on Argemone seedling smallest mean used as check.

	Treatment								
	DM	**DMXRC**	**DMXSO**	**SM**	**SMXRC**	**SMSO**	**RC**	**SO**	**Control**
Mean	7	8	12.66	14	12.33	12.33	5.66	14.3	5
Check	5	5	5	5	5	5	5	5	5
Difference	2	3	7.66	9	7.33	7.33	0.66	9.3	
Significance	--	--	--	--	--	--	--	--	--
Rank	1	2	3	4	5	6	7	8	9

***(Key** :- DM= Dry mulch only; MXRC= mulch with Ricinus comminis; DMXSO= Dry mulch with Senna occidentalis; SM= Synthetic mulch only; SMXRC = Synthetic mulch with Ricinus comminis; SMSO= Synthetic mulch Senna occidentalis; RC= Ricinus comminis only;SO = Senna occidentalis alone; control= no treatment)*

From above (Table 5) it can be observed that that there was significant difference in dry mulch with *Senna occidentalis*, synthetic mulch with *Senna Occidentalis* as compare to dry mulch with *Ricinus comminus*,dry mulch and *Ricinus comminus* on argemone seed at sixteenth day of emergence.

Percent Emergence

There were significant difference for seedling emergence of Parthenium and Argemone weed due to various cultural practice and plant extract. Maximum value of emergence percentage attributing traits were recorded for parthenium seedling in synthetic mulch with *Ricinus comminus* and synthetic mulch with *Senna occidentalis*,f ollowed by dry mulch with *Senna occidentalis* (Table 6). The entire weed control treatment caused significant improvement in emergence percentage of Parthenium and Argemone seedling over control or check treatment. However, the emerged seedling were rapidly inhibiting 3-5 days interval which indicated that , mulch were enhanced germination in a short time but the seedling were inhibited rapidly similar observation, Handreck, *et al.* (1994) reported that plastic mulch prevents light in reaching in the soil which can in habitué most annual and perennial weed . In addition to this, the same results was obtained by Desey *et al,* (1998) mulching prevent the surface soil from heating beyond the critical germination temperature of 30 during hot after noon hour obtained higher germination value on *Prosopis juliflora.*

Table 6: The effect of cultural control on percent emergence of Argemone and Parthenium seed

	Treatment								
Species	DM	DMXEC	DMXSO	SM	SMXEC	SHXSO	RC	SO	Control
Parthenium	14.66	16	29	16	36.6	36.6	23.3	13	12.6
Argemone	26	25.3	33.3	40.6	36	39.3	16.6	44	21

***(Key** :- DM= Dry mulch only MXRC= mulch with Ricinus comminis, DMXSO= Dry mulch with Senna occidentalis, SM= Synthetic mulch only, SMXRC = Synthetic mulch with Ricinus comminis SMSO= Synthetic mulch Senna occidentalis, RC= Ricinus comminis only, SO = Senna occidentalis alone, control= no treatment)*

Discussion

The experiment also showed that, they have greatest power of germination at a short time interval and cultural control methods are significantly affecting those weed at seeding emergence by preventing sunlight. For most among there were Parthenium and Argemone weeds. Currently, these invasive alien weeds are great concern in Ethiopian, posing particular problem in agricultural lands, range lands, national parks, water way, lakes, rivers, power dams, road sides and urban green species with great economic and ecological consensus.

This emergence study between invasive species found in the soil seed bank and those in the standing vegetation could be due in part to the presence of parthenium in soil seed bank. Hence, the prolonged presence of parthenium weed in soil seed bank might have been substantially reduced the ability of some of the native species to germinate (Navie *et al*., 2004). It could also be due to the deposition of the seeds for many seasons in the seed bank (Pierce and Cowling, 1991), or due to the presence of high level of seed predation (Wilson *et al.,* 1995). As a result, all of the seeds produced by the standing vegetation do not inter into the soil seed bank. Their loss could be one of the main factors that caused lower degree of concordance between standing vegetations and the species in the soil seed bank. Several internal and external factors prevent seed germination. Among the internal factors some the presence of biochemical inhibitor in the seed and immature embryo. The commonest external factors are soil water content and temperature (Fernandez-Qviatanilla *et al.,* 1991). The longevity of a seed represents a major mechanism of survival for weed species. It leads to a continuous source of emergency (Carvalho and Favoretto, 1995). However, the longevity of seed in soil varies according to the characteristics, burial depth, and climatic conditions of seeds (Carmona, 1992).

Studies conducted on the longevity of *P. hysterophorus* have produced inconsistent results. Butler (1984) came up with a finding that the viability of seed was 66% after one week of burial to 29% after two years. However, Navie *et al. (*1998) and Tamado *et al*. (2002) reported that the viability of seed was greater than 74% after 2 years and showed 50% viability after 26 months of burial in the soil, respectively. This suggests that a potential buildup of a substantial persistence in soil seed bank makes it difficult to eradicate a population of *P. hysterophorus* in a short period of time. The seedlings of *P. hysterophorus* emerged from shallow buried (< 0.5 cm) seeds and none from more than 5 cm depth possibly due to exhaustion of seedling reserves before emergence or an induced dormancy (Tamado *et al*., 2002).

Parthenium seeds do not possess dormancy mechanism (McFadyen, 1994). However, Picman and Picman (1984) demonstrated the presence of water soluble germination inhibitors (*i.e.* parthenin and phenolic acid) in the accessory structure and the seed coat of parthenium seeds. Parthenium has viability greater than 85% (Pandey and Dubey, 1988). Williams and Groves (1980) on their part reported maximum germination (88%) of the seed in dark, under a day/ night temperature regime of 21/16 ^{0}C. They also noted that the percentage of the germination decreased as the day/night temperature differential was increased. During their work on Indian parthenium achenes in continuous light or dark, Pandey and Dubey (1988) suggested that the weed does not have a strict light requirement for germination. However, they observed that germination was enhanced under the influence of alternating day night temperatures. On the basis of their study, Pandey and Dubey (1988) concluded that 25/2 ^{0}C day/night temperature regimes were optimum for germination of parthenium. In Ethiopia, Tamado *et al*. (2002) reported that germination of parthenium seed occurred at the mean minimum (10 0C) and maximum (25 ^{0}C) temperatures as well as over a widely range of fluctuating (12/2 ^{0}C - 35/25 ^{0} C) temperatures.

Conclusion

This study suggested that both *Argemone mexicana* and *Parthenium hysterophorus* has been influencing the composition and diversity of species both in Soil Seed Bank and aboveground vegetation. It also showed that the weeds weaken the carrying capacity of the other weeds, the seed production potential, and patterns of emergence and germination is generally becoming a threat to floral biodiversity and the farms in the small scale households. The study implied that integrated long-term management programs need to consider depletion of seed banks through controlled emergence and germination of noxious weeds. To control these weeds, competitive approaches of weed control can bring a sound result. The study suggested that it is difficult to control the noxious weeds in short period of time due to persistent soil seed bank formation and wider area coverage.

Recommendations

Cultural control mechanism should be recommended to improve the acquisition and flow of *Argemone mexicana* and *Parthenium hysterophorus* in formation among that cultural control. Consideration also be taken to the stage in to related problems and available control option should be enable they making effective and informed decision for handling the weed problem that bring awareness and educate the affected communities for effective management of weed. This study suggested that cultural control and plant extract in both non–parasitic weeds seedling affects in seedling emergence and growth seedling. Thus, it could be concluded that cultural control were effective to control Argemone and Parthenium weed in competition to other diseases drops. However, for the studies are regarded to determine the efficacy of cultural and botanical control emergence of *A. mexicana* weeds which must be evaluated under field condition. Well organized, coordinated and concerned efforts must be made to control or eliminate these noxious weeds. This requires the participation of local farmers, researchers, government bodies and NGO's to work in orchestrated way.

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Appendix

Appendix1:Efficacy of cultural control on days of emergence of *Parthenium* spp.

Source of variation	df	ss	ms	cf	5%	1%
Treatment	8	722.96	90.37	7.98**	2.51	3.71
Mulch (A)	2	307.84	152.92	13.6**	3.55	6.01
Seed extract (B)	2	162.74	81.37	7.18**	3.55	6.01
Mulch(A)x seed ext. (B)	4	252.38	63.1	5.57**	2.93	4.58
Error	18	204.00	11.33			
Total	**26**	**926.96**				

Appendix 2: Efficacy of cultural control on 16th day emergence of *Argemonemexicana*

Source of variation	Df	Ss	Ms	f -cal	5%	1%
Treatment	8	537.63	67.204	11.41**	2.51	3.71
Mulch (A)	2	178.74	89.37	15.17**	3.55	6.01
Seed extract (B)	2	201.49	100.7	17.1**	3.55	6.01
Mulch (A) x seed ext. (B)	4	157.49	39.37	6.68*	2.93	4.58
Error	18	106.00	5.89			
Total	26	643.63				

Appendix 3: The efficacy of plant extraction 5th day of germination on *Parthenium* spp

Source of variation	df	SS	Ms	5%	1%
Treatment	2	11.56	5.78	3.55	6.49*
Error	6	5.34	0.89		
Total	**8**	**16.9**			

Appendix 4: The efficacy of plant extraction 16th day of germination on *Argemone mexicana*

Source of variation	df	SS	Ms	5%	1%
Treatment	2	83	4.15	3.55	2.51
Error	6	9.92	1.65		
Total	**8**	**18.22**			