

### Soy hull as a source of pectin

Pectin is a complex carbohydrate consisting of D-galacturonic acid linked by  $\alpha$ 1-4 glycosidic linkages. Pectin is used as gelling agent in jams, jellies, and fruit preparations and as stabilizer in confections, dairy products, bakery fillings, and icings. Medical applications include serum cholesterol lowering agents, antidiarrhoeal, detoxicant, demulcent, and emulsion stabilizers for water-in-oil emulsions.

Pectin is commercially extracted from citrus peels and apple pomace, with hot acidified water. Citrus peel and apple pomace contain about 25 and 12% pectin, respectively. Extraction of pectins from sugar beets, sunflower head residues, and dehulled rapeseed has also been reported.

Soy hulls are major by-products of the soybean (*Glycine max* Merrill) processing industry; the insoluble carbohydrate fraction contains 30% pectin. Soy hull is potentially an

inexpensive commercial source of pectin. Citrus peel and apple pomace are difficult to process unless they are first dried. In contrast, soy hull can be stored and transported without further processing. Recently extraction of pectin from soy hull has been described. Monsoor and Proctor optimized the hull/solvent ratio for large-scale soy hull pectin preparation and evaluated the solubility and rheological properties of soy hull pectins relative to selected commercial food-grade pectins.

The pectin extracted showed a yield of 16% soy pectin with c. 68% galacturonic acid in pilot plant-scale production. The pectin content, yield, and functional properties of soy hull pectin were within the range of the commercial



Soybean pods



Soybean seeds

pectins and analytical-grade pectins [Monsoor & Proctor, *J Amer Oil Chem Soc*, 2001, 78(7), 709-713].

## Therapeutics

### Antiulcer activity of *Artemisia*

*Artemisia annua* Linn. has been used in Chinese folk medicine for many centuries to treat malaria. The activity is attributed to artemisinin, a sesquiterpene lactone with an



*Artemisia annua*

endoperoxide group. Keeping this background in mind, Patricia Dias and others from Brazil studied the antiulcer activity of crude ethanol extract and purified fractions of this plant.

The crude ethanol extract of aerial parts and enriched sesquiterpene lactone fraction showed anti-ulcerogenic activity, when administered orally, on the indomethacin induced ulcer in rats [Dias *et al*, *Phytother Res*, 2001, 15(8), 670-675].



## Chebolic myrobalan inhibits hepatitis B virus

Hepatitis B virus (HBV) is the causative agent of the most frequent viral infections of man. Since the non-human host range of HBV is restricted to a few animals, such as the chimpanzee, the development of new therapeutics for HBV has been hampered. Several cell lines were developed to identify potential therapeutics against HBV infection. One of these, the HepG2 2.2.15 cell line, was derived through transfection of a cloned HBV gene into a well characterized human hepatoblastoma cell line hepG2, with which a standardized cell culture assay was established for potential anti-HBV active agents.

Kim and others from National Institute of Toxicological Research, Seoul, South Korea examined the plant extracts for antiviral effects against human HBV using a cell culture system with HepG2 2.2.15 cells. The extracts were assayed for the inhibition of HBV multiplication by measurement of HBV DNA and surface antigen (HBsAg) levels in the extra-cellular medium of HepG2 2.2.15 cells after an 8-day treatment. All extracts decreased the levels of extra-cellular HBV virion DNA at concentrations ranging from 64 to 128 µg/ml and inhibited the secretion of HBsAg dose dependently. Of the four tested plants, Chebolic myrobalan, *Terminalia chebula* Retz. exhibited the most prominent anti-HBV activities [Kim *et al*, *Phytother Res*, 2001, 15(8), 718-720].



*Terminalia chebula*

## Pharmacological study of Anvirzel™ from Oleander

Anvirzel™ is a patented hot-water extract of Oleander (*Nerium oleander* Linn.). Both water and lipid extract preparations derived from this plant continue to be used as folk medicine remedies for the treatment of a wide variety of maladies and conditions including abscesses, corns, asthma, dysmenorrhoea, eczema, epilepsy, epitheliomas, herpes, malaria, psoriasis, ringworm, scabies, sores, warts and tumours. Oleandrin, a cardiac glycoside derived from this plant has been used for



the treatment of congestive heart failure in China for years. Newman and others studied the initial identification and characterization of the major biochemical and biological properties of Anvirzel™.

The analysis showed that the oleander extract contained oleandrin and oleandrigenin at concentrations of 2.5 and 4.4 µg/mg extract, respectively. Five proteins with molecular weights of 6, 20, 35, 68, and 150 kD were also identified in the extract. Cytotoxicity studies showed oleandrin to be a potent growth inhibitory compound against human melanoma BRO cells with an IC<sub>50</sub> of 4.0 ng/ml. In the same test system, the IC<sub>50</sub> values for oleandrigenin and the complete oleander extract against human melanoma cells were 17.0 ng/ml and 1.6 µg/ml, respectively [Newman *et al*, *J Herb Pharmacother*, 2001, 1(3), 1].



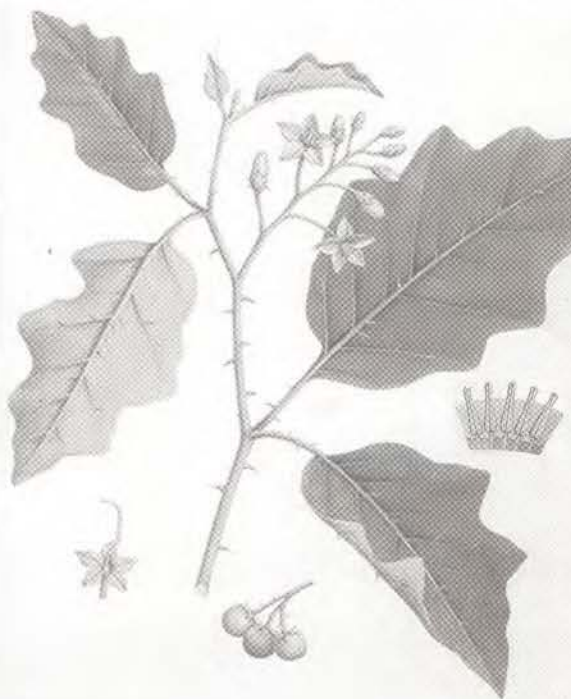
### Adaptogenic activity of *Trichopus*

The Kani tribe of Kerala use the plant *Trichopus zeylanicus* Gaertn. as a health tonic and rejuvenator. The fresh fruit kernels are eaten by the Kani to obtain instant energy, stamina and vitality. Singh and others from Regional Research Laboratory, Jammu-Tawi evaluated a glycopeptido lipid fraction (AF) from the alcoholic extract of this plant for putative antistress activity in a battery of tests. 'AF' exhibited significant antistress activity in dose dependent manner in all the parameters studied, against the different stresses used to induce non-specific stress. Ashwagandha, the commercial extract of *Withania somnifera* Dunal roots was used as control. A preliminary acute toxicity study in mice showed a good margin of safety, as the LD<sub>50</sub> value was more than 3000 mg/kg body wt p.o. with no signs of abnormalities [Singh *et al*, *Phytomedicine*, 2001, 8(4), 283-91].

### Cytotoxic compounds from Poison berry

Poison berry, *Solanum indicum* Linn., Hindi- *Barhanta* has the property of toxin elimination and is used as a treatment for swelling. It has been widely used in folk medicine as an analgesic for toothache, rhinitis, and breast

cancer. Syu and others from Taiwan isolated the compounds solavetivone, solafuranane, scopoletine, *N*-(*p*-*trans*-coumaroyl) tyramine, and *N*-*trans*-feruloyltyramine from the roots of this plant. The compound, solavetivone, showed cytotoxicity against OVCAR-3 cells (human ovarian carcinoma cells) with an IC<sub>50</sub> value of 0.1mM [Syu *et al*, *J Nat Prod*, 2001, 64(9), 1232-1233].



*Solanum indicum*



*Ficus carica*

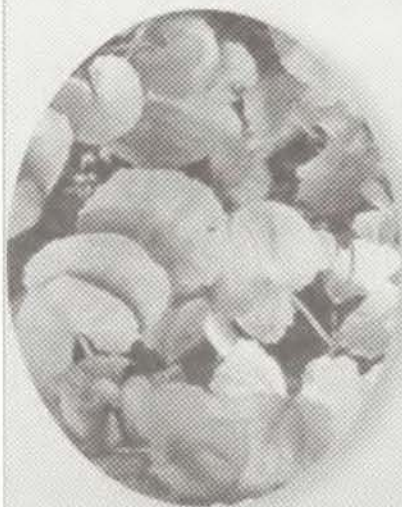
### Cytotoxic agent from Fig latex

The products from Common Fig, *Ficus carica* Linn., Hindi- *Anjir* are widely used both as a food and as medicine. The latex released on picking the fruits is used to treat skin tumours and warts. High doses of Fig latex injected into rats are lethal. Smaller doses injected into mice bearing a benzopyrene-induced sarcoma caused inhibition of the growth of the tumour and even the disappearance of small tumours. Fig latex has also been tested for its antihelmintic activity, but was found to cause acute toxicity with haemorrhagic enteritis.

Rubnov and the team from Israel described the isolation and identification of a potent cytotoxic agent from Fig latex. A mixture of 6-O-acyl- $\beta$ -D-glucosyl- $\beta$ -sitosterols (6-AGS), the acyl moiety being primarily palmitoyl and linoleyl with minor amounts of stearyl and oleyl, has been isolated as a potent cytotoxic agent from Fig latex of the compounds tested, the palmitoyl derivatives was the most effective. The steryl and linoleoyl derivatives were somewhat less effective. 6-AGS was cytotoxic not only to Raji cells but also to other cell lines [Rubnov *et al*, *J Nat Prod*, 2001, 64(7), 993-996].



## Anti-psoriatic effect of *Centella*



*Centella asiatica*

Psoriasis is a skin disorder estimated to affect 1-3% of populations. The underlying pathogenesis of psoriasis involves three main processes: inflammation, epidermal keratinocyte hyperproliferation and altered keratinocyte differentiation. Growth factors controlling the function of the normal epidermis are altered in psoriatic epidermis. The mean cell cycle time is reduced from 311 hrs in normal skin to 36 hrs in involved psoriatic skin, reducing the epidermal turnover time from up to 60 days to normal skin to less than 10 days in psoriatic lesions. Psoriasis is a difficult disease to treat. Current treatments display varying degrees of success. Hyperproliferation of keratinocytes may be reduced or completely suppressed by the application of dithranol cream or by PUVA treatment, which involves administration of psoralens followed by UVA irradiation. Both are associated with unpleasant side effects and practical difficulties for the patient.

In Ayurvedic medicine, *Centella asiatica* (L.) Urban, Hindi-Mandookaparni herb is used for the treatment of psoriasis, ulceration and eczema. Traditionally, the leaves may be squeezed or ground and the juice or powder used as an ointment. The effectiveness of its triterpenes, in particular the glycoside asiaticoside, in promoting wound healing have been demonstrated.

The seeds of *Psoralea corylifolia* Linn. are used to treat skin diseases such as psoriasis and vitiligo in both Ayurveda and traditional Chinese medicine. It contains the furanocoumarin compounds, psoralens, which are progenitors of the synthetic compounds used in modern PUVA therapy. Sampson and others from London, UK studied the fast growing cell line (SVK-14) to examine the extracts of the above plants for potential keratinocyte anti-proliferant activity. In this study, *C. asiatica*, a reputed anti-psoriatic herb has been compared against the psoralen-containing seeds of *P. corylifolia* and the synthetic anti-psoriatic agent dithranol. The crude aqueous extract of *C. asiatica* herb was less potent than that of *P. corylifolia* seed but its constituent triterpenoid glycosides (madecassoside and asiaticoside) had  $IC_{50}$  values similar to that of dithranol [Sampson *et al*, *Phytomedicine*, 2001, 8(3), 230-35].

## Hepatoprotective activity of legumes

The leguminous seeds such as, Mung bean, *Phaseolus radiatus* Linn., Adzuki bean, *Phaseolus aureus* Roxb., Black bean, *Glycine max* (Linn.) Merr. and Rice bean *Phaseolus calcaratus* Roxb., have been regarded as folk medicines and food or beverages in daily diet, and widely used in treatment as antidote, diuretic, antifebrile, carminative, etc.

Liver injury is caused by different agents, chemicals such as alcohol, viruses, autoimmune diseases, etc. Acetaminophen (APAP) in large doses could produce serious liver necrosis in humans and in experimental animals. Wu and others from Taiwan evaluated the hepatoprotective effect of legumes by using the acetaminophen induced acute liver injury model in rats, as assessed by SGOT (serum glutamate-oxalate-transaminase) and SGPT (serum glutamate-pyruvate-transaminase) activities *in vivo*.

The results showed that the SGOT and the SGPT activities, increased by APAP, were decreased significantly through treatment with increasing amounts up to 1000mg/kg body wt of the extracts. In particular the mung bean aqueous extract showed the best hepatoprotective effect on APAP-induced hepatotoxicity. The pathological changes of liver injury caused by APAP improved by the treatment with all the legume extracts, which were compared to silymarin as a standardized drug. In addition to these results, the extract of mung bean acted as a potential hepatoprotective agent in dietary supply [Wu *et al*, *Phytomedicine*, 2001, 8(3), 213-19].





### Toxicity of alkylphenols from Maidenhair Tree



Ginkgo biloba

Extracts from leaves of the Maidenhair Tree, *Ginkgo biloba* Linn. are increasingly used for the treatment of peripheral circulatory insufficiency, cerebrovascular disorders, geriatric complaints and Alzheimer disease. As potentially hazardous constituents in crude Ginkgo extracts a group of phenolic lipids like anacardic acids (ginkgolic acids) or cardanols (ginkgol) has been identified. Besides strong contact allergenic properties these alkylphenols inhibit various important enzyme

systems. Since no significant contribution of these constituents to the therapeutic action of Ginkgo extracts has been established, the concentration of ginkgolic acids has been limited to 5 ppm.

Baron-Ruppert and Luepke from Germany studied the toxicity of ginkgolic acids and biflavones using hen's egg test (HET). The result confirms a significant toxic potential of the alkylphenol containing lipid fraction, which is excluded during production of EGb 761. Since no contribution of these compounds to the therapeutic action of Ginkgo extracts has been established and elimination of alkylphenols does not imply technical problems, their complete possible removal is strongly recommended under toxicological considerations [Baron-Ruppert & Luepke, *Phytomedicine*, 2001, 8(2), 133-38].

### Antibacterial activity of Sweet Marjoram

Sweet marjoram, *Origanum majorana* Linn., is frequently used in the food industry in various liqueur formulations. Ezzeddine and others from Tunisia evaluated the antibacterial activity of essential oil of the plant.

Antibacterial activity was assayed against ten bacteria (Gram-positive bacteria: *Staphylococcus aureus*, *S. epidermis*, *Streptococcus A* and *Enterococcus faecalis*; Gram-negative bacteria: *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Shigella dysenteria* and *Salmonella enteritidis*). The results showed that the oil was active against all of the tested strains. The most susceptible were *Escherichia coli*, *Streptococcus A*, *Shigella dysenteria* and *Salmonella enteritidis*. The least susceptible one was *Pseudomonas aeruginosa* [Ezzeddine et al, *J Essent Oil Res*, 2001, 13(4), 295-7].



Origanum majorana



### Bioactive constituents from *Garcinia*

In folklore medicine, the plant *Garcinia atroviridis* Griff ex T. Anders has been used for the treatment of cough, dandruff, earache, stomach pains associated with pregnancy, and throat irritation. The roots have shown antibacterial and antioxidant activities. Permana and others studied the roots of the plant for the chemical constituents and their biological activities. They isolated a prenylated benzoquinone, atrovirone (1) and a prenylated depsidone, atroviridinone (2).

At the dose of 10 µg/disk, both the compounds exhibited significant inhibitory activity against *Staphylococcus aureus* and *Bacillus cereus*. The antibacterial activity of both compounds was less than the control, streptomycin sulfate. Only compound 1 showed cytotoxicity toward HeLa cells with an  $IC_{50}$  of 15 µg/ml, which was comparable to the standards doxorubicin ( $IC_{50}$ , 11 µg/ml) and colchicine ( $IC_{50}$ , 21 µg/ml) [Permana et al, *J Nat Prod*, 2001, 64(7), 976-79].



## Anti-tussive activity of *Bergenia*

In the traditional system of medicine, the rhizome of the plant *Bergenia ciliata* Sternb., is used fresh or in dried powdered form. It is used orally, simply chewed if fresh, for curing diarrhoea and during vomiting. It is also reportedly used against fever, cough and pulmonary affections. The juice of the rhizome is used as an anti-tussive for cold and cough.

Based on the traditional practices, Sinha and others from Jadavpur University, Kolkata evaluated anti-tussive activity of the rhizome extract against sulphur dioxide induced cough reflex in mice. The methanol extract of the rhizome exhibited significant anti-tussive activity in a dose dependent manner, as compared with control. The anti-tussive activity of the extract was comparable to that of codeine phosphate (10mg/kg body wt), a standard anti-tussive agent. The extract at doses of 100, 200 and 300 mg/kg body wt (p.o.) showed significant inhibition of cough reflex by 28.7, 33.9 and 44.2% respectively, within 90 min. of the experiment [Sinha *et al*, *Phytomedicine*, 2001, 8(4), 298-301].



*Bergenia ciliata*

## Antibacterial activity of *Safed-sanbhalu*

In traditional medicine, external application of the leaves of the plant *Vitex trifolia* Linn., Hindi-Safed-sanbhalu is considered useful in rheumatic pains, sprains, and inflammations. The leaves are claimed to possess insecticidal, antitubercular and anticancer properties. The flowers are prescribed in case of fever and vomiting. Hossain and others from Bangladesh studied the antibacterial activity of the leaves of the plant.

Petroleum ether and ethanol extracts exhibited moderate inhibiting activity against both Gram-positive and Gram-negative bacteria, the petroleum ether fraction being more active [Hossain *et al*, *Fitoterapia*, 2001, 72(6), 695-697].



*Vitex trifolia*

## Cytotoxic acetogenins from Soursop

Soursop or Guanabana, *Annona muricata* Linn. is a tropical fruit tree. More than 40 annonaceous acetogenins have been isolated from the stems, leaves and seeds of this plant. Chang and Wu from Kaohsiung Medical University, Taiwan further studied the seeds of this plant for acetogenins and tested their biological activity.

They isolated twelve acetogenins from the seeds of this plant, which include seven new acetogenins, muricins A-G (1-7) along with five known, a mixture of muricatetrocin A (8) and muricatetrocin B (9), longifolicin (10), corossolin (11), and corossolone (12). All the compounds except for 5 and 7 were tested against the human hepatoma cancer cell lines Hep G2 and Hep 2. 2. 15. The cytotoxic  $IC_{50}$  values against Hep G2 ranged from  $4.04 \times 10^{-4}$  to  $5.04 \mu\text{g/ml}$  and against Hep 2. 2. 15 ranged from  $3.86 \times 10^{-3}$  to  $4.50 \times 10^{-1} \mu\text{g/ml}$  [Chang & Wu, *J Nat Prod*, 2001, 64(7), 925-931].



### Safety and efficacy of Niprisan®

Sickle cell disorder (SCD) is a hereditary haemoglobinopathy with haemoglobin SS (HbSS) genotype. The major morbidity peculiar to patients with SCD is the recurrent episodes of red blood cell sickling, with vaso-occlusive, thrombotic, haemolytic and sometimes aplastic phenomena collectively referred to as sickle cell crisis.

Niprisan® is a phytomedicine developed by the National Institute for Pharmaceutical Research and Development (NIPRD) Abuja, Nigeria from medicinal plants for the management of SCD. Niprisan® was formulated into standardized capsule dosage form from the freeze dried extract of *Piper guineenses* seeds, *Pterocarpus osun* stem, *Eugenia caryophyllum* Thunb. fruit and *Sorghum bicolor* (Linn.) Moench leaves.

Wambebe and others from Nigeria undertook the study to determine the safety and efficacy of Niprisan®. The study design is a placebo-controlled double blind crossover trial. Eighty-two patients with SCD were recruited and randomised into two groups. An initial 4-month pre-trial study was undertaken to determine the similarity of the groups. The main study was conducted over a twelve-month period with crossover at six months. Safety of the drug was assessed clinically and biochemically.

Niprisan® significantly reduced the frequency of SCD crisis associated with severe pains. Acute toxicity to the liver assessed by the activities of liver enzymes, indicate that Niprisan® is safe. Renal function assessed by the serum levels of creatinine and blood urea nitrogen remained normal.

Both the clinical and laboratory results suggested that Niprisan® is a safe and efficacious phytomedicine for the management of patients with SCD [Wambebe *et al*, *Phytomedicine*, 2001, 8(4), 252-261].

### Antidiabetic activity of Syzygium

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycaemia. The metabolic disorders include alterations in the carbohydrate, fat and protein metabolisms associated with absolute or relative deficiencies in insulin secretion and/or insulin action. In diabetes, the body fails to produce insulin and excess glucose accumulates in the blood instead of being utilized or stored. The seed powder of *Syzygium alternifolium* (Wt) Walp in water is taken orally to control diabetes. Because of its ethnobotanical usage, Rao and Rao from Sri Venkateswara University, Tirupathi evaluated the hypoglycaemic and antihyperglycaemic activities of different extracts of seeds.

Aqueous, ethanolic and hexane extracts of seeds were given at different doses to different batches of rats (both normal and alloxan diabetic rats) after an overnight fast. The blood glucose levels were measured at 0, 1, 3, 5 & 7 hrs after the treatment. The aqueous extract at a dosage of 0.75g/kg body weight showed maximum blood glucose lowering effect in both normal and alloxan diabetic rats. The ethanolic and hexane fractions also showed hypoglycaemic and antihyperglycaemic activities, but the effect is significantly less than that of aqueous extract.

The magnitude of antihyperglycaemic activity of 0.75g/kg body weight of aqueous extracts of seeds was the same (22%) as that of 0.2g/kg bodyweight of glibenclamide, at 3<sup>rd</sup> hr after the treatment [Rao & Rao, *Phytomedicine*, 2001, 8(2), 88-93].

### Antidiarrhoeal activity of *Cassia nigricans* leaves

The dried leaves of *Cassia nigricans* Vahl have a long history of traditional medicinal use among the Rukuba community in Jos township of Nigeria and its neighbours, where they are used for the treatment of gastrointestinal disorders (peptic ulcer and diarrhoea), family planning and rheumatoid pains. Nwafor and Okwuasaba from Nigeria undertook the study with the aim to confirm the antidiarrhoeal and antiulcerogenic properties claimed by traditional medicine.

The effects of the methanolic extract of the leaves were investigated on experimentally-induced diarrhoea and ulceration in rat. The extract dose dependently reduced both the small intestinal propulsive movement and castor oil-induced fluid accumulation. Its inhibitory effects on intestinal propulsive movement and fluid accumulation were significantly antagonised by yohimbine. However, castor oil induced diarrhoea was increased. The extract also reduced significantly the ulcers induced by both indomethacin and ethanol. The results confirm the antidiarrhoeal and antiulcerogenic properties claimed by traditional medicine [Nwafor & Okwuasaba, *Fitoterapia*, 2001, 72(3), 206-214].





*Calendula officinalis*

## Therapeutics

### Gastroprotective effect of Marigold flowers

The flowers of Marigold, *Calendula officinalis* Linn. are used to treat inflammatory conditions of internal organs, gastrointestinal ulcers, and dysmenorrhoea and as a diuretic and diaphoretic in convulsions. They are also used externally for inflammation of the oral and pharyngeal mucosa, wounds, and burns. Yoshikawa and others from Japan studied biological activities of the methanolic extract and its butanol soluble fraction from the flowers of this plant. They also studied the activities of the saponins from butanol soluble fraction.

The methanolic extract and its butanol fraction showed a hypoglycaemic effect, inhibitory activity of gastric emptying, and gastroprotective effect. From this fraction twelve saponins, seven flavonol glycosides and a sesquiterpene glucoside were

isolated. Among the saponins whose hypoglycaemic activity were examined only two oleanolic acids 3-monodesmosides showed potent hypoglycaemic activity after a single oral administration of 50 mg/kg in rats. These two oleanolic acids 3-monodesmosides with potent hypoglycaemic activity also significantly inhibited gastric emptying at doses of 12.5, 25, 50 and 100 mg/kg in rats.

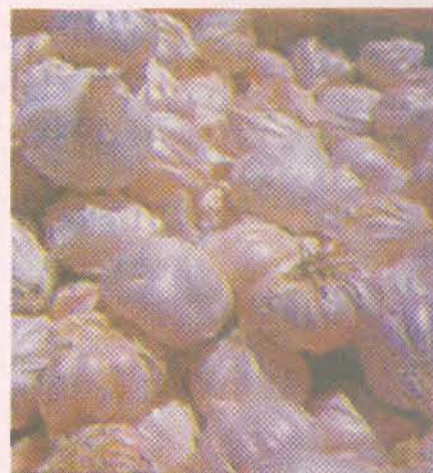
The oral application (20 mg/kg) of the saponins, oleanolic acid 3-monodesmoside exhibited protective effects against ethanol-induced gastric lesions in rats. The saponins strongly reduced the lengths of lesion than a reference drug, omeprazole. On the other hand two oleanolic acids 3,28-bisdesmosides and two oleanolic acid 3-monodesmosides showed inhibitory activity on indomethacin-induced gastric mucosal lesions in rats at a dose of 20 mg/kg [Yoshikawa *et al*, *Chem Pharm Bull*, 2001, 49 (7), 863-870].

### Anticarcinogenic property of Garlic

Oral squamous cell carcinoma, one of most prevalent cancers worldwide, is the third leading cancer in Chennai. Oral cancer arises due to lifestyle as well as nutritional and environmental results. Betel quid chewing with tobacco, smoking and alcohol consumption have been identified as the most important risk factors for the high oral cancer incidence in India.

Administration of 4-nitroquinoline 1-oxide (4 NQO) in drinking water has been reported to produce a spectrum of preneoplastic and neoplastic lesions in the dorsal side of the rat tongue. Various agents, both naturally occurring and synthetic, have been tried for their chemopreventive effects against NQO-induced oral carcinogenesis.

Extracts of garlic, *Allium sativum* Linn. and its constituents have been extensively studied for their alleged anticancer effects both *in vitro* and *in vivo*. Balasenthil and others from Annamalai University, Tamil Nadu studied the inhibitory effect of garlic on 4 NQO-induced tongue carcinogenesis in male rats, both in the initiation and post-initiation phases. Lipid peroxidation, reduced glutathione (GSH), glutathione peroxidase (GPx), and glutathione S-transferase (GST) were used to monitor the chemopreventive potential of garlic. Biochemical estimations were carried out on tumour and normal tongue tissues. Administration of garlic (250 mg/kg, p.o. three times a week) effectively suppressed 4 NQO-induced tongue carcinogenesis as revealed by the absence of carcinomas in the initiation phase and their reduced incidence in the post-initiation phase [Balasenthil *et al*, *Fitoterapia*, 2001, 72(5), 524-531].



*Allium sativum*