Catharanthus roseus, also known as Vinca rosea or Periwinkle, is a member of the Apocynaceae family. It is one of the most important medicinal plants, known for its rich source of active phytoconstituents that provide medicinal or health benefits against various ailments and diseases. It has been reported to contain more than 200 different alkaloids, some of the important being vinblastine, vincristine, vindesine, vindoline, tabersonine, ajmalicine, vincine, vincamine, rubavin, reserpine, catharanthine, etc. [6]. Leaves are used in the treatment of menorrhagia, rheumatism, dyspepsia, indigestion, dysmenorrhea, diabetes, hypertension, and in many other medical conditions.

INTRODUCTION

Discovery of natural plant-derived drugs from natural botanical herbarium has been the major breakthrough in paving the way for natural product chemistry [1]. Natural products are a substantial source of new drugs. They may have various sources or origins such as terrestrial plants, microorganisms, marine organisms, and terrestrial vertebrates and invertebrates [2,3]. From time immemorial, they play a significant role as phytochemicals in treating and preventing a number of human diseases. Phytochemicals have been derived from the Greek word “phyto” meaning plant. Phytochemicals are biologically active, naturally occurring, non-nutritive chemical compounds found in plants having a protective and disease preventive activity. Plants produce such chemicals to safeguard themselves, but research reveals that they also have the ability to protect humans against diseases [4]. The subject of phytochemistry has been developed in recent years as a strict discipline, closely related to both natural product organic chemistry and plant biochemistry [1].

Plant metabolism has been able to separate phytochemicals in two categories, namely, primary or secondary. Primary constituents include the common sugars, amino acids, proteins, purines and pyrimidines of nucleic acids, and chlorophylls. Secondary constituents are the remaining plant chemicals such as alkaloids, terpenes, flavonoids, lignans, plant steroids, curcumines, saponins, phenolics, flavonoids, and glucosides [4]. In a pharmaceutical landscape, plants with a long history of use in ethnomedicine are considered as a rich source of active phytoconstituents that provide medicinal or health benefits against various ailments and diseases. One such family with extensive traditional use is Apocynaceae family.

Catharanthus roseus is one of the most important medicinal plants belonging to this family. C. roseus or Periwinkle (Nayantara or Sadabahar) is an erect bushy perennial herb and evergreen shrub. It grows wildly in the Indian subcontinent in southern Asia and with medicinal importance in Australia, Africa, and Southern Europe. The leaves are long and they are arranged in the opposite pairs. They have oval to oblong shape, broad glossy green hairless with a pale midrib and a short petiole [5]. It has been reported to contain more than 400 types of different alkaloids. Some of the important are vinblastine, vincristine, vindesine, vindoline, tabersonine, ajmalicine, vinceine, vincamine, rubavin, reserpine, catharanthine, etc. [6]. Leaves are used in the treatment of menorrhagia, rheumatism, dyspepsia, indigestion, dysmenorrhea, diabetes, hypertension, menstrual disorders, antiallergic, anti-inflammatory, antimicrobial, antithrombotic, cardioprotective, antihelminthic, hypolipidemic, skin diseases, bleeding diarrea, and antiviral properties. Currently, herbal research has been mainly focusing on isolation, characterization, identification, and quantification of bioactive constituents and secondary metabolites [7-13]. Gas chromatography-mass spectrometry (GC-MS) is one such sophisticated analytical technique used in identification, detection, and analysis of the constituents. It comprises GC coupled to a MS, by which complex mixtures of plant-related compounds may be separated, identified, and quantified [14]. In the present work, we have identified and confirmed the structures of the active constituents by GC-MS from the ethanolic extract of dried leaves of C. roseus.

MATERIALS AND METHOD

Collection and authentication

- The fresh leaves of C. roseus were collected from Mumbai, Maharashtra, and air-dried at room temperature.
- The dried leaves’ sample was authenticated by Agharkar Research Institute, Pune.
- The sample was stored in an airtight container at 6°C.

Extraction

- The leaves of C. roseus were dried in the shade, powdered with a mechanical grinder, and passed through sieve no. 40.
• The dried powdered material (25 g) was extracted with 80% ethanol using Soxhlet apparatus at a temperature of 50°C for 21 h.
• The solvent was then evaporated on a water bath at temperature maintained at 70°C.

**GC-MS**

- The instrument used in the experimentation purpose was Joel, USA with model of Accu Time-of-Flight GCV. The column details comprise capillary (type), semi-standard non-polar (class), and 30 m/60 m (length).
Fig. 6: Mass spectrum showing the presence of hexadecanoic acid, ethyl ester

Fig. 7: Mass spectrum showing the presence of \textit{n}-hexadecanoic acid

Fig. 8: Mass spectrum showing the presence of phytol

Fig. 9: Mass spectrum showing the presence of oleic acid

Fig. 10: Mass spectrum showing the presence of 9-octadecenoic acid(Z),2-hydroxy-1-(hydroxymethyl)ethyl ester

Fig. 11: Mass spectrum showing the presence of hexadecanoic acid-1-(hydroxymethyl)-1,2-ethanediyl ester
The libraries used were NIST 2.0 f and Fine, NIH, EINECS, TSCA, RTECS, HODOC, IRDB, and LIB for identification and interpretation of compounds.

RESULTS AND DISCUSSION

In the present GC-MS study, the term is 17-Octadecynoic acid. hexadecenol derivatives, palmitic acid, phytol, oleic acid, isovindolinine, and tocopherols were eluted. The principal compounds found to be present in the extract were predominantly saturated and unsaturated fatty acids and their esters, diterpenes and methylated phenols, all of which possess a significant pharmacological activity. In the present research study, 15 compounds were identified by GC-MS technique from C. roseus ethanolic extract (Fig. 1). 10-Methyl-8-tetradecen-1-ol acetate (Fig. 2) with m/z 268 and fragment ions 43, 55, 67, 111, 151, 211, 268 and 5,5,8a-trimethyl-3,5,6,7,8,8a-hexahydro-2H-chromene (Fig. 3) with m/z 280 and fragment ions 41, 55, 69, 83, 96, 111, 124, 138, 180 and 3,7,11,15-tetramethyl-2-hexadecen-1-ol (Fig. 4) with m/z 296 and fragment ions 43, 55, 73, 88, 157, 199, 239, 284 and n-hexadecanoic acid (Fig. 6) with m/z 256 and fragment ions 43, 55, 73, 97, 111, 125, 137, 157, 180, 222, 264, 282 and n-hexadecanoic acid-1-(hydroxymethyl)-1,2-ethanediyl ester (Fig. 7) with m/z 568 and fragment ions 43, 57, 73, 83, 98, 116, 129, 157, 185, 213, 239, 256, 299, 313, 331, 367, 423, 451, 507 and the term is 2,20-cycloaspidospermid-3-carboxylic acid,6,7-didehydro-methyl ester-(2α,3α,5α,12β,19α, 20R). (Fig. 12) with m/z 336 and fragment ions 41, 51, 77, 91, 120, 134, 156, 170, 183, 202, 230, 247, 277, 305, 321, 336 and Vitamin E

Fig. 12: Mass spectrum showing presence of 2,20-cycloaspidospermid-3-carboxylic acid,6,7-didehydro-methyl ester(2α,3α,5α,12β,19α, 20R)

Fig. 13: Mass spectrum showing the presence of Vitamin E

Fig. 14: Mass spectrum showing presence of 2,2,4-trimethyl-3-(3,8,12,16-tetramethyl-heptadeca-3,7,11,15-tetraenyl)-cyclohexanol

Fig. 15: Mass spectrum showing the presence of 2-methyl-1-hexadecanol
Fig. 16: Mass spectrum showing the presence of 9,12,15-octadecatrienoic acid, 2-{[(trimethylsilyl)oxy]-1-[[[(trimethylsilyl)oxy)methyl]ethyl ester, (Z,Z,Z)}

(Fig. 13) with m/z 430 and fragment ions 43, 71, 85, 97, 121, 165, 205, 255, 341, 368, 402, 430 and 2,2,4-trimethyl-3-(3,8,12,16-tetramethyl-heptadeca-3,7,11,15-tetraenyl)-cyclohexanol (Fig. 14) with m/z 428 and fragment ions 41, 55, 69, 81, 95, 123, 149, 175, 203, 231, 271, 299, 341, 385, 428 and 2-methyl-1-hexadecanol (Fig. 15) with m/z 256 and fragment ions 43, 57, 69, 83, 97, 111, 125, 139, 168, 210, 238, 256 and 9,12,15-octadecatrienoic acid, 2-{[(trimethylsilyl)oxy]-1-[[[(trimethylsilyl)oxy)methyl]ethyl ester, (Z,Z,Z)} (Fig. 16) with m/z 496 and fragment ions 41, 55, 73, 103, 133, 149, 191, 221, 281, respectively, are seen prominently.

CONCLUSION

This research article will edify a researcher and the reader toward 15 compounds that have been screened from the ethanolic extract of C. roseus by a hyphenated technique of GC-MS. It will also help to build upon future research endeavors in related fields by further elaboration focusing on different extraction procedures and elucidation and comparison of various phytoconstituents and their ethnopharmacological activities by application of various chromatographic hyphenated techniques.

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