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Antifungal analysis of *Sapindus mukorossi* and *Accacia concinna* fruit extracts against plant pathogenic fungi

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Abstract
Objectives: To evaluate the distinctive dissolvable extracts of products of *Sapindus mukorossi* and *Acaccia concinna* were researched for their antifungal action in vitro against phytopathogenic organisms, *Aspergillus niger* and *Botrytis cinerea*.
Methods: Petroleum ether, chloroform, methanol and refined water crude extracts of *Sapindus mukorossi* and *Acaccia concinna* were evaluated for antifungal activity using slants, petri plates, Itraconazole and Fuzanozole Protocols.
Results: The extracts of *Sapindus mukorossi* organic product had the best inhibitory impact on mycelial development of *Botrytis* cinerea by 95.56% at 4 mg/ml. additionally, concentrate of *Acaccia concinna* caused exceptional decrease on the parasitic development (94.44%) of *Aspergillus niger* at 4 mg/ml. Rise in occurrence of *Botrytis cinerea*, methanol and chloroform extracts of S. *mukorossi* Gaertn. natural products demonstrated most extreme estimation of zone of restraint i.e. 36.333 ± 0.763a and 36 ± 2.12a separately. The oil ether concentrates of *A. concinna* (Willd.) DC. Displayed the base estimation of zone of restraint i.e. 13.45 ± 2.192c against B. *cinerea.*
Conclusion: Crude extracts of Target plants showed relative antifungal activity against *Aspergillus niger* and *Botrytis cinerea* positively.

Keywords: fungal, strains, extracts, crude, solvents

Introduction

The harm to crops caused by parasitic plant pathogens has required the utilization of scope of antifungal control operators. Among pesticides used to ensure crops, fungicides were seen as of not long ago as generally protected. In any case, the 1986 National Academy of Sciences (NAS) give an account of pesticide deposits on sustenance demonstrated that fungicides present all the more a cancer-causing hazard than bug sprays and herbicides together (National Research Council, 1987). Moreover, the utilization in edit security of numerous manufactured fungicides that have different degrees of determination has now been advised because of their cancer-causing nature, teratogenicity and other leftover toxicities. A few of the engineered fungicides are accounted for to cause unfriendly impacts on treated soil biological systems in light of their non-biodegradable nature (Tegegne *et al*., 2008; Castillo *et al*., 2010) [35, 7]. Manufactured fungicide buildups are suspected to exhibit a huge wellbeing danger to customers, and request is expanding to discover safe choices. Moreover, proceeded with utilization of fungicides prompts an expansion in opposition by plant pathogens, making a requirement for finding natural options with these pesticides.

New antifungal mixes with unmistakable methods of activity should be distinguished due to expanding occurrence of parasitic protection from existing anti-toxins (Loeffler *et al*., 2003) [20]. Plant optional metabolites have incredible potential as a wellspring of viable antifungal operators (Rocha *et al*., 2004) [26]. Plant-determined mixes, for example, hydroquinones and naphthoquinones (lapachol, juglone), sesquiterpenes (cinnamodial, capsidiol) and alkaloids (berberine) have demonstrated different exercises as antimicrobial and antifungal. Favorable position to the methodology of utilizing ethno botanical prompts distinguish mixes with antimicrobial movement (Galvan *et al*., 2008).

Plants have been a vital wellspring of medication with characteristics for a great many years (Al- Marzoqi *et al*., 2015; Hussein *et al*., 2016) [1]. Fundamentally on conventional cures, for example, herbs for their history, they have been utilized as mainstream people medicines (Mishra

et al., 2010; Hussein *et al*., 2016) [23, 1]. Since a huge number of years back, plants are utilized as a noteworthy hotspot for medication as they found to have a store of bioactive compound (Al- Tameme *et al*., 2015; Hadi *et al*., 2016) [2]. Parasites present a huge danger to humankind as causative specialists of plant and creature illnesses. Utilization of synthetic fungicides have progressively turned out to be disagreeable in the light of more tightly wellbeing and natural controls; recommending the requirement for elective sourcing of fungicidal operators which can be created for restorative utilize (Irobi *et al*., 1999) [15].

The most vital phyto pathogens incorporate microorganisms, growths, nematodes and infections, which can assault diverse yields bringing about significant monetary misfortunes. Among them, growths speak to the biggest gathering of these pathogens (Camele and Ippolito, 2012) [6] and can debase products of the soil from development to reap, amid transportation, stockpiling and handling (Braghini *et al*., 2009) [5]. Engineered additives and fungicides have been utilized for a considerable length of time to control parasitic waste, be that as it may, the unpredictable utilization of these substances has caused medical issues for people and creatures due their cancer-causing nature, teratogenicity and intense poisonous quality (Tian *et al*., 2011) [36], ecological pollution, other than causing obstruction in pathogens (Rodriguez and Jasso, 2011) [8]. In this way, agents are looking for more secure choices to supplant engineered mixes utilized as fungicides and additives. Naturally inviting antifungal operators, for example, plant extricates have indicated extraordinary potential to supplant engineered items due their minimal effort, nearby accessibility, absence of harmfulness and biodegradability (Maswada *et al*., 2013) [21].

Acaci*A concinna* Shikakai implies natural product for hair has been utilized for hair care in India for quite a long time, it is currently developed monetarily in India and Far East Asia. The medications utilized in indigenous arrangement of solutions like Ayurveda in India has around 18,000 types of angiosperms, of which around 3,000 species are considered as essential wellsprings of therapeutic and fragrant synthetic mixes. The plants part utilized for the dry powder or the concentrate are bark, leaves or cases. It is the normal bush found in the wildernesses all through India [19]. The bark contains abnormal state of saponins which are frothing operators that are found in a few other plant animal types [20].

Sapindus mukorossi Gaertn., an individual from the family Sapindaceae, is generally referred to by a few names, for example, soapnut, soapberry, washnut, reetha, aritha, dodan and doadni [21]. *Sapindus mukorossi* is notable for its people therapeutic qualities [22]. Pericarps of *Sapindus mukorossi* have been customarily utilized as an expectorant and additionally a wellspring of normal surfactant [23]. Because of the nearness of saponins, soapnut is outstanding for its cleanser and insecticidal properties and it is customarily utilized for expelling lice from the scalp. The organic products are of extensive significance for their restorative incentive for treating various sicknesses like intemperate salivation, pimples, epilepsy, chlorosis, migranes, dermatitis and psoriasis [24]. The powdered seeds are utilized in the treatment of dental caries, joint inflammation, regular colds, obstruction and queasiness [25]. The seeds of *Sapindus mukorossi* are utilized in Ayurvedic pharmaceutical to expel tan and spots from the skin. It rinses the skin of slick discharge and is even utilized as a chemical for washing hair as it frames a rich, regular foam. The leaves are utilized in showers to ease joint torment and the roots are utilized in the treatment of gout and stiffness. Since old occasions *Sapindus mukorossi* has been utilized as a cleanser for shawls and silks. The product of *Sapindus mukorossi* was used by Indian diamond setters for reestablishing the splendor of discolored decorations made of gold, silver and different valuable metals [26].

Materials and Methods

Plant material

S. mukorossi Gaertn.and *A. concinna* (Willd.) DC.

The plants were legitimately distinguished and extraction of organic products was performed by utilizing distinctive solvents i.e., Petroleum ether, chloroform, methanol and refined water.

Solvent extraction by maceration method

The extraction was completed by splashing 15g of each organic product powder in 30ml of a progression of polar and non-polar solvents for the time of 7 days. e.g., Petroleum ether, chloroform, methanol and refined water. The buildup was sifted and the filtrate was saved in named glass vials, though the deposit was absorbed the following dissolvable in arrangement.

3.10 Antifungal assay

3.10.1 Procurement and culturing of fungal strains *Aspergilus niger* and *Bottytis cinerea*

The fungal strains chose for the present examination were A. niger and B. *cinerea*. Unadulterated societies of test parasitic strains were delivered from the FFCB (First Fungal Culture Bank) University of the Punjab, Lahore. The way of life were safeguarded on malt remove agar (MEA) medium.

3.10.3 Slants for fungi

Around 5.0ml of malt remove was included each test tube and was cotton stopped. These test tubes were then sanitized via autoclaving it. These test tubes were put in inclining position and the medium was permitted to harden at room temperature. Growths were moved into these inclinations with help of immunizing needle, in laminar stream. Each inclination was marked with the name of parasite present in it and brooded for 5 days at 30°C. These parasitic societies were utilized for getting ready inoculum [27].

3.10.4 Preparation of inoculums

5 days old culture of every growth was utilized as inoculums for antifungal screening. The way of life were set up on inclines. Around 25ml refined water was included 250ml Erlenmeyer jars and was cleaned in autoclave. After appearance of settlements on inclines 10ml disinfected refined water from every cup was included to these inclinations, with the assistance of cleaned pipettes. Provinces were tenderly scratched over the surface of inclination with the assistance of immunizing needle. This suspension in incline was again included into 250 ml Erlenmeyer carafes which were kept in shaker for 30 minutes to break spores of organisms and to shape a homogenized blend.

3.10.5 Preparation of plates

Petri plates were sanitized at 180°C for two hours. The disinfected Petri plates were marked with the name of parasites and unrefined extracts. The disinfected liquefied malt concentrate and agar blend was filled these sanitized Petri plates at a temperature of 45°C. In the wake of pouring the medium in plates, it was then permitted to set at room temperature.

3.10.6 Experimental design

The arranged Petri plates containing the set and immunized medium subjected for the estimation of antifungal action of unrefined concentrate of given plant. For this reason the uniform gap of 0.5mm was made with the assistance of plug borer No. 2. In this gap the rough concentrate was poured, in the second arrangement of examination dissolvable was poured worse than broke, in the third arrangement of analyses industrially accessible standard antifungal plate was put in the gap as takes after:

- Itraconazole medication as weakening as 100mg/5ml against *Botrytis cinerea*.
- Fucanozole drug as weakening as 150mg/5ml against *Aspergillus niger*.

The antifungal plates were used in same way and entire process was completed in the aseptic conditions. The zone of restraint wound up noticeable after the brooding time i.e. 48 hours for the parasites. Some of plates demonstrating zone of hindrance were likewise shot. The zones of hindrance were estimated with the assistance of Vernier caliper in mm.

3.10.7 Statistical analysis for antifungal activity

To begin with, mean esteem and standard esteem was computed. The information was exhibited as Mean ± S.E. (M± S.E). The treatment impacts were looked at after and noteworthy contrasts among recreates was introduced as Duncan's various range tests, as likelihood <p> values, utilizing the PC programming Costat.

Results

If there should be an occurrence of *Botrytis cinerea*, methanol and chloroform extracts of S. *mukorossi* Gaertn. natural products indicated most extreme estimation of zone of restraint i.e. 36.333 ± 0.763a and 36 ± 2.12a individually. The oil ether concentrate of *A. concinna* (Willd.) DC. shown the base estimation of zone of restraint i.e. 13.45 ± 2.192c against B. *cinerea* as appeared in table 2.

S. *mukorossi* Gaertn. methanol separate demonstrated the most extreme estimation of zone of restraint against Aspergilus niger i.e. 17.333 ± 0.763a.

Fungal strains additionally keep running against the different solvents and diverse estimations of zone of restraint have been watched. B. *cinerea* keep running against Intracoazole estimation of zone of restraint watched i.e 59.333 ± 1.154a. Against A. niger the Fluconazol were run and the zone of hindrance displayed is 28.333 ± 0.577b.

Discussion

The present examination is improved the situation checking the antifungal action of S. *mukorossi* Gaertn, more, *A. concinna* (Willd.) DC. against various parasitic strains. The utilization of home-grown drug as the primary treatment is an all-inclusive wonder. From the antiquated occasions, distinctive societies are utilizing the natural cures. Plants utilized as natural cures are vital as medication as well as sustenance supplements with vitamins and minerals. Pharmaceuticals got from plants are generally accessible, more secure and less expensive than the manufactured prescriptions that are effortlessly accessible however costly and some of the time can cause destructive impacts.

Ameyaw directed an examination on Cryptolepis sanguinolenta (Lindl.) Schtr., Morinda lucida Benth and Voacanga Africana Stapt antimalarial plant species [28]. Phytochemical screening of the plant affirmed the nearness of alkaloid in the plant organs. The aggregate substance of V. africana was the most elevated among the three plant species. In present examination extracts of S. *mukorossi* Gaertn, more, *A. concinna* (Willd.) DC. Natural products there is no arrangement of creamish or orange accelerates which give negative outcomes for alkaloids.

Ezaeabara explored the distinctive parts of Citrus aurantifolia (Christm.) Swingle (Lime), C. grandis Osbeck(Shaddock/Pummelo), C limon (L.) Burm. f.(lemon), C.paradisii Macf. (Grapefruit), C.reticulata Blanco (Mandarin/Tangerine) and C. sinensis (L.) Osbeck (Sweat orange) normally developed in Southern Nigeria were researched for nearness of saponins. Every one of the parts of these Citrus species were found to contain saponins in shifting levels. In flow look into examination the generation of foam in organic products extracts of S. *mukorossi* Gaertn. Furthermore, *A. concinna* (Willd.) DC. Demonstrated that saponins are available in individual plant example. Henceforth there is some connection in the two investigates [29].

Wouters Separation and quantitative assurance of anthraquinones is accomplished by superior fluid chromatography in blends of methanol, water and formic corrosive on a turned around stage stationary stage. The items are distinguished by maintenance time and all the more precisely, by standard augmentations and UV-unmistakable spectroscopy. This strategy has been connected to extracts of plant roots and creepy crawlies, usually utilized in prior occasions as the wellspring of red dyestuffs for biting the dust materials. Quantitative assessment of the anthraquinones subsidiaries present in antiquated red colors was earned out after corrosive hydrolysis of 0.2 to 2.0mg of material fiber. Because of the considerable affectability of the strategy, vital minor contituents, such askermesic corrosive in cochineal, can be distinguished. In present examination by maceration technique arrangement of white shading foam give negative outcomes, though positive outcomes are development of pink, red or violet shading foam. The outcomes are repudiates to the past work [30].

Wadood explored to check the nearness or nonappearance of the phytochemical constituents. The leaves of the chose therapeutic plants were washed, and dried and after that powdered. The watery concentrate off leaf tests were utilized for the phytochemical examination to discover the phytochemical constituents in the plants. The consequences of the phytochemical investigation of these restorative plants demonstrated the nearness of terpenoids. In the ebb and flow look into action the examination of organic products concentrate of S. *mukorossi* Gaertn. Furthermore, *A. concinna* (Willd.) DC. of present work is as indicated by the guidelines set out by different researchersm [31].

Wozniak Coumarins are these days a critical gathering of natural mixes from normal sources that are valuable in

various fields. Since they have distinctive conditions for their partition from plant frameworks is critical advance. In this report Pressurized Liquid Extraction (PLE) under various temperature conditions and with various straightforward invert stage elite fluid chromatographic strategy (RP-HPLC) combined with a photodiode arraty finder (DAD) has been produced for partition and quantitative examination of the primary coumarins. In the present research work of S. *mukorossi* Gaertn. also, *A. concinna* (Willd.) DC. organic products remove demonstrated emanation of yellow inflorescence in UV light. Accordingly, it gave positive outcomes for coumarins [32].

Khan completed the appraisal of phytochemical and antimicrobial bioassay of five restorative plants, Lepidium sativum, Nerium oleander, Ranunculus repens, Tecomastans and Urtica dioca. These plants are generally utilized as pharmaceutical in the Northwest Pakistan, consequently it is important to distinguish and gauge their alkaloid, flavonoid, saponin, phenol and tannin substance. Phytochemical examination of plant tests confirms that tannin substance. Phytochemical examination of plant tests verifies that (0.61%) is available in L. sativum. As indicated by approach the end purpose of tannin testing ought to be appearance of earthy green shading and in my discoveries results are samem [33].

Rajeshwari reversed-stage elite fluid chromatography (RP-HPLC) strategy with UV/VIS location cause set up for the division and ID of flavonoids in the methanolic and ethanolic concentrate of coriander (Coriandrum sativum L.) seeds. In present research work a dull yellow shading in the natural products concentrate of S. *mukorossi* Gaertn. Furthermore, *A. concinna* (Willd.) DC. demonstrated the nearness of flavonoids. The outcome is same as the accessible gauges set out by different researchers [34].

Solihah investigated that Malaysian Zea mays hair extricate was screenedfor the occurance of bioactive mixes. They demonstrated the nearness of phlobotanins in both aqeous and methanol concentrate of Zea mays hair. In present examination there is no statement of red accelerate in organic products concentrate of S. *mukorossi* Gaertn, more, *A. concinna* (Willd.) DC. which demonstrates that phlobotanins are missing. The consequences of present work are inverse to the guidelines set by researchers [35].

Khan revealed that phytochemicals are trustworthy hotspots for the treatment of differenet medical issues. The work uncovers that phytochemicals screening of 20 distinctive restorative plants, which were gathered from various locale of the region Khyber Pakhtun khwa, Pakistan. In the majority of the examples every one of the phytochemicals i.e reducind sugars, glycosides were available. In the present examination sign of blue green colouration in organic products concentrate of S. *mukorossi* Gaertn, more, *A. concinna* (Willd.) DC. demonstrated that heart glycosides are available in individual plant tests. The consequences of present work are same as the gauges set out by different researchers [33].

Singh announced that cancer prevention agent properties have been evaluated by add up to cell reinforcement examine, lipid peroxidation measures and additionally free radical rummaging action and metal chelating techniques. Free radical rummaging movement was assessed utilizing diphenyl picryl hydrazyl (DPPH) radicals and these cancer prevention agent exercises contrasted with standard cell reinforcements, for example, a-tocopherol and butylated hydroxy toluene (BHT) [36].

In this examination, add up to cancer prevention agent test was utilized, table 4.2 demonstrated cell reinforcement action of different extracts of S. *mukorossi* Gaertn. furthermore, *A. concinna* (Willd.) DC. in various solvents i.e. oil ether, chloroform, refined water and methanol. Methanol concentrate of S. *mukorossi* Gaertn. natural products indicated most noteworthy cancer prevention agent esteem i.e. 0.576 ± 0.096a among every one of the extracts. While the oil ether concentrate of S. *mukorossi* Gaertn. natural products have most minimal cancer prevention agent esteem i.e. 0.203 ± 0.085c. Refined water esteem is 0.476 ± 0.096ab which is same as estimation of standard compound BHT, 0. 476.So it very well may be utilized instead of the standard substance. If there should arise an occurrence of *A. concinna* (Willd.) DC. refined water indicated greatest esteem i.e. 0.346 ± 0.050a while oil ether demonstrated least cancer prevention agent esteem i.e. 0.263 ± 0.025a.

The outcomes showed that plants are antifungal in nature as they have delivered a few qualities for the zone of hindrance against parasitic strains, while some of them were similarly less antifungal in nature. Distinctive antifungal plates were rushed to look at the zones of hindrance against growths like B.*cinerea* and A.niger.

Satish tried antifungal capability of fifty-two plant species from various families against eight critical types of Aspergillus, for example, A. candidus, A. columnaris, A. flavipes, A. flavus, A. fumigatus, A. niger, A. ochraceus, and A. tamarii which confined from sorghum, maize and paddy seed tests [37]. The test parasites were for the most part connected with seed biodeterioration amid capacity. Among fifty-two plants tried, fluid extracts of eleven species have recorded critical antifungal action against either Aspergillus species tried. Among the dissolvable extracts tried, methanol gave more viable than ethanol, chloroform, benzene and oil ether. These outcomes bolsters the aftereffects of the present examination i.e. methanol extracts of S. *mukorossi* Gaertn. demonstrated the most extreme estimation of one of restraint against B.*cinerea* i.e. 36.333 ± 0.763a. Methanol extracts of S. *mukorossi* Gaertn. indicated greatest estimation of zone of restraint against A.niger i.e. 17.333 ± 0.763a. The consequences of the present discoveries are in opposition to the aftereffects [38], as it was examined that antimicrobial action of C. roseus. They researched that Chloroform extracts of leaves indicate most extreme movement against fungal and bacterial strains tried.

Conclusion

As per the approach took after the present work uncovered that in greater part of cases least estimation of zone of restraint is created by oil ether separates i.e. against the fungal strain B. *cinerea* least estimation of zone of restraint is appeared by Petroleum ether extracts of *A. concinna* (Willd.) DC. i.e. 13.45 ± 2.192c. Kiran tried that Petroleum ether concentrate of seeds of Psoralea corylifolia was recorded a most extreme antifungal movement in Aspergillus flavus oryzae (93.5%) [39]. The outcomes are in opposition to the after effects of present examination. Hence it is proved that respective crude extracts demonstrated the appropriate antifungal activity against fungal strains.

References

1. Al-Marzoqi, Ali Hussein, Imad Hadi Hameed, Salah Ali Idan. "Analysis of bioactive chemical components of two medicinal plants (Coriandrum sativum and Melia azedarach) leaves using gas chromatography-mass spectrometry (GC-MS)." African Journal of Biotechnology. 2015; 14(40):2812-2830.
2. Al-Tameme, Huda Jasim, Mohammed Yahya Hadi, Imad Hadi Hameed. "Phytochemical analysis of Urtica dioica leaves by fourier-transform infrared spectroscopy and gas chromatography-mass spectrometry." Journal of Pharmacognosy and Phytotherapy. 2015; 7(10):238-252.
3. Ameyaw Y, Duker-Eshun G. "The alkaloid contents of the ethno-plant organs of three antimalarial medicinal plant species in the eastern region of Ghana." Int. J Chem. 2009; 7(1):48-58.
4. Aneja, Kamal Rai, Radhika Joshi, Chetan Sharma. "In vitro antimicrobial activity of Sapindus mukorossi and Emblica officinalis against dental caries pathogens." Ethnobotanical leaflets. 2010; 4(2010):3.
5. Braghini R, *et al*. "Effects of γ-radiation on the fungus Alternaria alternata in artificially inoculated cereal samples." Applied Radiation and Isotopes. 2009; 67(9):1622-1628.
6. Camele Ippolito, *et al*. "In vitro control of post-harvest fruit rot fungi by some plant essential oil components." International journal of molecular sciences. 2012; 13(2):2290-2300.
7. Castillo, Francisco, *et al*. "In vitro antifungal activity of plant extracts obtained with alternative organic solvents against Rhizoctonia solani Kühn." Industrial Crops and Products. 2010; 32(3):324-328.
8. De Rodríguez, D Jasso, *et al*. "In vitro antifungal activity of extracts of Mexican Chihuahuan Desert plants against postharvest fruit fungi." Industrial Crops and Products. 2011; 34(1):960-966.
9. Dhar JD, *et al*. "Morphological changes in human spermatozoa as examined under scanning electron microscope after in vitro exposure to saponins isolated from Sapindus mukorossi." Contraception. 1989; 39(5):563-568.
10. Ezeabar Chinelo Anthonia, *et al*. "Comparative determination of phytochemical, proximate and mineral compositions in various parts of Portulaca oleracea L." Journal of Plant Sciences. 2014; 2(6):294-298.
11. Galván Imelda J, *et al*. "Antifungal and antioxidant activities of the phytomedicine pipsissewa, Chimaphila umbellata." Phytochemistry. 2008; 69(3):738-746.
12. Hadi Mohammed Yahya, Ghaidaa Jihadi Mohammed, and Imad Hadi Hameed. "Analysis of bioactive chemical compounds of Nigella sativa using gas chromatography-mass spectrometry." Journal of Pharmacognosy and Phytotherapy. 2016; 8(2):8-24.
13. Hussein Ameera Omran, *et al*. "Phytochemical screening of methanolic dried galls extract of Quercus infectoria using gas chromatography-mass spectrometry (GC-MS) and Fourier transform-infrared (FT-IR)." Journal of Pharmacognosy and Phytotherapy. 2016; 8(3):49-59.
14. Hussein Hussein J, Mohammed Yahya Hadi, Imad Hadi Hameed. "Study of chemical composition of Foeniculum vulgare using Fourier transform infrared spectrophotometer and gas chromatography-mass spectrometry." Journal of Pharmacognosy and Phytotherapy. 2016; 8(3):60-89.
15. Irobi ON, Adedayo O. "Antifungal activity of aqueous extract of dormant fruits of Hyphaene thebaica (Palmae)." Pharmaceutical biology. 1999; 37(2):114-117.
16. Kasai Ryoji, *et al*. "Acyclic sesquiterpene oligoglycosides from pericarps of Sapindus mukurossi." Phytochemistry. 1986; 25(4):871-876.
17. Khan Amir Muhammad, *et al*. "Phytochemical analysis of selected medicinal plants of Margalla Hills and surroundings." Journal of Medicinal Plants Research. 2011; 5(25):6055-6060.
18. Kiran B, Lalitha V, Raveesha KA. "Screening of different solvent extracts for antifungal activity of seeds of Psoralea corylifolia L. against important seed borne Aspergillus species of maize." International Journal of Pharmaceutical Sciences and Drug Research. 2011; 3(3):241-245.
19. Kunst Frank, *et al*. "Pleiotropic mutations affecting sporulation conditions and the syntheses of extracellular enzymes in Bacillus subtilis 168." Biochimie. 1975; 56(11-12):1481-1489.
20. Loeffler Juergen, David A. Stevens. "Antifungal drug resistance." Clinical infectious diseases. 2003; 36(1):S31-S41.
21. Maswada H, Abdallah S. "In-vitro antifungal activity of three geophytic plant extracts against three post-harvest pathogenic fungi." Pakistan Journal of Biological Science. 2013; 16(23):1698-1705.
22. Mendelsohn Robert, Michael J Balick. "The value of undiscovered pharmaceuticals in tropical forests." Economic Botany. 1995; 49(2):223-228.
23. Mishra Neeraj, Behal KK. "Antimicrobial activity of some spices against selected microbes." Int J Pharm Pharm Sci. 2010; 2(3):187-196.
24. National Research Council. Regulating pesticides in food: The Delaney paradox. National Academies Press, 1987.
25. Rajeshwari CU, Andallu B. "Isolation and simultaneous detection of flavonoids in the methanolic and ethanolic extracts of Coriandrum sativum L. seeds by RP-HPLC." Pak J Food Sci. 2011; 21(1-4):13-21.
26. Rocha Alessandra Duarte, *et al*. "Antifungal constituents of Clytostoma ramentaceum and Mansoa hirsuta." Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives. 2004; 18(6):463-467.
27. Saravanan V Sakthi, *et al*. "Antimicrobial Activity of Chloroform Extract of Leaves of Catharanthus roseus (L) G. DON." Asian Journal of Chemistry, 2012; 24(7).
28. Satish S, *et al*. "Antifungal activity of some plant extracts against important seed borne pathogens of Aspergillus sp." An International Journal of Agricultural Technology. 2007; 3(1):109-119.
29. Segelman AB, Farnsworth. "Biological and phytochemical screening of plants. IV. A new rapid procedure for the simultaneous determination of saponins and tannins, 1969, 52-58.
30. Sharma A, *et al*. "Chemical constituents and bioactivities of genus Sapindus." Int J Res Ayurveda Pharm. 2011; 2(2):403-409.

31. Singh Narender, Avneet Kaur, Kuldeep Yadav. "A reliable in vitro protocol for rapid mass propagation of Sapindus mukorossi Gaertn." Nat Sci. 2010; (8):41-7.
32. Singh Sakshi, *et al*. "Centella asiatica (L.): A plant with immense medicinal potential but threatened." International Journal of Pharmaceutical Sciences Review and Research. 2010; 4(2):003.
33. Skalicka-Wozniak Krystyna, *et al*. "Evaluation of polysaccharides content in fruit bodies and their antimicrobial activity of four Ganoderma lucidum (W Curt.: Fr.) P. Karst. strains cultivated on different wood type substrates." Acta Societatis Botanicorum Poloniae, 2012, 81(1).
34. Solihah MA, Wan Rosli WI, Nurhanan AR. "Phytochemicals screening and total phenolic content of Malaysian Zea mays hair extracts, 2012.
35. Tegegne G, Pretorius JC, Swart WJ. "Antifungal properties of Agapanthus africanus L. extracts against plant pathogens." Crop Protection. 2008; 27(7):1052-1060.
36. Tian Jun, *et al*. "In vitro and in vivo activity of essential oil from dill (Anethum graveolens L.) against fungal spoilage of cherry tomatoes." Food Control. 2011; 22(12):1992-1999.
37. Upadhyay Aparna, Singh DK. "Pharmacological effects of Sapindus mukorossi." Revista do Instituto de Medicina Tropical de São Paulo. 2012; 54(5):273-280.
38. Wadood Abdul, *et al*. "Phytochemical analysis of medicinal plants occurring in local area of Mardan." Biochem Anal Biochem. 2013; 2(4):1-4.
39. Wouters Jan. "High performance liquid chromatography of anthraquinones: analysis of plant and insect extracts and dyed textiles." Studies in Conservation. 1985; 30(3):119-128.