SUMMARY

Nutritional value of herb is a well known fact, but identification of its role in curing several ailments, as believed across many cultures, is a challenging area of ethnopharmacology. This ethnopharmacological usage of food can be an alternative or accessory to modern day drug therapy. For such an endeavor the ethnic beliefs, regarding food, have to be scientifically validated.

Rheumatoid arthritis (RA), the most common form of chronic inflammatory polyarthritis, represents a significant health burden in the developed world. It is the leading cause of disability, and increase mortality. Rheumatoid arthritis occurs worldwide with a variable incidence and severity. It affects approximately 1% of the population worldwide and 0.6 – 1% in Indian population. However, these figures may be underestimated since patients with mild disease may never seek a medical opinion. The damage and deformity of the synovial joints characteristic of RA most commonly develops in the sixth decade but can occur at any age and will usually require treatments and interventions for the rest of an individual’s life. Current treatment modalities for RA either produce symptomatic relief (NSAIDs) or modify the disease process (DMARDs). Though effective, their use is also limited by their side effects including gastrointestinal ulcers and perforation, cardiovascular complications and emergence of opportunistic infections due to immunosuppressant. Evaluation of plant products to treat inflammation and pain is of growing interest as they contain many bioactive substances with therapeutic potential.

Among the phytochemicals, alkaloids, steroids, diterpene lactones, triterpenes, polyphenols and flavonoids are the major classes of plant natural product known to have anti-arthritic property. The present study pertains to phytochemical investigation and anti-arthritic activity of pure and authenticated herbal drugs namely: *Abutilon indicum*, *Hygrophila auriculata* and *Trichosanthes dioica* that are used to treat and prevent several diseases in Ayurvedic, Sidda and Unani system of medicine.

*Abutilon indicum* (L.) Sweet (Malvaceae) commonly called as ‘Country mallow’, ‘Kanghi’ and ‘Atibala’. It is a perennial shrub, softly tomentose and up to 3 m in height. The plant is widely distributed throughout India, Sri Lanka, topical regions of America.
and Malaysia. The phytochemical investigation of the whole plant of *Abutilon indicum* resulted in the isolation of five ester characterized 5′- hydroxyhexyl n-hexadecanoate (AB-01), n-octanoyl-β-D-glucopyranosyl-2-β-D-glucopyranoside (AB-02), n-deconoyl-β-D-glucopyranorlyl-2-β-D-glucopyranoside (AB-03), n-hexadecanoyl-β-D-glucopyranosyl-β-D-glucopyranoside (AB-04) and n-Octanoyl-β-D-glucopyranosyl-(2-1)-β-D-glucopyranosyl-(2-1)-β-D-glucopyranosyl- (2-1)-β-D-glucopyranoside (AB-05). Out of these 5′- hydroxyhexyl n-hexadecanoate (AB-01) and n-Octanoyl-β-D-glucopyranosyl-(2-1)-β-D-glucopyranosyl-(2-1)-β-D-glucopyranosyl- (2-1)-β-D-glucopyranoside (AB-05) is the the new phytoconstituents, isolated from the whole plant *A. indicum* for the first time.

**Structure of isolated compounds from *A. indicum***

![Structure of isolated compounds from A. indicum](image-url)

5′-Hydroxyl hexyl palmitate (AB-01)

Capryloyl diglucoside (AB-02)
Capryl diglucoside (AB-03)

Palmityl diglucoside (AB-04)
Hygrophila auriculata (K. Schum) Heine (Acanthaceae) occurs wild and has been advocated for the treatment of variety of diseases including most commonly diabetes, rheumatism and dysentery. The phytochemical investigation of the methanolic extract of *H. auriculata* resulted in isolation five alipahatic phytoconstituents viz; n-hexacos-21-one-1-ol (HA-01), trans-tetracont-7-en-1-ol (HA-02), n-octacosan-8-one (HA-03), n-octatriacontan-3-one -19,31,-diol (HA-04) and n-heptacosan-11α-ol (HA-05). Out of these n-octatriacontan-3-one -19,31,-diol (HA-04) is a the new phytoconstituents, isolated from the whole plant *H. auriculata* for the first time.
Structure of isolated compound from *H. auriculata*

\[
\begin{align*}
&26 \quad \text{O} \\
&\text{CH}_3 - (\text{CH}_2)_4 - \text{C} - \text{CH}_2 - (\text{CH}_2)_{18} - \text{CH}_2 - \text{OH} \\
&\text{21}
\end{align*}
\]

\begin{align*}
n\text{-Hexacos-21-one-1-ol (HA-01)}
\end{align*}

\[
\begin{align*}
&40 \quad 8 \\
&\text{H}_3\text{C} - (\text{CH}_2)_{31} - \text{CH} = \text{CH} - \text{CH} - \text{CH}_2 - (\text{CH}_2)_4 - \text{CH}_2 - \text{OH} \\
&\text{8} \quad 7 \quad 6 \\
&\text{4} \quad 1
\end{align*}
\]

\begin{align*}
\text{trans- Tetracent-7-en-1-ol (HA-02)}
\end{align*}

\[
\begin{align*}
&28 \\
&\text{CH}_3 - (\text{CH}_2)_{18} - \text{CH}_2 - \text{C} - \text{CH}_2 - (\text{CH}_2)_{5} - \text{CH}_3 \\
&\text{8} \quad 7 \\
&\text{1}
\end{align*}
\]

\begin{align*}
n\text{-Octacosan-8-one (HA-03)}
\end{align*}

\[
\begin{align*}
&38 \\
&\text{CH}_3 - (\text{CH}_2)_6 - \text{CH} - (\text{CH}_2)_{11} - \text{CH} - (\text{CH}_2)_{14} - \text{CH}_2 - \text{C} - \text{CH}_2 - \text{CH}_3 \\
&\text{31} \quad 19 \\
&\text{14} \quad 4 \\
&\text{1}
\end{align*}
\]

\begin{align*}
n\text{-Octatriacontan-3-one -19,31,-diol (HA-04)}
\end{align*}

\[
\begin{align*}
&27 \\
&\text{CH}_3 - (\text{CH}_2)_{15} - \text{CH} - \text{CH}_2 - (\text{CH}_2)_{7} - \text{CH}_2 - \text{CH}_3 \\
&\text{11} \quad 10 \\
&\text{2} \quad 1
\end{align*}
\]

\begin{align*}
n\text{-Heptacosan-11α-ol (HA-05)}
\end{align*}

*Trichosanthes dioica* Roxb. (Cucurbitaceae) known commonly as pointed gourd or “Sespadula” in English, Parwal in Hindi, and Patola in Sanskrit; it is a dioecious climber found wild throughout the plains of North and North-East India from Punjab to Assam and Tripura states of India. Detail chemical analysis of methanolic extract of leaves of *T. dioica* resulted in the isolation of heneicosanyl oleate (TD-01) and sesquiterpenic glucoside: farnasonoic acid α-L-glucoside (TD-02), triterpenic glycosides: lanosten-5-en-3β-ol-26-oic acid glucosyl capriate (TD-03), triterpenic tetraglycosides: lanosten-3β-ol-26-oic acid tetraglucoside (TD-04) and triterpenic tetraglucosides: lanastan-3β-ol-26-oic acid.
acid tetraglucoside (TD-05). Out of these the farnasonoic acid α-L-glucoside (TD-02), lanosten-5-en-3β-ol-26-oic acid glucosyl capriate (TD-03), lanosten-3β-ol-26-oic acid tetraglucoside (TD-04) and lanastan-3β-ol-26-oic acid tetraglucoside (TD-05) were the new phytoconstituents, isolated from the leaves of *T. dioica* for the first time.

**Structure of isolated compounds from *T. dioica***

\[
\begin{align*}
\text{CH}_3 (\text{CH}_2)_7 & \quad \text{CH} \quad \text{CH} \quad (\text{CH}_2)_7 \\
\text{CO} & \quad \text{O} \quad \text{CH}_2 \quad (\text{CH}_2)_{19} \quad \text{CH}_3
\end{align*}
\]

Heneicosanyl oleate (TD-01)

Farnasonoic acid α-L-glucoside (TD-02)
Lanosten-5-en-3β-ol-26-oic acid glucosyl capriate (TD-03).

Lanosten-3β-ol-26-oic acid tetraglucoside (TD-04)

Lanastan-3β-ol-26-oic acid tetraglucoside (TD-05)
The following parameters of standardization for each plant drug have been developed including preliminary phytochemical Screening. The extract obtained then subjected to qualitative chemical tests for identification of various plant constituents present in the crude drug. The extract should be subjected to preliminary phytochemical investigation for detection of alkaloids, carbohydrates, glycosides, phenolic compounds, flavonoids, Protein and amino acids, saponins, sterols, acidic compounds, resins, lipids/fat, TLC profile of *A. indicum*, *H. auriculata* and *T. dioica*, Ash value, Extractive value, Loss on drying, and quantitative estimation of phytocstituents such as total phenolic content, total flavonoidal content, total proanthocyanidin content, total saponin and total alkaloidal content have been studied.

Development and validation of HPTLC method for simultaneous estimation of bioactive “Lupeol and Stigmasterol” and “Quercetin and Gallic acid” in methanolic extracts of selected plants have been conducted. As far as we are aware, there is no any HPTLC method reported to quantify lupeol and stigmasterol and gallic acid and quercetin separately in extracts of selected plants. Therefore we have attempted to develop and validate a cost effective simple and sober hyphenated HPTLC technique to quantify bioactive marker components in this herb. In addition, this helped in the generating a better fingerprint data whereby species could be well differentiated on enhanced visual identification of individual compounds. The method developed here was found to be quite selective with good baseline resolution of each compound.

Anti-arthritic activities of the methanolic extracts of *A.indicum*, *H. auriculata* and *T. dioica* were performed on complete freund’s adjuvant induced arthritis rats. *A. indicum* (ABM) have shown the best results among the three test drugs in improving the behavioral parameters, hematological, restoring the biochemical and histological alterations occur in AIA rat model. Thus it is valid to conclude that the selected agents, *Hygrophila auriculata* (HAM), *Abutilon indicum* and *Trichosanthes dioica* (TDM) can be used as favoured remedies in arthritic studies pending elucidation of proper molecular mechanisms and deciphering appropriate molecular pathways involved.