3. Results

The study was conducted to assess allelopathic potential of selected medicinal plants. Key aim was to select plants and then their applicable doses, which could suppress weed growth but had no suppressive effect on selected crops viz. Legumes. Stepwise protocol was followed and the results are discussed separately.

3.1 Stage 1 - Primary Screening of Medicinal plants using their aqueous decoction against legumes.

Germination recital of legume seeds with different aqueous decoction of medicinal plants were experimented with three concentration viz. 1%, 5% and 10%w/v. Ten seeds were kept in a petri plate with two replicates of each treatment. Every second day of observation 2 ml of water decoction was added in each petri plate.

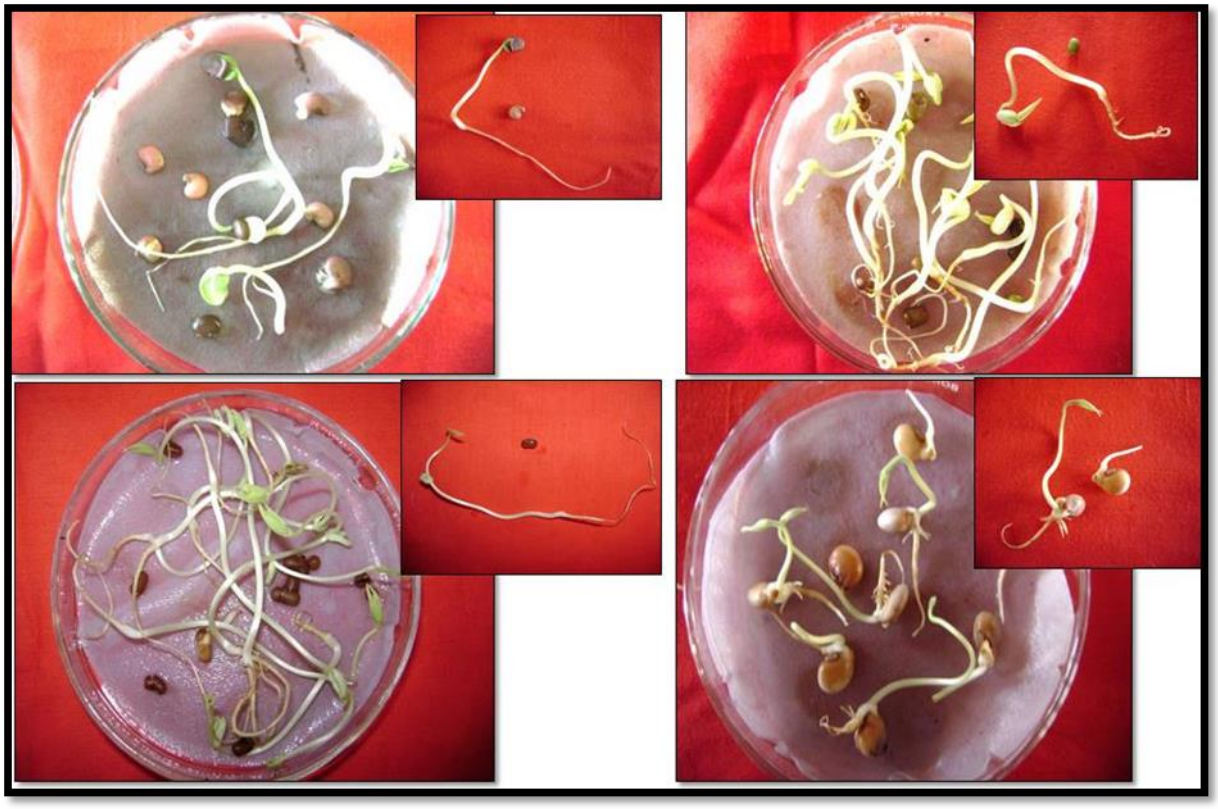


Plate – 1: Legume seed germination in aqueous decoction of different medicinal plants

Selected legumes for primary screening were Chick Pea (CP), Black Gram (BG), Lablab Bean (LB), Green Peas (GP), Moth Bean (MB), Lentil (LE), Pigeon Pea (PP), Cow Pea (CP), Green Gram (GG), and French Bean (FB).Experiment was first executed for screening of legumes. It is to check their response against three different aqueous concentrations of five medicinal plants (Plate -1) After analysing the response of legume growth, further screening of weeds had been done using concentration that affected least to the legume seed germination and seedling growth. Different growth parameters were calculated to analyse the effect of medicinal plants on legumes. Impact ofeach medicinal plant was assessed on ten legumes and is separately reported here. (**Note**: The values in Tables are Mean±SD. Standard Deviation in Graphs is represented in form of bars)

3.1.1. Impact of *Artemisia annua* L.

Artemisia annua L. aqueous decoction with three concentrations (1%,5% and 10%)were utilized against all the ten legumes.

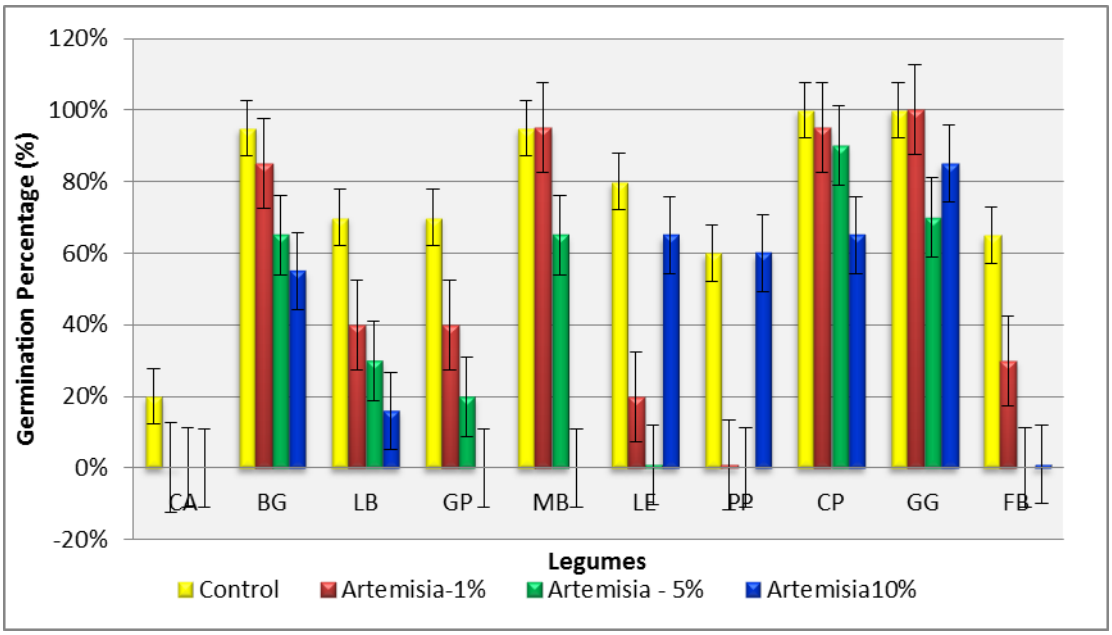


Figure 3.1: Germination (%)of legume seeds with Treatment of *Artemisia annua* L. aqueous decoction.

Here **GG**- green gram, **CP**-cow pea, **BG**- black gram, **PP**- pigeon pea, **LB**- lablab bean, **FB**- French bean, **MB**- moth bean, **LE**- lentil, **CA**- chick pea, **GP**- green pea

Each Legume responded differently with three treatments. Maximum germination was observed in green gram and cow pea with all three concentrations. Minimum germination was observed in chick pea, Pigeon pea and lentil with all treatments as compared to other legumes. As concentration increased, germination of Black gram, Lablab bean, French bean and Green peas was gradually reduced. Seed germination of Moth bean and Green pea was completely obstructed by 10% treatment. (Figure 3.1.)

Germination of Green gram seeds was inhibited only by 15% in 10% concentration. Other legumes were more susceptible to the treatment. Also cow pea seeds were more vulnerable with the 10% treatment showing 35% inhibition.

Mean germination time (MGT) was shortest for green gram and moth bean in control, which was also similar for other treatments. Except in 5% treatment, time duration had been increased from 1 to 1.34 days in Moth bean and from 1.05 to 1.5 days in Green gram. Average germination time of green peas was longest and it took more than 3.5 days to germinate the first seed. This time had been reduced noticeably in treatment from 3.5 to two days. In contrast to it, pigeon pea took 2.5 days to germinate for 10% concentration which was earlier 1.5 to 1.8 days in control and lower concentration respectively (Table 3.1).

Maximum Coefficient of velocity was detected in black gram and minimum in cow pea for control and treatments. French bean showed maximum CoV at 1% and lowest at 10%. Similarly, Green gram was responded with maximum values at 5% but minimum with 1% and 10%. Opposite results were noticed with Lentil seeds where with 10% treatment maximum value was observed, which was very less in control and lower treatments.

The mean germination rate represents speed of the seed germination per day, was maximum in green gram, moth bean and black gram with all three treatments. Minimum germination rate was observed in green pea and lablab bean.

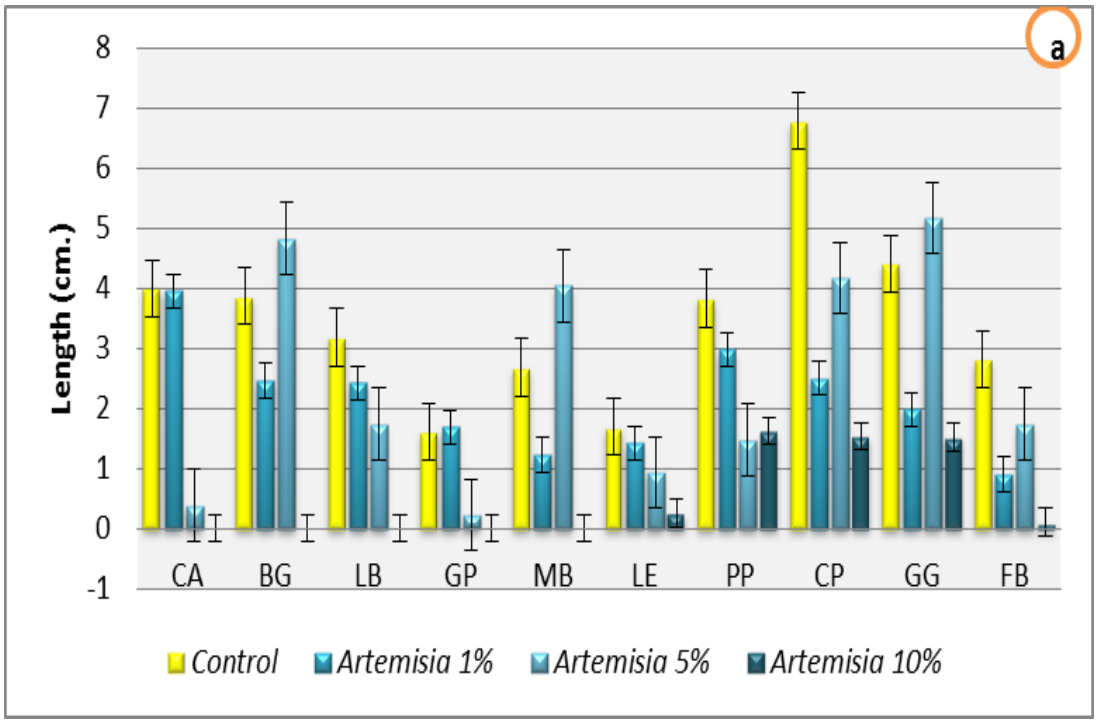
	CONTROL		*ARTEMISIA 1%*		*ARTEMISIA 5%*		*ARTEMISIA 10%*	
	CROP	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**
GERMINATION PERCENTAGE (%)								
Maximum	CP,GG	100	GG	100	CP	90	GG	85
Minimum	CA	20	LE,PP	10±14.142	LE	10±14.142	FB	5
			CA	0	CA, PP, FB	0		
MEAN GERMINATION TIME (DAYS)								
Shortest	MB	1	CP	0.5±0.7071	MB	1.3472±0.1374	GG	1
	GG	1.05±0.07	GG,MB	1	GG	1.5±0.101		
Longest	GP	3.875±0.1767	GP, LB	2	GP	3	PP	2.5
COEFFICIENT OF VELOCITY (%)								
Maximum	BG	36.68±0.2814	FB	47.939±18.806	GG	43.7425±8.9464	LE	57.1826±31.38
Minimum	CP	11.11±15.71	GG,CP, LE, MB, GP,LB	0	LE,PS,DL	0	FB, GG,CP,DL	0
	LE	11.31±15.74						
MEAN GERMINATION RATE (Speed per Day)(Day^{-1})								
Maximum	MB	1	GG, MB	1	MB	0.7461±0.07	GG	1
Minimum	GP	0.25±0.0117	LE	0.25±0.3536	LE	0.16±0.23	FB	0.125±0.176
			GP, LB,FB	0.5	GP	0.33		
UNCERTAINTY OF THE GERMINATION PROCESS								
Maximum	BG	0.98±0.014	BG	0.9781±0.0101	GG	0.98±0.0053	PP	0.83±0.164
							BG	0.81±0.2269
Minimum	GG	0.23±0.331	GG,GP,LE,MB,LB	0	LB,GP,LE	0	GG,CP ,LB	0
	MB,CA	0						
SYNCHRONITY OF THE GERMINATION PROCESS								
Maximum	MB	1	GG, MB, LB	1	PP	0.5694±0.294	GG , CP	1
	GG	0.9±0.1414						
Minimum	CA	0	CP	0	LE, GP	0	LB,FB	0

Table -3.1: Germination parameters of legume seeds with Treatment of *Artemisia annua* L. aqueous decoction.

Where **GG**- green gram, **CP**-cow pea, **BG**- black gram, **PP**- pigeon pea, **LB**- lablab bean, **FB**- French bean, **MB**- moth bean, **LE**- lentil, **CA**- chick pea, **GP**- green pea

Uncertainty of germination process was maximum in black gram except in 5% concentration, where green gram showed maximum uncertainty. Minimum uncertainty of germination process was observed in green gram and moth bean

Uncertainty is directly proportional to synchronism of the germination process. Synchronized germination was maximum in moth bean and green gram with control, 1% and 10% treatment; also in 5% concentration pigeon pea was detected with maximum value. Untreated seeds showed minimum synchronization in chick pea. Cow pea seeds with 1% treatment resulted with minimum synchronity, but maximum synchrony with 10% concentration. However least synchronity was observed with5% treatment in lentil and green pea and with 10% Treatment in lablab bean (showed maximum value with 1%) and French bean. Root and shoot length of each seedling was measured separately to analyse the seedling growth.



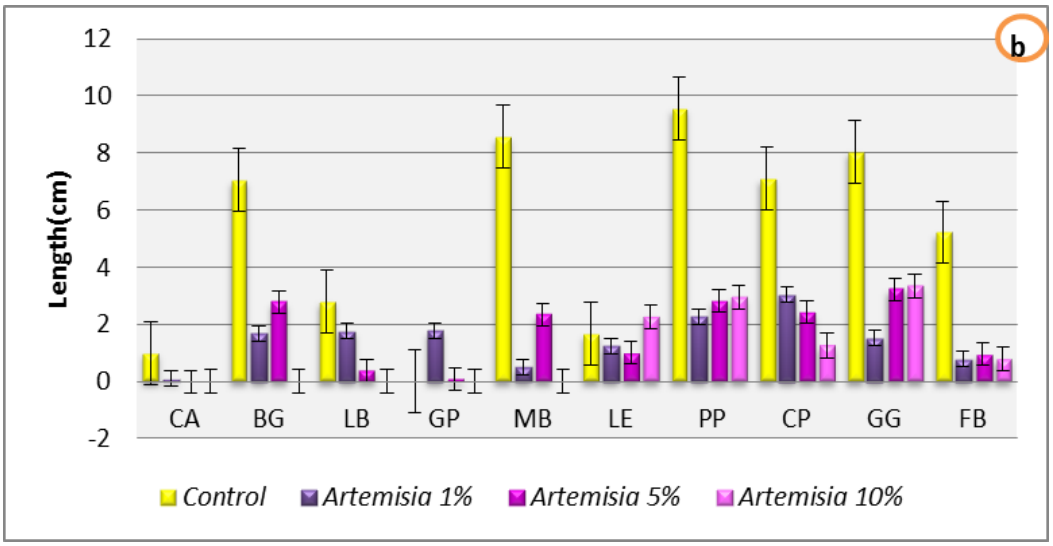


Figure 3.2: Root length (a) and Shoot length (b) of legume seeds with Treatment of *Artemisia annua* L. aqueous decoction.

Remarkable activation in root length was observed in treated Green pea, Black gram and Green gram as compared to Untreated. Root length decreased in Black gram, Moth Bean, cow pea, Green Gram and French bean with 1% treatment but again improved with higher dosage. Root length was decreasing with concentration in lablab bean, lentil, and pigeon pea seedlings. (Figure 3.2 (a))

Black gram, moth bean, green gram and pigeon pea were showing inhibition in shoot growth with 1% concentration as compared to control, but as Concentration increased shoot growth was comparatively stimulated. *Artemisia* decoction was affected more to shoot length than root length of the seedling. French bean, Cow pea, lablab bean responded to the treatment inversely, as concentration increased shoot length was decreased.(Figure 3.2(b))

Seed Vigour index (SVI) is principally to study the activity and performance of seed during germination and seedling growth. Compare to control SVI was decreased in all legume seeds. But Moth bean, green gram, cow pea and black gram responded positively with the 5% treatment as compared to 1%. (Figure 3.3 (a))

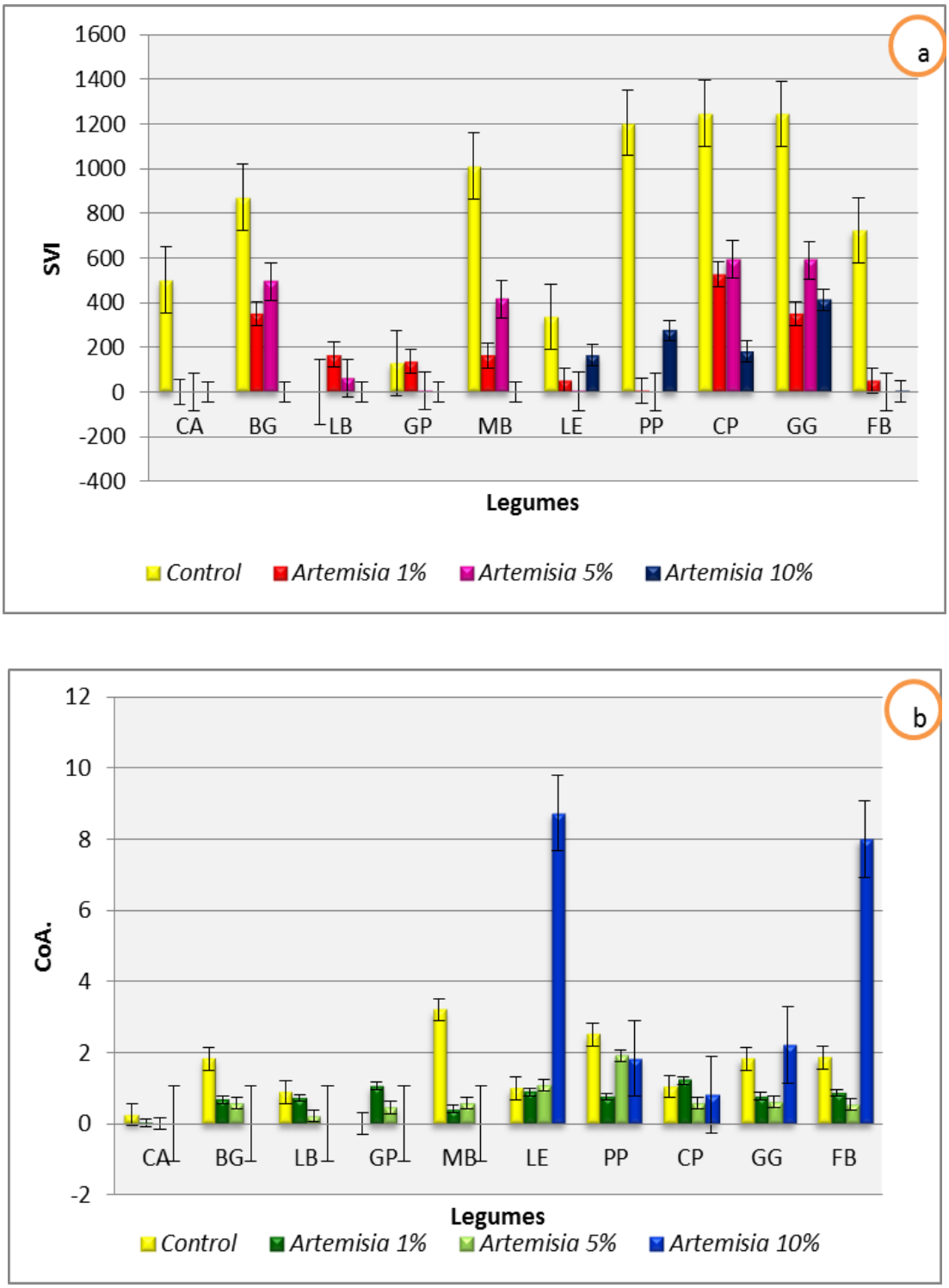


Figure 3.3: Seed Vigour Index (SVI)(a) and Coefficient of Allometry (b) of legume seeds with Treatment of *Artemisia annua* L. aqueous decoction.

Shoot and root length ratio was represented as Coefficient of Allometry (CoA). French bean and Lentil showed maximum value of CoA at 10% concentration. It was indicated that there is vast difference betweenroot and shoot length ratio. Lentil Shoot length(2.27cms.) was remarkably more than the root length(0.26cms), similarly inFrench bean (SL -0.8cm, RL -0.1cm) as compared to Control, and other two treatments. CoA value less than 1 was also observed for many legumes like lablab bean and chick pea where root length was more. (Figure 3.3 (b))

3.1.2. Impact of *Tridax procumbens* L.

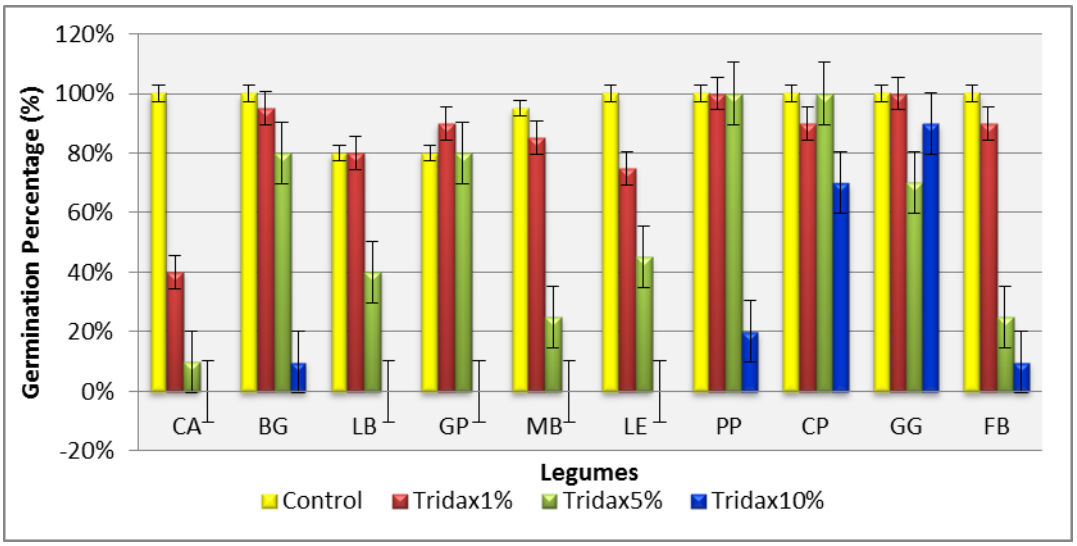


Figure 3.4: Germination (%) of Legume seeds with Treatment of *Tridaxprocumbens* L. aqueous decoction.

Where **GG**- green gram, **CP**-cow pea, **BG**- black gram, **PP**- pigeon pea, **LB**- lablab bean, **FB**- French bean, **MB**- moth bean, **LE**- lentil, **CA**- chick pea, **GP**- green pea

Figure 3.4 Represents Germination percentage of legume seeds with *Tridax* leaf aqueous decoction. Green gram showed minimum germination inhibition in allconcentration. Pigeon pea showed 100% germination at lower (1,5%) concentration which was even higher than untreated (90%) but in higher concentration germination of pigeon pea was reduced by 80%. Cow pea seeds germinated maximum (i. e. 100%) in 5% though it was reduced in the 10 % concentration by 30%.

	CONTROL		*TRIDAX 1%*		*TRIDAX 5%*		*TRIDAX 10%*	
	CROP	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**
GERMINATION PERCENTAGE (%)								
Maximum	LE, CA, GG	100	PP, GG	100	PP, CP	100	GG	90
Minimum	LB	80	CA	40	CA	10	CA,LB,GP,MB, LE	0
MEAN GERMINATION TIME (DAYS)								
Shortest	GG,FB	1	MB	1	GG	1.1875±0.2651	GG	1.055±0.07
							BG,CP	1
Longest	GP	3±0.95	CA	3.25±0.3535	FB	4.125±0.176	FB	2.5±0.7071
COEFFICIENT OF VELOCITY (%)								
Maximum	MB	97.97	GG	35.1364	MB	108.3594±48.19	GG	30
Minimum	CA,GG, FB	0	CA,LB	0	CA,LB	0	FB,CP,BG	0
MEAN GERMINATION RATE (Speed per Day)(Day^{-1})								
Maximum	GG,FB, BG	1	MB	1	GG	0.8636±0.1928	BG	1
Minimum	GP	0.3356±0.0395	CA	0.3995±0.0336	CA	0.125±0.1767	CP	0.5
					FB	0.2426±0.0103		
UNCERTAINTY OF THE GERMINATION PROCESS								
Maximum	GP	1.1556±0.487	LE	1.3387±0.0565	CP	1.1854±0.2623	PP	0.9182
Minimum	GG,FB, CA	0	LB ,MB	0	CA,LB	0	FB, BG,CP	0
SYNCHRONITY OF THE GERMINATION PROCESS								
Maximum	GG,FB, CA	1	MB	1.125±0.1767	LB	1	GG	0.88±0.1571
Minimum	GP	0.3333±0.235	LE	0.3630±0.0420	PP,CA	0	PP, FB	0

Table -3.2: Germination parameters of legume seeds with Treatment of *Tridaxprocumbens* L. aqueous decoction.

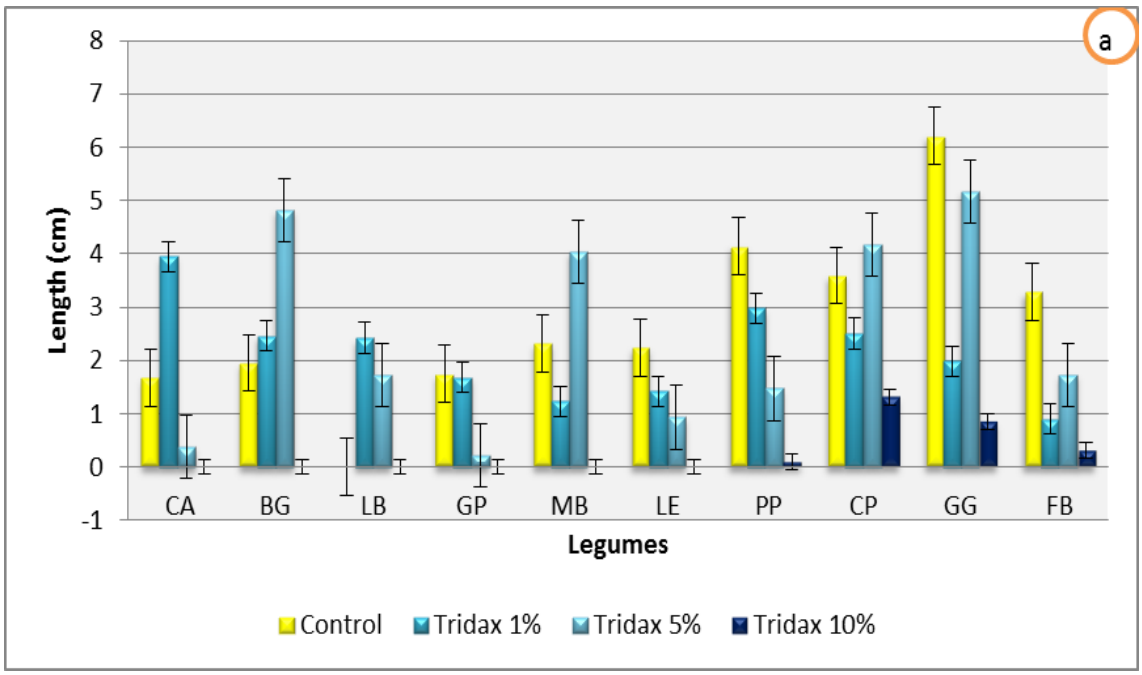
Where **GG**- green gram, **CP**-cow pea, **BG**- black gram, **PP**- pigeon pea, **LB**- lablab bean, **FB**- French bean, **MB**- moth bean, **LE**- lentil, **CA**- chick pea, **GP**- green pea

Mean germination time was maximum in green peas (3 days) in control, which was similar in chick pea with 1% concentration. Mean germination time of chickpea was increased with

concentration which was four days in 5% concentration. In French bean MGT was delayed by 3 days in at 5% concentration.

Maximum C_OV was observed in moth bean(with control and 5% treatment) and ingreen gram (for 1% and 10% treatment).The mean germination rate was maximum in green gram, black gram and moth bean in all treatments, also with control. The germination rate of French bean was gradually decreasing with treatment.

Uncertainty was highest in green peas, Chick pea, Lentil and Pigeon pea and minimum with green gram, black gram, French bean and moth bean. Maximum synchronity with seed germination was observed in Green gram, and Moth bean. Minimum synchronity was observed in in Lentil, Pigeon Pea and Green Pea germination process.(Table 3.2)



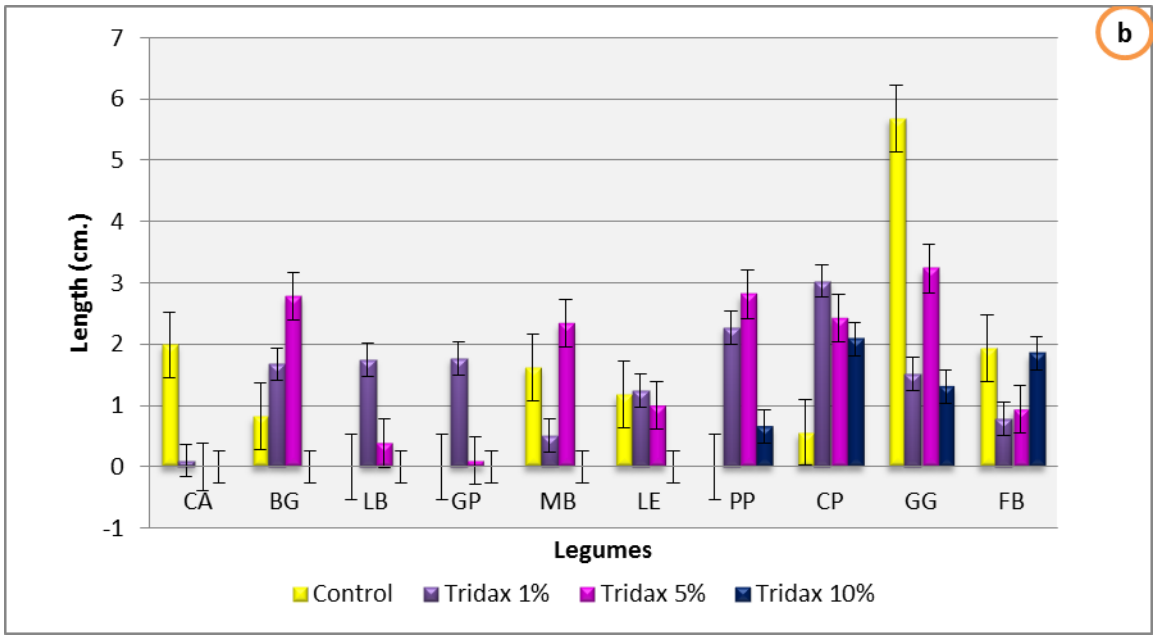


Figure 3.5: Root length (a) and Shoot length (b) of legume seeds with treatment of *Tridax* leaf aqueous decoction

Significant initiation of root length was observed in almost all legumes except pigeon pea, lentil and lablab bean. Chick pea, Moth bean, Black gram and Cow pea root length were increased in treated plants compare to untreated. Root length in 1% treatment was decreased in Moth bean; French bean, cow pea and green gram as compared to control but it gradually increased with higher dosage. Root length was decreasing with concentration in Lentil seedlings. (Figure 3.5(a))

Similarly in Black gram, moth bean, green gram and French bean were showing inhibition in shoot growth with 1% concentration compare to control, but with increase in concentration shoot growth was comparatively stimulated. Cow pea French bean, lentil and black gram shoot growth were inhibited gradually with increase in concentration. (Figure 3.5(b))

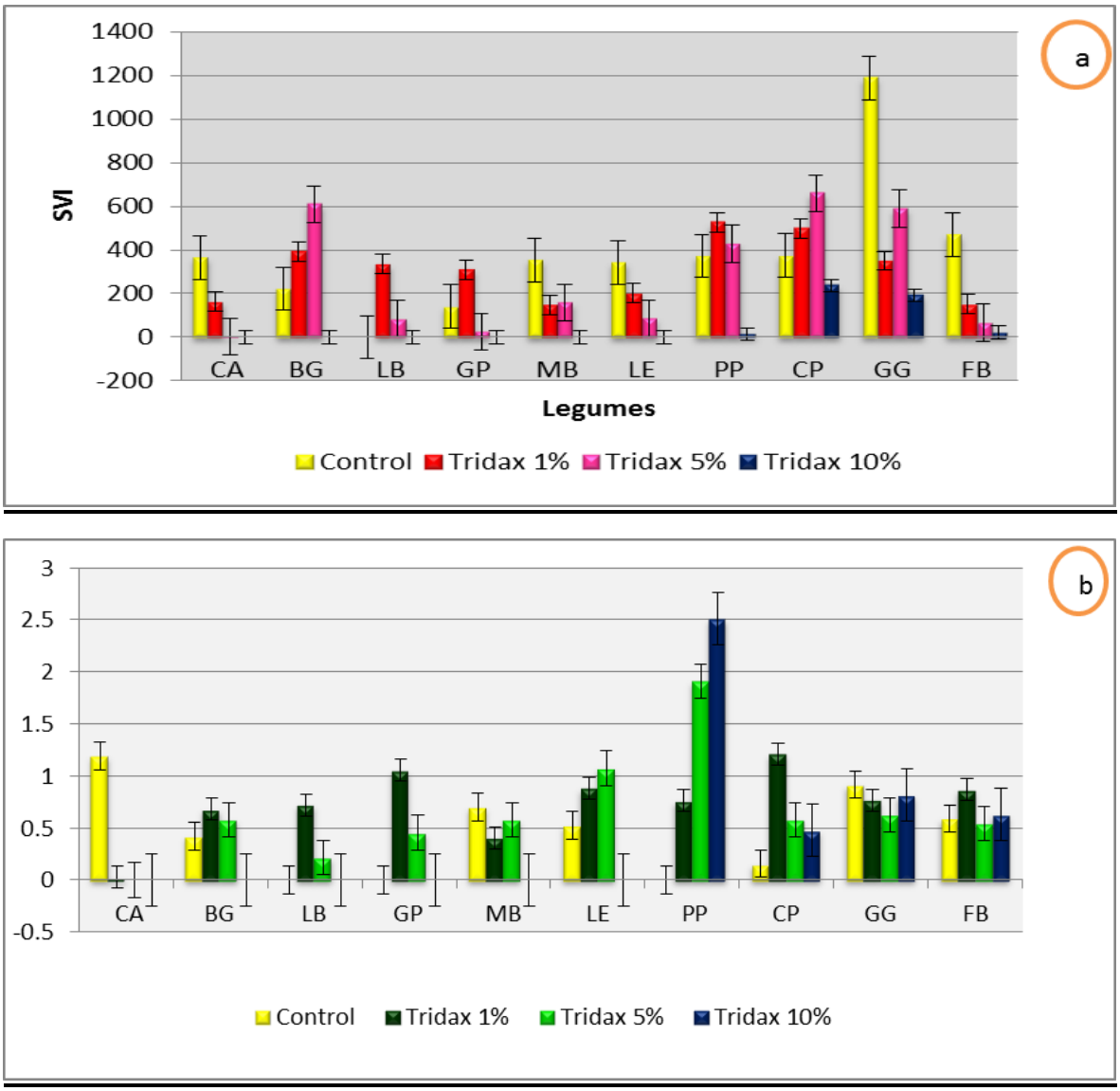


Figure 3.6: Seed Vigour Index (SVI) (a) and Coefficient of Allometry (b) of legume seeds with treatment of *Tridax* leaf aqueous decoction

Seed Vigour index (SVI) - figure 3.6 (a) is mainly to analyse the activity and performance of seed during germination and seedling growth. Compared to control SVI was increased in black gram, green pea, pigeon pea, cow pea and French bean. Green Gram was showing highest SVI compared to all treatments and other legumes, which gradually reduced with treatment.

Pigeon pea represented maximum Shoot :Root ratio in 5% and as compared to all other treated or untreated seedling. Green Gram and French bean exhibited small difference of allometry in all treatment but CoA<1 which showed that comparative length of root was

more than the shoot. CoA >1 was observed in 1% treated seedlings of green pea and cow pea.

3.1.3 Impact of *Tephrosia purpurea* L.(Pers.)

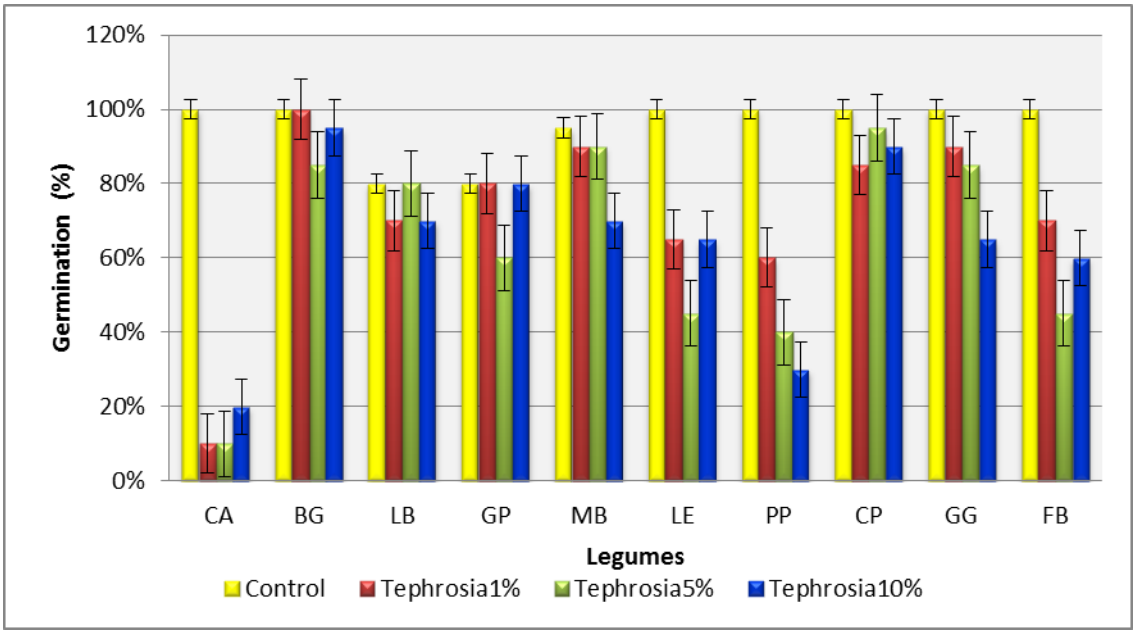


Figure 3.7: Germination (%) of Legume seeds with treatment of *Tephrosia purpurea*L.(Pers) aqueous decoction.

Legume seed germination with treatment of *Tephrosia* leaves was maximum in Green gram, Black Gram, Moth Bean and Cow Pea. While Chick pea showed minimum germination as compared to untreated seeds from 20 % to 10%. Only 10-15% inhibition was observed in Black gram, moth bean and cow pea at higher treatment as compared to control. Green gram with 65% germination at 10% concentration. *Tephrosia* was showing .minimum inhibition for treated seed in all legumes as compared to other four medicinal plants.(Figure 3.7)

	CONTROL		***TEPHROSIA 1%***		***TEPHROSIA 5%***		***TEPHROSIA 10%***	
	CROP	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**
GERMINATION PERCENTAGE (%)								
Maximum	BG , CP, MB	100	BG	100	PP	95	BG, PP	90±14.14
					MB	90		
Minimum	CA	40±28.28	CA	10±14.1421	CA	10	CA	20
MEAN GERMINATION TIME (Days)								
Shortest	GG	1	GG	1.25±0.176	BG	1.06	CA, GG, MB	1
Longest	GP	2.466±0.1885	GP	2.3±0.4242	GP	2.875	GP	3.125±0.5303
COEFFICIENT OF VELOCITY (%)								
Maximum	MB	49.9432	LB	99.6525	MB	91.1249	LE	35.4927±1.4454
Minimum	GG, CA	0	MB	0	FB, BG	0	GG, MB, CA	0
MEAN GERMINATION RATE (Speed per Day)(Day^{-1})								
Maximum	GG	1	GG	0.9±0.1414	BG	0.9444±0.078	CA, MB, GG	1
Minimum	GP	0.4065±0.031	GP	0.4423±0.0815	GP	0.3481±0.0214	GP	0.3246±0.0550
UNCERTAINTY								
Maximum	PP, LE	1.38±0.02452	GP, PP	0.68±0.96	LB	1.420±0.7096	LE	1.2028±0.2868
Minimum	GG, CA	0	LB,CA	0	FB, CA, BG	0	GG, MB, CA	0
			GG	0.4056±0.5156				
SYNCHRONITY OF THE GERMINATION PROCESS								
Maximum	GG	1	LB		FB	1	GG, MB	1
Minimum	CA	0	CA	0	CA	0	CA, LE	0

Table -3.3: Germination parameters of legumes seeds with treatment of *Tephrosia purpurea* L.(Pers.) aqueous decoction.

Where **GG**- green gram, **CP**-cow pea, **BG-** black gram, **PP**- pigeon pea, **LB-** lablab bean, **FB**- French bean, **MB**- moth bean, **LE**- lentil, **CA**- chick pea, **GP-** green pea

MGT of green gramrevealed no change in all treatments, while green pea seeds were germinated after 2 days in control and that time was increased gradually from lower to higher treatment. Similar results were obtained for green gram whichshowed maximum germination speed. Green peahad low mean germination rate, which was further decreased with higher treatment. Green gram and chick pea showed minimum uncertainty in their germination. Pigeon pea and lentil were observed with very higher uncertainty rate (Table 3.3)

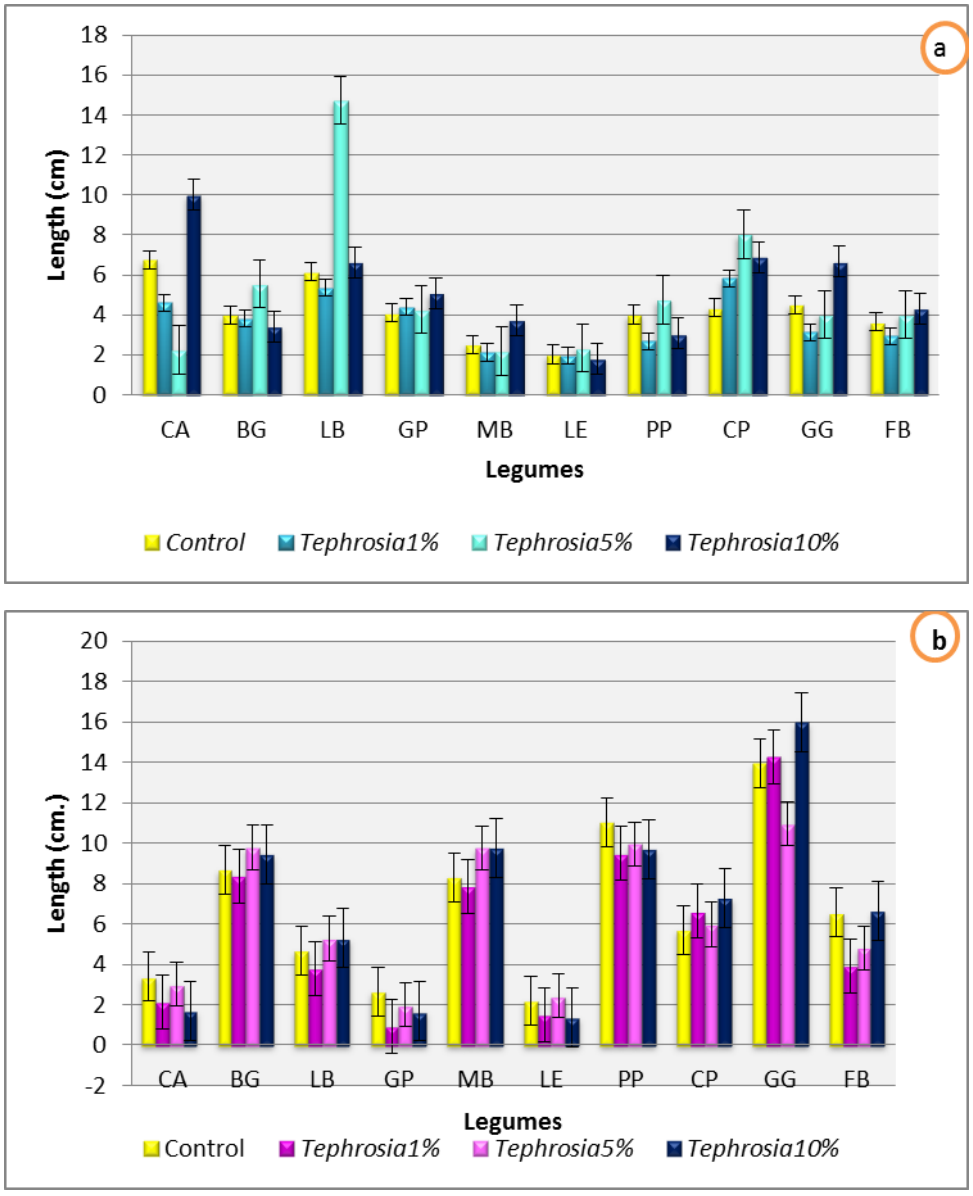


Figure 3.8: Root length (a) and Shoot length (b) measurement of legume seeds with treatment of *Tephrosia* leaf aqueous decoction

Legume root length responded equally for all the treatment of legumes compare to control. Major variation was observed for Lablab bean, black gram and cow pea where root measurement had been noticeably increased at 5% concentration compare to control. All legume seed were showing positive response to the treatment. (Figure 3.8 (a)). Similarly in shoot length was also induced with treatment compare to control especially Black gram, moth bean, green gram and lablab bean. In green gram – (control) average length of the shoot was near to 14cms which had been surged to 16cms with 10% concentration. Similar growth was observed for black gram shoot length. (Figure 3.8(b))

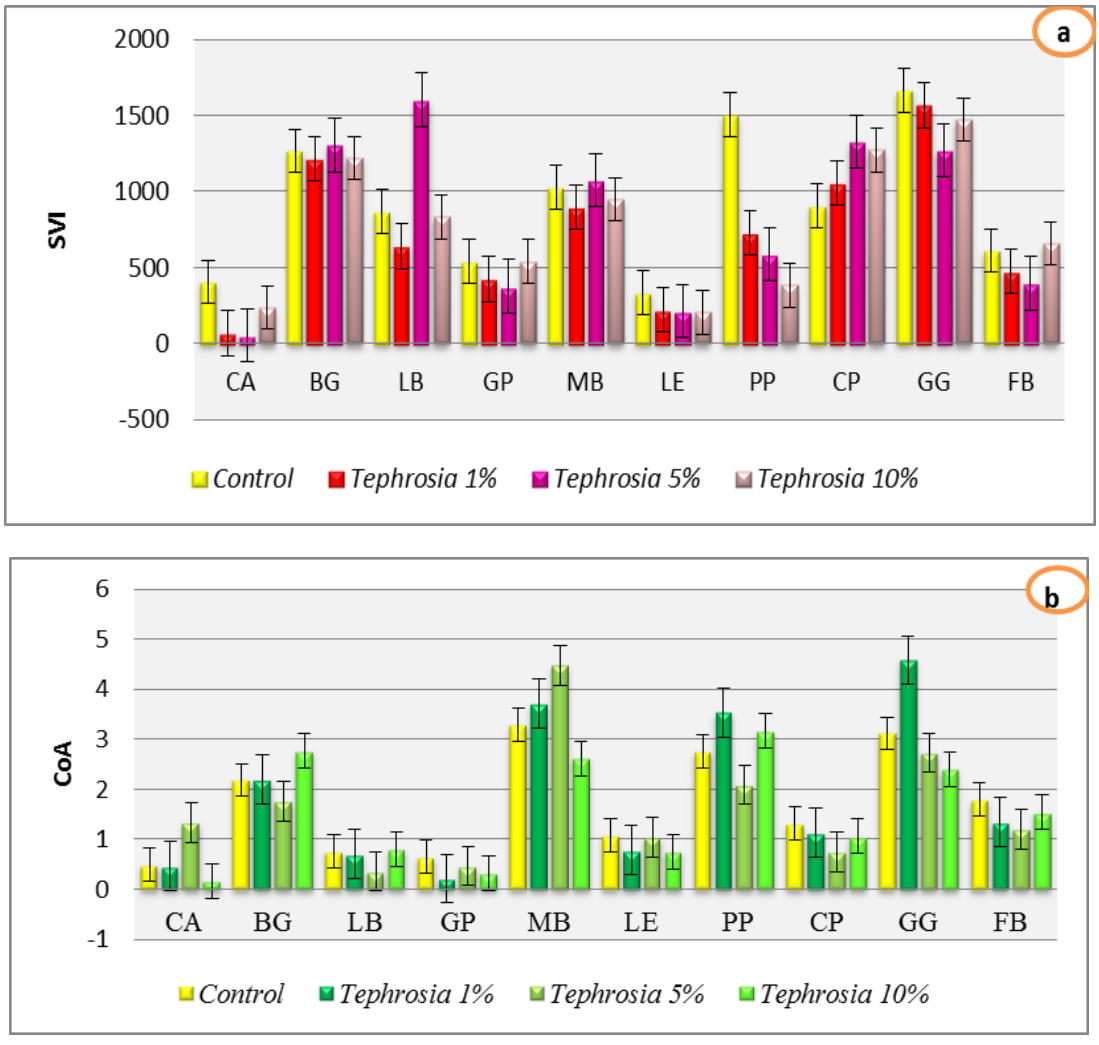


Figure 3.9: Seed Vigour Index (SVI) (a) and Coefficient of Allometry (b) of legume seeds with treatment of *Tephrosia* leaf aqueous decoction

Seed Vigour test represented various results, activity of legume seed were high as SVI was higher in black gram, green gram, and cow pea with all treatments as compared to control(Table 3.9(a))

Coefficient of allometry, which indicates growth rate of the seedling.was.>1 under treatments, in legumes as chick pea, black gram, moth bean, pigeon pea, green gram and French bean , which is a clear indication that in that particular treatment shoot length of the seedling is more than the root length. Control showed maximum shoot length ratio in legume green pea, Lentil, cow pea, French bean. Treatment 1% showed maximum shoot length in legume pigeon pea and green gram. Highest concentration showed maximum shoot growth in legume black gram and lablab bean. Above results showed that effect of treatment on shoot and root growth is species specific.

3.1.4. Impact of *Ocimum sanctum* L.

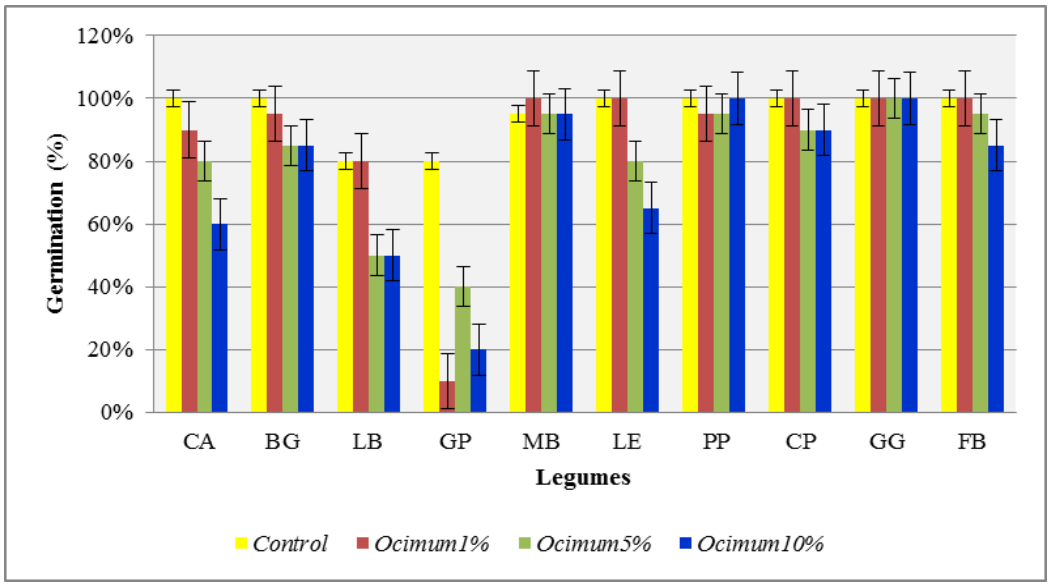


Figure 3.10: Germination (%) of Selected Legumes seeds with Treatment of *Ocimum sanctum* L. aqueous decoction

As can be seen in table 3.10, germination percentage of legume seeds with *Ocimum* leaf extract was showing minimum inhibition to the Green gram (0%) with all treatment as compared to control (Distilled water). Green pea showed maximum

inhibitory effect at 1% concentration. Moth bean, Cow pea , Pigeon Pea, French bean and black gram showed minimum inhibition with*Ocimum*. All legumes expressed least inhibitory effect on germination at lower concentration except green pea, which showed 90% inhibition at 1% concentration.

	CONTROL		*OCIMUM 1%*		*OCIMUM 5%*		*OCIMUM 10%*	
	CROP	VALUE	CROP	VALUE	CROP	VALUE	CROP	VALUE
GERMINATION PERCENTAGE (%)								
Maximum	CA,GG, LE	100%	GG,FB,L E,MB	100	GG	100	GG,PP	100
Minimum	LB	0	GP	10±14.1 421	GP	40	GP	20±28.28
MEAN GERMINATION TIME (Days)								
Shortest	GG	1 day	LE,BG	1	GG	1.05±0.0 707	MB	1.05±0.07 8
	FB	1 day					BG	1
Longest	GP	3±0.353 5	FB,PS	2	GP	3.25 ± 0.3535	CP	2.125±0.1
COEFFICIENT OF VELOCITY (%)								
Maximum	MB	97.97	MB	61±2640	MB	64.42	MB	64.4204
Minimum	CA, GG, FB	0	FB,LE,G P,BG	0	PP	21.4285	CA,BG ,GP	0
MEAN GERMINATION RATE (Speed per Day)(Day^{-1})								
Maximum	GG,FB	1	BG,LE	1	GG	0.9545	BG	1
Minimum	GP	0.3356± 0.039	GP,FB	0.5	GP	0.309	GP	0.125±0.1 767
UNCERTAINITY								
Maximum	GP	1.1556± 0.487	GG	0.9709	PS,LE	0.5	CP	1.09±0.39
							LE	1
Minimum	GG, FB	0	FB,BG, MB, LE,PS	0	GG	0.23	BG,CA ,GP	0
SYNCHRONITY OF THE GERMINATION PROCESS								
Maximum	CA,GG, FB	1	BG,LE,F B	1	LB, CP	1	BG,CA	1
Minimum	GP	0.33±0.2 357	GP	0	GP	0.5±0.70 7	LB	0.33

Table -3.4: Germination parameters of legume seeds with treatment of *Ocimum sanctum* L. aqueous decoction

Where **GG**- green gram, **CP**-cow pea, **BG-** black gram, **PP**- pigeon pea, **LB-** lablab bean, **FB**- French bean, **MB**- moth bean, **LE**- lentil, **CA**- chick pea, **GP-** green pea

Study of different germination parameters of legume seeds showed various result with Ocimum treatment. Germination time was shortest in GG (i.e 1 day in all

treatments) and longest in green pea (3 days). This time duration was increased with concentration. Similar results were observed in mean germination rate. Green gram showed fastest germination speed and slowest rate was observed in Green pea. CoV was maximum in Moth bean as compared to all legumes in all treatment. Maximum uncertainty was observed in Green pea, Lentil seeds and cow pea. Whereas maximum synchronity of the germination process was measured in Green gram and Black gram.

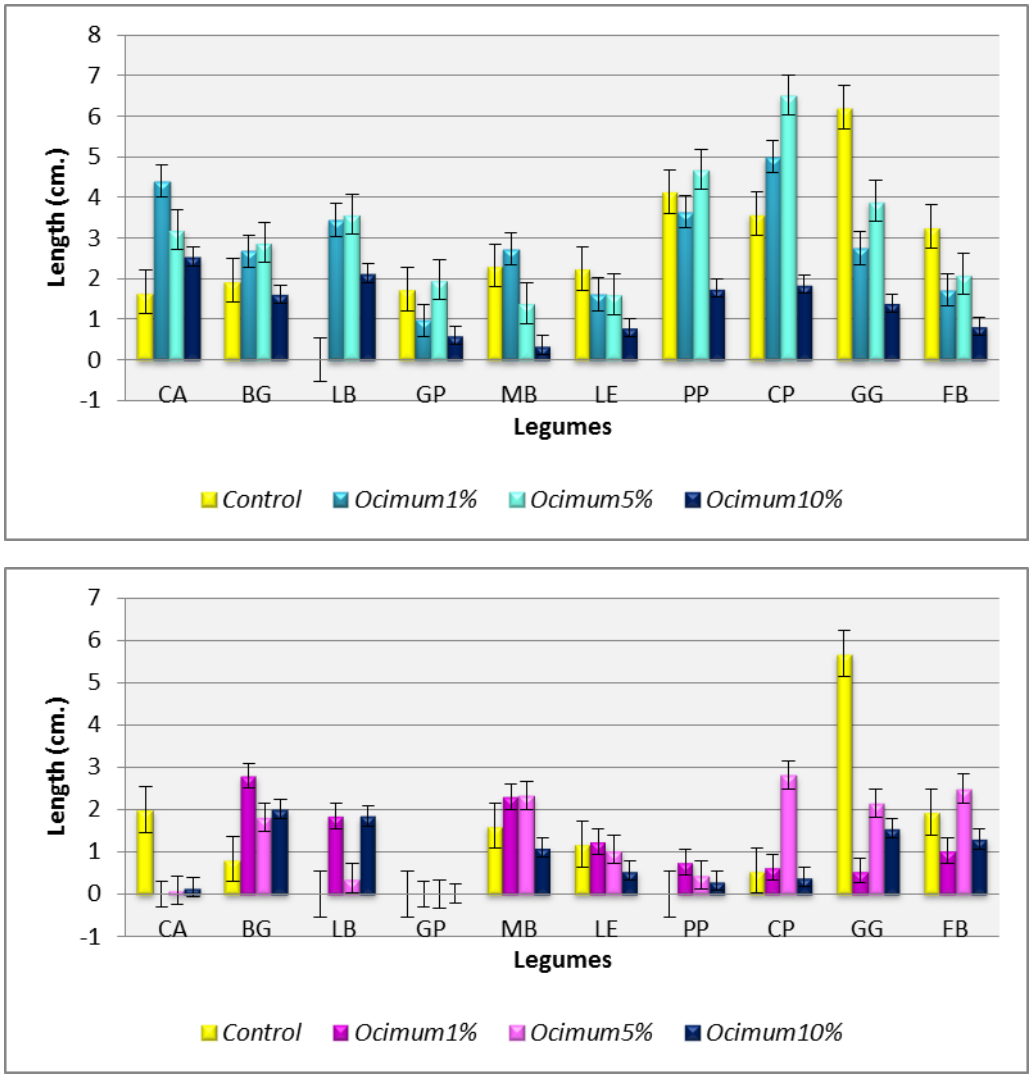


Figure 3.11: Root length (a) and Shoot length (b) of legume seeds with treatment of *Ocimum* leaf aqueous decoction

Root length of chick pea black gram lablab bean moth bean pigeon pea cow pea were increased with 1% treatment compare to control. *Ocimum* 10% concentration represented as

root growth inhibitor for all legume seedlings as per above data. Gradual decrease in root length was observed as moving from lower to higher *Ocimum* leaf concentration. Black gram , French been , lentil, moth bean and Cow pea seedlings were the most resistant against *Ocimum* treatment. 5% concentration was showing good results with moth bean and cow pea. Inhibition of shoot growth with higher treatment was found in pigeon pea and green gram (Fig.3.11)

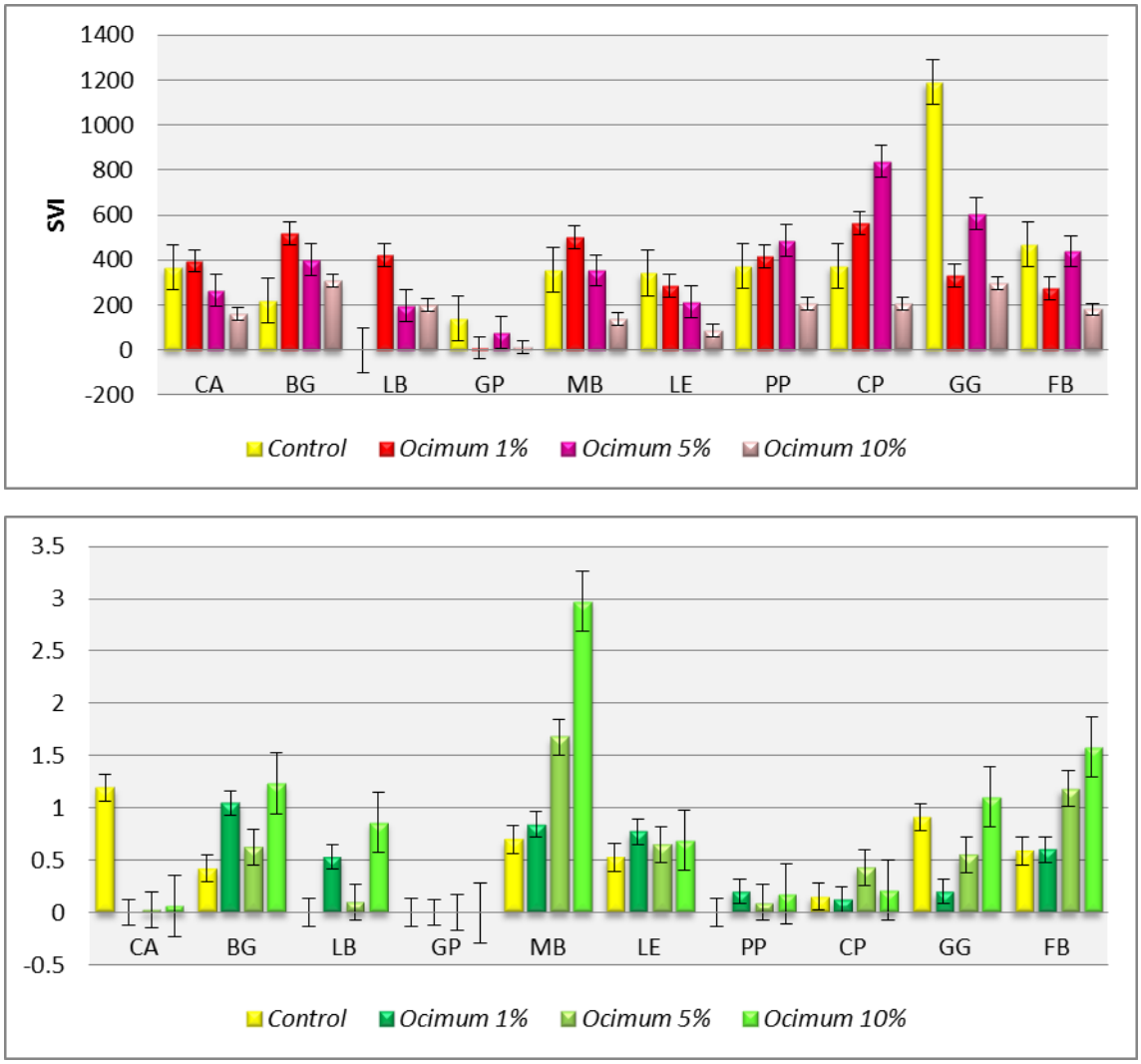


Figure 3.12: Seed Vigour Index (SVI) (a) and Coefficient of Allometry (b) of legume seeds with three concentration using *Ocimum*leaf aqueous decoction

Cow pea and pigeon pea were representing significant activity of the seeds with increasing concentration. Where as lentil , black gram and chick pea were decreasing their seed activity with higher concentration (Fig. 3.12 (a)). Allometry of moth bean, black gram and french

bean was more than 1. Other than this all other legumes representing more of root growth than shoot.(Fig. 3.12 (b)).

3.1.5 Impact of *Swertia chirata*(Wall.) C. B. Clar

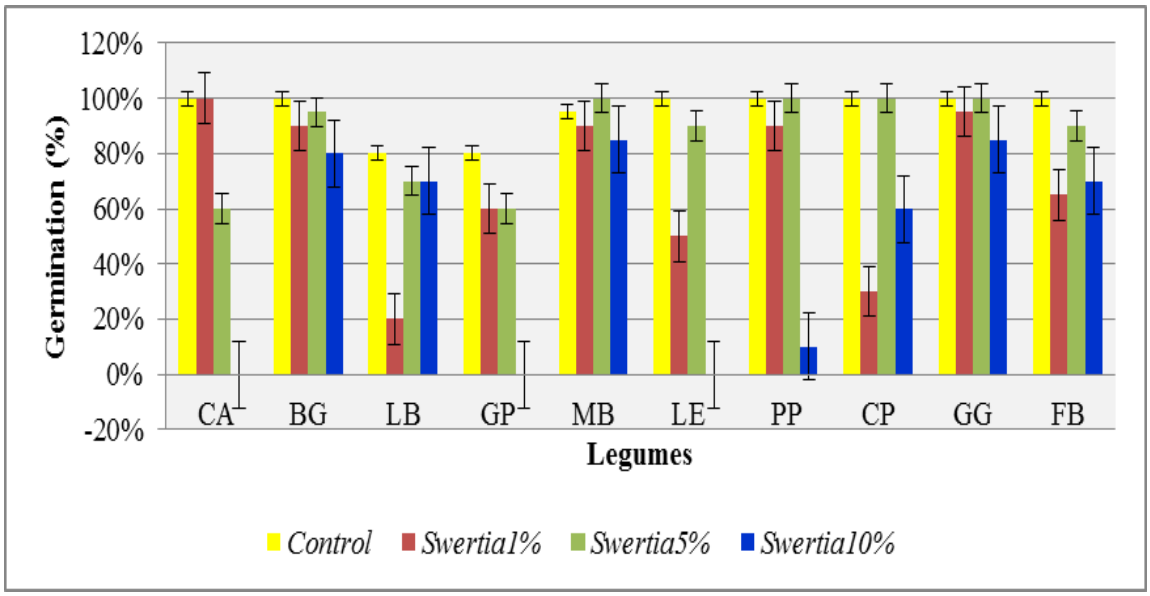


Figure-3.13: Germination Percentage (%) of Legume seeds with Treatment of *Swertiachirata*(Wall.) C. B. Clarke. aqueous decoction

Fig. 3.13 represents germination results of legumes with treatment of *Swertia*, where minimum inhibition was in green gram with all treatment (0-15%). At higher concentration moth bean also showed great resistance to the treatment. Pigeon pea seeds showed inhibition against 10% concentration only. Reverse to it cow pea, lentil and lab lab bean were affected with 1%, more than higher concentration. Green Pea was susceptible to *Swertia* 10% concentration.

	CONTROL		*SWERTIA 1%*		*SWERTIA 5%*		*SWERTIA10%*	
	CROP	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**	**CROP**	**VALUE**
GERMINATION PERCENTAGE (%)								
Maximum	GG, BG, FB, PP	100	CA	100	MB,PP,CP,GG	100	GG, MB	85
			GG	95±7.0710				
Minimum	CA, LE	10±14.1421	LB	20±28.2842	CA	60±28,28	CA, GP ,LE	0
MEAN GERMINATION TIME (DAYS)								
Shortest	GG	1	BG,MB	1	BG	1	CP	0.5±0.70
			GG	1.05±0.078				
Longest	GP	3	LB	2	GP	3.166±0.2357	LB	2.9166±0.5892
COEFFICIENT OF VELOCITY (%)								
Maximum	MB	84.983	GP, CP	43.3012	MB	91.1249	MB	107.886 ±2.039
Minimum	GG,LB ,LE	0	BG,LB,MB, FB,PP	0	GG, CP, BG	0	CP	0
MEAN GERMINATION RATE (SPEED PER DAY)(DAY^{-1})								
Maximum	GG	1	BG,MB	1	BG	1	GG	0.8±0.2828
Minimum	GP	0.33	LB	0.25±0.3535	GP	0.3166±0.0235	LB	0.35±0.07071
UNCERTAINITY								
Maximum	CP	1.8962±0.076	CA,LE	0.8464±0.1760	LB	0.8647±0.075	PP	1.3427±0.7071
Minimum	GG,LE, LB	0	MB, LB,BG, FB, PP	0	BG, GG,CP	0	CP	0
			GG	0.25±0.355			GG	0.4932±0.695
SYNCHRONITY OF THE GERMINATION PROCESS								
Maximum	GG, LB	1	BG,MB,FB, LE	1	GG,CP, BG		GG	0.7916±0.2946
Minimum	CP,GP, LE	0	CP	0	CA		PP, CP	0

Table -3.5: Germination parameters of legume seeds with treatment of *Swertia chirata* (Wall.) C. B. Clarke. aqueous decoction

Where **GG**- green gram, **CP**-cow pea, **BG**- black gram, **PP**- pigeon pea, **LB**- lablab bean, **FB**- French bean, **MB**- moth bean, **LE**- lentil, **CA**- chick pea, **GP**- green pea

Minimum germination time was taken by green gram and French bean i.e. 1 day in control, for *Ocimum* and *Swertia* black gram, moth bean and green gram showed similar time for all treatment while maximum time was taken by lablab bean and green peas i.e. 2-3 days.

Coefficient of velocity was maximum for moth bean for all the treatment of *Ocimum* and *Swertia*. But in all treatment of *Ocimum* velocity value was less than of control for moth bean. In *Swertia* at 1% cow pea and green pea showed maximum velocity. Between 5 and 10% of the treatment moth bean showed similar velocity range as compared to control. Control showed maximum Mean germination rate in green gram and lentil. Similar effect on green gram for *Ocimum* and *Swertia*treatments were observed. Black gram also exhibited a maximum germination rate for treatments which was not seen in control. The minimum germination rate was observed in green peas and lablab bean for control and treatments.

Uncertainty in the germination of legume seed varied in all the treatment compared to control. In control maximum uncertainty was observed in green pea while with *Ocimum* treatment it was maximum in green gram at 1%, green pea and lentil at 5%, cow pea and lentil at 10%. As compared to control, with *Ocimum* treatments all seeds showed less uncertainty in germination. In *Swertia* uncertainty rate was highly variable. Synchronization of seed germination was maximum in green gram and black gram while minimum in green pea, lentil, cow pea and lablab bean.

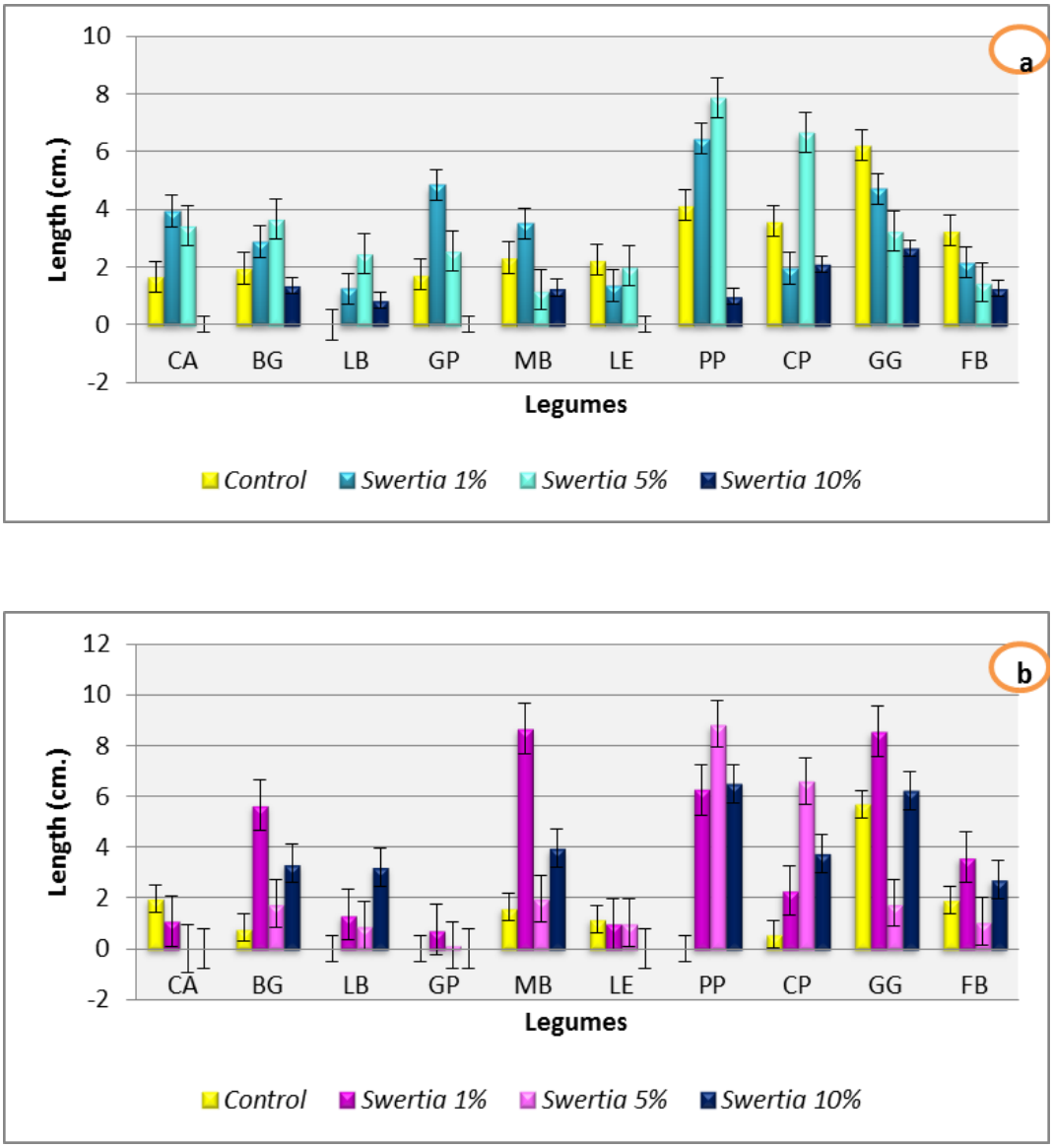


Figure 3.14: Root length (a) and Shoot length (b) of legume seeds with treatment of *Swertia* leaf aqueous decoction

Root length of green gram and French bean was inhibited with low to high concentration. In fact at lower concentration green pea, cow pea and pigeon pea root growth was stimulated(Figure 3.14 (a))Shoot Length results indicated stimulatory effect in shoot growth of black gram,moth bean, pigeon pea, cow pea and green gram by more than 2-4 cm. in length. Inhibitory effect was seen in chick pea, lentil and green pea.(Figure 3.14 (b))

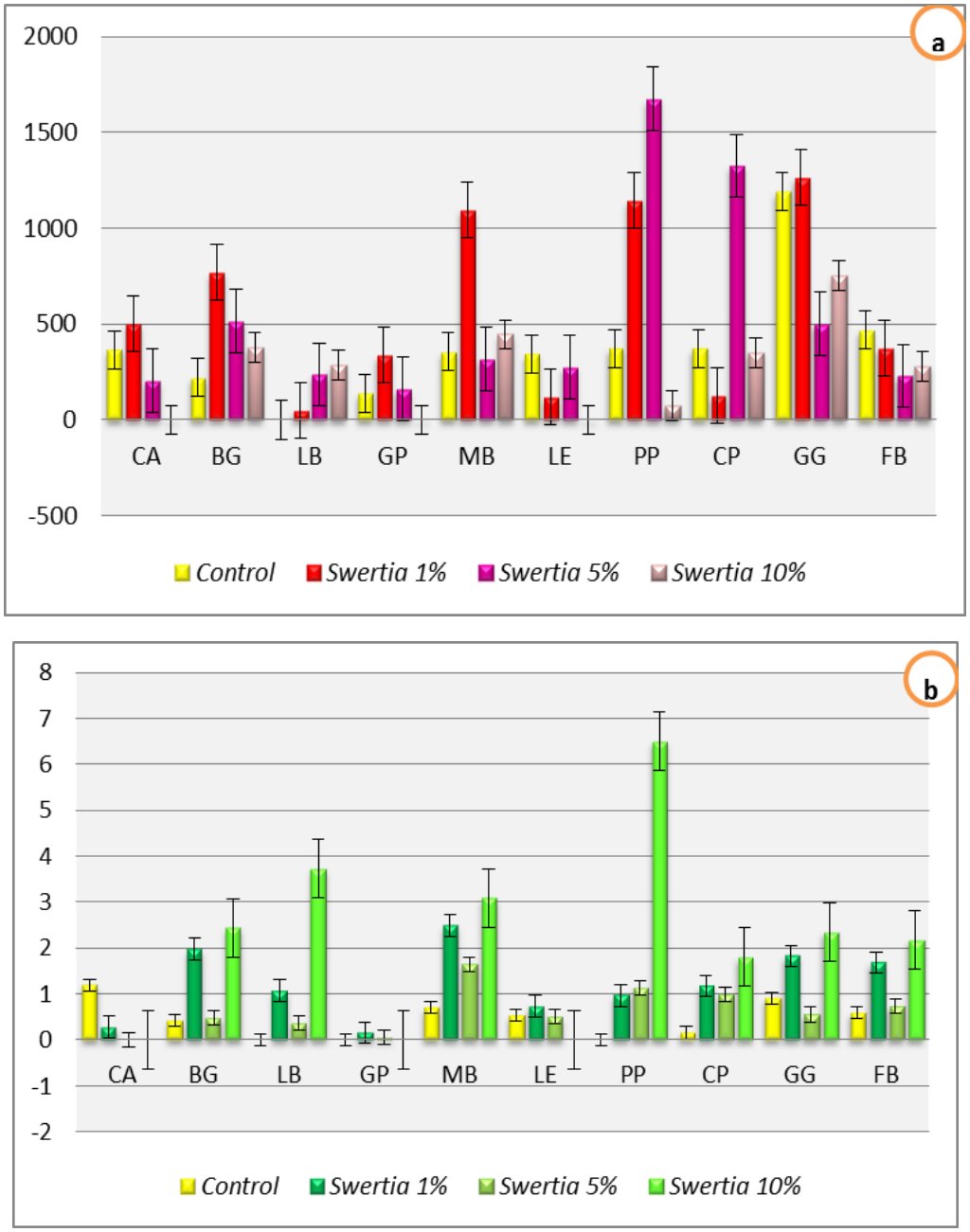


Figure 3.15: Seed Vigour Index (SVI) (a) and Coefficient of Allometry (b) of legume seeds with all concentrations using *Swertia leaf* aqueous decoction

SVI data of legumes treated with *Swertia* leaf aqueous decoction represented major activity in green gram and pigeon pea with higher SVI value.This value are declining with higher concentration for French bean and black gram.(Figure 3.15(a))CoA showed noticeable growth of the stem with 10% concentration in all legume seedlings. Except lentil, green pea and chick pea all legumes were showing CoA > 1. (Figure 3.15 (b))

3.2 Stage 1- Primary Screening of Medicinal plants using water based decoction against Weeds.

On the basis of previous results obtained from primary screening of legume seed study(3.1),weed study was done utilizing 1% aqueous decoction of all five medicinal plants as this concentration was not harmful to most of the legumes .For weeds especially *Parthenium* germination study was conducted after putting them in running water for 20 hours or after mild scarification process.

3.2.1.Germination study of Weed seeds

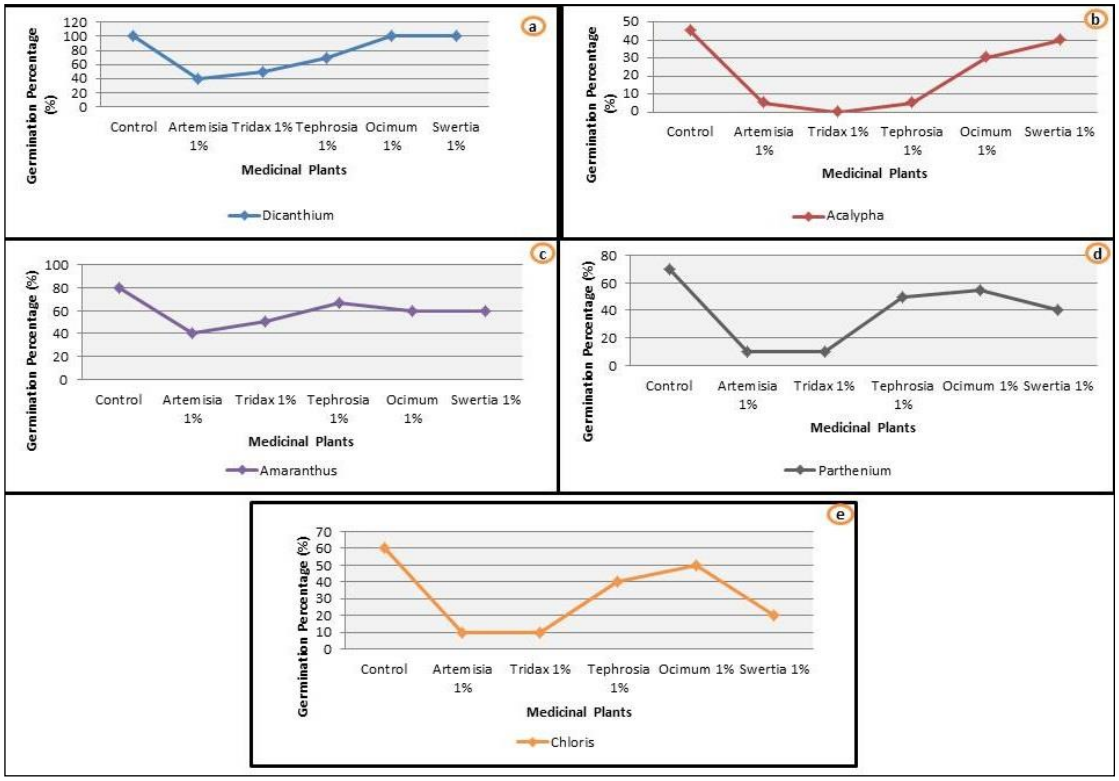


Figure 3.16 (a-e) Germination Percentage of weeds with treatment of 1% aqueous decoction of medicinal plants.

Seed germination in *Dicanthium annulatum* was not affected by *Ocimum* and *Swertia* 1% concentration. Maximum reduction was observed with *Artemisia* 1%. (Figure 3.16(a)).Germination value of *Acalypha* seeds, exhibited maximum inhibition with *Tridax* followed by *Artemisia* and *Tephrosia* treatments. Weeds were least affected by

*Swertia*and *Ocimum* treatment. (Figure 3.16 (b)). *Amamranthus virdis* seed germination was inhibited by 40% with *Artemisia* 1% followed by effect of *Tridax*. Minimum effect was observed by *Ocimum* and *Swertia.* (Figure 3.16 (c))

Effect of medicinal plants on *Parthenium* and *Chloris* seeds is shown in Fig. 3.16 d & e where maximum reduction in germination was observed with *Artemisia* and *Tridax* treatment. *Swertia* 1%was also inhibiting germination in weed seeds upto70% as compared to control. Weed seeds were showing resistant effect against *Ocimum*1% treatment.

3.2.2. Seedling Growth

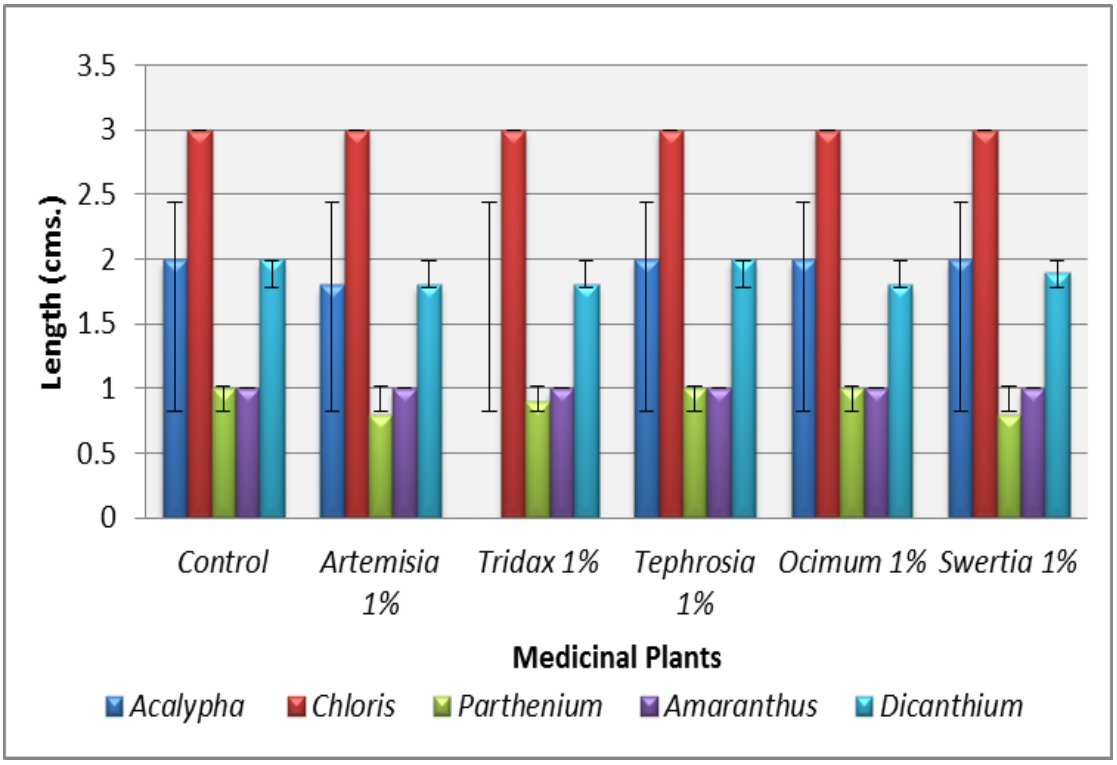


Figure 3.17 Seedling Length measurements of weeds using 1% aqueous decoction of five medicinal plants.

Figure 3.17 shows that seedling length of *Chloris* was not affected by any treatment, reduction was observed in the germination of the seeds. *Parthenium*seedling growth was slightly decreased with *Artemisia* and *Tridax*.

But no change was observed with other three medicinal plants as compared to control.

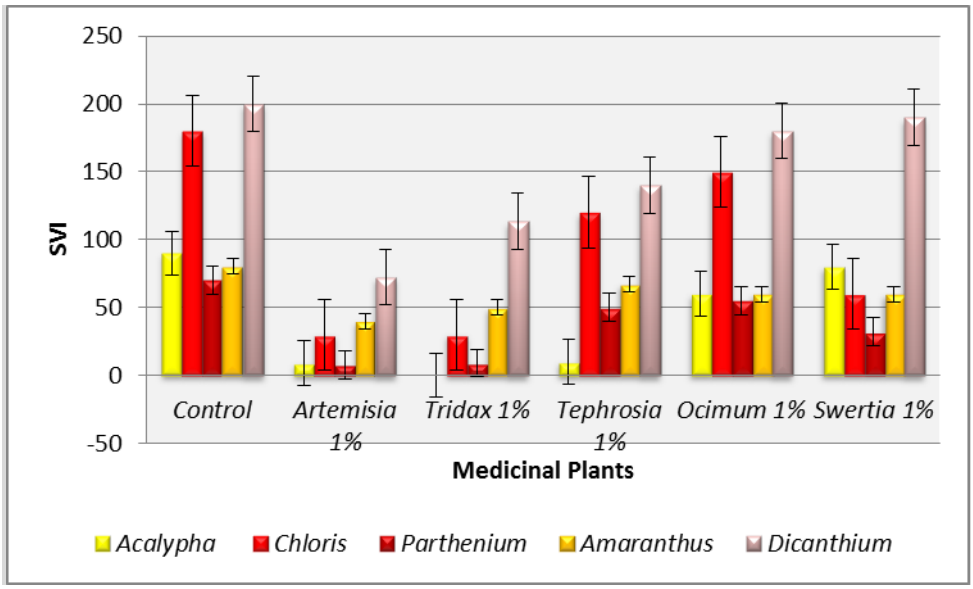


Figure 3.18 Seed Vigour Index (SVI) of weeds using 1% aqueous decoction of selected medicinal plants.

SVI represents here seed growth activity of weeds which were affected with *Artemisia* and*Tridax* treatment. *Dicanthium* seeds were highly resistant with *Ocimum* and *Swertia* treatment. *Artemisia* and *Tridax* treatment were inhibiting growth of all the weeds by more than 50% as compared to untreated. *Acalypha and Parthenium seeds were showing highest inhibition among all the weeds.* Where as in monocot weeds *Chloris* was inhibited more as compared to *Dicanthium*. *Amaranthus* seeds were showing less inhibition with all treatments as compared to control. (Figure 3.18)

3.3 Stage – 2 Secondary screening for legumes and weed using Sandwich method

After the primary screening of the legumes and weeds, second screening was done on the basis of different parameters, such as allelopathic effect of medicinal plants on selected weeds and on other hand viewing their least harmful effect on legume growth and seed germination.

Artemisia, *Tridax* and *Swertia* showed greater suppressive potential on weeds so these medicinal plants were selected for further study. Among legume crops, green gram was selected as it was almost unaffected by treatments, especially at lower concentrations. Out of all the weeds studied, *Parthenium* and *Chloris* were more susceptible and thus further studies were carried out on them.

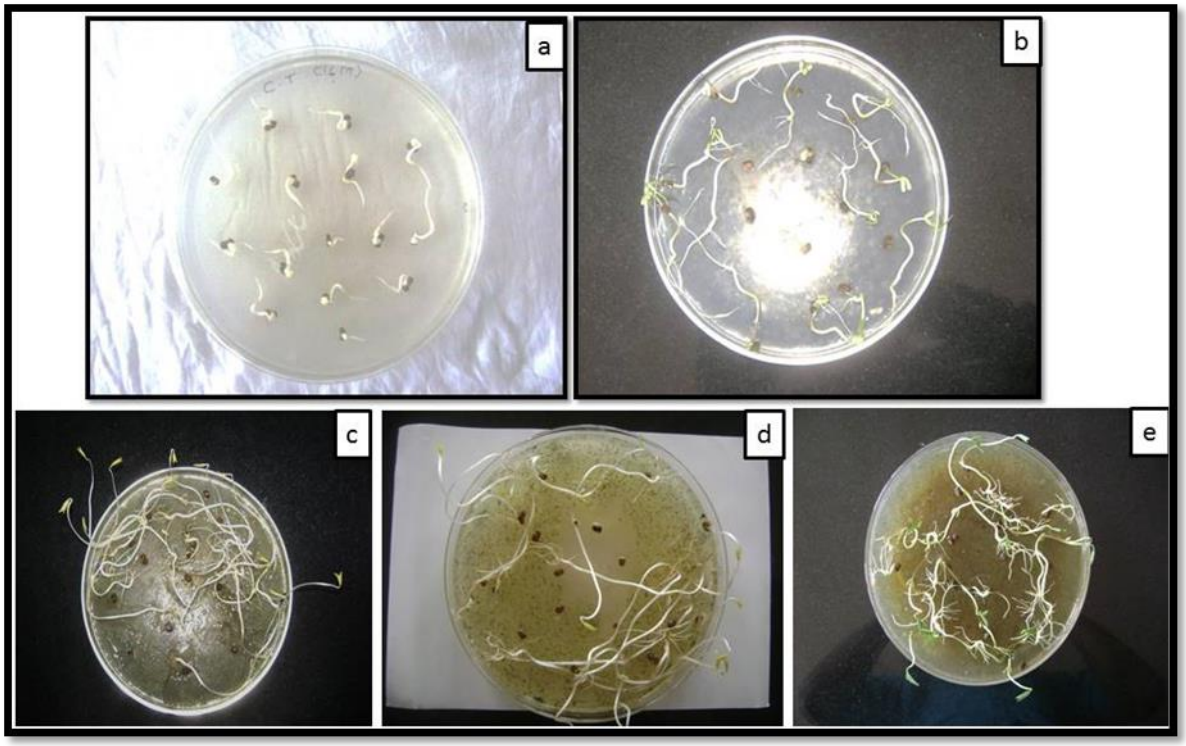


Plate -2: Green gram seed germination in – Control (a& b) and with treatments – *Artemisia* (c) ,*Tridax* (d), *Swertia* (e) leaf mulch

Further study was conducted to analyse more accurate dosage of medicinal plants on legumes and weeds. Experiments were conducted using sandwich method in which dry leaf mulch of medicinal plants were utilised in different concentrations.(Plate -2) Effect of mulch was analysed by evaluating seed germination, seedling growth, biomass accumulation and comparative HPTLC finger printing of treated legume and weed plants.

3.3.1Impact of *Artemisia, Tridax* and *Swertia* on Green Gram

The impact of medicinal plantson Green gram was assessed in two phases as described below,

3.3.1.1 Phase 1. Germination study and seedling growth of Green Gram seeds using(0.5% - 5% w/v) concentration of leaf mulch

Experiment 1: *Artemisia* Dry Leaf Mulch treatment with Green gram.

Treatment	Germination	MT	CVt	MR	U	Z
Control	100	1	0	1	0	1
Artemisia 0.5%	98±2.82	1.02±0.028	9.61±13.59	98±0.02	0.121±0.017	0.96±0.05
Artemisia 1%	100	1	0	1	0	1
Artemisia 5%	68±5.65	1.03±0.04	11.76±16.63	0.97±0.04	0.16±0.23	0.93±0.08

Table :3.6 Germination parameters of Green gram against treatment with *Artemisia* (0.5%-5%) using sandwich method

Maximum inhibition of seed germination was observed in 5% concentration as compare to other treatments. Regarding germination, Seeds in 0.5% and 1% concentration were not affected with treatment. Also no influence was observed in Germination time and rate. Which at the end resulted in synchronised germination process(Table 3.6)

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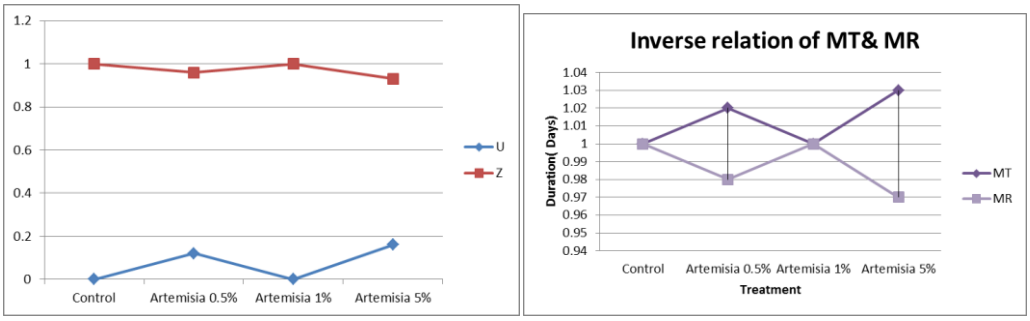


Figure 3.19 (a) inverse relation of uncertainty (U) and Synchronisation (Z),(b) inverse relation of Means Germination time (MGT) and Mean Germination rate(MGR) for treated seeds of Green gram.

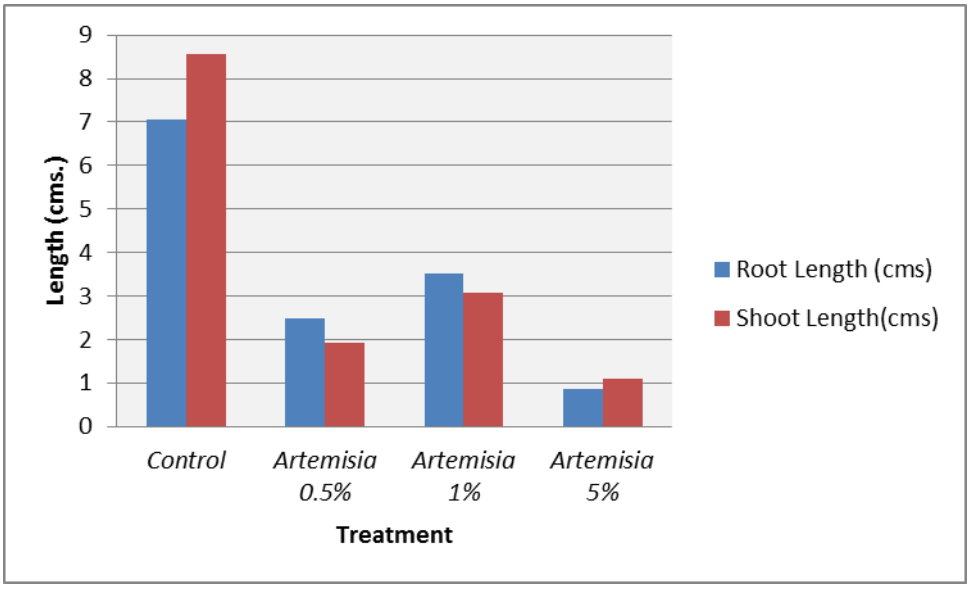


Figure 3.20 Seedling length Analysis of green gram against treatment with *Artemisia*

Impact of *Artemisia* on seedling growth is shown in figure 3.19, Root and shoot length were inhibited in all treatments. Seedling length was reduced by 80% in 5% concentration as compared to control. 1% concentration indicated less inhibitory effect as compared to 0.5% and 5%.

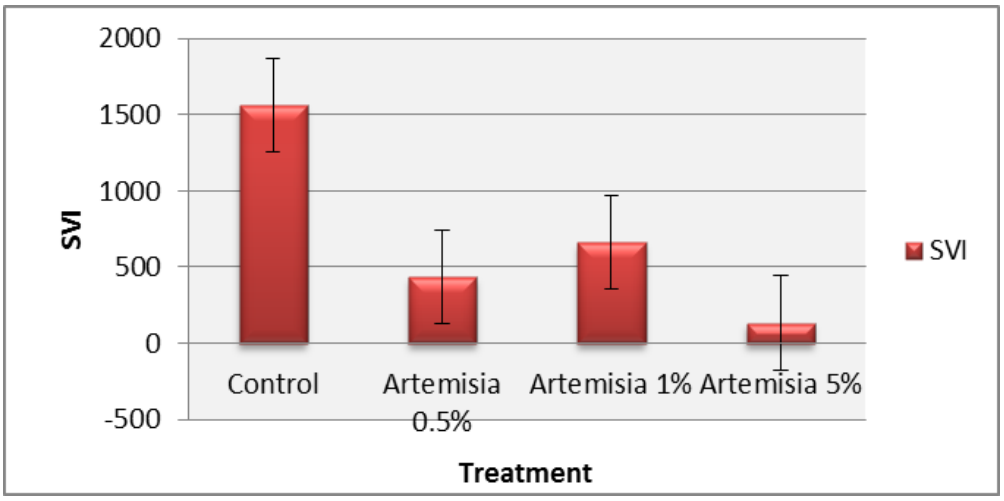


Figure 3.21 SVI (Seed vigour index) Analysis of green gram against treatment with *Artemisia*

SVI was prominently reduced as seedling growth was inhibited in all treatments. Minimum SVI was observed in 5% concentration.

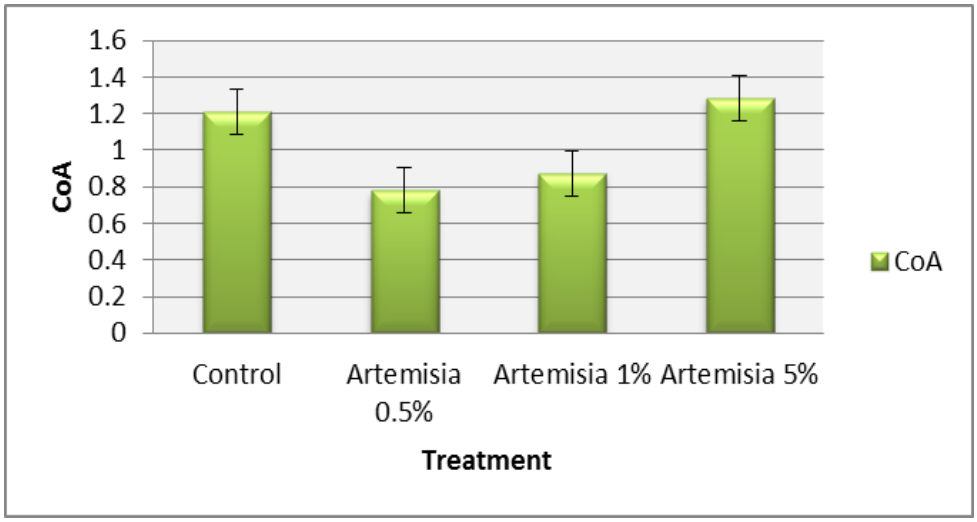


Figure 3.22 CoA(Coefficient of Allometry) Analysis of green gram against treatment with *Artemisia*

CoA value was reduced in 0.5% and 1% and was <1 , indicating reduction in shoot length. Value was >1 for *Artemisia* 5% resulting in more shoot growth as compared to roots.(Figure 3.22)

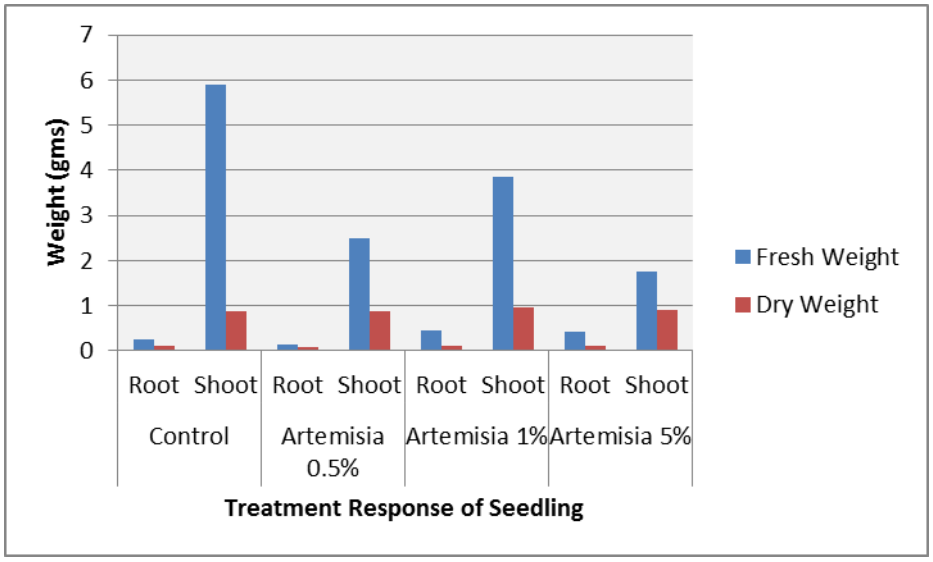


Figure 3.23 Biomass analysis of green gram against treatment with *Artemisia*

Biomass of treated Roots showed no difference as compared to control. But variation was observed in shoot weight. Fresh Weight of shoot was declined in all treatments specially 5% concentration. But Dry weight remained equal for all treatments and control.(Figure 3.23)

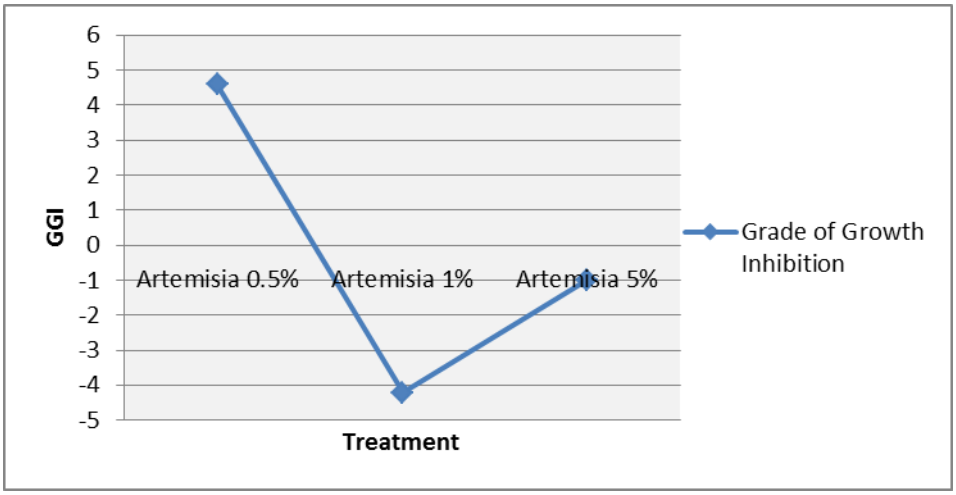


Figure 3.24 GGI (Grade of Growth inhibition) Analysis of green gram against treatment with *Artemisia*

Seedling growth of Green gram was inhibited in 0.5% concentration. Other two treatments with negative value of GGI resulted in stimulatory effect, especially 1%.

Experiment 2: *Tridax* Dry Leaf Mulch treatment with Green gram.

Treatment	Germination	MT	CVt	MR	U	Z
Control	98±2.8284	1.028±0.0294	9.79±13.85	0.98±0.02	0.124±0.17	0.95±0.05
Tridax 0.5%	100	1.02±0.028	9.61±13.59	0.98±0.02	0.1211±0.17	0.96±0.056
Tridax 1%	100	1.24±0.056	34.911±1.25	0.80±0.03	0.788±0.09	0.623±0.06
Tridax 5%	100	1.48	34.45	0.67	0.99	0.48

Table 3.7 Germination parameters of green gram against treatment with *Tridax*

Effect of *Tridax* dry leaf mulch using sandwich method was analysed on green gram seeds as per above mentioned concentrations. Results are presented in Table 3.7which indicatethat percentage of germination in Green gram was not affected with treatment. Mean germination time was definitely increased with concentration. Change in Mean germination time also affected synchrony of the germination process. Compared to control, treatment 0.5% and 1% enhanced the seed germination.

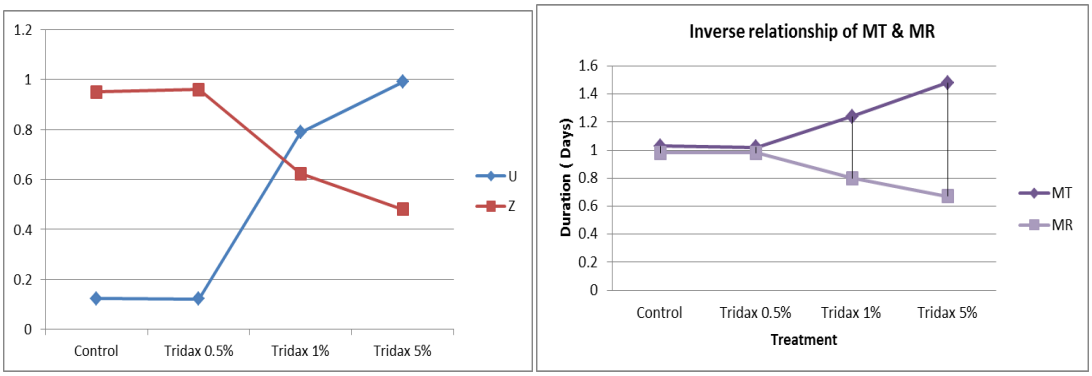


Figure 3.25(a) inverse relation of uncertainty (U) and Synchronisation (Z),(b) inverse relation of Means Germination time (MGT) and Mean Germination rate(MGR) for treated seeds of Green gram.

As shown in Figure 3.25(a) Uncertainty of the germination was near to zero for control and 0.5% treatment , that was showing synchronity in the growth. Likewise control and 0.5% treatment had taken minimum germination time, in other word we can also describe that thegermination rate was faster than the *Tridax* 5% treatment.

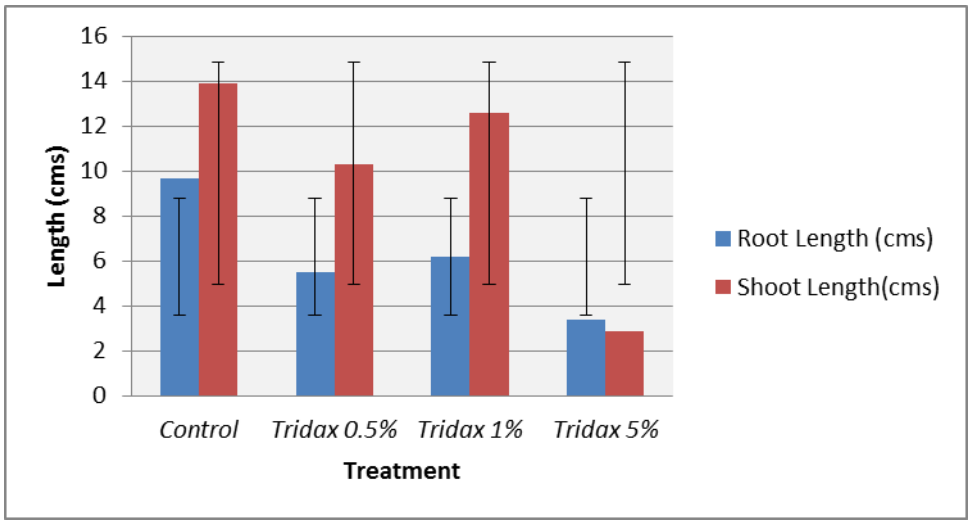


Figure.3.26:Seedling length Analysis of green gram against treatment with *Tridax*

Seedling growth of green gram was reducedalmost three times with 5% treatment as compared to control. Here shoot length was supressed more than root length. As seen in figure 3.25seed germination did not show major change with any treatment, but later on impact of the treatment was observed on seedling growth where total seedling length was supressed at higher concentration by 9-10cms.

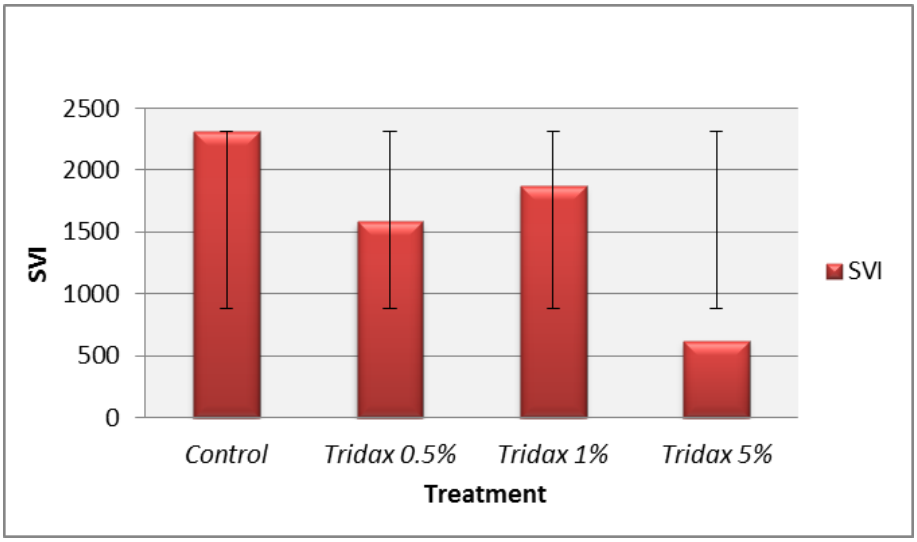


Figure 3.27 SVI (Seed vigour index) Analysis of green gram against treatment with *Tridax*

Remarkable reduction in SVI value was detected at 5% concentration (Fig. 3.27),in control and 1% treament higher SVI valueswere observed.

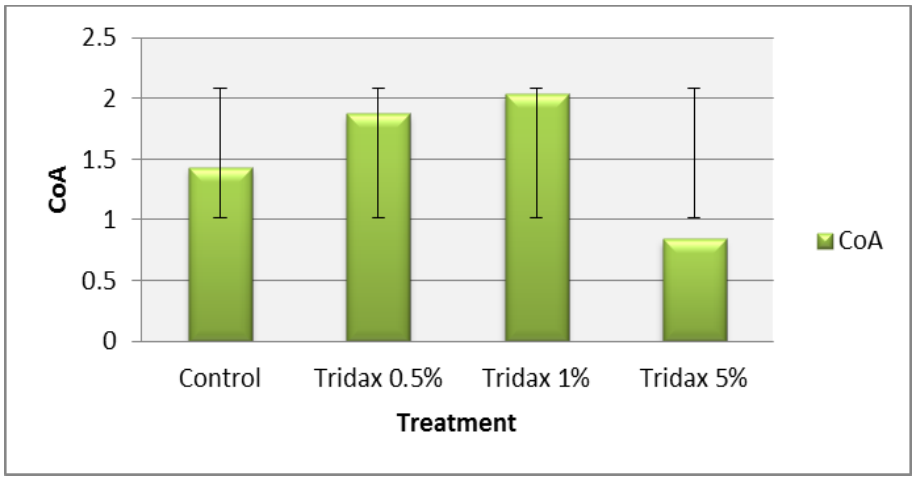


Figure 3.28 CoA(Coefficient of Allometry) analysis of green gram against treatment with *Tridax*

Coefficient of allometry as per Figure 3.28, reduced at 5% treatment where value of CoA was less than 1. Value below 1 showed more root length than shoot length. CoA value was increased from control to *Tridax* 1% treatment, which indicated shoot length was remarkably more than the root length of the seedling.

So with higher concentration, length of shoot decreased as compared to root growth.

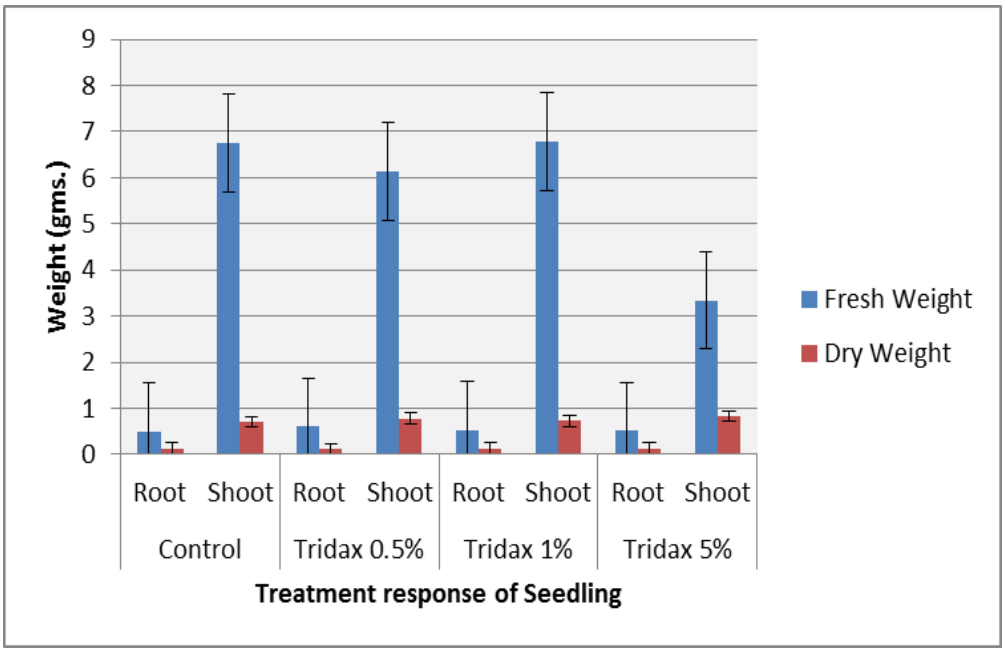


Figure 3.29 Biomass Analysis of green gram against treatment with *Tridax*

Tridax treatment to the green gram was showing very less effect to the fresh weight of the shoot at lower concentration ,fresh weight of stem in 5% noticeably decreased but then in dry weight no change was observed in control and other treatments. Root biomass was not affected by any of the treatment of *Tridax*(Fig. 3.29).

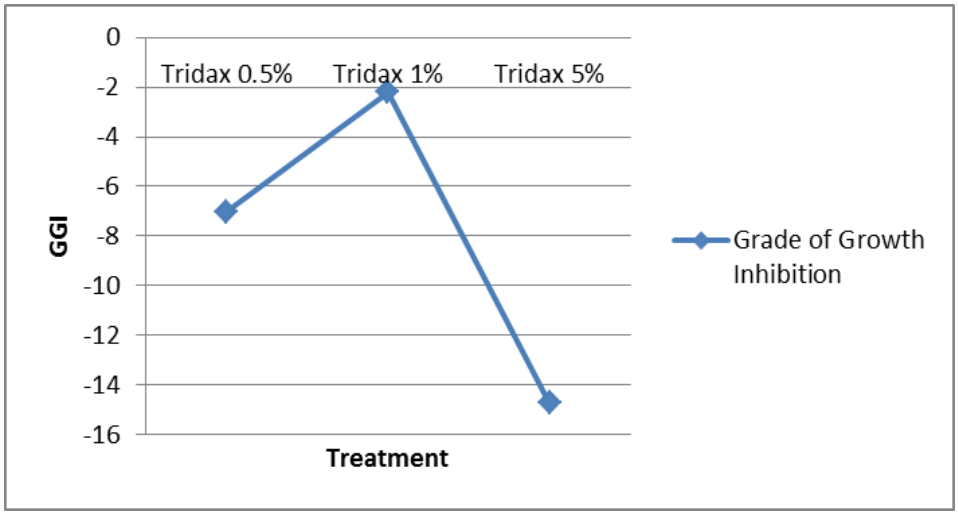


Figure 3.30 GGI(Grade of Growth Inhibition) analysis of green gram against treatment with *Tridax*

Growth inhibition was not observed for *Tridax* all results of growth inhibition were displayed in negative value which clearly indicated no inhibitory effect for seedling growth. Higher concentration shows more stimulatory growth compare to 0.5% and 1%(Fig. 3.30).

Experiment 3: *Swertia* Dry Leaf Mulch treatment with Green gram.

Treatment	Germination	MT	CVt	MR	U	Z
Control	100	1	0	1	0	1
Swertia 0.5%	98±2.82	1.18±0.023	37.14±6.38	0.84±0.01	0.6141±0.05	0.71
Swertia 1%	98±2.82	1.24±0.050	35.06±1.03	0.80±0.03	0.796±0.082	0.617±0.05
Swertia 5%	98±2.82	1.40±0.06	42.73±9.49	0.71±0.03	0.94±0.006	0.50±0.02

Table: 3.8 Germination parameters of green gram against treatment with *Swertia*

Experiment of *Swertia* dry leaf mulch against green gram are represented Table 3.8 Results were showing Germination reduction for all treatment by 2% as compared to control. There was delay in germination time as concentration increased which also indicated reduction in speed of germination. Uncertainty of the germination process was also increased with concentration. This can clearly be observed in figure 3.31.

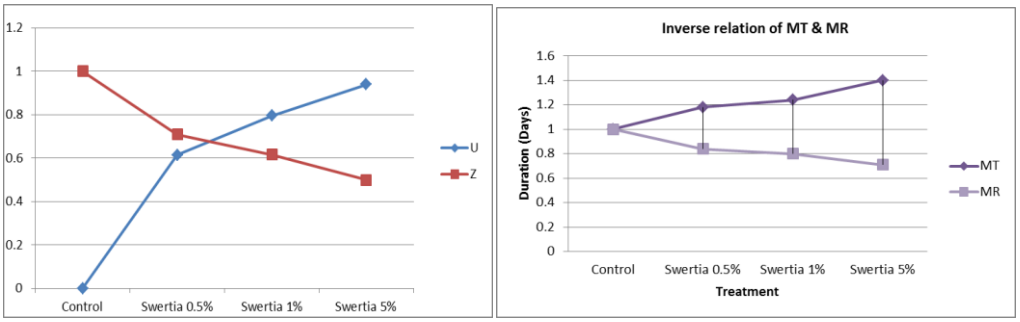


Figure 3.31(a) inverse relation of uncertainty (U) and Synchronisation (Z),(b) inverse relation of Means Germination time (MGT) and Mean Germination rate(MGR) for treated seeds of Green gram.

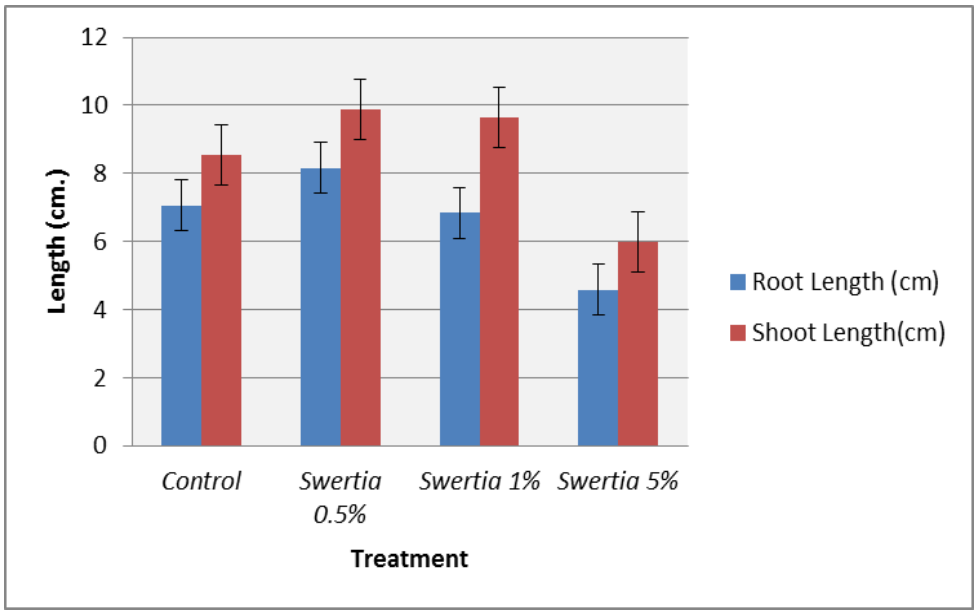


Figure 3.32 Seedling length Analysis of green gram against treatment with *Swertia*

Swertia was not affecting seed germination; similarly Seedling growth was reduced in 5% concentration only. Maximum root growth (8.2cms) was observed in 0.5% concentration and minimum (5.9cm) with 5% concentration. Similar growth was observed for shoot, where maximum shoot length (9.8cm) was obtained in 0.5% concentration and maximum reduction was observed with 5% concentration.

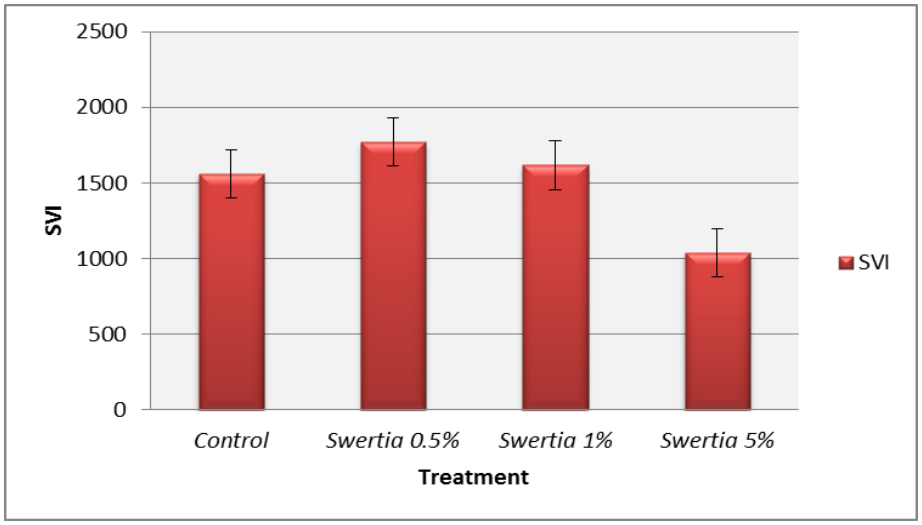


Figure 3.33 SVI (Seed vigour index) Analysis of green gram against treatment with *Swertia*

SVI was reduced at 5% concentration because seedling growth was noticeably reduced at this level. Seeds in Control and 1% treatment showed equal growth. But 0.5 % treatment pointed towards stimulation inseedling growth.

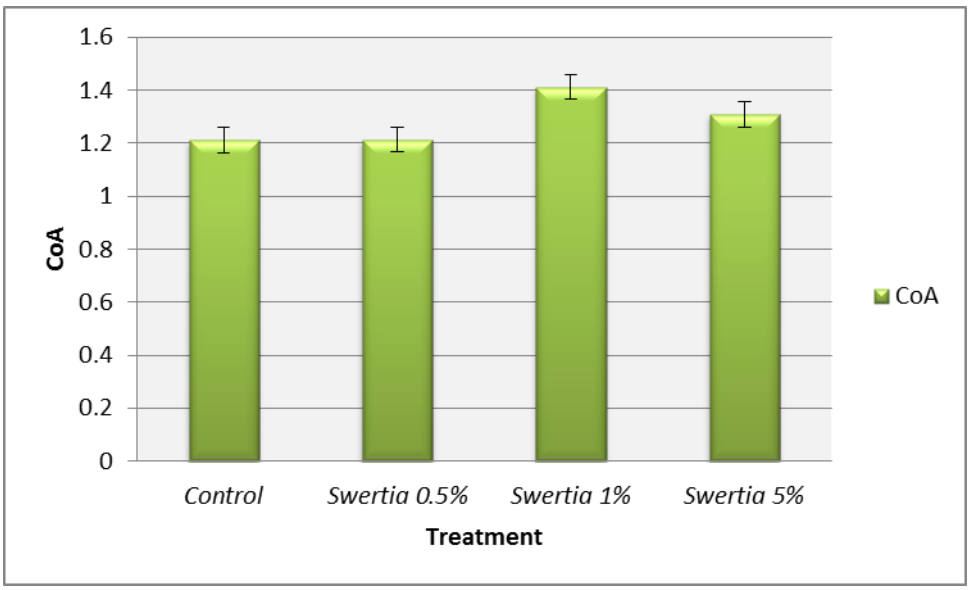


Figure 3.34CoA(Co efficient of Allemetry) analysis of green gram against treatment with *Swertia*

CoA assessment specified effect of *Swertia* on shoot – root ratio of green gram. Ratio for all the treatment including control was more than 1 which states shoot growth was comparatively more than the root growth. Maximum CoA Value was observed in 1% treatment.

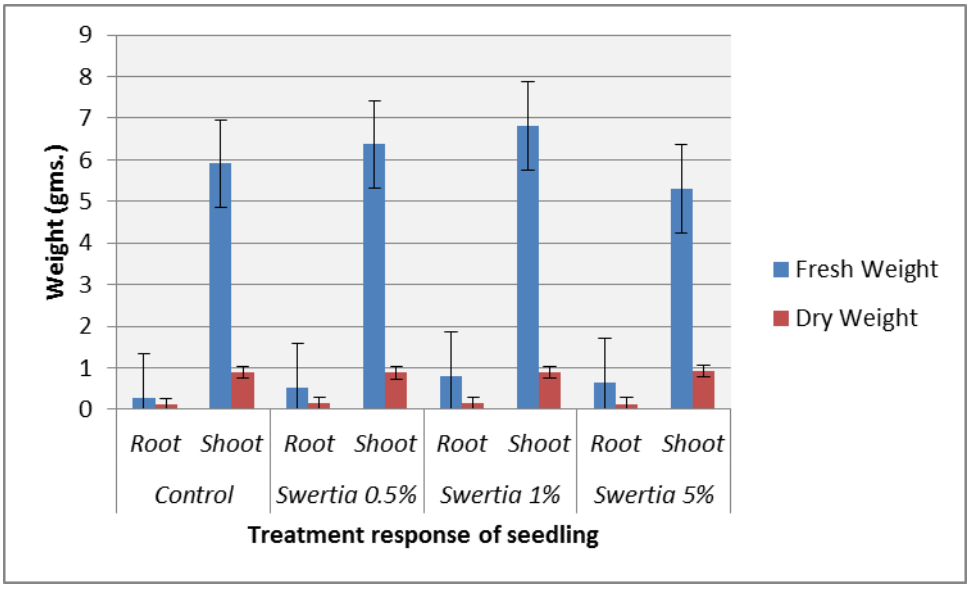


Figure 3.35 Biomass Analysis of green gram against treatment with *Swertia*

All results of *Swertia* treatment indicated reduction of growth and in 5% concentration. Biomass analysis represented reduction in root and shoot length with 1% treatment. Dry weight reduction was more in Control and 1% concentration(Fig.3.35).

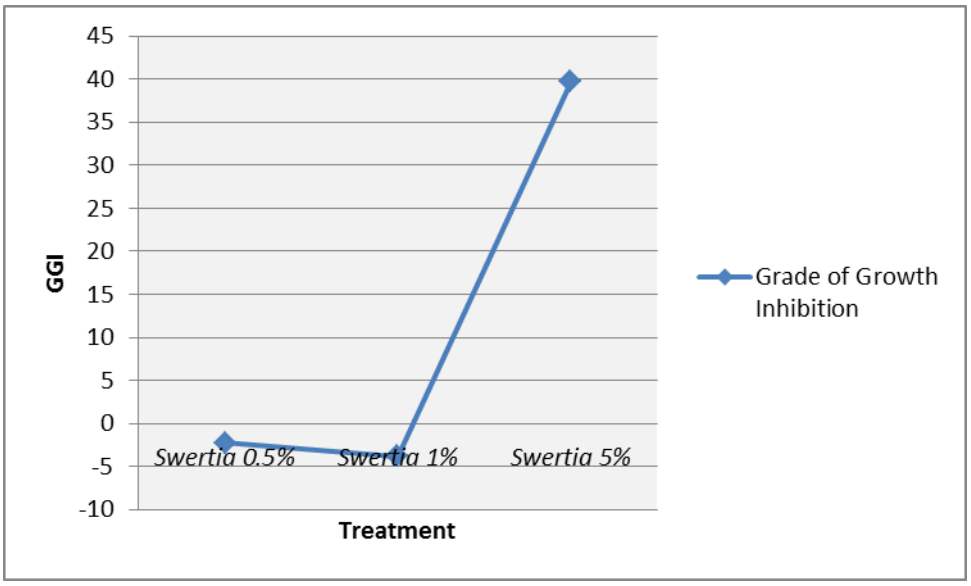


Figure 3.36 GGI(Grade of Growth Inhibition) Analysis of green gram against treatment with *Swertia*

Maximum Growth inhibition was observed in 5% concentration. Negative value of GGI in 0.5% and 1% concentration indicated stimulatory growth (Figure 3.36).

3.3.1.2Phase -2. Concentration of the dry leaf mulch was reduced to check the effect on Green gram,experiments were conducted using concentration 0.2%, 0.4%,0.6% and 0.8% of dry leaf mulch.

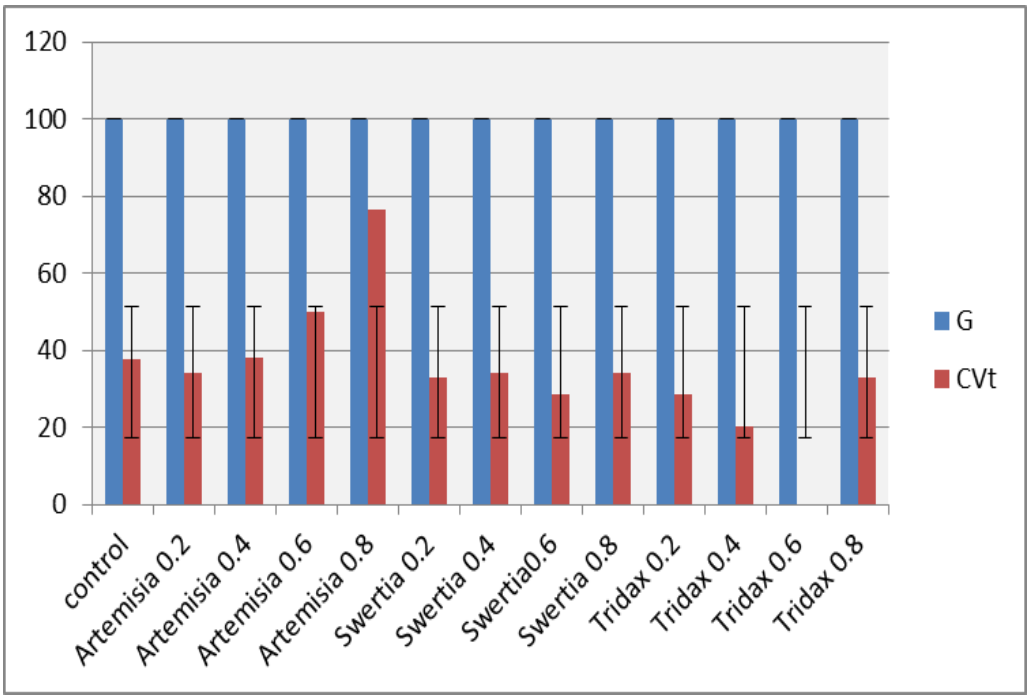


Figure 3.37 Germination (%) (G)and coefficient of velocity (CVt) for green gram Analysis using *Artemisia, Swertia and Tridax*

Figure3.37 indicates germination of green gram seeds with different treatments of *Artemisia*, *Swertia* and *Tridax*. 100% germination was observed for all treated , untreated plants. Coefficient of velocity was maximum in *Artemisia*0.8% and minimum in *Tridax*0 .6%.

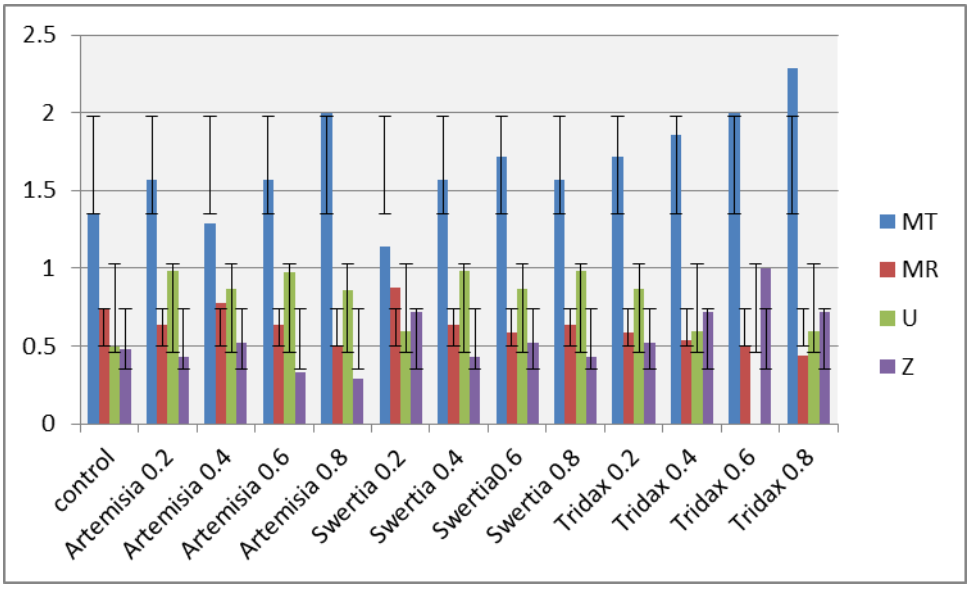


Figure 3.38 Germination parameters (MT- Mean Time,MR – Mean Rate, U – Uncertainty, Z – Synchronity) of green gram Analysis using *Artemisia, Swertia and Tridax*

Mean Germination Time was maximum in *Artemisia* 0.8% , and *Tridax* (0.6%,0.8%) delayed by 1 day as compared to control. Which indicated that germination time had been prolonged with treatment concentration in *Artemisia, Swertia and Tridax.* Which also indicated speed of germination process was declined as concentration increased. Uncertainty of germination process was also observed maximum in *Artemisia and Swertia*. (Fig.3.38)

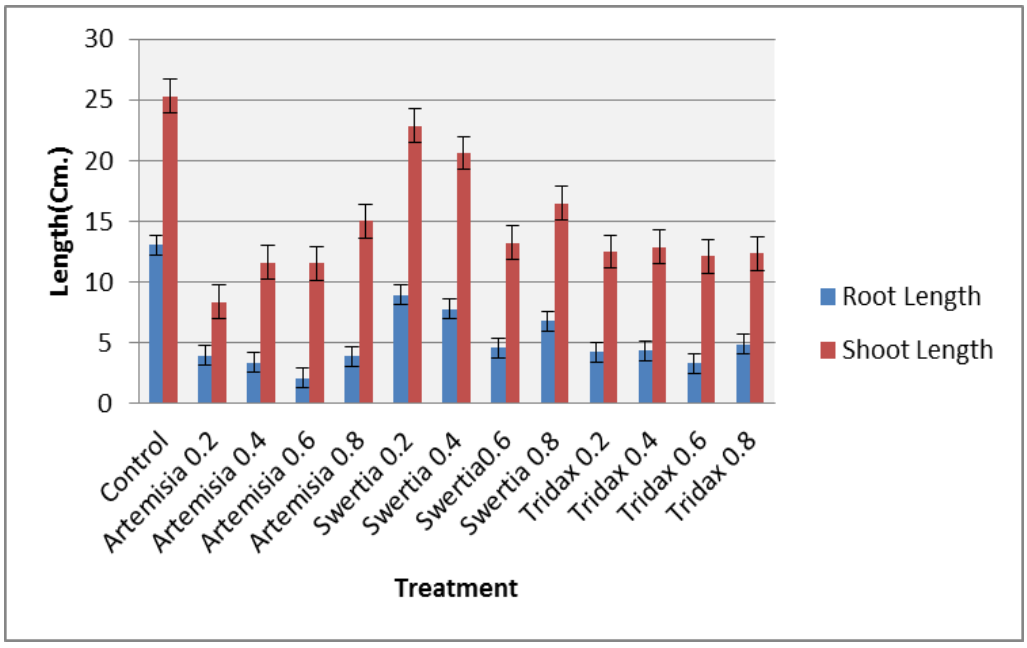


Figure 3.39 Seedling length of green gram Analysis using *Artemisia, Swertia and Tridax*

Seedling length was also affected with treatment of *Artemisia* and *Tridax* as compared to Control and *Swertia*. Maximum inhibition was observed in *Artemisia* 0.2%. Higher concentration posed less inhibition. *Swertia* and *Tridax* Inhibition in seedling growth declined gradually with increased concentration.

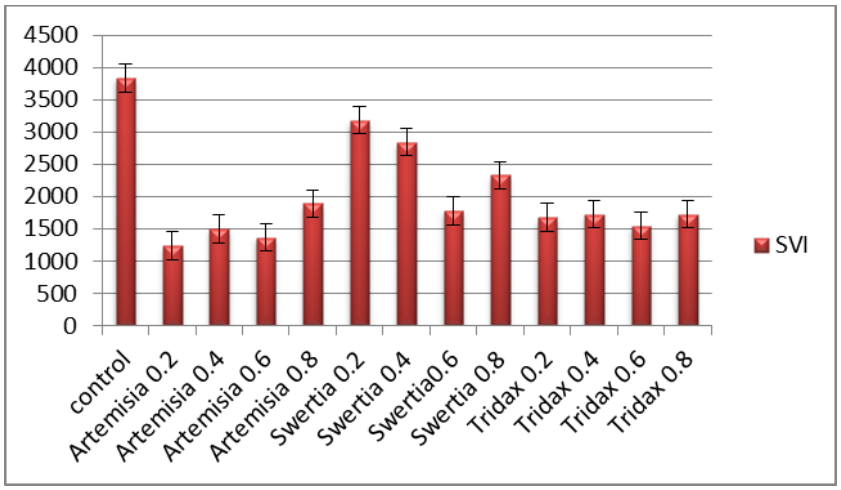


Figure 3.40 SVI (Seed vigour Index) of green gram Analysis using *Artemisia, Swertia and Tridax*(0.2-0.8% concentration) with sandwich method

SVI value was maximum in *Swertia* 0.2 and 0.4% .as per earlier results seedling growth was less in all treatments so SVI value also decreased gradually in *Tridax* and *Swertia* treatment. SVI value was minimum in seedlings treated with *Artemisia*.(Figure3.40)

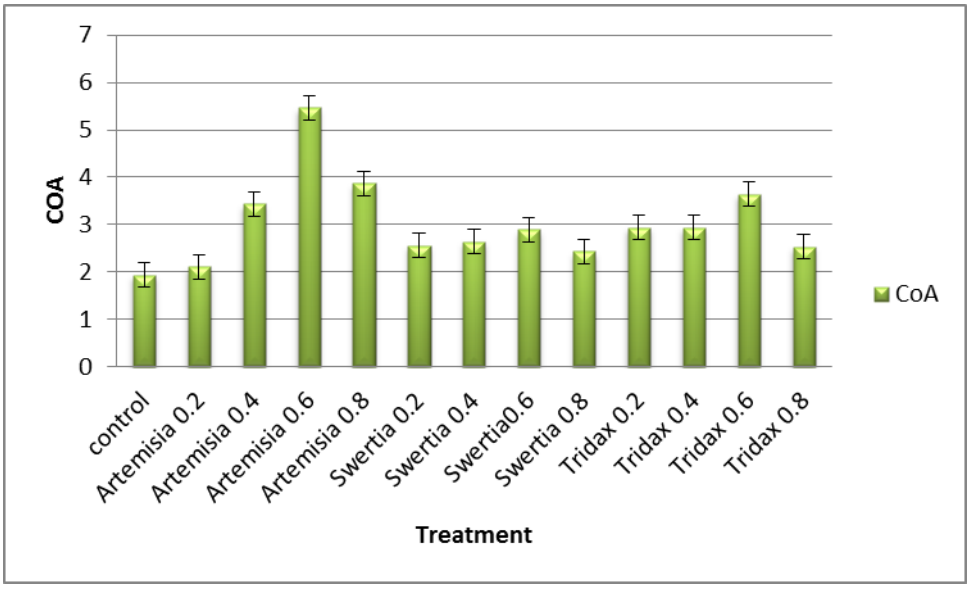


Figure 3.41CoA(Coefficient of Allometry) of green gram Analysis using *Artemisia, Swertia and Tridax*

CoA value for all the treated seedling were more than 1 which indicated more shoot growth than root growth. Maximum CoA value was observed in *Artemisia (0.6%,0.8%)and Tridax* (0.6%). Minimum CoA value was observed in Control. This indicated in reduction of root growth compare to control.

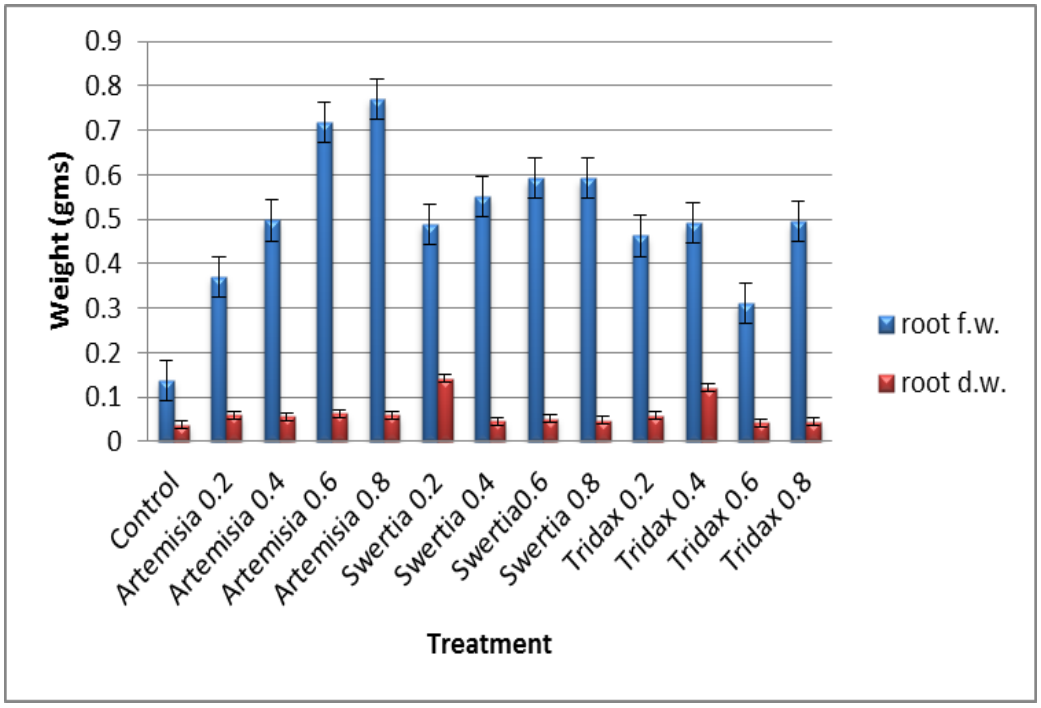


Figure 3.42 Root biomass (Fresh weight (F.W.) and Dry Weight (D.W.) of green gram Analysis using *Artemisia, Swertia and Tridax*

Root biomassas represented in above figure indicated noticeable increase in fresh weight in all treatments as compared to control. Maximum root weight was observed in 0.8% of all treatments. In *Swertia* and *Artemisia* treatment Fresh weight of the root was gradually increased as concentration increased. Dry weight of the root did not indicate any major change except for *Swertia* 0.2% and *Tridax* 0.4%, where it was remarkably increased as compared to other.

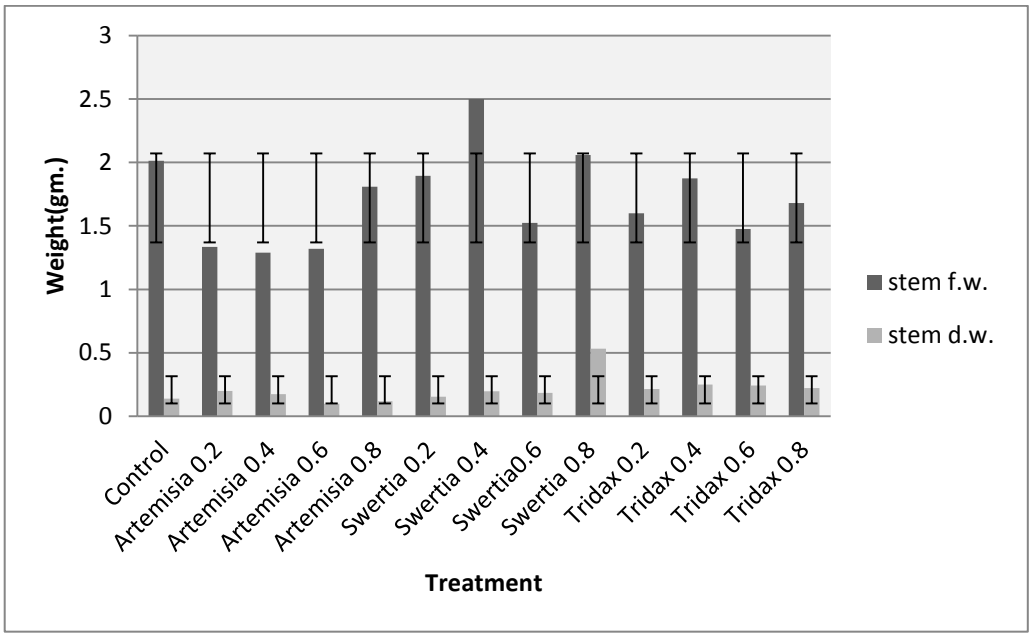


Figure 3.43 Shoot biomass (Fresh weight (F.W.) and Dry Weight (D.W.) of green gram using *Artemisia, Swertia and Tridax*

Shoot Biomass was maximum in *Swertia* 0.4%, 0.8%.In control Fresh weight of the Shoot was 2 gm and minimum. So as compared to control minimum fresh weight (1.3gm) in *Artemisia* 0.2-0.6% treatment which increased (1.8gm) in 0.8% concentration.

Maximum dry weight in shoot weight was observed for *Swertia* 0.8%, other than this other treatment resulted in similar dry weight as compare to control

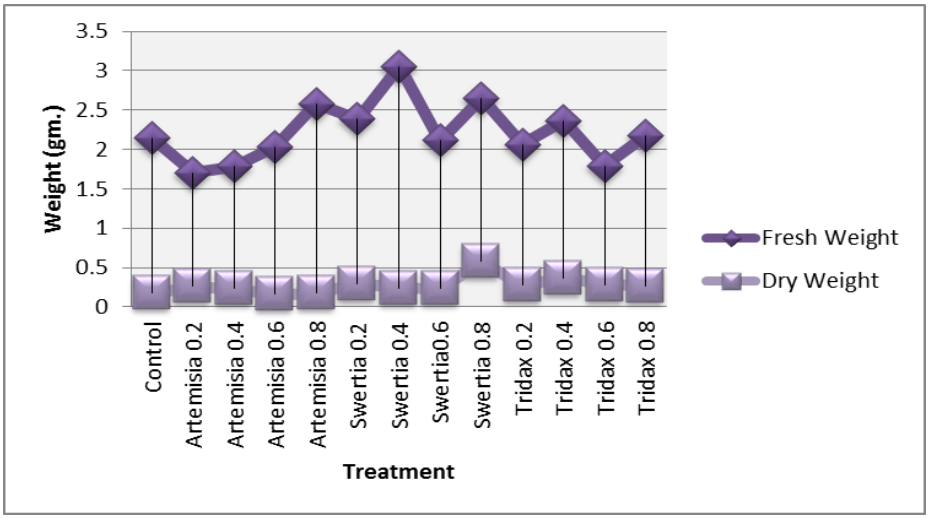


Figure 3.44Total Biomass Analysis of green gram using *Artemisia, Swertia and Tridax*

Comparative study of total biomass can be observed in figure 3.44. According to this maximum total fresh weight was observed with *Artemisia* 0.8%, *Swertia* 0.4%, 0.8% concentrations. Minimum Fresh weight was observed in *Artemisia* 0.2%,0.4% and *Tridax*0.6%. Maximum total dry weight was observed in *Swertia* 0.8% and Minimum in Control and *Artemisia* 0.6 and 0.8%.

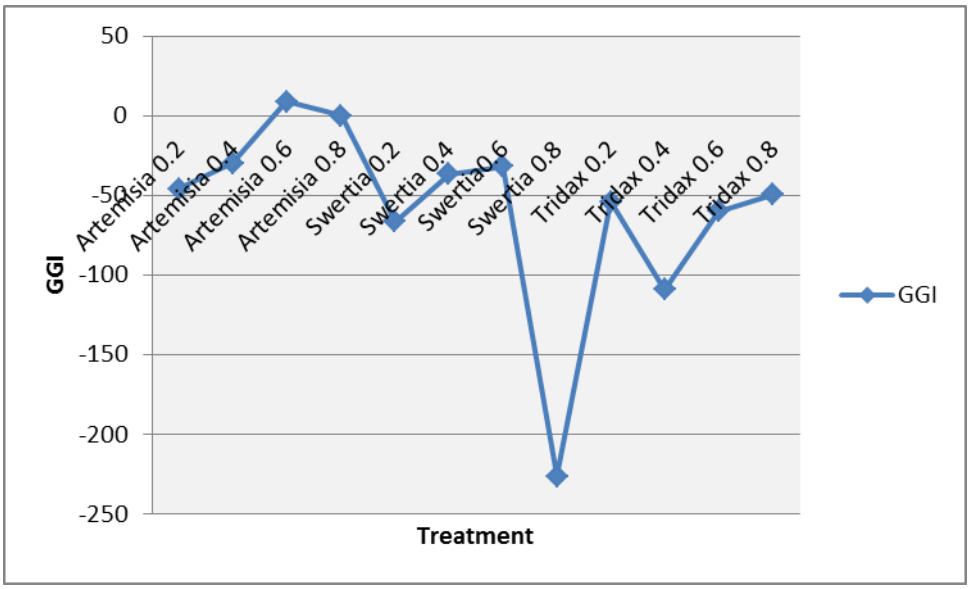


Figure 3.45 GGI (Grade of Growth Inhibition) analysis of Green gram using*Artemisia, Swertia* and *Tridax*

Growth inhibition was depended on dry weight of the treated seedling as compared to control. Negative value was indicating Growth stimulation which

was observed maximum in *Swertia* 0.8%, *Tridax* 0.6% and *Artemisia* 0.4%. Inhibition was observed only for *Artemisia* 0.6% and 0.8% treatment.

3.3.2 Impact of *Artemisia, Swertia and Tridax* on *Parthenium and Chloris*

Allthe three medicinal plants used in earlier study were selected to see their impact on weeds, the concentration used for assessment were 0.1, 0.25 and 0.5%.

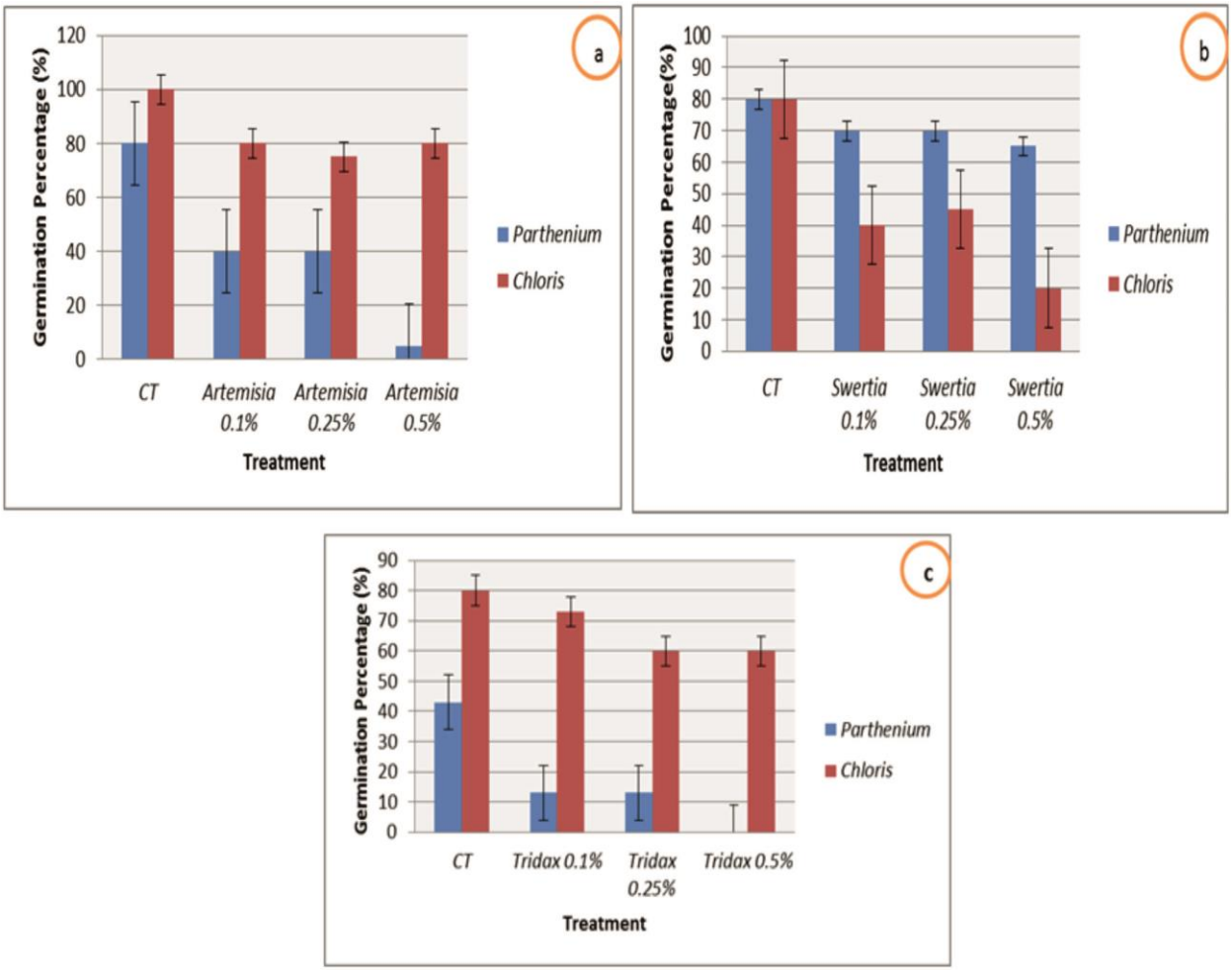


Figure 3.46 Effect of a) *Artemisia* b) *Swertia* and c)*Tridax* leaf mulch on *Parthenium* and *Chloris* seed germination

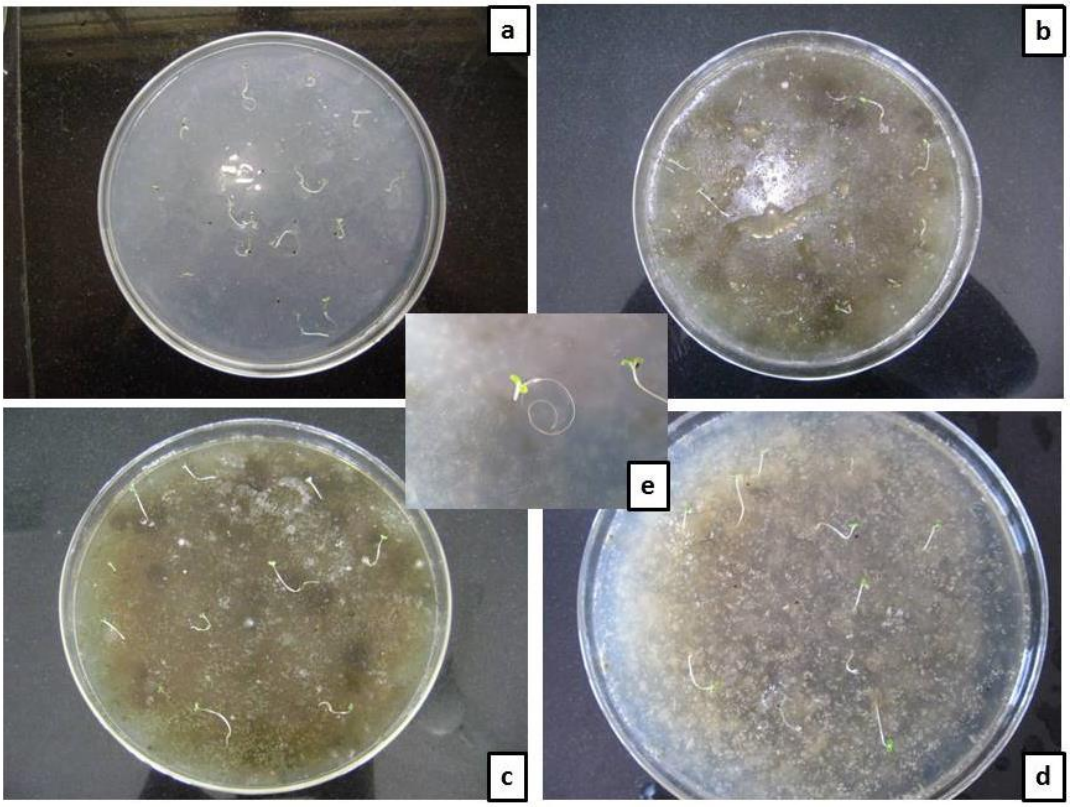


Plate 3 – Weed seed germination in- a) control, c-d) with leaf mulch, e) (inset picture) weed seedling.

Weed Seed germination was observed in three different concentrations for all three medicinal plants (Plate -3)

In *Artemisia* treatments maximum inhibition was observed in 0.5% ,*Parthenium* germination was reduced by 60% in 0.5% concentration as compared to control.*Chloris* was affected less than the *Parthenium*. Maximum inhibition of *Chloris*and *Parthenium* seed germination were observed in *Swertia* 0.5%. Inhibition in *Parthenium* was comparatively less than *Chloris*. Similar results were obtained for *Tridax,* here also inhibition of *Parthenium* seeds was more than *Chloris*. At 0.5% concentration, total inhibition was observed for *Parthenium*. Compared to that 60% seeds of *Chloris* successfully germinated. (Figure 3.46 a, b and c)

3.3.3. HPTLC Finger printing.

HPTLC fingerprinting was done for the test plants using 0.5w/v concentration of each *Artemisia, Tridax and Swertia* leaf Mulch.

Analysis was done to understand the uptake difference of secondary metabolites (Flavonoids, Phenolics, Terpenoids) between control and treated seedlings of green gram. Analysis was done at 254nm, 366nm, 540nm with or without using suitable spray as mentioned in chapter 2. But here only significant results are presented.

Data presented here are for,

- *Artemisia*, *Tridax* and *Swertia* for -Flavonoids – with NP at 366nm , Phenolics –with Fast Blue at 540nm, Terpenoids – with AS (Anisaldehyde sulphuric acid spray) at 366nm

Their Germination was highly supressed under *Artemisia* and *Swertia* treatments.Accordingly only significant results of these treatments are presented here.

3.3.3.1. *Artemisia* – Terpenoids using AS, HPTLC fingerprinting results of above solutions scanned at wavelength 366nm illustrated separation of elements present in the methanolic extract of *Artemisia* dry leaf mulch and green gram seedling(Figure 3.47)

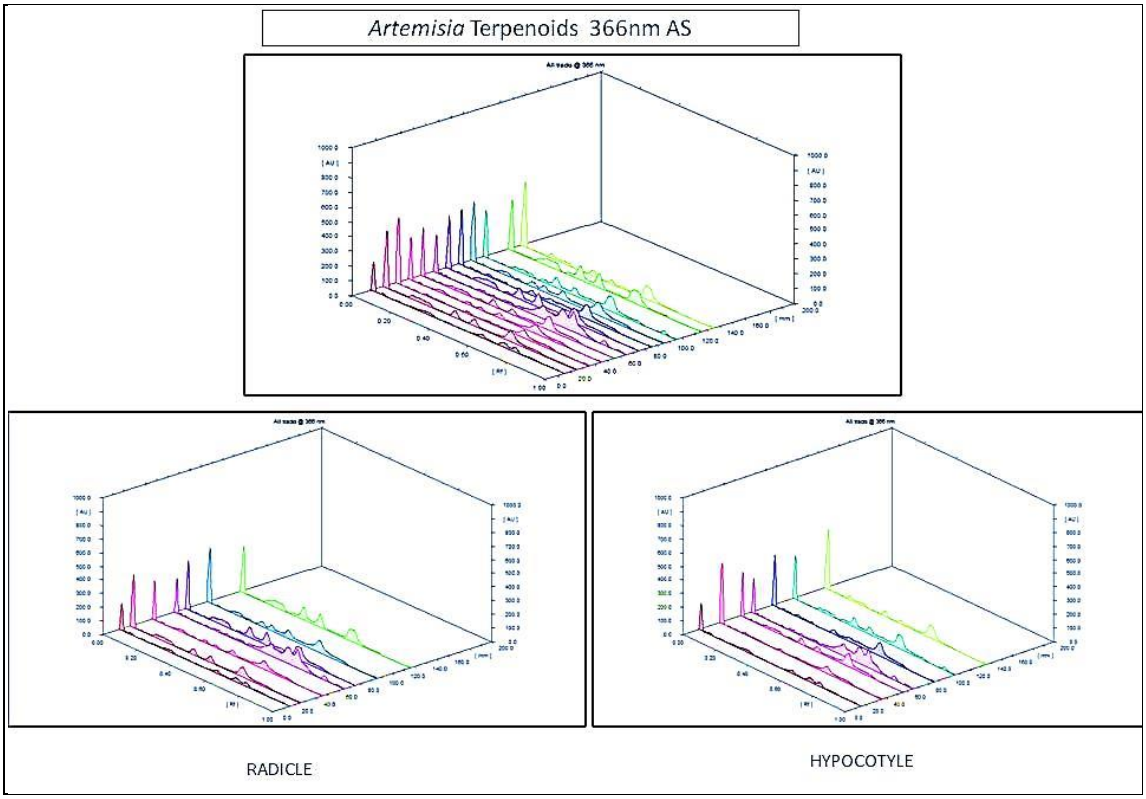


Figure 3.47: 3D display of spectral data for Terpenoid compound in green gram with *Artemisia* leaf mulch

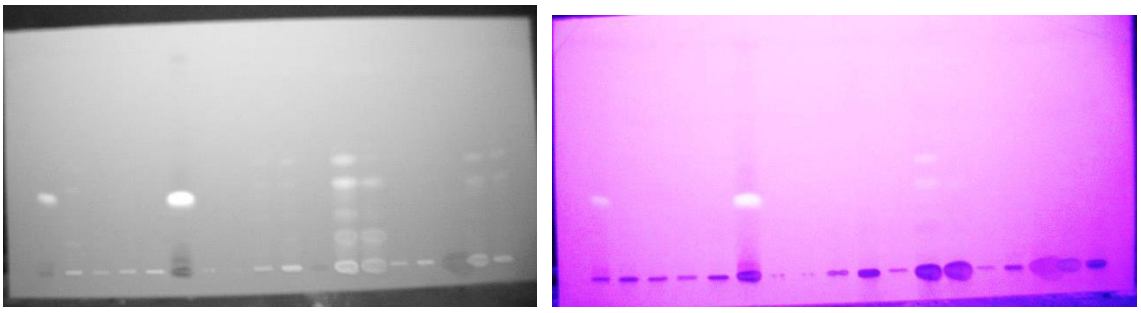


Figure 3.48 :TLC plate of *Artemisia* Terpenoid

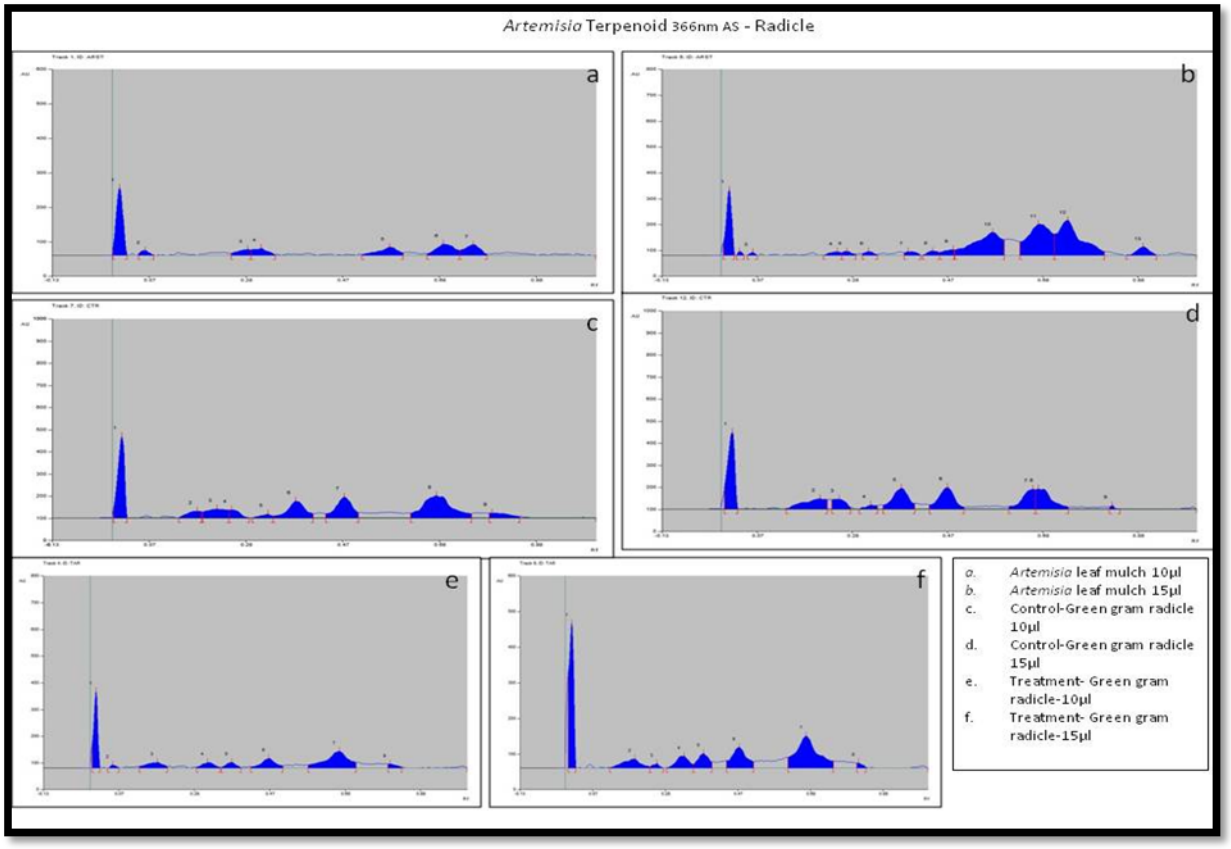


Figure 3.49: Peak densitogram of Terpenoid compounds using *Artemisia* leaf mulch with Green Gram Radicle.

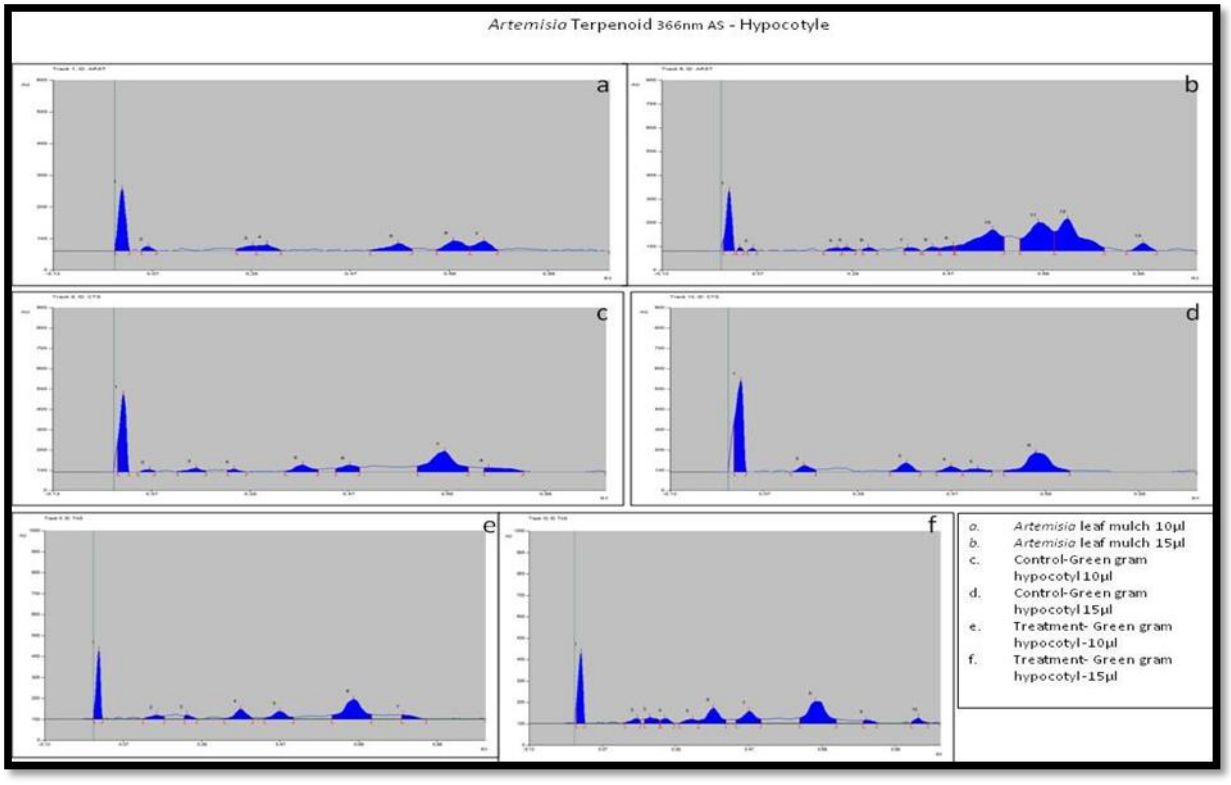


Figure 3.50: Comparative Peak densitogram of Terpenoid compounds using *Artemisia* leaf mulch with Green Gram Hypocotyl.

Artemisia leaf mulch 10µl							Control green gram radicle-10µl							Control green gram radicle-15µl						
Track	Peak	Max %	End Rf	Area	Area %	Assigned substance	Track	Peak	Max %	End Rf	Area	Area %	Assigned substance	Track	Peak	Max %	End Rf	Area	Area %	Assigned
1	1	58.53	0.03	2518.2	37.78	UnKn*	7	1	47	0.03	4541.5	22.84	UnKn*	12	1	41.13	0.04	4792.3	24.52	UnKn*
1	2	4.16	0.09	220.1	3.3	UnKn*	7	2	3.79	0.19	826.6	4.16	UnKn*	12	2	5.55	0.22	2118.6	10.84	UnKn*
1	3	5.06	0.29	430.6	6.46	UnKn*	7	3	5.13	0.24	1604.4	8.07	UnKn*	12	3	5.31	0.27	1158.4	5.93	UnKn*
1	4	6.09	0.34	559.6	8.4	UnKn*	7	4	4.7	0.28	722.6	3.63	UnKn*	12	4	2.08	0.33	360.6	1.84	UnKn*
1	5	7.1	0.6	862.9	12.95	UnKn*	7	5	2.12	0.33	331	1.66	UnKn*	12	5	11.16	0.41	2955.3	15.12	UnKn*
1	6	9.76	0.72	1155.8	17.34	UnKn*	7	6	9.6	0.41	2517.5	12.66	UnKn*	12	6	11.52	0.51	2979.3	15.24	UnKn*
1	7	9.31	0.78	917.8	13.77	UnKn*	7	7	11.99	0.51	2926.5	14.72	UnKn*	12	7	10.6	0.66	2268.1	11.6	UnKn*
							7	8	12.81	0.74	5570.2	28.01	UnKn*	12	8	10.75	0.73	2795.1	14.3	UnKn*
							7	9	2.86	0.84	844	4.24	UnKn*	12	9	1.9	0.84	120.7	0.62	UnKn*
Artemisia leaf mulch 15µl							Treatment green gram radicle -10µl													
Track	Peak	Max %	End Rf	Area	Area %	Assigned substance	Track	Peak	Max %	End Rf	Area	Area %	Assigned substance	treatment green gram radicle -15µl						
6	1	33.93	0.03	2678.3	12.5	UnKn*	4	1	60.82	0.03	2859	29.4	UnKn*	Track	Peak	Max %	End Rf	Area	Area %	Assigned
6	2	1.9	0.05	108.2	0.5	UnKn*	4	2	2.24	0.08	132.8	1.37	UnKn*	9	1	59.77	0.03	4843.6	31.06	UnKn*
6	3	1.43	0.08	101.6	0.47	UnKn*	4	3	4.39	0.2	817.4	8.4	UnKn*	9	2	3.76	0.23	1137.3	7.29	UnKn*
6	4	1.73	0.25	274.1	1.28	UnKn*	4	4	4.33	0.34	591.8	6.09	UnKn*	9	3	1.75	0.27	197.9	1.27	UnKn*
6	5	1.97	0.28	251.7	1.17	UnKn*	4	5	4.39	0.4	483.6	4.97	UnKn*	9	4	4.87	0.35	1095.5	7.03	UnKn*
6	6	1.89	0.33	238.9	1.11	UnKn*	4	6	7.47	0.51	1192.3	12.26	UnKn*	9	5	5.97	0.41	1138	7.3	UnKn*
6	7	1.86	0.42	290.4	1.36	UnKn*	4	7	13.16	0.7	3345.2	34.4	UnKn*	9	6	8.6	0.52	2160.1	13.85	UnKn*
6	8	2.09	0.46	332.1	1.55	UnKn*	4	8	3.2	0.83	303.6	3.12	UnKn*	9	7	13.2	0.74	4814.6	30.88	UnKn*
6	9	2.91	0.49	436.2	2.04	UnKn*								9	8	2.08	0.83	206.3	1.32	UnKn*
6	10	11.87	0.59	4579.6	21.37	UnKn*														
6	11	16	0.7	5416.3	25.28	UnKn*														
6	12	18.09	0.81	5959.3	27.81	UnKn*														
6	13	4.31	0.92	761.6	3.55	UnKn*														

Table 3.9: Comparative study between control and treated GG radicle with *Artemisia* at 366nm AS for Terpenoids (*Artemisia*, Control green gram Radicle, Treated Green Gram Radicle) Green colour indicates – Minimum value, Pink colour indicates– Maximum Value

a. *Artemisia* Leaf Mulch

Results of *Artemisia* with solution A showed 7 phytoconstituents and corresponding ascending order of Rf values starts from 0.03 to 0.78 in which highest concentration of the phytoconstituents was found to be 58.53% and its resultant Rf is 0.03 with highest peak area of 2518.2 occupied 37.78% of the total area. The Minimum concentration was about 4.16% at 0.09 R_f with minimum 220.1 peak area which had occupied 3.3% of the total peak area (Table.3.9)

Solution B gives us an idea of about 13 phytoconstituents present in it, where Rf value starts from 0.03 to 0.99. Here highest concentration amongst all phytoconstituents was found to be 33.93% with peak area of 2678.3 at 0.03 Rf. The highest peak area was observed at 0.81 Rf of about 5959.3 which is around 27.81% of the total peak area. The lowest concentration was of 1.43% with minimum peak area of 101.6 at 0.08 Rf.

If we compare both solution results A and B then maximum concentration of the phytoconstituents was observed at 0.03 Rf. Number of peaks were doubled with higher volume of the solution (Figure 3.49)

b. Green Gram Radicle

Green gram seedlings were analysed to check that there is any alteration of chemicals due to treatment, for that radicle and hypocotyl of legume seedling were separated for control and treated and both analysed separately with different volumes of 10µl and 15µl volume of each.

Green gram radicle of control with 10µl solution shows nine peaks of phytoconstituents and Rf starts from 0.03 to 0.84. Here highest concentration

was 47% at 0.03 Rf, with peak area of 4541.5 and the highest peak area was 5570.2 at 0.74 Rf. Here 2.12% was the minimum concentration observed at 0.33 Rf. It also had the Minimum area of the peak (331) occupying 1.66% of the total peak area.

Control showed similarity in FOUR peaks with *Artemisia* and SEVEN peaks with treatment.

Control at 15µl solution identified nine peaks, which was same with the earlier volume. Rf ranges from 0.04 to 0.84 in ascending order. The maximum concentration was 41.13% at 0.04 Rf. It was also represented by the highest peak area of 4792.3.This solution has the minimum concentration (1.9%) of phytoconstituents at 0.84 Rf with the minimum area (120.7) of the peak. Control at 15µl volume showed five similar peaks with *Artemisia* and all similar peaks with treatment. 0.66 Rf was absent in treatment compare to control. Treated radicle of legumes showed 8 peaks for both 10µl and 15µl volume. (Figure 3.49)

A treated sample with 10µl volume showed Rf value ranging from 0.03 to 0.83, nearly similar with control 10µl. Here the highest concentration was 60.82% at 0.03 Rf with 2859 peak area, which occupied 29.4% of the total area. Here maximum peak area was 3345.2, which occupied 34.4% of the total peak area. The least concentration detected was 2.24% at 0.08 Rf and 132.8 was the minimum peak area which occupies 1.37% of the total peak area. Treatment showed 0.08 Rf which was dissimilar to the control but having resemblance with *Artemisia*. (Figure 3.49)

Higher volume 15µl volume was detected with eight peaks where Rf ranges from 0.03 to 0.83 in ascending order. This solution shows maximum concentration of 59.77% at 0.03Rf. It also represented with the maximum peak area of 4843.6 which obtained 31.06% of the total area.

c. Green Gram Hypocotyl

Control of legume hypocotyl at 10µl and 15µl showed 8 and 6 peaks respectively. Two peaks were reduced with increased volume amount.10µl volume of control showed peak range from 0.03 to 0.83 Rf in which 0.03 Rf represented with highest concentration of the element with 62.29% with area of 4512.2 which is 33.94 % of the total area. The highest peak area was observed at 0.72 Rf which was engaged 35.87% of the total area. The least concentration was 1.91% with the area of 196 occupied 1.47% of the total area and was observed at 0.08 Rf.

Control showed similar four peaks with *Artemisia* and all peaks with treatment except 0.08 Rf which is present in both *Artemisia* and control but not in treatment. Control with 15µl volume showed peak range from 0.04 to 0.73Rf, at this time 0.04 represents highest concentration with 67.78 with maximum area of 6534.8. Here 0.56 Rf value showed least concentration with 2.37% and was occupying least area of 570.4 (3.98%) of the total peak area.15µl volume showed more peaks for *Artemisia* and treatment i.e. 13 and 10 respectively than previous volume, but one peak reduced in control. Here control showed similarity with *Artemisia* in three peaks. Control is similar with five peaks of treatment.

Treated hypocotyl at 10µl volume showed 7 peaks and corresponding Rf in ascending from 0.02 to 0.85. Where the highest concentration was 58.34% at 0.02 Rf with 3168 area which occupied 28.67% of the total area. The highest concentration was observed at 0.71Rf of 4092 which occupied 37.03% of the total peak area. While least concentration were observed in Rf 0.18. Here the concentration was 3.18 with minimum area occupying 4.78% of the total peak area.(Figure 3.50)

Artemisia 366nm AS																					
Artemisia leaf mulch *10µl*								Control green gram hypocotyle-10µl									treatment green gram hypocotyle -10µl						
Track	Peak	Max %	End Rf	Area	Area %	Assigned substance		Track	Peak	Max %	End Rf	Area	Area %	Assigned substance			Track	Peak	Max %	End Rf	Area	Area %	Assigned s
1	1	58.53	0.03	2518.2	37.78	UnKn*		8	1	62.29	0.03	4512.2	33.94	UnKn*			5	1	58.34	0.02	3168	28.67	UnKn*
1	2	4.16	0.09	220.1	3.3	UnKn*		8	2	1.91	0.08	196	1.47	UnKn*			5	2	3.18	0.18	527.7	4.78	UnKn*
1	3	5.06	0.29	430.6	6.46	UnKn*		8	3	2.89	0.19	451.2	3.39	UnKn*			5	3	3.36	0.26	312.2	2.83	UnKn*
1	4	6.09	0.34	559.6	8.4	UnKn*		8	4	2.17	0.27	227.4	1.71	UnKn*			5	4	8.42	0.41	1245.9	11.27	UnKn*
1	5	7.1	0.6	862.9	12.95	UnKn*		8	5	5.53	0.41	1055.3	7.94	UnKn*			5	5	6.54	0.51	1156	10.46	UnKn*
1	6	9.76	0.72	1155.8	17.34	UnKn*		8	6	5.27	0.5	1073.2	8.07	UnKn*			5	6	16.71	0.71	4092	37.03	UnKn*
1	7	9.31	0.78	917.8	13.77	UnKn*		8	7	16.59	0.72	4768.3	35.87	UnKn*			5	7	3.45	0.85	548.1	4.96	UnKn*
								8	8	3.36	0.83	1011.1	7.61	UnKn*									
Artemisia leaf mulch 15µl																							
Track	Peak	Max %	End Rf	Area	Area %	Assigned substance		Control green gram hypocotyle-15µl									treatment green gram hypocotyle-15µl						
6	1	33.93	0.03	2678.3	12.5	UnKn*		Track	Peak	Max %	End Rf	Area	Area %	Assigned substance			Track	Peak	Max %	End Rf	Area	Area %	Assigned s
6	2	1.9	0.05	108.2	0.5	UnKn*		13	1	67.78	0.04	6534.8	45.56	UnKn*			10	1	47.63	0.03	3889.8	24.16	UnKn*
6	3	1.43	0.08	101.6	0.47	UnKn*		13	2	4.73	0.19	751.1	5.24	UnKn*			10	2	3.31	0.18	495	3.07	UnKn*
6	4	1.73	0.25	274.1	1.28	UnKn*		13	3	6.6	0.41	1151.7	8.03	UnKn*			10	3	3.93	0.23	768.1	4.77	UnKn*
6	5	1.97	0.28	251.7	1.17	UnKn*		13	4	4.18	0.5	697.3	4.86	UnKn*			10	4	3.25	0.27	458.9	2.85	UnKn*
6	6	1.89	0.33	238.9	1.11	UnKn*		13	5	2.37	0.56	570.4	3.98	UnKn*			10	5	2.82	0.34	567.5	3.53	UnKn*
6	7	1.86	0.42	290.4	1.36	UnKn*		13	6	14.34	0.73	4637.1	32.33	UnKn*			10	6	10.2	0.41	2312.8	14.37	UnKn*
6	8	2.09	0.46	332.1	1.55	UnKn*											10	7	8.13	0.51	1920	11.93	UnKn*
6	9	2.91	0.49	436.2	2.04	UnKn*											10	8	14.79	0.72	4831.7	30.01	UnKn*
6	10	11.87	0.59	4579.6	21.37	UnKn*											10	9	2.3	0.83	364.6	2.26	UnKn*
6	11	16	0.7	5416.3	25.28	UnKn*											10	10	3.63	0.97	491.5	3.05	UnKn*
6	12	18.09	0.81	5959.3	27.81	UnKn*																	
6	13	4.31	0.92	761.6	3.55	UnKn*																	

Table 3.10: Comparative data of Peak, Rf value and Area at 366nm AS for Terpenoids (*Artemisia* leaf mulch, Control and Treated Green Gram Hypocotyl)

Green colour indicates – Minimum value, Pink colour indicates– Maximum Value

Treated legume hypocotyl at 10µl volume showed no changes in peak condition compare to control. Higher volume (15µl) showed Rf values ranging from 0.03 to 0.97, in which maximum concentration was observed at 0.03 Rf with 47.63%. Maximum peak area was 4831.7 at 0.72 Rf occupying 30.01% of the total peak area. The least concentration was 2.3 % at 0.83Rf with minimum area of 364.6 occupying 2.26% of the total area. Data with 15µl volume showed four newly formed peaks (0.23,0.27, 0.34 and 0.97), out of which first three showed resemblance with *Artemisia.(Table3.10)*

3.3.3.2. *Artemisia* - Phenolics illustrated separation of elements as described below,

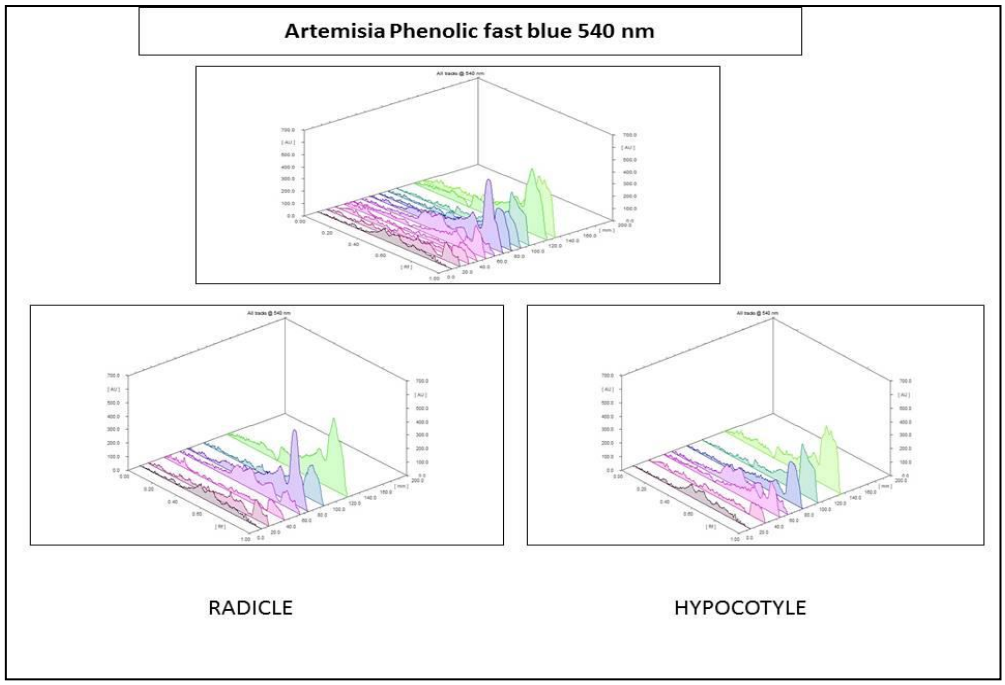


Figure 3.51: 3D display of spectral data of Green Gram at FB 540nm Phenolics

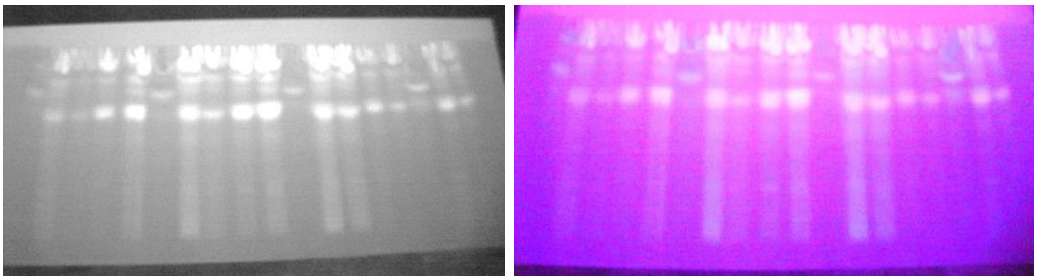


Figure 3.52: TLC plate of *Artemisia* Phenolic

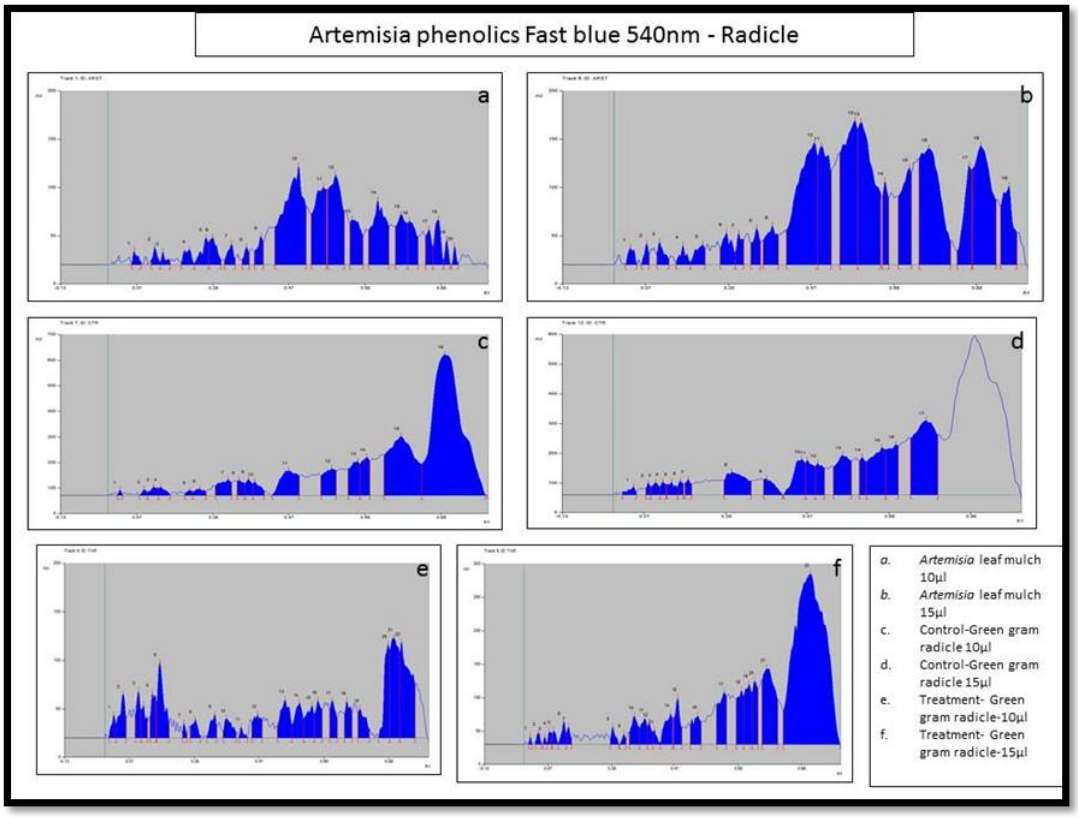


Figure 3.53: Peak densitogram of Phenolic compounds in Green gram Radicle with *Artemisia* leaf mulch

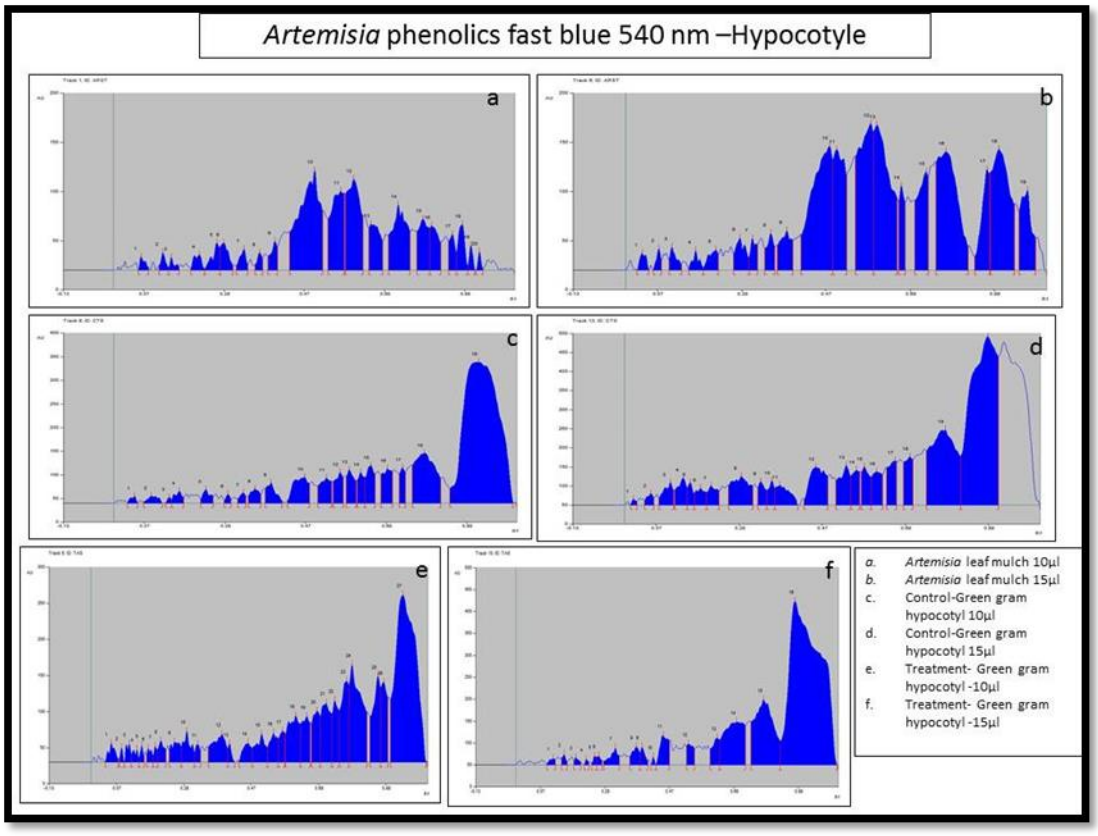


Figure 3.54: Peak densitogram of Phenolic compounds in Green gram Hypocotyl with *Artemisia* leaf mulch

Artemisia phenolics fast blue 540																	
Artemisia leaf mulch 10µl						control green gream 10µl - Radicle						Treatment green gram 10µl - Radicle					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned s
1	1	1.74	0.09	158.2	unknown *	7	1	1.23	0.04	130.2	unknown *	4	1	2.54	0.04	272.2	unknown
1	2	2.26	0.14	184.5	unknown *	7	2	1.36	0.1	225.1	unknown *	4	2	4.81	0.07	750.4	unknown
1	3	1.63	0.16	139.8	unknown *	7	3	1.89	0.13	573.6	unknown *	4	3	5.11	0.11	535.4	unknown
1	4	1.95	0.23	286.5	unknown *	7	4	1.89	0.16	523.8	unknown *	4	4	3.6	0.13	448.1	unknown
1	5	3.47	0.27	446.3	unknown *	7	5	1.14	0.22	259.3	unknown *	4	5	4.88	0.16	601.4	unknown
1	6	3.49	0.3	527.2	unknown *	7	6	1.48	0.26	564.8	unknown *	4	6	8.28	0.2	1453.5	unknown
1	7	2.69	0.34	305.6	unknown *	7	7	3.68	0.33	1752.6	unknown *	4	7	1.59	0.25	117.2	unknown
1	8	2.24	0.37	214.6	unknown *	7	8	3.53	0.36	892.8	unknown *	4	8	2	0.29	319.2	unknown
1	9	3.71	0.41	419	unknown *	7	9	3.76	0.38	943.4	unknown *	4	9	2.57	0.35	384.9	unknown
1	10	12.74	0.52	4603.7	unknown *	7	10	3.18	0.41	926.8	unknown *	4	10	2.1	0.41	446.5	unknown
1	11	10.1	0.58	2346.4	unknown *	7	11	5.85	0.51	3977.2	unknown *	4	11	1.18	0.44	106.7	unknown
1	12	11.61	0.62	2852.3	unknown *	7	12	6.3	0.6	3090.3	unknown *	4	12	2.55	0.49	531	unknown
1	13	5.93	0.67	1208.1	unknown *	7	13	8.09	0.66	3121.5	unknown *	4	13	4.2	0.58	995.4	unknown
1	14	8.35	0.74	2154.3	unknown *	7	14	9.05	0.69	3020.5	unknown *	4	14	3.81	0.61	801.9	unknown
1	15	6.51	0.79	1193.6	unknown *	7	15	14.04	0.83	14562.6	unknown *	4	15	3.53	0.65	714.9	unknown
1	16	5.69	0.82	910.2	unknown *	7	16	33.53	0.99	39501.9	unknown *	4	16	4.09	0.67	667.6	unknown
1	17	4.6	0.86	496.5	unknown *							4	17	4.08	0.72	603.3	unknown
1	18	5.83	0.88	675.3	unknown *							4	18	4.04	0.76	621.4	unknown
1	19	3.16	0.9	189.1	unknown *							4	19	3.2	0.82	622.1	unknown
1	20	2.33	0.92	123.4	unknown *							4	20	10.27	0.88	1404.3	unknown
												4	21	11.02	0.91	2503.8	unknown
												4	22	10.55	0.96	2896.9	unknown
Artemisia leaf mulch 15µl						control green gram 15µl - Radicle						Treatment green gram 15µl -Radicle					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned s
6	1	1.23	0.06	236.3	unknown *	12	1	1.63	0.06	437.7	unknown *	9	1	1	0.03	56.6	unknown
6	2	1.54	0.09	197.6	unknown *	12	2	2.47	0.09	333.5	unknown *	9	2	1.48	0.06	159.7	unknown
6	3	1.66	0.13	349.4	unknown *	12	3	2.57	0.12	624.2	unknown *	9	3	0.91	0.07	64.4	unknown
6	4	1.41	0.18	271.3	unknown *	12	4	2.73	0.13	467.6	unknown *	9	4	1.64	0.09	198.3	unknown
6	5	1.49	0.22	426.2	unknown *	12	5	2.71	0.16	739.4	unknown *	9	5	1.74	0.11	199	unknown
6	6	2.34	0.29	696.9	unknown *	12	6	2.86	0.17	504.2	unknown *	9	6	2.8	0.13	367.3	unknown
6	7	2.3	0.31	453.6	unknown *	12	7	3.21	0.19	600.7	unknown *	9	7	2.16	0.15	271	unknown
6	8	2.66	0.35	563.6	unknown *	12	8	4.77	0.34	3449.9	unknown *	9	8	2.16	0.3	302.5	unknown
6	9	2.86	0.4	1005.4	unknown *	12	9	3.35	0.42	1277	unknown *	9	9	1.25	0.32	136.4	unknown
6	10	8.97	0.49	5510.9	unknown *	12	10	7.5	0.47	3094.9	unknown *	9	10	3.59	0.36	825.1	unknown
6	11	8.72	0.53	3177	unknown *	12	11	7.26	0.5	2089.1	unknown *	9	11	3.27	0.39	663.1	unknown
6	12	10.63	0.59	4806.4	unknown *	12	12	6.59	0.52	1856.7	unknown *	9	12	2.71	0.41	360	unknown
6	13	10.51	0.65	5167.9	unknown *	12	13	8.31	0.58	4336.2	unknown *	9	13	1.81	0.43	262.1	unknown
6	14	6.13	0.67	1072.6	unknown *	12	14	7.86	0.62	1773.5	unknown *	9	14	3.84	0.47	1024.3	unknown
6	15	7.1	0.72	2323.6	unknown *	12	15	9.92	0.67	5342	unknown *	9	15	5.84	0.5	1004.5	unknown
6	16	8.59	0.81	5499.5	unknown *	12	16	10.6	0.7	4135.9	unknown *	9	16	3.62	0.56	1053.7	unknown
6	17	7.3	0.87	1856.8	unknown *	12	17	15.66	0.8	12157.8	unknown *	9	17	6.56	0.64	1832.4	unknown
6	18	8.77	0.92	4663.1	unknown *							9	18	6.83	0.69	1461.2	unknown
6	19	5.79	0.97	1984.8	unknown *							9	19	7.6	0.72	1799.2	unknown
												9	20	7.96	0.74	1393.4	unknown
												9	21	9.6	0.8	4001.1	unknown
												9	22	21.62	1	23255.6	unknown

Table 3.11: Comparative Peak list and R_f value of the *Artemisia* – Phenolics – FB 540nm chromatogram for Green gram Radicle with control and treatment

a. ***Artemisia* Leaf Mulch**

Results of *Artemisia for* phenolics with solution A showed 20 phytoconstituents and corresponding ascending order of Rf values starts from 0.09 to 0.92 in which highest concentration found to be 12.74% and its resultant Rf is 0.52 with highest peak area of 4603.7 occupied 23.69% of the total area. The Minimum concentration was about 1.63% at 0.16 $R_{f.}$ Minimum peak area was 123.4AU at 0.92 Rf which had occupied 0.63% of the total peak area.(Table 3.11)

Solution B identified 19 phytoconstituent at Rf value ranging from0.06 to 0.97. Highest concentration amongst all phytoconstituents was found to be 10.63% at 0.59Rf value, whereas maximum area was occupied at 0.49Rf and1.69% of the total area. The lowest concentration was observed at 0.09 and 0.06 Rf value. If we compare both solution results A and B then number of peaks were similar but amount of concentration and peak value were different.(Table 3.11)

b. Green Gram Radicle

10µl of Untreated Radicle solution indicated 16 peaks of phytoconstituents and Rf starts from 0.04 to 0.99. Here highest concentration was 33.53% at 0.99Rf, with peak area of 39501.9AU which occupied 53.33% of the total area. Rf value 0.2 stands last with minimum concentration and 259.3% area.

Control showed similarity in EIGHT peaks with *Artemisia* and treatment. Control with 15µl solution identified 17 peaks, which was one more as compared to lower volume. Rf ranges from 0.06 to 0.80 in ascending order. The maximum concentration was 51.66% at 0.8 Rf . It was also represented by

the highest peak area of 12157.8.This solution has the minimum concentration at 0.06Rf (1.63%). Minimum peak area was observed at 0.09Rf.

Control at 15µl volume showed three similar peaks with *Artemisia* and six similar peaks with treatment. Treated radicle of legumes showed 22 peaks for both volumes. (Figure3.53)

Treatment with 10µl volume showed Rf value ranging from 0.04 to 0.96, nearly similar with control 10µl. Here the highest concentration was 11.02% at 0.91 and 0.96 Rf , also with maxiumum peak area of 2503.8 and 2896 respectively which occupied total cumulative area of 30%. least concentration detected was 1.18% at 0.44 Rf and 106.7AU peak area. 15µl was showing more peaks as compared to 10µl, but compound showing highest concentration and peak area remained similar.

Here resemblance with *Artemisia* was observed at 0.88, 0.91Rf which was not observed in Control

Treatment with 15µl volume was detected with eight peaks where Rf ranges from 0.03 to 1 in Ascending order. This solution shows maximum concentration of 21.62% at 1Rf. it also represented with the maximum peak area of 23255.6 which obtained 56% of the total area.(Table 3)

c. Green Gram Hypocotyl

Untreated *Hypocotyl* of green gram at 10µl and 15µl showed 19 and 20 peaks respectively.

10µl volume of control resulted with peak range from 0.06 to 0.99 Rf in which 0.99 Rf represented with highest concentration of the element with 25.9% and

maximum area of 24341.8AU. Area occupied by this peak is 55.86% of the total area.33.94 % of the total area. Least concentration was observed at 0.99Rf.

Control showed similar two peaks with *Artemisia* and 5 peaks with treatment.C ontrol with 15µl volume showed peak range from 0.03 to 0.9Rf. Maximum concentration of22.76% with 25261AU peak area at 0.9Rf was observed which was similar to 10µl and treatment results (Table 4). Minimum value was obtained at 0.03Rf which varies from the lower volume. It also showed more 4 peak resemblance with *Artemisia* and six to seven peak similarity with Treatment.(Figure 3.54)

Treated *Hypocotyl* at 10µl volume showed 27 peaks and corresponding Rf in ascending from 0.08 to 1. Where the highest concentration was 14.84% at 1 Rf with 12814.4 area which occupied 31.35% of the total area. least concentration were observed in Rf 0.14. Here the concentration was 1.1%. Whereas minimum area was obtained at 0.1 Rf.(Table 3.11)

Artemisia phenolics fast blue 540																	
Artemisia leaf mulch 10µl						control green gream 10µl - Hypocotyle						Treatment green gram 10µl - Hypocotyle					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	Enf Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
1	1	1.74	0.09	158.2	unknown *	8	1	1.26	0.06	183.4	unknown *	5	1	1.64	0.08	444	unknown
1	2	2.26	0.14	184.5	unknown *	8	2	1.33	0.12	376.3	unknown *	5	2	1.25	0.1	136	unknown
1	3	1.63	0.16	139.8	unknown *	8	3	1.12	0.14	108.7	unknown *	5	3	1.59	0.12	308.2	unknown
1	4	1.95	0.23	286.5	unknown *	8	4	2.21	0.17	435.4	unknown *	5	4	1.11	0.14	233.1	unknown
1	5	3.47	0.27	446.3	unknown *	8	5	2.54	0.25	505.1	unknown *	5	5	1.48	0.16	177.3	unknown
1	6	3.49	0.3	527.2	unknown *	8	6	1.62	0.29	198.4	unknown *	5	6	1.22	0.18	231.2	unknown
1	7	2.69	0.34	305.6	unknown *	8	7	1.91	0.33	279.2	unknown *	5	7	1.37	0.2	199.3	unknown
1	8	2.24	0.37	214.6	unknown *	8	8	2.61	0.36	626.8	unknown *	5	8	1.87	0.22	460.5	unknown
1	9	3.71	0.41	419	unknown *	8	9	3.75	0.42	941.7	unknown *	5	9	1.77	0.27	699.4	unknown
1	10	12.74	0.52	4603.7	unknown *	8	10	4.76	0.49	1877.6	unknown *	5	10	2.73	0.31	864.9	unknown
1	11	10.1	0.58	2346.4	unknown *	8	11	4.59	0.54	1295.4	unknown *	5	11	1.59	0.33	304.2	unknown
1	12	11.61	0.62	2852.3	unknown *	8	12	5.67	0.57	1148.9	unknown *	5	12	2.47	0.41	1364	unknown
1	13	5.93	0.67	1208.1	unknown *	8	13	6.1	0.6	1239.1	unknown *	5	13	1.62	0.43	270.2	unknown
1	14	8.35	0.74	2154.3	unknown *	8	14	5.65	0.62	915.6	unknown *	5	14	1.69	0.48	614.2	unknown
1	15	6.51	0.79	1193.6	unknown *	8	15	6.9	0.65	1450.5	unknown *	5	15	2.5	0.53	955	unknown
1	16	5.69	0.82	910.2	unknown *	8	16	6.38	0.69	1604.9	unknown *	5	16	2.58	0.56	867.9	unknown
1	17	4.6	0.86	496.5	unknown *	8	17	6.51	0.72	970.8	unknown *	5	17	2.73	0.58	627.1	unknown
1	18	5.83	0.88	675.3	unknown *	8	18	9.18	0.81	5080.4	unknown *	5	18	4.11	0.62	2004.8	unknown
1	19	3.16	0.9	189.1	unknown *	8	19	25.9	0.99	24341.8	unknown *	5	19	4.04	0.65	1380.2	unknown
1	20	2.33	0.92	123.4	unknown *							5	20	4.52	0.68	1425.3	unknown
												5	21	5.24	0.72	2140.3	unknown
												5	22	5.47	0.74	1373	unknown
												5	23	7.2	0.77	2307	unknown
												5	24	8.64	0.82	4386.8	unknown
												5	25	7.61	0.86	2448.5	unknown
												5	26	7.09	0.88	1837.7	unknown
												5	27	14.84	1	12814.4	unknown
Artemisia leaf mulch 15µl						control green gram 15µl - hypocotyle						Treatment green gram 15µl -Hypocotyle					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
6	1	1.23	0.06	236.3	unknown *	13	1	0.76	0.03	135.4	unknown *	10	1	1.43	0.12	239.6	unknown
6	2	1.54	0.09	197.6	unknown *	13	2	1.53	0.07	451.6	unknown *	10	2	2.26	0.16	246.7	unknown
6	3	1.66	0.13	349.4	unknown *	13	3	3.01	0.12	1204.1	unknown *	10	3	1.67	0.2	210.6	unknown
6	4	1.41	0.18	271.3	unknown *	13	4	3.65	0.15	1362.2	unknown *	10	4	1.22	0.23	99.8	unknown
6	5	1.49	0.22	426.2	unknown *	13	5	3.04	0.17	648	unknown *	10	5	1.89	0.25	184.6	unknown
6	6	2.34	0.29	696.9	unknown *	13	6	2.25	0.2	918.1	unknown *	10	6	1.92	0.27	230.7	unknown
6	7	2.3	0.31	453.6	unknown *	13	7	2.58	0.23	1037.9	unknown *	10	7	3.69	0.32	821	unknown
6	8	2.66	0.35	563.6	unknown *	13	8	3.87	0.31	2949.2	unknown *	10	8	3.86	0.39	838.9	unknown
6	9	2.86	0.4	1005.4	unknown *	13	9	3.15	0.34	956.7	unknown *	10	9	3.85	0.41	524.3	unknown
6	10	8.97	0.49	5510.9	unknown *	13	10	3.25	0.36	797.1	unknown *	10	10	1.74	0.44	93.6	unknown
6	11	8.72	0.53	3177	unknown *	13	11	2.67	0.42	1653	unknown *	10	11	6.41	0.48	1615.6	unknown
6	12	10.63	0.59	4806.4	unknown *	13	12	5.14	0.49	3568.5	unknown *	10	12	4.58	0.56	911.4	unknown
6	13	10.51	0.65	5167.9	unknown *	13	13	5.34	0.55	2336.7	unknown *	10	13	5.91	0.63	1254.6	unknown
6	14	6.13	0.67	1072.6	unknown *	13	14	4.7	0.57	1543.2	unknown *	10	14	9.39	0.71	5633	unknown
6	15	7.1	0.72	2323.6	unknown *	13	15	5.13	0.59	1741.3	unknown *	10	15	14.28	0.82	8010.8	unknown
6	16	8.59	0.81	5499.5	unknown *	13	16	4.47	0.62	1904.7	unknown *	10	16	35.89	1	32781.6	unknown
6	17	7.3	0.87	1856.8	unknown *	13	17	5.99	0.66	2150.4	unknown *						
6	18	8.77	0.92	4663.1	unknown *	13	18	6.52	0.69	2274.8	unknown *						
6	19	5.79	0.97	1984.8	unknown *	13	19	10.17	0.81	11148.2	unknown *						
						13	20	22.76	0.9	25261	unknown *						

Table 3.12: Comparative Peak list and R_f value of the *Artemisia* – Phenolics – FB 540nm chromatogram for Green gram *Hypocotyl* with control and treatment

Treated legume *Hypocotyl* at 10µl volume showed many peaks as compared to control.

Treatment with 15µl volume showed Rf values ranging from 0.12 to 1, in which maximum concentration was observed at1 Rf with 35.89%. Maximum peak area was 32781.1 which was occupying 61.05% of the total area. Minimum concentration was 1.22 % at 0.23Rf. Minimum area was observed in 0.44Rf

Comparison between treated and untreated gave various results, such as at lower volume peaks in treatment were more but it decreased at higher volume compared to control.

Hypocotyl does not show much peak similarity with *Artemisia* as compared to radicle.(Figure -8)

3.3.3.3 *Artemisia* – Flavonoid with NP – PEG reagent

Visual interpretation from the 3D figure 3.9 Result showed that some of the peaks which were absent in control but present in *Artemisia*. These peak was also present in treated seedlings especially hypocotyl. These was very clearly seen in Figure – 3.10

In peak densitogram peaks were almost similar in treated solution and untreated for bot radicle and hypocotyl. In peak densitogram peak were reduced in treated solution than untreated. (Figure 3.55, Figure 3.56).

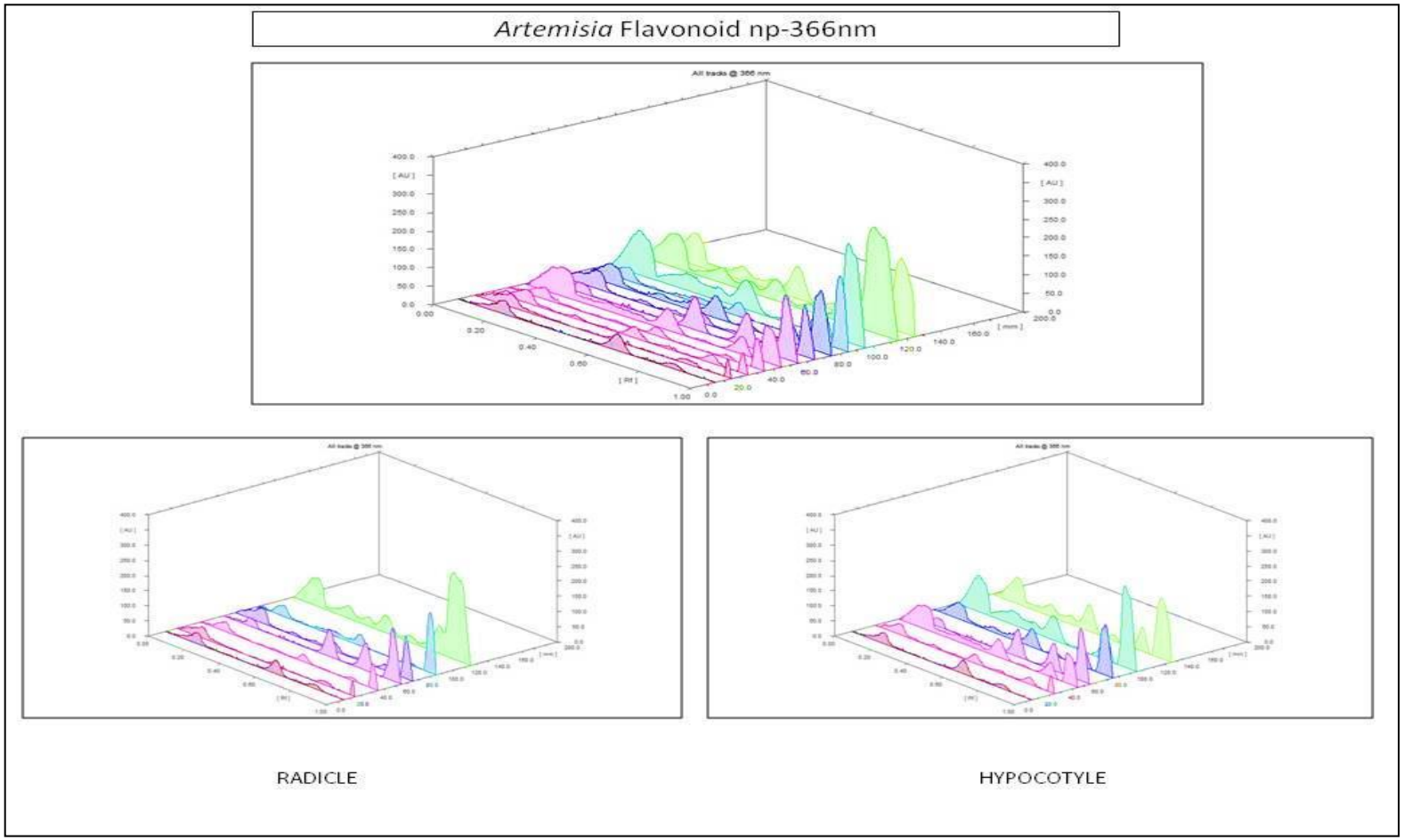


Figure 3.55: 3D display of spectral data at NP 366nm Flavonoid

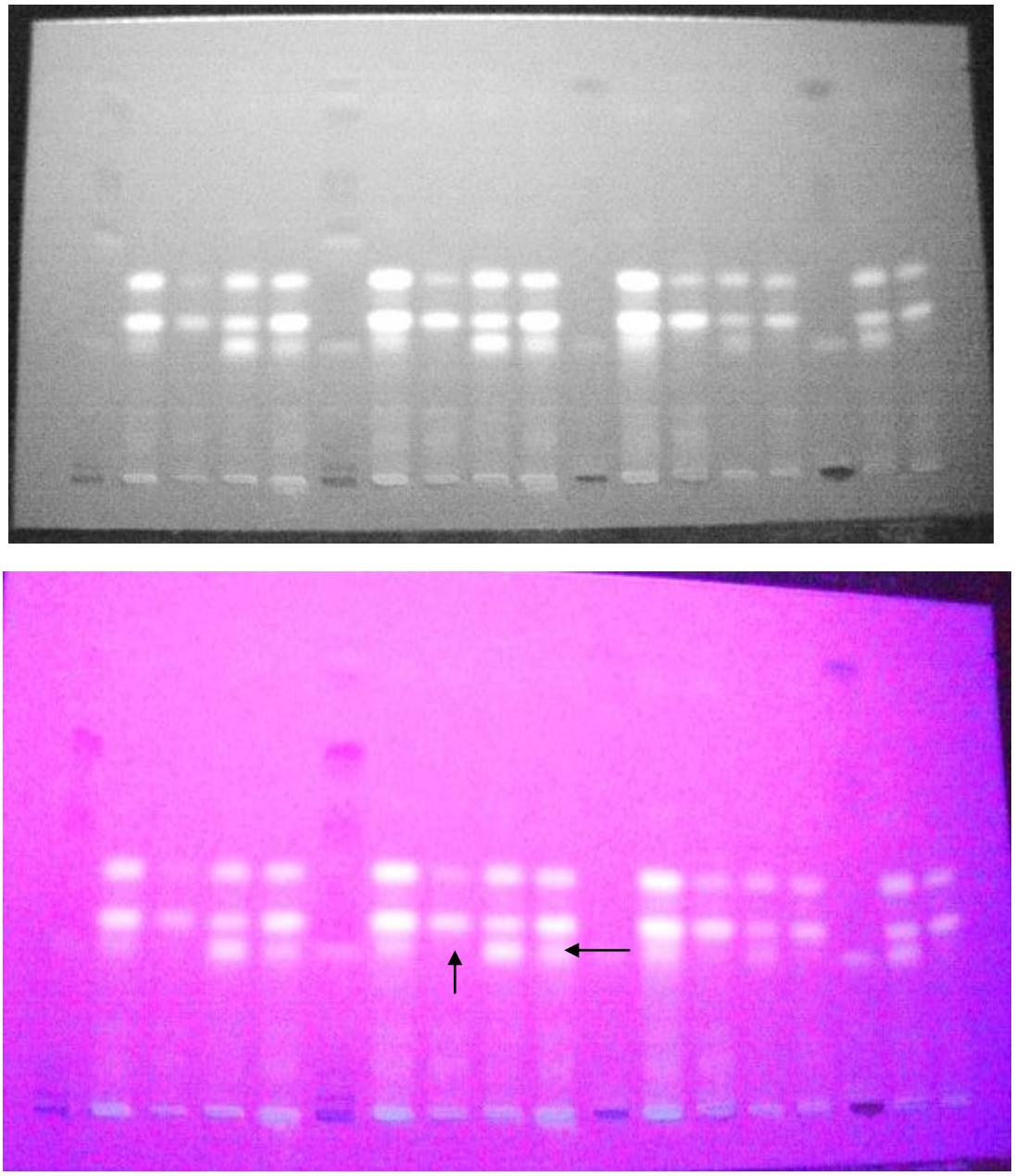


Figure 3.56: TLC plate of *Artemisia* Flavonoid

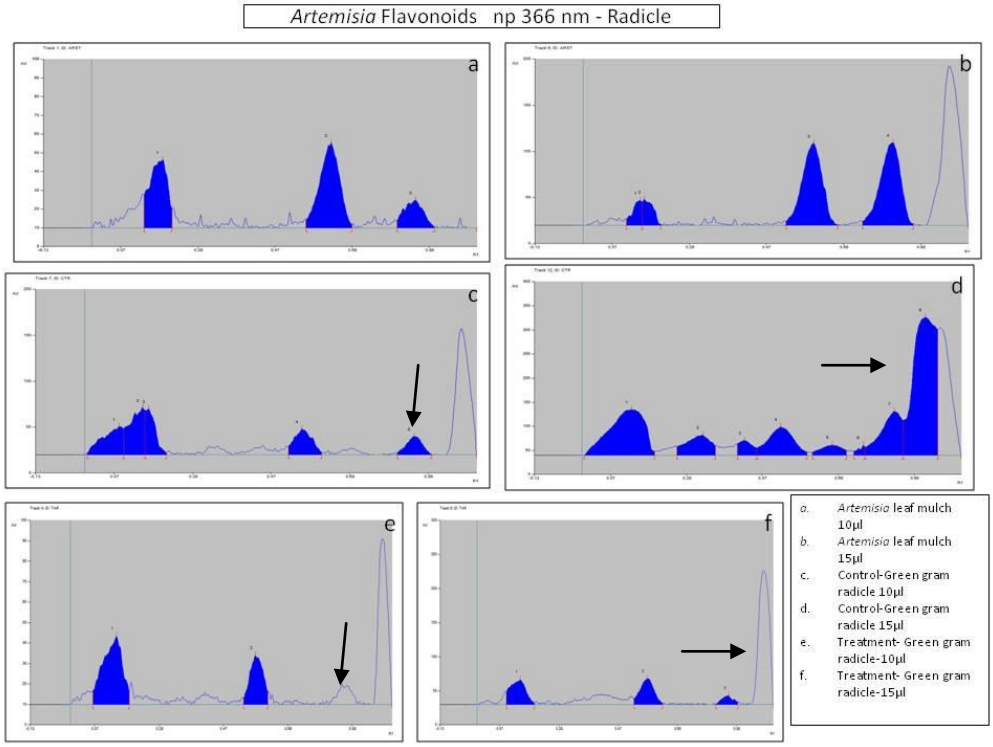


Figure 3.57: Peak densitogram of Flavanoid compounds in methanolic extract of *Artemisia* leaf, control and treated Radicle of Green gram (10µl and 15µl) at NP 366nm by HPTLC

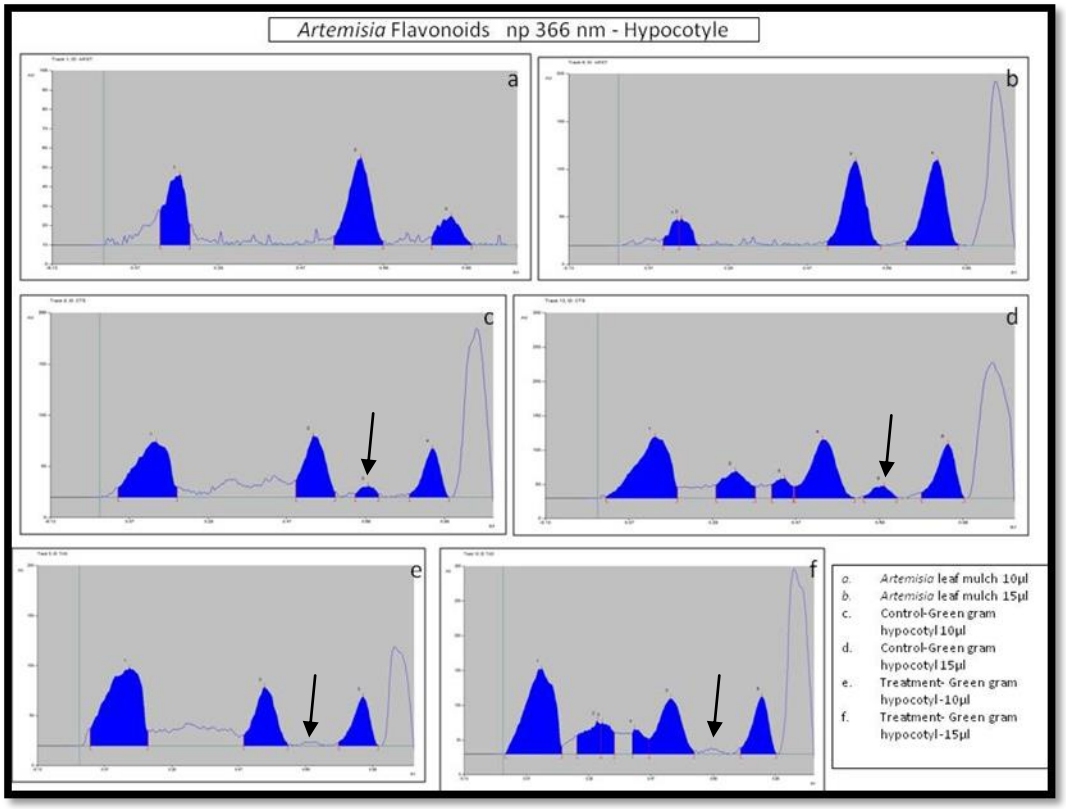


Figure 3.58: Peak densitogram of Flavanoid compound in methanolic extract of *Artemisia* leaf, control and treated *Hypocotyl* of green gram (10µl and 15µl) at FB 540nm by HPTLC

Artemisia flavonoid NP 366 nm																		
Artemisia leaf mulch-10µl							Control- green gram radicle -10µl						treatment- green gram radicle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned subs
1	1	37.56	0.21	1594	unknown *		7	1	17.02	0.1	1480.7	unknown *	4	1	58.29	0.18	1880.3	unknown
1	2	46.98	0.68	2189.4	unknown *		7	2	28.51	0.16	1813.6	unknown *	4	2	41.71	0.61	944.9	unknown
1	3	15.47	0.89	705.8	unknown *		7	3	27.64	0.21	1177.1	unknown *						
							7	4	15.71	0.6	1194.5	unknown *						
							7	5	11.13	0.89	770.7	unknown *						
Artemisia leaf mulch-15µl							Control- green gram radicle -15 µl						Treatment- green gram radicle -15 µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned subs
6	1	11.49	0.15	612.2	unknown *		12	1	14.74	0.19	8274.4	unknown *	9	1	41.59	0.19	1805.2	unknown
6	2	12.1	0.2	732.2	unknown *		12	2	6.53	0.35	2506.2	unknown *	9	2	43.15	0.63	1671.1	unknown
6	3	38	0.66	4314	unknown *		12	3	4.76	0.46	1064.7	unknown *	9	3	15.26	0.88	464.3	unknown
6	4	38.4	0.86	4417.9	unknown *		12	4	9.02	0.59	3649.7	unknown *						
							12	5	3.37	0.7	1119.2	unknown *						
							12	6	3.17	0.75	333.4	unknown *						
							12	7	14.12	0.85	4581.9	unknown *						
							12	8	44.3	0.94	16112.3	unknown *						

Table 3.13: Comparative Peak list and R_f value of the *Artemisia* – Flavanoid– NP 366nm chromatogram for Green gram Radicle with control and treatment

Artemisia flavonoid NP 366nm																		
Artemisia leaf mulch-10µl							Control- green gram hypocotyle -10µl						Treatment- green gram hypocotyle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned subs
1	1	37.56	0.21	1594	unknown *		8	1	31.43	0.2	4251.5	unknown *	5	1	41.86	0.21	7642.5	unknown
1	2	46.98	0.68	2189.4	unknown *		8	2	34.76	0.6	2964.3	unknown *	5	2	31.61	0.63	3359.5	unknown
1	3	15.47	0.89	705.8	unknown *		8	3	6.28	0.71	390.1	unknown *	5	3	26.53	0.9	2236.4	unknown
							8	4	27.53	0.89	1842	unknown *						
Artemisia leaf mulch-15µl							Control- green gram hypocotyle -15µl						Treatment- green gram hypocotyle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned subs
6	1	11.49	0.15	612.2	unknown *		13	1	26.41	0.19	6598.3	unknown *	10	1	29.69	0.19	10297.2	unknown
6	2	12.1	0.2	732.2	unknown *		13	2	11.55	0.38	2205.1	unknown *	10	2	11.36	0.32	2248.8	unknown
6	3	38	0.66	4314	unknown *		13	3	8.46	0.47	1029.5	unknown *	10	3	10.91	0.36	1431.4	unknown
6	4	38.4	0.86	4417.9	unknown *		13	4	25.2	0.62	4884.1	unknown *	10	4	8.69	0.47	1315.6	unknown
							13	5	5.16	0.72	700.1	unknown *	10	5	19.32	0.62	5340.4	unknown
							13	6	23.22	0.88	3222.9	unknown *	10	6	20.02	0.88	3870.5	unknown

Table 3.14: Comparative Peak list and R_f value of the *Artemisia* – Flavanoid –NP 366nm chromatogram for Green gram *Hypocotyl* with control and treatment

a. *Artemisia* Leaf Mulch

Comparative chromatogram of *Artemisia* leaf mulch in two volume resulted showing 3 and 4 peaks. Leaf mulch with10µl volume showed maximum peak area at 2189.4AU and maximum concentration was 46.98%. at 0.68 Rf. Minimum concentration was 15.47% at at 0.89 Rf. Peak area was also recorded minimum at this Rf. Where as in 15µl solution maximum Area was 4417.9 and concentration was 38.4% at 0.86 Rf but minimum at 0.15Rf. One peak was more in second solution.((Figure 3.55)

b. Green gram Radicle

Solution 10µ and 15µl showed 5 and 8 total number of peaks respectively**.** 10µl volume of the control obtained peaks ranging from 0.1-0.89Rf. out of which0.16 Rf showed maximum area of 1813.6AU and minimum at 0.89 Rf. Maximum and minimum concentration was similar as of Peak area. Two peaks with similar Rf as compared to *Artemisia*.

Higher volume of the solution showed 8 peaks out of which only one was similar to *Artemisia*. Here maximum peak area (16112.3) was obtained at 0.94 Rf. And minimum area was obtained at 0.75 Rf. Treated radicle were showing 2 and 3 peaks respectively and none of them having resemblance with *Artemisia*. Maximum results were obtained at 0.21 Rf and 0.19 Rf in control and treated radicle of both volume.(Figure:3.57)

C. Green Gram Hypocotyl

Untreated hypocotyl solutions showed 4 and 6 peaks respectively. 10µl solution had Rf value from0.2-0.89 while for 15µl Rf range was 0.19-0.88. Both solutions have maximum and minimum area / peak concentration at 0.20 and 0.19 Rf respectively.

Total number of peaks in treated 10µl was three and six in 15µl volume solution. Maximum peak area and concentration was obtained at 0.20Rf or 0.19 Rf which was also similar to the Control. No major change in peak was observed during comparison between control and treatment.

3.3.3.7. ***Swertia* – Terpenoids** using HPTLC fingerprinting resulted as below.

Result showed 14 and 12 peaks in *Swertia* leaf mulch with 10µl(A) and 15µl(B) respectively.

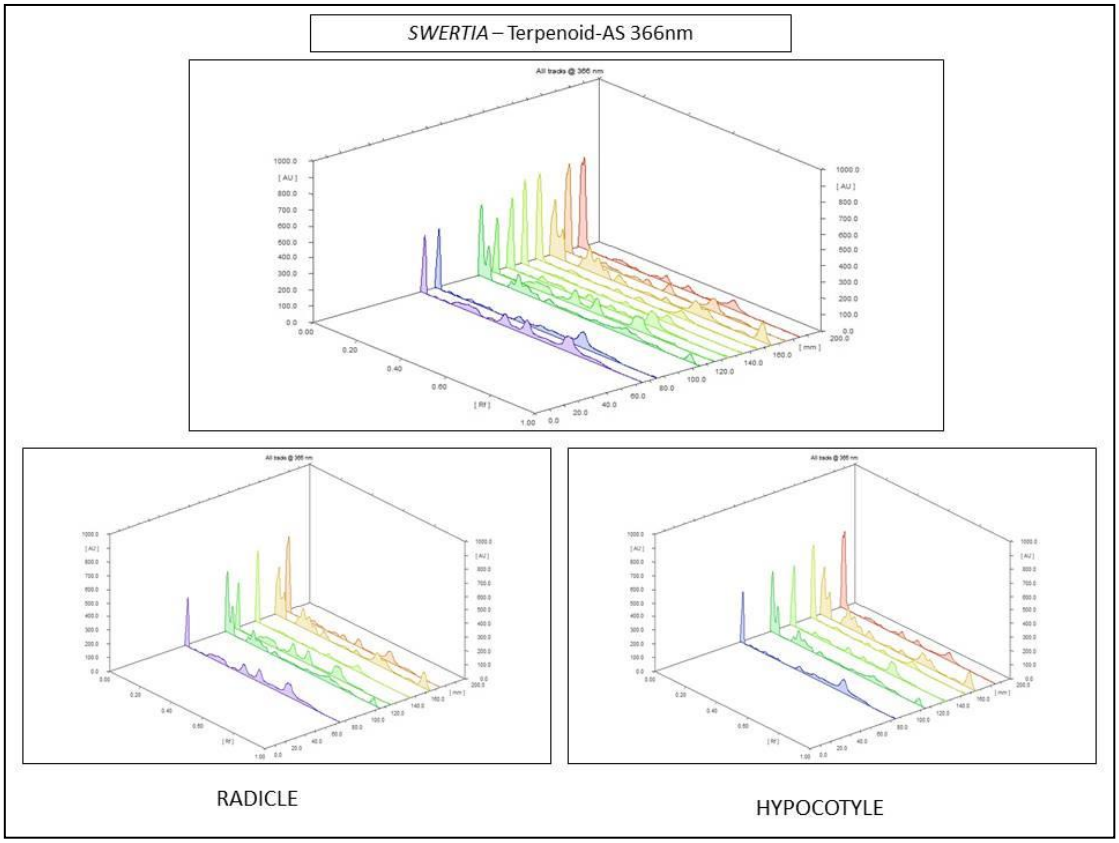


Figure 3.59: 3D display of spectral data at 366 nm AS for Terpenoids with *Swertia*

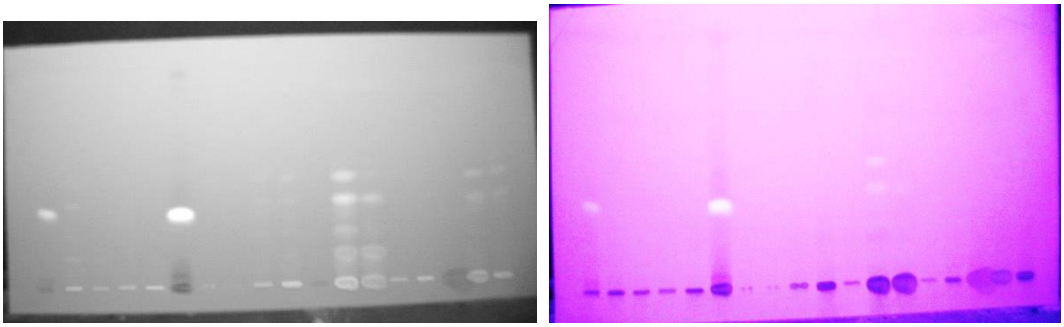


Figure 3.60: TLC plate of *Swertia* Terpenoid

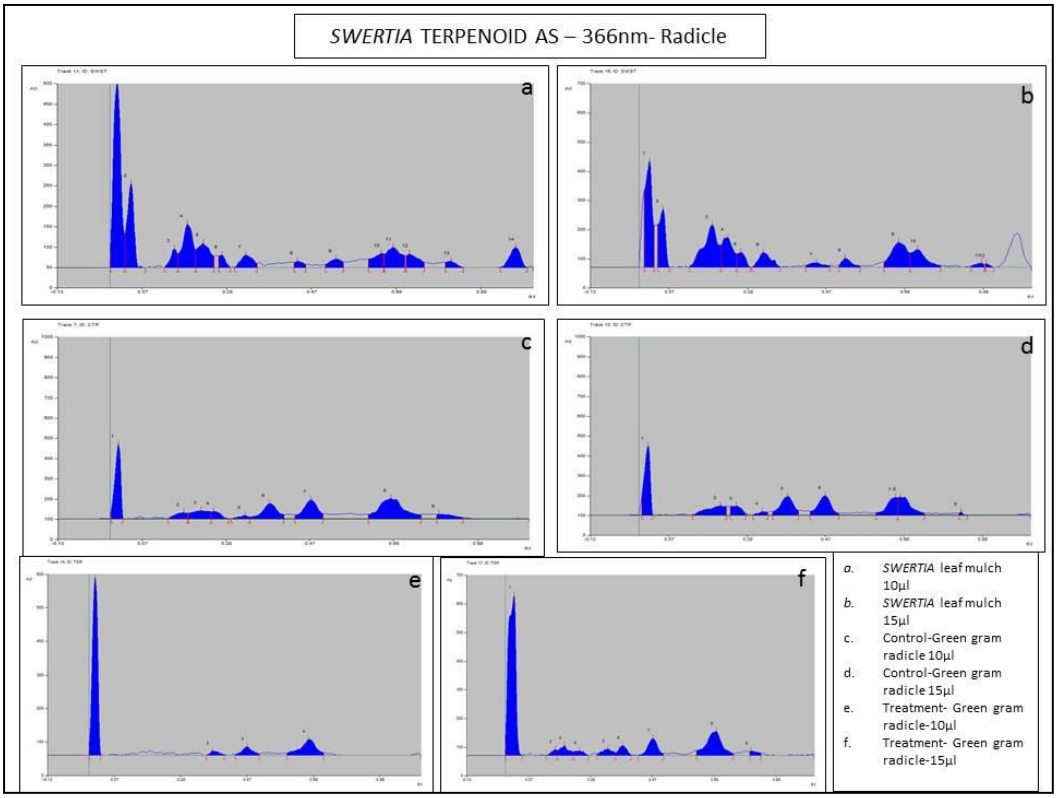


Figure 3.61: Peak densitogram of Terpenoid compound in methanolic extract of *Swertia* leaf, control and treated Radicle of Green gram (10µl and 15µl)at 366nm AS by HPTLC

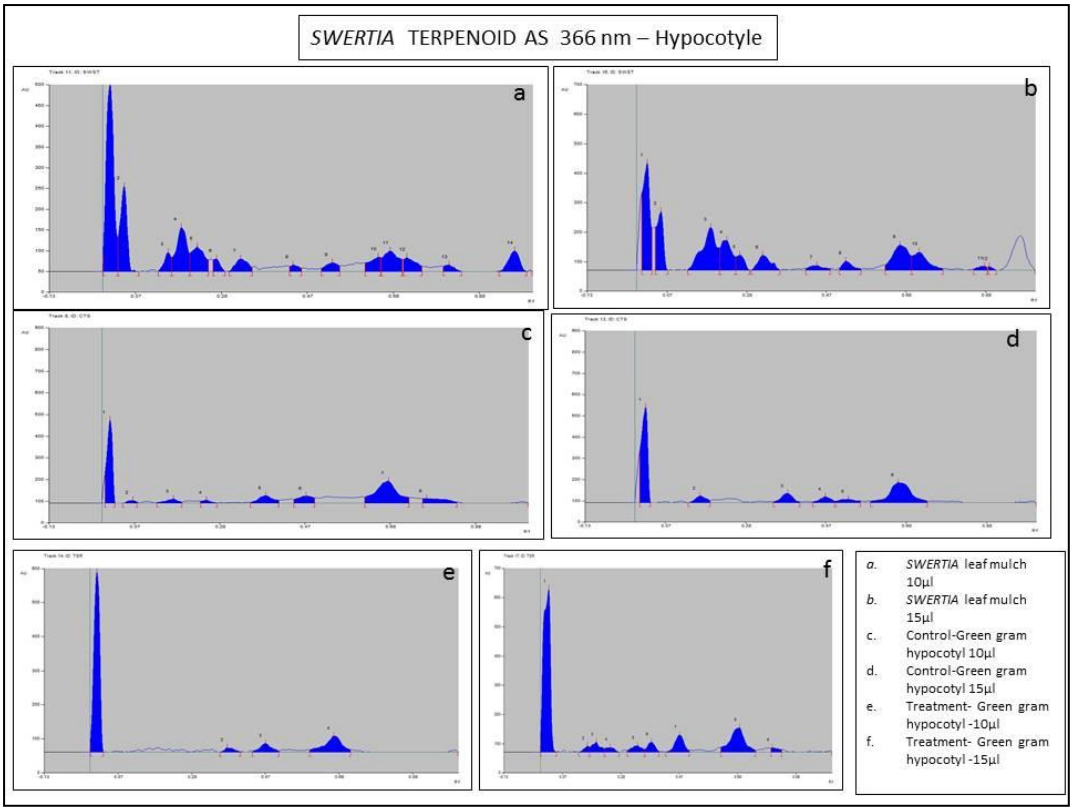


Figure 3.62: Peak densitogram of Terpenoid compound in methanolic extract of *Swertia* leaf, control and treated *Hypocotyl* of green gram (10µl and 15µl)at 366nm AS by HPTLC

Swertia leaf mulch 10µl						Control green gram radicle-10µl						Treatment green gram radicle -10µl					
Track	Peak	Max %	End Rf	Area	Assi sub	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
11	1	39.19	0.04	7416.7	unknown *	7	1	47	0.03	4541.5	unknown *	14	1	86.18	0.04	7881.8	unknown
11	2	17.87	0.08	3019.2	unknown *	7	2	3.79	0.19	826.6	unknown *	14	2	2.02	0.41	301.4	unknown
11	3	4	0.16	659.8	unknown *	7	3	5.13	0.24	1604.4	unknown *	14	3	4.13	0.51	740.4	unknown
11	4	9.23	0.2	2433.3	unknown *	7	4	4.7	0.28	722.6	unknown *	14	4	7.67	0.71	2026.3	unknown
11	5	5.19	0.25	1655.2	unknown *	7	5	2.12	0.33	331	unknown *						
11	6	2.63	0.28	440.6	unknown *	7	6	9.6	0.41	2517.5	unknown *						
11	7	2.63	0.35	827.3	unknown *	7	7	11.99	0.51	2926.5	unknown *						
11	8	1.39	0.46	306.1	unknown *	7	8	12.81	0.74	5570.2	unknown *						
11	9	1.83	0.55	582.3	unknown *	7	9	2.86	0.84	844	unknown *						
11	10	3.03	0.65	844.1	unknown *												
11	11	4.35	0.7	1588.4	unknown *												
11	12	2.91	0.74	877.8	unknown *												
11	13	1.41	0.83	342.7	unknown *												
11	14	4.33	0.99	1184.8	unknown *												
Swertia leaf mulch 15µl						Control green gram radicle-15µl						treatment green gram radicle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
16	1	32.25	0.04	5968.5	unknown *	12	1	41.13	0.04	4792.3	unknown *	17	1	66.25	0.06	12644.2	unknown
16	2	17.67	0.08	3146.4	unknown *	12	2	5.55	0.22	2118.6	unknown *	17	2	2.45	0.17	337.8	unknown
16	3	12.84	0.21	4728.1	unknown *	12	3	5.31	0.27	1158.4	unknown *	17	3	4.03	0.22	910.6	unknown
16	4	8.98	0.25	2626.1	unknown *	12	4	2.08	0.33	360.6	unknown *	17	4	1.89	0.27	434.1	unknown
16	5	4.52	0.28	988	unknown *	12	5	11.16	0.41	2955.3	unknown *	17	5	2.67	0.36	707.1	unknown
16	6	4.43	0.36	1464.8	unknown *	12	6	11.52	0.51	2979.3	unknown *	17	6	4.02	0.41	828.5	unknown
16	7	1.38	0.49	508.1	unknown *	12	7	10.6	0.66	2268.1	unknown *	17	7	6.92	0.51	1674.5	unknown
16	8	2.75	0.56	701.1	unknown *	12	8	10.75	0.73	2795.1	unknown *	17	8	10.02	0.74	3850.2	unknown
16	9	7.55	0.69	3174.9	unknown *	12	9	1.9	0.84	120.7	unknown *	17	9	1.75	0.83	362.9	unknown
16	10	5.42	0.77	2095.8	unknown *												
16	11	1.19	0.88	284.7	unknown *												
16	12	1.02	0.9	112.9	unknown *												

Table 3.15: Comparative Peak list and R_f value of the *Swertia* – Terpenoid – 366nm AS chromatogram for Green gram Radicle with control and treatment

a. *Swertia* Leaf Mulch

Results of *Swertia* with solution A showed 14 phytoconstituents and corresponding ascending order of Rf values starts from 0.04 to 0.99 in which highest concentration of the pytoconstituents was found to be 39.19% and its resultant Rf is 0.04 with highest peak area of 7416.7 occupied 33.44% of the total area. The Minimum concentration was about 1.39% at 0.46 R_f with minimum 306.1 peak area which had occupied 1.38% of the total peak area(Figure 3.59, 3.60)

Solution B gave an idea of about 12 phytoconstituent present in it, where is Rf value as of Solution B starts from 0.04 to 0.99. Here highest concentration amongst all phytoconstituents was found to be 32.25% with peak area of 5968.5 at 0.04 Rf. Which is highest peak area occupying around 23.13% of the total peak area. The lowest concentration was of 1.02% with minimum peak area of 112.9 at 0.99 Rf. Maximum concentration of the phytoconstituent was observed at 0.04 Rf. Number of peaks were less in higher volume of the solution.

b. Green Gram Radicle

Control showed nine peaks of phytoconstituents in both the volume and Rf starts from 0.03 to 0.84. in 10µl Here highest concentration was 47% at 0.03 Rf, with peak area of 4541.5 and the highest peak area was 5570.2 at 0.74 Rf. Here 2.12% was the minimum concentration observed at 0.33 Rf . It also had the Minimum area of the peak (i.e 331) occupying 1.66% of the total peak area.

Control showed similarity in Five peaks with *Swertia* and three peaks out of four in treatment. Numbers of peaks were less in treatment compared to control in 10µl

Control with 15µl solution identified nine peaks, which was same with treatment volume. Rf ranges from 0.04 to 0.84 in ascending order. The maximum concentration

was 41.13% at 0.04 Rf. It was also represented by the highest peak area of 4792.3.This solution has the minimum concentration (1.9%) of phytoconstituent at 0.84 Rf with the minimum area (120.7) of the peak. Control at 15µl volume showed five similar peaks with *Swertia* and all similar peaks with treatment. (Table 3.15)

10µl volume of treated sample showed Rf value ranging from 0.04 to 0.71, Here the highest concentration was 86.18% at 0.04 Rf with 7881.8 peak area, which occupied 71.98% of the total area. The least concentration detected was 2.02% at 0.41 Rf and 301.4 was the minimum peak area which occupies 2.75% of the total peak area.

Treatment showed all similar peaks with control but many constituents has been disappeared as compared to control

Higher volume (15µl)of the same sample was detected with nine peaks where Rf ranges from 0.06 to 0.83 in Ascending order. This solution shows maximum concentration of 66.25% at 0.06Rf. It also represented with the maximum peak area of 12644.2 which obtained 58.13% of the total area. Here all peaks except 0.14 Rf was not similar to control or *Swertia*.(Figure 3.61)

c. Green Gram Hypocotyl

Swertia leaf mulch results will remain same as mentioned in radicle. Control of legume *Hypocotyl* of control at 10µl and 15µl showed 8 and 6 peaks respectively. Two peaks were reduced with increased volume amount.

10µl volume of control showed peak range from 0.03 to 0.83 Rf in which 0.03 Rf represented with highest concentration of the element with 62.29% with area of 4512.2 which is 33.94 % of the total area. The highest peak area was observed at 0.72

Rf which was engaged 35.87% of the total area. The least concentration was 1.91% with the area of 196 occupied 1.47% of the total area and was observed at 0.08 Rf.

Control showed similar five peaks with *Swertia* and four peaks with treatment except 0.05,0.23 Rf. Control with 15µl volume showed peak range from 0.04 to 0.73Rf, at this time 0.04 represents highest concentration with 67.78 with maximum area of 6534.8. Here 0.56 Rf value showed least concentration with 2.37% and was occupying least area of 570.4 (3.98%) of the total peak area.15µl volume showed more peaks for *Swertia* and treatment i.e. 12 and 8 respectively than previous volume, but two peak reduced in control. Here control showed similarity with *Swertia* in two peaks. Control is similar with two peaks of treatment.(Table 3.16)

Treated *Hypocotyl* at 10µl volume showed 6 peaks and corresponding Rf in ascending from 0.05 to 0.7. Where the highest concentration 79.87% at 0.06 Rf with 9836.1AU area which occupied 72.01% of the total area. While least concentration (2.66%) was observed in Rf 0.23 with minimum peak area of 348.1. it occupied 2.55% of the total area.(Figure 3.62)

Swertia leaf mulch 10µl						Control green gram hypocotyle-10µl						Treatment green gram hypocotyle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
11	1	39.19	0.04	7416.7	unknown *	8	1	62.29	0.03	4512.2	unknown *	15	1	79.87	0.05	9836.1	unknown
11	2	17.87	0.08	3019.2	unknown *	8	2	1.91	0.08	196	unknown *	15	2	3.26	0.18	475.2	unknown
11	3	4	0.16	659.8	unknown *	8	3	2.89	0.19	451.2	unknown *	15	3	2.66	0.23	348.1	unknown
11	4	9.23	0.2	2433.3	unknown *	8	4	2.17	0.27	227.4	unknown *	15	4	3.14	0.4	460.1	unknown
11	5	5.19	0.25	1655.2	unknown *	8	5	5.53	0.41	1055.3	unknown *	15	5	3.86	0.51	744.1	unknown
11	6	2.63	0.28	440.6	unknown *	8	6	5.27	0.5	1073.2	unknown *	15	6	7.21	0.7	1796.2	unknown
11	7	2.63	0.35	827.3	unknown *	8	7	16.59	0.72	4768.3	unknown *						
11	8	1.39	0.46	306.1	unknown *	8	8	3.36	0.83	1011.1	unknown *						
11	9	1.83	0.55	582.3	unknown *												
11	10	3.03	0.65	844.1	unknown *												
11	11	4.35	0.7	1588.4	unknown *												
11	12	2.91	0.74	877.8	unknown *												
11	13	1.41	0.83	342.7	unknown *												
11	14	4.33	0.99	1184.8	unknown *												
Swertia leaf mulch 15µl						Control green gram hypocotyle-15µl						Treatment green gram hypocotyle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
16	1	32.25	0.04	5968.5	unknown *	13	1	67.78	0.04	6534.8	unknown *	18	1	73.35	0.06	13021.9	unknown
16	2	17.67	0.08	3146.4	unknown *	13	2	4.73	0.19	751.1	unknown *	18	2	3.19	0.23	1084.6	unknown
16	3	12.84	0.21	4728.1	unknown *	13	3	6.6	0.41	1151.7	unknown *	18	3	1.78	0.28	266	unknown
16	4	8.98	0.25	2626.1	unknown *	13	4	4.18	0.5	697.3	unknown *	18	4	2.32	0.38	517.1	unknown
16	5	4.52	0.28	988	unknown *	13	5	2.37	0.56	570.4	unknown *	18	5	5.54	0.43	994.3	unknown
16	6	4.43	0.36	1464.8	unknown *	13	6	14.34	0.73	4637.1	unknown *	18	6	4.52	0.54	967.3	unknown
16	7	1.38	0.49	508.1	unknown *							18	7	1.42	0.62	205.8	unknown
16	8	2.75	0.56	701.1	unknown *							18	8	7.88	0.75	2785.9	unknown
16	9	7.55	0.69	3174.9	unknown *												
16	10	5.42	0.77	2095.8	unknown *												
16	11	1.19	0.88	284.7	unknown *												
16	12	1.02	0.9	112.9	unknown *												

Table 3.16: Comparative Peak list and R_f value of the *Swertia* – Terpenoid – 366nm AS chromatogram for Green gram *Hypocotyl* with control and treatment

Treated legume *Hypocotyl* at 10µl volume showed two peaks less than as compared to control.

Treatment with 15µl volume showed Rf values ranging from 0.06 to 0.75, in which maximum concentration was observed at 0.06 Rf with 73.35%. and maximum area was 13021 with 65.62% of the total peak area. The least concentration was 1.42 % at 0.62 Rf with minimum area of 205.8 occupying 1.04% of the total area.

Treatment data with 15µl volume showed three newly formed peaks (0.23,0.28, 0.38), all showed resemblance with *Swertia* 15µl.

3.3.3.8. *Swertia* – Phenolics compounds were determined using 0.5% Fast Blue as reagent in HPTLC fingerprinting. Results were discussed as below, using Peak densitogram, and chromatogram. (Figure 3.63)

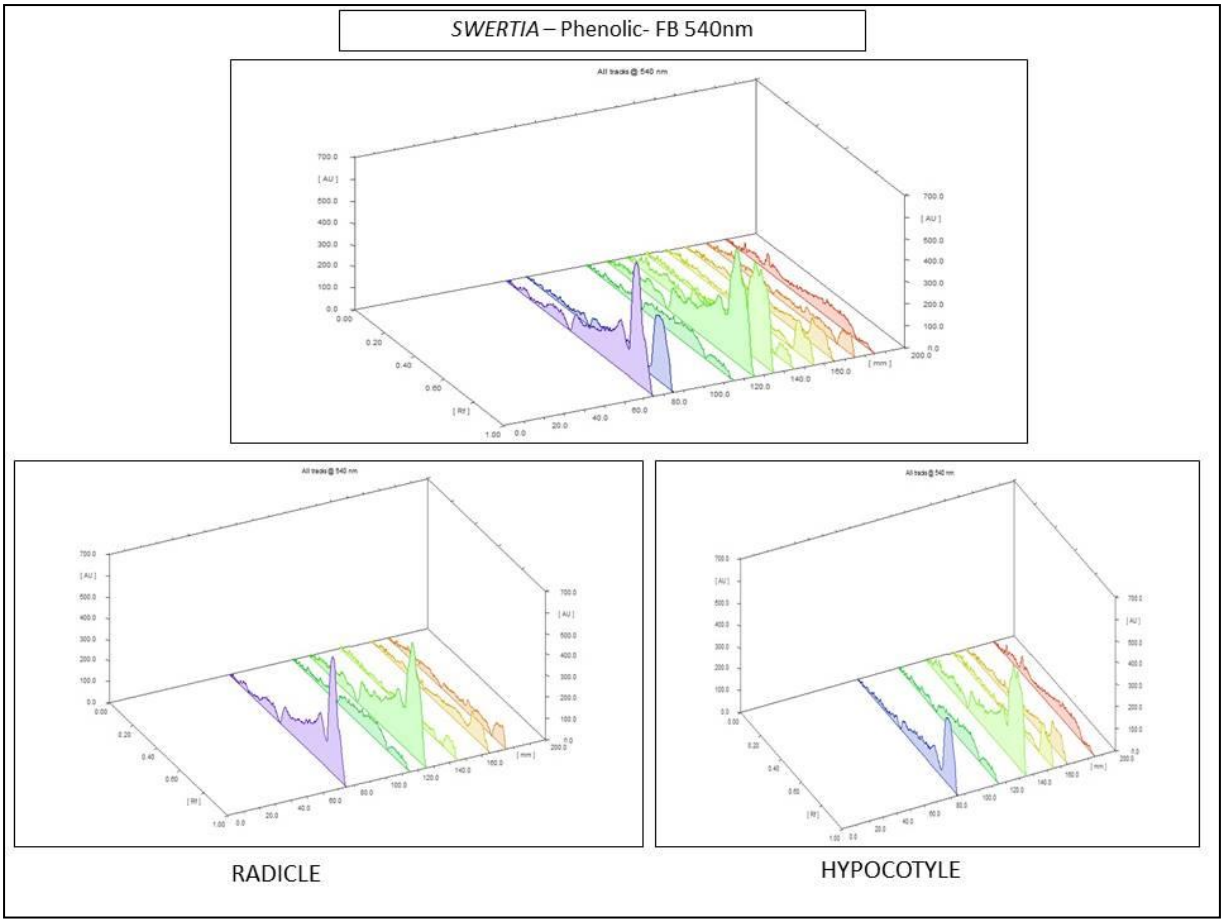


Figure 3.63: 3D display of spectral data at FB 540nm Phenolics

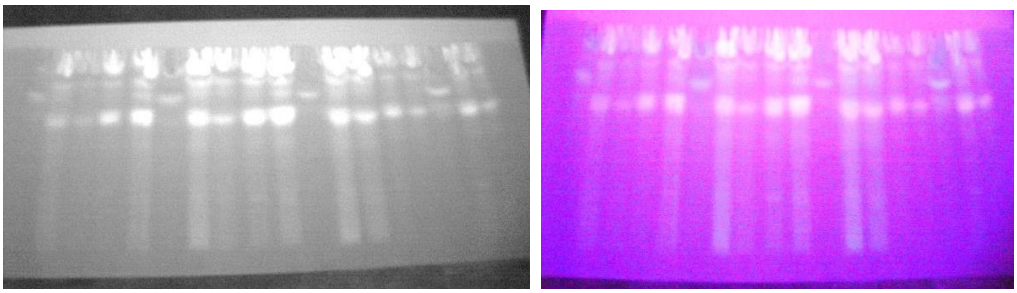


Figure 3.64: TLC plate of *Swertia* Phenolics

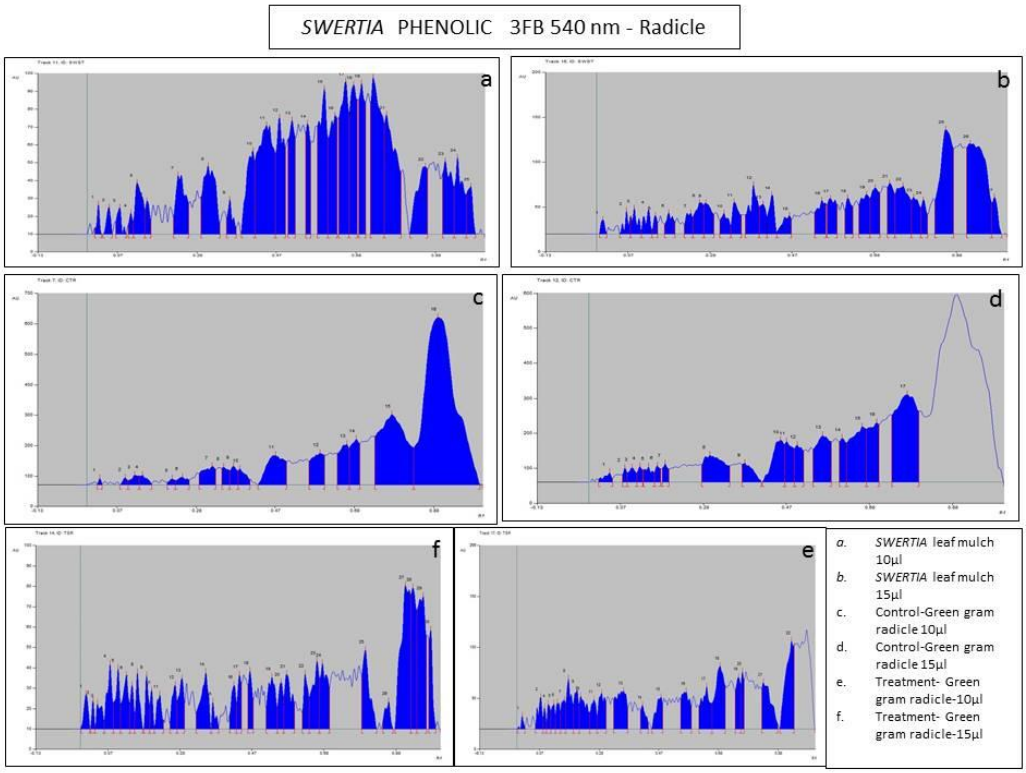


Figure 3.65: Peak densitogram of Phenolic compounds in methanolic extract of *Swertia* leaf, control and treated Radicle of Green gram (10µl and 15µl) at FB 540nm by HPTLC

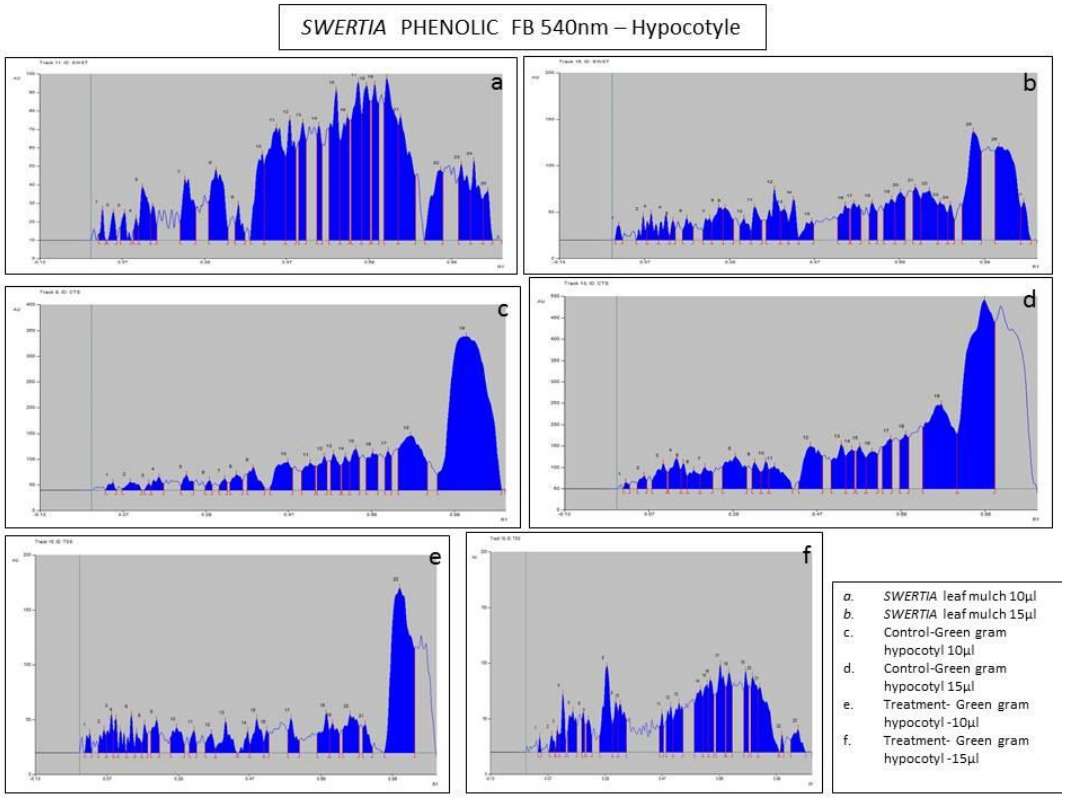


Figure 3.66: Peak densitogram of Phenolic compound in methanolic extract of *Swertia* leaf, control and treated *Hypocotyl* of green gram (10µl and 15µl) at FB 540nm by HPTLC

Swertia leaf mulch 10µl							Control green gram radicle-10µl							Treatment green gram radicle -10µl					
Track	Peak	Max %	End Rf	Area	Assi sub		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
11	1	1.41	0.04	106.8	unknown *		7	1	1.23	0.04	130.2	unknown *		14	1	1.95	0.03	184.3	unknown
11	2	1.28	0.06	140.6	unknown *		7	2	1.36	0.1	225.1	unknown *		14	2	1.58	0.04	82.2	unknown
11	3	1.25	0.1	155.8	unknown *		7	3	1.89	0.13	573.6	unknown *		14	3	1.41	0.07	178.6	unknown
11	4	1	0.12	96.2	unknown *		7	4	1.89	0.16	523.8	unknown *		14	4	3.62	0.09	399.4	unknown
11	5	2.4	0.14	516.5	unknown *		7	5	1.14	0.22	259.3	unknown *		14	5	3.37	0.11	319.3	unknown
11	6	1.55	0.16	182.8	unknown *		7	6	1.48	0.26	564.8	unknown *		14	6	2.98	0.14	382.6	unknown
11	7	2.75	0.26	765.3	unknown *		7	7	3.68	0.33	1752.6	unknown *		14	7	2.44	0.15	190	unknown
11	8	3.18	0.33	1110.5	unknown *		7	8	3.53	0.36	892.8	unknown *		14	8	3.16	0.17	261.1	unknown
11	9	1.61	0.37	217	unknown *		7	9	3.76	0.38	943.4	unknown *		14	9	2.99	0.19	205.1	unknown
11	10	3.89	0.42	939.7	unknown *		7	10	3.18	0.41	926.8	unknown *		14	10	2.16	0.2	145.6	unknown
11	11	5.08	0.47	2195.6	unknown *		7	11	5.85	0.51	3977.2	unknown *		14	11	1.91	0.23	208.9	unknown
11	12	5.46	0.5	1175.9	unknown *		7	12	6.3	0.6	3090.3	unknown *		14	12	2.46	0.27	250.4	unknown
11	13	5.31	0.52	926.8	unknown *		7	13	8.09	0.66	3121.5	unknown *		14	13	2.82	0.29	328.2	unknown
11	14	5.16	0.56	631.1	unknown *		7	14	9.05	0.69	3020.5	unknown *		14	14	3.16	0.36	533.7	unknown
11	15	6.76	0.61	1517.7	unknown *		7	15	14.04	0.83	14562.6	unknown *		14	15	1.51	0.38	114.9	unknown
11	16	5.55	0.63	1229.7	unknown *		7	16	33.53	0.99	39501.9	unknown *		14	16	2.44	0.43	260.4	unknown
11	17	7.13	0.66	1635.4	unknown *									14	17	3.02	0.45	251.3	unknown
11	18	6.96	0.68	1392.3	unknown *									14	18	3.24	0.48	313.5	unknown
11	19	7.02	0.7	1169.6	unknown *									14	19	2.9	0.55	493.3	unknown
11	20	7.3	0.75	2159	unknown *									14	20	2.6	0.56	271.2	unknown
11	21	5.55	0.79	1787.9	unknown *									14	21	3.05	0.59	482.7	unknown
11	22	3.16	0.86	931.6	unknown *									14	22	3.08	0.64	320.8	unknown
11	23	3.43	0.92	851.2	unknown *									14	23	3.78	0.67	572	unknown
11	24	3.57	0.95	749.2	unknown *									14	24	3.66	0.69	601.7	unknown
11	25	2.23	0.98	358.6	unknown *									14	25	4.4	0.82	704.7	unknown
														14	26	1.53	0.87	183.5	unknown
														14	27	7.98	0.92	1744	unknown
														14	28	7.87	0.94	905.4	unknown
														14	29	7.39	0.96	1358.8	unknown
														14	30	5.53	0.99	475.9	unknown
Swertia leaf mulch 15µl							Control green gram radicle-15µl							treatment green gram radicle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
16	1	1.44	0.02	145.7	unknown *		12	1	1.63	0.06	437.7	unknown *		17	1	1.53	0.03	94.1	unknown
16	2	2.32	0.08	243	unknown *		12	2	2.47	0.09	333.5	unknown *		17	2	3.8	0.09	391.7	unknown
16	3	2.59	0.11	366.9	unknown *		12	3	2.57	0.12	624.2	unknown *		17	3	2.55	0.1	142.3	unknown
16	4	2.48	0.13	327.2	unknown *		12	4	2.73	0.13	467.6	unknown *		17	4	2.96	0.11	242.3	unknown
16	5	1.89	0.15	185.2	unknown *		12	5	2.71	0.16	739.4	unknown *		17	5	3	0.13	286.4	unknown
16	6	2.12	0.19	363.1	unknown *		12	6	2.86	0.17	504.2	unknown *		17	6	3.15	0.15	301.4	unknown
16	7	2.12	0.23	351.5	unknown *		12	7	3.21	0.19	600.7	unknown *		17	7	3.49	0.16	380.9	unknown
16	8	3.18	0.26	676	unknown *		12	8	4.77	0.34	3449.9	unknown *		17	8	6.01	0.19	723.4	unknown
16	9	3.14	0.28	597.7	unknown *		12	9	3.35	0.42	1277	unknown *		17	9	4.74	0.21	547.4	unknown
16	10	2.11	0.33	402.6	unknown *		12	10	7.5	0.47	3094.9	unknown *		17	10	3.92	0.24	719.5	unknown
16	11	3.22	0.35	565.9	unknown *		12	11	7.26	0.5	2089.1	unknown *		17	11	3.47	0.27	473.7	unknown
16	12	4.96	0.4	977.1	unknown *		12	12	6.59	0.52	1856.7	unknown *		17	12	4.28	0.3	702.5	unknown
16	13	3.02	0.41	494	unknown *		12	13	8.31	0.58	4336.2	unknown *		17	13	4.53	0.37	1307.8	unknown
16	14	3.94	0.44	530.6	unknown *		12	14	7.86	0.62	1773.5	unknown *		17	14	2.83	0.44	361.8	unknown
16	15	1.85	0.47	399.5	unknown *		12	15	9.92	0.67	5342	unknown *		17	15	3.79	0.49	628.7	unknown
16	16	3.39	0.56	718.2	unknown *		12	16	10.6	0.7	4135.9	unknown *		17	16	4.44	0.59	948.4	unknown
16	17	3.59	0.59	767.6	unknown *		12	17	15.66	0.8	12157.8	unknown *		17	17	5.04	0.66	1068.4	unknown
16	18	3.64	0.63	577.9	unknown *									17	18	7.47	0.7	1718.4	unknown
16	19	3.99	0.67	919.7	unknown *									17	19	6.19	0.75	729.3	unknown
16	20	4.65	0.69	954.1	unknown *									17	20	6.81	0.76	502.4	unknown
16	21	5.09	0.73	837.5	unknown *									17	21	5.52	0.88	1312.9	unknown
16	22	4.82	0.77	1573.2	unknown *									17	22	10.48	0.93	2149.1	unknown
16	23	3.71	0.79	735.6	unknown *														
16	24	3.44	0.81	429.4	unknown *														
16	25	10.52	0.87	3320	unknown *														
16	26	9.09	0.96	4271.7	unknown *														
16	27	3.69	0.99	507.7	unknown *														

Table 3.17 : Comparative Peak list and R_f value of the *Swertia* – Phenolics – FB 540nm chromatogram for Green gram Radicle with control and treatment

a. *Swertia* – Leaf mulch

Swertia with solution A showed 25 phytoconstituents and corresponding ascending order of Rf values starts from 0.04to 0.98 in which highest concentration of the phytoconstituents was found to be 7.3% and its resultant Rf is 0.75 with highest peak area of 2159 contributing 9.41% of the total area. The Minimum concentration was about 1% at 0.12 R_f with minimum 96.2 peak area (Figure 3.63)

Solution B with 27 phytoconstituent, where Rf value starts from 0.02 to 0.99. Here highest concentration amongst all phytoconstituents was found to be 9.09% with peak area of 4271.7 at 0.96 Rf. Lowest concentration was of 1.44% with minimum peak area of 145.7 at 0.02 Rf.

If we compare both results then results were similar regarding lowest peak area. The higher concentration of the phytoconstituents was shifted from 0.75 Rf to 0.96 Rf in higher volume.(Figure 3.64)

b. Green Gram Radicle

Green gram radicle of control with 10µl solution showed 16 peaks of phytoconstituents and Rf starts from 0.04 to 0.99. Here highest concentration was 33.53% at 0.99 Rf, with peak area of 39501.9. was the minimum concentration observed at 0.33 Rf . It also had the Minimum area of the peak (i.e 259.3) occupying 0.35% of the total peak area.

Control showed similarity in FOUR peaks with *Swertia* and treated results. For 15µ Rf ranges from 0.06 to 0.8 in ascending order. The maximum concentration was 15.06% at 0.8Rf. It was also represented by the highest peak area of 12157.8.This solution has the minimum concentration (1.63%) of phytoconstituent at 0.06 Rf with the minimum area (437.7AU) of the peak.(Table 3.17)

Control at 15µl volume showed five similar peaks with *Swertia* and six similar peaks with treatment. Treated radicle solution resulted into more number of peaks.Treated radicle of legumes showed 30 and 22 peaks for both 10µl and 15µl volume.

Treatment with 10µl volume showed Rf value ranging from 0.03 to 0.99, nearly similar with control 10µl. Here the highest concentration was 7.98% at 0.92 Rf with 1744 peak area,. Here minimum peak area was 82.2 at 0.04 Rf having 1.58% concentration.Treatment with 15µl volume was detected where Rf ranges from 0.03 to 0.93 in Ascending order. This solution shows maximum concentration of 10.48% at 0.93Rf. It also represented with the maximum peak area of 2149.1.

In Radicle noticeable increase with number of peaks indicates presence of many chemicals other than present in control. It may also happen that due to treatment other secondary metabolites have activated which were not present in control or *Swertia*.(Figure 3.65)

c. Green gram Hypocotyl

Swertia leaf mulch results will remain same as mentioned in radicle. Control of legume *Hypocotyl* at 10µl and 15µl showed 18 and 20 peaks respectively. Two peaks were increased with volume amount.

10µl volume of control showed peak range from 0.06 to 0.81 Rf in which 0.81 Rf represented with highest concentration of the element with 9.18% with area of 5080.4which is 55.86 % of the total area. The least concentration was 1.12% with the area of 108.7.

Control showed similar six peaks with *Swertia* and seven with treatment. Control with 15µl volume showed peak range from 0.03 to 0.9Rf, where maximum

concentration of the element was also observed in 0.9 Rf. and minimum concentration in 0.03 Rf. Both control solution showed maximum concentration and area at similar Rf (i.e 0.9). Two peaks were increased in 15µl as compared to lower volume.

Treated *Hypocotyl* of green gram showed 22 and 23 number of peaks with 10 and 15µl volume. On 10µl peak range was from 0.03-0.94. This range has been increased as compared to control. There are two peaks at 0.33 and ,0.7 Rf which showed similarity with *Swertia* but not with control. Minimum peak area was observed at 0.38 Rf, which occupied 1.88% of the total area. Maximum peak area (7265.8)was observed at 0.94 Rf.

One peak was more in 15µl volume. Rf value ranges from 0.05-0.98 Rf. Here maximum concentration of 7.45% was observed at 0.7Rf and maximum area of 1955.7 was observed at 0.88Rf . Minimum area and concentration were observed at 0.05 Rf.(Table 3.18)

In *Swertia*, control and treated solutions highest peak with area and concentration was observed at 0.8-0.9 Rf value. In higher volume minimum area and concentration was also similar and restricted to 0.02-0.05 Rf value.(Figure 3.66)

As compared to control number of peaks were increased and 0.94, 0.98 Rf value were showing similarity with *Swertia* , as that was not observed in case of control.

Swertia leaf mulch 10µl						Control green gram hypocotyle-10µl						Treatment green gram hypocotyle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
11	1	1.41	0.04	106.8	unknown *	8	1	1.26	0.06	183.4	unknown *	15	1	2.58	0.03	174.7	unknown
11	2	1.28	0.06	140.6	unknown *	8	2	1.33	0.12	376.3	unknown *	15	2	3	0.07	290.9	unknown
11	3	1.25	0.1	155.8	unknown *	8	3	1.12	0.14	108.7	unknown *	15	3	5	0.1	394.6	unknown
11	4	1	0.12	96.2	unknown *	8	4	2.21	0.17	435.4	unknown *	15	4	4.52	0.11	230.2	unknown
11	5	2.4	0.14	516.5	unknown *	8	5	2.54	0.25	505.1	unknown *	15	5	2.84	0.13	200.6	unknown
11	6	1.55	0.16	182.8	unknown *	8	6	1.62	0.29	198.4	unknown *	15	6	4.9	0.15	312.5	unknown
11	7	2.75	0.26	765.3	unknown *	8	7	1.91	0.33	279.2	unknown *	15	7	2.67	0.17	209.3	unknown
11	8	3.18	0.33	1110.5	unknown *	8	8	2.61	0.36	626.8	unknown *	15	8	3.74	0.19	259.3	unknown
11	9	1.61	0.37	217	unknown *	8	9	3.75	0.42	941.7	unknown *	15	9	4.26	0.22	485.9	unknown
11	10	3.89	0.42	939.7	unknown *	8	10	4.76	0.49	1877.6	unknown *	15	10	3.28	0.29	577.7	unknown
11	11	5.08	0.47	2195.6	unknown *	8	11	4.59	0.54	1295.4	unknown *	15	11	2.89	0.33	250.2	unknown
11	12	5.46	0.5	1175.9	unknown *	8	12	5.67	0.57	1148.9	unknown *	15	12	2.55	0.38	295.7	unknown
11	13	5.31	0.52	926.8	unknown *	8	13	6.1	0.6	1239.1	unknown *	15	13	4.1	0.44	573.8	unknown
11	14	5.16	0.56	631.1	unknown *	8	14	5.65	0.62	915.6	unknown *	15	14	2.79	0.48	222.1	unknown
11	15	6.76	0.61	1517.7	unknown *	8	15	6.9	0.65	1450.5	unknown *	15	15	4.41	0.52	610.8	unknown
11	16	5.55	0.63	1229.7	unknown *	8	16	6.38	0.69	1604.9	unknown *	15	16	2.92	0.53	201.2	unknown
11	17	7.13	0.66	1635.4	unknown *	8	17	6.51	0.72	970.8	unknown *	15	17	4.42	0.62	516.9	unknown
11	18	6.96	0.68	1392.3	unknown *	8	18	9.18	0.81	5080.4	unknown *	15	18	5.09	0.7	670.7	unknown
11	19	7.02	0.7	1169.6	unknown *							15	19	3.83	0.73	502.3	unknown
11	20	7.3	0.75	2159	unknown *							15	20	4.99	0.78	1067.3	unknown
11	21	5.55	0.79	1787.9	unknown *							15	21	3.69	0.82	388.5	unknown
11	22	3.16	0.86	931.6	unknown *							15	22	21.53	0.94	7265.8	unknown
11	23	3.43	0.92	851.2	unknown *												
11	24	3.57	0.95	749.2	unknown *												
11	25	2.23	0.98	358.6	unknown *												
Swertia leaf mulch 15µl						Control green gram hypocotyle-15µl						Treatment green gram hypocotyle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
16	1	1.44	0.02	145.7	unknown *	13	1	0.76	0.03	135.4	unknown *	18	1	1.32	0.05	69	unknown
16	2	2.32	0.08	243	unknown *	13	2	1.53	0.07	451.6	unknown *	18	2	1.45	0.1	174.9	unknown
16	3	2.59	0.11	366.9	unknown *	13	3	3.01	0.12	1204.1	unknown *	18	3	1.91	0.12	148.6	unknown
16	4	2.48	0.13	327.2	unknown *	13	4	3.65	0.15	1362.2	unknown *	18	4	4.93	0.14	557.5	unknown
16	5	1.89	0.15	185.2	unknown *	13	5	3.04	0.17	648	unknown *	18	5	3.47	0.18	807.9	unknown
16	6	2.12	0.19	363.1	unknown *	13	6	2.25	0.2	918.1	unknown *	18	6	3.41	0.21	340.7	unknown
16	7	2.12	0.23	351.5	unknown *	13	7	2.58	0.23	1037.9	unknown *	18	7	2.78	0.23	415	unknown
16	8	3.18	0.26	676	unknown *	13	8	3.87	0.31	2949.2	unknown *	18	8	7.3	0.3	1718.4	unknown
16	9	3.14	0.28	597.7	unknown *	13	9	3.15	0.34	956.7	unknown *	18	9	4.31	0.32	615.9	unknown
16	10	2.11	0.33	402.6	unknown *	13	10	3.25	0.36	797.1	unknown *	18	10	4.08	0.35	917.7	unknown
16	11	3.22	0.35	565.9	unknown *	13	11	2.67	0.42	1653	unknown *	18	11	3.33	0.48	391.5	unknown
16	12	4.96	0.4	977.1	unknown *	13	12	5.14	0.49	3568.5	unknown *	18	12	3.9	0.52	716.3	unknown
16	13	3.02	0.41	494	unknown *	13	13	5.34	0.55	2336.7	unknown *	18	13	4.17	0.55	1098.6	unknown
16	14	3.94	0.44	530.6	unknown *	13	14	4.7	0.57	1543.2	unknown *	18	14	5.3	0.62	1285.1	unknown
16	15	1.85	0.47	399.5	unknown *	13	15	5.13	0.59	1741.3	unknown *	18	15	5.76	0.64	972	unknown
16	16	3.39	0.56	718.2	unknown *	13	16	4.47	0.62	1904.7	unknown *	18	16	6.14	0.66	954.9	unknown
16	17	3.59	0.59	767.6	unknown *	13	17	5.99	0.66	2150.4	unknown *	18	17	7.45	0.7	1757.5	unknown
16	18	3.64	0.63	577.9	unknown *	13	18	6.52	0.69	2274.8	unknown *	18	18	6.77	0.72	1229.9	unknown
16	19	3.99	0.67	919.7	unknown *	13	19	10.17	0.81	11148.2	unknown *	18	19	6.87	0.78	961.5	unknown
16	20	4.65	0.69	954.1	unknown *	13	20	22.76	0.9	25261	unknown *	18	20	6.41	0.81	1357.6	unknown
16	21	5.09	0.73	837.5	unknown *							18	21	5.52	0.88	1955.7	unknown
16	22	4.82	0.77	1573.2	unknown *							18	22	1.47	0.9	105.3	unknown
16	23	3.71	0.79	735.6	unknown *							18	23	1.95	0.98	533.7	unknown
16	24	3.44	0.81	429.4	unknown *												
16	25	10.52	0.87	3320	unknown *												
16	26	9.09	0.96	4271.7	unknown *												
16	27	3.69	0.99	507.7	unknown *												

Table 3.18: Comparative Peak list and R_f value of the *Swertia* – Phenolics – FB 540nm chromatogram for Green gram *Hypocotyl*

3.3.3.3 *Swertia* – **Flavanoids** using NP – PEG

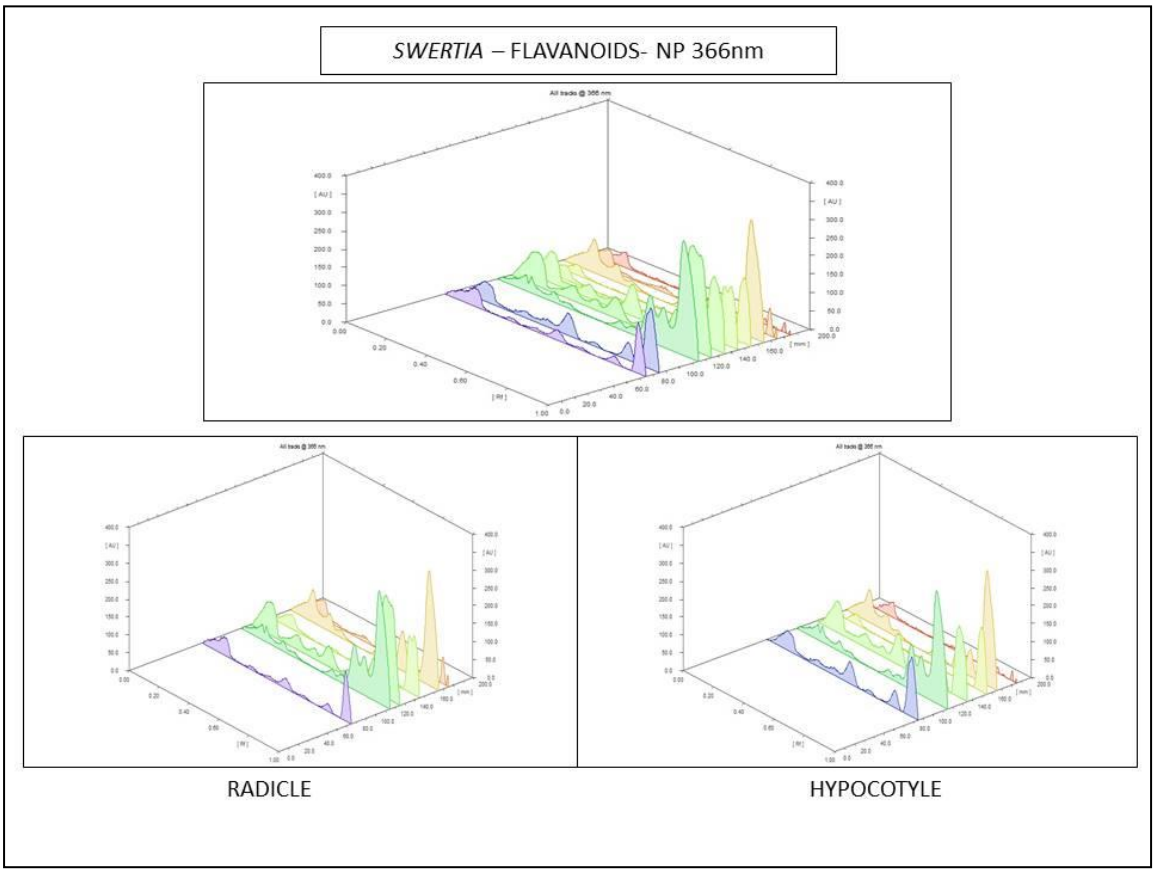


Figure 3.67: 3D display of spectral data at NP 366nm Flavonoid

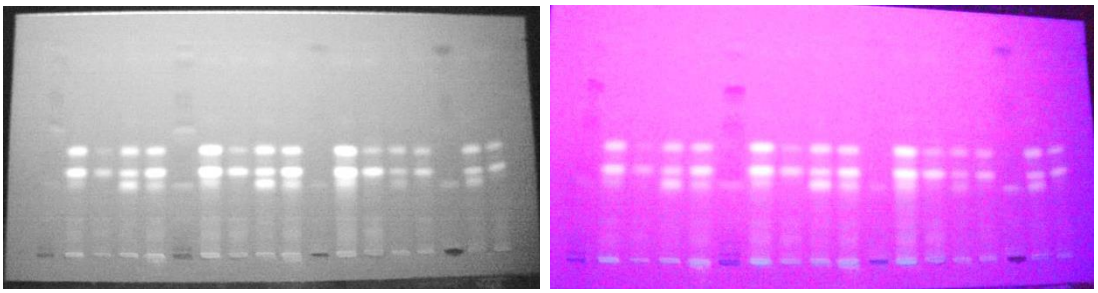


Figure 3.68: TLC plate of *Swertia* Flavonoid

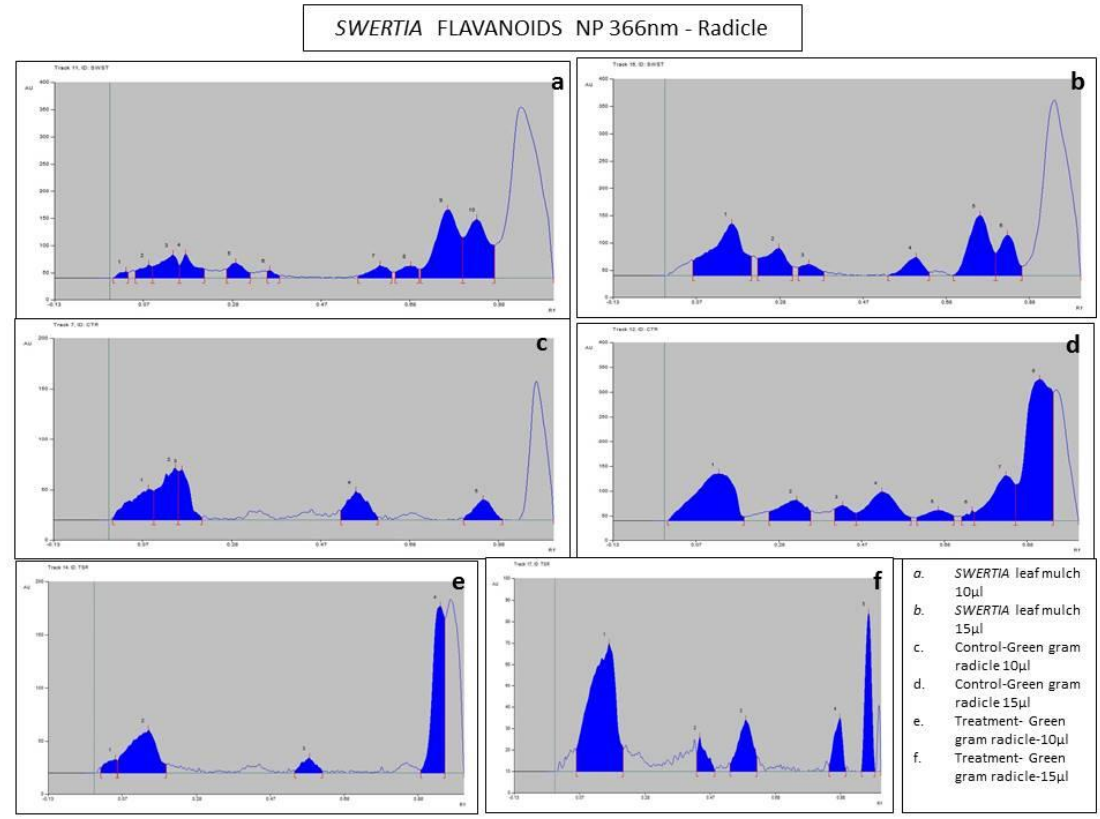


Figure 3.69: Peak densitogram of Flavanoid compounds in methanolic extract of *Swertia* leaf, control and treated Radicle of Green gram (10µl and 15µl) at NP 366nm by HPTLC

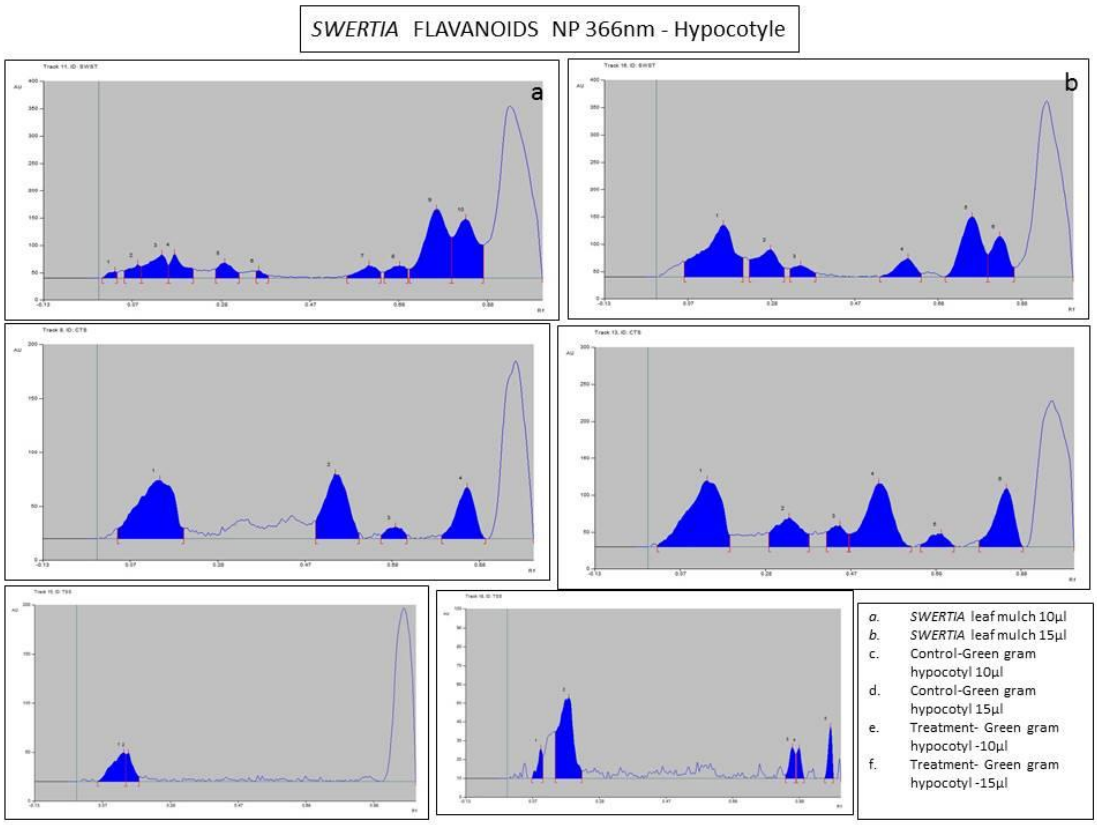


Figure 3.70: Peak densitogram of Flavanoid compound in methanolic extract of *Swertia* leaf, control and treated *Hypocotyl* of green gram (10µl and 15µl) at FB 540nm by HPTLC

Swertia leaf mulch 10µl							Control green gram radicle-10µl							Treatment green gram radicle -10µl					
Track	Peak	Max %	End Rf	Area	Assi sub		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned subst
11	1	2.75	0.04	235.1	unknown *		7	1	17.02	0.1	1480.7	unknown *		14	1	5.81	0.06	375.8	unknown *
11	2	5.51	0.1	621.5	unknown *		7	2	28.51	0.16	1813.6	unknown *		14	2	17.92	0.2	2762.6	unknown *
11	3	9.58	0.16	1537.3	unknown *		7	3	27.64	0.21	1177.1	unknown *		14	3	6.39	0.62	514	unknown *
11	4	9.79	0.21	1233	unknown *		7	4	15.71	0.6	1194.5	unknown *		14	4	69.87	0.95	4517.1	unknown *
11	5	6.24	0.32	891	unknown *		7	5	11.13	0.89	770.7	unknown *							
11	6	3.15	0.38	232.5	unknown *														
11	7	5.19	0.64	882.7	unknown *														
11	8	5.11	0.7	811.7	unknown *														
11	9	28.39	0.8	5928.6	unknown *														
11	10	24.29	0.87	5001.6	unknown *														
Swertia leaf mulch 15µl							Control green gram radicle-15µl							treatment green gram radicle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned subst
16	1	24.74	0.21	6358.5	unknown *		12	1	14.74	0.19	8274.4	unknown *		17	1	30.04	0.21	4329.8	unknown *
16	2	13.14	0.31	2488.6	unknown *		12	2	6.53	0.35	2506.2	unknown *		17	2	8.12	0.49	374.5	unknown *
16	3	5.39	0.38	810.3	unknown *		12	3	4.76	0.46	1064.7	unknown *		17	3	12.09	0.62	966.5	unknown *
16	4	8.76	0.64	1356.4	unknown *		12	4	9.02	0.59	3649.7	unknown *		17	4	12.5	0.89	593.1	unknown *
16	5	28.66	0.8	5023.5	unknown *		12	5	3.37	0.7	1119.2	unknown *		17	5	37.25	0.98	1316.7	unknown *
16	6	19.31	0.86	2685.4	unknown *		12	6	3.17	0.75	333.4	unknown *							
							12	7	14.12	0.85	4581.9	unknown *							
							12	8	44.3	0.94	16112.3	unknown *							

Table 3.19: Comparative Peak list and R_f value of the *Swertia* – Flavanoid– NP 366nm chromatogram for Green gram Radicle with control and treatment

Swertia leaf mulch 10µl							Control green gram hypocotyle-10µl							Treatment green gram hypocotyle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned subst
11	1	2.75	0.04	235.1	unknown *		8	1	31.43	0.2	4251.5	unknown *		15	1	50.2	0.14	1112.2	unknown *
11	2	5.51	0.1	621.5	unknown *		8	2	34.76	0.6	2964.3	unknown *		15	2	49.8	0.18	551.4	unknown *
11	3	9.58	0.16	1537.3	unknown *		8	3	6.28	0.71	390.1	unknown *							
11	4	9.79	0.21	1233	unknown *		8	4	27.53	0.89	1842	unknown *							
11	5	6.24	0.32	891	unknown *														
11	6	3.15	0.38	232.5	unknown *														
11	7	5.19	0.64	882.7	unknown *														
11	8	5.11	0.7	811.7	unknown *														
11	9	28.39	0.8	5928.6	unknown *														
11	10	24.29	0.87	5001.6	unknown *														
Swertia leaf mulch 15µl							Control green gram hypocotyle-15µl							Treatment green gram hypocotyle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned subst
16	1	24.74	0.21	6358.5	unknown *		13	1	26.41	0.19	6598.3	unknown *		18	1	13.33	0.11	206.4	unknown *
16	2	13.14	0.31	2488.6	unknown *		13	2	11.55	0.38	2205.1	unknown *		18	2	36.14	0.22	1722.2	unknown *
16	3	5.39	0.38	810.3	unknown *		13	3	8.46	0.47	1029.5	unknown *		18	3	13.92	0.86	268.7	unknown *
16	4	8.76	0.64	1356.4	unknown *		13	4	25.2	0.62	4884.1	unknown *		18	4	13.56	0.89	195.3	unknown *
16	5	28.66	0.8	5023.5	unknown *		13	5	5.16	0.72	700.1	unknown *		18	5	23.06	0.98	295.3	unknown *
16	6	19.31	0.86	2685.4	unknown *		13	6	23.22	0.88	3222.9	unknown *							

Table 3.20: Comparative Peak list and R_f value of the *Swertia* – Flavanoid –NP 366nm chromatogram for Green gram *Hypocotyl* with control and treatment

a. *Swertia* Leaf Mulch

Volume A (10µl) showed 10 phytoconstituents and corresponding ascending order of Rf values starts from 0.04 to 0.87 in which highest concentration of the phytoconstituents was found to be 28.39% and its resultant Rf is 0.8 with highest peak area of 5928.6 occupied 34.12% of the total area. The Minimum concentration was about 3.15% at 0.38 R_f with minimum 232.5 peak area.

Solution B(15µl) represented with 6 phytoconstituent ,where Rf value starts from 0.21 to 0.86. Here highest concentration amongst all phytoconstituents was found similar as of solution A (i.e. in Rf. 0.8). Number of peaks were decreased with increase of volume of the solution.(Figure 3.69). Also Rf 0.21 showed maximum area of the peak (6358.5)If we compare both solution results A and B then peak area at 0.21 Rf was three times more in solution B as compared to A (Figure 3.67)

b. Green gram Radicle

In control solution A with 5 peaks ranging from 0.1 -0.89 Rf . Here maximum concentration of 28.51 was found in Rf 0.16 with maximum peak area. Whereas minimum area and concentration was found in 0.8 Rf. It showed similarity with *Swertia* in three peaks. Whereas only one peak is similar to treatment.

Solution B was showing more peaks as compared to A. here 8 peaks were observed, Rf value ranging from 0.19-0.94. Minimum values obtained at Rf. 0.75 and Maximum values at 0.94 Rf. No similarity between *Swertia* and Control has been observed at higher volume.

Comparison between solution A and B showed different peak value. Peak area and concentration also shifted from lower to higher Rf.

Solution A (10µl) showed four peaks ranging from 0.2 -0.95 Rf. Where maximum peak area (4517.1) was observed in 0.95Rf and minimum at 0.06 Rf. That was totally inverse in compare to control.

Solution B showed 5 peaks , lesser than control. Rf value ranging from 0.21 -0.98Rf. Highest concentration was observed in 0.98 Rf whereas maximum peak area was observed in 0.21 Rf. Minimum value for peak area and concentration was observed in 0.49 Rf. (Figure 3.69)

Significant results were obtained when comparison between *Swertia* and Treated solution B was done. Rf 0.21 which was similar in *Swertia* and Treatment but not in control showed maximum concentration and peak area. This similar result showed absorption of this chemical compound in radicle of green gram during treatment.(Table 3.19)

c. Green gram Hypocotyl

Untreated *Hypocotyl* solution of green gram showed 4 and 6 peaks at Solution A and Solution B respectively.

Peak was increased with higher volume. Rf range in Solution A 0.2-0.89 where maximum Rf concentration of 31.43% was observed in 0.6 Rf and maximum peak area was observed in 0.2 Rf which occupied 45% of the total area. Minimum peak area and concentration was observed at 0.71 Rf.

Solution B ranging from0.19 – 088 Rf, which is similar to Solution A. Highest peak area and concentration was observed in 0.19Rf. Whereas 0.72 represented Minimum values. These results were showing similarity between A and B.

Treated hypocotyl solution A and B showed reduction in Peak numbers as compared to Control. Only two peaks were present in solution A ranging from 0.14 and 0.18 Rf. Solution B showed 5 peaks ranging from 0.11-0.98. Treatment peak did not represent any uptake from *Swertia* but reduction was observed. No major difference or significance was observed in solution B of treated hypocotyl.(Figure 3.70)

3.3.3.4 *Tridax* – Terpenoids

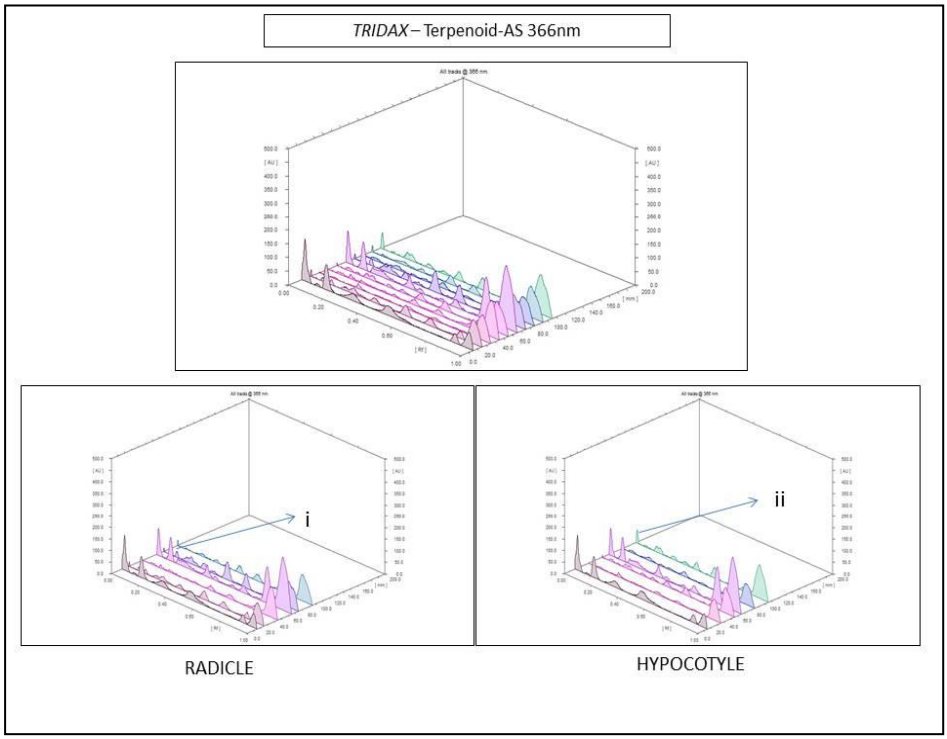


Figure 3.71: 3D display of spectral data at 366 nm AS for Terpenoids

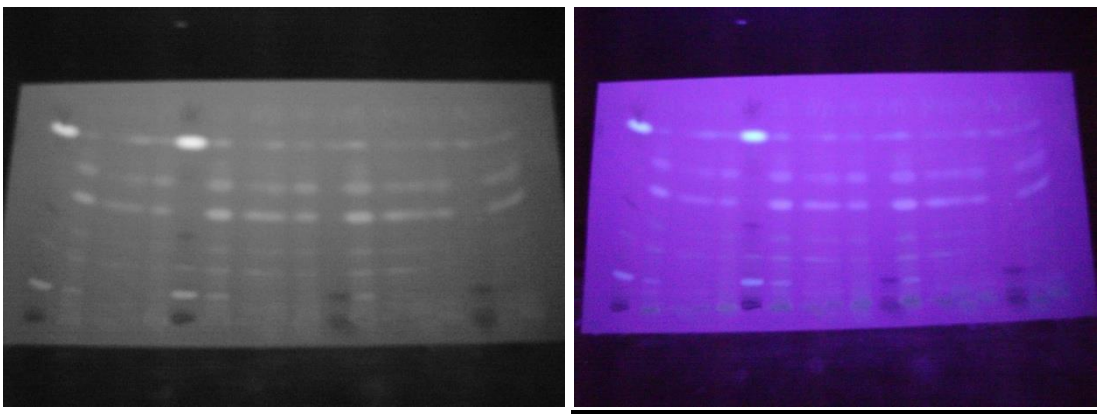


Figure 3.72: TLC plate of *Tridax* Terpenoid

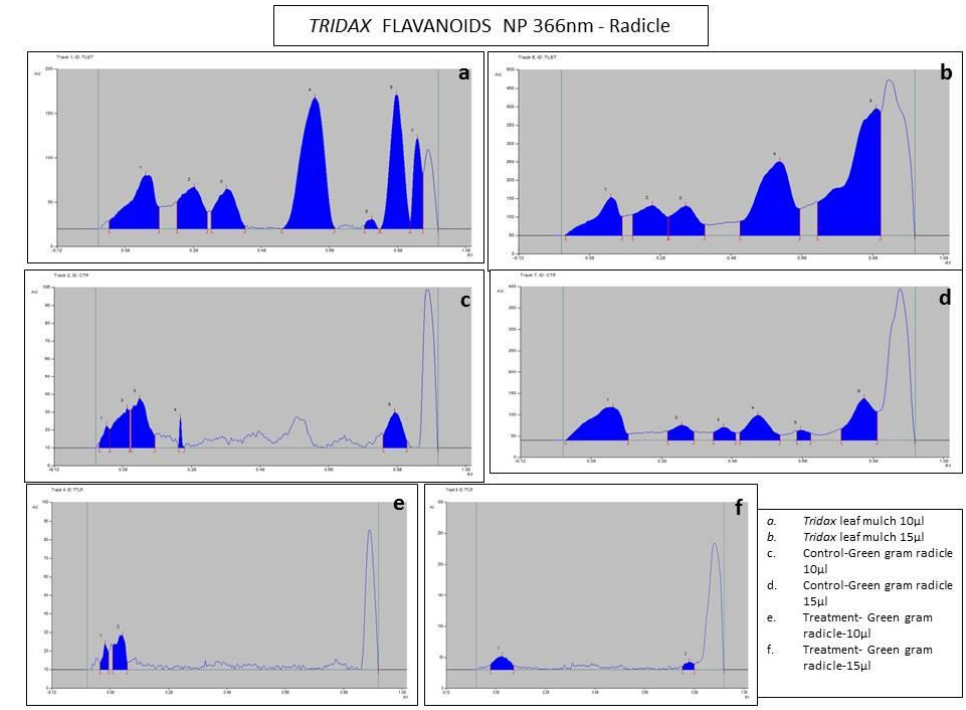


Figure 3.73: Peak densitogram of Terpenoid compound in methanolic extract of *Tridax* leaf, control and treated Radicle of Green gram (10µl and 15µl)at 366nm AS by HPTLC

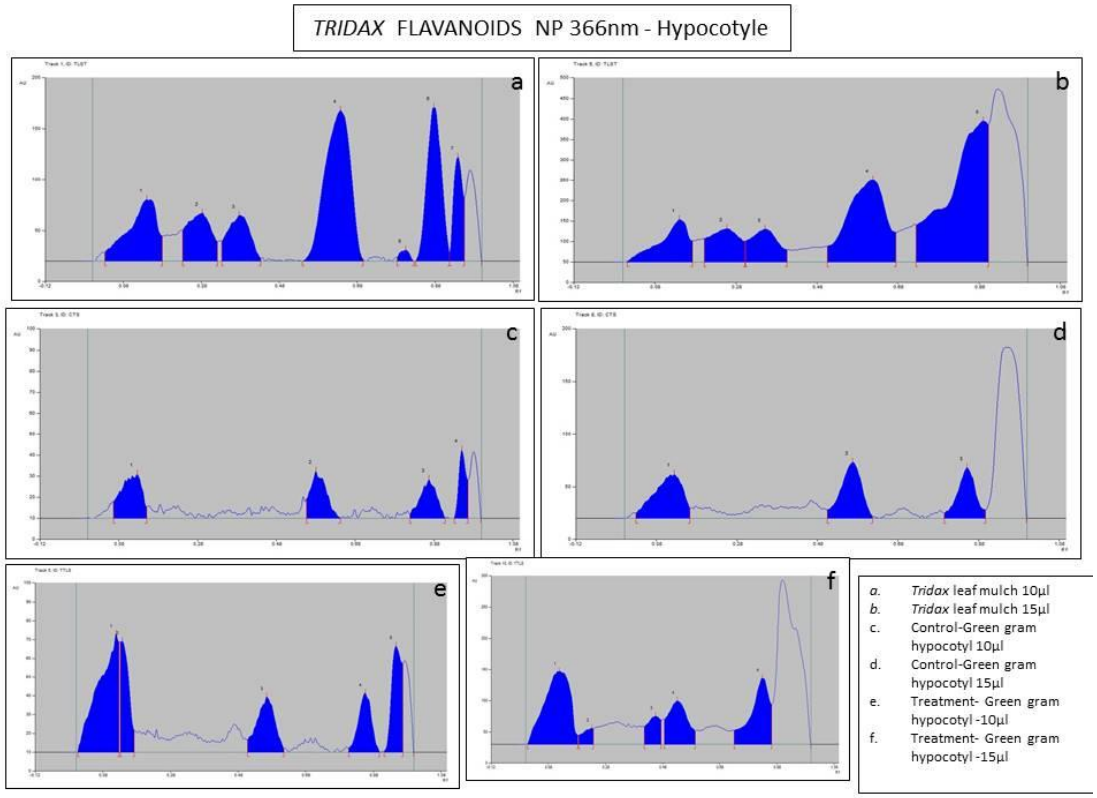


Figure 3.74: Peak densitogram of Terpenoid compound in methanolic extract of *Tridax* leaf, control and treated *Hypocotyl* of green gram (10µl and 15µl)at 366nm AS by HPTLC

Tridax leaf mulch 10µl							Control green gram radicle-10µl							Treatment green gram radicle -10µl					
Track	Peak	Max %	End Rf	Area	Assi sub		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
1	1	45.24	0.06	2777.5	unknown *		2	1	8.29	0.1	283.8	unknown *		4	1	21.77	0.15	195.3	unknown
1	2	27.13	0.19	2257.9	unknown *		2	2	11.18	0.14	283.6	unknown *		4	2	28.1	0.54	560.2	unknown
1	3	7.78	0.35	1310.8	unknown *		2	3	7.83	0.22	348.4	unknown *		4	3	23.46	0.68	601.4	unknown
1	4	10.15	0.55	1783.2	unknown *		2	4	12.2	0.29	674	unknown *		4	4	26.67	0.87	606.2	unknown
1	5	9.71	0.92	847.4	unknown *		2	5	9.68	0.41	485	unknown *							
							2	6	20.93	0.59	1158.8	unknown *							
							2	7	14.84	0.74	899.3	unknown *							
							2	8	15.06	0.9	667.3	unknown *							
Tridax leaf mulch 15µl							Control green gram radicle-15µl							Treatment green gram radicle -15µl					
Track	Peak	Max %	End Rf	Area	Assi sub		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
6	1	22.24	0.05	1813.5	unknown *		7	1	9.24	0.12	371.6	unknown *		9	1	11.64	0.19	246.6	unknown
6	2	18.99	0.13	2104.1	unknown *		7	2	7.51	0.19	462.5	unknown *		9	2	12.47	0.32	310.4	unknown
6	3	4.02	0.17	271.9	unknown *		7	3	10.79	0.24	794.1	unknown *		9	3	32.12	0.5	895.6	unknown
6	4	4.54	0.24	416.2	unknown *		7	4	10.25	0.33	725.9	unknown *		9	4	29.03	29.03	29.03	unknown
6	5	9.83	0.41	1197.9	unknown *		7	5	3.99	0.4	179.9	unknown *		9	5	14.74	0.84	409	unknown
6	6	2.85	0.46	354.2	unknown *		7	6	28.18	0.51	2353.1	unknown *							
6	7	2.01	0.58	167.3	unknown *		7	7	22.91	0.66	2068.2	unknown *							
6	8	5.54	0.68	985.5	unknown *		7	8	7.12	0.85	529.9	unknown *							
6	9	29.97	0.86	5646	unknown *														

Table 3.21: Comparative Peak list and R_f value of the *Tridax* – Terpenoid – 366nm AS chromatogram for Green gram Radicle with control and treatment

Tridax leaf mulch 10µl							Control green gram hypocotyle-10µl							Treatment green gram hypocotyle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
1	1	45.24	0.06	2777.5	unknown *		3	1	100	0.26	357.4	unknown *		5	1	8.72	0.1	255.2	unknown
1	2	27.13	0.19	2257.9	unknown *									5	2	12.66	0.19	317.4	unknown
1	3	7.78	0.35	1310.8	unknown *									5	3	13.33	0.23	411.1	unknown
1	4	10.15	0.55	1783.2	unknown *									5	4	9	0.4	226.1	unknown
1	5	9.71	0.92	847.4	unknown *									5	5	18.65	0.53	744.1	unknown
														5	6	25.49	0.67	1097.9	unknown
														5	7	12.15	0.87	402.3	unknown
Tridax leaf mulch 15µl							Control green gram hypocotyle-15µl							Treatment green gram hypocotyle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
6	1	22.24	0.05	1813.5	unknown *		8	1	100	0.5	608.2	unknown *		10	1	25.91	0.02	567.3	unknown
6	2	18.99	0.13	2104.1	unknown *									10	2	11.15	0.17	485.5	unknown
6	3	4.02	0.17	271.9	unknown *									10	3	10.44	0.23	476.4	unknown
6	4	4.54	0.24	416.2	unknown *									10	4	5.99	0.28	190.1	unknown
6	5	9.83	0.41	1197.9	unknown *									10	5	5.48	0.41	356.8	unknown
6	6	2.85	0.46	354.2	unknown *									10	6	14.64	0.49	899.2	unknown
6	7	2.01	0.58	167.3	unknown *									10	7	20.44	0.65	1447.8	unknown
6	8	5.54	0.68	985.5	unknown *									10	8	5.96	0.83	356.3	unknown
6	9	29.97	0.86	5646	unknown *														

Table 3.22: Comparative Peak list and R_f value of the *Tridax* – Terpenoid – 366nm AS chromatogram for Green gram *Hypocotyl* with control and treatment

a. *Tridax* Leaf Mulch

Tridax with solution A showed 5 phytoconstituents and corresponding ascending order of Rf values starts from 0.06 to 0.92 in which highest concentration of the phytoconstituents was found to be 45.24% and its resultant Rf is 0.06 with highest peak area of 2777.5 The Minimum concentration was about 9.71% at 0.92 R_f with minimum 847.4 peak area.

Solution B represented witht 9 phytoconstituent present in it, where Rf value starts from 0.05 to 0.86. Here highest concentration amongst all phytoconstituents was found to be 29.97% with peak area of 5646 at 0.86 Rf. The lowest concentration was of 2.01% with minimum peak area of 167.3 at 0.58 Rf.

Compared to Sol A . Sol B has more number of constituents, also found variation in peaks and area of the peak (Figure 3.71)

b. Green Gram Radicle

Solution A and B of Untreated Green gram Radicle showed equal number of peaks in both the volumes (i.e 8). Solution A gave Rf value Ranging from 0.1-0.9, In which maximum peak area of 1158.8 and concentration (20.93%) was observed at 0.59Rf. Whereas minimum was observed at 0.1 and 0.22Rf.(Figure 3.73)

Solution B resulted into Rf range from 0.12-0.85. Maximum value at 0.51 and minimum at 0.12. Though the number of peak was similar values and range of Rf were different. It shows resemblance with *Tridax* by 3 peaks (0.24, 0.4, and 0.86)

Treated Radicle represented four and five peaks in Solution A and B respectively. No major change in peak area was observed in all peaks of solution A except 0.15Rf where area was minimum by 195.2AU.Solution B showed remarkable change in Peak

area at 0.65 Rf Maximum area of 1035.5 AU was observed in 0.65 which occupied 35.74% of the total area.(Table 3.21)

c. Green gram hypocotyl.

Control in both volume showed one peak at 0.26 Rf and 0.5 Rf in higher volume. Treated Hypocotyl showed 7 and 8 peaks in solution A and B respectively. In solution A Rf range from 0.1-0.87 where as in solution B , Rf Range from0.02-0.83.(Figure 3.74)

Solution A of treated hypocotyl, showed Maximum values in 0.67Rf whereas minimum in 0.1Rf. Similarly in Solution B, maximum value of area and concentration was observed at Rf 0.65 and 0.02. Minimum value was observed at 0.41 and 0.28 Rf.(Table 3.22)

As no peaks were observed in control, all peaks were showing resemblance with *Tridax* solution A and B.

3.3.3.2. *Tridax* – Phenolics

Phenolic study was done using Fast blue reagent and results were obtained at 254,366 and 540 nm . Out of most significant results were shown.

a. *Tridax* Leaf Mulch

Result showed 16 and 19 peaks in *Tridax* leaf mulch with 10µl(A) and 15µl(B) respectively(Figure.3.75,3.76)

Rf value ranging from 0.08-0.9Rf in solution A, and 0.03-0.99Rf in Solution B. Maximum area was found in 0.9 Rf both the solution. Minimum area was in 0.08 Rf for solution A and 0.03 Rf for solution B.

b. Green gram Radicle

Solution A and Solution B represented with total 14 and 20 peaks in control which was highest among all. Rf value from 0.03-0.93 and 0.08-1 in solution A and B respectively. Maximum values were observed at 0.96 Rf in solution A and minimum at 0.24,0.36 Rf., Solution B also gave similar results where maximum value at 0.93and 1 Rf. Minimum value was at 0.15 Rf. Treated radicle with volume A showed 15 peak ranging from 005-0.97 Rf value. Maximum value observed at 0.97 and minimum at 0.21 and 0.22 Rf. In solution B Rf value ranging from 0.03-0.99 showing maximum area and concentration at 0.99 Rf and Minimum value at 0.09Rf. and 0.18Rf (Figure 3.77, Table 3.23)

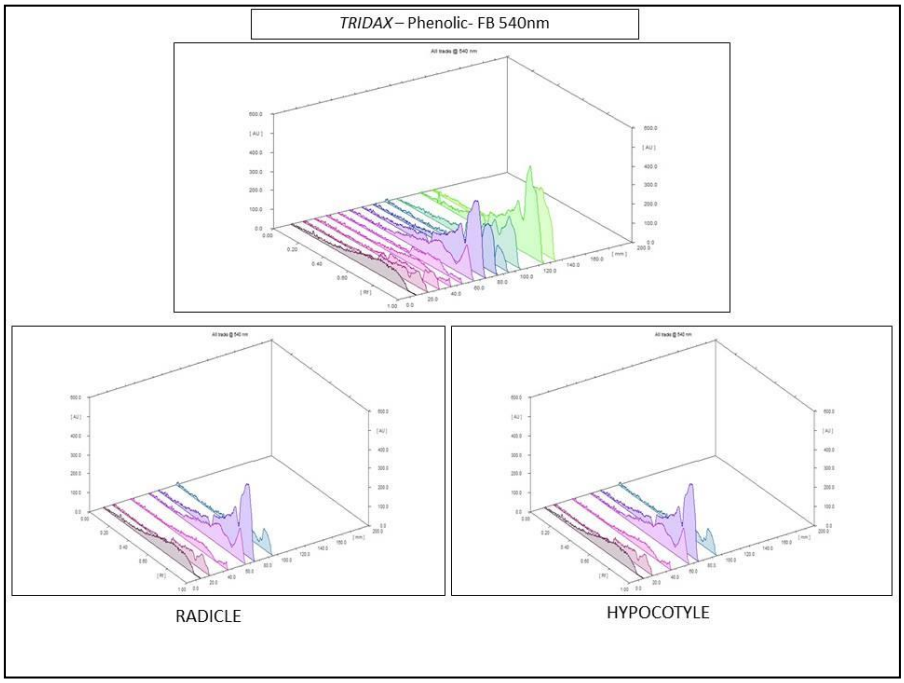


Figure 3.75: 3D display of spectral data at FB 540nm Phenolics

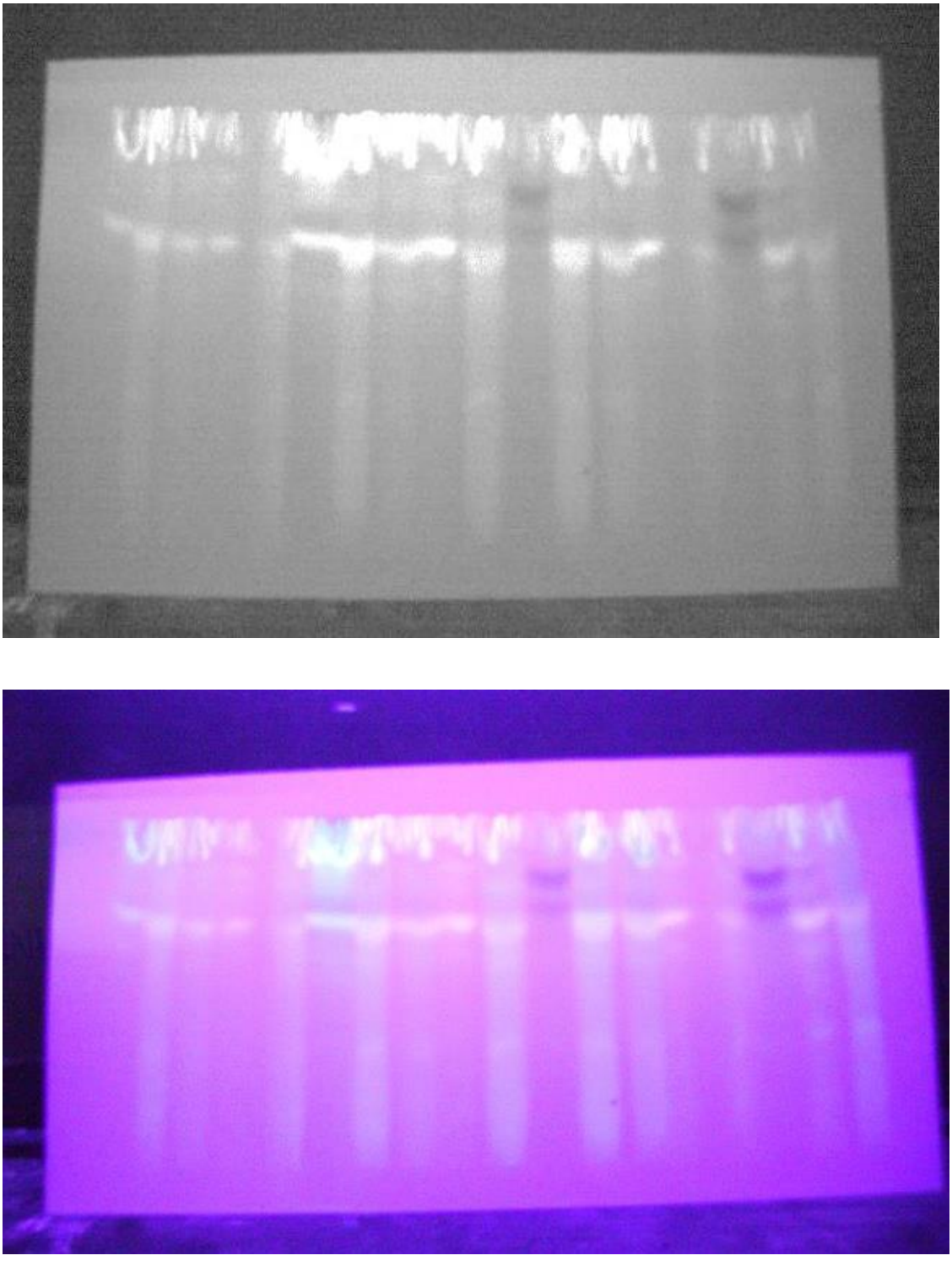


Figure 3.76: TLC plate of *Tridax* Phenolics

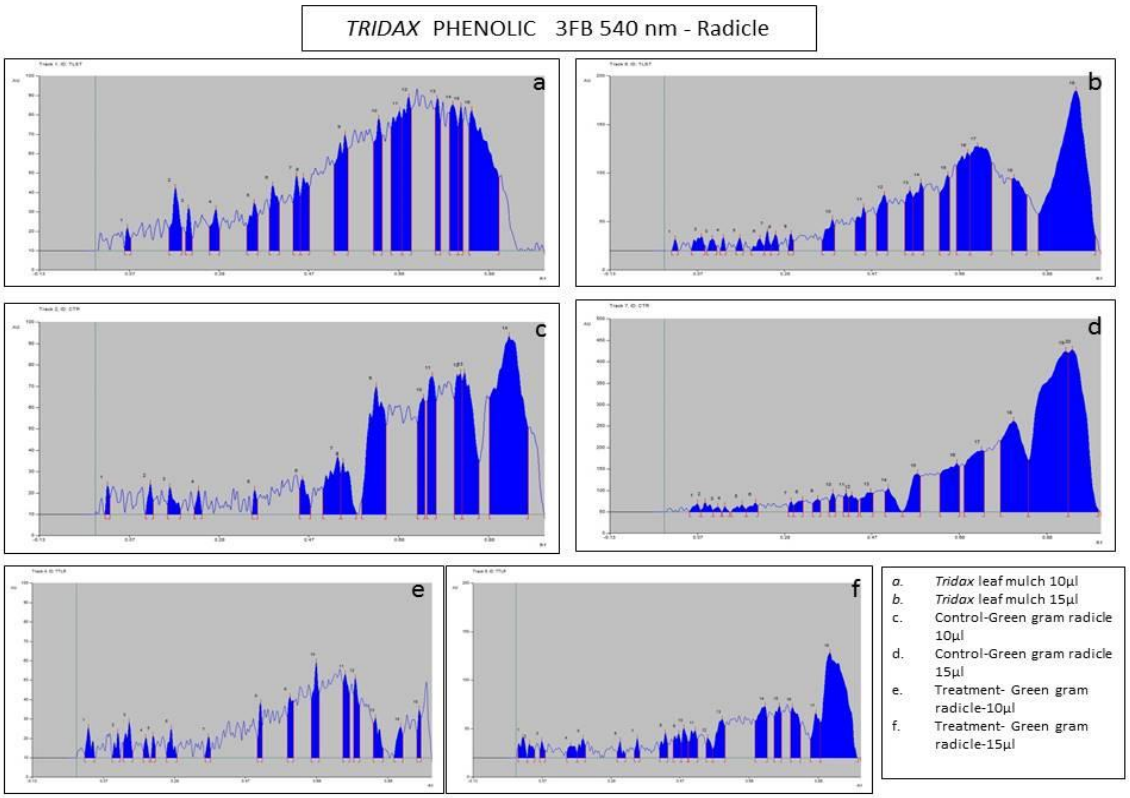


Figure 3.77: Peak densitogram of Phenolic compounds in methanolic extract of *Tridax* leaf, control and treated Radicle of Green gram (10µl and 15µl) at FB 540nm by HPTLC

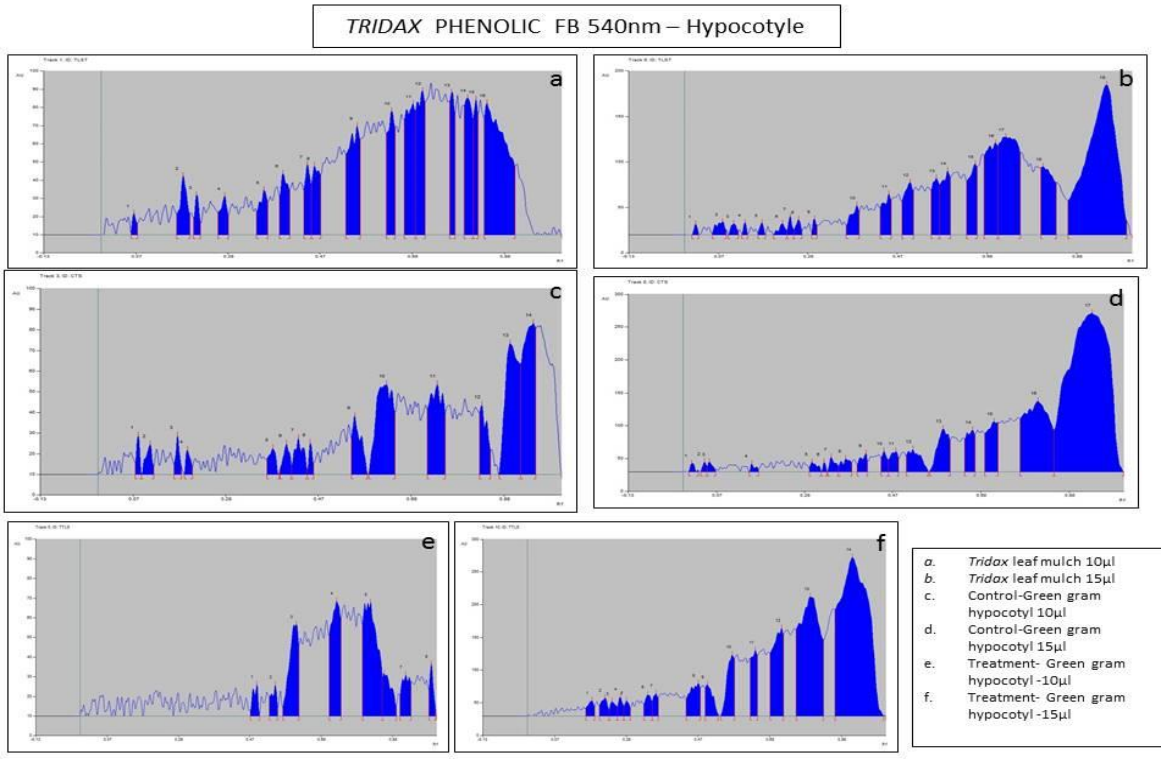


Figure 3.78: Peak densitogram of Phenolic compound in methanolic extract of *Tridax* leaf, control and treated *Hypocotyl* of green gram (10µl and 15µl) at FB 540nm by HPTLC

Tridax leaf mulch 10µl							Control green gram radicle-10µl							Treatment green gram radicle -10µl					
Track	Peak	Max %	End Rf	Area	Assi sub		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
1	1	1.47	0.08	93.6	unknown *		2	1	2.58	0.03	88.3	unknown *		4	1	4.47	0.05	191.1	unknown
1	2	4.04	0.19	476	unknown *		2	2	2.75	0.13	124.5	unknown *		4	2	3.73	0.12	121	unknown
1	3	2.74	0.22	199.4	unknown *		2	3	2.41	0.19	169.7	unknown *		4	3	5.28	0.16	247.1	unknown
1	4	2.66	0.28	296.4	unknown *		2	4	2.17	0.24	93.2	unknown *		4	4	2.99	0.21	90.4	unknown
1	5	3.09	0.36	401.5	unknown *		2	5	2.18	0.36	80.3	unknown *		4	5	3.26	0.22	81.5	unknown
1	6	4.2	0.41	533.3	unknown *		2	6	3.14	0.48	241.6	unknown *		4	6	4.32	0.28	173.4	unknown
1	7	4.85	0.46	450.3	unknown *		2	7	5.12	0.55	643.6	unknown *		4	7	3.07	0.38	87.8	unknown
1	8	4.72	0.48	582.8	unknown *		2	8	4.67	0.58	420.8	unknown *		4	8	8.02	0.52	239.7	unknown
1	9	7.46	0.56	1349.3	unknown *		2	9	11.36	0.65	1906.8	unknown *		4	9	8.99	0.61	426.8	unknown
1	10	8.5	0.64	1038.9	unknown *		2	10	10.33	0.73	761.5	unknown *		4	10	14.14	0.68	725.4	unknown
1	11	8.97	0.68	1432.5	unknown *		2	11	12.31	0.76	1075.4	unknown *		4	11	12.34	0.77	655.7	unknown
1	12	9.86	0.7	1325.1	unknown *		2	12	12.54	0.82	941.5	unknown *		4	12	11.75	0.8	508.6	unknown
1	13	9.75	0.77	808.2	unknown *		2	13	12.61	0.85	1563.2	unknown *		4	13	5.92	0.86	310	unknown
1	14	9.38	0.81	1215.7	unknown *		2	14	15.84	0.96	4682.3	unknown *		4	14	4.58	0.92	225	unknown
1	15	9.28	0.82	691	unknown *									4	15	7.13	0.97	203.7	unknown
1	16	9.03	0.9	3097.6	unknown *														
Tridax leaf mulch 15µl							Control green gram radicle-15µl							Treatment green gram radicle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned substance		Track	Peak	Max %	End Rf	Area	Assigned
6	1	1.29	0.03	77.6	unknown *		7	1	1.1	0.08	239.6	unknown *		9	1	3.53	0.03	301.5	unknown
6	2	1.57	0.09	261.1	unknown *		7	2	1.27	0.11	288.8	unknown *		9	2	2.4	0.05	183.7	unknown
6	3	1.31	0.12	146.4	unknown *		7	3	0.69	0.13	126	unknown *		9	3	2.88	0.09	163.1	unknown
6	4	1.45	0.14	80.1	unknown *		7	4	0.75	0.15	87.9	unknown *		9	4	2.12	0.18	261.2	unknown
6	5	1.41	0.18	104.4	unknown *		7	5	0.96	0.19	272.9	unknown *		9	5	3.27	0.2	286.9	unknown
6	6	1.33	0.23	165.8	unknown *		7	6	1.2	0.22	323.8	unknown *		9	6	2.84	0.32	176.1	unknown
6	7	2.21	0.24	151.7	unknown *		7	7	1.39	0.3	188.7	unknown *		9	7	3.3	0.36	169.3	unknown
6	8	1.85	0.26	170.1	unknown *		7	8	1.56	0.32	409.8	unknown *		9	8	4.23	0.44	356.8	unknown
6	9	1.89	0.3	128.4	unknown *		7	9	1.74	0.36	409.4	unknown *		9	9	4.11	0.48	406.7	unknown
6	10	3.52	0.39	549.6	unknown *		7	10	2.55	0.39	452.1	unknown *		9	10	5.07	0.5	395.3	unknown
6	11	4.86	0.46	768	unknown *		7	11	2.59	0.42	427.4	unknown *		9	11	4.69	0.53	516.6	unknown
6	12	6.24	0.51	1088.1	unknown *		7	12	2.29	0.45	639.4	unknown *		9	12	3.43	0.57	271.1	unknown
6	13	6.72	0.57	914.2	unknown *		7	13	2.65	0.48	950.5	unknown *		9	13	6.57	0.61	870.7	unknown
6	14	7.59	0.59	1299.4	unknown *		7	14	3.16	0.55	1008.1	unknown *		9	14	8.77	0.73	1391.5	unknown
6	15	8.36	0.66	1379.6	unknown *		7	15	5.16	0.59	1782.5	unknown *		9	15	8.8	0.77	909.1	unknown
6	16	10.9	0.7	2476.8	unknown *		7	16	6.58	0.68	3779.1	unknown *		9	16	8.61	0.83	1135.3	unknown
6	17	11.61	0.75	4242.5	unknown *		7	17	8.34	0.73	5012.1	unknown *		9	17	7.6	0.88	880.2	unknown
6	18	8.12	0.83	1982.9	unknown *		7	18	12.32	0.83	9302.8	unknown *		9	18	17.8	0.99	6153.3	unknown
6	19	17.78	0.99	10010.1	unknown *		7	19	21.73	0.93	21758.3	unknown *							
							7	20	21.94	1	12968.2	unknown *							

Table 3.23: Comparative Peak list and R_f value of the *Tridax* – Phenolics – FB 540nm chromatogram for Green gram Radicle with control and treatment

C. Green Gram Hypocotyl

Control of green gram hypocotyl showed 14 and 17 peak in solution A and B respectively. Rf value ranging from 0.09-0.94 in 10µl volume, and 0.04-1 in 15 µl volume. Maximum area was represented in 0.94 Rf with 1810.4 AU in solution A. it also represented the highest concentration of 17.84%.Minimum value was observed at 0.2 and 0.47 Rf. Solution B showed maximum area of 20889.2 at Rf 1 and Minimum at 0.05 and 0.17 Rf. Treated hypocotyl solution A and B showed total 8 peaks and 14 peaks ranging from 0.5-1 Rf and 0.19 Rf -1 Rf Respectively. Out of this solution A has maximum peak area and concentration at 0.73 and 085 Rf while Solution B has maximum value at 0.83 and 1 Rf. Minimum value was observed at 0.5Rf and 0.25Rf in solution A and B.(Table 3.24)

Above results of Radicle showed no much similarity between *Tridax* leaf mulch and treated radicle but hypocotyl results were showing decrease in peak and area as compared to control.(Figure 3.78)

Tridax leaf mulch 10µl						Control green gram hypocotyle-10µl						Treatment green gram hypocotyle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned s
1	1	1.47	0.08	93.6	unknown *	3	1	4.61	0.09	123.5	unknown *	5	1	6.07	0.5	211.3	unknown
1	2	4.04	0.19	476	unknown *	3	2	3.57	0.12	180.7	unknown *	5	2	6.02	0.56	219.9	unknown
1	3	2.74	0.22	199.4	unknown *	3	3	4.58	0.18	145.8	unknown *	5	3	17.68	0.61	1136.7	unknown
1	4	2.66	0.28	296.4	unknown *	3	4	2.87	0.2	107.6	unknown *	5	4	22.17	0.73	1448.2	unknown
1	5	3.09	0.36	401.5	unknown *	3	5	3.08	0.39	184.8	unknown *	5	5	21.92	0.85	2093.6	unknown
1	6	4.2	0.41	533.3	unknown *	3	6	3.6	0.42	194	unknown *	5	6	8.18	0.89	503	unknown
1	7	4.85	0.46	450.3	unknown *	3	7	4.3	0.45	303.5	unknown *	5	7	7.92	0.93	462.3	unknown
1	8	4.72	0.48	582.8	unknown *	3	8	3.7	0.47	106.1	unknown *	5	8	10.04	1	264.6	unknown
1	9	7.46	0.56	1349.3	unknown *	3	9	6.91	0.58	483.9	unknown *						
1	10	8.5	0.64	1038.9	unknown *	3	10	10.64	0.64	1473.9	unknown *						
1	11	8.97	0.68	1432.5	unknown *	3	11	10.65	0.75	1186.2	unknown *						
1	12	9.86	0.7	1325.1	unknown *	3	12	8.17	0.85	494.3	unknown *						
1	13	9.75	0.77	808.2	unknown *	3	13	15.48	0.91	1739.5	unknown *						
1	14	9.38	0.81	1215.7	unknown *	3	14	17.84	0.94	1810.4	unknown *						
1	15	9.28	0.82	691	unknown *												
1	16	9.03	0.9	3097.6	unknown *												
Tridax leaf mulch 15µl						Control green gram hypocotyle-15µl						Treatment green gram hypocotyle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned s
6	1	1.29	0.03	77.6	unknown *	8	1	1.58	0.04	119.1	unknown *	10	1	2.25	0.19	383.4	unknown
6	2	1.57	0.09	261.1	unknown *	8	2	1.9	0.05	112.7	unknown *	10	2	2.62	0.23	479.4	unknown
6	3	1.31	0.12	146.4	unknown *	8	3	1.82	0.07	163.8	unknown *	10	3	2.13	0.25	333.1	unknown
6	4	1.45	0.14	80.1	unknown *	8	4	1.52	0.17	121.3	unknown *	10	4	2.81	0.27	342	unknown
6	5	1.41	0.18	104.4	unknown *	8	5	1.83	0.31	214	unknown *	10	5	2.26	0.29	298.4	unknown
6	6	1.33	0.23	165.8	unknown *	8	6	1.86	0.33	78.5	unknown *	10	6	3.12	0.35	538.5	unknown
6	7	2.21	0.24	151.7	unknown *	8	7	2.74	0.35	275.4	unknown *	10	7	3.26	0.36	449.7	unknown
6	8	1.85	0.26	170.1	unknown *	8	8	2.45	0.38	381.5	unknown *	10	8	4.79	0.48	1347.6	unknown
6	9	1.89	0.3	128.4	unknown *	8	9	3.46	0.42	430.6	unknown *	10	9	4.59	0.53	948.3	unknown
6	10	3.52	0.39	549.6	unknown *	8	10	3.88	0.47	342.5	unknown *	10	10	8.96	0.58	1784.8	unknown
6	11	4.86	0.46	768	unknown *	8	11	3.84	0.49	518.4	unknown *	10	11	9.63	0.64	1587.1	unknown
6	12	6.24	0.51	1088.1	unknown *	8	12	4.29	0.56	926.6	unknown *	10	12	12.87	0.71	3629.2	unknown
6	13	6.72	0.57	914.2	unknown *	8	13	8.12	0.61	1590.9	unknown *	10	13	17.46	0.83	9621.5	unknown
6	14	7.59	0.59	1299.4	unknown *	8	14	7.89	0.66	1162.7	unknown *	10	14	23.25	1	17655	unknown
6	15	8.36	0.66	1379.6	unknown *	8	15	9.46	0.71	1720.4	unknown *						
6	16	10.9	0.7	2476.8	unknown *	8	16	13.36	0.84	5710.7	unknown *						
6	17	11.61	0.75	4242.5	unknown *	8	17	30.01	1	20889.2	unknown *						
6	18	8.12	0.83	1982.9	unknown *												
6	19	17.78	0.99	10010.1	unknown *												

Table 3.24: Comparative Peak list and R_f value of the *Tridax* – Phenolics – FB 540nm chromatogram for Green gram *Hypocotyl*

3.3.3.3 *Tridax* – Flavonoid

Flavonoid results in green gram radicle and *Hypocotyl* showed various peaks as shown in figure 3.79

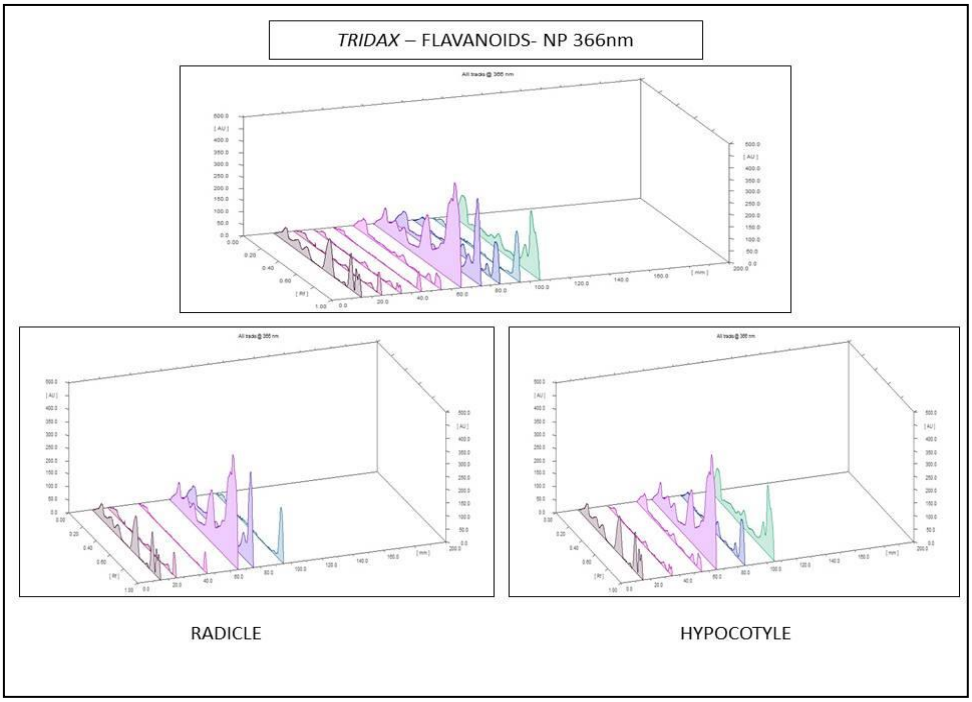


Figure 3.79: 3D display of spectral data at NP 366nm Flavonoid

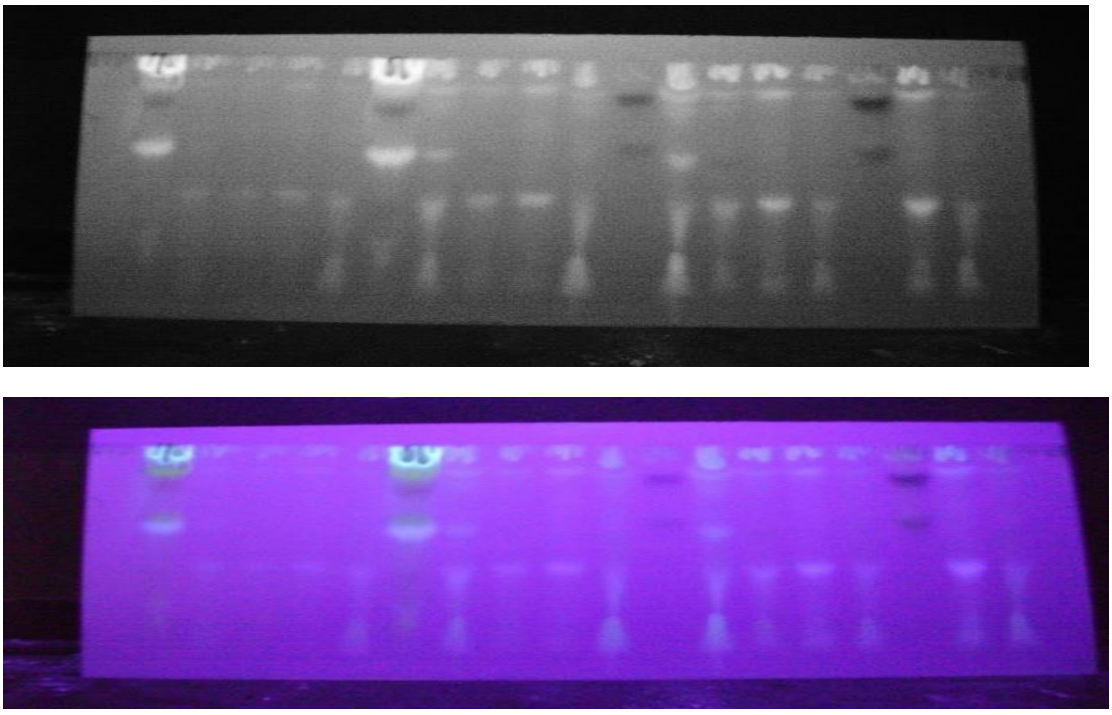


Figure 3.80: TLC plate of *Tridax* Flavonoid

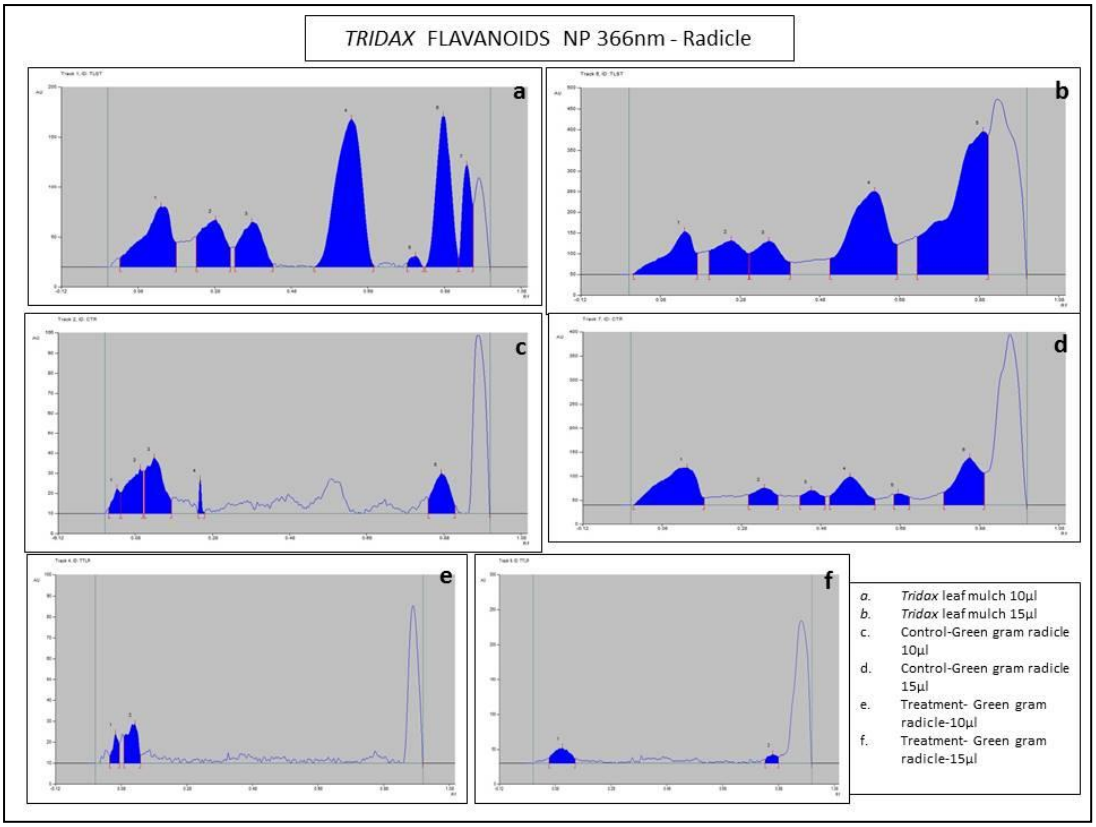


Figure 3.81: Peak densitogram of Flavanoid compounds in methanolic extract of *Tridax* leaf, control and treated Radicle of Green gram (10µl and 15µl) at NP 366nm by HPTLC

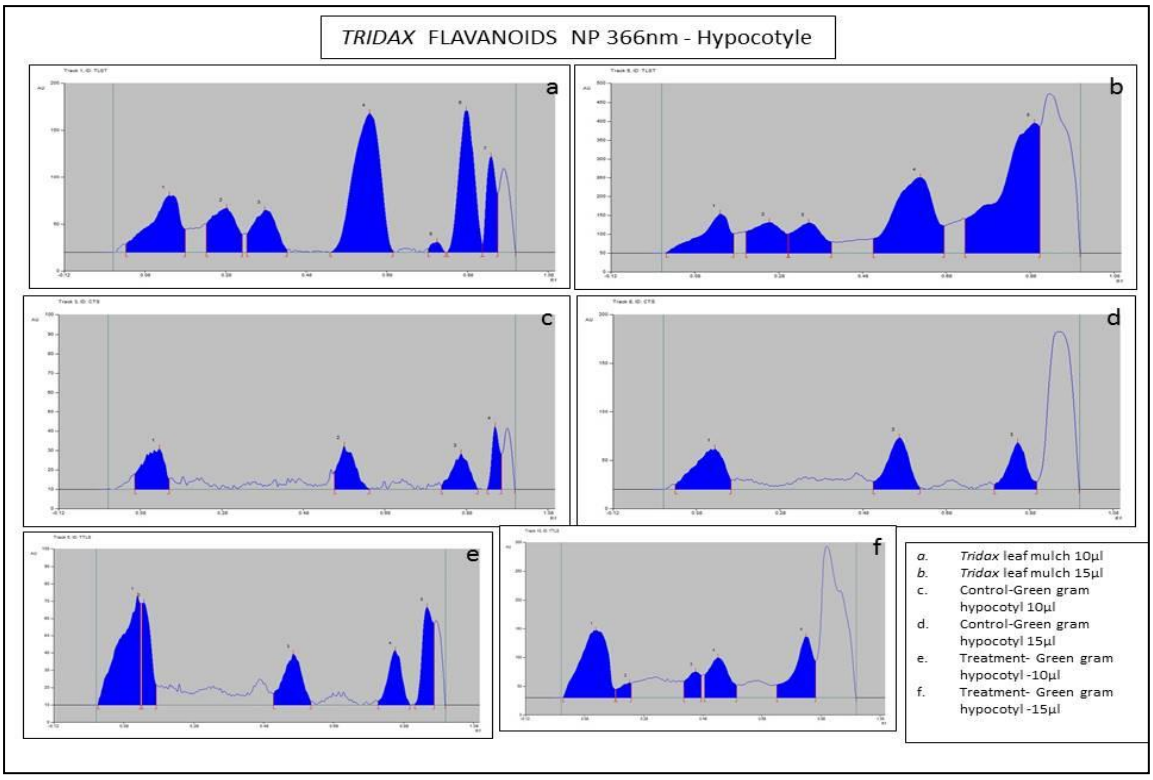


Figure 3.82: Peak densitogram of Flavanoid compound in methanolic extract of *Tridax* leaf, control and treated *Hypocotyl* of green gram (10µl and 15µl) at FB 540nm by HPTLC

Tridax leaf mulch 10µl						Control green gram radicle-10µl						Treatment green gram radicle -10µl					
Track	Peak	Max %	End Rf	Area	Assi sub	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
Track	Peak	Max %	End Rf	Area	Assigned substance	2	1	12.43	0.04	228.1	unknown *	4	1	42.85	0.07	234.9	unknown
1	1	10.71	0.18	4234.2	unknown *	2	2	22.38	0.1	811.7	unknown *	4	2	57.15	0.14	619	unknown
1	2	8.34	0.32	2754.1	unknown *	2	3	27.84	0.17	1146.3	unknown *						
1	3	7.93	0.43	2470.2	unknown *	2	4	17.15	0.26	91.7	unknown *						
1	4	26.22	0.7	9311	unknown *	2	5	20.2	0.91	791.2	unknown *						
1	5	1.92	0.83	262.2	unknown *												
1	6	26.75	0.92	5280.4	unknown *												
1	7	18.14	0.96	2289.8	unknown *												
Tridax leaf mulch 15µl						Control green gram radicle-15µl						Treatment green gram radicle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
6	1	12.75	0.17	6732.1	unknown *	7	1	23.89	0.19	6904.1	unknown *	9	1	63.44	0.15	1222.5	unknown
6	2	10.05	0.3	5656.5	unknown *	7	2	11.02	0.37	1797.2	unknown *	9	2	36.56	0.88	409.7	unknown
6	3	9.92	0.41	5169	unknown *	7	3	9.37	0.49	1301.4	unknown *						
6	4	24.75	0.68	17927.4	unknown *	7	4	18.18	0.62	3533.2	unknown *						
6	5	42.54	0.9	30249.9	unknown *	7	5	7.34	0.7	705.3	unknown *						
						7	6	30.2	0.89	5744.4	unknown *						

Table 3.25: Comparative Peak list and R_f value of the *Tridax* – Flavanoid– NP 366nm chromatogram for Green gram Radicle with control and treatment

Tridax leaf mulch 10µl						Control green gram hypocotyle-10µl						Treatment green gram hypocotyle -10µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
Track	Peak	Max %	End Rf	Area	Assigned substance	3	1	22.32	0.15	1049.8	unknown *	5	1	26.26	0.13	3457.3	unknown
1	1	10.71	0.18	4234.2	unknown *	3	2	23.81	0.64	853.9	unknown *	5	2	24.68	0.17	1419.4	unknown
1	2	8.34	0.32	2754.1	unknown *	3	3	19.56	0.91	719.9	unknown *	5	3	12.3	0.62	1484.7	unknown
1	3	7.93	0.43	2470.2	unknown *	3	4	34.3	0.97	568.8	unknown *	5	4	13.15	0.9	1156.5	unknown
1	4	26.22	0.7	9311	unknown *							5	5	23.62	0.97	1635.2	unknown
1	5	1.92	0.83	262.2	unknown *												
1	6	26.75	0.92	5280.4	unknown *												
1	7	18.14	0.96	2289.8	unknown *												
Tridax leaf mulch 15µl						Control green gram hypocotyle-15µl						Treatment green gram hypocotyle -15µl					
Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned substance	Track	Peak	Max %	End Rf	Area	Assigned
6	1	12.75	0.17	6732.1	unknown *	8	1	29.32	0.16	2854.1	unknown *	10	1	32.14	0.18	10166.8	unknown
6	2	10.05	0.3	5656.5	unknown *	8	2	37.15	0.62	2605.2	unknown *	10	2	7.18	0.24	932.2	unknown
6	3	9.92	0.41	5169	unknown *	8	3	33.53	0.9	2026.2	unknown *	10	3	12.48	0.48	1961.3	unknown
6	4	24.75	0.68	17927.4	unknown *							10	4	19.11	0.6	4525.3	unknown
6	5	42.54	0.9	30249.9	unknown *							10	5	29.09	0.86	6405.6	unknown

Table 3.26: Comparative Peak list and R_f value of the *Tridax* – Flavanoid –NP 366nm chromatogram for Green gram *Hypocotyl* with control and treatment

a. *Tridax* Leaf Mulch

Results of *Tridax* with solution A showed 7 phytoconstituents and corresponding ascending order of Rf values starts from 0.18 to 0.96 in which highest concentration of the phytoconstituents was found to be 26.75% and its resultant Rf is 0.92.Maximum peak area of 9311 was observed in 0.7Rf and Minimum concentration was about 1.92% at $0.83R_f$ with minimum 262.2 peak area. Solution B showed Rf value starts from 0.17-0.9 in which maximum concentration as observed at 0.9Rf and minimum at 0.41Rf. Number of peaks was reduced at higher volume.(Figure 3.79, Figure 3.80)

b. Green gram Radicle

Solution A and B resulted in 5 and 6 number of peaks in each and Rf Value starts from 0.04-0.91 and 0.19-0.89 respectively. Minimum concentration and area was observed at 0.26Rf at A, and 0.7Rf at B. Maximum value was obtained at 0.17Rf in A and 0.19 in B. which showed some similarity between two solutions.(Figure 3.81)

Treated solution with Volume A and Volume B showed 2 peaks in each. It was not showing resemblance with either control or *Tridax* observations.(Table 3.25)

C. Green Gram *Hypocotyl*

In this study results were different than radicle. As in radicle control showed more peaks than treatment , In case of Hypocotyl treatment showed more peaks (5) as compared to control(3-4).(Figure 3.82)

Green gram hypocotyl results in control were showing 4 peaks ranging from 0.15-0.97 Rf in Volume A and from 0.18-0.86Rf in Volume B.Maximum results were obtained at 0.13 Rf at volume A and 0.18 Rf at Volume B (Table 3.26)

3.3.4 *Chloris* : *Tridax* leaf mulch at 254nm

Similar study was conducted with weeds grown at 0.5% treatment. only *Chloris* germinated under *Tridax* treatment. The analysis was done using chloroform : Methanol solvent. No significant outcome could be drawn from the results. (Figure 3.83)

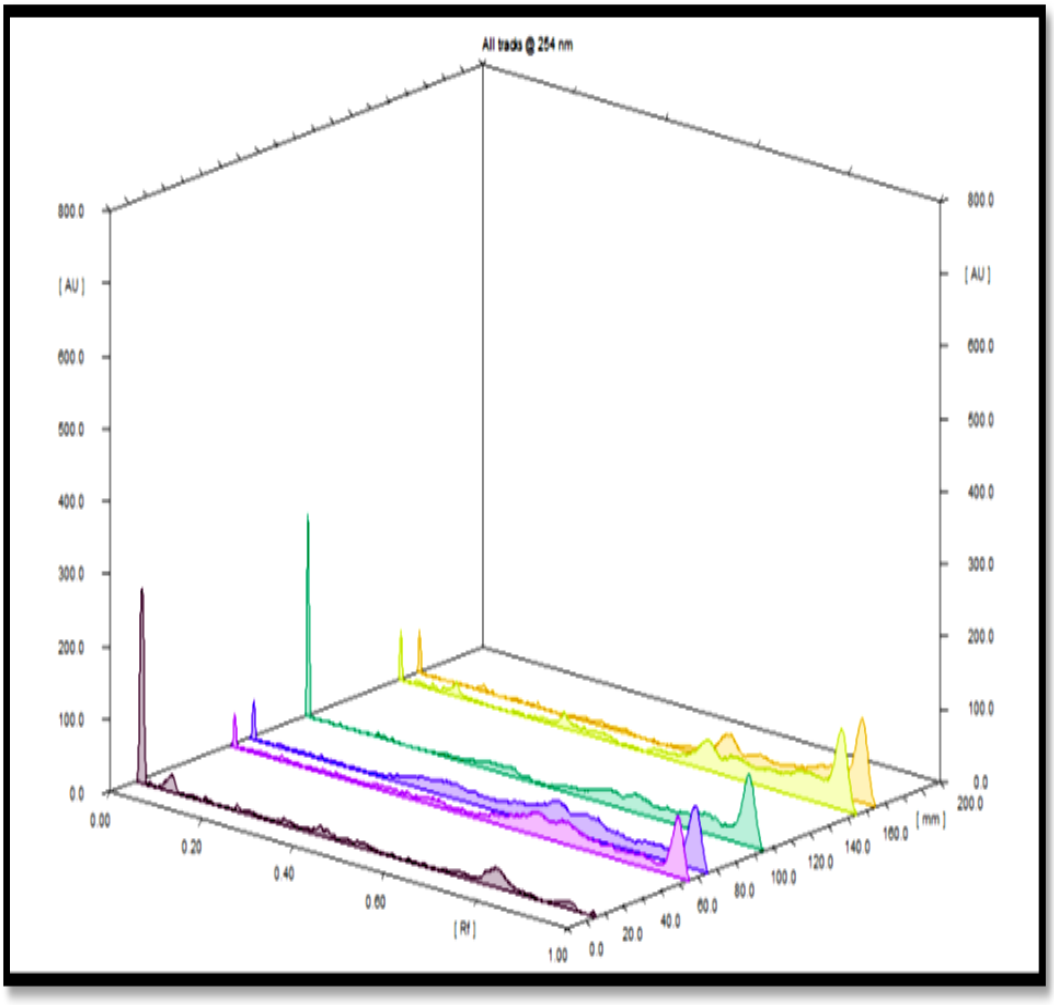


Figure :3.83. 3D Chromatogram of *Chloris* with *Tridax* treatment.

a. *Tridax* Leaf Mulch

Results were showing equal number of peaks for both the volumes A and B. In volume A, Rf range started with 0.03 to 0.83 and 0.69-1 in volume B. Volume A representing maximum area at 0.03Rf and Minimum at 0.09 Rf. Volume B: Maximum area was of 2921.7 occupying 57% of the total area at Rf 1. and minimum at 0.76.(Figure 3.84)

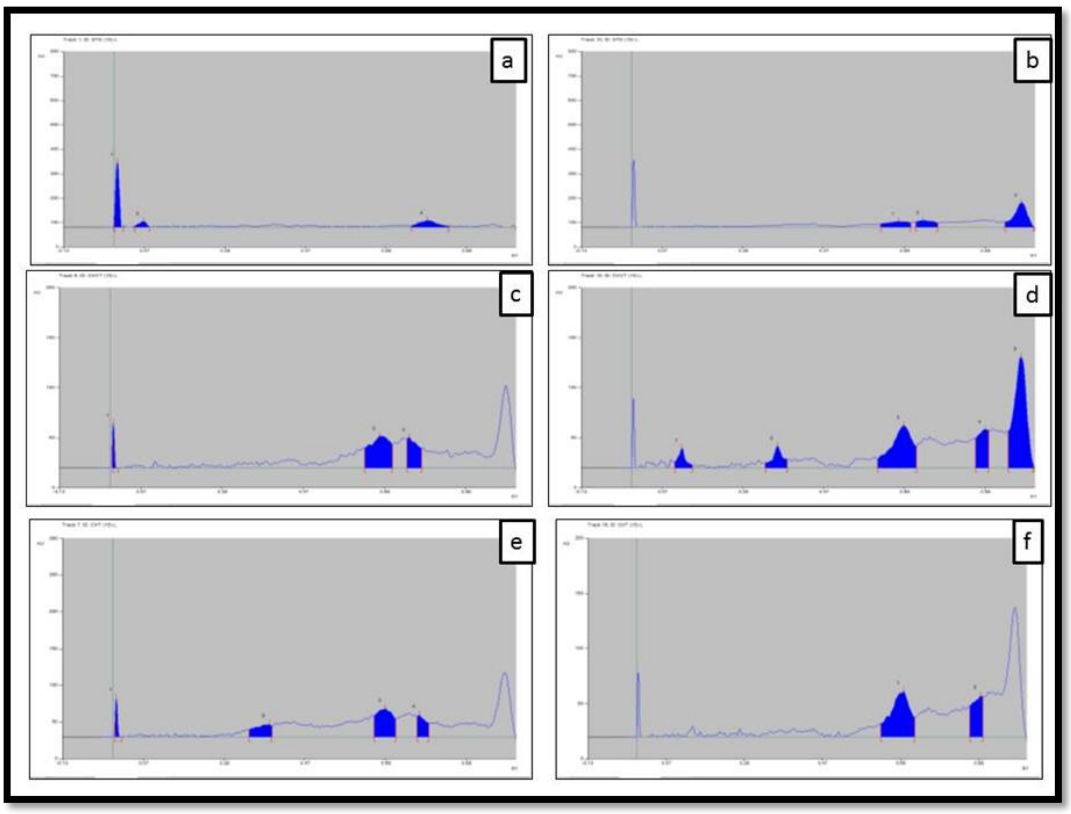


Figure 3.84. : Peak Densitogram of *Chloris* a-b : *Tridax* Leaf mulch at 10µl and 15µl,c-d : Control of *Chloris*, e-f: Treated *Chloris* at 254nmble 3. Comaprative study of *Chloris* with *Tridax*

b. Chloris :Untreated seedlings of *Chloris* were showing three peaks in volume A. Maximum peak area was 1498.7 AU at 0.7 Rf and Minimum at 0.02Rf. Volume B showed total 5 peaks where maximum area found at Rf 1 and Minimum at 0.15. one peak at 1 Rf was similar with *Tridax* at volume B.(Table 3.27)

Treated solution of *Chloris* at volume A showed four peaks and at volume B two peaks. In volume A 0.4 Rf peak was additional than control. In Volume B three peaks were not detected (At 0.15,0.39,1Rf). Above data represented absence of Peak showing phytoconstituents, can conclude that suppression of some chemicals during treatment.

Tridax 10µl							Control- Chloris 10µl							Treated- Chloris 10µl					
Track	Peak	Max %	End Rf	Area	Area %		Track	Peak	Max %	End Rf	Area	Area %		Track	Peak	Max %	End Rf	Area	Area %
1	1	84.58	0.03	2216.2	59.26		6	1	41.68	0.02	189.6	7.83		7	1	38.14	0.02	249.2	8.43
1	2	7.17	0.09	404.1	10.81		6	2	29.82	0.7	1496.7	61.76		7	2	12.44	0.4	646.3	21.86
1	3	8.25	0.83	1119.3	29.93		6	3	28.5	0.77	737	30.41		7	3	27.66	0.7	1469.8	49.71
														7	4	21.76	0.78	591.5	20
Tridax 10µl							Control- Chloris 15µl							Treated- Chloris 15µl					
Track	Peak	Max %	End Rf	Area	Area %		Track	Peak	Max %	End Rf	Area	Area %		Track	Peak	Max %	End Rf	Area	Area %
10	1	15.28	0.69	1152	22.49		15	1	8.44	0.15	337.7	4.83		16	1	52.61	0.71	1885	66.97
10	2	17.97	0.76	1049.2	20.48		15	2	9.4	0.39	503.3	7.2		16	2	47.39	0.89	929.5	33.03
10	3	66.76	1	2921.7	57.03		15	3	18.18	0.71	2015.8	28.85							
							15	4	16.49	0.89	959.2	13.73							
							15	5	47.48	1	3171	45.39							

Table 3.27. Comaprative study of *Chloris* with *Tridax*

3.4 Stage 3 – Experiments to study impact of leaf mulch mixed in soil on Green Gram (Pot Study)

Study was conducted after taking in to account the previous results of sandwich method, in which leaf mulch of *Artemisia, Tridax* and *Swertia* was utilized to see their allelopathic potential in different concentration against Green Gram, *Parthenium* and *Chloris*. Low dosage of the mulch was utilized for a further experiment where medium of dissipation was soil. This study was conducted using Green Gram (Three seeds in each plastic pot) and *Parthenium* (Five seeds in each pot). But *Parthenium* seeds germinated only in control, thus any data regarding *Parthenium* is not given. In this study, *Artemisia* and *Tridax* dry leaf mulch was taken and mixed with soil. Study was conducted in two phases with different dosages.

3.4.1: Phase 1 – Initial study was conducted using *Artemisia* and *Tridax* leaf mulch in three different quantities i.e. 1gm, 3 gm, 5 gm (Plate 4). Mulch was mixed with 300gm of soil to examine the effect on Green gram .

Plate 4 : Pot Experiments

A,B : Pots with soil and leaf mulch of *Artemisia* and *Tridax*, **D,E**: Pots showing different concentration and green gram growth **C :** Green gram plants at 30DAS with 1%*Artemisia* & *Tridax*, **F:** Control pot with Green Gram plant

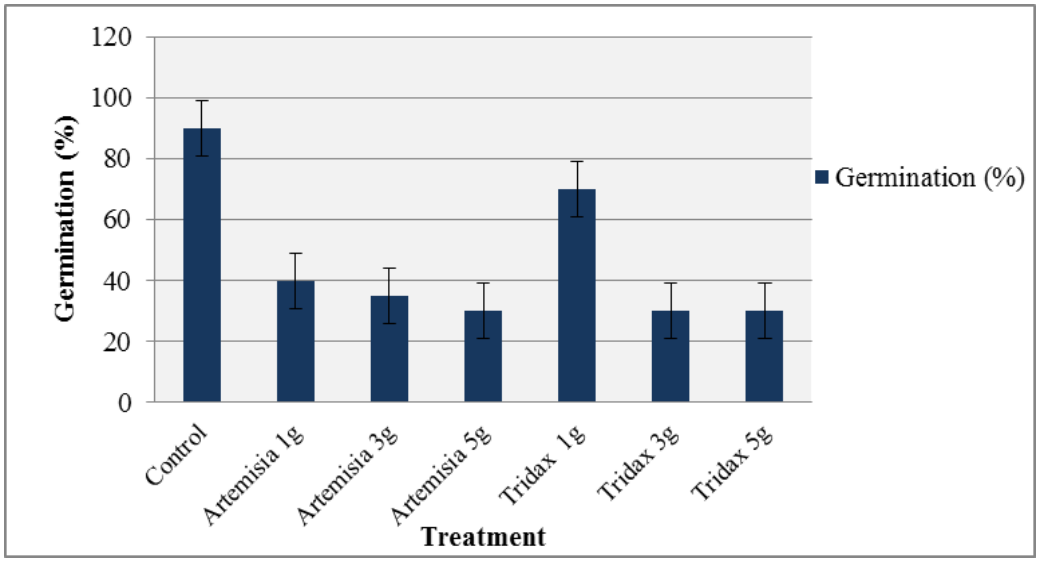


Figure 3.85: Germination (%) of Green Gram seeds with treatment of *Artemisia* and *Tridax* leaf mulch (pot study- Phase 1)

Germination of Green Gram seeds showed significant reduction in all treatments except in *Tridax* 1g. Maximum inhibition was observed in *Artemisia* treatment with 50% reduction as compared to untreated seeds.(Figure:3.85)

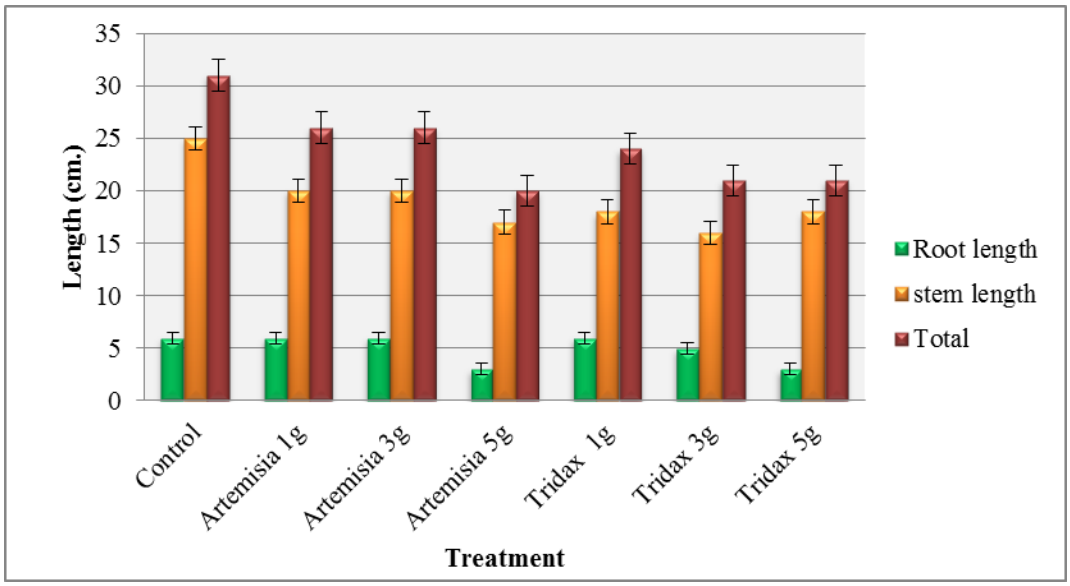
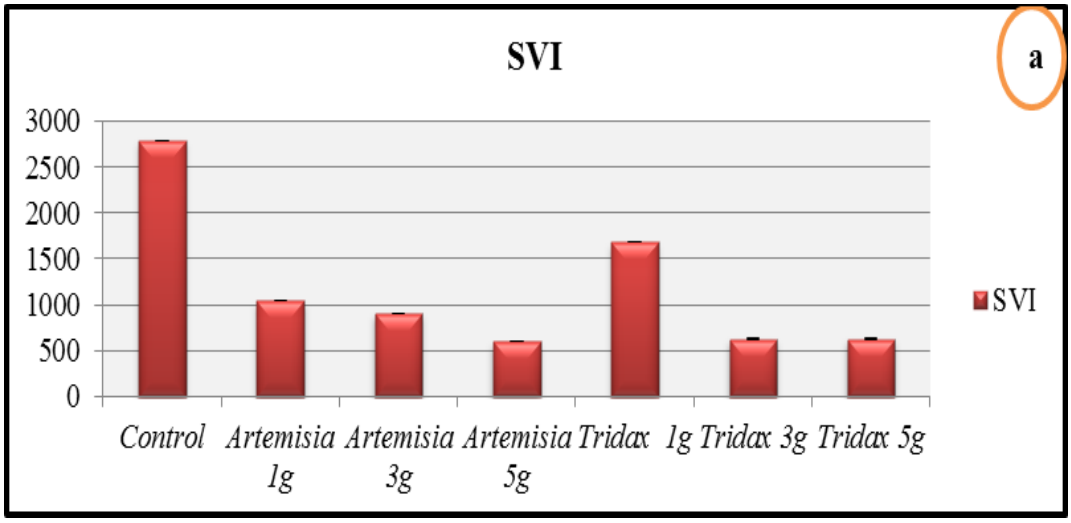


Figure 3.86: Seedling growth of Green Gram seeds with treatment of *Artemisia* and *Tridax* leaf mulch (Pot study – Phase 1)

Seedling length was measured separately for root and shoot as shown in figure 3.86. Root length of the plant was measured after 35 DAS (Days after sown). No inhibition was observed in root length treated with *Artemisia* except in 5g as

compared to untreated plants. Shoot length was reduced as concentration of the treatment increased. Total height of *Artemisia* treated plants was 3-4 cm less as compared to control.

Similarly, Plant Root length treated with *Tridax* was also not affected except for *Tridax* 5g treatment. Shoot length of the treated plants remained same for all three concentrations which was less by approx. 7-8 cm as compared to untreated ones. Maximum length was observed in untreated plants on 3DAS. Other treatments gave approx.10-15 cm height. Length of Green Gram in control and *Tridax* reached to 22- 25 cm.,at the end of 15 DAS. Total plant growth and biomass was observed after 35DAS.



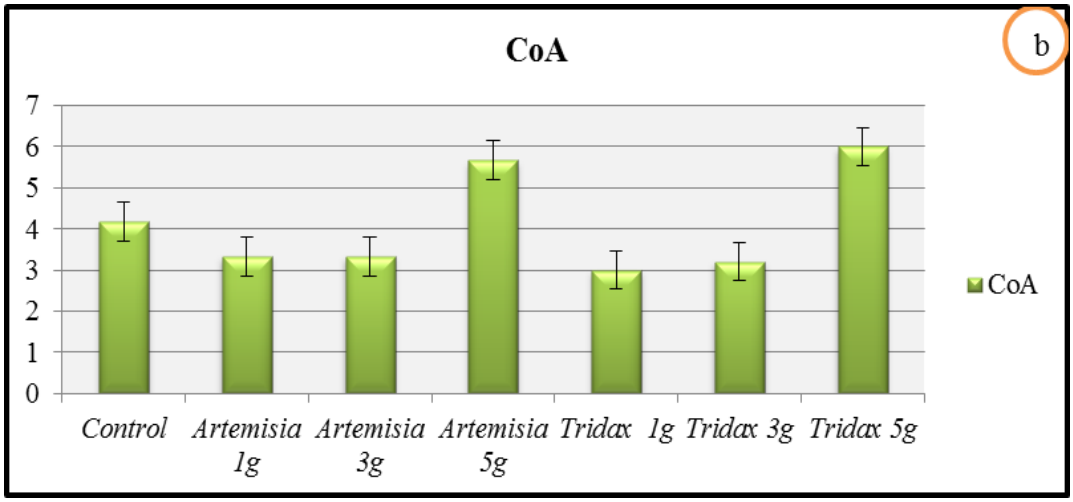


Figure 3.87 a) SVI (Seed Vigour index) and b) CoA (Coefficient of Allometry) of Green Gram with treatment of *Artemisia* and *Tridax* leaf mulch (Pot Study – Phase 1)

Seed vigour index of Green Gram plant was estimated for both the treatments. Most vigorous seeds were found in *Tridax* 1g treatment. SVI was decreasing with concentration in *Artemisia* treatment and in higher concentrations of *Tridax* i.e. 3 gm and 5 gm.(3.87 a)

Coefficient of Allometry (CoA) was maximum in *Tridax* and *Artemisia* 5g. this was indicating more shoot length than the root length as compared to untreated plants. Root length was comparatively less than shoot length which gives CoA value more than 1.(Figure 3.87 b)

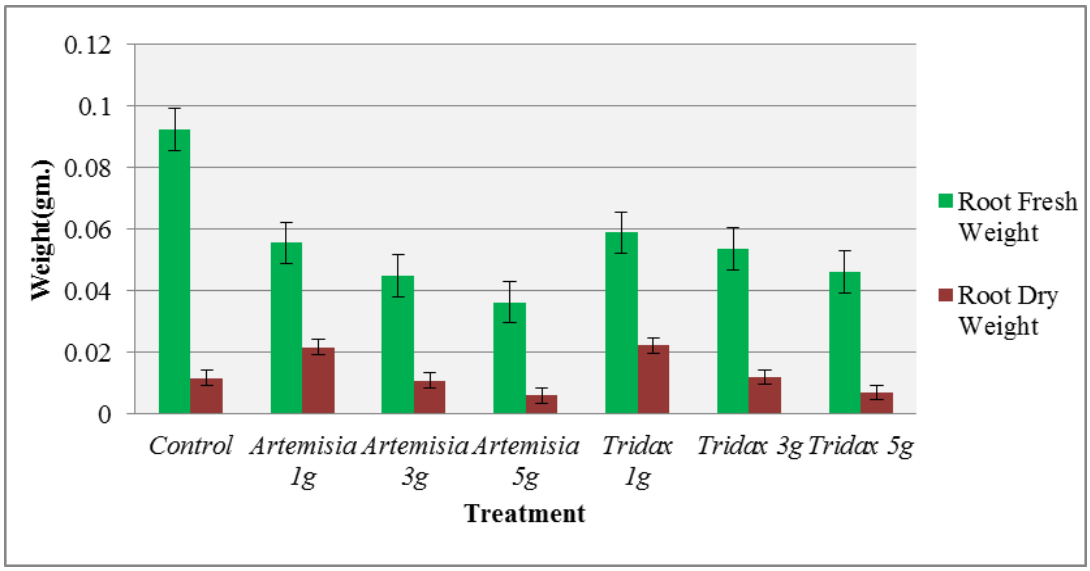


Figure 3.88 Root biomass of Green Gram plants with treatment of *Artemisia* and *Tridax* (Pot Study- Phase 1)

Fresh root biomass was decreased with *Artemisia* and *Tridax* treatment. Major suppression was observed in *Artemisia* as compared to *Tridax*. Stimulation was observed at 1g Treatment of *Artemisia* and *Tridax* for Root. Inhibition was only observed in roots with 5gm mulch treatment. .(Figure 3.88)

Average Fresh weight of the untreated shoot was about 0.35cms which was reduced to 0.25 – 0.14cms with treated plants. First leaf emergence was observed in more plants in Control as compared to 1g *Artemisia* and 1 g of *Tridax* treatment.(Figure 3.89)

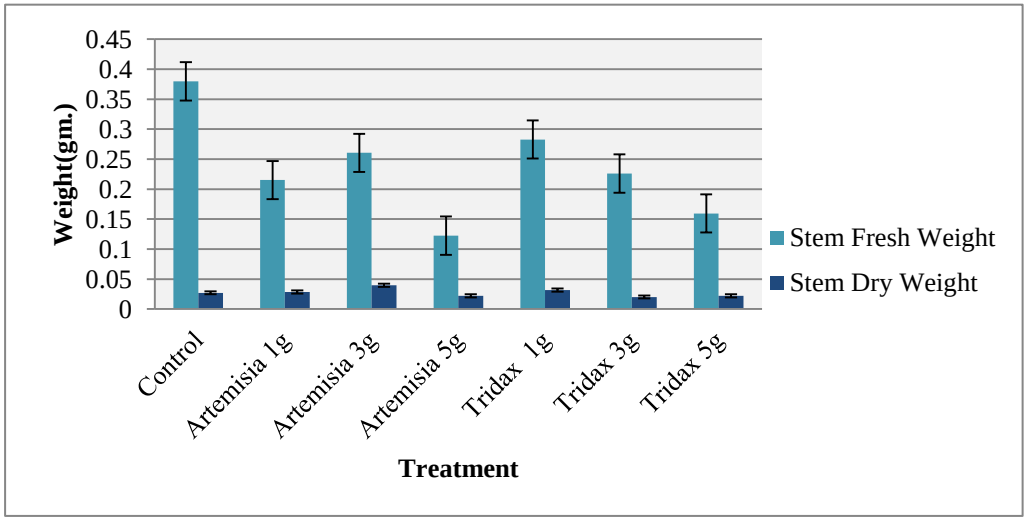


Figure 3.89Shoot biomass of Green Gram plants with treatment of *Artemisia* and *Tridax* (Pot Study- Phase 1).

Shoot weight was maximally supressed with *Artemisia* 5 g and Minimum with *Artemisia* 3 gm and *Tridax* 1 gm. Dry weight of the shoot was increased in *Artemisia* 3g and *Tridax* 1 gm treatment as compared to control. Maximum suppression in dry shoot weight was detected in *Tridax* 3g and *Artemisia* 5g treatment.(Figure 3.89).

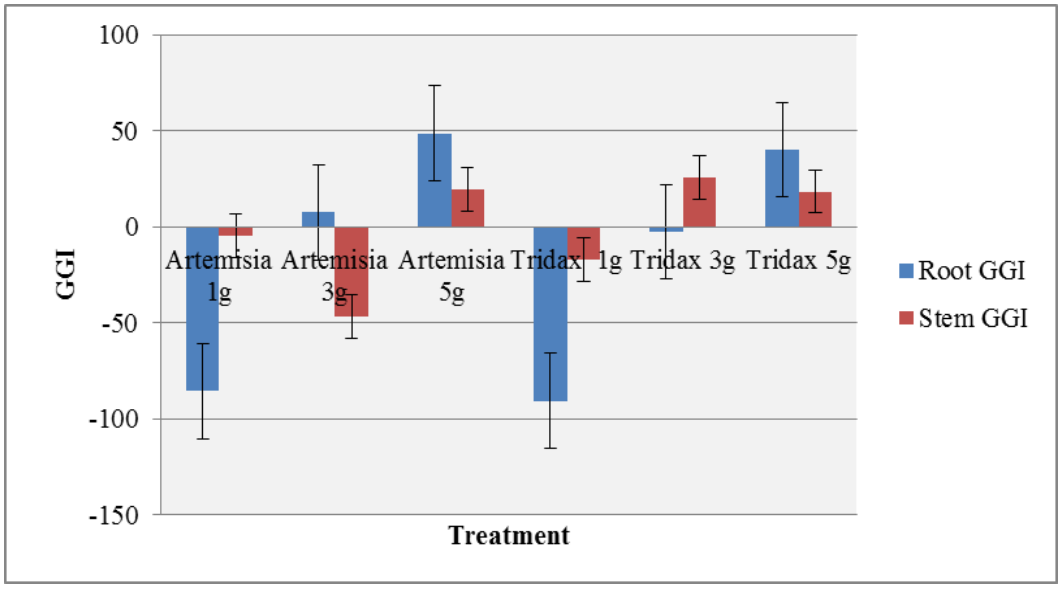


Figure 3.90 GGI (Grade of Growth Inhibition) in Green Gram with *Artemisia* and *Tridax* leaf mulch (Pot Study-Phase 1)

Stimulation in root and shoot growth was observed in *Artemisia* 1 g and *Tridax* 1 g. only shoot growth was stimulated in *Artemisia* 3 g treatment. Maximum inhibition was observed in *Artemisia* 5g, *Tridax* 3 g and 5 g. Root growth of Green Gram with *Tridax* 3g treatment was showing stimulatory effect as compared to its shoot growth which was inhibited with the treatment.(Figure 3.90)

3.4.2.: Phase 2 –Results of phase 1 study showed that the selected doses of leaf mulch were having suppressive effect on growth of legume crop. So the quantity of the leaf mulch was reduced to 0.2g - 0.8 g (i.e 0.06% to 0.26% and mulch was mixed thoroughly with 300gm of soil (Plate -5 (i)&(ii)).

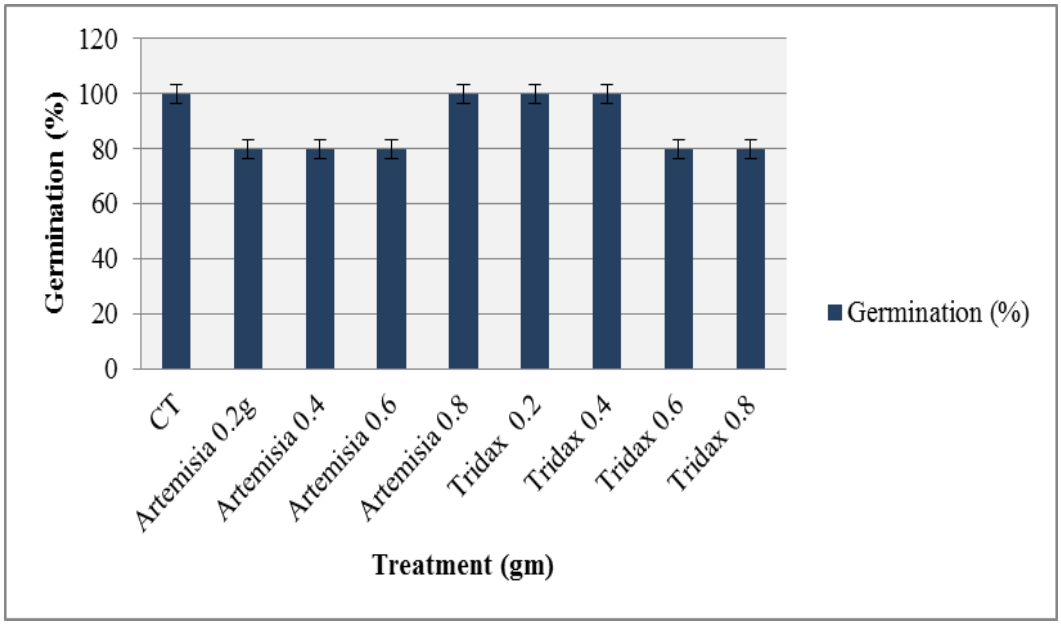


Figure 3.91 Germination (%) of Green Gram seeds with *Artemisia* and *Tridax* leaf mulch Treatments. (Pot Study – Phase 2)

Germination of Green Gram seeds was observed with different quantities of *Artemisia* and *Tridax* leaf mulch. Inhibition in treated seed germination was observed only by 10-20% especially in lower concentration of *Artemisia* (0.2g-0.6g) and higher concentration of *Tridax* (0.6g &0.8g). 100% seeds were germinated with *Tridax* 0.2g,0.4g and *Artemisia* 0.8g treatments. (Figure 3.91).

Plate 5 (i))Impact of *Artemisia* and *Tridax* leaf mulch treatment on Green Gram growth (Pot Study – Phase 2) A : Comparative growth of Green Gram using *Artemisia* mulch **B:** Comparative growth of Green Gram using *Tridax* leaf mulch

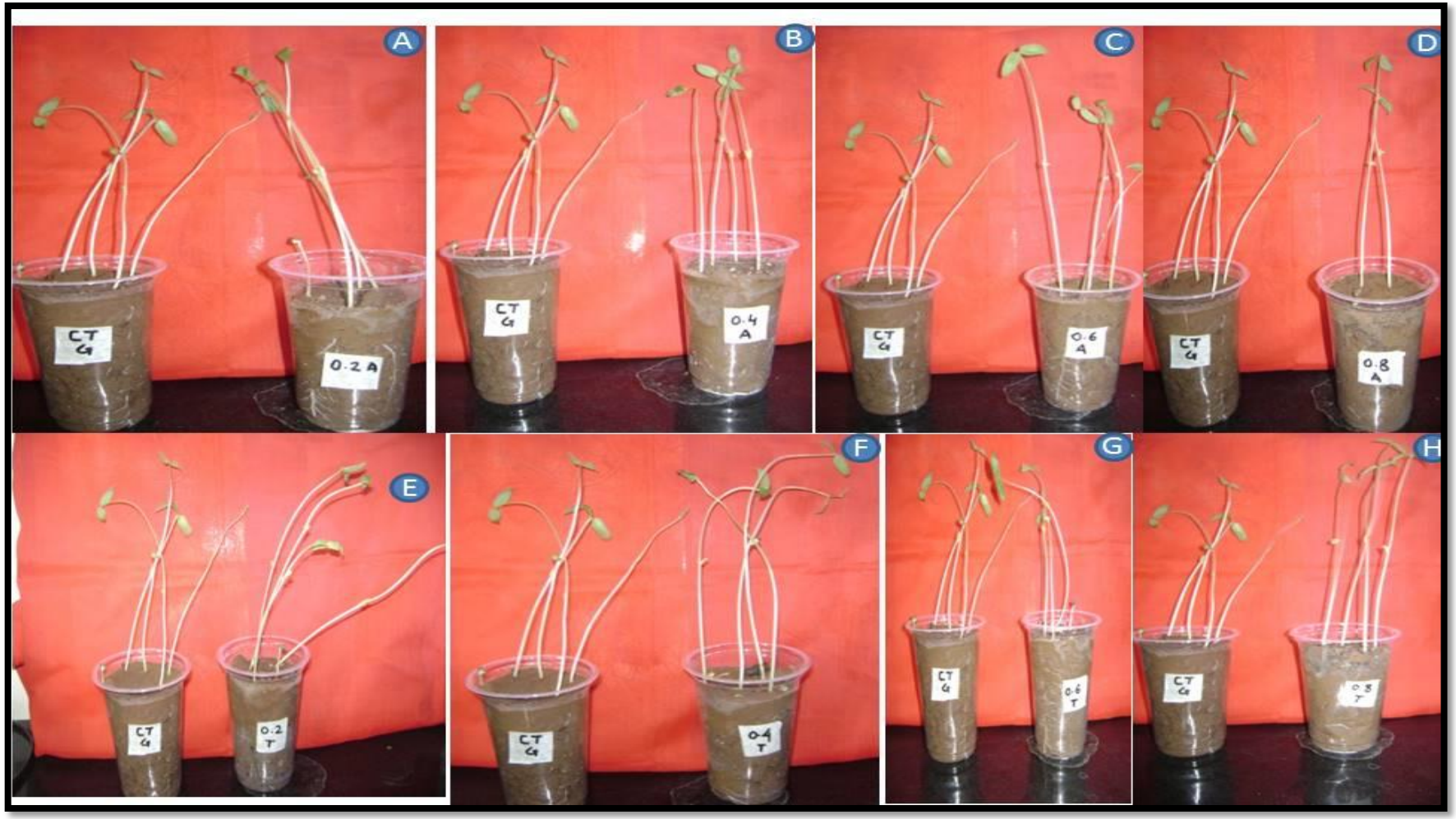


Plate 6 (ii) Impact of *Artemisia* and *Tridax* leaf mulch treatment on Green Gram growth (Pot Study – Phase 2) **A-D:** Comparative Growth of *Artemisia* treated Green Gram and Control **E-H** : Comparative Growth of *Tridax* treated Green Gram and Control

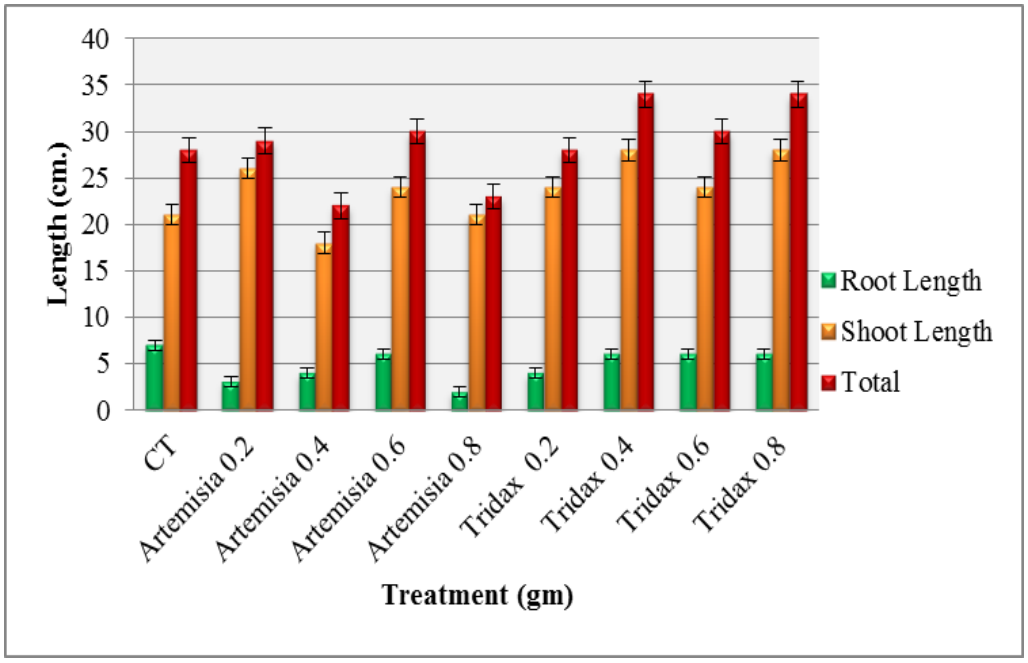


Figure 3.92: Seedling growth of Green Gram with *Artemisia* and *Tridax* leaf mulch (Pot stydy – Phase 2)

Root growth of plants was endured with no change with *Artemisia* (0.6g) and *Tridax* (0.4g-0.8g) treatments (Plate 5,6). Maximum reduction in root length was induced by *Artemisia* 0.8g and in *Tridax* (0.2g). Shoot length as compared to root length was showing less inhibitory effect. Major reduction in shoot growth was observed with *Artemisia* 0.4g only. All treated plants were observed with stimulatory growth of shoot length, as it was increased as compared to control. That led to increase in total growth of the plant height. Reduction in total plant length was observed about ±5 cm with *Artemisia* 0.4g and 0.8g treatment (Figure 3.92).

Seed Vigour Index was more in *Tridax* 0.2g, 0.4 and 0.8g treatment than untreated plants. Maximum reduction was noted with *Artemisia* 0.4g treatment. Also seed vigour index was more affected by *Artemisia* as compared to *Tridax* (Figure 3.93)

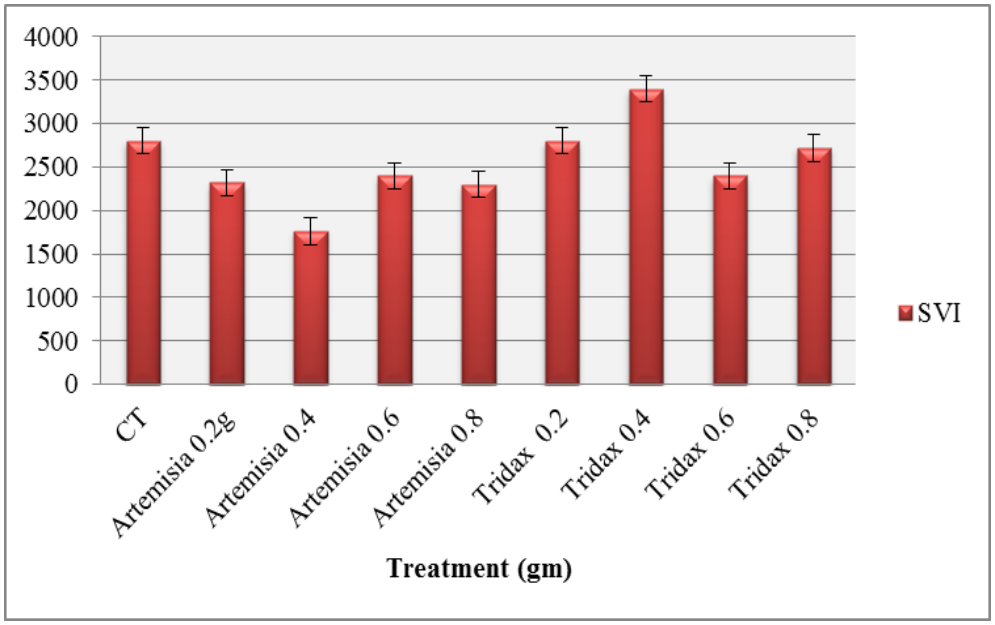


Figure 3.93 SVI (Seed Vigour Index) of Green Gram with *Artemisia* and *Tridax* leaf mulch (Pot Study – Phase 2)

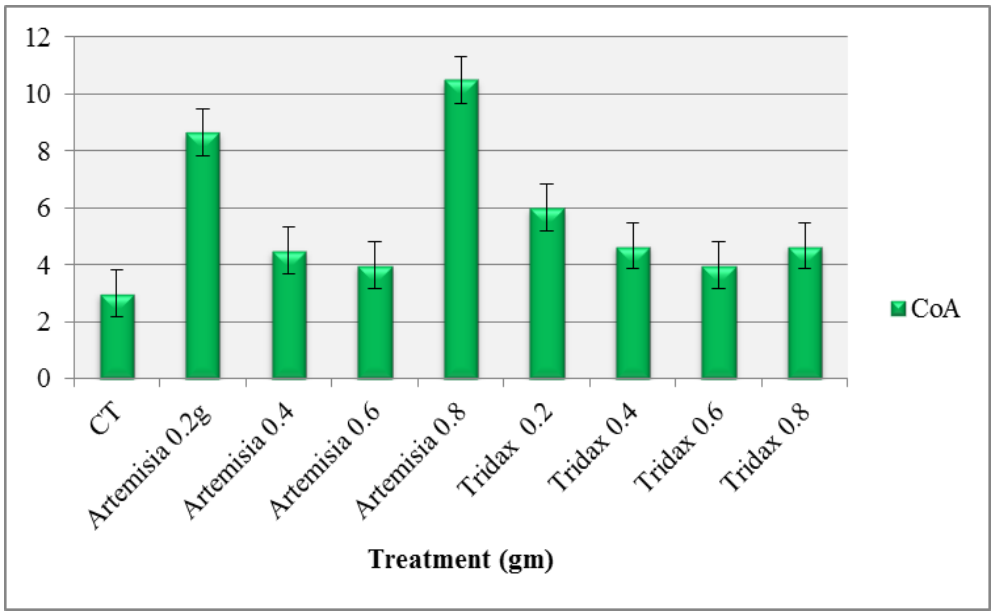


Figure 3.94 CoA (Coefficient of Allometry) of Green Gram with *Artemisia* and *Tridax* leaf mulch (Pot Study – Phase 2)

Maximum CoA was observed in *Artemisia* 0.8g and 0.2g,(Between 8- 10) which was above the control and other treatments indicating higher shoot :root ratio. CoA was minimum in Control(2.0±0.12) and in other treatment (approx. 4-5) of *Artemisia* and *Tridax*(Figure 3.94)

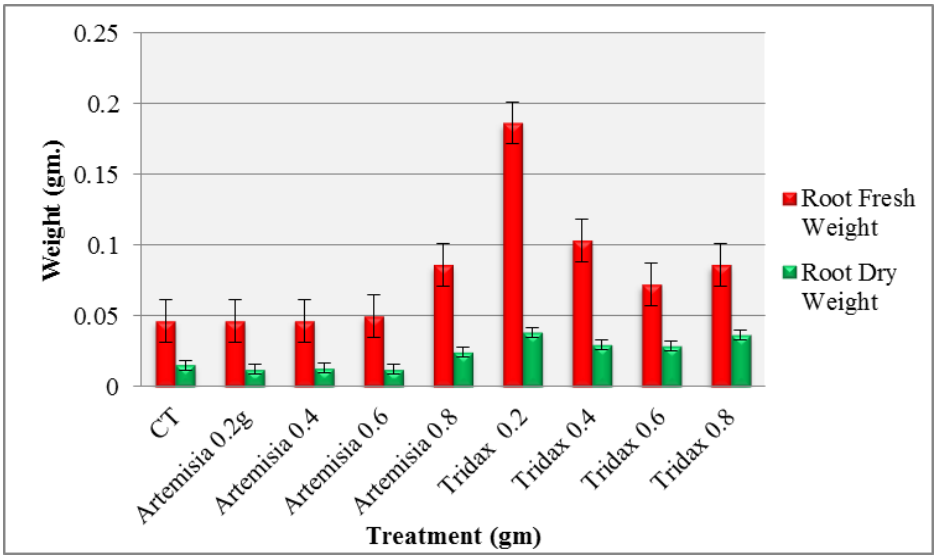


Figure 3.95 Root Biomass of Green Gram with *Artemisia* and *Tridax* leaf mulch (Pot Study – Phase 2)

Root biomass increased in all *Tridax* treated plants, specially with 0.2g where more than 50% stimulation as compared to untreated root weight was observed. No change in weight was observed for *Artemisia* (0.2-0.6g) treated plants as compared to control, except 0.8g which showed increase in weight.(Figure 3.95)

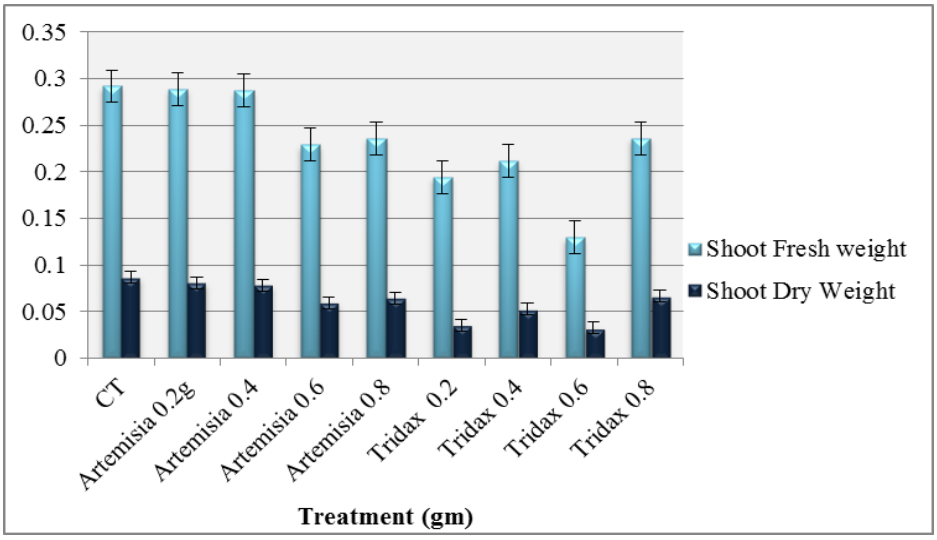


Figure 3.96. Shoot Biomass of Green Gram with *Artemisia* and *Tridax* leaf mulch (Pot study – Phase 2)

Shoot weight of Control, *Artemisia* 0.2g and 0.4g were similar. All Treatment of *Tridax* reduced shoot weight as compared to control. Fresh weight and dry weight

were showing equal results. Minimum shoot biomass was observed in *Tridax* 0.2g and 0.6g(Figure 3.96)

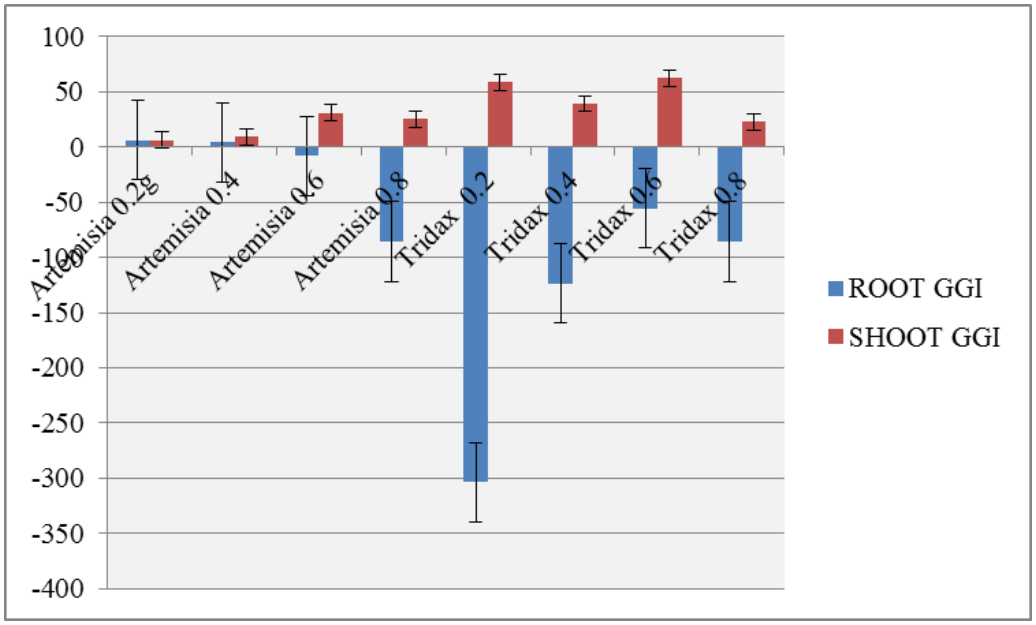


Figure 3.97 GGI (Grade of Growth Inhibition) of Green Gram using *Artemisia* and *Tridax* leaf mulch (Pot study – Phase 2)

The growth inhibition of root and shoot in treated plants were observed as compared to control. Root growth was inhibited only in *Artemisia* 0.2 and 0.4g. Treated plants with *Tridax* (all four) and *Artemisia* (0.6g and 0.8g) were showing stimulatory growth of roots. Shoot growth was inhibited minimum in *Artemisia* 0.2 and 0.4g treatment. Maximum shoot growth inhibition was found in *Tridax* 0.2g and 0.6g treatment(Figure3.97). Chlorophyll contents were analysed for the pot grown plants at 30 DAS when leaves grew well, by that time all the plants showed equal growth (Plate 4).

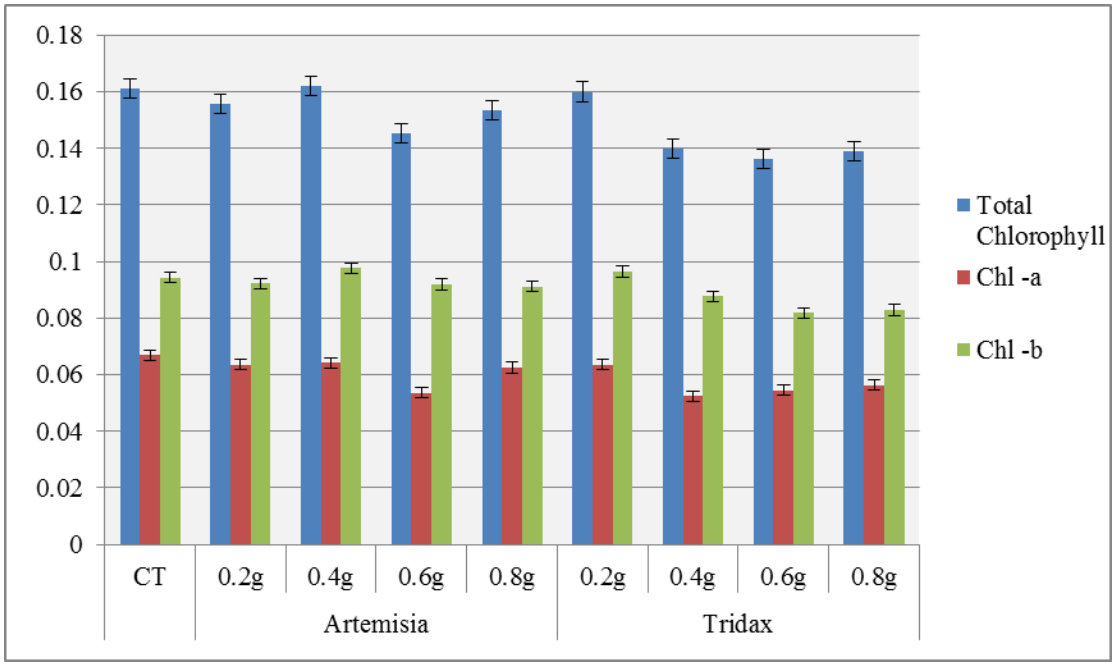


Figure 3.98 Chlorophyll study of green gram leaf at 30DAS with *Artemisia* and *Tridax* treatment. (Pot study – Phase 2)

Chlorophyll content was not showing any significant difference between control and treated plants. Maximum content (mg/g) was observed in CT, 0.4g *Artemisia* and 0.2g *Tridax* treatment. *Tridax* treated green gram was showing small reduction in chlorophyll content as compared to Untreated and *Artemisia* treated plants. Figure 3.98 showed more amount of chlorophyll b content than chlorophyll a. Similar results were obtained in control also.