RESULTS

Phytochemical studies

Phytochemical screening of Cassia siamea

On phytochemical screening, Cassia leaves yielded isoflavones besides flavones like acacetin and luteolin. Also present are quinones. Phenolic acids obtained were vanillic, syringic, ferulic, sinapic, gentisic, protocatechuic and *p*-coumaric. Glycoflavones and tannins were found to be absent (Table 1).

Bark gave a few steroids from the non-saponifiable lipids fraction besides free fatty acids from non-saponifiable and saponifiable lipid fractions. Phenolic acids obtained are vanillic and syringic. Wood gave flavonoids such as acacetin and luteolin. Phenolic acids were vanillic and syringic and an additional *p*-OH benzoic acid in root wood. Saponins present and wood saponification value was estimated to be 80.8247. Root wood gave dianthrone like cassiamin A, B and C and flavonol like kaempferol.

Pods of Cassia siamea gave acacetin, hydroquinones besides few saponifiable and non-saponifiable lipids and steroids (unidentified). Chlorophyll is present in pods. Also present are quinones. Phenolic acids present were vanillic, syringic and ferulic.

Table 1. The phytochemicals of C. siamea.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Leaves	+	+	+	.	.	+	.	.	.	.	.	+	+	.	+	+	+	+	+	.	.	+	.
Bark	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	+	.	.
Wood	.	+	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Root bark	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	+	.	.
Root wood	.	.	.	+	.		+	+	+	.	+	+	+	+	.	.	.	.	.	.	.	.	.
Pod	.	.	.	.	.		+	.	.	.	.	+	+	.	+	.	.	.	.	+	+	+	.
Seed	.	.	.	.	.		.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+

1. Isoflavones
2. Acacetin (Flavones)
3. Luteolin (Flavones)
4. Kaempferol
5. Glycoflavones
6. Quinones
7. Cassiamin A
8. Cassiamin B
9. Cassiamin C
10. Tannins
11. Saponins
12. Vanillic
13. Syringic
14. *p*-OH benzoic
15. Ferulic
16. Sinapic
17. Gentisic
18. Protocatechuic
19. *p*-coumaric
20. Steroids
21. Free fatty acids
22. Chlorophyll
23. Sugars

Seeds gave phenolic acids such as vanillic and syringic acids. Seed polysaccharide upon hydrolysis yielded sugars such as glucose, galactose, rhamnose, mannose and xylose.

Phytochemical screening of Pongamia pinnata

Pongamia leaves contained furanoflavonoids like pongapin, 3'-methoxy pongapin and 8-methoxy furano (4",5":6,7) flavone, besides phenolic acids like vanillic, syringic, *p*-OH benzoic acid, *p*-coumaric (cis and trans), melilotic, ferulic (cis and trans) gentisic and one unidentified phenolic acid (Table 2).

Pongamia stem and root bark gave pongachromene and flavonols like desmethoxykanugin and kanugin. Stem bark gave two unidentified steroids also. In addition, phenolic acids are vanillic, syringic, *o*-coumaric, *p*-coumaric, *p*-OH benzoic, ferulic (cis and trans), melilotic, gentisic and protocatechuic. Glycoflavones were absent. Phenolic acids of stem wood are vanillic, syringic, *p*-OH benzoic, ferulic, gentisic, melilotic and one unidentified acid. Root wood gave vanillic, syringic, *p*-OH benzoic and ferulic acids.

Seed coat yielded anthocyanins such as delphinidin and petunidin and phenolic acids like vanillic, syringic, *p*-OH benzoic, melilotic, gentisic and ferulic. Seeds gave vanillic, *p*-OH benzoic, gentisic, O-coumaric (trans), ferulic (cis and trans) and one unknown phenolic acid.

Table 2. The phytochemicals of *Pongamia pinnata*.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20a	21	22	23
Leaves	+	+	+	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	.	+	.	+	.
Bark	.	.	.	+	+	+	.	.	.	.	.	+	+	+	+	+	+	+	+	+	+	+	.	.
Wood	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.
Root bark	.	.	.	+	+	+	.	.	.	.	.	+	+	+	+	+	+	+	+	+	+	.	.	.
Root wood	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.	.	.
Pod	.	.	.	.	.	.	.	+	+	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.
Seed	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	+	.	.	+	.	.	.	+

1. Pongapin
2. 3-OMe Pongapin
3. 8-OMe furanoflavone
4. Pongachromene
5. Desmethoxy – kanugin
6. Kanugin
7. Glycoflavones
8. Delphinidin
9. Petunidin
10. Tannins
11. Saponins
12. Vanillic
13. Syringic
14. *p*-OH benzoic
15. cis-ferulic
16. trans-ferulic
17. Gentisic
18. Melilotic
19. Protocatechuic
20. *o*-coumaric
20a. *p*-coumaric
21. Steroids
22. Chlorophyll
23. Sugars

Allelopathic studies

The allelopathic interactions of both the trees with crops and weeds are as under.

C. siamea vs. wheat

i. Germination :

The effect of various extracts of C. siamea on germination percentage of wheat seeds (Table 3).

Leaf extract : Leaf extract of C. siamea at all the given concentrations, inhibited the germination of wheat seeds. Of all the concentrations, 40% was found to be highly inhibitory.

Stem bark extract : Except for 10% concentration which was inhibitory, all the other concentrations, were found to be promotory for germination of wheat seed.

Stem wood extract : Extractives from stem wood was found inhibitory for wheat seed germination in general, except for 10% concentration which was found highly promotory.

Root bark extract : Root bark extract at all the concentrations promoted the wheat seed germination. Maximum germination being observed in 60% concentration.

Root wood extract : In contrast to root bark, root wood extract was inhibitory to wheat seed germination at all the concentrations, with maximum inhibition being seen in 60% concentration.

Table 3. *Cassia siamea* treated wheat seeds : Germination percentage

Treatments	Control	Concentrations of the extracts			
		10%	20%	40%	60%
Leaf extract	100	83	96	65	69
Stem bark extract	100	88	111	111	104
Stem wood extract	100	153	95	84	89
Root bark extract	100	117	128	117	150
Root wood extract	100	90	96	86	48
Pod extract	100	143	148	95	38
Seed extract	100	83	58	75	50

Pod extract : Pod extract was promotory in effect at lower concentrations and found inhibitory at higher concentration. 60% concentration was proved to be highly inhibitory.

Seed extract : Unlike pod extract, seed extract inhibited the wheat seed germination at all the concentrations. 60% concentration was found to be highly inhibitory and 10% concentration was least inhibitory amongst all the concentration tested.

ii. Root length :

The influence of Cassia siamea extracts on the root length of wheat seedlings (Table 4).

Leaf extracts : Leaf extract promoted the root length of wheat seedlings significantly statistically at both the lower concentrations, 10% and 20%. Higher concentrations did not exert any effect on the seedlings.

Stem bark extract : Extractives of Stem bark did not exert any effect except at 60% concentration which was found to be promotory.

Stem wood extract : Stem wood extract decreased the shoot length at all the given concentrations. 20% concentration was very significantly inhibitory for shoot length elongation.

Root bark extract : Root bark extractives promoted the root length of wheat seedlings at all the concentrations. Lower concentrations (10% and 20%) were statistically, very significantly promotory for root length promotion of wheat seedlings.

Table 4 **C.siamea treated wheat seedlings : Root length (cms)***

Treatments	Control	Concentration of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	9.17 (±1.3106)	10.77 (±1.9899)	10.37 (±1.5293)	9.17 (±1.2169)	9.2 (±1.1285)
Stem bark extract	10.42 (±1.3106)	10.50 (±0.7609)	10.00 (±0.9733)	10.15 (±1.4244)	11.2 (±1.4271)
Stem wood extract	10.2 (±1.2607)	9.47 (±1.3025)	6.90 (±1.4473)	7.22 (±1.7582)	8.12 (±1.2863)
Root bark extract	5.5 (±0.9176)	10.5 (±1.4327)	11.42 (±1.3695)	9.25 (±1.0195)	7.35 (±1.4964)
Root wood extract	10.37 (±1.4130)	11.22 (±1.7657)	10.12 (±1.3266)	11.72 (±1.7280)	7.95 (±1.4132)
Pod extract	9.37 (±1.4223)	11.42 (±1.1951)	12.3 (±1.8524)	10.05 (±1.2128)	5.9 (±0.7539)
Seed extract	8.1 (±1.5861)	9.95 (±1.5551)	7.8 (±1.6009)	9.85 (±1.2680)	8.55 (±0.8720)

* Mean of 20 observations.

. Figures in the parentheses shows standard deviation.

Root wood extract : Extractives from root wood promoted the root length of wheat seedlings at 40%, followed by 20% concentrations. 60% concentration was proved to be highly inhibitory.

Pod extract : Root length increased with lower concentrations of the extract i.e., 10% and 20% whereas 60% concentration was found to be highly inhibitory for the roots of wheat. 20% concentration was statistically proved significantly promotory.

Seed extract : Seed extractives on an average appeared to be promotory for root length elongation except for 20% which was insignificantly inhibitory.

iii. Shoot length :

The influence of Cassia siamea extracts on the shoot length of wheat seedlings (Table 5).

Leaf extract : Leaf extract promoted the shoot length of wheat at all the concentrations and maximum promotion in shoot length was observed at 20% concentration, proved statistically significantly promotory than higher concentrations.

Stem bark extract : Except for 10% which is promotory, all other concentrations of the stem bark extract exhibited slight inhibitory action on shoot elongation of wheat seedlings.

Stem wood extract : Unlike stem bark extract, the extractives from stem wood, at all concentrations promoted the growth of shoot.

Table 5 **C.siamea treated wheat seedlings : Shoot length (cms)***

Treatments	Control	Concentration of the extracts			
		10 %	20 %	40 %	60 %
Leaf extract	12.17 (±1.5498)	12.60 (±1.9166)	13.25 (±1.0942)	12.42 (±1.5834)	12.42 (±1.3005)
Stem bark extract	12.58 (±0.9440)	13.6 (±0.8825)	12.1 (±1.2311)	12.0 (±1.0000)	12.25 (±1.5769)
Stem wood extract	12.3 (±1.4814)	12.5 (±1.3475)	13.0 (±1.4142)	12.92 (±1.6000)	12.62 (±1.2863)
Root bark extract	11.12 (±1.4945)	12.82 (±1.1035)	11.65 (±1.9741)	11.62 (±1.4037)	11.82 (±1.0547)
Root wood extract	13.55 (±1.0748)	13.05 (±0.9017)	12.4 (±1.1876)	12.95 (±0.8413)	13.55 (±1.2019)
Pod extract	12.8 (±1.3521)	12.44 (±1.2783)	12.97 (±1.1177)	12.28 (±1.3714)	11.4 (±1.4653)
Seed extract	12.52 (±1.6179)	13.72 (±1.5850)	12.82 (±1.6565)	13.32 (±1.5917)	12.6 (±1.5183)

* Mean of 20 observations.

. Figures in the parentheses show standard deviation.

Root bark extract : Similar to the stem wood extract, root bark extract also proved beneficial to wheat shoot elongation at all the concentrations.

Root wood extract : Some amount of inhibition was exhibited by the root wood extract at almost all concentrations. However there was no inhibition at 60% concentration.

Pod extract : Pod extract shows shoot inhibition at all the concentrations. 60% concentration was statistically proved significantly inhibitory for shoot length elongation. 20% extract concentration however was slightly promotory, but not significantly.

Seed extract : Seed extract enhanced the shoot elongation of wheat at all concentrations with a maximum promotory effect at 10% concentration.

iv. Dry weight :

The influence of Cassia siamea extracts on the dry weight of wheat seedlings (Table 6).

Leaf extract : Leaf extracted inhibited the weight of wheat seedlings at all the concentrations. There is a gradual decrease in weight with the increase in concentration. This effect was seen upto 40%. 60% concentration did not exert any effect.

Stem bark extract : Stem bark extractives were found to be promotory at all the concentrations. Maximum promotion being observed in 10% concentration in terms of weight gain of wheat seedlings.

Table 6 ***Cassia siamea*** **treated wheat seedlings : Dry weight (g per plant)**

Treatments	Control	Concentration of the extracts			
		10 %	20 %	40 %	60 %
Leaf extract	0.1833	0.1807	0.1733	0.1675	0.1835
Stem bark extract	0.1636	0.1706	0.1675	0.1686	0.1674
Stem wood extract	0.1892	0.1672	0.1605	0.1620	0.1734
Root bark extract	0.1560	0.1618	0.1756	0.1836	0.1804
Root wood extract	0.1859	0.1859	0.1819	0.1786	0.1607
Pod extract	0.1614	0.1601	0.1665	0.1784	0.1793
Seed extract	0.1781	0.1848	0.1807	0.1824	0.1786

Stem wood extract : In contrast to stem bark extract, stem wood extract was found to be inhibitory for weight gain of wheat seedlings at all the concentrations. 20% concentration was found to be highly inhibitory amongst all the concentrations.

Root bark extract : Root bark extract caused a gradual increase in weight of the seedlings with rise in concentration. This trend continued until 40% concentration followed by a slight decrease in 60% concentration which was also found to be promotory in effect.

Root wood extract : Root wood extract did not exert any effect at 10% concentration, followed by a gradual decrease in weight with increase in concentration. 60% concentration was found to be maximum inhibitory in effect.

Pod extract : Pod extract except at 10% which shows inhibition, promoted the weight gain of wheat seedlings at all the other given concentrations. Maximum dry weight of wheat seedlings was observed in 60% concentration.

Seed extract : Seed extract of C. siamea promoted the weight gain of wheat seedlings at all the given concentrations. Maximum promotory effect of weight gain was observed in 10% concentration.

C. siamea vs. rice

i. Germination :

The effect of various extracts of C. siamea on germination percentage of rice seeds (Table 7).

Leaf extract : Leaf extract promoted the germination at 20% concentration. The rest of the concentrations were found inhibitory for germination of rice seeds.

Stem bark extract : Except for 60% concentration, stem bark extract of C. siamea promoted the germination percentage of rice seeds at all concentrations.

Stem wood extract : 10% concentration was found slightly inhibitory. But at 20% and 60% concentration, the extract promoted the germination.

Root bark extract : Except for 10% concentration which was found inhibitory, all the increased concentrations are found to be promotory in effect for rice seed germination when treated with root bark extractives.

Root wood extract : Root wood extract at all the given concentration was found inhibitory for rice germination. Maximum inhibition was however seen at 40% concentration.

Pod extract : Pod extract in contrast to root wood extract promoted the germination of rice at all concentrations. Maximum promotion being observed at 40% concentration.

Seed extract : Except for 20% concentration which did not exert any effect on germination at all the given concentrations the extract was found to be inhibitory for rice seed germination.

Table 7 ***Cassia siamea*** **treated rice seeds : Germination percentage**

Treatments	Control	Concentration of extracts			
		10 %	20 %	40 %	60 %
Leaf extract	100	97	103	95	85
Stem bark extract	100	103	103	103	97
Stem wood extract	100	97	106	100	106
Root bark extract	100	97	103	108	103
Root wood extract	100	97	92	85	90
Pod extract	100	103	109	115	106
Seed extract	100	97	100	95	97

ii. Root length :

The effects of various extracts from C. siamea on root length of rice seedlings (Table 8).

Leaf extract : Leaf extract caused a gradual increase in root length upto 40% concentration. This effect was less pronounced in 60%. Both 20% to 40% extracts were found to be statistically significantly promotory for root length elongation of rice seedlings.

Stem bark extract : Stem bark extractives also resulted in a steady increase in length of the roots till 40% concentration. The effect was lesser in 60% concentration.

Steam wood extract : Except for the 40% concentration, the extract from the wood enhanced the root length elongation at all other concentrations. Maximum promotion being observed at 20% concentration.

Root bark extract : Root bark extract at all concentrations promoted elongation of roots of rice. Significant promotory effect was observed in 10%, 40% and 60% concentration.

Root wood extract : Root wood extractives were slightly inhibitory at all the concentrations, but statistically significant inhibition was observed only at 40% concentration.

Pod extract : Except at 60% concentration where there was an insignificant decrease in root length, the pods extract in general stimulated the growth of roots at all concentrations.

Table 8 *C. siamea* **treated rice seedlings : Root length (cms)***

Treatments	Control	Concentration of the extracts			
		10 %	20 %	40 %	60 %
Leaf extract	9.3 (±0.9787)	9.8 (±1.7501)	10.35 (±1.4876)	10.8 (±1.4545)	9.35 (±1.3188)
Stem bark extract	9.6 (±0.8366)	10.22 (±0.7517)	10.25 (±0.9665)	10.37 (±0.9850)	9.95 (±1.1573)
Stem wood extract	9.9 (±0.8522)	10.1 (±0.9947)	11.3 (±1.0052)	9.75 (±1.0821)	10.8 (±1.5761)
Root bark extract	9.42 (±0.7656)	10.07 (±0.7656)	9.95 (±0.7236)	10.07 (±0.7304)	10.2 (±0.8335)
Root wood extract	10.65 (±1.0525)	10.60 (±1.3138)	10.10 (±1.6351)	9.75 (±1.4001)	10.40 (±0.5982)
Pod extract	9.4 (±1.0954)	10.6 (±1.2937)	10.7 (±1.4363)	9.9 (±1.1876)	9.2 (±1.0310)
Seed extract	10.77 (±1.2924)	10.82 (±0.9770)	11.2 (±0.9090)	10.57 (±1.3106)	9.92 (±1.1035)

* Mean of 20 observations.

. Figures in parentheses show standard deviation.

Seed extract : Like pod extract, seed extract also exhibited a similar pattern of enhancing the root growth of rice at lower concentrations (10% and 20%) whereas the higher concentrations were found inhibitory, with 60% concentration statistically significantly inhibitory.

iii. Shoot length :

The effect of various extracts from C. siamea on shoot length of rice seedlings (Table 9).

Leaf extract : Leaf extract did not exert much effect on shoot length promotion of rice at lower concentrations. But at 40% concentration it was significantly promotory and 60% concentration was insignificantly inhibitory.

Stem bark extract : Stem bark extract also did not exert much effect on shoot length promotion at lower concentrations. Higher concentration (40% and 60%) were slightly promotory in effect.

Stem wood extract : Extractive from stem wood did not exert any significant effect on shoot length of rice. All the concentrations were slightly promotory in effect except 60% concentration which showed a weak inhibition in shoot length.

Root bark extract : Root bark extractives promoted shoot length of rice at all concentrations. Maximum promotion was being observed at 40% concentration.

Root wood extract : Root wood extract did not show much effect on rice shoot length at all the concentrations except 60% which was slightly promotory.

Table 9 *C. siamea* **treated rice seedlings : Shoot length (cms)***

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	5.8 (±0.6155)	5.8 (±0.4103)	5.95 (±0.4839)	6.4 (±0.5525)	5.55 (±0.5355)
Stem bark extract	5.95 (±0.2762)	5.97 (±0.3431)	5.92 (±0.3725)	6.27 (±0.4435)	6.19 (±0.4767)
Stem wood extract	5.95 (±0.6261)	6.15 (±0.6091)	6.15 (±0.5642)	6.2 (±0.6155)	5.85 (±0.5642)
Root bark extract	5.97 (±0.3024)	6.37 (±0.4552)	6.47 (±0.3024)	6.6 (±0.5281)	6.47 (±0.3796)
Root wood extract	6.25 (±0.4135)	6.35 (±0.4006)	6.15 (±0.7963)	6.4 (±0.4472)	6.7 (±0.4103)
Pod extract	5.5 (±0.3244)	5.75 (±0.5256)	5.9 (±0.7181)	6.35 (±0.5642)	6.4 (±0.7181)
Seed extract	6.07 (±0.5199)	6.2 (±0.4701)	6.57 (±0.4375)	6.55 (±0.4261)	6.37 (±0.4832)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Pod extract : Pod extract promoted the shoot length at all the concentrations. The length of shoot gradually increased with rise in concentration. 60% concentration showed maximum promotory effect.

Seed extract : Seed extractives were also found to be promotory in effect for shoot length of rice at all the concentrations. 20% concentration was found to be maximum promotory.

iv. Dry weight :

The influence of C. siamea extracts on the dry weight of rice seedlings (Table 10).

Leaf extract : Leaf extract reduced the dry weight of rice seedlings, at all the concentrations. The maximum inhibition was being observed at 20% concentration.

Stem bark extract : Stem bark increased the dry weight of seedlings of rice at all the concentrations. Maximum increase in weight being observed at 10% concentration.

Stem wood extract : Stem wood extractives did not exert any effect on dry weight of seedlings of rice except for 10% concentration which caused a decrease in weight.

Root bark extract : Root bark extractives at 20% concentration promoted the weight gain of rice seedlings and at 60% concentration inhibited the weight gain. The other two concentrations did not have any effect on the dry weight of rice seedlings.

Table 10. *Cassia siamea* treated rice seedlings : Dry weight (g per plant)

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	0.2036	0.2014	0.2005	0.2008	0.2030
Stem bark extract	0.1501	0.159	0.1530	0.1510	0.1510
Stem wood extract	0.2198	0.2160	0.2201	0.2197	0.2211
Root bark extract	0.1567	0.1567	0.1591	0.157	0.1557
Root wood extract	0.2122	0.2128	0.2108	0.2099	0.208
Pod extract	0.2101	0.2080	0.2094	0.2101	0.2152
Seed extract	0.1530	0.1588	0.1522	0.1603	0.1422

Root wood extract : Root wood extract decreased the weight of rice seedlings gradually with an equivalent rise in concentration. 10% concentration showed the maximum weight.

Pod extract : Except for 60% concentration which caused some promotion in weight of rice seedlings, all the concentrations were found to be inhibitory for weight gain of rice seedlings.

Seed extract : Seed extract at 10% and 40% concentration promoted weight gain however the other two concentrations were found to be inhibitory for rice seedlings.

C. siamea vs. C. occidentalis

i. Germination :

The effect of various extracts of C. siamea on germination percentage of C. occidentalis seeds (Table 11).

Leaf extract : Leaf extract caused a proportionate decrease in germination percentage of Cassia occidentalis seeds with increase in concentration. 60% concentration showed maximum inhibition in germination.

Stem bark extract : Stem bark extract, like leaf extract showed inhibition of germination at all concentrations. Maximum inhibition in germination was observed at 20% concentration.

Stem wood extract : Stem wood extract promoted the germination percentage of C. occidentalis seeds at 20% concentration. However, all other concentrations were found inhibitory for germination.

Table 11. *Cassia siamea* treated *C. occidentalis* seeds : Germination percentage

Treatments	Control	Concentrations of extract			
		10 %	20 %	40 %	60 %
Leaf extract	100	98	94	91	59
Stem bark extract	100	98	92	96	98
Stem wood extract	100	95	102	95	95
Root bark extract	100	98	100	98	96
Root wood extract	100	102	104	104	98
Pod extract	100	90	95	80	50
Seed extract	100	109	102	98	67

Root bark extract : Root bark extract in general was found inhibitory, except for 20% concentration which did not exert any effect. Maximum inhibition was observed at 60% concentration.

Root wood extract : Root wood extract promoted the germination of C. occidentalis seeds at all the concentrations except for 60% which was found slightly inhibitory.

Pod extract : Pod extractives in general decreased the germination at all the concentrations, inhibition was maximum at 60% concentration.

Seed extract : Seed extract except for higher concentration (40% and 60%) which were found inhibitory seed extract promoted the germination at both lower concentrations.

ii. Root length :

The effect of various extracts of C. siamea on root length of C. occidentalis seedlings (Table 12).

Leaf extract : All the concentrations were found inhibitory for the root elongation, 60% extract was found statistically significantly very inhibitory when compared to lower concentrations (10% and 20%).

Stem bark extract : Stem bark extract also exerted an inhibitory effect and except for 20% concentration which was slightly promotory, all the extract were found inhibitory for root length.

Stem wood extract : Stem wood, like its bark, was found inhibitory at all the concentrations. The inhibition was less at 20% concentration in relation to other.

Table 12. *C. siamea* treated *C. occidentalis* seedlings : Root length (cms)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	4.32 (±0.7688)	4.0 (±0.6488)	2.65 (±1.0525)	2.05 (±0.3590)	0.97 (±0.5006)
Stem bark extract	5.25 (±0.8029)	4.95 (±0.8720)	5.6 (±0.8522)	4.95 (±0.8094)	3.45 (±0.7762)
Stem wood extract	4.35 (±0.4616)	3.15 (±0.7272)	4.05 (±0.9304)	3.75 (±1.0323)	3.0 (±0.7254)
Root bark extract	7.15 (±1.1931)	6.15 (±0.6901)	4.95 (±0.9017)	4.30 (±0.5712)	5.0 (±1.0000)
Root wood extract	2.65 (±0.6509)	2.75 (±0.4729)	3.0 (±0.4588)	2.7 (±1.0310)	2.25 (±0.7694)
Pod extract	3.55 (±0.8720)	4.7 (±1.1742)	4.7 (±1.1050)	5.1 (±1.0462)	4.0 (±1.1470)
Seed extract	3.3 (±0.7326)	3.4 (±0.9119)	3.1 (±0.9119)	3.45 (±0.8094)	2.35 (±0.8599)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Root bark extract : All the concentrations were found to be inhibitory, the inhibition increased with increase in concentration of the extract.

Root wood extract : Except 60% extract, the root wood extract generally promoted the root elongation of C. occidentalis.

Pod extract : Pod extract was found to be promotory for all the concentrations. However, maximum promotion was being observed at 40% extract.

Seed extract : Except for the 60% concentration the seed extract did not have any significant effect on the radicle elongation of C. occidentalis.

iii. Shoot length :

The effect of various extracts of C. siamea on shoot length of C. occidentalis seedlings (Table 13).

Leaf extract : Leaf extract at 10% concentration is found to be highly promotory to the shoot elongation of Cassia occidentalis. But at all higher concentrations (i.e., 20%, 40%, and 60%) the shoot elongation was found to be inhibited with the extract. The increase in concentration is inversely proportional to the shoot length.

Stem bark extract : The stem bark exerted no significant effect on shoot length of Cassia occidentalis. A slight but an insignificant decrease was observed at 20% concentration.

Table 13. C. siamea treated C. occidentalis seedlings : Shoot length (cms)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	7.95 (±1.2449)	9.1 (±1.7740)	7.5 (±0.8583)	6.8 (±1.9628)	3.7 (±1.5078)
Stem bark extract	9.7 (±1.0809)	9.65 (±0.8599)	9.55 (±1.0117)	9.65 (±1.2576)	9.75 (±1.0323)
Stem wood extract	8.05 (±1.1573)	8.7 (±0.7677)	7.8 (±0.9233)	7.25 (±0.8350)	7.35 (±1.0013)
Root bark extract	10.8 (±1.0310)	11.0 (±0.8885)	10.7 (±1.1742)	10.4 (±1.0462)	10.45 (±0.8414)
Root wood extract	7.4 (±1.0462)	7.9 (±1.5694)	8.25 (±1.1975)	8.3 (±1.1516)	7.15 (±1.5736)
Pod extract	8.35 (±1.1931)	8.5 (±1.1697)	8.15 (±0.6509)	7.75 (±0.6177)	6.55 (±1.1798)
Seed extract	10.05 (±1.2865)	10.05 (±0.9854)	9.85 (±0.8599)	8.3 (±1.1516)	7.95 (±1.1573)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Stem wood extract : At low concentrations the stem wood extract (10%) was found to be promotory in effect. But this effect was reversed at higher concentrations.

Root bark extract : Extractives from root bark exhibited no significant effects on the shoot growth of C.occidentalis seedlings.

Root wood extract : Root wood extract at all concentrations (except at 60%) promoted the shoot growth of C.occidentalis. Though at 60% there is a decrease in shoot length elongation, this is not statistically significant.

Pod extract : Except for 10% where there is a slight increase (non significant) in shoot length, the extract from pods inhibited the shoot elongation of C. occidentalis at all concentrations, 60% concentration was statistically proved to be significantly inhibitory.

Seed extract : Similar to the pod extract the seed extract also did not favour the growth of the C. occidentalis at 20% and higher concentrations. It did not show any effect at lower concentration (10%).

iv. Dry weight :

The effect of various extracts of C. siamea on dry weight of C. occidentalis seedlings (Table 14).

Leaf extract : Except 20% concentration, which showed inhibition, leaf extract was, in general, found promotory in effect for weight gain of C. occidentalis seedlings. Maximum promotion in weight was observed at 60% concentration.

Table 14. C.siamea treated C. occidentalis seedlings : Dry weight (g per plant)

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	0.1710	0.1735	0.1672	0.1729	0.1743
Stem bark extract	0.2007	0.2033	0.2034	0.2054	0.2027
Stem wood extract	0.1999	0.1990	0.2018	0.1992	0.1990
Root bark extract	0.1885	0.1886	0.1893	0.1908	0.1914
Root wood extract	0.1997	0.1989	0.2008	0.1973	0.1976
Pod extract	0.1989	0.2006	0.1988	0.1979	0.1975
Seed extract	0.1920	0.1973	0.1959	0.1968	0.1983

Stem bark extract : Stem bark extract promoted the dry weight of C.occidentalis seedlings at all concentrations. Maximum promotory effect was observed at 40% concentration.

Stem wood extract : Stem wood extractives of C. siamea did not exert any effect on dry weight of C.occidentalis seedlings except for 20% concentration which was proved to be promotory in effect.

Root bark extract : Root bark extract promoted the dry weight of C.occidentalis seedlings at all the concentrations. A gradual increase in weight was observed with increase in concentration, with maximum promotory effect being observed at 60% concentration.

Root wood extract : Except for 20% concentration, the extractives from root wood decreased the weight of seedlings of C.occidentalis at all the concentrations.

Pod extract : Pod extract promoted the weight gain at 10% concentration followed by a gradual decrease in weight of the seedling of C.occidentalis at all higher concentrations. Maximum reduction in weight was seen at highest concentration (60%).

Seed extract : Seed extract promoted the weight gain at all the concentrations. Maximum weight gain was observed in 60% concentration and minimum effect was seen in 20% concentration.

C. siamea vs. C. tora

i. Germination :

The effect of various extracts of C. siamea on germination percentage of C. tora seeds (Table 15).

Leaf extract : Leaf extract of C. siamea, at all concentrations caused a decrease in germination percentage of the seeds, the maximum inhibition being observed in 20% concentration.

Stem bark extract : In contrast to leaf extract, the stem bark extract enhanced the germination at all the concentrations. Maximum promotory concentration with respect to germination was 40%.

Stem wood extract : Stem wood extractives were found to be inhibitory for C. tora germination in genaral. Maximum inhibitory effect was observed at 20% concentration.

Root bark extract : Root bark extract was found to be inhibitory for germination at lower concentrations. Higher concentration (40% and 60%) were however found promotory for germination. There was a gradual increase in germination percentage with increase in concentration.

Root wood extract : Root wood extractives decreased germination at all concentrations of the extract. The maximum decrease in germination was observed at 10% concentration.

Pod extract : Pod extract decreased the germination at all the concentrations. The maximum inhibition was seen in 20% concentration.

Table 15. C.siamea treated C.tora seeds : Germination percentage

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	100	93	74	90	90
Stem bark extract	100	152	143	170	126
Stem wood extract	100	98	92	101	98
Root bark extract	100	88	92	108	111
Root wood extract	100	84	91	88	97
Pod extract	100	89	74	85	89
Seed extract	100	113	90	77	103

Seed extract : Seed extractives decreased the germination at 20% & 40% concentrations. The other two concentrations were found to be promotory in effect.

ii. Root length :

The effect of various extracts of C. siamea on root length of C. tora seedlings (Table 16).

Leaf extract : A slight increase in root elongation is observed at 10% extract concentration but this is not statistically significant. At higher concentrations the extract inhibited the elongation of roots. The inhibition increased with increase in concentration of the extract.

Stem bark extract : Except for the 60% which is promotory the stem bark extract inhibited the elongation of roots.

Stem wood extract : At all concentrations the extractives from stem wood was proved inhibitory to the roots.

Root bark extract : Contrary to the stem bark and wood the extracts from the root bark were found to promote the growth of the roots at all concentrations.

Root wood extract : Except for the 60% which is highly inhibitory, root wood extract did not have any significant effect on the root elongation of C. tora.

Pod extract : At all the concentrations pod extract enhanced the growth of roots. Maximum promotory effect was observed in 10% concentration.

Table 16. C.siamea treated C.tora seedlings : Root length (cms)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	3.25 (±1.0065)	3.35 (±0.9472)	2.9 (±0.8825)	2.75 (±0.4729)	2.3 (±0.6155)
Stem bark extract	3.75 (±0.6589)	3.4 (±0.5525)	3.2 (±0.9514)	3.00 (±0.8271)	4.2 (±1.0563)
Stem wood extract	3.19 (±0.7493)	2.67 (±0.3274)	3.02 (±0.6972)	2.69 (±0.6163)	2.61 (±0.4470)
Root bark extract	2.60 (±0.6805)	3.5 (±1.1470)	2.9 (±0.5982)	3.9 (±0.5525)	3.55 (±0.8720)
Root wood extract	2.7 (±0.5938)	2.62 (±0.5820)	2.75 (±0.6386)	2.52 (±0.3795)	2.11 (±0.5981)
Pod extract	2.9 (±0.7181)	4.55 (±1.0625)	3.75 (±0.8029)	4.0 (±0.5619)	4.25 (±0.8029)
Seed extract	2.92 (±0.3941)	2.85 (±0.6509)	2.9 (±0.5982)	2.55 (±0.2762)	2.55 (±0.4261)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Seed extract : At lower cocentrations the seed extract did not exert any effect. But at higher concentration (40% and 60%) there was a significant inhibition of roots.

iii. Shoot length :

The effect of various extracts of C. siamea on shoot length of C. tora seedlings (Table 17).

Leaf extract : Leaf extract promoted the shoot elongation in all concentrations. A significant increase in 10% concentration was observed. Also 10% extract concentration was found to be statistically significantly promotory as compared to 20%, 40% and 60% extract concentrations.

Stem bark extract : In general, the extract from the bark was found to inhibit the shoot length. 10%, 20% and 40% were found to be equally effective. 60% was found to be statistically significantly inhibitory in terms of all other extracts.

Stem wood extract : The extract of wood inhibited the shoot length at all concentrations. There was a gradual decrease in shoot length with an increase in concentration of the extract.

Root bark extract : On an average the root bark extract exhibited a promotory influence on the elongation of shoot. The maximum effect was observed in 20% concentration. At higher concentration (60%) the extract was found to be significantly inhibitory.

Table 17. C.siamea treated C.tora seedlings : Shoot length (cms)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	8.25 (±1.4912)	10.25 (±1.4188)	8.4 (±1.3337)	8.8 (±0.8944)	8.35 (±2.0717)
Stem bark extract	11.95 (±1.6132)	11.1 (±0.9947)	11.05 (±0.9304)	11.15 (±0.8599)	9.65 (±1.2783)
Stem wood extract	9.45 (±0.7762)	8.31 (±0.8149)	8.27 (±1.0342)	8.14 (±0.7542)	7.95 (±0.8094)
Root bark extract	9.7 (±1.3611)	9.65 (±1.0772)	10.6 (±1.5861)	9.5 (±1.4509)	8.8 (±1.2607)
Root wood extract	7.0 (±1.1787)	8.65 (±1.0013)	7.81 (±1.7109)	7.5 (±1.0513)	7.35 (±1.1596)
Pod extract	11.3 (±1.3018)	11.5 (±1.1002)	11.0 (±1.1239)	10.4 (±0.8207)	8.9 (±0.9403)
Seed extract	9.45 (±1.2865)	10.15 (±1.2365)	9.95 (±0.6668)	9.15 (±0.6901)	8.15 (±0.6901)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Root wood extract : At all concentrations root wood constituents promoted the shoot. 10% extract concentration was however, found to be statistically significantly promotory than 20%, 40% and 60% concentrations.

Pod extract : At 20% concentration the pod extract was inhibitory to the shoot of C. tora seedlings. At higher concentration the length of the shoot decreased proportionately.

Seed extract : At 10% and 20% concentration seed extract was found statistically significantly promotory. Higher (40% and 60%) concentrations were found significantly inhibitory.

iv. Dry weight :

The effect of various extracts of C. siamea on dry weight of C. tora seedlings (Table 18).

Leaf extract : Leaf extract decreased the weight of the seedlings at all concentrations. The maximum decrease in weight was observed at 40% concentration.

Stem bark extract : Except for 10% there is an in general increase in weight with all the concentrations of stem bark extract. Maximum weight was observed at 40% concentration.

Table 18. C.siamea treated C.tora seedlings : Dry weight (g per plant)

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	0.2060	0.2035	0.2005	0.1996	0.2009
Stem bark extract	0.2177	0.2129	0.2194	0.2195	0.2189
Stem wood extract	0.2070	0.2046	0.2045	0.2063	0.2084
Root bark extract	0.2028	0.2044	0.2036	0.2087	0.2055
Root wood extract	0.1955	0.1910	0.1984	0.1805	0.1891
Pod extract	0.2046	0.2018	0.2006	0.2015	0.2046
Seed extract	0.2058	0.2078	0.2048	0.2064	0.2038

Stem wood extract : Except for 60% concentration which caused an increase in weight, the extractives from stem wood decreased the weight of C. tora seedlings.

Root bark extract : Root bark extractives were found promotory for weight gain of C. tora seedlings at all the concentrations. 40% concentration was found to be highly stimulatory amongst all the concentrations.

Root wood extract : Root wood extract decreased the weight at all the given concentrations except for 20% which was found promotory and 40% was found highly inhibitory.

Pod extract : Pod extract decreased the weight of C. tora seedlings at all concentrations except for 60% which did not exert any effect. 20% concentration caused maximum reduction in weight.

Seed extract : Seed extractives promoted the weight gain of C.tora seedlings at 10% and 40% concentration 20% and 60% were however proved to be inhibitory.

P. pinnata vs. wheat

i. Germination :

The effect of various extracts of P. pinnata on germination percentage of wheat seeds (Table 19).

Leaf extract : Except for 20% concentration, which did not exert any effect, leaf extract in general, decreased the germination of wheat at all other concentrations. Maximum inhibition was observed at 60% concentration.

Stem bark extract : Except for 10% concentration, stem bark extract was found inhibitory for germination of wheat seeds at all other concentration. 10% concentration did not exert any effect.

Stem wood extract : Similar to stem bark extract, stem wood extract also inhibited the germination of wheat except for 10% concentration.

Root bark extract : Like stem bark and wood extracts, root bark extract did not exert any effect at 10% concentration. Higher concentration were however found inhibitory for germination of wheat seeds.

Root wood extract : Root wood extractives were promotory at lower concentrations (10% and 20%) but at higher concentrations they inhibited wheat seeds germination.

Pod extract : Pod extract, inhibited the germination of wheat seeds at all concentrations. 40% concentration was found to be highly inhibitory amongst all the concentration tested.

Table 19. P. pinnata treated wheat seeds : Germination percentage

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	100	85	100	61	59
Stem bark extract	100	100	69	50	59
Stem wood extract	100	100	96	64	80
Root bark extract	100	100	72	37	37
Root wood extract	100	135	115	60	80
Pod extract	100	77	82	62	80
Seed extract	100	85	79	82	92

Seed extract : Like pod extract, seed extract also inhibited the germination of wheat seeds at all the concentrations. 20% concentration showed maximum inhibition.

ii. Root length :

The effect of various extracts of P. pinnata on root length of wheat seedlings (Table 20).

Leaf extract : Leaf extract was slightly promotory at 10% concentration, whereas, it was significantly inhibitory at all higher concentrations. The inhibition increased with increase in concentration of the extract.

Stem bark extract : Like leaf extract, stem bark extract also inhibited root length of wheat at all concentrations. However, inhibition was very significant for higher concentrations like 40% and 60%.

Stem wood extract : Unlike the above mentioned extracts stem wood extract, promoted the root length elongation at all the concentrations. 20% concentration was found to be highly promotory for wheat roots.

Root bark extract : In general, root bark extract inhibited the root elongation at all concentrations except for the 10% extract concentration which shows significant promotory effect.

Root wood extract : Root wood extract inhibited the wheat root elongation at all the concentrations significantly. However, the maximum inhibitory effect was noticed at higher concentrations (40% and 60%).

Table 20. P. pinnata treated wheat seedlings : Root length (cm)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	11.0 (±1.0000)	11.8 (±1.1285)	10.85 (±1.1482)	9.55 (±0.9017)	6.25 (±0.8660)
Stem bark extract	9.1 (±0.8825)	8.65 (±1.0772)	8.0 (±1.2977)	5.6 (±1.6982)	5.15 (±0.3284)
Stem wood extract	7.4 (±1.2096)	9.7 (±1.5423)	9.95 (±1.1798)	7.95 (±0.7052)	7.55 (±1.0374)
Root bark extract	6.7 (±1.3611)	8.07 (±1.7938)	6.32 (±1.7341)	5.32 (±1.5241)	5.32 (±1.4260)
Root wood extract	7.75 (±1.6423)	7.4 (±0.9403)	7.1 (±1.1876)	4.85 (±1.0525)	5.25 (±0.7694)
Pod extract	10.45 (±1.0625)	12.3 (±2.0416)	12.35 (±1.5736)	11.25 (±1.1975)	9.85 (±1.2150)
Seed extract	8.4 (±1.2096)	6.0 (±0.6882)	5.0 (±1.5043)	5.0 (±1.4142)	3.65 (±1.3188)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Pod extract : Pod extract was significantly promotory at all concentrations. 60% concentration however, shows an inhibitory effect.

Seed extract : Seed extract, unlike pod extract was found to be significantly inhibitory at all the concentration. 60% was showing maximum inhibitory potential for root elongation of wheat seedlings.

iii. Shoot length :

The effect of various extracts of P. pinnata on shoot length of wheat seedlings (Table 21).

Leaf extract : Leaf extract did not exert any effect at lower concentrations, however, higher concentrations (40% and 60%) were found to be statistically significantly inhibitory for shoot elongation of wheat.

Stem bark extract : 10% extract was found to be promotory. Otherwise at all higher concentrations extractives of stem bark are proved statistically, to be inhibitory for shoot length elongation.

Stem wood extract : Lower concentrations of the stem wood extractives were promotory while higher concentration did not exert any effect on shoot length promotion of wheat.

Root bark extract : Root bark extract at 10% was statistically significantly promotory whereas, both the higher concentrations (40% and 60%) were found inhibitory, 20% extract did not show any effect.

Table 21. P. pinnata treated wheat seedlings : Shoot length (cm)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	12.0 (±1.1697)	12.2 (±1.0809)	12.05 (±1.2236)	11.65 (±1.2365)	10.35 (±1.2365)
Stem bark extract	10.3 (±0.7677)	10.65 (±0.7963)	9.85 (±1.0272)	8.45 (±1.0117)	8.85 (±1.0272)
Stem wood extract	10.05 (±1.2659)	11.15 (±0.9190)	11.55 (±1.2659)	10.1 (±0.7880)	10.05 (±1.2019)
Root bark extract	10.15 (±1.0272)	10.67 (±1.3599)	10.25 (±1.8952)	9.37 (±1.5884)	9.67 (±1.4260)
Root wood extract	10.4 (±1.2311)	10.95 (±0.4839)	10.10 (±1.2523)	9.8 (±1.0052)	10.05 (±0.5826)
Pod extract	10.55 (±1.0870)	13.1 (±1.4832)	13.35 (±1.0013)	12.10 (±1.0711)	11.75 (±1.1062)
Seed extract	9.95 (±1.0625)	10.15 (±0.9746)	9.35 (±0.9190)	8.7 (±0.9514)	6.5 (±1.3764)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Root wood extract : Like root bark, root wood extractives also showed a promotion in shoot length only at 10% extract concentration. The maximum inhibition was in 40% extract.

Pod extract : Pod extract was found to be promotory at all the concentrations, however, lower concentrations 10% and 20% were found statistically significantly promotory for wheat shoot length elongation.

Seed extract : Unlike pod extract, seed extract except for 10% concentration was found to inhibit the shoot length elongation of wheat seedlings at all concentrations.

iv. Dry weight :

The effect of various extracts of P. pinnata on dry weight of wheat seedlings (Table 22).

Leaf extract : Leaf extract promoted the weight gain of wheat seedling at all the concentrations. Maximum promotion in weight was observed at 40% concentration.

Stem bark extract : Except for 40% concentration, which caused reduced weight of wheat seedlings, stem bark extract promoted the weight gain of seedling at all the concentrations. Maximum promotion of weight being observed at 20% concentration.

Stem wood extract : Application of stem wood extract resulted in reduced weight of wheat seedlings upto 40% concentration.

Table 22. P. pinnata treated wheat seedlings : Dry weight (g per plant)

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	0.1218	0.1224	0.1229	0.1249	0.1234
Stem bark extract	0.1237	0.1271	0.1325	0.1226	0.1262
Stem wood extract	0.2274	0.2266	0.2246	0.2136	0.2195
Root bark extract	0.2169	0.2119	0.2166	0.2076	0.2152
Root wood extract	0.2257	0.2215	0.2235	0.2156	0.2251
Pod extract	0.1193	0.1164	0.1121	0.1130	0.1204
Seed extract	0.2221	0.2244	0.2210	0.2254	0.2267

Root bark extract : Root bark extract in general was inhibitory for dry weight of wheat seedlings at all the given concentrations. 40% concentration showed maximum inhibitory potential.

Root wood extract : Like root bark, root wood extract also showed inhibitory potential at all concentrations. Maximum inhibition was observed in 10% concentration.

Pod extract : Except for 60% concentration which showed slight promotion in weight, all the other concentrations were found inhibitory for dry weight of wheat seedlings. Maximum inhibition was observed in 20% concentration.

Seed extract : Except for 20% concentration which showed slight inhibition, seed extract was found promotory for wheat seedling dry weight at all other concentration with maximum promotory concentration being observed as 60%.

P. pinnata vs. rice

i. Germination :

The effect of various extracts of P. pinnata on germination percentage of rice seeds (Table 23).

Leaf extract : Leaf extract in general, enhanced the germination percentage of rice seed. However, concentration did not have any effect and all concentrations were proved equally effective.

Stem bark extract : Stem bark extractives decreased the germination percentage gradually with rise in concentration. 60% concentration was proved to be highly inhibitory.

Table 23. P.pinnata treated rice seeds : Germination percentage

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	100	102	102	102	102
Stem bark extract	100	89	87	84	74
Stem wood extract	100	97	108	100	92
Root bark extract	100	97	100	92	97
Root wood extract	100	100	97	95	92
Pod extract	100	100	100	100	100
Seed extract	100	100	100	97	90

Stem wood extract : Stem wood extract inhibited the germination at 10% and 60% concentrations. An increase was being observed at 20%, whereas, 40% concentration did not exert any effect.

Root bark extract : Except for 20% the extract inhibited the germination percentage at all other concentrations. Maximum inhibition was being observed at 40% concentration.

Root wood extract : Root wood extract caused a gradual decrease in germination with the rise in concentration. 10% concentration did not exert any effect, whereas, 60% was proved to be highly inhibitory.

Pod extract : Pod extract did not exert any effect on rice seed germination.

Seed extract : Seed extract did not exert any effect at lower concentrations, however, higher concentrations are proved to be inhibitory for germination.

ii. Root length :

The effect of various extracts of P. pinnata on root length of rice seedlings (Table 24).

Leaf extract : Leaf extract promoted the root length of rice at all concentrations except at 60% which was statistically proved to be significantly inhibitory. 40% extract concentration showed maximum promotion of root length.

Table 24. P. pinnata treated rice seedlings : Root length (cm)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	10.77 (±1.1177)	11.00 (±0.9459)	11.22 (±1.1410)	12.12 (±1.5717)	10.2 (±1.3514)
Stem bark extract	10.7 (±1.6889)	11.8 (±1.3992)	10.65 (±1.8503)	9.7 (±1.4725)	9.35 (±1.5568)
Stem wood extract	10.4 (±1.6026)	10.2 (±1.4179)	10.8 (±0.9787)	10.45 (±1.7083)	10.6 (±1.4832)
Root bark extract	12.17 (±1.2489)	11.7 (±1.3317)	11.5 (±1.1470)	13.02 (±0.9101)	12.45 (±1.3068)
Root wood extract	10.82 (±1.3206)	11.15 (±1.4058)	11.22 (±1.6179)	12.32 (±1.9886)	10.92 (±1.0166)
Pod extract	10.8 (±1.5508)	12.52 (±1.0696)	12.7 (±1.4363)	11.65 (±1.0525)	12.57 (±1.4074)
Seed extract	10.22 (±1.0572)	11.15 (±1.0013)	11.12 (±1.4223)	8.92 (±1.3886)	8.2 (±1.2290)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Stem bark extract : Unlike leaf extract, stem bark extract except at 10% extract concentration, inhibited the root length at all the concentrations. 10% extract concentration, however, was significantly promotory in effect.

Stem wood extract : Unlike stem bark, stem wood extractives did not exert any effect on root length elongation of rice.

Root bark extract : Extractives from root bark at lower concentrations inhibited the root length (significantly at 20% concentration) and promoted at higher concentration (40%).

Root wood extract : Root wood extract promoted the root elongation of rice at all the given concentrations. Maximum promotory effect was observed at 40% concentration.

Pod extract : Extractives from pod also show a promotory effect on elongation of root in rice at all the concentrations, except at 40% which was not significantly promotory. Maximum promotory effect was observed at 20% concentration.

Seed extract : Seed extract was proved statistically significantly promotory at lower concentrations (10% and 20%), whereas, higher concentration (40% and 60%) are found to be significantly inhibitory.

iii. Shoot length :

The effect of various extracts of P. pinnata on shoot length of rice seedlings (Table 25).

Leaf extract : Leaf extract caused a gradual increase in shoot length with an equivalent rise in concentration. All the given

Table 25. P. pinnata treated rice seedlings : Shoot length (cm)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	5.9 (±0.3838)	6.27 (±0.2552)	6.65 (±0.5404)	7.15 (±0.5404)	7.1 (±0.6407)
Stem bark extract	5.3 (±0.5231)	6.5 (±0.5619)	6.6 (±0.5026)	6.45 (±0.5355)	6.75 (±0.8029)
Stem wood extract	5.8 (±0.2513)	5.8 (±0.4701)	6.4 (±0.6407)	6.3 (±0.4103)	6.05 (±0.6668)
Root bark extract	6.45 (±0.3590)	6.9 (±0.7711)	6.45 (±0.4559)	6.7 (±0.4412)	6.87 (±0.4832)
Root wood extract	5.92 (±0.3725)	6.5 (±0.3973)	6.42 (±0.3725)	6.45 (±0.3940)	6.97 (±0.4722)
Pod extract	5.82 (±0.4940)	6.55 (±0.3590)	6.6 (±0.5525)	6.95 (±0.5355)	7.15 (±0.8900)
Seed extract	5.72 (±0.3795)	6.2 (±0.3402)	6.62 (±0.5590)	6.67 (±0.7122)	6.77 (±0.5729)

* Mean of 20 observations

. Figures in parentheses show standard deviation

concentration were found to be promotory in nature. Maximum promotion in length was observed with higher concentration 40% and 60%.

Stem bark extract : Like leaf extract, stem bark extract also promoted shoot length of rice at all the concentrations. Maximum promotion in length being observed at 60% concentration.

Stem wood extract : Like stem bark, extractives of stem wood also promoted shoot length at all the concentration. Here 20% extract concentration resulted in maximum shoot length.

Root bark extract : Except for 20% concentration, root bark extract was also found promotory in effect for shoot length at all other concentrations.

Root wood extract : Like all other extracts, root wood extract was also found promotory in effect to rice seedlings at all the given concentration. 60% concentration was found to be highly stimulatory for shoot length elongation.

Pod extract : Pod extractives stimulated shoot length of rice seedlings at all the concentrations tested. 60% concentration showed maximum promotion.

Seed extract : Seed extract exhibited a similar trend as mentioned above. All the concentrations are stimulatory for shoot length of rice seedlings. Maximum promotion being seen in 60% concentration of Pongamia extract.

iv. Dry weight :

The effect of various extracts of P. pinnata on dry weight of rice seedlings (Table 26).

Leaf extract : Leaf extract in general, enhanced the dry weight of rice seedlings at all the concentrations. However, 20% and 60% are proved to be highly promotory in terms of weight gain, in comparison to the other concentrations.

Stem bark extract : Stem bark extract caused a gradual rise in weight with rise in concentration. 10% concentration did not exert any effect whereas 60% concentration showed maximum weight gain.

Stem wood extract : Extractives from stem wood are highly promotory at 10% concentration and followed by 40% concentration. 20% and 60% were in comparison less promotory. In general, all the extracts were promotory for weight gain.

Root bark extract : Except for 20% concentration which showed inhibition, all other concentrations were found to be promotory in effect in terms of weight gain. 60% was proved to be highly effective.

Root wood extract : Except for 20% concentration, which showed a promotory effect, root wood extract was in general, inhibitory for rice seedlings weight gain.

Pod extract : Except for 10% concentrations which was inhibitory, pod extract promoted the weight of rice seedlings gradually with the increase in concentration.

Table 26. P.pinnata treated rice seedlings : Dry weight (g per plant)

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	0.1605	0.1606	0.1628	0.1610	0.1629
Stem bark extract	0.2013	0.2013	0.2029	0.2029	0.2039
Stem wood extract	0.2117	0.2097	0.2124	0.2080	0.2119
Root bark extract	0.1502	0.1524	0.1497	0.1572	0.1610
Root wood extract	0.1553	0.1504	0.1619	0.1466	0.1498
Pod extract	0.1460	0.1421	0.1462	0.1491	0.1497
Seed extract	0.1523	0.1429	0.1451	0.1391	0.1462

Seed extract : Seed extractives at all concentrations were inhibitory in effect, however 40% was highly inhibitory for rice seedlings.

P. pinnata vs C. occidentalis

i. Germination :

The effect of various extracts of P. pinnata on germination percentage of C. occidentalis seeds (Table 27).

Leaf extract : Except for 10%, which did not exert any effect on germination, the extract at all other concentration was found to have some inhibitory effect on seed germination. The maximum inhibition was observed at 20% concentration.

Stem bark extract : Stem bark extract at 10% concentration promoted the germination of C. occidentalis seeds. All other concentrations were found to have an opposite effect. However, 40% concentration did not exert any effect.

Stem wood extract : Stem wood extractives decreased the germination percentage of C.occidentalis seeds at all concentrations. Lower concentrations (10% and 20%) were found more inhibitory than higher concentrations.

Root bark extract : Root bark extractives decreased the germination of C.occidentalis at all concentrations. Maximum inhibition in germination was observed at 60% concentration.

Root wood extract : Root wood extract, like root bark extract, decreased the germination percentage at all the concentrations with highest concentration (60%) showed maximum inhibition.

Table 27. P.pinnata treated C. occidentalis seeds : Germination percentage.

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	100	100	71	91	74
Stem bark extract	100	112	83	100	75
Stem wood extract	100	77	85	92	92
Root bark extract	100	96	85	92	81
Root wood extract	100	80	84	96	64
Pod extract	100	130	109	100	96
Seed extract	100	80	100	90	75

Pod extract : Pod extract unlike all other extracts promoted the seed germination of C. occidentalis at lower concentrations. It did not exert any effect at 40% concentration and at higher concentration (60%) slightly inhibited the germination of seeds.

Seed extract : Seed extract in general, was found to have some inhibitory effect for C. occidentalis seed germination. 20% concentration did not exert any effect. Higher concentration (60%) showed maximum inhibition.

ii. Root length :

The effect of various extracts of P. pinnata on root length of C. occidentalis seedlings (Table 28).

Leaf extract : Leaf extract inhibited root length of Cassia occidentalis at all concentrations, however, higher concentrations (like 40% and 60%) were very significantly inhibitory to root length promotion.

Stem bark extract : Unlike leaf extract, stem bark extract promoted the root elongation at all the concentrations, maximum promotion being observed at 20% concentration.

Stem wood extract : Like stem bark extract, stem wood extract also promoted the root length of Cassia occidentalis at all the concentrations. The maximum promotion in root length was observed at 40% extract concentration.

Table 28. *P.pinnata* treated *C.occidentalis* seedlings : Root length (cm)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	3.62 (±0.5349)	3.32 (±0.6934)	2.27 (±0.5954)	1.75 (±0.4442)	1.70 (±0.6958)
Stem bark extract	3.85 (±0.5642)	4.6 (±0.8522)	4.95 (±0.9304)	4.45 (±0.8720)	4.3 (±0.7326)
Stem wood extract	3.5 (±0.9733)	4.35 (±0.6091)	4.7 (±0.9787)	5.35 (±0.9472)	5.15 (±0.7626)
Root bark extract	4.0 (±0.8583)	3.45 (±0.9854)	2.25 (±0.3441)	2.8 (±0.8013)	2.35 (±0.4616)
Root wood extract	5.05 (±0.8720)	4.45 (±0.7416)	4.50 (±0.9176)	3.95 (±0.7416)	2.45 (±0.8094)
Pod extract	2.6 (±0.6805)	4.0 (±0.5619)	2.35 (±0.4006)	2.4 (±0.5026)	2.55 (±0.4839)
Seed extract	3.4 (±0.3838)	1.85 (±0.4616)	1.7 (±0.4103)	1.45 (±0.4839)	0.65 (±0.3284)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Root bark extract : Root bark extract inhibited the root length of Cassia occidentalis at all the concentrations. The inhibition increased with increase in concentration of the extract.

Root wood extract : Root wood extract like root bark extract was found to be inhibitory at all the concentrations. Higher concentrations were however very significantly inhibitory to root length elongation.

Pod extract : Except at 10% extract concentration which was promotory the pod extract did not exert any significant effect on root length of seedlings.

Seed extract : Seed extractives were very highly inhibitory at all the concentrations. Significant decrease with increase in concentration of the extract terms of root length was being observed.

iii. Shoot length :

The effect of various extracts of P. pinnata on shoot length of C. occidentalis seedlings (Table 29).

Leaf extracts : Leaf extract of Pongamia showed high inhibitory potential against shoot length elongation of Cassia occidentalis. All the concentrations were found significantly inhibitory.

Stem bark extract : Stem bark extract, like the leaf extract inhibited the shoot length of C.occidentalis at all concentrations and the inhibition increased with increasing concentration.

Table 29. P.pinnata treated C.occidentalis seedlings : Shoot length (cm)*

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	8.05 (±0.7930)	7.1 (±0.7539)	5.45 (±0.6668)	5.12 (±1.2234)	3.77 (±0.9930)
Stem bark extract	9.15 (±0.8900)	8.6 (±0.5525)	8.9 (±0.5026)	8.5 (±0.7254)	7.75 (±1.2193)
Stem wood extract	7.5 (±0.6488)	8.25 (±0.8958)	7.45 (±1.1109)	7.6 (±0.6805)	7.4 (±0.7539)
Root bark extract	6.85 (±0.6509)	6.4 (±0.9947)	6.4 (±0.7539)	5.85 (±0.9746)	4.9 (±0.9119)
Root wood extract	8.7 (±1.1050)	7.75 (±0.9248)	6.9 (±0.6407)	6.9 (±0.8522)	4.25 (±0.6177)
Pod extract	6.15 (±0.7963)	7.3 (±0.4103)	5.35 (±0.4006)	5.25 (±0.6589)	5.45 (±1.0117)
Seed extract	6.65 (±0.6091)	4.4 (±0.4472)	4.05 (±0.8094)	3.15 (±0.6091)	2.3 (±0.6155)

* Mean of 20 observations

. Figures in parentheses show standard deviation

Stem wood extract : Except at 10% extract which show promotory effect, the stem wood extract of Pongamia did not exert any effect on shoot length of Cassia occidentalis.

Root bark extract : In general root bark extract inhibited the shoot length of Cassia occidentalis at all the concentrations but lower concentrations were not significantly inhibitory. 60% extract showed maximum inhibition.

Root wood extract : Root wood extractives were also found significantly inhibitory at all the concentrations for shoot length. Here also 60% had maximum inhibitory action against shoot elongation.

Pod extract : Pod extract promoted the shoot length at 10% extract concentration. All the other concentration were significantly inhibitory to the shoot.

Seed extract : Seed extract was inhibitory at all concentrations, however, higher concentration were very significantly inhibitory for shoot length.

iv. Dry weight :

The effect of various extracts of P. pinnata on dry weight of C. occidentalis seedlings (Table 30).

Leaf extract : Except for 10% concentration which showed promotion, the treatment with extract, in general, resulted in weight loss in C. occidentalis seedlings at all other concentrations. Maximum inhibition was observed at 40% concentration.

Table 30. P.pinnata treated C.occidentalis seedlings : Dry weight (g per plant)

Treatments	Control	Concentrations of the extract			
		10 %	20 %	40 %	60 %
Leaf extract	0.1538	0.1550	0.1421	0.1363	0.1453
Stem bark extract	0.1418	0.1368	0.1207	0.1091	0.1114
Stem wood extract	0.2120	0.2094	0.2101	0.2080	0.2095
Root bark extract	0.2028	0.2007	0.2009	0.1999	0.2006
Root wood extract	0.2021	0.2027	0.2011	0.2011	0.2007
Pod extract	0.1995	0.2001	0.2024	0.2021	0.2022
Seed extract	0.2039	0.1998	0.2017	0.2002	0.1973

Stem bark extract : Like leaves, this extract also showed inhibition at all the concentrations tested. However, maximum inhibition in terms of weight gain was observed at 40% concentration.

Stem wood extract : Stem wood extract, like stem bark extract was found inhibitory at all the concentrations. 40% concentration showed maximum inhibitory potential for C. occidentalis seedlings.

Root bark extract : Root bark extract also followed the same trend of inhibition at all concentrations with maximum inhibitory potential being expressed by 40% concentration.

Root wood extract : Root wood extractives were found to be promotory at 10% concentration. All other concentrations, however, were found to be inhibitory for dry weight of C. occidentalis seedlings. 60% concentration was observed to be maximum inhibitory in potential.

Pod extract : Pod extract, unlike all other extracts promoted the weight gain of C.occidentalis seedlings at all concentrations. 20% concentration was found to be most effective.

Seed extract : Unlike pod extract, seed extract was found to be inhibitory at all concentrations in terms of dry weight of Cassia occidentalis seedlings. Highest concentration (60%) showed maximum inhibitory effect.

Pongamia vs. C. tora

i. Germination

C. tora failed to germinate in the extracts of various parts of P. pinnata irrespective of all the concentrations. In all the treatments the seeds absorbed water, swelled to a mucilaginous mass followed by microbial attack and decay. One or two seedling which germinated did not survive till the test period and degraded. Hence no study on the root, shoot elongation or the dry weight could be conducted.