Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 1144-1146
Received: 18-08-2020
Accepted: 30-09-2020

Manjesh GN
Scientist, Department of Horticulture, ICAR-Directorate on Medicinal and Aromatic Plants Research, Anand, Gujarat, India

Hima Bindu K
Principal Scientist, Division of Medicinal Crops, ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru, Karnataka, India

Mallikarjuna Gowda AP
Senior Scientist, Department of Horticulture, University of Agricultural Sciences, Bengaluru, Karnataka, India

Akula Chinapolaiah
Scientist, Department of Horticulture, ICAR-Directorate on Medicinal and Aromatic Plants Research, Anand, Gujarat, India

Halesh GK
Assistant Professor, Department of Biotechnology and Crop Improvement, College of Horticulture, Bengaluru, Karnataka, India

Corresponding Author:
Manjesh GN
Scientist, Department of Horticulture, ICAR-Directorate on Medicinal and Aromatic Plants Research, Anand, Gujarat, India

Elemental composition in male and female genotypes of betel vine (*Piper betle* L.)

Manjesh GN, Hima Bindu K, Mallikarjuna Gowda AP, Akula Chinapolaiah and Halesh GK

DOI: https://doi.org/10.22271/phyto.2020.v9.i6q.13102

Abstract
Betel vine (*Piper betle* L.,) is an evergreen perennial, dioecious creeper belongs to the family Piperaceae and cultivated commercially in South East Asian countries. In present study the sexually dimorphic genotypes were evaluated to know their elemental composition (nitrogen, phosphorous, potassium, iron, zinc, copper and manganese) and found significant results within male and female clones. On the other side, except copper the gender differences were not found significant. The nitrogen content was higher among major elements in Sirugamani-1 (6.63%). The phosphorous concentration was higher in genotype CARI-6 (0.72%). Similarly, potassium levels was found higher in genotype Kapoori TN (2.83%). The trace element copper was higher in male genotypes Kapoori TN and Swarna Kapoori (36.21 mg/kg). The copper concentration was slightly higher in male clones over female counterparts. In other hand iron was found higher among all the trace elements and higher contents in genotype Kapoori Chintalapudi (84.38 mg/kg).

Keywords: Betel vine, genotypes, dimorphs, trace elements

Introduction
Betel vine (*Piper betle* L.,) is an evergreen perennial, dioecious creeper belongs to the family Piperaceae and cultivated commercially in South East Asian countries. It is a heritage crop of India and is a cash crop grown mainly by small and marginal farmers in an estimated area of 50,000 ha. It is also being exported to different countries with foreign exchange to the tune of 30-40 million INR (Guha, 2006) [3]. It is widely used as masticatory agent due to the strong pungent aromatic flavor of leaves. The leaves and stalk of betelvine have been used since time immemorial to treat various ailments in *Ayurveda* and different folk medicines. The leaves exhibit antioxidant, anti-inflammatory, anticarcinogenic, antibacterial, antifungal and nematicidal properties and its essential oils known for their beneficial biological activities (Kumar *et al.*, 2010 and Rai *et al.*, 2011) [4, 5]. The previous report by Nagaraja and Kumar (2018) reported the mineral composition in healthy mature betel leaves on dry weight basis having magnesium (17.54 g 100^{-1}), calcium (324.8 mg 100^{-1}), phosphorous (211.26 mg 100^{-1}), zinc (94 mg 100^{-1}), manganese (64.66 mg 100^{-1}), copper (40.80 mg 100^{-1}), iron (25.40 mg 100^{-1}), nickel (21.20 mg 100^{-1}) and cobalt (11.80 mg 100^{-1}). Hence, the present study was undertaken to reveal the elemental compositions in ten male and ten female genotypes of betel vine.

Material and Methods
Geographical location of the experimental site
The field and laboratory experiments were carried out at ICAR- Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru situated at an altitude of 890 meter MSL at 13058′ North latitude and 78045′ East longitudes.

Plant material
A total of twenty clones including ten clones each in male and female types maintained at ICAR-IIHR, Bengaluru were used in the present study (Table 1).

Elemental analysis in leaves of betelvine male and female clones
Collection and preparation of plant samples
The harvestable leaves sample of each clone was collected from each clone and washed with water and dried in shade for 6 hours and then in a hot air oven at 65 °C for 30 minutes. The dried sample was powdered using stainless steel Willey mill. The powdered plant samples were stored in butter paper bags and kept in desiccator for further analysis.

Determination of nitrogen in leaf sample

Nitrogen content in samples was determined by digesting the samples in concentrated H_2SO_4 with K_2SO_4 + $CuSO_4$ + Se mixture and distilling in an alkaline medium.

Determination of phosphorus and potassium in leaf sample

The samples were dried at 40 °C and ground to pass through a 2-mm sieve, and were analysed for P by the Bray-1 method and for K by the NH4OAc method following procedures described by Frank *et al*. (1998) [1] for P and by Warncke and Brown (1998) [1, 2] for K.

Determination of trace elements in leaf sample

Digestion of plant sample

It was carried out using a 9:4 mixture of HNO_3:$HClO_4$. Exactly 1 g ground leaf material was taken in 100 ml conical flask. Add, 10 ml of di-acid mixture and mix the content of the flask by swirling. Placed the flask on low heat hot plate in a digestion chamber. Then, heat the flask at higher temperature until the production of red NO_2 fumes ceases, and continued the digestion until the volume is reduced to about 3 to 5 mL but not to dryness. The completion of digestion is confirmed by the snow white residue or when the liquid become colorless. After cooling make up the volume with glass distilled water deionized water and filter solution through Whatman No.1 filter paper. Use aliquots of this solution for the determination of Fe, Mn, Zn and Cu.

Determination of Fe, Mn, Zn and Cu

The digested samples were analyzed for Fe, Mn, Zn and Cu through Flame Atomic Absorption Spectroscopy. Prior to analysis, the instrument was calibrated with standards prepared from by dilution of 1000 mg l^{-1} stock solution. From the stock solution, four working standard solution were prepared at different concentration for each metal (Fe, Mn, Zn and Cu) and fed to AAS having appropriate hallow cathode lamps to record the reading.

Calculation

$$\text{Micronutrient conc. (ppm)} = \frac{\text{Graph ppm} \times \text{Vol. of digested sample}}{\text{Weight of sample}} \times 100$$

Results and Discussion

Elemental composition in leaves of male and female clones

The elemental composition (nitrogen, phosphorous, potassium, iron, manganese, copper and zinc) in leaves of betel vine clones was studied and given in table-2. The average nitrogen content of leaves of betel vine clones recorded was 4.63% which ranged from 3.72% (Swarna Kapoori) to 6.63% (Sirugamani-1) and found significantly different within clones. The average nitrogen content in leaves of male and female clones was 4.63% and resulted in nonsignificant difference between genders. Average phosphorus content in betel vine leaves recorded was 0.52% and ranged from 0.38% (Kapoori Chintalapudi) to 0.72% (CARI-2) and found significantly different among the clones. On an average male clones recorded 0.53% and females recorded 0.50% phosphorous content which did not differ significantly between genders. Significant differences were found within clones with an average concentration of 1.93% potassium and ranged from 1.05 (Sirugamani-1) to 2.83% (Kapoori TN). The average potassium concentration in male clones was 2.00%, female clones with 1.85% and noticed nonsignificant difference between genders. The previous reports by Tirkey *et al.* (2019) [6] reported that, high potassium content in Ramtake meetha (933mg/100g) followed by Bidhan pan (991mg/100g). The genotype, Karapaku possessed high potassium content (2.67mg/g).

Table 1: List of female and male clones in *Piper betle* L.

Sl. no.	Clones	Place of collection	Gender
1	Meetha Pan	West Bengal	Female
2	Mysore Local	Karnataka	Female
3	IIHR BV 67	Maharashtra	Female
4	Gangarampur Sanchi	Tamil Nadu	Female
5	Hirehalli Local	Karnataka	Female
6	Halisahar Sanchi	West Bengal	Female
7	Malvi	Madhya Pradesh	Female
8	Sirugamani-1	Tamil Nadu	Female
9	Ghanaghette	West Bengal	Female
10	Karapaku	Andhra Pradesh	Female
11	Kapoori TN	Tamil Nadu	Male
12	Kapoori Chintalapudi	Andhra Pradesh	Male
13	Kapoori Cuddapah	Andhra Pradesh	Male
14	Kapoori Arvi	Maharashtra	Male
15	CARI-6	Andaman Islands	Male
16	Kapoori Bihar	Bihar	Male
17	Vasani Kapoori	Maharashtra	Male
18	Shirpurkata	Maharashtra	Male
19	Yellow leaf	Andhra Pradesh	Male
20	Swarna Kapoori	Andhra Pradesh	Male

Trace elemental composition in male and female clones

The iron content was found with an average of 76.69 mg/kg and ranged from 65.95 mg/kg (Kapoori TN) to 84.38 mg/kg (Kapoori Chintalapudi) and found significant within clones. Whereas, it was nonsignificant between genders, and recorded an average iron concentration of 74.81 mg/kg in males and 78.58 mg/kg in female clones.

There was a significant difference found within clones with an average concentration of manganese recorded was 37.12 mg/kg and ranged from 26.55 mg/kg (Meetha Pan) to 48.17 mg/kg (Kapoori Cuddapa and Swarna Kapoori). The average manganese concentration of male clones was 39.17 mg/kg, female clones with 35.07 mg/kg and noticed non-significance difference between genders.

The average copper content was 27.50 mg/kg and ranged from 16.83 mg/kg (CARI-6) to 36.21 mg/kg (Swarna Kapoori). The average copper concentration of male clones was 30.04 mg/kg and 24.97 mg/kg in female clones and found to be significantly different within and between genders.

The average zinc content was found to be 32.88 mg/kg and ranged from 22.62 mg/kg (Sirugamani-1) to 40.12 mg/kg (Kapoori TN). The average zinc concentration of male clones was 33.50 mg/kg and 32.26 mg/kg in female clones and found to be significantly different within gender. Whereas, it was found no significance between genders.

The elemental composition (nitrogen, phosphorous, potassium, iron, manganese, copper and zinc) in leaves of male and female betelvine clones was studied. The nitrogen, phosphorous, potassium, iron, manganese, and zinc contents among the leaves of betel vine clones were significantly different within clones and non-significant between genders except for the element copper which showed significant differences within and between genders. The average nitrogen content in leaves of male and female clones was 4.63% and resulted nonsignificant between genders. The average phosphorous and potassium content of males and female clones were 0.53%; 0.50% and 2.00%; 1.50% respectively.

Earlier report by Pradhan *et al.* (2013) [7] reported 2.0-7.0% nitrogen, 0.05-0.6% phosphorus, and 1.1-4.6% potassium contents in the leaves of betle vine.

Table 2: Elemental composition in leaves of female and male clones of *P. betle* L.

Clones	N (%)	P (%)	K (%)	Fe (mg/kg)	Mn (mg/kg)	Cu (mg/kg)	Zn (mg/kg)
Meetha Pan	5.07	0.52	2.47	83.32	26.55	28.52	37.40
Mysore Local	3.87	0.45	1.44	83.67	37.71	22.62	35.40
IIHR BV 67	4.09	0.61	2.25	74.21	28.90	27.24	36.38
Gangarampur Sanchi	4.25	0.41	1.83	74.73	36.24	18.67	24.67
Hirehalli Local	3.84	0.48	2.15	75.33	42.28	22.67	33.29
Halisahar Sanchi	4.10	0.54	1.28	73.03	30.73	27.53	29.10
Malvi	4.04	0.44	2.47	83.23	39.33	20.73	35.38
Sirugamani-1	6.63	0.46	1.05	79.59	38.53	21.86	22.62
Ghanaghette	5.18	0.53	2.15	77.62	41.67	31.59	35.40
Karapaku	5.26	0.60	1.44	81.03	28.77	28.27	33.00
Kapoori TN	5.32	0.54	2.83	65.95	30.64	36.21	40.12
Kapoori Chintalapudi	3.88	0.38	2.14	84.38	43.27	24.95	39.20
Kapoori Cuddapah	4.12	0.53	1.38	73.42	48.17	30.10	27.51
Kapoori Arvi	5.35	0.44	2.15	81.62	37.37	26.00	29.53
CARI-6	4.13	0.72	2.62	66.74	34.22	16.83	35.23
Kapoori Bihar	5.49	0.70	2.28	80.91	44.18	35.47	31.13
Vasani Kapoori	5.42	0.61	1.83	67.47	30.06	34.42	37.07
Shirpurkata	4.04	0.53	1.11	68.70	42.27	26.97	29.40
Yellow leaf	4.84	0.43	1.92	82.94	33.33	33.22	31.41
Swarna Kapoori	3.72	0.44	1.73	75.96	48.17	36.21	34.42
Mean(±)S.Em	4.63±0.15	0.52±0.01	1.93±0.06	76.69±1.65	37.12±1.09	27.50±0.80	32.88±0.59
CD @5%	0.42	0.04	0.16	4.71	3.11	2.30	1.69
F-test	S	S	S	S	S	S	S
Male v/s Female							
Mean±Sem (Male)	4.63±0.23	0.53±0.04	2.00±0.17	74.81±2.31	39.17±2.19	30.04±2.00	33.50±1.38
Mean±Sem(Female)	4.63±0.28	0.50±0.02	1.85±0.16	78.58±1.30	35.07±1.84	24.97±1.32	32.26±1.62
T-test	NS	NS	NS	NS	NS	S	NS

S: Significant @5%; NS: Non significant @ 5%

Conclusion

In this study we could able to get the significant variations in elemental compositions within male and female genotypes. Interestingly copper has significantly varied between genders. The betel leaves are higher in iron among trace elements in comparison to other minor elements. Among major elements nitrogen was found higher among the genotypes followed by potassium and phosphorous.

References

1. Frank K, Beegle D, Denning J. Phosphorus. In J.L. Brown, editor, Recommended chemical soil test procedures for the North Central region. North Central Regional Publ. No. 221 (Rev.). Missouri Exp. Stn. Publ. SB 1001. Univ. of Missouri. Columbia 1998, p21–29.
2. Warncke D, Brown JR. Potassium and other basic cations. In J.L. Brown, editor, Recommended chemical soil test procedures for the North Central region. North Central Region Publ. 221 (revised). Missouri Exp. Stn. Columbia 1998, p31-33.
3. Guha P. Betel Leaf: The Neglected Green Gold of India, J Hum. Ecol 2006;19(2):87-93.
4. Kumar N, Misra P, Dube A, Bhattacharya S, Dakshit M, Ranade SA. *Piper betle* Linn. a maligned pan -Asiatic plant with an array of pharmacological activities and prospects for drug discovery. Curr. Sci 2010;99:922-932.
5. Rai MP, Thilkchand KR, Palatty P. *Piper betle* L. (Betelvine), the maligned Southeast Asian medicinal plant possess cancer preventive effects: Time to reconsider the wronged opinion. Asian Pacific J Cancer Prevention 2011;12:241-2456.
6. Tirkey A, Ramtake V, Porte1 SS, Joshi PK, Khare N, Tandon A, *et al*. Stability, correlation and path coefficient analysis for yield and quality traits in betelvine (*Piper betle* L.) genotypes under three different sets of conditions. Indian J Genet 2019;79(2):474-484.
7. Pradhan D, Suri KA, Pradhan DK, Biswasroy P. Golden heart of the nature: *Piper betle* L. J Pharmacogn Phytochem 2013;1(6):147-167.