Chemical composition, antibacterial and antioxidative activities of *Monotheca buxifolia* (Falc.) A. DC leaves essential oil

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**ABSTRACT**

*Monotheca buxifolia* (Sapotaceae) is used against different health ailments due to auspicious biological properties. Essential oil was extracted from leaves of *M. buxifolia* through steam distillation. Gas chromatography coupled with mass spectrometry (GC-MS) showed presence of 34 compounds. Geranyl acetone (12.6%), nonanal (9.0%) and champhor (8.0%) were abundant while (E)-\(\beta\)-ionone, cis-carvone oxide and caryophyllene oxide were also found. The oil presented 50.2% free radical scavenging activity while total antioxidant potential and total reducing power potential were 40.0 \(\mu\)g AAE/mL and 38.7 \(\mu\)g AAE/mL, respectively. The extracted oil presented moderate activity against *Escherichia coli* (14 mm) and *Bacillus subtilis* (11 mm). The study concludes that the essential oil of *M. buxifolia* leaves has diverse chemical composition and biological activities therefore can be explored for therapeutic potential.
1. Introduction

Volatile compounds have got more attention in recent years due to their ease of extraction, fragrance, and therapeutic potential. Phytochemically, essential oils are constituted by mono, sesqui-terpenes, benzenoids and short chain aromatic and aliphatic alcohols, aldehydes, and ketones. The essential oil interrelates with body by four distinct modes of actions due to presence of aromatic compounds, that is, pharmacological, physiological, psychological, and spiritual (Kaiser 1993).

*Monotheca buxifolia* (Falc.) A. DC. (family Sapotaceae) is known as Gurgura by local community. The local community uses it as fodder for domestic animals, and as hedge around fields. The wood is also used as roof material (Khan et al. 2011). This plant is used by the local community to cure many diseases, that is, it reduces temperature, works as digestive and laxative agent, provides relief in urinary tract problems, and others (Jan and Khan 2016; Ullah et al. 2017; Ali, Khan, et al. 2020; Khan et al. 2020). Recently, lupeol and benzene derivatives have been isolated from leaves of *M. buxifolia* (Ali et al. 2021) while many phenolics and flavonoids were identified by HPLC-PDA analysis (Ali, Saleem, et al. 2020).

Here we reported the chemical composition of essential oil extracted from leaves of *M. buxifolia*. This plant species has not been explored for essential oil composition. The essential oil extracted from leaves was analyzed by GC-MS for the identification of compounds and their percentage composition. Further antioxidant and antibacterial properties of extracted oil were also explored.

2. Results and discussion

*M. buxifolia* leaves contained little amount of volatiles constituents. The steam distillation process yielded 0.03% essential oil. Studies have reported low yield of essential oils in many plant species, that is, *Azadirachta indica* (0.028%), *Azadirachta siamensis* (0.018%) and *Azadirachta excels* (0.028%) (Kurose and Yatagai 2005). Likewise leaves of *Origanum majorana* contained 0.49% while *Lantana camara* and *Nerium oleander* have 0.18% and 0.07% essential oil, respectively (El-Seedi et al. 2017). The percentage yield of essential oil is depended on many factors such as climatic and environmental conditions. *M. buxifolia* wildly grows on dry mountains where water deficient stress impose by climatic conditions may decrease essential oil content percentage (Petropoulos et al. 2008).

Chemical constituents of essential oil were identified by GC-MS analysis. Total 34 compounds were identified in *M. buxifolia* oil representing 97.7% composition of essential oil contents (Table S1). The oil contains diverse types of compounds such as hydrocarbons, aldehydes, ketones, monoterpenes, sesquiterpenes, etc. Major compounds identified in the essential oil were 1,8-cineole (3.0%), nonanal (9.0%), Piperitenone oxide (5.7%), geranyl acetone (12.6%), β-ionone (6.2%), and caryophyllene oxide (4.6%) (Table S1).

A number of components present in *M. buxifolia* oil have been identified in other members of Sapotaceae family (Ishola et al. 2017). Ionone, caryophyllene, eudesmol, cadinol undecanal, etc are reported in *Vitellaria paradoxa* (Aboaba et al. 2014). Geraniol, α-pinene, β-pinene, carvone, eugenol, β-ionone and citral are present in *V.*
paradoxa (Obafemi et al. 2006). Geranyl acetone and ionone have been found in other species of Sapoteace (Ullah et al. 2017).

The oil presented moderate (50.2%) DPPH based free radical scavenging activity. Total antioxidant potential and total reducing power potential were 40.0 μgAAE/mL and 38.7 μgAAE/mL, respectively. The oil presented less phenolic contents, 20.8μg GAE/mL (Table S2). The oil presented moderate antibacterial activity against Gram positive and Gram negative bacterial strains. Maximum zone of inhibition 14 mm was depicted against Escherichia coli while against Bacillus subtilis the average zone on inhibition was 11 mm (Table S2). Biological activities, that is, antibacterial, free radical scavenging, antioxidant and reducing power potential etc. have been reported by polar and non-polar solvents extracts of M. buxifolia (Ali, Khan, et al. 2020; Ali, Saleem, et al. 2020; Khan et al. 2020; Ali et al. 2021). The present activities are in line with reported activities and these are due to diversity of biochemical constituents. It has also been reported that Sapotaceae is rich with triterpenes while low amount of sapo-

3. Experimental

The materials used in this study and methodologies followed for extraction, identification, and biological assessment is described in supplementary file.

4. Conclusion

The study concludes that M. buxifolia leaves oil has diverse phyto constituents and also bears antioxidative and antibacterial properties therefore can be further explored based on traditional therapeutic properties.

Disclosure statement

Authors declare no conflict of interest.

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