The vegetation ecology of the Seringveld Conservancy, Cullinan, South Africa

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The Seringveld Conservancy is situated near Cullinan and the area is characterised by deep sandy soils. Sand mining for the building industry has become a major threat to the biodiversity. The flora of the Conservancy is best described as a gradual ecotone between the grassland and savanna biome. The study aims to describe the vegetation of the Seringveld Conservancy, in terms of plant communities, plant species composition and habitat. The Braun-Blanquet approach was used for sampling and 125 relevés were compiled. The data was captured using TURBOVEG and data analysis followed in JUICE 7.0. A total of 376 species were found in the area. Analysis from JUICE resulted in a TWINSPAN dendogram, synoptic table and two phytosociological tables. The phytosociological tables obtained from JUICE were further ordered using Braun-Blanquet procedures. Ten main plant communities and two sub-communities were identified. Each plant community was described in terms of diagnostic, dominant and constant species as well as the habitat features of the plant community. ArcGIS was used to create various maps further highlighting the uniqueness of the area. A vegetation map indicating the locality of the plant communities was compiled. The combined results of the phytosociological tables as well as the GIS maps indicate that the Seringveld Conservancy is a complex area containing high biodiversity.

doi:10.1016/j.sajb.2010.02.026

The taxonomic value of fruit wall structure in the genus *Crotalaria* (Fabaceae, tribe Crotalarieae)

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★ *Awarded the Van Staden prize for best paper by a PhD student and the prize for the best Oral Presentation*

Crotalaria L. is a large genus of more than 700 species, of which more than 500 are endemic to Africa and Madagascar. The name *Crotalaria* is derived from the Greek word κροταλου (a castanet) because of the rattling sound made by the seeds when the often indehiscent and inflated pods are shaken. Despite the apparent diagnostic importance of the fruit and fruit wall, limited information is available on the anatomy of the pericarp in *Crotalaria* and related genera. Transverse sections were made of the mature pods of 73 species from 13 genera of the Crotalarieae. Three basic fruit wall types can be distinguished in the tribe: (1) a *Crotalaria* type (multiple layers of lignified cells); (2) a *Listia* type (single layer of lignified cells combined with large epicarp cells); (3) a *Calobota* type (multiple layers of small, thin-walled lignified cells). The *Crotalaria* type occurs in almost all the genera; the *Listia* type occurs only in *Listia*, *Lebeckia* and *Lotononis*; the *Calobota* type is found only in some species of the genus *Calobota*. Within the genus *Crotalaria*, considerable variation was encountered and the fruit wall structure seems to have taxonomic value at the species level. Indehiscent fruits typically have the lignified cells arranged in two differently orientated layers. Species also differ in the overall thickness of the wall, the relative proportions of the layers, the degree of lignification and the presence or absence of a hairy endocarp.

doi:10.1016/j.sajb.2010.02.027

Ethnobotany and pharmacognosy of three Cape herbal plants

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A review is given of the ethnobotanical uses of three historically important plants that were used in Cape Herbal Medicine. The species are *Centella glabrata* (persiegras), *Olea europaea* subsp. *africana* (olienhout) and *Tulbaghia alliacea* (wilde-knoffel). A comparison of the morphology and leaf anatomy of the species with their more famous and more widely used relatives, respectively *Centella asiatica* (pennywort or *gotu kola*), *O. europaea* subsp. *europaea* (cultivated olive) and *Tulbaghia violacea* and *T. simmleri* is discussed. Similarities and differences that can be used for pharmacognostic purposes are highlighted. The chemical difference between *C. glabrata* and *C. asiatica* points to the presence of three major triterpenoid glycosides that are in the process of being isolated and identified. Peltate scales that occur on the leaf surfaces of both subspecies of *O. europaea* provide an easy way to identify raw material. Subsp. *africana* leaf extract was found to be chemically similar to that of subsp. *europaea*. The main active compound of cultivated olive leaf, the secoiridoid oleuropein, was found in high concentrations in wild olive leaf. Other related compounds, tyrosol and hydroxytyrosol that co-occur with oleuropein were also present in the wild olive leaf extract. The compound verbascoside is present only in the cultivated olive and can be used to distinguish between the two subspecies. Wild olive leaf appears to be a suitable alternative source of raw material for commercial olive leaf extract. *T. alliacea* contains high levels of sulphur compounds that give an even more powerful garlic odour than commercial garlic (*Allium sativum*). Anatomical comparisons will be made

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

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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**), 3-0-demethyldigicitrin (**2**), 5,6,7,8,3′,4′-hexamethoxyflavone (**3**) and Quecertin (**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 EC_{50} value of 10.64±0.08 μg/ml. Compound **4** was the most potent radical scavenger, exhibiting EC_{50} 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 IC_{50} value of 107.8± 0.13 μg/ml. Compound **4** showed minimal toxicity effect by exhibiting IC_{50} value of 81.38±0.33 μg/ml as compared to compound **2 (**IC_{50}, 28.92±0.12 μg/ml) and compound **1** (IC_{50}, 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

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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-phospho-fructo-2-kinase (6-PF-2-K; EC 2.7.1.105)/fructose 2,6-bisphosphatase (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 ^{14}C 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.)

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Environmental stressors create challenges in the efforts of agricultural sectors to achieve sustainability in food production. Ozone (O_3), sulphur dioxide (SO_2) 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 SO_2 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 SO_2 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 SO_2 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 SO_2. The chlorophyll *a*