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Multi-, Inter- and Transdisciplinary Perspectives

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About this journal

The *International Journal of African Reflections (IJAR)*, which is housed at iYunivesithi Walter Sisulu, publishes multi-, inter- and transdisciplinary peer-reviewed articles that encourage and support researchers in all fields and disciplines, especially female, black and young researchers, by providing a platform to publish their work with the aim of eventually obtaining an NRF rating. The journal also intends to act as a facilitator in building a cohort of scholars from among the master's, doctoral and postdoctoral graduate students through the articles that are published in the journal. It is hoped that new epistemological ideas will emerge, and that this will contribute to improving the quality of teaching, research and learning.

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Preface

It is my privilege to present Volume 3 (2026) of the *International Journal of African Reflections* (*IJAR*), a scholarly platform that embodies iYunivesithi Walter Sisulu's commitment to disseminating knowledge that is intellectually rigorous, socially responsive and firmly rooted in African realities. This issue brings together researchers from the humanities, social sciences, law, health sciences and economics to examine some of the defining questions of our time: gender justice, historical memory, land governance, Indigenous knowledge, technological change, institutional accountability, public health and sustainable development. Its interdisciplinary reach reflects a fundamental truth: the challenges confronting Africa do not respect disciplinary boundaries and our responses cannot remain confined within them.

At iYunivesithi Walter Sisulu we understand that a university is not simply a place where existing knowledge is transmitted but a public institution with a duty to imagine, test and build better futures. Our Vision 2040+ is anchored in the aspiration to become a technology-infused African university that is locally responsive, continentally consequential and globally engaged. This vision calls upon us to draw intellectual strength from our location while refusing intellectual isolation; to use technology without surrendering human judgement, and to pursue academic excellence in ways that improve the lives of the communities we serve. The *IJAR* contributes directly to this purpose by creating a credible space in which African experiences generate concepts, evidence and solutions of wider significance.

Vision 2040+ is given practical direction through the university's three signature themes: Food Futures; One Health, and Leadership, Justice and Governance. These themes are not separate institutional compartments: together, they recognise that human flourishing depends on the relationship between sustainable livelihoods, healthy communities, ecological resilience, ethical institutions and responsible leadership. The contributions to this volume illuminate these relationships precisely. Research on external debt and agricultural development reveals the fiscal conditions that can advance or impede food security and rural transformation. Scientific enquiry into the bioactivity of medicinal plants brings indigenous and community-based knowledge into productive conversation with experimental research while opening up opportunities for health innovation. Studies of land boards, apartheid regulation, gendered violence and institutional power demonstrate that development cannot be separated from justice, legitimacy and accountable governance.

The volume also engages directly with the technological future of higher education. Artificial intelligence is already altering the way universities teach, learn, conduct research and administer their responsibilities. Yet technology is never transformative merely because it is new: its value depends on whether it advances equitable access, strengthens human capability and serves clearly defined educational purposes. The analysis of AI adoption in South African higher education, together with the dialogue on literary criticism, pedagogy and the digital humanities, underscores the importance of infrastructure, digital literacy, ethical governance and critical judgement. This is central to our Vision 2040+ ambition. A technology-infused African university must be technologically capable, but it must also remain intellectually independent, ethically grounded and attentive to any inequalities that may be reproduced through innovation.

Equally important is the volume's insistence that language and interpretation are forms of social action. The analysis of feminist speech acts in Chimamanda Ngozi Adichie's *Dear Ijeawele …* shows how language can challenge inherited assumptions and direct new practices. Historical research into the criminalisation of interracial relationships under apartheid reveals the opposite possibility: law and official language can classify, stigmatise and control human beings. These contributions remind us that knowledge is never detached from power. The terms through which society describes gender, race, authority, land, health and development influence what institutions permit, prohibit or neglect. Universities therefore carry a special responsibility to cultivate critical literacy: the capacity to identify the assumptions embedded in dominant categories and to formulate more just ways of understanding the world.

This responsibility is particularly urgent for an institution bearing the name of Walter Max Ulyate Sisulu. His legacy represents principled leadership, disciplined service, social justice and an enduring belief in people's capacity to transform their circumstances through collective action. To honour that name, the university must ensure that its scholarship is measured not only by quantity or visibility, but also by its integrity, relevance and impact. Research must confront the lived realities of rural and historically marginalised communities; strengthen democratic institutions; protect human dignity, and contribute to a more equitable distribution of knowledge and opportunity. *IJAR* serves this mandate by enabling scholars to respond to Africa's problems without reducing the continent to a catalogue of deficiencies. It foregrounds African agency, intellectual creativity and the capacity to produce solutions.

The geographical position of iYunivesithi Walter Sisulu gives this mission particular force. Our campuses are located within communities

that experience the opportunities and contradictions of contemporary development up close. Questions of rural livelihoods, public health, land, educational access, language, technology and governance are not distant research themes; they shape the everyday lives of our students, staff and surrounding communities. Vision 2040+ requires us to transform this proximity into a scholarly advantage. Community engagement must inform research questions; research must strengthen teaching; teaching must prepare graduates to act with competence and social responsibility, and innovation must yield benefits beyond the boundaries of the university.

The *IJAR* is therefore more than a publication outlet. It is part of the knowledge infrastructure through which our university advances research excellence, supports emerging and established scholars, strengthens interdisciplinary exchange and extends African scholarship into international conversations. A strong university journal safeguards rigorous peer review, promotes intellectual independence and preserves a public record of enquiry. It also enlarges the range of voices and contexts represented in global knowledge. For African universities, this work is essential to epistemic justice: not the rejection of global scholarship, but fuller and more equitable participation in its production, evaluation and circulation.

I commend the authors in this issue for having researched and placed on record difficult questions with methodological seriousness and a commitment to evidence-based knowledge dissemination. I thank the reviewers for the careful and often unseen intellectual labour through which the quality of scholarly publication is secured. I also acknowledge the Managing Editor, the Editorial Board, and the production team for sustaining *IJAR* and bringing this volume to completion. Their collective work demonstrates the institutional commitment required to convert research into an enduring scholarly resource.

As readers engage with this third volume of *IJAR*, I invite them to consider not only the individual findings in its articles but also the shared challenge they present. What kinds of universities, technologies, laws, economies and knowledge systems are needed for Africa's people to flourish? Vision 2040+ calls on iYunivesithi Walter Sisulu to help answer that question through courageous scholarship and purposeful action. The future we seek will not be produced by aspiration alone; it will be built on evidence, ethical leadership, interdisciplinary collaboration and sustained accountability to society.

This volume is a meaningful contribution to that undertaking. It affirms our confidence that African universities can generate the highest-quality knowledge while remaining responsive to place, community and history. It also renews our conviction that scholarly

reflection must lead to transformation. May the ideas gathered here stimulate further research, deepen institutional debate and inspire partnerships that advance healthy communities, sustainable livelihoods, justice and human dignity across the Eastern Cape, South Africa, the African continent, and beyond.

Prof Thandi Mgwebi
Vice-Chancellor and Principal
iYunivesithi Walter Sisulu

Africa in transformation

Knowledge, power and institutional responsibility

Editorial for Volume 3 (2026)

This third volume of the *International Journal of African Reflections* (*IJAR*) brings together nine contributions that examine the ways in which knowledge, power and institutional responsibility shape African lives. Moving between history, gender studies, biomedical research, higher education, economics, land law, literary pragmatics, palliative care and the humanities, the volume asks what makes scholarship answerable to the societies it studies. Its coherence emerges from a shared concern with the conditions under which people acquire recognition, exercise agency, secure livelihoods and receive care. The contributions approach these concerns through different methods and at different scales, demonstrating why African scholarship needs both disciplinary precision and sustained conversation across fields.

The volume affirms Africa as a site of knowledge production, theoretical reflection and methodological enquiry. Its studies engage inherited inequalities together with contemporary pressures, attending to the institutions through which both are reproduced or challenged. Read in their published sequence, they move from the coercive regulation of intimate life and the vulnerabilities of university students to questions of scientific investigation, technological change, economic development and land governance. Feminist language, culturally responsive care and the renewal of literary criticism extend this enquiry into the meanings and practices through which social transformation becomes possible. Together, these contributions give substance to *IJAR*'s commitment to multi-, inter- and transdisciplinary scholarship grounded in African realities.

The opening article, AA Marwarwa and M Petse's '"The forbidden fruit": The consequences of interracial sexual relationships in apartheid South Africa', examines the 1952 case of Olaf Abraham Voster and Nomathemba Emily Nomatiti in Umtata. Through this case, the authors trace the operation of the Immorality Act 5 of 1927 and the consequences of racial regulation for those brought within its reach. Their historical analysis shows how racial domination entered intimate life through policing, prosecution and punishment. The case also directs attention to the unequal vulnerabilities of the people involved: racialised law operated within existing differences of status and power. By connecting a particular legal proceeding to a wider system of exclusion, the article demonstrates the value of archival

research to recovering the human consequences of institutionalised discrimination.

Questions of power and vulnerability continue in Keneilwe Wanthitha Mashishi, Mahlodi Monica Rebecca Makupula, Jabulani Gilford Kheswa and Mvuyisi Notole's study of sexual harassment and the mental well-being of female students at a South African tertiary institution. Drawing on semi-structured interviews with ten participants and guided by Power and Control Theory, the authors examine student experiences shaped by poverty, patriarchal norms, alcohol abuse and unequal relations of authority. The accounts reveal the consequences for psychological well-being and academic participation that institutional policy alone cannot adequately describe. The study recommends ongoing counselling, empowerment programmes and education on sexual harassment policies. Its place after the historical article establishes a consequential connection: the protection of dignity requires attention to be given the way power is exercised in everyday relationships, and also to the formal rules intended to govern them. For universities, student safety must surely be integral to the conditions that make learning possible.

The third contribution turns to the investigation of medicinal plants. Azola Zukisani Ntshobane, Elona Ngqayimbane, Suparna Chakraborty, Saif Khan and Talkmore Ngarivhume screen extracts of *Drimia altissima* and *Crinum macrophyllum* bulbs for anticancer, antioxidant and anti-inflammatory activity. Their laboratory findings identify promising responses in selected extracts, including activity against cervical cancer cell lines and strong inhibition in an anti-inflammatory assay. These are results obtained from laboratory screenings; they establish grounds for further investigation rather than clinical effectiveness. The authors accordingly call for the isolation and characterisation of active compounds. Their article contributes to this volume by showing how medicinal plant use can inform research questions that are then examined through controlled experimentation. Its significance rests in the disciplined movement from biological resources and medicinal knowledge towards evidence that can support further scientific enquiry.

ST Pika's exploration of the adoption of artificial intelligence in South African higher education shifts our attention to the infra-structures through which knowledge is taught, assessed and administered. Using Rogers' Diffusion of Innovations Theory, the article considers relative advantage, compatibility, complexity, trialability and observability in interpreting the emerging trends and barriers. Personalised learning, student engagement and administrative efficiency feature among the potential benefits of adopting artificial intelligence, while infrastructure constraints,

digital literacy gaps, inequality and ethical concerns complicate its adoption. The analysis places institutional readiness central to the discussion: technologies acquire educational value through the conditions of their use. Investment, staff development and appropriate policies therefore belong in the same conversation as innovation. Following the biomedical study, Pika's contribution extends the volume's attention to responsible investigation and adoption, asking how promising developments can serve public purposes in unequal institutional settings.

Nnane Eric Sumelong's study of external debt sustainability and agricultural development in Cameroon broadens this institutional enquiry to national economic policy. Using data for the period 1996–2023, an Engle–Granger co-integration framework and an error-correction model, the article examines the relationships between external debt and agricultural value added. It reports a negative long-run association between long-term external debt and agricultural value added, together with a strong positive association with gross fixed capital formation. The analysis interprets debt pressures in relation to constrained fiscal space and the resources available for agricultural development. Its recommendations emphasise transparent debt governance, the protection of agricultural investment and the productive use of borrowing. By bringing rural livelihoods and agricultural capacity into the debates on debt, the article asks readers to assess macroeconomic choices balanced against their developmental consequences. The practical question is what public finance enables communities to produce, sustain and improve.

The next article, by Akame Winslow Melle and Akwe Ngole Ray Junior, examines four land management boards in Cameroon through the lens of legal pluralism. The Land Consultative Board, Site Board Commission, Inter-Village Boundary Settlement Commission and Farmer–Grazer Commission operate where statutory rules, customary authority and administrative practice intersect. Drawing on legal materials, interviews and comparative African experiences, the authors identify procedural ambiguity, bureaucratic delay and institutional constraints that limit dispute resolution. They argue for reforms that combine customary legitimacy with clearer safeguards, digitisation, gender inclusion and more effective administration. Its position after the agricultural development study renders the relationship between productive investment and land governance particularly visible. Land sustains livelihoods, but it also carries histories of belonging, authority and communal obligation; the institutions responsible for land management must respond appropriately to these overlapping claims if their decisions are to command confidence.

Gabriel Ndamzi Amadi's 'Doing feminism with words: a Searlean speech act analysis of Chimamanda Adichie's *Dear Ijeawele …*' then turns to the capacity of language to challenge inherited authority. Analysing 239 coded units from Adichie's manifesto, Amadi shows how assertives contest naturalised gender assumptions and directives translate feminist argument into practices of parenting and socialisation. Commissives and expressives establish ethical and affective positioning, while quasi-declaratives attempt to rename or reclassify familiar gendered categories. The recognition of hybrid forms also allows the article to test the usefulness and limits of its theoretical framework. This contribution returns the volume to gendered power at the level of ordinary speech and conduct. It demonstrates how feminist writing can intervene in the vocabularies through which inequality becomes familiar and in the practices through which it is passed from one generation to another.

The eighth contribution, K Zweni, A Mavembela and G Mkukuli's 'Decolonising South African palliative care psychosocial services for mental health benefit: eclectic context', brings the relationship between recognition and institutional responsibility into end-of-life care. Guided by an ecological perspective and an eclectic narrative review, the authors examine the ways patients' social, cultural and spiritual environments shape their experiences of care. They argue that the exclusion of African beliefs and knowledge systems can undermine culturally responsive psychosocial support, and they advocate their inclusion alongside allopathic approaches in healthcare training, policy and practice. The article offers a framework for reform rather than a clinical evaluation of a new intervention. Read alongside the earlier biomedical contribution, it widens the volume's understanding of health: research into biological activity and attention to the meanings through which patients experience suffering respond to different complementary dimensions of care. Respect for patient preferences and cultural diversity is central to that relationship.

The volume concludes with 'Beyond the Ibadan School', Mark Ighile's dialogue with Emeritus Professor Dan Izevbaye on literary criticism, pedagogy and digital humanities. Reflecting on six decades of scholarship, the conversation revisits the relationships between text, context, authorship, audience and interpretation. Its discussion of a declining tutorial culture and campus collegiality underscores the social conditions through which critical judgement develops. Its treatment of canon formation asks how intellectual inheritance can remain responsive to changing publics and media. Returning to the questions raised by Pika, the dialogue considers digital tools and artificial intelligence as supports for enquiry whose usefulness depends

on humanistic judgement and ethical interpretation. This is a fitting conclusion to the sequence: an issue concerned with institutional transformation ends by examining the ways in which scholars learn to interpret, evaluate and transmit knowledge responsibly.

Through these contributions, institutional legitimacy emerges as a demanding practical achievement. Courts, universities, land boards, healthcare services and fiscal systems exercise authority in ways that affect people's opportunities and vulnerabilities. Their legitimacy depends on how that authority is justified, scrutinised and experienced. The articles illuminate this problem through distinct forms of evidence, from a historical prosecution and students' accounts to legal analysis and economic modelling. Together, they encourage a conception of reform that is attentive to everyday consequences: access to education, security of livelihood, recognition of claims and dignity in care.

The volume also clarifies why the recognition of African knowledge must be accompanied by methodological care. Archival interpretation, laboratory screening, qualitative interviews, narrative synthesis, speech-act analysis and econometrics support different kinds of claim. Bringing them into conversation requires respect being shown for those differences. Medicinal knowledge can generate research questions; cultural understanding can inform care; literary criticism can examine the terms through which values are communicated. None of these contributions needs to assume the methods of another to acquire intellectual worth. Their collective strength lies in making evidence, interpretation and the limits of inference visible while responding to problems that exceed any single discipline.

We thank the authors for their contributions, the reviewers for their critical engagement, and the editorial and production teams for the sustained work that makes scholarly publication possible. Their efforts support a journal that is committed to widening participation in research while maintaining the rigour on which scholarly trust depends. For emerging and established researchers alike, that commitment entails the opportunity to contribute and the responsibility to formulate arguments that others can examine, question and develop.

Volume Three of *IJAR* invites readers to consider African scholarship through the quality of the understanding it produces and the opportunities it opens up. Its contributions recover histories of exclusion, scrutinise present institutions and propose directions for change without resolving their differences into a single account of Africa. Their shared achievement is to render the relationship between knowledge and responsibility concrete. *IJAR* advances that relationship

by providing a space in which African experiences inform enquiry, African intellectual resources shape interpretation and scholarship remains answerable to the people whose lives give its questions urgency.

Prof Enongene Mirabeau Sone
and
Dr Thoahlane Thoahlane
Editors, *International Journal of African Reflections*

Bioactivity screening of extracts of *Drimia altissima and Crinum macrophyllum* bulbs

Azola Zukisani Ntshobane[1*]
Elona Ngqayimbane[2]
Suparna Chakraborty[2]
Saif Khan[2]
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Abstract

There is a surge in the use of and research on plant-based remedies because of their unique chemical diversity, the emergence of resistance and the adverse effects of current drugs. The present study evaluated the anticancer, antioxidant and anti-inflammatory potential of crude extracts of *Drimia altissima* and *Crinum macrophyllum* bulbs, which are used as anticancer remedies. Hexane, dichloromethane and methanol crude extracts of the air-dried bulbs were screened on MCF-7, MDA-MB-231, CaSki, HeLa, PC3 and MRC5 cells at 200 μg/mL using the MTT viability assay. The DPPH and the egg-albumin denaturation assays evaluated the antioxidant and anti-inflammatory potential of these bulbs respectively. Cis-platin and doxorubicin were used as anticancer positive control drugs, whereas L-ascorbic acid and sodium dichlofenac were positive controls for antioxidant and anti-inflammatory activities. The *D altissima* methanol extract reported a percentage viability of 8.25 on Hela cells, whereas the *C macrophyllum* dichloromethane reported percentages of 6.12 and 4.30 on Hela and Caski cells, respectively. All the crude extracts reported much lower toxicities to the non-malignant MRC5 cells. The extracts exhibited concentration-dependent antioxidant and anti-inflammatory activities. They also exhibited stronger anti-inflammatory inhibitions, whereas the hexane extracts reported 86.96±4.47% (*C macrophyllum*) and 90.47±0.94% (*D altissima*), which are comparable to the inhibition of the positive control drug of 93.72±0.30%.

Keywords: bioactivity screening, anticancer, antioxidants, anti-inflammatory

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1. Introduction

An increasing number of scientific studies which show that bioactive chemicals have positive health effects have sparked interest in research into natural products (Al-Dabbagh et al, 2019). According to El-Fayoumy et al (2021), some bioactive compounds derived from natural sources have the potential to treat a range of human diseases, including those that are antiviral, anticancer, antibacterial, anti-inflammatory and antioxidant.

Cancer has become one of the world's leading adverse health effects, one with significant social and economic implications. According to the World Health Organization (WHO) (2015), cancer is a significant public health issue in Africa. The global prevalence of cancer is substantial, with an estimated 19 292 789 new cancer cases having been reported in 2020 (Sung et al, 2020). Currently, cancer statistics indicate that it is the cause of one in seven deaths in the world, which significantly exceeds the sum of deaths from tuberculosis, AIDS and malaria (Hamdi et al, 2021). Cancer radiotherapy and chemotherapy have many side effects, such as low efficacy and non-specificity, chemo-resistance and the responses of patients' immune systems – although chemotherapy is less likely to damage cells that are at rest, such as most normal cells (Liu et al, 2021; Li et al, 2023).

Natural products, along with their derivatives and analogues, play a major role in cancer treatment by modulating the cancer microenvironment and different signalling pathways (Hashem et al, 2022). The plant extracts might have compounds or molecules with anticancer activities that could be effective in treating and managing the disease. Some phytochemicals – for instance, flavopiridol, a *Dysoxylum binectariferum* isolate, and *meisoindigo*, an *Indigofera tinctoria* isolate – have exhibited anticancer effects with a higher level of selectivity than conventional drugs (Solowey et al, 2014). Approximately 60% of drugs currently used for cancer treatment have been isolated from or are inspired by natural products (Jiang et al, 2019; Singh et al, 2021).

Many compounds from plants, such as polyphenols, flavonoids and phenolic acids, may have different reducing potentials, which might protect normal cells against oxidative stress and cell damage (Stagos, 2019; Slika et al, 2022). In addition, the antioxidant and anti-inflammatory activities of phytochemicals can mitigate inflammatory responses, subduing the growth and metastasis of cancer cells (Kocyigit et al, 2018). Al-Dabbagh et al (2018) observed that extracts which reported high antioxidant activities displayed antiproliferative and antimetastatic activities at low concentrations, while Wangsawat et al (2021) suggest that potent antioxidants display good anticancer activities. The administration of low concentrations of antioxidants during chemotherapy reduces the severity of the chemotherapy side effects (Singh et al, 2018; Ferdous & Yusof, 2021).

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Drimia altissima and *Crinum macrophyllum* have traditionally been used in cancer management. In addition, some of the literature indicates that these plants are poisonous (Jäger et al, 2004; Manganyi et al, 2021). This project aimed to carry out selected bioassays to establish the potential medicinal benefits and drawbacks that could be associated with the use of these medicinal plants.

2. Literature review

2.1 Selected plants

D altissima and *C macrophyllum* bulbs were selected because they are used in traditional cancer management. Bioactivity screening of medicinal plants is a critical process in the establishment of new medicinal alternatives and validating traditional medicines.

2.1.1 Drimia altissima (taxonomy, morphological features and biological activities)

Taxonomy: D altissima is a member of the Asparagaceae family (formerly Hyacinthaceae) and is synonymous with *Urginea altissima* and *Ornithogalum altissimum*. It is a perennial bulbous plant that is widely distributed across tropical and southern Africa (Hyde et al, 2015).

Morphological features: D altissima is notable for its tall flowering stems, which can reach up to 2 m in height. The plant produces a dense cylindrical raceme of white flowers with green streaks before the emergence of its lanceolate leaves. Its large bulbs are globose to pear-shaped, often situated partially above ground. These morphological traits make it one of the tallest geophytes in Africa (Kirby, 2013; Iwu et al, 2017).

Biological activities: Phytochemical investigations have identified a novel flavonoid C-glycoside named altissimin in *D altissima*. Altissimin exhibits strong anti-proliferative activity against HeLa cervical cancer cells (Nyambe et al, 2021). This compound has a unique structure, a C-apioglucoside arrangement, attached to an apigenin aglycone, which contributes to its pharmacological potential. This discovery underscores the potential value of the plant in cancer research (Nyambe et al, 2021). However, many of the species of this genus are regarded as poisonous in southern Africa and have intoxicated both livestock and human beings (Pohl et al, 2000; Manganyi et al, 2021), although some species are reportedly edible (Pohl et al, 2000).

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2.1.2 *Crinum macrophyllum/asiaticum* (taxonomy, morphological features phytochemistry, pharmacological activities)

Taxonomy: C macrophyllum is synonymous with *Crinum asiaticum*, which is commonly known as the giant crinum lily or poison bulb. It belongs to the Amaryllidaceae family. It is a perennial bulbous herb widely distributed across tropical and subtropical regions. The plant is valued for its ornamental appeal and its extensive medicinal properties, which include anticancer, anti-inflammatory, antimicrobial and antioxidant activities (Patel, 2017; Rakhi et al, 2024). The lycorine found in the plant is a well-known toxic alkaloid that can cause symptoms such as vomiting, abdominal pain, diarrhoea and irregular breathing (Wang et al, 2014). In severe cases, it may lead to nervous system paralysis and even death if precautions are not followed according to the biodiversity explorer (Wang et al, 2014).

Morphological features: C macrophyllum is a perennial bulbous herbaceous plant with large bulbs and attractive leaves that emerge vertically. It produces white lily-like flowers arranged in umbels, making it popular as an ornamental plant. Its leaves are long, strap-like and glossy green. The plant propagates via adventitious bulbs (Archer & Condy, 1999).

Phytochemistry: The plant contains a rich array of bioactive compounds, primarily alkaloids such as lycorine and crinamine (Rakhi et al, 2024). Other notable constituents include flavonoids, saponins, tannins, phenols and β-sitosterol. These compounds are responsible for its pharmacological properties. Lycorine exhibits antitumour and antiviral effects, whereas crinamine demonstrates apoptosis-inducing activity in cancer cells (Khumkhrong et al, 2019). Phenols and flavonoids contribute to its antioxidant activity (Haque et al, 2014; Khumkhrong et al, 2019; Rakhi et al, 2024).

Pharmacological activities: The anticancer properties of alkaloids such as lycorine and crinamine display cytotoxic effects against various cancer cell lines – for example, cervical cancer SiHa cells (Khumkhrong et al, 2019; Rakhi et al, 2024). Crinamine inhibits unregulated cell multiplication, the invasion of other organs and angiogenesis in cancer models (Haque et al, 2014). Ethanolic extracts of *C macrophyllum* leaves exhibit potent anti-inflammatory effects. Pre-extraction treatments such as drying methods influence the chemical composition and efficacy of the extracts (Kongkwamcharoen et al, 2021). Hydrogel patches containing *C macrophyllum* extracts have been developed for topical anti-inflammatory applications (Kongkwamcharoen et al, 2023).

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3. Materials and methods

3.1 Collection and preparation of plant material

The plant organs that the traditional healers use were collected together with specimens of the plants. The specimens were identified at the Botanic Garden, which enabled us to conduct a focused literature review of the species. The samples were placed in aerated shade at room temperature in the Walter Sisulu University's organic laboratory.

3.2 Extractions

The air-dried powdered plant materials of *C macrophyllum* (621 g) and *D altissima* (911 g) bulbs underwent separate sequential and exhaustive maceration, and occasional shaking at room temperature with solvents of increasing polarity. The solvents were evaporated on a rotary evaporator at temperatures between 40 °C and 50 °C. The extracts from each solvent were combined and then air-dried, yielding the crude extract samples. Each crude extract had a laboratory code comprising the plant's field code and a letter – H, D or M – to indicate the extraction solvent, where H stands for hexane, D for dichloromethane and M for methanol.

3.3 Bioactivity assays of crude extracts

The anticancer, anti-inflammatory and antioxidant activities of the crude extracts were evaluated quantitatively. The anticancer screening was carried out at the University of Cape Town's biochemistry laboratory, whereas anti-inflammatory and antioxidant assays were carried out at Walter Sisulu University.

3.3.1 Anticancer activities of crude extracts

For the anticancer assays, the methodology of El-Fayoumy et al (2021) was adopted with slight modifications. The cytotoxic effects of the crude extracts were evaluated against two breast (MCF7 and MDA-MB-231) cell lines, two cervical (CaSki and HeLa) cell lines and one prostate (PC3) cancer cell line, using the 3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyl tetrazolium bromide (MTT) viability assay. The non-malignant lung fibroblast (MRC5) cell line was used for preliminary selectivity assessment. The negative control samples were treated with neither extracts nor known drugs, whereas doxorubicin and cisplatin were the positive control drugs.

Cancer cells, including the non-malignant cells, were seeded in 96-well plates and incubated overnight in 5% CO_2 at 37 °C. After incubation, duplicate single-dose treatments of the extracts at 200 µg/mL and the control drugs at 10 µM were carried out on each of the

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test-cell lines in micro wells, followed by a further 24 h incubation. The plates were incubated for an additional 4 h after adding 10 µL MTT reagent to each well. Then the MTT crystals that formed in the wells were dissolved using 100 µL of 1% DMSO solution. The plates were incubated overnight at 37 °C. A microplate reader measured the optical densities of the plates at 570 nm. The percentage viabilities of the test cells were evaluated using equation 1 below:

$$\% \text{ Viability} = \frac{\text{Abs (negative control} - \text{Abs (sample)}}{\text{Abs (negative control}} * 100 \quad \text{eqn … 1}$$

where:

Abs(negative control) = absorbance of untreated cancer cells minus absorbance of media.

Abs(sample) = absorbance of treated cells at a particular concentration of testing sample minus absorbance of media.

The preliminary selectivity indices (PSI) were calculated from equation 2 below:

$$\text{PSI} = \frac{\text{Cell viability in noncancerous cell line (MRC5)}}{\text{Cell viability in cancer cell line}} \quad \text{eqn … 2}$$

3.3.2 Antioxidant activities of crude extracts

This method was carried out according to that proposed by Xiao et al (2020), which is briefly described below.

1. A 0.1 mM DPPH solution was prepared in methanol.
2. 1 mg/mL stock solutions of each crude extract and l-ascorbic acid were prepared separately in dimethyl sulfoxide (DMSO).
3. Each stock solution was serially diluted to afford 100.00, 50.00, 25.00, 12.50, 6.25 and 3.13 µg/mL samples.
4. 2.96 mL DPPH (0.10 mM) solution was added to 40 µL of each concentration of the crude extracts and l-ascorbic acid.
5. The reaction mixtures were incubated in the dark at room temperature for 20 min.
6. After 20 min, the absorbances of the mixtures were read at 490 nm. DPPH was taken as the negative control and l-ascorbic acid was the reference antioxidant.
7. The per cent free radical scavenging activity (%RSA) of the plant extracts was calculated using the following equation 3:

$$\% \text{ inhibition of sample} = \frac{[\text{Abs (negative control} - \text{Abs (sample)}]}{[\text{Abs (negative control}]} \times 100 \quad \text{eqn … 3}$$

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where:

Abs (control) = Absorbance of the negative control.

Abs (sample) = Absorbance of test sample.

% inhibition = Percentage inhibition.

3.3.3 Anti-inflammatory egg albumin denaturation assay

The denaturation of egg albumin (protein) method was used to assess the *in vitro* anti-inflammatory activities of each of the crude extracts of the two plants (Madhuranga & Samarakoon, 2023) as follows:

1. 0.1 mL of 1% egg albumin solution from fresh hen's egg was added separately to 1.0 mL of each sample extract in DMSO and diclofenac sodium (reference anti-inflammatory drug) at concentrations of 100.00, 50.00, 25.00, 12.50, 6.25 and 3.13 µg/mL.
2. Then 1.4 mL of phosphate-buffered saline (pH 7.4) was added to form a reaction mixture of a total volume of 2.5 (1.0 + 0.1 + 1.4) mL.
3. A total volume of 2.5 mL of the negative control was prepared by combining 0.1 mL of 1% egg albumin solution, 1 mL of distilled water and 1.4 mL of phosphate-buffered saline.
4. The reaction mixtures were then incubated for 30 min at 37 °C.
5. They were later heated to 70 °C in a water bath for 15 min.
6. After cooling, the absorbances were measured at 655 nm by a microplate reader.
7. Equation 3 was used to determine the percentage inhibition of protein denaturation (% inhibition).

4. Results and discussion

Medicinal plants exhibit pharmacological activities owing to the presence of various bioactive compounds such as alkaloids, tannins, flavonoids, phenols, steroids, terpenoids and saponins. According to Situmorang et al (2023), cancer refers to the multiplication of malignant cells inside the human body.

Oxidative stress is a product of increased levels of free radicals, reactive metabolites or decreased antioxidant concentration in cells. Free radicals contain unpaired electrons and are involved in oxidative chain reactions with other reactive species such as carbonyl (methylgyoxal, glyoxal) and thiols, which leads to the generation of new reactive metabolites (Le et al, 2022). Over the years, research on antioxidants as potential therapeutic agents to prevent free-radical-generated damage in the human body has gained enormous popularity (Chandra et al, 2014).

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4.1 Anticancer activity

The cell viability results are presented in Table 1 and Figure 1, whereas Table 2 presents the preliminary selectivity indices.

Table 1: Percentage of cell viability of different plant extracts (n = 2; mean ± SD)

		Percentage cell viability					
Plant names	**Extracts**	**Breast cancer**		**Cervical cancer**		**Prostate cancer**	**Lung fibroblast**
		MCF-7	MDA-MB-231	HeLa	Caski	PC3	MRC5
	control	1002,47	1004,45	1000	1000	1002,17	1000,87
C macro-phyllum	Hex	86,272,02	51,121,66	74,9026,38	61,9521,90	49,156,10	65,092,41
	DCM	1007,49	1005,48	6,125,52	4,305,92	94,775,41	93,226,05
	MeOH	1003,69	1003,65	34,525,56	30,941,26	96,875,33	92,475,20
D altissima	Hex	69,924,92	78,766,72	40,912,61	19,6718,12	40,214,72	80,324,67
	DCM	23,316,18	49,874,17	17,571,62	13,180,93	20,202,42	65,50
	MeOH	53,872,68	74,903,69	8,251,00	14,295,57	42,544,00	66,955,21
+ control		6,632,33	24,171,38	97,2911,80	4,281,66	28,255,60	22,566,78

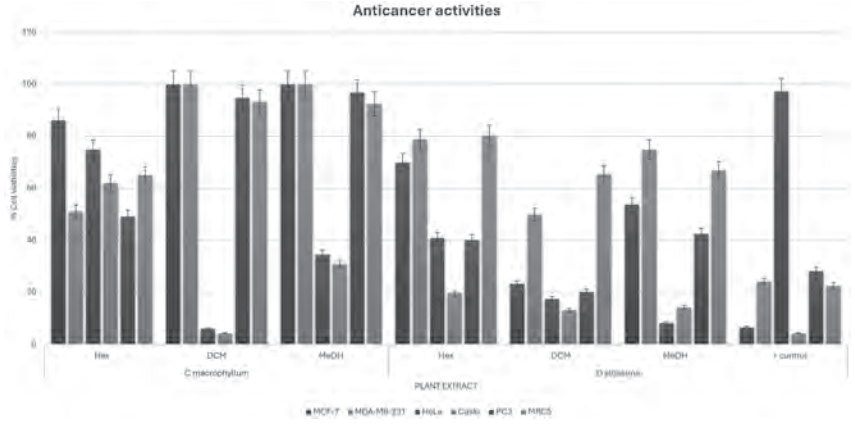


Figure 1: Percentage viability of cancer and non-malignant cell lines

Table 2: Preliminary selectivity analysis

Plant names	Extracts	MCF-7	MDA-MB-231	Hela	CaSki	PC3
C macrophyllum	Hex	0.75	1.27	0.87	1.05	1.32
	DCM	0.93	0.93	15.23	21.68	0.98
	MeOH	0.93	0.93	2.68	2.99	0.96
D altissima	Hex	1.15	1.02	1.96	4.08	2.00
	DCM	2.81	1.31	3.73	4.97	3.24
	MeOH	1.24	0.89	8.12	4.69	1.57

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In the present study, *C macrophyllum* DCM extract showed potent anticancer activities in both cervical cancer cell lines, reporting percentage viability values of 6.12±5.52 and 4.30±5.92 for Hela and Caski cells, respectively (Table 1 and Figure 1). Cisplatin, the positive control drug, reported a percentage viability of 4.28±1.16 on the Caski cells, which is practically equal to the viability of the DCM extract from the *C macrophyllum* bulb. The methanol extract reported moderate percentage viabilities of 34.52±5.56 and 30.94±1.26 against Hela and Caski cells, whereas the hexane extract exhibited the highest percentage viabilities of 74.90±26.38 and 61.95±21.90 against Hela and Caski cells, respectively.

All the *C macrophyllum* extracts reported high percentage viabilities on breast and prostate cancer cell lines, indicating their limited potential to suppress the survival of these cancer cells. However, the hexane extract showed moderate percentage viabilities on MDA-MB-231 of 51.12±1.66 and 49.15±6.10 against PC3 (Table 1 and Figure 1). All the extracts of *C macrophyllum* reported percentage viabilities that ranged between 65.09±2.41 and 93.22±6.05 on the normal lung fibroblast cell line (MRC5) (Table 1 and Figure 1). A compound hippeastrine in Figure 2 that was separated from *C macrophyllum* leaves reported low cytotoxicity on cell lines of HCT116 (IC_{50} = 104.52 µM), Huh7 (IC_{50} = 132.53 µM) and DU145 (IC_{50} = 85.42 µM) (Rakhi et al, 2024).

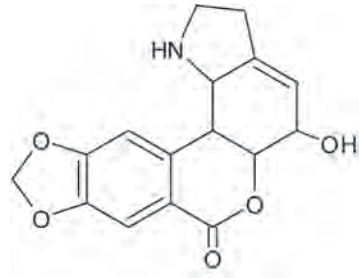


Figure 2: Hippeastrine compound

The *D altissima* DCM fraction showed the most generalised but moderate toxicity on the tested cancer cell lines. It exhibited moderate percentage viabilities for four of the five tested cancer cell lines, reporting percentage viability values of 13.18±0.93 for cell lines of Caski, 17.57±1.62 for Hela, 20.20±2.42 for PC3, 23.31±6.18 for MCF-7 and 49.87±4.17 for MDA-MB-231 (Table 1 and Figure 1). The positive control drug, doxorubicin, reported a percentage viability of 28.25±5.60 on the PC3 cell line, which is significantly lower than that of the DCM fraction. The methanol fraction of the *D altissima* reported the highest activity of 8.25±1.00 percentage viability on the Hela cell line and 14.29±5.57 on the Caski cell line. The hexane fraction reported 19.67±18.12 % on the Caski cell line. All the crude

extracts of the *D altissima* bulb reported a much higher percentage viability on the non-malignant lung fibroblast (MRC5) cell line, which ranged between 65.50±9.08 (DCM fraction) and 80.32±4.67 (hexane fraction). Novel bufadienolides and drimianins species were isolated from *D altissima* bulbs (Manganyi et al, 2021). In addition, in the NCI-60 screen, a screening test employing bufadienolide demonstrated anticancer efficacy against human cancer cell lines (Manganyi et al, 2021). According to Nyambe et al (2021), an *in vitro* bioassay demonstrated antiproliferative effectiveness against HeLa cervical cancer cells.

All the extracts exhibited the lowest preliminary selectivity for MDA-MD-231 cells, reporting PSI values between 0.894 and 1.313; but they reported very high selectivity for tested cervical cancer cell lines, except for the *C macrophyllum* hexane fraction (Table 2). A selectivity index greater than 1 suggests that the extracts preferentially select the cancer cells rather than non-malignant cells (Lica et al, 2021). However, Koch et al (2005) indicate that substrates with selectivity indices below 2 might be general toxins.

The negative control reported percentage viabilities between 100±0.00 and 100±4.45 on all the test cells. Cisplatin and doxorubicin were used as positive control drugs at 10 µM. Cisplatin was the positive control for tested cervical cells, whereas doxorubicin was the control drug for the breast and prostate cells. Cisplatin is reportedly a preferred drug (Larasati et al, 2014) for cervical cancer despite its documented side effects (Larasati et al, 2014) and low level of efficacy (Sasaki-Kudoh et al, 2017). It presents side effects such as nephrotoxicity, cytotoxicity, nausea, vomiting and resistance of the cancer cells (Larasati et al, 2014).

4.2 Antioxidant activity

The antioxidant activity findings are detailed in Table 3 and Figure 3 below, after which the discussion follows.

Table 3: Percentage inhibition of DPPH of 12 extracts of four plants (n = 3; mean ± SEM)

Plant names	Extracts	Concentrations in /mL					
		100	50	25	12.50	6.25	3.13
C macrophyllum	Hex	45,483,68	39,790,34	37,77,58	35,510,29	32,480,91	27,34,02
	DCM	41,320,34	38,670,47	37,34,10	36,33,38	35,441,14	33,02,08
	MeoH	44,430,25	41,82,26	39,79,12	36,760,20	36,130,64	31,850,79
D altissima	Hex	45,400,47	44,730,59	40,960,71	38,040,62	36,590,19	34,720,33
	DCM	45,670,51	43,301,51	40,92,17	36,75,47	35.07,57	33,78,54
	MeoH	42,340,50	41,34,08	38,230,311	37,330,14	36,870,11	34,480,70
L-ascorbic		60,020,51	53,500,58	51,440,41	48,900,81	43,181,62	38,190,85

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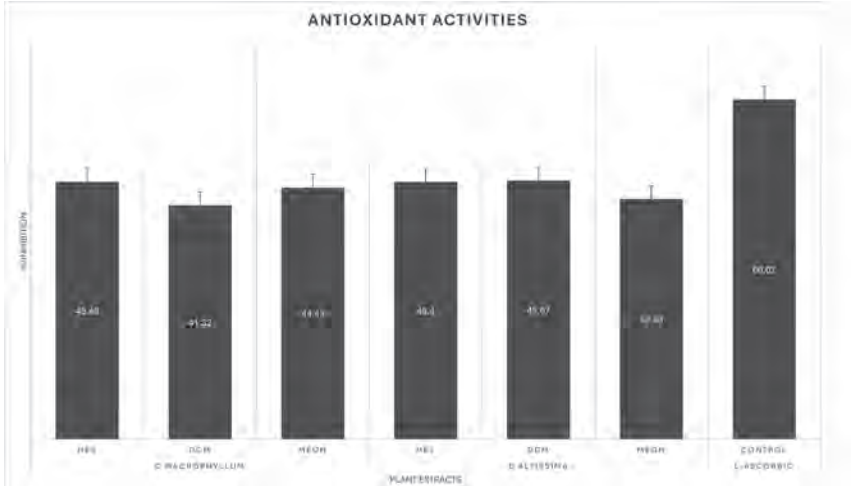


Figure 3: Antioxidant activities

The extracts of the two plants reported moderate antioxidant activities, reporting percentage inhibitions ranging from 40.73±0.88 to 45.67±0.51 at 100 µg/mL (Table 3 and Figure 3). Overall, these plant extracts exhibited a higher percentage inhibition at higher concentrations. Manganyi et al (2021) report that the *D altissima* bulb exhibited significant antioxidant properties. Rajput et al (2018) report that the ethyl acetate extract demonstrated good scavenging activity and reducing power in DPPH and ABTS tests. Furthermore, aqueous extract reported very high activities against superoxide anions, hydroxyl radicals and lipid peroxidation (Rajput et al, 2018). In a study by Goswami et al (2020), the aqueous *C macrophyllum* extract exhibited a free-radical scavenging capacity several times greater than that of ascorbic acid.

4.3 Anti-inflammation

The percentage inhibition of anti-inflammatory activities is presented in Table 4 and Figure 4.

Table 4: Percentage inhibition of denaturation of egg albumin by crude extracts (n = 3; mean ± SEM).

Plant names	Extracts	Concentrations in /mL					
		100	50	25	12.50	6.25	3.13
C macro-phyllum	Hex	86,964,47	82,631,28	77,442,90	70,400,98	69,311,67	24,510,84
	DCM	75,913,56	66,500,70	62,771,61	55,192,06	47,461,97	37,822,44
	MeoH	81,550,61	77,322,99	60,490,57	59,191,93	54,050,75	50,701,39
D altissima	Hex	90,470,94	87,170,28	77,970,05	75,860,05	75,214,26	78,402,99
	DCM	84,790,96	77,811,56	72,611,45	2,37	58,001,45	38,792,53
	MeoH	68,830,75	59,313,60	44,432,60	39,710,70	27,762,25	16,564,08
Diclofanac		93.72±0.30	93.12±0.54	92.64±0.14	90.85±0.14	87.39±0.33	77.43±0.25

Figure 4 below shows the percentage inhibition for the two plant extracts.

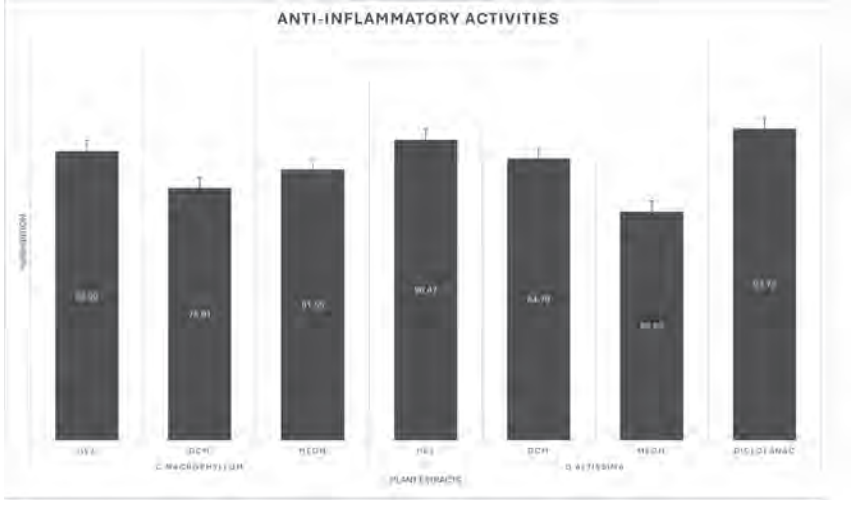


Figure 4: Anti-inflammatory activities

The extracts of the two plants reported very strong anti-inflammatory activities that ranged from 68.830.75 to 90.470.94 percentage inhibitions at 100 µg/mL (Table 4 and Figure 4). The inhibitions were significant even at lower concentrations. Surprisingly, the hexane extracts reported the most significant inhibition compared to extracts of more polar solvents. These results strongly suggest that the plants' extracts possess the potential to reduce inflammation. It is well known that phytochemicals derived from plants may contain anti-inflammatory properties (Gonfa et al, 2023). According to several studies, most people in underdeveloped countries manage inflammatory diseases mostly with the use of medicinal plants (Hosseinzadeh et al, 2015; Mbendana et al, 2019). The study by Alluri and Majumdar (2015) highlights the potent anti-inflammatory activity of *D altissima*

extracts: at a concentration of 100 µg/mL, these extracts exhibited an inhibition rate of 82.97 ± 1.16% against inflammatory markers, which highlights their efficacy. In addition, when administered at 2 g/kg body weight, the extract demonstrated significant anti-inflammatory effects at different time intervals: 51.6 ± 2.50% in the first hour and 40.80 ± 0.52% after four hours of treatment. These findings underline the potential therapeutic application of *D altissima* in managing inflammation-related conditions such as cancer.

5. Conclusion and recommendations

This study has demonstrated that both *C macrophyllum* and *D altissima* exhibit promising anticancer, antioxidant and anti-inflammatory properties, with varying levels of efficacy. The *C macrophyllum* DCM extract showed potent anticancer effects on cervical cancer cell lines, which are comparable to those of cisplatin, while the hexane extract had moderate effects on breast and prostate cancer cell lines. In contrast, the *D altissima* extracts displayed moderate toxicity across various cancer cell lines, with the methanol fraction showing the highest toxicity. Both plants exhibited moderate antioxidant activity and strong anti-inflammatory properties, especially at higher concentrations. Notably, the hexane extracts from both plants showed significant anti-inflammatory effects, highlighting their potential for therapeutic use in managing inflammation-related conditions. The active plant extracts may lead to new drug discoveries. Further studies will focus on isolating and characterising the active compounds in these extracts, which could possibly have applications in treating inflammatory diseases.

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