Biological Importance of Phytochemical Constituents Isolated from the Genus *Mesua*

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**ABSTRACT**

*Mesua* is a small genus of flowering plants. It is belongs to Calophyllaceae family, native to tropical southern Asia. Common names include iron wood and rose chestnut. They are evergreen shrubs or small trees growing to 13 m tall, with leaves arranged in opposite pairs. The compounds generally associated with this genus are alkaloids, saponins, terpenoids, phenolics, tannins etc. These compounds exhibit Antibacterial, anticancer, cytotoxic activity. We have systematically reviewed *Mesua* genus as it may be helpful to pharmaceutical industry as well as biologists, pharmacologists and phytochemists.

**Keywords**: Genus Mesua, Calophyllaceae, triterpenoids, tannins, alkaloids, saponins, biological activities.

**INTRODUCTION**

*Mesua ferrea* belongs to the family : Clusiaceae : Guttiferae. It is commonly known as ‘ Naagkesar’ (Bengali, Hindi and Punjabi), ‘Naagchampa’ (Gujarat, Kon. and Mar) and ‘Naagakeshara’ (Sanskrit). It is a medium to large evergreen tree which flourishes mostly in mountains and plains of Bengal and Assam, in eastern Himalayas as well as in western & western parts of south India, the most popular name is Ironwood, the mesua seeds is oval and average size is 2.5 cm in length & 1.2 cm thick. The oil content in seed was reported to be 52.5%1,2,3. Its various parts having tremendous use in the Indian traditional system of medicine for the treatment of various diseases. The barks are used as astringent and in combination with ginger as a sudorific. The leaves and flowers are used in snake bite and scorpion strings, flower buds are used in dysentery, flowers are used as astringent, stomachic and expectorant, unripe fruits have sudorific effects, seed oil is used externally for cutaneous affections as an embrocation in rheumatism4,5. The seed oil contains number of medicinally active compounds belonging to 4-phenyl coumarin derivatives. The crude native oil showed significant antispasmodic, antibacterial and hypotensive activity6.

**Table 1:** Phytoconstituents isolated from genus Mesua and their pharmacological activities

<table>
<thead>
<tr>
<th>Plant/Part</th>
<th>Name of Compounds</th>
<th>Biological activity</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>M. ferrea</em> L., <em>M. daphnifolia</em> (Heartwood, seed oil and stem bark)</td>
<td>1)1,3-Dimethoxy-5,6-dihydroxyxanthone</td>
<td>Cytotoxic</td>
<td>20-25</td>
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<td></td>
<td>2)1,3,5,6-Tetramethoxyxanthone</td>
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<td></td>
<td>3)1,3,6-Trimethoxy-5-hydroxyxanthone</td>
<td></td>
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<tr>
<td></td>
<td>4)1,3-Dimethoxy-5,6-diacetoxyxanthone</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5)Euxanthone</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>6)1,5-Dihydroxy-3-methoxyxanthone (Mesuaxanthone A)</td>
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<td></td>
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<tr>
<td></td>
<td>7)1,5,6-Trihydroxyxanthone (Mesuaxanthone B)</td>
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<tr>
<td></td>
<td>8)1,5- Dihydroxyxanthone</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9)Euxanthone-7-methyl ether</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>10) Cudraxanthone G</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11) Ananixanthone</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12)1,3,5-Trihydroxy-4-methoxyxanthone</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. ferrea</em> L., <em>M. elegans</em>, <em>M. racemosa</em> (Seed)</td>
<td>13)5,7-Dihydroxy-6-(isobutyryl)-8-(3-methylbut-2-enyl)-4-phenyl-2H-chromene-2-one (Mesuol)</td>
<td>Antibacterial, Acetylcholine sterse inhibitory</td>
<td>16, 25-29</td>
</tr>
<tr>
<td></td>
<td>14) Methyl ether mammeigin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15) 4-Phenyl-5,7-dihydroxy-6-isovalerylcoumarin</td>
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</tr>
</tbody>
</table>

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oil, bark, fruits and blossoms)

16) 5,7-Dihydroxy-6-(3-methylbutanoyl)-8-(3-methylbut-2-enyl)-4-phenyl-2H-chromen-2-one (Mammein)
(Mammea A/AA)

17) 5-Hydroxy-8,8-dimethyl-6-(2-methylbutanoyl)-4-phenyl-2H-pyran [2,3-h]chromen-2-one (Mammein)
(Mammea A/AB)

18) 5-Hydroxy-6-isobutyril-8,8-dimethyl-4-phenyl-2H-pyran [2,3-h]chromen-2-one (Mesuagin) (Mammea
A/AD cyclo D)

19) Mesuabixanthone A

20) Mesuabixanthone B

21) Mesuaferronol

22) Mesuaferrone A

23) Mesuaferrone B

24) Mesuanic acid

25) 5-Hydroxy-6-isobutyril-8-methyl-8-(4-methylpent-3-enyl)-4-phenyl-2H-pyran [2,3-h]chromen-2-one

26) 5,7-Dihydroxy-8-(2-methylbutanoyl)-6-{(E)}-3,7-dimethylocta-2,6-dienyl]-4-phenyl-2H-chromen-2-one

27) 5,7-Dihydroxy-6-(2-methylbutanoyl)-8-{(E)}-3,7-dimethylocta-2,6-dienyl]-4-phenyl-2H-chromen-2-one

28) 5,7-dihydroxy-8-(2-methylbutanoyl)-6-(3-methyl-but-2-enyl)-4-phenyl-2H-chromen-2-one (Mammea A/BB)
(Isomammein)

29) 8,9- Dihydro-5-hydroxy-6-(2-methylbutanoyl)-4-phenoxy-8-(prop-1-en-2-yl) furan [2,3-h]chromen-2-one

30) 5,7-Dihydroxy-4-(1-hydroxypropyl)-8-(2-methylbutanoyl)-6-(3-methylbut-2-enyl)-2H-chromen-2-one
(Asamene)

31) 8,9- Dihydro-5-hydroxy-8-(2-hydroxypropan-2-yl)-6-isobutyril-4-phenylfuran [2,3-h]chromen-2-one (Mammea
A/AD cyclo F)

32) 5,7-Dihydroxy-8-(3-methylbutanoyl)-6-{(E)}-3,7-dimethylocta-2,6-dienyl]-4-phenyl-2H-chromen-2-one

33) Mammea A/BA cyclo F

34) Mammea A/BA

35) Mesuagenin A

36) Mesuagenin B

37) Mesuagenin C

38) Mesuagenin D

39) Isomammein

40) 6-{(2E)}-3,7- Dimethylocta-2,6-dien-1-yl]-5,7-dihydroxy-8-(2-methylbutanoyl)-4-phenyl-2H-chromen-2-one-6-{(2E)}-3,7- dimethylocta-2,6-dien-1-yl]-5,7-dihydroxy-8-(3-methylbutanoyl)-4-phenyl-2H-chromen-2-one (1/1)

41) 5,7-Dihydroxy-8-(2"-hydroxy-3"-methylbut-3"-ene)-6-(1"-oxobutyl)-4-phenyl-2H-benzo [b] pyran-2- one
(Racemosol)

42) Mammea A/AC cyclo F

43) Mammea A/AC

44) Mammea A/AC cyclo D

M. ferrea L. (Leaves)

45) 12, 13- Furan-8- hydroxyl naphthyl -6- O-β-2', 3', 4', 6" tetrahydroxy-5', 5" dimethyl cyclohexyl ether

46) Friedelin

47) Friedelan-1,3- dione

Antibacterial 12, 15, 31-35

M. ferrea L., M. beccariana, M.
congestiflora, M. daphnifolia and M. nagassarium (Burm.f.) (M.kunstleri King) (Kosterma)
Heartwood, Stems, Stem bark, Root bark)

48) α- Amyrin
49) β- Amyrin
50) Lupeol
51) β- Sitosterol
52) Betulinic acid
53) 1,8-Dihydroxy-3-methoxy-6-methylanthraquinone
54) Lup-20 (29)-en-3β-ol
55) Stigmasterol
56) 10 [2,4,6-Tris-(14,24,35-enyl)-(3, 17, 5, 28) terphenyl-1-yl-oxo]-butyric acid methyl ester
57) 6-(19-hydroxy-20-oxo-19-phenyl-propyl)-3-methyl-8,8-bis- (11,16-methyl-but-10, 15-enyl)-2,5H-naphthalene-1,4,7-trione
58) Mesuarianone
59) Mesuasinone
60) Mesuadione
61) Beccamarin
62) Mesuaferrin A
63) Mesuaferrin B
64) Mesuaferrin C
65) Congestiflorone (rac-[3-Hydroxy-6,9-dimethyl-6-(4-methyloctan-3-en-1-yl)-6a,7,8,9,10a-hexa-hydro-6H-1,9-epoxybenzo [c] chromen-4-yl] (phenyl) methane)
66) 6-Deoxyjacareubin
67) 4-Methoxy-1,3,5-trihydro anthraquinone
68) 2,5-Dihydroxy-1,3,4-trimethoxy-anthraquinone
69) Caloxanthone C
70) Macluraxanthone
71) 1,5- Dihydroxyxanthone
72) Tovopyrifolin
73) α-Mangostin
74) 1,8-Dihydroxy-3-methoxy-6-methylanthraquinone
75) 3β-Friedelanol
76) 3-Oxo-betulin
77) Spinasterol
78) 6- [(E)-3,7- Dimethylocta-2,6-dienyl]-5,7- dihydroxy-8-(2-methylbutanoyl)-4-phenyl-2H-chromen-2-one

M. lepidota (Fruits)
79) Lepidotol A
80) Lepidotol B
81) Lepidotol C
82) Lepidotol D
83) Lepidotol E
The drug nagakeshara is found as an ingredient in many of the Ayurvedic formulations especially as prakshepa in various avalehakalpanas like vyaghrihareetaki avaleha etc and sandhanakalpanas like dasamoolarishta etc and as an ingredient in various other dosage forms like churnas, vati, rasa preparations like mahakaleshwara rasa etc. Extensive chemical examinations of this plant have been carried out and several constituents were isolated such as lignans, alkaloids, flavonoids, tannins, phthalic acid, gallic acid, terpenoids, steroids, glycosides, coumarins, xanthones, triglycerides and resins. Mesuol, mammeigin and mammeisin were isolated from the seed oil. Mesuol and mesuone showed antibacterial activity against S.aureus and Mycobacterium phlei. Mesuol also showed immunomodulatory activity.

ACKNOWLEDGEMENT
The authors are thankful to UGC and CSIR, New Delhi, India for financial support to S.K. Meena and A. Gupta respectively.
6. \( R = \text{OCH}_3 \)

7. \( R^1 = R^2 = R^3 = \text{H} \)

8. \( R = \text{H} \)

10. \( R = \text{OCH}_3 \)

11. \( R = \text{H} \)

12. \( R = \text{CH}_3 \)

1. \( R^1 = R^2 = \text{Me}, R^3 = R^4 = \text{H} \)
2. \( R^1 = R^2 = R^3 = R^4 = \text{Me} \)
3. \( R^1 = R^2 = R^4 = \text{Me}, R^3 = \text{H} \)
4. \( R^1 = R^2 = \text{Me}, R^3 = R^4 = \text{Ac} \)
5. \( R = \text{H} \)
6. \( R = \text{CH}_3 \)
13. $R_1 = A; R_2 = C$
16. $R_1 = B; R_2 = C$
15. $R_1 = B; R_2 = H$

18. $R_3 = A; R_4 = OH$
17. $R_3 = B; R_4 = OH$
14. $R_3 = B; R_4 = OCH_3$

$A = OCH_2CHC\text{H}_3$  $B = OCH_2CHC\text{H}_3$

$C = H_2CHC=CH_3$  

19. $R_1 = H; R_2 = OMe$
20. $R_1 = OH; R_2 = H$
21. 

$OCH_3$
22. 

23. 

24. 

25. R= CH(CH$_3$)$_2$

26. R= CH$_2$CH(CH$_3$)$_2$

27. R= CH(CH$_3$)$_2$CH$_3$
28. \(R = \text{CH(CH}_3\text{)}\text{CH}_2\text{CH}_3\)

29. \(R = \text{CH(CH}_3\text{)}\text{CH}_2\text{CH}_3\)

30. \(R = \text{CH}_3\)

31. \(R = \text{CH (CH}_3\text{)}_2\)

33. \(R = \text{CH}_3\)

34. \(R = \text{(CH}_2\text{)}_2\text{CHC(CH}_3\text{)}_2\)

38. \(R = \text{(CH}_2\text{)}_2\text{CHC(CH}_3\text{)}_2\)
35. $R = \text{CH}_2\text{CH}((\text{CH}_3)_2, R_1 = (\text{CH}_2)_2\text{CHC}(\text{CH}_3)_2$

36. $R = R = \text{CH}((\text{CH}_3)_2\text{CH}_3, R_1 = (\text{CH}_2)_2\text{CHC}(\text{CH}_3)_2$

39. $R = \text{CH}_2\text{CH}((\text{CH}_3)_2, R_1 = \text{CH}_3$

40. 

41. 

42. 

44. $R = \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
45. 

75. R -OH

46. R =O

47.

48.

49.

50.
REFERENCES