Symbiosis

ISSN Online: 2372-0956
www.symbiosisonlinepublishing.com

Research Article | SOJ Microbiology & Infectious Diseases | Open Access

Efficiency of Medicinal Plants to Control Seed Borne Fungi of Sorghum Grains

Kindu Geta*

Debre Tabor University, College of Natural and computational Sciences, Department of Biology Debre Tabor, Ethiopia

Received: 9th July 2019; Accepted: 9th August 2019 ; Published: 19th December, 2019

***Corresponding author:** Kindu Geta, Debre Tabor University, College of Natural and computational Sciences, Department of Biology Debre Tabor, Ethiopia, E-mail: kindu2012@gmail.com*

Abstract

Seed-borne fungi are the most important constrained factor which causing quantitative losses, produce highly toxic and carcinogenic mycotoxins. Plant based fungicides appear to be one of the better alternatives as they are known to have minimal danger to consumers in contrast to synthetic pesticides. In view of the negative public health and economic impacts of storage fungi this study, aimed to determine the efficiency of some plant extracts for reduction or control of seed borne fungi in sorghum grains in agar plate methods. The results obtained revealed that seed treated with *Olea europaea* leaf extract was found the least in incidence of seed-borne fungi (50%) followed by *Capsicum annuum* (53.3%) in agar plate methods. Therefore, utilization of these plants as bio-control agents is recommended to reduce the proliferation of storage fungi.

Keywords: plant extracts; seed borne fungi; sorghum

Introduction

Microbial bio-deterioration of food grains during storage is a well known phenomenon causing significant loss up to 30% [6]. The annual crop losses of world as a result of diseases have been estimated at 25,000 million US dollars; of this a major part is due to fungal pathogens carried through seed [1, 5]. Fungi are significant destroyers of foodstuffs and grains during storage, rendering them unfit for human consumption by retarding their nutritive value and often by producing mycotoxins [7, 18, 19].More than 25% of the world cereals are contaminated with known mycotoxins and more than 300 fungal metabolites are reported to be toxic to man and animals[8].

A sizable portion of the world population living below poverty line in the developing and underdeveloped countries of Asia and Africa are suffering from health problems associated with consuming mycotoxin contaminated grains and cereals. Even though effective and efficient control of seed borne pathogenic fungi can be achieved by the use of synthetic chemical fungicides, the same cannot be applied to grains for reasons of pesticide toxicity [9, 10]. The intensive and indiscriminate use of pesticides in agriculture has caused many problems to the environment such as water, soil, animals and food contamination; poisoning of farmers; elimination of non target organisms [20].

Due to very high and disproportionate monetary exchange rate, synthetic fungicides are now more expensive than they were before, thus making them unaffordable by most of the resource-poor farmers [19]. As a result of these problems there is a need to search for alternative approaches to store grains/ cereals for human consumption without toxicity problems that are ecofriendly and not capital intensive. This has resulted in the development of botanical fungicides for the control of seed borne pathogens of food crops.

Extracts of many higher plants have been reported to exhibit antibacterial, antifungal and insecticidal properties under laboratory trails [16]. Plant metabolites and plant based pesticides appear to be one of the better alternatives as they are known to have minimal environmental impact and danger to consumers in contrast to synthetic pesticides [23]. But there is little information available on the use of various plant parts/ plant extracts effective against fungal pathogens of stored cereals grains in Ethiopia. In view of these, the aim of the present study was undertaken to evaluate the efficiency of certain plant extracts used by farmers to control seed borne fungi known to cause significant crop loss during storage.

Materials and Methods

Study Site and Period

Experiments were carried out from October 2017 to March 2018 in the Microbiological Laboratory of the Biology Department; Debre Tabor University.

Study Design

Cross sectional experimental design was used to evaluate the efficiency of medicinal plants used by farmers to control sorghum seed borne fungi.

Treatment of Seeds with Plant Extracts

Collection and Preparation of Plant Extracts

Capsicum annuum (fruits), Olea europaea (leave) and Justicia schimperiana (leave) which are traditionally used by farmers were collected from Ebenat woreda in 2017. The identity of each plant specimen was confirmed by botanists. These plant parts were washed with tap water, dried in an open air protected from

direct exposure to sunlight, powdered to suitable size and made ready for extraction [21]. Grinded plant materials were soaked with distilled water separately at 10:1 solvent-to sample ratio (v/w) and extracted by maceration with occasional shaking at room temperature for three days. The extracts were separately filtered by Whatman No. 1 filter paper and concentrated with dry oven. Further, fresh solvents were added to the residue at the same ratio until required amount of extracts were obtained. The dry extracts were stored in sample bottles at refrigerator for further use [21].

Seed Treatment and Mycological Analysis of Treated Seeds

The seed samples with high incidence of seed borne fungi determined by plate agar method was treated with each of the prepared plant extracts (at 20% concentrations) by soaking the seeds in them for 12 hours. Seeds were also soaked water for 12 hours served as controls (Ahmad et al., 2016). Treated seeds were collected on blotter sheets and air-dried for 1 hour before plating on a wet blotter. The treated seeds were poured into a tray and ten seeds per dish were plated using a pair of forceps. Four hundred (400) seeds of a hundred (100) seeds per replicate were used for each treatment (Mathur and Kongsdal, 2003; ISTA, 2007). Then 15 seeds were evenly placed using a pair of forceps on Malt extract agar (MEA) with streptomycin and incubated at 25°C for seven consecutive days. After seven days of incubation, fungal species growing on the surface of seeds were observed under microscope and their percentage frequency (PF) of occurrence was calculated by applying the following formula: PF = (No. of seeds on which fungi appear / Total number of seeds) X 100.

Data Analysis

Incidence of seed borne fungi was recorded, analysed using SPSS version 20 software and presented in figure

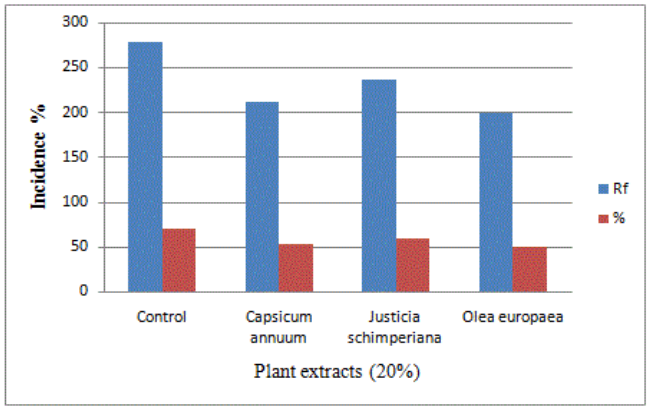

Figure 1: Efficiency of some plant extracts for reduce seed borne fungi of sorghum

Discussion

One of the major constraints that deteriorate the seed quality is the seed-borne fungi present inside or on the surface of seeds [17]. Seed treatment is the safest and the cheapest way to control the seed-borne fungal diseases and is used to prevent biodeterioration of grains [4]. Leaf extracts of many higher plants have been reported to possess antifungal activity under laboratory trails [16]. In the present investigation efficiency of three plants extracts viz., *Capsicum annuum, Justicia schimperiana* and *Olea europaea* were assessed at the rate of 20% concentration against reduce seed borne fungi of sorghum by agar plate method.

Seed treated with *Olea europaea* leaf extract was found the least in seed-borne fungi incidence (50%) followed by *Capsicum annuum* (53.3%) in agar plate methods. This finding agrees with Ahmad et al. (2016) who reported that seed treatment with *E. globules* leaf extract was found most effective in reduction of seed-borne incidence [2]. Similar investigation on antifungal activity of plant extracts against seed-borne mycoflora was reported by many workers [14, 22]. It is known that plants synthesize a variety of bioactive compounds in plant tissues like alkaloids, flavonoids, tannins, terpenoids, saponins, and other compounds, reported to have *in vitro* antifungal properties [3]. These antifungal compounds stop or inhibit the development of mycelia growth or reduce sporulation of fungal pathogens, it is considered that these compounds obtained from plants are biodegradable and safe for use as a substitute for disease control in a traditional production system [11].

Conclusions and Recommendation

Seed treated with all the tested plant extracts were found effective in reducing seed-borne incidence by agar plate methods. *Olea europaea* leaf and *Capsicum annuum* fruit extracts were found more effective in reducing seed-borne fungi incidence and their utilization as bio-control agents is imperative. Therefore, utilization of these plants as bio-control agents is recommended to reduce the proliferation of storage fungi. Further studies should be taken to find the exact mechanism of action by which plant extracts exert their antifungal effect, to find the active compounds responsible for plant biological activity and effective application of these active compounds in storage methods.

Acknowledgement

Author would like to thank DTU for providing financial support and Department of Biology for permit the laboratory to conduct this research.

References

1. Agrios GN. Control of plant diseases. Plant pathology. 1997;5:295-357.
2. Ahmad L, Pathak N, Zaidi RK. Antifungal potential of plant extracts against seed-borne fungi isolated from barley seeds (Hordeum vulgare L.). J Plant Pathol Microbiol. 2016;7(5):1-4. doi: 10.4172/2157-7471.1000350
3. Arif T, Bhosale JD, Kumar N, Mandal TK, Bendre RS, Lavekar GS, et al. Natural products–antifungal agents derived from plants. J Asian Nat Prod Res. 2009;11(7): 621-638. doi: 10.1080/10286020902942350
4. Bagga PS, Sharma VK. Evaluation of fungicides as seedling treatment for controlling bakanae/foot-rot (Fusarium moniliforme) disease in basmati rice. Indian Phytopathology. 2012;59(3).
5. Chandler J. Cost reduction in SIT programmes using exosect auto-dissemination as part of area wide integrated pest management. International pest control. 2005;47(5):257-260.
6. Chhokar RS. Development and use of herbicides. Pesticides Information. 2001;27:25-27.
7. Domijan AM, Peraica M, Jurjević Ž, Ivić D, Cvjetković B. Fumonisin B1, fumonisin B2, zearalenone and ochratoxin A contamination of maize in Croatia. Food additives and contaminants. 2005;22(7):677-680.
8. Galvano F, Piva A, Ritieni A, Galvano G. Dietary strategies to counteract the effects of mycotoxins: a review. Journal of food protection. 2001;64(1):120-131.
9. Gupta YP. Polluting pesticides. Science Reporter. 2001;14-15.
10. Harris CA, Renfrew MJ, Woolridge MW. Assessing the risks of pesticide residues to consumers: recent and future developments. Food Addit Contam. 2001;18(12):1124-1129.
11. Hernandez Lauzardo AN, Bautista Banos S, Velazquez del Valle MG. Prospective of plant extracts for controlling postharvest diseases of horticultural products. Revista Fitotecnia Mexicana. 2007; 30(2):119-123.
12. International Seed Testing Association. International rules for seed testing. Seed Science and Technology, (Suppl). Switzerland. 2007.
13. Koirala P, Kumar S, Yadav BK, Premarajan KC. Occurrence of aflatoxin in some of the food and feed in Nepal. 2005; 59(8): 331-336.
14. Manoorkar VB, Gachande BD. Evaluation of antifungal activity of some medicinal plant extracts against some storage seed-borne fungi of groundnut. Science Research Reporter. 2014; 4(1):67-70.
15. Mathur SB, Kongsdal O. Common laboratory seed health testing methods for detecting fungi. 2003.
16. Mohana DC, Raveesha KA, Lokanath Rai KM. Herbal remedies for the management of seed-borne fungal pathogens by an edible plant Decalepis hamiltonii (Wight & Arn). Archives of phytopathology and plant protection. 2008; 41(1):38-49.
17. Nayaka Chandra S, Udaya Shankar AC, Niranjana SR, Prakash HS, Mortensen CN. Anthracnose disease of chilli pepper. Technical bulletin. 2009;1-3.
18. Park JW, Kim EK, Kim YB. Estimation of the daily exposure of Koreans to aflatoxin B1 through food consumption. Food Addit Contam. 2004;21(1):70-75.
19. Salako, EA. Plant protection for the resource-poor farmers. A key note address at Nigerian Society for Plant Protection. In 30th Annual Conference. 2002;1-4.
20. Stangarlin JR, Schwan-Estrada KRF, Cruz MES, Nozaki MH. Medicinal plants and alternative control of phytopathogens. Biotecnologia Ciência & Desenvolvimento.1999;11:16-21.
21. Sukhdev SH, Suman PSK, Gennaro L, Dev DR. Extraction technologies for medicinal and aromatic plants international. Centre for Science and High Technology, Trieste Ed. 2008; 11.
22. Swami CS, Alane SK. Efficacy of some botanicals against seed–borne fungi of green gram (Phaseolus aureus Roxb.). Bioscience Discovery. 2013;4(1):107-110.
23. Varma J, Dubey NK. Prospectives of botanical and microbial products as pesticides of tomorrow. Current science. 1999;76(2):172-179.