Ecogical studies on the rice blast disease with special efferance to the nature of resistance

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Rice is one of the most important oereal orops inEgypt. It is the seoond export orop after ootton andimportant food orop. Rice blast incited by Pyriculariaoryzae avara., is considered, one of the most des tructivedisease of rioe allover the rioe growing areas inEgypt. It oauses considerable losses of the orop yearly.Results obtained from this investigati.on could be l!IUIDIIlarized•• followSl1- During 1980 rice growing season. eleven physiologio raoesof ~. oryzae designated as: IA28 IAS7' IBl, IBS' ~C19'.IC26, ID2~ IEI' IE.-r,IGI and Illl were identified from94 speoimens oollected from different rice growinggovernorates in ARE using the set of international differentialrice vari.eties.2- Twosubraoes of ~. oryzae were identified under each ofraoes IAs7' IE.-rand Ill1 by the use of 12 local and foreignrioevarieties. g,uring season 1980..s..3- Eighteen physiologio raoes of ~. oryzae were identifiedfrom 103 speoimens of infeoted~leaves and necks of rioeplants col1eoted from different localities of the rioegrOWing area during 1981 season. These raoes were designatedas: IA17, IAs7' 1A64, I~21' IB32, IB34• IBS7' IB59,IB62• IC14, 1°27, 1030' ID5, IFl, IFi' IF), 1Gi and 1G2•-- --- - - -_.---_ .. - -_.- --- 1}6 -4- Using 33 local and for eign rice varie ties two subracesof Pyricularia oryzae were identified under each raceof IFl and IG2 and three eLilracesunder race IF2 during1981 growing rice aeason.s- Using the set of international differential rice varietie.s. fifteen races of!.. oryzae were identified from107 specimens of infected leaf and necks collected fromdifferent localities of the rice growing areas in AREduring 1982 rice growing season. These races weredesignated as IA116• IB54• ICl, IC17, IC20, ID1, ID9,IE1, IE2• IES' IE6, IF1• IFi. IG1 and IH1•During 1982 rice growing seson, three subraces of!.. otyzae were identified under each of races IEl andlEi also two subraces under each of races IES' IFl andIF2, using 12 Japanese rice varieties and 4 local ~nes7-All races and subraces of !.. otyzae identified duringthe period from 1980 to 1982 varied in their virulene onall the tested varieties.8- Race groups IA. IB and IC are more common each year duringthe period 1980-1982 and there is f1.uctuation betweenraces groups namely ID, IE, IF and IG from year to other.9- Horizontal resistance occurred in five rice varieties i.e.• ~aby. Giza 180, CO 34. Sakha 2 and IR 36 and ten ricevarieties showed vertical resistance, these varieties are,i.e ,Nahda, SalJieni, Agamiml, Yabani 15, Giza 14, Giza159, Giza 1'70, Giza 171, Giza 172 and IR 8.10- No stable races were found from.the first asexual generationto the last one '(after 36 months)~ HoweverSOmeraces showedstability during the 24 generations as IGland IFlthen cllangedto other races, also their virulencechanged as race cllanged. However,someraces changed buttheir virulence was not changed such ~ race I026 (withdisease index 14) which cllanged to race I027 with the samedisease iIJdex (14).11- Bacterial and fungal spp were isolated from leaf surfacesof both susceptiblo or resistalllLrice varieties ..lfueirnumbersincreased with the increase of age of the plant andalso on the resistant varieties more than. sueceptible ones~12- ~o bacterial spp. showedant~onistic reaction againstE. aryza.e. These isolates wereidenti:fied as: Bacilluscerious var~ lD,ycoidss and the aecond sp, havetwo isolates which were identified as Bacillus sUbtilis •.B1ocer1ne,antibiotic, was isolated and identified frolllculture filtrate of Bacillus cerious var m,ycoidAlS andMyoosubtiline from culture filtrate of the two isolatesof 12. subtililll. 'fhese compoundswere effective in decreasingthe infection of rice plants with E~oryzae especiallyBioceren. Also the crude filtrate of the obovementionedBacilli Walileffective in controlling E~oryzae eapeciallythat of 12~cereus v ; lll,ycoidlS_13- Total free amino acids

showedsignificant differences atthe seedling stage between susceptible and resistantvarieties. Higher amounts were noticed in susceptiblevarieties. Yabani 15 found in leaf of healthy resistantAraby variety. However these amounts increased greatlyin the infected plants whethe~' susceptible or resistantthan healthy ones. Proline was fouhd in higher amountsin infeoted Giza 180 resistant rice variety while therionine.arginine and glutanine were found in higher amountsin both in fected Giza 180 (R) and Nahda (3) rice varieties.In this respect leucine + isoleucine and aspara-. tic acids were found in hi~;Aer amounts in infected Yabani15 (3' varie ty.14- At tillering stage althou~l total free amino acids wasequal for the two susceptD~le varieties, Yabani 15 andNahda but general decrease in all amino acids exceptttherionine + glutamine was noticed in both susceptibleanllresistant varieties. Higher amounts of alanine, serineand glycine werb present in infected Nahda (3) rice variety.However the lowest.amounts of total amino acids were foundin healthy Araby (R) variety. Although proline amount,were reduced in all varieties but it was noticed in higheramounts in infected Giza 180 (R) rice variety.15- At the adult stage of growth general increase in all theamounts of total amino acids was noticed in both infectedsusceptible and resistant varieties except incase of aloninein Nahda(S), Giza l80(R) and Araby (R) rice varieties.AlSO, proline amounts increased in Giza 180 infectedplants only and do,creased in all the other treatnents.As far leucine + isoleucine their amounts increasedexcept that oftherionine + glutamine in case of Nahdahealthy. 'plints. However,it could be noticed that thetotal amounts of free amino acids were higher in infectedplants than in heal thy ones and the highest amounts werenoticed in Yabani 15 susceptible variety.l6~ In four tested varieties, Araby and Giza 180 re 'lstant ricevarieties and Nahdaand Yabani 15 susceptible ones,, total sugars increased by ageing of the plantswhether infected or not. However, the total sugar'contentswere higher in infected plants than heaJtby one.specially the SLlSCep tible ones at tillering and adultstages of growth.11- Reducing sugars were generally higher in infected riceplants than heal thy ones speciaUy at tillering stage.However,a general decrease in the reducing sugar contentsWasnotioed by the increase in plant age in all testedvarieties.18~ Healthy su.soeptible rice varie ties showhigher amountsof suorose than the resistant ones. Infected susceptiblevarie ties contain higher amounts of sucrose than resistantones. Howeversucrose contents decreased at tilleringand adult stages in all tested varieties. Also 1:he sametrend was noticed as regards glucose and galactose exce~tthat.their amounts decreased in case of Araby (R) varietyin infeoted plants than in uninfeoted ones at the seedlingand adult stages only.19- Fruotose is found inhigner peroentages in infected plantsand in susceptible varieties than ~ninfected plants as wellas resistant varieties in different stages of plant growth.There was signifioant difference in fr~otose amounts betweeninfected and uninfeoted plants in oase of Giza 180(R) rioe varie ty at the adu.lt..ztage~20- The oontents of mannose were higher in susceptiLle varietyeither infected or not than the resistant one specially atthe seedling stage. This inorease was noticed in Yabani15 (3) variety and at the tillering stage mile no 'signifioantdifferenoes were noticed in the adult stage.21- The amounts of total phenols were higner in infected plantsin all teBted varieties.' Also their amounts were higher inresistant varieties than susceptible ones. It is olearlynotioed that these amounts increased also by the inoreasein plant age speoially in reBistant infeoted and uninfeotedplants •. 22- Resistant varieties contain higher amounts of free phenolsthan susoeptible ones specially •.t seedling and til1emingstages, whereas their amounts were almost similar exoeptin oese Q~ Araby (R) infected plants.•23- As for conjugated phenols their amounts were higher inall infected varieties than healthy ones speoially attillering and adult stages. Also their amounts werehigher in susceptible infected and lminfected plantsthan resistant varieties specially at seedling and adultstages, whereas the contrast was noticed at the tilleringstage.24- The highest amounts of 0 dihydroxyphenol were detectedin infected and uninfected resistant varieties in allstages of the growth. As regards the tested susceptiblevarieties, the infected plants showed higher amounts ofO. dihydroxyphenols than uninfected plants. It could benoticed also that it's amounts decreased by ageing of theplants, speoially at the adult stage of growth.25- Four organio acids, i.e. citric, malic, succinic andfUmarie acids were detected in rice varieties i.e. ~byand Giza 180, resistant varieties; Nahda and Yabani 15;susceptible -onea,26- The infection with r. oryzae caused little decl~ase incitric aoid contents in seedling stage while in the tilleringand adult stages it's amounts increased oonsiderablyspeoially in resistant varieties.27- The amounts of malic acid increased by infection

exceptin case of Yebani 15 in seedling stage. These amount sdecreased in infected plants in tillering stage except incase of Giza 180 resis tant varie ty. As for the adultstage malic acid amounts increased in infected plantsexcept in Hahda susceptible rice variety.28- The amounts of succinic and fumaric acids decreased insusceptible varieties due to infeotion, whereas contrastresults were noticed as regards the resistant varietiesin all stages of growth except Araby resistant variety inthe tillering stage of growth.29- The isolated races differed in there virulence and alsoin their contents of total free amino acids. Race I~7w'hichhave the highest disease index (22) produced lC1Neramounts of amino acids both in culture filtrate andmycelial mat, except asparatic, valine, phenylalanine andleuoine + isoleucine in culture filtrate whereas itproduoed lower amounts of all amino acids in mycelial mat.In this respeot the secord race in virulence IB5 ahowedlower amounts of total free amino acids either in thefiltrate or mycelial mat. The fifth race in virulencegave the highest amounts of amino acids whereas the leastamol.uitswere obtained by race IB5 which ranks the secondin it's virulence, whereas the highest amounts j,a obtainedby race I~21 which ranb the fourth in its virulence (16)both in the filtrate or mycelial mat. Thus it could beconoluded that there is no oorrelation between the virulenoeof the race and the amounts of free amino acids bothin filtrate or myoelial mat•30~ Also, results indicated that there is no correlationbetween the ra.ce virulence of l~or,y;zaeand the amounts·of total and reducing sugars in both the culture filtrateor the mycelial mat, of each race.31- As regards sucrose amounts, the h~hly pathogenic race-IA17(22) produced moderate amounts of it, while racesIA(l21) (16), IB5(20) and IBi5 (15) differed in theirvirulence but produced low amounts of Blorose whereasrace 1Fi(12) and IG2(10) the least virulent races pro'l('duced high amounts of sucrose. As before a reversblecorrelation ooeficient was obtained between ra.cesvirulence and different sugar contents.32- Nooorrelation was obtained between amino acids contentsand. different contents of sugars and race virulence withYabani 15 rice variety.:.n- The infection with the eight races ot l. or,y;zaeon Yabani15; susceptible rioe variety, decreased the amounts ofall organio acids, i.e. oitric, malio. auccini.o and tamaricaoids. Generaly no correlation was obtained between ra.cevirulence and all tested organic aoids.34- Results showed clearly that there is no oorrelation betweenthe race virulence end its ability of produc:U1gtoxins.,,5- Total, free and conjugatedphenols increased as a resultof infection of the susceptible variety Iabani 15. Asregards the interaction betweenrace virulence andphenolic compoundsa negative c~rrelation could b.noticed.