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EFFECT OF STONE CRUSHER DUST ON SOME MACRO- AND MICRO-NUTRIENTS AND BIOCHEMICAL PARAMETERS OF SOME SELECTED TREE SPECIES IN CENTRAL KASHMIR (INDIA)

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ABSTRACT

Stone crushing process leads to the emission of huge dust which depletes soil quality and adversely affects the plant growth and development. The present study was aimed to assess the impact of stone crusher dust on nutrient content and biochemical status of leaves of four widely growing tree species *viz. Salix alba, Robinia pseudoacacia, Populus deltoides,* and *Ailanthus excels* in districts Srinagar and Budgam of Kashmir. Leaf samples were collected both from the disturbed and undisturbed sites in separate polythene bags and analysed for micro-and macro nutrients, photosynthetic pigments, carotenoid and ascorbic acid contents. The results revealed low nitrogen content (1.90% in *S. alba*), phosphorus (0.15% in *A. excelsa*), potassium (0.25% in *R. pseudoacacia*) and photosynthetic pigments (total chlorophyll 1.26 mg g^{-1} in *A. excelsa*), and carotenoid (0.06 mg kg^{-1} *in A. excelsa*) at disturbed sites of Srinagar and Budgam; while higher contents were recorded at respective control sites. The highest content (in mg kg^{-1}) of Fe (61.54, in *S. alba*), Mn (38.23, in *P. deltoides*), Cu (27.54 in *P. deltoides*), Zn (37.16, in *P. deltoides*) and ascorbic acid (7.93, in *S. alba*) was recorded in disturbed site. The study revealed that stone crusher dust adversely affects the leaf physiology, and two plant species *viz., S. alba* and *P. deltoids* showed some degree of tolerance to dust pollution.

Keywords: *Ailanthus excels*, biochemical parameters, nutrients, *Populus deltoides*, *Robinia pseudoacacia*, *Salix alba*, stone dust

INTRODUCTION

The ruthless use of stone crushers in and around the districts of Srinagar and Budgam in Central Kashmir has created gloomy situation in the area and these districts have been categorized as highly polluted by State Pollution Control Board (*http://www.earlytimes.in/newsdet.aspx?q=317339*)**.** The anthropogenic activities show adverse impact on the physicochemical properties of plant, water and sediment (Bano *et al.*, 2021, 2022a,b). A large range of industrial processes, including stone crushing, produce particulate emissions. Stone crushers generate a considerable amount of micro-fine and air-borne dust particles at source which detrimentally affect the people and environment including flora and fauna. The particulate matters inflict foliar injuries, yield reduction and photosynthetic and transpirational changes (Kumar *et al.*, 2020). When a layer of dust accumulates on a plant leaf surface, it impedes photosynthesis and slows down gas exchange and water uptake potential (Shah *et al.*, 2017). Infrared radiations have an absorption level that is 2-3°C greater in dust covered leaves than in dust-free ones, which negatively affect tree growth (Sharifi *et al.*, 1997). The primary site of attack of stone dust are chloroplast in leaves which induce different morphological and anatomical disorders in plant (Sharma and Kumar, 2015). Chemical composition of dust, its particulate size and deposition rate determine its influence or toxicity on plants (Van Jaarsveld, 2008). Dust particulates reportedly are absorbed through the outer surface of plants showing some common effects such as necrosis and decline in growth (Swami, 2018). The impacts of dust fall on morphological or anatomical features of plant have been highlighted by many workers (Jharwal and Shrivastava, 2018; Leghari, 2018; Kumar *et al.*, 2020). The dust may also be responsible for altering the biochemical and macro- and micronutrient status of plant). Among micro-nutrients only four elements *viz.*, Fe, Mn, Cu, and Zn were chosen because these have specific role in plant metabolism. Till date no work has been carried out on these aspects in Kashmir valley. The present study was aimed to assess the impact of stone dust on biochemical and nutrient status of leaves in four tree species widely growing in stone crusher industrial areas in Kashmir valley.

MATERIALS AND METHODS

The present research work was conducted in the laboratories of the Divisions of Environmental Sciences and Soil Sciences in SKUAST, Shalimar, Srinagar, Kashmir during the year 2021-2022. Four plant species *viz.*, *Salix alba* L. (white willow), *Robinia pseudoacacia* L. (black locust), *Populus deltoides* L. (eastern cottonwood) and *Ailanthus excelsa* L. (tree of heaven) were taken for research purpose due to their wide presence in the area. Two districts of central Kashmir, i.e. Srinagar and Budgam, were selected for the study. Four sampling sites *viz.*., Lasjan (a disturbed site in Srinagar), Nowgam (control site in Srinagar), Rakh Shalina (a disturbed site in Budgam) and Seer Bagh (control site in Budgam) were selected. Disturbed and control (undisturbed) sites were 10-20 and 3000 m away from stone crusher sites. Leaf samples from mature selected tree species were collected in polythene bags during summer in the year 2021. A total of 100 leaves were collected from basal, middle and top portions of each tree from each location in three replicates. The leaf samples were brought to the laboratory, oven-dried at 80°C to constant weight after washing with clean tap water. The dried samples were crushed, passed through a 2 mm sieve, and stored at room temperature for analysis.

Fresh leaf samples were used for chlorophyll and biochemical estimations. The total nitrogen content in leaf samples was estimated by micro-Kjeldahl method (Jackson, 1973), total phosphorus by di-acid digestion method (Jackson, 1973), and total potassium by the method of Toth *et al*. (1948). The micro-nutrients (*viz*., Fe, Mn, Cu and Zn) contents in leaf samples were determined as per Lindsay and Norwell (1978). The chlorophyll and carotenoid contents were estimated as per Hiscox and Isrealstam (1979) and ascorbic acid as per Rangana (1986). The macro- and micro-nutrients/ biochemical components, as per the method, were estimated either spectrophotometerically (Shimadzu-UV1800ENG240V, Soft), flame photometerically (Labtronics-ISO 9001:2008 certified LT-67) or by using atomic absorption spectrophotometer (Electronics Corporation of India Limited, Element AS- AAS4141). The data was statistically analysis per Gomez and Gomez (1984) wherein T values (T-cal) were calculated at 0.5% level of significance. The T-cal refers to the t-statistic which is used to test hypotheses about population mean (the t-cal helps in determining if the difference between the groups is significant or not).

RESULTS AND DISCUSSION

Impact of stone crusher dust on macro-nutrient content of selected plants

The nitrogen (N) content in different plant species in disturbed and control sites of two districts ranged from 1.90-2.45 and 2.06-2.92%, respectively. The plant species in disturbed site of district Srinagar

Table 1: Impact of stone crusher dust on macro-nutrients (N, P and K) contents (%) of some selected plants in Central Kashmir

Plants	Districts	Locations	N	P	K
Salix alba	Srinagar	Disturbed site*	1.90	0.17	0.70
		Control site**	2.07	0.27	0.82
		T-Cal	4.10	4.05	4.03
	Budgam	Disturbed site*	2.00	0.23	0.55
		Control site**	2.37	0.34	0.92
		T-Cal	5.05	4.84	5.05
Robinia pseudoacacia	Srinagar	Disturbed site*	1.93	0.2	0.27
		Control site**	2.25	0.25	0.47
		T-Cal	3.12	3.01	3.09
	Budgam	Disturbed site*	2.05	0.24	0.25
		Control site**	2.86	0.42	0.52
		T-Cal	4.28	3.02	4.12
Popular deltoides	Srinagar	Disturbed site*	1.97	0.19	0.40
		Control site**	2.23	0.20	0.55
		T-Cal	3.10	3.01	3.04
	Budgam	Disturbed site*	2.45	0.16	0.35
		Control site**	2.69	0.34	0.62
		T-Cal	4.33	3.22	4.48
Ailanthus excelsa	Srinagar	Disturbed site*	1.91	0.15	0.65
		Control site**	2.06	0.18	0.72
		T-Cal	5.02	4.03	3.36
	Budgam	Disturbed site*	2.10	0.26	0.46
		Control site**	2.92	0.36	0.74
		T-Cal	4.65	3.65	5.12

*Disturbed site = 8-10 m within the vicinity of stone crusher, **control site 3 km away from crusher site; T-Cal value was tested at 5% level of significance with $P \leq 0.05$

showed lower N content (1.90-1.97%) as compared to the disturbed site of district Budgam (2.05-2.45%) (Table 1). The higher N content in plant species in control sites may be attributed to the presence of huge vegetation and dead organic matter in the form of dead leaves twigs and weeds, etc. in soil (Bot and Benites, 2005). The low N content in plants at disturbed sites may be due to the disturbance by dust which appears to have distorted the photosynthetic efficiency and hindered overall plant development (Sharma *et al*., 2017). Decreased photosynthesis results in decreased protein content (Sharma *et al*., 2020). The low N content were recorded in plant species of both disturbed and control sites of district Srinagar as compared to disturbed and control sites of district Budgam. Among the four tree species selected, the highest N content (1.97 and 2.45%) was found in *P. deltoides* at disturbed sites of both the districts (Lasjan and Rakh Shalina), indicating that this plant species could bear stressful conditions.

Phosphorus (P) is an essential structural component of cell membranes and nucleic acids, and necessary for maintaining the vital biological activities (Bano *et al*., 2021). The P content in different plant species at disturbed and control sites was in the range of 0.15-0.26 and 0.18-0.42%, respectively. The plant species at disturbed site of district Srinagar showed lower P content (0.15-0.20%) as compared to disturbed site of district Budgam (0.16-0.26%) (Table 1). Similar trend was observed at control sites of both districts as well. Among the four selected tree species, the highest P content was found in *R. pseudoacacia* (0.20%) and *A. excelsa* (0.26%) at disturbed sites of Lasjan and Rakh Shalina, respectively. Overall higher P content in tree species was recorded at control site and lower at crusher site. P content in leaves of all the tree species within and control sites of both the districts differed significantly. It appears that the soils at disturbed sites had less organic matter which affected the phosphorus availability to plants (Khan *et al.*, 2019). Our findings are in conformity with Leghari *et al*. (2018) who observed low P content in plants within the vicinity of stone crusher.

The potassium (K) content differed in plant species both at disturbed and control sites which ranged between 0.25-0.70 and 0.47-0.92%, respectively. Plant species at disturbed site of district Srinagar showed higher K content (0.27-0.70%) as compared to disturbed site of district Budgam (0.25-0.55%) (Table 1). However, contradictory results were obtained at control sites. Among the four selected tree species, the highest K content (1.97 and 2.45%) was observed in *S. alba* at disturbed Lasjan and Rakh Shalina. The leaf K in tree species at disturbed and control sites of both the districts differed significantly. Similar results were reported by Dubey (2016).

Impact of stone dust on some micro-nutrients contents of plants

The data recorded with respect to Fe, Mn, Cu and Zn contents in various plant species is depicted in Table 2. The Fe content in plant species in disturbed and control sites ranged between 40.11-61.54 and 38.02-51.16%, respectively. The plant species in disturbed site of district Srinagar had lower Fe content (48.81-60.23%) as compared to the disturbed site of district Budgam (40.11-61.54%) [Table 2]. Among the selected tree species, the high Fe content (60.23 and 61.54%) was recorded in *S. alba* at disturbed sites Lasjan and Rakh Shalina (Table 2). Fe content in leaves of all the tree species at disturbed and control sites of both districts differed significantly.

Manganese (Mn) is a plant micronutrient and is naturally occurring element found in rock, soil and water. Manganese is one of the 9 essential nutrients that plants require for growth. Many processes including chloroplast formation, photosynthesis, nitrogen metabolism and synthesis of some enzymes are dependent on this nutrient. The Mn content in different plant species in disturbed and control sites

Table 2: Impact of stone crusher dust on some micro-nutrient contents (mg kg^{-1}) in some selected tree plants in Kashmir

Plants	Districts	Locations	Fe	Mn	Cu	Zn
Salix alba	Srinagar	Disturbed site*	60.23	27.11	20.76	27.17
		Control site**	51.16	18.20	11.23	18.20
		T-Cal	6.19	6.44	6.36	6.24
	Budgam	Disturbed site*	61.54	33.12	22.21	27.25
		Control site**	50.24	19.32	14.22	20.89
		T-Cal	6.25	6.01	6.24	6.20
Robinia pseudoacacia	Srinagar	Disturbed site*	48.81	35.22	18.09	25.18
		Control site**	45.13	30.78	12.42	22.49
		T-Cal	6.06	7.25	8.97	7.86
	Budgam	Disturbed site*	40.11	29.12	15.33	19.14
		Control site**	38.02	17.26	13.21	17.257
		T-Cal	6.57	8.35	5.12	5.02
Popular deltoides	Srinagar	Disturbed site*	56.12	38.23	27.54	34.81
		Control site**	40.18	25.23	13.10	23.12
		T-Cal	8.73	8.15	8.32	7.03
	Budgam	Disturbed site*	50.13	33.09	27.45	37.16
		Control site**	40.23	25.22	15.22	25.22
		T-Cal	7.12	6.21	6.02	7.42
Ailanthus excelsa	Srinagar	Disturbed site*	54.32	21.15	16.34	22.13
		Control site**	43.64	18.45	15.13	16.32
		T-Cal	8.98	5.75	5.50	7.28
	Budgam	Disturbed site*	55.11	27.12	14.23	18.14
		Control site**	48.02	19.20	12.96	16.20
		T-Cal	6.59	6.82	4.21	4.68

*Disturbed site = 8-10 m within the vicinity of stone crusher, **control site 3 km away from crusher site.
T-Cal value was tested at 5% level of significance with $P \leq 0.05$

of district Srinagar and Budgam ranged between 21.15-38.23 and 17.26-30.77%, respectively. The plant species in disturbed site of Srinagar showed higher Mn content (21.15-38.23%) as compared to disturbed site of Budgam (27.12-33.12%) (Table 2). Similar trend was followed in control sites of Srinagar. Of the selected tree species, the highest Mn content was found in *P. deltoides* (38.23%) and *S. alba* (33.12%) at disturbed sitesLasjan and Rakh Shalina, respectively. Mn content in the leaves of test tree species in disturbed and control sites differed significantly.

Copper (Cu) is an important micronutrient for plants and is a constituent of enzymes which catalyse oxidative reactions in a variety of metabolic pathways. It also activates enzymes which are involved in lignin synthesis; however, at high concentration it can be very toxic. It is an essential component in photosynthesis, plant respiration and carbohydrate metabolism. The Cu content in different plant species in disturbed and control sites ranged between 14.23-27.54 and 11.23-15.22%, respectively. The plant species in disturbed and control sites of district Srinagar and Budgam showed almost similar Cu content (Table 2). Among the four selected tree species, the highest Cu content was found in *P. deltoides* (27.54 and 27.45%) at disturbed sites Lasjan and Rakh Shalina, respectively. Cu content in the leaves of test tree species at disturbed and control sites differed significantly (Table 2).

Zinc (Zn) is an essential micronutrient that helps the plant to produce chlorophyll and a key component of many proteins and enzymes and (Bano *et al.*, 2021). Zn content in different plant species in disturbed and control sites varied from 18.14 to 37.16 and 16.20 to 33.12%, respectively. The plant species in disturbed site of district Srinagar showed lower Zn content (22.13-34.81%) as compared to disturbed site of district Budgam (18.14-37.16%) (Table 2). However, almost similar values of Zn were obtained at control sites of both the districts. Among the four selected tree species, the highest Zn content of 34.81 and 37.16 was found in *P. deltoides* at disturbed sites of Lasjan and Rakh Shalina, respectively. This is because of high concentration of Zn in sediment/soil which trigger the absorption by plants as the rate of photosynthesis is higher during this period because of favourable environmental conditions, hence more Zn get accumulated in plants during summer season (Bano *et al*., 2021). Similar observations were reported by Bragato *et al.* (2009). Zn content in the leaves of test tree species at disturbed and control sites differed significantly.

The higher mean values of micronutrients (Fe, Mn, Cu and Zn) recorded at disturbed sites in all the tree species may be due to heavy metal contamination in soil because of higher deposition of stone crusher dust in soil. Since stones are rich in metals and when crushed, release these metals as particulate matter which settles down under the influence of gravity near the point source (Haygarth and Jones, 1992). Tomasevic *et al*. (2004) also reported higher concentrations of Fe, Mn, Cu and Zn in tree leaves due to heavy metal contamination in soil. Changes in plant metal accumulations have also been reported by Zhang *et al.,* 2017, who observed that plants in polluted areas have higher heavy metal concentrations than plants in unpolluted areas. Our results are in line with Ogbonna *et al.,* 2020. Among all the plant species *S. alba* showed more content of Fe, Mn, Cu and Zn (Table 2) in disturbed sites which represents its phytoremediation potential, as also evident from the studies of Malik *et al*. (2020) who observed that *Salix alba* is having a high translocation rate from the root to the shoot and same with the metal accumulation (like Fe, Mn, Cu and Zn), which makes it the useful phyto-extractor for the polluted soils.

Impact of stone dust on photosynthetic pigments and ascorbic content in plants

The chlorophyll "a" in the selected plant species in disturbed and control sites ranged in between 0.87-2.59 and 1.12-3.12 mg g^{-1}, respectively. The plant species in disturbed site of Srinagar had higher chlorophyll "a" content of 0.87-2.59 mg g^{-1} as compared to 1.22-2.23 mg g^{-1} in the disturbed site of Budgam (Table 3). Among the selected tree species, the highest chlorophyll "a" content of 2.59 and 2.23 mg g^{-1} was found in *S. alba* at the disturbed sites Lasjan and Rakh Shalina. Chlorophyll "a" content in the leaves of studied tree species at disturbed and control sites differed significantly. The chlorophyll "b" in different plant species in disturbed and control sites were in the range of 0.11-3.69 and 0.76-5.81 mg g^{-1}, respectively. The plant species in disturbed site of Srinagar showed higher chlorophyll "b" content (0.11-3.69 mg g^{-1}) as compared to disturbed site of district Budgam. Among the selected tree species, the highest chlorophyll “b” content of 3.69 and 3.62 mg g^{-1} was found in *R. pseudoacacia* at disturbed sites Lasjan and Rakh Shalina. The chlorophyll “b” content in the leaves of studied tree species within the vicinity of crusher sites and control sites differed significantly. Also, the total chlorophyll in selected plant species in disturbed and control sites ranged in between 1.26-4.87 and 1.88-8.73 mg g^{-1}, respectively. The plant species in disturbed site showed almost similar values of total chlorophyll (1.26-4.87 and 2.27-4.84 mg g^{-1}), respectively. However, control sites showed higher total chlorophyll in district Budgam (2.85-8.73 mg g^{-1}) as compared to 1.88-3.67 mg g^{-1} in district Srinagar. Of the selected tree species, the highest total chlorophyll content (4.87 and 4.84 mg g^{-1}) was observed in *R. pseudoacacia* at disturbed site sLasjan and Rakh Shalina. Chlorophyll “b” in leaves of the studied tree species within the vicinity of crusher sites and control sites differed significantly. Total chlorophyll in leaves of the test tree species in disturbed and control sites also differed significantly. Carotenoid content in test plant species in disturbed and control sites ranged in between 0.06-1.04 and 0.19-1.97 mg g^{-1}, respectively. The plant species in disturbed site of Srinagar showed higher carotenoid content (0.14-1.049 mg g^{-1}) as compared to disturbed site of Budgam. Among the selected tree species, the highest carotenoid content was found in *R. pseudoacacia* (1.04 mg g^{-1}) and *S. alba* (0.93 mg g^{-1}) at disturbed sites Lasjan and Rakh Shalina, respectively. The carotenoid content in the leaves of tree species in disturbed and control sites differed significantly.

Low content of photosynthetic pigments (chlorophyll “a, chlorophyll “b”, total chlorophyll and carotenoid) recorded in all test tree species at disturbed sites probably may be due to the dust accumulation on plant leaves which causes a shading effect and interferes in light availability, so results in drop in pigment synthesis (Kumar and Thambavani, 2012). It may also be due to chlorophyll

Table 3: Impact of stone crusher dust on photosynthetic pigments, carotenoid and ascorbic acid contents (mg g^{-1}), in four selected tree plant species in Central Kashmir

Plants	Districts	Locations	Chlorophyll (mg g^{-1})			Carotenoid content (mg g^{-1})	Ascorbic acid (mg g^{-1})
			‘a’	‘b’	Total		
Salix alba	Srinagar	Disturbed site*	2.59	1.47	4.05	1.00	7.92
		Control site**	2.98	2.19	5.17	1.97	4.72
		T-Cal	3.21	3.68	4.61	3.98	5.07
	Budgam	Disturbed site*	2.23	1.20	3.43	0.93	7.93
		Control site**	3.12	2.22	5.34	1.76	4.74
		T-Cal	5.73	5.25	5.50	4.12	5.02
Robinia pseudoacacia	Srinagar	Disturbed site*	1.19	3.69	4.87	1.04	3.34
		Control site**	2.71	5.57	8.28	1.38	2.60
		T-Cal	3.95	4.62	6.57	4.20	4.97
	Budgam	Disturbed site*	1.22	3.62	4.84	0.63	3.51
		Control site**	2.92	5.81	8.73	0.64	2.52
		T-Cal	4.08	5.67	6.68	3.92	3.99
Popular deltoides	Srinagar	Disturbed site*	1.45	0.11	1.57	0.68	5.38
		Control site**	1.86	1.81	3.67	1.32	2.77
		T-Cal	3.03	3.96	4.61	3.00	5.99
	Budgam	Disturbed site*	1.23	1.04	2.27	0.56	6.52
		Control site**	1.63	1.22	2.85	0.96	3.81
		T-Cal	3.24	3.04	3.58	3.08	5.56
Ailanthus excelsa	Srinagar	Disturbed site*	0.87	0.39	1.26	0.14	4.04
		Control site**	1.12	0.76	1.88	0.29	1.82
		T-Cal	3.25	3.65	3.87	3.21	5.03
	Budgam	Disturbed site*	1.56	1.08	2.64	0.06	5.05
		Control site**	1.82	1.62	3.44	0.19	0.99
		T-Cal	4.06	4.14	4.25	3.17	5.03

*Disturbed site = 8-10 m within the vicinity of stone crusher, **control site 3 km away from crusher site.
T-Cal value was tested at 5% level of significance with $P \leq 0.05$

deterioration and decrease in photosynthetic activity caused by the alkaline conditions that occur as a result of the solubility of dust particles in cell sap (Gunamani, 1991). Further, $Ca(OH)_2$ (very alkaline) is released during the hydration phase of crust formation caused by dust deposition on dusted plant leaves. Through the stomata, this damages cell below, partially denatures the chloroplast, and subsequently decreases the pigments in the cells of injured leaves (Krishna, 1999). Also, dust particulate pollutants cover leaf surface thereby clogging the stomatal pores and alter light penetration as well as interfere in gas exchange and photosynthetic activity (Naik and Somashekar, 2006). Our results are in agreement with those of Leghari *et al*. (2018) who reported reduction in photosynthetic pigments due to dust accumulation on apricot leaves and fruits. Saha and Pandhy (2011) reported decrease in pigment concentration in the plants near stone crusher. Gupta (2018) while working on the effect of stone crusher dust pollutants on chlorophyll content of leaves also observed decrease in photosynthetic pigments of plant leaves growing in polluted site as compared to less polluted sites. Our results are in congruence with findings of Raina *et al*. (2008) and Sharma and Kumar (2015).

The ascorbic acid content in all the test plant species at disturbed and control sites is presented in Table 3. Ascorbic acid content in different plant species in disturbed and control sites of two districts ranged in between 3.34-7.93 and 0.99-4.74 mg g^{-1}, respectively. The plant species in disturbed sites of both districts showed almost similar values of ascorbic acid as 3.34-7.92 mg g^{-1} in Srinagar and 3.51-7.93 mg g^{-1} in Budgam. Similar trend was observed with respect to control sites of both districts. Among the test tree species, the highest ascorbic acid content of 7.92 and 7.93 mg g^{-1}) was found in *S. alba* at disturbed sites i.e. Lasjan and Rakh Shalina (Table 4). Ascorbic acid content in the leaves of all the tree species at disturbed and control sites differed significantly. The highest mean values of ascorbic acid were recorded at disturbed sites in all the plant species, whereas minimum values were observed at control sites (Table 3). Higher ascorbic acid content in plants at disturbed sites may be attributed to the high stress caused by dust which increases the number of antioxidants like ascorbic acid in plants. This is considered as a sign of its tolerance against dust pollution (Madan and Verma, 2015). Younis *et al*. (2013) also reported increase in the concentration of ascorbic acid in different plant species as a result of more dust accumulation while working on variations in leaf dust accumulation, foliage and pigment in fruiting plant species exposed to particulate pollution. Our results are in line with Prajapati and Tripathi (2008) who reported more ascorbic acid content in plant species growing near the dust pollution site.

S. alba and *P. deltoids* showed some degree of tolerance to dust pollution as evident from higher values of ascorbic acid 7.92 and 7.93 mg g^{-1}, respectively, and micronutrient contents like Fe {(61 mg kg^{-1}) in *S. alba*} in Budgam, Mn {(38 mg kg^{-1}) in *P. deltoides*} in Srinagar, Cu {(27.54 mg kg^{-1}) in *P. deltoides*} in Srinagar and Zn {(37.16 mg kg^{-1}) in *P. deltoides*} in Srinagar at disturbed sites.

Conclusion: Accumulation of stone dust causes substantial changes in leaf physiology by destroying the photosynthetic pigments as evident from the lower values of these pigments and higher values of Fe, Mn, Cu and Zn obtained in selected plant species at disturbed sites of both districts. *S. alba* and *P. deltoids* showed some degree of tolerance to dust pollution, hence could be avenue plantation around stone crushers.

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