(ISSN: 0973-7049(P))

The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 20(3): S.I (3), 51-59, 2025 www.thebioscan.com

Comparative Phytochemical Analysis of Leaf and Root Extracts of *Codiaeum variegatum* (L.) Rumph. ex A. Juss. and *Euphorbia tortilis* Rottl. Ex Ainslie from Kanyakumari District, Tamil Nadu

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DOI: https://doi.org/10.63001/tbs.2026.v21.i03.S.I(3).pp51-59

KEYWORDS

Codiaeum variegatum, Euphorbia tortilis, phytochemical analysis, leaf and root extracts, methanol, bioactive compounds

Article Info

Received:13.05.2026
Accepted:20.06.2026
Published:07-07-2026

Abstract

Codiaeum variegatum and *Euphorbia tortilis* belongs to the family Euphorbiaceae. *C. variegatum,* commonly known as Croton is widely cultivated for its ornamental and medicinal values. The plant has been traditionally used to treat various ailments, including skin diseases, wounds and fever. *E. tortlis,* commonly known as Tortilis spurge is native to India and Sri Lanka. Traditionally, it has been used in folk medicine to treat various ailments including skin diseases, fever and respiratory problems. In this study, the phytochemical composition of the leaf and root extracts of the samples were evaluated using four different solvent extracts: aqueous, methanol, ethanol, petroleum ether. The results revealed that the methanol extract of the roots of both the samples exhibited a higher diversity of phytochemical compounds compared to the leaves of the plants. The study highlights the potential of *C. variegatum* and *E. tortilis* as a rich source of bioactive compounds with potential medicinal applications.

INTRODUCTION

Natural products, particularly medicinal plants, have played an important role in drug discovery and development of therapeutic compounds. More than 35,000 plant species have been used in various parts of the world for therapeutic

purposes (AL-Faifi *et al*., 2017). Traditional medical practitioners around the world frequently recommend plant-based treatments against infectious diseases (Komakech *et al*., 2017). The phytochemicals present in the plant extracts target the biochemical pathway, making herbal medicine or phytomedicine safer than synthetic pharmaceuticals (Zaidan *et al*., 2005). The plant species *Codiaeum variegatum* and *Euphorbia tortilis* belongs to the family Euphorbiaceae. *Codiaeum variegatum* is commonly known as croton and the plant is native to tropical Asia and has been naturalized in many parts of the world including India. *Codiaeum* is the second largest genera of the family Euphorbiaceae which has about 7000 species (Taylor, 1938). In addition to its aesthetic values, it has therapeutic uses. Gastric ulcers can be treated with root decoction. Crushed leaves are used to cure diarrhoea, have antimicrobial and antibacterial properties (Moundipa *et al*., 2005). Common uses for croton species include the treatment of intestinal worms, fever, malaria, diabetes (Doria *et al*., 2010). Croton leaf extracts were reported to have a variety of therapeutic benefits, such as sedative, purgative, antiameobic and anticancer effect (Deshmukh & Borle 1975; Kupchan *et al*., 1976). *Euphorbia tortilis* is commonly known as spiral spurge, which is indigenous to Sri Lanka and Peninsular India. Euphorbia is one of the sixth largest genus of flowering plants (Ali & Nasir 1986). *E. tortilis* has spirally twisted stem, three angled with paired spines. The stem is fleshy and it performs photosynthesis. Leaves are used to treat burns, diarrhoea, diabetes, and stomach issues. Root is used to cure paralysis, snake bite, Infertility in women and stomach problems. This study aimed to compare the phytochemical constituents of leaf and root extracts of *C. variegatum and E. tortilis* from Kanyakumari District.

***Codiaeum variegatum* (L.) Rumph. ex A. Juss**

***Euphorbia tortilis* Rottl. ex Ainslie**

Collection of plant materials and authentication

The plant materials were collected from Poottety, Kanyakumari District. Poottety is a small village in Killiyoor block and comes under Nattalam Panchayath. The soil type of the area is mainly red soil. The plant specimen were identified and authenticated by Botanical Survey of India, Coimbatore with accession no: 317 and 318. Fresh plant specimen of the experimental samples were thoroughly washed with running tap water and then with sterile water. Then the specimens were shade dried for about 14 days and powdered using mechanical device and stored for further analysis.

Preparation of plant extracts (Harborne, 1998)

The soxhlet extraction method was used to extract 7g of powdered plant material using 180 ml of four different solvents namely aqueous, methanol, ethanol and petroleum ether. The process of extraction continues for 24 hours or till the solvent in siphon tube of an extractor becomes colourless. Then the extract was concentrated by evaporating the solvent using Rotary Evaporator at 40 to 60° C for 30 minutes till all the solvents gets evaporated separately, finally the extracts becomes in semisolid state. The dried extract was stored in refrigerator at 4° C.

Phytochemical analysis

Test for Carbohydrates (Brain & amp; Turner, 1975)

Benedict's test

To 2 ml of test sample about 2ml of Benedict's reagent is added. The mixture is heated on a boiling water bath for 2 minutes. Formation of red brick precipitate indicates the presence of carbohydrate.

Test for Protein (Ansari, 2006)

Biuret test

To 3 ml of test sample, few drops of 4% naOH and 1% $CuSO_4$ solution were added. The sample tubes were observed for violet or pink color formation.

Test for Aminoacid (Evans 1996)

Ninhydrin test: To 2 ml of the test sample, 2 drops of freshly prepared 0.2% Ninhydrin reagent was added and heated. The appearance of pink or purple colour indicates that the presence of proteins, peptides or aminoacids.

Test for Alkaloids (Ansari, 2006)

Mayer's Test: 1ml of extract was mixed with 2ml of 1% HCl and heated gently. To this add 2-3 ml of Mayer's reagent. Formation of yellow precipitate shows the presence of alkaloids.

Test for Flavonoids (Harborne, 1984)

Aluminium Chloride test: To few drops of Conc. HCl, 2ml of Crude extract was mixed, then add a pinch of Magnesium turning and again add few drops of HCl and add few drops of 10% NaOH. Pink color formation which indicated the presence of flavonoids.

Test for Glycosides (Ansari, 2006)

Keller-Killiani Test: To 2 ml of test sample, 2 ml glacial acetic acid, one drop 5% $FeCl_3$ and conc. H_2SO_4 were added. If Reddish brown colour appeared at junction of two liquid layers and upper layer turns bluish green indicates the presence of glycosides.

Test for Steroids (IP, 1996)

Salkowski Test: To 2 ml of extract, 2 ml of chloroform and 2 ml of conc. H_2SO_4 were added. The solution was shaken well. As a result chloroform layer turned red and acid layer shows greenish yellow fluorescence indicates the presence of steroids.

Test for Saponin (Ansari, 2006)

Foam Test: The 1ml of extract was shaken vigorously with 1ml of distilled water, persistent foam formation indicates the presence of Saponin.

Test for Phenol (Mukherjee, 2002)

Ferric chloride Test: The 1ml of extract, it was diluted to 5 ml of distilled water. Then few drop of neutral 5% ferric chloride solution was added. A dark green colour indicates the presence of phenolic compounds.

Test for Tannins (Mukherjee, 2002)

Lead Acetate Test: On addition of lead acetate solution to the 1ml of extract, if white precipitate appeared, it indicates the presence of Tannins.

Test for Triterpenoids (Horbone, 1984)

To 2 ml of test sample, 2 ml chloroform was added with few drops of conc. Sulphuric acid at the side of the test tube. An interface with a reddish brown colour formation occur, if terpenoids constituent is present.

Test for Anthraquinones (Evans, 1996)

Borntrager Test: About 2ml of the extract was boiled with 10% HCl for few minutes in water bath. It was then filtered and allowed to cool. Equal volume of $CHCl_3$ was added to the filtrate. Few drops of 10% NH_3 were added to the mixture and heated. Formation of pink colour indicates the presence of anthraquinones.

Test for Phlobatannin (Egwaikhide *et al*., 2007).

To 2ml of the test sample, distilled water is added and filtered. To this filtrate few drops of 2%HCl is added and boiled. Red precipitate indicates the presence of phlobatannin.

RESULTS AND DISCUSSION

The qualitative phytochemical analysis of leaf and root extracts of *Codiaeum variegatum* and *Euphorbia tortilis* were analyzed using aqueous, methanol, ethanol and petroleum ether extract and the results were analyzed in Table 1 and 2.Phytochemical analysis helps to identify the phytoconstituents present in the leaf and root extract of the samples. The phytochemical analysis of *Codiaeum variegatum* leaf showed the presence of various phytochemical constituents. Table 1 revealed that methanol extract of leaf revealed 11 compounds except saponins and phlobatannins. Tannins were found in high concentration. While the ethanol extract of the sample contain nine

phytochemical compounds with aminoacids in high concentration. Carbohydrates, proteins, alkaloids, steroids, phenols tannins and anthraquinones were found in moderate concentration. In the case of aqueous extract the sample revealed eight phytochemical compounds. While the petroleum ether extract of the sample revealed four phytochemical compounds.

Table:1 Phytochemical Analysis of *Codiaeum variegatum* (L.) Rumph. ex A. Juss. Leaf extracts

Phytochemicals	Aqueous	Methanol	Ethanol	Petroleum Ether
Carbohydrates	+	++	++	+
Proteins	++	++	++	-
Aminoacids	+	+	+++	-
Alkaloids	-	++	++	-
Flavonoids	++	++	-	++
Glycosides	+	+	-	+
Steroids	+	+	++	-
Saponins	-	-	-	-
Phenols	++	+	++	-
Tannins	-	+++	++	-
Terpenoids	+	++	-	-
Anthraquinones	-	+	++	-
Phlobatannins	-	-	+	+

(-) Absence; (+) Presence; (++) Moderate concentration; (+++) High concentration

The preliminary phytochemical analysis of *Codiaeum variegatum* root extracts were summarized in the table 2. The results revealed that the methanol extract of root shows maximum number of phytochemicals compounds (12) except glycosides. It revealed that carbohydrates, phenols and phlobatannins were found in high concentration. While proteins, aminoacids, alkaloids, flavonoids, saponins, tannins, terpenoids and anthraquinones were found in moderate concentration. The ethanolic extract of the root shows the presence of 10 phytochemical compounds. Where carbohydrates, proteins, flavonoids, steroids and phenols were found in moderate concentration. In the case of petroleum ether extract, six phytochemical compounds were revealed with flavonoids alone with moderate concentration. In the case of aqueous root extract, carbohydrates and phenols showed its moderate concentration.

Table: 2 Phytochemical Analysis of *Codiaeum variegatum* (L.) Rumph. ex A. Juss. Root extracts

Phytochemicals	Aqueous	Methanol	Ethanol	Petroleum Ether
Carbohydrates	++	+++	++	+

Proteins	+	++	++	-
Aminoacids	+	++	+	-
Alkaloids	+	++	+	-
Flavonoids	+	++	++	++
Glycosides	-	-	-	+
Steroids	+	+	++	+
Saponins	+	++	-	-
Phenols	++	+++	++	+
Tannins	-	++	+	-
Terpenoids	+	++	-	+
Anthraquinones	-	++	+	-
Phlobatannins	-	+++	+	-

(-) Absence; (+) Presence; (++) Moderate concentration; (+++) High concentration

The preliminary phytochemical analysis of *E. tortilis* leaf extract reveals the presence of maximum number of phytoconstituents in methanol extract with 11 compounds except glycosides and tannins. Carbohydrates, flavonoids, saponins and phenols were found in higher concentration. Whereas alkaloids, anthraquinones and phlobatannins were found in moderate concentration. The ethanol extract contain 10 phytochemical compounds where carbohydrates, protein, alkaloids, flavonoids, and steroids are found in moderate concentration. In the case of aqueous extract, six phytochemical compounds were found with carbohydrates and alkaloids in moderate concentration. But, petroleum ether shows the presence of only four phytochemical compounds.

Table: 3 Phytochemical Analysis of *Euphorbia tortilis* Rottl. ex Ainslie leaf extracts

Phytochemicals	Aqueous	Methanol	Ethanol	Petroleum Ether
Carbohydrates	++	+++	++	+
Proteins	-	+	++	-
Aminoacids	-	+	+	-
Alkaloids	++	++	++	-
Flavonoids	-	+++	++	++
Glycosides	-	-	-	-
Steroids	+	+	++	+
Saponins	+	+++	-	-
Phenols	+	+++	+	-
Tannins	+	-	+	-
Terpenoi	-	+	-	+

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Anthraquinones	-	++	+	-
Phlobatannins	-	++	+	-

(-) Absence; (+) Presence; (++) Moderate concentration; (+++) High concentration

The preliminary phytochemical analysis of *Euphorbia tortilis* root extracts were summarized in the table 4. The phytochemical analysis of root reveals the presence of maximum number of compounds in methanol extract with 12 compounds except saponins. Ethanol extract shows the presence of 11 phytochemical compounds except saponins and phlobatannins. While, aqueous extract reveals the presence of six phytochemical compounds. But, petroleum ether shows the presence of only three phytochemical compounds with flavonoids in moderate concentration. Saponin is absent in all the four extracts.

Table: 4 Phytochemical Analysis of *Euphorbia tortilis* Rottl. ex Ainslie Root Extracts.

Phytochemicals	Aqueous	Methanol	Ethanol	Petroleum Ether
Carbohydrates	+	++	++	+
Proteins	+	++	++	-
Aminoacids	++	+	+	-
Alkaloids	++	++	+	-
Flavonoids	-	+	++	++
Glycosides	+	++	+	-
Steroids	-	+	+	-
Saponins	-	-	-	-
Phenols	-	+	++	-
Tannins	-	++	++	-
Terpenoids	+	++	+	-
Anthraquinones	-	++	++	-
Phlobatannins	-	++	-	+

(-) Absence; (+) Presence; (++) Moderate concentration; (+++) High concentration

In *Codiaeum variegatum*, the leaf and root extract reveals the highest number of compounds in methanol, which is followed by ethanol. While comparing the phytochemical components of leaf and root extracts of *C. variegatum*, root extracts reveals (Table 1, 2) more compounds than leaf extracts. In the case of *Euphorbia tortilis*, methanol extract reveals the presence of more compounds in both the leaf and root extracts (Table 3 and 4). By comparing leaf and root extracts of *E. tortilis*, root extract reveals the presence of more compounds than leaf extracts. Overall, methanol extract revealed the presence of more compounds in all the four samples. Whereas petroleum ether extract revealed the least number of compounds. Also

the root extract contains more phytochemical components than the leaf extract.

The recent research shows that methanol extract possess more number of phytochemicals in *C. variegatum* than other extracts which was against the study of (Bijekar & Gayatri, 2014) which possess highest number of compounds in ethanol extracts. In the present study methanol extract possess more number of phytoconstituents in *Euphorbia tortilis* than other extracts while petroleum ether possess more number of phytochemical compounds such as steroids, alkaloids, tannins, flavonoids, saponins, coumarins, cardiac glycosides, phytosteroids in *E.tortilis* (Jeyanthi *et al.,* 2016).When comparing the phytochemical analysis of two Euphorbia species, methanol extracts possess more phytochemical constituents, it was in accordance with the study of (Murugan *et al*., 2022). The presence of phlobatannins in samples reveals the presence of antioxidant property of the plant. The antioxidant property of the plant is due to the presence of phenolic compounds (Ali *et al*., 2008). The recent study shows the presence of various phytoconstituents such as carbohydrates, flavonoids, tannins, alkaloids, glycosides, terpenes, sterols. Similar results were found in *C. variegatum* cv. Gold dust leaves (Elsayed *et al*., 2020).

CONCLUSION

Qualitative phytochemical analysis of *Codiaeum variegatum and Euphorbia tortilis* leaf and root extract have been evaluated using four different solvents namely, aqueous, methanol, ethanol and petroleum ether. The results revealed the maximum number of phytochemical compounds in methanol extract of root in both the samples. This is followed by ethanol, aqueous and petroleum ether. The methanol extract of root exhibited maximum diversity of phytochemical compounds compared with leaf extracts in both the samples. Even though leaf and root of both the samples are medicinally important, the root extract possess more medicinal properties than the leaf because of the presence of more phytochemical constituents. The study highlights the potential of *C. variegatum and E. tortilis* as a rich source of bioactive compounds with potential medicinal application. The medicinal importance of the plant is due to the presence of phytochemical compounds present in plant.

ACKNOWLEDGMENT

The authors wish to thank Manonmanium Sundaranar University, Abishekapatti, Tirunelveli 627 012, Tamil Nadu, India.

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