The rhizomes of *Alepidea amatymbica* and *A. natalensis* are used for colds, coughs, asthma and abdominal cramp in traditional medicine. Antibacterial (two Gram-positive: *Bacillus subtilis*, *Staphylococcus aureus* and two Gram-negative: *Escherichia coli*, *Klebsiella pneumoniae*), antifungal (*Candida albicans*), anti-inflammatory (COX 1 and 2) and genotoxicity tests (Ames test) were carried out on petroleum ether (PE), dicloromethane (DCM), 80% ethanol (EtOH) and water extracts of the two *Alepedia* species, *A. natalensis* and *A. amatymbica*. Water extracts of *A. natalensis* rhizomes exhibited high activity (MIC values of 0.78 mg/ml) against the four bacterial strains. High activity was also observed in the PE and DCM leaf extract of the same plant against the Gram-positive bacteria. The PE and DCM extracts of *A. amatymbica* rhizomes exhibited the best activity (MIC values of 0.39 mg/ml) against *Bacillus subtilis*. The rest of the extracts showed low activity (MIC values>1 mg/ml). All the extracts showed activity against *Candida albicans*, with *A. natalensis* leaf extracts exhibiting the highest antifungal activity with MIC values of 0.88, 0.2 and 0.78 mg/ml for PE, DCM and EtOH respectively. The PE and DCM extracts had high COX-1 activity with percentage inhibitions above 70%. Ethanol extracts had inhibition less than 40% for both *A. natalensis* and *A. amatymbica*. All the PE extracts showed higher COX-2 inhibitory activity than for COX-1. PE and DCM extracts both had percentage inhibitions above 70% for both COX-1 and COX-2 inhibition. The Ames test for genotoxity revealed that none of the plant extracts were toxic to the *Salmonella* TA98 tester strain.

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Establishing a tissue culture system to increase secondary metabolite production: Over-expression of geranyl diphosphate synthase to up-regulate production of terpenes in *Salvia stenophylla*

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Salvia stenophylla is known to have medicinal properties that are important in the cure of a number of skin diseases. This is largely due to the presence of essential oils, which are derived from terpenoid synthesis regulated by the enzyme geranyl diphosphate synthase. The study is aimed at improving the levels of secondary compounds of the essential oil produced by this plant by over-expressing the gene coding for geranyl diphosphate synthase using *Agrobacterium* transformation. Such improvements have conservation and economical benefits as they will not only reduce wild harvesting of the plant, but also provide a basis for *in vitro* production of metabolites of interest. Germination in *S. stenophylla* seeds was investigated and seeds were subjected to four different treatments (chemical scarification, smoke extract treatment, smoke extract and scarification). The control was left untreated. Smoke-treated and scarified seeds exhibited a high germination under both dark and light conditions and had similar effect germination ($P>0.05$). This suggests that *S. stenophylla* seed germination is depended on smoke as a germination cue and the removal of the seed coat. However, a combination of both treatments had no effect on germination ($P<0.05$). Some of the germinating seeds were used to establish a tissue culture system. Upon establishment of *in vitro* seedlings, *Agrobacterium*-mediated transformation with the AgGPPS2 synthase gene (Burke and Croteau, 2002) was examined using hypocotyl and cotyledon explants. The AgGPPS2 gene was sub-cloned into a pCambia vector and *Agrobacterium tumefaciens* EHA105 transformation was conducted using standard methods. Selection of putative transformants was done using kanamycin-supplemented medium and transformation was tested using PCR analysis.

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Galactomannan production in sugarcane callus

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Sugarcane is an ideal higher plant bioreactor, owing to its large biomass and efficient carbon fixation pathway. Through the application of biotechnology, novel value-adding products can be produced in sugarcane. This study was conducted to determine whether the galactomannan polymer from guar (*Cyamopsis tetragonoloba*) can be produced in sugarcane. The expression of exogenous Mannan Synthase and Galactosyltransferase resulted in sugarcane callus that produce the galactomannan polymer. This research indicates that sugarcane indeed has great potential as a bioreactor for the production of novel products.

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A comparative floristic analysis of peri-urban and rural homegardens in Zululand, South Africa

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The Zulu *muzi* (homegarden) is an indigenous knowledge system. However, there is a widely held notion that gardens of indigenous cultures are spontaneous and disorganized. This reconnaissance survey considered this by comparing peri-urban

and traditional rural homegardens in Zululand to (1) assess the useful-plant diversity, (2) determine the origin of the species (alien or indigenous), (3) examine the different use categories, and (4) document the positions of plants in indigenous gardening systems. We conducted a survey of 40 *muzis* selected from eight locations along an urbanisation gradient in north-eastern KwaZulu-Natal. A total of 149 useful plant species belonging to 72 plant families were recorded, comprising 91 medicinal, 32 food and 26 spiritual plants. Most of these species (68%) are indigenous (semi-wild domesticates), while the rest (32%) are aliens (naturalized and cultivated exotics). The ten most dominant plant species (50-65% frequency) were the fruit trees *Hyphaene coriacea*, *Mangifera indica*, *Persea americana*, *Psidium guajava* and *Vangueria infausta*, the crops *Cucurbita pepo*, *Ipomoea batatas* and *Zea mays*, and medicinals *Bidens pilosa* and *Catharanthus roseus*. A comparison between rural and peri-urban gardens revealed that rural gardens have a higher mean species richness (26 compared to 17), and 35% of the taxa are alien in contrast to the 44% of peri-urban gardens. Nearly 78% of the plants from the peri-urban homesteads were cultivated, whereas 46% of the species from the rural gardens occur naturally (54% cultivated). For instance, the third most dominant species in rural gardens is *Sclerocarya birrea* (marula), an indigenous fruit tree (80% of gardens). No significant difference was evident with regard to different use categories. Homegarden floras are collectively planted and positioned according to cultural practices passed down generations. This results in a common layout plan which is repeated in the gardens of rural areas, but is absent from the peri-urban areas.

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Isolation of rhizobia from *Lebeckia* species indigenous to South Africa and their nodulation properties on *Lebeckia* and the promiscuous legumes cowpea and siratro

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The genus *Lebeckia* (family *Leguminosae*, tribe *Crotalarieae*) contains close to 35 shrubby and herbaceous legume species native to the Western Cape region of South Africa. Members of this genus typically have spiky yellow pea-flowers and are divided into five sections based on growth habit and leaf shape. The shrubby trifoliate-leaf species are included in the sections *Viborgioides, Calobota* and *Stiza* and herbaceous needle-leaf species in the sections *Lebeckia* and *Spira*. Many *Lebeckia* species are recognized as valuable forage plants and, like most other legumes, *Lebeckia* species also form symbiotic relationships with rhizobial bacteria that fix atmospheric nitrogen in root nodules. Any effort to exploit these plants for agricultural purposes would therefore require knowledge of the specificity of *Lebeckia* for their rhizobial symbionts. As a first step towards this goal, the nodulation specificity of the rhizobia associated with ten *Lebeckia* species representing three sections (*Calobota*, *Stiza* and *Lebeckia*) and the two growth habits were studied. Seventy nine rhizobial strains were isolated, after which their nodulation abilities were confirmed on their homologous hosts and the promiscuous legumes cowpea and siratro. These tests suggested some degree of specificity, as 56% of the strains were effective on cowpea and 77% on siratro, while all effectively nodulated their homologous *Lebeckia* hosts. The nodulation specificity was even more evident from the results of cross-inoculation studies where rhizobia isolated from shrubby *Lebeckia* species were not able to effectively nodulate suffrutescent *Lebeckia* species and *vice versa*. Root nodules were formed when rhizobia from *Lebeckia* species with a specific growth habit were inoculated onto other species with the same habit, but nodulation was most effective when rhizobia from a specific section were inoculated onto other members of that section. These results suggest that the apparent specificity between the two symbiotic partners will complicate commercial inoculation of these legumes.

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Short term impact of commercial Cape honeybee (*Apis mellifera capensis*) colony congregations on invertebrate flower visitors within a near pristine Fynbos habitat in the Cape Floristic Region

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The Western Cape has the most well-developed large-scale apicultural practice in South Africa as a result of the great demand for pollination services by the region's extensive agricultural production of deciduous fruit and other crops that are dependent on pollination services for the improvement of the quality and quantity of the produce. However, the amount of available bee forage is the main limitation to the number of managed honeybee (*Apis mellifera*) colonies that can be sustained in the Western Cape. *Eucalyptus* trees, especially *Eucalyptus grandis* or the Sugar Gum, provides the most adequate forage for large numbers of honeybees. Unfortunately, *Eucalyptus* is targeted by the aggressive alien clearing done by the Working for Water programme that was initiated in 1995. This challenges beekeepers to seek alternative forage, either in the form of planting their own *Eucalyptus* plantations under permit or by making an effort to gain access to remaining unutilized fynbos habitat. The impact of commercial congregations of managed honeybee colonies on other floral resource-dependent species in the Cape Floristic Region is unknown. Numerous studies have been done on the impact of *A. mellifera* subspecies