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## *FUSARIUM OXYSPORUM F. SP.* AGAINST VASINFECTUM *PAENIBACILLUS SP.* ANTAGONISTIC ACTIVITY OF BACTERIA

Annotation

In this study, the antagonistic activity of the bacterium *Paenibacillus sp*. against the fungus *Fusarium oxysporum f. sp. vasinfectum* (FOV) under in vitro conditions was studied. The interaction between bacteria and fungi was studied in 3 repeated experiments in Petri dishes using the dual culture method. The results showed a slowdown in the growth of the fungal mycelium around the bacterial colony and the formation of an inhibitory zone. This indicates the possibility of using Paenibacillus sp. as a potential biocontaminant.

**Keywords:** *Paenibacillus sp., Fusarium oxysporum*, antagonistic activity, biocontrol, in vitro.

## АНТАГОНИСТИЧЕСКАЯ АКТИВНОСТЬ БАКТЕРИЙ *PAENIBACILLUS SP.* ПРОТИВ *FUSARIUM OXYSPORUM F. SP. VASINFECTUM*

Аннотация

В данном исследовании была изучена антагонистическая активность Paenibacillus sp. против гриба *Fusarium oxysporum f. sp. vasinfectum* (FOV) в условиях in vitro. Взаимодействие бактерий и грибов изучали в 3-х повторных экспериментах в чашках Петри методом дуальной культуры. Результаты проявились в замедлении роста грибного мицелия вокруг колонии бактерий и образовании зоны ингибирования. Это указывает на возможность использования *Paenibacillus sp*. в качестве потенциального биоконтролирующего агента.

**Ключевые слова:** *Paenibacillus sp., Fusarium oxysporum*, антагонистическая активность, биоконтроль, in vitro.

## *FUSARIUM OXYSPORUM F. SP. VASINFECTUM* GA QARSHI *PAENIBACILLUS SP.* BAKTERIYASINING ANTAGONISTIK FAOLLIGI

Annotatsiya

Ushbu tadqiqotda *Paenibacillus sp.* bakteriyasining *Fusarium oxysporum f. sp. vasinfectum* (FOV) zamburug‘iga qarshi in vitro sharoitda antagonistik faolligi o‘rganildi. Bakteriya va zamburug‘ o‘rtasidagi o‘zaro ta’sir dual kultura usuli yordamida petri kosachalarida 3 takroriy tajribada o‘rganildi. Natijalar bakteriya koloniyasi atrofida zamburug‘ mitseliy o‘sishini sekinlashuvi va ingibitsiya zonasining hosil bo‘lishi bilan namoyon bo‘ldi. Bu esa *Paenibacillus sp.* ning potentsial biokontrol agent sifatida foydalanish imkoniyatini ko‘rsatadi.

**Kalit so‘zlar:** *Paenibacillus sp., Fusarium oxysporum*, antagonistik faollik, biokontrol, in vitro.

**Mavzuga oid adabiyotlar tahlili.** Paxtaning ildiz chirish kasalligi (*Fusarium oxysporum f. sp. vasinfectum*) dunyo bo‘yicha paxtachilikda keng tarqalgan va iqtisodiy jihatdan katta zarar keltiruvchi muhim fitopatogen zamburug‘ hisoblanadi. Ushbu zamburug‘ o‘simlik ildizlariga kirib, o‘sishni sekinlashtiradi, tomir o‘tkazuvchanligini buzadi va o‘simlikning so‘lishiga olib keladi [1]. Dunyo bo‘ylab keng tarqalgan bu kasallik madaniy paxtaning barcha to‘rt turi — *Gossypium arboretum* L., *G. barbadense* L., *G. herbaceum* L. va *G. hirsutum* L. da uchraydi [2].

An’anaviy tarzda ushbu kasallikka qarshi kurashishda kimyoviy fungitsidlar qo‘llanadi, biroq ularning uzoq muddatli qo‘llanishi atrof-muhitga salbiy ta’sir ko‘rsatadi. Ular tuproq va suv tizimlariga o‘tib, mikroorganizmlar, o‘simliklar va hayvonlarga toksik ta’sir ko‘rsatadi hamda rezistent zamburug‘larning paydo bo‘lishiga sabab bo‘ladi. Shuningdek, ayrim fungitsidlar inson salomatligiga zararli bo‘lib, fungitsidlarni o‘rnini bosuvchi ekologik xavfsiz bo‘lgan muqobil variantlarni qo‘llash zaruratini keltirib chiqarmoqda [3].

*Paenibacillus* jinsiga mansub bakteriyalar ekologik jihatdan muhim mikroorganizmlar bo‘lib, ular o‘simliklarning o‘sishini rag‘batlantirish va kasallik qo‘zg‘atuvchi mikroorganizmlarga qarshi biologik nazoratni ta’minlash xususiyatiga ega [4]. Ularning ayrim turlari, xususan *Paenibacillus polymyxa*, *P. peoriae* va *P. terrae* antifungal faol moddalarning (*fusaricidinlar*, *polimiksinlar*, *paenibacillin* va boshqalar) ishlab chiqaruvchisi sifatida ma’lum [5]. Ushbu birikmalar turli xil fitopatogen zamburug‘lar, jumladan *Fusarium spp.*, *Rhizoctonia solani* va *Botrytis cinerea*ga qarshi yuqori antagonistik faollik ko‘rsatadi [6].

Bundan tashqari, *Paenibacillus* turlari sideroforlar, indol-3-sirka kislotasi (IAA) va fosfat erituvchi moddalar ishlab chiqarib, o‘simliklarning oziqlanishini yaxshilaydi va ularning stressga bardoshliligini oshiradi [7]. Shu sababli, ushbu tadqiqotda *Paenibacillus sp.* bakteriyasining *Fusarium oxysporum f. sp. vasinfectum* (FOV) zamburug‘iga qarshi antagonistik faolligi in vitro sharoitda dual kultura usuli yordamida baholandi [8]. Tadqiqot natijalari *Paenibacillus* turining paxtada Fusarium so‘lish kasalligini biologik nazorat qilishda potentsial biokontrol agent sifatidagi istiqbolini aniqlashga qaratildi.

**Tadqiqot metodologiyasi.** Tadqiqot obyekti sifatida ilgari ajratib olingan *Paenibacillus sp.* bakteriyasi hamda paxtaning so‘lish kasalligi qo‘zg‘atuvchisi - *Fusarium oxysporum f. sp. vasinfectum* (FOV) zamburug‘i ishlatildi. Bakteriya va zamburug‘ kulturalari Genetika va O’simliklar eksperimental biologiyasi insititutining Fitopatogen va boshqa mikroorganizmlar noyob ilmiy obyekti kolleksiyasidan olindi.

Tadqiqod olib borish uchun *Fusarium oxysporum f. sp. vasinfectum* (FOV) zamburug‘i kartoshka dekstroza agar PDA (potato starch 4 gm L-1, dextrose 20 gm L-1, va agar 15 gm L-1, pH 5.6) ozuqa muhitida bakteriya kulturasi esa ozuqaviy agar (pepton 5g/l, yeast extract 1.50 g/l, sodium chloride g/l, agar 15 g/l) ozuqa muhitida yangilab olindi.

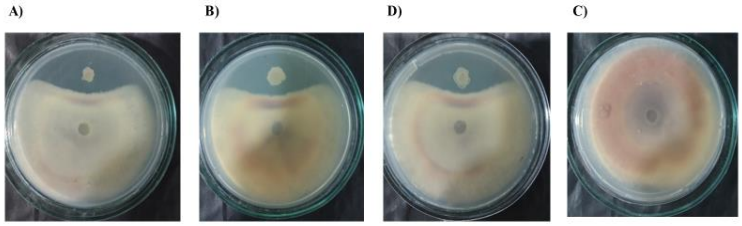
*Paenibacillus sp.* bakteriyasining antagonistik ta'siri dual-kulturali ozuqa muhitida 3 takoriy tajriba orqali baholandi. Dual-kulturali ozuqa muhiti PDA (potato starch 4 gm L-1, dextrose 20 gm L-1, va agar 15 gm L-1, pH 5.6) va ozuqaviy agar (pepton 5g/l, yeast extract 1.50 g/l, sodium chloride g/l, agar 15 g/l) 1:1 nisbatda aralashtirilib tayyorlandi.

*Tajriba uchun Fusarium oxysporum f. sp. vasinfectum* (FOV) zamburug‘i mitseliylaridan kesilgan diametri 5 mm li bo‘lgan diskni dual-kulturali ozuqa muhiti bo‘lgan petri likopchasi markaziga qo‘yildi va bakterial izolyat markazdan 3 sm masofada joylashgan joyga ekildi, 30 °C haroratda 7 kun davomida termostatda inkubatsiya qilindi**.** Inkubatsiya muddati tugagach, zamburug‘ koloniyalarining o‘sish diametrlari (mm) o‘lchandi va bakteriya ta’siridagi mitseliy o‘sish darajasi nazorat varianti bilan solishtirildi. Ingibitsiya foizi quyidagi formula bilan aniqlandi:

**Ingibitsiya (%) = [(R-r)/R]*100%**

bunda R- nazorat zamburug’ diametri, r- bakteriya bilan ekilgandagi zamburug’ diameti [9].

**Tahlil va natijalari.** Tajriba natijalariga ko‘ra, *Paenibacillus sp.* bakteriyasi *Fusarium oxysporum f. sp. vasinfectum* (FOV) zamburug‘i mitseliysini o‘sishini sezilarli darajada pasaytirdi (1 – rasm).




**1–rasm:** *Paenibacillus sp.* bakteriyasining *FOV* mitseliylariga ta’sirini ko‘rsatuvchi uchta takroriy namuna (dual kultura, 7 kun, 30 °C). **(A,B,D – tajriba variantlari, C – nazorat )**

Nazorat varianti (faqat FOV)da zamburug‘ koloniyasi diametri **86.36 mm** bo‘lgan bo‘lsa, bakteriya bilan ekilgan petri chashkalarda mitseliy diametri mos ravishda **58.82 mm**, **62.17 mm** va **59.72 mm** ni tashkil etdi. O‘rtacha mitseliy diametri **60.24** bo‘lib, bu nazoratga nisbatan **30.25 %** o‘sish ingibitsiyasini ko‘rsatdi (1 – jadval). Bakteriya ta’sirida zamburug‘ mitseliylari atrofida to‘xtab qolgan o‘sish zonalari (ingibitsiya zonalari) kuzatildi. Bu holat *Paenibacillus sp.* tomonidan ishlab chiqarilgan antifungal metabolitlar yoki volatil moddalar mitseliy o‘sishini to‘sib qo‘yganini ko‘rsatadi. Shunga o‘xshash natijalar boshqa tadqiqotchilar tomonidan ham qayd etilgan.

1-jadval

| № | Tajriba varianti | Koloniya diametri (mm) | Ingibitsiya (%) |
|---|---|---|---|
| A | *Paenibacillus sp.* + FOV | 58.82 | 31.89 |
| B | *Paenibacillus sp.* + FOV | 62.17 | 28.01 |
| D | *Paenibacillus sp.* + FOV | 59.72 | 30.84 |
| **C** | **Nazorat (FOV)** | **86.36** | – |
| **O‘rtacha** | — | **60.237** | **30.25** |

Masalan, Paenibacillus elgii JCK1400 shtammi tomonidan ishlab chiqarilgan pelgipeptin turkumiga mansub lipopeptidlar ham turli o‘simlik patogen zamburug‘lariga qarshi yuqori antifungal faollik ko‘rsatgani aniqlangan. Xususan, pelgipeptin C birikmasi *Botrytis cinerea* va *Rhizoctonia solani* kabi zamburug‘larning mitseliy o‘sishini samarali ravishda to‘xtatgan [10].

**Xulosa.** Olingan natijalarga ko‘ra, *Paenibacillus sp.* bakteriyasi paxtaning Fuzarium so‘lish kasalligiga sabab bo‘luvchi zamburug‘ga qarshi samarali antagonistik xususiyat ko‘rsatdi. Bakteriyaning tabiiy antifungal faoliyati uni ekologik xavfsiz, kimyoviy fungitsidlarga muqobil biopreparat ishlab chiqishda istiqbolli ob’yekt sifatida tavsiya etish imkonini beradi.

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