

## Karakterisasi dan ekspresi *heat shock protein 70* (Hsp70) pada *Pentalonia nigronervosa* yang mengaksess tanaman pisang terinfeksi *Banana bunchy top virus* (BBTV)

Indah Nuraini  
18/435049/PMU/09560

### INTISARI

*Heat shock protein* (Hsp) adalah superfamili *molecular chaperone* yang fungsinya meregulasi kerja berbagai proses seluler. Famili Hsp70 adalah anggota superfamili Hsp yang paling banyak dipelajari karena mempunyai tingkat kelestarian (*conserved*) yang tinggi. Terdapat dua kategori Hsp70; Hsp70 yang bersifat *inducible* dan Hsp70 diekspresikan secara terus menerus (Hsc70). Hsp70 diketahui berperan dalam percepatan pematangan protein virus, regulasi siklus virus serta koordinasi kondisi fisiologi antara virus dan inangnya. *Banana bunchy top virus* (BBTV) ialah agen penyebab penyakit *Banana bunchy top disease* (BBTD) yang ditransmisikan oleh aphid pisang yaitu *Pentalonia nigronervosa*. Analisis *in silico* yang dilakukan terhadap data transkriptomik *RNA-Seq* yang diunduh dari *GenBank* menunjukkan adanya keragaman anggota Hsp70 serta perbedaan ekspresi gen *hsp70* pada *P. nigronervosa* Vr (*viruliferous*) dan NVr (*Non-viruliferous*) terhadap BBTV. Dalam penelitian ini dilakukan analisis *in silico* untuk mempelajari karakteristik fisikokimia, pemodelan homologi dan hubungan filogenetik Hsp70 dan Hsc70 pada *P. nigronervosa* serta validasi pengaruh periode akses virus *P. nigronervosa* yang dipaparkan terhadap tanaman pisang yang diinfeksi BBTV untuk dilihat asosiasinya dengan level ekspresi gen *hsp70* melalui uji *quantitative Real-time Polymerase Chain Reaction* (qRT-PCR). Lama perlakuan periode akses virus ialah 0, 1, 5, 10 dan 20 jam. Hasil penelitian ini menunjukkan terdapat 7 dan 3 gen penyandi PnHsp70 dan PnHsc70, secara berturut-turut. Struktur PnHsp70 dan PnHsc70 disusun oleh 3 kelompok domain; *nucleotide-binding domain* (NBD) pada bagian N terminus dan *substrate-binding domain* (SBD) (SBD $\beta$  dan SBD $\alpha$ ) pada bagian ujung C terminus yang diakhiri oleh motif EEVD yang *conserved*. Analisis hubungan filogenetik menunjukkan bahwa PnHsp70 berada pada cabang yang sama dengan Hsp70 milik spesies anggota ordo Hemiptera. Sedangkan PnHsc70 berada di luar grup Hsc70 yang berasal dari spesies anggota ordo Hymenoptera, Diptera dan Lepidoptera. Hasil uji perlakuan periode akses virus *P. nigronervosa* terhadap BBTV menunjukkan bahwa secara umum ekspresi gen *hsp70* mengalami *upregulated* dengan tidak ada beda signifikan ( $p > 0.05$ ) pada semua perlakuan. Penelitian ini diharapkan dapat memberikan informasi mengenai karakteristik Hsp70 serta ekspresinya terkait interaksi antara *P. nigronervosa* sebagai vektor BBTV dengan tanaman inang yang sudah diinfeksi BBTV.

**Kata kunci:** *Heat shock protein*, Hsp70, Hsc70, *Banana bunchy top virus* (BBTV), *Pentalonia nigronervosa*

## Characterization of heat shock protein 70 and its expression related to the plant accession period of *Pentalonia nigronervosa* on BBTV-infected banana plants

Indah Nuraini  
18/435049/PMU/09560

### ABSTRACT

Heat shock proteins (Hsps) are superfamily of molecular chaperones involved in regulating various cellular processes. The Hsp70 family is the most studied member of the Hsp superfamily because it's highly conserved. There are two categories of Hsp70; inducible Hsp70 and constitutive Hsp70 (Hsc70). Hsp70 is known to play a role in the acceleration of viral protein maturation, regulation of the viral cycle, and coordination of physiological conditions between the virus and its host. *Banana bunchy top virus* (BBTV) is an agent causing Banana bunchy top disease (BBTD) transmitted by banana aphids, *Pentalonia nigronervosa*. In silico analysis carried out on RNA-Seq data downloaded from GenBank showed the diversity of Hsp70 members and their expression difference in BBTV Vr (viruliferous) and NVr (non-viruliferous) *P. nigronervosa*. In this research, in silico analysis was carried out to study physicochemical characteristics, homology modeling, phylogenetic relationships of Hsp70 and Hsc70 of *P. nigronervosa*, and validation of the effect of the plant access period of *P. nigronervosa* exposed to BBTV-infected banana plants to study its association with the expression level of the *hsp70* gene through Real-time Polymerase Chain Reaction (qRT-PCR) quantitative test. The variation of treatments for the plant access period was 0, 1, 5, 10, and 20 hours. The results of this study indicated that there were 7 and 3 genes encoding PnHsp70 and PnHsc70, respectively. The PnHsp70 and PnHsc70 structures are composed of 3 domain groups; The nucleotide-binding domain (NBD) at the N terminus and the substrate-binding domain (SBD) (SBD $\beta$  and SBD $\alpha$ ) at the end of the C terminus terminated by the conserved EEVD motif. Phylogenetic relationship analysis showed that PnHsp70 is on the same branch with Hsp70 belonging to the species of the order Hemiptera. Meanwhile, PnHsc70 is outside the Hsc70 group belonging to the species of the order Hymenoptera, Diptera, and Lepidoptera. The results of the plant access period of *P. nigronervosa* showed that in general, the *hsp70* gene expression was upregulated with no significant difference ( $p > 0.05$ ) in all treatments. This research was expected to provide information of the Hsp70 characteristics and its expression related to the interaction between *P. nigronervosa* as a BBTV vector and BBTV-infected host plants.

**Keywords:** Heat shock protein, Hsp70, Hsc70, *Banana bunchy top virus* (BBTV), *Pentalonia nigronervosa*.