Current Botany 2012, 3(4): 05-07
ISSN: 2220-4822
Available Online: http://currentbotany.org/

A review on biological control of post-harvest fungal diseases of fruits

Gulab Rathod

Department of Botany, Shrikrishna Mahavidyalaya, Gunjoti Dist. Osmanabad (M.S.), India

Abstract

A number of physical and chemical treatments have been evaluated for controlling post-harvest diseases. The physical treatment includes heat therapy, low temperature storage and radiation, while chemical treatment includes the use of chemical agents like antibiotics, growth regulators, fungicides, oils, chemicals and vapour emitting compounds. Biopesticides and their use in the control of plant diseases has become a modern trend in agriculture practice, which is termed as biological control. Biocontrol agents are found to be belonging to different groups of plants and microbes besides, which have been reported to be highly potent economical and eco-friendly for the successful control of plant pathogens.

Keywords: Eco-friendly management, fruits, fungal diseases, post-harvest

INTRODUCTION

Tsai (1969) [1] has observed a decrease in the severity of papaya post-harvest anthracnose after a hot water treatment (45-49^{0}C) Coursey et al. (1972) [2] have demonstrated that when the harvested fruits of papaya are subjected to a hot water spray treatment at 45^{0}C for 3 minutes, the resultant decrease in the incidence of the common post-harvest diseases, can be compared well with the results obtained from the common commercial practice of immersing the fruits in hot water at 48^{0}C for 20 minutes. Hot water treatment at 49^{0}C for 20 minutes [3] and washing of fruits with water immediately after harvesting minimize the losses. Store houses may be kept clean and rotting fruits may be removed and destroyed. Currently, a majority of the fruit receive a two-stage, hot- water treatment [4], which has been associated with occasional fruit damage [5 and 6] and with failure to destroy eggs and larvae of fruit flies in fruit with defective blossom ends [7]. A forced, hot water treatment for papaya fruit developed by Armstrong et al. (1989) [5] and was developed subsequently approved by USDA-APHIS for meeting quarantine regulations. High post-harvest losses due to development of anthracnose during storage and distribution of papaya fruit is being reported [8 and 9].

Little work has been done on the use of low- pressure storage of tropical and sub-tropical fruits. Chau and Alvarez (1983) [10] have, however, demonstrated that papaya fruits inoculated with *Colletotrichum gloeosporioides* and stored at a low pressure (15 mm of Hg, 10^{0}C, 21 d) develop less anthracnose rot during the subsequent 5 days of ripening at room temperature, as compared to the fruits stored at normal atmosphere pressure. Chau and Alvarez (1983) [10] have observed that storing papaya fruits at 6^{0}C causes chilling injury but no such effect occurs at 10^{0}C. These investigation have, however, observed that an extended storage (1-3 weeks) of fruits at 10^{0}C render them more vulnerable to the infection caused by *Stemphyllum lycopersici*. The fruits after harvesting should be stored at 10^{0}C or below. Post-harvest fruit dip treatment as in case of anthracnose can control *Rhizopus* rot also. Control of this disease is usually achieved by hot water treatment, heat or chemical fungicides [11 and 12]. However, in papaya heat treatment leads to enhanced senescence, while chemical treatments can cause damage that diminish post-harvest quality of fruit [13].

Tandon and Mishra (1969) [14] have found that storage of papaya fruits at 10^{0}C is suitable for controlling the rot caused by *Rhizopus stolonifer.* Quimio (1973) [15] has also found that 10^{0}C is suitable for papaya fruits in checking the rot incited by *Colletotrichum gloeosporioides.* Biological control with *Bacellus subtilis* is also observed to be effective. Pre-treatment with the culture filtrate of *B. subtilis* protected the fruits from storage decay due to *R. nigricans* for three days.

Control of papaya stem end rot of fruit by hot water treatment or hot air treatment gives good control [2 and 16] . Hot water treatment offers protection of fruits by *Botryodiplodia* fruits rots [17].

Use of vegetable oils in plant disease control is a relatively recent development in the field of plant pathology [18, 19 and 20]. Vegetables oils generally contribute in the three different ways to the control of fungal diseases of plants: as spreader-stickers, as carriers for conventional fungicidal chemicals, and as direct agents for preventing diseases. Similarly garlic extract which contains allicin (antibiotic in nature) can be used for the control of pathogenic bacteria and fungi [21 and 22]. Sumbali and Mehrotra (1980b) [20] have reported the efficacy of different garlic concentrations for controlling *Aspergillus niger, Gliocladium roseum* and *Sclerotium rolfsii* rots of Apple, peach and pear fruits. Systematic investigation of the antifungal activities of essential oils and their constitutes has been reported by different authors. Kurita et al. (1981) [23] screened 40 such compounds against seven species of fungi.

The essential oils produced by plants have long been known to have fungicidal properties [24, 25, 26 and 27] safer environment to consumers and for the control of post-harvest disease than synthetics. Most of the essential oils have been reported to inhibit post-harvest fungi in *in vitro* conditions [28, 29, 30 and 31].

Prasad and Ojha (1986) [32] studied and found that the leaf extract of *Adhatoda vasica, Andrographis paniculata, Azadirachta indica, Catharanthus roseus, Cinnamomum camphora, Ocimum*

Received: July 08, 2012; Revised: Aug 17, 2012; Accepted: Sept 25, 2012.

*Corresponding Author
Gulab Rathod
Department of Botany, Shrikrishna Mahavidyalaya, Gunjoti Dist. Osmanabad (M.S.), India

Email: skmg_gulabrathod@rediffmail.com

sanctum, Plumbago zeylanica, Strychnos nux-vomica, Lantana camera, and *Vitex nigundo* were active against *Fusarium equiseti, Fusarium semitectum* and *Curvularia lunata* which cause post-harvest decay of cucurbits. Chemical control which is used to reduce incidence of post-harvest diseases in papaya is causing the development of fungal resistance to chemical products [33].

Numerous studies have demonstrated the fungicidal potential of plant extracts against post-harvest fungi. Sonwane (2002) [34] reported the maximum growth inhibition of *Alternaria alternata, Curvularia lunata* and *Helminthosporium tetramera* by toxin produced by *Trichoderma viride.* He also observed that leaf extracts of *Polyalthia longifolia* inhibited the growth of *Alternaria alternata, Aspergillus flavus,* where as *Azadirachta indica* leaf extract inhibited the growth of *Aspergillus flavus* and *Curvularia lunata.*

CONCLUSION

Biological control is alternative method to the chemical method for control of post-harvest diseases of fruits.

REFERENCES

[1] Tsai, W.H. 1969. Studies on ecology and physiology of papaya anthracnose and its control. *J. Taiwan Agric. Res*. 18: 51- 57.

[2] Coursey, D. S. and Booth, R.H. 1972. The post-harvest Phytopathology of perishable tropical produce. *Review of Plant Pathology*.24: 383-409.

[3] Pathak, V. N., Sharma, H. C. and Bhatnagar, L. G. 1972. Third International Symposium. *Subtropic and Tropic. Horticulture*, Bangalore. 118-119.

[4] Couey, H.M. and Hayes, C.F. 1986. Quarantine procedure for Hawaiian papaya using fruit selection and stage hot water immersion. *J. Econ. Entomol.* 79: 1307-1314.

[5] Armstrong, J.W., Hansen, J. D., Hu, B. K. S. and Brown, S. A. 1989. High temperature, forced-air quarantine treatment for papayas infested with Tephritid fruit flies. *J. Econ. Entomol.* 82: 1667-1674.

[6] Couey, H.M. 1989. Heat treatment for control of post-harvest diseases and insect pests of fruits. *Hort. Science* 24: 198-202.

[7] Zee, F.T., Nishima, M.S., Chan, H.T., Jr. and Nishijima, K.A. 1989. Blossom end defects and fruit fly infestation in papayas following hot water quarantine treatment. *Hort. Science.* 24: 323-325.

[8] Alvarez, A. M. and Nishijima, W.T. 1987. Post-harvest diseases of papaya. *Plant Dis.* 71: 681-686.

[9] Paull, R. E., Nishijima, W. Reyes, M. And Cavallito, C. 1997. Post-harvest handling and losses during marketing of papaya (*Carica papaya* L.). *Post-harvest Biol. Technol.* 11: 165-179.

[10] Chau, K.F. and Alvarez, A.M. 1979. A historical study of anthracnose on *Carica papaya. Phytopathology*. 75: 1113-1116.

[11] Couey, H.M. and Farias, C.F. 1979. Control of post-harvest decay of papaya. *Hort. Science* 14: 719-721.

[12] Couey, Alvarez, A. M. and Nelson, M. G. 1984. Comparison of hot water spray and immersion treatments for control of post-harvest decay of papaya. *Plant Dis.* 68: 436-437.

[13] Lay-Yee, Care, M., Petry, G.K., Fillerton, R.A., and Gunsosnl, A. 1998. Quality and disease incidence of 'Waimanalo Solo' papaya following forced air heat treatments. *Hort. Science* .33: 878-880.

[14] Tandon, R. N. and Misra, A. N. 1969. Fruit rot diseases of *Carica papaya* and *Musa paradisiaca* caused by *Rhizopus stolonifer*. *Indian Phytopath.* 22: 334-341.

[15] Quimio, T.H. 1973. Temperatures as a factor for growth and sporulation of anthracnose organisms of papaya. *Philippine Agriculturist.* 57:245-253.

[16] Nishijima, K. A., Miura, C. K., Armstrong, J. W., Brown, S. A. and Hu, B. K. S. 1992. Factors influencing development of post-harvest incidence of *Rhizopus* soft rot of papaya. *Acta Hort.* 269: 495-502.

[17] Tandon, M. P., Jamaluddin, and Bhargava, V. 1976. Some new fruit rot diseases. *Indian Phytopathol.* 28(4): 570-572.

[18] Grover, R. K. and Aulakh, K. S. 1968. Oospores rot of tomato fruits and its control by oils. *Indian Phytopathol*.4: 37-42.

[19] Sumbali, G. and Mehrotra, R.S. 1980. Evaluation of some fixed oils for the control of certain temperate fruit rot fungi. *Indian Phytopath.* 33: 517.

[20] Sumbali, G. and Mehrotra, R.S.1980a.Garlic extracts an effective antifungal treatment for the control of storage fruit rots. *Proc. Nat. Acad. Sci. India* 50: 5-10.

[21] Cavallito, C. J. and Bailey, J. H. 1994. Allicin, the antibacterial principle of *Allium sativum* l., Isolation, physical properties and antibacterial action. J. Am. Chem. Soc. 66: 1950-1951.

[22] Durbin, R. D. and Uchytil, T. F. 1971. The role of allicin in the resistance of garlic to *Penicillium spp. Phytopathologia Mediterranea*.10:27-230.

[23] Kurita, N., Miyaji, M., Kurane, R., and Takahara, Y. 1981. Antifungal activity of components of essential oils. *Agric. Biol. Chem.* 45(4): 945-952.

[24] Wilson, C.L., Solar, J.M., El Ghaouth, A., and Wisniewski, M.E. 1997. Rapid evaluation of plant extracts and essential oils for antifungal activity against *Botrytis cinerea.* Plant Dis. 81: 204-210.

[25] Gogol, R., Baruah, P. and Nath, S.C. 1997. Antifungal activity of the essential oil of *Litsea cubeba* Pers. *J. Essential Oils Res*. 9(2):213-215.

[26] Pitarokili, D., Tzakou, O., Couladis, M. and Verykokidou, E. 1999. Composition and antifungal activity of the essential oil of *Salvia pomifera* subsp. *Calycina* growing wild in Greece. *J. Essential Oil Res.* 11(5): 655-659.

[27] Meepagala, K.M., Sturtz, G. and Wedge, D.E. 2002. Antifungal constituents of the essential oil fraction of *Alternaria drancunculus* L. var. *drancunculus*. *J. Agric. Food Chem.* 50: 6989-6992.

[28] Bishop, C.D., and Reagan 1998. Control of the storage pathogen *Botrytis cinerea* on Dutch white cabbage (*Brassica oleracea* var. *capitata*) by the essential oil of *Melaleuca alternifolia. J. Essential Oil Res.*10 (1): 57-60.

[29] Singh, J. and Tripathi, N.N. 1999. Inhibition of storage fungi of

black gram (*Vigna mungo* L.) by some essential oils. *Flavour Fragrance J*.14: 42-44.

[30] Bellerbeck, V.G., De Roques, C.G., Bessiere, J.L., Fonvieille and Dargent, R. (2001). Effect of *Cymbopogon nardus* (L) W. Watson essential oil on the growth and morphogenesis of *Aspergillus niger. Can. J. Microbiol.* 47 (1): 9-17.

[31] Hidalgo, P. J., Ubera, J.A., Santos, F. LaFont, C. Caselanos, A. Palomino and M. Roman 2002. Essential oils in *Culamintha sylvatica*. Broma. ssp. Ascendes (Jorden) P.W.Ball wild and cultivated productions and antifungal activity. J*. Essential Oil Res.* 14(1): 68-71.

[32] Prasad A. and Ojha 1986. Antifungal evaluation of leaf extracts for the control of some cucurbitaceous fruit rot diseases. *J. Ind. Phytopathol.* 39(1): 174.

[33] Brent, K.J, and Hollomon, D.W.1998. Fungicides resistance: the assessment of risk. FARC, Global Crop Protection Federation. Brussels, Belgium. Pp 1-48.

[34] Sonwane, V.V. 2002. Studies on seed pathology of pea. Ph.D. Thesis, Dr. B.A.M.U. Aurangabad (M.S.).