

between the *Tulbaghia* species and the main sulphur compounds will be compared and presented.

doi:10.1016/j.sajb.2010.02.028

Antioxidant activity and cytotoxicity of three flavonoids from *Athrixia phylicoides* ethanol extract

E.J. Mavundza^a, T.E. Tshikalange^a, N. Lall^a, F.N. Mudau^b, A.A. Hussein^c

^aDepartment of Plant Science, University of Pretoria, Pretoria 0002, South Africa

^bCentre for Agro-Food Processing, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa

^cDepartment of Chemistry of Medicinal Plants, National Research Centre, El-Tahrir st., Dokki, Cairo, Egypt

Bioassay-guided fractionation of ethanol extract from aerial parts of *Athrixia phylicoides* using silica and sephadex column chromatography led to the isolation of four known flavonoids; 5-hydroxy-6,7,8,3',4',5'-hexamethoxyflavon-3-ol (**1**), 3-O-demethyldigicitrin (**2**), 5,6,7,8,3',4'-hexamethoxyflavone (**3**) and Quercetin (**4**). Due to low yield, no further tests were done on compound **3**. Isolated compounds together with crude extract were tested for antioxidant activity using DPPH-scavenging method. The crude extract showed a concentration-dependent radical scavenging activity with EC₅₀ value of 10.64±0.08 µg/ml. Compound **4** was the most potent radical scavenger, exhibiting EC₅₀ value of 1.27±0.25 µg/ml, followed by compounds **1** and **2** showing 2.74±0.10 and 3.41±0.09 µg ml⁻¹ respectively. Cytotoxicity of ethanol extract and isolated compounds was determined against Vero cell lines using XTT colorimetric assay. The crude extract showed no or little toxicity on Vero cells at lower concentrations tested exhibiting the IC₅₀ value of 107.8±0.13 µg/ml. Compound **4** showed minimal toxicity effect by exhibiting IC₅₀ value of 81.38±0.33 µg/ml as compared to compound **2** (IC₅₀, 28.92±0.12 µg/ml) and compound **1** (IC₅₀, 27.91±0.18 µg/ml). The results obtained from this study provide a clear rationale for the medicinal uses of *A. phylicoides*.

doi:10.1016/j.sajb.2010.02.029

Arabidopsis thaliana knockout mutants lacking fructose 2,6-bisphosphate have decreased growth rates under fluctuating environmental conditions

A.J. McCormick, N.J. Kruger

Department of Plant Sciences, University of Oxford, South Parks Rd, OX13RB, United Kingdom

The aim of this work was to examine the physiological role of fructose 2,6-bisphosphate (Fru 2,6-P) during photosynthesis, growth and reproduction in *Arabidopsis thaliana* (L.). Three separate homozygous T-DNA knockout lines of 6-phosphofructo-2-kinase (6-PF-2-K; EC 2.7.1.105)/fructose 2,6-bisphosphate

(F26BPase; EC 3.1.3.46) (F2KP), the bifunctional enzyme responsible for both the synthesis and degradation of Fru 2,6-P, were isolated. In all three F2KP-KO lines Fru 2,6-P metabolism was shown to be absent. Distribution of a ¹⁴C label confirmed a significant increase in carbon partitioning to sucrose and a decrease in starch synthesis in F2KP-KO plants. Similarly, during the light period F2KP-KO lines exhibited an increase in sugar accumulation and decreased starch levels at both high light (300 µmol m⁻² s⁻¹) and low light (80 µmol m⁻² s⁻¹). When grown under high or low light conditions no growth phenotype was observed. However, F2KP-KO plants exhibited significantly reduced growth rates (ca. 20%) when grown under fluctuating light (80–300 µmol m⁻² s⁻¹) or temperature (22–10 °C) during an 8 h light period or under ambient light in a glasshouse environment. Gas exchange and fluorescence analyses indicated that photosynthetic induction is delayed in F2KP-KO plants, leading to a decrease in growth and fecundity when grown in a variable environment. This work confirms the role of Fru 2,6-P in partitioning of carbon between starch and sucrose in leaves during the photoassimilation period but furthermore demonstrates a competitive growth advantage for fine metabolic regulation by Fru 2,6-P under fluctuating environmental conditions.

doi:10.1016/j.sajb.2010.02.030

Sulphur dioxide fumigation leads to increases in antioxidant enzymes and changes in the photosynthetic capability of canola plants (*Brassica napus* L.)

M.M. Minnaar, J.M. Berner, G.H.J. Krüger

School of Environmental Sciences and Development, North-West University, Potchefstroom 2520, South Africa

Environmental stressors create challenges in the efforts of agricultural sectors to achieve sustainability in food production. Ozone (O₃), sulphur dioxide (SO₂) and nitrogen oxides (NO_x) are among the most important air pollutant gases in the atmosphere. There has been a considerable increase in the concentration of air pollutants such as SO₂ in the lower atmosphere. This phenomenon can be attributed to increases in anthropogenic activities in industrialised areas of the world. Plants respond to stress conditions by increasing the levels of reactive oxygen species (ROS). In this study the effects of different SO₂ levels on the antioxidant metabolism and the photosynthetic capability of canola plants (*Brassica napus* L.) were determined. Canola plants were grown over a time period of five months in an Open Top Chamber (OTC) system. The canola plants were fumigated with 0, 50, 100 and 200 ppb of SO₂ for 8 h per day. Chlorophyll *a* fluorescence and photosynthetic gas exchange were routinely measured. Leaf samples were taken on four different occasions to quantify the changes in the activity of the stress enzymes ascorbate peroxidase (APX), guaiacol peroxidase (POD) and superoxide dismutase (SOD). Increases in the activity of APX, POD and SOD were observed in canola plants in accordance with an elevation in the fumigation level of SO₂. The chlorophyll *a*

fluorescence data indicated a concomitant decline in PS II function (photosynthetic performance index) of canola plants fumigated at 200 ppb. No significant changes in photosynthetic gas exchange were evident at this level of SO₂.

doi:10.1016/j.sajb.2010.02.031

Are fleshy fruits of alien shrubs a preferred food resource for avian frugivores in the Cape Floristic Region?

T.M. Mokotjomela^{a,b}, C.F. Musil^a, K.J. Esler^b

^aSouth African National Biodiversity Institute, Kirstenbosch Research Centre, Private Bag X7, Claremont 7735, South Africa

^bDepartment of Conservation Ecology and Entomology, and Centre for Invasion Biology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

It has been proposed that alien shrubs with their attractive fruit displays could out-compete native shrubs for the attention of avian frugivores, thereby restricting seed dispersal of native species which is crucial for ecosystem maintenance. This hypothesis was tested by comparing the abundance and duration of avian species visitations and foraging activity in two fleshy-fruited alien shrubs (*Solanum mauritianum* and *Lantana camara*) with those of two fleshy-fruited native shrubs (*Chrysanthemoides monilifera* and *Olea africana*) at four different study sites (Cape Town, Paarl, Hermanus and Swellendam) in the Cape Floristic Region where these alien and native shrubs co-occur. Tests for significant differences (Generalized Linear Model) in the numbers of birds of different species and size class visiting, foraging and perching on alien and native shrubs during their fruiting stage were based on over 1000 records compiled from 240 h of observation at the four study sites. The results showed no significant differences in the total avian species complement visiting native and alien shrubs, but significantly greater numbers of birds of different species and size class visiting, foraging and perching on native than alien shrubs. These differences were apparent at all sites, except Paarl. They were most prominent among small to medium (50–150 g) and large birds (>150 g) and also apparent among individual avian species visiting the shrubs. Insignificantly different numbers of small birds (>30 g) were observed visiting, foraging and perching on native and alien shrubs. It is concluded that alien shrubs do not restrict seed dispersal of native species since more avian frugivores prefer fruits of indigenous plants, which could be due to their natural adaptation to the local flora. Since local avian frugivores forage both alien and native fruits, they share available avian dispersal services and thus, a potential exists for further spread of alien species. A shorter bird foraging bouts on the alien than indigenous shrubs may suggest that alien fruits have higher energy content than indigenous fruits which are being investigated.

doi:10.1016/j.sajb.2010.02.032

Taxonomic studies on the genus *Dolichos* (Phaseoleae, Fabaceae) in South Africa

A.N. Moteetee, B.-E. Van Wyk

Department of Botany and Plant Biotechnology, PO Box 524, Auckland Park 2006, Johannesburg, South Africa

Taxonomic studies on the mainly African genus *Dolichos* are presented. The genus belongs to the tribe Phaseoleae and can be distinguished from the closely related *Macrotyloma* by the short standard appendages, reticulate pollen grains and purple flowers. It is also closely related to, and often confused with, the two monotypic genera *Lablab* and *Dipogon* (previously placed under *Dolichos*), from which it differs in the characters of the style. Many species of *Dolichos* have a rootstock which is sometimes large and woody or fibrous and is eaten in some parts of southern Africa. The species can be distinguished from each other mainly by the growth form (scandent, prostrate or erect), shape and size of leaflets and shape of calyx lobes (round versus triangular). In South Africa, the genus is represented by ten species, two of which (*D. sericeus* and *D. trilobus*) also extend to Tropical Africa. Diagnostic characters, nomenclature and distribution of these species are briefly discussed.

doi:10.1016/j.sajb.2010.02.033

Antimicrobial and phytochemical evaluation of twelve medicinal plants used by the Venda People

R.B. Mulaudzi, M.G. Kulkarni, J.F. Finnie, J. Van Staden

Research Centre for Plant Growth and Development, School of Biological and Conservation Sciences, University of KwaZulu-Natal Pietermaritzburg, Private Bag X01, Scottsville 3209, South Africa

High demand for the development of new drugs from natural products to counter resistant pathogens has led to an increase in research to validate bioactivities of plants used in traditional medicine. Twelve plants used in Limpopo province to treat venereal diseases, wounds, colds and fever, were extracted with petroleum ether, dichloromethane (DCM), 80% ethanol (EtOH) and water. The extracts were evaluated for antimicrobial [Gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*), Gram-negative (*Escherichia coli* and *Klebsiella pneumoniae*) bacteria and a fungus *Candida albicans*] activities using micro-dilution techniques. The extracts were also tested for phytochemical composition including phenolics, condensed tannins, gallotannins and flavonoids using spectrophotometric methods. The DCM and EtOH extracts of *Bolusanthus speciosus* bark and stem showed good antibacterial activity against *B. subtilis*, *E. coli* and *S. aureus* with MIC values ranging from 0.0123 to 0.098 mg/ml. The water extracts of *Ximenia caffra* leaf showed a good activity with a MIC value of 0.049 mg/ml against *S. aureus*. All the extracts showed a broad-spectrum antifungal activity with MIC values ranging from 0.39 to 12.5 mg/ml against *C. albicans*.