Impact of reed bamboos on the surrounding vegetation in reserve forests of Thiruvananthapuram, Kerala.

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ABSTRACT *The reed bamboos, Ochlandra wightii and Ochlandra travancorica shows some effect on the nearby vegetation which can be due to the presence of some toxins or due to any biochemical interactions. The study areas of reserve forests in Thiruvananthapuram district, confirms the inhibitory effect of bamboos that is directly or indirectly affecting the growth and survival of other plants. The different plant species in the forest areas with bamboos were documented and was compared with those of the control site. The control sites where reed bamboos were absent were rich in vegetation when compared to the study area. The analysis for chlorophyll pigment was also carried out and the results showed much variation between plants in sample sites and control sites. The results draw the conclusion that there is an allelopathtic effect of reed bamboos in the reserve forest areas of Thiruvananthapuram which suppresses other plant growth.*

Keywords: *Ochlandra, Ecophysiology, Allelopathy*

Introduction

Bamboos are evergreen fast-growing perennials in the grass family Gramineae. Usually bamboos have hollow stems that cannot be bent easily. Sometimes bamboos reach upto 100 ft. or more in height. Bamboo has many ecological functions, most significantly soil conservation and carbon sequestration. Competition is seen between plants for moisture, light and soil nutrients. In this competition, these plants have developed various defence strategies against their neighbouring plants, it is known as allelopathy when this defence is chemical in nature. Alleopathy is most frequent when one type of plant competes with another type. Allelopathic inhibition results from the interaction between flavonoids, alkaloids, terpenoids, steroids, carbohydrates and aminoacids. However environmental stresses, temperature levels, diseases and solar radiation can also affect allelopathic inhibition. An allelopathic plant releases its protective chemicals by many ways such as volatilization, leaching and exudation. These toxic chemicals are absorbed by other plants and die. The present investigation entitled “Impact of reed bamboos on the surrounding vegetation in reserve forests of Thiruvananthapuram, Kerala”is an attempt to study and compare the eco-physiological aspects of reed bamboos *Ochlandra travancoria* and *Ochlandra wightii*.

Materials and Methods

The two species selected for study were *Ochlandra travancorica* and *Ochlandra wightii* from the protected forest areas of Thiruvananthapuram district in Kerala. The areas of study were visited in the month of June 2018 and analyzed for vegetation growth. Primary data collection was done by taking 3 plots of size (3m*3m) and a control site. The list of plants was documented and chlorophyll analysis was also done from the plots and control areas.

Result and Discussion

The plants present in the three different plots of *O.wightii* and *O.travancorica* were analysed. The botanical name, family and the frequency of each plants present were identified and documented.

The plots 1, 2 and 3 which contained *O.wightii* had a total number of 47 plants belonging to more than 7 families. The botanical name, family and frequency of each plant were identified and are given in Table 1.1. The plot which lack *O.wightii* contained 180 plants belonging to more than 10 families and is represented in Table 1.2. The most dominant plant in the control plot was *Nephilium longana*, belonging to the family Sapindaceae, 82 of which were present.

The botanical name, family and frequency of each plant found in plot 1, 2 and 3 containing *O.travancorica* is presented in Table 1.3. These plots contained a total of 54 plants belonging to more than five families. The plants in the control plot were also identified and are presented in the Table 1.4. More than 113 plants were present in the control plot. The most abundant plant in this plot was *Oplismenus hirtellus* belonging to the family Poaceae. Numerous plants of *Oplismenus hirtellus* were found in this plot.

Table 1.1 Botanical names, family and frequency in plots containing *O.wightii*

Sl.No.	Plot number	Botanical name	Family	Frequency
1	Plot 1	*Goniothalamus cardiopetalus*	Annonaceae	6
2		*Chassalia curviflora*	Rubiaceae	2
3		*Ficus hispida*	Moraceae	3
4		Tree species	-	6
5	Plot 2	*Alstonia scholaris*	Apocynaceae	3
6		*Rhaphidophora pertusa*	Araceae	4
7		Tree species	-	5
8	Plot 3	*Clidemia hirta*	Melastomaceae	9
9		*Mesua ferrea*	Calophyllaceae	2
10		Tree species	-	7

Table 1.2 Botanical names, family and frequency in control plot

Sl.No.	Botanical name	Family	Frequency
1	*Nephilium longana*	Sapindaceae	82
2	*Rhaphidophora pertusa*	Araceae	13
3	*Caryota mitis*	Arecaceae	4
4	*Cinnamomum malabatrum*	Lauraceae	12
5	*Calamus javensis*	Arecaceae	15
6	*Piper argyrophyllum*	Piperaceae	2
7	*Ficus hispida*	Moraceae	12
8	*Clidemia hirta*	Melastomaceae	18
9	*Mallotus philippinensis*	Euphorbiaceae	4
10	Asparagus species	Asparagaceae	2
11	*Angiopteris evecta*	Pteridophyta	2
12	Tree species	-	14

Table 1.3 Botanical name, family and frequency in plots containing *O. travancorica*

Sl.No.	Plot number	Botanical name	Family	Frequency
1	Plot 1	*Nephilium longana*	Sapindaceae	3
2		*Piper argyrophyllum*	Piperaceae	12
3		Tree species	-	8
4	Plot 2	Artabotrys species	Annonaceae	8
5		*Spatholobus parviflorus*	Fabaceae	6
6		Tree species	-	4
7	Plot 3	*Rhaphidophora pertusa*	Araceae	7
8		Tree species	-	6

Table 1.4 Botanical name, family and frequency in the control plot

Sl.No.	Botanical name	Family	Number
1	*Thottea siliquosa*	Aristochiaceae	9
2	*Piper argyrophyllum*	Piperaceae	15
3	*Macaranga peltata*	Euphorbiaceae	11
4	Zingiber species	Zingiberaceae	13
5	Selaginella species	Selaginellaceae	18
6	*Globba sessiliflora*	Zingiberaceae	8
7	*Mimosa pudica*	Fabaceae	7
8	*Nephilium longana*	Sapindaceae	16
9	*Oplismenus hirtellus*	Poaceae	numerous
10	Tree species	-	16

It can be inferred from the results that both *O.wightii* and *O.travancorica* has an influence on the neighbouring plants, which may be the reason behind the deduction of plants in the sites containing them. The reason behind the reduction of plants due to the effect of one plant has been studied by various workers. In 1944, a study conducted by Bonner and Galston found that a toxin is released as root exudates from Parthenium, as a result of which other plants did not grew near it. Muller (1966) reported the inhibition of vegetation in California by Salvia and Artemisia shrubs and the reason behind it was due to the release of some volatile compounds by these shrubs.

The composition of plant community is greatly influenced by the phytotoxic chemicals released in the form of root exudates, leaf leachates etc. A study conducted by Del Moral and Muller in 1969 reported allelopathy as the reason behind the formation of bare areas near Eucalyptus species. Stickney and Hoy in 1881 found sparse vegetation around *Juglans nigra*. Perez and Ormemeno-Nunez (1991) in their study reported the role in allelopathy for the Difference in hydroxamic acid content in roots and root exudates of wheat and rye. Chaves and Escudero in 1997 conducted a study on the influence of the exudate secreted by *Cistus ladanifer* leaves on different plant species. They found that the diversity and richness of herbs near Cistus was lower than that of the neighbouring plots without this plant. They also reported that the allelopathic activity of a plant may reduce the number of other plants by reducing their competitive ability.

Chlorophyll analysis of sample sites and control sites of *O.wightii*

The chlorophyll a, chlorophyll b and total chlorophyll of the plants present commonly in sample sites and control sites was estimated and is represented in the figure1.1 and 1.2. *Ficus hispida* and *Clidemia hirta* were the plants analysed for chlorophyll estimation. The chlorophyll a, chlorophyll b and total chlorophyll of *Ficus hispida* present in the sample site were 2.72 mg/g tissue, 0.43 mg/g tissue and 0.50 mg/g tissue respectively whereas *Ficus hispida* in the control site was having 4.71 mg/g tissue of chlorophyll a, 4.33 mg/g tissue of chlorophyll b and 3.92 mg/g tissue of total chlorophyll.

Clidemia hirta found in sample site was with 3.65 mg/g tissue of chlorophyll a, 1.29 mg/g tissue of chlorophyll b and 1.29 mg/g tissue of total chlorophyll whereas *Clidemia hirta* found in *O.wightii* lacking plot was having 5.14 mg/g tissue of chlorophyll a, 4.37 mg/g tissue of chlorophyll b and 3.97 mg/g tissue of total chlorophyll.

Both *Ficus hispida* and *Clidemia hirta* found in the control sites have more amounts of chlorophyll a, chlorophyll b and total chlorophyll than those found in the sample sites with *O.wightii*. So the rate of photosynthesis is low in the plants present along with *O.wightii* than the plant species in the control site which lack *O.wightii*.

Fig.1.1 Chlorophyll analysis of *Ficus hispida* in sample site and control sites of *O.wightii*

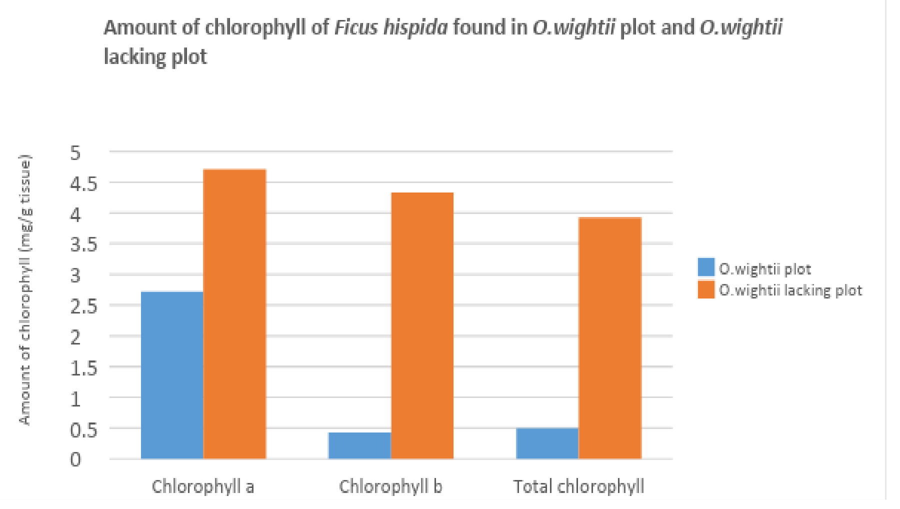
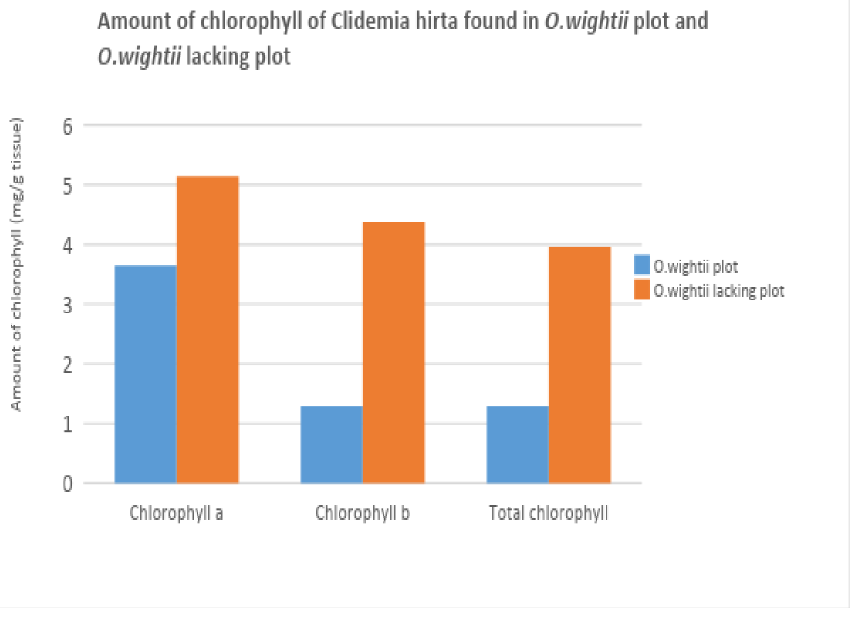


Fig.1.2 Chlorophyll analysis of *Clidemia hirta* in sample site and control sites of *O.wightii*



Chlorophyll analysis of sample sites and control sites of *O.travancorica*

The amount of chlorophyll a, chlorophyll b and total chlorophyll of the plants common in both sites with and without *O.travancorica* is presented in the figure 1.3 and 1.4. *Nephilium longana* and *Piper argyrophyllum* were the plants taken for chlorophyll estimation. The chlorophyll a, chlorophyll b and total chlorophyll of *Nephilium longana* in sample site were recorded as 3.25 mg/g tissue, 0.93 mg/g tissue and 0.95 mg/g tissue respectively and those in the control site represented 5.38 mg/g tissue of chlorophyll a, 2.11 mg/g tissue of chlorophyll b and 2.02 mg/g tissue of total chlorophyll.

Piper argyrophyllum found in the sample site with *O.travancorica* was 2.16 mg/g tissue of chlorophyll a, 3.00 mg/g tissue of chlorophyll b and 2.69 mg/g tissue of total chlorophyll while the chlorophyll a, chlorophyll b and total chlorophyll of *Piper argyrophyllum* in the site lacking *O.travancorica* were 4.04 mg/g tissue, 3.51 mg/g tissue and 3.19 mg/g tissue respectively.

Nephilium longana and *Piper argyrophyllum* in the control site devoid of *O.travancorica* had higher amount chlorophyll a, chlorophyll b and total chlorophyll than those found in sample sites with *O.travancorica*.

Fig.1.3 Chlorophyll analysis of *Nephilium longana* in sample site and control sites of *O.travancorica*

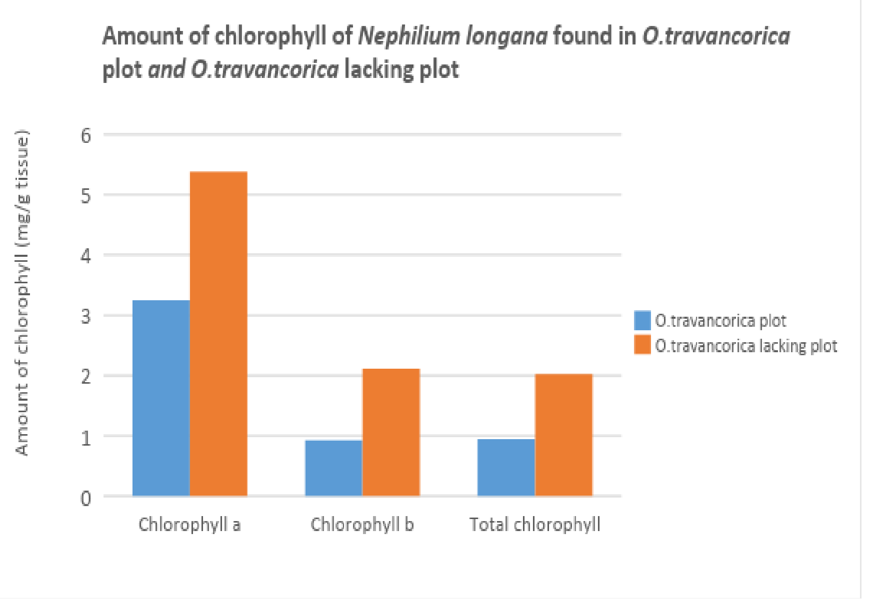
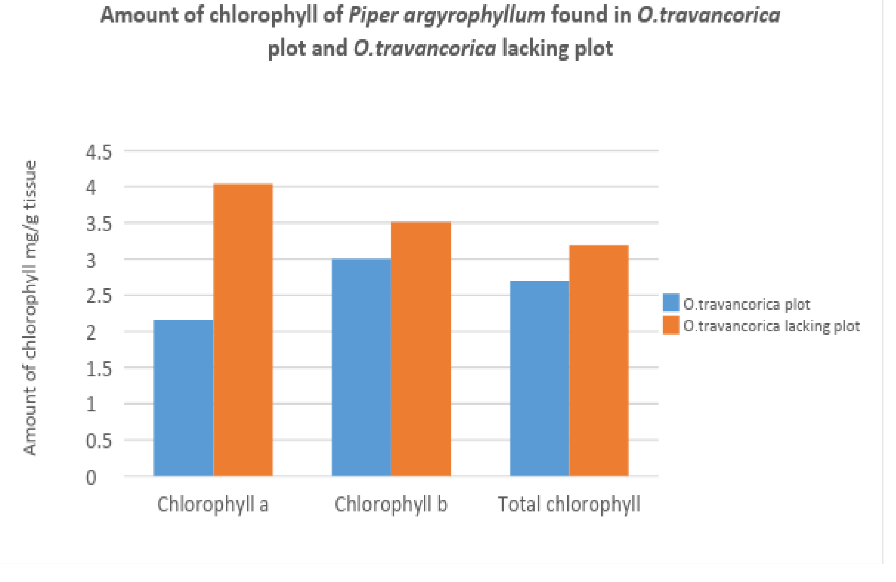


Fig.1.4 Chlorophyll analysis of *Piper argyrophyllum* in sample site and control sites of *O.travancorica*



Similar results were observed with *Ochlandra wightii* and *Ochlandra travancorica*. The plants found in both sample sites of *O.wightii* and *O.travancorica* were having less amount of chlorophyll a, chlorophyll b and total chlorophyll than that of the plants which were found in the control plots. So both *O.wightii* and *O.travancorica* has an influence on the chlorophyll content of the neighbouring plants. The rate of photosynthesis is also low in these plants. Studies conducted earlier report that allelochemicals leads to the decrease in chlorophyll synthesis of plants thereby resulting in retarding of photosynthesis and poor plant growth. So the release of allelochemicals by *O.wightii* and *O.travancorica* may be the reason behind the reduction of chlorophyll synthesis of plants present in the plots containing them.

Conclusion

There occurs both harmful and beneficial biochemical interaction between all types of plants. The release of some chemicals to the environment by the reed bamboos *O.wightii* and *O.travancorica* may be the reason for low growth of other plant species near them. The vegetation under these species was very sparse which indicates the inhibitory effect to the surrounding vegetation. The plant chemicals cause allelopathy and it is possible to determine which chemicals are responsible for allelopathy, their release, quantity and also the mechanisms through which these chemicals affect the plants in the neighbourhood. Hence, further detailed study is needed to understand the allelopathic effect of bamboos on other neighbouring plants.

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