Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary materials on

Unveiling therapeutic efficacy of extract and multi-targeting phytocompounds from *Christella dentata* (Forssk.) Brownsey & Jermy against multidrug-resistant *Pseudomonas aeruginosa*

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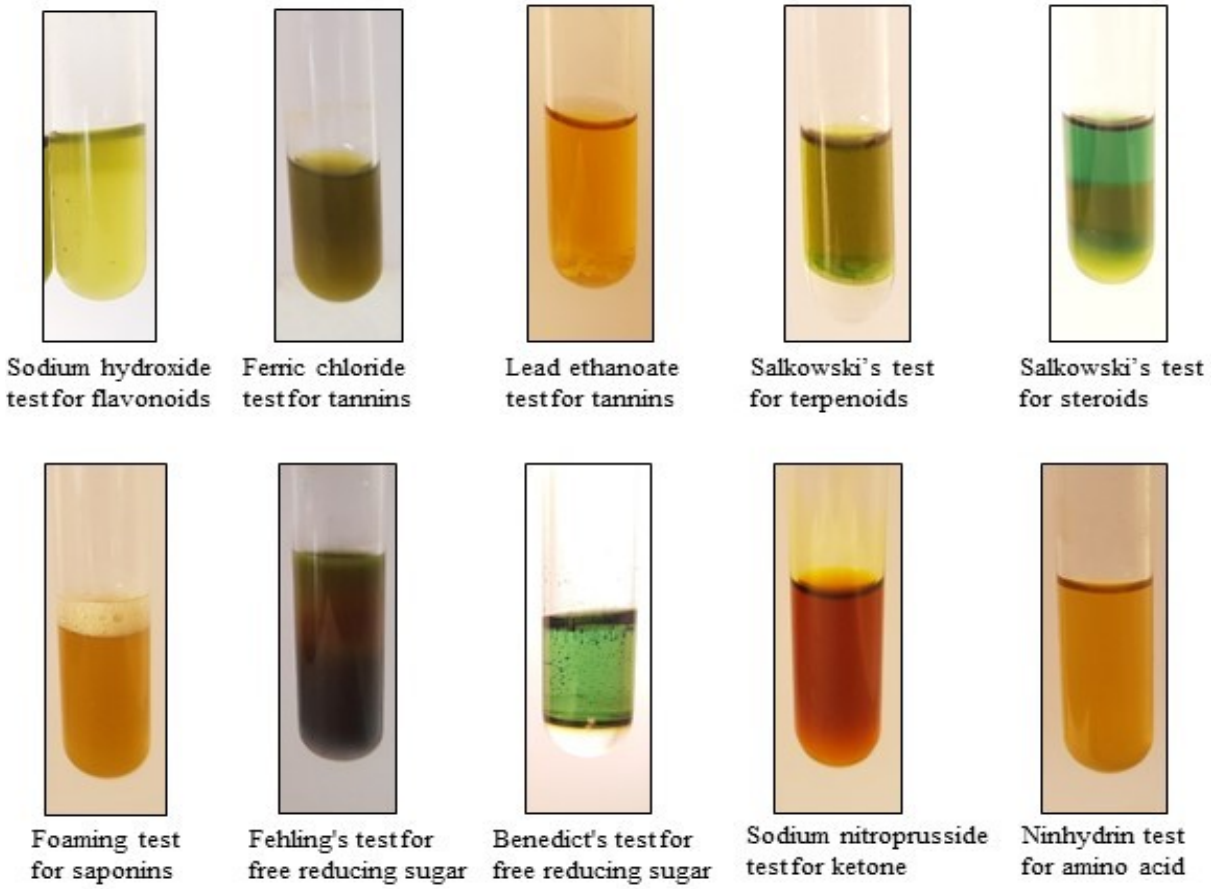
Supplementary Figure S1. Morphology of *Christella dentata* (Forssk.) Brownsey & Jermy.

Supplementary Table S1. Preliminary phytochemical screening of ethanol extract of *Christella dentata* (Forssk.) Brownsey & Jermy (EECD).

Test name	Observed color	Result	Phytochemical nature
Sodium hydroxide	Colorless	+	Flavonoids
$FeCl_3$	Greenish-black	+	Tannins
Lead acetate	Grey-white precipitate	+	Tannins
Salkowski's	Brown layer at upper surface	+	Terpenoids
Salkowski's	Blackish layer in the bottom	+	Steroids
Foaming	Foam formation	+	Saponins
Fehling's test	Yellow-lime precipitate	+	Reducing sugar
Benedict's test	Greenish-yellow layer	+	Reducing sugar
Sodium nitroprusside	Dark-brown	+	Ketone
Ninhydrin test	Intense yellow color	-	Amino acid

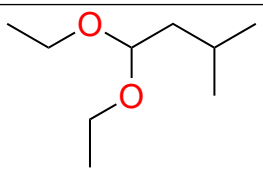
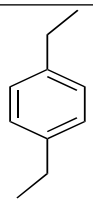
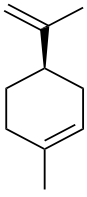
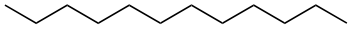


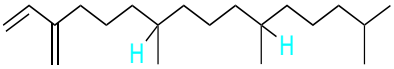
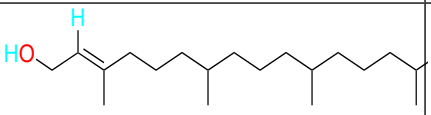
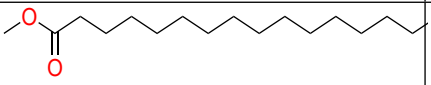
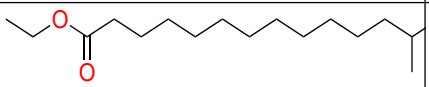
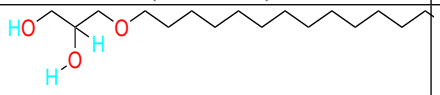
Supplementary Figure S2. Preliminary phytochemical screening (PPS) of EECD.

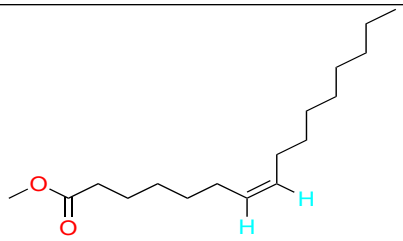
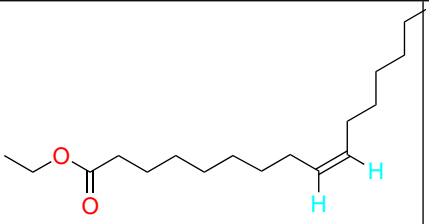
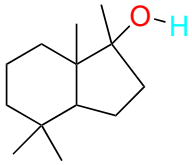
Supplementary Table S2. Fourier transform-infrared spectra (FT-IR) of EECD.

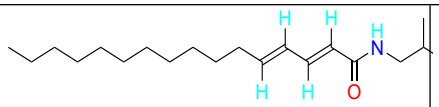
Wavenumber (cm^{-1})	Peak intensity	Functional group assignment
3650-3000	Broad	Primary and secondary amines or amides (N-H stretch)
2926.14	Weak	Aldehyde (C-H)
2853.81	Weak	Aldehyde (C-H)
1737.94	Weak	Ester (C=O)
1638.60	Strong	Aromatic (C=C)
1456.36	Weak	Alkanes (-CH_3 bend)
1402.31	Weak	Aromatic alkene (C=C stretch)
1076.33	Medium	Alkyl halide (C-X)
594.10	Medium	Alkyl halide (C-Br)
417.57	Weak	Alkyl halide (C-X)

Supplementary Table S3. GC-MS annotated phytochemicals in EECD

PN	Retention time	Similarity%	Area (%)	Structure, name and formula of the phytochemicals	Compound CID	Nature of phytochemicals
1	5.06	60	0.76	Unknown	-	-
2	5.117	91	1.38	 1,1-diethoxy-3-methylbutane ($C_9H_{20}O_2$)	19695	Alkane
3	5.845	68	0.22	Unknown	-	-
4	5.97	91	0.24	 1,4-diethylbenzene ($C_{10}H_{14}$)	7734	Aromatic hydrocarbon
5	6.019	95	1.44	 D-Limonene ($C_{10}H_{16}$)	440917	Monoterpene
6	7.762	91	0.22	 Dodecane ($C_{12}H_{26}$)	8182	Alkane
7	8.535	74	0.27	Unknown	-	-
8	8.802	94	0.63	 Hexadecane ($C_{16}H_{34}$)	11006	Alkane

9	9.529	81	0.29	Unknown	-	-
10	10.57	79	3.42	Unknown	-	-
11	10.615	76	3.34	Unknown	-	-
12	10.702	93	5.29	 Tetradecane ($C_{14}H_{30}$)	12389	Alkane
13	10.885	62	0.98	Unknown	-	-
14	11.02	82	1.18	Unknown	-	-
15	11.638	90	0.81	 Hexadecane ($C_{16}H_{34}$)	11006	Straight-chain alkane
16	12.098	71	0.37	Unknown	-	-
17	12.688	91	1.17	 Eicosane ($C_{20}H_{42}$)	8222	Alkane
18	13.203	76	0.26	Unknown	-	-
19	14.417	93	1.7	 Neophytadiene ($C_{20}H_{38}$)	10446	Alkene
20	14.499	82	0.35	Unknown	-	-
21	15.021	90	0.49	 3,7,11,15-Tetramethyl-2-hexadecen-1-ol ($C_{20}H_{40}O$)	5366244	Acyclic diterpene alcohol
22	15.691	92	1.2	 Hexadecanoicacid,methylester ($C_{17}H_{34}O_2$)	8181	Fatty acid methyl ester
23	16.231	88	0.33	Unknown	-	-
24	16.701	92	3.24	 Ethyl 13-methyltetradecanoate ($C_{17}H_{34}O_2$)	71380066	Esters
25	16.81	98	0.4	 1,2-Propanediol,3-(tetradecyloxy)- ($C_{17}H_{36}O_3$)	64674	Phenolics (alcohol)

26	18.428	91	0.82	 7-Hexadecenoic Acid,methyl ester,(Z)- ($C_{17}H_{32}O_2$)	14029831	Fatty acid methyl esters
27	18.724	92	0.56	 Triacontane,1-iodo- ($C_{30}H_{61}I$)	12696145	Alkyl iodide
28	19.409	58	0.65	Unknown	-	-
29	19.502	90	1.82	 (Z)-Ethyl heptadec-9-enoate ($C_{19}H_{36}O_2$)	91692507	Fatty acid ethyl esters
30	23.299	88	0.29	Unknown	-	-
31	24.889	81	0.19	Unknown	-	-
32	25.488	86	0.3	Unknown	-	-
33	29.201	89	36.09	Unknown	-	-
34	29.44	91	7.88	 Bicyclo [4.3.0] nonane, 2,2,6,7 - tetramethyl-7-hydroxy- ($C_{13}H_{24}O$)	536446	Monoterpene (terpenoids)
35	29.56	50	3.17	Unknown	-	-
36	29.625	48	1.5	Unknown	-	-
37	29.665	47	1.5	Unknown	-	-
38	29.72	54	3.31	Unknown	-	-
39	29.82	47	0.75	Unknown	-	-
40	29.953	52	2.52	Unknown	-	-
41	30.089	49	1.74	Unknown	-	-
42	30.13	54	0.66	Unknown	-	-
43	31.33	44	0.27	Unknown	-	-
44	31.685	45	0.36	Unknown	-	-
45	31.795	50	0.29	Unknown	-	-

46	32.685	96	0.17	 (2E,4E)-N-Isobutylhexadeca-2,4-dienamide ($C_{20}H_{37}NO$)	6442402	N-acyl amines
47	33.356	49	0.42	Unknown	-	-
48	33.655	45	0.24	Unknown	-	-
49	34.5	43	0.22	Unknown	-	-
50	37.24	41	0.19	Unknown	-	-

Supplementary Table S4. Molecular docking and MM-GBSA analysis

Receptor	**Compounds CID**	**Docking score**	**MM-GBSA**							
			MM-GBSA ΔG Binding	ΔG Bind Coulomb	ΔG Bind Covalent	ΔG Bind Hbond	ΔG Bind Lipo	ΔG Bind Packing	ΔG Bind Solv GB	ΔG Bind vdW
LasR	CID 6442402	-7.383	-46.59	-18.15	17.56	-1.86	-40.31	0	25.63	-29.46
	CID 536446	-7.285	-16.56	-5.06	6.44	-0.5	-24.04	0	7	-0.4
	CID 7734	-7.169	-39.48	-2.46	0.94	0	-19.11	-0.54	7.05	-25.35
	CID 6249 (Ampicillin)	-7.003	-7.17	8.32	18.75	-1.78	-27.74	-2.77	6.92	-8.87
LpxC	CID 536446	-6.984	-31.5	-2.91	0	-0.47	-13.41	0	13.35	-28.06
	CID 7734	-6.826	-29.15	-0.37	0	0	-12.58	0	9.62	-21.82
	CID 6249 (Ampicillin)	-6.333	-29.02	15.45	0	-4.37	-10.07	0	3.48	-33.51

Supplementary Table S5. Molecular features and toxicity of selected phytocompounds

CID Number		**CID 536446**	**CID 7734**	**CID 6249 (Ampicillin)**
Physico-chemical Properties	MW (g/mol)	196.33	134.22	349.4
	Heavy atoms	14	10	24
	Aromatic heavy atoms	0	6	6
	RB	0	2	5
	HBA	1	0	5
	HBD	1	0	3
	TPSA	20.23 Å²	0.00 Å²	0.00 Å²
Lipophilicity	Log Po/w(MLOGP)	3.29	4.47	0.75
Water solubility	Log S (ESOL)	-3.32	-3.87	-1.15
PK	GI absorption	High	Low	Low
Drug likeness	RO5	0	1	0
Medicinal chemistry	Synthetic accessibility	3.02 (easy)	1 (very easy)	4.16 (easy)
Toxicity and mutagenicity	Hepatotoxicity	I	I	I
	Immunogenicity	I	I	I

	Mutagenicity	I	I	I
	Cytotoxicity	I	I	I

MW = Molecular weight, I=Inactive, RB = Rotatable bond, HBA= Hydrogen bond acceptor, HBD = Hydrogen bond donor; PK = Pharmacokinetics; GI = Gastrointestinal; RO5 = Lipinski's rule of five.

Supplementary Table S6. The molecular docking bonded interactions and interacting residues of LasR and LpxC proteins with the best phytocompound and the control drug (ampicillin, CID 6249) were listed for each docked complex.

Receptor name	Compounds CID	Interacting residues	Interacting bonds
LasR	CID 536446	LEU36	Hydrophobic
		GLY38	Glycine
		LEU39	Hydrophobic
		LEU40	Hydrophobic
		TYR47	Hydrophobic
		ALA50	Hydrophobic
		ILE52	Hydrophobic
		ARG61	Charged (positive)
		TYR64	Hydrophobic H-bond
		ASP65	Charged (negative)
		ALA70	Hydrophobic
		VAL76	Hydrophobic
		CYS79	Hydrophobic
		LEU125	Hydrophobic
		GLY126	Glycine
		ALA127	Hydrophobic
LasR	CID 7734	LEU36	Hydrophobic
		GLY38	Glycine
		LEU39	Hydrophobic
		LEU40	Hydrophobic
		TYR47	Hydrophobic
		ALA50	Hydrophobic
		ILE52	Hydrophobic
		ARG61	Charged (positive)
		TYR64	Hydrophobic
		ALA70	Hydrophobic
		VAL76	Hydrophobic
		CYS79	Hydrophobic
		THR80	Polar
		LEU125	Hydrophobic
		GLY126	Glycine

		ALA127	Hydrophobic
LasR	CID 6249	LEU36	Hydrophobic
		GLY38	Glycine
		LEU39	Hydrophobic
		LEU40	Hydrophobic
		TYR47	Hydrophobic
		ALA50	Hydrophobic
		ILE52	Hydrophobic
		TYR56	Hydrophobic H-bond
		TRP60	Hydrophobic
		TYR64	Hydrophobic
		ALA70	Hydrophobic
		ASP73	Charged (negative) H-bond-Salt bridge
		THR75	Polar
		VAL76	Hydrophobic
		TRP88	Hydrophobic
		TYR93	Hydrophobic
		PHE101	Hydrophobic
		ALA105	Hydrophobic
		LEU110	Hydrophobic
		THR115	Polar
		LEU125	Hydrophobic
		GLY126	Glycine
		ALA127	Hydrophobic
		SER129	Polar H-bond
LpxC	CID 536446	LEU18	Hydrophobic
		MET62	Hydrophobic
		ILE102	Hydrophobic
		THR190	Polar H-bond
		PHE191	Hydrophobic
		GLY192	Glycine
		ILE197	Hydrophobic
		LEU200	Hydrophobic
		ALA206	Hydrophobic
		GLY209	Glycine
		SER210	Polar
		ASN213	Polar
		ALA214	Hydrophobic
		VAL216	Hydrophobic
LpxC	CID 7734	LEU18	Hydrophobic
		ILE102	Hydrophobic
		THR190	Polar
		PHE191	Hydrophobic
		GLY192	Glycine
		PHE193	Hydrophobic
		ASP196	Charged (negative)
		ILE197	Hydrophobic

		LEU200	Hydrophobic
		ALA206	Hydrophobic
		GLY209	Glycine
		SER210	Polar
		ASN213	Polar
		ALA214	Hydrophobic
		VAL216	Hydrophobic
LpxC	CID 6249	LEU18	Hydrophobic
		MET62	Hydrophobic H-bond
		SER63	Polar
		THR75	Polar
		GLU77	Charged (negative)
		HIS78	Polar
		ILE102	Hydrophobic
		PHE160	Hydrophobic
		THR190	Polar H-bond
		PHE191	Hydrophobic H-bond
		GLY192	Glycine
		ALA206	Hydrophobic
		ALA214	Hydrophobic
		HIP237	Charged (positive) H-bond
		LYS238	Charged (positive) Salt bridge
		ASP241	Charged (negative)
		HIS264	Polar