EFFECT OF SALT STRESS ON THE PHYSIOLOGICAL RESPONSES, PHYTOCHEMICALS AND ANTIOXIDANT ACTIVITIES OF *CLITORIA TERNATEA* VAR. *PLENIFLORA*

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DEDICATION

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ABSTRACT

Soil salinity is a process of increasing salt in soils. It has become a problem since it keeps spreading geographically from coastal areas to other fertile lands. Therefore, many plants have developed some series of adaptations to mitigate against salinity. Salinity limits the vegetative productions and changes the ecological health of estuaries due to unproductive lands. It lowers the crop yields for daily purposes as well as a threat for biodiversity in which living things loses habitat for both land and in water. Thus, the purpose of this study was to evaluate the growth traits of *Clitoria ternatea* var. *plenifora* exposed to different concentrations of sodium chloride, NaCl. Accordingly, it also brings insights into the effect of various concentrations of salt stress on the qualitative phytochemicals content of tannins, flavonoids, glycosides, steroids, terpenoids, alkaloids, phenols and saponins. Moreover, the total phenolic and flavonoid contents were determined quantitatively. Ferric reducing antioxidant power (FRAP), 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid (ABTS) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) assays were conducted to evaluate the antioxidant activities of the *Clitoria ternatea* var. *plenifora*. Thus, the results from this study revealed that all of the test growth traits–the number of branches and leaves, height of plants, fresh weight of leaves and dry weight of stem, leaves and roots–were the highest under 200 mM of NaCl treatment. Apart from that, under 200 mM of NaCl, *Clitoria ternatea* var. *pleniflora* was shown to contain the highest total of phenolic and flavonoid contents among of all the salt stress treatments. Thereupon, the antioxidant activities of FRAP, DPPH and ABTS were also showed to reach at their highest activities under 200 mM of NaCl. In conclusion, 200 mM of NaCl is the optimum concentration for *Clitoria ternatea* var. *pleniflora* to improve the growth traits, phytochemicals and antioxidants of *Clitoria ternatea* var. *pleniflora*.

ABSTRAK

Tanah masin adalah satu masalah kerana perkara ini sentiasa berkembang dari kawasan berdekatan laut ke tanah subur yang lain. Banyak tumbuh-tumbuhan juga telah mempunyai siri penyesuaian untuk mengatasi kemasinan tanah. Tanah yang masin menjadi tanah yang tidak produktif dan menjadi batas kepada pengeluaran tumbuhan. Ini akan memberi kesan kepada pengurangan bekalan makanan untuk keberlansungan kehidupan manusia. Oleh itu, tujuan kajian ini adalah untuk menilai ciri-ciri pertumbuhan *Clitoria ternatea* var. *plenifora* semasa pendedahan sodium klorida NaCl. Ini juga memberi asas penting kepada kesan terhadap fitokimia kualitatif yang ditentukan oleh kehadiran tanin, flavonoid, glikosida, steroid, terpenoid, alkaloid, fenol dan saponin. Selain itu, fitokimia kuantitatif juga dinilai berdasarkan kandungan total fenolik dan flavonoid. Ujian Ferric reducing antioxidant power (FRAP), 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid (ABTS) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) dilakukan untuk menilai aktiviti antioksidan *Clitoria ternatea* var. *plenifora*. Oleh itu, hasil kajian ini telah menunjukkan bahawa semua sifat pertumbuhan: jumlah dahan dan daun, tinggi tanaman, berat daun yang segar dan berat batang, daun dan akar yang kering, adalah tertinggi di bawah tekanan 200 mM sodium klorida. Selain itu, di bawah 200 mM NaCl, *Clitoria ternatea* var. *pleniflora* memperolehi jumlah kandungan fenolik dan flavonoid tertinggi. Aktiviti antioksidan FRAP, DPPH dan ABTS juga mencapai aktiviti tertinggi di 200 mM NaCl. Kesimpulannya, 200 mM NaCl adalah tekanan garam yang sesuai kepada *Clitoria ternatea* var. *pleniflora* untuk memperbaiki tumbesaran, fitokimia dan antioksidan *Clitoria ternatea* var. *pleniflora*.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

°C	-	Degree celsius
%	-	Percentage
1/4	-	Quarter
cm	-	Centimetre
dSm^{-1}	-	Decisiemens per metre
g	-	Gram
h	-	Hour
m	-	Metre
µg/mL	-	Microgram per millilitre
mg/g	-	Milligram per gram
mg/kg	-	Milligram per kilogram
mg/mL	-	Milligram per millilitre
mL	-	Millilitre
mm	-	Millimetre
mM	-	Millimolar
mM/g	-	Millimolar per gram
nm	-	Nanometre

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background and rationale of study

Nowadays, most countries around the world face soil salinity, which it is affecting plant growth. Salinity is a problem because it became one of the limiting factors towards the environment and life. It limits the production of plants and decreases the agricultural land areas. This problem is more challenging and threatening since 23% of 1.5x 10^9 hectares of the world's cultivated land is saline (Shereen *et al.*, 2005). Earth is losing an average of 2000 hectares of soil into salt-affected lands continuously every day (Hamilton, 2014). In many countries, soil salinity is a threatening problem and is affecting human health and environmental resources. Currently, it is affecting around 1 billion hectares globally and is having significant impacts on the ecological balance of the soil physicochemical properties (Shrivastava & Kumar, 2015). Additionally, most researchers found that soil salinity is irreversible and it causes damages continuously and diminishes the capacity of the ecosystem services (Li & Li, 2017; Sangadji *et al.*, 2019). Furthermore, soil salinity leads to less food production and sustainability, damaging the ecological area and affecting plants growth (Hasanuzzaman *et al.,* 2013).

Moreover, the productivity and growth of plants are reduced since most of them have low tolerance towards soil salinity (Machado & Serralheiro, 2017). The majority of plants species are not well-adapted towards salt-affected soil, and only 0.14% can adapt towards salinity. These species suggest that salt tolerance adaptation is not a fundamental trait within them, but the ability appeared and occurred during their evolution (Flowers & Colmer, 2015) as a series of defences against damages.

Moreover, the plants undertake the salt tolerance evolution by two main mechanisms, either by limiting the salt's entrance through roots or controlling salts concentration and distribution (Hanin *et al.,* 2016) which is more relevant to improve their tolerance and adaptations. Currently, the developing countries are making few alternatives and strategies to understand the functional studies of the gene where it involves the engineered crop. It is to enhance the traits of salt stress-tolerance plants to overcome the salinity problem.

Many studies bring up the significant role of plants in overcoming soil salinity. For instance, the impacts of salt stress have been faced by species of *Clitoria ternatea* in semi-arid and arid regions, where they are considered as low to medium salt-tolerant (Talukdar, 2011). *Clitoria ternatea* has 6.4 dS m^{-1} of tropical legume tolerance rate based on the electrical conductivities, (EC) towards salinity (Keating *et al.*, 2015). This shows that *Clitoria ternatea* is more tolerant and can mitigate salt stress than other comparative legumes (Talukdar *et al.,* 2011; Nasim & Pa'ee, 2021).

Besides of its tolerance towards salinity, these attractive perennial climbers produce various beneficial phytochemicals in which contribute to the medicinal properties. Some *Clitoria ternatea*'s species extracts have medicinal values on its wide range of phytochemical constituents. They are beneficial for antipyretic, analgesic, diuretic, local anaesthetic, antidiabetic, insecticidal properties of vascular smooth muscle relaxing (Kumar *et al.*, 2017) and antimicrobial properties (Durga *et al.*, 2015; Jamil *et al.*, 2018). In addition, viable cells and cancer cells have been shown to decrease with the exposure of their leaves' methanol extract (Al-Snafi, 2016). The growth and germination of *Clitoria ternatea* may be influenced by the change of natural environment such as abiotic stress, including salinity. The changes of physiological, phytochemicals and antioxidants may be interrupted by the salinity during plant growth and development. Salt stress affects the growth of plants by inducing the osmotic stress and lead to sodium, Na+ and Cl- toxicities. Hence, it will cause the closure of stomata and reduce the rate of phtotosynthesis (Sarker *et al.,* 2018). Furthermore, many plants may be affected by pathogens interference, thus decreasing the crop yield of many plants during the stress. However, there are fewer studies on the effect of salt stress on the physiological responses and the phytochemical productions of *Clitoria ternatea* var. *pleniflora* (Nasim & Pa'ee, 2021). Besides, *Clitoria ternatea* var. *pleniflora* was chosen since, our literature review suggests there are fewer studies and discoveries on the scientific values of this variety (Nasim &

Pa'ee, 2021). Hence, this study was conducted to explore the new potential of *C. ternatea* var. *pleniflora* as salt-tolerant plant. Besides, this study will provide insights on the relation of the physiological, phytochemical and antioxidant activities responses of *C. ternatea* var. *pleniflora* towards the abiotic stress, soil salinity.

1.2 Problem statement

Natural process such as sea-level rise has induced seepage into areas that are below sea level. Furthermore, evapotranspiration and lack of rainfall to flush the soils also lead to soil salinity (Wada *et al*., 2017; Corwin, 2020). These natural processes are unavoidable and will cause an increment of saline soils. In the early stages, salinity reduces soil productivity by affecting the metabolism of soil organisms, and it is becoming more serious when the vegetation and organisms in the soils are destroyed. Consequently, it transforms the productive and fertile land into barren land (Shrivastava & Kumar, 2015; Prasad *et al*., 2016; Machado & Serralheiro, 2017). Presently, plants are the main sources for humans to sustain food availability, survival, and as a source of medications. Thus, the increment of soil salinization around the world will give impacts on the ecology and future survival of living things. Subsequently, the variety of *Clitoria ternatea* var. *pleniflora* is an underutilised plant (Prasad *et al*., 2016; Tomaz *et al*., 2020). Some of the varieties in the genus *Clitoria* were recorded to be adaptable to natural environmental changes and abiotic stresses– such as light and drought and able to produce different phytochemicals in their extract. However, there are fewer studies on the varieties of *Clitoria ternatea* var. *pleniflora* in physiological responses when treated with salt stress (Jamil *et al*., 2018; Marget *et al*., 2019).

Thus, an approach of a study using *Clitoria ternatea* var. *pleniflora* is important. This is because most of the practitioners are from different backgrounds (Quazi & Yogekar, 2020). Besides, their new potential for producing new and valuable phytoconstituents treated with salt stress was less scrutinized. In addition, the production of antioxidants of this variety is still uncovered wholly scientifically.

1.3 Significance of study

Saline soils are increasing day by day and many researchers are finding alternatives to overcome this arising problem. Saline soils can be controlled and mitigated by the introduction of salt-tolerant plants. Meanwhile, species of *Clitoria ternatea* was known to tolerate the saline soils. Therefore, this study will provide new insights into *Clitoria ternatea* var. *pleniflora's* significance to tolerate on saline soils. On the other hand, *Clitoria ternatea* var. *pleniflora* was chosen because it can grow well under a certain concentration of salt stress.

This variety of *Clitoria ternatea* var. *pleniflora* is an alternative to most of the industrial sectors since it is easily grown in Malaysia. Although they are abundantly available in Malaysia, not many people are aware of the existence and importance of *Clitoria ternatea* var. *pleniflora*. In addition, *Clitoria ternatea* var. *pleniflora* was chosen because the plants will respond to abiotic stresses, leading to changes in their phytochemical constituents and antioxidants activities. Hence, this study provides an important opportunity for new discovery that may generate fresh insights and a useful option for future needs.

1.4 Study limitations

Due to the nature of research environment, there were few limitations occured in this study. Firstly, the limitation was time constraint where, the longest period of one year and half was taken on the plant material to grow the samples. In addition, another 3 months were taken to treat the samples since they had diseases such as rust and verticillium wilt. Due to these constraints, they were also affecting the remaining time for the other analysis such as phtochemical and antioxidant analysis.

Besides, there was a limitation in data collections and analysis of soil moisture and air humidity during the experimental period. These analysis cannot be done because, some equipments such as air humidity meter and soil moisture meter were broken and not available in the workplace. Hence, these analysis cannot be done for the data collections.

Then, the other limitation was financial resources. Better financial resources was needed since, necessary equipment such as glassware to keep the stock of samples was needed and they come in large quantities. Better financial resources also needed to grow the samples. The quantity of the samples was in hundreds, thus enough money was needed to purchase the pots, soils and seeds for growing the samples.

Besides, other limitation was the payment service for plant identification. Enough financial resources was important to pay the professional taxonomist to identify the species of *Clitoria ternatea* and to obtain the confirmation identification letter of the sample. Besides, there was a limitation in the availability of equipments. Some of the equipment such as UV-VIS spectrophotometer and oven dryer in a laboratory were always broken and required a long period of time to undergo maintenance. Thus, these limitations might be reflected in the results of the study.

1.5 Research objectives

The objectives of this study were:

i. To measure the growth rate of *Clitoria ternatea* var. *pleniflora* exposed to different concentrations of sodium chloride, NaCl.
ii. To determine the phytochemical content of *Clitoria ternatea* var. *pleniflora* with the effects of salinity treatment.
iii. To evaluate the antioxidant activities of *Clitoria ternatea* var. *pleniflora* exposed to different concentrations of NaCl.

1.6 Research scopes

The scopes of this study were:

i. The study was carried out in six different salt concentrations (0, 100, 150, 200, 250, 300) mM on *Clitoria ternatea* var. *pleniflora* in 8 weeks of propagation stage. This is to evaluate the physiological adaptation of *Clitoria ternatea* var. *pleniflora* based on their growth: height, increment number of leaves, braches and fresh and dry weight of each plants' part.

ii. The study was designed to investigate the resulting potential secondary metabolites for qualitatively (tannins, saponins, steroids, alkaloids, glycosides, phenols, flavonoids and terpenoids) and qualitatively (total phenolics and flavonoids content) of *Clitoria ternatea* var. *pleniflora*'s extract.

iii. Antioxidants activity was measured using three assays which were ABTS, DPPH and FRAP. They were furthered from the the phytochemical analysis, to reveal their possibilities on holding their role against free radicals.

CHAPTER 2

LITERATURE REVIEW

2.1 Classification of morphology and taxonomy

Clitoria ternatea commonly known as ‘butterfly pea’ is a prominent white or blue of an appealing perennial climber flower (Figure 2.1). *Clitoria ternatea* is from South East Asia and abundantly found in Philippines, Madagascar and India (Manjula *et al.*, 2015). *Clitoria ternatea* has naturalized and disseminated widely at subtropical and tropical East and West Indies, South and Central America, China and India countries (Gomez & Kalamani, 2003; Lijon *et al.*, 2017).

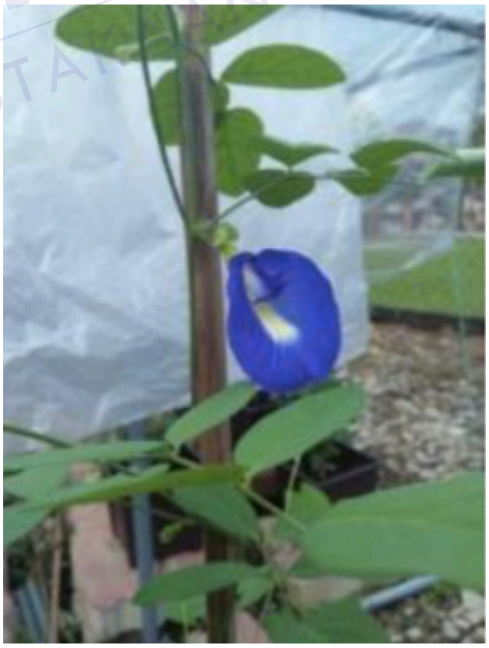

Figure 2.1: Blue *Clitoria ternatea* (Jamil *et al.*, 2018.

Low land tropic and humidity are some of the determinants for their wide distribution, besides their adaptability in a wide range of rainfall, temperature and altitude (Chauhan *et al.,* 2012). Moreover, *Clitoria ternatea* species has a high growth rate, high adaptation to heavy clay soil and drought tolerance trait. Therefore, these traits will be useful to provide and help other species to survive and adapt to irrigation channels, disturbed sites, a margin of waterholes, grasslands and river banks (Staples, 1992).

Clitoria ternatea is commonly used by the Malaysians to give the blue colour to Nasi Kerabu. Additionally, it is also used to make the traditional dish known as 'Kueh Tekan' in Baba and Nyonya culture (Lijon *et al.*, 2017). In addition, other vernacular names of *Clitoria ternatea* in some of the western countries are blue pea and butterfly pea in English, Cunhã, Fula criqua in Portuguese, Cunha in Brazilian, and Mavi kelebek sarmaşığı in Turkish (Gupta *et al*., 2010). Additionally, in most of the eastern countries, these attractive blue flowers are called as 'Aparijita' in Sanskrit and Bengali, 'Buzrula' in Arabic, 'Lan hu die' in Chinese, 'Kajroti' in India, 'Tembang telang' in Indonesian, 'Dangchan' in Thai, and 'chi dậu biếc' in Vietnamese (Kosai *et al.*, 2015). Table 2.1 shows the taxonomic classification of *Clitoria ternatea*.

Table 2.1: Taxonomy classification of the species of *Clitoria ternatea* (Sethiya *et al.,* 2009)

Taxonomy hierarchy	Description of *Clitoria ternatea*
Kingdom	Plantae
Sub-kingdom	Tracheobionta
Super-division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub-class	Rosidae
Order	Fabeles
Family	Fabaceae
Genus	*Clitoria*
Species	*ternatea*

This legume of Fabaceae family is an ornamental perennial climber, which has twinning fine stems with the vine's length up to 1.5 to 5 m. Their leaves are pinnate with 5-9 foliolate, petioles of 2 until 2.5 cm long with 4 mm long of stipules (Kosai *et al.,* 2015; Liji, 2018). The flowers' petals are blue or white, ranging from deep blue to blue mauve. The petals are orange colour at the centre, very short pedicelate, solitary and showy, style bearded below the stigma, and 4 to 5 cm long. Furthermore, the fruit pods are linear and compressed with a slightly pubescent of 6 to 10 seeds in each pods. They are flat and beaked with 6 to 12 cm long and 0.7 to 1.2 mm of wide. The colours of the seeds are blackish and yellowish-brown, often mottled, oval or sub-globose in shape with 3 to 4 mm wide and 4.5 to 7 mm long (Gupta, Chahal *et al*., 2010; Komaraiah & Rao, 2010; Lijon *et al.,* 2017).

Although the species of *Clitoria ternatea* is well-known for its ornamental value, the application in medical uses is also important, as discussed in the following section. Thus, this study will make a major contribution to research the species of *Clitoria ternatea* for the significant of its phytochemical productions when treated with various concentrations salt stress.

2.2 Application and uses of the species of *Clitoria ternatea* in medical prospect

Clitoria ternatea has been used by many traditional and herbal practitioners as one of the alternatives to help, cure and treat diseases. This is because medicinal properties lie on almost every part of this plant. It has been used to treat worm infestation, tonsillitis, cough, asthma, and infertility (Deka *et al*., 2013). Then, it was found that *Clitoria ternatea'*s extracts have anticonvulsant activity, antidiabetic activity, antimicrobial activity, anti-inflammatory, antipyretic and analgesic activities, and able to enhance memory and improve the efficacy of learning (Sethiya *et. al.,* 2009).

Consequently, the values of *Clitoria ternatea* have attracted researchers to conduct more studies to reveal their true potential. Their findings showed that the extract of *Clitoria ternatea* possessed anti-diabetic activity (Chayaratanasin *et al*., 2015). It was focused on the advanced glycation end products (AGE) as an imperative approach to alleviate the complication of the diabetes. The results showed that the formation of advanced glycation end products was inhibited significantly with 0.25-1.00 mg/ml of *Clitoria ternatea* extract in a concentration-dependent manner (Chayaratanasin *et al*., 2015). Moreover, the level of fructosamine has been reduced markedly and the decreasing protein carbonyl content leads to decreasing of protein's oxidation (Chayaratanasin *et al.*, 2015). Thus, the extract of *Clitoria ternatea* may have strong antioxidant and antiglycation properties and be able to prevent the AGE-mediated diabetic complication of therapeutic potentials.

A study has claimed and provided some evidence to prove the ethanolic extract of C*litoria ternatea* might be a useful treatment for the obsessive compulsory disorder (OCD), a disabling psychiatric condition (Shende *et al.,* 2012). Marble-burying behaviour is a test to measure anxiety-related behaviour in rodent. 100, 200 and 400 mg/kg of ethanolic *Clitoria ternatea* extract reduced the marble-burying reading compared to the 5, 20 and 15 mg/kg of fluoxetine. In addition, 100 mg/kg of fluoxetine's sub-effective dose effects also have been studied with the sub-effective dose of 5 mg/kg of fluoxetine which significantly reduced the marble-burying behaviour of mice. Thus, the ethanolic extract of *Clitoria ternatea* has been suggested to modulate and serve as a potential herbal treatment for OCD (Shende *et al.,* 2012).

In sum, *Clitoria ternatea* possessed valuable phytochemicals in which making it as one of the important herb for practitioners. This is because every part of it is beneficial to consumers. However, the scientific advantages of *Clitoria ternatea* var. *pleniflora* are still unexplored (Lakshan *et al.,* 2019). Thus, the discovery of the benefits of a new variety of the species *Clitoria ternatea* is important.

2.3 Difference between *Clitoria ternatea* and *Clitoria ternatea* var. *pleniflora.*

Clitoria ternatea var. *pleniflora'*s morphology is different from *Clitoria ternatea*. Then, genus of *Clitoria* belongs to the family of Fabaceae or Leguminosae. The genus *Clitoria* means "clitoris", which refers to the shape of the flowers (Pendbhaje *et al.,* 2011). *Ternatea* means ternate, which is the epithet of the flowers known in Maluku Island, Indonesia (Pendbhaje *et al.,* 2011). *Pleniflora* means multi-petals, which refers to the flowers that are blue to purplish (Lakshan *et al*., 2019). However, the difference between both varieties can only be seen by their flower morphology. Flowers of *Clitoria ternatea* (Figure 2.2A) are papilionaceous, which resemble the shape of a butterfly. *Clitoria ternatea*'s flower is also zygomorphic, which is bilaterally symmetrical (Acevedo-Rodriguez, 2005). On the other hand, flowers of *Clitoria ternatea* var. *pleniflora* (Figure 2.2B) are actinomorphic, that is radially symmetrical (Acevedo-Rodriguez, 2005). *Clitoria ternatea* var. *pleniflora* is recognized by five vexillary-like petals (Oguis *et al*., 2019). In some cases, the flowers have five petals but rarely in four petals. Their flowers' morphology is important because it is the only way to differentiate their variations (Oguis *et al*., 2019).

Figure 2.2A: The flower's morphology of *Clitoria ternatea.* Figure 2.2B: The flower's morphology of *Clitoria ternatea* var. *pleniflora* varities. Both figures were retrieved from National Park for Flora and Fauna Web, A Singapore Government Agency Website

The variety of *Clitoria ternatea* var. *pleniflora* is important for new discoveries and provide new insights for future scientific uses and domestications of food supplies (Oguis *et al.,* 2019). On the other hand, the survival of most vegetative plants depends on fertile soils and lands. Salinity is one of the limitations for some plants to grow well and there is lacking in the studies of this salt stress on *Clitoria ternatea* var. *pleniflora* (Oguis *et al.,* 2019). Thus, it is important to learn how salt stress is triggering *Clitoria ternatea* var. *pleniflora* to produce phytochemicals as plant-self defence (Oguis *et al.,* 2019).

2.4 Salinity

Saline soils are soils containing neutral soluble salts that affect the growth of most crop plants. Sodium chloride and sodium sulphate are predominant soluble salts (Torres *et al*., 2018). Chloride and sulphate of calcium and magnesium are present in substantial quantities in saline soils (Torres *et al.,* 2018). Therefore, the salt-affected soils not only differ in their chemical characteristics but also in their geochemical and geophysical distribution, as well as their biological and physical properties (FAO, 1988) (Table 2.2).

REFERENCES

Ashetty, A. (2013). Vegetables as sources of antioxidants. *Journal of Food & Nutritional Disorders*, *02*(01). https://doi.org/10.4172/2324-9323.1000104

Abbas, M., Saeed, F., Anjum, F. M., Afzaal, M., Tufail, T., Bashir, M. S., Ishtiaq, A., Hussain, S., & Suleria, H. A. R. (2017). Natural polyphenols: An overview. *International Journal of Food Properties*, *20*(8), 1689–1699.

Abdul Qados, A. M. S. (2011). Effect of salt stress on plant growth and metabolism of bean plant *Vicia faba* (L.). *Journal of the Saudi Society of Agricultural Sciences*, *10*(1), 7–15.

Abdul Razak, N., Shaari, A. R., Jolkili, M., & Leng, L. Y. (2016). Drying curves and colour changes of *Cassia Alata* leaves at different temperatures. *MATEC Web of Conferences*, *78*(3), 3–7.

Abideen, Z., Koyro, H. W., Huchzermeyer, B., Ahmed, M. Z., Gul, B., & Khan, M. A. (2014). Moderate salinity stimulates growth and photosynthesis of *Phragmites karka* by water relations and tissue specific ion regulation. *Environmental and Experimental Botany*,*105*(1),70–76.

Agarwal, A., Tadros, H., & Tvrdá, E. (2016). Role of oxidants and antioxidants in female reproduction. *Oxidative Stress and Antioxidant Protection*, *12*(3), 253–280.

Agu, K. C. and Okolie, P. N. (2017). Proximate composition phytochemical analysis, and in vitro antioxidant potentials of extracts of Soursop. *Food Science and Nutritions*, *4*(5), 1029-1036.

Ahmad, M., Kaloo, Z. A., Ganai, B. A., Ganaie, H. A., & Singh, S. (2016). Phytochemical screening of *Meconopsis aculeat*a royle an important medicinal plant of Kashmir Himalaya: A perspective. *Research Journal of Phytochemistry*, *10*(1), 1–9.

Ahmad, P., Azooz, M. M., & Prasad, M. N. V. (2013). Ecophysiology and responses of plants under salt stress. *Ecophysiology*, *23*(6), 45-47.

Ahmad, P., Jaleel, C. A., Salem, M. A., Nabi, G., & Sharma, S. (2010). Roles of enzymatic and nonenzymatic antioxidants in plants during abiotic stress. *Critical Reviews in Biotechnology*, *30*(3), 161–175.

Ahmadinejad, F., Møller, S. G., Hashemzadeh-Chaleshtori, M., Bidkhori, G., & Jami, M. S. (2017). Molecular mechanisms behind free radical scavengers function against oxidative stress. *Antioxidants*, *6*(3), 1–15.

Al-Snafi, A. E. (2016). Pharmacological importance of *Clitoria ternatea*-A review. *IOSR Journal Of Pharmacy, 6*(3), 68–83.

Al-Snafi, A. E. (2020). Phenolics and flavonoids contents of medicinal plants, as natural ingredients for many therapeutic purposes-A review. *IOSR Journal Of Pharmacy*, *10*(7), 42–81.

Alderete-Chavez, A., Guerra-Santos, J. J., Cruz-Landero, N. D. la, Brito, R., Guevara, E., Gelabert, R., Nunez, E., Endanu, E., & Ange, L. E. A. (2011). Cultivation of *Clitoria ternatea* L. under arid conditions: Effects of fertilization and season on leaf traits, stomatal conductance, leaf area index and forage yield. *Bothalia Journal, 44*(6), 1044-1048.

Almeida, I. V., Cavalcante, F. M. L., & Vicentini, V. E. P. (2016). Different responses of vanillic acid, a phenolic compound, in HTC cells: Cytotoxicity, antiproliferative activity, and protection from DNA-induced damage. *Genetics and Molecular Research*, *15*(4), 23-25.

Amer, N., Chami, Z. Al, Bitar, L. Al, Mondelli, D., & Dumontet, S. (2013). Evaluation of *Atriplex halimus*, *Medicago lupulina* and *Portulaca oleracea* for phytoremediation of Ni, Pb, and Zn. *International Journal of Phytoremediation*, *15*(5), 498–512.

Amudha, M., & Rani, S. (2016). Evaluation of in vitro antioxidant potential of *Cordia retusa*. *Indian Journal of Pharmaceutical Sciences*, *78*(1), 80–86.

Anigboro, A. A., Avwioroko, O. J., Ohwokevwo, O. A., & Nzor, J. N. (2018). Phytochemical constituents, antidiabetic and ameliorative effects of *Polyalthia longifiola* leaf extract in alloxan-induced diabetic rats. *Journal of Applied Sciences and Environmental Management*, *22*(6), 993-999.

Anuj, Y., Rewa, K., Ashwani, Y., J.P., M., Seweta, S., & Shashi, P. (2016). Antioxidants and its functions in human body. *Research in Environment and Life Sciences*, *9*(11), 1328–1331.

Arbona, V., Manzi, M., de Ollas, C., & Gómez-Cadenas, A. (2013). Metabolomics as a tool to investigate abiotic stress tolerance in plants. *International Journal of Molecular Sciences*, *14*(3), 4885–4911.

Arboretum, T. H. E. A. (1968). Propagation of Woody Plants by Seeds. *Life Sciences*, *49*(4), 69–111.

Arienzo, M., Adamo, P., & Cozzolino, V. (2004). The potential of *Lolium perenne* for revegetation of contaminated soil from a metallurgical site. *Science of the Total Environment*, *319*(3), 13–25.

Aryal, S., Baniya, M. K., Danekhu, K., Kunwar, P., Gurung, R., & Koirala, N. (2019). Total Phenolic content, flavonoid content and antioxidant potential of wild vegetables from western Nepal. *Plants*, *8*(4), 88-96.

Ashraf, M., & Foolad, M. R. (2007). Roles of glycine betaine and proline in improving plant abiotic stress resistance. *Environmental and Experimental Botany*, *59*(2), 206–216.

Aslam, R., Bostan, N., Nabgha e Amen, Maria, M., & Safdar, W. (2011). A critical review on halophytes: Salt tolerant plants. *Journal of Medicinal Plant Research*, *5*(33), 7108–7118.

Athar, M. (2002). Oxidative stress and experimental carcinogenesis. *Indian Journal of Experimental Biology*, *40*(6), 656–667.

Auwal, M. S., Saka, S., Mairiga, I. A., Sanda, K. A., Shuaibu, A., & Ibrahim, A. (2014). Preliminary phytochemical and elemental analysis of aqueous and fractionated pod extracts of *Acacia nilotica* (Thorn mimosa). *Veterinary Research Forum : An International Quarterly Journal*, *5*(2), 95–100.

Acevedo-Rodriguez, P. (2005). Vines and climbing plants of Puerto Rico and the Virgin Island. *United States National Herbarium, 2*(51), 1-483.

Ayoola, G., Coker, H., Adesegun, S., Adepoju-Bello, A., Obaweya, K., Ezennia, E., & Atangbayila, T. (2008). Phytochemical screening and antioxidant activities of some selected medicinal plants used for malaria therapy in Southwestern Nigeria. *Tropical Journal of Pharmaceutical Research*, *7*(3), 1019–1024.

Ayoub, Z., & Mishra, S. (2018). Medicinal plants as natural antioxidants : A review. *Journal of Botanical Society, 1*(9), 100–107.

Badder, R. Y. and R. M. A. (2015). Plant sciences feed effect of salinity and water stress in Mungbean (*Vigna*). *Plant Sciences Feed*, *2(9)*, 130–134.

Banjarnahor, S. D. S., & Artanti, N. (2014). Antioxidant properties of flavonoids. *Medical Journal of Indonesia*, *23*(4), 239–244.

Barbour, M. M., Mcdowell, N. G., Tcherkez, G., Bickford, C. P., & Hanson, D. T. (2007). A new measurement technique reveals rapid post-illumination changes in the carbon isotope composition of leaf-respired CO_2. *Plant Cell Environment, 30*(4)*,* 469–482.

Ben Taârit, M., Msaada, K., Hosni, K., & Marzouk, B. (2012). Fatty acids, phenolic changes and antioxidant activity of clary sage (*Salvia sclarea* L.) rosette leaves grown under saline conditions. *Industrial Crops and Products*, *38*(1), 58–63. Bendary, E., Francis, R. R., Ali, H. M. G., Sarwat, M. I., & El Hady, S. (2013). Antioxidant and structure–activity relationships (SARs) of some phenolic and anilines compounds. *Annals of Agricultural Sciences*, *58*(2), 173–181.

Benzarti, M., Rejeb, K. Ben, Messedi, D., Mna, A. Ben, Hessini, K., Ksontini, M., Abdelly, C., & Debez, A. (2014). Effect of high salinity on Atriplex portulacoides: Growth, leaf water relations and solute accumulation in relation with osmotic adjustment. *South African Journal of Botany*, *95*(1), 70–77.

Bhagyawant, S. S., Narvekar, D. T., Gupta, N., Bhadkaria, A., Koul, K. K., & Srivastava, N. (2019). Variations in the antioxidant and free radical scavenging under induced heavy metal stress expressed as proline content in chickpea. *Physiology and Molecular Biology of Plants*, *25*(3), 683–696.

Bhuiyan, M. S. I., Raman, A., & Hodgkins, D. S. (2017). Plants in remediating salinity-affected agricultural landscapes. *Proceedings of the Indian National Science Academy*, *83*(1), 51–66.

Bistgani, Z. E., Hashemi, M., DaCosta, M., Craker, L., Maggi, F., & Morshedloo, M. R. (2019). Effect of salinity stress on the physiological characteristics, phenolic compounds and antioxidant activity of *Thymus vulgaris* L. and *Thymus daenensis* Celak. *Industrial Crops and Products*, *135*(10), 311–320.

Boligon, A. A. (2014). Technical evaluation of antioxidant activity. *Medicinal Chemistry*, *4*(7), 517–522.

Boualem, B., Sofiane, B., Abdelhamid, G., Benzohra, I. E., M'hamed, B., Mohamed, B., & Omar, K. (2018). Effects of different levels of saline water on infection of tomato by *Botrytis cinerea*, the causal agent of gray mold. *Indian Journal of Agricultural Research*, *52*(5), 530–535.

Bowles, J. M. (2004). Guide to plant collection and identification.*Natural Resources,3*(1), 3-11.

Brewer, M. S. (2011). Natural antioxidants: Sources, compounds, mechanisms of action, and potential applications. *Comprehensive Reviews in Food Science and Food Safety*, *10*(4), 221–247.

Brodowska, K. M. (2017). Classification, potential role, and application of flavonoid analogues. *European Journal of Biological Research*, *7*(2), 108–123.

Buehler, B. A. (2012). The free radical theory of aging and antioxidant supplements: A systematic review. *Journal of Evidence-Based Complementary and Alternative Medicine*, *17*(3), 218–220.

Butnariu, M., & Samfira, I. (2012). Free radicals and oxidative Stress. *Journal of Bioequivalence & Bioavailability*, *4*(3),3–5.

Carillo, P., Grazia, M., Pontecorvo, G., Fuggi, A., & Woodrow, P. (2011). Salinity stress and salt tolerance. *Abiotic Stress in Plants - Mechanisms and Adaptations*, *9*(4)., 1-15

Chauhan, N., Rajvaidhya, S., & Dubey, B. . (2012). Pharmacognostical, phytochemical and pharmacological review on *Clitoria ternatea* for antiasthmatic Activity. *International Journal of Pharmeceutical Science and Research*, *3*(2), 398–404.

Chayaratanasin, P., Barbieri, M. A., Suanpairintr, N., & Adisakwattana, S. (2015). Inhibitory effect of *Clitoria ternatea* flower petal extract on fructose-induced protein glycation and oxidation-dependent damages to albumin in vitro. 1–9.

Cheeseman, J. M. (1988). Mechanisms of salinity tolerance in plants. *Plant Physiology*, *87*(3), 547–550.

Chelombitko, M. A. (2018). Role of reactive oxygen species in inflammation: A minireview. *Moscow University Biological Sciences Bulletin*, *73*(4), 199–202.

Chen, B. M., Wang, Z. H., Li, S. X., Wang, G. X., Song, H. X., & Wang, X. N. (2004). Effects of nitrate supply on plant growth, nitrate accumulation, metabolic nitrate concentration and nitrate reductase activity in three leafy vegetables. *Plant Science*, *167*(3), 635–643.

Cheynier, V. (2012). Phenolic compounds: From plants to foods. *Phytochemistry Reviews*, *11*(2–3), 153–177.

Choe, E., & Min, D. B. (2009). Mechanisms of antioxidants in the oxidation of foods. *Comprehensive Reviews in Food Science and Food Safety*, *8*(4), 345–358.

Coley, P. D. (1986). Costs and benefits of defense by tannins in a neotropical tree. *Oecologia*, *70*(2), 238–241.

Collin, F. (2019). Chemical basis of reactive oxygen species reactivity and involvement in neurodegenerative diseases. *International Journal of Molecular Sciences*, *20*(10),34-39.

Cömert, E. D., Mogol, B. A., & Gökmen, V. (2020). Relationship between color and antioxidant capacity of fruits and vegetables. *Current Research in Food Science*, *2*(3), 1–10.

Cortez, R., Luna-Vital, D. A., Margulis, D., & Gonzalez de Mejia, E. (2017). Natural pigments: Stabilization methods of anthocyanins for food applications. *Comprehensive Reviews in Food Science and Food Safety*, *16*(1), 180–198.

Corwin, D. L. (2020). Climate change impacts on soil salinity in agricultural areas. *Europian Journal of Soil Science*, *2*(72), 842-862.

Costa, A., Pegas Pereira, E. S., Assumpção, E. C., Dos Santos, F. B. C., Ota, F. S., De Pereira, M. O., Fidelis, M. C., Fávaro, R., Barros Langen, S. S., De Favaro Arruda, L. H., & Abildgaard, E. N. (2015). Assessment of clinical effects and safety of an oral supplement based on marine protein, vitamin C, grape seed extract, zinc, and tomato extract in the improvement of visible signs of skin aging in men. *Clinical, Cosmetic and Investigational Dermatology*, *8*(2), 319–328.

Crizel, R. L., Perin, E. C., Siebeneichler, T. J., Borowski, J. M., Messias, R. S., Rombaldi, C. V., & Galli, V. (2020). Abscisic acid and stress induced by salt: Effect on the phenylpropanoid, L-ascorbic acid and abscisic acid metabolism of strawberry fruits. *Plant Physiology and Biochemistry*, *152*(5), 211–220.

Da Silva, E. C., Nogueira, R. J. M. C., de Araújo, F. P., de Melo, N. F., & de Azevedo Neto, A. D. (2008). Physiological responses to salt stress in young umbu plants. *Environmental and Experimental Botany*, *63*(3), 147–157.

Damjibhai Hirpara, D., Jamnadas Ramoliya, K., Damjabhai Patel, A., & Pandey, A. (2005). Effect of salinisation of soil on growth and macro- and micro-nutrient accumulation in seedlings of Butea monosperma (Fabaceae). *Anales de Biología*, *27*(4), 3–14.

Daszkowska-Golec, A., & Szarejko, I. (2013). Open or close the gate - Stomata action under the control of phytohormones in drought stress conditions. *Frontiers in Plant Science*, *4*(5), 1–16.

De Paiva, L. B., Goldbeck, R., dos Santos, W. D., & Squina, F. M. (2013). Ferulic acid and derivatives: Molecules with potential application in the pharmaceutical field. *Brazilian Journal of Pharmaceutical Sciences*, *49*(3), 395–411.

Deka, M., Medhi, A. ., Kalita, J. ., Sarma, K. ., & Deka, L. (2013). Proximate analysis of primary metabolites in different parts of *Clitoria ternatea* L. : A Comparative Study. *Plant Science, 4*(9), 62–67.

Deshmukh, S., & Jadhav, V. (2014). Bromatological and mineral assessment of *Clitoria ternatea* linn . Leaves. *Innovare Academic Sciences 6*(3), 14–16.

Devi, B. P., Boominathan, R., & Mandal, S. C. (2003). Anti-inflammatory, analgesic and antipyretic properties of *Clitoria ternatea* root. *Fitoterapia*, *74*(4), 345–349.

Dolatabadian, A., Modarres Sanavy, S. A. M., & Ghanati, F. (2011). Effect of salinity on growth, xylem structure and anatomical characteristics of soybean. *Notulae Scientia Biologicae*, *3*(1), 41–45.

Douglas, S. M. (1875). Basic techniques for propagating plants. *The Connecticut Agricultural Experiment Station,6*(8),1-7.

Duangkhet, M., Chikoti, Y., Thepsukhon, A., Thapanapongworakul, P., Chungopast, S., Tajima, S., & Nomura, M. (2018). Isolation and characterization of rhizobia from nodules of *Clitoria ternatea* in Thailand. *Plant Biotechnology*, *35*(2), 123–129.

Durga, C. N., Lakshmi, M., Mahitha, B., Madhavi, T., & Sushma, N. J. (2015). Phytochemical screening and FTIR analysis Of *Clitoria ternatea* leaves. *International Journal of Scientific & Engineering Research*, *6*(2), 287–290.

Eisa, S., Hussin, S., Geissler, N., & Koyro, H. W. (2012). Effect of NaCl salinity on water relations, photosynthesis and chemical composition of Quinoa (*Chenopodium quinoa* Willd.) as a potential cash crop halophyte. *Australian Journal of Crop Science*, *6*(2), 357–368.

Ellis, B., Daly, D. ., Hickey, J., Johnson, K. ., Mitchell, J. ., Wilf, P., & Wing, S. . (2017). Leaf terminology. *The New York Botanical Garden*, *4*(5), 182-185.

Fantz, P. R. (1977). A monograph of the genus *Clitoria* (Leguminosae ; Glycineae). *Florida Journal of Educational Research*, *10*(2), 163-166.

Ferdinandi, M., Brunetti, C., Fini, A., & Tattini, M. (2012). Flavonoids as antioxidants in plants under abiotic stress. *Plant Biotechnology, 2*(4), 171–180.

Finnegan, P. M., & Chen, W. (2012). Arsenic toxicity: The effects on plant metabolism.*Frontiers in Physiology*,*6*(6),1–18.

Flowers, T. J. (2004). Improving crop salt tolerance. *Journal of Experimental Botany*, *55*(396), 307–319.

Flowers, Timothy J, & Colmer, T. D. (2015). Plant salt tolerance : Adaptations in halophytes. *Annals of Botany*, *115*(3), 327–331.

Flowers, Timothy J, Munns, R., & Colmer, T. D. (2015). Sodium chloride toxicity and the cellular basis of salt tolerance in halophytes. *Annals of Botany,* 115(3), 419–431.

Francenia Santos-Sánchez, N., Salas-Coronado, R., Hernández-Carlos, B., & Villanueva-Cañongo, C. (2019). Shikimic acid pathway in biosynthesis of phenolic compounds. *Plant Physiological Aspects of Phenolic Compounds*, 5(7), 1–15.

Francenia Santos-Sánchez, N., Salas-Coronado, R., Villanueva-Cañongo, C., & Hernández-Carlos, B. (2019). Antioxidant compounds and their antioxidant mechanism. *Antioxidants*, *13*(8), 1–28.

Garbisu, C., & Alkorta, I. (2001). Phytoextraction: A cost-effective plant-based technology for the removal of metals from the environment. *Bioresource Technology*, *77*(3), 229–236.

Garcia-Salas, P., Morales-Soto, A., Segura-Carretero, A., & Fernández-Gutiérrez, A. (2010). Phenolic-compound-extraction systems for fruit and vegetable samples. *Molecules*, *15*(12), 8813–8826.

Gauche, C., da Silva Malagoli, E., & Luiz, M. T. B. (2010). Effect of pH on the copigmentation of anthocyanins from cabernet sauvignon grape extracts with organic acids. *Scientia Agricola*, *67*(1), 41–46.

Ghasemzadeh, A., & Ghasemzadeh, N. (2011). Flavonoids and phenolic acids: Role and biochemical activity in plants and human. *Journal of Medicinal Plant Research*, *5*(31), 6697–6703.

Ghorbani, A., Razavi, S. M., Omran, V. O. G., & Pirdashti, H. (2018). *Piriformospora indica* alleviates salinity by boosting redox poise and antioxidative potential of tomato. *Russian Journal of Plant Physiology*, *65*(6), 898–907.

Giles, H. E., Lambrides, C., Dalzell, S. A., Macfarlane, D. C., & Shelton, H. M. A. X. (2014). The growth response of tropical and subtropical forage species to increasing salinity. *Forrajes Tropicales Journal*, *2*(4), 57–60.

Giordano, D., Locatelli, M., Travaglia, F., Bordiga, M., Reyneri, A., Coïsson, J. D., & Blandino, M. (2017). Bioactive compound and antioxidant activity distribution in roller-milled and pearled fractions of conventional and pigmented wheat varieties. *Food Chemistry*, *233*(5), 483–491.

Globe (2005). Soil pH protocol. *Global Learning and Observations for Environment*,*7*(14), 1-9.

Golkar, P., Bakhshi, G., & Vahabi, M. R. (2020). Phytochemical, biochemical, and growth changes in response to salinity in callus cultures of *Nigella sativ*a L. *In Vitro Cellular and Developmental Biology - Plant*, *56*(2), 247–258.

Gomez, S. M., & Kalamani, A. (2003). *Clitoria ternatea*; A Nutritive Multipurpose Forage Legume for the Tropics. *Pakistan Journal of Nutrition, 8*(9), 374–379.

Gonçalves, S., Moreira, E., Grosso, C., Andrade, P. B., Valentão, P., & Romano, A. (2017). Phenolic profile, antioxidant activity and enzyme inhibitory activities of extracts from aromatic plants used in Mediterranean diet. *Journal of Food Science and Technology*, *54*(1), 219–227.

Gorai, M., Vadel, A. M., Neffati, M., & Khemira, H. (2007). The effect of sodium chloride salinity on the growth, water status and ion content of Phragmites communis trin. In *Pakistan Journal of Biological Sciences*, *10*(13), 2225–2230

Graifenberg, A., Botrini, L., Giustiniani, L., Filippi, F., & Curadi, M. (2003). Tomato growing in saline conditions with biodesalinating plants: *Salsola soda* L., and Portulaca oleracea L. *Acta Horticulturae*, *609*(5), 301–305.

Grzeszczuk, M., Salachna, P., & Meller, E. (2018). Changes in photosynthetic pigments, total phenolic content, and antioxidant activity of *Salvia coccinea Buc'hoz* Ex Etl. induced by exogenous salicylic acid and soil salinity. *Molecules*, *23*(6), 1–11.

Gul, B., & Khan, M. A. (2003). Saline Agriculture : Promises and prospects for future agriculture in degraded saline lands. *Technology & Development in the New Millennium*, *12*(5), 149–156.

Guo, J., Du, M., Tian, H., & Wang, B. (2020). Exposiure to high salinity during seed development markedly enhanced seedling emergance and fitness of the progeny of the extreme halophyte *Suade salsa*. *Plant sciences, 3*(11), 1-11.

Gupta, G. K., Chahal, J., & Bhatia, M. (2010). *Clitoria ternatea* (L .): Old and new aspects. *Journal of Pharmacy Research*, *3*(11), 2610–2614.

Gupta, M., Karmakar, N., & Sasmal, S. (2017). In vitro antioxidant activity of aqueous and alcoholic extracts of polyherbal formulation consisting of *Ficus glomerata* Roxb. and *Symplocos racemosa* Roxb. stem bark assessed in free radical scavenging assays. *International Journal of Pharmacognosy and Phytochemical Research*, *9*(2), 181–189.

Habish, H. A., & Mahdi, A. A. (1979). Nodulation of legumes in the Sudan. *East African Agricultural and Forestry Journal*, *44*(3), 229–236.

Halder, M., Joardar, J. C., & Amin, M. S. (2015). Potassium, calcium and sodium distribution in different part of common vegetable plants grown under field condition. *Research Journal of Soil Biology*, *7*(3), 91–97.

Han, B., Jaurequi, J., Tang, B. W., & Nimni, M. E. (2003). Proanthocyanidin: A natural crosslinking reagent for stabilizing collagen matrices. *Journal of Biomedical Materials Research - Part A*, *65*(1), 118–124.

Han, Y. N., Bai, Z. Q., Liao, J. J., Bai, J., Dai, X., Li, X., Xu, J. L., & Li, W. (2016). Effects of phenolic hydroxyl and carboxyl groups on the concentration of different forms of water in brown coal and their dewatering energy. *Fuel Processing Technology*, *154*(8), 7–18.

Hanin, M., Ebel, C., Ngom, M., Laplaze, L., & Masmoudi, K. (2016). New insights on plant salt tolerance mechanisms and their potential use for breeding. *Frontiers in Plant Science*, *7*(11), 1–17.

Hannan, P. A., Khan, J. A., Ullah, I., & Ullah, S. (2016). Synergistic combinatorial antihyperlipidemic study of selected natural antioxidants; Modulatory effects on lipid profile and endogenous antioxidants. *Lipids in Health and Disease*, *15*(1), 1–10.

Harborne, J. B. (1998). Phytochemical Methods. *Frontiers in Plant Science*, *11*(6), 7-18.

Hasanuzzaman, M., Nahar, K., & Fujita, M. (2013). Plant response to salt stress and role of exogenous protectants to mitigate salt-induced damages, *Frontiers in Plant Science, 65*(1), 18–24.

Hasegawa, P. M. (2013). Sodium (Na+) homeostasis and salt tolerance of plants. *Environmental and Experimental Botany*, *92*(8), 19–31.

Hasegawa, P. M., & Bressan, R. A. (2000). Plant cellular and molecular responses to high salinity. *Frontiers in Plant Science,10*(6), 463-499.

Herken, E. N., & Guzel, S. (2010). Total antioxidant capacity and total phenol contents of selected commercial fruit juices in Turkey. *International Journal of Food Properties*, *13*(6), 1373–1379.

Hidalgo, F. J., Delgado, R. M., & Zamora, R. (2017). Protective effect of phenolic compounds on carbonyl-amine reactions produced by lipid-derived reactive carbonyls. *Food Chemistry*, *229*(8), 388–395.

Hura, T., Szewczyk-Taranek, B., Hura, K., Nowak, K., & Pawłowska, B. (2017). Physiological responses of *Rosa rubiginosa* to saline environment. *Water, Air,* *and Soil Pollution*, *228*(2), 24-35.

Hussain, M. ., Saquib, M., & Khan, M. . (2019). Techniques for extraction, isolation,and standardization of bioactive compounds from medicinal plants. 92(8), 19–31.

Hussain, S., Cao, X., Zhong, C., Zhu, L., Khaskheli, M. A., Fiaz, S., Zhang, J., & Jin, Q. (2018). Sodium chloride stress during early growth stages altered physiological and growth characteristics of rice. *Chilean Journal of Agricultural Research*, *78*(2), 183–197.

Hussain, T., Tan, B., Yin, Y., Blachier, F., Tossou, M. C. B., & Rahu, N. (2016). Oxidative stress and inflammation: what polyphenols can do for us? *Oxidative Medicine and Cellular Longevity*, *9*(8), 19–24

Huyut, Z., Beydemir, Ş., & Gülçin, I. (2017). Antioxidant and antiradical properties of selected flavonoids and phenolic compounds. *Biochemistry Research International*, *7*(6), 18–29.

Ibrahim, M., Shibli, N., Izad, A., & Zain, N. (2018). Growth, Chlorophyll fluorescence, leaf gas exchange and phytochemicals of *Centella asiatica* exposed to salinity stress. *Annual Research & Review in Biology*, *27*(2), 1–13.

Ighodaro, O. M., & Akinloye, O. A. (2018). First line defence antioxidants-superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPX): Their fundamental role in the entire antioxidant defence grid. *Alexandria Journal of Medicine*, *54*(4), 287–293.

Incesu, M., Cimen, B., Yesiloglu, T., & Yilmaz, B. (2014). Growth and photosynthetic response of two persimmon rootstocks (*Diospyros kaki* and *D. virginiana*) under different salinity levels. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, *42*(2), 386–391.

Iqbal, E., Salim, K. A., & Lim, L. B. L. (2015). Phytochemical screening, total phenolics and antioxidant activities of bark and leaf extracts of *Goniothalamus velutinus* (Airy Shaw) from Brunei Darussalam. *Journal of King Saud University - Science*, *27*(3), 224–232.

Isayenkov, S. V., & Maathuis, F. J. M. (2019). Plant salinity stress: Many unanswered questions remain. *Frontiers in Plant Science*, *10*(9),12-21.

Isemura, M. (2019). Catechin in human health and disease. *Molecules*, *24*(3), 1-15.

Ismail, A. M., Mohamed, E. A., Marghany, M. R., Abdel-Motaal, F. F., Abdel-Farid, I. B., & El-Sayed, M. A. (2016). Preliminary phytochemical screening, plant growth inhibition and antimicrobial activity studies of *Faidherbia albida* legume extracts. *Journal of the Saudi Society of Agricultural Sciences*, *15*(2), 112–117.

Iwuala, E. ., Kanu, R. ., & Eze, C. (2015). Effects of salinity and drought on the phytochemical production in *Jatrophacurcas* L : Evaluate *Jatropha curcas* plants grown from stem cuttings. *Journal of Pure and Applied Sciences*, *8*(2), 12-19.

Jadhav, R. V, & Bhujbal, S. S. (2020). A review on natural food colors.*Pharmaceutical resonance, 2*(2), 12-20.

James, R. A., Davenport, R. J., & Munns, R. (2006). Physiological characterization of two genes for Na^+ exclusion in durum wheat, Nax1 and Nax2. *Plant Physiology*, *142*(4), 1537–1547.

James, W. (1953). Alkaloid formation in plants. *Botany Research International, 7*(9), 809–822.

Javid, M., Nicolas, M., & For, R. (2011). Current knowledge in physiological and genetic mechanisms underpinning tolerances to alkaline and saline subsoil constraints of broad acre cropping in dryland regions. *Botany Research International*, *5*(14), 23-31.

Jenci, M., & Natarajan, S. (2009). Growth and organic constituent variations with salinity in *Excoecaria agallocha* L ., an important halophyte. *Research International*, *2*(1), 50–54.

Junqueira-Gonçalves, M. P., Yáñez, L., Morales, C., Navarro, M., Contreras, R. A., & Zúñiga, G. E. (2015). Isolation and characterization of phenolic compounds and anthocyanins from murta (*Ugni molinae* Turcz.) fruits. Assessment of antioxidant and antibacterial activity. *Molecules*, *20*(4), 5698–5713.

Kamh, M., Abdou, M., Chude, V., Wiesler, F., & Horst, W. J. (2002). Mobilization of phosphorus contributes to positive rotational effects of leguminous cover crops on maize grown on soils from northern Nigeria. *Journal of Plant Nutrition and Soil Science*, *165*(5), 566–572.

Kauppila, J. H. K., & Stewart, J. B. (2015). Mitochondrial DNA: Radically free of free-radical driven mutations. *Biochimica et Biophysica Acta - Bioenergetics*, *1847*(11), 1354–1361.

Kchaou, H., Larbi, A., Gargouri, K., Chaieb, M., Morales, F., & Msallem, M. (2010). Assessment of tolerance to NaCl salinity of five olive cultivars, based on growth characteristics and Na^+ and Cl^- exclusion mechanisms. *Scientia Horticulturae*, *124*(3), 306–315.

Keating, B. A., Strickland, R. W., & Fisher, M. J. (2015). Salt tolerance of some tropical pasture legumes with potential adaptation to cracking clay soils Salt tolerance of some tropical pasture legumes with potential adaptation to cracking clay soils. *231*(5), 411-421.

Khedr, A. H. A., Serag, M. S., Nemat-Alla, M. M., El-Naga, A. Z. A., Nada, R. M., Quick, W. P., & Abogadallah, G. M. (2011). Growth stimulation and inhibition by salt in relation to Na+ manipulating genes in xero-halophyte *Atriplex halimus* L. *Acta Physiologiae Plantarum*, *33*(5), 1769–1784.

Khoo, H. E., Azlan, A., Tang, S. T., & Lim, S. M. (2017). Anthocyanidins and anthocyanins: Colored pigments as food, pharmaceutical ingredients, and the potential health benefits. *Food and Nutrition Research*, *61*(1), 91-102.

Kisa, D., Kayır, Ö., Sağlam, N., Şahin, S., Öztürk, L., & Elmastaş, M. (2019). Changes of phenolic compounds in tomato associated with the heavy metal stress. *Journal of Natural and Applied Sciences*, *2*(1), 35–43.

Klaunig, J. E., Kamendulis, L. M., & Hocevar, B. A. (2010). Oxidative stress and oxidative damage in carcinogenesis. *Toxicologic Pathology*, *38*(1), 96–109.

Koilpillai, Y. J., R.Devika and Justin Koilpillai1. (2012). An overview on plant secondary metabolites : Its medicinal importance. *Journal of Pharmacy Research*, *5*(2), 984–986.

Koksal, N., Alkan-Torun, A., Kulahlioglu, I., Ertargin, E., & Karalar, E. (2016). Ion uptake of marigold under saline growth conditions. *SpringerPlus*, *5*(1), 1–12.

Komaraiah, K., & Rao, B. R. R. (2010). Morphological comparison between blue and white flower morphotypes of ugc & apcost. *Holticulture Society, 23*(9), 43-55.

Kosai, P., Sirisidthi, K., Jiraungkoorskul, K., & Jiraungkoorskul, W. (2015). Antiepileptic and antipsychotic effects of review on ethnomedicinal uses of memory in boosting butterfly pea , *Clitoria ternatea*. *Journal of Natural Remedies*, *15*(2), 78-85.

Kozłowska, A., & Szostak-Wegierek, D. (2014). Flavonoids food sources and health benefits. *Biotechnology Reports*, *65*(2), 79–85.

Kozłowska, A., & Szostak-Węgierek, D. (2018). Flavonoids – Food sources, health benefits, and mechanisms involved. *Journal of Natural Remedies,7*(3), 1–27.

Krishnamurthy, P., & Wadhwani, A. (2012). Antioxidant enzymes and human health. *Antioxidant Enzyme*, *12*(6), 3–18.

Ku, C. S., Jang, J. P., & Mun, S. P. (2007). Exploitation of polyphenol-rich pine barks for potent antioxidant activity. *Journal of Wood Science*, *53*(6), 524–528.

Kumar, I., & Sharma, R. K. (2018). Production of secondary metabolites in plants under abiotic stress: An overview. *Significances of Bioengineering & Biosciences*, *2*(4), 1–5.

Kumar, N., & Goel, N. (2019). Phenolic acids: Natural versatile molecules with promising therapeutic applications. *Biotechnology Reports*, *24*(3), 27-38.

Kumar, R. T., Kumar, S. R., & Rajesh Kumar, C. T. (2017). Phytochemical and antibacterial activities of crude leaf and root extracts of *Clitoria ternatea* varieties (Fabaceae). *Journal of Pharmacognosy and Phytochemistry*, *6*(6), 1104–1108.

Kumar, V., Mukherjee, K., Kumar, S., Mal, M., & Mukherjee, P. K. (2008). Validation of HPTLC method for the analysis of taraxerol in *Clitoria ternatea*. *Phytochemical Analysis*, *19*(3), 244–250.

Kurt, S., & Osueke, K. K. (2014). The effects of color on the moods of college students. *SAGE Open*, *4*(1), 215-225.

Kurutas, E. B. (2016). The importance of antioxidants which play the role in cellular response against oxidative/nitrosative stress: Current state. *Nutrition Journal*, *15*(1), 1–22.

Lae, K. Z. W., Su, S. S., Win, N. N., Than, N. N., & Ngwe, H. (2019). Isolation of lasiodiplodin and evaluation of some biological activities of the stem barks of *Phyllanthus Albizzioides* (Kurz) Hook.f. *Sci Medicine Journal*, *1*(4), 199–216.

Lakshan, S. A., Jayanath, N. Y., Abeysekera, K. M., Abeysekera, S. M. (2019). A commercial potential blue pea (*Clitoria ternatea* L.) flower extract incorporated beverage having functional properties. *Alternative medicine, 12*(9), 1-14.

Läuchli, A., & Grattan, S. R. (2007). Plant growth and development under salinity stress-Advances in molecular breeding toward drought and salt tolerant crops. *Nutrition Journal*, 5(3), 1–32.

Läuchli, André, & Grattan, S. R. (2011). Plant responses to saline and sodic conditions. *Agricultural Management, 5*(7), 23-34.

Lev-Yadun, S., & Gould, K. S. (2008). Role of anthocyanins in plant defence. *SAGE Open*, *8(7),* 22–28.

Li, W. (2017). Effect of environmental salt stress on plants and the molecular mechanism of salt stress tolerance. *International Journal of Environmental Sciences & Natural Resources*, *7*(3), 2–7.

Liji, K. . (2018). Taxonomical characters of essential plants in ayurveda under different families. *International Journal of Current Trends in Science and Technology*, *8*(4), 20205–20212.

Lijon, B., Meghla, N. S., Jahedi, E., Rahman, A., & Hossain, I. (2017). Phytochemistry and pharmacological activities of *Clitoria ternatea*. *Native Plants Journal, 4*(1), 1–10.

Lin, D., Xiao, M., Zhao, J., Li, Z., Xing, B., Li, X., Kong, M., Li, L., Zhang, Q., Liu, Y., Chen, H., Qin, W., Wu, H., & Chen, S. (2016). An overview of plant phenolic compounds and their importance in human nutrition and management of type 2 diabetes. *Molecules*, *21*(10), 54-63.

Liu, Z., Zhu, J., Yang, X., Wu, H., Wei, Q., Wei, H., & Zhang, H. (2018). Growth performance, organ-level ionic relations and organic osmoregulation of *Elaeagnus angustifolia* in response to salt stress. *PLoS ONE*, *13*(1), 1–18.

Lobo, V., Patil, A., Phatak, A., & Chandra, N. (2010). Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacognosy Reviews*, *4*(8), 118–126.

Louda, D. W. (2012). Overview of biochemical. *Florida Journal of Educational Research*, *2*(15), 108-118.

Luna, T. (2011). Nursery manual for native plants: A guide for tribal nurseries, volume one, nursery management. *Native Plants Journal*, *12*(1), 75–78.

Lv, S., Jiang, P., Chen, X., Fan, P., Wang, X., & Li, Y. (2012). Multiple compartmentalization of sodium conferred salt tolerance in *Salicornia europaea* L. *Plant Physiology and Biochemistry*, *5*(1), 47–52.

M. Azza Mazher, A., El-Quesni, Fatma, E., & Farahat, M. (2007). Responses of ornamental and woody trees to salinity. In *World Journal Agriculture Science*,*7*(3), 386–395.

Machado, R. M. A., & Serralheiro, R. P. (2017). Soil salinity: Effect on vegetable crop growth: Management practices to prevent and mitigate soil salinization. *Horticulturae*, *3*(2), 65-73.

Madalinski, N. A, Adams, N, Wilson, T. (2000). Introduction to phytoremediation. *Frontiers in Pharmacology, 3*(2), 24-58.

Maddu, N. (2019). Diseases related to types of free radicals. *Antioxidants*, *8*(12), 1–18.

Manjula, P., Mohan, C., Sreekanth, D., Keerthi, B., & Devi, B. P. (2015). Phytochemical analysis of *Clitoria ternatea Linn*. : A valuable medicinal. *Journal* *of Indian Botanical Society*, *4*(7), 76-83.

Marget, A., A., Dhayabaran, V., Suvaithenamudhan, S., & Parthasarathy (2019). Analysing the antidepressant and drug efflux competence of *Clitoria ternatea* L. as P-glycoprotein inhibitor to facilitate blood brain barrier. *Acta scientiarum*, *7*(41), 1-15.

Martínez-Valverde, I., Periago, M. J., & Ros, G. (2000). Nutritional importance of phenolic compounds in the diet. *Archivos Latinoamericanos de Nutricion*, *50*(1), 5–18.

Masoko, P. (2017). Phytochemical analysis, antioxidant and antibacterial properties of spilanthes mauritiana used traditionally in limpopo province, South Africa. *Journal of Evidence-Based Complementary and Alternative Medicine*, *22*(4), 936–943.

Mazlun, H., Tun, U., & Onn, H. (2019). Studies on phytochemical constituents and antimicrobial properties of *Citrullus lanatus* peels studies on phytochemical constituents and antimicrobial properties of *Citrullus Lanatus* peels. *Physiological Research, 4*(5), 66-71.

Meliyo, J. L., Kashenge-killenga, S., Victor, K. M., Mfupe, B., Hiza, S., Kihupi, L., Boman, B. J., & Dick, W. (2017). Evaluation of salt affected soils for rice (*Oryza sativa*) production in ndungu irrigation scheme same district, Tanzania. *Biological Journal, 6*(1), 24–38.

Mergia, E., Shibeshi, W., Terefe, G., & Teklehayamanot, T. (2014). Phytochemical screening and in vitro antitrypanosomal activity of aqueous and methanol leaf extract of *Verbascum sinaiticum* (Scrophulariaceae) against *Trypanosoma congolense* field isolate. *Journal of Clinical & Experimental Pathology*, *4*(4), 54-61.

Mierziak, J., Kostyn, K., & Kulma, A. (2014). Flavonoids as important molecules of plant interactions with the environment. *Molecules*, *19*(10), 16240–16265.

Minatel, I. O., Borges, C. V., Ferreira, M. I., Gomez, H. A. G., Chen, C.-Y. O., & Lima, G. P. P. (2017). Phenolic compounds: Functional properties, impact of processing and bioavailability. *Biological journal,6*(8), 33-39.

Mohamed, E. ., Faouzy, A., Ales, I., Kaled, A., Soad, A., & Radim, H. (2017). Phytochemical screening and antibacterial activity of *Genista microcephala* and *Rosmarinus officinalis* extracts from Libyan’s regions. *International Journal of Research in Ayurveda & Pharmacy*, *8*(4), 52–56.

Mojžišová, G., & Kuchta, M. (2001). Dietary flavonoids and risk of coronary heart disease. *Physiological Research*, *50*(6), 529–535.

Monica, N., Vidican, R., Rotar, I., Stoian, V., & Pop, R. (2014). Plant nutrition affected by soil salinity and response of rhizobium regarding the nutrients accumulation. *ProEnvironment*, *7*(18), 71–75.

Muchate, N. S., Rajurkar, N. S., Suprasanna, P., & Nikam, T. D. (2019). NaCl induced salt adaptive changes and enhanced accumulation of 20-hydroxyecdysone in the in vitro shoot cultures of *Spinacia oleracea* (L.). *Scientific Reports*, *9*(1), 1–10.

Mühling, K. H., & Läuchli, E. (2001). Physiological traits of sodium toxicity and salt tolerance. *Plant Nutrition*, *19*(3), 378–379.

Mujeeb, F., Bajpai, P., & Pathak, N. (2014). Phytochemical evaluation, antimicrobial activity, and determination of bioactive components from leaves of aegle marmelos. *BioMed Research International*, *24*(5), 32-40.

Munns, R. (2002). Comparative physiology of salt and water stress. *Plant, Cell and Environment*, *25*(2), 239–250.

Munns, R., James, R. A., & Läuchli, A. (2006). Approaches to increasing the salt tolerance of wheat and other cereals. *Journal of Experimental Botany*, *57*(5), 1025–1043.

Munns, R., & Tester, M. (2008). Mechanisms of salinity tolerance. *Annual Review of Plant Biology*, *59*(1), 651–681.

Murugan, R., & Parimelazhagan, T. (2014). Comparative evaluation of different extraction methods for antioxidant and anti-inflammatory properties from *Osbeckia parvifolia* Arn. - An in vitro approach. *Journal of King Saud University - Science*, *26*(4), 267–275.

Mushtaq, Z., Faizan, S., & Gulzar, B. (2020). Salt stress, its impacts on plants and the strategies plants are employing against it: A review. *Journal of Applied Biology and Biotechnology*, *8*(3), 81–91.

Nair, V., Bang, W. Y., Schreckinger, E., Andarwulan, N., & Cisneros-Zevallos, L. (2015). Protective role of ternatin anthocyanins and quercetin glycosides from Butterfly pea (*Clitoria ternatea*) blue flower petals against lipopolysaccharide (lps)-induced inflammation in macrophage cells. *Journal of Agricultural and Food Chemistry*, *63*(28), 6355–6365.

Nasim, N. A & Pa'ee, F. (2021). Evaluating physiological responses of Butterfly pea, *Clitoria ternatea* L. var. Pleniflora to salt stress. *IOP Conference Series: Earth* *and Environmental Science, 736*(1),1-8.

Ncer, T (2019). Plant propagation. *Plants and Nature*, *3*(51), 51-88.

Newsome, A. G., Culver, C. A., & Van Breemen, R. B. (2014). Nature's palette: The search for natural blue colorants. *Journal of Agricultural and Food Chemistry*, *62*(28), 6498–6511.

Niazi, B. H., Athar, M., Saum, M., & Rozema, J. (2005). Growth and ionic relations of fodderbeet and seabeet under saline environments. *International Journal of Environmental Science and Technology*, *2*(2), 113–120.

Nimse, S. B., & Pal, D. (2015). Free radicals, natural antioxidants, and their reaction mechanisms. *Royal Society of Chemistry Advances*, *5*(35), 27986–28006.

Nishanth, M. J., Sheshadri, S. A., Rathore, S. S., Srinidhi, S., & Simon, B. (2018). Expression analysis of cell wall invertase under abiotic stress conditions influencing specialized metabolism in *Catharanthus roseus*. *Scientific Reports*, *8*(1), 1–15.

Nivas, D., Gaikwad, D. K., & Chavan, P. D. (2011). Physiological responses of two morinda species under saline conditions. *American Journal of Plant Physiology*, *6*(3), 157–166.

Njoku, V. O., Obi, C., & Onyema, O. M. (2011). Phytochemical constituents of some selected medicinal plants. *African Journal of Biotechnology*, *10*(66), 15020–15024.

Nosál, R., Drábiková, K., Jančinová, V., Mačičková, T., Pečivová, J., Perečko, T., Harmatha, J., & Šmidrkal, J. (2015). On the pharmacology of oxidative burst of human neutrophils. *Physiological Research*, 64(2), 445–452.

Nurhadi, M., Wirhanuddin, Erwin, Muflihah, Erika, F., & Widiyowati, I. I. (2017). The development of learning media of acid-base indicator from extract of natural colorant as an alternative media in learning chemistry. *AIP Conference Proceedings*, *8*(5), 1823-1831.

Ock, K. C., Sang, J. C., & Song, W. O. (2007). Estimated dietary flavonoid intake and major food sources of U.S. adults. *Journal of Nutrition*, *137*(5), 1244–1252.

Oguis, G. K., Gilding, E. K., Jackson, M. A., & Craik, D. J. (2019). Butterfly pea (*Clitoria ternatea*), a cyclotide-bearing plant with applications in agriculture and medicine. *Frontiers in Plant Science*, *10*(5), 1–23.

Ola, H. A. E., Reham, E., Farag, S. S. E., & Habib, S. A. (2012). Morpho-anatomical changes in salt stressed kallar grass (*Leptochloa fusca* L . Kunth). *Journal of*

Agriculture and Biological Sciences, *8*(2), 158–166.

Oliveira Junior, L. F. G. de, Reis, F. de O., Fagundes, J. L., Gagliardi, P. R., & Oliveira, L. F. M. (2016). Ecophysiological and biochemical responses of saltbush subjected to salinity. *Pesquisa Agropecuária Tropical*, *46*(2), 116–122.

Onyema, A. M. (2019). Extraction, phytochemical, physicochemical and toxicological study of ginger lily (*Costusafer* Ker Gawl) leaf and snail (*Archachatinamarginata*) slime for potential use as anti-diabetic drug delivery. *IOSR Journal of Applied Chemistry, 12*(9), 8–19.

Otitoloju, K. (2014). Growth, yield and seed nutritional composition of groundnut (*Arachis hypogaea* Linn) under elevated level of soil salinity. *Soil Biology*, *14*(3), 190-197.

Panche, A. N., Diwan, A. D., & Chandra, S. R. (2016). Flavonoids: An overview. *Journal of Nutritional Science*, *5*(1), 165-177.

Patel, A. D., & Pandey, A. N. Ã. (2007). Effect of soil salinity on growth , water status and nutrient accumulation in seedlings of *Cassia montana* (Fabaceae). *Plant Biology,12*(4), 359-367.

Pendbhaje, N. S. (2011). Ethanopharmacoloy, pharmacognosy and phytochemical profile of *Clitoria ternatea* Linn. *Pharmacology, 6*(12), 1-10.

Pereira, D. M., Valentão, P., Pereira, J. A., & Andrade, P. B. (2009). Phenolics: From chemistry to biology. *Molecules*, *14*(6), 2202–2211.

Pervaiz, T., Songtao, J., Faghihi, F., Haider, M. S., & Fang, J. (2017). Naturally occurring anthocyanin, structure, functions and biosynthetic pathway in fruit plants. *Journal of Plant Biochemistry & Physiology*, *5*(2), 35-41.

Pessarakli, M., Marcum, K. B., & Kopec, D. M. (2005). Growth responses and nitrogen-15 absorption of desert saltgrass under salt stress. *Journal of Plant Nutrition*, *28*(8), 1441–1452.

Peterson, J., Dwyer, J., Bhagwat, S., Haytowitz, D., Holden, J., Eldridge, A. L., Beecher, G., & Aladesanmi, J. (2005). Major flavonoids in dry tea. *Journal of Food Composition and Analysis*, *18*(6), 487–501.

Petropoulos, S. A., Levizou, E., Ntatsi, G., Fernandes, Â., Petrotos, K., Akoumianakis, K., Barros, L., & Ferreira, I. C. F. R. (2017). Salinity effect on nutritional value, chemical composition and bioactive compounds content of *Cichorium spinosum* L. *Food Chemistry*, *21*(2), 129–136.

Phaniendra, A., Jestadi, D. B., & Periyasamy, L. (2015). Free Radicals: Properties, sources, targets, and their implication in various diseases. *Indian Journal of Clinical Biochemistry*, *30*(1), 11–26.

Polash, M. A. S., Sakil, M. A., & Hossain, M. A. (2019). Plants responses and their physiological and biochemical defense mechanisms against salinity: A review. *Tropical Plant Research*, *6*(2), 250–274.

Polizelli, P. P., Facchini, F. D. A., Cabral, H., & Bonilla-Rodriguez, G. O. (2008). A new lipase isolated from oleaginous seeds from *Pachira aquatica* (bombacaceae). *Applied Biochemistry and Biotechnology*, *150*(3), 233–242.

Prasad, R., Majumdar, K., Shivay, Y. S., & Kapil, U. (2016). Minerals in plants and human nutrition and health. *International Plant Nutrition Institute*, *5*(8), 1-3.

Prasanth, M. I., Sivamaruthi, B. S., Chaiyasut, C., & Tencomnao, T. (2019). A review of the role of green tea (*Camellia sinensis*) in antiphotoaging, stress resistance, neuroprotection, and autophagy. *Nutrients*, *11*(2), 79-88.

Prod, J. N., Resour, P., Zohra, S. F., Meriem, B., Samira, S., & S, A. M. M. (2012). Phytochemical screening and identification of some compounds from mallow. *Nutrients, 2*(4), 512–516.

Proestos, C., Lytoudi, K., Mavromelanidou, O. K., Zoumpoulakis, P., & Sinanoglou, V. J. (2013). Antioxidant capacity of selected plant extracts and their essential oils. *Antioxidants*, *2*(1), 11–22.

Qadir, M., Oster, J. D., Schubert, S., Noble, A. D., & Sahrawat, K. L. (2007). Phytoremediation of sodic and saline-sodic soils. *Advances in Agronomy*, *96*(7), 197–247.

Qazi, M. A., & Molvi, K. I. (2018). Free Radicals and their management. *American Journal of Pharmacy And Health Research*, *6*(4), 1–10.

Quazi, S. & Yogekar, T. (2020). A review on ethanopharmacological importance of *Clitoria ternatea* (2020). *Scholar Academic Jounal of Biosciences*, *8*(3), 63-67.

Rabhi, M., Hafsi, C., Lakhdar, A., Hajji, S., Barhoumi, Z., Hamrouni, M. H., Abdelly, C., & Smaoui, A. (2009). Evaluation of the capacity of three halophytes to desalinize their rhizosphere as grown on saline soils under nonleaching conditions. *African Journal of Ecology*, *47*(4), 463–468.

Rahneshan, Z., Nasibi, F., & Moghadam, A. A. (2018). Effects of salinity stress on some growth, physiological, biochemical parameters and nutrients in two pistachio (*Pistacia vera* L.) rootstocks. *Journal of Plant Interactions*, *13*(1), 73–82.

Raja, K. S., Taip, F. S., Azmi, M. M. Z., & Shishir, M. R. I. (2017). Effect of pre-treatment and different drying methods on the physicochemical properties of *Carica papaya* L. leaf powder. *Journal of the Saudi Society of Agricultural Sciences*, *18*(2), 150–156.

Rao, U. S. M., Abdurrazak, M., & Mohd, K. S. (2016).Phytochemical screening, total flavonoid and phenolic content assays of various solvent of Tepal of *Musa paradisiaca*. *Malaysian Journal of Analytical Sciences*, *20*(5), 1181–1190.

Relf, D., Specialist, E., Horticulture, E., & Tech, V. (2009). Propagation by cuttings, layering and division. *Journal of Pharmacy And Health Research, 16*(4), 97-104.

Rengasamy, P. (2018). World salinization with emphasis on Australia. *Plant Science, 57*(5), 1017–1023.

Rezazadeh, A., Ghasemzadeh, A., Barani, M., & Telmadarrebei, T. (2012). Effect of salinity on phenolic composition and antioxidant activity of artichoke (*Cynara scolymus* L.) leaves, *Plant Science, 57*(4), 245–252.

Rice-Evans, C. A., Miller, N. J., & Paganga, G. (1997). Antioxidant properties of phenolic compounds. *Plant Science*, *2*(4), 152–159.

Rudrapal, M., & Chetia, D. (2016). Plant flavonoids as potential source of future antimalarial leads. *Systematic Reviews in Pharmacy*, *8*(1), 13–18.

Ruiz- Cruz, S., Chaparro- Hernández, S., Ruiz, K. L. H., Cira- Chávez, L. A., Estrada- Alvarado, M. I., Ortega, L. E. G., Ornelas- Paz, J. de J., & Mata, M. A. L. (2017). Flavonoids: Important biocompounds in food. *PLoS ONE*. *11*(2), 43–48

Sade, N., Rubio-Wilhelmi, M. D. M., Umnajkitikorn, K., & Blumward, E. (2017). Stress-induced senescence and plant tolerance to abiotic stress. *Journal of Experimental Botany*, *4*(69), 845-853.

Safari, F., Akramian, M., & Salehi-Arjmand, H. (2020). Physiochemical and molecular responses of salt-stressed lemon balm (*Melissa officinalis* L.) to exogenous protectants. *Acta Physiologiae Plantarum*, *42*(2), 1–10.

Said, O., Khalil, K., Fulder, S., & Azaizeh, H. (2002). Ethnopharmacological survey of medicinal herbs in Israel, the Golan Heights and the West Bank region. *Journal of Ethnopharmacology*, *83*(3), 251–265.

Sakharkar, P., & Chauhan, B. (2017). Antibacterial, antioxidant and cell proliferative properties of *Coccinia grandis* fruits. *Avicenna Journal of Phytomedicine (AJP)*, *14*(162), 39–43.

Samuel, E. L. G., Marcano, D. C., Berka, V., Bitner, B. R., Wu, G., Potter, A., Fabian, R. H., Pautler, R. G., Kent, T. A., Tsai, A. L., & Tour, J. M. (2015). Highly efficient conversion of superoxide to oxygen using hydrophilic carbon clusters. *Proceedings of the National Academy of Sciences of the United States of America*, *112*(8), 2343–2348.

Sang, S., Li, S., Fan, W., Wang, N., Gao, M., & Wang, Z. (2019). Zinc thiazole enhances defense enzyme activities and increases pathogen resistance to Ralstonia solanacearum in peanut (*Arachis hypogaea*) under salt stress. *PLoS ONE*, *14*(12), 1–13.

Sangadji, M. N., Edy, N., Nursalam, Rahman, A., Mozin, S., Rahmatu, R., Lakani, I., MacHmud, Z., & Musbah, M. (2019). Environmental carrying capacity based on ecosystem services for sustainable development in Banggai Island. *IOP Conference Series: Earth and Environmental Science*, *270*(1), 1-19.

Saptarini, N. M., Suryasaputra, D., & Nurmalia, H. (2015). Application of Butterfly Pea (*Clitoria ternatea* Linn) extract as an indicator of acid-base titration. *Journal of Chemical and Pharmaceutical Research*, *7*(2), 275–280.

Sarker, U. & Oba. S. (2020). The response of salinity stress-induced A. tricolor to growth, anatomy, physiology, non-enzymatic and enzymatic antioxidants. *Frontier Plant Science*, *7*(13), 24-37.

Schneider, C. D., & de Oliveira, A. R. (2004). Oxygen free radicals and exercise: Mechanisms of synthesis and adaptation to the physical training. *Revista Brasileira de Medicina Do Esporte*, *10*(4), 308–318.

Selmar, D. (2008). Potential of salt and drought stress to increase pharmaceutical significant secondary compounds in plants. *Agriculture and Forestry Research*, *28*(58), 139–144.

Senguttuvan, J., Paulsamy, S., & Karthika, K. (2014). Phytochemical analysis and evaluation of leaf and root parts of the medicinal herb, *Hypochaeris radicata* L. for in vitro antioxidant activities. *Asian Pacific Journal of Tropical Biomedicine*, *4*(1), 359–367.

Senhaji, S., Lamchouri, F., & Toufik, H. (2020). Phytochemical content, antibacterial and antioxidant potential of endemic plant *Anabasis aretioides* Coss. & Moq. (Chenopodiaceae). *BioMed Research International*, *87*(2), 67-78.

Senterre, B. (2016). Practical plant identification training guide BSc environmental science with specialisation. *Plant Science, 7*(6), 237-246.

Sethiya, N. K., Nahata, A., Mishra, S. H., & Dixit, V. K. (2009). An update on Shankhpushpi, a cognition boosting ayurvedic medicine. *Journal of China Integrated Medical*, *1*(11), 1001–1022.

Shah, P., & Modi, H. A. (2015). Comparative Study of DPPH , ABTS and FRAP assays for determination of antioxidant activity. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, *3*(98), 2321–2334.

Shaheen, N., Akhter, K. T., Khan, I. N., & Irfan, N. (2018). Bioresearch communications differently processed *Camellia Sinensis* of Bangladesh. *Acta Physiologiae Plantarum, 45*(3), 21-35.

Shaheen, S., Naseer, S., Ashraf, M., & Akram, N. A. (2013). Salt stress affects water relations, photosynthesis, and oxidative defense mechanisms in *Solanum melongena* L. *Journal of Plant Interactions*, *8*(1), 85–96.

Shannon, M. ., & Grieve, C. (1999). Tolerance of vegetable crops to salinity. *Horticulture Science*, *78*(12), 5–38.

Sharma, N. (2014). Free radicals, antioxidants and disease. *Biology and Medicine*, *6*(3), 1–6.

Sharma, V., & Ramawat, K. G. (2013). Salinity-induced modulation of growth and antioxidant activity in the callus cultures of miswak (*Salvadora persica*). *Biotech*, *3*(1), 11–17.

Sharma, V., & Ramawat, K. G. (2014). Salt stress enhanced antioxidant response in callus of three halophytes (*Salsola baryosma*, *Trianthema triquetra*, *Zygophyllum simplex*) of Thar Desert. *Biologia (Poland)*, *69*(2), 178–185.

Sheldon, A., Menzies, N. W., So, H. B., & Dalal, R. (2004). The Regional Institute - The effect of salinity on plant available water. *Biotechnology, 7*(9), 111-127.

Shende, V., Sahane, R., Lawar, M., Hamdulay, N., & Langote, H. (2012). Effect of ethanolic extract of *Clitoria ternatea* in mice. *Asian Journal of Pharmaceutical and Clinical Research*, *5*(3), 9–12.

Shereen, A., Mumtaz, S., Raza, S., Khan, M. A., & Solangi, S. (2005). Salinity effects on seedling growth and yield components of different inbred rice lines. *Pakistan Journal of Botany*, *37*(1), 131–139.

Shin, Y. K., Bhandari, S. R., Jo, J. S., Song, J. W., Cho, M. C., Yang, E. Y., & Lee, J. G. (2020). Response to salt stress in lettuce: Changes in chlorophyll fluorescence parameters, phytochemical contents, and antioxidant activities. *Agronomy*, *10*(11), 56-70.

Shipunov, A. (2019). How to make herbarium. *Plant Systematics and Evolution, 32*(8), 66-75.

Shrivastava, P., & Kumar, R. (2015). Soil salinity: A serious environmental issue and plant growth promoting bacteria as one of the tools for its alleviation. *Saudi Journal of Biological Sciences*, *22*(2), 123–131.

Silva, E. N., Ribeiro, R. V., Ferreira-Silva, S. L., Viégas, R. A., & Silveira, J. A. G. (2011). Salt stress induced damages on the photosynthesis of physic nut young plants. *Scientia Agricola*, *68*(1), 62–68.

Sinjushin, A. A., Bagheri, A., Maassoumi, A. A., & Rahiminejad, M. R. (2015). Terata of two legume species with radialized corolla: some correlations in floral symmetry. *Plant Systematics and Evolution*, *301*(10), 2387–2397.

Smetanska, I. (2018). Sustainable Production of Polyphenols and Antioxidants by Plant In Vitro Cultures. *Pakistan Journal of Botany, 82*(4), 77-89.

Solíz-Guerrero, J. B., Rodriguez, D. J. De, Rodríguez-García, R., Angulo-Sánchez, J. L., & Méndez-Padilla, G. (2002). Quinoa Saponins: Concentration and composition analysis. *Trends in New Crops and New Uses*, *7*(2), 110–114.

Soltis, P. S., Brockington, S. F., Yoo, M. J., Piedrahita, A., Latvis, M., Moore, M. J., Chanderbali, A. S., & Soltis, D. (2009). Floral variation and floral genetics in basal angiosperm. *American Journal of Biology, 96*(1), 110-128.

Spring. (2006). Flowers and Flower Terminology. *Biotechnology, 43*(9), 53-68.

Sripakdee, T., Mahachai, R., & Chanthai, S. (2017). Phenolics and ascorbic acid related to antioxidant activity of Mao fruit juice and their thermal stability study (Review article). *Oriental Journal of Chemistry*, *33*(1), 74–86.

Srivastava, H. S. (1980). Regulation of nitrate reductase activity in higher plants. *Phytochemistry*, *19*(5), 725–733.

Sterling, T. M. (2005). Transpiration: Water movement through plants. *Journal of Natural Resources and Life Sciences Education*, *34*(1), 123–123.

Stemman, D. C. (1998). The complexicity in coastal marsh ecosystems : Alook at the fresh fluid ecological site. *Soil & Plant Science, 4*(23), 1-3.

Sultana, M., Verma, P. K., Raina, R., Prawez, S., & Dar, M. A. (2012). Quantitative analysis of total phenolic, flavonoids and tannin contents in acetone and n-hexane extracts of *Ageratum conyzoides*. *International Journal of ChemTech Research*, *4*(3), 996–999.

Suresh, P. K., & Sah, A. K. (2013). Free radicals: Generation, defenses and implications in various diseases. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, *4*(2), 247–269.

Sytar Oksana. (2012). Plant phenolic compounds for food, pharmaceutical and cosmetics production. *Journal of Medicinal Plants Research*, *6*(13), 2526–2539.

Tada, Y., Komatsubara, S., & Kurusu, T. (2014). Growth and physiological adaptation of whole plants and cultured cells from a halophyte turf grass under salt stress. *AoB PLANTS*, *6*(1), 1–11.

Talmaciu, A. I., Ravber, M., Volf, I., Knez, Ž., & Popa, V. I. (2016). Isolation of bioactive compounds from spruce bark waste using sub- and supercritical fluids. *Journal of Supercritical Fluids*, *117*, 243–251.

Talukdar, D. (2011a). Isolation and characterization of NaCl-tolerant mutations in two important legumes, *Clitoria ternatea* L. and *Lathyrus sativus* L.: Induced mutagenesis and selection by salt stress. *Journal of Medicinal Plants Research*, *5*(16), 3619–3628.

Talukdar, D. (2011b). Morpho-physiological responses of grass pea (*Lathyrus sativus* L.) genotypes to salt stress at germination and seedling stages. *Legume Research*, *34*(4), 232–241.

Tan, B. L., Norhaizan, M. E., Liew, W. P. P., & Rahman, H. S. (2018). Antioxidant and oxidative stress: A mutual interplay in age-related diseases. *Frontiers in Pharmacology*, *9*(10), 1–28.

Tanase, C., Cosarcă, S., & Muntean, D. L. (2019). A critical review of phenolic compounds extracted from the bark of woody vascular plants and their potential biological activity. *Molecules*, *24*(6), 2-25.

Tandon, V., Gupta, B. M., & Tandon, R. (2005). Free radicals/reactive oxygen species. *Journal of Current Medical Science & Practice*, *12*(3), 143–148.

Tanwar, B., & Modgil, R. (2012). Flavonoids: Dietary occurrence and health benefits. *Spatula DD - Peer Reviewed Journal on Complementary Medicine and Drug Discovery*, *2*(1), 59-70.

Telkoparan Akillilar, P., Tuglu, Y. B., & Shomali Moghaddam, N. (2018). Anticancer, antioxidant properties and phenolic, flavonoid composition of *Heracleum platytaenium* plant methanolic extracts. *Marmara Pharmaceutical Journal*, *22*(3), 396–404.

Terahara, N. (2015). Flavonoids in foods: A review. *Natural Product*

Communications, *10*(3), 521–528.

Tester, M., & Davenport, R. (2003). Na+ tolerance and Na+ transport in higher plants. *Annals of Botany*, *91*(5), 503–527.

Tomas, A., Palma, P., Fialho, S., Lima, A. Alvarenga, P., Potes, M., Codta, M. J., & Salgado, R. (2020). Risk assessment of irrigation-related soil salinization and sodification in Mediterranean areas. *Water*, *2*(12), 1-22.

Torres, I. W., Reyes, G. C., & Perez, D. M. (2018). Determination of predominant soluble salts in soils of the irrigation district Alto Chicamocha of Boyaca. *Agronomia, 5*(1), 1-12.

Torskangerpoll, K., & Andersen, Ø. M. (2005). Colour stability of anthocyanins in aqueous solutions at various pH values. *Food Chemistry*, *89*(3), 427–440.

Trouillas, P., Sancho-García, J. C., De Freitas, V., Gierschner, J., Otyepka, M., & Dangles, O. (2016). Stabilizing and modulating color by copigmentation: insights from theory and experiment. *Chemical Reviews*, *116*(9), 4937–4982.

Tsao, R. (2010). Chemistry and biochemistry of dietary polyphenols. *Nutrients*, *2*(12), 1231–1246.

Tung, J. P., Fraser, J. F., Wood, P., & Fung, Y. L. (2009). Respiratory burst function of ovine neutrophils. *BMC Immunology*, *10*(5), 1–11.

Uddin, K., Dandan, H. M., Alidin, A. H., Juraimi, A. S., Ali, Q., & Karim, S. M. R. (2016). Salinity effects on germination and growth of Malaysian weedy rice biotypes and cultivated rice. *Frontiers in Pharmacology, 66*(5), 122–128.

University of Florida. (2009). Illustrated glossary of leaf shapes. *Annals of Botany, 6*(12), 19-42.

Valifard, M., Mohsenzadeh, S., Kholdebarin, B., & Rowshan, V. (2014). Effects of salt stress on volatile compounds, total phenolic content and antioxidant activities of *Salvia mirzayanii*. *South African Journal of Botany*, *9* (3), 92–97.

Vasudevan, V., & Manickavasagam, M. (2018). Effect of salinity on growth , photosynthetic pigments and antioxidant activity in watermelon *Citrulluslanatus (L .)*. *6*(2), 2024–2032.

Veatch-Blohm, M. E., Sawch, D., Elia, N., & Pinciotti, D. (2014). Salinity tolerance of three commonly planted Narcissus cultivars. *Horticulture Science*, *49*(9), 1158–1164.

Veeramuthu, D., Raja, W. R. T., Al-Dhabi, N. A., & Savarimuthu, I. (2017). Flavonoids: Anticancer properties. Flavonoids - From biosynthesis to human health. *Biochemistry & Analytical Biochemistry, 14*(7), 65-78.

Venturi, S., & Venturi, M. (2007). Evolution of dietary antioxidants: role of iodine. *Journal of Nutritions*, *5*(3), 1–25.

Verri, W. A., Vicentini, F. T. M. C., Baracat, M. M., Georgetti, S. R., Cardoso, R. D. R., Cunha, T. M., Ferreira, S. H., Cunha, F. Q., Fonseca, M. J. V., & Casagrande, R. (2012). Flavonoids as anti-inflammatory and analgesic drugs: Mechanisms of action and perspectives in the development of pharmaceutical forms. *Natural Products Chemistry*, *36*(1), *143-156*.

Vindhya, K., Kk, S. K., Hs, N., & Leelavathi, S. (2014). Research journal of pharmaceutical , biological and chemical sciences preliminary phytochemical screening of *Gardenia latifolia* Ait . and *Gardenia*. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, *5*(2), 527–536.

Wada, Y., Reager. J. T., Chao. B. F., Wang. J., Lo. M., & Gardner. A. S. (2017). Recent changes in land water storage and its contribution to sea level variations. *Survival Geophysics*, *3*(131), 131-152.

Wadood, A. (2013). Phytochemical analysis of medicinal plants occurring in local area of Mardan. *Biochemistry & Analytical Biochemistry*, *2*(4), 25-38.

Wahyuningsih, S., Wulandari, L., Wartono, M. W., Munawaroh, H., & Ramelan, A. H. (2017). The effect of pH and color stability of anthocyanin on food colorant. *IOP Conference Series: Materials Science and Engineering*, *193*(1), 78-90.

Welch-Keesey, M., & Rosie Lerner, B. (2009). HO-37 New plants from cuttings. *Horticulture and Landscape Architecture*, *9*(16), 80-91.

White, P. J., & Broadley, M. R. (2003). Calcium in plants. *Annals of Botany*, *92*(4), 487–511.

Wong, C. C., Li, H. Bin, Cheng, K. W., & Chen, F. (2006). A systematic survey of antioxidant activity of 30 Chinese medicinal plants using the ferric reducing antioxidant power assay. *Food Chemistry*, *97*(4), 705–711.

Xia, H., Ni, Z., & Pan, D. (2017). Effects of exogenous melatonin on antioxidant capacity in Actinidia seedlings under salt stress. *IOP Conference Series: Earth and Environmental Science*, *94*(1), 187-193.

Xu, G., Magen, H., Tarchitzky, J., & Kafkafi, U. (1999). Advances in chloride nutrition of plants. *Advances in Agronomy*, *68*(1), 74-89.

Xu, Z., Zhou, J., Ren, T., Du, H., Liu, H., Li, Y., & Zhang, C. (2020). Salt stress decreases seedling growth and development but increases quercetin and kaempferol content in Apocynum venetum. *Plant Biology*, *9*(4), 23-40.

Yadav, S. P., Bharadwaj, R., Nayak, H., & Mahto, R. (2019). Impact of salt stress on growth , productivity and physicochemical properties of plants : A Review. *International Journal of Chemical Studies*, *7*(2), 1793–1798.

Yao, S., Chen, S., Xu, D., & Lan, H. (2010). Plant growth and responses of antioxidants of Chenopodium album to long-term NaCl and KCl stress. *Plant Growth Regulation*, *60*(2), 115–125.

Young-Mathew, A., & Winslow, S. (2010). Plant Guide. *USDA-Natural Resorces Conversation Service, Plant Material Center*.*3*(8), 25–38.

Yousif, B., Nguyen, N., & Fukuda, Y. (2010). Mineral composition, photosynthesis and water relations of two vegetable crops; New Zealand spinach (*Tetragonia tetragonioides*) and water spinach (*Ipomoea*). *International Journal Agriculture*, *10*(2), 211–216.

Yu, Z., Duan, X., Luo, L., Dai, S., Ding, Z., & Xia, G. (2020). How plant hormones mediate salt stress responses. *Trends in Plant Science*, *25*(11), 1117–1130.

Yue, L. J., Li, S. X., Ma, Q., Zhou, X. R., Wu, G. Q., Bao, A. K., Zhang, J. L., & Wang, S. M. (2012). NaCl stimulates growth and alleviates water stress in the xerophyte *Zygophyllum xanthoxylum*. *Journal of Arid Environments*, *87*(3), 153–160.

Zaroug, M. G., & Munns, D. N. (1980). Effects of phosphorus and sulfur nutrition on soluble sugars and growth in *Clitoria ternatea* L. *Plant and Soil*, *55*(2), 243–250.

Zhang, T., Zhang, Z., Li, Y., & He, K. (2019). The effects of saline stress on the growth of two shrub species in the Qaidam Basin of Northwestern China. *Sustainability*, *11*(3), 122-137.

Zhao, C. Y., Si, J. H., Feng, Q., Deo, R. C., Yu, T. F., & Li, P. Du. (2017). Physiological response to salinity stress and tolerance mechanics of *Populus euphratica*. *Environmental Monitoring and Assessment*, *189*(11), 341-357.

Zhu, J.-K. (2001). Plant Salt Stress. *Encyclopedia of Life Sciences*, *8*(3), 87-95.

Zhu, J. K. (2003). Regulation of ion homeostasis under salt stress. *Plant biology*, *6*(5), 441–445.

Zillich, O. V., Schweiggert-Weisz, U., Eisner, P., & Kerscher, M. (2015). Polyphenols as active ingredients for cosmetic products. *International Journal of Cosmetic Science*, *37*(5), 455–464.

Zingare, M. L., Zingare, P. L., & Dubey, A. K. (2013). Valorization of blue pea flower

(*Clitoria ternatea*) through developing a functional beverage. *Plant Science, 3*(1), 86-93.