Bangladesh J. Bot. **47**(1): 33-38, 2018 (March)

PHYTOCHEMICAL PROPERTİES AND ANTIOXIDANT ACTIVITIES OF LEAVES AND FRUITS EXTRACTS OF *PARTHENOCISSUS QUINQUEFOLIA* (L.) PLANCH

ZAHEER-UD-DIN KHAN, SUMMIYA FAISAL, ANJUM PERVEEN[1], ANDLEEB ANWAR SARDAR[*] AND SABAHAT ZAHARA SIDDIQUI[2]

Department of Botany, GC University Lahore, Pakistan

Keywords: Parthenocissus, Antioxidant activities, DPPH scavenging, Pharmacology

Abstract

The present study was conducted to evaluate phytochemical properties and antioxidant potential of leaves and fruits of *Parthenocissus quinquefolia* (L.). The reducing sugars, anthraquinones, alkaloids, flavonoids, saponins, tannins, terpenoids and cardiac glycosides were detected in leaves and fruits extracts. Different tests *viz.* DPPH free radical scavenging activity, total antioxidant activity, total phenolic content, ferric reducing antioxidant power (FRAP) and metal chelating activity were used to check the antioxidant potential of the extracts. The chloroform extracts of leaves and fruits showed the best DPPH free radical scavenging activity. The ethanolic fruit extract showed maximum GAE value (140.5 ± 0.07 µg/ml) i.e. total phenolic content. The ethanolic leaves extract showed highest % inhibition of ferrozine-ferrous complex formation. These results reinforce the traditional use of this plant in treatment of harmful human ailments.

Introduction

Nature has a diverse collection of species of plants possessing multiple usages with mankind (Holmstedt 1991). Plants possessing antioxidant properties play a significant role in defending the body against free radical damage, or repair the damage of the body cells caused by oxygen. They work by preventing the formation of new free radical species, converting existing free radicals into less harmful molecules, preventing radical-chained reactions (Aruoma 1998).

Flavonoids and phenolic compounds and the secondary metabolites in plants are very important for growth, development and play key role in defence against microbial activities and infections. They provide oxidative stabilities to the plants in case of injuries (Cetkovic *et al.* 2007). Phenolic compounds are considered beneficial for human health, decreasing the risk of degenerative diseases by the reduction of oxidative stress and inhibition of macromolecular oxidation, e.g. quercetin and ellagic acid (Sroka and Cisowski 2003). The present study was conducted to evaluate the antioxidant capabilities of leaves and fruits of *Parthenocissus. quinquefolia* (L.) Planch an ethnobotanically important medicinal plant. It is a climbing shrub belonging to family Vitaceae.

Materials and Methods

Leaves and fruits of *Parthenocissus quinquefolia* collected from District Lahore, Pakistan, were dried at room temperature and grounded to powder form. The 300 g of powdered leaves and 30 g of fruits were macerated in n-Hexane, chloroform, ethanol and double distilled water successively for 8 days in each solvent.

*Author for correspondence: andleebanwar@gcu.edu.pk. [1]Centre for Plant Conservation, University of Karachi, Karachi, Pakistan. [2]Department of Chemistry, GC University, Lahore, Pakistan.

The crude extracts thus obtained were subjected for phytochemical analysis, using standard protocols, according to Ayoola *et al.* (2008) to detect reducing sugars by Fehling's test, alkaloids (Draggendorff's reagent and Mayer's reagent), flavonoids by ammonia solution, terpenoids by Salkowski test, cardiac glycosides by Keller-Killani test, tannins by 0.1% ferric chloride solution, saponins by olive oil and anthraquinones by chloroform.

The parameters considered to verify the antioxidant potential of leaves and fruits of *P. quinquefolia,* included; DPPH free radical scavenging activity after Lee *et al.* (1998), total antioxidant activity by the method of Prieto *et al*. (1999); Ferric reducing antioxidant power (FRAP) assay according to Benzie and Strain (1996); Total phenolic contents (TPC) after Makkar *et al.* (1993) and metal chelating activity by the method of Dinis *et al*. (1994).

All parameters were repeated three times and represented as mean value ± standard error. The results were assessed statistically by using ANOVA and DMRT using co-stat software (version 3.03) to find out the significant value, after Steel *et al*. (1997).

Results and Discussion

The phytochemical screening of different extracts of leaves and fruits of *P. quinquefolia* revealed the presence of secondary metabolites such as alkaloids, reducing sugars, tannins, saponins, flavonoids, terpenoids, anthraquinones and cardiac glucosides (Table 1). Similar phytochemicals, *viz.* alkaloids, flavonoids, tannins, saponins and cardiac glycosides had been reported by Soladoye and Chukwuma (2012) while analysing the stem and root of *Cissus populnea* Guill & Perr of family Vitaceae.

Table 1. Phytochemical screening of leaves and fruits of *Parthenocissus quinquefolia*.

Plant parts	Solvents	Presence/absence of phytochemical constituents							
		Reducig sugars	Anthra-quinones	Terpenoids	Flavonoids	Saponins	Tannins	Alkaloids	Cardiac glycosides
Leaves	n-hexane	+	-	+	+	+	-	+	+
	Chloroform	-	-	+	+	-	-	+	-
	Ethanol	+	+	+	+	+	+	+	+
	Water	+	+	+	+	+	+	+	+
Fruits	n-hexane	+	-	-	-	+	-	+	+
	Chloroform	+	-	+	+	+	-	-	+
	Ethanol	+	-	+	+	+	+	+	+
	Water	+	+	+	+	+	-	+	-

IC_{50} value was calculated and compared with standard antioxidant, i.e. BHT (butylated-hydroxytoluene) as shown in Fig. 1. Lower absorbance indicated higher free radical scavenging activity of the extracts. The best activity was found by chloroform extracts of leaves and fruits with IC_{50} value 12.90 ± 1.00 mg/ml and 13.60 ± 0.32 mg/ml respectively almost equal to BHT, i.e. 12.03 mg/ml. However, the crude extracts showed DPPH scavenging activity more than 50%. Similar results had been documented by Jindal and Mohammad (2012) while estimating the antioxidant activity of *Ardisia crispa* (Thunb) A.DC.

The analysis of total antioxidant activity (TAA) after comparison of ascorbic acid revealed maximum values, i.e. 77.66 ± 3.44 mg/g of ascorbic acid (Fig. 2). The lowest activity was shown by n-hexane fruits extracts, i.e. 27.5 ± 1.61 mg/g of ascorbic acid. The total antioxidant activity (TAA) was based on the reduction of Mo(VI) to Mo(V) by the extract and subsequent formation of green phosphate-Mo (V) complex at acid pH. Thus the ethanol leaf extract possessed significant total antioxidant capacity equivalent to 77.66 mg/g ascorbic acid. Similar results had been

recorded by Aliyu *et al*. (2013) while assessing total antioxidant activity of root extracts of *Anchomanes difformis* (Blume) Engl.

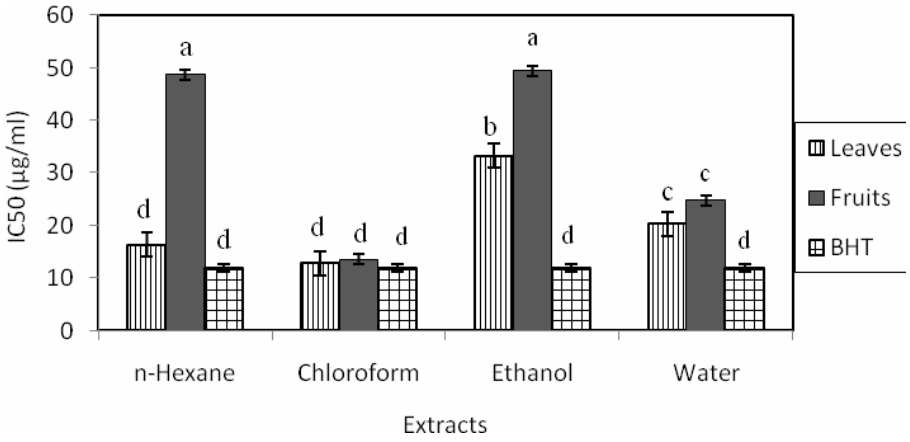

Fig. 1. Comparative analysis of DPPH free radical scavenging activity of leaves and fruits of *P. quinquefolia.*

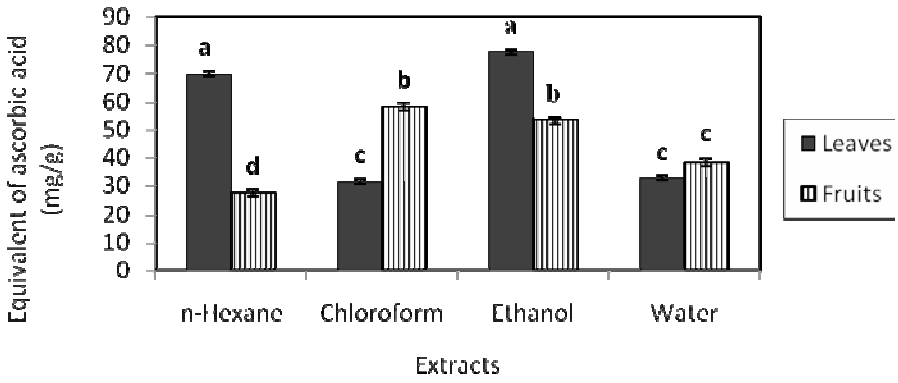

Fig. 2. Comparative analysis of total antioxidant activity of *P. quinquefolia.*

The total phenolic content assay depicted that ethanolic fruits extract showed maximum GAE value, i.e. 140.5 ± 0.07 µg/ml while n-hexane extract of fruit has minimum GAE value, i.e. 5 ± 2.09 µg/mlm (Fig. 3). Similar results were reported by Zheng and Wang (2001) while determining antioxidant activity and phenolic compounds in some selected herbs.

In this activity, deep blue colour was produced due to the reduction aptitude of ferric tripyridyltriazine (Fe (III)-TPTZ) complex to ferrous tripyridyltriazine (Fe (II)-TPTZ) in acidic conditions (Fig. 4). The maximum FRAP value was observed by chloroform leaves extracts, i.e. 199 ± 1.06 µM/ml while the least FRAP value was shown by n-hexane fruit extract, i.e. 14.5 ± 0.85 µM/ml. However, the maximum FRAP value was observed by chloroform leaves extracts, i.e. 199 ± 1.06 µM/ml. Almost similar results were displayed by Meda *et al.* (2013) while investigating antioxidant activity of *Cleome gynandra* L. and *Maerua angolensis* D.C. of involving FRAP assay.

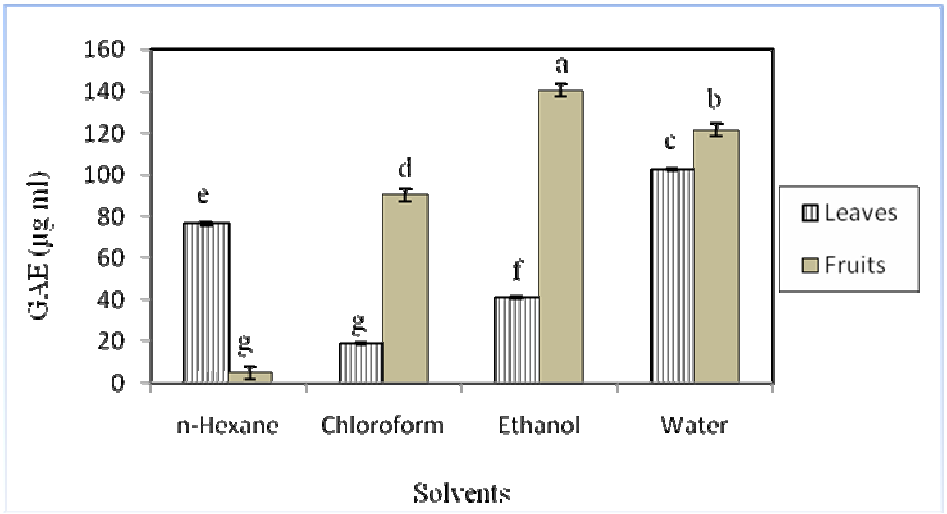

Fig. 3. Graphical representation of total phenolic content of leaves and fruits of *P. quinquefolia.*

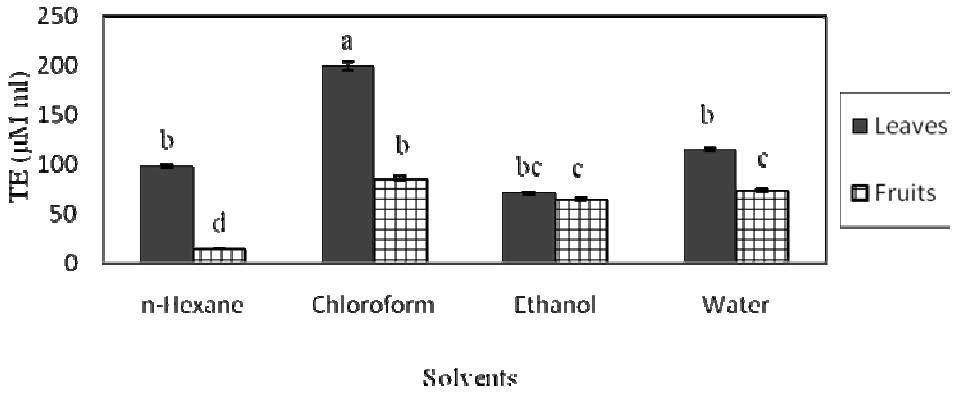

Fig. 4. Graphical representation of ferric reducing antioxidant power of leaves and fruits of *P. quinquefolia.*

The metal chelating activity showed maximum % and minimum % inhibition of ferrozine-ferrous complex formation by ethanolic leaves extract i.e. 66.52 ± 0.27 % and chloroform fruits extract i.e. 10.76 ± 1.2, respectively (Fig. 5). Similar results had been reported by Serteser *et al*. (2009) while determining the antioxidant activity of some plants in Turkey using metal chelating activity method. The results indicated that the ethanolic fruits extract of *Cornus mas* L. was highest in metal chelating activity, i.e. 60.64% among all extracts.

The phytochemical screening of different extracts of leaves and fruits of *P. quinquefolia* exposed the presence of secondary metabolites like alkaloids, reducing sugars, tannins, saponins, flavonoids, terpenoids, anthraquinones and cardiac glucosides.

Five parameters were performed in order to test the antioxidant potential of leaves and fruits of *P. quinquefolia* (L.) Planch. DPPH free radical scavenging activity showed the best activity, executed by chloroform extracts of leaves and fruits. Likewise, the ethanol leaf extract possessed significant total antioxidant capacity equivalent to 77.66 mg/g ascorbic acid. Similar results had

been recorded by Aliyu *et al.* (2013) while assessing total antioxidant activity of root extracts of *Anchomanes difformis.*

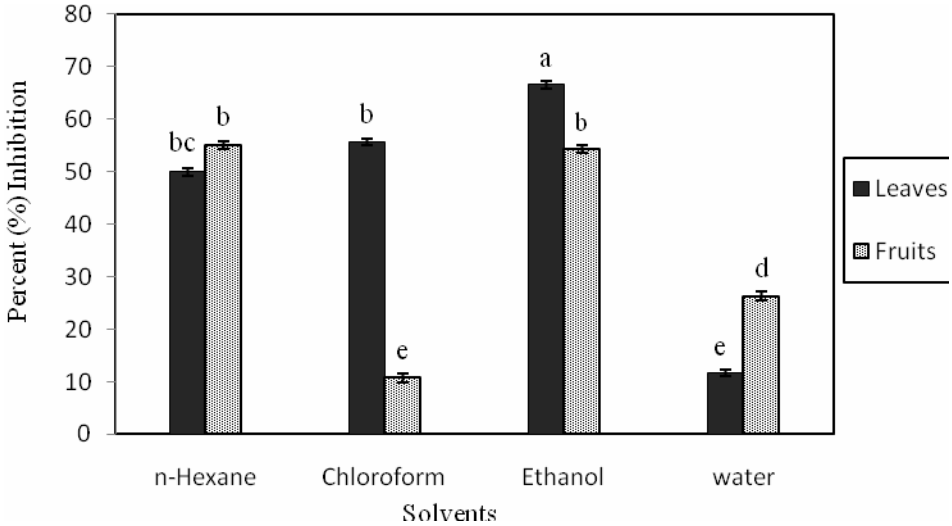

Fig. 5. Graphical representation of the metal chelating activity exhibited by *P. quinquefolia.*

Total phenolic content assay depicted maximum GAE value ethanolic fruits extract. The maximum FRAP value was observed by chloroform leaves extracts, i.e. 199 ± 1.06 µM/ml. Among metal chelating activity, the ethanolic extract of leaves showed highest % inhibition value, i.e. 66.52 ± 0.27%. Similar results had been reported by Serteser *et al.* (2009) while determining the antioxidant activity of some plants in Turkey using metal chelating activity method. The results indicated that the ethanolic fruits extract of *Cornus mas* Linn. was highest in metal chelating activity, i.e. 60.64% among all extracts.

Overall, chloroform and ethanolic extracts of both leaves and fruits showed best antioxidant potential in all the parameters. Thus the traditional use of leaves and fruits of *P. quinquefolia* can be recommended for the treatment of human ailments.

References

Aliyu AB, Ibrahim MA, Musa AM, Musa AO, Kiplimo JJ and Oyewale AO 2013. Free radical scavenging and total antioxidant capacity of root extracts of *Aanchomanes difformis* Engl. (Araceae). Acta Poloniae Pharma Drug Res. **70**: 115-121.

Aruoma OI. 1998. Free radicals, oxidative stress and antioxidants in human health and disease. J. Am. Oil. Chem.Soc. **75**: 199-212.

Ayoola GA, Coker HAB, Adesegun SA, Adepoju-Bello AA, Obaweya K, Ezennia EC and Atangbayila TO 2008. Phytochemical screening and antioxidant activities of some selected medicinal plants used for Malaria therapy in Southwestern Nigeria. Trop. J. Pharm. Res. **7**: 1019-1024.

Benzie IEF and Strain JJ. 1996. The ferric reducing ability of plasma (FRAP) as a measure of antioxidant power, the FRAP assay. Anal. Biochem. **239**: 70-76.

Cetkovic GS, Brunet JM, Bjilas SM, Tumbas VT, Markov SL and Cetkovic DD 2007. Antioxidant potential, lipid peroxidation inhibition and antimicrobial activities of *Satureja montana* L., sub sp. Kitaibelli extracts. Int. J. Mol. Sci. **3**: 156-162.

Dinis TCP, Madeira VMC and Almeida MLM 1994. Action of phenolic derivates (acetoaminophen, salycilate and 5-aminosalycilate) as inhibitors of membrane lipid peroxidation and as peroxyl radical scavengers. Arch. Biochem. Biophys. **315**: 161-169.

Holmstedt B 1991. Historical perspective and future of ethnopharmacology. J. Ethnopharmacol. **32**: 7-24.

Jindal HMK and Mohamad J 2012. Antioxidant Activity of *Ardisia crispa* (Mata pelanduk). Sains Malaysiana **41**: 539-545.

Lee SR, Mbwambo ZH, Chung HS, Luyengi L, Games EJC and Mehra RG 1998. Evaluation of antioxidant potential of natural products. Combination Chem. & High Throughput Screening. **1**: 35-46.

Makkar HPS, Blummel M, Borowy NK, Becker K. 1993. Gravimetric determination of tannins and their correlation with chemical and protein precipitation methods. J. Sci. Food and Agric. **61**: 161-165.

Meda NTR, Bangou MJ, Bakasso S, Millogo-Rasolodimby J and Nacoulma OG 2013. Antioxidant activity of phenolic and flavonoid fractions of *Cleome gynandra* and *Maerua angolensis* of Burkina Faso. J. Appl. Pharm. Sci. **3**(2): 36-42.

Prieto P, Pineda M and Agular M 1999. Spectrophotometric quantitation antioxidant capacity through the formation of a phosphomolybdenum complex. Anal. Biochem. **269**: 337-341.

Serteser A, Kargolu M, Gok V, Bagc Y, Ozcan MM and Arslan D 2009. Antioxidant properties of some plants growing wild in Turkey. Abril-Junio. **60**: 147-154.

Soladoye MO and Chukwuma CE 2012. Phytochemical analysis of the stem and root of Cissus populnea (Vitaceae) an important medicinal plant in Central Nigeria. Phytologia balcanica **18**: 149-153.

Sroka Z and Cisowski W 2003. Hydrogen peroxide scavenging, antioxidant and anti-radical activity of some phenolic acids. J. Food and Chem. Toxicology **41**: 753-758.

Steel RGD, Torrie JH and Discky DA 1997. Principles and Procedures of Statistics: A Biometrical Approach. 3rd ed. McGraw Hill Book Co., New York. pp. 248-263.

Zheng W and Wang SY 2001. Antioxidant activity and phenolic compounds in selected herbs. J. Agric. Food Chem **49**: 5165-5170.

(Manuscript received on 28 February, 2017; revised on 22 March, 2017)