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Study of Air Pollution Tolerance Index (APTI) of Some Plants In Vasai-Virar location (Palghar district)

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Abstract

The 20th century has been the era of industries and their industrial growth with sharp increase in vehicular population, which has caused a serious change in the atmospheric system. As plants are immobile, they are continuously being exposed to the environment, therefore they show changes depending on their sensitivity level. The tolerance level of any plant species is mainly dependent on its physiological and morphological characteristics. Various types of biotic, abiotic and physical factors control plant life, including temperature, humidity, soil chemistry, pH, oxygen levels and salinity. It is well known that the plants change it's characteristics in various locations depending upon its adaptability and various environmental factors, due to this plants species shows different tolerability in different locations or region. In the present work an attempt was made to study the Air pollution tolerance index of some plants growing in the Vasai-Virar areas, in Palghar district of Maharashtra. It was observed that out of the five common plants studied, air pollution tolerance index (APTI) was found to be maximum in ***Ficus religiosa*** (L.) i.e 9.040 and minimum in ***Bauhinia purpurea*** (L.) Another observation made was that in most of the plants studied, APTI value was found to be higher in the plants collected from control site.

Key Words : Air pollution, APTI, Green belt, tolerant plants,

Introduction:

The world has witnessed development and industrialization in all the cities and towns, there has been increase in vehicular traffic and air pollution. All these man made emissions has made a huge negative impact on our Atmosphere and these are responsible for some of the problems cropping up these days. The negative impact of air pollution and vehicular traffic is not only limited to human population but has also been creating problems to the plant community.

When plants are exposed to pollution they show a different level of change in their physiological activity such as photosynthesis, enzymatic activity, respiration. The economic loss of plants due to air pollution is still not known or documented properly by any of the authorities in India, but there are certain reports present which give the figures of loss of crops due to air pollution. Since plants are immobile, they are

exposed to the surrounding atmosphere more severely. The Changes happening due to pollutants in the atmosphere is directly proportional to the change in the biochemical parameter such as pH, relative water ascorbic acid and total chlorophyll. The possibility of damage can be calculated as the overall effect of pollutants .Studies have shown the impact of air pollution on Chlorophyll content (TC), leaf extract pH (P), relative water content (RWC) and ascorbic acid Content(AA). Air pollution tolerance index (APTI), can indicate to us the potential of vegetation and crops to encounter the changes occurring due to air pollution. Plants themselves have the natural tendency to purify the surrounding air by consuming smoke and particulate matter (pm 2.5 and 10), sensitive plant species are said to bio indicators (Juyoung Ha and Hederlyn Martinez 2018).

Air Pollution Tolerance Index (APTI), help us to find and choose tolerant plant species and help to monitor and assess the plants which are tolerant towards air pollution. The assessment of plants based on its APTI and their tolerance level is very crucial and essential. To check the APTI, biochemical parameters play a crucial role, and with the help of these biochemical parameters the tolerance level of plants can be easily detected.

Different plant species show different tolerance level depending upon their physiological and morphological characteristic. Ascorbic acid and chlorophyll are two of the main indicators for pollution, the ascorbic acid when present in high amounts are considered to be tolerant to the air pollution. Whereas the chlorophyll is considered to be an important stress metabolite, higher the chlorophyll, higher will be the chances for plants to be tolerant towards different air pollutants in the atmosphere.

MATERIAL AND METHODS:

Sites Selected

Vasai-Virar area in the district of Palghar, Maharashtra, was selected as the experimental site. This area is a densely populated area with a total area of around 311 km² with population of around 12.30lakh (2011), Due to the affordable property rates, there has been a vast migration in this region. Due to population growth , the development projects are at its highest rate because of which pollution is also increasing in this zone.

The research work was carried in the urban area of the Vasai Virar region. The plant samples were collected from Achole Road (Nalasopara).

Control site

Sanjay Gandhi National park at Borivili East, Mumbai, was selected as the control site for comparison.

Plants selected

1. Ficus religiosa (L.), 2. Mangifera indica (L.), 3.Polyalthia longifolia **(Sonn.),** ***4.Syzigium cumini*** **(L.) Skeels,** ***5.Bauhinia purpurea (L.)***

AIR POLLUTION TOLERANCE INDEX (APTI)

The air pollution tolerance index was calculated by using the formula given by (Singh and Rao, 1983):

$$APTI=[A(T+P)+R]/10$$

Where,

A = Ascorbic acid (mg g-1 FW),

T = Total chlorophyll (mg g-1 FW),

P = Leaf extracts pH and

R = Relative water content in (%) of the leaves extracts.

OBSERVATIONS

After calculating the APTI using the formula given by Singh and Rao (1983), it was observed that Air pollution tolerance index (APTI) was found to be maximum in *Ficus religiosa* (L.) i.e 9.040 and minimum in *Bauhinia perpurea* i.e 5.87 in the plants collected from experimental site. (Table1) However in the control site APTI in *Ficus religiosa* (L.) was found to be 7.42(Table2).

Table 1: APTI value of plants along with ascorbic acid content AA, total chlorophyll TC, pH and relative water content RWC(Experimental site)

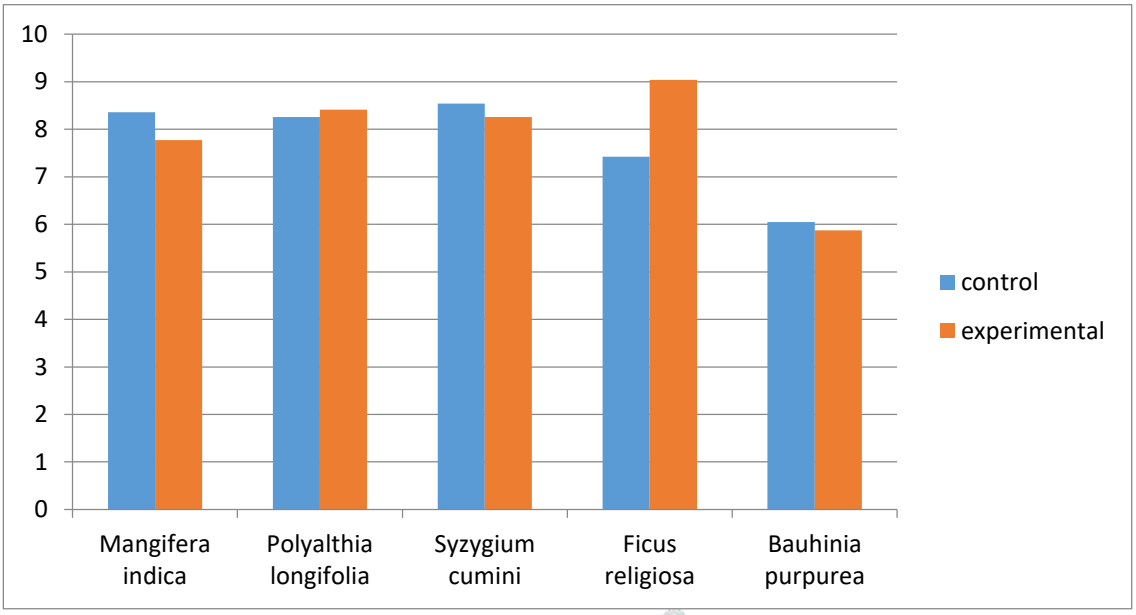
Sr no	Name of the Plant	AA (mg/gm FW)	TC (mg/gm FW)	PH	RWC (%)	APTI
01	*Mangifera indica(L)*	0.370±0.1	0.159±0.6	6.4±0.08	75.35±0.8	7.77±0.8
02	*Polyalthia longifolia(Sonn)*	0.258±0.3	0.158±0.09	6.5±0.8	82.39±0.7	8.41±0.8
03	*Syzygium cumini (*Skeel)	0.379±0.01	0.193±0.09	4.7±0.7	80.79±0.09	8.26±0.06
04	*Ficus religiosa (L)*	0.447±0.06	0.221±0.9	7.6±0.08	86.95±0.08	9.04±0.08
05	*Bauhinia purpurea(L)*	0.305±0.4	0.139±0.8	6.4±0.08	56.75±0.08	5.87±0.07

Values given are Mean ± SD

Table 2: APTI value of plants along with ascorbic acid content AA, total chlorophyll TC, pH and relative water content RWC (Control site):

Sr no	Name of the plant	AA (mg/gm FW)	TC (mg/gm FW)	PH	RWC (%)	APTI
01	*Mangifera indica(L)*	0.331±0.8	0.207±0.08	5.7±0.09	81.69±0.09	8.36±0.7
02	*Polyalthia longifolia* (Sonn)	0.264±0.07	0.174±0.08	5.7±0.8	81.05±0.09	8.26±0.7
03	*Syzygium cumini* (Skeel)	0.355±0.08	0.128±0.08	4.1±0.09	83.92±0.09	8.54±0.8
04	*Ficus religiosa* (L)	0.300±0.09	0.166±0.07	8.1±0.9	71.88±0.04	7.42±0.7
05	*Bauhinia purpurea* (L)	0.221±0.8	0.127±0.08	7.0±0.08	58.96±0.04	6.05±0.7

Values given are Mean ± SD



APTI IN EXPERIMENTAL AND CONTROL AREA

RESULTS AND DISCUSSION

In the present study the Air Pollution Tolerance Index (APTI) in experimental area from highest to lowest value was found as *Ficus religiosa* (9.04) followed by *Polyalthia longifolia*(8.41), *Syzygium cumini* (8.26), *Mangifera indica* (7.77) and *Bauhinia purpurea* (5.87) . Similar observations were made by Lakshmi *et al (2008)* in plant species around industrial area of Visakhapatanam they found that *Ficus religiosa* showed highest APTI which is 25.77 and *Casuarina equisitifolia* showed lowest APTI which is 6.51. Gupta et. al. (2011) also worked and calculated the APTI and API of some tree species in Burdwan town, West Bengal.

In the experimental Area the highest APTI was found in the *Ficus religiosa* (9.04), where as in the control area the highest APTI was found in the *Syzygium cumini* (8.54). Similar type of observations were made by Begum et Al (2010), They examined the Air pollution tolerance index (APTI) of different trees species in the industrial areas of the Bangalore city and observed that *Syzygium cumini* showed the highest APTI value which is 16.4, 32, and 35 in three different industrial areas and they have considered it as tolerant species..

In the present study our finding that Ficus religiosa shows maximum APTI is also supported by the work of Pathak *et al*(2011) who evaluated the API of some plant species growing alongside Varanasi city, Uttar Pradesh ,and observed that *Ficus infectoria*, *Mangifera indica* and *Ficus religiosa* were classified under the 'excellent' category. Tiwari et al (2019**)** also studied the APTI of Raigarh, in Madhya Pradesh from iron and steel industries and found that APTI of *Ficus glomerata* showed a maximum value of 15.02. In both the experimental as well as in control area, lowest APTI was found in *Bauhinia purpurea* . Tripathi *et al* (2019), has also made similar observations while evaluating the APTI of selected plant species growing alongside Moradabad city. They also observed that *Bauhinia variegata has comparatively low APTI values* (18.22) and considered it susceptible species. There has been similar type of work on APTI done by other workers, Ogunrotimi *et al.*(2017) evaluated the sensitivity and tolerance levels of plants

from 3 major roads using APTI and the APTI of selected tree species were in the range of 9.2 to 12.7 and the highest value was recorded in *Polyalthia longifolia* and the lowest value in *Psidium guajava.*

In the present work ATPI value was found to be more in plants collected from control site. Similar type of work was carried out by other workers as well, Aasawari *et al.(2017) have* evaluated APTI of Thane city and they have also made similar observations, and from the observation it can be said that the control site got more APTI Value as compared to the polluted site respectively.

CONCLUSIONS

In the present study it was found that, as per APTI value, the tolerant species are *Ficus religiosa*, *Polyalthia longifolia* and *Syzygium cumini*, hence these species can be cultivated along the road side as they are least effected by the pollutants.

APTI was found to be minimum in *Bauhinia purpurea*, hence this species should be avoided to be planted along the polluted areas.

Out of five plant species studied, *Ficus religiosa* was found to be the best to be grown in both polluted as well as control locality. It has a dense canopy, which can give protection against pollution stress. The economic and aesthetic value of this tree is well known and it can be recommended for extensive planting as a first curtain.

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