

BACILLUS THURINGIENSIS, MPOB SRBT1 FOR CONTROLLING METISA PLANA (LEPIDOPTERA: PSYCHIDAE)

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B *acillus thuringiensis* (*Bt*) is a rod-shaped 1-1.2 microns, gram-positive, facultative anaerobic, spore forming bacterium. During sporulation, it produces insecticidal crystal proteins (ICP) or δ -endotoxins or Cry proteins. The primary insecticidal activity of *Bt* is due to the ICP. The Cry proteins were grouped according to their specific toxicity towards certain insect orders. The δ -endotoxins have been classified into four (Cry1 to Cry4) major classes based on insect specificity and DNA homology (Hofte and Whiteley, 1989). *Bt* is very target specific, therefore field application can conserve beneficial predators, parasitoids, pollinators, birds, fishes, man and the ecosystems. More than 50 insect species belonging to the orders Lepidoptera, Diptera and Coleoptera are known to be susceptible to *Bt* (Bajwa and Kogan, 2001). Palm defoliators including bagworms, and nettle caterpillars and bunch moth were successfully controlled using commercial *Bt* product (Mohd Basri *et al.*, 1994).

MECHANISM OF ACTION

To be effective, *Bt* must be ingested by palm defoliators. Susceptible insect has strongly alkaline mid-gut, specific proteolytic enzymes and suitable tissue receptor sites for the toxin (Bajwa and Kogan, 2001). Several of these Cry proteins are efficacious and have receptor proteins in gut lining of *M. plana* sized 125, 110, 100 and 45 kDa. Like a key fitting into the lock that allows the door to be opened with the toxins being the key and the receptors being the lock, this toxin binding led to insertion of toxin into

bbmv manifested as irreversible binding (Ramlah Ali, 2000; Ramlah Ali and Mahadi, 2001) generated 1-2 nm pores permeable to cations and small solutes. Consequently, the osmotic imbalance led to osmotic lysis (Carrol and Ellar, 1997) and insect death (Chen *et al.*, 1995).

NATIONAL SURVEY ON POSSIBLE USE OF MPOB SRBT1

Currently, a total of 24 574 ha of oil palm plantations are affected by defoliators. Of the 382 estates that responded, 48% expressed interest in MPOB SRBT1 involving infested area of 19 652 ha and 4922 ha with bagworms and nettle caterpillars, respectively (Figure 1) (Ramlah Ali, 2002).

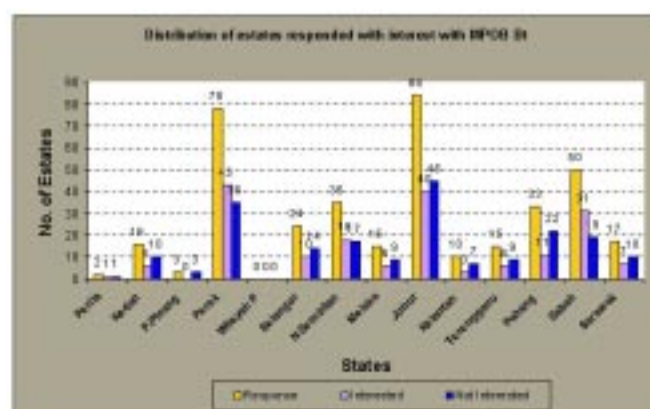


Figure 1. Nationwide survey on possible use of MPOB SRBT1 for palm defoliators.

Total distributed: 1565

Total hectarage infested with bagworms: 19 652 ha.

Total hectarage infested with nettle caterpillar: 4922 ha.



PROPAGATION AND FORMULATION OF MPOB SRBT1

The potential of SRBT1 for controlling *M. plana* was documented (Ramlah Ali and Mohd Basri, 1997). PCR screening for gene content showed that it has toxins effective for bagworm. Isolate was cultured for solid and liquid fermentation. Fermented propagules were harvested, autolysed and analysed qualitatively and quantitatively prior to formulation (Figure 2).



Figure 2. Laboratory scale production of MPOB SRBT1. a) harvesting of active ingredient and b) formulated powder.

LABORATORY BIOASSAY

Laboratory evaluation of active ingredient of MPOB SRBT1 for controlling fourth larval instars of *M. plana* is as shown in Figure 3. At dose of C5, MPOB SRBT1 was as good as cypermethrin. At economical dose, C4, MPOB SRBT1 resulted in 94% kill. While, the laboratory evaluation of formulated wetttable powder of MPOB SRBT1 is as shown in Figure 4.

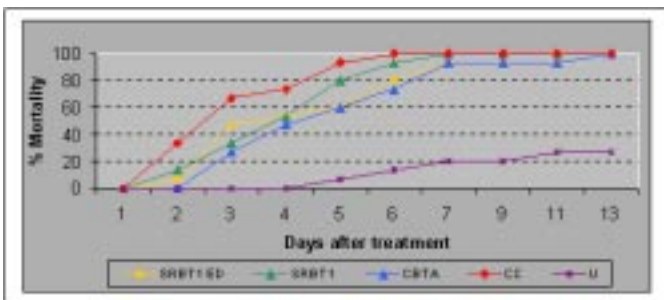


Figure 3. Daily mortality of fourth larval instar of *M. plana* treated with active ingredient of MPOB SRBT1 obtained using liquid state fermentation.

Control used were CBTA (Bt control), CC (sprayable chemical control) and U (untreated). Treatments were applied at recommended rate except ED (at economic dose).

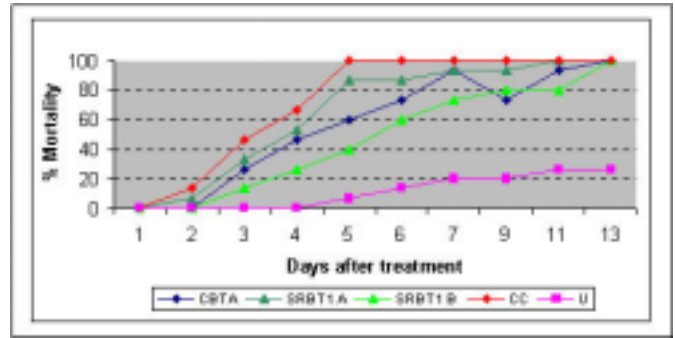


Figure 4. Daily mortality of fourth larval instar of *M. plana* treated with formulated MPOB SRBT1 obtained using liquid and solid state fermentation.

Control used were CBTA (Bt control), CC (sprayable chemical control), U (untreated) and SRBT1 A, B were obtained using liquid and solid state fermentation, respectively. Treatments were applied at recommended dose.

FIELD TRIAL

Field application of powder formulated MPOB SRBT1 at economic dose conducted using hand held motorized sprayer (Figure 5) covered about 60% of the palm foliage. Three days after treatment MPOB SRBT1 gave 70% control. MPOB SRBT1 was superior to cypermethrin, commercial Bt A and B (Figure 6).



Figure 5. Field application of MPOB SRBT1 using motorized hand held sprayer.

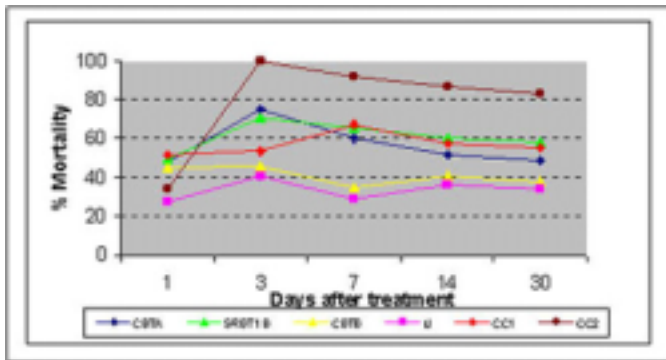


Figure 6. Field application of MPOB SRBT1 formulated product for controlling fourth larval instar of *M. plana*.

Control used were CBTA and CBTB (*Bt* control), CCI (sprayable chemical control), CC2 (trunk injected chemical control) and U (untreated).

BENEFIT OF THE PRODUCT

The MPOB SRBT1 product is non-toxic to the environment and it is comparable to chemicals in both laboratory and field applications. It is water soluble, easily sprayable and the active ingredient remained viable long enough on the foliage for control of palm insect pests. Cost for chemical control CC2 and CC1 was RM 175 and RM 110 ha⁻¹ round⁻¹, while that for MPOB SRBT1 was RM 90 and RM 130 ha⁻¹ round⁻¹ when applied with turbo mist blower and hand held motorized sprayer, respectively.

RECOMMENDATION

For better foliage and hectare coverage, protection for operators and to reduce labour cost of *Bt* spray, it is recommended that the turbo mist blower (Figure 7) with flexible nozzles or



Figure 7. Field application of MPOB SRBT1 using turbo mist blower.

spraying aircraft, be used. It is also strongly recommended that the spraying be conducted against second larval instars so that second round of spray can be conducted one week after the first spray.

CONCLUSION

MPOB SRBT1 formulated product is recommended to reduce reliance on chemicals for the control of bagworms.

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