Helichrysum cymosum is a valuable and well-known medicinal plant in tropical Africa. The current study critically reviewed the medicinal uses, phytochemistry and biological activities of H. cymosum. Information on medicinal uses, phytochemistry and biological activities of H. cymosum, was collected from multiple internet sources which included Scopus, Google Scholar, Elsevier, Science Direct, Web of Science, PubMed, SciFinder, and BMC. Additional information was gathered from pre-electronic sources such as journal articles, scientific reports, theses, books, and book chapters obtained from the University library. This study showed that H. cymosum is traditionally used as a purgative, ritual incense, and magical purposes and as herbal medicine for colds, cough, fever, headache, and wounds. Ethnopharmacological research revealed that H. cymosum extracts and compounds isolated from the species have antibacterial, antioxidant, antifungal, antiviral, anti-HIV, anti-inflammatory, antimarial, and cytotoxicity activities. This research showed that H. cymosum is an integral part of indigenous pharmacopeia in tropical Africa, but there is lack of correlation between medicinal uses and existing pharmacological properties of the species. Therefore, future research should focus on evaluating the chemical and pharmacological properties of H. cymosum extracts and compounds isolated from the species.

Keywords: Asteraceae, Ethnopharmacology, Helichrysum cymosum, Herbal medicine, Indigenous pharmacopeia, Tropical Africa.

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INTRODUCTION

Helichrysum cymosum (L.) D.Don is a member of the Asteraceae or Compositae family, commonly referred to as aster, daisy, or sunflower family. The family Asteraceae is one of the largest families of flowering plants, which is cosmopolitan except for Antarctica region [1-3]. The family consists of over 1600 genera and 23,000 species which have been recorded in grassland, wooded grassland, montane vegetation, and tropical forests [1]. Research by Jeschke et al. [4] showed that the family Asteraceae has at least 420 known medicinal species and these include Arnica montana L. [5-11], Artensia annua L. [12-19], Calendula officinalis L. [20-25], Chamaemelum nobile (L.) All. [26-30], Inula helenium L. [31-36], and Matricaria recutita L. [37-43]. Another important source of herbal medicines among Asteraceae taxa is the genus Helichrysum Mill. [44-60]. According to Lourens et al. [61] and Pjivjakšič et al. [62], the genus Helichrysum is characterized by acylchlorogluclins, humulone derivatives, flavonoids, chalcones, phenolic acids, phthalides, sterols, coumarins, pyrones, diterpenes, sesquiterpenes, and polyacetylenes. The genus Helichrysum is characterized by several biological activities such as antimicrobial, anti-inflammatory, antioxidant, chologogue, choleretic, hepatoprotective, detoxifying, protease-inhibiting, and antiallergic properties [61-63]. H. cymosum (L.) D.Don, Helichrysum auroumnesens Sch. Bip., Helichrysum nudifolium (L.) Less., Helichrysum odoratissimum (L.) Sweet, Helichrysum pedunculatum Hilliard and B.L. Burt., and Helichrysum petiolare Hilliard and B.L.Burt. are among the species widely used as herbal medicines in South Africa [64]. The genus name “Helichrysum” is derived from the Greek words “helios” which means “sun” and “chrysos” which means “gold” in reference to the “golden flowers” which are characteristic of the genus [62]. The specific name “cymosum” is a Latin word which means “with cymes” in reference to the flat-topped clusters of flower heads, as the flowers of the species occur in clusters in which the flowers open from the center outward [65]. The leaves, stems, and twigs of H. cymosum are sold as herbal medicines in the informal herbal medicine markets in the Gauteng and the Western Cape provinces in South Africa [65-68]. Therefore, the current study is aimed at providing a critical appraisal of the existing ethnomedicinal value, phytochemistry and biological activities of H. cymosum, as well as exploring the potential of the species as herbal medicine in tropical Africa.

BOTANICAL DESCRIPTION OF H. CYMOSUM

In South Africa, H. cymosum is known as guld carpet or yellow-tipped strawflower in English, goutey tapty in Afrikaans, and impumpos in isiXhosa or Zulu [65]. H. cymosum is divided into two subspecies, H. cymosum subsp. cymosum and H. cymosum subsp. calvum Hilliard [65,69]. These two subspecies are differentiated on the basis that the head of subsp. cymosum has 6–20 flowers, fimbrils are more than twice as long as the ovary, and the pappus is copious [65,70]. While the head of subsp. calvum has 4–7 flowers, fimbrils are about as long as the ovary and the pappus is wanting [65,70]. In South Africa, subsp. calvum is shorter, ranging in height from 15 to 55 cm and has been recorded at an altitude ranging from 1200 to 3170 m above sea level [69]. The subsp. cymosum is taller than subsp. calvum, with height ranging from 10 to 180 cm and has been recorded at an altitude ranging from 5 to 2010 m above sea level [69]. However, most ethnobotanical and ethnopharmacological literature does not separate H. cymosum into specific subspecies but rather to H. cymosum sensu lato, and this is the approach that has been adopted in this study. There are four synonyms associated with H. cymosum and these include Gnpauhium cymosum L., G. serratum L., G. tricostatum Sieber ex DC., Helichrysum infustum J.M. Wood and M.S. Evans var. discolor Moeser, and Lepiscinle cymosa Cass [69,70].

H. cymosum is a well-branched spreading, perennial dwarf shrub with thin grayish-white woolly branches densely covered with leaves and becoming pedunculoid upward. The leaves are variable in shape and size, becoming smaller and more distant upward. The leaves are elliptic-oblong or linear-oblong in shape, the apex is acute, sometimes acuminate, mucronate, slightly narrowed, and clasping at the base [65,70]. The leaf margins are flat or subrevolute, upper surface covered in thin silvery gray and paper-like hairs, while the lower surface has white-woolly hairs. The flower heads are disciform,
PHYTOCHEMICAL AND NUTRITIONAL COMPOSITION OF H. CYMOSUM

Very little attention has been paid to the macro- and microelements of H. cymosum. One report done by Street et al. [90] partly studied this subject and reported values of the nutritional composition of leaves, roots, and stems of H. cymosum (Table 2). Bohmann et al. [91], Jakupovic et al. [92], and van Vuuren et al. [89] identified heliolumone, helichromanochoalone, and 5-hydroxy-8-methoxy-7-prenyloxyflavanone from leaves and roots of H. cymosum. The composition of essential oils appears to vary with the geographical origin of the specimens as shown in Table 3. The major compounds that have been identified from the species include α-pinene (0.6%–12.4%), Δ-3-carene (6.8%–16.1%), β-caryophyllene (8.5%–17.8%), 1,8-cineole (1.0%–20.4%), trans-caryophyllene (27.0%), and (Z)-β-ocimene (<0.01%–50.4%) [85,89,93-97]. Future research should focus on evaluating the biological activities of the isolated compounds.

BIOLOGICAL ACTIVITIES

The following biological activities have been reported from H. cymosum crude extracts and compounds isolated from the species: Antibacterial [72,74,85,89,94], antioxidant [95], antifungal [89,94,95,98], antiviral [72], anti-HIV [99,100], anti-inflammatory [74], antimarial [89], cytotoxicity [99,100], and toxicity [89] activities.

Antibacterial activities

Sindambwe et al. [72] evaluated antibacterial activities of 80% ethanol whole plant extracts of H. cymosum using the liquid dilution method against Escherichia coli, Klebsiella pneumoniae, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella paratyphi, Bacillus cereus, Mycobacterium fortuitum, Staphylococcus aureus, and Streptococcus pyogenes. The extract was active against S. pyogenes with minimum inhibitory concentration (MIC) value of 5 mg/ml [72].

Table 1: Medicinal uses of Helichrysum cymosum

| Disease                      | Parts used                     | Country               | References |
|------------------------------|--------------------------------|-----------------------|------------|
| Blocked nose                 | Whole plant                    | South Africa          | [81]       |
| Boost immunity               | Aerial parts and leaves        | South Africa          | [77]       |
| Cardiovascular problems      | Aerial parts                   | South Africa          | [76]       |
| Cold                         | Leaves                         | South Africa          | [61,73,78,91-86] |
| Cough                        | Roots                          | South Africa          | [61,73,78,91,85,86] |
| Diarrhea                     | Aerial parts and leaves        | South Africa          | [77]       |
| Dizziness                    | Aerial parts, flowers, leaves, roots and twigs | South Africa          | [80]       |
| Eye problems                 | Aerial parts                   | South Africa          | [76]       |
| Fever                        | Leaves                         | South Africa          | [73,82-84] |
| Flatulence                   | Whole plant                    | Cameroon              | [75]       |
| Headache                     | Leaves                         | South Africa          | [61,73,79,82,86,87] |
| Improve appetite             | Aerial parts and leaves        | South Africa          | [77]       |
| Induce trance                | Aerial parts, flowers, leaves, roots and twigs | South Africa          | [61,79,80,86] |
| Influenza                    | Whole plant                    | Rwanda                 | [72]       |
| Insect repellent             | Whole plant                    | South Africa          | [81]       |
| Insomnia                     | Whole plant                    | South Africa          | [81]       |
| Kidney problems              | Whole plant                    | South Africa          | [81]       |
| Laxative                     | Aerial parts                   | South Africa          | [79]       |
| Magical (chase away evil spirits and rain making) | Aerial parts, leaves and whole plant | South Africa and Uganda | [77,83,84,87,88] |
| Menstrual pain               | Whole plant                    | South Africa          | [73,89]    |
| Pertussis                    | Whole plant                    | Rwanda                 | [72]       |
| Pulmonary problems           | Aerial parts                   | South Africa          | [76]       |
| Purgative                    | Aerial parts                   | South Africa          | [61,79,86] |
| Skin infections              | Roots                          | South Africa          | [78]       |
| Urinary problems             | Whole plant                    | South Africa          | [81]       |
| Varicose veins               | Aerial parts                   | South Africa          | [76]       |
| Vomiting                     | Aerial parts                   | South Africa          | [79]       |
| Weak bones                   | Whole plant                    | Cameroon              | [75]       |
| Wounds                       | Aerial parts and roots         | South Africa          | [78,85,90] |
et al. [74] evaluated the antibacterial activities of ethanol extracts of whole plant parts of H. cymosum against Bacillus subtilis, S. aureus, E. coli, and K. pneumonia using the micro plate method. The extract exhibited activities with MIC values ranging from 0.8 to 1.6 mg/ml [74]. Van Vuuren et al. [89] and Van Vuuren [94] evaluated the antibacterial activities of acetone extracts of aerial parts of H. cymosum, essential oil and compound helihumulone isolated from the species against Enterococcus faecalis, B. cereus, B. subtilis, S. aureus, P. aeruginosa, Yersinia enterocolitica, and E. coli using disc diffusion and micro dilution techniques with ciprofloxacin as a positive control. The extract exhibited activities against E. faecalis, B. cereus, B. subtilis, and S. aureus with zone of inhibition ranging from 3.7 to 8.0 mm which was comparable to 3.0 mm to 11 mm exhibited by the positive control. The extract, essential oil and compound helihumulone exhibited activities with MIC values ranging from 0.02 to 8.0 mg/ml [89,94]. Reddy [85] evaluated antibacterial activities of acetone and methanol extracts of aerial parts of H. cymosum as well as essential oils isolated from the species against E. coli, Yersinia enterocolitica, Klebsiella pneumoniae, S. aureus, and B. cereus using disc diffusion assay with ciprofloxacin (0.01 mg/ml) as a positive control. The acetone and methanol extracts exhibited activities against S. aureus and B. cereus with zone of inhibition of 7 and 5 mm, respectively, and MIC value of <0.25 mg/ml exhibited against both pathogens. The positive control exhibited zone of inhibition of 6 mm and MIC value of 0.003 mg/ml [85].

Antioxidant activities
François et al. [95] evaluated the antioxidant activities of essential oil isolated from the leaves of H. cymosum using 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay with butylated hydroxytoluene as a positive control. The extract exhibited activities with IC₅₀ (concentration of sample required to scavenge 50% of DPPH radicals) value of 6.3 g/l which was less than the value of the positive control which exhibited value of 7.0 mg/l [95].

Antifungal activities
Van Vuuren et al. [89] and Van Vuuren [94] evaluated the antifungal activities of acetone extract of aerial parts of H. cymosum, essential oil and compound helihumulone isolated from the species against Cryptococcus neoformans and Candida albicans using micro dilution technique with amphotericin B as a positive control. The extract, essential oil and compound helihumulone exhibited activities with MIC values ranging from 0.03 to 4.0 mg/ml [89,94]. François et al. [95] evaluated the antifungal activities of essential oil isolated from the leaves of H. cymosum against Penicillium oxalicum using micro dilution technique with amphotericin B as a positive control. The extract showed activities with 54.7% inhibition starting from 2.5 to 5 mg/ml [95]. Runyoro et al. [98] evaluated the antifungal activities of the essential oils isolated from H. cymosum against C. albicans using the bioautography agar overlay method with amphotericin B (0.01 µg) as a positive control. The extract showed activities with zone of inhibition ranging from 6 to 8.5 mm while the positive control exhibited zone of inhibition of 14.2 mm [98].

Antiviral activities
Sindambwe et al. [72] evaluated antiviral activities of aqueous and 80% ethanol whole plant extract parts of H. cymosum using the method of 50% end point titration technique (50% EPTT) assay against herpes simplex virus Type 1, measles virus strain Edmonston A, Semliki Forest virus A7 (SF A7), and vesicular stomatitis virus T2 (VSV T2). The extract exhibited virucidal activities against VSV T2 and SF A7 [72].

Anti-HIV activities
Heyman [99] evaluated anti-HIV activities of methanol and chloroform extracts of aerial parts of H. cymosum subsp. Cymosum on Vero African green monkey kidney cells using the cytopathic effect (CPE) inhibition assay with acyclovir (0.75 µg/ml) as a positive control. The methanol/water extract showed slight toxicity with CPE of 400.0 µg/ml in comparison to 0.8 µg/ml exhibited by the positive control [99]. Heyman [79] and Heyman et al. [100] evaluated anti-HIV activities of dichloromethane and methanol/water extracts of aerial parts of H. cymosum subsp. Cymosum and H. cymosum subsp. Clavum using the DeCIPhR method. The extracts exhibited activities with median lethal concentration value ranging from 10.0 to 21.0 µg/ml [79,100].

Anti-inflammatory activities
Stafford et al. [74] evaluated the anti-inflammatory activities of aqueous and ethanol extracts of whole plant parts of H. cymosum using the cyclooxygenase (COX-1) inhibition assay. The COX-1 inhibition exhibited by aqueous and ethanol extract was 52.0% and 100.0%, respectively [74].

Antimalarial activities
Van Vuuren et al. [89] evaluated the antimalarial activities of acetone extract of aerial parts of H. cymosum, essential oil and compound helihumulone isolated from the species using the [G-H] hypoxanthine incorporation assay using Plasmodium falciparum as the test organism with chloroquine and quinine as positive controls. The extract, essential oil and compound helihumulone showed activities, exhibiting half maximal inhibitory concentration (IC₅₀) values of 0.80 to 0.1 µg/ml exhibiting zone of inhibition of 14.9 µg/ml respectively. The positive controls exhibited IC₅₀ values ranging from 0.99 to 0.1 µg/ml [89].

Cytotoxicity activities
Heyman [99] evaluated cytotoxicity activities of chloroform and methanol/water extracts of aerial parts of H. cymosum subsp. Cymosum on Vero African green monkey kidney cells using the XTT (sodium 3’-[1-(phenyl amino-carbonyl)-3,4-tetrazolium]-bis-[4-methoxy-6-nitro] benzene sulfonic acid hydrazide) method with zearalenone as a positive control. The chloroform and methanol/water extracts exhibited IC₅₀ values of 36.5 µg/ml and 59.7 µg/ml respectively, which were higher than 13.5 µg/ml exhibited by the positive control [99]. Heyman [79] and Heyman et al. [100] evaluated anti-HIV activities of dichloromethane and methanol/water extracts of aerial parts of H. cymosum subsp. Cymosum and H. cymosum subsp. Clavum using the DeCIPhR method. The extracts exhibited activities with median lethal dose value of 50.0 µg/ml [79,100].

Toxicity activities
Van Vuuren et al. [89] evaluated the toxicity activities of acetone extract of aerial parts of H. cymosum, essential oil and compound helihumulone isolated from the species against transformed human kidney epithelial cells using a colorimetric tetrazolium-based 3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide cellular viability assay. The extract, essential oil and compound helihumulone showed activities, exhibiting IC₅₀ values of 172.0 µg/ml, 17.5 µg/ml, and 57.1 µg/ml respectively [89].

CONCLUSION
In this review, the medicinal uses, phytochemistry, biological and toxicity activities of different extracts, and compounds of H. cymosum have been summarized. The diverse medicinal uses of H. cymosum and the preliminary phytochemical and ethnopharmacological
Table 3: Phytochemical composition of *Helichrysum cymosum*

| Phytochemical composition (%) | Values       | Plant parts                        | References          |
|-------------------------------|--------------|------------------------------------|---------------------|
| **cis-Alloocimene**           | 0.4          | Aerial parts                       | [85,89,94]          |
| **α-Amorphene**               | <0.01–3.7    | Aerial parts, flowers and leaves    | [93,97]             |
| **Aromadendrene**             | 1.5–3.6      | Aerial parts, flowers and leaves    | [85,89,94,95]       |
| (+)-**Aromadendrene**         | 1.4          | Aerial parts                       | [93]                |
| **Alloaromadendrene**         | <0.01–1.3    | Flowers and leaves                 | [97]                |
| **Aromadendrene epoxide**     | 0.08         | Aerial parts                       | [93]                |
| **Benzaldehyde**              | 0.1–0.3      | Aerial parts                       | [85,89,94]          |
| **Benzylacetone**             | 0.3          | Aerial parts                       | [85,89,94]          |
| **Bicyclogermacrene**         | 0.9          | Aerial parts                       | [93]                |
| **Borneol**                   | <0.1–1.8     | Aerial parts, flowers and leaves    | [85,89,93-95]       |
| **Borromyene**                | 2.7          | Leaves                             | [95]                |
| **β-Bourbonene**              | 0.2–0.6      | Aerial parts                       | [85,89,93,94]       |
| **trans-Cadina-1 (6),4-diene**| 0.1          | Flowers and leaves                 | [97]                |
| **α-Cadinol**                 | 0.1–0.7      | Aerial parts, flowers and leaves    | [85,89,93-95,97]    |
| **epi-α-Cadinol**             | 0.1–0.3      | Flowers and leaves                 | [97]                |
| **δ-Cadinol**                 | 0.3          | Aerial parts                       | [93]                |
| **α-Cadinene**                | <0.01        | Flowers and leaves                 | [97]                |
| **γ-Cadinene**                | 2.0          | Aerial parts                       | [93]                |
| **δ-Cadinene**                | 0.3–1.6      | Aerial parts, flowers and leaves    | [85,93,97]          |
| **trans-γ-Cadinene**          | 0.1–0.3      | Flowers and leaves                 | [97]                |
| **α-Calacorene**              | <0.01–0.1    | Aerial parts, flowers and leaves    | [85,89,94,97]       |
| **β-Calacorene**              | 0.4          | Aerial parts                       | [93]                |
| **Calamenene**                | 0.6          | Aerial parts                       | [85]                |
| **cis-Calamenene**            | 0.6          | Aerial parts                       | [89,94]             |
| **Camphene**                  | 0.1–7.4      | Aerial parts, flowers and leaves    | [85,89,93-95,97]    |
| **Camphor**                   | <0.01–0.04   | Aerial parts, flowers and leaves    | [93,97]             |
| **∆-3-Carene**                | 6.8–16.1     | Aerial parts and leaves            | [93,95]             |
| **Carvacrol**                 | 1.6          | Flowers                            | [97]                |
| **trans-1-carveol**           | 0.09–0.2     | Aerial parts                       | [85,89,93,94]       |
| **Caryophylla-4 (14),8 (15)-dien-5-ol** | 0.1–0.2     | Flowers and leaves                 | [97]                |
| **Caryophylladienol I**       | <0.01        | Aerial parts                       | [85,89,94]          |
| **Caryophylladienol II**      | 0.4          | Aerial parts                       | [85,89,94]          |
| **Caryophyllenol I**          | 0.2          | Aerial parts                       | [85,89,94]          |
| **Caryophyllenol II**         | 0.1          | Aerial parts                       | [85,89,94]          |
| **Caryophyllene alcohol (%)** | <0.01–1.1    | Aerial parts, flowers and leaves    | [93,97]             |
| **α-Caryophyllene alcohol**   | 1.2          | Aerial parts                       | [93]                |
| **β-Caryophyllene oxide**     | 1.1–7.7      | Aerial parts, flowers and leaves    | [85,89,93,95,97]    |
| **trans-Caryophyllene**       | 27.0         | Aerial parts                       | [93]                |
| **β-Caryophyllene (%)**       | 8.5–17.8     | Aerial parts, flowers and leaves    | [85,89,94-97]       |
| **1,8-Cineole**               | 1.0–20.4     | Aerial parts, flowers and leaves    | [85,89,94,95,97]    |
| **Clovenol**                  | 0.1          | Aerial parts                       | [85,89,94]          |
| **α-Copaene**                 | 0.3–1.8      | Aerial parts, flowers and leaves    | [85,89,93-95,97]    |
| **β-Copaene**                 | <0.01–0.1    | Flowers and leaves                 | [97]                |
| **1-epi-Cubenol**             | 0.1–0.2      | Flowers and leaves                 | [97]                |
| **Cyclosativene**             | <0.01–0.2    | Flowers and leaves                 | [97]                |
| **α-Cymene**                  | 0.4–0.7      | Flowers and leaves                 | [97]                |
| **p-Cymen-8-ol**              | 0.1–0.2      | Aerial parts                       | [85,89,93,94]       |
| **p-Cymene**                  | 0.6–7.6      | Aerial parts and leaves            | [85,89,93-95]       |
| **Decanal**                   | 1.4          | Flowers                            | [97]                |
| **1,10-Di-epi-cubenol**       | 0.1–0.2      | Flowers and leaves                 | [97]                |
| **Dodecanal**                 | 0.3          | Flowers                            | [97]                |
| **β-Elemene**                 | 0.8          | Leaves                            | [95]                |
| **δ-Elemene**                 | 1.9          | Leaves                            | [95]                |
| **Epiglobulol**               | 0.3          | Aerial parts                       | [85,89,94]          |
| **α-Eudesmol**                | 1.3          | Leaves                            | [95]                |
| **β-Eudesmol**                | 2.7          | Leaves                            | [95]                |
| **E, e-α-Farnesene**          | 1.6          | Aerial parts                       | [93]                |
| **α-Fenchene**                | 0.1–6.3      | Aerial parts                       | [85,89,93,94]       |
| **Fenchyl alcohol**           | 0.7          | Aerial parts                       | [85,89,94]          |
| **β-Fenchyl alcohol**         | 0.9          | Aerial parts                       | [93]                |
| **endo-Fenchol**              | 0.2          | Aerial parts                       | [93]                |
| **Furfuryl alcohol**          | 0.2          | Aerial parts                       | [93]                |
| **Germacrene B**              | 2.3          | Leaves                            | [95]                |
| **Germacrene D**              | 0.6          | Leaves                            | [95]                |
| **Globulol**                  | 0.6–1.5      | Aerial parts and leaves            | [85,89,94,95]       |
| **α-Guaiene**                 | 1.7          | Flowers                            | [97]                |
| **δ-Guaiene**                 | 1.1          | Aerial parts                       | [85,89,94]          |
| **Guaiol**                    | 0.1–0.2      | Flowers and leaves                 | [97]                |
| **α-Gurjunene**               | 0.1          | Aerial parts                       | [85,89,94]          |

(Contd...)
| Phytochemical composition (%) | Values | Plant parts | References |
|-------------------------------|--------|-------------|------------|
| 2-Heptanol                    | 0.1    | Aerial parts | [85,89,94] |
| 1-Hexanol                     | <0.01  | Aerial parts | [85,89,94] |
| (Z)-3-Hexen-1-ol              | 0.1    | Aerial parts | [85,89,94] |
| (Z)-3-Hexen-1-yl acetate      | 1.6    | Flowers      | [97]       |
| (Z)-3-Hexen-1-yl 3-methylbutyrate | 1.2 | Flowers       | [97]       |
| Humulene epoxide II           | 0.2    | Aerial parts | [85,89,94] |
| Humulene oxide                | 0.9    | Leaves       | [95]       |
| α-Humulene                    | 1.2–8.7| Aerial parts, flowers and leaves | [85,89,94,95] |
| Humulene epoxide II           | 0.9–2.3| Flowers and leaves | [97] |
| Isoborneol                    | 0.2    | Flowers      | [97]       |
| Isoborneol acetate            | 4.3    | Flowers      | [97]       |
|endo-Isocamphane              | 0.06   | Aerial parts | [93]       |
| Isocaryophyllene oxide        | 0.1    | Aerial parts | [85,89,94] |
| iso-italicene                 | 0.1    | Flowers      | [97]       |
| Limonene-4-ol                 | 0.2    | Aerial parts | [85,89,94] |
| Limonene                      | 0.5–7.2| Aerial parts, flowers and leaves | [85,89,93,95,97] |
| Linalool                      | <0.01–1.6| Aerial parts and leaves | [85,89,93-95] |
| Longiborneol (+ Juniperol)    | 0.2    | Aerial parts | [93]       |
| cis-p-Mentha-1 (7),8-dien-2-ol| <0.01  | Aerial parts | [85,89,94] |
| cis-p-Mentha-3-en-1,2-diol    | 0.1    | Aerial parts | [85,89,94] |
| Methyl hexyl bourgene          | 7.2    | Leaves       | [95]       |
| α-Murolene                    | 0.1–1.5| Aerial parts, flowers and leaves | [85,89,93,97] |
| γ-Murolene                    | 0.3–0.6| Flowers and leaves | [97] |
| t-Murolol                     | 1.2    | Aerial parts | [89,94]    |
| Myrcene                       | 0.4–1.2| Aerial parts, flowers and leaves | [85,89,93,94,97] |
| Methyl heyl bourgene          | 0.7    | Aerial parts | [89,94]    |
| α-Phellandrene epoxide        | 0.2    | Aerial parts | [89,94]    |
| 2-Phenylethylacetate          | <0.01  | Aerial parts | [85,89,94] |
| cis-β- Ocimene                | 0.3    | Aerial parts | [85,89,94] |
| trans-β-Ocimene               | 0.2    | Aerial parts | [93]       |
| (E)-β-Ocimene (%)             | <0.01–8.0| Aerial parts, flowers and leaves | [85,89,94,95,97] |
| (Z)-β-Ocimene (%)             | <0.01–50.4| Aerial parts, flowers and leaves | [85,89,94,95,97] |
| allo-Ocimene                  | 0.4    | Aerial parts | [85,89,94] |
| neo-αllo-Ocimene              | 0.6    | Aerial parts | [85,89,94] |
| 2-Octanol                     | 0.5    | Aerial parts | [85,89,94] |
| 1-Octen-3-ol                  | 0.3–0.8| Aerial parts | [85,89,93,94] |
| Octyl acetate                 | 1.6    | Aerial parts | [85,89,94] |
| Perilla aldehyde              | 0.1    | Aerial parts | [85,89,94] |
| α-Pinene                      | 0.8–12.4| Aerial parts, flowers and leaves | [85,89,93-97] |
| β-Pinene                      | 0.5–3.7| Aerial parts, flowers and leaves | [85,89,93,95,97] |
| α-Pinene oxide                | 0.3–0.5| Flowers and leaves | [97] |
| Pinocarvone                   | 0.1    | Aerial parts | [85,89,94] |
| trans-Pinocarvone             | 0.6    | Aerial parts | [85,89,94] |
| Rosifoliol                    | 0.2    | Aerial parts | [85,89,94] |
| Sabinene                      | 0.2–1.0| Aerial parts and flowers | [85,89,94,97] |
| cis-Sabinene hydrate          | 0.4    | Aerial parts | [85,89,94] |
| Safranal                      | 0.04   | Aerial parts | [93]       |
| Selina-5,11-diene             | 0.3    | Aerial parts | [85,89,94] |
| α-Selinene                    | 2.3    | Aerial parts | [85,89,94] |
| γ-Selinene                    | 1.2    | Aerial parts | [85,89,94] |
| β-Selinene                    | 0.7–5.7| Aerial parts | [85,89,94] |
| Spathulanol                   | 0.9    | Aerial parts | [85,89,94] |
| α-Terpine                     | 0.2–2.8| Aerial parts, flowers and leaves | [85,89,93-95,97] |
| γ-Terpine                     | 0.1–1.4| Aerial parts, flowers and leaves | [85,89,93,94,97] |
| Terpinen-4-ol                 | <0.01–0.4| Aerial parts and leaves | [93,95] |
| 1-Terpineol                   | 0.04   | Aerial parts | [93]       |
| 4-Terpineol                   | 0.5    | Aerial parts | [85,89,94,95,97] |
| α-Terpineol                   | 0.1–2.6| Aerial parts, flowers and leaves | [85,89,94,97] |
| δ-Terpineol                   | 0.1–0.9| Aerial parts, flowers and leaves | [85,89,94,97] |
| Terpinolene                   | <0.01–0.4| Aerial parts, flowers and leaves | [85,89,94,97] |
| α-Terpinochemide              | 0.3    | Aerial parts | [93]       |

(Contd...)
studies carried out so far indicate that the species has potential as herbal medicine. Therefore, there is need to validate the documented ethnomedicinal uses of *H. cymosum* through advanced phytochemical and pharmacological studies. There is a lack of *in vivo* and clinical research on *H. cymosum* and compounds isolated from the species. Further research is required to establish the safety profiles of different *H. cymosum* preparations. Therefore, future studies should address these knowledge gaps through experimental animal studies, randomized clinical trials, and target-organ toxicity studies involving *H. cymosum* crude extracts and compounds isolated from the species.

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**AUTHOR'S CONTRIBUTIONS**

The author declares that this work was done by the author named in this article.

**CONFLICTS OF INTEREST**

The author declares that he has no conflict of interest.

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