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A Note on the Current Status of Bioactivity Tests Involving Plant Material from Two Southern Regions of South Africa

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Abstract

This paper is a short note about the current status of bioactivity testing involving plant material. A generalised science overview is provided, with two South African provinces, *viz*. Cape Town and KwaZulu-Natal, used as examples to explain the discrepancies often encountered in bioactivity testing outcomes. (All of the views provided in this paper are those of the author. Only some of the information provided, I (the author) had obtained while based in the School of Life Sciences at the University of KwaZulu-Natal (Westville campus) in 2014).

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INTRODUCTION

The southern regions of South Africa are known, throughout the world, for its moderate to temperate climates, an attribute that enables vegetation types and varieties to flourish well during the Spring season, and seasons required by particular plant or tree species to propagate optimally (Singh, 2015). However, the temperature between different cities and provinces in Africa, like in all other countries, vary either minimally or greatly due to – as it's been scientifically proven – their height above sea level (Singh, 2015). This means that the same or similar plants in different regions of the world, may possess structurally similar, if not the same, biologically-significant compounds, but in varied concentrations between regions or places in countries due to synthetic mechanisms being influenced by high and low temperatures, since the enzymes catalysing the mechanistics involved in the biosynthetic pathways of bioactive (including those of nutritional value) compounds are affected by temperature fluctuation – as one of the many known factors (adapted from Salisbury and Ross, 1992; Starr and Taggart, 2001; Becker *et al*., 2003). This variation in the compounds between similar and dissimilar plant or tree species in different proximity to each other, has complicated the status of bioactivity tests in Africa. Africa – a developing country – faces the dire need to secure adequately world-class facilities, in general, to perform laboratory tests in confidence that a high degree of accuracy can be achieved (Singh, 2015).

A COMPARISON BETWEEN THE CAPE TOWN AND KWAZULU-NATAL PROVINCES IN SOUTH AFRICA

The Cape Town and KwaZulu-Natal provinces in South Africa lie on different regions on the world map. The differences in the location of provinces, in general and in any region of the world, has been discovered by astronomers, and has suggested to evolutionary, environmental, and developmental biologists, that there is definitely a difference in seasonal and temperature conditions during different periods between similarly or dissimilarly distanced areas or places (Singh, 2015). During the summer months in Durban – a city located in the KwaZulu-Natal province – temperatures are mild to moderate, while during the winter months, temperatures reach as low as an estimated value of 20°C, however, negative temperatures, to my knowledge being a national resident of Durban, has never been encountered. In contrast – in Cape Town – although the Western Cape coast sea lines all south coast areas, as it's located on the world map and can be deduced from that, the winters are very different compared to the winters experienced by people in Durban (KwaZulu-Natal). One of the traits of winter in Cape Town is the snowfall, frost-like conditions (Singh, 2015). The season (and climatic, temperature) differences between similar and dissimilar locations on the world map, arises due to the manner in which the Earth spins on its axis, receiving sunlight of different intensities every minute and by several splits of a second (Starr and Taggart, 2001). Therefore, the plant or tree species in KwaZulu-Natal and Cape Town receive their precursor abiotic factors, such as sunlight and rainfall, for photosynthesis at different time intervals – a factor that probably contributes toward the different growing rates between the same tree or plant species (Singh, 2015).

BIOACTIVITY TESTING IN KWAZULU-NATAL AND CAPE TOWN

As mentioned, KwaZulu-Natal and Cape Town have temperature differences that include seasonal variation. However, in general, global warming also contributes – as a confounding climate change variable – toward the current climate change differences every, or almost every, province, territorial, equatorial, aquatic, and dessert area is prone to experience (Singh, 2015). Bioactivity testing is defined as a biological means whereby a variety of tests are performed to screen compounds, including plant materials, against various eukaryote and prokaryote cell types to determine whether a plant extract, compound, or natural product, has any specific biological (or bio-chemical) properties (Singh, personal definition, 2015). The biological properties – inferred to here – include antimicrobial (sometimes referred to as antibacterial), anti-oxidant, anti-cancer, anti-tumour, anti-haemorrhagic, and anti-fungal activities – just to name a few (read Cock, 2012). The current status of bioactivity testing in Cape Town and KwaZulu-Natal can, however, be considered the same, not only because of the seasonal and temperature differences that have been made mention to in this paper, but also due to different research facilities that are available in research institutes, universities, as well as research testing laboratories, including industries and businesses (Singh, 2015). Although the discrepancies in bioactivity testing results in Cape Town and KwaZulu-Natal are obvious, these discrepancies can definitely be expected in, and between – any places between – any countries (Singh, 2015). For example, it has been found in the literature that some organic extracts of bottlebrush (*Callistemon citrinus*) were antibacterial against specific bacterial species only, and not some gram-positive and –negative species (read Cock, 2012). Although the study that provides this result that can be critically discussed by scientists was not performed in Africa, the antibacterial results obtained can be justified to enhance its validity (Singh, 2015). One reason for this result – a universal fact that has been described in many text books – has been ascribed to the differences in the structure (particularly the outer wall of the bacterium) between gram-positive and –negative bacterium (read Alexander and Strete, 2001). Furthermore, in my opinion, it's the structure of the bacterium in combination with the polarity of the plant extracts, or plant-extracted compounds, or natural compounds – particularly due to the constituent components of each compound that's being tested – that cause discrepancies in antibacterial tests, and, thus, bioactivity testing result outcomes. However, an in-depth analysis of the bioactivity test results also entails analysing the environmental conditions plants used in the bioactivity testing are taken from, since the environment definitely exposes plant and tree species to many growth challenges (Saupe, 2004). It's definite, from this, that plants which are collected in Cape Town during the winter months, for bioactivity testing, may suffer some physical damage, and therefore the quality of plant material used during the bioactivity testing wouldn't be as good, when compared to the same plant species collected in KwaZulu-Natal (Singh, 2015). Furthermore, the current status of bioactivity testing in Cape Town and KwaZulu-Natal, as mentioned – like in other places in Africa and abroad – are complicated due to research being conducted on, and involves the, screening of plant structures for their biological properties (Singh, 2015). Trichomes (also known as a kind of hair-like appendage that emerges out from the outer coverings – or epidermis – of the leaves and/or stems of some plant or tree species) (Uphof, 1962 – this is the earliest reference I was able to locate on plant trichomes) are one of the plant or tree structures that have been studied for the biological properties, apart from ultrastructural studies. Although the plant or tree species that produce trichomes, as a protective mechanism, so that they are able to thrive in their growing habitat (Uphof, 1962; adapted from Werker, 2000), it's obvious that the cold winter conditions of Cape Town – particularly during and after snowfall – might affect the bioactive compounds in the plant material, including trichomes (Singh, 2015). The affect of heating, as well repeated freezing and thawing on compounds have been well reported, particularly in the protocols that are provided in the manufacturer's instructions that are supplied with chemicals, solutions, reagents, and compounds, that are purchased from companies (British Pharmacopoeia, 1993). Therefore, from the former statement, there's a probability – and possibility – that the current outcomes achieved in bioactivity testing studies for screened plant or tree species in KwaZulu-Natal may be more valid due to the higher temperatures (all year) and the lack of frost-like conditions compared to Cape Town (Singh, 2015).

CONCLUSION

In conclusion, the one and, probably, only way in which the bioactivity outcomes can be made reliable are by using bio-statistics. However, the one problem that would persist is the lack of internal validity – which would, or could, be eliminated by using theoretical understanding and explanation. Alternatively, the internal, as well as the external validity, in the bioactivity test outcomes (between KwaZulu-Natal and Cape Town) could, definitely, be improved by making generalisations after the same bioactivity test had been conducted using a greater sample (prokaryote and eukaryote cell type) set and replicating individual bioactivity test in each province. Overall, a lot has to still be done in order to improve the current status of bioactivity tests involving plant material.

REFERENCES

[1]. Alexander SK and Strete D. (2001). Microbiology: a photographic atlas for the laboratory. Benjamin Cummings, Addison Wesley Longman Inc, Canada/USA.

[2]. Becker MW, Kleinsmith JL and Hardin J. (2003). The World of the Cell (Fifth Edition). Benjamin/Cummings Publishing company, Inc, San Francisco, USA.

[3]. British Pharmacopoeia (1993). Northern Ireland, Goverment Buildings, Stanmore, Middlesex (read pp 372-373).

[4]. Cock IE. (July – Sep 2012). Antimicrobial activity of *Callistemon citrinus*and *Callistemon salignus* methanolic extracts. *Pharmacognosy Communications,* 2 (3), 50 – 57.

[5]. Salisbury BF and Ross WC. (1992). Plant Physiology (Fifth Edition). Wadsworth Publishing Company, Belmont, California, USA.

[6]. Saupe GS. (2004). Plant Physiology (Biology 327). College of St. Benedict/St. John's University, Biology Department, Collegeville, USA.

[7]. Singh R. (2015). Personal writing and understanding, representing the Republic of South Africa, my country.

[8]. Starr C. and Taggart R. (2001). The Unity and Diversity of Life (ninth edition), Brooks/Cole, USA

[9]. Uphof JLY. (1962). Plant hair. Encyclopedia. *Plant Anatomy , IV* (5), 1 – 206.

[10]. Werker E. (2000). Trichome density and development. *Advanced Botanical Research,* 31, 1 – 35.

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