Algerian Academy of Allergology and Clinical Immunology
8ème Congrès National – 29 & 30 Novembre 2024

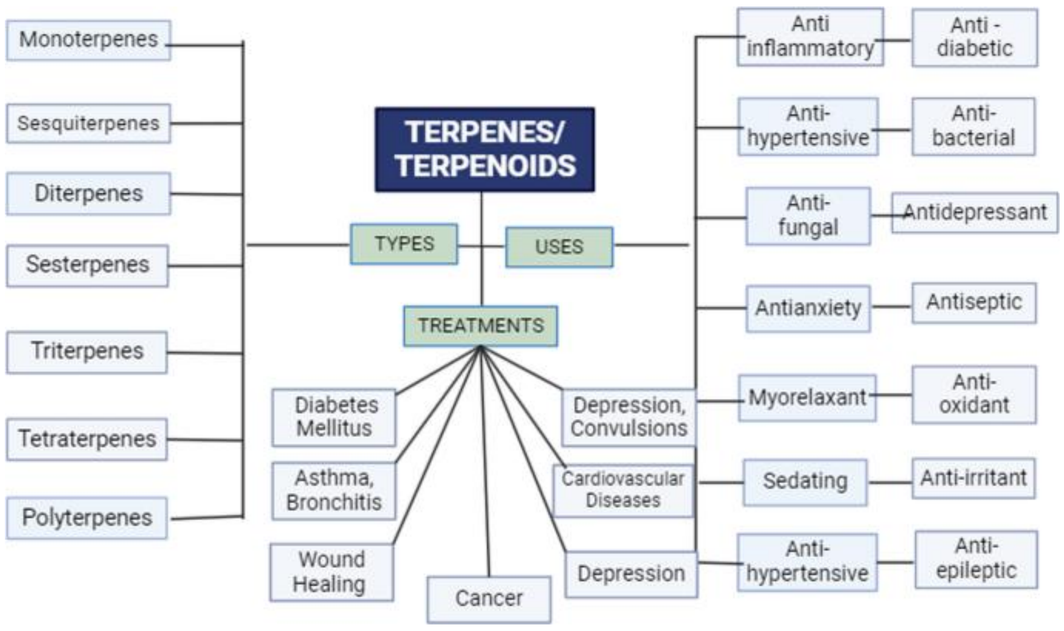
Anti-inflammatory Properties of Terpenes and Plant-derived Essential Oils: An Update

BOUKHATEM Mohamed Nadjib [1]
1/ Laboratoire Plantes Médicinales et Aromatiques, Université Blida 1, Blida.

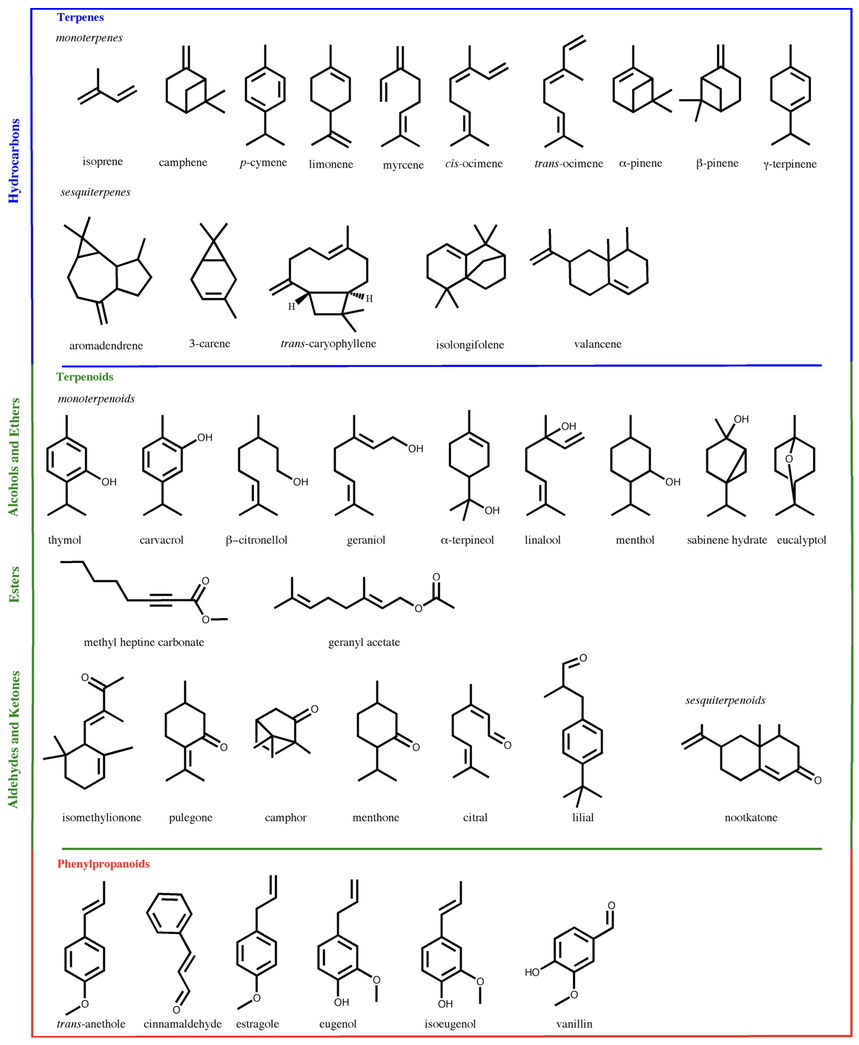
ABSTRACT

Inflammation and allergies are closely related processes in the body's immune response. Allergic reactions often involve inflammation as a key component. Inflammation is a physiological reaction to a variety of agents such as microbial or viral infections, toxic chemicals, and physical injury. Skin inflammation, autoimmune diseases, and cancer are all linked with the progression of inflammation. Treatments may include anti-inflammatory medicines, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids, but they both have a great variety of adverse effects. Essential oils (Eos) are derived from aromatic and medicinal plants, and have been used for decades in complementary and alternative medicines. EOs and their constituent terpenes (monoterpenes and sesquiterpenes) have garnered attention for their potential anti-inflammatory activities. Several research and scientific investigations suggest that certain EOs may have anti-inflammatory effects in vitro and using different animal models, which could be beneficial for some inflammatory conditions such as arthritis, asthma, and inflammatory bowel disease. For example, lavender EO, contains linalool and linalyl acetate, two oxygenated monoterpenes with well-documented anti-inflammatory actions. One of the mechanisms by which terpenes and EOs exert their anti-inflammatory effects is through their antioxidant potential. Moreover, these natural biomolecules have been found to inhibit the production of inflammatory cytokines, such as tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6), which play key roles in the inflammatory reaction. However, more studies are needed to confirm these effects and determine safe concentrations. This presentation provides an update of the anti-inflammatory activity of selected EOs and their characteristic terpenes *in vitro* and *in vivo*, as well as a discussion of potential mechanisms of action.

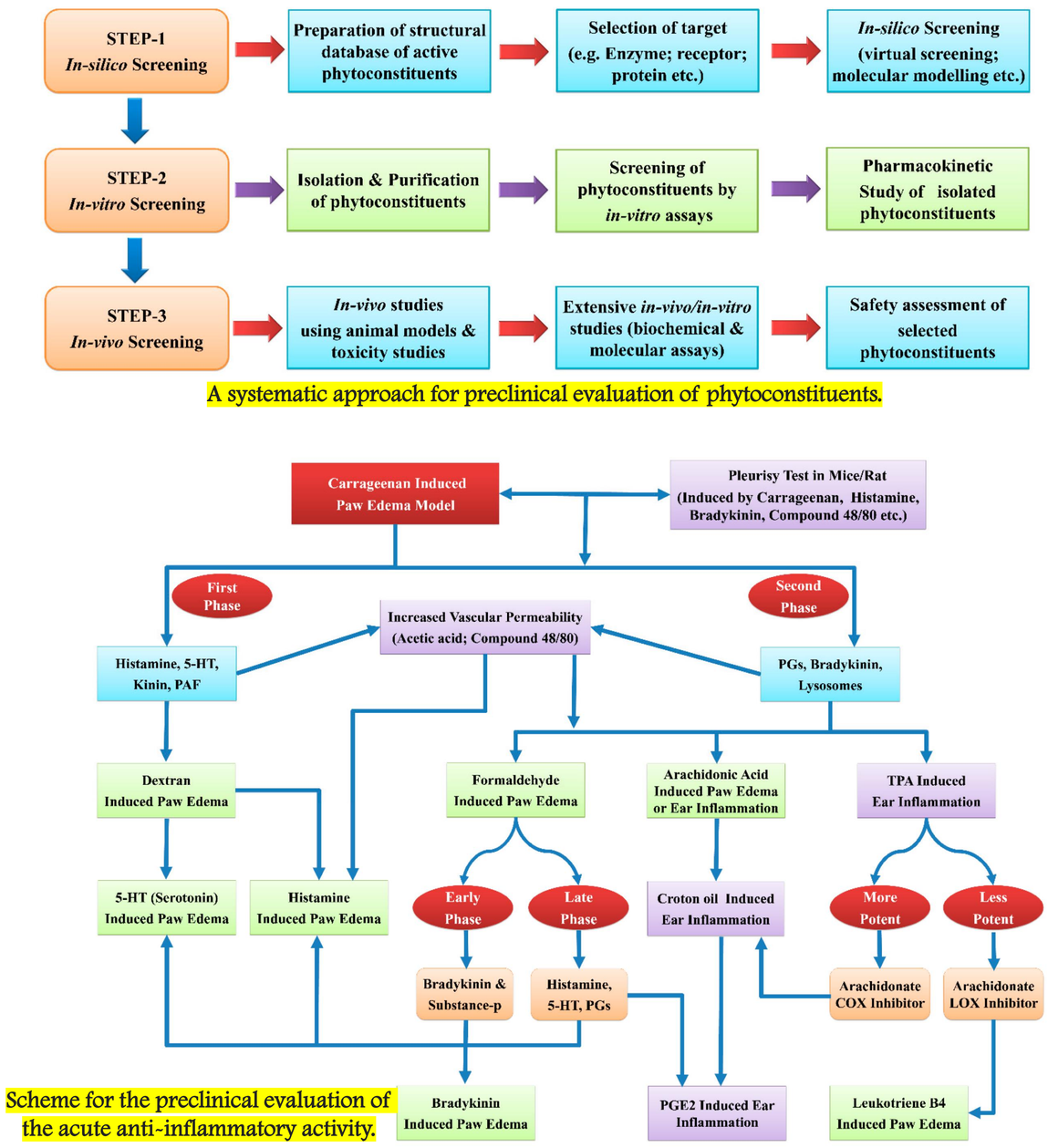
Keywords: Oxygenated terpenes; Aromatic herbs; Essential oils; Topical anti-inflammatory activity; Histological examination.



Health-benefits of plant-derived essential oil compounds.



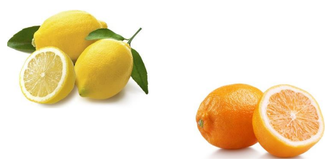
Chemical structure of some typical essential oil components.
They can be subdivided into three groups of related chemical constituents: terpenes, terpenoids and phenylpropanoids



A systematic approach for preclinical evaluation of phytoconstituents.

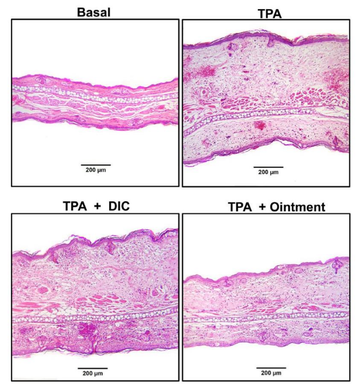
Scheme for the preclinical evaluation of the acute anti-inflammatory activity.

Essential oils as natural anti-inflammatory agents.

	Name of the Plant	Part Used	Main Component	Experimental Model	Mechanism of Action
	*Thymus carnosus*, *Thymus camphoratus*	Flowering aerial parts	*T. carnosus* [Borneol (29%), Camphene (19.5%)] *T. camphoratus* [Borneol (20%), 1, 8-cineole (29%)]	RAW 264.7 and HepG2 cell lines	Inhibition of nitric oxide production; *T. camphoratus* inhibits COX-2 and iNOS
	-	-	Citronellol, α-terpineol, carvacrol	OVA induction in male Swiss mice	Reduction in leucocyte migration and TNF-α levels, modulates COX, PGE_2, and H1 receptors
	*Citrus limon*, *Citrus aurantifolia*, *Citrus limonia*	Fruit peel	Limonene, β-pinene, γ-tripinene	In vivo anti-inflammatory tests: Hot plate test, Formalin test; Subcutaneous air pouch (SAP) model	Reduce increased levels of TNF-α, IL-1β, IFN- γ
	*Citratus aurantium* L.	Fresh blossoms	Linalool	Inflammatory paw edema test, cotton plate-induced granuloma	Inhibition of expression of prostaglandin synthesis through the COX pathway, inhibits formation or release of nitric oxide
	*Boswellia ovalifoliolata*	Leaves and bark	Bark [β-Farnesene, caryophyllene oxide, etc.]; Leaves [spathulenol, caryophyllene oxide]	In vitro test: albumin denaturation assay	-

The ointment's effect on TPA-induced acute ear edema.

Representative histological images (H&E staining) of ear biopsies from mice treated with acetone solution (basal), TPA only, treated with the ointment (containing plant extracts from *Eucalyptus globulus*, *Curcuma longa*, *Hamamelis virginiana*, *Echinacea purpurea*, and *Zingiber officinale*), and diclofenac (DIC).



References
1) Pal, S., & Jha, S. (2022). A Delve into the Novel Field of Essential Oil-Based Silver Nanoparticles and Its Anti-Inflammatory Potential. Materials Proceedings, 9(1), 3.
2) Kfoury, M., Auezova, L., Greige-Gerges, H., & Fourmentin, S. (2019). Encapsulation in cyclodextrins to widen the applications of essential oils. Environmental Chemistry Letters, 17, 129-143.
3) Patil, K. R., Mahajan, U. B., Unger, B. S., Goyal, S. N., Belemkar, S., Surana, S. J., & Patil, C. R. (2019). Animal models of inflammation for screening of anti-inflammatory drugs: implications for the discovery and development of phytopharmaceuticals. International journal of molecular sciences, 20(18), 4367.
4) Barragan-Galvez, J. C., Gonzalez-Rivera, M. L., Jiménez-Cruz, J. C., Hernandez-Flores, A., & Alonso-Castro, A. J. (2024). A Patent-Pending Ointment Containing Extracts of Five Different Plants Showed Antinociceptive and Anti-Inflammatory Mechanisms in Preclinical Studies. Pharmaceutics, 16(9), 1215.