Antioxidant and antibacterial activity of Mesembryanthemum acinaciformis L flower extract

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Abstract:

The aim of our study was to evaluate several biological properties of the methanolic extract of Mesembryanthemumacinaciformis, in particular its antioxidant, and antimicrobial capacities

With regard to antioxidant capacity, we determined the IC50 value of the plant's methanolic extract, which was 116.020 ± 14.162 µg/ml, compared with the reference value of 11 µg/ml for ascorbic acid. These results indicate that the methanolic extract exhibits moderate antioxidant activity compared with the standard.

With regard to the antimicrobial activity of the methanolic extract, our observations showed that its efficacy varied depending on the plant organ considered, the type of extraction, the concentration of extract and the bacterial strain tested. The results indicate moderate antimicrobial activity, suggesting that Mesembryanthemumacinaciformis could be used therapeutically against certain bacterial strains.

In summary, our study suggests that Mesembryanthemumacinaciformis could be a potential source of anti-inflammatory and antimicrobial therapeutic agents. The plant has interesting

therapeutic potential, although further research is needed to better understand and exploit these biological properties.

Key words: *Mesembryanthemumacinaciformis*, Biological activity, Antibacterial, Antioxidant, medicinal plant.

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Introduction:

The phenomenon of bacterial resistance has become a critical problem in the treatment of many diseases.The use of medicinal plants and the search for new bioactive substances is one of the greatest concerns of scientists (1).

MesembryanthemumacinaciformisL. (M. acinaciformisL.), a solitary flowering plant at the end of a short stem. It is found throughout the Mediterranean coast of Algeria (2)(3).In this article, we have attempted to examine the bacterial, antioxidant and anti-inflammatory activities of the methanolic extract of Mesembryanthemumacinaciformis L to enrich the Algerian pharmacopoeia and conserve this species.

MaterielsandMethodes

Plant material

The plant was harvested in the region of Mostaganem - Algeria (Western Algeria) during the spring season.The spring season; identified by Professor LaouarHocine "laboratory of valorisation of plants'.

A random sampling was taken of the aerial parts of *Mesembryanthemumacinaciformis*, which were harvested and dried in the open air at room temperature.

Preparation of the methanolicextract

The aerial parts werepowdered and macerated in 80% methanol for 24, 48 and 72 hours at laboratorytemperature (1:10 w/v, 10 g dried herb). Aftermaceration, the extractswerecollected, filtered and evaporated to drynessunder vacuum [4]. The dry extractwasstored at -18 °C for further use.

Determination of Total Phenolic Content

To determine total polyphenols, the FolineCioalteumethodwasused [5].Thesamples(0.2 mLwere mixed with 1 ml of Folin-Ciocalteu Reagentproducedwith 10 ml of deionized water. After 4 minutes of rest of the 25°C solutions, 0.2 mL of saturated sodium carbonate solution (75 mg/mL) wasadded. The mixed solutions wereleft at rest for 120 minutes before the absorbance

wasmeasured at 765 nm. Gallicacidwasused as a standard for the calibration curve. Total phenolic content wasexpressed in mg gallicacidequivalent per gram of extract (mg EAG/GE).

Determination of total flavonoidscontents

According to the methoddescribed by [6], 1 mL of the methanol solution of the extractwasadded to 1 mL of $AlCl_3$ at 2% in the methanol. Absorbance wasdetermined at 430 nm after10 minutes. Quercetinwasused as a standard. Resultswereexpressed in mg quercetinequivalent per gram of extract (mg EQ/GE).

DPPH Assay

According to the method of Hanato et al., (1998)[7], the capacity of the extractwasmeasured by the bleaching of the colour solution for the 1, 1-diphenyl-2picrylhydrazyl (DPPH) radical. One milliliter of extract at different concentrations wasadded to 0.5 mL of methanol DPPH solution. The mixtures wereshaken vigorously and left at laboratorytemperature for 30 minutes in the dark. The absorbance of the resulting solutions wasmeasured at 517 nm. The antiradialactivitywasexpressed in IC50 (micrograms per millilitre).The ability to scavenge the DPPH radical wascalculatedusing the followingequation: DPPH scavengingeffect (%) = [(A0 – A1)/ A0] Where: A0: the absorbance of the control at 30 minutes A1: is the absorbance of the sample at 30 minutes. BHT wasused as standard [8].

Assessment of antimicrobial activity

Strains studied

The pathogenic strains: *Staphylococcus aureus (ATCC 33862), Pseudomonas aeruginosa (ATCC27853), Bacillus sublilis (ATCC10876), as well as the commensal strain Escherichia coli (ATCC 25922)* come from the collection of the Beneficial Microorganisms, Functional Foods and Health Laboratory (University of Mostaganem).

Preparation of dilutions

The methanolic extracts of each variety were dissolved in dimethyl sulphoxide (DMSO) to prepare the different concentrations: 100; 50, 25, 12.5 mg /10ml.

Determination of the minimum inhibitory concentration (MIC)

The minimum inhibitory concentration (MIC) of the stone ash extracts of the three date varieties (MECH-DEGLA, HMIRA AND DEGLET NOUR) was determined using the diffusion method described by Benjilali et al (1986), reported by Billerbeck et al (2002). Different solutions of ash extracts were prepared at various concentrations (100; 50, 25, 12.5 mg

/10ml). These extracts were soaked onto sterile blotting paper discs, then the culture dishes were incubated at 37°C for 24 hours.

The MIC of the plant extract on the strain studied is defined as the lowest concentration inhibiting microbial activity after 18 to 24 hours of contact at 37°C, i.e. no bacterial growth is visible to the naked eye (Skandamis and Nycha, 2001) according to Nsemimuanda (2010).

Statisticalanalysis

The data analysiswasperformedusing Microsoft Office Excel 2007 for the classification of raw data and for the development of graphs and using stat box version 6.0 for the ANOVA analysis and the Newman-Keuls test.

Results And Discussion

The resultsobtained by the extraction method have a verylowyieldcontaining5,191± 0,639 mg EAG/GE of polyphenols and 4,453± 0,09 mg QG/GE of flavonoids. The DPPH radical has been widelyused as a model system for studyingtrappingseveralnatural compounds (Huang et al. 2004). The results are shown in Fig 1 obtained.

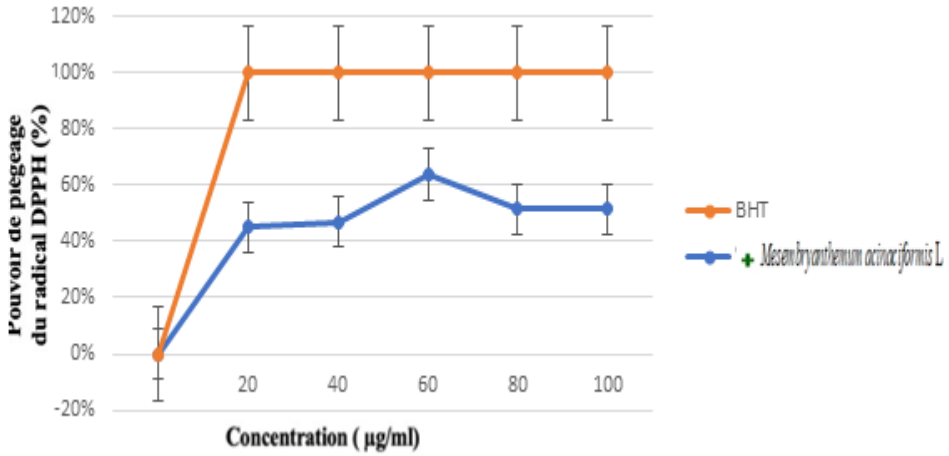

Fig 1 :Antioxidant activity of Mesembryanthemumacinaciformis L flower extract

Antibacterial test results

The results of (retima,2016) indicate that Mesembryanthemumacinaciformis flower extract showed a bacteriostatic effect against Escherichia coli species. Zones of inhibition of up to 11 mm were observed and a bactericidal effect for the three species Staphylococcus aureus, Pseudomonas and Enterobacteriaceae.

HAYOUNI et al (2007) have shown that the extraction method and the nature of the solvent can influence the antimicrobial activity of phenolic compounds in plants. The diameter of the zone of inhibition differs from one bacterium to another and from one extract to another. The

variation in the antimicrobial activity of extracts explains the variations in their chemical compositions.

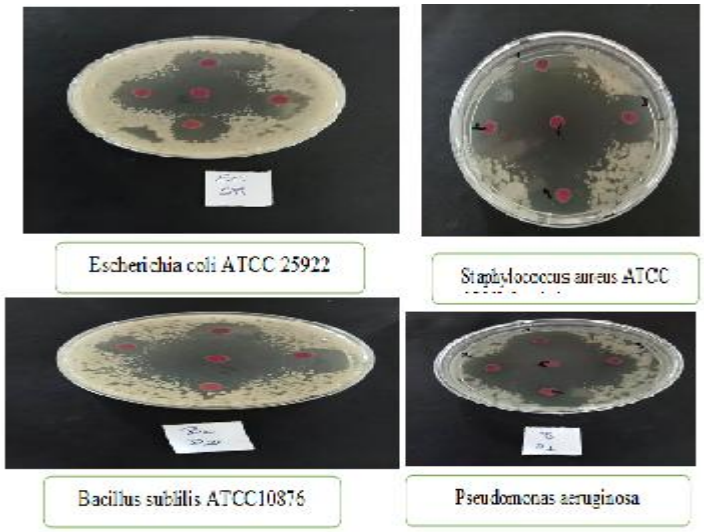

Fig 2 :antibacterialactivity of *Mesembryanthemumacinaciformis L* flower extract

Conclusion

The results of this study highlight the potential antioxidant and antibacterial properties of polyphenols and flavonoids extracted from Mesembryanthemumacinaciformis L. These findings underline the importance of selective extraction of these natural bioactive molecules, particularly those specific to this endemic species, using appropriate techniques.

These extracts could serve as raw materials for the production of highly active products, which could eventually be considered as alternatives to synthetic molecules. This approach would help to reduce pollution while promoting more environmentally-friendly and cost-effective solutions.

In addition, these results are of significant importance in providing a solid scientific basis for the further development of these extracts in the creation of new medicinal and agronomic products. This approach could open up new prospects in the fields of health and agriculture by exploiting the benefits of the natural compounds extracted from Mesembryanthemumacinaciformis L.

Références

[1] Bruneton, J. 1999. Pharmiognosie, phytochimie, plantes médicinales, 2eme édition, Paris : Editions médicales internationales, Tec et Doc Lavoisier, p1120.

[2] Quezel P. et Santa S., 1963; Nouvel Flore de l'Algérie et des régions désertiques méridionales. Vol 3, CNRS., P 365.
[3] Maire R., 1967; La flore de l'Afrique du Nord. Encyclopédiebiologique, Vol 12-13, Paris.
[4] Neda S L, Neda M M D, Jelena M I. and Biljana N B Antioxidantproperties of Galiumverum L. (Rubiaceae) extracts, Cent. Eur. J. Biol. 2010; 331–337.
[5] Li WD, Wei C L, White P J. and Beta T. High-amylose corn exhibitsbetterantioxidantactivitythantypical and waxygenotypes. Journal of Agricultural and Food Chemistry, 2007; 55: 291-298.
[6] T.Bahorun,B. Gressier, F.Trotin, C. Brunete, T. Dine T, J. Vasseur, J C.Gazin, M. Pinkas,M .Luycky, M. Gazin, 1996,.ArzneimForsch / Drug Res, pp 1-6.
[7] Hanato T, Kagawa H, Yasuhara T and Okuda T. Two new flavonoids and otherconstituents in licoriceroot:Their relative astringency and radical scavengingeffects. Chemical& Pharmaceutical Bulletin, 1998; 2090–2097.
[8] Retimifatima. Etude de l'activité antibactérienne de trois extraits phénoliques des noyaux des dattes palmiers: «Deglet-Nour ,Degla-Baida et Ghars.» . Mémoire Master en chulieorganique,université CHAHID HAMMA LAKHDER El-oudi 2016.
[9] R IBettaieb S, Bourgou I, Ben SlimenDebez I, JabriKaroui I, HamrouniSellami K, Msaada , F Limam and B.Marzouk. Food Bioprocess Techno, 2011- 1007.
[10] Skandamis, P. N., &Nychas, G. J. E. (2001). Development and evaluation of a model predicting the survival of Escherichia coli O157: H7 NCTC 12900 in homemade eggplant salad at various temperatures, pHs, and oregano essential oil concentrations. Applied and EnvironmentalMicrobiology, 67(5), 272-278.
[11] NsemiMuanda, J. A. (2010). Etude des potentialités antimicrobiennes de quelques plantes médicinales de la province de l'Équateur, R.D.C. (Doctoral dissertation).