Journal of Medicinal Plants Research Vol. 3(11), November, 2009
Available online at http://www.academicjournals.org/JMPR
ISSN 1996-0875© 2009 Academic Journals

Editorial

Opportunities for the exploration, investigation and utilization for biological activity of novel medicinal plants

Natural products from plants, fungi, bacteria and other organisms are used in pharmaceutical preparations world wide. Indole alkaloids and morphine from plants are used as models for drug designing and clinical applications (Phillipson 1994). A bioactive styryl-lactones was first reported and was crystallized from *Goniothalamus* (Annonaceae) bark. It has anti-cancer and apoptosis-inducing properties against human tumour (MCF-7, HeLa cells) and animal cell lines (Jewers et al., 1972). This compound can serve as an antimicrobial (Mosaddik and Haque, 2003), insecticidal, anti-fertility agent in rats, mosquito larvicide in lymphatic filariasis (Kabir et al., 2003). Investigations on the therapeutic potential of *G.umbrosus* is limited to its bioactive compound goniothalamin which isolated from the petroleum extract of this plant bark. Abdelwahab et al. (2009 in this issue) investigated antibacterial, antioxidant, anticancer properties and chemical compositions of *Goniothalamus umbrosus* (GU) hexane extracts using disc diffusion method, DPPH assay, MTT cytotoxicity test (MCF-7 breast cancer cell line, HT-29 colon cancer cell line and CEMss leukemia cell line) and GC-MS, respectively. Anti-tumor effect of GU was further confirmed by microscopy. Anticancer properties and apoptotic were only observed on MCF-7 (Fig. 1and Fig. 2 Abdelwahab et al. 2009 in this issue)). The extract failed to exhibit any antibacterial activity towards two Gram-positive bacteria, Methicillin Resistant *Staphylococcus aureus* (MRSA) and *Bacillus subtilis* B29, and other two Gram-negative bacteria, *Pseudomonas aeruginosa* 60690 and *Salmonella choleraesuis*. Gas chromatography (GC) and GC- MS revealed 68 compounds, including a group naphthalene derivatives and eudesma-4(14),7(11)-diene. However, the mechanism of oncolytic action of the hexane extract of *G. umbrosus* is yet to be elucidated.

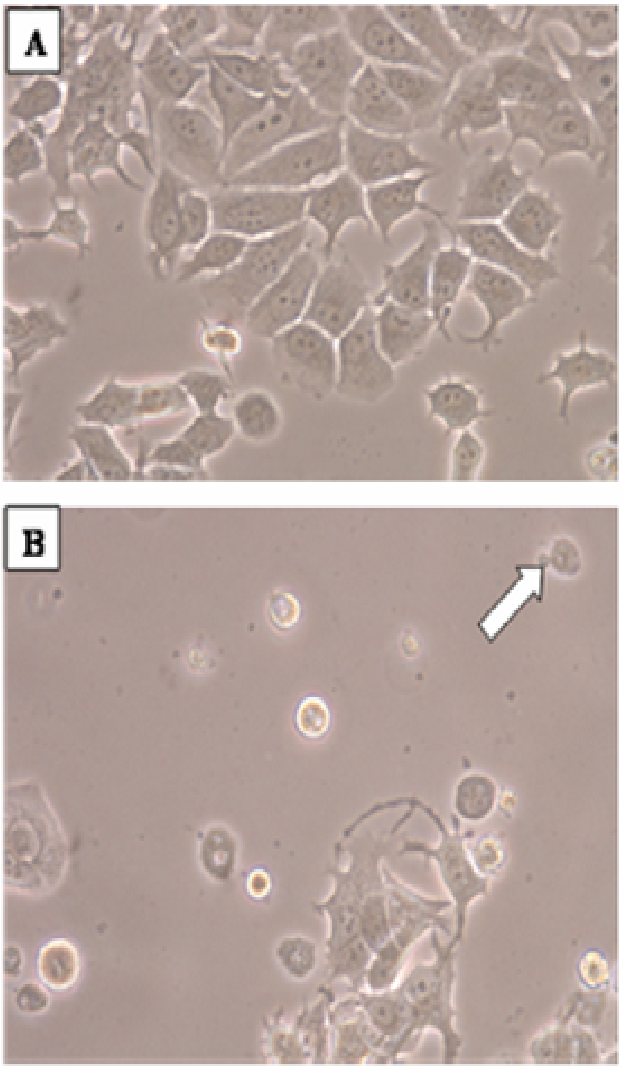

Figure 1. A: Untreated MCF-7 control cells B: Treated MCF-7 with IC_{50} of hexane extract of *G. umbrosus*. Appearance of membrane blebs (Arrow) and decreased number of cells signified that apoptosis had occurred. (x400)

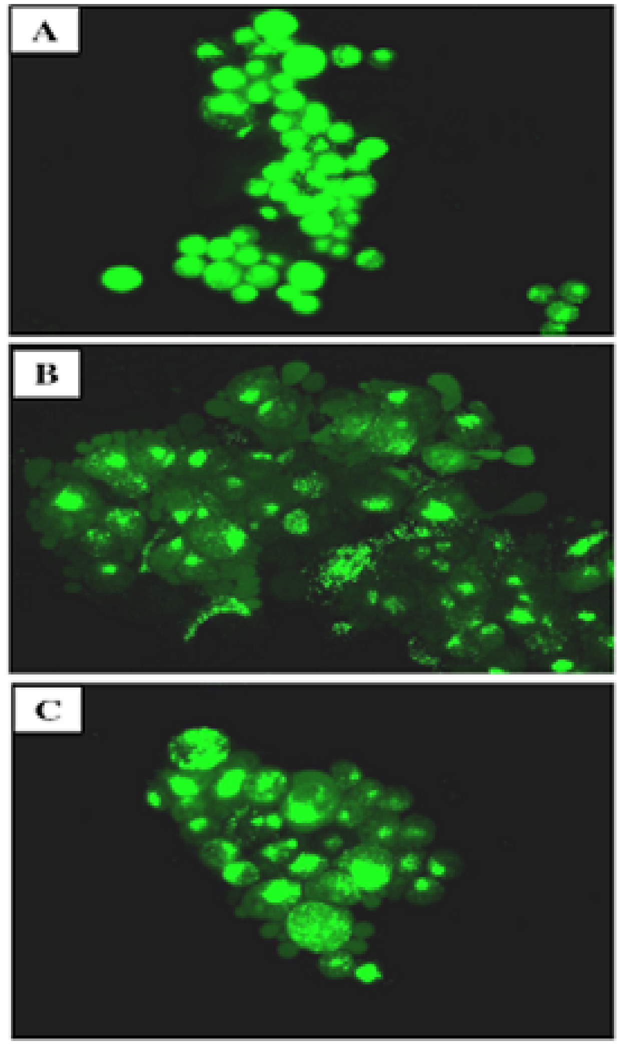

Figure 2. A: Untreated MCF-7 control cells B: Treated MCF-7 with IC_{50} of hexane extract of *G. umbrosus*.. Morphological characterizations of cells undergo apoptotic death by AO and PI. Appearance of membrane blebs and DNA fragmentation are signs of apoptosis of cells.

Diabetes has become a serious public health problem worldwide. Diabetes is one of the causes of frequent mortality in Mexico and the third important causes of death among people living along the US border (PAHO, 2007). In Mexico, high-fructose agave syrup (HFAS) is a sweetener commercially produced from some species of agave (that is, *Agave salmiana* Otto ex Salm-Dick). HFAS has 60% fructose, similar to HFCS-55 with 55% fructose but the glucose content was 41% (Hanover and White, 1993) and 22% (Michel et al., 2008), respectively derived from fructans (Mancilla-Margalli and Lopez, 2006), which has modulating effect on lipid metabolism (Delzenne et al., 2002). Fructose induced lower blood glucose and insulin secretory reactions than other dietary carbohydrate like sucrose (Gaby, 2005). However, dietary fructose may induce hyper-triglyceridemia, obesity, insulin resistance syndrome, and cardiorenal disease (Johnson et al., 2007). Besides diabetes, obesity has risen concurrently with high fructose corn syrup (HFCS) in beverages (Bray et al., 2004).

García-Pedraza et al. (2009 in this issue) studied the effect of HFAS (high-fructose agave syrup) intake on the blood plasma concentrations of diabetes related compounds such as plasma glucose, cholesterol, triglycerides, blood glycosylated hemoglobin (HbA1c), urine albumin and cread antinine and liver steatosis on non-diabetic (ND) and streptozotocin-diabetic (D) rats. Daily feed intake decreased with an increase in HFAS dose, without any weight change.

Triglycerides in D rats increased with an increase in HFAS doses. There were opposite trends in the accumulation of glucose and HbA1c, as HFAS doses increased. Streptozotocin-diabetic rats with HFAS had lower liver steatosis. HFAS had a protective effect on steatosis in D rats. The comparison between the ND and D with or without HFSA is shown in Figure 4 and Figure 5 (García-Pedraza et al. 2009 in this issue). Further studies on the effect of long term HFAS intake on liver steatosis are needed before any recommendation.

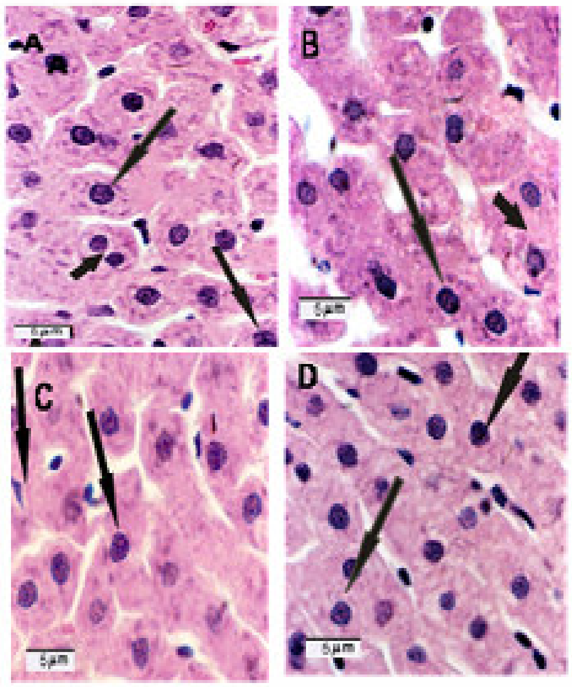

Figure 4. Liver photomicrographs (H-E 1000 x) of non-diabetic (ND) rats fed high-fructose agave syrup (HFAS): A) 0.0, B) 0.5, C) 2.0 and D) 5.0 g HFAS/kg body weight. Normal hepatocytes (long-arrow) with cell borders well defined, some of them binuclear (short-arrow).

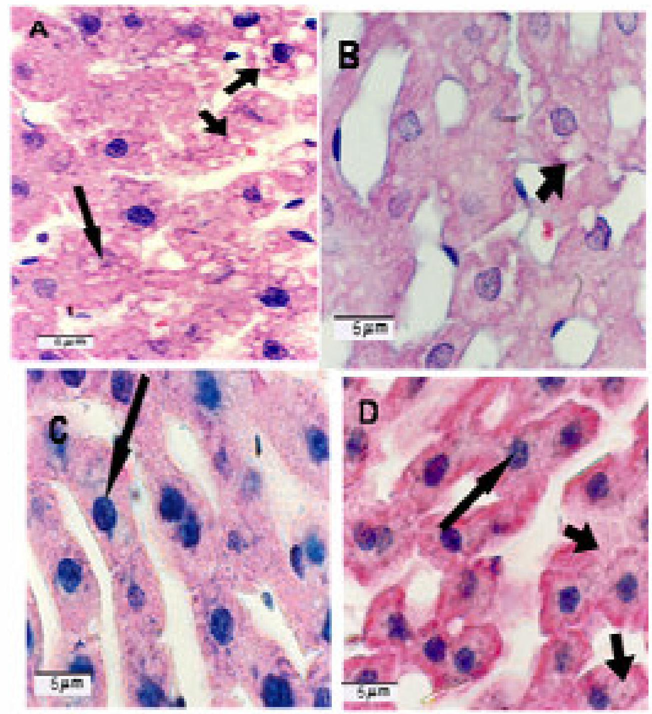

Figure 5. Liver photomicrographs (H-E 1000 x) of streptozotocin-diabetic (D) rats fed high-fructose agave syrup (HFAS): A) 0, B) 0.5 C) 2 and D) 5 g HFAS/kg body weight. A and B: hepatocytes with cell borders non-defined (long-arrows) and cytoplasm fat accumulation (short-arrows). C and D: hepatocytes without intracellular fat and cell borders well defined (long-arrows).

In a preliminary study on the compositions of the tropical mushroom *Pleurotus tuber regium* (tiger milk mushrooms or sclerotia producing mushroom) and the effect of its dietary incorporation on body organ weight and total triacylglycerols in albino mice (*Mus musculus*) Ifeoma et al. (2009 in this issue) reported a non-significant dose dependent reduction in total triacyl glycerol concentration and changes in percentage relative weight of liver, intestine, kidney and pancreas.

Besides cancer and diabetes, dermatitis is also a global health problem. Herbal medicine has been widely formulated and used as an integral part of primary health care and are used to treat different kind of microbial diseases (Akinyemi et al., 2005). Dermatophytes are the most important microorganisms that cause superficial mycoses on man. The lesions are characterized by circular disposition, desquamation, alopecia and erythma of the edges (Gallardo et al., 2004). The infections include the athlete's foot, jockey itch and ringworm occurs through direct contact with the spores or hyphae of any of the genera of *Microsporum*, *Trichopect hyton* or *Epidermophyton*. *Trichophyton* species (*T. mentagrophytes, T. rubrum and T. schoenleinii*) can grow on hair, skin and nails. Adejumo and Bamidele (2009 in this issue) studied the effect of water and ethanol extracts of leaves from *Azadirachta indica*, *Jatropha curcas*, *J. gossypifolia*, *Cassia alata, Aloe vera* and *Anacardium occidentale* against *Trichophyton mentagrophytes* and *T. rubrum* isolated from the skin of ringworm-infected patients. Ethanol extracts of these plants completely inhibited the growth *T. rubrum* while partial growth inhibition of *T. mentagrophytes* was observed with *J. curcas*, *A. vera* and *C. alata* extracts. Aqueous extracts of *A. vera*, and *A. occidentale* showed *T. mentagrophytes* growth inhibition at low concentrations compaed to that of *C. alata*, *A. vera* and *J. curcas*. Aqueous extracts of *C. alata*, *A. vera* and *J. curcas* inhibited *T. rubrtum* growth at lower dose than that *J. gossypifolia*, *C. alata* and *A. vera A. vera*, *C. alata, J. gossypifolia* and *A.*

occidentale compared favourably with mycoten, therefore they can be used as an alternative for treating ringworm infections on man caused by *Trichophyton* species.

Antibiotic resistance is of grave concern clinically, more so in quinolone-resistant and extendedspectrum beta-lactamase (ESBL)-producing isolates that causes complicated infections. Ladan et al. (2009 in this issue) reported the potency of *Hyptis spicigera* leaf extract against some pathogenic microorganisms is described. The phytochemistry of the leaf extracts revealed the presence of tannins, sterols, alkaloids, saponin glycosides and flavonoids. The results indicate antimicrobial potency of the leaf extract on a broad spectrum of microorganisms that are resistant to ampicillin.

Cassava is the tuber of *Manihot esculenta*. In Guyana the tubers are grated and the sap is extracted through squeezing or pressing and evaporated to a viscous, caramel-like liquid known as *casareep*, which is used for the distinctive flavor it imparts to meats during cooking (Shier, 1848). The *casareep* sauce is believed to have preservative properties and extend the life of cooked meats (Shier, 1848). *Casareep* has been used since times preceding the availability of synthetic food preservatives and refrigeration in the hinterlands of Guyana and its use continues (Dewprashad and Vaz, 2005). Now a days *Casareep* is readily available commercially in New York City. The antibacterial effect of *casareep* has not been previously investigated. Dewprashad et al. (2009 in this issue) studied the preservative properties of *casareep's* and showed its antibacterial activity against both gram-positive and gram-negative organisms which prevented bacterial growth in cooked beef. The sauce was bacteriostatic at lower concentrations and bactericidal at higher concentrations. Comparatively *Bacillus subtilis* was more sensitive to *casareep* than *Escherichia coli.* It is probable that this antibacterial effect is due to chemical(s) present in either in cassava or formed during the heating of the cassava sap to form *casareep*. Isolation and identification of these chemical(s) would focus on new antibacterial compounds. It is concluded that cooking meats along with *casareep* extends the life of the dish through its antimicrobial activity.

Yang et al. (2009 in this issue) studied the antibacterial properties of *Pericarpium trichosanthis* against nosocomial drug resistant strains of *Acinetobacter baumannii*. *P. trichosanthis* (Gua Lou Pi) is the pericarp of *Trichosanthes kirilowii* Maxim *syn. Trichosanthes rosthornii* Harms (Fam. Cucurbitaceae). It is traditionally used in Chinese herbal medicines for the treatment of dry cough, asthmatic tracheitis, cor pulmonale asthma and coronary heart disease (Guo et al., 2006). Among the 58 plant extracts tested by the authors, the extracts of *P. trichosanthis* showed higher broad antibacterial spectrum against a wide range of test organisms. GCMS analysis of the extract showed that probably 4-hydroxybenzoic and isovanillic acid were evidenced to provide the antibacterial and antioxidant activity, respectively. SEM observations showed that the extract is functional on the outer membrane of the organisms.

African trypanosomes are protozoan parasites responsible for Sleeping sickness (Human African trypanosomiasis - HAT) and nagana in livestock and are transmitted by the bite of an infected tsetse fly (WHO 1988; Barrett, 1999). The treatment of this condition is a major challenge. The trypanocides are toxic and are costly (Legros et al., 2002). Therefore, there is need for new, safe, effective and cheaper alternative drugs to complement the existing drugs.Several well-known drugs, such as quinine and artemesinin used as antiprotozoan agents are of plant origin (Kirby, 1996; Camacho et al., 2000; Tagboto and Townson, 2001). Therefore, Peter et al. (2009 in this issue) investigate the therapeutic potential of extracts from four plants, commonly used in Africa as traditional medicine, for example *Kigelia africana*, *Artemesia annua*, *Bidens pilosa and Azadirachta indica* against African human trypanosomiasis. These authors are on the way of purifying and isolating bio-active compound for the development of safer and cost effective alternative drugs for human trypanosomiasis.

The signaling for most of the diseases or stress symptoms in living systems are mediated through oxidative pathways (Nanasombat and Teckchuen 2009). Oxygen is indispensable for sustaining life on earth. But it can be deleterious through the formation of reactive oxygen species (ROS) and oxygen free radicals with its deleterious effects on atherosclerosis, ischaemic heart disease, ageing, inflammation, diabetes, immunosuppression, neurodegenerative diseases, cancer and others (Jadhav and Bhutani, 2002). Therefore, antioxidants with radical scavenging activities have great relevance in the prevention and treatment of these diseases. Considering these facts for the importance of antioxidants Hasan et al. (2008) in this paper reported the antioxidant activity of hydromethanol extracts from medicinal plants from Bangladesh, which are traditionally used in folkloric remedies for various disorders where free radicals are reported to be involved. The results suggest that all the tested plant extracts have moderate to potent antioxidant activity. *Cocos nucifera, Caesalpinia pulcherrima, Punica granatum* and *Syzygium cumini* were found displaying strong (90% or more) DPPH radical scavenging activity. Further extensive investigations are necessary to find out the active antioxidative principles present in these plants.

Also, ROS such as singlet oxygen, superoxide anion radical, hydroxyl radical and hydrogen peroxide cause skin aging. Therefore, free radical scavengers are used as cosmetic ingredient to retard skin aging (Takeda el al., 2003). Elastin is an extracellular matrix protein providing elasticity to the connective tissues e.g. skin (Daamen et al., 2007). Elastase is the proteinase responsible for the degradation of elastin (Nar et al., 2001). Therefore, inhibition of the elastase activity could be used as a method to protect against skin aging (Kim et al., 2007). Previous phytochemical studies on the leaves and flowers of *Callistemon lanceolatus* (Myrtaceae) have yielded triterpenoids (Younes, 1975; Jeong et al., 2009), flavonoids (Mahmoud et al., 2002), ellagic acid derivatives and tannins (Marzouk, 2008). Kim et al. (2009b in this issue) reported the presence of strong elastase inhibition and DPPH radical scavenging activities of ethanol extract of *C. lanceolatus*. The active ingradients like betulinic acid (1), pyracrenic acid (2), arjunolic acid (3), catechin (4), and piceatannol (5) are reported through the bio-active assay (Fig. 7 Kim et al. 2009b in this issue). So this plant could be potential candidate for the development of novel cosmetic additives and anti-aging formulations.

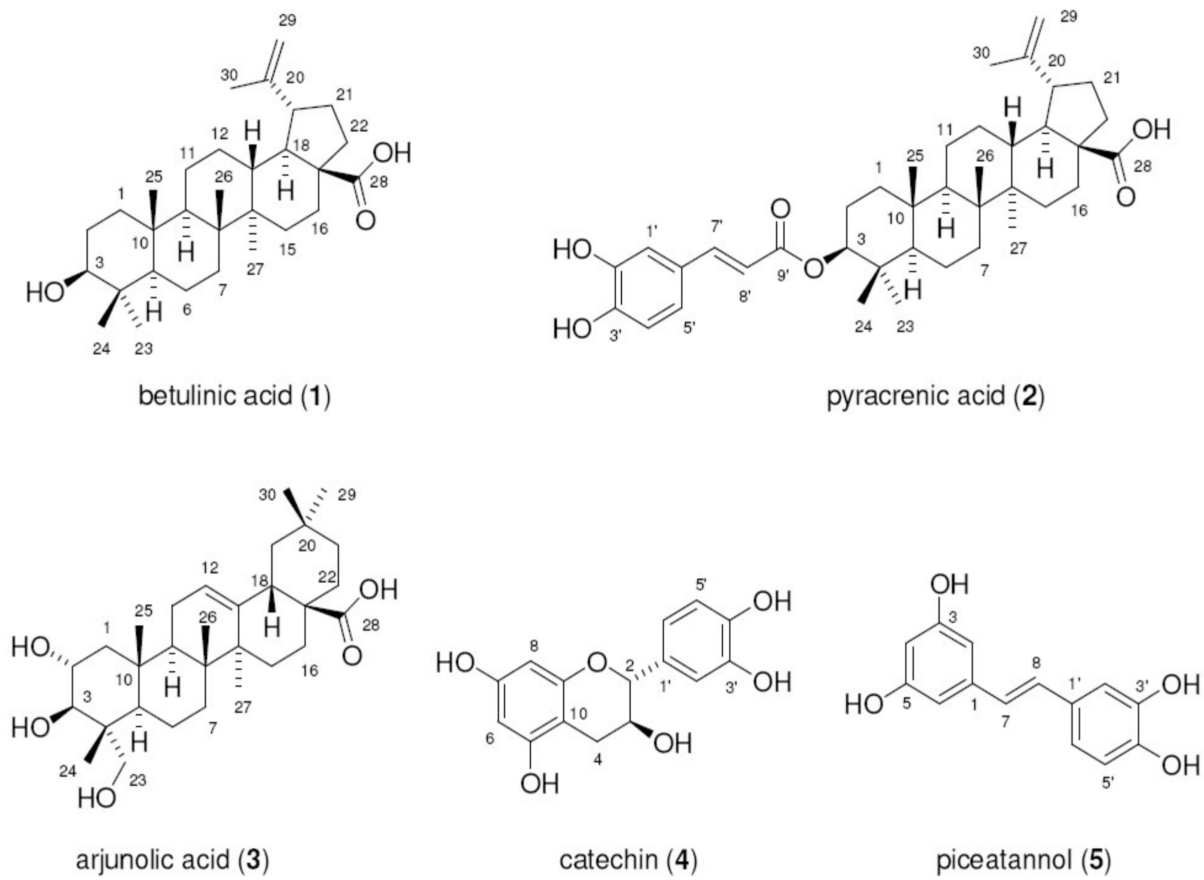

Figure. 6. Structures of the isolated compounds 1 - 5 from *C. lanceolatus*

Polyphenols and particularly flavonoids are widely appreciated for their potential beneficial health effects, like antioxidant or anticarcinogenic activities. Luis et al. (2009) studied the antioxidant activity of extracts of *Pterospartum tridentatum*, *Cytisus scoparius* and *Erica* spp. and showed a positive correlation between antioxidant activity index and total phenolic content of these plants.

Maternal diabetes mellitus (MDM) is associated with many teratological aspects which can be the origin of a perinatal morbidity (Li et al., 2007). The crucial role of oxidative stress in diabetic embryopathies were strongly suggested (Reece et al., 2006) and in mothers (Peuchant et al., 2004). Among the natural compounds, flavonoids were reported as potent anti-diabetic agents (Aslan et al., 2007). Toumi et al. (2009 in this issue) investigated the effect of hesperidin, a natural antioxidant citrus flavanone (Chiba et al., 2003; Garg et al., 2001), on diabetes-induced embryopathies in mice. Hesparin attenuated glycaemia, enhanced number of implantations per litter, number and weight of foetus but reduced maternal body weight, malformations and resorptions rates. The red alizarin-staining demonstrated a fully protective role of hesperidin in diabetic group (Fig. 8 Toumi et al. 2009 in this issue). These findings suggest that hesperidin may have a prophylactic effect against diabetic embryopathies in mice.

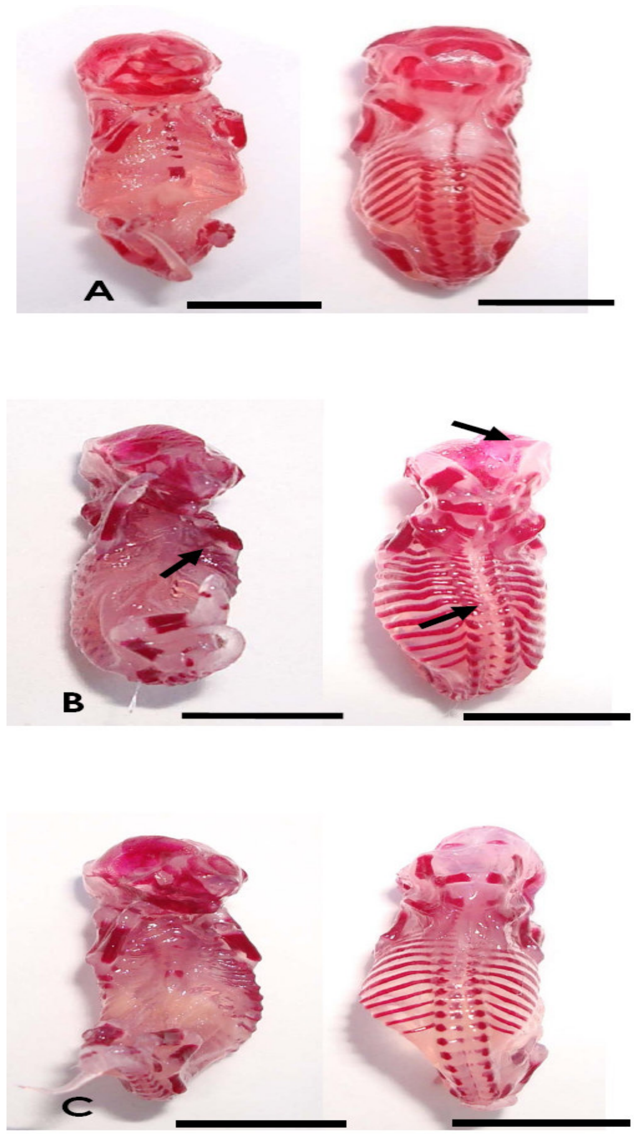

Figure. 7. The red alizarin-stained foetal skeleton demonstrating full protection by hesperidin. The ventral (to the left) and the dorsal (to the right) views of foetuses from control pregnant mice (A), from untreated diabetic pregnant mice (B) and from hesperidin-treated diabetic pregnant mice (C) and skeletal defects (craniopathies, nonossified sterna and crooked ribs) were observed (B, arrows) only in offspring of untreated diabetic dams (Toumi et al. 2009 in this issue).

The increasing interest and scope the drug of natural origin provides opportunities for its exploration, investigation and utilization for biological activity. The scaffolds of drug interactions can provide opportunities for the discovery of new and useful antimicrobial substances for drug resistant bacteria in addition to emerging verocytotoxygenic ones. Doughari et al. (2009 in this issue) reviewed the current problems associated with the development of multidrug resistant (MDR) bacterial strains especially *Escherichia coli* 0517: H7 and *Acinetobacter* species that are verocytotoxin producers and produce increased level of toxins when challenged with antibiotics. The authors suggest that an abundant medicinal plant resource, their antioxidant properties and possibly undiscovered novel modes of action can be a solution to the control of multidrug resistant verocytotoxic bacteria.

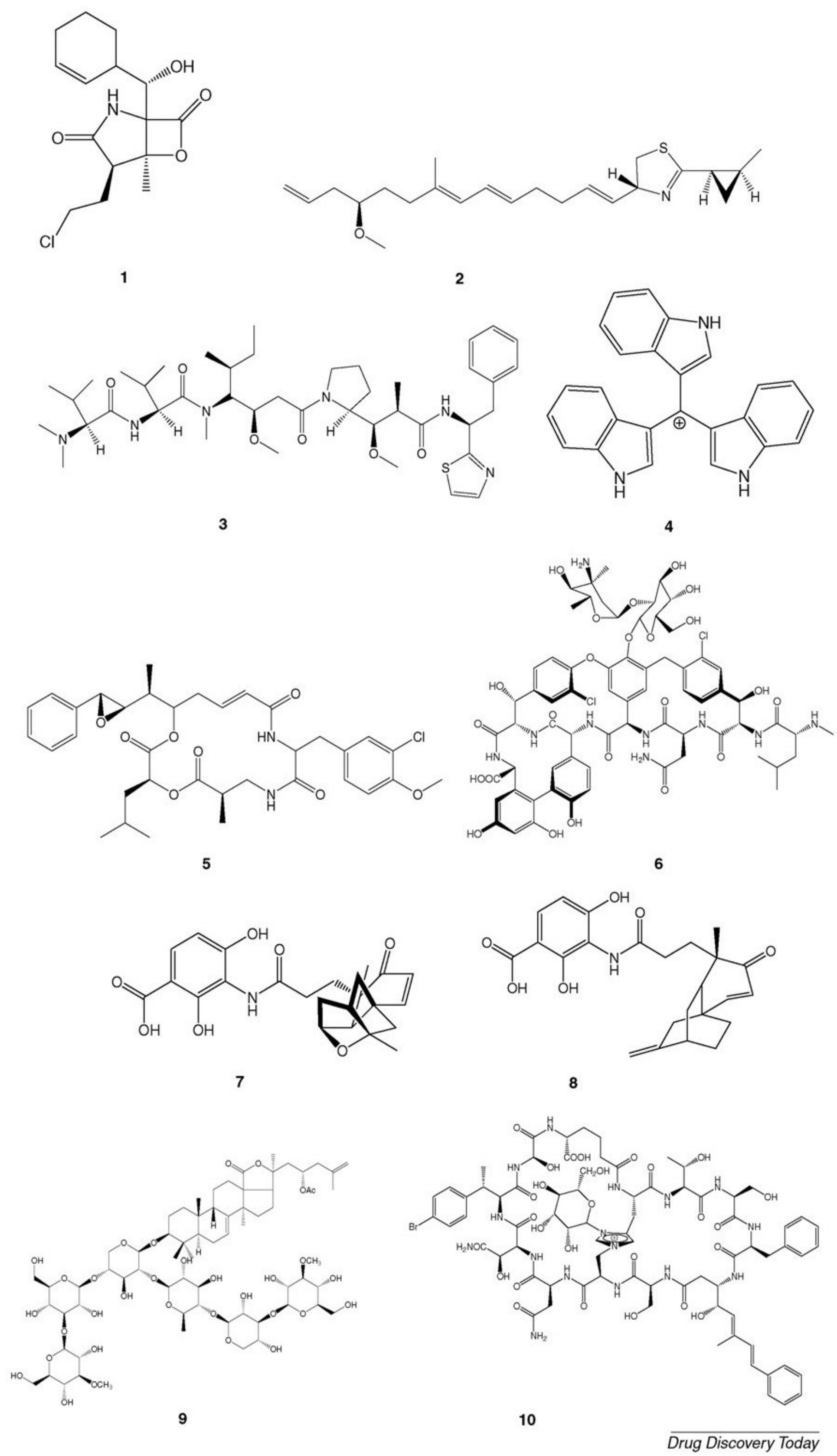

Figure. 9 Chemical formula of few recently developed natural products (1) Salinosporamide A; (2) curacin A; (3) dolastatin 10; (4) turbomycin A; (5) cryptophicin; (6) vancomycin; (7) platensimycin; (8) platencin; (9) stichloroside; (10) theopalauamide (Source; Harvey, 2008 as cited by Doughari et al. 2009 in this issue).

Momordica charantia L. (Cucurbitaceae) commonly known as bitter guard is cultivated and used for its medicinal value. Fruits and seeds of bitter guard are reported to have anti-HIV, anti-ulcer, antiinflammatory, anti-leukemic, antimicrobial, anti-diabetic and anti-tumor properties (Basch et al., 2003; Shih et al., 2008; Alam et al., 2009; Lii et al., 2009). Gamma-aminobutyric acid (GABA, Figure 1) is a nonprotein amino acid synthesized via the decarboxylation of L-glutamate in a reaction catalyzed by the cytosolic enzyme L-glutamate decarboxylase (Forde and Lea, 2007). It is a valuable component of the free amino acid pool in most prokaryotic and eukaryotic organisms. In vertebrates, GABA is the major neurotransmitter inhibitor in the central nervous system that prevents anxiety and stress-related messages from reaching the motor centers of the brain (Schousboe and Waagepetersen, 2007). It has been used to enhance the secretion of growth hormone from the pituitary gland. In addition, it is known to inhibit the migration of colon carcinoma cells, paving the way to the development of specific pharmacological agents that delay or inhibit invasion and metastasis of various cancer types (Enna, 2001; Kowalski et al., 2007; Sarto-Jackson and Sieghart, 2008). In spite of this, very few work is done on amino acid and GABA content of bitter guard.

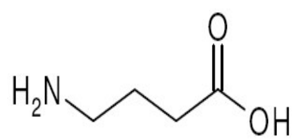

Figure 6. Chemical structure of Gamma-aminobutyric acid (GABA).

Kim et al. (2009a in this issue) screened bitter guard cultivars from China, Japan, Philippines and Korea, and showed variations in the amount of different amino acids and GABA. They concluded that bitter guard is a potential source of amino acids and GABA for the development of food supplements.

Ocimum spp. (Lamiacae) contain a wide range of essential oils rich in phenolic compounds, flavonoids and anthocyanins (Phippen et al., 1998) with a wide range of medicinal use (Misra 1998, Misra et al. 1998). It was reported that the growth and essential oil yield of *Ocimum* is determined by the growth light conditions in the field (Misra 1998, Misra and Sahu 1997). In this issue Caliskan et al. (2009) made a theoretical analysis of the relationships between temperature, light intensity and growth parameters namely net assimilation rate, relative growth rate, leaf weight ratio, leaf area ratio and specific leaf area for sweet basil. The measured and predicted growth parameters showed a positive correlation.

Shaheen et al. (2009 in this issue) developed a taxonomic key for identification of fourteen species belonging to the two medicinally important plant genera, *Abutilon*. and *Hibiscus* (family Malvaceae) based on palynomorphological characters.

Scutellaria baicalensis Georgi, is a well-known Traditional Chinese Medicine, officially listed in the China Pharmacopoeia for treating various ailments such as fever, ulcer, bronchitis, hepatitis, tumor and inflammatory disease (National Committee of China Pharmacopoeia, 2005). However, due to commercial exploitation, this plant is endangered (Su et al., 2008). Only the cultivated populations are now the source of this drug. Recently genetic analysis of wild and cultivated populations by using randomly amplified polymorphic DNA (RAPD) markers only is reported (Su et al., 2008). Among various molecular markers, inter-simple sequence repeats (ISSRs) use repeat-anchored primers to amplify DNA sequences between two inverted SSRs (Zietkiewicz et al., 1994). Because of high annealing temperature and longer sequence of ISSR primers, they can yield reliable and reproducible bands, and the cost of the analysis is relatively lower than that of other markers like amplified fragment length polymorphism (AFLP). Therefore, ISSRs have wide applications in genetic diversity studies (Yao et al., 2008). Guo et al. (2009 in this issue) developed an efficient protocol of PCR condition and screen one hundred primers to select those with high clarity and repetition to estimate genetic diversity and authenticate the medicinal materials of *Scutellaria baicalensis* Georgi.

Wang et al. (2001) developed sequence specific amplified regions (SCAR) marker from RAPD fragments to authenticate *P. ginseng* and *P. quinquefolius* species. In this issue Kwon et al. (2009) developed two species specific SCAR primers for *P. notoginseng*.

With the advent of molecular biology and biotechnology 'Molecular Farming' developed as a technique to use transgenic plants or genetically modified organisms (GMO) for the synthesis of pharmaceutical or industrial products, preferably recombinant proteins. This is one of the convenient ways to produce biomolecules on a large scale at low costs and facilitates rapid scaling up, convenient storage of raw material and less contamination (Raskin et al., 2002; Twyman et al., 2005). The production of GMO raises biosafety concerns, in particular the spread of transgene in the environment or contamination of the food. Breyer et al. (2009 in this issue) reviewed the present status of the biosafety aspects of GMOs and relevant regulatory issues linked to plant molecular farming.

In this issue of Journal of Medicinal Plants Research, the authors highlighted the immense scope for the exploration, investigation and utilization for biological activity of novel medicinal plants. There is a need to utilize molecular methods and probes for the use in biotechnology. Safety aspects and scaling up of production of medicinally important compounds in plants through climatic or genetic manipulations for use in future are the few salient features of the present issue.

REFERENCES

Abdelwahab SI, Abdul AB, Elhassan MM, Mohan S, Al-zubairi AS, Al Haj NA, Abdullah R, Mariod AA (2009). Biological and Phytochemical Investigations of *Goniothalamus umbrosus* leaves hexane extract

Adejumo TO, Bamidele BS (2009). Control of dermatophyte-causing agents (*Trichophyton mentagrophytes* and *Trichophyton rubrum*) using six medicinal plants. J. Med. Plants Res. 3(11):909-915.

Akinyemi KO, Oladapo 0, Okwara CE, Ibe CC, Fasure KA (2005). Screening of Crude Extracts of Six Medicinal Plants used in Southwest Nigerian Unorthodox Medicine. BioMed. Central Complementary and Alternative Medicine Vol 5.6.

Aslan M, Orhan DD, Orhan N, Sezik E, Yesilada E (2007). In vivo antidiabetic and antioxidant potential of *Helichrysum plicatum* ssp. *plicatum* capitulums in streptozotocin-induced diabetic rats. J. Ethnopharmacol. 109:54-59.

Bray GA, Nielsen SJ, Popkin BM (2004). Consumption of high-fructose corn syrup in beverages may play a role in the epidemic of obesity. Am. J. Clin. Nutr. 79: 537-543.

Breyer D, Goossens M, De Schrijver A, Herman P, Sneyers M (2009). Biosafety considerations associated with molecular farming in genetically modified plants. J Med. Plants Res. 3(11): 825-838.

Caliskan O, Odabas MS, Cirak C (2009) The modeling of the relation among the temperature and light intensity of growth in *Ocimum basilicum* L. J Med. Plants Res. 3(11):967-979.

Chiba H, Uehara M, Wu J, Wang X, Masuyama R, Suzuki K, Kanazawa K, Ishimi Y (2003). Hesperidin, a citrus flavonoid, inhibits bone loss and decreases serum_ and hepatic lipids in ovariectomized mice. J. Nutr.133:1892-1897.

Delzenne NM, Daubioul C, Neyrinck A, Lasa M, Taper HS (2002). Inulin and oligofructose modulate lipid metabolism in animals: review of biochemical events and future prospects. British J. Nutr. 87(Suppl. 2), S255-S259

Dewprashad B, Vaz GS (2005). Cassava: Food for Thought. September Guyana J. 10(9):28-29.

Dewprashad B, Zakia-Masiak S, Katamaya S and Hendrix R (2009) Antibacterial effects of the sauce from cassava. J. Med. Plants Res. 3(11): 880-882.

Doughari JH, Human IS, Bennade S, Ndakidemi PA (2009). Phytochemicals as chemotherapeutic agents and antioxidants: possible solution to the control of antibiotic resistant verocytotoxin producing bacteria. J. Med. Plants Res. 3(11): 839-848.

Gaby AR (2005). Adverse Effects of Dietary Fructose. Alternative Med. Rev. 10: 294, 306.

Gallardo S, Moretto D, Palamara G (2004). Epidemiology of Dermatophytoses Observed in Rome, Italy between 1985 and 1993 Mycoses 38: 415-417.

García-Pedraza LG, Juárez-Flores BI, Aguirre-Rivera JR, Pinos-Rodríguez JM, Martínez JF, Santoyo ME (2009) Effects of *Agave salmiana* Otto ex Salm-Dick highfructose syrup on non-diabetic and streptozotocindiabetic rats. J. Med. Plants Res. 3(11): 932-940 .

Garg A, Garg S, Zaneveld LJ, Singla AK (2001) Chemistry and pharmacology of the citrus bioflavonoid hesperidin. Phytother. Res. 15:655–669.

Guo HB, Huang KY, Zhou TS, Wu QH, Zhang YJ, Liang ZS (2009) DNA isolation, optimization of ISSR-PCR system and primers screening of *Scutellaria baicalensis*. J. Med. Plants Res. 3(11):901-904

Hanover LM, White JS (1993). Manufacturing, composition, and applications of fructose. Am. J. Clin. Nutr. 58:724S-732S.

Hanover LM, White JS (1993). Manufacturing, composition, and applications of fructose. Am. J. Clin. Nutr. 58: 724S-732S.

Hasan S M R, Hossain Md M, Akter R, Jamila M, Mazumder Md E H and Rahman S (2009) DPPH free radical scavenging activity of some Bangladeshi medicinal plants. J. Med. Plants Res. 3(11): 875-879.

Ifeoma II, Ikechukwu AO, Princess CN, Henry IN (2009). Phytochemical, composition of *Pleurotus tuber regium* and effect of its dietary incorporation on body /organ weights and serum triacylglycerols in albino mice. J Med. Plants Res. 3(11): 941-945.

Jewers K, Davis JB, Dougan J, Machanda AH, Blunden G, Kyi A, Wetchaipan S (1972). Goniothalamin and its distribution in four *Goniothalamus* species. Phytochemistry, 11:2025–2030.

Johnson RJ, Segal MS, Sautin Y, Nakagawa T, Feig DI, Kang DH, Gersch MS, Benner S, Sánchez-Lozada LG (2007). Potential role of sugar (fructose) in the epidemic of hypertension, obesity and the metabolic syndrome, diabetes, kidney disease, and cardiovascular disease. Am. J. Clin. Nutr. 86: 899 - 906.

Kabir KE, Khan AR, Mosaddik MA, (2003). Goniothalamin: a potent mosquito larvicide from *Bryonopsis laciniosa*. L. J. Appl. Ent, 127:112–115.

Kim YK, Byun JC, Reddy Bandi AK, Hyun C-G, Lee NH (2009b). Compounds with elastase inhibition and free radical scavenging activities from *Callistemon lanceolatus*. J. Med. Plants Res. 3(11): 897-900.

Kim YK, Xu H, Park NI, Boo HO, Lee SY, Park SU (2009a) Amino acid and GABA content in different cultivars of *Momordica charantia* L. J. Med. Plants Res. 3(11):916-922.

Ladan Z, Amupitan JO, Okonkwo EM, Aimola IA, Habila N (2009) Antimicrobial potency of *Hyptis spicigera* leaf extracts against some pathogenic microorganisms. J. Med. Plants Res. 3(11): 905-908.

Li R, Thorens B, Loeken MR (2007). Expression of the gene encoding the high-km glucose transporter 2 by the early postimplantation mouse embryo is essential for neural tube defects associated with diabetic embryopahy. Diabetologia 50:682-689.
Luís A, Domingues F, Gil1 C and Duarte A P (2009) Antioxidant activity of extracts of Portuguese shrubs: *Pterospartum tridentatum*, *Cytisus scoparius* and *Erica* spp. J. Med. Plants Res. 3(11): 889-896.
Mancilla-Margalli NA, López MG (2006). Water-soluble carbohydrates and fructan structure patterns from *Agave* and *Dasylirion* species. J. Agric. Food Chem. 54: 7832-7839.
Michel C, Juárez B, Aguirre JR, Pinos-Rodríguez JM (2008). Quantitative characterization of non-structural carbohydrates of mezcal agave (*Agave salmiana* Otto ex Salm-Dick). J. Agric. Food Chem. 23: 5753-5759.
Misra M, Sahu S (1997). Growth and development of *Ocimum basilicum* L. at RRL, Bhubaneswar. Nat. Sem. for Sustainable Agric., New Delhi. p.12.
Misra M (1998). Photosynthetic pigment content and essential oil yield of *Ocimum basilicul* L. during different stages of growth in the field. In: Photosynthesis : Mechanisms and Effects. (ed. G. Garab). Vol. V, pp. 3825-3828. Kluwer, The Netherlands.
Misra M, Sahoo S, Devta BK (1998). Micropropagation of sweet basil (*Ocimum basilicum* L.). National Seminar on Aromatic Plants of India: Exploration and utilisation. Bhubaneswar. p.17.
Mosaddik MA, Haque ME, (2003). Cytotoxicity and antimicrobial activity of goniothalamin isolated from Bryonopsis laciniosa. Phytother. Res. 17:1155–1157.
Nanasombat S, Teckchuen N (2009). Antimicrobial, antioxidant and anticancer activities of Thai local vegetables. J. Med. Plants Res. 3:443-449.
National Committee of Pharmacopoeia (2005). China Pharmacopoeia. Chemical Industry Press, Beijing, China: p.211.
PAHO, Pan American Health Organization (2007). The U.S.-Mexico border diabetes prevention and control project. First report of results. PAHO. El Paso, Texas, USA.
Peter O, Magiri E, Auma J, Magoma G, Imbuga M and Murilla G (2009) Evaluation of *in vivo* antitrypanosomal activity of selected medicinal plant extracts. J. Med. Plants Res. 3(11): 849-854.
Peuchant E, Brun J-L, Rigalleau V, Dubourg L, Thomas M-J, Daniel JY, Leng J-J, Gin H (2004). Oxidative and antioxidative status in pregnant women with either gestational or type 1 diabetes. Clin. Biochem. 37:293-298.
Phillipson JD (1994). Natural products as drugs. Trans R Soc. Trop. Med. Hyg. 88: 17-19.
Raskin I, Ribnicky DM, Komarnytsky S, Ilic N, Poulev A, Borisjuk N, Brinker A, Moreno DA, Ripoll C, Yakoby N, O'Neal JM, Cornwell T, Pastor I, Fridlender B (2002). Plants and human health in the twentyfirst century. Trends Biotechnol. 20:522-531.
Reece EA, Wu KY, Zhao Z, Dhanasekaran D (2006). Dietary vitamin and lipid therapy rescues aberrant signalling and apoptosis and prevents hyperglycemia-induced diabetic embryopathy in rats. Am. J. Obst. Gynecol. 194:580-585.
Shaheen N, Hayat MQ, Yasmin G, Ajab M (2009). Pollen morphology of 14 species of *Abutilon* and *Hibiscus* of the family Malvaceae (*sensu stricto*). J Med. Plants Res. 3(11):923-931.
Shao AJ, Li X, Huang LQ, Lin SF, Chen J (2006). RAPD analysis of *Scutellaria baicalensis* from different germplasms. China J. Chin. Mat. Med. 31(6): 452-455.
Shier J (1848). On the starch and meal of the sweet and bitter cassava. In Bell J (ed) Pharm. J. Trans. 8: 197.
Su S, He CM, Li LC, Chen JK, Zhou TS (2008). Genetic characterization and phytochemical analysis of wild and cultivated populations of *Scutellaria baicalensis*. Chem. Biodivers. 5: 1353- 1363.
Toumi M L, Merzoug S, Boutefnouchet A, Tahraoui A, Ouali K, Guellati A (2009) Hesperidin, a natural citrus flavanone, alleviates hyperglycaemic state and attenuates embryopathies in pregnant diabetic mice. J. Med. Plants Res. 3(11):862-869.
Twyman RM, Schillberg S, Fischer R (2005). The transgenic plant market in the pharmaceutical industry. Expert Opin Emerg Drugs 10:185–218.
Wang J, Ha WY, Ngan FN, But PPH, Shaw PC (2001). Application of sequence characterized amplified region (SCAR) analysis to authenticate Panax species and their adulterants. Planta Med. 67:781-783.
Yang J-F, Yang C-H, Chang H-W, Yang C-S, Lin C-W, Chuang L-Y (2009). Antioxidant and antibacterial properties of *Pericarpium trichosanthis* against nosocomial drug resistant strains of *Acinetobacter baumannii* in Taiwan. J Med. Plants Res. 3(11);984-993.
Yao H, Zhao Y, Chen DF, Chen JK, Zhou TS (2008). ISSR primer screening and preliminary evaluation of genetic diversity in wild populations of *Glycyrrhiza uralensis*. Biol. Plantarum 52: 117-120.
Zietkiewicz E, Rafalski A, Labuda D (1994). Genome fingerprinting by simple sequence repeat (SSR)-anchored polymerase chain reaction amplification. Genomics 20: 176-183.

Dr. (Mrs.) Meena Misra[*]
Institute of Frontier Sciences & Biotechnology, 116B BDA Duplex, Baramunda, Bhubaneswar-751003, India.
[*]Present address: School of Biotechnology, Department of Biosciences & Biotechnology, Fakir Mohan University, Jnan Bigyan Vihar, Balasore-756020, India.

Associate Editor