

IMPACT OF QUARRY DUST ON FLOWERING AND FRUITING PATTERN- A CASE STUDY IN BANGALORE DISTRICT

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ABSTRACT

Air pollution has become a major threat to the survival of plants in the industrial vicinity. The premature falling of plant parts like leaves, flowers and fruits is referred to as abscission. Generally physiological and anatomical changes result in reponse to certain disturbances, which is considered as stressor that can induce an alteration in plant physiology resulting in the premature falling of flowers and fruits. Hence a comprehensive study has been made in stone quarry area to understand the flowering and fruiting abscission pattern. The study results revealed the effect of quarry dust on the flowering and fruiting pattern.

INTRODUCTION

The effect of air pollution on the morphology, physiology and biochemistry of plants have long been recognized. (Koziol *et al.* 1984; Treshow., 1985; Ahamed *et al.* 1988). Studies have been made on the impact of particulate matter in the case of kiln dust on garden fruit (Pierce, 1910; Anderson, 1914). In addition several other studies have highlighted the effect of dust on the morphological and physiological aspects of plants (Maiti, 1992). The physiological cause of abscission is however still largely unknown. Abscission of fertilized flower may also be regulated by the availability of resources (Stephenson, 1981; Lee, 1988). In citrus species high rate of flower abscission is correlated with lower level micronutrients such as Zinc (Kaska, 1989). Similarly decrease in water potential could increase abscission due to increased ethylene synthesis (Apelbaum *et al.* 1981). Jiang *et al.* (1993), opened that darkness or shade often increases flower fall. Various other environmental factors such as elevated

temperature and low soil water potential (Cochran, 1936) are also known to stimulate flower abscission. Cameran *et al.* 1981; Weis *et al.* (1988) are of the view that exposure of plants to exogenous ethylene enhances flower and fruit abscission (Yager *et al.* 1958). The mechanism of the abscission at the cellular level was worked out by various scientists in different plant species (Wauter *et al.* 1997).

Although several reports are available from Indian subcontinent (Das *et al.*; 1978, Chaphekar *et al.* 1982) and abroad (Bach; 1972, Bennet; 1973, Lerman *et al.* 1975), so far no comprehensive study has been made to discern the qualitative effect of dust on plant parts growing in a deteriorated environmental condition of a stone quarry area. Hence the present study has been undertaken to explore the effect of quarry dust pollution on flowering and fruiting abscission pattern.

MATERIALS AND METHODS

The criteria used for the selection of the appropriate study site is 'dust fall' and greater abundance of vegetation in selected quarry locations from Bangalore district. Most prevalent plant species (*Muntingia calabura*) was sampled. The same species collected away from the quarry area served control. The plants were sampled at a distance of 100 to 500 from the study site. The dust deposited on the plant parts were estimated by washing method. (Pattanayak *et al.* 1994). In each tree branches were selected randomly on the observation on the flower and fruit abscission was recorded. Similar observation was made in the controlled studies. An attempt has also been made to highlight the biochemical effect of foliar dust deposition. Correlation among Fdd and flower and fruit abscission were made by following the Standard procedures (Agarwal *et al.* 1988, Tiwari *et al.* 1989).

RESULTS

The data are presented in Table 1. Regular monitoring of the sampled plants revealed that quarry dust which cumulatively gets deposited on the plant parts leads to premature falling or abscission of flowers and fruits. It is evident from the experimental data that the flower abscission ranged from 18.4 to 62.6% and the fruit abscission ranged from 16.3 to 46.4 %. The foliar dust deposition ranged from 15.9 g/m² at 500m, 4.62 g/m² at 100m distance from the quarry site.

In Kallugoppanahalli village the flower abscission ranged from 11.9 to 43.5% and fruit abscission from 11.7 to 40.0%. The Foliar dust deposition ranged between 1.5 to 6.26 g/m² at 500m and 100m distance respectively.

In Basavanahalli village the percentage of flower abscission ranged from 11.9% to 25.0% and the fruit abscission ranged from 8.5 to 17.8% taken in the different directions between 100m and 500m respectively. The Foliar dust deposition ranged between 1.64 to 4.52 g/m² at 500m and 100m distance respectively, in control studies which is carried out away from the stone quarry

Table 1
Percentage of flower and fruit abscission pattern in
Muntingia calabura (Bettahalsur)

Sample	Distance (m)	Foliar dust deposition g/m ²	Initial	Fruit born	% of fall	Initial	Final	Fruit % of fall
A	100	4.26	75	28	62.6	28	1	5
46.4	B	200	3.28	98	45	54.0	43	3 0
30.2	C	300	2.52	104	76	26.9	86	7 1
17.4	D	400	2.02	86	65	24.4	65	5 2
20.0	E	500	1.59	125	102	18.4	98	8 2
16.3	(Kallugoppanahalli)							
A	100	6.26	62	35	43.5	35	2	1
40.0	B	200	5.19	74	54	27.0	54	3 9
27.7	C	300	4.02	83	62	25.3	62	5 1
17.7	D	400	3.12	105	86	16.1	86	7 5
11.7	E	500	1.52	92	81	11.9	79	6 8
13.9	(Basavanahalli)							
A	100	4.52	136	102	25.0	102	86	15.6
B	200	3.87	118	98	16.9	95	78	17.8
C	300	3.52	96	84	12.5	84	72	14.2
D	400	2.94	93	82	11.9	82	75	8.5
E	500	1.64	69	58	15.9	58	52	10.3

Table 2
Percentage of flower and fruit abscission pattern in
Muntingia calabura (Control)

Sample	Flower			Fruit		
	Initial	Fruit borne	% of fall	Initial	Final	% of fall
A	138	112	18.8	112	102	8.9
B	124	104	16.1	104	94	9.6
C	142	128	9.8	128	116	9.3
D	125	103	17.6	103	96	6.7
E	145	129	11.0	129	119	7.7

area.

CONCLUSION

Dust may act as environmental stress in plants and trigger numerous phytohormones that regulate abscission. There is also possibility of the interference of Ethylene, Auxin, Gibberellin and Cytokinin which cause flower fall as shown in many studies (Clifford *et al.* 1982). It is known that dust fall induces flower and fruit shedding. Higher foliar dust deposition may induce obstruction in light pathway, stomatal function etc. This may account for larger reason for the failure of flowering and fruiting among plants growing in the near vicinity of stone quarry area. Further the comprehensive and detail

investigations are required to establish the relationship between quarry dust and abscission pattern.

REFERENCES

- Ahamed, K.J. Yunus, M. Singh, S.N. Srivastava, K. and Kulshreshtha, K. 1998. Survey on Indian Plants in relation to Atmospheric Pollution. pp 283-306. In: *Prospective in Environmental Botany* Vol.2. Ed by D.N. Rao, Ahmed, S.N.J. Today's and Tomorrow's Publis. New Delhi.
- Bach, 1972. *Atmospheric Pollution*, Mc. Graw Hill Book Co., New York.
- Bennet, J.H. and Hill, A.C. 1973. Absorption of gaseous air pollutants by Standardized plant canopy. *J. Air. Poll. Cont. Assoc.* 23 : 203-206.
- Das, T.M and Patanayak, P. 1978. Dust filtering property of plants and the effect of air borne particles in growth and yield. *Int. Sym on Env agents and their biological effects.* Hyderabad, pp- 223- 234.
- Clifford, P.E. Rentland, B.S. and Baylis, A.D. 1992. Effects of growth regulators on reproductive abscission in Faba bean (*Vicia faba* ev. Try). *J. Agri. Sci.* 119 : 71-78.
- Jiang, H. and Egli, D.B. 1993. Shade induced changes in flower and pod number and flower and fruit abscission in Soybean. *Agronomy Journal.* 85 : 221- 225.
- Kozil, M.J. Whatly F.R. (Eds) 1984. *Gaseous Air Pollutants and Plant Metabolism.* Butterworths, London
- Lerman, S.L. and Darley, E.F. 1973. In : J. B. Mudd and Kozlowski, edited. *Particulates in Response of Plants to Air Pollutants.* Ed Academic Press, Inc., New York, pp, 141-158.
- Lal, B. and Ambashta, R.S. 1980. Effect of Cement Dust Pollution on Plants of *Psidium guava*. *Ind. J. Env. Health.* 22 (3) : 231-237.
- Lee, T.D. 1988. In: Doust J.L. Doust J.L. Eds. Patterns of seed and fruit production. *Plant Reproductive Ecology. Patterns and Strategies.* New York: Oxford University Press.
- Kaska, N. 1989. In: Osborne D.J. Jackson, M.B. eds. Bud, flower and Fruit drop in citrus and other fruit trees. *Cell separation in plants.* Berlin: Springer verlag, 309 -321.
- Maiti, S.K. 1992. Dust collection capacity of plants growing in coal mining areas. *IJEP* .13 (4) : 276 To 280.
- Perice G.J. 1910. An effect of cement dust on orange trees. *Plant World.* 13 : 283-288.
- Stephenson, A.G. 1981. Flower and Fruit Abortion : Proximate Causes and Ultimate Functions. *Annual Review of Ecology and Systematics.* 12 : 253-279.
- Treshow, M. 1985. *Air Pollution and Plant Life.* John Wiley and Sons, New York.
- Trivedy, R.K. and Goel, P.K. 1987. *Practical Methods in Ecology and Environmental Science.* Environmental Publications, Karad, India.
- Tiwari, T.N. and Patel, M.K. 1993. Effect of Cement Dust on Some Plants: Correlations among Foliar Dust Deposition, Chlorophyll Content and Calcium Content. *Ind. J. Env't. Prot.* 13 (2) : 93-95.