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Screening of some Wild and Cultivated Egyptian Plants for their Free Radical Scavenging Activity

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Abstract: Two hundred wild and cultivated plants growing in Egypt, belonging to seventy four families have been randomly collected from different localities. The methanol extracts of these plants have been subjected to preliminarily screening assay for their free radical scavenging potentialities against stable DPPH$^{\bullet}$ (2, 2-diphenyl-1-picrylhydrazyl), using ascorbic acid as a positive control. Remarkable free radical scavenging activities ($\geq$ 90%) were obtained with fifty seven of the tested extracts (at 50ppm). The effective concentration required for scavenging 50% of free radical (EC_{50}) with each of these promising fifty seven methanolic extracts was calculated where their values ranged between 2.9± 2.3 and 25.1± 2.8 µg/ml, whereas that of ascorbic acid was 4.1± 0.8 µg/ml. *Acacia nilotica, Pinus canariensis, Harpullia pendula* and *Moringa peregrina* exhibited the most free radical scavenging potentialities.
Keywords: antioxidant, ROS, EC_{50}, DPPH.

Introduction:

In a healthy individual a balance exists between the production of free radicals and antioxidant defense mechanisms. Under stress conditions, this balance is usually disturbed resulting in overproduction of free radicals or lowering of antioxidant defenses which results in oxidative stress [1]. Oxidative stress is excess formation and/or incomplete removal of highly reactive molecules such as reactive oxygen species (ROS), including superoxide radicals, hydroxyl radicals, etc., as well as non-radical species such as hydrogen peroxide generated by endogenous and exogenous factors [2]. Free radicals play an important role in degenerative or stressful processes, such as aging, cancers, cardiovascular disease, cataracts [3]. Such processes cause damaging of essential biomolecules such as proteins, DNA and lipids [1]. Thus, antioxidant-based drug formulations are used for the prevention and treatment of a number of complex diseases including cancer [4]. Currently there has been an increased interest globally to identify antioxidant compounds that are pharmacologically potent and have low or no side effects for use in preventive medicine and food industry. Antioxidants from natural origin are preferred to the synthetic ones because of their perceived safety, potential therapeutic value, and long shelf life [5]. Plants produce significant amounts of antioxidants to prevent the oxidative stress caused by photons and oxygen, so they represent a potential source of new compounds having antioxidant activities with multiple mechanisms of action [6, 7]. This needs inspired widespread screening of plants for exploring their possible antioxidant potentials [7]. Thus, the present study intended to evaluate the free radical scavenging activities of the methanolic extracts of two hundred wild and cultivated plants collected randomly from different localities in Egypt.

Material and Methods:

Plant Materials:

Two hundred cultivated and wild plant species were randomly collected from different localities in Egypt. These species were identified according to [8] as presented in Table 1. A voucher specimen representing each collection was kept in the herbarium of the National Research Centre (NRC), Cairo, Egypt.

Preparation of Plant extracts

Plant extracts were prepared according to the procedure described by [9] with slight modifications as follows: The plant parts under investigation (75g) were dried in a solar oven at 40°C followed by grinding and percolation in 450 ml methanol and then fully extracted by further percolation at ambient temperature. The extracts were filtered using Whatman No.1 paper and then dried by high vacuum and stored at -70°C in glass vials, ready for use.

Free Radical Scavenging Activity

DPPH$^{\bullet}$ (2, 2-diphenyl-1-picrylhydrazyl) free radical scavenging method is an easy and rapid method to evaluate free radical scavenging abilities of various samples [10]. The DPPH$^{\bullet}$ radical is a stable organic free radical with an absorption band at 517 nm. The antioxidants reduce the DPPH$^{\bullet}$ radical (purple colour) to a yellow coloured compound (diphenylpicryl-hydrazine) when the odd electron of DPPH$^{\bullet}$ radical becomes paired with a hydrogen from a free radical scavenging antioxidant to form the reduced DPPH-H that is followed by a decrease in the absorbance at 517 nm. The changes in colour (from deep-violet to light-yellow) are measured at 517nm.

Chemicals

DPPH$^{\bullet}$ was obtained from Fluka. Vitamin C (ascorbic acid) obtained from Laboratory Rasayan. Methanol used was of analytical grade.

Procedure

It was carried out using radical scavenging activity against 2, 2-diphenyl-1-picrylhydrazyl (DPPH$^{\bullet}$) antioxidant assay [11]. Plant extracts were screened at 50µg/ml using 0.1mM DPPH$^{\bullet}$ dissolved in methanol. The absorbance of the mixture was measured at 517 nm, exactly 30 min. After the addition of 50 ppm of each of the extracts under investigation. Each assay was carried out in triplicate. The resulting decolourization was measured at 517 nm and a reference wavelength of 690nm. Ascorbic acid (Vitamin C) was used as an antioxidant standard at different concentrations ranging from 11 – 2.75 µg/ml (freshly dissolved in methanol). The DPPH$^{\bullet}$ / methanol mixture was used as a negative control.

Calculation of the Percentage of Radical Scavenging activity of the extracts

The DPPH$^{\bullet}$ scavenging activity of each extract was calculated according to the following equation:

Percentage reduction = (1-(X/ (av (NC))) ×100

Where x indicates the absorbance of sample and av indicates the average absorbance of control and NC indicates the absorbance of negative control.

Determination of EC_{50} Values:

EC_{50} values were calculated for the promising active extracts possessing ≥ 90% scavenging activity using probit analysis and utilizing the SPSS computer program (SPSS for windows, statistical analysis software package /version 9/ 1989 SPSS Inc., Chicago, USA).

Results:

Table 1 shows *in vitro* screening of free radical DPPH$^{\bullet}$ scavenging potentiality of the two hundred methanolic plant extracts under investigation, (tested at 50 ppm). Out of these 200 methanolic extracts 57 possessed high free radical scavenging activity (90≥ %). The free radical scavenging activities of the remaining plant extracts (143) ranged from moderate (<90- 40%) to weak (<40%). Table 2 shows the EC_{50} values of the plant extracts that showed high free radical scavenging activities (≥ 90%).

Table1. List of selected plants collected from different localities in Egypt, their scientific names, families and parts used for screening the antioxidant activities of methanolic extracts, in vitro, using the DPPH•assay. In each case, 10mg plant extract were dissolved in 500 µl DMSO to make 20000 ppm (µg/ml). Preliminary concentration for screening was 50ppm. Each result is a mean of 3 replicate samples.

No.	Species	Part used	Family	DPPH• % at 50PPM
1*	*Abutilon hybridum* Hort.	Br	Malvaceae	37.2
2**	*Acacia nilotica* (L.) Delile	Br, L, Fr	Leguminosae	94.2
3**	*Acacia saligna* H.L.Wendl.	H	Leguminosae	93.6
4*	*Acokanthera oblongifolia* (Hochst.) Codd	L	Apocynaceae	35.6
5*	*Acrocarpus fraxinifolius* Arn.	L	Leguminosae	95.7
6**	*Adonis dentata* Delile	H	Ranunculaceae	23.8
7**	*Aegilops ventricosa* Tausch	H	Gramineae	33.7
8*	*Agave filifera* Salm-Dyck	L	Agavaceae	8
9*	*Agave sp.*L.	L	Agavaceae	0.8
10*	*Agave macroacantha* Zucc.	L	Agavaceae	11.8
11**	*Agropyron junceum* (L.) P. Beauv.	H	Gramineae	5.6
12*	*Ailanthus altissima* (Mill)Swingle	B	Simaroubaceae	0
13*	*Aloe grandidentata* Salm-Dyck	L	Liliaceae	24.8
14*	*Aloe mitriformis* Mill.	L	Liliaceae	20.4
15*	*Alpinia nutans* K.Schum.	Fl	Zingiberaceae	84.7
16**	*Anarrhinum pubescens* Fresen.	H	Scrophulariaceae	27.9
17*	*Anisacanthus virgularis* Nees	L, Br	Acanthaceae	33.7
18*	*Antirrhinum majus* L.	Shoot system	Scrophulariaceae	8.7
19**	*Apium graveolens* L.	W	Umbelliferae	17.1
20**	*Artemisia monosperma* Del.	H	Asteraceae	92.1
21**	*Asparagus stipularis* Forssk.	R	Liliaceae	11.4
22**	*Asphodelus ramosus* Gouan ex Willk. & Lange	Root system	Liliaceae	3.9
23**	*Atractylis carduus* C.Chr.	H	Asteraceae	19.3
24**	*Atriplex lindleyi* Moq. subsp. inflata (F. Muell.) P. G. Wilson	H	Chenopodiaceae	1.6
25*	*Balanites aegyptiaca* (L.) Delile	L	Balanitaceae	20.2
26*	*Barleria cristata* Lam.	L	Acanthaceae	8.2
27**	*Bassia scoparia* (L.)A.J.scott.	H	Chenopodiaceae	14.6
28**	*Beta vulgaris* L.	H	Chenopodiaceae	3.5
29*	*Brachychiton australis* (Schott & Endl.) Terrac.	L	Sterculiaceae	94.8
30**	*Brachypodium distachyon* (L.) P. Beauv.	H	Gramineae	20.4
31*	*Brahea armata* S.Watson	L, Br	Arecaceae	86.4
32**	*Brassica nigra* (L.) W.D.J.Koch	H, Fl, Fr	Cruciferae	29.7
33*	*Butea frondosa Roxb. ex Willd.*	L	Leguminosae	59.5
34*	*Caesalpinia ferrea* Mart.	Fr, S	Leguminosae	94.6
35*	*Caesalpinia pulcherrima* (L.) Sw.	L ,Fl	Leguminosae	94.9
36**	*Capparis sinaica* Veill.	H	Capparaceae	4.1
37*	*Carica papaya* L.	Br	Caricaceae	7
38*	*Carissa carandas* L.	L, Br	Apocynaceae	93.8
39**	*Carrichtera annua* L.(DC.)	L, B, Fl	Cruciferae	14.8
40*	*Carya illinoinensis* (Wangenh.) K.Koch	L	Juglandaceae	62.3
41*	*Casimiroa edulis* La Llave	L	Rutaceae	14.5
42*	*Cassia candolleana* Vogel.	L, Br, Fl, Fr	Leguminosae	12.3
43*	*Cassia fistula* L.	Fl	Leguminosae	54.8
44*	*Cassia grandis* L.f.	L	Leguminosae	92.1
45*	*Cassia nodosa* Buch,-Ham-ex Roxb.	B	Leguminosae	90.6
46*	*Casuarina equisetifolia* L.	L, Br	Casuarinaceae	95.1
47*	*Catalpa bignonioides* Walter	L, Fl	Bignoniaceae	55.4
48*	*Cedrela odorata* L.	B	Meliaceae	88.3
49*	*Cedrela toona* Roxb. ex Rottler & Willd.	S	Meliaceae	0
50**	*Cenchrus biflorus* Roxb.	H	Gramineae	11.8
51**	*Centaurea calcitrapa* L.	H	Asteraceae	28.6
52*	*Chorisia insignis Kunth*	Br	Bombacaceae	54.5
53*	*Chrysalidocarpus lutescens* H.Wendl.	L	Arecaceae	94.9
54*	*Cinnamomum zeylanicum* Breyne	Br	Lauraceae	78.8
55*	*Citharexylum quadrangulare* Moc. & Sessé ex D.Don	L	Verbenaceae	34.3
56*	*Citrus sinensis* (L.) Osbeck	L	Rutaceae	8
57**	*Cleome chrysantha* Decne.	H	Cleomaceae	18.5
58*	*Clerodendrum trichotomum* Thunb.	L, Br	Labiatae	58.2
59**	*Corchorus olitorius* L.	L	Tiliaceae	41.6
60*	*Cordia myxa* L.	L	Boraginaceae	49.6
61**	*Coronopus niloticus* Spreng.	W	Cruciferae	5
62*	*Cryptostegia grandiflora* R.Br.	L	Apocynaceae	19.8

63*	*Cycas revoluta* Thunb.	Br	Cycadaceae	94.3
64**	*Cynanchum acutum* L.	H	Asclepiadaceae	27.6
65**	*Cynara cornigera* Lindl.	H	Asteraceae	37.6
66*	Dalbergia sissoo *Roxb.*	L, Fr	Leguminosae	26.1
67*	*Dendrocalamus giganteus* Munro	Shoot system	Gramineae	24.1
68*	*Deutzia scabra* Siebold & Zucc.	L	Hydrangeaceae	51.3
69**	*Dichanthium annulatum* (Forssk.) Stapf	H	Gramineae	40
70*	*Diospyros kaki* Thunb.	L	Ebenaceae	72.3
71*	*Dovyalis caffra* (Hook.f. & Harv.) Warb.	Br	Flacourtiaceae	15.3
72**	*Echinops galalensis* Schweinf.	H	Asteraceae	37.2
73*	*Encephalartos villosus* Lem.	L	Zamiaceae	60.5
74*	*Enterolobium timbouva Mart.*	B	Leguminosae	92.9
75*	*Eriobotrya japonica* (Thunb.) Lindl.	L	Rosaceae	79.5
76**	*Eryngium creticum Lam.*	H	Umbelliferae	9.8
77*	*Eucalyptus citriodora Hook.*	Br	Myrtaceae	94.5
78*	*Eugenia jambos L.*	Br	Myrtaceae	94.6
79*	*Euonymus japonicus Thunb.*	L	Celastraceae	42.5
80*	*Ficus afzelii* G.Don	L	Moraceae	89
81*	*Ficus obliqua* G.Forst.	L	Moraceae	31.8
82*	*Ficus pyriformis* Hook. & Arn.	L	Moraceae	13.3
83*	*Ficus trijuja* L.	B	Moraceae	68.3
84*	*Flacourtia cataphracta* Roxb. ex Willd.	L	Flacourtiaceae	93.3
85*	*Flacourtia rukam* Zoll. & Moritzi	L	Flacourtiaceae	17.9
86**	*Foeniculum vulgare* Mill.	H	Umbelliferae	25.1
87*	*Gingko biloba* L	L	Ginkgoaceae	11.9
88*	*Gleditsia caspica* Desf.	Br	Leguminosae	56.8
89*	*Gmelina arborea* Roxb.	L	Verbenaceae	47.2
90**	*Gnaphalium luteoalbum* L.	W	Asteraceae	90.4
91*	*Grewia occidentalis* L.	L	Tiliaceae	94.7
92**	*Gypsophila capillaris* C.Chr.	H	Caryophyllaceae	18.8
93**	*Halocnemum strobilaceum* M.Bieb.	H	Chenopodiaceae	7.1
94*	*Harpullia cupanioides* Roxb.	Br	Sapindaceae	40.8
95*	*Harpullia pendula* Planch. ex F.Muell.	L	Sapindaceae	95.3
96**	*Helianthemum vesicarium* Boiss.	H, Fl	Cistaceae	93.8
97**	*Herniaria hemistemon J.Gay*	H	Caryophyllaceae	95.2
98**	*Hyoscyamus boveanus (Dunal) Asch. & Schweinf.*	H	Solanaceae	12
99*	*Hyphaene thebaica Mart.*	Fr	Arecaceae	93.1
100**	*Inula crithmoides L.*	H	Asteraceae	36.4
101**	*Ipomoea carnea Jacq.*	L	Convolvulaceae	38.4
102*	*Jacaranda acutifolia Humb. & Bonpl.*	L, Fl, very Small Br.	Bignoniaceae	81.8
103*	*Jasminum primulinum Hemsl. ex Baker*	L	Oleaceae	18.5
104*	*Khaya grandifoliola C.DC.*	Fl	Meliaceae	17
105*	*Khaya senegalensis A.Juss.*	L	Meliaceae	94.5
106**	*Kickxia aegyptiaca Nábělek*	H	Scrophulariaceae	29.4
107*	*Koelreuteria elegans* (Seem.) A.C.Sm.	L	Sapindaceae	95.1
108*	*Koelreuteria paniculata* Laxm.	L	Sapindaceae	95
109*	*Lagerstroemia indica* L.	L	Lythraceae	93.7
110*	*Lagerstroemia speciosa* (L.) Pers.	L	Lythraceae	94.5
111**	*Lathyrus annuus* L.	H	Leguminosae	27.7
112**	*Leontodon hispidulus Boiss.*	H	Asteraceae	21.3
113**	*Limonium meyeri* (Boiss.) kuntze	Shoot System	Plumbaginaceae	94.4
114**	*Limonium pruinosum* Kuntze	H	Plumbaginaceae	95
115*	*Livistona decipiens* Becc.	B	Arecaceae	71.5
116**	*Lobularia libyca* Meisn.	H	Cruciferae	46.1
117*	*Lonchocarpus speciosus* Bolus	B	Leguminosae	89.6
118*	*Lonicera japonica* Thunb.	L, B	Caprifoliaceae	40.3
119*	*Macadamia integrifolia* Maiden & Betche	L	Proteaceae	64
120*	*Magnolia grandiflora* L.	B	Magnoliaceae	82.6
121**	*Malva neglecta* Wallr.	H	Malvaceae	18.2
122**	*Malvaviscus arboreus Cav.*	Br	Malvaceae	4.8
123*	*Mangifera indica L.*	L	Anacardiaceae	95.2
124**	*Marrubium vulgare L*	L, B, Fl	Labiatae	54.2
125**	*Matricaria aurea (Loefl.) Sch. Bip.*	H, Fl	Asteraceae	30.5
126**	*Matthiola arabica Boiss.*	H	Brassicaceae	8.2
127**	*Medicago intertexta (L.) Mill.*	H, Fl	Leguminosae	12.4
128**	*Medicago polymorpha L.*	W	Leguminosae	5.9
129*	*Melia indica Brand.*	L, B	Meliaceae	37
130**	*Moricandia nitens E.Durand & Barratte*	H	Cruciferae	12.1
131*	*Moringa peregrina C.Chr.*	L, Br, Fr	Moringaceae	93.1
132*	*Morus rubra L.*	Br	Moraceae	32.8
133*	*Nephelium tomentosa F.Muell.*	L	Sapindaceae	94.8

134*	*Nerium oleander* L.	L	Apocynaceae	26.8
135**	*Neurada procumbens* L.	H	Neuradaceae	93.5
136**	*Nicotiana glauca* Graham	L, Fl	Solanaceae	73.9
137*	*Opuntia brasiliensis* (Willd.) Haw.	L	Cactaceae	2.1
138**	*Oryzopsis miliacea* (L.) Batt. & Trab.	H	Gramineae	17.3
139*	*Oscularia* Schwantes.	L, Br	Aizoaceae	94.3
140**	*Papaver rhoeas* L.	H	Papaveraceae	22
141*	*Passiflora edulis* Sims	L, Br, Fl	Passifloraceae	55.5
142*	*Paulownia tomentosa* (Thunb.) Steud.	L	Scrophulariaceae	59.9
143**	*Phlomis aurea* Decne.	H	Labitae	50.6
144*	*Phoenix dactylifera L.*	L	Arecaceae	94.9
145**	*Picris sprengeriana* Chaix ex Lapeyr.	H	Asteraceae	25.6
146*	*Pinus canariensis* C.Sm. ex DC.	B	Pinaceae	92.7
147*	*Pinus pinnae* L.	L	Pinaceae	77.6
148*	*Pistachia sp.*Salisb.	B	Anacardiaceae	91
149*	*Platanus orientalis L.*	L	Platanaceae	81
150*	*Platycladus orientalis* (L.) Franco	L, B	Cupressaceae	52.1
151*	*Plumbago capensis* Thunb.	L	Plumbaginaceae	54.3
152*	*Plumeria acutifolia Poir.*	L	Apocynaceae	10.2
153*	*Podocarpus gracilior Pilg.*	L	Podocarpaceae	20.2
154**	*Polygonum salicifolium Schur*	H	Polygonaceae	95
155**	*Polypogon viridis (Gouan) Breistr.*	W	Gramineae	17.3
156**	*Prosopis juliflora (Sw.) DC.*	H	Leguminosae	42.4
157*	*Punica granatum L.*	Br	Punicaceae	95.5
158*	*Pyracantha fortuneana (Maxim.) H.L.Li*	L	Rosaceae	93.6
159*	*Ravenala madagascariensis J.F.Gmel.*	L , B	Strelitziaceae	82.8
160**	*Reseda muricata C.Presl*	L, Br	Resedaceae	14.3
161*	*Rhus sp.*L.	L	Anacardiaceae	44.8
162*	*Robinia pseudoacacia* L.	L	Leguminosae	64.4
163*	*Ruprechtia salicifolia* L.	L	Polygonaceae	94.6
164**	*Salix mucronata* Thunb.	H	Salicaceae	59.1
165**	*Salix tetrasperma* Roxb.	L	Salicaceae	51.2
166*	*Saraca cauliflora* Baker	L	Leguminosae	94.7
167*	*Saraca indica* L.	L	Leguminosae	93.8
168*	*Schinopsis balansae* Engl.	B	Anacardiaceae	91.5
169**	*Schinus dependens* Ortega	Br	Anacardiaceae	94.2
170**	*Schinus Terebinthifolius* Raddi	L	Anacardiaceae	94.1
171**	*Scorpiurus muricatus* L.	H	Leguminosae	12.2
172**	*Scrophularia hypericifolia* Wydler	H	Scrophulariaceae	49.4
173*	*Senecio cineraria* DC.	L	Asteraceae	11.3
174*	*Senna surattensis* (Burm.f.) H.S.Irwin & Barneby	Br	Leguminosae	94
175*	*Sophora japonica* L.	L	Leguminosae	13.2
176**	*Sorghum halepense (L.) Pers.*	H	Graminae	14.4
177*	*Spathodea nilotica* Seem.	L, Br	Bignoniaceae	90.7
178**	*Sporobolus pungens* (Schreb.) Kunth B22	H	Gramineae	10.2
179*	*Sterculia foetida L.*	Br	Sterculiaceae	94
180*	*Sterculia lurida F.Muell. ex Benth.*	L, Br	Sterculiaceae	13.3
181**	*Suaeda vera Forssk. ex J.F.Gmel.*	H	Chenopodiaceae	90.1
182*	*Swietenia macrophylla King*	L	Meliaceae	93.1
183*	*Swietenia mahagoni (L.) Jacq.*	L	Meliaceae	94.4
184*	*Tabernaemontana coronaria Willd.*	L, Immune Fl	Apocynaceae	61.8
185*	*Tamarindus indica L.*	L, Br, Fr	Leguminosae	95.1
186*	*Tecoma radicans (L.) DC.*	L, Br	Bignoniaceae	93.1
187*	*Terminalia angustifolia Sauvalle*	L	Combretaceae	42.8
188*	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	B	Combretaceae	93.8
189**	*Teucrium leucocladum* Boiss.	H	Labiatae	81.9
190**	*Thymus capitatus* Hoffmanns. & Link	H	Labiatae	78.2
191**	*Trichodesma africanum* (L.) Lehm.	H	Boraginaceae	9.8
192**	*Triticum aestivum L.*	H	Graminae	9.7
193**	*Verbascum fruticulosum* post	H	Scrophulariaceae	28.9
194**	*Verbesina encelioides* Benth. & Hook.f. ex A.Gray	H	Asteraceae	6.5
195*	*Vitex agnus* castus L.	Br	Verbenaceae	77.5
196*	*Washingtonia filifera* (Linden ex André) H.Wendl.	S	Arecaceae	52
197**	*Xanthium pungens* Wallr.	L , Br	Asteraceae	61.8
198**	*Zilla spinosa* Prantl	Shrub	Brassicaceae	5.1
199**	*Ziziphus spina-christi* (L.) Willd.	W	Rhamnaceae	91.1
200**	*Zygophyllum coccineum* L.	H	Zygophyllaceae	2.1

B= bud, Br= branch, Fr= fruit, H= whole herb, L= leaf., * = cultivated, ** = wild

Table 2: EC_{50} (the concentration required to scavenge 50% of the DPPH•) of active plant extracts exhibiting more than 90% scavenging activity of DPPH•. The serial numbers given herein are similar to those given for the plant species in Table 1.

No.	Species	Part used	Family	EC_{50}
2**	*Acacia nilotica* (L.) Delile	Br, L, Fr	Leguminosae	2.9±2.3
3**	*Acacia saligna* H.L.Wendl.	H	Leguminosae	20.4±2.7
5*	*Acrocarpus fraxinifolius* Arn.	L	Leguminosae	7.9±1.7
20**	*Artemisia monosperma* Del.	H	Asteraceae	24.7±2.7
29*	*Brachychiton australis* (Schott & Endl.) Terrac.	L	Sterculiaceae	9.9±1.8
34*	*Caesalpinia ferrea* Mart.	Fr, S	Leguminosae	6.7±1.3
35*	*Caesalpinia pulcherrima* (L.) Sw.	L ,Fl	Leguminosae	11.5±1.8
38*	*Carissa carandas* L.	L, Br	Apocynaceae	12.5±2.1
44*	*Cassia grandis* L.f.	L	Leguminosae	17.2±1.7
45*	*Cassia nodosa* Buch,-Ham-ex Roxb.	B	Leguminosae	12.4±1.9
46*	*Casuarina equisetifolia* L.	L, Br	Casuarinaceae	11.5±1.7
53*	*Chrysalidocarpus lutescens* H.Wendl.	L	Arecaceae	8±1.4
63*	*Cycas revoluta* Thunb.	Br	Cycadaceae	18.2±2.7
74*	*Enterolobium timbouva Mart.*	B	Leguminosae	9.6±1.8
77*	*Eucalyptus citriodora* Hook.	Br	Myrtaceae	5.5±1.3
78*	*Eugenia jambos* L.	Br	Myrtaceae	12.2±1.7
84*	*Flacourtia cataphracta* Roxb. ex Willd.	L	Flacourtiaceae	11.1±1.6
90**	*Gnaphalium luteoalbum* L.	W	Asteraceae	23.8±2.8
91*	*Grewia occidentalis* L.	L	Tiliaceae	11.9±1.6
95*	*Harpullia pendula* Planch. ex F.Muell.	L	Sapindaceae	3.7±1.2
96**	*Helianthemum vesicarium* Boiss.	H, Fl	Cistaceae	11.1±1.9
97**	*Herniaria hemistemon J.Gay*	H	Caryophyllaceae	9.7±1.7
99*	*Hyphaene thebaica Mart.*	Fr	Arecaceae	8.8±2.1
105*	*Khaya senegalensis A.Juss.*	L	Meliaceae	20.9±3.3
107*	*Koelreuteria elegans (Seem.) A.C.Sm.*	L	Sapindaceae	5.5±1.7
108*	*Koelreuteria paniculata Laxm.*	L	Sapindaceae	6.8±1.4
109*	*Lagerstroemia indica* L.	L	Lythraceae	6.9±1.4
110*	*Lagerstroemia speciosa* (L.) Pers.	L	Lythraceae	6.8±1.3
113**	*Limonium meyeri* (Boiss.) kuntze	Shoot System	Plumbaginaceae	12.1±4.3
114**	*Limonium pruinosum* Kuntze	H	Plumbaginaceae	6.4±1.2
123*	*Mangifera indica L.*	L	Anacardiaceae	5.8±0.7
131*	*Moringa peregrina* C.Chr.	L, Br, Fr	Moringaceae	4.4±0.5
133*	*Nephelium tomentosa* F.Muell.	L	Sapindaceae	9.8±1.6
135**	*Neurada procumbens* L.	H	Neuradaceae	15.9±1.2
139*	*Oscularia* Schwantes.	L, Br	Aizoaceae	13.1±1.7
144*	*Phoenix dactylifera L.*	L	Arecaceae	10.1±1.6
146*	*Pinus canariensis* C.Sm. ex DC.	B	Pinaceae	3.1±0.3
148*	*Pistachia sp.*Salisb.	B	Anacardiaceae	4.7±2.2
154**	*Polygonum salicifolium* Schur	H	Polygonaceae	7±2.3
157*	*Punica granatum* L.	Br	Punicaceae	5.7±2.7
158*	*Pyracantha fortuneana* (Maxim.) H.L.Li	L	Rosaceae	13.4±1.4
163*	*Ruprechtia salicifolia* L.	L	Polygonaceae	10.2±1.6
166*	*Saraca cauliflora* Baker	L	Leguminosae	7.9±2.1
167*	*Saraca indica* L.	L	Leguminosae	9.1±1.9
168*	*Schinopsis balansae Engl.*	B	Anacardiaceae	4.9±1.6
169**	*Schinus dependens Ortega*	Br	Anacardiaceae	10.9±3.2
170**	*Schinus Terebinthifolius Raddi*	L	Anacardiaceae	11.3±1.7
174*	*Senna surattensis (Burm.f.) H.S.Irwin & Barneby*	Br	Leguminosae	12.8±1.6
177*	*Spathodea nilotica Seem.*	L, Br	Bignoniaceae	25.1±2.8
179*	*Sterculia foetida L.*	Br	Sterculiaceae	7.4±1.4
181**	*Suaeda vera Forssk. ex J.F.Gmel.*	H	Chenopodiaceae	21.9±2.6
182*	*Swietenia macrophylla King*	L	Meliaceae	8.7±2
183*	*Swietenia mahagoni (L.) Jacq.*	L	Meliaceae	10.4±3.4
185*	*Tamarindus indica* L.	L, Br, Fr	Leguminosae	6.1±0.7
186*	*Tecoma radicans* (L.) DC.	L, Br	Bignoniaceae	20.8±2.6
188*	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	B	Combretaceae	4.9±2.5
199**	*Ziziphus spina-christi* (L.) Willd.	W	Rhamnaceae	16.2±1.8
Positive control	Vitamin C			4.1±0.8

Discussion

Chemoprevention is a promising anticancer approach aiming for reducing the morbidity and mortality of cancer by delaying the process of carcinogenesis [12]. Chemoprevention is recognized as an important approach to control malignancy by suitable chemo-preventive agents [12]. Antioxidants are considered as possible protective agents that reduce the body's oxidative damage resulting from ROS. Consequently, antioxidants can reduce the risk of some human diseases as well as lipid peroxidation of cell membrane [13]. Exogenous antioxidants, usually found in foods, can delay or inhibit the initiation or propagation of oxidative chain reactions [14]. Therefore, there is a growing interest in exploring new substances of plant origin that exhibit antioxidant properties. These substances are supplied to human and animal organisms as food components or as specific pharmaceuticals. Synthetic antioxidants have been used in preservation of foods, for example butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and tert-butylated hydroxyquinone (TBHQ). But, due to the safety problems related to synthetic antioxidants, an increasing interest in the development of safe and inexpensive supplements of natural origin is continuously required. Many natural antioxidants have been found in various kinds of plants, such as cereals, vegetables, fruits and herbs, in which ascorbic acid, tocopherol, carotenoids, flavonoids, and phenol compounds represent abundant sources of antioxidants [15]. In this connection, screening of plant samples through simple, sensitive, rapid assays are applicably preferable as having high throughputs and reproducible results. In this connection, the DPPH• method is very convenient and does not require special instrumentations [16]. In this study, in vitro antioxidant potentials of the methanolic extracts of the two hundred plant species under investigation showed that 33.5% of these extracts exhibited remarkable antioxidant activity (90≥ %), 21.5% had moderate antioxidant activity (<90-40%), whereas 44% had low antioxidant activity (<40%) and 1% did not show antioxidant activity. On the basis of the calculated EC_{50} values of the 57 methanolic extracts with promising activities, it was concluded that highest free radical scavenging potentials were shown by the methanolic extracts of *Acacia nilotica* (branches, leaves, fruits), *Pinus canariensis* (bark), *Harpullia pendula* (leaves) and *Moringa peregrine* (leaves, branches, fruits) (Table 2). However, further work is running on to identify the compound(s) responsible for free radical scavenging activity in each of these extracts.

Note: Our Co-Author Prof. Dr. Gamila M. Wassel†**2** was deceased in *25 Nov, 2012.*
Our Co- Author Bassem El-menshawi †**2** was deceased in Nov, 2013.

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