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Spatial Variation in Mineral Composition of Puncture Vine (*Tribulus terrestris*) Collected from Different Sites of Tehsils Silanwali

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Abstract
The present study was conducted to explore the spatial variation in mineral composition of medicinal plant puncture vine (Tribulus terrestris) commonly called as Bhakra collected from different sites of tehsil Silanwali. The results of the study showed that maximum magnesium, zinc, iron, chromium concentration was noted in puncture vine collected from near Chak NO. 126SB (S1) while the maximum manganese and potassium concentration was observed in puncture vine collected from near Chak No. 126NB (S2). However, variation in mineral composition was present in puncture vine collected from different sites which may be attributed to different factors such as spatial variation, soil composition, and availability of nutrients in the soil.

Keywords: Spatial variation, Mineral composition, Puncture vine (*Tribulus terrestris*)

Introduction
Minerals are basically the spark plugs of life, or keystones to our health. Minerals are the catalysts that keep our 'battery'going and hold its 'charge.' Minerals compose about 5% of the human body (Alexander *et al*., 2008). We cannot produce minerals within our bodies, so we must obtain them through our food.... Plants absorb them from soil with water. They come from the earth and will eventually return to the earth. They are much important for the proper functioning of the body because they take part in ion balance of the body, also involve in gastric juice formation in human body (Brody. 1998). They involve in maintaining blood lipid level (Cu), cholesterol level is controlled by Mg, mycocardial infarction is caused by iron deficiency (Devi *et al*., 2008)
There are 103 known minerals; at least 18 of these are necessary for good health. Minerals act as co-factors for enzymes in many reactions of the body. Many enzymes does not work without minerals. All cells require enzymes to work and for their proper functioning. They give us our vitality, maintain pH, facilitate the transfer of nutrients across cell membranes important for immune health, for proper nerve function like Mn deficiency lead to immunodeficiency syndrome, heart diseases, muscle disorders (Khan *et al*., 2008). They are also important for proper food digestion, metabolism, utilization of all nutrients in food (Alexander *et al*., 2008; Ahmad *et al*., 2006), vital to our mental health, important for our memory and learning. Helpful in curing headache (Peikert *et al*., 1996) migraine and pain (Soave *et al*., 2009), good in sadness by reducing tension (Eby *et al*., 2006), weakness, stress, asthma (Cheuk, *et al*., 2005), nervousness (Kara *et al*., 2002)
The objective of the study is to explore the spatial variation in mineral composition of puncture vine collected from different sites of tehsils Silanwali, District Sargodha, Punjab, Pakistan.

Material and methods
Plants sample collection
Three sites (S1= Near Chak No. 126SB, S2= Near Chak No. 126NB, S3= Near Railway

Station) of tehsil Silanwali, District Sargodha, Punjab, Pakistan were selected for the purpose of sample collection. Each sample is randomly picked up, wrapped in a particular envelop and labeled.

Digestion of Plants Samples

The oven dried plants samples were grinded into fine powder and then digested by wet digestion method. 0.687 g sample was taken in digestion flask and 10ml HNO_3 was added in each sample and kept it for overnight. Then the process of digestion was carried out on hot plate by adding 5ml perchloric acid in sample. Repeat the process until sample solution become transparent. Then added distilled water to make the solution up to 100 ml was added to make 50 ml final solution and placed for analysis. Then standard solutions were formulated and with the help of those standards the digested samples were ready for elemental analysis.

For elemental analysis the filtered sample solution was loaded to the atomic absorption spectrophotometer. Standard curve for each metal was prepared by running samples of known strength. The elemental contents of the samples were estimated by using the respective standard curve prepared for each metal according to the method (AOAC 1998).

Following mineral contents studied using standard methods.

1) Magnesium (Mg^{2+})
2) Zinc (Zn^{2+})
3) Manganese (Mn^{+})
4) Iron (Fe^{2+})
5) Potassium (K^{+})
6) Chromium (Cr^{+})

For each metal, 1000 mg/kg concentration stock solution was prepared by the given formula:

$$X = \frac{Molecular\ weight\ of\ salt}{Molecular\ weight\ of\ mineral} \times 0.1$$

X grams of the salt were dissolved in 100 ml distilled H_2O to make 1000 mg/kg solution that was further diluted to 100 mg/kg solution for preparation of solutions for preparation of the standard curve. For calibration of instrument, 1 mg/kg to 10 mg/kg diluted solution was used.

Following formula was used to make dilutions

$C_1V_1 = C_2V_2$

Where,

C_1 = concentration of stock solution
V_1 = volume of stock solution
C_2 = Required concentration
V_2 = Required volume

Statistical Analysis

Statistical analysis was carry out using Microsoft Excel 2007 (Steel *et al*., 1997).

Results & Discussion

Observed results in table 1 showed that mineral analysis of the Tribulus terrestris showed significant variation among different elements. The maximum chromium concentration was observed in case of S1 which was 4.78±0.01mg/Kg followed by S3 (4.70±0.03mg/Kg), while the minimum concentration was present in S2 and that was 4.10±0.11mg/Kg. Results regarding Cr are in collaboration with the findings of (Dastagir et al., 2013). The Concentration of Cr in the leaves of Tribulus terrestris were 0.01 mg/kg. The Difference in results is due to many reasons such as difference in soil texture, Seasonal changes or May attributed to growing conditions.

The maximum Iron concentration was observed in case of S1 (1.87±0.04mg/Kg) followed by S2 (1.38±0.03mg/Kg) while the minimum concentration was present in S3 and that was 0.94±0.01mg/Kg. Results regarding Fe are in collaboration with the findings of (Dastagir et al., 2013). The concentration of Fe in Chenopodium album was 1.89 mg/kg. Fe deficiency has connected with myocardial infarction. Fe plays an important role in adjusting blood lipid level.

Noted results showed that maximum magnesium concentration was observed in S1 (6.71±0.08mg/Kg) followed by S2 (6.61±0.07mg/Kg), while the minimum concentration was observed in S3 and that was 5.83±0.08mg/Kg. Results regarding Mg are in collaboration with the findings of (Dastagir et al., 2013). The concentration of Mg in the leaves of Tribulus terrestris was 11.04mg/Kg. their studies also showed that Mg contents were significantly high in winter, low in summer in Tribulus terrestris and Ricinus communis Ocimum sanctum and Peganum harmala while it significantly decreased in winter while same as in Calotropis procera. Our results are nearly similar with their results however, variation in results may attributed to spatial variation.

The highest manganese concentration was observed in puncture vine collected from S2 (0.18±0.07 mg/Kg) followed by S1 (0.12±0.09mg/Kg), while the lowest concentration was noted in S3 (0.06±0.08mg/Kg). Results regarding Mn are in collaboration with the findings of (Hashem and Alfarhan. 1993). The concentration of Mn in the leaves of Tribulus terrestris was 0.09 mg/kg in Peshawar. Their studies also showed that Peganum harmala has 0.3 mg/Kg Mn content. Manganese is used as co-factor, involve in activation of many enzymes. Our results slightly differ with their findings which may be due to different climatic conditions or may be due to difference in soil composition.

The maximum potassium concentration was observed in case of S2 (0.84±0.006mg/Kg) followed by S1 (0.470.002mg/Kg) while the minimum concentration was present in S3 and that was 0.14±0.008mg/Kg. Results regarding K are in collaboration with the findings of (Nessa and Khan, 2015: Sebastiani et al., 2004). The concentration of K in Tribulus terrestris was 0.86 mg/Kg. At vegetative stage, highest level of P was present in Tribulus terrestris at Waziristan and that was 2.450 mg/Kg.

The maximum zinc concentration was observed in S1 (0.34±0.04mg/Kg) followed by S2 (0.25±0.03mg/Kg while the minimum concentration was observed in S3 and that was 0.24±0.02mg/Kg. Results regarding Zn are in collaboration with the findings of (Rajendar et al., 2011). Zn concentration found to be varying in Tribulus terrestris watered with wastewater at vegetative stage. Higher levels of Zn were noticed (2.450 $mg.kg^{-1}$) grown with wastewater. The lowest concentration of Zn was observed (0.87mg/kg), irrigated with canal water in Registan, India. The difference in results nay attributed to many reasons such as difference in soil texture, seasonal changes, growing conditions and soil nature.

Table 1: Spatial variation in mineral composition of puncture vine (Tribulus terrestris) collected from different sites of tehsil Silanwali

Sr. No.	Sites	Concentration					
		Cr	Fe	Mg	Mn	K	Zn
1	**S1**	4.78±0.01	1.87±0.04	6.71±0.08	0.12±0.09	0.47±0.002	0.34±0.04
2	**S2**	4.10±0.03	1.38±0.07	6.61±0.07	0.18±0.07	0.84±0.006	0.25±0.03
3	**S3**	4.62±0.03	0.94±0.01	5.83±0.08	0.09±0.08	0.14±0.008	0.24±0.02

S1= Near Chak No. 126SB; S2= Near Chak No. 126NB; S3=Near Railway Station

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