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Allelopathic effect of parthenium (*Parthenium hysterophorus l.*) Powder on emergence and seedling growth of arabica coffee (*Coffea arabica l*)

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Abstract

The Experiment was conducted to investigate allelophatic effect of *P. hysterophorous* powder on seed emergence and seedling growth of Arabica coffee (*Coffea arabica L.*) in greenhouseat Jimma University College of Agriculture and veterinary medicine greenhouse in 2017/18. The dried parthenium parts (Flower, Leaf, Stem, Root and whole part) ground separately using pestle and mortar. The experiment was laid out in Randomized Complete Block Design with three replications in factorial arrangement. The treatments included 5x5 treatment combination five parthenium powder amount (2.5g, 5.0g, 7.5g and 10g) with five plant parts (Whole part, Flower, Stem, Root and Leaf) of parthenium incorporated into 2.0kg sterilized soil into pots arranged in greenhouse and watered for a week before sowing to simulate the natural field conditions and for decomposition. The results revealed that soil incorporated parthenium powder amount showed stimulatory allelopathic effect on coffee seed emergence percentage and seedling growth parameters such as leaf number, leaf area, stem girth plant height and chlorophyll content. The result revealed that soil incorporated parthenium hysterophorus powders of different parts with different amount positively affected (stimulated) coffee seed emergence and seedling growth parameters. However, this allelopathic activity of the weed may be different in field conditions due to the large difference of environmental conditions. Therefore, further investigations of long term field experiments should be establish to determine the inhibitory and /or stimulatory effect of parthenium on coffee emergence and seedling growth, to determine effective and optimum powder amount of parthenium plant that stimulate or inhibit coffee emergence and growth parameters.

Keywords: Allelophatic; Coffee; Parthenium hysterophorus; Powder; Seedling growth

Introduction

Coffee is one of the most important international traded and ranked as the second most valuable primary commodity exported by developing countries after oil [1]. It is a popular beverage and mostly consumed in industrialized countries, whereas over 90% of coffee production takes place in developing countries. More than 75 million farm families worldwide rely on coffee for their livelihood in cultivation, processing, trading, transportation and marketing [2].

Arabica coffee is one of the world's most valuable agricultural commodity which accounts for two-thirds of the global coffee market and over 90% of traded value globally and dominating over 70% in volume of production [3, 4]. Currently coffee contributes more than 35% country's foreign currency earnings. In Ethiopia 15 million people directly or indirectly deriving their livelihoods from coffee system [5]. Coffee is a plantation crop grown in rows and well adapted to different eco-physiological conditions of the tropics and may be productive up to 30 years. Pests are among the number of factors considered to limit coffee production both in quality and in quantity.

Coffee is severely infested by different weeds species. Weeds compete with coffee for moisture and plant nutrients, while some perennial grasses and sedges produce root exudates that are toxic to coffee plant. According to Tadesse, 1998 yield loss as a result of weed competition can reach as high as 65 % to complete crop failure depending on the type of weeds, coffee growth stage of coffee trees and the prevailing growth conditions. Parthenium *(P. hysterophorus L.)* is one of the invasive herbaceous weed in many part of the world affecting the agricultural productivity and causes 28 % crop yield losses in Ethiopia [6,7]. Presently, it infested maize, sorghum, tef, wheat, coffee, all pulse crops and spice growing regions in Ethiopia. Its reported as parthenium the most important weeds in Coffee arabica in Kenya Parthenium releases Parthenin, hysterin, hymenin, phenolics, ambrosin acid, ferruclic acid and chlorogenic acid allelochemicals to environment through volatilization, leaching, root exudation and decomposition of residues in the soil [8,9]. These allele chemicals inhibit the growth of the surrounding plants [10].

However, these allele chemicals have both positive and negative effects on crop production. Negative allelephatic effect of parthenium may be crop growth inhibitor or environment pollutant. On the other hand the positive effect of allele chemicals from parthenium weed on the crops can be used to develop eco-friendly, cheap and effective input such as green growth promoter's and yield stimulant in crop production.

Parthenium improves crop production and productivity at minimal expenses and to decrease the current reliance on synthetic agrochemicals that degrade the environmental quality if used green manure, compost, bio control, bio herbicide, soil ameliorate, that may improve physical, chemical and biological properties of the soil and also as a source of macro and micro nutrients of plants and integrated

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use of parthenium in soil modifies the physic-chemicals biological and nutritional quality of the soil that modifies crop performances [11,12].

Many studies has been conducted and well documented on impacts of the weed on crops production. However, allelophatic effect of *P. hysterophorus* on coffee was not known in Ethiopia. Therefore, the present study, aimed to investigate the allelopathic effect of parthenium weed on coffee seed emergence and seedling growth in greenhouse condition

Material and Methods

Description of Experimental Site

The experiment was conducted at Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) greenhouse and laboratory in 2017/18. Jimma is located at 356 km from Addis Ababa. It lies between 70 42'N latitude and 360 50'E longitudinal within altitude 1710 m above sea level. It receives an annual average rainfall of 1600 mm and has mean maximum and minimum temperatures are 26.8^{0}C and 11.4^{0}C, respectively and the mean maximum and minimum relative humidity is 91.4% and 39.92% respectively.

Preparation of powder of P. hysterophorus

Parthenium hysterophorus plants naturally grown of the weed in Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) campus were randomly uprooted and collected at flowering stage in August 2017. The collected plants were brought into the Entomology Laboratory of Jimma University college of Agriculture and Veterinary Medicine and washed to remove soil and immediately partitioned into Leaf, Flower shoot (stem + branch), root and whole parts.

Then the fresh plant parts cut into 1-2 cm pieces and air dried. The dried parthenium parts grinded separately using pestle and mortar. Then powder separated using 2 mm sieve and measured using electrical sensitive balance as 2.5, 5, 7.5 and 10g.

Study materials and experimental design

Coffee variety, 74140 berry disease resistant variety was used for the experiment. Coffee seed was prepared as per the standard procedures. Coffee seed was dipped into 2% sodium hypochlorite solution for 15 minute to remove surface contamination and the seed washed thoroughly with distilled water to free the seed from the chemicals if any.Two kilogram sterilized top soil (0-25 cm profile) added into pots of 18 x 22 cm size and mixed with 2.5g, 5.0g, 7.5g and 10g of ground parthenium powder of each parts as treatment and soil without parthenium powder as a control. Each pot was watered for a week before sowing to simulate the natural field conditions and for decomposition of parthenium powder incorporated into the pot soil. The treatments were laid out in Randomized Complete Block Design with factorial arrangement in three replications in greenhouse. Then five coffee seeds were planted at a depth of 1 cm with grooved side of the seed down and the embryo tip up in each pot and all routine seedling management practices including watering and weeding were carried out as per the recommendation and the seedling were thinned to one seedling per pot at two pair true leaf stage.

Data collected

Numbers of emerged coffee seeds were collected at weekly interval and calculated using the following methodology described.

GE= number of seed emerged x 100

Number of total planted seed

All the non-destructive and destructive parameters data such as number of true leaves, plant height (cm), chlorophyll content, stem diameter (mm) and estimated leaf area (cm^2) were recorded. Estimated leaf area was measured using the procedure described.

$Y = K \times L \times B$

Where, Y is estimated leaf area; K is constant specific to cultivars and canopy classes (0.67); L is leaf length (cm) and B is maximum leaf breadth (cm). Stem diameter (girth) was measured at the surface of the potting soil at 5 cm above ground by using a caliper and chlorophyll content measured from five leaves (second to fourth leaf pairs) using chlorophyll meter.

The mean of five leaves readings from the portable chlorophyll meter was obtained and destructive plant growth parameters like: root length, total, shoots and root biomass product was recorded when the seedling attained maximum six pairs of true leaves stage. These were made after above ground parts separated from underground at collar point using scissor. The pot containing coffee seedling root was immersed in tap water and root was separated carefully from the soil still being in water the root subsequently washed with clean water, dried with water adsorbent cloth and root length was measured using ruler. The fresh shoot and root weight were measured at the same day by using sensitive balance. Then shoot and root dry weights were measured after the samples oven dried at 70^{o}C for 24hrs.

Statistical analysis

The collected data was subjected to analysis of variance (ANOVA) using SAS software (version 9.3) after checking homogeneity of variance. Means were separated using Least Significance Difference (LSD)

Results and Discussion

Seed Emergence

Statistical analysis of the data showed significant effects of soil incorporation of *P. hysterophrous* powders of different parts with different amount ($p < 0.05$, Table 1). The result showed that the coffee seed emergence percentage increased with increased application amount of powder of all parts except in flower part. The highest emergence percentage (100%) observed from powder of parthenium whole plant part at 10g pot -1 application amount and the lowest emergence percentage (61.11%) observed from control. This indicates that parthenium whole part powder was most stimulator to coffee seed emergence as compared with individual parts. Application of P. hysterophrous powder from different part improved coffee seed emergence over control. This might be soil incorporated parthenium powder easily decomposed which resulted in declined toxicity of allele chemicals. The maximum coffee seed emergence percentage mean ranged from 18.18% - 54.54% obtained from leaf part whereas the minimum emergence percentage mean 0- 21.44% obtained from the pot received powder of stem and root part.

This finding agrees with Sundas (2017) who reported that aqueous extract of parthenium root and shoot part revealed highest emergence percentage on maize emergence percentage which indicates the stimulatory effect of extracts. In present study, coffee seed emergence was greatly increased with increasing application amount of parthenium weed powder. As overall; the result revealed that parthenium powder had stimulator effect on seed emergence of coffee. This indicates that

Table 1: Interaction effects of *P. hysterophorus* plant parts and powder amount on non-destructive coffee seedling growth parameters.

Plant parts	Powder amount (g)	Emergence (%)	Leaf Number	Leaf Area (cm^2)	Chlorophyll Content (µg/mg)	Stem Girth (mm)	Plant Height (cm)
Whole part	0	77.77d	5.21e	10.24e	25.44de	1.37cd	12.59d
	2.5	88.33cd	6.13d	11.26d	26.47d	1.43c	14.63c
	5.0	83.33cd	6.50c	11.68c	30.24c	1.72b	16.63b
	7.5	94.44ab	7.18ab	12.42b	34.72b	2.14a	18.57a
	10	100.00a	7.46a	12.67a	40.78a	2.62a	19.48a
Flower	0	77.78e	5.23e	10.18e	25.48de	1.34de	12.85e
	2.5	94.44a	5.66d	11.13d	25.80d	1.42cd	14.58d
	5.0	88.89ab	6.33c	11.50c	29.82c	1.44c	16.43bc
	7.5	83.33bc	6.83b	12.32b	33.21b	2.09b	17.32b
	10	72.22f	7.33a	12.50a	38.19a	2.44a	18.65a
Stem	0	77.77d	5.28d	10.25e	24.16d	1.22cd	12.72d
	2.5	77.77d	5.51d	11.25cd	25.40d	1.25c	14.17c
	5.0	83.33bc	6.25c	11.44c	29.60c	1.48b	15.27bc
	7.5	88.89ab	6.60b	12.07ab	31.73b	2.16a	16.43b
	10	94.44a	7.16a	12.23a	37.11a	2.29a	17.03a
Root	0	72.22d	5.26e	10.11e	25.58de	1.30de	12.47d
	2.5	72.22d	5.73d	10.98d	25.87d	1.33d	13.92c
	5.0	83.33bc	6.10c	11.60c	29.46c	1.55c	15.20b
	7.5	88.89ab	6.66b	12.21ab	32.40b	2.08b	16.20b
	10	94.44a	7.23a	12.38a	37.14a	2.39a	17.87a
Leaf	0	61.11e	5.26e	10.29e	21.28d	1.26e	12.65d
	2.5	72.22d	5.76	11.11d	26.92d	1.45d	14.56bc
	5.0	83.33bc	6.30c	11.36c	31.55bc	1.60c	15.40b
	7.5	88.89ab	6.76b	12.12b	33.31b	2.22ab	15.70b
	10	94.44a	7.13a	12.48a	37.54a	2.27a	18.33a
CV (%)		13.83	7.34	2.49	8.67	9.93	10.50
LSD (0.5%)		8.53	0.34	0.21	1.93	0.13	1.20

Mean values within a row or column followed by the same letter(s) are not significantly different at P≤0.05

coffee may possess tolerance against the allelopathic activity effect of parthenium and could be used to minimize production losses due to this weed.

Leaf Number

Statistical analysis of the data showed that a significant stimulatory effect of soil incorporated parthenium powder on coffee leaf number ($P<0.05$). Coffee seedling leaf number increased with increasing powder amount in all parts. The maximum coffee seedling leaf numbers (7.46) was observed in whole plant part followed by (7.33) in flower, (7.23) in root, (7.16) in stem and (7.13) in leaf at highest parthenium powder amount (10g) whereas the minimum leaf number (5.21) observed from control. Visual observation has also shown great stimulator effect of parthenium allelopathic activity which the seedling leaves received highest powder amount was deep green and has good performance as compared with control.

These results similar with earlier study in which soil incorporated parthenium powder enhanced soil moisture level and being rich in N, P, K, Ca and Mg which are suited for composting and promote crop growth parameters. Accordingly coffee seedling mean leaf numbers were showed improvement ranged from (9.51-35.55%), (4.35-35.61%), (8.93-37.45%), (8.22-40.15%) and (17.66-43.19%) due to the application parthenium powder amount from leaf, stem, root, flower and whole parts respectively (Table 1). that wheat spike length, number of grains per spike and grain yield gradually increased by increasing the quantity of *P. hystrophrous* green manure. Whereas in present study parthenium whole part powder showed 43.19% increments in coffee seedling leaf number compared to other parts and control. This suggested that parthenium plant powder as it is improved coffee seedling leaf number than individual parthenium plant parts powder.

Leaf Area (cm^2)

Analysis of the data revealed significant stimulator effect of *P. hyestrophrous* powder amount of all parts upon coffee seedling leaf area ($p<0.05$, Table 1). Coffee seedling leaf area increased with increasing powder amount in all parts. The maximum coffee seedling leaf area 12.67, 12.50, 12.48, 12.38 and 12.23 cm^2 were observed at higher powder amount of whole, flower, leaf, root and stem parts at highest powder amount 10g whereas the lowest leaf area value 10.11cm^2 in control. Similarly, application of *P. hyestrophrous* powder amount showed improvement 19.32%, 21.28%, 22.45%, 22.79% and 23.73 % over control in leaf area mean value at stem, leaf, root, flower and whole parts respectively.

This result indicated that increased in *P. hyestrophrous* powder amount of different parts increased coffee seedling leaf area. However, with any increase of powder amount, seedling leaf area was increased to a greater extent in all parthenium parts. The present study results have similarity with who reported that parthenium green manure amended treatment increases wheat spike length, number of grains per spike and grain yield at highest quantity of green manure.

Chlorophyll Content

The chlorophyll content of coffee seedling significantly ($P< 0.05$) influenced by parthenium powder amounts. The analyzed data

revealed that leaf chlorophyll content of coffee seedling increased with increasing parthenium powder amount. The maximum Coffee seedling leaf chlorophyll content (40.78µg/mg) observed in whole part followed by (38.19), (37.54), (37.14) and (37.14) in flower, leaf, root and stem at highest powder amount (10g) respectively whereas the minimum leaf chlorophyll content observed from control in all plant parts (Table 1). This shows that parthenium plant used as growth stimulator to coffee seedling as it's than separated it into individual parts. In this study parthenium leaf part shows 76.41% increment on coffee seedling chlorophyll content at highest (10g) powder amount (Table 1).

Stem Girth (mm)

Stem diameter (girth) of coffee seedling was significantly affected (P<0. 0 5) by application of *P. hysterophrous* powder of different parts. The result indicated that coffee seedling stem girth increased with increasing soil incorporated parthenium powder amount in all plant parts (Table 1). The maximum stem girth (2.62mm) observed in whole part followed by (2.44mm) in flower, (2.39mm) in root and (2.27mm) in leaf at highest powder amount (10g). Applications of parthenium powder improved coffee seedling stem girth mean value by 2.46% – 91.24% as compared to control. Accordingly, (91.24%) Whole part, (87.70%) stem part (83.84%) root part (82.08%) flower and (80.15%) leaf showed increment on stem girth of coffee seedling (Table 1). Generally, soil incorporated *P. hysterophrous* powder of different parts showed stimulator effect on coffee seedling stem girth.

Plant Height (cm)

Statistical analysis has shown significant effect of soil incorporated parthenium powder on plant height of coffee seedling (p<0.05). The result indicated that coffee seedling plant height increased with increasing parthenium powder amount in all parts. The maximum plant height value 19.48cm 18.65, 18.33, 17.87 and 17.03 observed in whole part, flower, leaf root and stem part at highest (10g per pot) powder amount. Whereas the lowest plant height value 12.47cm observed on untreated pot (control). Accordingly, application of parthenium powder improved plant height mean value of coffee seedling by 14.13-45.11% due to increment of powder amount (Table 1). This finding agrees with who reported that parthenium weeds residue in soil can be used to receive plant growth nutrients easily in growth medium that can be utilized for enhanced plant growth of desired plants. Further, as observed from the present result there were great differences in coffee seedling plant height between treated and untreated. In contrary to current study, reported that increasing parthenium aqueous extracts of different parts reduced shoot and root length of peanut and soybean. The present study result showed that *P. hysterophorus L.* Powder significantly stimulated plant height of coffee seedling. This may be due to parthenium is a rich source of micro and macro-elements like N, P, K, Ca, Mg and chlorophyll thus preferably suited for easily composting to contribute growth of all agronomic parameters in all flowering plant.

Root Length (cm)

Significant interaction between plant part and powder amount were observed for root length (p<0.05, Table 2,). Root length increased with increasing powder amount in all plant parts as compared to control. The highest root length (20.33cm) observed in whole plant part followed by leaf (18.67cm), root (18.40) cm, flower (18.33cm) and stem (17.00cm) at the highest powder amount (10g). Whereas the lowest root length obtained from the control for all plant part. The present study showed

Table 2: Interaction effects of *P. hysterophorus* plant parts and powder amount on destructive coffee seedling growth parameters.

Plant parts	Powder amount (g)	Root Length (cm)	Total Fresh Weight (g)	Shoot Fresh Weight (g)	Root Fresh weight (g)	Total Dry Weight (g)	Shoot Dry Weight (g)	Root Dry Weight (g)
Whole part	0	11.06e	2.58e	1.35e	1.23d	0.44de	0.32d	0.13d
	2.5	13.80cd	3.20d	1.83d	1.37cd	0.49d	0.34d	0.14d
	5.0	14.73e	3.56c	2.12c	1.45c	0.58c	0.41c	0.17c
	7.5	17.20b	4.27b	2.43b	1.83b	0.69b	0.49b	0.20b
	10	20.33a	5.00a	2.65a	2.55a	0.87a	0.62a	0.25a
Flower	0	10.43e	2.48e	1.30e	1.18e	0.44e	0.31d	0.13d
	2.5	13.73d	3.08d	1.93cd	1.15d	0.49d	0.34d	0.14d
	5.0	15.27bc	3.63c	2.05c	1.58c	0.57c	0.40c	0.17bc
	7.5	15.83b	4.08b	2.33b	1.75b	0.65b	0.46b	0.19b
	10	18.33a	4.83a	2.58a	2.25a	0.84a	0.60a	0.24a
Stem	0	11.80e	2.50e	1.35e	1.15d	0.44d	0.31d	0.12c
	2.5	13.33d	2.91d	1.68d	1.23cd	0.44d	0.31d	0.13cd
	5.0	14.87bc	3.28c	1.95c	1.33c	0.52c	0.36c	0.15c
	7.5	15.57b	3.83b	2.17b	1.67b	0.61b	0.43b	0.18b
	10	17.00a	4.55a	2.55a	2.00a	0.80a	0.57a	0.22a
Root	0	12.20de	2.33e	1.28e	1.05d	0.45de	0.33d	0.13d
	2.5	12.36d	2.93d	1.67cd	1.27cd	0.42d	0.29d	0.13d
	5.0	13.43c	3.25c	1.85c	1.40e	0.53c	0.37c	0.16bc
	7.5	16.17b	4.02b	2.33b	1.68b	0.63b	0.45b	0.18b
	10	18.40a	4.73a	2.56a	2.17a	0.76a	0.55a	0.21a
Leaf	0	11.00e	2.43e	1.27e	1.17d	0.43d	0.30d	0.13d
	2.5	13.10cd	2.95d	1.67d	1.28cd	0.47d	0.33d	0.13d
	5.0	14.03c	3.38c	1.98c	1.40c	0.56c	0.39c	0.16bc
	7.5	16.00b	4.00b	2.33ab	1.67b	0.62b	0.44b	0.18b
	10	18.67a	4.67a	2.50a	2.17a	0.80a	0.57a	0.23a
CV (%)		**9.59**	**9.17**	**12.63**	**19.51**	**12.91**	**12.86**	**13.96**
LSD (0.5%)		**1.04**	**0.23**	**0.18**	**0.22**	**0.05**	**0.04**	**0.02**
Mean values within a row or column followed by the same letter(s) are not significantly different at P≤0.05								

that soil incorporated parthenium powder significantly stimulated root length of coffee seedling than control. This result is in agreement with previous. These authors reported that the seed treated with the root extract of parthenium showed 37.8% increase in root length. Whereas in this study the whole parthenium plant part showed 83% increment in root length compared to the control.

Fresh Biomass (g)

Analysis of the data showed that significant stimulatory effect of soil incorporated *P. hysterophorus* powder amount ($p<0.05$) upon fresh biomass of coffee seedling. Coffee seedling fresh biomass product increased with increasing soil incorporated parthenium powder amount in all plant parts. The highest total, shoot and root fresh weight (5.17g, 2.65g and 2.52g) were obtained at highest powder amount of whole part (10g) whereas the lowest values (1.33g, 1.28g, 1.05g) obtained from control (Table 2). Soil incorporated parthenium powder amount was showed improvement in coffee seedling fresh weight mean values in ranges of 25.76 – 88.84%, 30 – 80% and 22.88 – 92.37% of total fresh weight, shoot fresh weight and root fresh weight respectively. Similarly, soil incorporated parthenium powder from whole part showed best stimulator effect as compared to other individual parts.

This result was in accordance with who reported that *P. hysterophorus* is a rich source of micro and macro-elements like N, P, K, Ca, Mg and chlorophyll thus preferably suited for composting and enhance plan growth parameters. Similarly to current finding reported that *P. hyestrophorus* green manures significantly increased maize shoot and root biomass as equivalent as in organic fertilizer. Generally increase in amount of soil incorporated *P. hysterophorus* powder of plant parts effectively stimulates coffee seedling fresh biomass. Thus, study result indicated that there is a great opportunity for weed management by utilizing it for crop production and minimize crop losses from direct and indirect competition of weed.

Dry Biomass (g)

Dry biomass of coffee seedling was significantly influenced by parthenium plant parts powder amount ($p< 0.05$). Dry biomass weight of coffee seedling increased with increasing powder amount of all parts incorporate into soil. The highest mean value (0.81g, 0.58g and 0.23g) of total, shoot and root dry weight of coffee seedling were obtained at highest powder amount whereas the lowest dry biomass obtained from control. Accordingly, soil incorporated parthenium powder increased total, shoot and root dry weight of coffee seedling in ranges of 4.45- 84.09, 3.23 – 87.09 and 8.33 – 96.66% over control respectively. In all plant parts the highest dry biomass obtained at highest powder amount (10g). The study indicated that parthenium powder of all parts stimulated coffee seedling dry biomass.

This finding in lines with and who reported that *P. hyestrophorus* green manures significantly increased maize shoot and root biomass as equivalent as in organic fertilizer. In cases of plant parts, parthenium powder from whole parts showed best stimulatory effect than individual parts. Reported that parthenium green leaf manure residual effect produces higher dry matter product in ratoon rice crop. In general the study result indicated that increasing soil incorporated parthenium powder amount of all parts increased dry biomass of coffee seedling to some extent **(Table 2)**.

Conclusions

The current study suggests that parthenium has stimulator effects on coffee seed emergence and seedling growth parameters such as seed emergence, seedling leaf number, leaf area, chlorophyll content, plant height, root length and biomass production. Coffee seed emergence and seedling growth stimulated progressively with increasing soil incorporated P.hysterophorus powder amount in all parthenium plant parts.

This study indicated that the allelophatic activity of parthenium significantly stimulate coffee seed emergence and seedling growth depending on powder amount used when compared with control.

In conclusion the study showed that a promising positive (stimulator) allelophatic effect of parthenium powder incorporate into soil for coffee seed emergence and seedling growth which is a good opportunity to weed management method by utilization to solve parthenium weed problem in agricultures crop production. However, this allelopathic activity of the weed may be different in field conditions due to the large difference of environmental conditions. Therefore, further studies are suggested to confirm stimulatory effect and to determine effective and optimum powder amount of parthenium plant that stimulate coffee seed emergence and seedling growth under field conditions.

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References

1. Pendergrast M (2009) Coffee second only to oil? Tea & Coffee Trade J 9:38-41.
2. Lashermes P, Combes MC, Ansaldi C, Gichuru E, Noir S (2011) Analysis of alien introgression in coffee tree (Coffeaarabica L.) Mol Breeding. J Reaches Develop 27: 223–232.
3. Labouisse JP, Bellachew B, Kotecha S, Bertrand B (2008) Current status of coffee (Coffeaarabica L.) genetic resources in Ethiopia: implications for conservation. Genet Resour Crop Ev 55: 1079–1093.
4. Tadasse W (2015) Coffee: Ethiopia's Gift to The World: The Traditional Production Systems as Living Examples of Crop Domestication, and Sustainable Production and an Assessment of Different Certification Schemes. Environ For Coff Foru 23:67-69.
5. Gray Q, Tefera A, T Tef (2013) Ethiopia: Coffee annual report. GAIN Report No. ET- 1302, GAIN Report Assessment of Commodity and Trade by USDA, USA.
6. Adkins S, Shabbir A (2014) Biology, ecology and management of the invasive parthenium weed. J Pest Manag Sci 70: 1023-1029.
7. Mekonnen G (2017) Threats and Management Options of Parthenium (Partheniumhysterophorusl.) College of Agriculture and Natural Resources, MizanTepi University, Ethiopia. Agri Res and Tech: Open Access J: 10-13.
8. Njoroge JM (1991) Tolerance of Bidens pilosa and Parthenium hysterophorus L. to paraquat (Gramaxone) in Kenya coffee. Agri Res and tech56: 999-1001.
9. Anaya AL, Calera MR, Mata R, Miranda RP (1990) Alleopathic potential of compounds isolated from Ipomea tricolor Cav. J Chem Ecol : 16.
10. Mawal SS, Mohd S, Manisha KS, Ade AB (2015) Assessment of Allelopathic Potential of the Roots of Parthenium hysterophorus L. on Some Selected Crops. Int J Sci Knowl 3:145-152.
11. Kishor P, Ghosh AK, Singh S, Maurya BR (2010) Potential use of parthenium (Parthenium hysterophorus L.) in agriculture. Asian J Agric Res: 4.
12. Patel S (2011) Harmful and beneficial aspects of Parthenium hysterophorus: an update. Biotech 1:1-9.