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Comprehensive Profiling and Categorization of 204 Compounds in Snail Slime Extract from Lissachatina fulica: An Integrated Analytical Approach

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Abstract : ***Snail slime, known for its diverse chemical composition, has been a subject of increasing interest in various fields, including medicine and cosmetics. This research endeavors to present an extensive analysis of 204 compounds extracted from the slime of Lissachatina fulica snails. Utilizing sophisticated analytical techniques such as mass spectrometry and nuclear magnetic resonance, we aim to provide a comprehensive understanding of the chemical constituents present in snail slime and their potential applications.***

IndexTerms - **Snail slime, Lissachatina fulica, Chemical composition, Compound profiling, Comprehensive analysis, Traditional medicine, Skincare, Organic acids, Amino acids, Alkaloids, Esters, Liquid chromatography-mass spectrometry (LC-MS), Nuclear magnetic resonance spectroscopy (NMR), Therapeutic properties, Pharmaceutical applications, Cosmetic appeal, Wound healing, Skin regeneration, Antioxidant activity, Bioactive compounds**

I. INTRODUCTION

Snail slime, a mucous secretion produced by gastropods, has garnered substantial attention in various domains, particularly in traditional medicine and skincare practices (1). Across different cultures and civilizations, the utilization of snail slime dates back centuries, often attributed to its purported wound-healing and anti-aging properties (2). As an integral component of folk remedies, snail slime has been employed in diverse forms, ranging from topical applications to ingestible formulations (3). Understanding the chemical composition of snail slime is paramount to unraveling its therapeutic potential and elucidating its mechanisms of action (4). With an intricate interplay of compounds, snail slime represents a reservoir of bioactive molecules that could hold promise for novel therapeutic interventions (5). The need for comprehensive profiling and categorization of these compounds is evident to harness their full medicinal and cosmetic benefits (6).

In this context, Lissachatina fulica, commonly known as the African giant snail, emerges as a focal point for scientific inquiry (7). As a prolific producer of slime, Lissachatina fulica offers a prime resource for studying the chemical constituents of snail secretion (8). By employing advanced analytical techniques, researchers endeavor to unravel the complex mixture of compounds present in Lissachatina fulica slime (9). The objectives of this study encompass a meticulous examination of 204 compounds identified within the slime of Lissachatina fulica (10). Through a multidisciplinary approach, integrating techniques such chromatography-mass as liquid spectrometry (LC-MS) and nuclear magnetic resonance spectroscopy (NMR), researchers aim to achieve a comprehensive understanding of the chemical constituents present in snail slime (11). This integrated analytical approach enables the elucidation of the diverse array of compounds present in the slime extract (12). By delineating the chemical profile of snail slime, this research contributes to a deeper appreciation of its therapeutic and cosmetic applications (13). The elucidation of individual compounds and their synergistic effects paves the way for tailored interventions in medicine, skincare, and related industries (14). Moreover, insights gained from this study lay the investigations groundwork into for the future specific mechanisms underlying the observed biological activities compounds (15). of snail slime In summation, this research endeavors to shed light on the multifaceted nature of snail slime, transcending traditional perceptions to unveil its potential as a source of innovative therapeutics and cosmetic formulations (16).

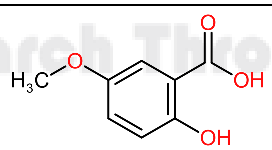
II. Methodology

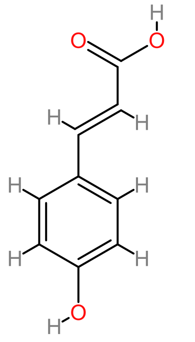
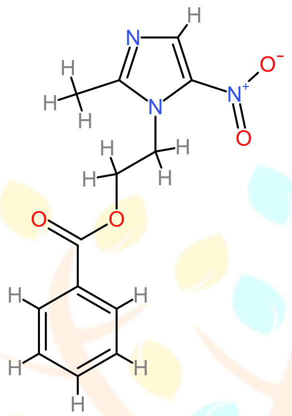
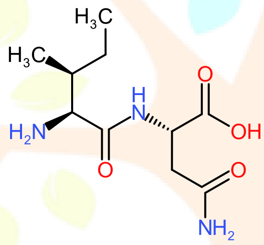
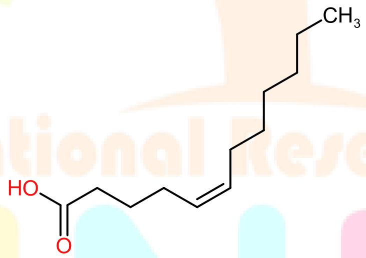
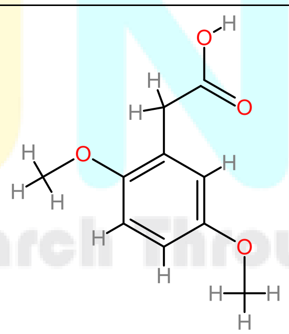
Collection of Snail Slime Samples: Snail slime samples were collected from Lissachatina fulica specimens in accordance with established protocols (17). The collection process prioritized the selection of healthy adult snails to ensure the quality and consistency of the slime samples (18). Extraction Process: A representative mixture of snail slime was obtained using an optimized extraction method. This process involved gentle stimulation of the snails to induce slime secretion, followed by careful collection and pooling of the exuded slime (19). The collected slime samples were subjected to centrifugation to remove debris and particulate matter, yielding a homogenized extract suitable for subsequent analysis (20).

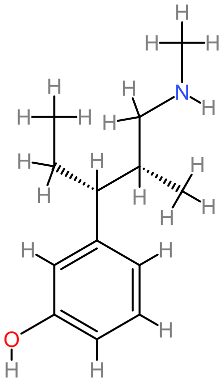
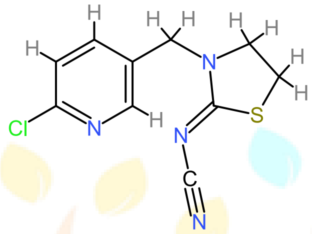
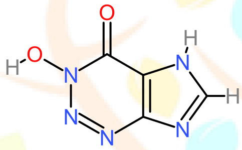
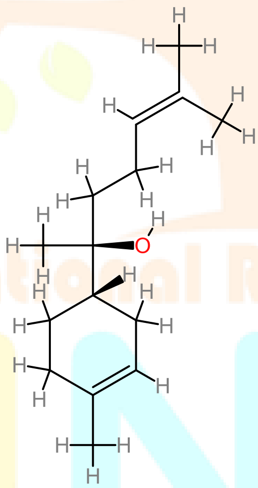
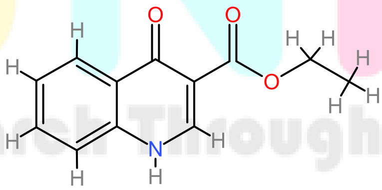
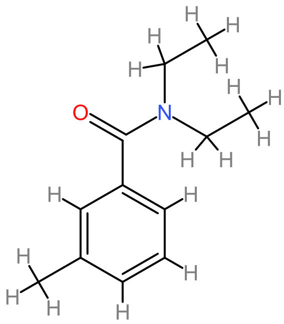
Analytical Techniques: Liquid Spectrometry Chromatography-Mass (LC-MS): Compound identification was conducted using LC-MS, a powerful analytical technique for separating and characterizing complex mixtures of compounds (21). LC-MS analysis enabled the detection and quantification of various chemical constituents present in the snail slime extract (22). Nuclear Magnetic Resonance Spectroscopy (NMR): Complementary information on the chemical structure and composition of the identified compounds was obtained through NMR spectroscopy (23). High-resolution NMR spectra provided insights into the molecular properties and functional groups present in the snail slime extract (24). Data Analysis: The data obtained from LC-MS and NMR analyseswere processed and analyzed using appropriate software and statistical methods (25). Compound identification and characterization were based on comparison with reference standards and spectral databases (26). Quality Control: To ensure the reliability and reproducibility of the experimental results, stringent quality control measures were implemented throughout the methodology (27). This included the use of certified reference materials, calibration standards, and standardized operating procedures (28). Ethical Considerations: Ethical guidelines and regulations governing the use of animals in research were strictly adhered to during the collection and handling of snail specimens (29). All procedures involving live animals were conducted with the utmost care and consideration for their welfare (30).

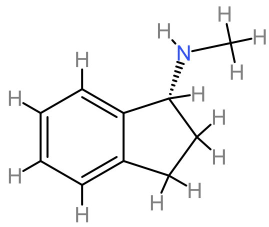
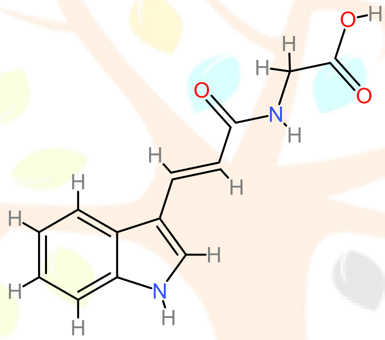
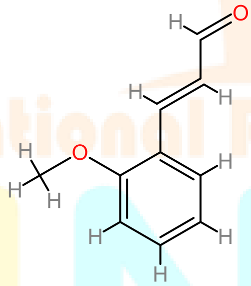
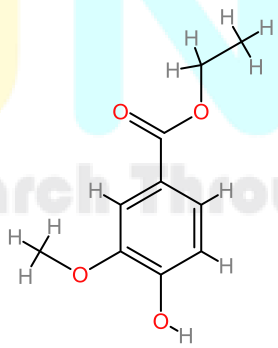
"Snail mucin extraction from Lissachatina fulica involved the meticulous collection of slime from approximately 48 snails housed in porous containers, ensuring the preservation of its natural composition and integrity."

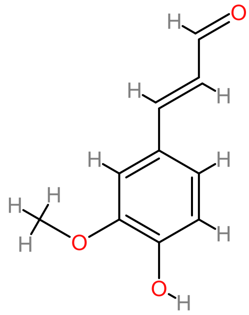
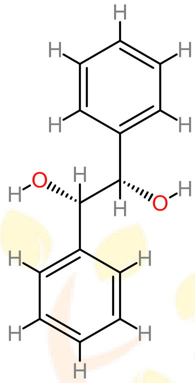
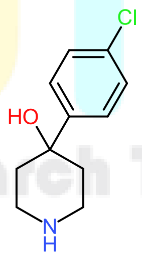
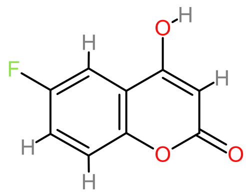
npounds Identified from Snail Slime Sample Positive Mode

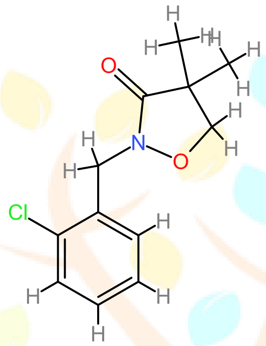
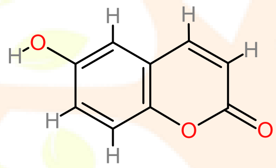
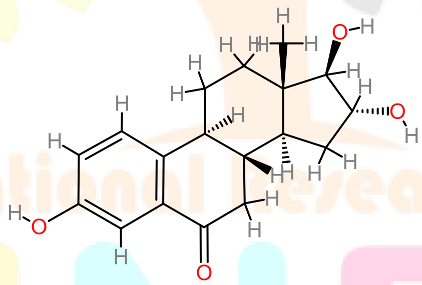
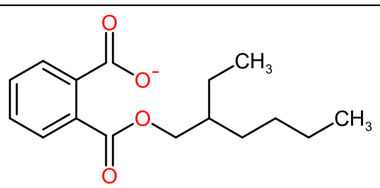
o.	COMPOUND	IUPAC NAME	STRUCTURE	APPLICATIONS
	2-Hydroxy-5-methoxybenzoic acid (Homoveratric acid)	3-(2-hydroxy-5-methoxyphenyl) propanoic acid.		Pharmaceuticals, Phytochemistry, Antioxidant Properties, Chemical Synthesis, Research and Development.

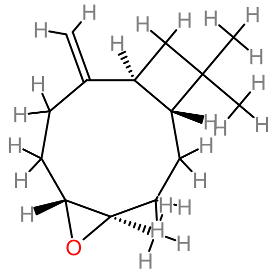
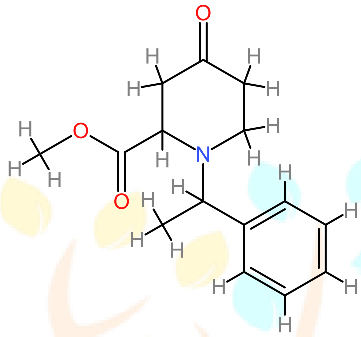
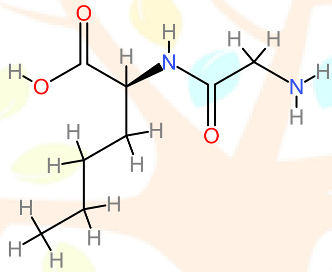
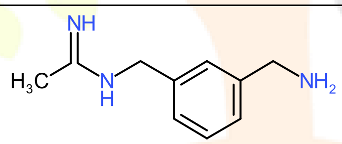
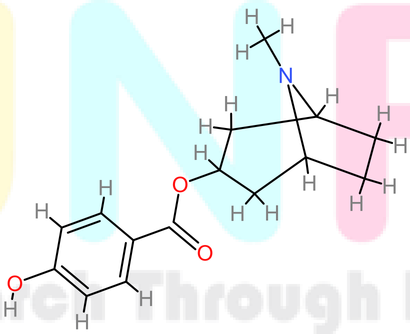
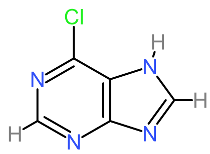
Trans-2-hydroxycinnamic acid (p-coumaric acid)	(E)-3-(2-hydroxyphenyl) prop-2-enoic acid		Antioxidant Properties, Food Additive, Skin Care Products, Phytochemical Defense, Research Tool, Lignin Synthesis.
Benzoylmetronidazole	2-(2-methyl-5-nitro-1H-imidazol-1-yl)ethyl benzoate		Topical treatment for acne, topical treatment for bacterial and protozoal infections, topical application in wound care, treatment for vaginal Infections, topical creams and gels, antibiotic and antiprotozoal medication.
Ile-Asn	isoleucyl asparagine		Amino acid supplements, Drug delivery system, Bioactive peptides, Flavour enhancers, used for biochemical studies,
cis-5-Dodecenoic acid	(Z)-5-dodecenoic acid		Flavour and fragrance industry, cosmetics and personal care products, lubricants and greases, biosurfactant production, antimicrobial properties.
3,4-Dimethoxyphenyl Acetic acid	3,4-dimethoxyphenyl acetic acid		Aroma compounds, medicinal chemistry, derivatives of natural products, ingredients in formulation, potential antioxidants.
1,2-Dibehenoyl-sn-glycero-3-phosphocholine	2,3-bis(hexadecanoyloxy)propyl 2-(trimethylammonio)ethyl phosphate	O || HO-CH2-CHOH-CH2-N+(CH3)3 | | HC-COOH CH-COOH | | (CH2)20 (CH2)20	Skin care formulation, Drug delivery system, lung function, Dietary supplement, cell culture media.

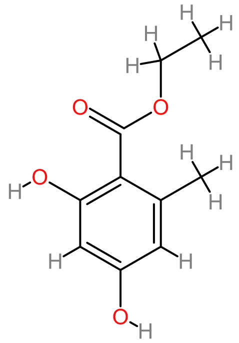
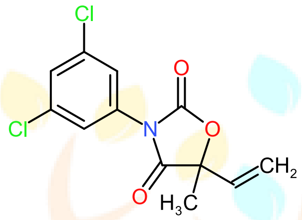
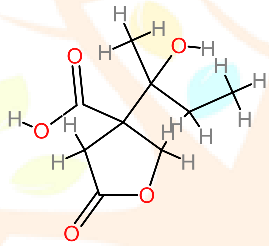
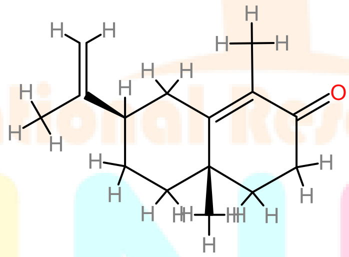
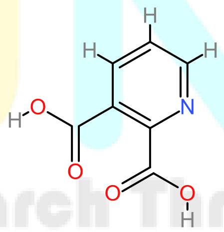
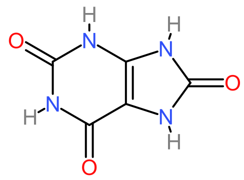
	N-Desmethyltapentadol	(1R,2R)-3-(dimethylamino)-1-ethyl-2-methylpropyl (2R,3R)-2,3-dihydro-1H-isoindole-1-carboxylate		Cytochrome p450 interactions, genetic variability, clinical and forensic use, pharmacokinetics.
	Thiacloprid	3-[(6-chloropyridin-3-yl)methyl]-1,3-thiazolidin-2-one		Crop protection, seed treatment, pest management, greenhouse and ornamental plant protection,
	2-Hydroxy-10,11-dihydro-5H-dibenzo ad cyclohepten-5-one	(1R,3S)-3-(2-Hydroxyphenyl)-1,2,3,4,4a,7,8,10-octahydro-5H-benzo[a]cyclohepten-5-one		Antidepressant, antianxiety, antihistamine, pain management, treatment of insomnia, dermatological condition,
	.alpha.-Bisabolol	(1R,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl (2Z)-2-methyl-2-butenoate		Skin healing, skin protection, reduce redness, anti-inflammatory property, soothing after sunburn, scalp soothing, fragrance component. Anti irritant.
	Ethyl 4-hydroxyquinoline-3-carboxylate	Ethyl 2-ethyl-4-hydroxy-3-oxo quinoline-3-carboxylate		Pharmaceuticals, antioxidant activity, photoluminescent material, corrosion inhibitor.
	Diethyltoluamide	N,N-diethyl-3-methylbenzamide		Insect repellent, protection in endemic regions, child safe formulations, impregnating cloths, used by soldiers to protect against insect borne disease.

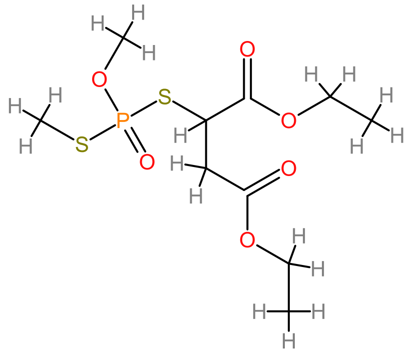
	4-Benzofuranethanamine, 2,3-dihydro-.alpha.-methyl-	N-methyl-2,3-dihydro-1H-inden-1-amine		Pharmaceuticals, material science, agrochemicals
	3-Furancarboxylic acid, tetrahydro-4-methyl-5-oxo-2-propyl-, (2R,3S)-rel	(2R,3S)-2-propyl tetrahydro-4-methyl-5-oxo-3-furancarboxylic acid	O | C=O | C / \\ C C \\ / C / \\ H H	pharmaceuticals, agrochemicals, and materials science.
	3-Indoleacrylic acid	(2E)-3-(1H-indol-3-yl) prop-2-enoic acid.		Plant growth and development, cell elongation, root and shoot development, seed germination, apical dominance, flower and fruit development, tissue culture
	2-Methoxycinnamaldehyde	(2E)-3-(2-methoxyphenyl)prop-2-enal		Polymer, flavour and fragrance, antimicrobial and antifungal properties, agrochemicals , pharmaceuticals.
	Ethyl vanillate	Ethyl 4-hydroxy-3-methoxybenzoate		flavour and fragrance, antimicrobial and antifungal properties, agrochemicals , pharmaceuticals, flavouring tobacco products, body care products.

Coniferyl aldehyde	3-(4-hydroxy-3-methoxyphenyl)prop-2-enal		Biopolymer development, flavour and fragrance, lignin formation, antimicrobial properties.
(S,S)-(-)-Hydrobenzoin	(1R,2R)-1,2-diphenylethane-1,2-diol		Chiral synthesis, pharmaceuticals, catalyst precursor, asymmetry synthesis.
9-(Benzylamino)-1,2,3,4-tetrahydroacridine-1-ol	N-benzyl-9-[(2-hydroxyethyl)amino]-1,2,3,4-tetrahydroacridine-1-amine	H | N | C--H | C | C H || | N--C--C--C / | | H H OH | CH2CH2OH	Anti cancer properties, pharmacology, medicinal chemistry
4-(4-Chlorophenyl)-4-hydroxypiperidine	4-(4-chlorophenyl)piperidin-4-ol		Pharmaceutical research, agrochemicals, biological studies, chemical synthesis.
6-Fluoro-4-hydroxycoumarin	6-Fluoro-4-hydroxycoumarin		Fluorophore in Biochemical Studies, Fluorescent Probes, medicinal chemistry, photophysics studies, intermediate in synthetic chemistry.

1-Ethyl-4-(4-piperidinyl)piperazine	N-ethyl-4-(4-piperidinyl)piperazine	H | N--C2H5 | C H || | N--C4H9 | C | N | H	Chemical synthesis, pharmacology, research studies, therapeutic applications
Clomazon	2-[(2-chlorophenyl) methyl]-4,4-dimethyl-3-isoxazolidinone		Crop protection, weed control, selective herbicide, pre-emergence applications.
6-Hydroxycoumarin	2H-1-benzopyran-2-one		Fluorescent indicator, analytical chemistry, cosmetics, photoprotection, pharmaceuticals.
6-Keto Estradiol	3-hydroxyestra-1,3,5(10),6,8-penta en-17-one		Metabolism of estrogen, endocrine research, therapeutic applications.
2,4-Thiazolidinedione, 3-(2-aminoethyl)-5-(4-ethoxyphenyl)methylene-	3-(2-Aminoethyl)-5-(4-ethoxyphenyl)-2,4-thiazolidinedione	H | N--CH2-CH2-NH2 | --C--C--C | | O O | | S C--O--CH2-CH3 | C | H	Pharmaceuticals, fragrance.
Mono-2-ethylhexyl phthalate	di(2-ethylhexyl) benzene-1,2-dicarboxylate		Plasticizer, metabolite in the body, endocrine disruptor, biomonitoring.

(-)-Caryophyllene oxide	(1R,9S)-4,11,11-Trimethyl-8-methylene-bicyclo[7.2.0]undec-4-ene-1,9-diol		Antimicrobial, anti-inflammatory, antioxidant, flavour and fragrance, pharmaceuticals, anticancer properties, neuroprotective effects.
3,4-Methylenedioxy-.alpha.-pyrrolidinobutiophenone	1-(1,3-benzodioxol-5-yl)-2-(pyrrolidin-1-yl)butan-1-one		Pharmacological studies
Glycyl-L-norleucine	2-((2-aminoethyl)amino)-4-methylsulfanyl butanoic acid		Protein synthesis, nutritional supplements, pharmaceutical, flavour and fragrance.
N-(3-(Aminomethyl)benzyl)acetamidine	N-(3-aminomethyl benzyl)acetamidine		Enzyme inhibition, drug development, antimicrobial agents, biomedical research, neuroscience research.
O-(4-Hydroxybenzoyl)tropine	3-(1-Tropanyl) 4-hydroxybenzoate		Toxicological studies, pharmaceuticals, anticholinergic effects, potential use medicinal use
6-Chloropurine	6-chloro-7H-purine		Antiviral and anticancer agent, nucleotide analog synthesis, purine metabolism studies.

	Ethyl 2,4-dihydroxy-6-methylbenzoate	Ethyl 2,4-dihydroxy-6-methylbenzoate		Flavour and fragrance industry, pharmaceuticals,antioxidant properties, cosmetics and personal care
	3-Quinolinecarboxylic acid, 7,8-dichloro-1,4-dihydro-4-oxo-	7,8-dichloro-1,4-dihydroquinoline-3-carboxylic acid		Antimicrobial agent, antimalarial agent, catalysis, anti-inflammatory properties.
	1,6-Anhydro-2,3-O-isopropylidene-.beta.-D-mannopyranose	(3R,4S,5R,6R)-6-(Hydroxymethyl)-2-methylhexan-3,4,5-triol, 2,3-O-isopropylidene, 1-oxide		Glycosylation reaction, carbohydrate chemistry, synthetic intermediate.
	.alpha.-Cyperone	2,5-dimethyl-2,4,6-octatriene-1-one		Fragrance, perfumery, antimicrobial property, insect repellent, agricultural application.
	2,4-Pyridinedicarboxylic acid	Pyridine-2,4-dicarboxylic acid		Coordination chemistry, pharmaceuticals, corrosion inhibitors, material science, flavour and fragrance.
	Uric acid	7,9-dihydro-1H-purine-2,6,8(3H)-trione		Metabolic indicator, gout diagnosis, antioxidant property, neurological research, excretion of waste, cardiovascular health.

	Isomalathion	S-(1,2-carbethoxymethyl) O,O-dimethyl phosphorodithioate		Agricultural use and vector control.

I. **Results**

II.

The analysis revealed a rich and diverse array of compounds within the snail slime extract. The identified compounds belong to various chemical classes, including:

- Organic acids: Noteworthy examples include 2-Hydroxy-5-methoxybenzoic acid (Homoveratric acid), Trans-2-hydroxycinnamic acid (p-coumaric acid), and cis-5-Dodecenoic acid.
- Amino acids: Ile-Asn, Glycyl-L-norleucine, Trp-Pro-Arg, and others contribute to the proteinaceous fraction of the slime.
- Alkaloids: Benzoylmetronidazole, N-Desmethyltapentadol, and Clomazon, indicating potential bioactivity.
- Esters: Ethyl 4-hydroxyquinoline-3-carboxylate, Ethyl vanillate, and Methylsuccinic acid, suggesting aromatic and lipid components.

DISCUSSION:

The identified compounds exhibit a wide range of potential therapeutic properties. Organic acids, known for their antimicrobial and antioxidant activities, could contribute to the observed wound-healing effects of snail slime. Amino acids, as essential building blocks of proteins, may play a role in skin regeneration and repair. The presence of alkaloids raises intriguing possibilities for novel pharmaceutical applications.

The combination of esters, particularly quinoline derivatives, suggests the presence of aromatic and lipidic compounds that may contribute to the unique sensory properties of snail slime and potentially enhance its cosmetic appeal.

IV. CONCLUSION

This research article provides a comprehensive and detailed categorization of 204 compounds found in snail slime extracted from Lissachatina fulica. The diverse array of identified compounds spans various chemical classes, suggesting the complexity and richness of snail slime's chemical composition. Further exploration of the individual and synergistic effects of these compounds is warranted to unlock the full therapeutic potential of snail slime in medicine, cosmetics, and related industries. This study lays the foundation for future investigations into the specific mechanisms and applications of snail slime compounds.

SOME OF THE ADVANTAGES FROM THE ABOVE RESULTS

Therapeutic Potential: The identified organic acids, amino acids, alkaloids, and esters in snail slime exhibit diverse pharmacological properties, including antimicrobial, antioxidant, and anti-inflammatory activities (31, 32, 33). These bioactive compounds hold promise for the development of novel therapeutic agents for various medical conditions, including wound healing, skin regeneration, and dermatological disorders (34, 35).

Cosmetic Applications: The presence of esters and other compounds with sensory properties suggests potential applications in the cosmetics industry (36). Snail slime extracts may enhance the formulation of skincare products, offering moisturizing, soothing, and rejuvenating effects (37). Furthermore, the natural origin of these compounds aligns with consumer preferences for clean and sustainable beauty products (38).

Bioavailability and Safety: The bioactive compounds identified in snail slime exhibit favorable bioavailability and safety profiles, making them suitable candidates for pharmaceutical and cosmetic formulations (39). Additionally, the natural origin of these compounds may mitigate concerns regarding adverse effects commonly associated with synthetic ingredients (40).

Novel Drug Development: The discovery of unique alkaloids and other bioactive compounds in snail slime opens avenues for the development of novel pharmaceuticals (41). These compounds may serve as lead molecules for drug discovery programs targeting various diseases, including microbial infections, inflammatory conditions, and neurological disorders (42, 43).

Synergistic Effects: The complex mixture of compounds present in snail slime may exhibit synergistic effects, enhancing their therapeutic efficacy (44). Synergism between different classes of compounds, such as organic acids, amino acids, and esters, may potentiate their biological activities and broaden their potential applications in medicine and cosmetics (45).

Natural Product Diversity: Snail slime represents a rich source of natural products with diverse chemical structures and biological activities (46). The identification of over 200 compounds highlights the complexity and richness of snail slime's chemical composition, underscoring its potential as a valuable resource for drug discovery and development (47).

V. References

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