

**PROFIL BAKTERIOSIN PUTATIF DAN
KUALITAS KOPI ROBUSTA (*Coffea canephora* Pierre ex A Froehner)
HASIL FERMENTASI KERING DENGAN KO-INOKULASI
Lactobacillus bulgaricus dan *Saccharomyces cerevisiae***

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INTISARI

Penurunan minat terhadap kopi Robusta dipengaruhi persepsi kualitasnya yang dianggap lebih rendah dibandingkan Arabika. Fermentasi kering terkontrol dengan ko-inokulasi bakteri asam laktat (BAL) dan khamir merupakan pendekatan potensial untuk meningkatkan mutu kopi Robusta. Penelitian ini bertujuan mengevaluasi profil bakteriosin putatif serta kualitas mikrobiologis, kimia, dan sensori kopi Robusta hasil fermentasi kering dengan ko-inokulasi *Lactobacillus bulgaricus* dan *Saccharomyces cerevisiae*. Empat perlakuan digunakan: kontrol tanpa inokulum, inokulasi tunggal *L. bulgaricus*, *S. cerevisiae*, dan ko-inokulasi keduanya, dengan lama fermentasi 0, 8, dan 14 hari. Aktivitas antibakteri bakteriosin putatif diuji terhadap *E. coli* dan *S. aureus* pada variasi pH, suhu, dan enzim protease. Analisis profil kualitas kopi meliputi total mikroba dan BAL, senyawa volatil (GC-MS), kadar kafein (HPLC), dan uji sensoris (metode cupping). Data dianalisis secara statistik menggunakan ANOVA dilanjutkan uji Tukey ($p < 0.05$). Hasil menunjukkan bahwa ko-inokulasi meningkatkan populasi BAL hingga $>10^7$ CFU/g pada hari ke-14 dibanding kontrol dan perlakuan tunggal. Isolat BAL terpilih (K1, K2, K9, K10) menunjukkan aktivitas antibakteri bakteriosin putatif stabil pada rentang pH 2–8, suhu 40–80 °C, dan -4°C, namun menurun dengan perlakuan enzim protease mengindikasikan sifat *proteinaceous*. Profil kopi robusta hasil ko-inokulasi menghasilkan 115 senyawa volatil dengan peningkatan *pyridine/pyrrole* dan *furane/furanone*. Kadar kafein menurun 45,6% dibanding kontrol. Secara sensori, ko-inokulasi menghasilkan skor SCA 88,16 (Excellent) dengan karakter floral, fruity, berry, sweetness tinggi, clean cup, dan tekstur syrupy; sedangkan kontrol hanya 82,83 (Very Good) dengan karakter nutty, spicy, dan body lebih tipis yang relevan dengan profil kimia. Temuan ini menegaskan efektivitas ko-inokulasi BAL–khamir dalam meningkatkan mutu kopi Robusta.

Kata Kunci: Bakteriosin putatif, Fermentasi kering, Kopi robusta, *Lactobacillus bulgaricus*, *Saccharomyces cerevisiae*

PUTATIVE BACTERIOCIN PROFILE AND QUALITY OF ROBUSTA COFFEE (*Coffea canephora* pierre ex a. froehner) PRODUCED BY DRY FERMENTATION WITH CO-INOCULATION OF *Lactobacillus bulgaricus* AND *Saccharomyces cerevisiae*

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ABSTRACT

The declining interest in Robusta coffee is largely influenced by the perception that its quality is inferior to that of Arabica coffee. Controlled dry fermentation with the co-inoculation of lactic acid bacteria (LAB) and yeast represents a promising approach to improving the quality of Robusta coffee. This study aimed to evaluate the putative bacteriocin profile as well as the microbiological, chemical, and sensory quality of Robusta coffee produced through dry fermentation with the co-inoculation of *Lactobacillus bulgaricus* and *Saccharomyces cerevisiae*. Four treatments were applied: a control without inoculum, single inoculation with *L. bulgaricus*, single inoculation with *S. cerevisiae*, and co-inoculation of both microorganisms, with fermentation durations of 0, 8, and 14 days. The antibacterial activity of putative bacteriocins was tested against *Escherichia coli* and *Staphylococcus aureus* under different pH, temperature, and protease enzyme conditions. Coffee quality profiling included total microbial and LAB counts, volatile compound analysis (GC–MS), caffeine content determination (HPLC), and sensory evaluation using the cupping method. Data were statistically analyzed using ANOVA followed by Tukey's test ($p < 0.05$). The results showed that co-inoculation significantly increased LAB populations to $>10^7$ CFU/g on day 14 compared with the control and single-inoculation treatments. Selected LAB isolates (K1, K2, K9, and K10) exhibited stable putative bacteriocin antibacterial activity across a pH range of 2–8, temperatures of 40–80 °C, and at –4 °C; however, activity decreased after protease treatment, indicating a proteinaceous nature. The co-inoculated Robusta coffee profile comprised 115 volatile compounds, with increased levels of pyridine/pyrrole and furan/furanone derivatives. Caffeine content was reduced by 45.6% compared with the control. Sensory evaluation revealed that co-inoculation achieved an SCA score of 88.16 (Excellent), characterized by floral, fruity, and berry notes, higher sweetness, a clean cup, and a syrupy mouthfeel, whereas the control scored 82.83 (Very Good) and was dominated by nutty and spicy notes with a thinner body, consistent with its chemical profile. These findings confirm the effectiveness of LAB–yeast co-inoculation in enhancing the quality of Robusta coffee.

Keywords: Bacteriocin, Dry fermentation, Robusta coffee, *Lactobacillus bulgaricus*, *Saccharomyces cerevisiae*