

# Comprehensive review on Phytoconstituents and Biological activity of *Nepeta Cataria*

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**Abstract :** Plants are generally considered as a biogenetic laboratory as for the production of the primary metabolites such as carbohydrates, fats, vitamins and amino acid sand have physiological role besides primary metabolites plants also produce secondary metabolites which have therapeutic role when used by humans. these secondary metabolite are also known as phytoconstituents plants utilize these phytoconstituents for their protection .they also have some medicinal value among those plants is *Nepeta cataria* .Beside having narcotic effect on the rats nepeta cataria have major biological role as it has Anti-inflammatory ,Antimicrobial repellent etc properties and also it is a source of essential oils ,reducing sugars,phenolics and diterpiens.

## IndexTerms – Catnip, Essential oil,Nepeta

### I. INTRODUCTION

The name “*Nepeta*” seems to be attributed from *Nepe*, ancient Etruscan city of modern *Tuscia* in *Viterbo* province (Lazio region of central Italy), conquered by the Romans after the fall of Veii (396 BC), in whose territory the plant grew very abundant. The term “*Cataria*” derives from the Latin word *catus* (cat) for the strong preference of the feline is an aromatic plant herbaceous perennial plant, of Lamiaceae family. It is an erect plant with whitish and somewhere it produces pinkish flowers It is distributed from the eastern Mediterranean region to the western Himalayas, central Asia, southern Siberia, and China. it is grown wild in almost every part of the Kashmir in Kashmir it is locally known as Braad-e-gass and gandh soi. It is mainly found in the river banks and has been obserd that it grows along sides of the plant *Utrica dioica* locally known as Soi.

*Nepeta cataria*(catnip) known for its narcotic effect in cats. It is an erect plant with normal branching and exceeds up to the height of the 1 meter normally 55-100cm. stem is light green 4 angled pubescent and leaves are in the shape of heart with small hairs at the bottom.

### II.PHARMACOLOGIC PROFILE

#### Anti microbial activity of extract of *Nepeta cataria*

The diethyl ether extracts of *Nepeta cataria* (Lamiaceae) has shown antimicrobial activity against fungi and gram positive bacteria and the anti microbial concentrations was found to be ½ and ¼ of MIC . A reduction of adherence was also observed (Nostro, Antonia, et al.2001)

The essential oils from *Nepeta cataria* (Lamiaceae) obtained by hydro-distillation show bactericidal activity against all food borne gram positive microorganisms at a concentration of 0.5-8ul/ml while as gram negative organisms where susceptible to catnip oil at concentration of 0.25-2ul/ml also essential oils showed inhibitory effect against the standard spices of aspergillum’ at concentration 0.25-1ul/ml (Zomorodian, Kamiar, et al).

The tested EOs exhibited antimicrobial activities against the tested bacteria at concentrations of 0.125–4 µL/mL. Moreover, the oils entirely inhibited the growth of common causes of oral infections (*Candida* species) at a concentration less than 1 µL/mL. Zomorodian, Kamiar, et al The aqueous extracts of *Nepeta cataria* when tested for anti microbial activity by disc diffusion method showed significant activity against *S.aureus*, *B.subtillis*, *E.coli*, *P.aureginosa* . The lowest antibacterial activity was recorded against the *P.aureginosa* measured against 10+0.33 The Methanolic and dichloromethane leaf extracts of *Nepeta cataria* where seen to be potent against the *S.typhi*, *S.aureus*, and *K.pnemonia* with MIC of 0.1mg/ml (Edewor, T. I., and L. A. Usman.)

#### Gastrointestinal and respiratory disorders

*Nepeta cataria* oil These data indicate that *Nepeta cataria* possesses spasmolytic and myorelaxant activities mediated possibly through dual inhibition of calcium channels and PDE, which may explain its traditional use in colic, diarrhea, cough and asthma. (Heuskin, Stéphanie, et al)

#### Repellent activity of essential oil found in nepeta cataria

When the main iridoid compounds (4a*S*,7*S*,7a*R*) and (4a*S*,7*S*,7a*S*)-nepetalactone, of Essential oil from catnip when accessed against Major Afro-tropical pathogen vector mosquitoes i.e. the malarial mosquitoes ,*Anopheles gambiae* s.s and the southern house mosquito , *culex quinquefasciatus*, using world health organization (WHO)- approved topical application bioassay shows repellent activity of the essential oil (Birkett, Michael A., et al)

Evidences of repellent properties of *Nepeta cataria* was found in preliminary studies. The essential oil constituent Neptalactone occurs in two isomers and previous studies have shown the *E,Z*-nepetalactone [2-(2-hydroxy-1-methylethenyl)-5-methyl-cyclopentanecarboxylic acid delta lactone] isomer to be even more repellent to cockroaches than the dominant isomer, *Z,E*-nepetalactone. This study examined the seasonal variation of the two isomers, *Z,E*- and *E,Z*-nepetalactone, in catnip. Samples of fresh catnip mature leaves, immature leaves, and stems were steam-distilled separately, and isomer composition was analyzed using high-performance liquid chromatography and gas chromatography (GC). An analysis of variance (ANOVA) showed significant differences by week. The mature leaf essential oil samples were tested in a repellency bioassay and exhibited significant repellency to German cockroaches, *Blattella germanica* L. The catnip floral volatiles were sampled using solid phase microextraction, and analysis with GC/mass spectrometry showed the presence of *Z,E*-nepetalactone, *E,Z*-nepetalactone, and  $\beta$ -caryophyllene as the major constituents. Phytophagous insects and potential pollinators present on sampling dates were recorded. In general nepeta cataria was found to have repellency properties against the house flies, *Musca domestica*L., and American cockroaches, *Periplaneta americana* L., (Schultz, Gretchen, et al.)

The alcohol extract of *nepeta cataria* catnip has a biphasic effect on the behavior of young chicks. Low and moderate dose levels (25–1800 mg/kg) cause increasing numbers of chicks to sleep, while high dose levels (i.e. above 2 g/kg) cause a decreasing number of chicks to sleep (Sherry, C. J., and P. S. Hunter.)

### Efficacy and safety of nepeta cataria (lamiaceae) as a novel repellent

Bioassays conducted by **Zhu, J. J., et al.** showed that catnip essential oil at a dose of 20mg resulted in average repellency rates of 96% stable flies, *Stomoxys calcitrans* (L.) and 79% against houseflies, *Musca domestica* (L.), respectively. acute oral, dermal, eye toxicity and primary dermal toxicity studies were conducted in order to provide broad spectrum safety profile of the essential oil from catnip (*nepeta cataria*) he acute oral LD<sub>50</sub> of catnip oil was found to be 3160 mg/kg body weight (BW) and 2710 mg/kg BW in female and male rats, respectively. The acute dermal LD<sub>50</sub> was > 5000 mg/kg BW. The acute inhalation LD<sub>50</sub> was observed to be > 10 000 mg/m<sup>3</sup>. Primary skin irritation tested on New Zealand white rabbits showed that catnip oil is a moderate irritant. Catnip oil oil *nepeta cataria* was classified as practically non-irritating to the eye. In comparison with other U.S. Environmental Protection Agency-approved mosquito repellents (DEET, picaridin and *p*-menthane-3,8-diol), catnip(*Nepeta cataria*) oil can be considered as a relatively safe repellent, which may cause minor skin irritation. (**Zhu, J. J., et al.** )

### Behavioral responses to catnip oil by two different species of mosquito

Using automated excite-repellency test system the behavioral responses of field collected two different species mosquitoes (*Aedes aegypti* and *Anopheles harrisoni*) was conducted. From the contact chamber at 5% catnip oil *Aedes aegypti* showed significantly higher escape rates compared to other concentrations ( $P < 0.05$ ) With *Anopheles harrisoni*, a high escape response was seen at 2.5% catnip oil from the contact chamber, while in the noncontact chamber a higher escape response was observed at a concentration of 5%.. whichj shows that compound neptalactone of the essential oil show both irritant and repellent actions. (**Polsonboon, Suppaluck, et al.**)

Long term and acute effects have been found to be associated with the nepeta cataria when administered in mice acute effects associated with plant nepeta cataria in mice include increased stereotyped behavior and susceptibility to seizures and sleeping time after sodium pentobarbital administration. Tolerance to catalepsy and sleeping time, increased the susceptibility to seizures induced by picrotoxin and strychnine, and stereotypic behavior, where seen as long term exposure effects in mice (**Massoco, C. O., et al.**)

Rats trained on sidmans avoidance schedule showd significant decrease in performance following intraperitoneal injection of catnip oil(500-750mg/kg) neptalactone (500-750-mg/kg) and the neptalic acid(125-250mg/kg) enriched fraction. Rats trained on same avoidance schedule showed behavioral tolerance after daily injection of 750mg/kg of catnip oil. The LD<sub>50</sub> of catnip oil, neptalactone enriched fraction and that of neptallic aid was found to be 1300mg/kg, 1550 mg/kg, and 1050mg/kg respectively (**Harney, J. W., I. M. Barofsky, and J. D. Leary**)

### Insecticidal effect

Essential oil from *nepeta cataria* where seen to be highly toxic against larvae of *Spodoptera littoralis* with with LC<sub>50</sub> ≤ 10.0 ml/m<sup>3</sup>. (**Sharaby, Aziza, et al.**)

Larvicidal property cum repellency property of the catnip oil along with the other oils was assayed against the three species of mosquito *Aedes albopictus*, *Ae. aegypti*, and *Culex pipiens pallens*, during which catnip oil was demonstrated to be most effective and provided a 6hr protection at concentrations (23 and 468 µg/cm<sup>2</sup>) (**Zhu, Junwei, et al**)

The essential oil obtained from the flowering tops of *Nepeta cataria* was assayed for the insecticidal property by fumigant assay and topical assay on the house flies *Musa domestica* showed topical LD<sub>50</sub> as 24microgram/fly and with Fumigant LD<sub>50</sub> as more than 80microgram/cm<sup>3</sup> (**Pavela, Roman.**)

### Anti-nociceptive and anti-inflammatory actions nepeta cataria along with var-citriodora essential oil on mice

There was increase in general activity of the female mice after observing in an open field with a dose of NCEO 0.0005-0.001mg/kg by IP route with reduction of mobility at a dose of 0.0005mg/kg more ever the treated animals exhibited an increased latency of tail withdrawal and reduced acetic acid-induced abdominal constrictions at a dose of 0.0005ml/kg of NCEO indicating the Anti-nociceptive properties further more there was reduction of induced edema after carrageenan injection (**Ricci, Esther Lopes, et al**)

### Ant diabetic properties of Nepeta catria extract.

The different extracts of nepeta cataria along with the typical anti diabetic drug(gliclazide) can be used clinically to reduce the complications against the diabetes mellitus as was evidenced by the inhibitory oxidative stress indices and carbohydrate hydrolyzing enzyme ( $\alpha$ -amylase,  $\alpha$ -glucosidase and  $\beta$ galactosidase) in a dose dependant manner while observing in invitro screening models. Furthermore most potent reducing power was observed in ethanolic(70%) petroleum ether and chloroform extracts, while ethyl acetate and ethanol extracts of soxhlet extraction showed low or moderate reducing action. in addition to the invitro models invivo anti glycemc, anti oxidant and antilipidimic effects of different extracts (chloroform, petroleum ether, as well as crude ethanolic extracts in comparison with the reference drug(gliclazide)) showed that these extracts have significant role in controlling the glycemia causing free radical damage(indicating the ant diabetic effect as that of alloxan and streptozotocin) blocking of lipid synthesis, normalizing the liver function associated with the complications of diabetes

These extracts also have role in normalizing the liver function as well as they have major role in maintaining the pancreatic architecture. (**Aly, Hanan F., et al.**)

The different successive extracts of *N. cataria* exhibited an inhibitory effect on oxidative stress indices and carbohydrate hydrolysing enzymes. It is observed that 70% ethanol, petroleum ether and chloroform extract where shown to have, the most potent inhibitory activities, while ethyl acetate and ethanol successive extracts appeared with moderate or low reducing activities. (**Naguib, Abdel Moneam Mohamed, et al.**)

Different extracts of nepeta cataria such as DCM, water extract, ethanolic extract have shown aldose reductase inhibition percentage as 18%,9%,& 20% respectively when observed by bioassays as described by **Haraguchi et al (Guzman, A., and Ricardo O. Guerrero)**

### Anti oxidant property of nepeta genus

Different solvent Acetone, methanol and water extracts where prepared based on there polarity and evaluated for their anti oxidant properties using insitu assays radical scavenging and total phenolic content. Among the different solvents used methanolic extracts demonstrated superior Anti oxidant comparing to less polar Acetone extracts. Further more the extracts from single part of the plant showed lesser activity than that of the whole plant extracts. in addition the extracts of nepeta cataria was found to have higher radical scavenging activity in the methenolic extracts (80.9+\_1.4%) than that of the other nepeta species (**Kraujalis, Paulius, Petras Rimantas Venskutonis, and Ona Ragazinskiene.**)

### Effect on sexual behavior

Nepeta cataria leaf extracts where see to have penile erection properties in the rats after acutely fed with chow enriched 10% nepeta cataria leaves which was observed after the 15 minutes of said treatment (**Bernardi, Maria Martha, et al.**)

The acute and concurrent treatment of chow enriched with 10% nepeta cataria leaf extract and a polar extracts where seen to have some behavioral changes associated with the antidepressant response. These treatments also causes the reduction of immobility vs the control group of behavioral despair test further concurrent treatment of a polar extracts reduced the latency in immobility. This suggests that there was behavioural profile similar to that of antidepressants effects. (**Bernardi, Maria Martha, et al.**)

**Antifungal properties**

Essential oil from the nepeta cataria along with other 25 species of medicinal plants was evaluated against the *Fusarium oxysporum*, *Fusarium verticillioides*, *Penicillium expansum*, *Penicillium brevicompactum*, *Aspergillus flavus* and *Aspergillus fumigatus*. All the essential oils along with the essential oil from the nepeta cataria were found to be effective against the said organisms with essential oil from nepeta cataria the inhibitory concentration against the said organisms was found to be *Fusarium oxysporum*  $97.86 \pm 0.05$  MIC, *Fusarium verticillioides*  $91.72 \pm 0.12$  MIC, *Penicillium expansum*  $80.65 \pm 0.08$  MIC, *Penicillium brevicompactum* 100 MIC, *Aspergillus flavus*  $84.53 \pm 0.09$  MIC and *Aspergillus fumigatus*  $16.09 \pm 0.17$  MIC. Respectively which culminates that essential oil from the nepeta cataria have shown to have fungal properties against all the microorganisms among them the lower effective concentration was seen against *Aspergillus fumigatus*. (Zabka, Martin, Roman Pavela, and Ludmila Slezakova).

**REPORTED PHYTOCONSTITUENTS**

Catnip oil has been found to contain.

Five compounds were identified dimethyl-3,7-oxa-1-bicyclo [3,3,0] oct-2-ene, piperitone, thymol methyl ether, hexenyl benzoate and humulene oxide by employing GCMS of essential oil obtained by hydro distillation method (Bourrel, C., Perineau, F., Michel, G., & Bessiere, J. M. (1993)).

Four compounds were identified by using GC-EMIS were 1,8-cineol,  $\alpha$ -humulene,  $\alpha$ -pinene and geranyl acetate Gilani, (Anwar H., et al)

By employing GCMS five compounds such as diethyl-3,7-oxa-1-bicyclo [3,3,0] oct-2-ene, piperitone, thymol methyl ether, 3-hexenyl benzoate and humulene oxide I, were identified from Nepeta cataria Extract (Bourrel, C., et al)

GCMS Analysis of 0.3% of the total essential oil obtained from aerial part of the plant *Nepeta Cataria* revealed presence of Iridomyrmecidisoiridomyrmecin, 4 $\alpha$ ,7 $\alpha$ -dehydronepetalactone and nepetalic. (Handjjeva, N. V., Popov, S. S., & Evstatieva, L. N. (1996))

Nepetalactone, Iridomyrmecidisoiridomyrmecin, nepetalactone/ epinepetalactone; 1, 8-cineole; (E or Z)  $\alpha$  or  $\beta$ -caryophyllene/  $\beta$ -caryophyllene oxide;  $\beta$ -elemene/  $\beta$ -elemol; (Z)- $\beta$ -farnesene/farnesol; germacrene-D; limonene/ linalool;  $\alpha$ -pinene/  $\beta$ -pinene;  $\alpha$ -terpineol/4-Terpeneol; 4 $\alpha$ ,7 $\alpha$ ,7 $\alpha$ -nepetalactone, 7 $\alpha$ -dehydronepetalactone and nepetalic acid were found first time in the *nepeta cataria*. nepetalactones are the major constituents of the essential oil found in nepeta cataria. Nepetalic acid is also found in all species *Nepeta* but higher concentration is found in nepeta cataria.

Other constituents reported apart from the above are

Nepetalactone 4 $\alpha$ ,7 $\alpha$ ,7 $\alpha$ -nepetalactone 4 $\alpha$ ,7 $\alpha$ ,7 $\alpha$ - $\beta$  3,4 $\beta$ -dihydronepetalactone 4 $\alpha$ ,7 $\alpha$ ,7 $\alpha$ - $\beta$  iridomyrmecin/soiridomyrmecin 3,4 $\alpha$ -dihydronepetalactone 4 $\alpha$ ,7 $\alpha$ ,7 $\alpha$ - $\beta$

**CONCLUSION:**

Besides having Narcotic effect on Cats *Nepeta Cataria* possesses Anti-diabetic, Anti-inflammatory, Anti-microbial, and the essential oil from the plant was found to have Repellent properties for houseflies and was found to have anti oxidant properties.

Different compounds were isolated from the essential oils and extracts of *Nepeta cataria* prominent among them are nepetalactone, limonene,  $\beta$ -pinene,  $\beta$ -caryophyllene,  $\alpha$ -humulene, geranyl acetate etc

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