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Antifungal Potential of *Calligonum polygonoides* L. floral buds extract

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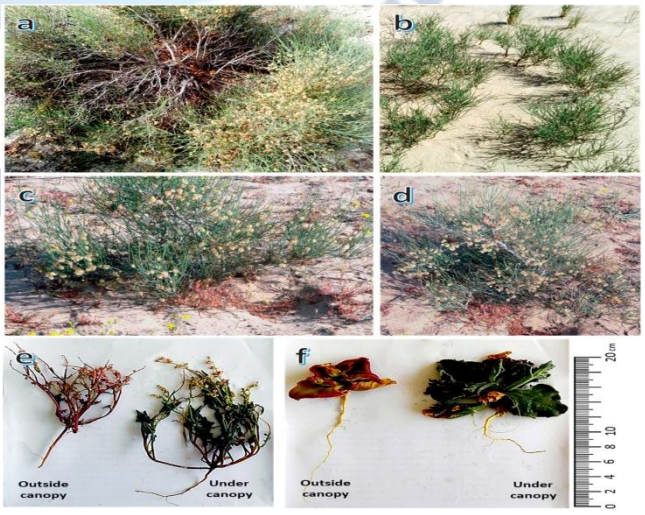
ABSTRACT

Calligonum polygonoides L. (Phog) is an endemic perennial herb that is highly resistant to all type of abiotic stresses and dominant biomass as well as phytochemicals producer in its natural habitat of the "Thar Desert" of Rajasthan, India. The present study was conducted to evaluate the antifungal potential of *C. polygonoides* L. floral buds extract. It exhibited a significant variation in the content of phenolic compounds, flavonoids, tannins, and antioxidant activity with harvesting time and all parameters are positively correlated to each other. The highest phenolic compounds,antifungal and antioxidant activity was observed during severe winter and summer months, when monthly average environmental temperature was lowest and highest of the year, respectively. On the basis of the results, the harvests of *C. polygonoides* foliage were advised to maximize the antifungal compound production with highest antioxidant activity. These results demonstrate *C. polygonoides,* which is a dominant biomass producer under the harsh climatic conditions, can be an important source for the development of the functional foods rich in antifungal compounds and antioxidants in hot arid regions.

Keywords: antifungal, potential, extract, floral, buds, *Calligonum polygonoides* L., phytochemicals

INTRODUCTION

Antifungal compounds are plant secondary metabolites, which are constituents of both edible and non-edible parts of plants . They are considered active substances in plant and play a role in plant growth or defense against competitors, pathogens, or predators as well as abiotic stress and have beneficial effects on human health due to their biological activity like anticancer, antioxidant, anti-inflammatory, and even antibacterial activities . These compounds possess the antioxidant activity through free radicals scavenging by donating hydrogen atoms or electron or by chelating metal ions[1,2] .In the ever-changing scenario, awareness toward healthy and balance eating habit to cope with stressful everyday life has attracted people towards natural antioxidant-rich foods instead of synthetic antioxidants .[3,4]



***Calligonum polygonoides* L.**

Calligonum polygonoides L. is an abiotic, antifungal stress-tolerant perennial shrub of sand-dunes eco-system and well-known for its energy-rich fuel-wood, leaf-fodder, and flower-buds. It grows well under resource-poor conditions where any type of vegetation is not possible. *C. polygonoides* is a dominant biomass producer under extremes of concurrent abiotic stresses at sandy areas of the Thar Desert . Under rainfed cultivation, 6–7 years old plant gives about 14.85 kg biomass annually including flower bud, foliage, and fuel wood. The foliage of *C. polygonoids*, which is an extremely rich source of antifungal compounds, is also a byproduct, since almost 70–80% foliage dropped down during the month of December–January and behaves deciduous. [5,6]

***Calligonum polygonoides* L.**

During last week of February, when night temperature crosses 12 °C, new flesh starts coming along with flowers . Plants showed quick growth, huge flowering, and seed formation from March–May month, and this is the period for bio-mass harvest through phogala collection, looping of foliage, and light pruning. [7,8]The plant starts re-sprouting during the on-set of monsoons and foliage may be ready for looping in November–December. These flower buds convert to seed which matures in the month of May–June. If the plant is pruned (seeds and Foliage) during the month of June, post monsoon new flush starts showing up in the months of August–September. In this way, almost double biomass can be harvested from the *C. polygonoids* plant . *C. polygonoides* has high economic values as all its plant parts are utilized in different purposes. [9,10]

Table: Antifungal compounds in *C. polygonoides* discovered by researchers

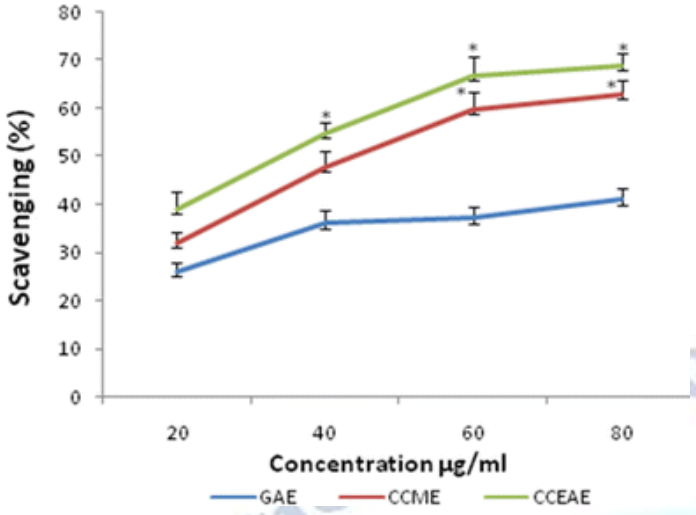
S. No.	Compound	Structure reference
	quercetin 3-O-β-D-(6″-n-butyl glucuronide)	Lin et al. 2011
	kaempferol-3-O- β -D(6″-0-0-methyl glucuronide)	Al Sayed et al. 2010
	quercetin-3-O- β -D-(6-0-0-methyl glucuronide)	Lin et al.2009
	quercetin-3-O-glucuronide (mequilianin)	Badria et al. 2007
	kaempferol-3-O-glucuronide	Badria et al. 2007
	quercetin-3-O-α-rhamnopyranoside (quercitrin)	Badria et al. 2007
	astragalin	Markham & Ternai 1976
	quercetin-3-O-glucopyranoside (isoquercitrin)	Badria et al. 2007
	taxifolin	Kim et al. 2009
	(+)-catechin	Badria et al. 2007
	dehydrodicatechin A,	Badria et al. 2007
	quercetin	Badria et al. 2007
	kaempferol	Badria et al. 2007

All its plant parts are highly rich sources of phenolic compounds and possessed 13–35% phenolic compounds on dry weight basis with major portion of gallic acid, catechin vanillic, chlorogenic acid, epicatechin, coumaric acid, catechol, vanillic acid, epicatechin, and syringic acid . Scientists reported the presence of different antifungal secondary metabolites viz., phenolics, flavonoids, tannin, steroids and terpenoids in different parts of phog plant and its higher scavenging activity against 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid (ABTS), and superoxides and also identified some flavonoid compounds in flower buds. [11,12] Recently, they reported very high antioxidant activity along with the presence of many antifungal phytochemicals like furan-2,5-dimethyl, 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-Pyran-4-one (DDMP), dehydromevalonic lactone, deoxyspergualin, 2-methoxy-4-vinylphenol, benzeneethanol-4-hydroxy-, quinic acid, lauric acid, linolenic acid, and squalene in flower buds (phogala) with scientifically proven bio-activities like antifungal, anti-inflammatory, anticancer, anti-diabetic, hepatoprotective, cardiovascular, antioxidant, and anti-mutagenic.[13,14]

DISCUSSION

Seasonal Variations of Total Antifungal Content as secondary metabolites

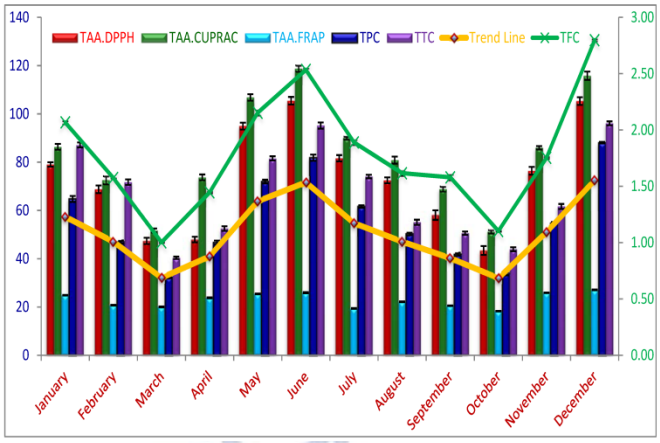
Antifungal content were estimated following the standard protocols in methanolic extracts of *C. polygonoides* foliage harvested during different months from plants grown under hot arid region. All the parameters viz., antifungals (secondary metabolites) varied significantly ($p < 0.05$) along the years with harvesting months. [15,16]



Antifungal compound activity of *C. polygonoides*

The significant difference in these secondary metabolites with harvesting month is due to the differences in environmental conditions which has a great influence on biosynthesis and accumulation of these compounds in the plants .[17]

The seasonal fluctuations in antifungal extracts content *C. polygonoides* foliage was expressed using the standard curve equation. A significant difference was observed among antifungals recorded during different months ($p < 0.05$). Antifungals of *C. plygonoides* foliage, harvested during different months ranged from 32.28 ± 0.54 to 88.08 ± 0.59 mg. antifungal. TPC content in foliage is lower than that of previous reports with 151 mg.antifungal in *C. polygonoides* foliage because the authors reported values on dry weight basis while our results are on fresh weight basis. Researchers also reported higher values for TPC in *C. polygonoides* plant. The highest antifungal was recorded during December month, reaching to 88.08 ± 0.59 mg.antifungal followed by June, January, and May with 81.84 ± 2.28, 71.97 ± 1.33, and 64.75 ± 2.13 mg.antifungal respectively. The lowest secondary metabolite was observed during the month of March and October with a magnitude of 32.28 ± 0.54 and 34.05 ± 1.53 mg.antifungal, respectively which are statistically at par to each other ($p < 0.05$).



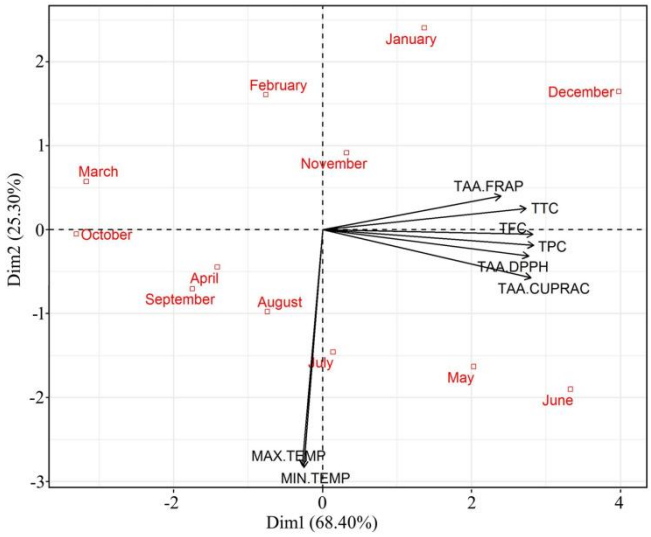
Changes in total antifungal activity of *Calligonum polygonoides* L. Foliage during different seasons under extreme climatic condition. Data are presented as mean ± SD, n = 3 experiments, $p < 0.05$[18]

Antifungal activities are- TAA (Total Antioxidant Activity), TPC(Total Phenolic Content), TTC(Total Terpene Content), TFC(Total Flavonoid Content)

RESULTS

The parameters like TAAs, phenolic, flavonoids, and tannin content (antifungals), explained 93.7% of variability in axis one and two. The first component PC1 explained 68.4% of the combined variance and the second component (PC2) explained 25.3% . This clearly demonstrated that there is a variability in the parameters assayed in relation to the sampling months or environmental temperature. The level of all parameters (TAA, phenolics, flavonoids, and tannin contents) was strongly related to axle one. The biplot graph from this analysis confirmed the occurrence of seasonality in antioxidant responses in *C. polygonoides* foliage, marked by all the assayed parameters like TAA, phenolic, flavonoids, and tannin contents . The sampling units of summer months (May and June) and winter months (December and January) were grouped on the positive side of axle one and characterized by the highest values for antifungals TAA, phenolics, flavonoids, and tannin content. On the other hand, the sampling units of the remaining months were generally grouped at the opposite side of this axle. Plants generally produce more antifungal compounds like antioxidants under oxidative stress conditions and in the hot arid region, the environmental conditions are highly toward extreme sides. During summer months the environmental temperature remains as high as 48 °C

with very high radiations and winter with extremely low temperature reaching to subzero °C. [19]



Principal component analysis (antifungal compounds) of TAA, phenolics, flavonoids, and tanning content in *C. polygonoides* foliage during different months.

CONCLUSION

In conclusion, the results of the present study evidently demonstrated that *C. polygonoides* foliage possessed very higher antifungal activity. Both phenolic compounds and antioxidant activity exhibited a significant seasonal variation. The strong positive correlation between phenolic compounds and antioxidant activities indicates that phenolic compounds are major antioxidant compounds in *C. polygonoides* foliage. The harvest season variation in phenolic content and antioxidant activities is solely dependent on the environmental temperature and the highest values were observed during severe winter and summer months. Based on the results, two harvest of *C. polygonoides* foliage is advised, first during the month of June and second during the month of December to achieve maximum yield of bioactive compounds of antifungal yield. The present study gives the clue about the new insights of concurrent abiotic stresses in molecular farming for production of bioactive compounds for nutraceuticals and pharmaceutical industry through arid horticultural flora specifically *C. polygonoids* under hot arid region of Rajasthan. This strategy can be a boon for local rural farming community for improving their socio-economic status with livelihood security.[20]

REFERENCES

[1] Jalili, A.; Sadeghzade, A. Comparative phenolic profile of persian walnut (Juglans regia L.) leaves cultivars grown in Iran. Afr. J. Biochem. Res. 2012, 6, 33–38. [Google Scholar]

[2] Figueroa, F.; Marhuenda, J.; Cerda, B.; Zafrilla, P.; Martinez-Cacha, A.; Tejada, L.; Villaño, D.; Mulero, J. HPLC-DAD determination and availability of phenolic compounds in 10 genotypes of walnuts. Int. J. Food Prop. 2016, 20, 1–33. [Google Scholar]

[3] Heim, K.E.; Tagliaferro, A.R.; Bobilya, D.J. Flavonoid antioxidants: Chemistry, metabolism and structure-activity relationships. J. Nutr. Biochem. 2002, 13, 572–584. [Google Scholar] [CrossRef]

[4] Amarowicz, R.; Pegg, R.B.; Rahimi-Moghaddam, P.; Barl, B.; Weil, J.A. Free-radical scavenging capacity and antioxidant activity of selected plant species from the canadian prairies. Food Chem. 2004, 84, 551–562. [Google Scholar] [CrossRef]

[5] Balasundram, N.; Sundram, K.; Samman, S. Phenolic compounds in plants and agri-industrial by-products: Antioxidant activity, occurrence, and potential uses. Food Chem. 2006, 99, 191–203. [Google Scholar] [CrossRef]

[6] Oliveira, I.; Sousa, A.; Ferreira, I.C.F.R.; Bento, A.; Estevinho, L.; Pereira, J.A. Total phenols, antioxidant potential and antimicrobial activity of walnut (Juglans regia L.) Green Husks. Food Chem. Toxicol. 2008, 46, 2326–2331. [Google Scholar] [CrossRef]

[7] Contini, M.; Baccelloni, S.; Massantini, R.; Anelli, G. Extraction of natural antioxidants from hazelnut (Corylus Avellana L.) shell and skin wastes by long maceration at room temperature. Food Chem. 2008, 110, 659–669. [Google Scholar] [CrossRef]

[8] Khan, T.I. Conservation of biodiversity in Western India. Environment 1997, 17, 283–287. [Google Scholar]

[9] Samadia, D.K.; Berwal, M.K.; Gurjar, P.S.; Verma, A.K.; Chaodhary, H.R. Phog Production Techniques Standardized for Horticultural Promotion; ICAR-CIAH: Beechhwal Rural, India, 2020; Bikaner News Letter: July–December. [Google Scholar]

[10] Bhandari, M.M. Flora of the Indian Desert; Scientific Publishers: Jodhpur, Rajasthan, 1978; pp. 331–332. [Google Scholar]

[11] Berwal, M.K.; Haldhar, S.M.; Chet Ram Saroj, P.L. Phenolic compositions, total phenolic, flavonoids and antioxidant capacity of an unexploited herb Calligonum polygonoides L. from Thar Desert. J. Environ. Biol. 2021, 42. (accepted). [Google Scholar]

[12] Samejo, M.Q.; Memon, S.M.I.; Bhanger, K.; Khan, M. Preliminary phytochemical screening of Calligonum polygonoides Linn. J. Pharma. Res. 2011, 4, 4402–4403. [Google Scholar]

[13] Khan, A.; Khan, R.A.; Ahmed, M.; Mustaq, N. In-vitro antioxidant, antifungal and cytotoxic activity of methanolic extract of Calligonum polygonoides. Bangladesh J. Pharmaco. 2015, 10, 316–320. [Google Scholar] [CrossRef]

[14] Gomes, S.M.C.; Fernandes, I.P.G.; Shekhawat, N.S.; Kumbhat, S.; Oliveira-Brett, A.M. Calligonum polygonoides linnaeus extract: HPLC-EC and total antioxidant capacity evaluation. Electroanalysis 2015, 27, 293–301. [Google Scholar] [CrossRef]

[15] Yawer, M.A.; Ahmed, E.; Malik, A.; Ashraf, M.; Rasool, M.A.; Afza, N. New lipoxygenase inhibiting constituents from

Calligonum polygonoides. Chem. Biodiver. 2007, 7, 1578–1585. [Google Scholar] [CrossRef] [PubMed]

[16] Berwal, M.K.; Haldhar, S.M.; Chet Ram Gora, G.S.; Singh, D.; Samadia, D.K. GC-MS/MS based phytochemical screening revealed the therapeutic potential of Calligonum polygonoides L. flower bud against chronic diseases. Pharmacog. Mag. 2021, accepted. [Google Scholar]

[17] Gomez-Martineza, M.; Ascacio-Valdesa, J.A.; Flores-Gallegosa, A.C.; Gonzalez-Dominguezb, J.; Gomez-Martinezb, S.; Aguilara, C.N.; Morlett-Chaveza, J.A.; Rodriguez-Herreraa, R. Location and tissue effects on phytochemical composition and in vitro antioxidant activity of Moringa oleifera. Ind. Crop. Prod. 2020, 151, 112439. [Google Scholar] [CrossRef]

[18] Kumar, M.; Saurabh, V.; Tomar, M.; Hasan, M.; Changan, S.; Sasi, M.; Maheshwari, C.; Prajapati, U.; Singh, S.; Prajapat, R.K.; et al. Mango (Mangifera indica L.) leaves: Nutritional composition, phytochemical profile, and health-promoting bioactivities. Antioxidants 2021, 10, 299. [Google Scholar] [CrossRef]

[19] Kumar, M.; Changan, S.; Tomar, M.; Prajapati, U.; Saurabh, V.; Hasan, M.; Sasi, M.; Maheshwari, C.; Singh, S.; Dhumal, S.; et al. Custard Apple (Annona squamosa L.) Leaves: Nutritional Composition, Phytochemical Profile, and Health-Promoting Biological Activities. Biomolecules 2021, 11, 614. [Google Scholar] [CrossRef]

[20] Kumar, M.; Tomar, M.; Punia, S.; Grasso, S.; Arrutia, F.; Choudhary, J.; Singh, S.; Verma, P.; Mahapatra, A.; Patil, S.; et al. Cottonseed: A sustainable contributor to global protein requirements. Trends Food Sci. Technol. 2021, 111, 100–113. [Google Scholar] [CrossRef]