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Detrimental effects of Road dust on plants and its environmental impacts

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Abstract

Present study was conducted to investigate the Road dust effects on plant communities along with bad impact on our environment. Plants are important source of oxygen and they maintain the natural ecosystem. Plants communities along the roads are important for the beauty and they play key role for environment. Dust due to road traffic is big issue in many countries of the word especially where annual rainfall is low. Plants clean the environment on the road by capturing road dust that comes with wind or by road traffic but in this case they are partially or completely occupied by road dust that produces serious injuries like reduce in size, leaf falling and their stomata don't function properly and hence loss in transpiration and plant may die. Road dust contains many heavy metals due to road traffic and their deposition on plants is alarming. Study surveys were conducted on the Main Mianwali Banu Road during May 2018 to June 2019 a total 100 plant species were recorded consist of Tree 40%, Shrubs 10% Herbs 30% and 20% grasses and it was concluded that leaves having more capacity to hold dust were greatly affected by road dust following stem, flower and branches.

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Introduction

Pakistan is rich with plant diversity and plant have key role to maintain the healthy atmosphere. (Ali, 2008). Plants are economically and medicinally very important and they are helpful in reducing soil erosion. Plant diversity is distributed according to its geographical conditions (Ahmad *et al*., 2010).

Plant communities affected by road dust never received the same level of attention in the past as other So2; No2 etc pollutants were investigated. Dust particles are small enough they can be easily deposited by wind or road traffic. In small amount of dust deposition over plant body is adjustable while in larger amount is harmful for plants (Fen- nelly, 1975) Dust particles have variation in their size (Darley, 1966). Dust particles that comes from motor vehicles that deposited over plant communities nearby road are 0.01-5000 micro meter in diameter (Farmer, 1993). Level of dust deposition on plants vary greatly, unpaved roads are main factors in producing higher level of dust (Roberts *et al*, 1975). Commercial crops nearby roads are heavily affected by dust and it was realised that dust particles are main limiting factors for plant productivity, because dust particles block the whole leaf function by reducing their photosynthesis. (Duggar and Cooley, 1914).

Chemistry of road dust is varied because some dust are inert and some or alkaline in their chemical effects (Everett, 1980) Increased concentration of dust particles over plants block the stomata (Pierce, 1909) in result plant cell plasmolysis, no starch production and at the end death of the plant (Czaja, 1961). Dust particles contain mixture of elements that pollute our environment and in result cause many respiratory disorders (Gilson, 1970). Dust is particular material that move from the land with the help of wind erosion and is very small that can suspend anywhere in the atmosphere and disturbs the natural environment and dust emission vary with climatic conditions (Bagnold, 1941). Aims and objective of the present study were to explore the floral diversity on both side of the famous Main Mianwali Kalabagh road in District Mianwali, Punjab Pakistan and secondly to investigate the detrimental effects of Road dust on plants and their environmental impacts which were previously not investigated.

Material method

Study area

Study area is grand trunk road of Mianwali district, Punjab Pakistan, and Road is covered with different types of plant diversity. Extensive survey to measure Detrimental effects of Road dust on plants and its environmental impact were carried out during may 2018 to June 2019 on Main Mianwali Kalabagh Road, starting from Mianwali city, about 50 km area was covered to investigate along the road side.

Fig. 1. Map of study area district Mianwali, Punjab Pakistan.

Climatic condition and annual rain fall

Mianwali district has extreme weather; June is hottest month with 43°C average temperature while in winter temperature drops to 3°C and average rainfall is 370mm.

Methodolgy

A total of 100 plant species were collected, dried and later mounted over herbarium sheets along with their voucher numbers. Quadrate method was applied. For plant identification aid was taken from the Flora of Pakistan (Nasir and Ali, 1970-2003). Photographs of the original habitat were taken with good quality camera. Dust samples were also collected from different points of the Main Road and dust was further analysed in the laboratory for checking of harmful heavy metals. All the investigated results were documented.

Results

Floral diversity was different all across the Main Road of Mianwali district. Tree species were in greater numbers and shrubs were minimum as shown in fig 2. Accumulation of dust particles over plant surface was creating serious problems for plants and environment of the area. Dust particles contain heavy metals that are dangerous for plant communities because growth rate under Road dust declines as shown in fig3 and 4. Roads were not in proper condition, heavy traffic and low annual rainfall in the area were creating problems as shown in fig 6. Overexploitation, grazing pressure was also involved in limiting floral diversity.

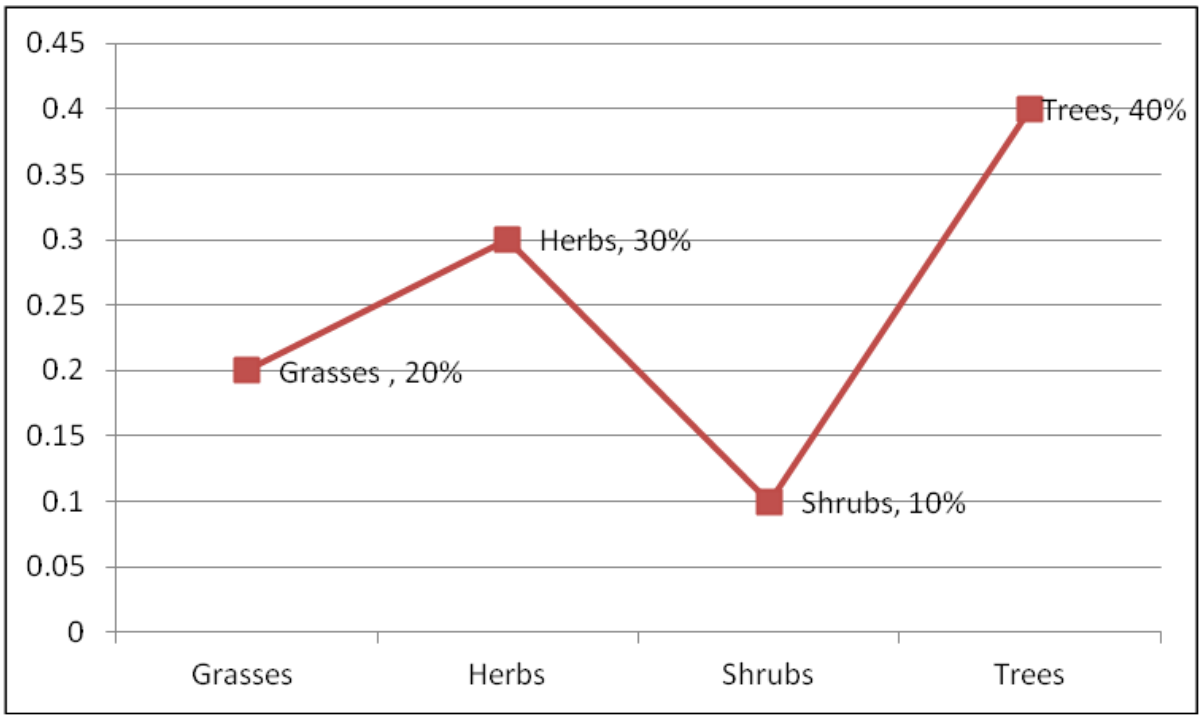

Fig. 2. % of Plant species recorded on both sides of Road.

Multiple forms of plant diversity was present on the road sides including tree, shrubs, herbs and grasses as shown in fig 2 but floral diversity and environment all around the Main Road area was under pressure because different factors were involved that were degrading plant communities and polluting clean environment. There was rich concentration of *Fe* in the road dust samples as shown in fig 5 and *Cd* was in lowest concentration. Presence of heavy metals in the road dust clearly indicating that they are generated by traffic related activities and accumulation of such a dangerous heavy metals over plant surface was major limiting factor for plant communities all across the road. Other factors for limiting the floral diversity were overgrazing, anthropogenic activities and unpaved roads as shown in fig 4 and fig 6 because

people in the area are not well aware with the importance of plants, they cut the trees for making households material and for burning purposes. Dust particles accumulate over plant surfaces they block the stomata, shading leaf, increasing leaf temperature and result in low photosynthesis, presence of heavy metals in the dust is also a major problem for plants and environment.

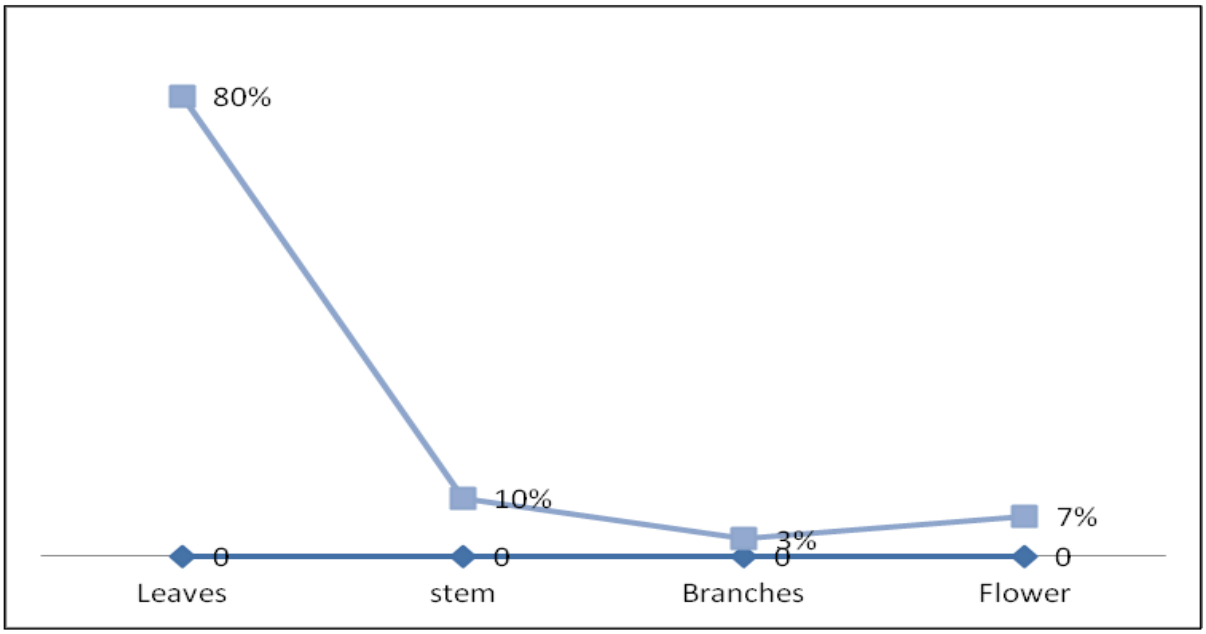

Fig. 3. % of affected plant parts by Road dust.

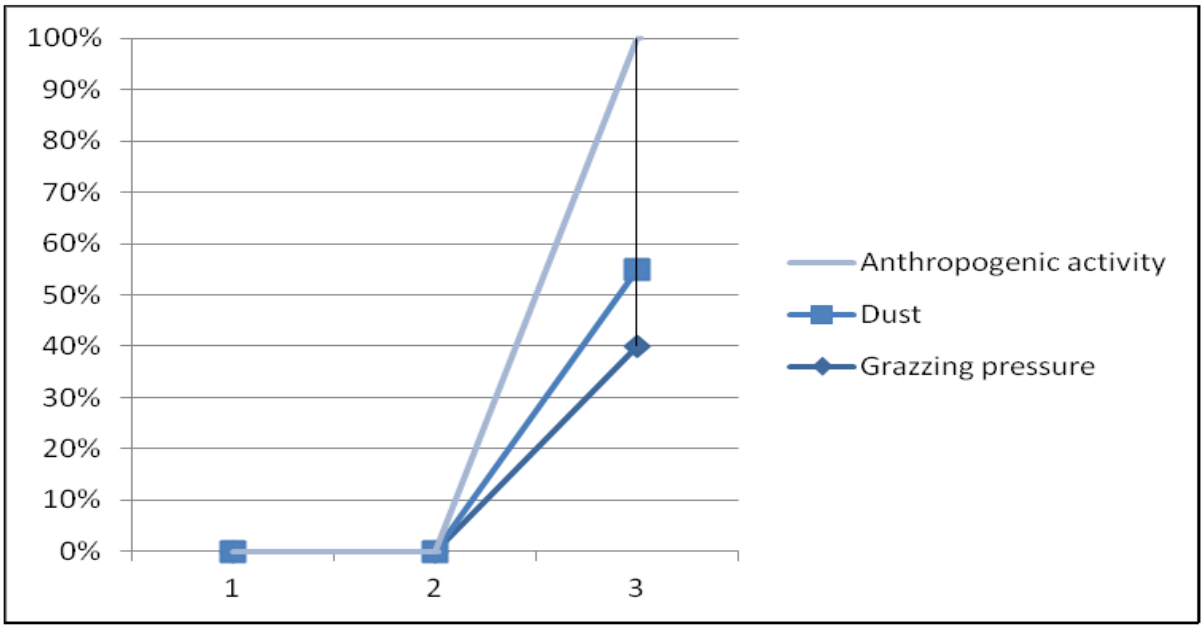

Fig. 4. % of factors involve in decline of floral diversity.

Road traffic is increasing day by day along with open-cast mining are depositing large amount of dust on vegetation, this condition become more serious in areas where annual rainfall is very low. Dust is involved in affecting photosynthesis, transpiration and allows phytotoxic gaseous pollutants. Visible injuries are generally decreased growth and productivity and at larger scale plants community structure is altered.

From above discussion about the detrimental effects of road dust on plants and its environmental impacts

it can be easily concluded that road dust is producing serious threats to plant life along with this environment is being polluted. Plants are source of oxygen and they provide many services that are healthy for all creation living in the planet. Dust is present everywhere and it consist of textile fibers, Heavy metals, plant pollens, minerals from outdoor soil and mud from tires of traffic vehicles.

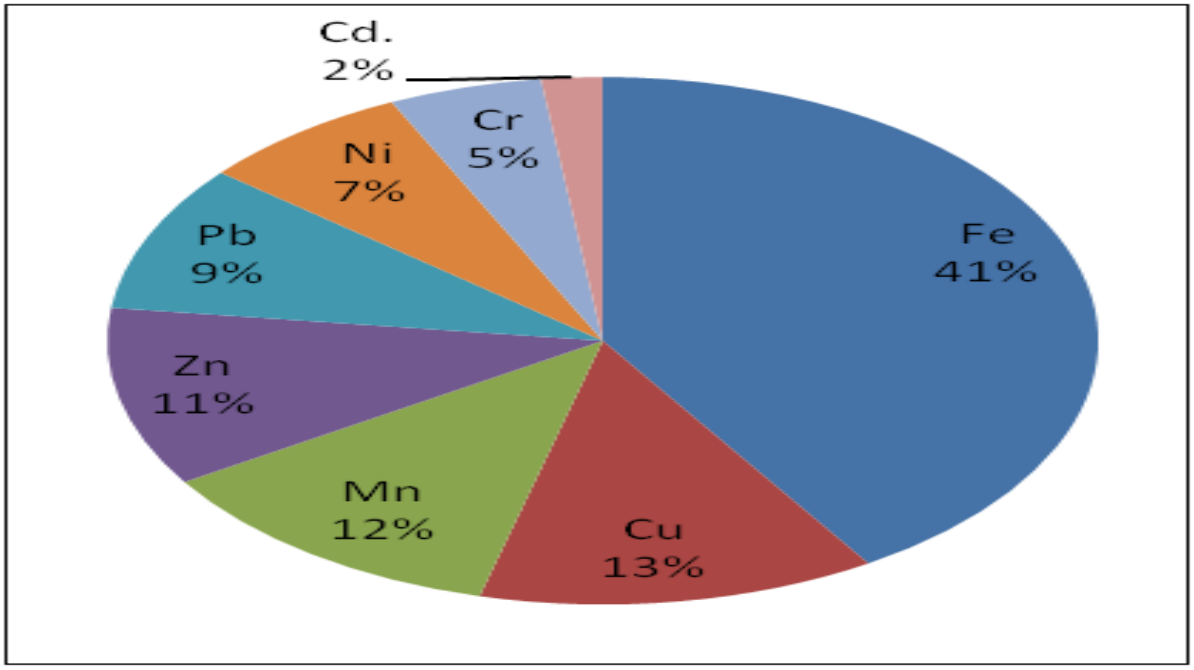

Fig. 5. % concentration of Heavy metals present in Road dust.

Fig. 6. Habitat of Main MIanwali Kalabagh road in District Mianwali.

Approximately 35% air pollution is caused by vehicles moving on the roads. Overgrazing and anthropogenic activities are also involved in limiting plant diversity. All these factors are destroying the natural environment and producing serious health issues because people with heart and other lungs issues are at more risk. In order to overcome this serious problem proper management is required.

Conclusion

Plant species present along the both sides of the main Mianwali Kalabagh Road were found to be under serious pressure. Accumulation of dust particles over plant surface was creating serious problems for plants and environment of the area. Dust particles contain heavy metals that are dangerous for plant communities because growth rate under Road dust declines.

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