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FITOPATOGEN ZAMBURUG'LARGA QARSHI *BACILLUS* AVLODIGA MANSUB FAOL ANTAGONIST SHTAMMLARNI TANLASH

Аннотация

Ushbu tadqiqotda o'simliklarda kasallik keltirib chiqaruvchi, kuchli fitopatogenlardan hisoblangan *Fusarium solani* 915, *Aspergillus flavus* 1/15, *Verticillium dahliae* 936 va *Alternaria alternata* 879 zamburug' shtammlariga nisbatan *Bacillus* avlodiga mansub bakteriya shtammlarining antagonistlik xususiyatlari o'rganildi va eng faol antagonistlar tanlandi. *B. subtilis* 1/16 ning *A. flavus* 1/15 va *F. solani* 915 ga nisbatan 39 mm, *A. alternata* 879 ga nisbatan 37 mm, *B. paramycoides* 1/15 shtammining *V. dahliae* 936 ga nisbatan 40 mm o'sishini ingibirolovchi zonalar hosil qilishi aniqlandi.

Kalit so'zlar: Bacillus, antagonizm, zamburug', fitopatogen, *Fusarium solani*, *Aspergillus flavus*, *Verticillium dahliae*, *Alternaria alternata*, *B. subtilis*, *B. pumilus*.

ВЫБОР АКТИВНЫХ АНТАГОНИСТИЧЕСКИХ ШТАММОВ РОДА *BACILLUS* ПРОТИВ ФИТОПАТОГЕННЫХ ГРИБОВ

Аннотация

В данном исследовании изучены антагонистические свойства бактериальных штаммов рода *Bacillus* в отношении сильнопатогенных грибов *Fusarium solani* 915, *Aspergillus flavus* 1/15, *Verticillium dahliae* 936 и *Alternaria alternata* 879. Были выявлены наиболее активные антагонисты. Установлено, что *B. subtilis* 1/16 ингибирует рост *A. flavus* 1/15 и *F. solani* 915 на 39 мм, *A. alternata* 879 на 37 мм, *B. paramycoides* 1/15 ингибирует *V. dahliae* 936 на 40 мм.

Ключевые слова: *Bacillus*, антагонизм, грибок, фитопатоген, *Fusarium solani*, *Aspergillus flavus*, *Verticillium dahliae*, *Alternaria alternata*, *B. subtilis*, *B. pumilus*.

SELECTION OF ACTIVE ANTAGONIST STRAINS OF THE *BACILLUS* GENUS AGAINST PHYTOPATHOGENIC FUNGI

Annotation

This study examined the antagonistic properties of bacterial strains belonging to the genus *Bacillus* against highly pathogenic fungi such as *Fusarium solani* 915, *Aspergillus flavus* 1/15, *Verticillium dahliae* 936, and *Alternaria alternata* 879. The most active antagonists were identified. It was determined that *B. subtilis* 1/16 inhibited the growth of *A. flavus* 1/15 and *F. solani* 915 by 39 mm, *A. alternata* 879 by 37 mm, *B. paramycoides* 1/15 inhibited *V. dahliae* 936 by 40 mm.

Key words: *Bacillus*, antagonism, fungus, phytopathogen, *Fusarium solani*, *Aspergillus flavus*, *Verticillium dahliae*, *Alternaria alternata*, *B. subtilis*, *B. pumilus*.

Kirish. Fitopatogen mikroskopik zamburug'lar qo'zg'atadigan kasalliklar butun dunyo bo'ylab iqtisodiy jihatdan ekinlarga sezilarli darajada zarar keltirmoqda. Hosildorlikning pasayishi va yig'im-terimdan keyingi saqlash jarayonlarida insoniyat uchun katta yo'qotishlarga olib keladi [1]. Shu jihatdan, fitopatogenlar qo'zg'atadigan kasalliklarni kamaytirish va oldini olish orqali hosildorlikni oshirish, dolzarb vazifalardan biri hisoblanadi.

Adabiyotlar tahlili. O'simlik kasalliklari har yili jahon iqtisodiyotiga ko'p miqdorda zarar keltiradi. Oziq-ovqat va qishloq xo'jaligi ma'lumotlariga ko'ra, Oziq-ovqat va qishloq xo'jaligi tashkiloti tomonidan dunyo miqyosida aholi soni jadal ravishda ortib boryatgani va 2030-yilga kelib 8-9 milliardga yetishi kutilmoqda [2]. Bundan tashqari, fitopatogen zamburug'lar butun dunyoda ekinlarning katta miqdorda yo'qotilishiga olib keladi [3]. Qishloq xo'jaligi o'simliklarida kasalliklar kelib chiqishining taxminan 30% fitopatogen zamburug'lar salmog'iga to'g'ri keladi [4].

Antagonist mikroorganizmlar o'simlik kasalliklarini oldini olish va to'xtatish uchun ishlatiladigan asosiy bionazorat agentlari (BNA) hisoblanadi [5]. Ular yordamida fitopatogenlarning bionazorati ekologik jihatdan barqaror va xavfsiz deb baholanadi [6]. Bakterial antagonistlar biologik nazorat agentlari orasida keng qo'llaniladigan organizmlardan hisoblanadi. Antifungal antibiotiklar yoki metabolitlarning ishlab chiqarilishi fitopatogen zamburug'larga qarshi antagonistik bionazorat bakteriyalari ta'sirining asosiy mexanizmidir [7]. Ushbu metabolitlar fitopatogen hisoblangan zamburug' mikromitsetlarining

metabolizmiga to'sqinlik qiladi va ularning o'sishini cheklaydi [8]. Hozirgi kunga kelib Respublikamizning shimoli-sharqiy qismida ayniqsa mevali o'simliklarida turli xil kasalliklarni keltirib chiqaruvchi patogen zamburug'larning keng tarqalib borishi kuzatilmoqda [9]. *Bacillus* avlodiga mansub ko'plab shtammlarning fitopatogenlarga qarshi to'g'ridan-to'g'ri ta'sir qilishi va o'simliklarning o'sishini stimullab berishi tufayli bionazorat agentlari sifatida qo'llanilmoqda [10].

Ushbu tadqiqotning maqsadi turli xil qishloq xo'jaligi ekinlarida patogenlik qiluvchi zamburug'larga qarshi *Bacillus* avlodiga mansub faol antagonist shtammlarini aniqlash va eng faol shtammi tanlashdan iboratdir.

Tadqiqot obyekti va usullari. Tadqiqotda O'zR FA Mikrobiologiya institutida amalga oshirilgan IL-402104392 sonli amaliy loyiha doirasida ajratib olingan *Bacillus* avlodiga mansub bakteriya shtammlaridan foydalanildi. Shirin qalpampir (*Capsicum annuum*) bargidan ajratilgan *B. subtilis* 6/23, *B. subtilis* 6/20; pomidor poyasidan ajratilgan *B. pumilus* 2/17, *B. safensis* 3/11; kartoshka bargidan ajratilgan *B. pumilus* 4/24, *B. pumilus* 1/2; *B. subtilis* 1/17, *B. subtilis* 1/16, *B. paramycooides* 1/15 bakteriyalari loyiha tadqiqotlari davomida Maldit tof va molekulyar genetik usullarda identifikasiya qilingan. O'zR FA Genetika va o'simliklar ekperimental biologiyasi instituti kolleksiyasidan olingan *F. solani* 915, *A.alternata* 879, *V. dahliae* 936 shtammlari va Mikrobiologiya institutida IL-402104392 sonli amaliy loyiha doirasida ajratib olingan *A. flaus* 1/15 zamburug' shtammlaridan fitopatogen test zamburug'lari sifatida foydalanildi.

Dual kulturali plastinka metodi zamburug' antagonizmi uchun bakteriya izolyatlarini skrining qilishda ishlatiladigan eng keng tarqalgan usul hisoblanadi [11]. Antagonizmning BNA ta'sir qilish mexanizmini dual kulturali plastinka tahlili orqali aniqlash mumkin, chunki antagonistik o'zaro ta'sir ozuqa muhiti yuzasida bakteriya koloniyasi va zamburug' gifasi o'rtasidagi antagonistik zonasi mavjudligi bilan baholanadi [12]. Tajriba dual kulturali plastinka metodi asosida, patogen zamburug'larga qarshi antagonizmni aniqlash uchun ozuqa muhiti yuzasida "ikkita antagonist – bitta patogen" sifatida amalga oshirildi [13]. GPA (go'sht peptonli agar) ozuqa muhiti solingan Petri likopchalariga bakteriya shtammlarining 10^9 KHB/ml konsentratsiyali suspenziyalari 0,1 ml dan quyildi va gazon usulida ekib olindi. 3 kun davomida o'stirilgan antagonist *Bacillus* avlodiga mansub bakteriyalardan diametri 8 mm bo'lgan bloklar kesib olindi. Fitopatogen zamburug'larning 10^6 KHB/ml konsentratsiyali suspenziyasi agarli Chapek ozuqa muhiti solingan Petri likopchasida gazon usulida 0,1 mldan ekildi va antagonist bakteriya bloklari Petri likopchasining o'rtasida 2 tadan joylashtirib chiqildi [14].

Tajribalar 3 takroriy nisbatda olib borildi. Barcha namunalar 7 kun davomida 25°C haroratda inkubatsiya qilindi. Antagonistik halqalar HiAntibiotic ZoneScale-c (Himedia) o'lchagichi yordamida o'lchandi.

Tadqiqot natijalari. O'tkazilgan tadqiqotlar natijasida eng faol antagonistlar *B. subtilis* 1/16 va *B. paramycooides* 1/15 shtammlari ekanligi ma'lum bo'ldi. Bu shtammlar *F. solani* 915, *A. flaus* 1/15, *A.alternata* 879, *V. dahliae* 936 zamburug'lariga qarshi eng katta ingibirolovchi zonalar hosil qilishi aniqlandi. *B. subtilis* 6/20 va *B. subtilis* 6/23 shtammlarining eng kuchsiz antagonist ekanligi kuzatildi. (1-jadval, 1-rasm).

1-jadval.

Test shtammlarning fitopatogen mikromitsetlariga nisbatan antagonistligi (mm)

Shtamm nomlari	<i>A. flaus</i> 1/15	<i>A.alternata</i> 879	<i>F. solani</i> 915	<i>V. dahliae</i> 936
<i>B. subtilis</i> 1/16	39±0,9	37±0,5	39	0
<i>B. subtilis</i> 1/17	0	40±0,6	0	23
<i>B. subtilis</i> 6/20	0	18±0,2	0	11
<i>B. subtilis</i> 6/23	0	16±0,1	14	0
<i>B.paramycooides</i> 1/15	14	20±0,9	0	40
<i>B. pumilus</i> 1/2	20±0,9	17±0,8	0	0
<i>B. pumilus</i> 4/24	13	16±0,8	0	11

Olib borilgan tadqiqotlar davomida *B. subtilis* 1/16 shtammi *V. dahliae* 936 mikromitsetiga nisbatan 0 mm, *A. flaus* 1/15 ga nisbatan 39 mm, *A.alternata* 879 ga nisbatan 37 mm, *F. solani* 915 ga nisbatan 39 mm zona hosil qilishi aniqlandi. *B. subtilis* 1/17 shtammi *F. solani* 915 va *A. flaus* 1/15 zamburug'iga antagonistlik namoyon qilmadi, biroq, *A.alternata* 879 ga nisbatan 40 mm, *V. dahliae* 936 ga nisbatan 23 mm ingibirlash zonalarini hosil qildi. *B. pumilus* 1/2 bakteriya shtammi *A. flaus* 1/15 ga nisbatan 20 mm, *A.alternata* 879 ga nisbatan 17 mm antifungal faollik namoyon qildi. *B. paramycooides* 1/15 shtammi *V. dahliae* 936 ga nisbatan 40 mm, *A.alternata* 879 ga nisbatan 20 mm, *A. flaus* 1/15 ga nisbatan 14 mm zona hosil qilishi aniqlandi. *B. pumilus* 4/24 bakteriya shtammi *A. flaus* 1/15 ga nisbatan 13 mm, *A.alternata* 879 ga nisbatan 16 mm, *V. dahliae* 936 zamburug' mikromitsetiga nisbatan 11 mm antagonistlik xususiyatini namoyon qildi.





1-rasm. 1- *A. flaus* 1/15, 2- *A. alternata* 879, 3- *F. solani* 915, 4- *V. dahliae* 936 mikromitsetlariga nisbatan bakteriya shtammlarining antagonistlik munosabati.

Xulosa. O'tkazilgan tadqiqot natijalari asosida quyidagicha xulosa qilish mumkin: o'simliklarda kuchli patogenlik qiluvchi *F. solani*, *A. flaus*, *A. alternata* zamburug' shtammlariga nisbatan *Bacillus subtilis* va *V. dahliae* ga nisbatan *Bacillus paramycooides* bakteriya shtammlari kuchli antagonistlikni namoyon qilishi kuzatildi. Demak, ushbu turga mansub fitopatogen zamburug'larga qarshi biologik kurash chora-tadbirlarini kelgusida ishlab chiqishda tanlab olingan *B. subtilis* 1/16 va *B. paramycooides* 1/15 bakteriya shtammlaridan samarali foydalanish mumkin.

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