

Potential use of *Euphorbia hirta* and *Euphorbia jolkinii* extracts as antimicrobial agents against *Pseudomonas aeruginosa*, *Morganella morganii*, and *Klebsiella pneumoniae*

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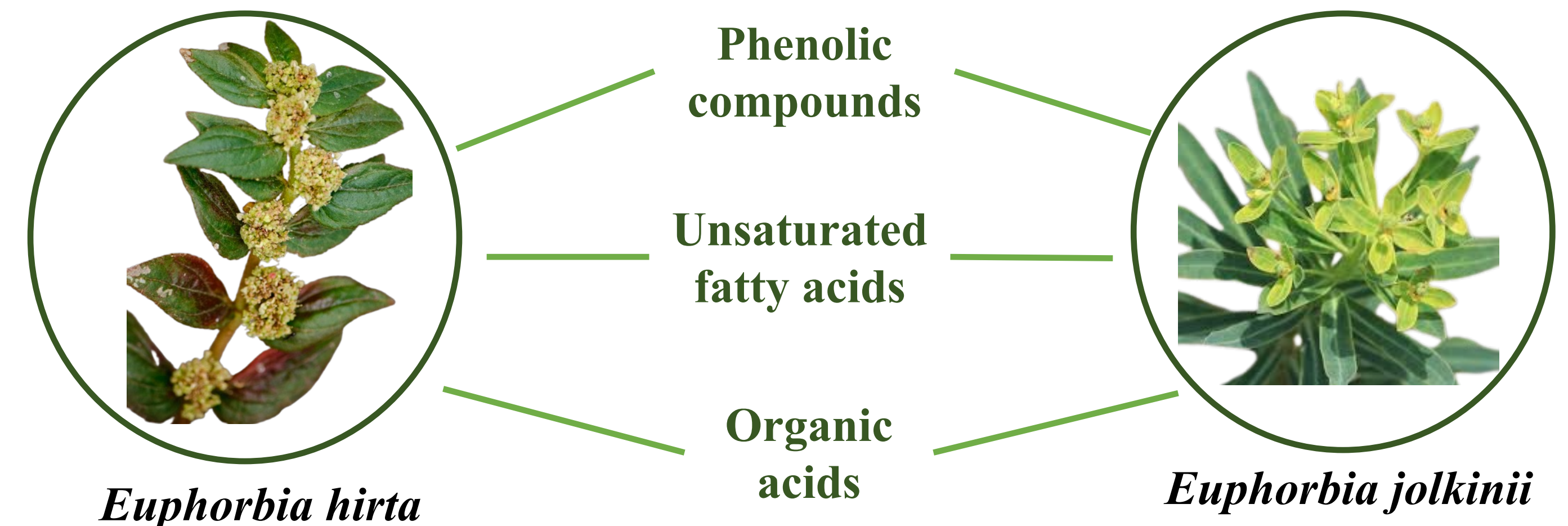
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I. Introduction

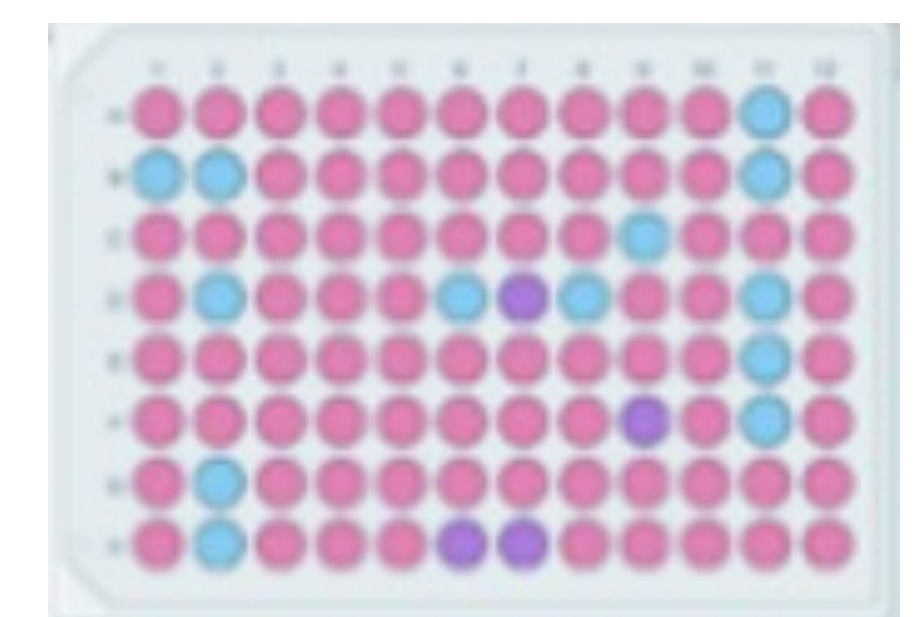
Euphorbia hirta and *Euphorbia jolkinii* are two plants belonging to the **Euphorbiaceae** family. *Euphorbia hirta* has been traditionally used in the **folk medicine** of different cultures, awakening the interest of the scientific community because of the link of its **bioactivities** to the **compounds** present in this species. Therefore, this study was run considering the need to find novel natural antimicrobial extracts to be used in the industry replacing the synthetic ones by testing both *E. hirta* and *E. jolkinii* ethanol extracts.



II. Objective and methodology

Considering the need of society to find **new antibacterial extracts** and the potential use of these plants for this goal, the **antibacterial activity of ethanol extracts** (10 mg/mL) against eight food and nine clinical bacteria have been characterized.

By a **colorimetric assay**, minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined, being **streptomycin** (1 mg/mL), **ampicillin** (10 mg/mL), and **methicillin** (1 mg/mL), **the antibiotics used as controls**.



III. Results

Table 1. Antibacterial activity of *E. hirta* and *E. jolkinii* tested in both clinical and food contaminant bacteria

ANTIBACTERIAL ACTIVITY						
Clinical bacteria						
		<i>E. hirta</i> (10 mg/mL)	<i>E. jolkinii</i> (10 mg/mL)	Ampicillin (10 mg/mL)	Imipenem (1 mg/mL)	Vancomycin (1 mg/mL)
<i>Escherichia coli</i>	MIC	5	2.5	<0.15	<0.0078	ND
	MBC	>10	>10	<0.15	<0.0078	ND
<i>Klebsiella pneumoniae</i>	MIC	5	1.25	10	<0.0078	ND
	MBC	>10	>10	>10	<0.0078	ND
<i>Morganella morganii</i>	MIC	1.25	1.25	>10	<0.0078	ND
	MBC	>10	>10	>10	<0.0078	ND
<i>Proteus mirabilis</i>	MIC	2.5	0.6	<0.15	<0.0078	ND
	MBC	>10	>10	<0.15	<0.0078	ND
<i>Pseudomonas aeruginosa</i>	MIC	>10	1.25	>10	0.5	ND
	MBC	>10	>10	>10	1	ND
<i>Enterococcus faecalis</i>	MIC	0.6	1.25	<0.15	ND	<0.0078
	MBC	>10	>10	<0.15	ND	<0.0078
<i>Listeria monocytogenes</i>	MIC	2.5	1.25	<0.15	<0.0078	ND
	MBC	>10	>10	<0.15	<0.0078	ND
MRSA	MIC	2.5	0.3	<0.15	ND	0.25
	MBC	>10	>10	<0.15	ND	>0.5
<i>Propionibacterium acnes</i>	MIC	2.5	2.5	ND	ND	0.07
	MBC	>10	>10	ND	ND	5
Food contaminant bacteria						
		<i>E. hirta</i> (10 mg/mL)	<i>E. jolkinii</i> (10 mg/mL)	Streptomycin (1 mg/mL)	Methicillin (1 mg/mL)	Ampicillin (10 mg/mL)
<i>Enterobacter cloacae</i>	MIC	5	2.5	0.007	ND	0.15
	MBC	>10	>10	0.007	ND	0.15
<i>Escherichia coli</i>	MIC	5	10	0.01	ND	0.15
	MBC	>10	>10	0.01	ND	0.15
<i>Pseudomonas aeruginosa</i>	MIC	>10	>10	0.06	ND	0.63
	MBC	>10	>10	0.06	ND	0.63
<i>Salmonella enterocolitica</i>	MIC	10	10	0.007	ND	0.15
	MBC	>10	>10	0.007	ND	0.15
<i>Yersinia enterocolitica</i>	MIC	2.5	2.5	0.007	ND	0.15
	MBC	>10	>10	0.007	ND	0.15
<i>Bacillus cereus</i>	MIC	5	5	0.007	ND	ND
	MBC	>10	>10	0.007	ND	ND
<i>Listeria monocytogenes</i>	MIC	5	1.25	0.007	ND	0.15
	MBC	>10	>10	0.007	ND	0.15
<i>Staphylococcus aureus</i>	MIC	2.5	0.6	0.007	0.007	0.15
	MBC	>10	>10	0.007	0.007	0.15

As it is shown in Table 1, results showed an **antibacterial activity comparable to or superior to ampicillin** when extracts were tested against three clinical bacteria (*Pseudomonas aeruginosa*, *Morganella morganii*, and *Klebsiella pneumoniae*). Thus, the MIC values obtained when *E. hirta* extract was used were: 5, 1.25, and <10 for *K. pneumoniae*, *M. morganii*, and *P. aeruginosa*, respectively. For the *E. jolkinii* extract, MIC values were 1.25 for the three bacteria, while MIC values for ampicillin were 10, <10, and <10 for *K. pneumoniae*, *M. morganii*, and *P. aeruginosa*, respectively.

These results open a new potential use of ethanol extracts of both *E. hirta* and *E. jolkinii* in the **food industry as natural inhibitors of different microorganisms**.

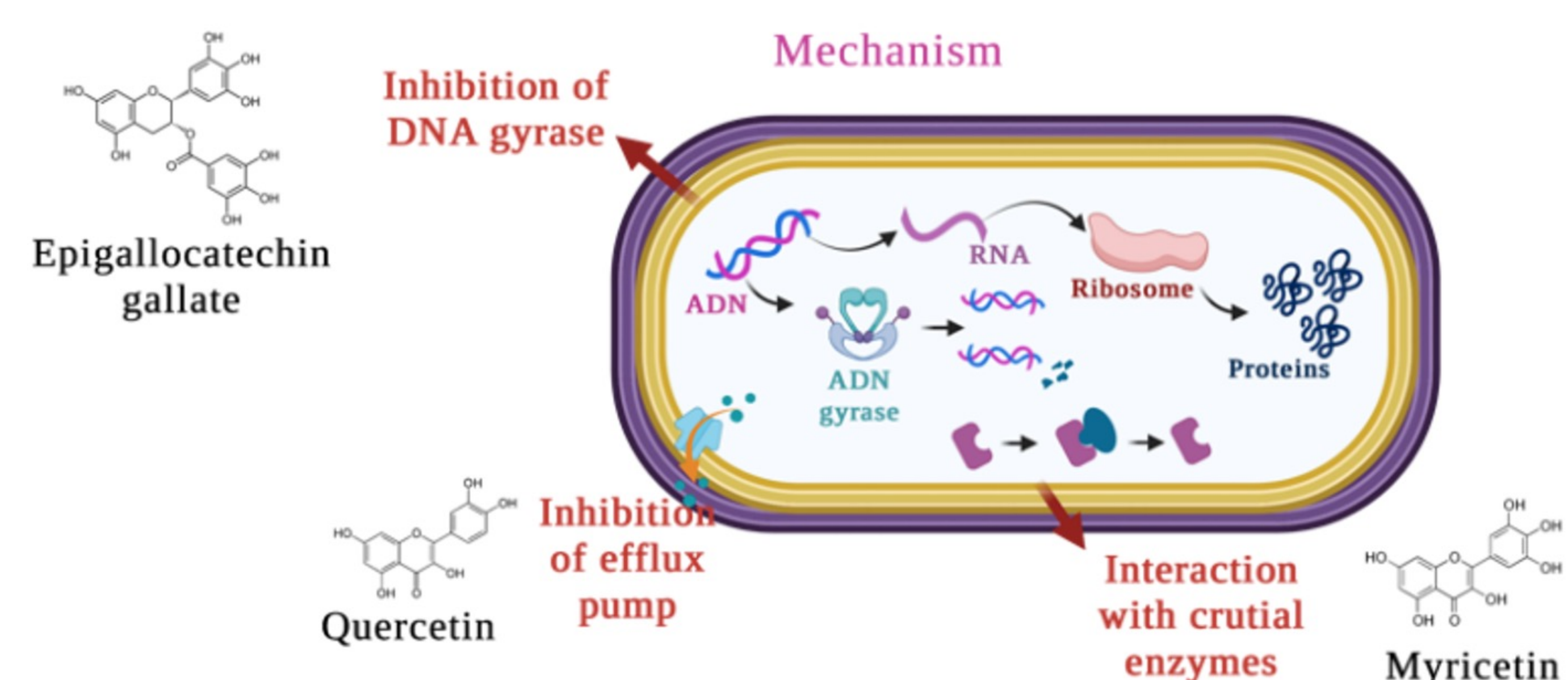


Figure 1. Antibacterial activity mechanism of both plant extracts and the compounds likely to have this activity.

IV. Conclusions and future directions

Considering the data provided, **both extracts** could be used as **natural antimicrobial alternatives** since they showed high antibacterial activity against three clinical bacteria, with *E. jolkinii* having the best results.

The **potential industrial application** of both extracts as **natural antimicrobials** should be tested in the future

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