Emerging Pharmaceutical Sciences and Innovation

Review
Volume 1(1), 2026, 27–37
https://doi.org/10.53623/epsi.v1i1.1310

Isolation and Characterization of Bioactive Compounds from Medicinal Plants for Anticancer Drug Development in Tanzania: A Review

Faraja E. Mwakalinga*, Neema R. Kimaro

Muhimbili University of Health and Allied Sciences, United Nations Road, Dar es Salaam, Tanzania

*Correspondence: faraja.mwakalinga@gmail.com

SUBMITTED: 23 July 2026; REVISED: 1 September 2026; ACCEPTED: 3 September 2026

ABSTRACT: Cancer remains a growing public health challenge in Tanzania and across sub-Saharan Africa, where limited access to conventional chemotherapy and high treatment costs continue to drive reliance on medicinal plants as therapeutic alternatives. Tanzania harbors exceptional floristic diversity and a long-documented tradition of ethnomedical cancer treatment, yet the systematic isolation, structural characterization, and pharmacological validation of anticancer bioactive compounds from its flora remain comparatively underdeveloped relative to neighboring East African countries. This review synthesizes current knowledge on medicinal plants traditionally used for cancer management in Tanzania, the extraction and chromatographic isolation techniques applied to recover their bioactive constituents, the spectroscopic and spectrometric methods used for structural elucidation, and the in vitro and in vivo evidence supporting their anticancer activity. Particular attention is given to terpenoids, flavonoids, and alkaloids as the dominant classes of cytotoxic phytochemicals reported from East African flora, and to the structure-activity relationships that underpin their mechanisms of action. The review further identifies methodological, regulatory, and conservation-related challenges that constrain translation of ethnobotanical leads into validated drug candidates, and proposes priorities for future research, including bioassay-guided fractionation, dereplication-based metabolomics, and strengthened intellectual property and benefit-sharing frameworks. Collectively, the evidence indicates that Tanzanian medicinal plants represent an underexploited reservoir for anticancer drug discovery that merits coordinated, multidisciplinary investigation.

KEYWORDS: Medicinal plants; bioactive compounds; anticancer; phytochemistry; Tanzania; drug discovery

1. Introduction

Cancer has emerged as one of the leading causes of morbidity and mortality worldwide, with an estimated 20.0 million new cases and 9.7 million deaths recorded globally in 2022 [1]. Earlier GLOBOCAN estimates for 2020 similarly documented a substantial and increasing global cancer burden, with approximately 19.3 million new cases [2]. In Africa, this burden is further intensified by late-stage diagnosis, limited screening infrastructure, and restricted

access to radiotherapy, chemotherapy, and other specialized oncology services, contributing to mortality-to-incidence ratios that remain considerably higher than the global average [3]. At the cellular level, malignant transformation involves the acquisition of multiple biological capabilities, including sustained proliferative signaling, resistance to apoptosis, and induction of angiogenesis, collectively recognized as key hallmarks of cancer [4]. Consequently, the development of anticancer agents capable of selectively disrupting these processes while minimizing toxicity to normal cells remains an important challenge in cancer therapy.

Natural products, particularly plant-derived secondary metabolites, have played a fundamental role in anticancer drug discovery. A substantial proportion of approved small-molecule anticancer agents are derived directly from natural sources or were developed based on natural-product scaffolds, with vinca alkaloids, taxanes, and camptothecin derivatives representing prominent clinical examples [5]. This success has encouraged continued bioprospecting of botanically diverse regions for new cytotoxic and antiproliferative compounds. Terpenoids, alkaloids, flavonoids, and other phytochemicals have attracted particular attention because their reported anticancer mechanisms include apoptosis induction, cell-cycle arrest, modulation of signaling pathways, and inhibition of tubulin polymerization [6–8].

Tanzania represents an important setting for such investigations because of its rich botanical diversity and longstanding use of medicinal plants in traditional healthcare. Ethnopharmacological surveys conducted since the late 1980s have documented numerous medicinal species and associated traditional practices, particularly in the eastern regions of the country [9–11]. Subsequent pharmacological investigations have identified several plants traditionally used for tumors, persistent wounds, and other cancer-associated conditions that exhibit measurable cytotoxic activity against human cancer cell lines [12,13]. These findings establish an important ethnomedical basis for anticancer natural-product discovery. However, a substantial gap remains between the documentation of traditional use and the development of chemically defined and mechanistically characterized anticancer lead compounds. Many investigations remain focused on crude extracts or partially purified fractions, whereas comparatively fewer studies have progressed through bioassay-guided isolation, comprehensive structural characterization, biological validation, and subsequent lead development.

Accordingly, this review aims to critically synthesize current knowledge on medicinal plants used for cancer management in Tanzania and the wider East African region, with particular emphasis on the progression from ethnobotanical knowledge to the isolation, structural characterization, and biological validation of bioactive anticancer compounds. Specifically, the review examines medicinal plants and their reported traditional applications in cancer management; evaluates extraction, fractionation, and chromatographic isolation techniques used to recover active constituents; assesses spectroscopic and spectrometric approaches employed for structural elucidation; and critically evaluates available *in vitro* and *in vivo* evidence of anticancer activity. The review also identifies methodological, analytical, and translational limitations that currently hinder the progression of promising natural products toward preclinical investigation and drug development. Where Tanzania-specific evidence is limited, comparative findings from Kenya, Uganda, Malawi, Ethiopia, and other relevant East African settings are considered to provide broader regional context.

The overall pathway from traditional medicinal knowledge to anticancer lead development is illustrated in Figure 1. The process begins with ethnobotanical selection of candidate medicinal plants and progresses through extraction, chromatographic isolation, structural characterization, bioactivity evaluation, and ultimately lead optimization and drug development. These stages should be regarded as interconnected rather than independent processes. Biological activity detected in a crude plant extract, for example, cannot be confidently attributed to a specific constituent without systematic fractionation, isolation, and chemical characterization. Conversely, identification of a structurally defined natural compound has limited therapeutic significance unless its anticancer activity, selectivity, mechanism of action, and biological relevance are adequately demonstrated. Integrating these stages therefore provides a systematic framework for translating Tanzania's traditional medicinal knowledge and botanical resources into experimentally validated anticancer candidates with potential for further preclinical development.

Figure 1. Workflow for anticancer compound discovery from Tanzanian medicinal plants.

2. Medicinal Plants of Tanzania Traditionally Used in Cancer Management

2.1. Ethnobotanical Diversity and Documentation.

Systematic documentation of Tanzanian traditional medicine began with a landmark series of ethnopharmacological surveys covering pteridophytes and angiosperms of the country's eastern regions, spanning Coast, Dar es Salaam, Kilimanjaro, Morogoro, and Tanga [9−11]. These surveys recorded several hundred plant species together with their vernacular names, plant parts used, and reported medicinal applications, including a substantial subset used against tumors, swellings, and wound-related conditions consistent with cancer-like presentations. Complementary single-disease ethnomedical enquiries have since focused specifically on cancer, directly interviewing traditional health practitioners in districts such as Mkuranga and Same to compile a more targeted inventory of plants claimed to treat malignancies [12]. Comparable single-disease surveys conducted in neighboring Kenya, Malawi, and Ethiopia reinforce a recurring pattern across the region: traditional healers consistently nominate a core

set of plant families, most notably Fabaceae, Rutaceae, Euphorbiaceae, and Asteraceae, as sources of anticancer remedies, suggesting shared phytochemical rationale across ethnically and geographically distinct healing traditions [14−16].

2.2. Priority Plant Families, Species, and Parts Used.

Building on this ethnobotanical foundation, several Tanzanian and regional studies have progressed from documentation to laboratory screening, evaluating crude extracts of traditionally nominated plants for cytotoxic activity against human cancer cell lines or surrogate bioassays such as the brine shrimp lethality test. Table 1 summarizes representative plant species that recur across these studies, together with the parts used and traditional applications reported. Species such as *Erythrophleum zimmermannii* (Fabaceae) and *Warburgia ugandensis* (Canellaceae) have attracted particular attention because their crude extracts have demonstrated cytotoxicity comparable to, or exceeding, that of reference cytotoxic standards in preliminary screening [12, 17, 18]. The recurrence of specific families across independent surveys, rather than a diffuse spread across the whole flora, supports a chemotaxonomically informed rather than purely random approach to future bioprospecting in Tanzania.

Table 1. Selected Tanzanian and East African anticancer medicinal plants.

Plant species (Family)	Part(s) used	Traditional use / reported evaluation	Ref.
Erythrophleum zimmermannii (Fabaceae)	Stem bark	Traditional anticancer remedy; extracts screened against HepG2 hepatocarcinoma cells	[17]
Warburgia ugandensis (Canellaceae)	Stem bark, leaves	Traditional wound and tumor remedy; highly cytotoxic ethanol extract reported	[13]
Zanthoxylum chalybeum (Rutaceae)	Root bark	Used traditionally for cervical cancer management in East Africa	[13,15]
Mystroxylon aethiopicum (Celastraceae)	Leaves, bark	Traditional Tanzanian remedy; extract cytotoxicity exceeding cyclophosphamide standard	[19]
Uvaria acuminata (Annonaceae)	Root	Traditional Tanzanian remedy; source of cytotoxic C-benzylated dihydrochalcones	[18]
Psorospermum febrifugum (Hypericaceae)	Root, bark	Traditional remedy for cervical cancer management in the East African region	[15]

2.3. Traditional Preparation, Administration, and Regional Comparison.

Traditional preparation of these remedies follows patterns common to African ethnomedicine more broadly: decoction and aqueous or hydro-alcoholic maceration predominate, with roots and stem bark favored over leaves for chronic conditions such as tumors, reflecting perceived potency and the belief that woody tissues concentrate active principles [11,14]. Administration is typically oral, sometimes combined with topical application for accessible lesions. Cross-regional comparison indicates that while specific recipes vary between Tanzanian, Kenyan, Malawian, and Ugandan healers, the underlying plant families and preparation logic are broadly conserved, which strengthens the rationale for treating East African ethnobotanical knowledge as a shared evidentiary base rather than as strictly national datasets when prioritizing species for phytochemical investigation [13−16].

3. Extraction and Isolation of Bioactive Anticancer Compounds

3.1. Extraction Techniques and Solvent Selection.

Extraction is the foundational step that determines which classes of phytochemicals are available for subsequent isolation, and the choice of solvent and method directly shapes the polarity range, yield, and thermal stability of the recovered constituents [20]. Conventional solvent-based methods, principally cold maceration, sequential Soxhlet extraction, and decoction, dominate the Tanzanian and regional literature, reflecting both resource availability and the historical continuity of these techniques with traditional preparation methods [12, 17, 20]. Methanol and aqueous methanol are the most frequently applied solvents for initial broad-spectrum recovery of secondary metabolites, while sequential extraction with solvents of increasing polarity, from n-hexane through dichloromethane and ethyl acetate to methanol, is used to generate polarity-graded fractions that simplify downstream bioassay-guided isolation [17]. Table 2 summarizes the extraction approaches most commonly reported for Tanzanian and East African medicinal plants investigated for anticancer potential.

Table 2. Common extraction methods for anticancer bioactive compounds.

Extraction method	Typical solvent(s)	Compound class favored / application	Ref.
Cold maceration	Methanol; aqueous methanol	Broad-spectrum secondary metabolites (alkaloids, flavonoids, terpenoids)	[12]
Sequential (polarity-graded) extraction	n-Hexane → dichloromethane → ethyl acetate → methanol	Fractionation prior to bioassay-guided isolation	[17]
Decoction	Water (heated)	Polar glycosides, tannins, and mucilaginous constituents	[20]
Ultrasound-assisted extraction	Ethanol; aqueous ethanol	Phenolics and flavonoids, with reduced extraction time and solvent volume	[20]

3.2. Chromatographic Isolation and Purification Strategies.

Following crude extraction, bioassay-guided fractionation is the predominant strategy for narrowing complex mixtures down to single bioactive constituents: crude extracts are partitioned or chromatographed, each fraction is re-tested for cytotoxic activity, and only the active fractions are advanced to further purification [21]. Column chromatography over normal-phase silica gel remains the workhorse technique for East African natural product isolation, frequently combined with thin-layer chromatography for fraction monitoring and with preparative or semi-preparative high-performance liquid chromatography for final purification of closely related congeners [20, 21]. Size-exclusion chromatography on dextran gel media is additionally used to remove pigments, waxes, and high-molecular-weight tannins that would otherwise co-elute with target compounds and complicate spectroscopic interpretation. The iterative, activity-guided nature of this workflow, summarized schematically in Figure 1, means that isolation and bioactivity evaluation are not sequential but mutually reinforcing steps repeated across successive rounds of fractionation.

3.3. Major Classes of Isolated Bioactive Compounds.

Across the East African literature, three classes of secondary metabolites dominate the reported anticancer bioactive compounds: terpenoids, flavonoids, and alkaloids. Terpenoids, particularly triterpenoids and diterpenoids, are the most frequently isolated class from woody

plant parts such as stem bark and root, consistent with their role in constitutive plant chemical defense, and exert anticancer effects through mechanisms including apoptosis induction, cell-cycle arrest, and suppression of angiogenesis [6]. Flavonoids, recovered predominantly from leaf and aerial tissue extracts, act through modulation of reactive oxygen species homeostasis, activation of intrinsic and extrinsic apoptotic pathways, and inhibition of pro-inflammatory signaling implicated in tumor progression [7]. Alkaloids, though less frequently isolated in the Tanzanian literature to date, remain mechanistically the most clinically validated class, exemplified by the vinca alkaloids vincristine and vinblastine derived from Catharanthus roseus, which act as microtubule-destabilizing agents that arrest mitosis [8]. The relative scarcity of fully characterized alkaloid isolates from Tanzanian flora specifically, compared with the more extensively documented terpenoid and flavonoid classes, represents a notable gap given the demonstrated clinical importance of this compound class.

4. Structural Characterization and Anticancer Bioactivity Evaluation

4.1. Spectroscopic and Spectrometric Characterization Techniques.

Unambiguous structural characterization is what distinguishes a fully validated bioactive compound from an unidentified active fraction, and it is at this stage that much of the Tanzania-focused literature remains incomplete. Ultraviolet-visible (UV-Vis) and Fourier-transform infrared (FTIR) spectroscopy provide preliminary information on chromophores and functional groups, respectively, and are typically used as rapid dereplication tools before committing material to more resource-intensive analysis [22]. One-dimensional nuclear magnetic resonance (1H and 13C NMR) establishes the carbon-hydrogen framework of a molecule, while two-dimensional experiments, including correlation spectroscopy (COSY), heteronuclear single-quantum coherence (HSQC), and heteronuclear multiple-bond correlation (HMBC), resolve connectivity and substitution patterns that cannot be assigned from one-dimensional data alone, particularly in structurally congested terpenoid and flavonoid glycosides [22]. High-resolution mass spectrometry (HRMS) complements NMR by providing accurate molecular formula determination, while X-ray crystallography, where suitable crystals can be obtained, offers unambiguous confirmation of absolute stereochemistry. Table 3 summarizes these techniques and the structural information each provides.

Table 3. Characterization techniques for isolated anticancer compounds.

Technique	Structural information provided	Typical application	Ref.
UV-Vis spectroscopy	Chromophore identification; conjugation pattern	Rapid dereplication of flavonoid and alkaloid classes	[22]
FTIR spectroscopy	Functional group identification (OH, C=O, C=C, etc.)	Preliminary screening of crude fractions	[20]
1D NMR (1H, 13C)	Carbon-hydrogen framework; proton and carbon count	Core skeleton assignment of isolated compounds	[22]
2D NMR (COSY, HSQC, HMBC)	Atom connectivity and substitution pattern	Resolution of structurally congested terpenoid/flavonoid glycosides	[22]
High-resolution mass spectrometry (HRMS)	Accurate molecular formula and mass	Molecular formula confirmation; fragmentation analysis	[22]

4.2. In Vitro and In Vivo Anticancer Bioactivity Evaluation.

Anticancer bioactivity is most commonly evaluated in vitro using colorimetric viability assays, principally the MTT and MTS tetrazolium reduction assays, applied to human carcinoma cell lines such as HeLa (cervical), HepG2 (hepatocellular), MCF-7 (breast), and HT29 (colorectal), with potency expressed as the half-maximal inhibitory concentration (IC50) [17,23]. Surrogate assays, most notably the brine shrimp (Artemia salina) lethality test, are widely used in resource-limited settings as an inexpensive preliminary indicator of general cytotoxicity ahead of more resource-intensive cell-line-based confirmation [19]. Table 4 summarizes representative bioactivity findings reported for Tanzanian and East African plant extracts and compound classes. In one screening study of 137 Tanzanian plant extracts against HepG2 cells, 16% displayed moderate-to-strong inhibitory activity, with the bark extract of Erythrophleum zimmermannii the most potent (IC50 = 17.1 ± 1.1 μg/mL) [17]. Separately, extracts of selected Tanzanian plants including Mystroxylon aethiopicum exhibited cytotoxicity in the brine shrimp assay exceeding that of the reference cytotoxic agent cyclophosphamide (LC50 = 16.57 μg/mL) in approximately one-third of samples tested [19]. Comparable potency has been reported for Warburgia ugandensis extracts against glioblastoma cell lines in neighboring Uganda [13], reinforcing the cross-border relevance of shared East African flora.

Table 4. Reported anticancer bioactivity of East African plant extracts.

Plant / extract	Cell line / assay	Reported activity	Ref.
Erythrophleum zimmermannii bark extract	HepG2 (hepatocellular carcinoma)	IC50 = 17.1 ± 1.1 μg/mL	[17]
Panel of 137 Tanzanian plant extracts	HepG2 (hepatocellular carcinoma)	16% showed IC50 = 17.1–79.2 μg/mL	[17]
Mystroxylon aethiopicum and related extracts	Artemia salina (brine shrimp lethality)	LC50 below 16.57 μg/mL in ~33% of extracts	[19]
Warburgia ugandensis ethanol extract	U87.CD4.CXCR4 (glioblastoma)	CC50 = 7.6 μg/mL (highly cytotoxic)	[13]
Kenyan flora phenolics and terpenoids	Human carcinoma cell line panel	Cytotoxic activity reported across multiple isolates	[21]
Ethiopian plant extracts (22 species)	MCF-7, A427, RT-4, SiSo, and others	Selective cytotoxic activity in active species	[24]

4.3. Structure-Activity Relationships and Mechanisms of Action.

Structure-activity relationship analysis across these compound classes indicates that cytotoxic potency is strongly influenced by the degree and position of hydroxylation, glycosylation, and lipophilicity. Among flavonoids, unglycosylated aglycones with free hydroxyl groups at the C-3 and C-7 positions generally show greater pro-apoptotic activity than their glycosylated counterparts, an effect attributed to improved membrane permeability and more efficient generation of reactive oxygen species within cancer cells [7]. Among terpenoids, the presence of an α,β-unsaturated carbonyl (Michael acceptor) moiety is strongly associated with covalent modification of cysteine residues on key regulatory proteins, including IKKβ and Keap1, underlying much of the pro-apoptotic and anti-inflammatory activity observed for this class [6]. Among alkaloids, the indole-dihydroindole dimeric scaffold shared by vincristine and vinblastine is essential for high-affinity binding to the vinca-domain of β-tubulin, and even minor structural modification at this dimer interface substantially reduces microtubule-

destabilizing potency [8]. These structure-activity principles provide a rational basis for prioritizing which isolated Tanzanian compounds warrant semi-synthetic derivatization in future lead-optimization efforts.

5. Challenges, Future Directions, and Concluding Remarks

5.1. Analytical, Methodological, and Resource Challenges.

Several methodological and resource constraints limit progression from crude-extract screening to fully characterized anticancer leads in Tanzania. Access to high-field NMR spectrometers and high-resolution mass spectrometers remains concentrated in a small number of regional and international collaborating laboratories, so that isolated compounds frequently must be shipped abroad for full structural elucidation, introducing delays, cost, and sample-stability risks [22]. Extraction and fractionation methods themselves carry trade-offs: conventional maceration and Soxhlet extraction are simple and inexpensive but slow and solvent-intensive, while more efficient modern techniques such as ultrasound- and microwave-assisted extraction, though increasingly documented in the wider phytochemical literature, remain underutilized in Tanzanian laboratories owing to equipment cost [20]. In vitro cytotoxicity data are additionally rarely accompanied by counterpart evaluation against non-malignant cell lines, so that many reported “cytotoxic” extracts have not yet been confirmed as selectively antitumor rather than generally toxic.

5.2. Regulatory, Conservation, and Bioprospecting Considerations.

Beyond the laboratory, regulatory and conservation considerations shape how Tanzanian bioprospecting can responsibly proceed. Several of the plant species most frequently implicated in anticancer screening, including slow-growing stem-bark and root sources, are harvested destructively by traditional practitioners, raising sustainability concerns if demand were to scale toward pharmaceutical production without cultivation or sustainable wild-harvest protocols [15]. Formal access and benefit-sharing arrangements are essential to ensure that traditional ecological knowledge holders and the communities from which plant material and associated ethnomedical information are sourced receive equitable recognition and benefit should a Tanzanian-derived compound eventually progress toward commercial drug development, a concern also raised in the comparable Kenyan ethnopharmacological context [14]. The absence of a well-resourced national natural products repository or centralized voucher specimen and compound library in Tanzania further limits the reproducibility and cumulative value of isolation studies conducted by different research groups over time.

5.2. Future Research Directions.

Future research on Tanzanian medicinal plants with anticancer potential should move beyond preliminary screening of crude extracts toward systematic bioassay-guided fractionation, isolation, and characterization of individual bioactive compounds. Greater emphasis should be placed on linking chemical structures with specific anticancer mechanisms, including apoptosis, cell-cycle regulation, oxidative stress, angiogenesis, and cancer-related signaling pathways. Studies should also evaluate selectivity by comparing cytotoxicity against cancerous and normal cell lines rather than relying solely on inhibition of cancer cell growth.

Further progress will require greater use of advanced analytical techniques, including LC–MS/MS, HRMS, multidimensional NMR, and metabolomics, to improve compound identification and reduce duplication of previously characterized natural products. Promising compounds should subsequently undergo *in vivo* validation, pharmacokinetic assessment, toxicity testing, and structure–activity relationship studies. Standardization of extraction procedures, bioactivity assays, and reporting criteria would also improve comparability among studies. Future investigations should additionally strengthen collaboration among ethnobotanists, natural-product chemists, pharmacologists, oncologists, and traditional medicine practitioners. Integrating traditional knowledge with modern analytical and computational approaches may accelerate the identification of promising candidates. Establishing well-characterized regional natural-product libraries and expanding research to underexplored Tanzanian plant species could further support the translation of ethnomedicinal knowledge into clinically relevant anticancer leads.

6. Conclusions

Tanzanian medicinal plants represent a valuable but still underexplored source of bioactive compounds for anticancer drug discovery. Existing ethnobotanical and pharmacological evidence demonstrate considerable potential, but much of the available research remains concentrated on crude extracts and preliminary *in vitro* cytotoxicity screening. Progress toward drug development therefore requires stronger integration of ethnobotanical selection, systematic extraction and chromatographic isolation, structural characterization, and rigorous biological validation. Advancing promising compounds from preliminary activity to validated anticancer leads will depend on improved analytical characterization, mechanistic studies, selectivity assessment, *in vivo* validation, and multidisciplinary collaboration. A more integrated discovery pathway could enhance the scientific validation of Tanzania's medicinal plant resources and provide a stronger foundation for developing novel natural-product-based anticancer candidates.

Author Contributions

Both authors contributed equally to this work, including conceptualization, literature search and synthesis, drafting, critical revision, and approval of the final manuscript. F.E.M. and N.R.K. jointly take responsibility for the integrity of the review.

Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this review.

Data Availability

No new data were generated or analyzed in this review. All information discussed is drawn from previously published, publicly accessible peer-reviewed sources cited in the reference list.

References

[1] Bray, F.; Laversanne, M.; Sung, H.; Ferlay, J.; Siegel, R.L.; Soerjomataram, I.; Jemal, A. (2024). Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*, *74*(3), 229–263. https://doi.org/10.3322/caac.21834.

[2] Sung, H.; Ferlay, J.; Siegel, R.L.; Laversanne, M.; Soerjomataram, I.; Jemal, A.; Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*, *71*(3), 209–249. https://doi.org/10.3322/caac.21660.

[3] Sharma, R.; Aashima; Nanda, M.; Fronterre, C.; Sewagudde, P.; Ssentongo, A.E.; Yenney, K.; Arhin, N.D.; Oh, J.; Amponsah-Manu, F.; Ssentongo, P. (2022). Mapping cancer in Africa: A comprehensive and comparable characterization of 34 cancer types using estimates from GLOBOCAN 2020. *Frontiers in Public Health*, *10*, 839835. https://doi.org/10.3389/fpubh.2022.839835.

[4] Hanahan, D.; Weinberg, R.A. (2011). Hallmarks of cancer: The next generation. *Cell*, *144*(5), 646–674. https://doi.org/10.1016/j.cell.2011.02.013.

[5] Newman, D.J.; Cragg, G.M. (2020). Natural products as sources of new drugs over the nearly four decades from 01/1981 to 09/2019. *Journal of Natural Products*, *83*(3), 770–803. https://doi.org/10.1021/acs.jnatprod.9b01285.

[6] Kamran, S.; Sinniah, A.; Abdulghani, M.A.M.; Alshawsh, M.A. (2022). Therapeutic potential of certain terpenoids as anticancer agents: A scoping review. *Cancers*, *14*(5), 1100. https://doi.org/10.3390/cancers14051100.

[7] Kopustinskiene, D.M.; Jakstas, V.; Savickas, A.; Bernatoniene, J. (2020). Flavonoids as anticancer agents. *Nutrients*, *12*(2), 457. https://doi.org/10.3390/nu12020457.

[8] Dhyani, P.; Quispe, C.; Sharma, E.; Bahukhandi, A.; Sati, P.; Attri, D.C.; Szopa, A.; Sharifi-Rad, J.; Docea, A.O.; Mardare, I.; Calina, D.; Cho, W.C. (2022). Anticancer potential of alkaloids: A key emphasis to colchicine, vinblastine, vincristine, vindesine, vinorelbine and vincamine. *Cancer Cell International*, *22*, 206. https://doi.org/10.1186/s12935-022-02624-9.

[9] Chhabra, S.C.; Mahunnah, R.L.A.; Mshiu, E.N. (1987). Plants used in traditional medicine in eastern Tanzania. I. Pteridophytes and angiosperms (Acanthaceae to Canellaceae). *Journal of Ethnopharmacology*, *21*(3), 253–277. https://doi.org/10.1016/0378-8741(87)90103-6.

[10] Chhabra, S.C.; Mahunnah, R.L.A.; Mshiu, E.N. (1990). Plants used in traditional medicine in eastern Tanzania. III. Angiosperms (Euphorbiaceae to Menispermaceae). *Journal of Ethnopharmacology*, *28*(3), 255–283. https://doi.org/10.1016/0378-8741(90)90078-8.

[11] Chhabra, S.C.; Mahunnah, R.L.A.; Mshiu, E.N. (1993). Plants used in traditional medicine in Eastern Tanzania. VI. Angiosperms (Sapotaceae to Zingiberaceae). *Journal of Ethnopharmacology*, *39*(2), 83–103. https://doi.org/10.1016/0378-8741(93)90024-Y.

[12] Matata, D.Z.; Ngassapa, O.D.; Machumi, F.; Moshi, M.J. (2018). Screening of plants used as traditional anticancer remedies in Mkuranga and Same districts, Tanzania, using brine shrimp toxicity bioassay. *Evidence-Based Complementary and Alternative Medicine*, *2018*, 3034612. https://doi.org/10.1155/2018/3034612.

[13] Anywar, G.U.; Kakudidi, E.; Oryem-Origa, H.; Schubert, A.; Jassoy, C. (2022). Cytotoxicity of medicinal plant species used by traditional healers in treating people suffering from HIV/AIDS in Uganda. *Frontiers in Toxicology*, *4*, 832780. https://doi.org/10.3389/ftox.2022.832780.

[14] Omara, T.; Odero, M.P.; Obakiro, S.B. (2022). Medicinal plants used for treating cancer in Kenya: An ethnopharmacological overview. *Bulletin of the National Research Centre*, *46*, 148. https://doi.org/10.1186/s42269-022-00840-x.

[15] Tembo, N.; Lampiao, F.; Mwakikunga, A.; Chikowe, I. (2021). Ethnobotanical survey of medicinal plants used for cervical cancer management in Zomba District, Malawi. *Scientific African*, *13*, e00941. https://doi.org/10.1016/j.sciaf.2021.e00941.

[16] Tesfaye, S.; Belete, A.; Engidawork, E.; Gedif, T.; Asres, K. (2020). Ethnobotanical study of medicinal plants used by traditional healers to treat cancer-like symptoms in eleven districts, Ethiopia. *Evidence-Based Complementary and Alternative Medicine*, *2020*, 7683450. https://doi.org/10.1155/2020/7683450.

[17] Choi, C.W.; Song, S.B.; Oh, J.S.; Kim, Y.H. (2015). Antiproliferation effects of selected Tanzania plants. *African Journal of Traditional, Complementary and Alternative Medicines*, *12*(2), 96–102. https://doi.org/10.21010/ajtcam.v12i2.15.

[18] Kamuhabwa, A.; Nshimo, C.; de Witte, P. (2000). Cytotoxicity of some medicinal plant extracts used in Tanzanian traditional medicine. *Journal of Ethnopharmacology*, *70*(2), 143–149. https://doi.org/10.1016/S0378-8741(99)00161-0.

[19] Kilonzo, M.; Ndakidemi, P.A.; Chacha, M. (2016). In vitro antifungal and cytotoxicity activities of selected Tanzanian medicinal plants. *Tropical Journal of Pharmaceutical Research*, *15*(10), 2121–2130. https://doi.org/10.4314/tjpr.v15i10.10.

[20] Bitwell, C.; Indra, S.S.; Luke, C.; Kakoma, M.K. (2023). A review of modern and conventional extraction techniques and their applications for extracting phytochemicals from plants. *Scientific African*, *19*, e01585. https://doi.org/10.1016/j.sciaf.2023.e01585.

[21] Kuete, V.; Omosa, L.K.; Midiwo, J.O.; Karaosmanoğlu, O.; Sivas, H. (2019). Cytotoxicity of naturally occurring phenolics and terpenoids from Kenyan flora towards human carcinoma cells. *Journal of Ayurveda and Integrative Medicine*, *10*(3), 178–184. https://doi.org/10.1016/j.jaim.2018.04.001.

[22] Burns, D.C.; Mazzola, E.P.; Reynolds, W.F. (2019). The role of computer-assisted structure elucidation (CASE) programs in the structure elucidation of complex natural products. *Natural Product Reports*, *36*(6), 919–933. https://doi.org/10.1039/c9np00007k.

[23] Tesfaye, S.; Asres, K.; Lulekal, E.; Alebachew, Y.; Tewelde, E.; Kumarihamy, M.; Muhammad, I. (2020). Ethiopian medicinal plants traditionally used for the treatment of cancer, Part 2: A review on cytotoxic, antiproliferative, and antitumor phytochemicals, and future perspective. *Molecules*, *25*(17), 4032. https://doi.org/10.3390/molecules25174032.

[24] Tesfaye, S.; Braun, H.; Asres, K.; Engidawork, E.; Belete, A.; Muhammad, I.; Schulze, C.; Schultze, N.; Guenther, S.; Bednarski, P.J. (2021). Ethiopian medicinal plants traditionally used for the treatment of cancer; Part 3: Selective cytotoxic activity of 22 plants against human cancer cell lines. *Molecules*, *26*(12), 3658. https://doi.org/10.3390/molecules26123658.