In the Cape flora, pollination by rodents is well known in the Proteaceae and has recently been documented in the Ericaceae. *Erica lanuginosa*, a Klein River Mountains (southern Overberg) endemic, has unusually acorn-shaped flowers that do not look like those of a typical *Erica*: the sepals are downy, coloured reddish brown; the lobes of the corolla, which are also covered with fine, soft hairs, are tightly pressed together at the tips to form a sharp “beak” and are split almost to the receptacle, where the angle between them bears a short triangular tooth. These unusual floral traits suggested the possibility of rodent-pollination in this species. Digital camera traps recorded fourteen images of rodents visiting flowers on seven separate days. PVC gutter traps were then used to capture rodents and their scats were examined for the presence of pollen. Dropping samples were crushed and vortexed to separate heavier faecal matter from the lighter pollen which were stained using fuchsin red. Pollen tetrads typical of Ericaceae were observed in droppings of Acomys subsinuus using a compound microscope. Flowers of *E. lanuginosa* covered with pollinator exclusion bags set no seeds while the proportion of open, control flowers that set seed was high indicating that pollinators are important for seed set in *E. lanuginosa*. Additional bagged flowers were either self- or cross-pollinated artificially and show that *E. lanuginosa* is self-compatible.

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Biological activity of Ochna species

Phytochemistry Programme; and
Section Pharmacology and Toxicology, Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa
Toxicology and Ethnoveterinary Medicine, Food, Feed and Veterinary Public Health, ARC-Onderstepoort Veterinary Institute, Onderstepoort, South Africa

Ochna species are traditionally used by the Zulu tribe of South Africa for the treatment of dysmenorrhea, fertility problems, diarrhoea, haemorrhoids, stomach pains and gangrenous rectitis. The antibacterial activity and number of antibacterial compounds of the acetone leaf extracts of *Ochna natalitia*, *O. pretoriensis*, *O. pulchra*, *O. gamostigmata*, and *O. serulata*, against *Staphylococcus aureus*, *Escherichia coli*, *Enterococcus faecalis* and *Pseudomonas aeruginosa* were determined using the serial dilution microplate assay and bioautography respectively. The cytotoxic effects of the extracts and selective index values were also determined in monkey kidney cells (Vero), human hepatocellular carcinoma cells (HepG2) and bovine dermis cells using the MTT assay. Furthermore, their potential mutagenic effects were determined using the Ames test (*Salmonella typhimurium* TA98 and TA100). Bioautography showed that each extract had at least 1 antibacterial compound and *O. gamostigmata* had at least 4 active compounds. The MIC values of the five extracts ranged from 39 to 1250 μg/ml. The IC50 values of the extracts ranged from 26 to 99 μg/ml. All the plant extracts had low selective index values (SI) with SI ≤ 1.3. This is a clear indication of non-selective toxicity i.e. extracts are toxic to bacteria as well as mammalian cell lines. Two antibacterial ochanavolines were successfully isolated following bioassay-guided fractionation. The MIC values of the two compounds ranged from 31.3 to 125 μg/ml with selectivity index values ranging from 1.29 to 5.18 against monkey kidney cells. None of the plant extracts and compounds was mutagenic in *S. typhimurium* TA98 and TA100 (mutagenic index values ≤ 1.59 for TA98 and ≤ 0.92 for TA100). As a result of non-selective toxicity, the extracts may have limited application as ingestible/intravenous therapeutic agents. It may be useful to evaluate acute toxicity in animal studies because cellular toxicity does not always equate to in vivo toxicity.

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Genetic and floral variation in two closely related Jumella spp. (Orchidaceae) in Mascarene Islands

B. Mallet, S. Dafreville, L. Blambert, T. Pailler, L. Humeau
UMR C53 Peuplements Végétaux et Bioagresseurs en Milieu Tropical, Université de La Réunion, 15 av. René Cassin, 97715 Saint-Denis cedex 9, France

Conservation strategies may not be effective when there are taxonomic confusions within a group of close related species, creating difficult for field biologists to identify the functional biological entities. This is the case of two sister species of orchids endemic to Réunion and Mauritius (Mascarene Islands) *Jumella fragrans* (Thouars) Schltr. and *Jumella rossii* Senghas. They are both known as “Faham” and usually named *Jumella fragrans*, causing taxonomic mix-up and hindering the protection of the species. This study aimed to clarify the taxonomy of “Faham” using a biometric approach at population scale and a population genetics approach. Ten floral characters were measured for 161 individuals collected from ten natural populations. Population genetics were performed for 584 individuals from 20 natural populations representative of the altitudinal range of “Faham” using 13 nuclear microsatellite markers. Spur length was found to be the most useful floral character to distinguish *J. rossii* and *J. fragrans*. Multivariate analysis on genetic pairwise distances between individuals reveals a clear separation between the two species. In terms of conservation, the first recommendation is to recognize the application of the names *Jumella fragrans* and *Jumella rossii*. Moreover, *J. fragrans* should be classified as Vulnerable as per IUCN Red List category, and adoption of a protection status is recommended.

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Micropropagation of *Helichrysum populifolium*, which produces medicinally active dicaffeoylquinic acid derivatives

C.M. Martin, A. Veale, H.M. Heyman, B.G. Crampton
Department of Plant Science, University of Pretoria, Pretoria 0002, South Africa

The consumption of food and drinks high in phenolic compounds, is associated with good health and lowers the risk of serious health disorders. *Helichrysum populifolium* is a South African shrub high in phenolic compounds such as dicaffeoylquinic acids, or derivatives thereof. Extracts of *H. populifolium* have been previously shown to exhibit antiviral activity. Large scale isolation of the medicinally active dicaffeoylquinic acid from the plant is challenging since the plant is difficult to cultivate. The aim of this experiment was to establish and optimize an in vitro micropropagation technique for *H. populifolium* using leaf discs as the starting material. Leaf discs were sterilised in 1% ethanol followed by a 2% sodium hypochlorite solution with 1 drop of Tween-20® and finally washed thoroughly in
Sterile distilled water before being placed on Murashige and Skoog (MS) tissue culture media supplemented with phytohormones. The phytohormones α-naphthaleneacetic acid (NAA) and thidiazuron (TDZ) were tested in combination at different concentrations to induce cell differentiation and shoot formation. Shoots were optimally produced in the dark on MS media with 10.74 µM NAA and 4.43 µM TDZ. Rooting could be induced from elongated shoots by adding indole butyric acid (IBA) to the MS media. Plantlets produced were successfully acclimatized in either Jiffy-7® pellets or a 1:1 mixture of vermiculite and potting soil. The availability of clonal *H. populifolium* material will enable the testing of active dicaffeoylquinic acid derivative production under different environmental conditions.

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The chemical basis of specialization in a pollination system

F. Martos, B. Bytebier, S.D. Johnson
School of Life Sciences, University of KwaZulu-Natal Pietermaritzburg, Private Bag X01, Scottsville 3209, South Africa

During angiosperm evolution, plants evolved floral signals that target the sensory systems of specific groups, or even species, of animals, thus enabling the development of specialized mutualisms. Whereas the majority of these systems are mutualisms in which pollinators are rewarded, a subset of plants exploit the sensory responses of animals by deploying attractive signals without offering floral rewards. A challenge for ecologists is to determine the functional basis of specialization in these systems, and this can only be achieved if we manage to understand the sensory preferences of the insect visitors. Here, we present our latest field experiments on a new deceptive pollination system that targets the sensory systems of drosophilid flies through olfactory mimicry of fermenting fruits. In this system, the flowers of the tropical orchid *Gastrodia similis* release a simple mixture of ester volatiles during the day, thus attracting a narrow subset of the drosophilid flies present in the habitat. By carrying out thorough tests on the olfactory response of these drosophilid flies in natura, we reached an original, comprehensive insight into the chemical basis of specialization in this pollination system.

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Scientific investigation of the anti-HIV properties of a South African medicinal plant

P.F. Mbokela, G. Fouche, C. Kenyon, V. Maharaj, P. Pillay, X. Peter, N. Van der Berg
Council for Scientific Industrial Research (CSIR), Biosciences, Natural Product Chemistry, Meiring Naude Road, Brummeria East, P.O. BOX 395, Pretoria 0001, South Africa

The HIV-1 pandemic affects millions of people worldwide with approximately 70% of those affected residing in sub-Saharan Africa. The majority of those infected in this region rely on traditional medicines for treatment and alleviation of opportunistic infections and symptoms. CSIR’s collaboration with Traditional Healers on the use of medicinal plants in South Africa led to the identification of a plant used in the Eastern Cape for the treatment of HIV. A scientific investigation of this plant identified a macromolecule with anti-HIV properties. The nature of the natural product and its mode of action identified it as a potential microbicide. Current efforts are focused on optimizing the production and fully characterizing the compound. Formulation studies and pre-clinical evaluations are being conducted in collaboration with local and international partners. The development of an effective female-controlled, safe and acceptable microbicidal gel to prevent sexual transmission of HIV could play a major role in the world-wide reduction of the estimated 14 000 new HIV infections per day.

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Effects of *Helinus integrifolius* (Lam.) Kuntze crude leaf extract on ruminant gas production and fodder digestibility

B. Mdaka, P.W. Mokwala
Faculty of Science and Agriculture, School of Molecular and Life Sciences, Department of Biodiversity, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa

A crude saponin leaf extract from *Helinus integrifolius* was examined for its effect on ruminant gas production and fodder digestibility. The saponin-rich root extract of this plant was found to reduce gas production by yeast cells hence the leaf extract was examined to establish whether it contains active secondary metabolites (saponins) of similar activity. Powdered dry leaves were defatted by overnight Soxhlet extraction in n-hexane. The crude saponin extract was prepared by overnight Soxhlet extraction in methanol. A positive froth test on the extract indicated the presence of saponins. The reaction mixture consisted of MacDougall’s buffer, “fresh cow faeces” inoculum and ground dry fodder. The mixtures were incubated for 96 h at 39 °C in a water bath and the gas emitted collected in an inverted burette. The crude leaf extract inhibited gas emission at a concentration of 16.0 mg/ml. The extract concentration that inhibited gas emission resulted in more fodder digestion. This indicates that the plant extract has a potential in the reduction of gases by ruminants and as the concentration increases fodder digestibility is enhanced.

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Seed dispersal distances by frugivorous birds in the Cape Floristic Region: Predicted distances and movement distributions from ring-recapture records

T.M. Mokotiomiela<sup>a,b</sup>, C.F. Musil<sup>b</sup>, K.J. Esler<sup>b</sup>
<sup>a</sup>Climate Change and Bio-Adaptation Division, Private Bag X7, Claremont 7735, South Africa
<sup>b</sup>Department of Conservation Ecology and Entomology & Centre for Invasion Biology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

Knowledge of seed dispersal distance by frugivorous birds has important implications on distribution and invasion of fleshy-fruited of alien shrubs in the Cape Floristic Region (CFR). For 10 bird species most frequently foraging on fruits of the indigenous *Chrysanthemoides monilifera*, *Olea europaea* subsp. *africana*, and invasive *Lantana camara* and *Solanum mauritianum* in CFR, we computed mean dispersal distance as a product of seed gut-retention time and flight speed predicted from body mass (using vector-based model), and plotted dispersal curves of their movement distributions derived from bird ring-recapture frequency. We also computed relative seed rain as product of movement frequency and number of seeds ingested per day for three bird species *i.e.* *Zosterops palidus*, *Pycnonotus capensis* and *Collis striatus*. Long mean distances ranging