



ISSN : 0973-7057

## ***Centella asiatica* and *Oldenlandia corymbosa* as a rich source of bioactive compounds**

Partha Pratim Kalita<sup>a</sup>, Maya Konwar<sup>b</sup>, Prasenjit Bhagawati<sup>c</sup>, Mrinmoy Basak<sup>d</sup> & Manash Pratim Sarma<sup>a\*</sup>

<sup>a</sup>Program of Biotechnology, Assam down town University, Panikhaiti, Guwahati, Assam, India

<sup>b</sup>Faculty of Science, Assam down town University, Panikhaiti, Guwahati, Assam, India

<sup>c</sup>Program of Botany, Assam down town University, Panikhaiti, Guwahati, Assam, India

<sup>d</sup>Faculty of Pharmaceutical Science, Assam down town University, Panikhaiti, Guwahati, Assam, India

Received : 23<sup>rd</sup> December, 2022 ; Revised : 24<sup>th</sup> January, 2023

**Abstract-** *Centella asiatica* and *Oldenlandia corymbosa* are in traditional medicinal use for thousands of years. *Centella asiatica* is mainly used for wound healing and treating different skin condition whereas *Oldenlandia corymbosa* is used for the removing toxins as well as activating blood circulation etc. The present study was designed to identify different active compound present in both the plants and to look for their biological activity. GC-MS analysis was performed to identify different active compounds and their activity was identified using the previous literature.

**Key words:** *Centella asiatica*, *Oldenlandia corymbosa*, GC-MS, bioactive compound, traditional medicine

### INTRODUCTION

North Eastern part of India is a biodiversity hotspot. The rich natural resources of this region have been used as indigenous traditional knowledge in the form of herbal medicines since ages.<sup>1,2</sup> The medicinal properties of *Centella asiatica* include its role as immune system enhancers, antioxidant molecule, antimicrobial agent<sup>3</sup>, skincare formulations<sup>4</sup>, an oral rinse<sup>5</sup>, a lower limb ulcer treatment<sup>6</sup>, a memory enhancer in Alzheimer's disease<sup>7</sup>, and a topical hair composition<sup>8</sup> are well documented. A study from Malaysia has also demonstrated that the method of extraction of bioactive compounds plays an important role in detection and antimicrobial affect of the plant extract.<sup>9</sup> Two such plants studied in current research were *Centella asiatica* and *Oldenlandia corymbosa* whose medicinal properties have been studied. There are very few studies on documentation of bioactive compounds for these two

studied plant from this part of the country. However, Different studies published worldwide have reported that as many as seventy compounds extracted from *C. asiatica*. Some of the most abundant bioactive compounds reported in *C. asiatica* were nmely asiatic, asiaticoside, madecassoside and madecassic acid from the triterpene class.<sup>10-13</sup> Compounds from the saponins group that could be found in a smaller quantity were brahmoside, centelloside, glycosides and alkaloids.<sup>10,14</sup>

The whole plant of *Oldenlandia corymbosa* is associated with compounds such as geniposide, 6 alpha-hydroxygeniposide, scandoside methyl ester (6 beta-hydroxygeniposide), asperulosidic acid, deacetylasperul oside, asperuloside, 10-O-benzoylscandoside methyl ester, 10-O-p-hydroxybenzoylscandoside methylester, (+)-lyoniresinol-3 alpha-O-beta-glucopyranoside, and rutin a study carried out from Thailand.<sup>15</sup> Another study from China has elucidated the antiproliferative properties of *Oldenlandia corymbosa* based on animal cell line study.<sup>16</sup>

\*Corresponding author :

Phone : 8638513709

E-mail : manash3268@gmail.com

There are very scanty of reports on this particular plant species. However, other species of *Oldenlandia* has been studied for chemical composition<sup>17</sup> and presence of important peptides<sup>18</sup>. A detailed study on *O. corymbosa* pertaining to its antioxidant properties, presence of phytochemicals and bioactive compounds was carried out by Datta *et al.*, (2019)<sup>19</sup>.

However, the key factor of the research work was to analyses the active compounds which known biological role from these plants.

#### METHODS

The dry samples of the studied plant extracted were sent for GC-MS analysis and the compounds present in the extracts were identified based on library research. Their 3D structures were extracted from Pub chem compound database.

#### RESULT

The results are tabulated below (table 1) reflecting the compounds chemical formulae, molecular weight and their beneficial role. In the study, Neophytadiene was detected in *Centella asiatica* which is known to have anti-inflammatory, antioxidant and cardio protective properties as described previously by an extensive study carried out by Bhardwaj *et al.*, (2020)<sup>20</sup> based on *in vivo* and coupled with *in vitro* study. The antimicrobial activity of the compound has been established by another study carried out by a Turkish study where a methanolic extract at a plant extract containing 70% of Neophytadien content (based on AC/MS data) was found to show effectiveness against certain studied microorganisms.<sup>21</sup> Further antioxidant and anti cancerous properties at the same molecule (isolated from *Menthe pulegium* L.) has been well documented to

Table 1- Showing the compounds chemical formulae, molecular weight and their beneficial role.

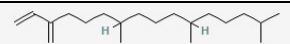

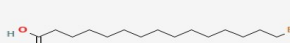
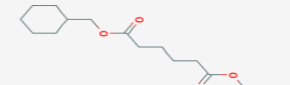


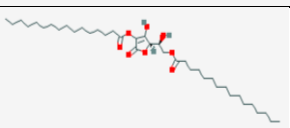

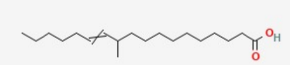
| Sl. No.                                  | Name of the compound                      | Molecular formula                                | Molecular weight (g/mol) | Peak area (%) | Structure   |
|--|---|--|--------------------------|---------------|---|
| <i>Plant name: Centella asiatica</i>     |   |  |                          |               |   |
| 1.                                       | NEOPHYTADIENE                             | C <sub>20</sub> H <sub>38</sub>                  | 278                      | 3.794         |  |
| 2.                                       | EICOSANOIC ACID                           | C <sub>20</sub> H <sub>40</sub> O <sub>2</sub>   | 312.5                    | 17.888        |  |
| 3.                                       | PENTADECANOIC ACID, 15-BROMO-             | C <sub>15</sub> H <sub>29</sub> BrO <sub>2</sub> | 321.29                   | 0.332         |  |
| 4.                                       | ADIPIC ACID, CYCLOHEXYLMETHYL ETHYL ESTER | C <sub>15</sub> H <sub>26</sub> O <sub>4</sub>   | 270.36                   | 15.37         |  |
| 5.                                       | GLYCIDYL PALMITATE                        | C <sub>19</sub> H <sub>36</sub> O <sub>3</sub>   | 312.5                    | 2.762         |  |
| <i>Plant name: Oldenlandia corymbosa</i> |   |  |                          |               |   |
| 1  | 11,14-EICOSADIENOIC ACID, METHYL ESTER    | C <sub>21</sub> H <sub>38</sub> O <sub>2</sub>   | 322.5                    | 1.998         |  |
| 2  | L-(+)-ASCORBIC ACID 2,6-DIHEXADECANOATE   | C <sub>38</sub> H <sub>68</sub> O <sub>8</sub>   | 652.9                    | 0.781         |  |
| 3  | GLYCIDYL OLEATE                           | C <sub>21</sub> H <sub>38</sub> O <sub>3</sub>   | 338.5                    | 1.914         |  |
| 4  | 11-METHYLOCTADEC-12-ENOIC ACID            | C <sub>19</sub> H <sub>36</sub> O <sub>2</sub>   | 296.5                    | 1.265         |  |

exhibit anti-oxidant protection and free radical scavenging activity, antimicrobial activity, anti coagulating potential as well as anti cancerous affects.<sup>22</sup>

The next key compound found in the *Centella asiatica* extract was Eicosanoic acid and its anti inflammatory and anti therogetic properties have been represented by a previous study conduct in 2015.<sup>23</sup> The same compound has been also found to have surfactants properties as recorded by another study carried out in India.<sup>24</sup>

Glycidyl Palmitate (GP) in the current plant extract was found to be associated with anti-cancerous activity as demonstrated by a study carried out earlier.<sup>25</sup> However, a contrarian study was also carried out to reserve at using activated bleaching earth during the manufacturing of edible oils.<sup>26</sup>

Apoptosis inhibitory role of GP has been represented by few studies carried out earlier on indigenous medicinal plants.<sup>27-29</sup> Again, larvicidal, nematocidal and pesticidal properties at the same compound have been reported by a previous study conducted on Sharma *et al.* (2021)<sup>29</sup>, which was an extracted AC-MS analysis of *Azadiracta indica* leaf extract. Compounds such as *Pentadecanoi caced*, 15- Is Bromo, adipic acid and cyclohexylme thyl ethyle ester were also observed in the studied extract which are not directly found to have biological activity, but might have synergistic effect along with other biological active compounds. The record plant extract evaluated was 11,14- Eicosadienoic acid, methyl-ester which has reported antimicrobial activity.<sup>30</sup>

The study by Suresh *et al.* (2014)<sup>30</sup>, could see antimicrobial activity of fractions of fatty acid methyl ester against a range of clinically pathogenic bacteria's as well as few fungal species.

The second compound detected in the same sample was ascorbic acid 2,6 dihex- decanoate and is found to be associated with antioxidant, cardio protective properties as well as cancer preventive nature.<sup>31-33</sup> The same study also reported anti- infertility characters of the studied compound. The flavor and the presence of bioactive compounds are commercialized as food or herbal medicine looking into its capacity to fight against pathological conditions.<sup>34</sup> Transporters like properties along with anti-inflammatory, anti- scorbutic and wound healing properties of the compound has also been previously reported.<sup>35</sup> A range of health benefits ranging from anti-allergic, anti-anxiety, anti-cancers to neuro transmitter and

neuroprotective properties are associated with the studied compound.<sup>36-37</sup>

Glycidyl Oleate, another compound isolated from *Oledenlandia corymbosa*, extract has been reported to have insectifugal properties.<sup>38</sup> The same compound is also recorded to have anti-arthritis as well as anti- inflammatory properties as studied earlier.<sup>39</sup>

Compounds like methyloctade C-12 enoic acid reported in the current study do not have any reported activity just like many other compounds (not shown in table) documented in the current study. The biological role of such compounds alone or their synergistic affect may elucidate further knowledge to their ever evolving field of traditional knowledge.

## CONCLUSION

To conclude the current research findings, it will be at utmost importance to document the bioactive compounds of the traditional plants of Indian sub- continent as a whole and NE-India in particular. The study findings may be of interests for pharmaceutical companies as well as companies dealing with herbal medicine ecosystem.

## REFERENCES

1. **Sapam R., Kalita P. P., Sarma M. P., Talukdar N. & Das H. 2018.** Screening of phytochemicals and determination of total phenolic content, anti-oxidant and antimicrobial activity of methanolic extract of *Piper nigrum* leaves. *Pharmaceutical Research*. **8(02)**.
2. **Minakshi B., Jharna D., Chanbi Devi E., Nayan T., Partha P. K., Kundal N. & Manash P. S. 2016.** Phytochemical analysis of traditional medicinal plants and their antimicrobial activity: An experience from North East India. *Open Access Journal of Pharmaceutical Research*, **1(1)**: 000104.
3. **Transparency Market Research. Centella asiatica Market—Global Industry Analysis, Size, Share, Trends, Growth, and Forecasts, 2020 to 2030.** Available online: <https://www.transparencymarketresearch.com/centella-asiatica-market.html> (accessed on 25 February 2021).
4. **Sene G., Loiseau A., Lepetit J. C, 2017.** Use of Compounds from *Centella asiatica*. WO 2007054211, 18 October 2017.
5. **Loewy Z. G., Levine W. Z., Saffer A. J. 2011.** Oral Rinse. U.S. Patent 807,592,4B2, 13 December 2011.

6. **Montanez-Soto F. L. 2016.** Pharmaceutical Composition Based on *Centella asiatica* (*Hydrocotyle asiatica* L.) for the Treatment of Lower Limb Ulcers. U.S. Patent 10,232,004, 17 March 2016.
7. **Palpu P., Rao C. V., Kishore K., Gupta Y. K., Kartik R., Govindrajan R. 2006.** Herbal Formulation as Memory Enhancer in Alzheimer Condition. U.S. Patent 7,429,397, 29 June 2006.
8. **Kodgule M. M., Kumar Y. 2020.** Topical Hair Composition. WO 2020234794A1, 26 November 2020.
9. **Idris FN, Mohd Nadzir M. 2021.** Comparative Studies on Different Extraction Methods of *Centella asiatica* and Extracts Bioactive Compounds Effects on Antimicrobial Activities. *Antibiotics* (Basel). **10(4):457.** doi: 10.3390/antibiotics10040457. PMID: 33920563; PMCID: PMC8073564.
10. **Alfarra, H.Y.; Omar, M.N. 2013.** *Centella asiatica*: From folk remedy to the medicinal biotechnology—A state revision. *Int. J. Biosci.* **3:49–67.**
11. **Monton C., Settharaksa S., Luprasong C., Songsak T. 2019.** An optimization approach of dynamic maceration of *Centella asiatica* to obtain the highest content of four centelloids by response surface methodology. *Braz. J. Pharmacogn.* **29:** 254–261.
12. **Azwanida, N.N. 2015.** A review on the extraction methods uses in medicinal plants, principle, strength and limitation. *Med. Aromat. Plants.* **4:1–6.**
13. **Rengganaten V. 2013.** *In vitro* Screening of Cytotoxic Effect and Antioxidant Activity of *Pereskia bleo* and *Centella asiatica* Crude Extracts. Bachelor's Thesis, Universiti Tunku Abdul Rahman, Perak, Malaysia, 2013.
14. **Long, H.S.; Stander, M.A.; Van Wyk, B.E. 2012.** Notes on the occurrence and significance of triterpenoids (asiaticoside and related compounds) and caffeoylquinic acids in *Centella* species. *S. Afr. J. Bot.* **82:53–59.**
15. **Noiarsa P., Ruchirawat S., Otsuka H., Kanchanapoom T. 2008.** Chemical constituents from *Oldenlandia corymbosa* L. of Thai origin. *J Nat Med.* **62(2):249-50.** doi: 10.1007/s11418-007-0212-1. Epub 2007 Dec 5. PMID: 18404335.
16. **Liang Z., He M., Fong W., Jiang Z., Zhao Z. 2008.** A comparable, chemical and pharmacological analysis of the traditional Chinese medicinal herbs *Oldenlandia diffusa* and *O. corymbosa* and a new valuation of their biological potential. *Phytomedicine.* **15(4):259-67.** doi: 10.1016/j.phymed.2008.01.003. Epub 2008 Mar 12. PMID: 18339527.
17. **Tsai Ct, Qian XI, Jiang Dq, Djiang Dt. 1964.** [Chemical Investigation of *Oldenlandia diffusa* (Willd.) Roxb. I]. *Yao Xue Xue Bao.* **11:809-14.** Chinese. PMID: 14254780.
18. **Gran L., Sandberg F., Sletten K. 2000.** *Oldenlandia affinis* (R&S) DC. A plant containing uteroactive peptides used in African traditional medicine. *J. Ethnopharmacol.* **70(3):197-203.** doi: 10.1016/s0378-8741(99)00175-0. PMID: 10837983.
19. **Datta S., Sinha B. K., Bhattacharjee S., Seal T. 2019.** Nutritional composition, mineral content, antioxidant activity and quantitative estimation of water-soluble vitamins and phenolics by RP-HPLC in some lesser used wild edible plants. *Heliyon.* **5(3):e01431.** doi: 10.1016/j.heliyon.2019.e01431. PMID: 30976701; PMCID: PMC6441826.
20. **Bhardwaj M., Sali V. K., Mani S. & Vasanthi H. R. 2020.** Neophytadiene from *Turbinaria ornata* suppresses LPS-induced inflammatory response in RAW 264.7 macrophages and Sprague Dawley rats. *Inflammation.* **43(3): 937-950.**
21. **Ceyhan-Güvensen N. & Keskin D. 2016.** Chemical content and antimicrobial properties of three different extracts of *Mentha pulegium* leaves from Mugla Region, Turkey.
22. **Al-Rajhi A. M., Qanash H., Almuhayawi M. S., Al Jaouni S. K., Bakri M. M., Ganash M., & Abdelghany T. M. 2022.** Molecular interaction studies and phytochemical characterization of *Mentha pulegium* L. constituents with multiple biological utilities as antioxidant, antimicrobial, anticancer and anti-hemolytic agents. *Molecules.* **27(15): 4824.**

23. Achi N. K. & Ohaeri O. C. 2015. GC-MS determination of bioactive constituents of the methanolic fractions of *Cnidioscolus aconitifolius*. *British Journal of Pharmaceutical Research*. **5(3)**: 163.
24. Kushwaha P., Yadav S. S., Singh V. & Dwivedi L. K. 2019. Phytochemical screening and GC-MS studies of the methanolic extract of *Tridax procumbens*. *International Journal of Pharmaceutical Sciences and Research*, **10(5)**: 2492-2496.
25. Imo C., Yakubu O. E., Imo N. G., Udegbunam I. S. & Onukwugha O. J. 2018. Chemical composition of *Xylopiya aethiopica* fruits. *Am J Physiol Biochem Pharmacol*. **7(2)**: 48-53.
26. Shimizu M., Moriwaki J., Shiiba D., Nohara H., Kudo N. & Katsuragi Y. 2012. Elimination of glycidyl palmitate in diolein by treatment with activated bleaching earth. *Journal of Oleo Science*. **61(1)**: 23-28.
27. Yakubu O. E., Otitoju O. & Onwuka J. 2017. Gas chromatography-mass spectrometry (GC-MS) analysis of aqueous extract of *Daniellia oliveri* stem bark. *Pharmaceutica Analytica Acta*, **8(11)**: 1-8.
28. Sistla R., Tata V. S. S. K., Kashyap Y. V., Chandrasekar D., Diwan P. V. 2005. Development and validation of a reversed-phase HPLC method for the determination of ezetimibe in pharmaceutical dosage forms. *J. Pharm Biomed Anal*. **39**: 517-522.
29. Khanday S. & Sharma G. D. 2021. GC-MS Analysis and Antifeedant Activity of *Azadirachta indica*-Leaf Extract. *Stechnolock Plant Biol Res*, **1**: 1-15.
30. Suresh A., Praveenkumar R., Thangaraj R., Oscar F. L., Baldev E., Dhanasekaran D. & Thajuddin N. 2014. Microalgal fatty acid methyl ester a new source of bioactive compounds with antimicrobial activity. *Asian Pacific Journal of Tropical Disease*, **4**: S979-S984.
31. Mohammed Y. H., Ghaidaa J. M. & Imad H. H. 2016. Analysis of bioactive chemical compounds of *Nigella sativa* using gas chromatography-mass spectrometry. *Journal of Pharmacognosy and Phytotherapy*, **8(2)**: 8-24.
32. Ponnamma S. U. & Manjunath K. 2012. GC- MS analysis of phytochemicals in the methanolic extract of *Justicia wynaadensis* (Nees) T. anders. *International Journal of pharma and bio sciences*, **3(3)**: 570-576.
33. Raval S. S., Vaghela P. G., Mandavia M. K. & Golakiya B. A. 2016. Phytochemical analysis of *Malaxis acuminta* D. Don (Jeevak), an ingredient of Jeevaniya Group of Ashtavarga. *Indian J Agric Biochem*, **29(2)**:155-160.
34. Sharma N. K., Ahirwar D., Jhade D. & Gupta S. 2009. Medicinal and phamacological potential of *Nigella sativa*: a review. *Ethnobotanical Leaflets*. **2009(7)**:11.
35. Gomathi Rajashyamala L., & Elango V. J. 2015. Identification of bioactive components and its biological activities of *Evolvulus alsinoides* linn. *A GC-MS study*, **3(1)**:41-44.
36. Ramya B., Malarvili T. & Velavan S. 2015. GC-MS analysis of bioactive compounds in *Bryonopsis laciniosa* fruit extract. *International Journal of Pharmaceutical Sciences and Research*. **6(8)**: 3375.
37. Karthikeyan S. C., Velmurugan S., Donio M. B. S., Michaelbabu M. & Citarasu T. 2014. Studies on the antimicrobial potential and structural characterization of fatty acids extracted from Sydney rock oyster *Saccostrea glomerata*. *Annals of Clinical Microbiology and Antimicrobials*. **13(1)**: 1-11.
38. Ghosh A., Majumder S., Saha S., Chakraborty S. & Bhattacharya M. 2021. Leaves and barks of *Albizia* shade trees in tea plantation shows both insect attractant and pesticidal properties: a GC-MS based investigation. *Asian Journal of Agriculture*, **5(2)**.
39. Lalitharani S., Mohan V. R., Regini G. S. & Kalidass C. 2009. GC-MS analysis of ethanolic extract of *Pothos scandens* leaf. *J. Herb. Medi. Toxicology*, **3**: 159-160.

