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Opinion

Photorhabdus Insect-Related Proteins (*Pir*AB) an Insecticidal Toxin against Dengue Vectors, *Aedes aegypti*

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A number of vector-borne diseases posed genuine problems, including health and economic problems. Dengue fever is among the most hazardous vector-borne disease, which concern the public health issue [1]. The major cause of the fever is dengue virus (DENV), is a mosquito-borne RNA$^{(+)}$ (positive stranded) virus, belongs to *Flaviviridae* family and *Flavivirus* genus [2]. Mosquito *Aedes aegypti* is the major vector and source of transmission of dengue virus. Toxins from *Bacillus thuringiensis* had been successfully used against the larvae of *A. aegypti*, but a gradual resistance was notice in the insects against the toxins over the years [3].

Photorhabdus bacteria such as *P. luminescens, P. temperata* and *P. asymbiotica* produce an array of new toxins and virulence factors, against the insects including *A. aegypti,* and no resistance has been reported in the insect vectors against these toxins to date [3,4]. All three species of *Photorhabdus* are nematodes symbiont of the genus *Heterorhabditis* [5].

Photorhabdus sp. are now well known entomopathogenic bacteria against a wide range of insects when released in to the gut of insects [2]. Complete genome analysis of *Photorhabdus* sp. revealed that genes encoding hemolysins, and proteases are critical of insecticidal activities [6]. The lici; plu4092-4093 and plu4436-4437 encoding polypeptide chains in *Photorhabdus* sp., have been termed as *Pir*A and *Pir*B, respectively, for "*Photorhabdus* insect-related proteins A and B," reveal sequence similarity with endotoxins of *B. thuringiensis* as well as with developmentally regulated protein from *Leptinotarsa decemlineata* [7].

Moreover, it has been reported that the *Pir*AB toxin from *Photorhabdus* sp. had the potential to kill larvae of many insects including *A. aegypti.* The *Pir*AB toxin have been determined to equally effective, either expressed in *E. coli* expression system or/and purified from the culture of *Photorhabdus* sp [8]. The *Pir* toxins function as binary proteins and both are necessary for insecticidal activity [9]. All the two components of *Pir* (*Pir*A and *Pir*B) are encoded by genes, located at plu4093-4092 (*pir*A) and plu4437-4436 (*Pir*B) loci in *Photorhabdus* genome. Both *Pir* components exhibit a strong functional similarity to the δ-endotoxins of *B. thuringiensis*, which make them a substitute of *Bt* toxin [9]. *Pir*A component of the binary protein exhibits a bit sequence similarities with known toxic proteins, however, its counterpart (*Pir*B) shows strong sequence similarity with the N-terminal side of the pore-forming domain of the Cry2A insecticidal toxin [10]. These similarities suggest the presence of a similar motif in *Pir*AB. Moreover, *Pir*B has also a strong similarity with the developmentally regulated protein (DRP) of *L. decemlineata* [11]. The DRP has been thought to have a putative juvenile hormone esterase (JHE) property because of its pattern of expression, that matches insect development profile and the levels of JH produced [12]. It is therefore, assumed that *Pir*B may exhibit the same kind of activity. However, further study is need to elucidate a the *Pir*B activity [6,13].

It has been evaluated in a comparative study of the rate of mortality of *Pir*AB, *Pir*A and *Pir*B, when applied to *A. aegypti*. The *Pir*AB was most effective against the larvae of *A. aegypti* as compared to *Pir*A or *Pir*B exclusively [14]. The *Pir*B activity was improved gradually and was tended to be stable after 2 days. However, *Pir*A caused mortality in larvae of *A. aegypti* and tended to be stable after 4 days of treatment [14].

It is concluded that chemical control of *A. aegypti* has more hazardous environmental consequences and biological control is a best solution against the dengue virus. However, there are consistent raise of resistance against *Bt* and other biocontrol system. *Photorhabdus* toxins are comparatively new and more efficient and the level of the resistance in the insects is still at very primitive. The *Photorhabdus* toxins *Pir*AB is more efficient *A. aegypti,* and can to used against *A. aegypti* to control the dengue fever.

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