Potato tuber rots caused by Fusaria

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Potato 1s considered one of the most importantexport vegetable crop in Egypt. Unfortupate1~ thiscrop is affected many diseases in the field, storageand during transport. Potato tuber rot caused bydifferent species of Fusarium causes great economielosses during storage, transportation and during thegrowing season. This study was carried out to :a) determine the causal agents of potato tuber rots,b) to study factors affecting the disease incidenceand spread, c) to study parasitic behaviour and chemicalchanges occurring during this period, and d)disease control methods under laboratory, storageand field conditions.The most important results obtained in thisstudy are summarized as follows :1. Seven different species of the genus Fusarium,causing potato tuber rots, were isolated and identified.The most prevalent were F. oxysporum andF. sambucinum. The latter is considered as the firstrecord of this species on potatoes in Egypt. Also,l. 1ateritium and l. reticulatum were first recordedon potatoes.- 1’42. The most virulent species, causing tuber rotsand seed piece decay were F. sambucinum,!. solaniand F. avenaceum, while F. reticulatum and F. later.-tiumwere the least virulent.3. Potato tuber stem-end was the most sensitivesite for Fusarium spp. entrance and infection. While,rose-end and tuber sides were less susceptible.4. ~. eambucinum was the most virulent causingsprout rot on all varieties Arr~n Banner andClaudia variety were z-ea Lstan t to F. solani,F. avenaceum, F. oxysporum, F. reticulatum andF. latertium, while Arr”an and Grata was resistant tol. semitectwn. On the other hand, Spollnta was themost susceptible variety to all Fusarium spp.5. During storage infection with F. sambucinumincreased gradually at 10-25°C. then decreased at 30°0.oand 35 C. Infection of Alpha and King Edward varietieswith F. avenaceum increased at 10-20°0., while,l. solani was more virulent at 30 and 35°0.6. Potato tuber rots increased consequently till80 % R.H. and there was no significant differencesbetween 90, 95 and 100 % relative humidity.7. Slice rot, caused by!. sambucinum, decreasedby elongate curing period for all potato varieties.It was found that placing tuber wounded slices in- ”H:;5 -good ventilated areas for 1-4 days gained best resultsagainst the infection by F. sambucinum. Potatovarieties differed in their sensitivity to infectiondepending on their ability for wound suberization.Arran Banner and Alpha were resistant, while KingEdward and Spounta were susceptible.8. Degree of maturity has significant effect onpotato tuber rots during storage period. Tuber rotincreased by increasing tuber maturity.9. Increasing inspection intervals during storageperiod increased tuber rots in Nawalla comparedwith examination one time at the end of storage period.10. Alpha, Arran Banner and Rosalai varieties wereresistant, Claustar, Claudia and Dimont were lessresistant, while Grata, Spounta and King Edward weresusceptible. On the other hand, Baraka, Clada andCara were highly susceptible to Fusarium potatotuber rot in Nawalla.11. Change in growth period affected chemical constituentsin tubers tissues Fusarium rotsla) Increasing growth period caused reduction oftotal and non-reducing sugars in King Edward variety.Reducing and non-reducing sugars increased susceptibilityto tuber rot. Reducing sugars decreased inAlpha tubers by prolonging growth period. It was·also found that total, reducing and non-reducing sugarsincreased in tubers inoculated with l·sambucinumexcept in Alpha tubers 110, 120 and 130 days oldwhen reducing sugars decreased after inoculation.b) Total and free phenols decreased by increasingplant age. Rate of reduction in King Edward was morethan in Alpha cultivar. Total and free phenols increasedafter inoculation with the causal agent.c) Amino acid content was higher in 80 days old tubersthan in 90, 100, 110, 120 and 130 days old. InoculatingAlpha tubers increased all amin~acids comparedwith non-inoculated ones except Alanine, Leucine, andIso-leucine which were

higher in non-inoculated tubers.In King Edward tubers, non-inoculated tubers containedhigher amounts of amino acid than in inoculated ones,except Arginine and Aspartic at 80 and 90 days old,Tyrosine at 80 days old and Proline and Valine at allages.12. Storage period also affected reaction potatotuber rots :a) Increasing storage period increased sugar contentsespecially at the end of the storage period.b) Orthodihydroxyphenol contents increased after allstorag~ periods after inoculation in both Alpha andKing Edward varieties. Rate of accumulation oftheiJe phenols was higher in tubers inoculated immediatelyafter harvesting than in tubers inoculatedone, two or three months after harvesting. It wasalso found that Alpha tubers contained higher quantitiesof orthdihydroxyphenols than King Edward.These phenols decreased by prolonging storage periodfor both varieties.c) Total, free and conjugated phenols decreased graduallyby prolonging storage period.13. Sugar content decreased by increasing storagetemperature and inoculation with the causal agent inboth Alpha and King Edward. On the other hand, orthodihydroxyphenolsdecreased by increasing storagetemperature and rate of infection increased in bothcultivars. OrLhodihydroxyphenol content was higherin Alpha tubers than in King Edward.14. Orthodihydroxyphenol contents increased by prolongingcuring period in all varieties. It reachedmaximum in Alpha and Arran Banner varieties, whileClada and Spounta contained the least amounts of thephenols.15. Inoculated tubers of Alpha variety exhibitedhigher auxin activities than in King Edward varietyat all Rf (a) values except at Rf (a) 0.7 and 1.0.Inculation decreased auxins activity in Alpha var.at all Rf (8) except Rf 0.6, 0.7 and 0.9. On theother hand, King Edward showed less activities exceptat 0.1, 0.1 and 1.0.- 168 -Concerning gibberellins, inoc.King Edward gained moreactivity than Alpha var.except at Rf 0.6.lated tubers, King Edward tubersIn inocuwithF. ~bucinum showed higher activity at all Rf valuesexcept at Rf (s) 0.6 and, while Alpha was lessactive after inoculation at 0.1, 0.3 and o. 5 Rfvalue.16. Pectinase and cellulase enzymes increased graduallyby increasing incubation temperature ofcultures till 20°0. then it decreased at 30 and 35°0.for all Fusarium species except F. solani was whichpolygalacturonase enzymes activity increased at 20.25 and 30 °c. then decreased at 35 0c. However.oactivity of theseenzymes increased at 35 c. whenl. oxysporum was used. Concerning!. semi tectumenzymes activity increased by increasing incubationo 0 temperature till 20 c. then decreased at 25 C •• incr-° eased again at 30 c. then decreased at 35 0C.17. l. sambucinum showed higher activity in producingpectinase and cellulase enzymes when inoculated tuberswere incubated at different temperatures. Activityenzyme increased in inoculated tubers by increasingincubation temperature till 20°C. then decreased at25,)0 and 35 °C. In non-inoculated tubers. pectinmethylesteraseincreased till 20°C. then decreased at while polygalacturonase and cellulase increased tillo 0 25 c. then decreased at 30 and 35 C. The same resultswere obtained in Alpha and King ~dward varieties. Ingeneral, activity of these enzymes was somewhat higherin King Edward variety than in Alpha inoculated andnon-inoculated tubers.18. Effect of different relative humidities on cellulaseand pectinase enzymes in the host inoculatedwith three Fusarium species it was found that pectinmethylesteraseincreased by increasing relativehumidity till 90 %. This occurred when ~. sambucinumand F. avenaceum were used in inoculation. Thisenzymes increased till 80 % R.H. when F. solani wasused. It was also found that polygalacturonaseincreased till 95 % R.H. when ”inoculating withF. sambucinum. In case of F. solani and E.avenaceumthis enzyme increased till 90 % R.H. But cellulaseenzyme increased gradually till 100 % R.H. in thethree Fusarium tested. Similar results were obtainedin both Alpha and King ~dward varieties but the enzymesactivity were higher in King Edward than in Alphatubers.19. Phenoloxidase enzyme activity increased incultural filtrate of l. sambucinum than the other twospecies, F. solani and !.. avenaceum. While, enzymeactivity was nearly similar in the mycelium of thethree species.20. Peroxidase enz~]e activity in culture filterateof F. sambucinum was higher than in F. solani andl. avenaceum. Concerning the mycelium, the enzymeactivity was similar in the cultural filtrate of thethree species.21. Rate of increase of phenoloxidase activity washigher in Alpha tubers than in other tested varieties.Spounta and Clada were the least ones. Peroxidaseactivity reached its maximum in Claudia variety after2 minutes, While it reached its highest activity inArran Banner after 3-4 minutes and after 5 minutesin Alpha variety.22. It was found that Tecto (thiabendazole), as asystemic fungicide, reduced rots of potato tubersartificially inoculated with F. sambucinum, usingleast concentration of active ingredients.

Using highconcentrations of this product did not cause phytotoxicityon tuber germination. On the other hand,high concentrations of chlorotha1onil or Vitavax/Captan caused toxicity on tuber germination.23. Thiabendazole (Tecto) can pentrate the tuberperiderm at distance of 16 and 20 Mm. inside thetuber tissues. However, this fungicide preventedspore germination of l. sambucinum upto 98 % at s110es ~ .to 5 depth after 6 days of tuber treatment with 100 ppm.24. Pectolytic and cellulolytic activities wereinhibited by using Tecto, Benlate, Vitavax/Captanand Chlorothalonil at 1, 25, 50 and 100 ppm was themost effective in reducing enz~nes activity. Enzymesactivity reducing reached the maximum at the time ofadding fungicides to the medium. F. sambucinum cultureswere used in this experiment.25. Using a mixture of Tecto or VitavaxlCaptan(fungicide) and 10 % Sevin (insecticide) dusting at1 : 1 (1~25 kg/ton tubers) reduced potato tuber rots.26. Using VitavaxfThiram, Orthocide-8J, Terrazol,Terrachlor and Agrimycin 500, increased average percentof tuber storage rots when adding thoroughlyafter digging more than when using after two weeksof harvesting.Vitavax/Captan and Benlate fungicides decreasedtuber rots in the field under artificial and naturalconditions.