Studies on deterioration aspects of some horticultural fruits during storage

Mohmoud Soliman El Shamma

SOJIlIARY AJID aB:LUSIOBFruit rots caused by various fungi are consideredone of the most serious troubles that reflectingconsiderable deterioration in both quantity and qualityof pome fruits during storage and retail marketing.So, the present work was planned to study thephysiological and pathological deterioration of storedfruits in order to reduce losses and increase the storagelife of fruits using some fungicides such asthiabendazole a systemic or Botran a contact fungicidesas well as pre storage treatments with compounds thatincrease the resistance of fruits to fungal invasionand fruit deterioration such as caC12 and Vapor Gard(Poly-I-methene 8-9 diyl). Moreover, evaluation someconsumer packages was carried out in this respect.The present work was udnertaken during the seasonsof 1985, 1986 and 1987 in order to identification thedeterioration aspects of pome fruits during storage andretail marketing.In the first season, results obtained could hesummarized as follows :1. Isolation from naturally rotted fruits indicatedthat Penicillium expansum, Botrytis cinerea, Alternariaalternata and ASpergillus ~ were the more frequentisolates responsible for causing apple (Anna, Bercker)cultivars and pear (Le Conte, Bartlett) cultivars, fruitrots. Other fungi such as Rhiwopus ~ CladosporiumPencillium ~ and stymphyllium sp., occurredin less frequency, while Diploida natalensis, Fusarium§.E.:...L Trichothecium roseum and Negrospora .§.E..:.. showedthe least frequent rate.2. Pathogenicity tests revealed that the degreeof infection was affected by the cultivar and the kindof fungus. Le conte pear fruits showed higher vlauesof infection followed by either Anna apple or Bartlettpear fruits, but Bercker apple showed the least valuesof disease severity.Gray mould caused by the fungus B. cinerea wasthe most important causal of fruit rot followed indecreasing order by P. expansum, Alt. alternata andASpergillus .§E.Therefore, the work was facused up on thephysiology of B. cinerea and its metabolic activitieson the more susceptible cultivar (Le Conte pear fruits)during cold storage.3. Physiological studies indicate that theincidence of Botrytis rot developed on a _w___id--,e_....--------.-ranger-· oftempera.tur-e for' either -r------ ..frui t infection or diseaseseverity. The proper temperature ranged between 20 -While at 5°C the rot didn't exceed. the inoculated• region of the fruit till 6 days of incubation •Under high relative humdiity (90 100 %) thehighest infection with B. cinerea was obtained. No~i-n-f--e-ction was bserved at 14.5 % R.H. ... - ~----"""The effect of different stages of fruit maturityon fruit rot development proved that there was a ..p..o.=s-i.-t-.i--v--ec~~ 19t..iPll between the c1e9r~~_.9£ fruit maturity an,.the incidence of Botrytis rot, where matursseemed to 'be resi$ts.nt~ Moreover, in vitro, mycelialbiomass increased significantly as the maturity stageof fruit extract advanced.4. Biochemical studies indicated that in~fectio---n------.Jwith B. cinerea led to a pronouncing ir:n: s_~--ill. _r~g.'p-ciM---'~. J:~. f;?~~ content of of mature fruits, whilesugars content in inoculated riEe fruits tended to ,defter 10 days incubationTotal phenols in mature green and greenhish yellowpear frai ts were. generally higher than those in fruitsl'- i- ,Ii -of other stages of maturity, where ,n.-o-----c--l-~a.x:..-..d--i.f-f" e-r-e-R---e-swere noted between inoculated andln-inocu But at yellow green stage, the phenolic contents ofinoculated fruits were relatively higher than those inhealthy ones.5. Rnzymatic assays in B. cinerea culture filtrateresulted in detecting Peroxidase and polyphenol oxidase>-~t a }((' ~ 't> J(P. P•0) enzymes and ~th-"e"'-._m--a-x--i_m._u-m---_a.c_ti .._v-~-i" ~ was obtainedat the end of incubation~iod. Peroxidase and P.P.o.enzymes activity was higher in the extracts of fruitsinoculated at m~~ or gre~~w stage thanother stages of maturity. Also,

the levels of enzymesIn addition, the activity of Peroxidase enzymes was lowerin ripe fruits than that of mature green ones.Studies 'of Pectolytic and cellulolytic enzymesactivity showed that B. cinerea produced Pectinmethylestrase, polygalacturonase and cellulase enzymesin its culture filtrate, and its jactivities wereincreased by prolonging the incubation period, in vitroas well as in ~., In extracts of inoculated pearfrui ts, and after 10 days incubation PMEand PG enzymesactivity were as much two times as those of healthyfruits. Futhermore, ex: enzymes acti vi ty was increasedin both infected and heal thy fruits and the reductionin viscosity was more pronounced in inoculated fruitsthan in healthy ones.Studies on rot control in vitro revealed thatsystemic fungicides (TBZ or Benlate) almost checked thegrowth at relatively lower concentrations (500 ppm.),while contact ones (Botran or Rovral) showed the sameeffect at higher concentrations (1000 or 2000 ppm), butcaC12was less effective. ~ studies, indicated thatall pre inocualtion treatments at higher concentrations·gave highly protective effect against Botrytis rot. TBZtreatment showed the best values followed in decreasingorder by Botran, Benlate, CaC12 and Vapor Gard, whileRovral treatment was less effective in this respect.Post inoculated treatments showed that TBZat 1500ppm was more effective in reducing Botrytis rot followedby Benlate and Botran treatments respectively. WhileRovral,CaCIZand Vapor Gard treatments were lesseffective' in this respect.Results showed that residues in peel extractreflected higher reduction in mycelial weight than thatIn .p.;e..e.-l-.-extract, Benlate atreduction effect followed in~ CaCIZand Botran respectivley.1500of flesh extract.ppm gave the highest'.-decreasing order by TBZ,(1500 ppm)in f.l.e.-s-h-= of TBZ,extract, the highest concentration2- vJ ~Benlate and -Botran as well However,at 2 % were statistically similar in theiras~residualeffect.On the other hand, -R_ovr.al- or - .Va--p-o-r. Gard.c>_ 68 -treatments showed lower effects in either peel or fleshextract.7. St..o.-r--a--g...e studies were carried out for two seasons(1986, 1987) on physical and chemical changes associatedwith inoculation. Le conte pear fruits with B. cinereaand storedtdecayat ResultsZtotalshowed a marked increaseloss in weight, c~lourtotal soluble-=fsoluble pectin,~chlorophyll,solids,percentage,,.J(carotenoid('total nitrogen contentaccumulationindevelopment,and totalon the other hand a.continuous decreases in1:- 3 ., ~ .4'Calc~um, titratable ac~d~ty and mo~sture contents asywell as fruit firmness was obtained by increasing the(25 ± 2°C) , fruitsAf~t-e--r---r--emoval to roo~ temperaturewere subjected to a sharpperiod of incubation.deterioration.8. All compounds applied as a post-inoculatedtreatments (TBZ, Botran, CaC12 and Vapor - Gard)significantly reduced the percentage of deca.y and totalloss in weight as compared with inocualted control. TBZat 1000 ppm induced the lowest losses percentage duringcold storage and extended the shelf-life of treatedfrui ts up to 12 days. The colour development was slowerthan that in inocualted control, while the totalti tratable acidity, moisture and calcium content wereincreased as compared with inocualted control. Oncontrary, total soluble solids, total soluble pectinand total nitrogen content decreased in treated fruits.9. Botran treatment at 1000 ppm, significantlyreduced the Botrytis rot during both cold storage andshelf-life, but it was less effective than othertreatments in extneidng the shelf-life of treated fruits.Moreover, the effect of Botran on the physical andchemical properties of stored pears was somewhat similarto that of healthy fruits.10. The use of calcium chloride deQreasedsignfiicant1y the total loss in weight, total solublepectin and total nitrogen content, delayed chlorophylldegradation, carotenoids accumulation and subsequentlycolour development and reduced loss of fruit firmness.Decay percentage of inoculated fruits, was also reducedduring either cold storage or shelf-life to rank thefirst treatment in this respect.11. vapor Gard (V.G.) at 2 or 1 % was effectivein delaying the physical and chemical changes ofinocua1ted fruits, which led to fruit ripening. Butwhen V.G. was used at -2 % (in the first season) as ~confirmed by .i:E. vitro data, fruits were subjected to ---- internal browning. For this reason, V.G. at 2 % was¢ ~ es;;:: replaced by the concentration of 1 % in the second Iseason. Moreover, V.G. treatment reduced significantlyloss in fruit weight, moisture content, the degradationof either chlorophyll or pectin content and also theaccumulation of either total nitrogen or carotenoids.A signficiant decrease in loss of fruit firmness, colourdevelopment and Botrytis rot were signficiantly obtainedduring cold storage, where the shelf-life was extendedfor 12 days.with 2 kg. capacity, i.e. perforated polyethylene bags,Open meshed plastic bags, carton-box (with wrappedor un-wrapped fruits) and kept at SoC, reducedsignfiicantly thatotal loss in weight and Botrytis rotof packed fruits, except those packed in open meshedbags.13. perforated bags led to higher moisture

content,pronounced decrease in decay percentage during coldstorage and extended the shelf-life for 6 days. Moreover,a significant increase in fruit firmness, totaltitratable, acidity and chlorophyll contents wasobtained. On the other hand, colour development, totalsoluble solids, carotneoids content, total nitrogen andsoluble pectin were markedly decreased.14. Wrapping inoculated Le Conte pear fruits intissue papers and packing in caroton box, led to a markedreduction in Botrytis rot during cold storage andextended the shelf-life up to 6 days.wrapped fruitsbehaved similarly as those packed in perforated bags,where the development showed a slow rate.15. Levels of rotting and deterioration ininocualted fruits packed in open meshed plastic bagswere significantly equal to those in inocualted controlduring cols storage andafter transference to roomtemperature.16. Inoculated fruits packed in c..a.r..to.-n----b-o-x-, showeda significant reduction in Botrytis rot and loss in fruitweight, and extended the shelf-life for packed fruitsfor only 6 days with less than 50 % sound fruits.Moreover, the physical and chemical changes in packedfruits were more or less the same as that of healthyfruits.from the previous results it could be concludedthat :1. Store mature greeen Le conte pear fruits at50C. seems to be suitable for prolonging the storagelife._ liz -2. Treatments with some chemicals could beconsidered supplementary to refrigeration of Le Contepear fruits.3. The application of CaCl2 at 2 % revealed asatisfactory results in reducing Botrytis rot as wellas Vapor Gard at I %, where CaCl2 ranked the first inthis respect.4. post-harvest treatment with the. systemicfungicide II Thiabendazolell revealed higher reduction infrui trot, where vitro studies showed the rpesent ofits residues in both peel and flesh extract in treatedfruits.S. When fruits were wrapped and packed in cartonbox or when fruits were packed in perforated bage, asa consumer package with 2 kg. capacity and kept at SoC.,led to less decay percentages.