



RESEARCH ARTICLE

Quantitative determination of secondary compounds in populations of *Eryngium foetidum* L. from India

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Abstract

Eryngium foetidum L. belongs to the family Apiaceae is known as, cilantro or spiny coriander. It is an aromatic herb containing 0.1-0.95% of essential oil. The herb is used as a substitute to coriander and contains iron, carotene, riboflavin, calcium, vitamins and a peculiar saponin. It is widely used as food flavoring and seasoning herb for variety of dishes. The present study aims at quantitative analysis of total phenols, flavonoids, tannin and vitamin C content present in different ecotypes of *E. foetidum* collected from Andaman, Darjeeling and Karnataka. The investigations showed that a significant variation in secondary compounds from the three different regions collected. The phenolic content was high in Darjeeling sample whereas, Andaman sample showed high amount of flavonoids and tannins. The sample from Karnataka was rich in vitamin C content. The study shows that variation in ecotypic condition has lead to the difference in percentage of secondary compound synthesis.

Keywords: *E. foetidum*, total phenols, flavonoids, tannin, vitamin C

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Introduction

Eryngium foetidum L. is an herb extensively used as a medicinal and aromatic plant in most of the tropical region. The herb is originated from the Caribbean and distributed in parts of Asia and Africa. *E. foetidum* is rare, endemic in India and is localized in small pockets of Tamil Nadu, Kerala, Karnataka, Assam, Andaman and Nicobar Islands (Chandrika et al., 2011; Chandrika et al., 2013). The plant is called as wild coriander because of its aroma similar to that of normal coriander (Chandrika et al., 2011). It is indispensable in varied range of culinary preparations like salads, soups, sauces, noodles, and ceviche. The essential oils are obtained from the plant having a high value in the international trade for their application in perfumery and pharmaceutical industries (Ignacimuthu et

al., 2004). In ethnomedicine the plant is used to treat burns, ear ache, fevers, hypertension, constipation, seizures, asthma, stomach ache, worms, infertility complications, snake bites, arthritis, diarrhea and malaria (Mohammad Amin Shavandi et al., 2012). The most important bioactive constituents of herb are phenols, flavonoids, tannin compounds are referred as polyphenols. Active phenolic compounds isolated from higher plants are flavonoids and phenolic acid (Daniel Modniki and Maciej Balcerek, 2009). These polyphenolic compounds have shown a wide range of biological activities such as anti-inflammatory, hepatoprotective, antioxidant, antithrombotic, anticarcinogenic, free radical scavenging, antimutagenic, antimicrobial properties etc. (Wong, 1976; Min et al., 2008; Daniel Modniki and Maciej Balcerek, 2009).

Vitamins are micronutrients, required in small quantities for human nutrition but play a vital role in the metabolism. Vitamin C is a water soluble vitamin acts as a coenzyme for large number of metabolic activities in the living organisms and also possesses antioxidant property (Amina Abd EMI and Hamid ALY, 2010).

Earlier studies suggested that there is a variation in the low dose treatment of gamma irradiation to *E. foetidum* plants in their phenolic and water soluble vitamins contents (Amina Abd EMI and Hamid ALY, 2010). By this background, we collected *E. foetidum* from three different places in India like Karnataka, Andaman and North Eastern region (Darjeeling) for the variation studies. There is no literature found on quantification of phenol, flavonoids, tannins and vitamin C content in this herb record of different populations of India. Hence, the present study has been undertaken to quantitative determination of total phenol, flavonoid, tannin and vitamin C content using methanol extract of *Eryngium foetidum* L. leaves of three populations.

Materials and Methods

Collection of Eryngium foetidum plants

The populations of *E. foetidum* were collected from 3 ecological locations in Karnataka (12° 96'N and 75° 78' E), Andaman and Nicobar islands (16° to 14° N and 92° to 94° E) and Darjeeling (27° 01' 59'' N and 88° 16' E). These plant materials were used further for the following analysis.

Preparation of plant extract

2 g of leaves is dried to a fine powder (RT) was used for extraction (20 ml methanol) of secondary metabolites. The extract is further used for the analysis of total phenols, flavonoids and tannin contents.

Determination of total phenolic content

The phenolic content was determined using Folin-ciocalteu method (Singleton and Rossi, 1965; Daniel Modniki, Maciej Balcerak, 2009; Amina Abd El and Hamid, 2010) and the absorbance is measured at 760 nm. Phenolic contents of the samples are calculated on the basis of standard curve of pyrogallol. The results were expressed as mg/g of pyrogallol equivalents of dry weight of the extract.

Determination of total flavonoid content

The total flavonoid content was determined with Aluminum chloride colorimetric method (Shaghghi et al., 2009; Amina Abd El-Hamid, 2010; Shivakumar et al., 2012; Pawan Kumar Verma et al., 2012) and the absorbance was measured at 415 nm. The results were expressed as mg/g of quercetin equivalents of dry weight of the extract.

Determination of total tannin content

The tannin content was determined by Folin-ciocalteu method (Tamilselvi et al., 2012) and the absorbance was measured at 725 nm. The results were expressed as mg/g of gallic acid equivalents of dry weight of the extract.

Preparation of plant extract for vitamin C: Extraction

1 g of fresh leaves samples were mechanically grounded using a pestle and mortar having 25 ml of 4% oxalic acid solution. Homogenate was filtered and centrifuged and finally liquid was collected. 10 ml of an aliquot was transferred to a conical flask by adding bromine water drop wise with constant mixing. Ascorbic acid contains enolic hydrogen atoms are removed by the addition of bromine water. The extract turns to orange yellow color due to excess of bromine, so it has to be

expelled by blowing air. The volume of mixture was made up to (25 or 50 ml) with 4% oxalic acid solution. Similarly, standard ascorbic acid solution was prepared into dehydro form bromination (Sadashivam and Manickam, 1997).

Determination of total Vitamin C content

The total vitamin C content was colorimetrically determined (Sadashivam and Manickam, 1997) and the absorbance was determined at 540 nm by using ascorbic acid as a reference standard. The results were expressed as mg/g of ascorbic acid of fresh weight of plant extract.

Statistical analysis

The tests were conducted (n=10) and results were expressed as mean \pm standard error. Statistical analysis were done by ANOVA followed by Tukey HSD test with $p=0.05$ as a limit of significance.

Results

Eryngium foetidum was tested for biosynthesis of different secondary compounds (phenolic compounds, flavonoids, tannins) and vitamin C content were shown in Tables 1 and 2. Total phenolic content was significantly high in Darjeeling population (41.61 ± 0.29059) followed by Andaman (24.953 ± 0.33466) and least value is Karnataka population (18.099 ± 0.23195) of dried plant extract. Likewise the total flavonoid content was significantly high in Andaman (34.35 ± 0.19004), followed by Darjeeling (15.765 ± 0.18223) and least value was Karnataka (12.95 ± 0.22044) of dried plant extract. Similarly total tannin content was significantly high in Andaman population (34.35 ± 0.19004) followed by Darjeeling (15.765 ± 0.18233) and least value was Karnataka population (12.957 ± 0.22044) of dried plant extract. Finally total vitamin C content was significantly high in Karnataka population (129.09 ± 0.2460) followed by Andaman

(86.314 ± 0.2160) and least value is Darjeeling (69.066 ± 0.2700) of fresh leaves extract.

Table 1. Total phenolic, flavonoid and tannin content of methanolic extract

Ecotypes	Phenols mg Pyrogallol/g	Flavonoids mg QE/g	Tannins mg GAE/g
Andaman	24.953 ± 0.33	34.358 ± 0.19	45.026 ± 0.23
Darjeeling	41.61 ± 0.29	15.765 ± 0.18	42.333 ± 0.22
Karnataka	18.099 ± 0.23	12.957 ± 0.22	29.55 ± 0.21

Mean \pm standard error values of different samples

for their phenols, flavonoids and tannin content are shown.

$P=0.05\%$ (Tukey HSD) level of significance

Table 2. Total vitamin C content of plant extract

Ecotypes	Vitamin C mg Ascorbic acid/g
Andaman	86.31 ± 0.21
Darjeeling	69.07 ± 0.27
Karnataka	129.09 ± 0.25

Mean \pm standard error values of different samples for their vitamin C content are shown. $P=0.05\%$ (Tukey HSD) level of significance

Discussion

E. foetidum being considered as medicinal herb (Mohammad Amin Shavandi et al., 2012) posses rich sources of antioxidants mainly polyphenols like phenols, flavonoids, tannins (Daniel Modniki, Maciej Balcerek, 2009) along with vitamin C. The present population studies revels that there is a much variation in their secondary compounds and vitamin C contents, Darjeeling ecotype shows a highest phenol content than other two populations. Flavonoid and tannin contents were high in Andaman region samples. Vitamin C content was found to be high in

Karnataka sample. This suggested that due to variation in geographical locations showing different soil contents, atmospheric strategies and physical components of nature the secondary compounds and vitamin C production in the herb also shows variation.

Conclusion

In the present study, the variation in the polyphenols and vitamin C content in *E. foetidum* of different ecotypes from India were determined. This finding helps us to know the importance of secondary compounds and their variation in different populations. Due to its medicinal importance of the herb poses a high value on the Industrial field, further studies are needed for the large scale production of the plants through *in vitro* culture methods.

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