International Journal of Advanced Scientific Research
www.multidisciplinaryarticle.com
ISSN: 2456-0421
Received: 16-07-2023, Accepted: 02-08-2023, Published: 17-08-2023
Volume 8, Issue 2, 2023, Page No. 14-17

Antimicrobial activity of different extracts of various parts of *Carissa carandas* L.

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Abstract
Carissa carandas L. (Karonda) is an evergreen deciduous shrub, that is believed to have originated in the Himalayas, thus making it an indigenous crop. Healthy leaves, stem, fruits and seeds of the plant were collected from Campus, University of Rajasthan, Jaipur. Water, methanol and pet ether extracts of these plant parts were prepared using cold extraction method. Extracts were subjected to evaluate against *E. coli. B. subtilis, A. niger* and *P. chrysogenum.* Results revealed that these plant parts showed good antimicrobial potential against these bacteria and fungi. So, these plant parts can be used as source of antimicrobial agents.

Keywords: Karonda, extracts, antibacterial, antifungal etc

Introduction

Infectious diseases are still a major health concern accounting for 41% of the global disease burden measured in terms of Disability – Adjusted Life Years (DALYS) (Noah and Fidas, 2000) [1]. One of the main causes of this problem is the widespread of acquired bacterial resistance to antibiotics in such a way that the world is facing today, a serious threat to global public health (Chopra, 2000) [11] in the form of not only epidemics, but also pandemics of antibiotic resistance (Chanda *et al*., 2010 [3], Osman *et al*., 2012 [4]). Due to this problem of resistance against antibiotics, attention is now being shifted towards biologically active components isolated from plant species communing used as herbal medicine, as they may produce a new potent source of antibacterial and antifungal activities (Maiyo *et al*., 2010 [5], Erfan and Marouf, 2019) [6]. The antimicrobial properties of plants related to their ability to give several secondary metabolites of relatively complex structures possessing antimicrobial activities (Matasyoh *et al*., 2009 [8], Souza *et al*., 2005) [9].

Carissa carandas L. (Karonda) is an evergreen deciduous shrub, that is believed to have originated in the Himalayas, thus making it an indigenous crop. It is extensively cultivated in the Northern mountains and the Western Ghats in India, as well as in Nepal, Sri Lanka and other South-East Asian countries.

The karonda plant grows up to a height of 2 to 4 m, with a thick grey bark holding branches that contain sharp spines, hence giving it the name of Christ's thorn. The leaves are oblong and conical in shape, green-brown in colour, from which bloom small white flowers. Upon developing, the unripe karonda fruit, a berry, is globular in shape with tiny seeds within, occurring in clusters of 3 to 10 fruits. The unripe fruits have a tart, sour taste, being greenish-white in colour and once ripened, turn dark red or purple, secreting a tasty liquid content inside with a delicious sweet flavour.

The nutritional profile of the karonda plant is quite impressive, being rich in vitamin C, the B vitamins and iron, thus effectively flushing out free radicals and rectifying anaemia. Moreover, the karonda fruit is bestowed with myriad antioxidants, such as flavonoids, alkaloids, tannins, carissone and triterpenoids, which offer significant advantages like anti-inflammatory, antipyretic, cardiotonic and analgesic traits. Read on, to gain further insight into the marvelous wellness incentives of the karonda fruit (Netmed, 2023) [10].

In the present investigation, leaves, stem, fruits and seeds of *C. carandas* L. were subjected form antimicrobial evaluation.

Materials and methods

Collection and processing of plant parts

Healthy leaves, stem, fruits and seeds of the plant were collected from Campus, University of Rajasthan, Jaipur. Those were washed and airdried. After grinding 1 gm of each plant part was extracted in 10 ml of water, methanol and pet ether extracts by keeping at shaker overnight. After filtration, solvents were evaluation and extracts were dissolved in Dimethyl sulphoxide (1 mg/ml concentration).

Antibacterial and antifungal activity

Both bactericidal and fungicidal investigations used agar well diffusion. PDA and NA plates were each used with a different test pathogen. Well diffusion techniques were used to conduct the antibacterial bioassay. Bacterial or fungal colony was inoculated in NA. Bacterial samples were spread out over cooled, solidified agar plates after being diluted with saline solution. The inoculated agar plates were drilled with a sterile borer to create 5 mm wells. Extracts were added to the 6 mm diameter wells at a concentration of 50 mg/ml, The plates were then kept for further incubation at 37^0C. after 24 hour (in case of bacteria) and after 72 hours (in case of fungi), zone of inhibition and activity index were calculated.

Standard drugs were used as streptomycin and ketoconazole respectively for bacteria and fungi. Used bacteria were *E. coli*, *B. subtilis*, *A. niger* and *P. chrysogenum*.

Results

Against *E. coli*

The details of water, methanolic and pet ether extracts of stem, leaves, fruits and seeds showed good inhibitory potential. Table 1 showed inhibition zone and activity index values of different extracts including standard antibiotic drug while in figure 1, photographs of all the tested samples against *E. coli* are given. Results revealed that pet ether extracts of all plant parts showed the lowest activity while methanol extracts showed the maximum activity. Among all the plant parts, the highest activity against this bacterium was shown by leaves while the lowest by the stem.

Table 1: Antibacterial activity of different parts of *Carissa carandas* against *E. coli*.

	Pet ether		Water		Methanol	
	IZ	AI	IZ	AI	IZ	AI
Stem	NA		NA		3	0.11
Leaves	3	.11	8	.30	14	0.53
Fruits	NA		3	0.11	7	0.26
Seeds	2	.07	6	0.23	9	0.34
Standard	26					

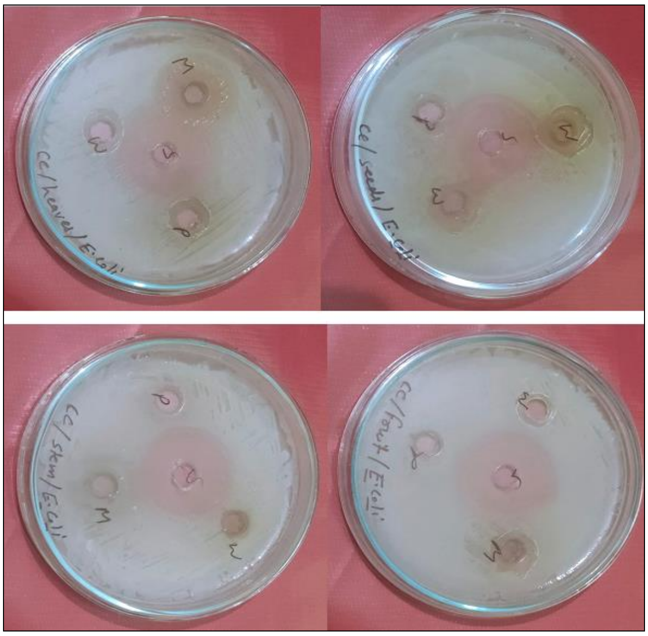

Fig 1: Antibacterial activity of different parts of *Carissa carandas* against *E. coli*.

Fig 2: Antibacterial activity of different parts of *Carissa carandas* against *B. subtilis*.

Against *Bacillus subtillis*

The details of water, methanolic and pet ether extracts of stem, leaves, fruits and seeds showed good inhibitory potential. Table 2 showed inhibition zone and activity index values of different extracts including standard antibiotic drug while in figure 2, photographs of all the tested samples against *B. subtilis* are given. Results revealed that pet ether extracts of all plant parts showed the lowest activity while methanol extracts showed the maximum activity. Among all the plant parts, the highest activity against this bacterium was shown by stem while the lowest by the seeds and fruits.

Table 2: Antibacterial activity of different parts of *Carissa carandas* against *B. subtilis.*

	Pet ether		Water		Methanol	
	IZ	AI	IZ	AI	IZ	AI
Stem	5	0.17	6	0.21	9	0.32
Leaves	3	0.10	5	0.17	9	0.32
Fruits	NA		4	0.14	10	0.35
Seeds	NA		6	0.21	8	0.28
Standard	28					

Against *Aspergillus niger*

The details of water, methanolic and pet ether extracts of stem, leaves, fruits and seeds showed good inhibitory potential. Table 3 showed inhibition zone and activity index values of different extracts including standard antibiotic drug while in figure 3, photographs of all the tested samples against *Aspergillus niger* are given. Results revealed that pet ether extracts of all plant parts showed the lowest activity while methanol extracts showed the maximum activity. All the plant parts showed higher activity among these, stem and seeds showed the highest inhibitory potential.

Table 3: Antifungal activity of different parts of *Carissa carandas* against *A. niger.*

Name of plant part	Pet ether		Water		Methanol	
	IZ	AI	IZ	AI	IZ	AI
Stem	4	0.19	9	0.42	11	0.52
Leaves	5	0.23	6	0.28	10	0.47
Fruits	NA		5	0.23	10	0.47
Seeds	2	0.09	5	0.23	11	0.52
Standard	21					

Fig 3: Antifungal activity of different parts of *Carissa carandas* against *A. niger.*

Against *Penicillum chrysogenum*

The details of water, methanolic and pet ether extracts of stem, leaves, fruits and seeds showed good inhibitory potential. Table 4 showed inhibition zone and activity index values of different extracts including standard antibiotic drug while in figure 4, photographs of all the tested samples against *Penicillum chrysogenum* are given. Results revealed that pet ether extracts of all plant parts showed the lowest activity while methanol extracts showed the maximum activity. Among all the plant parts, the highest activity against this bacterium was shown by seeds while the lowest by the seeds and fruits.

Table 4: Antifungal activity of different parts of *Carissa carandas* against *P. chrysogenum.*

Name of sample	Pet ether		Water		Methanol	
	IZ	AI	IZ	AI	IZ	AI
Stem	3	0.15	9	0.47	11	0.57
Leaves	4	0.21	6	0.31	9	0.47
Fruits	NA		NA		3	0.15
Seeds	7	0.36	8	0.42	13	0.68
Standard	19					

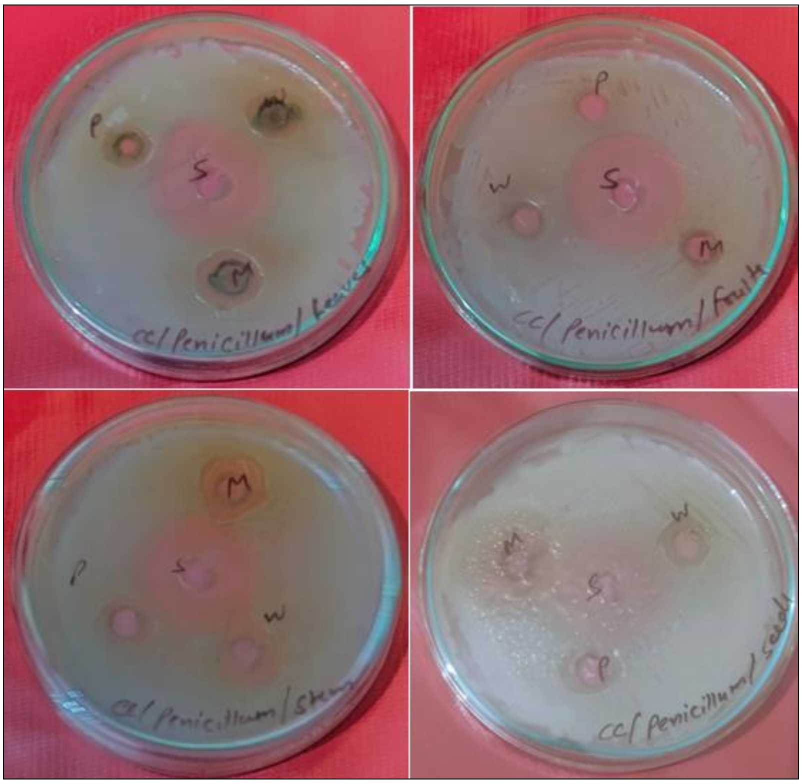

Fig 4: Antifungal activity of different parts of *Carissa carandas* against *P. chrysogenum.*

Discussion

According to Bhatia and Narain (2010) [2], antimicrobial drugs play a crucial role in global initiatives to reduce the impact of infectious diseases. However, a major new danger to public health is posed by the emergence and spread of multidrug-resistant (MDR) types of harmful bacteria. This is due to the fact that antimicrobial medications available for treating illnesses caused by dangerous bacteria are less effective, and in some cases, nonexistent. The decline in the number of antimicrobial drugs on the market is a contributing factor.

Phytochemicals, which are formed in the secondary metabolism of plants, are responsible for the antibacterial actions that have led to the medicinal usage of numerous plants. Tannins, alkaloids, phenolic compounds, and flavonoids are examples of plant secondary metabolites that have been demonstrated to have antimicrobial properties in *In vitro* experiments. Many of these metabolites can be found in high concentrations in plants (Djeussi *et al*., 2013) [7].

In the present study, water, methanol and pet ether extracts of stem, leaves, fruits and seeds of *Carissa carandas* L. were subjected to evaluate their antibacterial potential against *E. coli, B. subtilis, A. niger* and *P. chrysogenum*. Results revealed that pet ether extracts of all plant parts showed the lowest activity against all the tested pathogens while methanol extracts showed the maximum activity. Against *E. coli*, the highest activity against this bacterium was shown by leaves while the lowest by the stem. Against *B. subtilis*, the highest activity against this bacterium was shown by stem while the lowest by the seeds and fruits. Against *A. niger*, all the plant parts showed higher activity among these, stem and seeds showed the highest inhibitory potential. Against *P. chrysogenum*, the highest activity against this bacterium was shown by seeds while the lowest by the seeds and fruits.

Conclusion

So, results of the present study revealed that edible as well as non-edible parts of *Carissa carandas* L. can be used to control infectious diseases. After identification and isolation of the specific compound/compounds responsible for antimicrobial activity, these plant parts can be utilized as natural source of therapeutic agent in pharmaceutical industry.

Acknowledgement

The authors are grateful to Head, Department of Botany, UOR, Jaipur, for providing facilities to conduct the research work.

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