Research Article

Air Pollution Tolerance Index Assessment of Yercaud Road Side Plants

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ABSTRACT

The air pollution tolerance index was studied by collecting plants located at Yercaud roadsides. Totally 11-12 plants were selected for the study from three points. Among the plants studied at each point, the relative water content, ascorbic acid level was high for *Azadirachta indica*. Alkaline pH was observed for most of the plants, whereas, few plants like *Tectona grantis, Cardia Sebestina Eucalyptus* and *Jatropha carcus* showed acidic pH. Likewise, air pollution tolerance index was found to be high for *Azadirachta indica, Morinda tinctoria, Anacardium oxidetale, Mimusops elengi, Pisivum Sativam, Pongamia pinnata, Aayamaram*. Eventhough, it was higher, all these plants were categorized under sensitive species.

Keywords: APTI, Biochemical changes, Pigments, Roadsides, Yercaud.

INTRODUCTION

Vehicles a symbol of major cause of air pollutants such as, carbonmonoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and particulate matters. Emission from vehicles increases pollution. In order to see the effect of pollution on road side plants, it was decided to study the Yercaud road side plants from Adivaram to top. Yercaud range is one among the five territorial ranges of Salem. Lands in Yercaud is surrounded by a beautiful environment, conserved by enforcing Tamil Nadu Forest Act 1882, Forest conservation Act 1980, Wildlife protection Act 1972, Tamil Nadu hill preservation Act 1955, with the aim of protecting Shervaroyan hills. The old name of Yercaud was " Ericadu" later it was named as Yercaud. Yercaud, a southern tropical dry decidious as well as evergreen forest containing huge number of tree species including Kurunji, bushes, climbers, shrubs, grasses. Totally 20 bends were there in Yercaud road from Adivaram to Top. For simplicity, the total bends were divided into three points. The descriptions of each point is as follows: Point 1: Plants located at road sides of bend 1, Point 2: Plants located at road sides between bend 10 and 11, Point 3: Plants located at road sides with in two kilometers from bend 20. For the present study, plants were selected randomly at each point.

The following plants were selected from point 1: *Pisivum Sativam, Cassia fistula, Morinda tinctoria, Bambusa bambos, Peltophorum acutifolium, Aayamaram, Cassia alata, Manilkara zapota, Pongamia pinnata, Azadirachta indica, Ficus religiosa, Tamarindus indica.*

The list of plants selected from point 2: *Callistemon, Cardia sebestena, Plumeria alba, Polyalthia longifolia, Psidium guajava, Mangifera indica, Annona squamosa, Ficus bangaliansis, Tectona grandis, Mimusops elengi, Anacardium oxidetale.*

Selected plants from point 3: *Morinda tinctoria, Nerium oleander, Tecoma stans, Cardia Sebestina, Eucalyptus, Citrus limon, Atrocarphous heterophyllus, Psidium guajava, Jatropha carcus, Causarina equistifolia, Tectona grandis.* Fresh leaves were collected from selected plants at each points at early morning was used for the whole study.

MATERIALS AND METHODS

Leaf sample collection

For the present study, fresh leaves from each plant were collected from the experimental sites near road sides of Yercaud at three different points during the month of January to March, 2014. Common plants identified were selected in both the areas. All experiments were carried out in triplets.

Extract preparation

Fresh leaves were used according to the standard prescribed methods adopted. Aqueous extract was used for the whole study.

Biochemical Parameters

pH

100mg of the fresh leaves was homogenized in 10ml deionized water. This was filtered and the pH of the leaf extract was determined after calibrating pH meter with buffer solution pH 4 and pH 9.

Relative water content

Fresh weight was obtained by weighing the leaves. The leaf samples were then immersed in water over night blotted dry and then weighed to get the turgid weight. The leaves were then dried overnight in a hot air oven at 70^0c and reweighed to obtain the dry weight. RWC was determined and calculated by the method as described by

Singh 1977.[1] RWC=[(FW-DW)/(TW-DW)] x 100. Where: FW-Fresh weight, DW-Dry and TW-Turgid weight.

Ascorbic acid content

Ascorbic acid content was measured by Titrimetric method of Sadasivam 1987[2] using 2,6, Dichlorophenol indo phenol dye. 500mg of leaf sample was extracted with 4% oxalic acid and then titrated against the dye until pink colour develops. Similarly a blank is also developed.

Total chlorophyll content

This was carried out according to the method described by Arnon 1949.[3] 500mg of fresh leaves were blended and then extracted with 10 ml of 80% acetone and leave for 15min. The liquid protein was decanted into another test tube and centrifuged at 2,500rpm for 3min. The supernatant was then collected and the absorbance was taken at 645nm and 663nm using UV- Visible spectrophotometer- Shimadzu, Japan make. Model UV 1800.

Calculation of APTI

The air pollution tolerance indices of the selected plants were determined by following the method of Singh and Rao (1983).[4] The formula of APTI is given as: APTI= [A (T+P) + R] / 10. Where: A=Ascorbic acid content (mg/gm), T=Total chlorophyll (mg/gm), P=pH of the leaf extract, R=Relative water content of leaf (%).

RESULTS AND DISCUSSION

The results of biochemical components and APTI studied for plants at Yercaud sides are shown in Table 1 to Table 5.

Table 1: Depicting results of pH

Name of plants	Point 1	Name of plants	Point 2	Name of plants	Point 3
Pisivum Sativam	8.5	*Callistemon*	7.0	*Morinda tinctoria*	8.0
Cassia fistula	8.5	*Cardia sebestena*	9.0	*Nerium oleander*	7.0
Morinda tinctoria	8.5	*Plumeria alba*	9.0	*Tecoma stans*	7.0
Bambusa bambos	8.5	*Polyalthia longifolia*	8.2	*Cardia Sebestena*	6.0
Peltophorum acutifolium	8.8	*Psidium guajava*	8.0	*Eucalyptus*	5.0
Aayamaram	8. 5	*Mangifera indica*	8.5	*Citrus limon*	7.0
Cassia alata	8.8	*Annona squamosa*	8.5	*Atrocarphous heterophyllus*	7.0
Manilkara zapota	8.2	*Ficus bangaliansis*	8.8	*Psidium guajava*	7.0
Pongamia pinnata	8.5	*Tectona grandis*	8.5	*Jatropha carcus*	3.0
Azadirachta indica	8.5	*Mimusops elengi*	8.0	*Causarina equistifolia*	8.0
Ficus religiosa	8.0	*Anacardiumoxidetale*	8.0	*Tectona grandis*	6.0
Tamarindus indica	8.2				

Point 1: Plants collected at bend 1; Point 2: Plants collected between bend 10 &11; Point 3: Plants collected within 2km from bend 20.

Table 2: Showing Relative water content

Name of plants	Point 1	Name of plants	Point 2	Name of plants	Point 3
Pisivum Sativam	97.81	*Callistemon*	51.56	*Morinda tinctoria*	65.55
Cassia fistula	98.52	*Cardia sebestena*	73.93	*Nerium oleander*	84.45
Morinda tinctoria	98.88	*Plumeria alba*	37.19	*Tecoma stans*	76.10
Bambusa bambos	92.6	*Polyalthia longifolia*	78.31	*Cardia Sebestena*	90.32
Peltophorum acutifolium	79.87	*Psidium guajava*	67.18	*Eucalyptus*	85.6
Aayamaram	99.24	*Mangifera indica*	93.77	*Citrus limon*	88.08
Cassia alata	96.77	*Annona squamosa*	55.05	*Atrocarphous heterophyllus*	93.06
Manilkara zapota	99.61	*Ficus bangaliansis*	79.82	*Psidium guajava*	92.14
Pongamia pinnata	97.41	*Tectona grandis*	54.81	*Jatropha carcus*	96.05
Azadirachta indica	97.67	*Mimusops elengi*	82.38	*Causarinaequistifolia*	30.81
Ficus religiosa	99.75	*Anacardiumoxidetale*	92.31	*Tectona grandis*	94.60
Tamarindus indica	20.24				

Point 1: Plants collected at bend 1; Point 2: Plants collected between bend 10 &11; Point 3: Plants collected within 2km from bend 20.

Table 3: Showing Ascorbic acid content

Name of plants	Point 1	Name of plants	Point 2	Name of plants	Point 3
Pisivum Sativam	2.77	*Callistemon*	0.90	*Morinda tinctoria*	2.98
Cassia fistula	0.37	*Cardia sebestena*	0.80	*Nerium oleander*	1.81
Morinda tinctoria	2.88	*Plumeria alba*	0.21	*Tecoma stans*	0.74
Bambusa bambos	1.86	*Polyalthia longifolia*	0.42	*Cardia Sebestena*	0.69
Peltophorum acutifolium	2.88	*Psidium guajava*	4.48	*Eucalyptus*	0.58
Aayamaram	2.77	*Mangifera indica*	3.46	*Citrus limon*	0.37
Cassia alata	3.62	*Annona squamosa*	1.81	*Atrocarphous heterophyllus*	0.69
Manilkara zapota	1.81	*Ficus bangaliansis*	0.32	*Psidium guajava*	0.53
Pongamia pinnata	2.88	*Tectona grandis*	0.70	*Jatropha carcus*	0.37
Azadirachta indica	3.84	*Mimusops elengi*	5.44	*Causarinaequistifolia*	1.49
Ficus religiosa	0.32	*Anacardium oxidetale*	4.21	*Tectona grandis*	0.94
Tamarindus indica	0.85				

Point 1: Plants collected at bend 1; Point 2: Plants collected between bend 10 &11; Point 3: Plants collected within 2km from bend 20.

Table 4: Showing Chlorophyll content

Name of plants	Point 1	Name of plants	Point 2	Name of plants	Point 3
Pisivum Sativam	0.93	*Callistemon*	0.2	*Morinda tinctoria*	0.73
Cassia fistula	0.52	*Cordia sebestena*	0.24	*Nerium oleander*	0.47
Morinda tinctoria	1.78	*Plumeria alba*	0.50	*Tecoma stans*	0.25
Bambusa bambos	0.23	*Polyalthia longifolia*	0.35	*Cardia Sebestena*	0.35
Peltophorum acutifolium	1.10	*Psidium guajava*	0.49	*Eucalyptus*	0.24
Aayamaram	0.19	*Mangifera indica*	0.43	*Citrus limon*	0.31
Cassia alata	1.66	*Annona squamosa*	0.42	*Atrocarphous heterophyllus*	0.23
Manilkara zapota	0.14	*Ficus bangaliansis*	0.29	*Psidium guajava*	0.30
Pongamia pinnata	0.69	*Tectona grandis*	0.58	*Jatropha carcus*	0.41
Azadirachta indica	0.54	*Mimusops elengi*	0.41	*Causarinaequistifolia*	0.62
Ficus religiosa	0.75	*Anacardium oxidetale*	0.50	*Tectona grandis*	0.41
Tamarindus indica	3.57				

Point 1: Plants collected at bend 1; Point 2: Plants collected between bend 10 &11; Point 3: Plants collected within 2km from bend 20.

Table 5: Showing air pollution tolerance index of plants at Yercaud road sides

Name of plants	Point 1	Name of plant	Point 2	Name of plant	Point 3
Pisivum Sativam	12.42	*Callistemon*	5.80	*Morinda tinctoria*	12.82
Cassia fistula	10.10	*Cardia sebestena*	8.13	*Nerium oleander*	9.79
Morinda tinctoria	12.85	*Plumeria alba*	3.91	*Tecoma stans*	8.19
Bambusa bambos	10.89	*Polyalthia longifolia*	8.19	*Cardia Sebestena*	9.46
Peltophorum acutifolium	11.01	*Psidium guajava*	10.44	*Eucalyptus*	10.65
Aayamaram	12.32	*Mangifera indica*	12.46	*Citrus limon*	9.07
Cassia alata	13.46	*Annona squamosa*	7.14	*Atrocarphous heterophyllus*	9.80
Manilkara zapota	11.52	*Ficus bangaliansis*	8.26	*Psidium guajava*	9.59
Pongamia pinnata	12.38	*Tectona grandis*	6.14	*Jatropha carcus*	9.80
Azadirachta indica	13.32	*Mimusops elengi*	12.80	*Causarinaequistifolia*	4.37
Ficus religiosa	10.25	*Anacardiumoxidetale*	12.81	*Tectona grandis*	10.06
Tamarindus indica	3.02				

Point 1: Plants collected at bend 1; Point 2: Plants collected between bend 10 &11; Point 3: Plants collected within 2km from bend 20.

pH

The pH was found to be same for all the plants studied at point 1 and alkaline in nature. The pH of *Ficus religiosa* was found to be 8.0. Similar result was reported by Krishnaveni et.al for *Ficus religiosa.*[5] Likewise, the pH was alkaline for the plants studied at point 2. *Tectona grandis* at point2 showed pH 8.5. Similar result was reported by Krishnaveni et.al for *Tectona grandis*[5] and also for *Callistemon,*[6] *Ficus bangaliansis,*[7,8] *Polyalthia longifolia.*[8] At point 3, Whereas, the pH for *Tectona grantis, Cardia Sebestina* was 6.0, and for *Eucalyptus* it was 5.0, for *Jatropha carcus* it was 3.0. From the obtained results, it is clear that plants like *Tectona grantis, Cardia Sebestina, Eucalyptus* at point 3 were acidic in nature (Table.1). Similar result was reported by Krishnaveni et.al for *Psidium guajava.*[8]

Relative Water Content

The results of relative water content of plants studied at point 1, 2 and 3 at Yercaud road sides are shown in Table 3.

The results of plants collected from road sides of point 1 showed that, the relative water content was very low for *Tamarindus indica*. Whereas all the other plants showed higher relative water content. For point 2, the relative water content was higher for *Mangifera indica, Anacardium oxidetale* whereas all the other plants showed moderate amount of relative water content. Plants such as *Jatropha carcus, Tectona grandis, Atrocarphous heterophyllus, Psidium guajava, Cardia Sebestina* showed higher amount of relative water content from point 3. Other plants showed moderate amount of water content at point 3. (Table 2) Similar relative content was reported by Krishnaveni et.al for *Tectona grandis.*[8]

Ascorbic Acid

The results of ascorbic acid studied for plants collected at Yercaud road sides are shown in Table 3.

The observations of point 1, tells that plants such as *Azadirachta indica, Cassia alata* have higher levels of ascorbic acid, moderate levels of ascorbic acid was found with *Morinda tinctoria, Peltophorum acutifolium, Pongamia pinnata, Bambusa bambos, Manilkara zapota.* But very lower level was observed with *Tamarindus indica, Ficus religiosa, Cassia fistula* (Table 3).

The results of point 2, shows that *Mimusops elengi, Psidium guajava, Anacardium oxidetale* was found to be higher and very low level was observed with *Callistemon, Cardia sebestena, Plumeria alba, Polyalthia longifolia, Ficus bangaliansis, Tectona grandis. Annona squamosa* showed moderate level of ascorbic acid (Table 3).

Morinda tinctoria, Nerium oleander, *Causarina equistifolia* showed higher ascorbic acid content , while the remaining plants were found to have very low ascorbic acid content when observed from point 3 (Table 3).

Chlorophyll

The results of chlorophyll studied for plants collected at Yercaud road sides are shown in Table 4.

The chlorophyll content was found to be higher for *Tamarindus indica.* Moderate amount was found with *Morinda tinctoria, Cassia alata, Peltophorum acutifolium.* The remaining plants were found to have very low chlorophyll content; these findings were for the plants studied at point 1. All plants at point 2 and 3 showed only very low level of chlorophyll. At point 2 *Polyalthia longifolia* showed 0.37mg/g chlorophyll. Similar result was reported by Krishnaveni et.al for *Polyalthia longifolia*,[9] *Cardia Sebestena*[6] at point 2 and for *Psidium guajava*[6] at point 3 (Table.4).

Air Pollution Tolerance Index

The plants studied at point 1, 2 and 3 and their APTI values are depicted in Table 5.

Point 1:

The air pollution tolerance index of each plant is shown in increasing order: *Tamarindus indica< Cassia fistula< Ficus religiosa< Bambusa bambos< Peltophorum acutifolium< Manilkara zapota< Aayamaram< Pongamia pinnata< Pisivum Sativam< Morinda tinctoria< Azadirachta indica<Cassia alata.* (Table 5) Slightly higher result was reported by Krishnaveni et.al for *Morinda* genus plants,[10] whereas similar result for *Ficus religiosa*[5,7,10] and *Azadirachta indica*,[9] while closely related values for *Ficus religiosa.*[5]

Point 2:

The air pollution tolerance index of each plant is shown in decreasing order: *Anacardium oxidetal> Mimusops elengi> Mangifera indica> Psidium guajava> Ficus bangaliansis> Polyalthia longifolia> Cardia sebestena> Callistemon> Annona squamosa> Tectona grandis> Plumeria alba* (Table.5) similar result was reported by Krishnaveni et.al for *Psidium guajava.*[5]

Point 3:

The air pollution tolerance index of the plants studied are as follows: *Morinda tinctoria* 12.82, *Nerium oleander* 9.79, *Tecoma stans* 8.19, *Cardia Sebestena* 9.46, *Eucalyptus* 10.65, *Citrus limon* 9.07, *Atrocarphous heterophyllus* 9.80, *Psidium guajava* 9.59, *Jatropha carcus* 9.80, *Causarina equistifolia* 4.37, *Tectona grandis* 10.06 (Table 5). Slightly higher result was reported by Krishnaveni et. al for *Morinda* genus plants.[10] Closely related result was reported for *Tectona grandis*[5] and similar result for *Tectona grandis.*[8] The obtained APTI values were categorized according to Kalyani and singaracharya,1995. [11]The following are the four categories APTI index range < 1-Very sensitive, 1to 16-Sensitive, 17 to 29 -Intermediate and 30 to 100 - Tolerant. Our study enumerates, that all plants were found to be sensitive as they have APTI value less than 16 and none found to be very sensitive, intermediate, tolerant.

CONCLUSION

From the study it is concluded, that most of the plants showed moderate amount of ascorbic acid, relative water content and air pollution tolerance index. All plants analyzed show APTI of less than 16 there by classed under sensitive species, which needs proper care and attention. The changes observed might be due to climatic condition prevailed during sample collection.

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