International Journal of Pharmacy
Journal Homepage: http://www.pharmascholars.com

Research Article **CODEN: IJPNL6**

ANTIOXIDANT ACTIVITY OF SOME WILD EDIBLE TUBEROUS PLANTS

Swati Deshmukh* and Varsha Jadhav (Rathod)

Depatement of Botany, Shivaji University, Kolhapur (M. S.), India

***Corresponding author e-mail:** swatideshmukh814@gmail.com

ABSTRACT

The antioxidant properties of three wild edible tuberous plants viz. *Brachystelma edulis* Coll. and Helmls, *Ceropegia bulbosa* var. *bulbosa* Roxb. and *Ceropegia hirsuta* Weight and Arn. were determined by using polyphenols, ascorbic acid, carotenoid, enzyme peroxidase, catalase and superoxide dismutase assay. The total phenol content varied from 448.1±0.81 mg/100g FW (Leaves) to 131.4±0.86g/100g FW (Tuber) of *C. bulbosa*. Among all these tubers, *B. edulis* showed the highest antioxidant capacity. The result indicates that could be utilized as potential source of natural antioxidant in the food or in pharmaceutical industry.

KEY WORDS: Wild edible tubers, antioxidant potential, polyphenol, superoxide dismutase.

INTRODUCTION

In recent years much attention has been devoted to natural antioxidant and their association with health benefits[1]. Wild plants are potential sources of natural antioxidants. Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species, such as singlet oxygen, superoxide, peroxyl radicals and hydroxyl radicals. An imbalance between antioxidants and reactive oxygen species results in oxidative stress, leading to cellular damage[2]. Antioxidants have become synonymous with good health. Several plants and vegetables used in traditional medicine can provide diverse secondary metabolites with antioxidant potentials in that most of which are isolated phenolic compounds[3]. The continued search among plant secondary metabolites for natural antioxidants has gained importance in recent years because of the increasing awareness of herbal remedies as potential sources of antioxidants. Currently there is growing interest globally to identify antioxidant compound and its role in human health therefore it has promoted research in the field of food science to access the antioxidant. *Brachystelma edulis* Coll. and Helmls is a perennial dwarf herb with linear to narrowly elliptic leaves bearing tuberous roots. *Ceropegia bulbosa* var. *bulbosa* Roxb is a perennial twinning tuberous herb with thick, fleshy, orbicular to ovate succulent leaves. and *Ceropegia hirsuta* Weight and Arn is a perennial coarse twinner with membranous, broad, elliptic to ovate petiolate leaves covered with hairs. These three wild tubers are from asclepiadaceae family. Aim of the present study is to explore the antioxidant potential of wild edible tuberous plants through polyphenols, ascorbic acid, carotenoid, enzyme peroxidase, catalase and superoxide dismutase contents of tubers and leaves. Tuber and leaves were eaten raw and cooked as vegetable [4, 5]. These are also used in cough, cold, stomachache, dysentery, enhancing fertility and applied on inflammation of skin [6].

MATERIALS AND METHODS

The method of Folin and Denis[7] was employed for determination of the total polyphenols content in plant material. A titrimetric method described by Sadasivam and Manikam [8] was followed to determine the tubers and leaves ascorbic acid content. The carotenoids were estimated following the method of Kirk and Allen[9]. To study the enzyme peroxidase activity the method of Maehly[10] was followed. Catalase activity was assayed by following the method of Luck [11] (1974) as described by Sadasivam and Manikam[8]. Superoxide dismutase was

determined by following the method described by Giannopolitis and Ries[12], with slight modifications. The soluble proteins were determined by following the method of Lowry *et al*.,[13].

RESULTS AND DISCUSSION

POLYPHENOL: The polyphenols content of tubers and leaves are recorded in Table 1. It is clear from result polyphenols content is highest in tubers of *Brachystelma edulis* (146.8±1.21 mg/100 g of fresh weight) and is lowest in *Ceropegia bulbosa* (131.4 ±0.86 mg/100 g of fresh weight) tubers. Similarly polyphenol content is highest in leaves of *C. bulbosa* (448.1±0.81 mg/100 g fresh weight) and is lowest in *B. edulis* (418.32±1.04 mg/100g of fresh weight) leaves. On the whole plant basis, the leaves contained higher polyphenols than the tubers. Marwah *et al.* [14] carried out the antioxidant capacity of some edible and wound healing plants in Oman. They reported the total phenolics in tubers of *Dorstenia flava* (26.5±1.6 mg/g of ethanol extract) and *Remusatia vivipara* (14.9±1.6 mg/g of ethanol extract). Also they concluded the total phenolics of the wound healing plants were directly proportional to the antioxidant activity. In our work tuber of *Brachystelma edulis* showed slightly equal polyphenols to the *Remusatia vivipara* and *Ceropegia bulbosa and C. hirsuta* showed lower polyphenol than the above mentioned plants. Simopoulous[15] found out antioxidant in edible wild plants. He reported the total phenols content in leaves of certain wild edible plants within the range of 6.736±0.52 to 102.56±3.13 mg/100g wet weight. In our work the leaves showed higher total polyphenols than the above reported wild edible plants. Recent researches report that the phenolic compound is the main human dietary antioxidant and has a decreased incidence of chronic diseases under the present nomenclature phenols fall under the category of nutraceuticals, offering many nutritional advantages to man [16].

ASCORBIC ACID: The ascorbic acid content of tubers and leaves are recorded in Table 1. It is clear from the results that ascorbic acid content is highest in tubers of *Ceropegia hirsuta* (2.27±0.23mg/100 g of fresh weight) and lowest is in *Brachystelma edulis* (2.04 ±0.32mg/100 g of fresh weight) tubers. Similarly ascorbic acid content is highest in leaves of *C.hirsuta* (3.86±0.21mg/100 g fresh weight) and lowest is in *Ceropegia bulbosa* (2.95±0.13mg/100g of fresh weight) leaves. On the whole plant basis, the leaves contained higher ascorbic acid than the tubers. Odukoya *et al.*[17] analyzed antioxidant activity of selected Nigerian green leafy vegetable. They reported that the leaves of *Gongronema latifolium* (Asclepiadaceae) contained 187.11±0.98 mg/100g dry weight. In present work the leaves of wild edible tuberous plants showed very low amount of ascorbic acid than the *G. latifolium*. The human body cannot produce ascorbic acid, so it must be obtained entirely through diet. Ascorbic acid is an antioxidant which helps to protect the body against cancer, blood pressure, immunity and drug metabolism and other degenerative diseases such as arthritis and type II diabetes mellitus [18].

CAROTENOID: The carotenoid content of tubers and leaves are recorded in Table 1. In present study carotenoid content is highest in tubers of *Brachystelma edulis* (0.9±0.44 mg/100 g of fresh weight) and is lowest in *Ceropegia bulbosa* (0.6±0.002 mg/100 g of fresh weight) tubers. Similarly carotenoid content is highest in leaves of *C.bulbosa* (17.36±0.98 mg/100 g of fresh weight) and is lowest in *B. edulis* (10.8±1.03 mg/100g of fresh weight) leaves. On the whole plant basis, the leaves contained higher carotenoids than the tubers. The study on screening of antioxidant activity and antioxidant compounds of some edible plants of Thailand was carried out by Chanwitheesuk *et al*.[19] .They reported the carotenoid contents in leaves of *Dregea volubilis* (6.14±0.07 mg %), *Gymnema inodorum* (1.31±0.03 mg %), *Marsdenia glabra* (8.92±0.04 mg %). In our work the leaves of wild edible tuberous plants showed higher carotenoid than the earlier mentioned values. Carotenoid is important powerful antioxidant present in chloroplasts in the leaves of dark green leafy vegetables, which are not readily digested in the body. Hence, cooking of the vegetables before eating increases its bioavailability [17].

ENZYME PEROXIDASE: Peroxidase activity of tubers and leaves were recorded in Table 1. The peroxidase activity is highest in tubers of *Brachystelma edulis* (8.43 ±0.085 unit $min^{-1}.mg^{-1}$protein) and is lowest in *Ceropegia hirsuta* (7.28±0.13 unit $min^{-1}.mg^{-1}$protein) tubers. Similarly peroxidase activity is highest in leaves of *C. hirsuta* (4.12 ±0.01 unit $min^{-1}.mg^{-1}$protein) and is lowest in *Ceropegia bulbosa* (3.28±0.11 unit $min^{-1}.mg^{-1}$protein) leaves. On the whole plant basis, the tubers contained peroxidase activity higher than the leaves. Peroxidase catalyses the oxidation of various electron donor substrates. Peroxidase is utilized in neurodegenerative diseases [20]. Dogan *et al.* [21] carried out the partial characterization of peroxidase from the leaves of *Thymbra spicata*. They reported the peroxidase enzyme controlling the specific flavour of thymbra leaves and observed activity 3580 EU $ml^{-1}.min^{-1}$ in leaves. In present work leaves of

Brachystelma edulis, Ceropegia bulbosa and *Ceropegia hirsuta* showed lower peroxidase activity than the thymbra leaves.

ENZYME CATALASE: Catalase activity of tubers and leaves are recorded in Table 1 enzyme catalase activity is highest in tubers of *Brachystelma edulis* (0.3±0.03 unit $min^{-1}.mg^{-1}$protein) and is lowest in *Ceropegia hirsuta* (0.20±0.02 unit $min^{-1}.mg^{-1}$protein) tubers. Similarly catalase activity is highest in leaves of *B. edulis* (0.39 ±0.01 unit $min^{-1}.mg^{-1}$protein) and is lowest in *Ceropegia bulbosa* (0.32±0.02 unit $min^{-1}.mg^{-1}$protein) leaves. On the whole plant basis, the leaves contained catalase activity higher than the tubers. Catalases are ubiquitous antioxidant enzymes irrespective of their origin; catalyze the same basic reaction, the breakdown of hydrogen peroxide into water and oxygen [22]. Catalase is an unusual enzyme since, although hydrogen peroxide is its only substrate. Catalases are utilized in cancer and diabetic retinopathy.

ENZYME SUPEROXIDE DISMUTASE: Superoxide dismutase activity of tubers and leaves are recorded in Table 1. The enzyme superoxide dismutase activity is highest in tubers of *Ceropegia bulbosa* (0.30±0.005 unit $min^{-1}.mg^{-1}$protein) and is lowest in *Brachystelma edulis* (0.21±0.004 unit $min^{-1}.mg^{-1}$protein) tubers. Similarly enzyme superoxide dismutase activity is highest in leaves of *C. bulbosa* (0.46±0.03 unit $min^{-1}.mg^{-1}$protein) and is lowest in *B. edulis* (0.35±0.001 unit $min^{-1}.mg^{-1}$protein) leaves. On the whole plant basis, the leaves contained enzyme superoxide dismutase activity higher than the tubers. Enzyme superoxide dismutase is a group of enzymes important for removing biologically generated superoxide anion radical. Superoxide dismutase is a class of enzymes that catalyze the dismutation of superoxide into oxygen and hydrogen peroxide, and their action helps to protect cells from oxidation of lipids, proteins and DNA [23]. The superoxide dismutase enzyme mostly is utilized in neurodegenerative diseases. Stajner *et al.* [24] studied the antioxidant properties of wild growing and cultivated *Allium* species. They reported superoxide dismutase, catalase and peroxidase activities in bulbs and concluded that the cultivated *Allium* species had better antioxidant properties compared with wild growing species. Work showed higher enzyme activities than the above reported wild growing *Allium* plants. The superoxide dismutase plays important role in therapeutic approaches for treatment of various diseases.

CONCLUSION

The highest polyphenols, carotenoids, catalase and peroxidase observed in tubers of *Brachystelma edulis.* Leaves and tuber of *Ceropegia hirsuta* found highest ascorbic acid. The leaves *Ceropegia bulbosa* showed highest superoxide dismutase activity. The high enzyme activity is directly related to the high antioxidant activity. These wild edible tuberous plants possess effective antioxidant properties indicating their possible nutritional and medicinal value.

Table 1: Antioxidant composition of wild edible tuberous plants

Sr. No.	Parameter	Plant part	*Brachystelma edulis*	*Ceropegia bulbosa*	*Ceropegia hirsuta*
1.	Polyphenol (mg/100g FW)	Tuber	146.8±1.21	131.4±0.86	140.1±0.75
		Leaves	418.32±1.04	448.1±0.81	434.24 ±0.39
2.	Ascorbic Acid (mg/100g FW)	Tuber	2.04±0.32	2.23±0.11	2.27±0.23
		Leaves	3.18±0.27	2.95±0.13	3.86±0.21
3.	Carotenoid (mg/100g FW)	Tuber	0.9±0.44	0.6±0.002	0.8±0.001
		Leaves	10.8±1.03	17.36±0.98	15.72±1.43
4.	Peroxidase (unit $min^{-1}.mg^{-1}$protein)	Tuber	8.43±0.085	7.37±0.087	7.28±0.13
		Leaves	4.07±0.096	3.28±0.11	4.12±0.01
5.	Catalase (unit $min^{-1}.mg^{-1}$protein)	Tuber	0.3±0.03	0.24±0.001	0.20±0.02
		Leaves	0.39±0.01	0.32±0.02	0.37±0.05
6.	Superoxide dismutase (unit $min^{-1}.mg^{-1}$protein)	Tuber	0.21±0.004	0.30±0.005	0.26±0.01
		Leaves	0.35±0.001	0.46±0.03	0.39±0.006

The data are mean values ± Standard Deviation (SD) of three replicates.

REFERENCES

1. Moon JK, Shibamoto T. J Agri Food Chem, 2009; 57: 1655-666.
2. Cheng SS, Chang HT, Vchang ST, Tsai KH, Chen WJ. Bioresource Tech, 2003; 89: 99-02.
3. Ramarathnam N, Ochi H, Takeuchi M. Antioxidants Defense system in Vegetable Extracts. In: Shahidi F (ed). Natural antioxidants: Chemistry, Health Effects and Applications. Aoca Press: Champaign, IL, 1997, pp. 76-87.
4. Gaikwad SP, Yadav SR, Endemic flowering plant species of Maharashtra and their possible utilization. Biodiversity in India vol.3 (Editor T. Pullaiah Regency publication), 2004, pp. 28-58.
5. Choudhary K, Singh M, Pillai U. American-Eurasian J Botany, 2008; 1(2): 38-45.
6. Swarnkar S, Katewa SS. Ethnobotanical Leaflets, 2008; 12: 647-66.
7. Folin O, Denis WA. J Biol Chem, 1985, 22: 305-08.
8. Sadashivam S, Manikam A, Biochemical method for agricultural sciences, Willey, Eastern Ltd, 1992, pp. 105.
9. Kirk JOT, Allen RL. Biochem Biophys Res Commun, 1965; 21: 523-30.
10. Maehly AC, Methods in biochemical analysis (Ed.) Glick D. (Publ.) Interscience publishers Inc. New York, 1954, pp. 385-86.
11. Luck H, In: Methods in Enzymatic Analysis II (ed.) Bergmeyer. (Publ.) Academic Press, New York, 1974, pp. 885.
12. Ginnopolitis CN, Ries SK. Plant physiol, 1977; 59: 309-14.
13. Lowry OH, Rosenbrough NJ, Furr AL, Randall RJ. J Biol Chem, 1951; 193: 262-63.
14. Marwah RG, Fatope MO, Mahrooqi RA, Varna GB, Abadi HA, Suad KS, Burtamani A. Food Chem, 2007; 101(2): 465-70.
15. Simopoulos AP. Biol. Res, 2004; 37: 263-77.
16. Padmaja G, Moorthy SN, Nambisan B, Babu L, Sundaresan S, Sajeev MS, Nanda SK, Susan JK, Rajalekshmi L, Sudha D; Manikantan NM, Digestibility of Starch and Protein. In: Analytical Methodologies for Tropical Tuber Crops. Eds: Central Tuber Crops Research Institute, Kerala, 2005, pp. 34-8.
17. Odukoya OA, Inya-Igaha SI, Segum FI, Sofidiya MO, Hori OO, American J Food Tech, 2007; 2 (3):169-75.
18. Mensah J, Okoli K, Ohaju-Obodo RI, Eifediyi K. Afr. J. Biotech., 2008; 7(14): 2304-09.
19. Chanwitheesuk A, Teerawutgulrag A, Rakariyatham N. Food Chemistry, 2005; 92:491-97.
20. Ursini F, Maiorino M, Brigeliuys-Flohé R, Aumann KD, Roveri A, Schomburg D, Flohé L, Methods Enzymol, 1995; 252: 38-53.
21. Dogan S, Turan P, Dogan M, Arslan O, Alkan M. European Food Res Tech, 2007; 225: 865-71.
22. Chelikani P, Ramana T, Radhakrishnan TN. Indian J Clin Biochem, 2005; 20 (2): 131-35.
23. Powers KM, Oberley LW; Domann FE, The adventure of superoxide dismutase in health and diseases: superoxide in the balance. G. Valacchi, Davis P.A. (eds.) Oxidants in Biology, 2008, pp. 183-196.
24. Stajner D, Igic R, Popovic BM, Malencic D. Phytother Res, 2008; 22: 113-17.