International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Impact of Temperature and Humidity on Disease, the Fruit Rot of Two Cultivars of Litchi caused by the B. Theobromi and C. Gloeosporioides

Dr. Anupam Rakesh

M.Sc, Ph.D, House No. 361, Nehru Nagar, Patna, Bihar – 800013, India

Abstract: ***To observe the effect of temperatures and humidity on the fruit rot of two cultivars of Litchi fruits viz, Shahi and China, infected by B. theobromae and C. gloeosporioides, the fruits were incubated at 15, 20, 25, 30, 35 and 40°C and humidity was maintained at 30,40, 50, 60, 70, 80, 90 and 100% under artificial conditions. Observation was made at the interval of two days of incubation and upto 10th day. With increase in temperature and with time, the percentage rot in both the cultivars increased. For Shahi, no symptoms at 15°C, 2nd day; 20.5% rot at 35°C, 6th day; and 100% rot at 35°C, 10th day, when infected by B. theobromae. And no symptoms at 15°C, 2nd day; 15.5% rot at 35°C, 2nd day; 16.5% rot at 35°C, 4th day; 92.5% rot at 35°C, 6th day; 100% rot at 35°C, 8th day, when infected by C. gloeosporioides. For China, 34.2% rot at 35°C, 2nd day; 66.4% rot at 35°C, 4th day; 100% at 35°C, 6th day, when infected by B. theobromae. And, 26.4% rot at 35°C, 2nd day; 55.8% rot at 35°C, 4th day; and 100% at 35°C, 6th day, when infected by C. gloeosporioides. It is observed that intensity of fruit rot is influenced by the percentage of relative humidity. Both the Shahi and China cultivars of Litchi fruits infected by B. theobromae and C. gloeosporioides revealed partial rot at low humidity which increased along with the increasing percentage of humidity. Therefore, it was concluded that among the cultivars China was more suitable for the pathogens than Shahi. Similarly, B. theobromae was more virulent than C. gloeosporioides and among the incubation 8th to 10th day was maximum period for maximum rotting and 35°C was the best temperature while 90 - 100% relative humidity promoted maximum loss.***

Keywords: Litchi, Shahi Litchi, China Litchi, fruit rot, temperature, humidity, Botryodiplodia theobromae, Colletotrichum gloeosporioides

1. Introduction

The Litchi is an exotic fruit introduced into India many years ago from South Eastern China. It is one of the most environmentally sensitive subtropical tree, fruit crop is adapted to areas of the world characterized by warm subtropics and elevated tropics having cool dry winters and warm wet summers. They consists of a single seed converted by an agreeable sweet acid tasting, white, juicy translucent aril of pulp, which is high in vitamin C. Bihar accounts for three - fourth of the Litchi production in the country.

2. Research Related

Bhargava et al; (1965) worked on the percentage loss in the fruits of mango, guava and banana infected by Botryodiplodia theobromae under different conditions. They concluded that temperature plays a decisive role in the incidence of different fruits rots. Srivastava and Tondon (1968) also observed the importance of temperature in the fruit rot of Sapodilla and Citrus infected by B. theobromae. Sinha (1986) reported effect of temperature and humidity on fruit rot of mango caused by B. theobromae and Macrophoma magnifera. Impact of temperature and humidity have been also reported by Kaushik et al; 1969; Thakur, 1972; Kanvar et al; 1973; Jamaluddin; 1973; Prakash and Singh, 1978; Poddar, 1980; Prasad and Sinha, 1981; Rawat 1984; Prasad et al; 1986; and Chandra et al; 1987. Prasad and Bilgrami (1973) have also worked on the fruit rot of Shahi cultivars of Litchi fruits due to the final infection by Aspergillus, Bortryodiplodia theobromae, Colletotrichum gloeosporioides, Cylindrocarpon tonkinense and Pastalotia sp. under varying range of temperatures and humidity.

3. Material and Methodology

The degree of fruit rot is related with the growth rate and metabolic activities of the pathogen present within it. It is true because the rate of synthesis of enzymes for the degradation of the host's issues is related with the metabolic activities of the pathogens. Furthermore, the growth of pathogens is influenced by the climatic factors of which the temperature and the humidity are most important. Litchi fruits are stored in wooden boxes, lined with green leaves of the litchi tree. Thus in the storage both the fruits and the broken green leaves do respiration and liberate thermal energy in the wooden boxes. This promotes fungal invasion and growth during storage. Here, humidity is also maintained due to green leaves. Both the temperature and the humidity influence the metabolic activities of the host and the pathogen.

In the present research works such as calibration of microscopic constant for a given ocular micrometer with the help of stage micrometer because it is used for the measurement of the spores conidia etc. Three standard culture media PDA, Zepec-Dox, and modified Asthana and Hawker, were prepared for the culture isolation and purification of the pathogens. Out of the total fungal species only two were selected for further studies because they were more prevalent in all the times.

For isolation diseased fruits were collected from the orchard, the storage house and from the local markets. Symptoms were recorded and the fruits were properly sterilized. From the above fruits a small piece of tissue were cut near the junction of the infected and healthy looking reason and were aseptically inoculated in the culture tubes and flasks. In this

way the fungal pathogens were isolated and identified. Above identified pathogens, particularly, **B. theobromae** and **C. gloeosporioides** were used for further studies. These pathogens were used for inoculation in the healthy fruits and percentage rot. Impact of temperature and humidity etc. were studied in the laboratory conditions.

4. Observation

To observe the effect of temperatures and humidity on the fruit rot of two cultivars of Litchi fruits viz, Shahi and China, infected by **B. theobromae** and **C. gloeosporioides,** the fruits were incubated at 15,20, 25, 30, 35 and 40^{0}C and humidity was maintained at 30, 40, 50, 60, 70, 80, 90 and 100% under artificial conditions. Observation was made at the interval of two days of incubation and upto 10th day.

5. Result

The data have been analyzed and placed in the tables below:-

Pathogen	Cultivar	Days of Incubation	Temperature in ^{o}C						
			15	20	25	30	35	40	RT
B. theobromae	Shahi	2	-	5.8	16.2	19.6	20.5	14.8	18.6
		4	-	18.5	33.6	62.4	73.4	18.5	62.5
		6	6.4	28.8	56.5	72.5	97.5	22.2	38.6
		8	8.6	38.4	85.6	96.8	++	29.5	++
		10	14.5	58.6	++	++	++	46.4	++
	China	2	-	16.5	24.4	26.6	34.2	18.8	28.4
		4	-	22.6	38.8	31.5	66.4	32.2	68.6
		6	9.8	36.2	88.5	97.8	++	58.4	++
		8	11.4	64.6	++	++	++	82.8	++
		10	28.5	++	++	++	++	82.8	++
C. gloeosporioides	Shahi	2	--	6.5	10.8	12.2	15.6	9.4	14.2
		4	--	16.2	18.6	32.4	46.5	18.2	32.8
		6	6.6	25.2	29.8	47.6	92.5	22.4	86.5
		8	10.2	37.6	55.5	73.4	++	31.8	++
		10	16.4	52	93.2	++	++	41.6	++
	China	2	--	11.6	22.8	25.6	26.4	12.5	24.6
		4	--	22.8	38.6	42.5	55.8	26.4	52.5
		6	8.6	31.2	72.4	95.8	++	62.2	++
		8	16.5	61.4	95.2	++	++	98.8	++
		10	26.8	92.6	++	++	++	++	++

(--) No response, (++) 100% rotting

6. Discussion

Perusal of the table indicates that Shahi cultivar of the Litchi fruits inoculated with above two pathogens such as **B. theobromae** and **C. gloeosporioides** incubated at different range of temperatures revealed different percentage of loss due to rot caused by the above pathogens. Shahi cultivars of the Litchi fruits revealed no symptoms at 15^{0}C after 2nd day of incubation. At this incubation, however, at 35^{0}C, 25.5% rot was noted among the fruits inoculated wih **B. theobromae** where as it was 15.5% when infected by **C. gloeosporioides** on the 4th day this temperatures, the percentage loss was 73.4 when infected with **B. theobromae** and **16.5** when infected with **C. gloeosporioides**. On 6th day the percentage of loss was 97.5 when infected with **B. theobromae** and 92.5 when infected with **C. gloeosporioides.** There was cent percent rot in the fruits of Shahi cultivar of Litchi on 8th day at the above temperature, infected by both the pathogens. Not only was this even at 25^{0}C, 30^{0}C there were 100% rot in Shahi cultivar, when infected with **B. theobromae.** However, when infected by **C. colletotrichum** the rot was partial at 25^{0}C that is 93.2%. Here also 100% rot was noted at 30^{0}C. Even at room temperature 100% rot was observed on 6th, 8th and 10th day of incubation in case of **B. theobromae**, while in case of **C. gloeosporioides** it was on 8th day of incubation.

In case of China cultivar of the Litchi fruits infected by **B. theobromae** and **C. gloeosporioides**, 100% rot was noted at 35^{0}C on 8th day of incubation, when infected by **B. theobromae**, and on 6th day in case of **C. gloeosporioides.** At 30^{0}C the rot was 100% in case of both the pathogen on 10th day of incubation. However, in case of **C. gloeosporioides** the rot was 100% on 10th day of incubation at 25^{0}C. Perusal of the table indicates that intensity of the fruit rot is influenced by the percentage of relative humidity. Both the Shahi and China cultivars of Litchi fruits infected by **B. theobromae** and **C. gloeosporioides** revealed partial rot at low humidity which increased along with the increasing percentage of humidity. It is further noted that on 6th day of incubation Shahi cultivar revealed 100% rot at 90 and 100% humidity when infected with **B. theobromae**, while China cultivar revealed 100% rot even 80% humidity on 10th day of incubation when infected by the above pathogen.

In case of **C. gloeosporioides**, it is noted that there were partial rotting at humidity below 90%. While Shahi and China both cultivars revealed 100% rot on 8th and 10th day of incubation at 90 and 100% of incubation the rot was 90 and 94.6% at 80% humidity on 10th day of incubation.

Pathogen	Cultivar	Days of Incubation	Temperature in ^{o}C							
			30	40	50	60	70	80	90	100
B. theobromae	Shahi	2	--	6.8	13.5	24.2	33.5	42.5	53.6	57.8
		4	4.6	12.5	16.8	36.6	42.8	56.4	72.6	86.2
		6	10.2	16.6	20.4	42.5	44.6	59.4	76.8	97.5
		8	12.4	18.8	26.2	46.6	48.5	63.8	++	++
		10	14.2	20.6	30.5	50.2	58.8	78.4	++	++
	China	2	3.8	8.2	16.4	26.6	34.5	44.6	56.2	59.4
		4	5.4	14.4	18.6	38.2	44	58.8	78.2	84.6
		6	12.6	15.2	22.8	43.6	46.2	61.5	++	++
		8	14.8	22.5	28.4	48.2	52.4	80.2	++	++
		10	16.4	23.6	32.8	53.5	62.8	++	++	++
C. gloeosporioides	Shahi	2	--	7.4	14.6	25.8	35.2	44	55.2	58.5
		4	4.8	14.2	18.4	37.5	44.2	58.6	74.8	87.6
		6	14.2	16.8	22.5	45.8	48.5	63.4	94.2	98.5
		8	15.6	23.4	30.5	51.2	56.4	82.5	++	++
		10	16.4	24.8	32.2	55.5	58.6	90.2	++	++
	China	2	3.6	8.5	16.2	27.4	38.5	46.8	58.4	60.2
		4	5.4	16.8	18.6	40.2	47.4	66.2	76.5	88.4
		6	15.8	18.2	24.5	47.4	51.8	68.6	95.4	++
		8	17.2	25.6	32.8	53.6	58.8	87.2	++	++
		10	18.6	26.8	34.5	57.8	62.2	94.6	++	++

(--) No response, (++) 100% rotting

7. Conclusion

Therefore, it may be concluded that among the cultivars China was more suitable for the pathogens that Shahi, similarly, **B. theobromae** was more virulent than **C. gloeosporioides** and among the incubation 8 to 10th day was maximum period for maximum rotting and 35^{0}C was the best temperature while 90-100% relative humidity promoted maximum loss.

References

[1] Adisa, V.A. (1985). Fruit rot diseases of guava (Psidium guajava) in Nigeria. Indian Phytopath., 38: 427-430. Agarwal, G.P. and (Miss) K. Ghosh (1979).
[2] Post-infection changes in ascorbic acid content in Lemon, Musambi and Orange fruits induced by Colletotrichum gloeosporioides. Indian Phytopath., 32: 108- 109.
[3] Agarwal , S.R. (1986). Ph.D. Thesis, Bihar University, Muzaffarpur.
[4] Agarwal, V.K. (1981). Research Bulletin 108, G.B.P. University of Agriculture and Technology, Pant Nagar, India 146pp.
[5] Ambasta, K.K (1988). Ph.D. Thesis, Bihar University, Muzaffarpur.
[6] Bhargava, S.N. and A.P. Singh (1974). Thiabendazole – storage of guava fruit. Indian Phytopath., 27: 613-615.
[7] Bhargava, S.N. and A.P. Singh (1975). Aspergillus rot of mango and its control. Indian J. Hort., 32: 190.
[8] Bhargava S.N. and D.N. Shukla (1980). Losses of protein contents due to fungal invasion. Nat. Acad. Sci. Letters. 3:18.
[9] Bhutani. R.C. (1946). Vitamin contents of the mango. Punjab Fruit Journ., 10: 112-115.
[10] Chakrabarty, N. (1983). A note on post - harvest rot of guava caused by Fusarium Solano. Indian Phytopath, 36: 556.
[11] Chaudhary, B. (1968). Diseases of vegetables during transit, storage and marketing and their control. Bull. Indian Phytopath, Soc., 4: 52 - 56.
[12] Dastur, J.F. (1915), Ripe rot of banana. Agri. Jour. India, 10: 278 - 284.
[13] Dastur, J.F. (1921). Die back of chillies in Bihar. Men. Dept. Agri. Indian Bot. Soc., 11: 129 - 144.
[14] Frank. W. (1955). Ascorbinasaure. In modern method of plant analysis (Ed. K. Parche and M.V. Tracey). Vol. II, Springerverbay, Berlin.
[15] Gupta, S.C. and D.K. Pandey (1959). Market diseases of fruits and vegetables in Kumaon III, Penicillium rot of fruits. Jour. Biol. Sci., 2: 6 - 8.
[16] Gupta, S.C. and D.K. Pandey (1965). Botryodiplodia theobromae, a mango fruit rot organism in India. Agra Univ. J. Red., 14: 25.
[17] Jamaluddin (1973). Effect of temperature on the rotting of fruits due to fungal pathogens. D. Phill. Thesis, University of Allahabad, Allahabad.
[18] Kapoor, I.J. (1982). Changes in ascorbic acid content of macrophoma infected guava fruits. Indian phytopath., 35: 699 - 700.
[19] Kaul, J.L. (1981). Effect of temperature on the development of fungal lots of Apple. Indian phytopath., 37: 573 - 574.
[20] Mathur, S.K. (1979). Studies on seed borne fungal infections in Bajra (Pennisetum typhoides stapf and Hubb.) in relation to leaf spots. Proc. J. Indian Bot. Soc., pp. 17.
[21] Ojha, N.L. (1983). Pathological and biochemical studies on fruit rot of legenaria vulgaris. Ser. Ph.D. Thesis, Bhagalpur University, Bhagalpur.
[22] Ojha, N.L., A.K. Roy and N. Choubey (1982). Changes in total phenol of bottle gourd fruits by Botryodiplodia Theobromae. Pat. Book. Bill. India. 4: 50 - 51.
[23] Prasad, S.S. and R.S. Bilgrami (1977). Some physiological aspects of soft rot diseases of Litchi. In physiology of microorganisms (Eds. K.S. Bilgrami), today and tomorrow's printers and publishers, New Delhi, pp. 249 - 261.

[24] Prasad, S.S. (1962). Two new leaf spot diseases of Nephelium lichi. Camb. Curr. Sci., 31: 293. Prasad, S.S. (1963), Ph.D. Thesis, University of Bihar, Muzaffarpur.
[25] Prasad, S.S. (1985/86). Fungal diseases of Litchi and management. Rev. Trop. Pl. Path., 2: 221 - 233.
[26] Prasad, S.S. and A.K. Sinha (1980), Macrophoma rot of mango in Bihar. Nat. Acad. Sci. Letters. 3: 356.
[27] Prasad, S.S., R.S. Bilgrami and S.K. Sinha (1970). Ascorbic acid, total acid and moisture contents of Litchi fruits. J. Appal. Sci., 2: 19 - 21.
[28] Reddy, S.M. and P. Laxminarayana (1984). Post - infection changes in ascorbic acid contents of mango and Amla caused by two fruit rot fungi. Curr. Sci., 53: 927 - 928.
[29] Sharma, R.B., A.H. Roy and R.K. Verma (1979). A soft rot of Aegle marmelos. Curr. Sci., 48: 23 - 23.
[30] Tandon, M.P., Jamaluddin and V. Bhargava (1975). Some new fruit rot diseases, Indian phytopath., 38: 571. Tandon, R.N. (1967). Final technical report on post harvest diseases of tropical and subtropical fruits. Allahabad University, Allahabad.
[31] Wadia, K.D.R. and M. Manoharachary (1982). New post-harvest disease of Jumbolan fruits. Indian phytopath., 35: 707 - 708.