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Anti-proliferative Effect of Nine Resins from Medicinal Plants of Burkina Faso

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Abstract: Exudates are substances that ooze out of the pores of diseased and/or damaged tissue in plant that are well-used in flourishing international and local uses in Burkina Faso. Previously, the ethnopharmacological investigations in Center region showed that there are lot of medicinal uses like as old wounds, skin disorders diseases treatment. The current study aims to highlight the antitumoral potential of nine resins form central region. One hundred grams of each resin were placed at -80°C before extraction. The resins were grinded, and the powder was stirred twice with 1L and 500 mL of $CHCl_3$ respectively for 24h. The antiproliferative effect was determined by using MTT colorimetric assay with chloroformic extracts from resin of each plant and the concentrations which inhibited 50% of cell proliferation (IC_{50}) were determinated graphically. The results showed that the IC_{50} of A549 proliferative inhibition was form 5.78 (*Lannea microcarpa*) to 32.48 µg/mL (*Daniellia oliveri*) and U373 inhibition IC_{50} was from 12.90 (*L. macrocarpa*) to 41.12 µg/mL (*Boswellia dalzielli*). The Keratinocytes IC_{50} was form 1.57 (*L. macrocarpa*) to 20.4 µg/mL (*Boswellia dalzielli*). Interestingly, the resin extract form *L. macrocarpa* resin was a best source of anticancer compounds for the A549 and U373 following by *Bombax costatum* resin. In the contrast *Commiphora africana* (Burseraceae) resin was the less antiproliferation effect. The exudates resin from plants that were a source of bioactive compounds could explain of the medicinal uses like as anti-inflammatory, wound healing, and skin ailments in Burkina Faso.

Keywords: Traditional Medicine, Resins, Antiproliferative

1. Introduction

Exudates are substances that ooze out of the pores of diseased or damaged tissue in plant. According to Lambert *et al.* data, these are complex mixtures of organic compounds which are secreted in the extracellular matrix and which normally appear on the surface of the plant [1]. These substances have been collected and used throughout history for example as adhesives and coatings, thickeners, cosmetic ingredients and in industrial application [2]. Some exudates have been appreciated for their medicinal uses, including, antimicrobial, anti-inflammatory, antioxidant, wound healing and anti-nociceptive [2, 3].

In Burkina Faso, gums and resins are well-used in flourishing international and local trades [4]. It is a good way for fighting the poverty in rural areas. The resin and gum productions were promoted by the public authorities [4]. In parallel, the medicinal uses of the resin and gum were promoted in Burkina traditional medicine according to Nacoulma study [5]. The medicinal, commercial, and industrial uses and the demonstrated biological properties of the resins from medicinal plants were showed in the table 1.

Table 1. *Bibliographical data of Exudate from nine medicinal plants in Burkina.*

Species	Commercial or Industrial uses	Medicinal uses	Biological activities data
Acacia senegal (Mimosaceae)	Commercial exploitation in Burkina [4], [6], in Ethiopia and Kenya [7]	Medicinal uses like as dysentery, stomach bloating, colds, all, toothache [4, 6]	
Bombax costatum (Bombacaceae)	Gum and its Application [8]	Treatment of gastrointestinal complaints, a variety of genitor-urinary tract diseases, wound healing, and skin ailments [5].	
Boswellia dalzielli (Burseraceae)	Commercial exploitation in Burkina [4, 9] Gum and resin resources in Ethiopia [7]		Analgesic properties and the acute toxicity of Ethanol Extract of the Resin Exudate [10]
Commiphora africana (Burseraceae)	Commercial exploitation in Burkina [4] Gum and resin resources in Ethiopia [7]	Treatment snakebite, skin wounds, tumor, stomachache, and as anti-ticks [7, 11]	Anti-proliferative activity [12]
Daniellia oliveri (Caesalpiniaceae)	Commercial exploitation in Burkina [4]	Treatment of gastrointestinal complaints, genitor-urinary tract diseases, wound healing, and skin ailments [4, 5]	Anti-melanogenesis effect daniellic acid [13], antioxidant and cytotoxicity Potential [14]
Khaya senegalensis (Meliaceae)	Industrial uses [15, 16], Pharmaceutical Excipients [17, 18]	Medicinal uses in Burkina [19]	
Lannea acida (Anacardiaceae) *Lannea microcarpa* (Anacardiaceae) *Sclerocarya birrea* (Anacardiaceae)		Treatment of gastrointestinal complaints, a variety of genitor-urinary tract diseases, wound healing, and skin ailments [5]	

According to bibliographic data, the antiproliferative and/cytotoxicities of resins from *Boswellia dalzielli* (Burseraceae), *Commiphora africana* (Burseraceae) and *Daniellia oliveri* (Caesalpiniaceae) were demonstrated. The current study aims to highlight the medicinal uses of nine resin form Burkina by evaluating their antitumoral potential. These resins were selected from well-known medicinal uses in Burkina.

2. Material and Methods

2.1. Chemicals and Tumor Cells Origins

All chemicals, substrates, standards, and analytical grade solvents used were supplied by Sigma (Belgium) and Chemlab (Belgium). Various tumor cells including carcinomas (lung A549); glioblastoma (U373) used and keratinocytes in cell viability were from Sigma.

2.2. Plant Material

The 9 plant resins were obtained from authorized traditional healer, at Burkina Faso central region in October 2012. They were harvested form *Daniellia oliveri*, (Rolfe) Hutch. & Dalziel (Leguminosae) *Lannea acida* A. Rich., *Lannea microcarpa* Engl. & K. Krause (Anacardiaceae), *Boswellia dalzielii* Hutch., *Commiphora africana* (A. Rich.) Endl., (Burseraceae), *Bombax costatum* Pellegr. & Vuillet (Malvaceae), *Khaya senegalensis* (Desv.) A. Juss. (Meliaceae) and *Acacia senegal* (L.) Willd. (Fabaceae). Specimens were available at the plant biology and ecology laboratory herbarium numbering from NA_152 to NA_160 (University Joseph Ki-Zerbo, UFR/SVT, Ouagadougou, Burkina Faso).

2.3. Extraction

100 g of each resin were placed at -80°C before extraction. The resins were grinded, and the powder was stirred twice with 1L and 500 mL of $CHCl_3$ respectively for 24h. The organic phases were pooled and evaporated under reduced pressure.

2.4. Anti-proliferative Studies

2.4.1. Cell Culture Conditions

Two tumor cell lines (A549 lung carcinoma and U373 brain glioblastoma) and keratinocytes (USA) from ATCC were used to investigate antiproliferative activity of nine resins. Cells were propagated in red RPMI-1640 medium supplemented with 10% heated-inactivated FCS, 100 U/mL of penicillin, streptomycin, gentamicin, and 2 mM of L-glutamine (Gibco, USA), and incubated in a 5% CO_2 incubator at 37°C. The medium was renewed every 72 hours. The cells are treated with trypsin and suspended in medium to obtain a density allowing a specific cellular count for biological analysis.

2.4.2. Cell Viability Assay

Cell viability was determined by using the MTT (3-[4,5-dimethylthiazole-2-yl]-2,5-diphenyltetrazoliumbro mide) colorimetric assay (MTT, Sigma, USA). Mitochondrial dehydrogenases metabolize MTT salt to an orange formazan dye, which was measured at 570 nm by using a scanning multi-well spectrophotometer [13]. Briefly, 2.10^4 cells were seeded in 96-well plates; after a 24 h stay in the CO_2 incubator, different dilutions of samples (extracts of plant resins) were added. After 72 h incubation, the media were replaced by a MTT solution in white RPMI-1640 medium (0.5mg/mL) and the plates were left for a further 3h in the 5% CO_2 incubator at 37°C. The MTT solution after centrifugation was then replaced by DMSO to dissolve the crystals of reduced formazan (15min under low agitation, 700rpm) and the absorbance was measured at 570

nm versus a 620 nm reference [20]. Concentration of sample which inhibited 50% (IC_{50}) of cell proliferation was determined from dose-response-inhibition curves, by fitting experimental data to a non-linear regression using a polynomial curve (GraphPad Prism 5.0). The experiments were performed in duplicate (n=3x2).

2.5. Data Analysis

All data are represented as the Mean±Standard deviation (S. D) of replicates. Group means were compared using the Kruskal-Wallis or Mann-Whitney non-parametric test (Statistica 7, USA). Values were determined to be significant when $P<0.05$.

3. Results and Discussion

According to the previous data, the cancer represented a public health problem in Burkina Faso. The statistic showed that 1,669 case of cancer in 2010 [21, 22]. For example, breast cancer accounts for 12.3% of cancers and is the most common, after that of the cervix at 21.6%. For resolving the cancer development, the traditional medicine and the use medicinal plants were play a main role [21, 22]. In the study the uses of nine resin extracts in the controlling the cancer were highlighted by evaluating the antiproliferative effect (tables 1 and 2).

Table 2. *Cytotoxicities of resins extract.*

Species	A549 (IC_{50} µg/mL)	U373 (IC_{50} µg/mL)	Keratinocytes (IC_{50} µg/mL)
L. acida	$22.34±7.01^{b,c}$	$32.77±4.16^{b}$	Not determined
L. microcarpa	$5.78±0.17^{e}$	$12.90±0.55^{c}$	$1.57±0.78^{c}$
S. birrea	$13.49±0.02^{d,e}$	$26.33±5.41^{b}$	$5.18±1.93^{b,c}$
B. dalzielli	$30.01±4.75^{a,b}$	$41.12±3.74^{a}$	Not determined
C. africana	$26.60±1.35^{a,b}$	$26.11±1.04^{b}$	$13.14±3.17^{a,b}$
B. costatum	$12.26±3.04^{d,e}$	$8.80±1.99^{c}$	$14.06±1.95^{a}$
D. oliveri	$32.48±1.39^{a}$	$33.45±4.51^{ab}$	Not determined
K. senegalensis	$25.26±1.95^{a,b}$	$29.08±3.02^{b}$	Not determined
A. senegal	$16.85±4.6^{c,d}$	$15.57±3.02^{c}$	$20.4±5.57^{a}$

Mean ± SD (n=3x2) values followed by different letters within the same row are significantly different according to ANOVA-test at $P < 0.05$ and Tukey's Multiple Comparison test.

For A549 proliferative inhibition, the IC_{50} was form 5.78 (*L. microcarpa*) to 32.48 µg/mL (*D. oliveri*) and U373 inhibition was from 12.90 (*L. macrocarpa*) to 41.12 µg/mL *(B. dalzielli*). The Keratinocytes IC_{50} was form 1.57 (*L. microcarpa*) to 20.4 µg/mL (*A. Senegal*). Remarkably *L. microcarpa* resin extract presented the best inhibition of all cell proliferation. According to the American National Cancer Institute (NCI), the criteria of cytotoxicity for crude extracts *L. microcarpa* resin was a best source of anticancer compounds for the A549 and U373 following by *B. costatum* resin [23]. This finding could justify the traditional uses of the plant in Burkina (Table 1). According to bibliographical data, the antiproliferative effects of resin extract from *Boswellia dalzielli; Commiphora african* and *Daniellia oliveri* were found (Table 1). These resins contained some terpenoid compounds like as daniellic acid, tricyclic triterpenoid acid and polyalthic acid with antiproliferative effect according to previous phytochemical studies [12-14]. But it was the first study of resin cytotoxicities *from Acacia Senegal, Bombax costatum, Khaya senegalensis, Lannea acida, Lannea macrocarpa, Sclerocarya birrea* used in traditional medicine application. Generally, exudates mainly resin from medicinal plants were a source of mixture of organic molecules which possess several biological activities like as antimicrobial, anti-inflammatory, antioxidant, wound healing and anti-nociceptive that could explain of their medicinal uses [1, 3]. In contrast the commercial uses exudates were more developed mainly industrial and pharmaceutical applications [2, 4].

4. Conclusion

For the first time an attempt has been made to evaluate the antiproliferative effect of resin form medicinal plant for Burkina. It also provides first pharmacological data on the cytotoxicity of some plants, such *Acacia Senegal, Bombax costatum, Khaya senegalensis, Lannea acida, Lannea microcarpa, Sclerocarya birrea*. Various studies have demonstrated the potential of natural resin of Burkina for pharmaceutical and industrial application and this present study have shown that resin form nine medicinal plant could find their uses justifications. The *L. macrocarpa* resin that was a best source of anticancer compounds could be recommended for its promoting by politics in Burkina. The identification of cytotoxic compounds from these plants, the evaluation of their possible modes of action may foster the development of new treatment strategies against drug-resistant and refractory tumoral diseases.

Conflicting Interest

All the authors do not have any possible conflicts of interest.

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