South Africa has one of the most diverse temperate flora in the world, with more than 30,000 species of higher plants, 3000 of which are utilized for medicinal purposes. Plants historically served as a rich source of medicines and continue to form the basis of traditional medicine systems. Traditional medicine is widely used in South Africa for various infectious diseases such as malaria, tuberculosis and fungal infections. The emergence and spread of drug resistant malaria parasites has highlighted the need for new chemically diverse, effective drugs. One of the major sources of antimalarial agents and novel template compounds is higher plants. This study describes the investigation of one of South Africa’s medicinal plants, Warbugia salutaris as a source of antiplasmodial hit compounds. The initial screening of the leaf extract of Warbugia salutaris showed that the ethanol extract possessed in vitro antiplasmodial activity with an IC50 value of 1.9–2.4 μg/ml. Bioassay-guided fractionation using a combination of chromatography techniques yielded an active sesquiterpene lactone. The isolated compound displayed in vitro activity against chloroquine sensitive strain D10 (IC50 = 0.9 μg/ml) and chloroquine resistant strains K1 (IC50 = 1.2 μg/ml) and RSA11 (IC50 = 0.96 μg/ml) of P. falciparum. The compound showed very low in vitro cytotoxicity against a mammalian cell line (CHO) and human epithelium cell line (Hela) (IC50 = 32.1 μg/ml). The structure elucidation of the compound was achieved using high-resolution mass spectrometry and 2D nuclear magnetic resonance spectroscopy. Interestingly, this compound was found to have no antimicrobial activity against Mycobacterium aurum, Staphylococcus aureus, Escherichia coli and Candida albicans, yet a structurally related compound isolated from the same plant has been found to possess good anti-bacterial activity but no antiplasmodial activity. These findings facilitated identification of active functional groups specific to each microorganism.

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Competitive relationships between grass and leaf succulent shrub at the ecotone between arid grassland and succulent shrubland

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The objective of this study was to investigate the nature of interactions between Stipagrostis brevifolia, a perennial C4 grass and Ruschia robusta, a facultative CAM leaf succulent shrub, the two codominant species along the ecotone between Bushmanland arid grassland and Namaqualand succulent shrubland. Nearest-neighbour analysis was used to examine the competitive interactions between S. brevifolia and R. robusta in mixed communities along the ecotone. Regressions between the sum of sizes of nearest-neighbour comparisons and the distance between them showed significant positive correlations for S. brevifolia and R. robusta, indicating the presence of competition. Intraspecific competition in both of these species was stronger than interspecific. There was a stronger relationship between the size of R. robusta and the distance from S. brevifolia, than between the size of S. brevifolia and the distance from R. robusta, indicating that grass exerted a stronger competitive force on the succulent R. robusta shrub than R. robusta on S. brevifolia.

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Pollination by spider-hunting wasps (Hymenoptera: Pompilidae) with special reference to Pachycarpus asperifolius (Apocynaceae) in KwaZulu-Natal, South Africa

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Aside from the classic fig and fig wasp pollination system, pollination by wasps is not well documented and mostly involves sexual deception systems in orchids. Several species in the Apocynaceae, Orchidaceae and Hyacinthaceae were observed to be pollinated primarily by pompilid wasps belonging to the genus Hemipepsis. Within the asclepiad genus Pachycarpus, there appears to be some form of specialization for pollination by these pompilid wasps. The pollination and breeding system of Pachycarpus asperifolius was investigated to determine the degree of ecological and evolutionary specialization of this species for pollination by pompilid wasps. Hand pollinations showed that P. asperifolius is genetically self-incompatible and thus reliant on cross-pollination for seed production. Observations of flower visitors and cage experiments showed that P. asperifolius is pollinated exclusively by Hemipepsis capensis, H. hilaris and H. dedjas. Pollinaria are attached and transported on the palps of visiting wasps, and the palps are frequently broken off between guide rails or when the pollinia are inserted. To try and understand why P. asperifolius flowers are visited almost exclusively by wasps, we analyzed scent and conducted nectar palatability experiments with honeybees. In the scent analysis, gas chromatography–electroantennographic detection (GC–EAD) revealed several active compounds, with 3,5 Dimethoxystyloene giving the strongest response. In the nectar experiments, we presented droplets of nectar and control sugar solutions of the same concentration (c. 70%) to honeybees (Apis mellifera scutellata). Honeybees readily consumed the sugar solutions, but rejected P. asperifolius nectar, suggesting that secondary compounds in P. asperifolius nectar may deter insects other than pompilid wasps. It was concluded that P. asperifolius is specialized for exclusive
pollination by pompilid wasps. A number of other asclepiad species appear to be specialized for pollination by these wasps. Further studies could ultimately lead to the formal description of a pompilid wasp pollination syndrome in South African grassland plants.

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The genus *Oxalis* in South Africa and its special approach to heterosty

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Currently there are six types of heterosty described in different families of flowering plants. They are all believed to promote out-crossing and thus avoid inbreeding. The genetics and inheritance of these systems are very complex and have been assessed in many studies. A form of heterosty, known as tristyly, has been recorded in about 5 angiosperm families, including the genus *Oxalis* in the Oxalidaceae. The state of tristyly expression has been studied for various American *Oxalis* species, and this has shown breakdown in different aspects of the system. Very little is known about tristyly expression among southern African (SA) members. The most recent taxonomic revision of SA very generally states that all species are believed to still be morphologically tristylos, but no in depth study of this has been undertaken. The present study investigates tristyly expression among selected southern African species through an assessment of morph morphology, population structure and self-incompatibility testing. Results show deviations in floral morphologies, the isoplethic equilibrium of morph representation in different populations and/or a breakdown of the self-incompatibility system in various species.

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Alien grass infestation in renosterveld fragments: Effect on threatened life-history types and potential controls

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Alien grasses are thought to pose a significant threat to the growth and survival of indigenous species. Within the Cape Floristic Region, there is concern surrounding the establishment of alien grasses in renosterveld fragments. This study aimed to determine the impact of alien grass infestation on the life history type of *Moraea tulbaghensis*, a threatened geophyte endemic to renosterveld. *Moraea tulbaghensis* was found to be unaffected by varying densities of alien grass infestation. A second aspect of this study attempted to evaluate potential control methods for alien grasses that would not detrimentally affect indigenous species. Organic amendments in the forms of woodchips and sugar were applied to the alien grass *Lolium multiflorum*, and the endemic threatened species *Lampranthus filicaulis* and *Moraea tulbaghensis*. Additional nitrogen was applied to particular treatments in order to gauge the various responses of alien and indigenous species to nitrogen enrichment. Organic amendments were found to be ineffective in controlling germination and growth of *Lolium multiflorum* over 5 months, whilst nitrogen enrichment significantly enhanced its growth. *Moraea tulbaghensis* was unaffected by all treatments, and *Lampranthus filicaulis* was found to respond positively to nitrogen addition. These findings suggest that alien grass threat may vary according to life