Effect of Suspended Marble Slurry Dust on Venation patterns of *Azadirachta indica* A. juss. *and Albizia lebbeck* (L.) Benth.

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ABSTRACT

Effect of the suspended Marble Slurry dust, on the venation pattern of leaves of Azadirachta indica A. juss. and Albizia lebbeck (L.) Benth. growing at control sites and polluted sites have been studied using light microscope. The qualitative parameters likes marginal ultimate venation, shape of areoles, type of areolar venation , type of veinlets and type of venation pattern and the quantitative parameters such as number of Vein-islets and Veinlet Termination Points were recorded. The study shows that the qualitative characteristics of leaf venation pattern of tree species growing in polluted area were not much affected by marble slurry pollution while the quantitative characteristics were influenced.

Keywords: Air Pollution, Qualitative Parameters, Quantitative parameters, Marble Slurry, Tree species Venation pattern

1. INTRODUCTION

Environmental stress, like air pollution, is among one of the major factors which limits plant productivity and survivorship [1]. Air pollution is a serious problem in many heavily populated and industrialized areas in the world [2]. The interactions between plants and different types of pollutants were investigated by many authors: most studies on the influence of environmental pollution focus on physiological and ultra structural aspects [3-4]. The air pollutants are responsible for plant injuries and great loss of productivity [5]. Foliar surface of plants is the main receptor of dust as it is continuously exposed to the surrounding atmosphere [6].The most noticeable damage occurs in the leaves. Basically, outer surface of the plants like leaves play a role in absorbance of these dust particles [7]. Plants when exposed to air borne pollutants, most plants experienced physiological changes before exhibiting visible damage to leaves [8].

Dust emission occurs from the various processing units in the marble industries viz., cutting, buffing, polishing, loading and transportation etc. Marble Slurry is a suspension of marble fines in water, generated during processing and polishing, etc. At the marble-city, Kishangarh, Ajmer, the slurry is transported to the dump-yard on whose embankment, plantation has been done. The vegetation is exposed to the fine dust of marble which deposits on the leaves. Each plant leaves show a specific venation pattern. The remarkable diversity in the leaf venation pattern of plants has attracted the attention of researchers.

In the present course of study the effect of Marble Slurry dust on leaf venation pattern was studied: both qualitatively and quantitatively. The selection of plants was on the basis of their common occurrence on the site of study.

2. MATEIAL AND METHODS

The Marble slurry dump yard situated in the industrial area of Kishangarh Tehsil, this is the part of Ajmer district. Kishangarh lies about 30 K.M. on the North-East of Ajmer, Rajasthan. The area of the Tehsil falls between 26^0 15’ to 27^0 0’ North latitudes and 74^0 30’ to 75^0 15’ East longitudes.

Leaves of *Azadirachta indica* A. juss. and *Albizia lebbeck* (L.) Benth were collected from the vicinity of marble slurry dump yard and the control samples of leaves were collected from the Botanic Garden of Samrat Prithviraj Chouhan Government College Ajmer. Tenth leaf from the tip of branch was selected for the present study in order to maintain uniformity in collection of study samples. Duration of the study was from April, 2014 to March 2015.

The leaf samples collected from control and polluted sites were thoroughly washed with tap water followed by distilled water and fixed in F.A.A. The preserved leaf samples of selected species from polluted area as well as control area were cleared using 5-10 % KOH, in an oven at 60ºC for 1 to 2 days, depending on the thickness of the leaf specimen. The cleared leaf specimens were stained with safranin and were mounted in glycerine. The slides were photographed using a Sony digital camera. The leaf venation patterns were observed using compound microscope under 10X magnification.

Details of the analysis and descriptions of the leaf venation types followed the classification of Hickey [8].Following parameters related to leaf venation patterns were worked out. The parameters such as marginal ultimate venation, areoles shape, type of areolar venation, type of veinlets and type of venation pattern and the quantitative parameters such as number of Vein-islets and Veinlets Termination Points were observed in per unit microscopic area.

3. FIGURES AND TABLES

Table 1: **: Effect of suspended marble slurry dust on quantitative parameters of Leaves (Average Reading of control and polluted site)**

***Albizia lebbeck* (L.) Benth.**					***Azadirachta indica* A. juss.**			
Months	**Vein-islet No.**		**Veinlet Termination Points**		**Vein-islet No.**		**Veinlet Termination Points**	
	Control	**Polluted**	**Control**	**Polluted**	**Control**	**Polluted**	**Control**	**Polluted**
Apr-14	16	26	42.5	42	42	40	54	74
May-14	18	32	32	51	31.5	47	46	71.5
Jun-14	12	10.5	32.33	25	47.5	42.5	70.5	80.5
Jul-14	17	14.66	38	31.66	30	44	45	72.33
Aug-14	14	20.33	46.5	42.66	42.5	35.33	61	52
Sep-14	18	24	50	49	29	27	76	61.33

Oct-14	17	26.5	51	47.5	37.5	35	55	50.5
Nov-14	16.5	13	45	40.5	43	24.5	66	55.5
Dec-14	24.5	22.5	53.5	44.5	38.5	34	58	53
Jan-15	16	14	46	29.5	49	53	70	87
Feb-15	16.5	24.5	42.5	45.5	55	41.5	76.5	56.5
Mar-15	30	25.66	74	58.33	38	32.5	65	62.5

(Cl =Control site, P*= Polluted site)

Table 2: **: Effect of suspended marble slurry dust on qualitative parameters of Leaves of *Albizia lebbeck* (L.) Benth.**

***Albizia lebbeck* (L.) Benth.**						
Month & Month & Year	**Type of ultimate marginal venation**	**Areolar Shape**	**Type of areolar venation**	**Types of veinlets**		**Vention Pattran**
	Cl &P*	**Cl &P***	**Cl &P***	**Cl**	**P***	**Cl &P***
Apr-14	Looped	Polygonal	Incomplete	Univeinlets	Univeinlets and Biveinlets	Camptodromous
May-14	Looped	Polygonal	Incomplete	Univeinlets	Univeinlets	Camptodromous
Jun-14	Looped	Polygonal	Incomplete	Univeinlets	Biveinlets	Camptodromous
Jul-14	Looped	Polygonal	Incomplete	Univeinlets	Univeinlets and Biveinlets	Camptodromous
Aug-14	Looped	Polygonal	Incomplete	Simple & Univeinlets	Simple & Univeinlets	Camptodromous
Sep-14	Looped	Polygonal	Incomplete	Simple & Univeinlets	Simple & Biveinlets	Camptodromous
Oct-14	Looped	Polygonal	Incomplete	Simple & Univeinlets	Univeinlets	Camptodromous
Nov-14	Looped	Polygonal	Incomplete	Biveinlets	Univeinlets and Biveinlets	Camptodromous
Dec-14	Looped	Polygonal	Incomplete	Univeinlets and Biveinlets	Simple ,Univeinlets & Biveinlets	Camptodromous

Jan-15	Looped	Polygonal	Incomplete	Biveinlets	Univeinlets and Biveinlets	Camptodromous
Feb-15	Looped	Polygonal	Incomplete	Univeinlets and Biveinlets	Biveinlets	Camptodromous
Mar-15	Looped	Polygonal	Incomplete	Simple ,Univeinlets & Biveinlets	Univeinlets and Biveinlets	Camptodromous

Table 3: Effect of suspended marble slurry dust on qualitative parameters of leaves of *Azadirachta indica* A. juss.

***Azadirachta indica* A. juss.**						
Month & Year	**Type of ultimate marginal venation**	**Areolar Shape**	**Type of areolar venation**	**Types of veinlets**		**Vention Pattran**
	Cl &P*	**Cl &P***	**Cl &P***	**Cl**	**P***	**Cl &P***
Jun-14	Incomplete	Polygonal	Incomplete	Univeinlets & Biveinlets	Simple & Univeinlets	Craspedodromous
Jul-14	Incomplete	Polygonal	Incomplete	Simple & Univeinlets	Simple & Univeinlets	Craspedodromous
Aug-14	Incomplete	Polygonal	Incomplete	Simple & Univeinlets	Simple & Univeinlets	Craspedodromous
Sep-14	Incomplete	Polygonal	Incomplete	Simple & Univeinlets	Simple & Univeinlets	Craspedodromous
Oct-14	Incomplete	Polygonal	Incomplete	Simple & Univeinlets	Simple & Univeinlets	Craspedodromous
Nov-14	Incomplete	Polygonal	Incomplete	Simple & Univeinlets	Simple & Univeinlets	Craspedodromous
Dec-14	Incomplete	Polygonal	Incomplete	Simple & Univeinlets	Simple & Univeinlets	Craspedodromous
Jan-15	Incomplete	Polygonal	Incomplete	Univeinlets and Biveinlets	Univeinlets and Biveinlets	Craspedodromous
Feb-15	Incomplete	Polygonal	Incomplete	Simple , Univeinlets & Biveinlets	Simple , Univeinlets & Biveinlets	Craspedodromous
Mar-15	Incomplete	Polygonal	Incomplete	Simple , Univeinlets &	Simple , Univeinlets &	Craspedodromous

				Biveinlets	Biveinlets	

4. RESULT AND DISSCUSSION

The present study shows that the marginal ultimate venation is incomplete polygonal areole shape , incomplete areolar venation, types veinlets vary from simple veinlets to biveinlets and venation pattern is craspendrodomous in *Azadirachta indica* in both control and polluted site . In *Albizia lebbeck,* marginal ultimate venation is looped, polygonal areole shape , incomplete areolar venation, type of veinlets vary from simple veinlets to biveinlets and venation pattern is camptodromous in both control and polluted sites. Qualitative parameters were found similar both in polluted and reference area (Table 2,3). Thus the qualitative parameters of leaf venation are not much affected by marble slurry pollutant.

Thus in general significant difference in venation pattern is not observed in selected leaves in control site and polluted site . It might be due to high tolerance power against air pollution in plants [9] . It has also been reported by Radhapriya *et al,.* [10] that *Azadirachta indica and Albizia lebbeck* are the air pollution tolerant species.

The results of the present study exhibits consistency with the inferences drawn by Dwivedi and Dubey [11] and Sachs [12] whose studies supported the fact that the effect of air pollution is not observed on leaf venation pattern of selected plant species. Sachs reported that the growth hormone auxin has enormous effect on the venation pattern. Furthermore, it has been also found about mutations that affect the auxin transport lead to strongly modified venation patterns [13- 16].

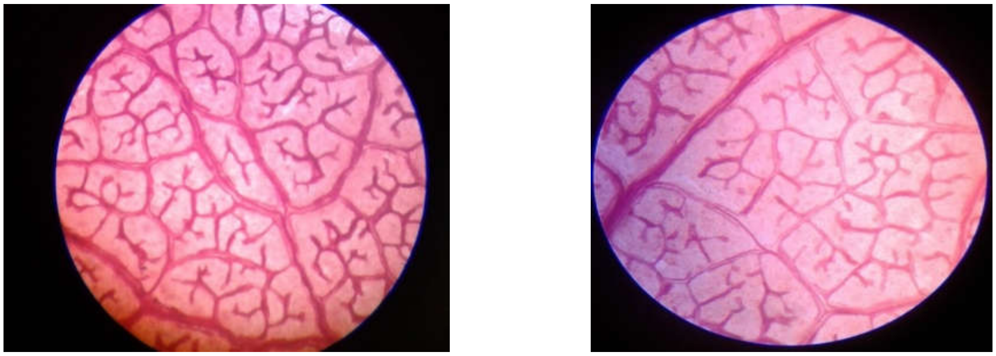
Table 1show the quantitative parameters Number of Veinislets was reduced in polluted site from June 2014 to July 2014 and November 2014 to March 2015 in *Albizia lebbeck* , in *Azadirachta indica* Number of veinislets was reduced in polluted site from August 2014 to March 2015 . Number of Veinlets Termination Points were reduced in *Azadirachta indica* form August 2014 to March 2015 and in *Albizia lebbeck* Number on Veinlets termination points was reduced in polluted site from June 2014 to March 2015. The origin of the major veins and of the minor venation are related to the changes in the distribution of meristematic activity in the leaf. The major veins arise while the leaf exhibits meristematic activity at the apex and margin, while the minor venation appears during general intercalary extension of the leaf.

At the cessation of meristematic activity of apex and margins, the minor venation consists of a closed mesh in which there are relatively few veinlets ending blindly in islets of mesophyll. No new veins arise thereafter. However, there may be a steady increase in the number of vein endings. This is due to the mechanical rupture of the finer veins in the system. Furthermore, light decreases the amount of lateral expansion of the blade, of its spongy mesophyll and of its venation system. Hence there is closer spacing of veins in Sun than in shade leaves.

In case of *Albizia*, in general, the number of vein-islets in pollution infested leaves was more as compared to the control samples, except for the rainy months of june and july and when the temperature was low during winter season. A reverse trend was exhibited by the number of vein terminations. These observations indicate a decrease in intercalary growth of leaves of *Albizia lebbeck* under the impact of Marble slurry dust.

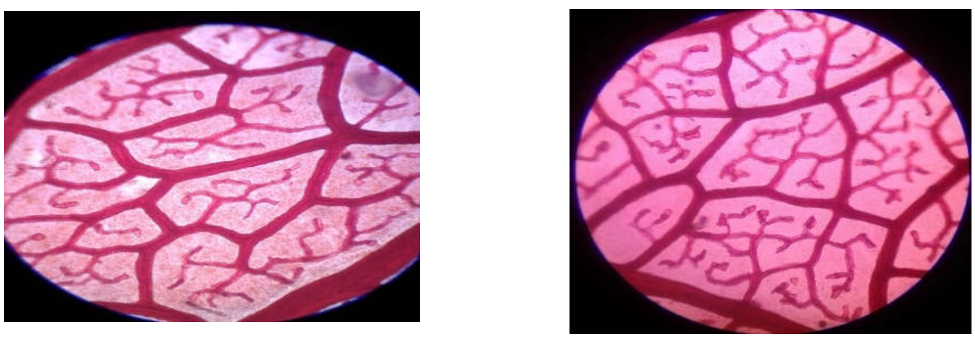
Greater intercalary growth results in rupturing of veins and the resulting coalescence of adjoin islets. This leads to lesser number of vein islets with more vein terminations. This situation is exhibited by *Azadirachta indica* leaves exposed to suspended marble slurry dust in the phyllosphere.

Another interpretation of the observation may be based on the fact that leaves not exposed to sufficient light leads to greater intercalary growth in the leaf tissue. Hence the *Azadirachta* leaflets which are individually of lesser dimensions as compared to *Albizia lebbeck* exhibit greater intercalary growth of leaf tissue under the impact of marble slurry.



(a) (b)

Figure 1: Areoles of *Azadirachta indica* in (a) control and (b) polluted leaf (10 X 10)



(a) (b)

Figure 2: Areoles of ***Albizia lebbeck*** in (a) control and (b) polluted leaf (10 X 10)

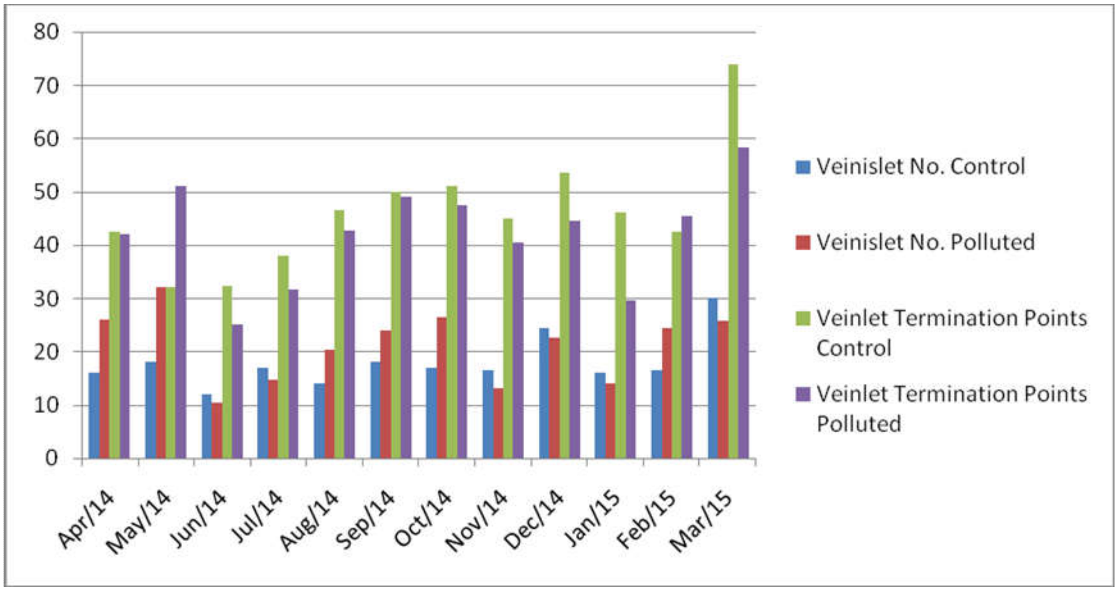


Figure 3: Leaves of *Albizia lebbeck* (L.) Benth. showing Number of Veinlets and Number of Veinislets in polluted and control

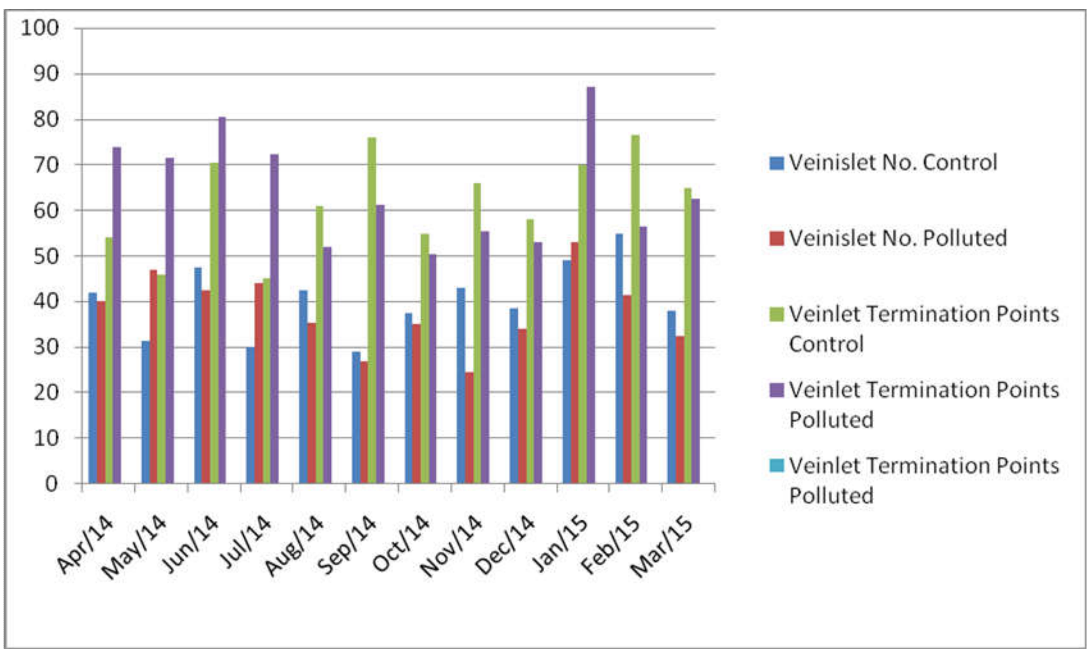


Figure 4: Leaves of *Azadirachta indica* showing Number of Veinlets and Number of Veinislets in polluted and control

5. CONCLUSION

In this study, we focused on effect of Marble slurry on leaf venation pattern of *Azadirachta indica* and *Albizia lebbeck* and concluded that the leaf venation pattern of these plants species is not affected by Marble slurry, so far as qualitative parameters are concerned.

However the quantitative parameters such as; Number of Veinislets and Veinlets Termination Points were found to be affected in polluted site samples. Thus the Marble slurry affects leaf architecture quantatively by influencing the intercalary meristematic activity of the leaf blade.

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