A REVIEW ON COMMIPHORA MYRRHA

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ABSTRACT
In recent years more people throughout world are turning to use medicinal plant products in healthcare system. Worldwide need of alternative medicine has resulted in growth of natural product markets and interest in traditional systems of medicine. Herbal drug technology is used for converting botanicals materials into medicines, where standardization and quality control with proper integration of modern scientific techniques and traditional knowledge is important. Thus it becomes necessary to evaluate the health claims of these agents and to develop standards of quality and manufacture. The herbal industry needs to follow strict guidelines and regulations are needed. Products from many species of Commiphora have been used for various purposes, sometimes as timber, building material, and natural fencing, but more often valued for the aromatic resins produced by several members of the genus. "Myrrh", the common name for these dried resins, is fragrant and has been used both as fragrance and for medicinal purposes (e.g., Balsam of Mecca, C. gileadensis). The generic epithet is derived from Greek ‘kommis’ and ‘phora’ meaning gum bearer. Myrrh has been used as an ingredient for perfumes, incense and cosmetics for thousands of years. According to ancient Greek legend, Greek soldiers carried myrrh with them to treat battle wounds. Myrrh oil is also considered the holy oil of the Jewish faith and is mentioned throughout the Old and New Testament in the Bible. This review article is written to gather as much information as possible on the drug Commiphora myrrha and its various species which has been published in various journals.

Keywords: Commiphora myrrha, review, chemistry, Burseraceae, standardization, uses.

INTRODUCTION
The botanical identity of a majority of the plants mentioned in the pharmacopoeia of various indigenous systems of medicine has been established since the introduction of the modern system of plant classification in India. There are however a number of crude drugs where the plant source has not yet been scientifically identified. In other cases it has been seen that, more than one plant species, sometimes with widely different morphological and taxonomic characters are considered the source of a particular drug. The true source of the crude drug in such cases can be located only after detailed chemical and pharmacological studies.
As commercialization of the herbal medicine has happened, assurance of safety, quality and efficacy of medicinal plants and herbal products has become an important issue. The herbal raw material is prone to a lot of variation due to several factors, the important ones being the identity of the plants and seasonal variation (which has a bearing on the time of collection), the ecotypic, genotypic and chemotypic variations, drying and storage conditions and the presence of xenobiotic.

To include the monograph of a drug in a standard book, containing all the parameters of standardization, it is necessary to perform an extensive and exhaustive study of the herbal drug. Starting from the research on its geographical source to the method of cultivation that gives a uniform yield of the active constituents, the identification, authentication of the herbal drug and standardization of the microscopic, macroscopic, physical, chemical, and biological parameters have to be carried out to make the drug to be acceptable to the commercial market as these parameters have a direct effect on its clinical value.

INTRODUCTORY PROFILE

Synonym: Commiphora molmol, Gum Myrrh

Biological source: It is the oleo-gum-resin obtained by incision from the stem of Commiphora molmol Engler and from other Commiphora species.

Family: Burseraceae. The genus of Commiphora consists of about 185 species.

Habitat: Found in India, W. Pakistan, Arabia, Tropical and Southern Africa. It is usually found in low brush lands and in shallow soil, most often over limestone.¹⁰

Different species: C. africana - C. boranensis - C. caudata - C. corrugata - C. gileadensis - C. guidottii - C. habessinica - C. kataf - C. madagascarensis - C. mossambicensis - C. myrrha - C. schimperi - C. wightii

VERNACULAR NAMES

Sanskrit : Bolah, Rasagandhah
English : Myrrh
Hindi : Bol, Hirabol
Kannada : Bola
Malayalam : Narumpasamaram, Narumpasa
Tamil : Vellaippapolam
Telugu : Balimtra-Polam
TAXONOMICAL PROFILE\textsuperscript{[13]}

Domain: Eukaryota  
Kingdom: Plantae  
Subkingdom: Viridaeplantae  
Phylum: Tracheophyta  
Subphylum: Euphyllphytina  
Infraphylum: Radiatopses  
Class: Spermatopsida  
Subclass: Rosidae  
Superorder: Rutanae  
Order: Sapindales  
Family: Burseraceae  
Tribe: Burseraceae  
Genus: Commiphora  
Specific epithet: myrrha - Engl.  
Botanical name: Commiphora myrrha Engl.

MACROSCOPIC DESCRIPTION

Plant type: Trees or shrubs, often armed or thorny.
Leaves: Alternate or fascicled, compound, 1-3 (or more)-foliolate, imparipinnate; leaflets sessile or subsessile, serrate, crenate, or entire.

Inflorescence

Flowers: solitary or in fascicles of 2-5 or in panicles, small, sessile-subsessile, bisexual or unisexual

Calyx: Copular, urceolate or tubular, 4 toothed or lobed, persistent.

Petals: 4, valvate

Stamens: Mostly 8, inserted on the margin of the annular or cupular disc, filaments usually unequal, dilated at the base

Ovary: ovoid, sessile, 2-4-loculed, each locule 2 ovuled; style short with 2-4 obtusely lobed stigma

Fruit: a drupe, globose or subglobose, compressed or not.

PLANT AT A GLANCE [14]

Parts used: Gum (an unorganized drug)

Color: Externally reddish brown, internally brown.

Odour and taste: Aromatic and agreeable

Flowering season: Late spring

Leaf type: Alternate or fascicled, compound

Plant type: Trees or shrubs

Appearance: It is brittle and breaks with a granular fracture. The gum resin exudates from wounds in the stem are pale yellow at first and later solidify to brown-black.

PHYTOCHEMICAL CONSTITUENTS [15,16]

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile oil (7-17%)</td>
<td>Cuminic aldehyde, eugenol, metacresol, pinene, limonene, diterpenes and two sesquiterpenes</td>
</tr>
<tr>
<td>Resin (25-40%)</td>
<td>Ether soluble portion: $\alpha$, $\beta$ and $\gamma$ commiphoric acids, and esters of another resin acid and two phenolic resins.</td>
</tr>
<tr>
<td></td>
<td>Ether insoluble portion: $\alpha$ and $\beta$ herabomyrrholic acids.</td>
</tr>
<tr>
<td>Gum (57-61%)</td>
<td>Associated with enzyme oxidase and on hydrolysis yields arabinose</td>
</tr>
<tr>
<td>Essential oil of Commiphora abyssinica</td>
<td>Nine sesquiterpene hydrocarbons, elemol a sesquiterpene alcohol furanosesquiterpenoids furanodiene, furanodienone, isofuranogermacrene, curzerenone and lindestrene</td>
</tr>
<tr>
<td>3-4% impurities</td>
<td></td>
</tr>
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ETHNOBOTANICAL USES \[17,18\]

- It is useful in vitiated conditions of vata, pitta and kapha, stomatitis, dyspepsia, menstrual disorders, bronchitis, asthma, wounds and ulcers, etc.
- The Herabol myrrh is also used in perfumery, dentifrices and in religious ceremonies as incense.
- This is reported to be used by ancients for embalming.
- Gum or resin: The oleo-gum resin from the stem has an aromatic taste and odour, may be acrid and bitter. It is inflammable, but burns feebly. Its products are highly prized in Asia.
- Essential oil: Myrrh oil is deep amber in color with a warm, spicy, bitter and smoky aroma. Today myrrh oil is still considered helpful for meditation, and aroma therapists recommend the naturally antiseptic essential oil for skin and mouth problems.
- Poison: This herb is contraindicated during pregnancy because of its emmenagogic activity. It is advisable to dilute myrrh before use and administer moderate doses. Allergic reactions have been observed.
- Medicine: Myrrh stimulates the production of gastric juices, tones the digestive tract and used to treat diarrhoea, flatulence, dyspepsia, loss of appetite. Stimulates the production of menstrual blood (emmenagogue). Also used to treat genital infections, leucorrhoea, thrush, scanty periods, used for hemorrhoids, arthritis has expectorant activity and is also used for flu, catarrh, bronchitis, asthma, sore throat. Stimulates the production of white blood cells regeneration of skin cells, assists in the healing of wounds. Myrrh treats eczema, wounds, and wrinkles and has very good mollifying qualities. Use of myrrh imparts a cooling, calming effect, combating apathy and increasing mental clarity and focus. Myrrh is also administered as horse tincture in veterinary practice for healing wounds. Because of its anti-fungal properties it can be used as a vaginal wash for thrush or in a footbath for athlete's foot.
Other products: Myrrh is a common ingredient of toothpowder, and is used with borax in tincture, with other ingredients, as a mouth-wash. The thick, pale yellow oil contains myrrholic acid and heerabolene, a sesquiterpenene.

**AGRICULTURAL REVIEW**

Influence of length and diameter of semi-hardwood stem cuttings on cutting success of *Commiphora wightii*[^19^]: Effects of length and diameter were determined on regeneration of semi-hardwood stem cuttings of Indian Bdellium *Commiphora wightii* (Burseraceae). The stem cuttings of three levels each of length 15 cm, 20 cm, and 25 cm, and diameter 0.5 cm, 1.0 cm, and 1.5 cm, were taken for planting. The treatments were arranged in a randomized complete block design with three replications. The number of branches and primary roots per plant increased significantly with thick cuttings (1.0 cm or 1.5 cm). Dry matter partitioning (leaf, stem, and root) was significantly enhanced with cuttings of 25-cm length and 1.5-cm diameter. Irrespective of length, the diameter did not significantly influence the cutting success. However, the longer cuttings of 20-25 cm were found to be most successful in their field establishment.

Ecology and cultivation practices of guggal (*Commiphora wightii*): an endangered medicinal plant of the Thar desert in India[^20^]: Seeds are apomictic and exhibit polyembryony. Two types of seeds, viz. black (viable) and yellowish-white (non-viable) are observed in this plant. Black seeds showed 35-40.0 percent germination under controlled laboratory and nursery conditions. Seeds sown during mid-March at a depth of 0.5-1.0 cm exhibited maximum seedling emergence in soil mixture with an equal proportion of sand: clay: farm yard manure (FYM). This soil mixture was also effective in obtaining maximum plant growth and biomass under nursery conditions. Ceradik (a rooting hormone) and IBA mgl-1 treatment gave early rooting. Ceradik, hexamel (an organic manure) and ceradik + NPK treatments maintained high survival percentage under field conditions. Spacing of 3x3m between plant-to-plant and row-to-row with fortnightly irrigation were found to be optimum for maximum growth, while 2x2 m spacing for survival. To achieve and cent percent rooting, air-layering technique was found to be most favorable. The result of air-layering experiment revealed that ceradik and guggal solutions (500, 750 & 1000 ppm) promote root initiation, root length as well as their
survival under field conditions than other chemicals. Ethephon (6 ml dose) induced high gum yield (140.64 g).

Biology, conservation and med culture of important medicinal plants from Indian Thar desert [21]: Air layering experiments on Commiphora wightii by that guggul solution (500 and 1000 ppm) was found to be more suitable for initiation of roots and increasing the length of roots and survival rate under field conditions than other treatments. Soil mixture made up of sand: clay : FYM (1:1:1) gave good height and above ground biomass of this plant. Seeds sown during 20-30 June gave maximum emergence of seeds. Conc H2SO4(25 min) and mechanical scarification helped in breaking the hard seed coat dormancy of Evolvulus alsinoides. Plant treated with NPK, FYM, Hexameal and their combinations showed better growth performance over control under field conditions. Freshly harvested seeds of Leptadenia reticulate showed 93.33 percent germination under control conditions, while cent percent germination was observed in seeds pretreated with 50 percent H2SO4 for 2 min, soaked for 24h in tap water and in hot water (55-60 degree C) for 2 and 5 min. The survival percentage of air layered twigs treated with Ceradik was high as compared to control under field conditions.

PHARMACOLOGICAL REVIEW

Isolation and biological activities of neomyrrhaoi and other terpenes from the resin of Commiphora myrrha. [22]: A new cycloartane-type triterpene named cycloartane-1alpha,2alpha,3alpha,25-tetraol (neomyrrhaoi) along with four known terpenes were isolated from the resin of Commiphora myrrha (Burseraceae). Their structures were elucidated by means of 1D, 2D NMR and HR-mass spectroscopy. Compounds 2-methoxy-5-acetoxy frurano- germacr-1(10)-en-6-one and dehydroabietic acid exhibited significant aromatase inhibitory activity with IC50 values at 0.2 microM and 0.3 microM, respectively. As shown in the MTT assay all the known compounds had inhibitory effects on HUVEC growth. None of the compounds inhibited contraction of the isolated uterine and did not protect HUVEC from damage induced by H2O2 at the tested concentration.

Antioxidant activity of guggulsterone the active principle of guggulip from Commiphora mukul. (National Seminar on the Frontiers of Research and Development in Medicinal Plants, September 16-18, 2000,CIMAP, Lucknow,
Abstr.No.P-17). [23]: Guggulsterone is an active constituent of guggulipid, a lipid lowering agent developed from a resin of Commiphora mukul. Antioxidant activity of guggul sterone was examined to inhibit the in vitro oxidative modification in human LDL induced by metal ions as well as by incubation with rat peritoneal macrophases. It was observed that guggul sterone significantly inhibited the formation of induced lipid peroxidation in LDL lipids. However, the effects were lower for the modification induced by macrophase lipoxigenase mediated changes in LDL lipids. Guggulsterone inhibited [in vitro]generation of OH -radicals. The effect of this compound as inhibitor of macrophase lipoxygenases was non significant

Inhibitory effects of some herbal extracts on the acetylcholinesterase (AChE) in vitro. [24]: The methanol extracts of 340 kinds of Korean medicinal herbs were examined [in vitro] for the inhibitory effect on the acetyl cholinesterase from electric eel using acetylthiocholine as a substrate. Among tested extracts, the extracts of Coptidis rhizoma, Phellodendri Cortex, Evodiae Fructus, Myrrha, Arecae Semen and Piperis nigri Fructus were found to exhibit a significant inhibition upon the acetyl cholinesterase in a dose dependent manner, respectively.

Lipid lowering and antioxidant activities of some herbal preparations. [25]: The hypo lipidaemic and antioxidant activities of seven herbal samples code names SSB, B/Sj/k, S/pg/k, Jtmn, Tmfg, FCBN and TBLH)have been studied. Administration of these drugs to rats at the dose of 200 mg/kg p.o. showed lowering in the levels of serum total cholesterol, phospholipids and triglycerides to varying extents intriton WR-1339-induced hyperlipidaemia. Hypolipidaemic action of SSB,B/Sj/k, FCB and TBLH was more significant and comparable to that of guggulipid (100 mg/kg, p.o.), a standard drug from Commiphora mukul. All these preparations at a concentration of 0.1-1 mg/ml inhibited the [in vitro] generation of hydroxyl radicals byFe+2-sodium ascorbate-H2O2 as well as superoxide anions by xanthine-xanthene oxidase-NBT systems in a concentration-dependent manner.

Toxicity studies in mice of Commiphora molmol oleo-gum-resin. [26]: Acute (24 h) and chronic (90 days) oral toxicity studies on Commiphora molmol (oleo-gum-resin) were carried out in mice. Dosages in acute study were 0.5, 1.0 and 3 g/kg, while in chronic study dosage was 100 mg/kg per day. All external morphological, biochemical and
hematological changes, in addition to body and vital organ weights were recorded. There was no significant difference in mortality in acute or chronic treatment as compared to controls. At the end of the treatment, weight gain in the treated as well as control group was significant. There was a significant increase in weight of testes, caudae epididymides and seminal vesicles in C.molmol treated group. Biochemical studies revealed no differences in C.molmol treated animals, however, hematological studies revealed a significant increase in RBC and hemoglobin levels as compared to the control group. C.molmol failed to show any spermatotoxic effects.

Therapeutic efficacy of Ashwagandha and guggul against cadmium toxicity in male: Administration of Ashwagandha (Withania somnifera and guggul(Commiphora mukul) extracts at 20 mg/kg b.wt. and 3 mg/kg b/wt. respectively, daily for 15 days by gastric incubation could inhibit cadmium-induced decrease in serum triiodothyronine (T3) concentration. However, neither of the plant extracts could arrest cadmium-induced decrease in serum thyroxin (T4) concentration. On the other hand, both the plant extracts were found to inhibit hepatic lipid peroxidation without altering the activities of the two antioxidant enzymes, superoxide dismutase and catalase significantly, suggesting a direct free radical scavenging activity of the extracts. These findings reveal that Ashwagandha and guggul may ameliorate the cadmium induced thyroid dysfunction primarily by augmenting serum T3 concentration, apparently without any hepatotoxic effects.

Diuretic activity of isolated fractions from petroleum ether extract of Commiphora berryi: The diuretic activity of isolated fractions from petroleum ether extract (40-60 degree C) of Commiphora berryi (Burseraceae) on healthy albino rats was studied with frusemide as reference drug. The urine output increased with isolated fractions treatment. The level of electrolytes in urine also increased. The diuretic activity was mild compared to frusemide.

Secondary metabolites from Commiphora opobalsamum and their antiproliferative effect on human prostate cancer cells: A cycloartane-type triterpenoid (1), an aliphatic alcohol glycoside (2), a eudesmane-type sesquiterpenoid (3), and a guaiane-type sesquiterpenoid (4) were isolated from the resinous exudates of Commiphora opobalsamum (Burseraceae) along with six known sesquiterpenoids (5-10). Their structures were established by extensive analysis of their 1D and 2D NMR spectroscopic
data and chemical methods. The isolated compounds 1-3 and 5-9 were tested against human prostate cancer cell PC 3 and LNCaP. Among them, 1 and 2 showed moderate antiproliferative effects on human prostate cancer cell lines with IC50 values ranging from 5.7 to 23.6 microM; they were also able to inhibit the expression of androgen receptor (AR) in LNCaP cells. The six sesquiterpenoids were inactive in the bioassays.

Effect of Commiphora mukul extract on cardiac dysfunction and ventricular function in isoproterenol-induced myocardial infarction. Hydro alcoholic extract of Commiphora mukul (Burseraceae) significantly improved the cardiac function and prevented myocardial ischemic impairment manifested in the form of increased heart rate, decreased arterial pressure, increased left ventricular end diastolic pressure, and altered myocardial contractility indices. C. mukul treatment additionally also produced a significant increase in lactate dehydrogenase levels and prevented decline of protein content in heart. C. mukul preserved the structural integrity of myocardium. Reduced leakage of myocyte enzyme lactate dehydrogenase and maintenance of structural integrity of myocardium along with favorable modulation of cardiac function and improved cardiac performance indicate the salvage of myocardium with C. Mukul treatment. Guggulsterones which are considered to be responsible for most of the therapeutic properties of C. Mukul may underlie the observed cardio protective effect against cardiac dysfunction in isoproterenol-induced ischemic rats.

Antioxidant activity of guggulsterone, the active principle of guggulipid from Commiphora mukul. The oxidation of human low-density lipoprotein induced by Fe2+ or by rat peritoneal macrophages, caused marked formation of lipidperoxidation products. Guggulsterone (50 microM) prevented the generation of thiobarbituric acid reactive substances, and lipidhydroperoxide of low density lipoprotein in above systems. However, it did not protect lipids against the formation of conjugated dienes, the initial step of lipid peroxidation cascade. Guggulsterone significantly inhibited the reaction of lipid peroxidation in liver microsomes challenged with Fe2+ and sodium ascorbate. Thus, the protective action of guggulsterone may also be due to its free radical scavenging property as it inhibited the generation of superoxide anions and hydroxyl radicals in non enzymic systems. The metal chelating capacity of guggulsterone might be contributing to its antioxidant activity of the molecule.
Polyherbal preparation for the prevention of atherosclerosis and hyperlipidemia, US[32]: A polyherbal preparation for the prevention of atherosclerosis and hyperlipidemia comprising a mixture of Commiphora mukul, Boswellia serrata, Semecarpus anacardium, Strychnos nux vomica, Terminalia arjuna and Shankha Bhasma.

The in vitro biological activity of selected South African Commiphora species.[33]: Ten South African Commiphora (Burseraceae) species were investigated to validate their use in traditional healing rites. The leaf and stem extracts of each species were analyzed for the antioxidant (ABTS and DPPH assays), antimicrobial (MIC and death kinetic assays), anti-inflammatory (5-LOX assay), anticancer (SRB assay) properties, as well as the cytotoxic effects (tetrazolium-based assay). The best antioxidant activity (ABTS assay) was observed for the stem extracts of Commiphora tenuipetiolata (IC50 = 5.10 microg/ml), Commiphora neglecta (IC50 = 7.28 microg/ml) and Commiphora mollis (IC50 = 8.82 microg/ml). Extracts generally exhibited poor antioxidant activity in the DPPH assay, with the exception of Commiphora schimperi (stem), Commiphora neglecta (stem), Commiphora tenuipetiolata (stem and leaf) and (Commiphora edulis) (stem), with IC50 values ranging between 7.31 and 10.81 microg/ml. The stem extracts exhibited moderate to good 5-LOX inhibitory activity with Commiphora pyracanthoides (stem) displaying the greatest inhibitory effect (IC50 = 27.86 plus or minus 4.45 microg/ml). For the antimicrobial (MIC) assay, a greater selectivity was exhibited by the extracts against the Gram-positive bacteria (0.01-8.00 mg/ml) and the yeasts (0.25-8.00 mg/ml) than against the Gram-negative bacteria (1.00-8.00 mg/ml). Using death kinetic studies (time-kill studies), the rate at which Commiphora marlothii (stem) kills Staphylococcus aureus over a 24 h period was determined. Mostly, a concentration-dependent antibacterial activity was observed beginning after ca. 30 min. All concentrations exhibited antibacterial activity, with complete bactericidal effect achieved by the 24th hour. The most active Commiphora species against the HT-29 cells (SRB anticancer assay) were Commiphora glandulosa (leaf and stem) and Commiphora marlothii (leaf). The MCF-7 cells (SRB anticancer assay) exhibited the highest sensitivity to indigenous Commiphora species, with Commiphora edulis (leaf and stem), Commiphora glandulosa (leaf and stem), Commiphora marlothii (leaf), Commiphora pyracanthoides (leaf and stem), and Commiphora schimperi (stem), and
Commiphora viminea (stem) all possessing a percentage inhibition greater than 80 percent at 100 microg/ml, Commiphora glandulosa (leaf and stem) and Commiphorapyracanthoides (leaf and stem) were the two most active species against the SF-268 cells (SRB anticancer assay), with IC50 values ranging between 68.55 plus or minus 2.01 and 71.45 plus or minus 1.24 microg/ml. The majority of the Commiphora extracts were largely non-cytotoxic against Graham human kidney epithelial cells when investigated in the MTT assay.

Antiectogarasitic activity of the gum resin, gum haggar, from the East African plant, Commiphora holtziana. The mechanism of ixodid tick (Acari: Ixodidae) repellency by gum haggar, a resin produced by Commiphora holtziana (Burseraceae), was investigated by evaluating activity against the cattle tick, Boophilus microplus. In an arena bioassay, a hexane extract of the resin of C. holtziana exhibited a repellent effect lasting up to 5 h. The hydrocarbon fraction of the resin extract was shown to account for the repellent activity, and was analyzed by coupled gas chromatography-mass spectrometry (GC-MS). Major sesquiterpene hydrocarbons were tentatively identified as germacrene-D, delta-elemene and beta-bourbonene. The identity and stereochemistry of the former compound was confirmed as the (+)-isomer by peak enhancement using enantioselective GC, whereas the latter 2 compounds, which are most likely degradation products of germacrene-type precursors, were identified through isolation by preparative gas chromatography followed by microprobe-NMR spectroscopy. GC comparison of gum haggar with another resin C. myrrha which was inactive in the tick bioassay, showed that the latter contained much lower levels of these hydrocarbons. To assess the suitability of the gum haggar resin as a general acarine repellent, further tests were made on a major acarine pest of European and US animal husbandry systems, the red poultry mite, Dermanyssus gallinae (Acari: Dermanyssidae). Gum haggar extract, and the isolated hydrocarbon fraction, showed strong repellent effects in an olfactometer assay and again gum myrrha showed no effect. These findings provide a scientific basis for the observed anti-tick properties of gum haggar, and demonstrate the potential for its development as a general acarine repellent for use in animal husbandry systems.

Activity of a traditional South African epilepsy remedy in the GABA-benzodiazepine receptor assay: Aqueous and ethanol extracts of six plants, Acrotome
inflata, Aptosimum indivisum, Asparagus suaveolens, Barleria bolusii, Commiphora Marlothii and Sesamum triphyllum, which constitute an ancient Northern Sotho remedy for epilepsy, Sehlare sa Seebana, was tested in the GABAA-benzodiazepine receptor binding assay. Both aqueous and ethanol extracts of Aptosimum indivisum and Asparagus suaveolens and the aqueous extract of Commiphora marlothii showed good dose-dependent activity. The ethanol extract of all six plants extracted together was more active than the aqueous extract. The results did not suggest a synergistic effect of the plant mixture.

Mirazid: A new schistosomicidal drug \[^{[36]}\]: Schistosomiasis is a debilitating, and sometimes deadly, parasitic infection that afflicts hundreds of millions of people in developing countries. Myrrh is an oleo-gum-resin obtained from the stem of Commiphora molmol. An alcohol extract of this plant followed by steam distillation produced resin and volatile oil. Efficacy, toxicity and side effects of a special formulation of myrrh, mirazid have been reported. Oral administration of this combination resulted in a significant reduction in the worm burden of mice. It also induced separation of male-female coupled worms. Moreover, it shifted female worms from their normal habitat to the liver. Coincident with the shift of the female worms to the liver, progressive reduction in the number of immature eggs laid in the wall of the small intestine was proved.

Guggulu (Commiphora mukul) potentially ameliorates hypothyroidism in female mice \[^{[37]}\]: The efficacy of guggulu, the gum resin of Commiphora mukul (Burseraceae) in regulating hypothyroidism was evaluated in female mice. In addition to estimating serum levels of thyroxin and triiodothyronine, hepatic 5' monodeiodinase, hepaticglucose-6-phosphatase and lipid-peroxidation (LPO), the activities of the antioxidative enzymes, superoxide dismutase (SOD) and catalase (CAT), were investigated. While 6-n-propyl-2-thiouracil (PTU, 10.00mg/kg/d for 30 days) induced hypothyroidism in mice, as evidenced by a decrease in thyroid hormone concentration and in hepatic 5"S-lactivity, simultaneous administration of guggulu (200 mg/kg/d for 30 days) reverses this effect, indicating its potential to stimulate thyroid function. Although in PTU treated animals a marginal increase in hepatic LPO was observed, when simultaneously treated with guggulu, it was decreased. A parallel increase in the activity of endogenous antioxidants, SOD and CAT, in the latter group indicated the safe and antiperoxidative
nature of the drug. These finding suggest the possible use of guggulu in the amelioration of hypothyroidism.

Effect of Commiphora opobalsamum (L.) Engl. (Balessan) on experimental gastric ulcers and secretion in rats \cite{38}: The ulcer protective potential of an ethanol extract of Commiphora opobalsamum (Burseraceae) 'Balessan' was assessed against different acute gastric ulcer models in rats induced by necrotizing agents (80 percent ethanol, 0.2 M NaOH and 25 percent NaCl), hypothermic restraint stress, pyloric ligation (Shay) and indomethacin. Balessan. 250 and 500 mg/kg administered orally (intraperitoneally in Shay rat model) showed a dose-dependent ulcer protective effects in all the above ulcer models. Besides, the extract offered protection against ethanol-induced depletion of stomach wall mucus and reduction in nonprotein sulfhydryl (NP-SH) concentration.

Antimicrobial activity of some medicinal plants of the island Soqotra \cite{39}: Twenty-five selected plants belonging to 19 families were collected from different localities of the island Soqotra, dried and extracted with the solvents chloroform, methanol and hot water to yield 80 extracts. The greatest antibacterial activity was exhibited by the methanolic extracts of Boswellia elongata, B.ameero, Buxus hildebrandtii, Commiphora parvifolia, Jatropha unicosata, Kalanchoe farinacea, Pulicaria stephanocarpa, Punica protopunica, Withania adunensis and W.riebeckii. Only the methanolic extract of Buxus hilderbrandtii (Buxaceae) displayed significant antifungal activity.

BIOTECHNOLOGICAL REVIEW

Brineshrimp lethality bioassay of selected Indian medicinal plants \cite{40}: Ethanolic extracts of six Indian medicinal plants Acorus calamus (Araceae) rhizome, Centella asiatica (Apiaceae) whole plant, Centratherum anthelminticum (Asteraceae) seeds, Mangifera indica (Anacardiaceae) bark, Commiphora mukul (Burseraceae) gumresin and Piper longum (Piperaceae), piperine, guggulsterone E and guggulsterone Z were tested for cytotoxicity using brine shrimp lethality test. Piper longum showed most potent cytotoxic activity. Piperine, guggulsterone E and guggulsterone Z showed potent activity.

Studies on somatic cell variability in Commiphora wightii (Arnott.) Bhandari for guggulsterone production \cite{41}: The Commiphora wightii (Burseraceae) clones were established by aggregate cloning from stock cultures maintained on MS medium supplemented with 0.25 mg/l 2,4,5-trichlorophenoxyacetic acid and 0.1 mg/l kinetin.
few high productive clones were isolated while majority (greater than 80 percent) were low productive. In the present paper, the somatic cell variability in callus cultures of C. wightii and their growth in shake flasks and bioreactor for high yield of guggulsterones has been reported. A high productive clone yield 80 microg/l guggulsterones when grown in cell suspension culture in shake flasks and 2 litre stirred tank bioreactor. The colour variations of the cultures (due to anthocyanin accumulation) were also explored to isolate high guggulsterone producing lines; however, no correlation relationship could be established between anthocyanin accumulation and guggulsterone contents of the clones.

Synthesis and antimicrobial screening of a new guggul preparation. [42]: The in vitro antimicrobial activity of a new guggul (oleo-gum resin obtained from Commiphora spp.) preparation was investigated against Staphylococcus aureus, Staphylococcus epidermidis, Pseudomonas aeruginosa, Proteus vulgaris, Alcaligenes faecalis, Serratia marcesens, Escherichia coli, Micrococcus glutamicus, Bacillus thermodenitrificans, Bacillus subtilis and Bacillus subtilis and Bacillus pumilus. The preparation containing a 5:10 proportion of guggul and coconut oil showed more antimicrobial activity than other preparations. Guggul and coconut oil when tested alone failed to show any antimicrobial activity.

Studies on in vitro clonal propagation of some medicinal plants of Madhya Pradesh [43]: Results of the in vitro propagation of Chlorophytumborivilianum, Commiphora wightii, Oroxylum indicum, Pterocarpus marsupium and Rauvolfia serpentina. Different species vary in terms of the time taken to respond to the applied stimuli and the manipulated culture conditions. The initial efforts to develop efficient protocols stimulated morphogenesis in these species is underway.

Intraspecific isozymes variation in Commiphora wightii (Arn.) Bhandari: A traditional hypocholesteremic medicinal shrub from Gujarat, India. [44]: Germplasm of 22 accessions of Commiphora wightii (Burseraceae) was collected from various parts of Gujarat and grown in a field gene bank under identical conditions. Young leaves were collected to prepare crude enzyme extracts and were analyzed using nine enzyme systems. This enzyme system provided total 13 loci and 31 alleles for 22 accessions. The mean percentage of polymorphic loci was 30.42 percent and the mean observed number of alleles per locus was 1.5. The highest Shannon's information index was noticed in PRX-3 with mean genetic variation for all loci 0.603. Average observed and expected
heterozygosity were 0.381 and 0.221, respectively. The genetic identity was highest between accessions IC-370 and IC-378 and lowest between accessions IC-389 and IC-377. Dendrogram depicted the spectia of genetic diversity among various accessions and formed two major groups and divided into six clusters Nei's genetic distance was found to be highest between the accessions IC-389 and IC-375 and minimum between the accessions IC-383 and IC-380. Based on the results the accessions IC-370 and IC-373 should be conserved and maintained in the field gene bank for use

Establishment of embryonic cultures and somatic embryogenesis in callus culture of guggul- Commiphora wightii (Arnott.) Bhandari [45]: Somatic embryogenesis in callus cultures of Commiphora wightii was achieved. Though the frequency of explants producing embryonic culture was low, immature zygotic embryos were the only suitable explants to produce embryonic callus after reciprocal transfers on media containing 2,4,5-trichlorophenoxy acetic acid (0.1 mg/l) and kinetin (0.1 mg/l) or devoid of growth regulators. All other media failed to produce embryonic callus. Embryonic cells were small, densely filled with cytoplasm and isodiametric as compared to non-embryonic cells, which were large, elongated and vacuolated. Maximum growth of embryonic callus was recorded on modified MS medium (MS-2 medium) supplemented with BA (0.25 mg/l) and IBA (0.1 mg/l). MS-2 salts supported higher growth of callus as compared to tissues grown on B5 medium containing same concentrations of plant growth regulators. Exogenous medium nutrients had no effect on somatic embryo development whereas plant growth regulators had little effect.

ANALYTICAL REVIEW
Preliminary study on crystal dissolution activity of Rotula aquatica, Commiphora wightii and Boerhaavia diffusa extracts. [46]: Several Ayurvedic plants are known to have activity against diverse urinary crystals. The traditional knowledge of Ayurveda, collective clinical experience in arthritis and the earlier experimental studies on urinary crystals led to the selection of three plants. viz. Rotula aquatica, Commiphora wightii Bhandarisyn. C. mukul and Boerhaavia diffusa for screening anticrystal activity against basic calcium phosphate (BCP), calcium pyrophosphate(CPPD) and monosodium urate monohydrate (MSUM). The effects of each plant were assayed on microcrystals in 24-
well microplates in vitro. The results show that the aqueous extracts of the only R. aquatic and C. wightii have shown crystal dissolving activity against MSUM.

Bioactive constituents from gum guggul (Commiphora wightii) [47]: Bioactivity-directed fractionation and purification afforded cytotoxic components of Commiphora wightii. The exudates of C. wightii were extracted with EtOAc and the extract was subjected to repeated column chromatography. A fraction showing cytotoxic activity was characterized as a mixture of two ferulates with an unusual skeleton by spectral and chemical methods, including by NMR, GC-MS and chemical derivatization. This fraction also showed moderate scavenging effect against 2,2-diphenyl-1-picrylhydrazyl (DPPH) radicals.

Chemical investigation of the bark of Commiphora africana (Burseraceae). [48]: The methanolic extract of bark of the plant Commiphora africana gave a homogeneous product through chromatographic separation which after crystallization from methanol furnished needles characterized as dimethylterephthalate (benzene-1,4-dicarboxylic acid dimethylester) on the basis of spectral analysis.

Quenching of singlet molecular oxygen by Commiphora myrrha extracts and menthofuran [49]: The quenching activity against singlet oxygen, an actor of lipid peroxidation and DNA degradation, of the essential oil and resinoid of Commiphora myrrha (Burseraceae) from Somalia has been studied and compared to DL-alpha-tocopherol using 1,3-diphenylisobenzofuran (DPBF) as a probe. To insure that the furan ring was the site of the reaction, experiments were conducted with menthofuran. The essential oil and menthofuran show a higher activity than DL-alpha-tocopherol, suggesting their potential usefulness to neutralize the deleterious form of molecular oxygen.

Aromatic plants of tropical west Africa. Part XV. chemical and biological evaluation of leaf essential oil of Commiphora africana from Benin. [50]: The essential oil from leaves of Commiphora Africana (Burseraceae) collected in Benin was analyzed by capillary GC and GC/MS. The essential oil was characterized by a majority of sesquiterpenoid constituents with bisabolane skeleton among them bisabolone (38.4 percent) and beta-sesquiphellandrene (19.1 percent were the most abundant. The radical
scavenging activity of the oil was found to be low comparatively to that of butylated hydroxytoluene (BHT).

**PHYTOCHEMICAL REVIEW**

Phytochemistry and medicobotany of some medicinal plants used in treatment of arthritis \[^{51}\]: Present paper highlights the phytochemistry of some medicinal plants which are used traditionally for the treatment of arthritis in India. These herbs have properties that can significantly reduce joint pain or swelling and have no side effects. Some herbs viz. *Boswellia serrata* (Salai Guggul), *Curcuma longa* (Haldi), *Commiphora mukul* (Gugul), *Ricinis communis* (Arandi), *Vitex negundo* (Nirgundi), *Withania somnifera* (Ashwagandha), and *Zingiber officinale* (Adrakh) are enumerated along with their botanical names, local names, family, biological descriptions, phytochemistry and medicinal uses. These plants are considered safe and effective drug for the treatment of rheumatoid arthritis and osteoarthritis.

**CLINICAL REVIEW**

Study on the effect of tab. *Arthnex Forte* on rheumatoid arthritis and osteoarthritis \[^{52}\]: *Arthnex forte* was tried in 80 patients in the dose of 2 tabs t.i.d. for 1 month, 2 tabs b.i.d for 1 month and 1 tab t.d. from then onwards, with warm water. *Arthnex forte* contains 8 plant which are reputed vatahara drugs namely, *Pluchea lanceolata*, *Tinospora cordifolia*, *Ricinus communis*, *cedrus deodara*, *Zingiber officinale*, *Sida cordifolia*, *Vitex negundo* and *Commiphora myrrha* gum of the 80 patients, 74 patients (92.5 percent) improved remarkably and 6 (7.5 percent) showed moderate improvement. NSL, New Delhi.

Evaluation of clinical efficacy of OB-200G on body mass index, lipid profile and skin fold thickness: Phase III open clinical trial \[^{53}\]: OB-200G, an herbal formulation comprising of mainly *Garcinia cambogia*, *Commiphora mukul*, *Achyranthes aspera*, *Zingiber officinale*, *Piper longum* and *Gymnema sylvestre*, at a dosage of 2 capsules twice daily for 6 months was given to 32 obese patients. At the end of 6 months, patients were evaluated for efficacy and tolerability to OB-200G. Results showed that OB-200G was effective in weight reduction in all the patients clinically, though statistically body mass index, skin fold thickness and lipid profile did not decrease significantly. NSL, New Delhi.
Treatment of 256 cases of osteoarthritis of knee joint with Guo Jianhua's four-step therapy [54]: Patients of osteoarthritis of knee joint were treated using acupuncture massotherapy and fumigation and steaming with hot decoction of herbs to promote blood circulation and expel swelling. 121 cases were cured, 117 cases markedly improved, with a total effective rate of 92.97 percent. Prominent herbs used for fumigation and steaming decoction were Radix Cyathulae, Myrrha Olibanum, CortexErythrinae, Flos Carthami, Herba Lycopodii, Radix Clematidis, Ramulus Cinnamomi etc..

Epidemiological Review
Conservation of desert biodiversity in special reference to Little Rann of Kutch [55]: The major threat factors to rare species of Little Rann of Kutchh (LRK) are loss of habitat, human interference and invasion of Prosopis juliflora. Medicinal plants like Commiphora weightii, Asparagus racemosus, Moringa concanensis etc. are exclusively restricted to Mardak bet in LRK. Schwinfurtia papilionaceae and Cleome brachycarpa are found only in Akot bet. Various strategies for biodiversity conservation such as blocking of sea water entry, to stop groundwater exploitation, plantation of life supporting species etc. are discussed.

The Jerusalem balsam: From the Franciscan monastery in the old city of Jerusalem to [56]: The Jerusalem Balsam, a remedy based on an ethanolic extract of a herbal mixture, was formulated in 1719 in the pharmacy of the Saint Savior monastery in the old city of Jerusalem. Having gained fame, the Jerusalem Balsam was replicated and prepared in Europe. One can still find variations of the formula in current pharmacopoeias (B.P., 1998. The Stationary Office, London, p. 1510; Sweetman, S.C.. Blake, P.S., McGlashan, J.M.. Parsons, A.V., 2002. Martindale: The Extra Pharmacopeia, 33rd ed. Pharmaceutical Press, London p. 1101). Five different formulas, all referred to as "The Jerusalem Balsam" are reported. Three of those formulas were translated and two of these translations are presented in the text. A third one is available as Supplementary data online. As the formulas originate from different historical periods, the Jerusalem Balsam may be a good case study of the development of pharmaceutical formulations over a 250 years period. One of the formulas, found in a manuscript form in the archive of the monastery, contains four plants: olibanum Boswellia spp., myrrh Commiphora spp., aloe
Aloe sp. and mastic Pistacia lentiscus L. Pharmacological assays on this four-plant formula showed anti-inflammatory, as well as antioxidative, and antiseptic properties.

Critically threatened plants of the Thar desert, India—their utilization and conservation strategies: Eleven most critically threatened plants of the Thar desert as regard to their distribution, cultivation and conservation strategies are discussed. Some of the endemic/threatened plants of the Thar desert used by locals for treatment of various diseases includes Barleria prionitis (Acanthaceae), Commiphora wightii (Burseraceae), Peganum harmala (Zygophyllaceae), Tribulus rajasthanensis (Zygophyllaceae), Ziziphus truncata (Rhamnaceae) etc.

CHEMICAL REVIEW

7-O-Methylaloeresin A - A new chromoneglycoside from Commiphora socotrana: A new 5-methylchromone glycoside, named 7-O-methylaloeresin A (2-acetonyl-8-beta-D-[2'O-(E)-4-hydroxycinnamoyl]glucopyranosyl-7-methoxy-5-methylchromone, was isolated from Commiphora socotrana (Burseraceae) leaves collected from Yemen. Its structure was elucidated by spectroscopic data (MS, UV, 1H- and 13C-NMR).

Absolute sterostructures of polypodane-type triterpenes, myrrhanol A and myrrhanone A, from guggul-gum resin (the resin of Balsamodendron mukul): Two new polypodane-type triterpenes, myrrhanol A and myrrhanone A, were isolated from the 50 percent aqueous methanolic extract of guggul-gum resin (the resin of Balsamodendron (=Commiphora mukul)). The structures of the new constituents, including their absolute configurations, were determined on the basis of chemical and physicochemical evidence.

Chemistry and pharmacological profile of guggul-A review: Oleo gum resin secreted by Commiphora wightii (Burseraceae)(A.) Bhandari known as guggul, one of the most reputed drugs in Ayurveda has been extensively studied for its medicinal applications. The plant contains essential oil, mainly consisting of myrecene, dimyrecene and polymyrecene. Z-gugglusterone, E-gugglusterone, gugglusterone-I, gugglusterone-II, and gugglusterone-III. These isolates have been found useful in curing many diseases like rheumatism, arthritis, hyperlipidemia, obesity, inflammation, atherosclerosis, wrinkles, acne and other diseases.
Kinetics studies on the lignan class of natural compounds that inhibits alpha-chymotrypsin [61]: The mechanism of inhibition of the alpha-chymotrypsin enzyme by two lignans of the fused bistetrahydrofuran series, epiexcelsin (1) and 5'-demethoxyepiexcelsin (2), which were isolated from the Commiphora mukul was investigated. Lineweaver-Burk and Dixon plots and their secondary reports showed that these compounds were noncompetitive inhibitors of the enzyme. Ki values for 1 and 2 were found to be 22.29 plus or minus 0.015 and 336.30 plus or minus 0.053 microM, respectively.

Cycloartane-type triterpenoids from the resinous of exudates Commiphora opobalsamum [62]: Eight new cycloartane-type triterpenoids, cycloartan-24-ene-1alpha, 2alpha, 3alpha-triol (1), 3beta-acetoxycycloartan-24-ene-1alpha, 2alpha-diol (2), 1alpha-acetoxycycloartan-24-ene-2alpha 3 beta-diol (3) 3beta-isovalcroyloxycycloartan-24-ene-1alpha, 2alpha-diol (4), cycloartan-24-ene-1alpha, 3beta-diol (5), cycloartan-23E-ene-1alpha, 2alpha, 3beta, 25-tetrol (6), and an epimeric mixtures of 24R,25-epoxycycloartane-1alpha, 2alpha, 3beta-triol (7) and 24S,25-epoxycycloartane-1alpha, 2alpha, 3beta-triol (8), together with one known compound, cycloartan-24-ene-1alpha, 2alpha, 3beta-triol(9), were isolated from the resinous exudates of Commiphora opobalsamum, (Burseraceae). Their structures were established on the basis of mass spectrometry and multidimensional NMR spectroscopy. The cytotoxicity of compounds 1-9 was evaluated against the PC3 and DU145 human prostate tumor cell line. All of the compounds except 1 and 5 exhibited moderate cytotoxicity against PC3 or DU145 cells with IC50 values ranging from 10.1 to 37.2 microM.

Two octanordammarane triterpenes from Commiphora kua [63]: The petrol extract of the resin of Commiphora kua yielded two new octanordammarane triterpenes namely 15alpha-hydroxymansumbinone and 28-acetoxy-15alpha-hydroxymansumbinone, along with the four known compounds, mansumbinone, mansumbinol, (16S,20R)-dihydroxydammar-24-en-3-one and T-cadinol. These structures were elucidated by spectroscopic techniques, including 1D and 2D NMR spectroscopy, and X-ray analysis.

Furanosesquiterpenes from Commiphora sphaerocarpa and related adulterants of true myrrh [64]: A new furanosesquiterpenone, (1E)-8,12-epoxygermacra-1,7,10,11-tetraen-6-one (C15H18O2), was isolated from the resin of Commiphora sphaerocarpa.
together with the known compounds curzerenone, furanodienone,(1E)-3-methoxy-8,12-epoxygermacra-1,7,10,11-tetraen-6-one,1(10)E,2R*,4R*-2-methoxy-8,12-epoxygermacra- 1(10),7,11-trien-6-oneand dihydropyrocurzerenone. Hydro distillates of the resins of *C.sphaerocarpa*, *C.holtziana*, *C.kataf* and *C.myrrha* were analysed. The identifications were aided by NMR, GC and GC-MS.

**Furanosesquiterpenoids of Commiphora myrrha** [65]: An investigation on the gum exudates of *Commiphora myrrha* has led to the isolation of six sesquiterpenoids. On the basis of spectroscopic data interpretation, they were determined as two newfuranosesquiterpenoids, rel-1S,2S-epoxy-4R-furanogermacr-10(15)-en-6-one (1) and rel-2R-methyl-5S-acetoxy-4R-furanogermacr-1(10)Z-en-6-one (2), and four known furanosesquiterpenoids. Compound 1 exhibited weak cytotoxic activity against a MCF-7 breast tumor cell line in an aclonogenic assay, while the other five compounds were inactive in this assay.

**Flavonoids from Commiphora wightii**. [66]: *Commiphora wightii* (Syn.*C.mukul*) (Burseraceae) is used in Oman to treat skin diseases. Investigation report the isolation of known flavonoids, naringenin and 3-hydroxynaringenin from a species of *Commiphora*. The structures of the two compounds were determined from interpretation of NMR, EIMS and UV spectral data. The antioxidant activities (percent IP) of compounds 1 and 2 were estimated in the DPPH assay. The percent IP of the crude ethanol extract, naringenin, 3-hydroxynaringenin and gallic acid (control) were 54, 39, 66 and 88 percent respectively.

**Further bisabolenes and dammarane triterpenes of Commiphora kuaresin** [67]: From the resins of *Commiphora kua* a novel bisabolene;6-hydroxy-2-methyl-5(5'-hydroxy-1'(R), 5'-dimethylhex-3'-enyl)-phenol together with two new dammarane triterpenes,3beta,16beta,20(S),25-tetrahydroxydammar-23-ene and 3beta-acetoxydammar-16, beta,20(S),25-tri hydroxydammar-23-ene were isolated along with known compounds identified as 2-methyl-5-(4'(S)-hydroxy-1'(R), 5'-dimethylhex-5'-enyl)-phenol, 2-acetoxyfuranodienone, 2-methoxyfuranodienone, 3beta,16beta,20(R)-tri hydroxydammar-24-ene and its acetate derivative, 3beta-acetoxy-16beta,20(R),5'-dimethylhex-5'-enyl-phenol displayed fungicidal activity against *Cladosporium cucumerinum* on TLC assay.
Dammarane triterpenes of Commiphora confusa resin [68]: Fractionation of a steam distilled residue of Commiphora confusa resin has yielded four novel dammarane triterpenes characterized as (20S)-3β-acetoxy-12β,16β-trihydroxydammar-24-ene, (20S)-12β,16β-trihydroxydammar-24-ene-3β-O-beta-glucopyranoside, (20S)-3β-acetoxy-12β, 16β,25-tetrahydroxydammar-23-ene, and (20S)3β,12β,16β,25-pentahydroxydammar-23-ene. The known compounds beta-amyrin, 3β-amyrinacetate, 2-methoxyfuranodienone,2-acetoxyfuranodienone,(20R)-3β-acetoxy-16β-dihydroxydammar-24-ene,(20R)-3β,16β-trihydroxydammar-24-ene,3β-acetoxy-16β-hydroxydammar-24-ene,3β-hydroxydammar-24-ene, 3β-acetoxydammar-24-ene, and beta-sitosterol were also isolated from the same extract. The structures of the compounds were determined using spectroscopic, physical, and chemical methods.

A dihydroflavonol glycoside from Commiphora africana that mediates DNA strand scission [69]: A crude CH2Cl2-MeOH extract prepared from Commiphora Africana was found to mediate Cu2+ dependent relaxation of supercoiled plasmid DNA. Bioassay-guided fractionation of this extract was carried out and was monitored by the use of an in vitro DNA strand scission assay. The dihydroflavonol glycoside phellamurin was identified as the active principle responsible for the DNA cleavage activity of the crude extract.

Four lignans from Commiphora erlangeriana [70]: Four new lignans, two of the polygamatin-type, named erlangerin A and erlangerin B and two related to podophyllotoxin, named erlangerin C and erlangerin D, were isolated from the MeOH-EtOAc(1:1) extract of the resin of Commiphora erlangeriana, a plant occurring in Ethiopia and Somalia. The structures of these compounds including their relative stereochemistry were elucidated on the basis of spectral evidence, chemical data, and X-ray crystallographic analysis.

ETHNO MEDICAL REVIEW

Prevention of bone loss in calcium deficient ovariectomized rats by OST-6, a herbal preparation [71]: OST-6, a herbomineral preparation contains: Terminalia arjuna bark, Withania somnifera root, Commiphora mukul gum resin and Praval bhasma. Calcium deficient ovariectomized rats were administered with OST-6 at 250 mg/kg b.w. twice a
day orally for 16 weeks. Compared with sham operated animals, OVX animals showed an increase in serum ALP, urinary excretion of calcium and phosphorus, which were significantly prevented in OST-6 administered rats. The treatment with OST-6 prevented the epiphyseal bone resorption and maintained Ca:P ratio. The results of ash analysis indicated a reduced bone mineral content (calcium and phosphorus) and ash weight and percent ash in OVX animals when compared with sham operated animals.

**Antiatherogenic effect of Caps HT2, a herbal Ayurvedic medicine formulation [72]:**

The formulation contained the methanolic extracts of selected parts of plants, Commiphora mukul, Allium sativum, Plumbago indica, Semecarpus anacardium, Hemidesmus indicus, Terminalia arjuna, Tinospora cordifolia, Withania somnifera and Ocimum sanctum. The formulation, Caps HT2 was found to scavenge superoxide and hydroxyl radicals; the IC50 required being 55.0 and 610.0 microg/ml respectively. The lipid peroxidation was found inhibited (50 percent) by 48.5 microg/ml of Caps HT2. The intravenous administration of the formulation (5 mg/kg) delayed the plasma recalcification time in rabbits and enhanced the release of lipoprotein lipase enzyme significantly (p less than 0.001). The formulation also inhibited ADP induced platelet aggregation [in vitro], which was comparable to commercial heparin. The anti-inflammatory action of the formulation was significant (p less than 0.001) with acute and chronic inflammations induced by carrageenan and formalin respectively in rats. The hypolipidaemic effect of Caps HT2 was significant (p less than 0.001) with the administration of the formulation, in diet-induced hyperlipidaemia of rats for a period of 30 days. Oral administration of the formulation, Caps HT2 (100, 200, 300, and 400mg/kg) significantly raised HDL cholesterol levels. The atherogenic index and the reduction in body weight were significant indicating the effectiveness against hyperlipidaemia and obesity. All these results revealed the therapeutic potential of Caps HT2 against vascular intimal damage and atherogenesis leading to various types of cardiovascular problems.

**Dental care in herbal way: Some ethno botanical findings [73]:**

The paper deals with 119 medicinal plant species distributed under 106 genera and 57 families used by the tribal for different gum and tooth diseases. Plant species have been listed alphabetically with correct scientific name, family, local/common names, uses of plant parts and related
diseases. Some of the medicinal plants used for dental care from the study area includes *Achillea millefolium* (Asteraceae), *Commiphora wightii* (Burseraceae), *Hedychium spicatum* (Zingiberaceae), *Oroxylum indicum* (Bignoniaceae), *Xylocarpus granatum* (Meliaceae) etc.

**Ethno botany of some plants of Dang region, Rajasthan.** [74]: The Dang region is distributed in three districts of Rajasthan. This region is inhabited mainly by tribal and traditional communities. Main tribal group is Meena and traditional communities are Gurjar, Mali, Kumhar, Kahaar, Mongia etc. They use the plants for their daily requirements like food, fibre, medicine and others. About fifty plants are described which are widely used by them for various purposes. Some of the medicinal plants from the study area used by the tribal communities for treating various disorders includes *Abrus precatorius* (Fabaceae), *Achyranthes aspera* (Amaranthaceae), *Commiphora wightii* (Burseraceae), *Leptadenia pyrotechnica* (Asclepiadaceae), *Nerium oleander* (Apocynaceae), *Urginea indica* (Liliaceae)

**Siddha way to cure Chikungunya** [75]: The symptoms and signs of Chikungunya were studied among 500 patients and the methods to fight the disease with traditional Siddhamedicines are described. The patients were administered doses of decoction prepared with the powder of *Acalypha indica* (leaves), *Adhatoda vasica* (leaves), *Aegle marmelos* (leaves), *Andrographis paniculata* (whole plant), *Ocimum sanctum* (leaves), *Piper longum* (fruits), *Piper nigrum* (fruits), and *Zingiber officinale* (dried rhizome). Equal amount of the powder of the above ingredients is added with 400 ml of water and boiled till it is reduced to 50 ml and is then filtered. The decoction (50 ml) is administered thrice a day. In the second preparation, mixture prepared from ten leaves of *Acalypha indica* ground with five numbers of *Piper nigrum* fruits was administered in the form of bolus in morning and evening and Gandhaga Rasayanam at the dosage of 1 g thrice a day were administered. In the third preparation, mixture of *Amukra choornum* (prepared from 1 g roots of *Withania somnifera*), *Kukil parapam* (prepared from 100 mg gum of *Commiphora mukul*), *Silajitu parapam* (100 mg) and *Triphala choornam* (1 g) was administered thrice a day in hot water. In the first 12 hrs, pain was reduced but fever persisted. In the next three hrs, pain was reduced further and fever
came down by 2 degreeC. In next 6 hrs normality was attained. Out of 500 patients treated, 450 got cured of the disease.

Role of Shodana process (purification) in Ayurvedic guggulu preparations. [76]: Guggulu, the gum resin of the Commiphora mukul tree of family Burseraceae, originates as a result of pathologic disturbances or normal metabolic activity is obtained through a process called ‘tapping’. Guggulu is a complex mixture of steroids, diterpenoids, aliphatic esters, carbohydrates and varieties of inorganic ions. The active constituents of the resins are present in the steroidal fraction which yield sterol, guggulusterols. The aim of this article was to purify guggulu by various methods, to analyze the different sample of raw guggulu by applying two different media by two different methods and to observe disintegration time of preparation of guggulu at different stages. The process shodhana purified guggulu, changed its chemical composition and made it bio-assimilable. Its disintegration time was less in gomutra than in triphala decoction. The micro-crystalline-cellulose P-30 was found to be an ineffective disintegrator of guggulu.

Clinical evaluation of Arogyavardhini vati, Kaishore guggulu and Chakramardakera taila in the management of Keith (psoriasis) [77]: Fifty seven patients were selected for the clinical trail with Arogyavardhini Vati {Kuataki (Picrorrhiza kurrao, Scrophulariaceae) being the main content}, Kaishore Guggulu {Guggulu (Commiphoramukul, Burseraceae)} and Chakramardakera taila revealed 13 cases showing good response, 23 cases having fair response, 12 having poor response, only 2 having no response and 7 cases were dropped out.

MISCELLANEOUS REVIEW

Medical plant extracts influencing insect growth and reproduction. (National Seminar on the Frontiers of Research and Development in Medicinal Plants, September 16-18, 2000, CIMAP, Lucknow, Abstr.No.P-39). [78]: Commercially available extracts of Acorus calamus (roots), Rauvolfia serpentina (roots), Sapindus trifoliatus (fruit cortex) and Commiphora mukul (gum) adversely affected postembryonic development and adult emergence of Tribolium castaneum. A marked decline in the reproductive potential, in terms of female fecundity and egg hatchability was observed when the extracts were applied topically or administered orally through diet.
Anthelmintic activities of three medicinal plants from Nigeria: Aqueous extracts of the leaf, stem hark and root bark from Canna bidentata (Cannaceae), Spondias mombin (Anacardiaceae) and Commiphora africana (Burseraceae) were examined for anthelmintic activity against earthworm. All the extracts demonstrated a concentration-dependent activity at tested concentrations of 10-80mg/ml. Higher activities were observed at the higher concentrations, 40-80 mg/ml for all the plant extracts C. bidentata with a paralysis time of 3-5 min and death time of 5-18 min at these concentrations for the stem bark, and S. mombin which exhibited comparatively higher efficacy (34-44 min paralysis time and 105 min death time for the leaf) at lower concentrations of 10-20 mg/ml were adjudged the outstanding anthelmintics of plant origin accordingly.

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