

Database of Research on Medicinal and Aromatic Plants of Nepal

Cinnamomum tamala (Buch.-Ham.) Nees & Eberm (Tejpatta)

1. Scientific name: *Cinnamomum tamala* (Buch.-Ham.) Nees & Eberm

Cinnamomum albiflorum Nees

2. Common name:

Tejpatta (Bhojpuri), Bay leaf, Sunkauli (Nepali), Tamalpatra (Sanskrit), Lep (Gurung) Dalchini (Hindi), Pattai illai (tamil), Sangsornyo (Lepcha), Sorong tetala (Limbu), Tejpat(Newari), Belakhan (Rai), Sijakaulisapha (Sunwar), Dalchini, Lepte (Tamang), Taji, Sinkaaulee, Taj

3. Geographical distribution:

Udaypur and Palpa districts (900-2500 m)¹, subtropical to temperate zone (1000-2100 m)², west to east at an elevation of 450-2100m³, Jajarkot, Gulmi (Dhurkot rural Municipality), Kaski, Makwanpur, Pyuthan, Salyan, Surkhet, Dailekh, Rukum and somewhere sparsely in Palpa district (Koldanda and Masyam VDCs)
⁴. North-western Himalayas, Nepal

4. Plant material of interest: Stem, Barks, and Leaves

5. Methods (Extraction and Isolation):

| Extraction Methods |
|--|
| Cold percolation methods using methanol as a solvent, ⁵⁻⁷ , Both Ethanol and methanol as a solvent ^{8,9} , |
| 50% ethanol and soxhlet apparatus methods ¹⁰⁻¹² , Dried powder was mixed with ethanol ¹³ . |
| |

6. Phytochemicals and Biological Screening results:

On the study of preliminary phytochemical screening, Polyphenols, Flavonoids, Tannins, Quinones, Carbohydrates, Glycosidases, Terpenoids, Diterpenes, Reducing sugars are found in methanol and ethanol extract of mature and young leaves^{7,9}, also coumarin with their derivatives, volatile oil, saponins, steroids gave positive results of ethanol extract¹⁰, flavonoids test positive¹⁴. Also, Highest concentration of Ca (5634.25 mg/kg) was recorded followed by Na (273.7 mg/kg) and Fe (273.66 mg/kg)¹⁵.

| S.N. | Parts of plant | Solvent | TPC | TFC | Total alkaloids Content | Reference |
|------|--------------------------------|---------------------|---|---|-------------------------|-----------|
| 1. | Young leaves and mature leaves | Ethanol Methanol | 9.83 ± 0.30 mg GAE/g 13.73 ± 0.55 mg GAE/g | 12.59 ± 0.71 mg QE/g 7.02 ± 0.32 mg QE/g | 9 | 9 |
| 2. | Leaves | Methanol | 17.3 ± 0.02 mg GAE/g | 4.5 ± 0.07 mg QE/g | 7 | 7 |
| 3. | Leaves | Hydroalcoholic | 48.1 mg GA/g | 22.1 mg QE/g | 59.9 mg/g | 12 |

| | | | | | | |
|----|--------|-------------|-----------------------------|----------------------------|--|----|
| 4. | Leaves | 90% ethanol | 73.08 ± 0.0078 mg GAE/g | 52.63 ± 0.0060 mg QE/g | | 16 |
| 5. | Leaves | Methanol | 6.7 mg (GAE)/100g | 17 | | |

7. Biological activity

| S.N | Biological activity | Parts of plant | Methods | Results | References |
|-----|--|-------------------------|------------------------------|---|------------|
| 1. | Acetylcholinesterase inhibitory potential | Leaves | Ellman's colorimetric method | Showed highest inhibition ($IC_{50}=46.12 \pm 1.52$ % at 1mg/mL) | 18 |
| 2. | Antibacterial or Antimicrobial activity/ Antibiofilm activity | Leaves | Paper disc diffusion method | Not showed any significant effect on the bacterial (<i>E. coli</i> , <i>P. aeruginosa</i> , and <i>K. pneumonia</i>) | 13 |
| | | | Agar well diffusion method | Ethanol extract of young leaves ($ZOI = 19$ mm) showed strong antibacterial activity while standard neomycin showed ($ZOI = 23$ mm) against <i>Escherichia coli</i> at a concentration of 50 μ g/mL | 8 |
| | | | | Showed MIC and MBC value 5 and 5 respectively at 2.5 mg/mL Also, 63.4 % of inhibition against <i>E. coli</i> at 0.5 mg/mL | 7 |
| | | | | Showed significant inhibition against <i>Streptococcus pyogenes</i> (13.53 ± 0.92 mm) and <i>Staphylococcus aureus</i> (20.77 ± 0.64 mm) in methanol extract 100 μ L. | 19 |
| | | Leaves | Agar well diffusion method | <ul style="list-style-type: none"> Methanol extract, showed efficacy against <i>Staphylococcus aureus</i> (10mm) Not effective antimicrobial effect against <i>S. Typhi</i> | 6,11 |
| 3. | Antidiabetic activity | Mature and young leaves | Enzyme inhibition assay | Methanol young leaves extract showed strong α -amylase inhibition with IC_{50} value 224.6 ± 2.76 μ g/mL as compared to acarbose with $IC_{50} 5.93 \pm 0.14$ μ g/mL. -Showed less than 50 % inhibition against alpha amylase at 500 μ g/mL | 9,5 |

| | | | | | |
|----|--|---------------------------|--|---|----|
| 4. | Antioxidant activity | Leaves | Ferric reducing ability of plasma (FRAP Assay) | FRAP value of ethanol extract of Cinnamon was found to be 0.40mM/100gm | 13 |
| | | Leaves | DPPH assay | 96.99 ± 0.99 % at 100 µm/Ml in hydroalcoholic extract | 12 |
| | | Mature and young leaves | DPPH assay | Methanolic extract of young leaves (IC ₅₀ value= 67.19±14.96 µg/mL) at a concentration range of 31.25-500 µg/mL as compared with standard ascorbic acid (IC ₅₀ value = 33.53±0.97 µg/mL at the concentration range of 10-50 µg/mL | 8 |
| 5. | Swarming inhibitory potential of <i>Pseudomonas aeruginosa</i> | Leaves(M ethanol extract) | - | Significant inhibited the swarming motility (at 12.5 µg/mL) and biofilm formation (at 25 µg/mL) of <i>P. aeruginosa</i> . | 20 |
| 6. | Anti-Inflammatory activity | Leaves | Protein Inhibitory Action | Ethanolic extract showed the maximum inhibition 58.72±0.50% at 800 µg/ml ($r^2= 0.99$) | 13 |
| 7. | Antidiabetic activity Antihyperlipidemic activity | Bark | Alpha-amylase inhibition assay | Significant inhibition percentage value were found to 97.49% at 25 µg/mL concentration in methanol extract with an IC ₅₀ value 1.80 µg/mL | 21 |

7. Information about Essential oil:

a. Steam Distillation

Analytic method: GC-MS ²²,

b. Hydro-distillation process using Clevenger apparatus

Analytic method: GC-MS ^{23,24}

c. Essential oil of leaves were isolated by Hydro distillation process ^{25,26,4}

Table 1: List of pharmacological activity of essential oil of *Cinnamomum tamala*

| S.N | Biological activity | Parts of plant | Method | Results | References |
|-----|---------------------|----------------|--------|---------|------------|
|-----|---------------------|----------------|--------|---------|------------|

| | | | | | |
|----|---|--|---|--|--|
| 1. | Antimicrobial activity | Leaves from three different places of Makwanpur District i.e. Brindawan Botanical Garden (BBG), Tistung Botanical Garden (TBG), Tistung & District Plant Resources Office (DPRO) | Agar well diffusion method | <ul style="list-style-type: none"> Highest inhibition shown by all three oils were against <i>S. aureus</i> (bacterium) and <i>S. cerevisiae</i> (fungus) Widest ZOI was shown by oil from TBG for <i>S. aureus</i> (ZOI= 23mm) and <i>S. cerevisiae</i> (ZOI= 29mm). | ²⁴ |
| 2. | Antifungal activity against the dermatophytes | Leaves | Disc diffusion | Anti-dermatophytic activity was determined against <i>Microsporum audouinii</i> and <i>Trichophyton mentagrophytes</i> (Significantly mycelial growth inhibition (MGI) and MIC) | ²⁷ |
| 2. | Anticancer activity | Leaves | - | Highly toxic against brine-shrimp (with LC ₅₀ value = 44.28 µg/ml) and possessing anticancer property | ²⁵ |
| 3. | Antifungal activity | Leaves Leaves collected from TU area | In-vitro study (Two way ANOVA test- Statistical analysis) | <ul style="list-style-type: none"> Showed anti-fungal effect in controlling <i>Colletotrichum gloeosporioides</i>, <i>Alternaria alternata</i> and <i>Aspergillus niger</i>, which inhibited the mycelial growth by 95.45%, 89.82% and 90.57%, respectively at 40µl/ml concentration. At 40 µl/ml oil concentration, all fungi (<i>Alternaria alternate</i>, <i>Fusarium oxysporum</i>, <i>Colletotrichum gloeosporioides</i>), were completely inhibited.(18) Showed potent antifungal activity against <i>Aspergillus niger</i> and <i>Fusarium oxysporum</i>, inhibited nearby 70% mycelial growth at 40µl/ml. Found significantly inhibit (p<0.05) the growth and spore germination of both <i>Aspergillus niger</i> and <i>Rhizopus sp</i> fungi at 20µg/mL. | ²⁸ ²⁶ ⁴ |

| | | | | | |
|---|--|---|---|---|---------------|
| | | | | | |
| 6 | Antioxidant activity | EO were purchased from different suppliers in Katmandu, Nepal (Confirmed with standard oil by CO-TLC) | - Rapid DPPH staining TLC method -DPPH assay DPPH and H ₂ O ₂ assay | <ul style="list-style-type: none"> • Shown white spots with strong intensity. • Found 83%, at 300 µg/mL and IC₅₀ value = 131.61±1.34 µg/mL as compared with ascorbic acid with IC₅₀ value = 86.57±1.23µg/mL) • IC₅₀= 250 ± 1.2 and 180 ± 1.4 µg/ml²⁹ | ³⁹ |
| 7 | Antifungal activity | Leaves | Agar diffusion assay | Potent antifungal activity against Aspergillus niger, A. fumigatus, Candida albicans, Rhizopus stolonifer and Penicillium spp. with zone of inhibition 17 to 25 mm | ³¹ |
| 8 | Synergized effect/ Antibiofilm activity | Leaves | In-vitro study | 70% inhibition against matured biofilms of <i>P. aeruginosa</i> | ³² |

8. Pharmacological activity/Bioactivity:

| S.N | Pharmacological activities | Parts of plant | Methods | Results | References |
|-----|--|----------------|---|---|---------------|
| 1. | Anti-fertility activity/ Abortifacient activity | Leaves | <i>In-vivo</i> (Substituted acetamidobenzene derivatives) | Doses= 500 mg/kg, Antifertility % = 25% No Foetal loss | ¹⁰ |
| 2. | Antioxidant/ Antidiabetic activity | Leaves | <i>In-vivo</i> | At 200 mg/kg, significantly reduced blood glucose level (347 mg/dl to 272 mg/dl), fall in plasma glucose level (312 mg/dl to 118 mg/dl on 29 th day) | ²⁹ |

| | | | | | |
|----|---|--------------------------|--|--|---------------|
| 3. | Antidiabetic activity | Leaves | Extract at 200 mg/kg per day for 4 weeks (8-week-old diabetic mice) | Mainly improved the insulin concentration in the blood and pancreas (exhibited the antidiabetic activity) | ³³ |
| 4. | Macrophage function | Leaves (hexane fraction) | In-vivo (orally to rats for 10 days in various doses) | suppressed phagocytosis activity ($EC_{50} 2,355 \pm 52.45 \text{ mg/kg}$), reduced production of O_2^- ($EC_{50} 275.91 \pm 10.21 \mu\text{g/ml}$), cellular NADPH ($EC_{50} 384.959 \pm 4.85 \mu\text{g/ml}$), inhibited LPS induced production of nitric oxide ($EC_{50} 143.75 \pm 3.40 \mu\text{g/ml}$) and iNOS protein expression ($EC_{50} 183.132 \mu\text{g/ml}$). | ³⁴ |
| 5. | Antianxiety/ Antidepressed/Anti stress Activity | Leaves (Aqueous extract) | In-vivo study in different fields (100, 200, and 400 mg/kg) at once a daily for 7 days via oral route and the efficacy was compared with elicited by lorazepam (1 mg/kg, p.o.), imipramine (10 mg/kg, p.o.), and <i>Withania somnifera</i> (100 mg/kg, p.o.) | at 400 mg/kg produced an antianxiety effect equivalent to lorazepam, induced an antidepressant activity similar to imipramine and antistress effect comparable to <i>W. somnifera</i> | ³⁵ |
| 6. | Antihyperlipidemic activity | Leaves | In-vivo study (doses of 400 mg/kg/day p.o. each for 10 days) | Significantly ($p<0.001$) prevent the rise in serum levels of total cholesterol, triglyceride, LDL-C, VLDL-C and Atherogenic index and significant ($p<0.01$) increases in the level of HDL-C. | ³⁶ |

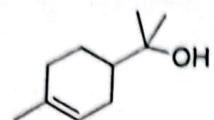
9. Pharmacognosy:

Cinnamaldehyde is the main constituents found in the *cinnamomum tamala*.

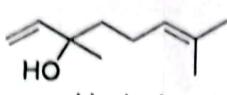
10. Major chemical constituents with structure (Extract and essential)

| Essential oil |
|--|
| Linalool (54.66%) (Major Component), α -pinene (9.67%), p-cymene (6.43%), β -pinene (4.45%), limonene (2.64%), camphene (1.17%), 1, 8-cineol (1.17%), trans-cinnamyl acetate (1.17%), cinnamaldehyde (1.16%), myrcene (1.02%) and other 10 minor components ²² |

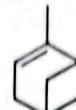
α -Pinene, β -Pinene, Myrcene, α - Phellandrene, p-Cymene, Limonene, Eucalyptol, Linalool, α -Terpineol, E-Cinnamaldehyde, Bornyl acetate, E-Caryophyllene, E-Cinnamyl acetate, eucalyptol, and Caryophyllene oxide are the major chemical constituents of EO of leaves²⁴ p-eugenol and myricetin, ocimene, , γ -terpinene camphor, eugenylacetate, β -phellandrene Ascabin, Hydro cinnamyl acetate, Beta-caryophyllene, Benzofuran, Acrolein, Pivalic acid, Naphthalene, Alpha-copaene, Phenetol, Methyl eugenol, Alpha-humulene²⁹ procyanidin oligomer³³ cinnamtannin B1²⁰



α -Terpineol



Linalool



α -Pinene



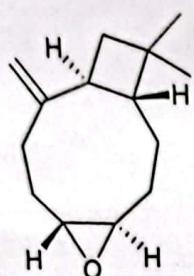
p-Cymene



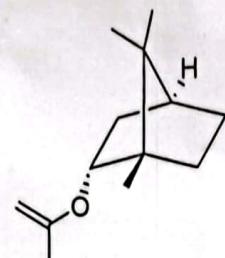
Limonene



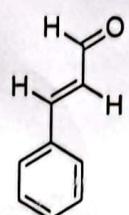
Eucalyptol



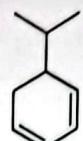
Caryophyllene oxide



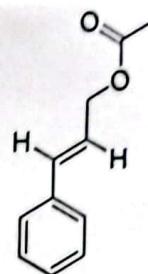
Bornyl acetate



Cinnamaldehyde



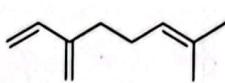
α -Phellandrene



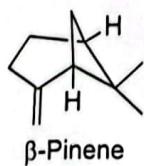
(E)-Cinnamyl acetate



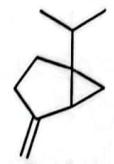
Camphene



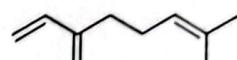
Myrcene



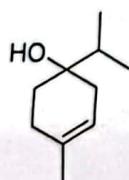
β -Pinene



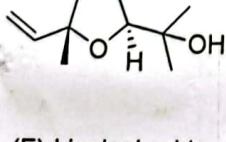
Sabinene



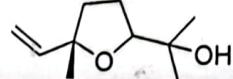
Myrcene



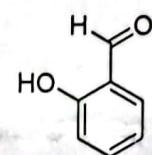
Terpinen-4-ol



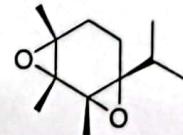
(E)-Linalool oxide



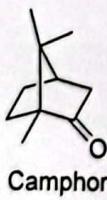
(Z)-Linalool oxide



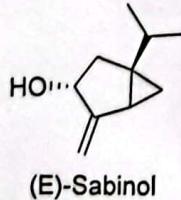
Salicylaldehyde



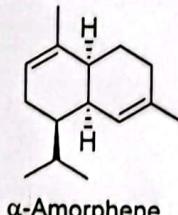
Isoascaridole



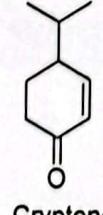
Camphor



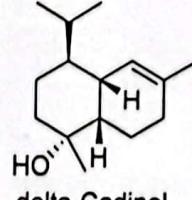
(E)-Sabinol



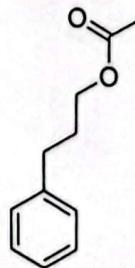
α -Amorphene



Cryptone



delta-Cadinol



Hydrocinnamyl acetate

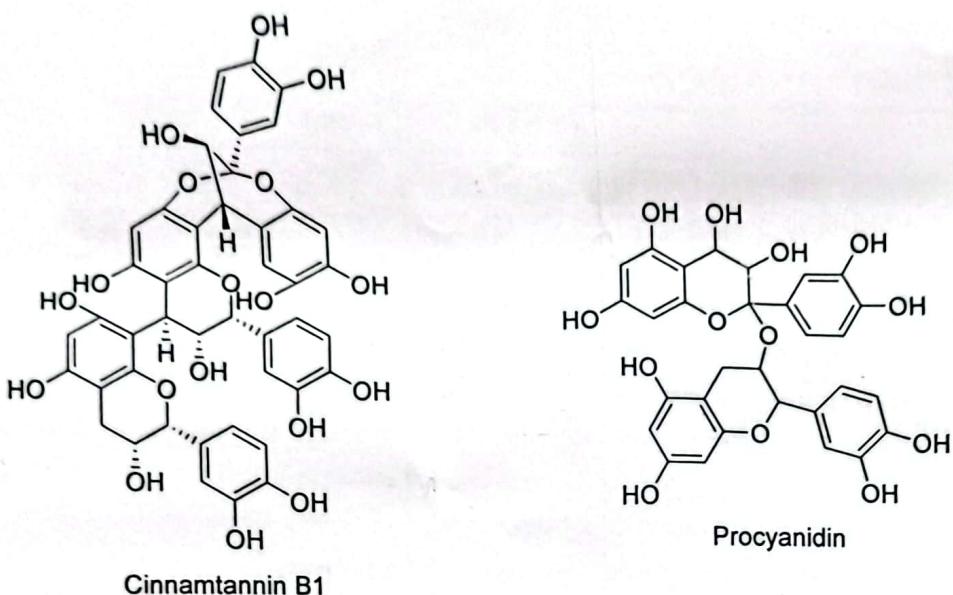


Fig: Chemical constituents isolated from Essential oil of *Cinnamomum tamala* ^{22,24}

11. Bioactive Compounds (Structure and stereochemistry)

Cinnamaldehyde is the major bioactive compound which possess antioxidant activity with an IC_{50} 120 ± 0.8 $\mu\text{g/ml}$, Anti-diabetic and Anti-hyperlipidemic activity ²⁹

12. Ethno botanical uses:

| | |
|-----------------|---|
| Leaves | Essential oil : Used as a flavouring agent, for flavouring food, fodder, as medicinal ingredient, as a spice but can be employed with myrobalans during dyeing and in the manufacture of vinegar ¹ , Leaf infusion (about 5 leaves boiled in a cup of water) is given twice a day for 5 days to control diarrhea and colic pain ³⁷ , Natural food preservatives for pineapple juice, Diabetes, Digestion, Cardiovascular Benefits, gastritis, Cold and Infection, Pain, Anti-cancer, Menstrual Problems ⁶ , Used for the treatment of fever, treatment of skin rashes, bad odor of mouth, nausea and vomiting ^{38,39} . |
| Bark/ Leaves | Oil of the bark is a powerful germicide and fungicide usually used as valuable flavoring ingredient, Bark juice is useful for diarrhea and nausea and leaves are used as spices and stimulant in tea and making foods and meat ²⁸ . Both parts are used in food for better taste and smell, Contain vitamin A and folic acid (Bhandari et al., 2023). Decoction of bark and leaves are used in the treatment of Dysentery, stomachache, indigestion and common cold. |

13. Potential application:

- *Cinnamomum tamala* was the most traded species through Division Forest Office Darchula, Nepal (good source of income) ⁴¹.
- It is one of several traditional remedies used under the Ayurvedic system.
- Used as therapeutic agents against various compilations.
- Used as a food preservative could be a good alternative to synthetic compounds.

- *Cinnamomum tamala* essential oil has remarkable antidermatophytic activity, which suggests the development of formulations that can control both animal and human dermatophytic infections²⁷

14. Clinical Trial:

| S.N | Trial Method | Results |
|-----|--|---|
| | 50 patients diagnosed with major depressive disorder based on randomized, double-blind, placebo-controlled, (6-week trial) two parallel groups to receive sertraline (100 mg twice a day) plus placebo or sertraline (100 mg twice a day) plus <i>Cinnamomum tamala</i> (500 mg daily) for 6 weeks | Showed significant improvement in HAM-D (Hamilton depression rating scale) score of the tejpat group compared with the placebo group from baseline to 2, 4 and 6 weeks. [Ps = 0.012, 0.008 and 0.009; respectively] ⁴² |
| | Emulgel formulation loaded with 4% <i>C. tamala</i> (13 healthy female test volunteers by comparing with placebo): Facial parameters including melanin, erythema, sebum, and visible facial pores (size and area) were studied by using Mexameter®, Sebumeter®, and VisioFace® at regular interval for 90 days. | CT emulgel was found to be significantly ($P \leq .05$) effective in minimizing skin photo-damaging effects by reducing the levels of melanin, erythema, and sebum and size and count of both fine and large facial pores ¹⁶ |
| | Diabetes mellitus case (30 patients having polyurea polydypsia and polyphagia) : 2 groups, 20 patients= powder of C. Tamal leaves in the dose of 2 TSF T. D. S. and 15 patients= Inula racemosa in the dose of 1 TSF T. D. S. for 3 months | Treated with <i>C. tamala</i> group 50% cases were in good control. 33.33% were in fair control and 16.67% cases were in poor control ⁴³ . |

15. Industrial Application:

Used as a cosmetic product (Emulgel formulation loaded with tezpat extract)

16. Toxicity:

| S.N | Parts of plant | Methods | Results | References |
|-----|-------------------------|--|---|---------------|
| 1. | Essential oil of Leaves | Brine-shrimp assay | Most prominent activity with LC ₅₀ value of 44.28 µg/ml was displayed by CT oil which means highly toxic | ²⁵ |
| 2. | Essential Oil | Median lethal dose | LD ₅₀ = 1400 (mg/Kg BW) i.e., Hazard Statement: Harmful if swallowed Death on Next day | ⁴⁴ |
| 3. | Leaves | Oral administration of draded dose of oil (Actual toxicity test in rats) | Non-lethal up to the dose of 1000 mg/kg body weight and 2000 mg/kg body weight caused 50% motility in the animals | ²⁹ |

17. SDS (safety data sheet):

Flammable: Combustible liquid, chemically stable hazardous materials, produces oxides of carbon when burning.

Handing and Precaution: Keep away from the heat, source of ignition, drains, surface and ground water, Eliminate all ignition source and ventilate the area, Don't breathe gas/flume/vapour/spray and to avoid contact with skin and eyes, Keep container tightly closed and sealed until ready for use.

Acute Oral Toxicity (LD50)/Acute Dermal Toxicity (LD50)/Acute Inhalation Toxicity (LC50)/Chronic Effects/Short Term Toxicity/Long Term Toxicity/Exposure Limits/Human Exposure Tests/Mutagenic Effects/Reproductive Effects/Sensitisation= Not identified⁴⁵

| Phisochemical character / EO of plants | Specific gravity | Refractive index | Optical rotation | Solubility | Acid value | Ester value | Ester value after acetylation/Flash point | Reference |
|--|--------------------|-------------------|--------------------|---|------------|-------------|---|-----------|
| Leaves | 0.8921 at 25° C | 1.470 at 25° C | 2.99 at 26.3° C | Soluble in ethyl alcohol and insoluble in water | 3.7 | 13.3 | 113.9/ 54° C | 45 |

18. References:

- (1) Lamichhane, D.; Karna, N. K. Harvesting Methods of *Cinnamomum Tamala* Leaves in Private Land: A Case Study from Udayapur District, Nepal. *Banko Janakari* 2009, 19 (2), 20–24.
- (2) Subedi, M.; Timilsina, Y. Distribution Pattern of *Cinnamomum Tamala* in Annapurna Conservation Area, Kaski, Nepal. *Nepal J. Sci. Technol.* 2015, 15. <https://doi.org/10.3126/njst.v15i2.12110>.
- (3) Shrestha, R.; Joshi Bhatta, J.; Sharma Dhakal, K. Good Agricultural and Collection Practices (GACP) of *Cinnamomum Tamala* (Buch.-Ham.) Nees and Eberm, 2015.
- (4) Adhikari, H.; Jha, S. Postharvest Microbial Contamination in Oyster Mushroom and Their Management Using Plant Essential Oils. 2017, 3, 105–108.
- (5) Khadayat, K.; Marasini, B. P.; Gautam, H.; Ghaju, S.; Parajuli, N. Evaluation of the Alpha-Amylase Inhibitory Activity of Nepalese Medicinal Plants Used in the Treatment of Diabetes Mellitus. *Clin. Phytoscience* 2020, 6 (1), 34. <https://doi.org/10.1186/s40816-020-00179-8>.
- (6) Manandhar, S.; Luitel, S.; Dahal, R. K. In Vitro Antimicrobial Activity of Some Medicinal Plants against Human Pathogenic Bacteria. *J. Trop. Med.* 2019, 2019, e1895340. <https://doi.org/10.1155/2019/1895340>.
- (7) Bhandari, S.; Khadayat, K.; Poudel, S.; Shrestha, S.; Shrestha, R.; Devkota, P.; Khanal, S.; Marasini, B. Phytochemical Analysis of Medicinal Plants of Nepal and Their Antibacterial and Antibiofilm Activities against Uropathogenic *Escherichia Coli*. *BMC Complement. Med. Ther.* 2021, 21. <https://doi.org/10.1186/s12906-021-03293-3>.
- (8) Kalauni, S. K.; Maharjan, R.; Pathak, I.; Khadayat, K.; Niraula, M.; Thapa, P. Different Crude Extracts of *Cinnamomum Tamala* with Antioxidant and Antibacterial Capabilities. *Amrit Res. J.* 2021, 2 (01), 68–74. <https://doi.org/10.3126/arj.v2i01.40740>.

- (9) Maharjan, R.; Thapa, P.; Khadayat, K.; Kalauni, S. Phytochemical Analysis and α -Amylase Inhibitory Activity of Young and Mature Leaves of *Cinnamomum Tamala*. *Nepal J. Biotechnol.* 2021, 9, 14–20. <https://doi.org/10.54796/njb.v9i2.41909>.
- (10) Karanjit, N.; Shakya Kulshova, N.; Pradhan, N.; Gautam, L.; Shakya, D. A Compilation Report of Preliminary Phytochemical and Biological Screening of Some Medicinal Plants of Nepal, 2015.
- (11) Lakhey, P. B.; Tandukar, U.; Shrestha, N.; Pradhan, R. Some Nepalese Medicinal Plants Showing Potential Antimicrobial Activity Against *Salmonella Enterica* Subsp. *Enterica Serovar Typhi*. *J. Plant Resour.* 2018, 16 (1), 106–111.
- (12) Raksha, R.; Rajesh, K.; Preeti, S.; Younis Ahmad, H.; Seema, R. Phytochemical Screening and Free Radical Scavenging Activity of *Cinnamomum Tamala* Leaf Extract. *Int. J. Zool. Investig.* 2021, 7 (2). <https://doi.org/10.33745/ijzi.2021.v07i02.008>.
- (13) Thakur, R.; Yadav, K.; Khadka, K. B. Study of Antioxidant, Antibacterial and Anti-Inflammatory Activity of Cinnamon (*Cinnamomum Tamala*), Ginger (*Zingiber Officinale*) and Turmeric (*Curcuma Longa*). *Am. J. Life Sci.* 2013, 1 (6), 273. <https://doi.org/10.11648/j.ajls.20130106.16>.
- (14) Tuladhar, S.; Bajracharya, G.; Pokharel, D. R.; Giri, R. The Potentially Anticarcinogenic Flavonoids in Vegetables, Fruits and Spices. *Nepal J. Sci. Technol.* 2000, 2, 17–26.
- (15) Hassan, W.; Syeda, N.; Kazmi, N.; Noreen, H.; Riaz, A.; Zaman, B. Antimicrobial Activity of *Cinnamomum Tamala* Leaves. *Vitam. Miner.* 2016, 5, 1000139. <https://doi.org/10.4172/2161-0509.1000190>.
- (16) Arshad, W.; Khan, H. M. S.; Akhtar, N.; Nawaz, M. Assessment of Changes in Biophysical Parameters by Dermocosmetic Emulgel Loaded with *Cinnamomum Tamala* Extract: A Split-Faced and Placebo-Controlled Study. *J. Cosmet. Dermatol.* 2020, 19 (7), 1667–1675. <https://doi.org/10.1111/jocd.13198>.
- (17) Devi, S. L.; Kannappan, S.; Anuradha, C. V. Evaluation of in Vitro Antioxidant Activity of Indian Bay Leaf, *Cinnamomum Tamala* (Buch. -Ham.) T. Nees & Eberm Using Rat Brain Synaptosomes as Model System. *Indian J. Exp. Biol.* 2007, 45 (9), 778–784.
- (18) Rawat, A.; Bhatt, D.; Kholiya, S.; Chauhan, A.; Bawankule, D. U.; Chanotiya, C. S.; Padalia, R. C. Comparative Chemical Composition and Acetylcholinesterase (AChE) Inhibitory Potential of *Cinnamomum Camphora* and *Cinnamomum Tamala*. *Chem. Biodivers.* 2023, 20 (8), e202300666. <https://doi.org/10.1002/cbdv.202300666>.
- (19) Goyal, P.; Chauhan, A.; Kaushik, P. Laboratory Evaluation of Crude Extracts of *Cinnamomum Tamala* for Potential Antibacterial Activity. *Electron. J. Biol.* 2009, 5, 75–79.
- (20) Lakshmanan, D.; Harikrishnan, A.; Vishnupriya, S.; Jeevaratnam, K. Swarming Inhibitory Potential of Cinnamtannin B1 from *Cinnamomum Tamala* T. Nees and Eberm on *Pseudomonas Aeruginosa*. *ACS Omega* 2019, 4 (16), 16994–16998. <https://doi.org/10.1021/acsomega.9b02471>.
- (21) Raghunathan, K.; Sellappan, M.; Saleemulla; Khan, S.; Dhanabal, S. P.; M.J, N. 9. Screening of Bark of *Cinnamomum Tamala* (Lauraceae) by Using α -Amylase Inhibition Assay for Anti-Diabetic Activity. *Int. J. Pharm. Biomed. Res. IJPBR* 2010, 1.
- (22) Upadhaya, S. P.; KIRIHATA, M.; Ichimoto, I. Cinnamon Leaf Oil from *Cinnamomum Tamala* Grown in Nepal. *Nippon Shokuhin Kogyo Gakkaishi* 1994, 41 (7), 512–514.
- (23) Oli, N.; Singh, U. K.; Jha, S. K. Antifungal Activity of Plant's Essential Oils against Post Harvest Fungal Disease of Apple Fruit. *For. J. Inst. For. Nepal* 2019, 16, 86–100. <https://doi.org/10.3126/forestry.v16i0.28361>.
- (24) Rana, M.; Lakhey, P. B.; Bhatt, T. D.; Khadgi, S.; Adhikari, A. K.; Bhattachari, M. R.; Upadhyay, S. GCMS Qualitative Analysis and Antimicrobial Activity of Essential Oils of *Cinnamomum Tamala* (Buch.-Ham.) Nees and Eberm. (Tejpat) Leaves Collected from Different Parts of Makwanpur District, Nepal. 2017, No. 1.
- (25) Bajracharya, G.; Tuladhar, S. Brine-Shrimp Bioassay for Assessment of Anticancer Property of Essential Oils from Spices. *Nepal J. Sci. Technol.* 2012, 12. <https://doi.org/10.3126/njst.v12i0.6495>.
- (26) Regmi, S.; Jha, S. K. Antifungal Activity of Plant Essential Oils against *Fusarium Oxysporum* Schlecht. and *Aspergillus Niger* van Tiegh. from Papaya. *Int. J. Curr. Trends Sci. Technol.* 2018, Vol. 8, Page no: PS 20196-20204. <https://doi.org/10.15520/ctst.v8i01.233.pdf>.
- (27) Sirohi, S.; Malik, T.; Pant, S.; Chauhan, N.; Lohani, H.; Tripti, M. ANTI-DERMATOPHYTIC POTENTIAL OF *CINNAMOMUM TAMALA* LEAF ESSENTIAL OIL. *Int. J. Pharma Bio Sci.* 2016, 7, 291–295.
- (28) Bista, U.; Bist, D.; Aryal, H.; Amgain, L.; Shrestha, A. Anti-Fungal Activities and Responses of Plant Essential Oils against Post-Harvest Disease of Mango (*Mangifera Indica* L.) Fruit. 2020.
- (29) Kumar, S.; Vasudeva, N.; Sharma, S. GC-MS Analysis and Screening of Antidiabetic, Antioxidant and Hypolipidemic Potential of *Cinnamomum Tamala* Oil in Streptozotocin Induced Diabetes Mellitus in Rats. *Cardiovasc. Diabetol.* 2012, 11 (1), 95. <https://doi.org/10.1186/1475-2840-11-95>.
- (30) Bhandari, D. P.; Ranjitkar, R.; Bhandari, L. Quantitative Determination of Antioxidant Potential of Five Selected Essential Oils of Nepalese Origin. *J. Plant Resour.* 2018, 16 (1), 84.

- (31) Pandey, A. K.; Mishra, A. K.; Mishra, A. Antifungal and Antioxidative Potential of Oil and Extracts Derived from Leaves of Indian Spice Plant Cinnamomum Tamala. *Cell. Mol. Biol.* 2012, 58 (1), 142–147.
- (32) Farisa Banu, S.; Rubini, D.; Rakshitaa, S.; Chandrasekar, K.; Murugan, R.; Wilson, A.; Gowrishankar, S.; Pandian, S. K.; Nithyanand, P. Antivirulent Properties of Underexplored Cinnamomum Tamala Essential Oil and Its Synergistic Effects with DNase against Pseudomonas Aeruginosa Biofilms – An In Vitro Study. *Front. Microbiol.* 2017, 8.
- (33) Chen, L.; Sun, P.; Wang, T.; Chen, K.; Jia, Q.; Wang, H.; Li, Y. Diverse Mechanisms of Antidiabetic Effects of the Different Procyanidin Oligomer Types of Two Different Cinnamon Species on Db/Db Mice. *J. Agric. Food Chem.* 2012, 60 (36), 9144–9150. <https://doi.org/10.1021/jf3024535>.
- (34) Chaurasia, J. K.; Pandey, N.; Tripathi, Y. B. Effect of Hexane Fraction of Leaves of Cinnamomum Tamala Linn on Macrophage Functions. *Inflammopharmacology* 2010, 18 (3), 147–154. <https://doi.org/10.1007/s10787-009-0029-5>.
- (35) Upadhyay, G.; Khoshla, S.; Kosuru, R.; Singh, S. Anxiolytic, Antidepressant, and Antistress Activities of the Aqueous Extract of Cinnamomum Tamala Nees and Eberm in Rats. *Indian J. Pharmacol.* 2016, 48 (5), 555–561. <https://doi.org/10.4103/0253-7613.190752>.
- (36) Dhulasavant, V.; Shinde, S.; Pawar, M.; Naikwade, N. S. Antihyperlipidemic Activity of Cinnamomum Tamala Nees. on High Cholesterol Diet Induced Hyperlipidemia. *Int. J. PharmTech Res.* 2010, 2 (4), 2517–2521.
- (37) Mahato, R. B.; Chaudhary, R. P. Ethnomedicinal Study and Antibacterial Activities of Selected Plants of Palpa District, Nepal. *Sci. World* 2005, 3 (3), 26–31.
- (38) Chudamani, B.; Kunwar, R. Folk Herbal Medicines of Mahakali Watershed Area, Nepal. In *Medicinal Plants in Nepal: An Anthology of Contemporary Research*; 2008; pp 187–193.
- (39) Sigdel, S.; Acharya, S. Ethnomedicinal Study of Home Garden Species in Palpa District-Western Nepal. 2021.
- (40) Bhandari, R.; Pandeya, B.; Ghimire, B. Ethnobotanical Study of Plant Resources in Dhurkot Rural Municipality, Gulmi District Nepal. *Ethnobot. Res. Appl.* 2023, 25, 1–19.
- (41) Sah, A. P.; Mandal, R. A. Revenue and Employment Generation from Medicinal Herbs in Darchula, Nepal. *Open Access J. Biog. Sci. Res.* 2020, 1 (4). <https://doi.org/10.46718/JBGSR.2020.01.000023>.
- (42) Ghaffari, S.; Ghobadi, A.; Jamshidi, A. H.; Mortazavi, S. H.; Naderi, S.; Aqamolaei, A.; Mortezaei, A.; Sahebolzamani, E.; Shamabadi, A.; Jalilvand, S.; Daraei, B.; Shalbafan, M. R.; Akhondzadeh, S. Cinnamomum Tamala as an Adjuvant Therapy in the Treatment of Major Depressive Disorder: A Double-Blind, Randomized, Placebo-Controlled Clinical Trial with Placebo Control. *Adv. Integr. Med.* 2020, 7 (3), 141–147. <https://doi.org/10.1016/j.aimed.2019.12.002>.
- (43) Singh, T. N.; Upadhyay, B. N.; Tewari, C. M.; Tripathi, S. N. MANAGEMENT OF DIABETES MELLITUS (PRAMEHA) WITH INULA RACEMOSA AND CINNAMOMUM TAMALA. *Anc. Sci. Life* 1985, 5 (1), 9–16.
- (44) 1-10-Dec-2020-11-12-01Toxicity of Some Essential Oils 076.Pdf. <http://nprl.gov.np/files/multipleupload/1-10-Dec-2020-11-12-01Toxicity%20of%20Some%20Essential%20Oils%20076.pdf> (accessed 2023-10-12).
- (45) 0-27-Nov-2017-05-11-33publication3.Pdf. <http://nprl.gov.np/files/multipleupload/0-27-Nov-2017-05-11-33publication3.pdf> (accessed 2023-10-12).