

## INTISARI

### PENGARUH PROBIOTIK TERHADAP MIKROBIOM BAKTERI DAN EKSPRESI GEN DI USUS NILA MERAH (*Oreochromis sp.*) YANG DIBERI PAKAN MAGGOT BSF (*Hermetia illucens*)

Maggot *black soldier fly* (BSF) merupakan pakan alternatif potensial untuk budidaya nila yang memiliki kelemahan berupa kandungan kitin dan lemak yang tinggi sehingga rendah daya cernanya. Penambahan probiotik pada pakan ikan berbasis maggot berpotensi untuk memperbaiki daya cerna. Penelitian ini bertujuan untuk mengetahui pengaruh aplikasi probiotik terhadap mikrobiom bakteri dan ekspresi gen di usus nila merah (*Oreochromis sp.*) yang diberi pakan maggot BSF (*Hermetia illucens*). Pemeliharaan ikan dilakukan dengan dua perlakuan dan tiga ulangan. Perlakuan yang diberikan yaitu perlakuan A : pemberian pakan dengan komposisi 30% maggot dan 70% pelet komersial yang diberi probiotik dan perlakuan B : pemberian pakan dengan komposisi 30% maggot dan 70% pelet komersial tanpa probiotik. Pengambilan sampel usus nila dilakukan setelah dua bulan pemeliharaan. Analisis mikrobiom dimulai dari ekstraksi DNA, pengecekan kualitas DNA, dilanjutkan analisis molekuler dengan metode *next generation sequencing* (NGS) menggunakan sekuensing amplicon 16S rDNA. Berdasarkan hasil analisis mikrobiom bakteri di usus, aplikasi probiotik dapat meningkatkan keragaman bakteri yang bermanfaat bagi inang dengan *Amplicon Sequence Variant* (ASV) pada perlakuan probiotik (A) sebanyak 25, sedangkan perlakuan tanpa probiotik (B) sebanyak 8. Selain itu, keragaman alfa bakteri usus ikan yang diberi probiotik lebih tinggi dari ikan yang tidak diberi probiotik. Analisis ekspresi gen dimulai dengan ekstraksi RNA, pengecekan kualitas RNA, dilanjutkan *Reverse transcription*-qPCR, dan analisis data. Aplikasi probiotik dapat meningkatkan ekspresi gen Ghrelin, Muc-2, IL-1 $\beta$ , dan I-FABP, tetapi tidak meningkatkan ekspresi gen CD-36. Penelitian ini meningkatkan pengetahuan mengenai teknik aplikasi probiotik dalam budidaya nila dengan pakan kombinasi maggot sehingga meningkatkan efisiensi pakan dan produktivitas budidaya.

**Kata kunci :** bakteri, molekuler, *next generation sequencing* (NGS), RT-qPCR

## ABSTRACT

### THE EFFECTS OF PROBIOTICS ON THE BACTERIAL MICROBIOME AND GENE EXPRESSION IN THE GUT OF RED TILAPIA (*Oreochromis sp.*) FEED WITH BSF MAGGOTS (*Hermetia illucens*)

Despite the potency of black soldier fly (BSF) maggots for an alternative feed in tilapia culture, the high chitin and fat contents in maggots cause the low digestibility. The addition of probiotics to maggot-based fish feed has the potential to improve the digestibility. This study aimed to determine the effect of probiotic application on the bacterial microbiome and gene expression in the intestines of red tilapia (*Oreochromis sp.*) fed with BSF maggot (*Hermetia illucens*). Fish rearing was carried out with two treatments in three replications. The treatment A: feeding with a composition of 30% maggot and 70% commercial pellets with probiotics and treatment B: feeding with a composition of 30% maggot and 70% commercial pellets without probiotics. Red tilapia intestine samples were taken after two months of rearing. Microbiome analysis was initiated by DNA extraction, checking DNA quality, followed by molecular analysis using the next generation sequencing (NGS) method using 16S rDNA amplicon sequencing. Based on the results of the analysis of the bacterial microbiome in the intestine, the application of probiotics increased the diversity of bacteria that were beneficial to the host with Amplicon Sequence Variant (ASV) in the probiotic treatment (A) by 25, while in the treatment without probiotics (B) by 8. In addition, the alpha diversity of bacteria the intestines of fish given probiotics were higher than fish control group. Gene expression analysis begun with RNA extraction, checking RNA quality, followed by reverse transcription-qPCR, and data analysis. Probiotic application increased the expression of the Ghrelin, Muc-2, IL-1 $\beta$ , and I-FABP genes, but did not increase the expression of the CD-36 gene. This research improved the understanding of probiotic application techniques in tilapia culture with a combination of maggot feed, thereby increasing feed efficiency and productivity.

**Keywords :** bacteria, molecular, next generation sequencing (NGS), RT-qPCR