The African potato (*Hypoxis hemerocallidea*): a chemical–historical perspective

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We trace the history of the usage of *Hypoxis* extracts from the 1960s to the present time. In particular, we follow the fortunes of the principal active component, rooperol, in detail from its isolation in 1980 to the role it now occupies in a variety of over-the-counter preparations. We also highlight the controversy regarding its use as an effective agent for treating HIV/AIDS and cancer. Despite strong opposition to its claims from some quarters, we believe that the use of *Hypoxis* extracts has a future.

**Introduction**

In September 2004, it was 25 years since the chemical constituents in *Hypoxis hemerocallidea* Fisch.Mey. & Ave-Lall. (syn. *H. rooperii* T. Moore) (the African potato) were first examined in detail. Since that time, and particularly in the last five years, this plant has become a household name for many South Africans. It is possibly South Africa’s best-known *muthi* (medicinal) plant. Its most prominent promotion in the public domain was given to it by the utterances of the South African minister of health, who advocated that a combination of African potato, garlic and olive oil should be included in the daily diet of HIV and AIDs patients. In Mpumalanga, KwaZulu-Natal and Gauteng the trade in *Hypoxis* is very much less. Dold and Cocks speculate that this discrepancy can be attributed to differences in healing practices among various ethnic groups, as well as the availability of the plant species in different parts of the country. (See also the later discussion under ‘Factory-scale preparation’).

**Early beginnings**

Many aspects of the *Hypoxis* plant, such as classification, distribution, habitat, etymology and horticulture, have been described in a comprehensive article by Singh. The epithet *Hypoxis* was coined by Linnaeus in 1759 from the Greek words *hypo* (‘below’) and *oxy* (‘sharp’), which refer to the fruit, which is pointed at the base. In isiZulu the plant species *H. hemerocallidea* is mainly called ‘inkomfe’ or ‘ilaluthaka’ and its usage dates back many generations. In present-day South Africa, the plant is invariably referred to as the ‘African potato’. This remains the case, although the underground portion does not resemble a potato and is indeed a corm (a swollen stem of several nodes and nodules).

The story of *Hypoxis* as a commercial product goes back to 1967, when R.W. Liebenberg, an entrepreneur from Midrand, north of Johannesburg, became interested in the chemical constituents of *Hypoxis rooperii* (now considered synonymous with *H. hemerocallidea*). With the assistance of Karl Pegel (a chemist then at the University of Natal, Durban) a commercial product, *Harzol*, was launched in 1974 and subsequently gained wide acceptance in Germany. *Harzol* consisted of a combination of β-sitosterol and its glucoside. The glucosides were originally obtained from the *Hypoxis* plant. *Harzol* was used to treat benign prostate hypertrophy and its action was ascribed to inhibition of 5α-reductase or to diminished binding of dihydrotestosterone within the prostate. The current trade in *Harzol* is not known, but it is small.

**The birth of hypoxoside and rooperol**

The first author’s initial contact with the *Hypoxis* plant dates back to September 1979, when Liebenberg, as chairman of the chemical company Essential Sterolin Products (ESP), presented him with two large *Hypoxis rooperii* corms. Liebenberg firmly believed that the plant had considerable medicinal potential. At this stage the plant was known to contain β-sitosterol and its glucosides, in common with thousands of other plants and, in particular, fresh vegetables. Based on his own experiences, Liebenberg was convinced that the *Hypoxis* corms had anti-cancer properties.

The wheels were set in motion to study in-depth the chemistry of the *Hypoxis* plant in the Warren laboratories of the Chemistry Department of the University of Natal in Pietermaritzburg. On 1 August 1980, Alida Hall, an M.Sc. graduate from David Roux’s group in Bloemfontein, started work as the first author’s research assistant. For the princely sum of R500 per month she collected corms, ground them up, extracted them, and separated the components on very long chromatography columns. It was

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**Fig. 1.** The African potato has featured in the popular press, as shown by this cartoon that appeared in the *Sunday Times* (Johannesburg) of 15 February 2004. (Published with permission of Jonathan Shapiro, ‘Zapiro.’)
soon clear that the plant contained a phenolic fraction (7.3% of the wet plant material), which was extremely rich (up to 54%) in a particular phenolic compound. On 18 December 1980, five months after the start of operations, the pure crystalline compound was laid on the table. It was designated P₂A with the systematic name of: 4',4'-di-O-β-D-glucoside of (E)-1,5-bis-(3',4'-dihydroxyphenyl)pent-4-en-1-yn (1). It was an impressive achievement that with only a 60-tesla NMR instrument available in the department, it had been possible to unravel the structure. The pent-4-en-1-yn moiety was previously unknown in nature and P₂A represented something special! The sponsors of the project (ESP) were delighted and Mrs Hall received a special bonus.

As a result of the great interest in the newly discovered properties of rooperol, the team working on the Hypoxis project was enlarged. Thus, Pegel, B.C. Rogers (University of Durban-Westville), Hans Kundig (a pharmacologist in the employ of ESP) and Hannes van Staden (University of Natal, Pietermaritzburg), a specialist in tissue culture propagation, were all taken on as consultants by ESP.

Numerous trials (mainly on mice), carried out by Kundig on ethanolic extracts of Hypoxis and also on the pure compounds (1) and (2) pointed to the fact that the rooperol was indeed the active component which killed cancer cells. The next step was to take out a provisional patent on the discovery and action of (1) and (2). This was done with the assistance of Ian Morrison of the Durban legal firm Spoor and Fisher (as it was called at the time).

**Patenting and publication problems**

On 19 April 1982, a U.K. patent (GB 2120650A) was filed with Pollack Mercer and Tench of High Holborn House, London, under the names of the first author and R.W. Liebenberg. The application was to patent ‘Rooperol derivatives, being organic compounds comprising a C-5 carbon chain having at least one of the end carbons in the chain joined by a double or triple bond’. In describing the field of invention, specific reference was made to the fact that ‘the compounds also show important properties in relation to the treatment and prevention of cancerous conditions and leukaemia’.

Having dealt with the problem of patent protection, the first author felt strongly that the important findings should be written up for publication in the scientific literature. The ESP directors considered, however, that one should not ‘jump the gun’ and publication was delayed.

**The bombshell — August 1982**

The July issue of the journal *Tetrahedron* arrived in the Pietermaritzburg library in August 1982, and there it was, in black and white: ‘Hypoxis, a new glucoside of uncommon structure from *Hypoxis obesa* Busch.’ The authors were a group working under the leadership of G.B. Marini-Bettolo, from the University of Rome, and they had stolen our thunder. Their hypoxoside was none other than our compound P₂A, which we had characterized in December 1980. Amid all the disappointment, we could console ourselves with two observations: 1) Marini-Bettolo proposed a chemical structure of hypoxoside identical to ours for P₂A. 2) There was no mention in the Marini-Bettolo article of any biological activity, nor of that of its hydrolysate product, which we had named rooperol.

The directors of ESP held a crisis meeting where they proposed a meeting with the Italian group. On Friday 28 October 1982, therefore, a delegation of five (the first author, Liebenberg, Morrison, Pegel and Roelf van Heerden) jetted out of Johannesburg for Rome. Professor Marini-Bettolo received us most graciously and over the weekend some crucial negotiations were concluded in an honest and friendly spirit. Having dealt with the serious matters of confidentiality, Marini-Bettolo related to us how his work on *Hypoxis* started. He had been on a short visit to Mozambique in February 1981, and had driven to the airport for his return to Rome. Being somewhat early for his flight, and with security a little slack, he wandered around the airport grounds and noticed some bulbous plants being peddled alongside the runway. Ever the alert natural-products chemist, he purchased three of the hairy bulbs and slipped them into his briefcase. And so unfolded the story of Ian Morrison of the Durban legal firm Spoor and Fisher (as it was called at the time).

**Attempted total synthesis of rooperol and its analogues**

During the period 1982–88, literally hundreds of analogues were synthesized in Pietermaritzburg and several other patents were lodged, for example UK Patent No. 8211293 (19 April 1982) and US Patent No. 4644085 (17 February 1987). Permission was finally also granted to the ‘Maritzburg team’ to publish openly its findings on rooperol. This was a comprehensive paper with several M.Sc. students (A. Hall, U. Upfold and R. Learmonth), who had joined the first author from 1982 onwards.

The decision to prepare analogues of rooperol, as the next step in the investigation, was based on the following considerations:

1. That a compound, simpler than rooperol, but with the same or better activity might be found.
2. Knowledge about the activity, or lack of it, would enable the ESP team to write an all-encompassing patent which would not readily be infringed by outside competitors.
3. Since the isolation of hypoxoside (and rooperol) from natural sources was probably not viable on a large scale, synthesis of these two compounds was regarded as a high priority, since superficially the structures looked relatively simple. It was
only realized subsequently that this was a simplistic view.

vi) While the above considerations appeared logical at the time, with the advantage of hindsight it would probably have been far better to have proceeded with more comprehensive anti-cancer tests on rooperol as early as 1982. Also, with judicious marketing, the first author is of the opinion that an international sponsor would have advanced the project at a much greater pace, and possibly in a different direction, from the one described above.

Our attempts at the synthesis of rooperol were successful in obtaining the tetramethoxy derivative from compound (3) (Scheme 2) but the demethylation step (to rooperol) proceeded in only low yield. The tetramethoxyrooperol (4) was inactive against a variety of cancer cells. This observation clearly indicated that the free hydroxyl groups on the benzene rings played a role in the overall activity.

A simple derivative with good activity, despite its lack of hydroxyl groups, was compound (5). However, it was extremely toxic, probably as a result of the carbonyl group, and had to be discarded. Its synthesis, which illustrates a particular strategy for linking the two benzene rings, is shown in Scheme 3.

The challenge of preparing analogues of rooperol also provided an opportunity to investigate the scope of new synthetic procedures which had appeared in the literature from the early 1970s. One of these reactions, now known as the Baylis-Hillman reaction (first patented in 1972), presented a new procedure which had gone unnoticed for 10 years as a result of being unappreciated in the patent literature. The new reaction involved the generation of novel C–C bonds by ingenious generation of a reactive carbanion. The first author was one of the first to draw attention to the great scope of the Baylis-Hillman reaction. It was used to prepare analogue (6) (Scheme 4). While compound (6) was a novel derivative, obtained by innovative synthesis, it proved to be inactive.

Considerably more active than (6) but not matching rooperol itself, was compound (7), produced by a different coupling procedure (Scheme 5).

While literally hundreds of analogues of rooperol were prepared in the first author’s laboratory, under sponsorship of ESP, not one of these had the specific anti-cancer properties of rooperol.

Following the two initial publications on rooperol, other pentenynes were reported from nature. These include nyasaside, nyasicoside, mononyasine A and B, from H. nyasica Bak., as well as interjectin from H. interjecta Nel, all emanating from Marini-Bettolo’s group in Italy. In all these examples the compounds possess the pent-1-en-4-yne ‘backbone’, or an obvious modification of it. Some of the analogues synthesized by the Maritzburg group were similar to the above natural compounds but none was identical.

Studies on the metabolism of a wide range of phenolic pent-1-en-4-yne analogues in mammals have confirmed that the pattern of phenolic substitution has an influence on the metabolic pathway followed. It is also of interest to note that one feature of the structure of rooperol has not drawn comment until now: In rooperol the CH2 group is located between two non-identical moieties (8), and the two protons are termed prochiral. This feature allows rooperol to interact in a very specific way with a receptor. If this interaction involves one of

![Scheme 2](image2.png)

**Scheme 2.** Synthesis of tetramethyl rooperol.

![Scheme 3](image3.png)

**Scheme 3.** Synthesis of analogue (5).

![Scheme 4](image4.png)

**Scheme 4.** Synthesis of analogue (6) using the Bayliss-Hillman route.

![Scheme 5](image5.png)

**Scheme 5.** Synthesis of alcohol analogue of rooperol.
the two protons on the CH₂ group, a chiral intermediate results. It is well known that many bioactive compounds require at least one chiral centre to express their activity. This is an aspect of the particular structure of rooperol which has not been considered previously.

The main reason why synthesis of rooperol, or a closely related analogue, has met with little success is that coupling of the two halves of the molecule invariably proceeds via ‘partners’ with protected phenolic groups. Under these conditions the initial coupling occurs satisfactorily but on de-protection (under base conditions) the pentenyl system undergoes re-arrangement as follows:

\[
R^*-C=C-C-C=C-R^* \xrightarrow{\text{base}} \ R^*-C=C-C=C=C-R^*
\]

(where \(R^*\) and \(R^*\) are phenolic moieties)

### Biological activity and uses of Hypoxis extracts

1. **Cell-growth inhibitory activity**

‘Rooperol, when tested as a pure chemical, caused 50% inhibition of mouse BL6 melanoma cell growth at 10 µg/ml. This statement comes from a publication by Albrecht and co-workers in the Department of Pharmacology at the University of Stellenbosch. This is where all the work on the ‘activity’, as opposed to the earlier ‘chemistry’, moved on to from about 1985 onwards.

Additional findings in the above paper reveal that rooperol metabolites (sulphates and glucuronides), isolated from human urine, were non-toxic to BL6 melanoma cells in the culture up to high concentrations (200 µg ml⁻¹). However, in the presence of β-glucuronidase (which releases the rooperol from the metabolite), 50% growth inhibition was achieved at a 75 µg ml⁻¹ metabolite concentration. The authors conclude that rooperol has promising properties as an oral pro-drug for cancer therapy in humans.

2. **Pharmacokinetic behaviour of hypoxoside in lung-cancer patients**

A group of seven medical researchers carrying out studies on lung-cancer patients at Tygerberg Hospital outside Cape Town was unable to detect either hypoxoside (1) or rooperol (2) in the bloodstream following administration of the two compounds. This is consistent with the observation (1) above that both compounds are converted into specific metabolites. In order to reach tumouricidal rooperol concentrations, it was found that metabolite serum concentrations needed to be in the order of 100 µg ml⁻¹. This could be achieved (for most patients) by administering a daily dose of 2400 mg of plant extract (that is, 4 capsules 3 times a day).

3. **Toxicity studies on hypoxoside when used as a pro-drug for cancer therapy**

In this study, 24 patients with lung cancer took part in a phase 1 trial. The principal conclusions of the trial are that short- and long-term therapy (up to 5 years) with relatively high doses of hypoxoside plant extract (see (2) above), did not result in any obvious toxic effects. Of the 24 patients, 19 survived for an average of 4 months with progression of their primary tumours and metastases, whereas five survived for more than a year. One of these lived for five years and histological examination of the primary lesion showed the absence of cancer. One should also bear in mind that the traditional use of the Hypoxis plant goes back a long time. This in itself constitutes a form of clinical trial, since evidence of toxicity would have led to its abandonment by traditional healers long ago. ‘Clinical trial’ is used here in a guarded sense, since it is accepted that toxicity is always dose-related. It is of interest to note that Vahrmeijer, in his book Poisons Plants of Southern Africa, makes no mention of Hypoxis species. It should be noted, though, that Hutchings, in reference to H. colchicifolia Bak., relates how corns are ground and placed in food to kill small vermin.

Having considered the use of Hypoxis extracts, or the application of pure components of the plant, in cancer treatment, what overall conclusions can be drawn? There is no clear-cut answer that can yet be presented. Part of the problem arises from the fact that medical colleagues, involved in various cancer trials, including a phase 2 trial on cancer patients, have a different interpretation of the results relating to the toxicity of the extract and reasons for decreased lymphocyte counts in patients using the extract for extended periods (C.F. Albrecht, pers. comm.).

After the initial euphoria that Hypoxis extracts were the cure-all for all types of cancer, perhaps the words of B.J. Smit, head of Oncology at Tygerberg Hospital, sum up the present situation: ‘There is no specific evidence that the Hypoxis plant treatment eliminated cancer growths, but it does seem to slow down the growth of certain types of cancer.’ (pers. com.)

4. **The effects of Hypoxis extracts on HIV-positive patients**

The HIV/AIDS epidemic and its devastating implications for South Africa is an everyday topic in newspapers, and on radio and television. Since vested interests are at stake, it is not surprising that the usefulness of Hypoxis extracts in the treatment of HIV-positive persons has developed into a highly controversial topic. As a typical example, Singh, a botanist at the Natal Herbarium of the National Botanical Institute, writing in Veld & Flora, says ‘hypoxoside is readily converted into rooperol, a biologically active compound that inhibits the proliferation of certain cancer cells and HIV-1.’ This statement elicited a sharp reply from Bouic, of the Department of Microbiology at the University of Stellenbosch, a member of the consortium involved in the marketing of Moducare (see later). Bouic states that his group has stopped all studies on the Hypoxis plant. Among the reasons given for this decision are the ‘toxicity of some Hypoxis extracts’ and that the extended use of the extracts could lead to bone marrow suppression in some individuals. A more detailed report on the alleged harmful use of Hypoxis extracts is lodged with the Medicines Control Council [MCC Report 26/8/1/2/1 (1017)]. This was in 1996. So far, efforts to obtain a copy of the report have been unsuccessful both via Bouic, and from Essential Sterolin Products that sponsored the research.

In stark contrast to the above is a paper delivered by Albrecht on patients with HIV, who had been given a methanolic extract of H. hemerocallidea over a period of two years. He reports that the CD lymphocyte counts remained remarkably stable, while there was a decrease in serum p24 HIV antigen and a decreased expression of the HLA-DR CD8 lymphocyte activation marker. Albrecht concludes that ‘these studies have demonstrated that rooperol has potent, diverse and important pharmacological properties relevant to cancer, inflammation and HIV’.

In the popular press the controversy continues unabated. One such example is that written by Clarke in a local Sunday newspaper. The article tells of the remarkable recovery of HIV-infected ‘Sylvia’ after she changed to a strictly controlled diet of vitamins, trace elements, protein and some natural extracts, including Hypoxis. In the same paper, Stephen Gunn, a medical doctor in Durban specializing in diets for HIV/AIDS patients, states that both Hypoxis and Sutherlandia extracts, correctly processed, were safe and effective.
Cardiovascular effects of intravenously administered hypoxoside and rooperol

The two compounds were administered separately to Chacma baboons. Careful monitoring indicated that hypoxoside was eliminated without significant conversion to metabolites. Its presence in the blood revealed no cardiovascular effects. By contrast, rooperol was rapidly metabolized (as could be predicted from earlier studies) into several metabolites, of which the mixed glucuronide–sulphate conjugate was the major one. Rooperol caused moderate transient increased cardiac output, stroke volume and vascular pressures without raised heart rate. These observations are consistent with increased myocardial contractility. The long-term effects on the cardiovascular system as a result of rooperol intervention are not known, but this study in the Faculty of Medicine at the University of Stellenbosch is significant as it opens up an unexplored property of rooperol.

Hypoglycaemic effects of Hypoxis extract on rats

This study is a contribution of Ojewole’s group at the erstwhile University of Durban-Westville. Again, it investigated under scientific conditions the effect of Hypoxis extract in a medicinal application known only in indigenous folklore.

Adult, male Wistar rats, both normoglycaemic and hyperglycaemic, were fed chosen doses of Hypoxis hемerocallisidе methanolic extract. Subsequently, blood samples were taken and blood glucose concentrations established. Glibenclamide, an antidiabetic drug, was chosen as reference compound. The plant extract induced maximal reductions in the blood glucose concentrations of normal and diabetic rats and were found to be 35% and 55%, respectively.

For glibenclamide the corresponding values were 46.3% and 68.7% reduction. The authors conclude that the Hypoxis extract undoubtedly possesses hypoglycaemic activity and rationalizes the practice of some indigenous communities in South Africa in their choice of treatment for adult-induced diabetes mellitus.

Rooperol as an anti-oxidant (radical scavenger) in the human body

The effect on ageing in the human body by free radicals is well-established. Certain compounds such as hydroquinone (used in photographic processing) and vitamin E (a radical scavenger in the body) are able to destroy free radicals by chemical interaction.

In addition, it is now generally accepted that the moderate ingestion of red wines can counteract diseases of the heart. The active compounds in the wine are flavonoids, particularly catechin. All these anti-oxidants have a common feature — a 1,4- or 1,2-dihydroxy group. In compounds (9) and (10) the phenolic groups are 1,4 relative to each other. In rooperol the phenolic OH groups are 1,2 relative to each other. The process by which rooperol can ‘eliminate’ a free radical is shown in Scheme 6.

Over-the-counter preparations based on Hypoxis extracts

The following list of preparations is not meant to be exhaustive. It merely illustrates the widespread use of Hypoxis extracts available in South Africa from pharmacies, health shops, supermarkets and open air ‘Sunday markets’. The vial or bottle containing the Hypoxis preparation is commonly labelled with words such as ‘this product has been tried and tested and has lived up to expectations’ or ‘this preparation is an extremely versatile complement to the treatment of a wide variety of diseases and ailments including diabetes, impotency, HIV/AIDS, cancer, arthritis and memory loss’. At present these vague statements are not in contravention of the law, but this is likely change in the future. The increase in consumption of Hypoxis extracts over the past 7 years is undoubtedly the result, to a large extent, of perceived experiences passed on by word of mouth coupled with the ‘true life’ stories found in weekend magazines.

Moducare®

The history of this preparation has been traced earlier. Although the product no longer contains β-sitosterol and its glucoside (100:1 mass ratio) isolated from Hypoxis species, but draws on other sources (pine oil and soya) for its active components, many people still believe that the ‘African potato’ is the source of supply. This misconception is not lessened by the fact that the Moducare® packaging still depicts the ‘sterretjie’ (Hypoxis) flower. Moducare® was initially prepared and marketed by ESP (R.W. Liebenberg’s original firm in Midrand). The present supplier is given as Aspen Pharmacare, Woodmead.

The background to the development of Moducare® as a human immune system booster is a fascinating one. It illustrates how two phytosterols (β-sitosterol and its glucoside), plentiful in most plant extracts, and generally regarded by organic chemists seeking novel metabolites as having nuisance value only, have become important money-spinners. The secret the original researchers uncovered was that the two sterols, in a specific ratio, enhance the in vitro proliferative response of human T cells more than the individual sterols at the same concentration. Also, the in vitro activity of Moducare® in human trials was shown to bring about significant increases (20–920%) in proliferation of T...
cells when compared to baseline values. An important aspect of the stimulation is that the two sterols appear to activate and ‘sensitize’ the immune system. By this procedure they not only stimulate the immune system but they ‘sensitize’ it, helping it to identify correctly what it should, and should not, be destroying. A paper on the subject has been published by Bouic and co-workers.29

Hypo-Plus

This is an OTC product manufactured by Hypo-Plus Naturals (2 Clyde Street, Murrayfield, Pretoria) and is marketed as a food supplement, energy booster and immunity modulator. It contains a range of amino acids, vitamins C, B1 and B6, an anti-oxidant component, plant sterols and ‘variable ratios of *Mopanum vermes* and *Hypoxis*. The manufacturer lists, amongst others, diabetes, impotency, gout, arthritis, HIV/AIDS and memory loss, as illnesses for which Hypo-Plus ‘is an extremely versatile complement’.

Hypoxis extract in capsule form

Preparations of ‘100% extract of *Hypoxis hemerocallidea*’ are readily available via the Internet. The manufacturers involved make a variety of claims regarding the efficacy of their product, including that it is ‘anti-fungal, sedative and detoxifying, also contains rooperol which is both anti-mutagenic and cytotoxic to cancer cells’.

Factory-scale preparation

On the KwaZulu-Natal north coast at Isithebe the firm Impilo Drugs (Pty) Ltd has set up a factory for the production of a variety of indigenous *muliths*. One of the top sellers in the range is ‘Impilo African Potato’ or ‘*ilabathuka*. These preparations are sold in the form of capsules or tablets and consist of the whole *Hypoxis hemerocallidea* plant, which has been milled, freeze-dried and packaged. Current production is about 1.5 tons per month and this will increase to about 3 tons per month in the near future (A. Tully, Impilo Drugs, pers. comm.). The preparation is sold through trading stores, health shops and pharmacies. The label makes no specific claims for the product, since the name *ilabathuka* is well known throughout the province and customers buy it for a wide variety of ailments.

Conclusion

The chemistry of the major constituent hypoxoside is clearly understood: the compound itself exists in the inactive form, but it is transformed by enzymic hydrolysis to the active (anti-cancer) form, rooperol. The question of its toxicity to human beings remains a controversial one and will only be resolved finally when a comprehensive toxicity study has been done. The medical fraternity is at loggerheads over the safe use of *Hypoxis* extract (or the whole plant) in humans. By contrast, the public, at large, both ‘western’ and ‘traditional’, continue to consume increasing quantities for a variety of ailments.30 The demand is being met in many cases by *Hypoxis* being grown on a commercial scale, particularly in KwaZulu-Natal (for example, at Impilo Drugs), but uncontrolled ‘wild harvesting’ undoubtedly still takes place. Coupled with this development has been the rapid expansion of the demand for over-the-counter preparations which boost the immune system. The care of HIV/AIDS patients has played an important role in growing this particular market. In the mind of the public the memory that the major immune-system boosters, β-sitosterol and β-sitosterol glucoside, were originally obtained from the *Hypoxis* plant lingers on, and has further stimulated the sales of *Hypoxis*-based preparations. It is not clear where the *Hypoxis* saga is leading, but without doubt the star of the ‘sterretjie’ flower is shining bright at present.

We thank the National Research Foundation and the University of KwaZulu-Natal Research Fund for financial assistance.

Received 14 June. Accepted 6 October 2004.

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