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# Antioxidant potential of some common weeds of agriculture fields of Punjab plains

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**Abstract**
**Aim:** The aim of the present study was to analyse the phenols, flavonoids content and antioxidant activity of common weeds growing around agriculture fields of Punjab plains.
**Methods:** Eight weed species have been analysed for the secondary metabolites content and antioxidant activity in the different plant parts. Methanolic extracts have been prepared by the maceration method. Total phenolic, flavonoid content and DPPH radical scavenging activity, total antioxidant capacity have been performed using UV-Vis spectrophotometer.
**Results and conclusion:** Maximum content of phenolics were reported in *Ageratum conyzoides* (flower, 9.51±0.00 mg CA/g DW), *Launaea procumbens* (stem, 7.94±0.01 mg CA/g DW), *Ranunculus muricatus* (flower, 7.15±0.07 mg CA/g DW) and *Sonchus asper* (flower, 8.12±0.34 mg CA/g DW). The flavonoid content was measured high in case of *Silybum marianum* (stem, 4.83±0.00 mg Q/g DW), *Ranunculus muricatus* (leaves, 2.96±0.01 mg Q/g DW), *Solanum nigrum* (leaves, 2.45±0.03 mg Q/g DW) and *Ageratum conyzoides* (leaves, 2.15±0.01 mg Q/g DW). All the species of weeds having high phenol and flavonoid content, also have strong antioxidant potential in terms of DPPH radical scavenging activity and total antioxidant capacity. Our results demonstrate that, these weeds could be a potential source of natural antioxidants in future for the pharmaceutical industry.

**Keywords:** Antioxidant activity, Weeds, *Ranunculus, Ageratum, Launaea, Sonchus*

## Introduction
Weeds are the unwanted plants growing in the areas such as agricultural lands, abandoned lands, gardens, road sides etc. and reproduces devastatingly outside its natural habitat. Weeds generally have negative effects as they compete with the main crops for light, nutrition, growing area and reduce crop growth and productivity [1]. They also have some beneficial effects as many of the weeds were also reported to be used in the traditional medicine systems all over the world [2].There were numerous reports for biological activities of the weeds. To mention some of the examples are *Achyranthes aspera* (anti-rheumatism and cure skin diseases), *Adhatoda vasica* (anti-inflammatory activity), *Ageratum conyzoides* (antioxidant and anticancer activity), *Amaranthus spinosus* (antimicrobial), *Calotropis procera* (anticancer activity), *Eichornia crassipes* (antioxidant activity), *Lantana camara* (antipyretic and antispasmodic), *Mimosa pudica* (antiproliferative), *Parthenium hysterophorus* (neurological disorders), *Sida cordifolia* (cure oral mucosal inflammation and asthmatic bronchitis), *Solanum nigrum* (anticonvulsant activity), etc. [3-6].
According to WHO, 70–80% of the world's populations depend upon herbal sources for their prime healthcare [7]. The medicinal weeds can be an alternate source for naturally occurring antioxidants especially phenolic and flavonoids contents. Many weeds were used in human diets, which reduce oxidative damage to cell membrane lipid, protein and nucleic acid due to these antioxidants as they have strong quenching property for free radicals [8, 9]. Thus, they can provide protection against cardiovascular, immune/autoimmune, neurological disorders, etc. [10, 11].
In the present study, we have analysed the total phenols, flavonoids and antioxidant activity of different plant parts of common weeds, growing in the Ferozepur district of Punjab.

## Materials and Methods
### Collection of plant material
The weeds species have been collected in the month of October-November, 2017 and February-March, 2018 from agricultural fields of Ferozepur district of Punjab. The weed species are *Ageratumconyzoides*, *Datura metel*, *Launaea procumbens*, *Ranunculus muricatus*, *Ricinus communis*, *Silybum marianum*, *Solanum nigrum* and *Sonchus asper*

**Chemical Reagents**

HPLC grade methanol was procured from the Merck, India. Aluminium chloride, ammonium molybdate, chlorogenic acid, 2, 2-diphenyl-2-picrylhydrazyl hydrate, Folin-Ciocalteu reagent, quercetin, sodium nitrite, sodium phosphate**,** sodium carbonate, sodium hydroxide and sulphuric acid were purchased from Hi-Media.

**Preparation of plant extracts**

The collected plants were washed, air-dried and grinded with home blender to make fine powder. Two grams of fine powder of different plant parts were soaked with 100ml of methanol, followed by intermediate shaking for 48 hours. The solution was filtered with Whatman's filter paper. The extracts so obtained were stored at 4 °C until further use.

**Determination of Total Phenolic and Flavonoid Content**

Total phenolic content (TPC) of methanol extracts of different plant parts was determined by spectrophotometer using Folin-Ciocalteu reagent. Total flavonoid content (TFC) was determined using Aluminum chloride method [12]. Total phenolic and flavonoid content was expressed as mg/g chlorogenic acid (CA) equivalents and mg/g quercetin (Q) equivalents.

***In vitro* Antioxidant activity**

DPPH radical scavenging activity was calculated by standard method and Total antioxidant capacity was determined using the Phosphomolybdenum assay [12].

**Results**

**Total phenol and flavonoid content**

Total phenol content in the different plant parts of the weeds were studied and given in Table 1. The content in *Ageratum conyzoides* was ranged from 3.503±0.107 to 9.514±0.003 mg CA/g DW, *Launaea procumbens* (2.528±0.052 to 7.942±0.013 mg CA/g DW), *Silybium marianum* (2.386±0.138 to 4.819±0.207 mg CA/g DW), *Datura metel* (1.974±0.048 to 4.454±0.702 mg CA/g DW), *Ranunculus muricatus* (1.550±0.053 to 7.154±0.079 mg CA/g DW), *Ricinus communis* (2.678±0.204 to 6.800±0.259 mg CA/g DW), *Solanum nigrum* (1.646±0.075 to 6.517±0.222) and *Sonchus asper* (1.726±0.053 to 8.124±0.346 mg CA/g DW). There is a lot of variation in the accumulation in the different plant parts of the weeds. Highest amount of phenol was recorded in the flower parts of *A. conyzoides*, *S. asper* and *R. muricatus*. The leaves and flower parts contain more phenols as compared with the other plant parts (Table 1).

**Table 1:** Total phenol content of different plant parts of weeds (mg chlorogenic acid equivalents per gram dry weight).

| TPC | Leaves | Stem | Flower | Root | Fruit |
|---|---|---|---|---|---|
| *Ageratum conyzoides* | 7.13±0.06 | 3.50±0.10 | 9.51±0.00 | N.S. | N.S. |
| *Launaea procumbens* | 2.52±0.05 | 7.94±0.01 | N.S. | 4.37±0.01 | N.S. |
| *Silybum marianum* | 2.38±0.13 | 4.61±0.11 | N.S. | 4.81±0.20 | N.S. |
| *Datura metel* | 4.17±0.05 | 1.97±0.04 | N.S. | 4.45±0.70 | N.S. |
| *Ranunculus muricatus* | 5.78±0.11 | 2.42±0.18 | 7.15±0.07 | 1.55±0.05 | N.S. |
| *Ricinus communis* | 6.80±0.25 | 2.67±0.20 | N.S. | N.S. | 4.081±0.01 |
| *Solanum nigrum* | 6.57±0.22 | 3.08±0.04 | 6.35±0.28 | 1.64±0.07 | 4.183±0.08 |
| *Sonchus asper* | 4.41±0.16 | 3.22±0.09 | 8.12±0.34 | 1.72±0.05 | N.S. |

Values are Mean ± S.E. of three individual experiments. N.S.= Not studied

The flavonoid content in the different plant parts was also studied and given in Table 2. Among the different plant parts, maximum quantity of total flavonoids was found in leaves extract of *R. muricatus* (2.96±0.01 mg Q/gDW), *S. nigrum* (2.45±0.03 mg Q/gDW), *A. conyzoides* (2.15±0.01 mg Q/gDW), *D. metel* (1.65±0.05 mg Q/gDW), *L. procumbens* (1.32±0.05 mg Q/gDW), and stem extract of *S. marianum* (4.83±0.00 mg Q/gDW), *R. communis* (1.62±0.04 mg Q/gDW). In case of *S. asper*, flower extracts (1.66±0.06 mg Q/gDW) contain maximum quantity of flavonoids.

**Table 2:** Total flavonoid content of different plant parts of weeds (mg quercetin equivalents per gram dry weight).

| TFC | Leaves | Stem | Flower | Root | Fruit |
|---|---|---|---|---|---|
| *Ageratum conyzoides* | 2.15±0.01 | 1.06±0.00 | 1.18±0.05 | N.S. | N.S. |
| *Launaea procumbens* | 1.32±0.05 | 1.10±0.01 | N.S. | 0.40±0.05 | N.S. |
| *Silybum marianum* | 1.16±0.02 | 4.83±0.00 | N.S. | 0.95±0.00 | N.S. |
| *Datura metel* | 1.65±0.05 | 0.40±0.02 | N.S. | 1.09±0.03 | N.S. |
| *Ranunculus muricatus* | 2.96±0.01 | 1.52±0.07 | 2.20±0.05 | 0.83±0.01 | N.S. |
| *Ricinus communis* | 1.22±0.12 | 1.62±0.04 | N.S. | N.S. | 1.23±0.10 |
| *Solanum nigrum* | 2.45±0.03 | 1.54±0.04 | 1.26±0.09 | 1.26±0.00 | 1.13±0.07 |
| *Sonchus asper* | 0.95±0.00 | 1.56±0.10 | 1.66±0.06 | 0.92±0.04 | N.S. |

Values are Mean ± S.E. of three individual experiments. N.S.= Not studied

**Antioxidant activity**

**DPPH radical scavenging activity**

This is a simple method for calculating antioxidant activity of plant extracts as they have ability to reduce the stable DPPH radical to the yellow-coloured diphenyl picryl hydrazicine and can be measured by absorbance at 517 nm. The $IC_{50}$ values of the different weed extracts are given in Table 3. The extracts having lower the $IC_{50}$ value, have higher antioxidant activity. Among different weeds studied in the present work, highest radical scavenging activity was found in the leaves extract of *S. marianum*, *L. procumbens* and root extracts of *S. nigrum*. Other weeds have also strong antioxidant activity. Majorly the leaves and flower extracts have highest antioxidant potential.

**Table 3:** DPPH radical scavenging activity of different plant parts of weeds (µg/ml).

| DPPH radical scavenging activity | Leaves | Stem | Flower | Root | Fruit |
|---|---|---|---|---|---|
| *Ageratum conyzoides* | 244.8±2.03 | 161.9±5.01 | 134.4±0.13 | N.S. | N.S. |
| *Launaea procumbens* | 119.1±0.01 | 506.6±6.60 | N.S. | 433.0±27.06 | N.S. |
| *Silybum marianum* | 117.0±0.12 | 122.1±3.44 | N.S. | 134.3±1.96 | N.S. |
| *Datura metel* | 249.2±3.09 | 194.1±3.62 | N.S. | 161.1±1.67 | N.S. |
| *Ranunculus muricatus* | 139.5±1.44 | 522.0±18.53 | 133.5±0.63 | 493.9±15.4 | N.S. |
| *Ricinus communis* | 130.3±0.08 | 180.8±4.67 | N.S. | N.S. | 127.4±1.06 |
| *Solanum nigrum* | 130.2±0.53 | 142.9±3.26 | 143.1±0.90 | 126.4±0.06 | 215.3±64.5 |
| *Sonchus asper* | 151.8±1.53 | 338.2±4.04 | 130.6±0.38 | 299.0±9.63 | N.S. |

Values are Mean ± S.E. of three individual experiments. N.S.= Not studied

**Total antioxidant capacity**

Total antioxidant capacity of different plant parts of weeds has been calculated and shown in Table 4. Among all weeds studied, the maximum antioxidant capacity was found in the root extracts of *S. nigrum* and *D. metel*. Overall, aerial parts of *R. muricatus* showed maximum antioxidant capacity as compared to the other weed species (Table 4).

**Table 4:** Total antioxidant capacity of different plant parts of weeds (mg Ascorbic acid equivalents per gram dry weight).

| TAC | Leaves | Stem | Flower | Root | Fruit |
|---|---|---|---|---|---|
| *Ageratum conyzoides* | 5.65±0.43 | 3.39±0.11 | 5.73±0.07 | N.S. | N.S. |
| *Launaea procumbens* | 3.01±0.01 | 2.63±0.12 | N.S. | 3.21±0.26 | N.S. |
| *Silybium marianum* | 4.76±0.06 | 3.95±0.01 | N.S. | 2.81±0.16 | N.S. |
| *Datura metel* | 6.44±1.66 | 5.56±0.31 | N.S. | 11.21±1.37 | N.S. |
| *Ranunculus muricatus* | 6.30±0.19 | 5.05±0.03 | 6.38±0.43 | 3.51±0.12 | N.S. |
| *Ricinus communis* | 5.12±0.01 | 5.26±0.18 | N.S. | N.S. | 6.23±0.23 |
| *Solanum nigrum* | 3.65±0.18 | 2.77±0.02 | 9.03±0.69 | 9.10±0.43 | 4.33±0.36 |
| *Sonchus asper* | 3.33±0.14 | 3.97±0.04 | 6.77±0.31 | 1.38±0.00 | N.S. |

Values are Mean ± S.E. of three individual experiments. N.S.= Not studied

## Discussion

The phenols and flavonoids play important role in the antioxidant activity of any plant extracts [13, 14]. In the present study we have compared the total phenol and flavonoid content of different plant parts of the weeds. Leaves and flower extracts contains maximum amount of total phenol and flavonoid content. Differences in metabolite accumulation in different plant parts have been detected many workers [15, 16]. The tissue-specific accumulation and variation may be due to adaptive advantages in relation to biotic or abiotic stress and environmental conditions [16]. These phenols and flavonoids may help weeds to establish themselves in the harsh conditions, grow exhaustively and might have adversely affect the growth of another crops. In addition to this, they also contribute to pest and disease resistance [17-21]. Phenols and other related compounds have beneficial health benefits rendering them for applied attention in pharmacology [22]. Most of the weed species studied in the present work have significant biological activities, this can be attributed to their polyphenolic content and other secondary metabolites. Dores *et al*. demonstrated the higher antioxidant activity of flower extracts in *A. conyzoides* as compared to other plant parts. Further they also reported higher content of phenols in the leaves as in line with the present work [23]. The content of phenols and flavonoids in *L. procumbens* and *S. marianum* is low as compared with other weed species, but they exhibit highest antioxidant potential. Other compounds not studied in the plant extracts may be adding synergetic effects to the antioxidant potential [4, 24]. This also suggests for different types of biological activities reported by many workers for the two species [25-28]. We have compared the all plant parts (leaf, stem, flowers, roots and fruits) in case of *S. nigrum*. The root extracts of two Solanaceae species (*D. metel* and *S. nigrum*) have high antioxidant activity as compared to other plant parts. Recently, Oplos *et al*. reported nematocidal activity in these two weed species [29]. Among all plant parts, flower extracts of *S. asper* have highest polyphenol content and responsible for high antioxidant activity [30]. The total phenol, flavonoid content and antioxidant activity of *Ranunculus muricatus* from different plant parts (leaves, stem, flowers and roots) have been reported for first time in the present work Other species of the genera were reported for various biological activities [31]. The flower and leaves extracts have maximum phenol, flavonoid content, DPPH radical scavenging activity and total antioxidant capacity. Aslam *et al*. 2014 studied 22 species of weeds growing in the wheat fields of Lahore, and selected this species for phytochemical analysis as due to easy availability [32].

## Conclusion

The present work has demonstrated that the weeds can be used as natural source of antioxidants and specific parts of the plant can be used for harvesting of natural active compounds.

## Conflicts of Interest

The authors declare that there are no conflicts of interest.

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