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Evaluation of Effect of *Px*GV-Taiwanii on Cabbage moth *Plutella xylostella* (Lep.: Plutellidae) in Laboratory Conditions

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Abstract: The effect of one entomopathogenic virus (*Px*GV) was studied on cabbage moth *Plutella xylostella* with hope to find management strategies of this insect, based on biological control. Bioassay showed that, this virus has high virulence and can be considered as the important agents on the control of this insect. The LC_{50} value of *Px*GV for second instar larvae of cabbage moth was calculated 448.58 g mm^{-2}. The LT_{50} values for the same larvae with 749.89 and 1883.65 g mm^{-2} doses of *Px*GV were 6.04 and 6.85 days, respectively.

Key words: Baculovirus, cabbage moth, bioassay, LC_{50}, LT_{50}, canola

Cabbage moth is one of the important pest of cruciferous crops in Iran. This moth damages cruciferous plants especially varieties of cabbages, turnip, canola (oilseed rape), mustard by feeding from leaves. Occurrence of pesticide Resistance faced this pest control with challenge (Vastard *et al*., 2004; Sayyed *et al*., 2002). As a result, considering to biological agents like parasitoids, or microbial agents has been the goal of researchers (Sarfraz *et al*., 2005). Of course, there is some reports about occurring resistance in *P. xylostella* to biopesticides including *Bacillus thuringiensis* Kr (Narayanan, 2004), but another factors like being non-toxic for another animals made them trustful (Gelernter and Trumble, 1999). Granoluviruses are important parts of baculoviruses that used in biological control of insects especially Lepidoptera (Hunter-fujita *et al*., 1998; Moscardi, 1999). There is a cumulative trend for using these viruses in control of Lepidopteran pests (Lacey *et al*., 2001; Farrar and Ridgway, 1999; Kariuki and Mcintosh, 1999). *Cydia pommonella* GV is a successful sample in control of codling moth (Rezapanah *et al*., 2002). In recent decade many instances of GV application in IPM programs of cabbage moth recorded (Grzywacz *et al*., 2004; Ivey and Johnson, 1998). Different strains of this virus were collected and recognized by ren analysis from each other (Parnell *et al*., 2002; Abdul Kadir *et al*., 1999a). Because of great lack of study about utilizing baculoviruses in control of *P. xylostella* in Iran we conducted this research to begin a way to develop biological control of this pest in our country.

The larvae of *P. xylostella*, which were sampled from a trial in research farm of campus of agriculture and natural resources of University of Tehran in Karaj, Iran, were cultured in growth chambers. The isolate of virus was provided by Dr. Doreen Winstanely in 2005. The concentration of the specimen was estimated 7.1×10^{9} g mL^{-1}. The second instar larvae were used for estimating LC_{50} and LT_{50}. Experiments were carried out in 6 treatments, including different doses of virus plus distilled water (control) poured on leaf discs of canola and replicated three times. Every replicate consisted of 15 larvae and infection was performed by feeding on implicated leaves. 0.1 mL of each treatment was poured on leaf discs with a microaplicator and scattered monotonously. Survival rate was recorded in 24 h periods and going on until hatching of pupae. Determination of LC_{50} and LT_{50} was carried out by POLO-PC software.

The LC_{50} value was estimated 448.58 g mm^{-2} (Table 1, Fig. 1). Abdul Kadir *et al*. (1999b) recorded LC_{50} of Taiwanian isolate of *Px*GV on first, second and third instar larvae of cabbage moth $3.82\text{-}34.20\times10^{5}$, $1.51\text{-}2.63\times10^{6}$ and $0.64\text{-}1.07\times10^{6}$ OB mL^{-1}, respectively.

Table 1: Probit analyses of LC_{50} of on second larvae of cabbage moth

Virus	Slope±SE	LC_{50} (g mm^{-2})	Fiducial limits (g mm^{-2})
*Px*GV	1.06±0.15	448.58	276.3-687.35

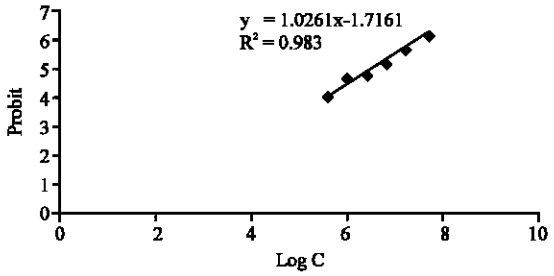

Fig. 1: Second instar larval mortality feeding on different concentrations of *Px*GV

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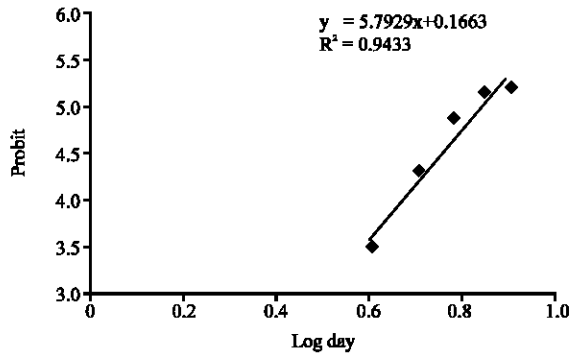

Fig. 2: Second larval mortality of cabbage moth feeding on 749.89 g mm^{-2} in different times

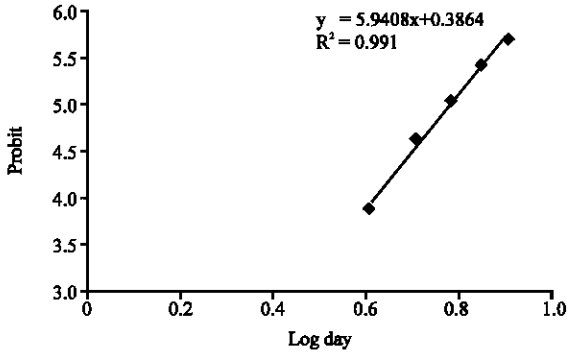

Fig. 3: Second larval mortality of cabbage moth feeding on 1883.65 g mm^{-2} in different times

Table 2: Probit analyses of LT_{50} of *Px*GV on second larvae of cabbage moth

Concentration of virus (g mm^{-2})	Slope±SE	LT_{50} (day)	Fiducial limits (day)
749.89	6.09±0.835	6.85	6.13-8.09
1883.65	6.64±0.7901	6.04	5.52-6.60

Bioassay experiments of *Px*GV Kenya (Nya 01), *Px*GV Kenya (Nya 04), *Px*GV Taiwan on second instar larvae of cabbage moth on Chinese cabbage leaves showed the values of 2.36×10^6, 3.94×10^7 and 1.55×10^7 OB mL^{-1} for LC_{50} in laboratory conditions. Comparisons of these data have shown no differences between potency of isolates (Grzywacs *et al.*, 2004). Results of Woodward *et al.* (2004) research have shown 1.3-2.1 OB as LD_{50} for *Px*GV Kenya. This value for *Px*GV China was 1.1 OB and for Japanese and Taiwanian isolates were recorded as 1.6 and 2.2 OB, respectively. They used droplet assay for experiments.

Rabindra *et al.* (1997) assayed *Px*GV India on second instar larvae of cabbage moth 5.89 OB mm^{-2} on Cauliflower leaf discs. In other researches which were conducted with non specific baculoviruses LC_{50} value was evaluated 5.54 OB cm^{-2} (Kariuki and Mcintosh, 1999).

As shown earlier there is a little difference in present results with other studies. Different biotypes of experiment insect and host plants, method of assay and condition of experiments (laboratory or field) could explain it to some extent.

The LT_{50} values for 749.89 and 1883.65 g mm^{-2} (which making 57.78 and 75.56% mortality, respectively) were calculated 6.04 and 6.85 days (Table 2, Fig. 2, 3). According to Woodward's report time mortality assays showed that one Kenyan isolate is 22% quicker than others in killing cabbage moth (Cherry *et al.*, 2004).

Present research proved that *Px*GV Taiwan as confirmed in another countries (Abdul Kadir *et al.*, 1999b; Grzywacs *et al.*, 2004; Woodward *et al.*, 2004) could be a reliable agent in controlling cabbage moth in Iran. Present preliminary research should be followed by field experiments and to find the best utilization of this virus for control of cabbage moth especially in IPM programs. There is a great domain of questions about application of *Px*GV alone or with other controlling agents such as parasitoids, predators, fungi, bacteria and pesticides.

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REFERENCES

Abdul Kadir, H., C.C. Payne, N.E. Crook and D. Winstanely, 1999a. Characterization and cross-transmission of baculoviruses infective to the diamondback moth, *Plutella xylostella* and some other lepidopterous pests of brassica crops. Bio. Sci. Technol., 9: 227-238.

Abdul Kadir, H., C.C. Payne, N.E. Crook, J.S. Fenlon and D. Winstanely, 1999b. The comparative susceptibility of the diamondback moth (*Plutella xylostella*) and some other major lepidopteran pests of Brassica crops to a range of baculoviruses. Bio. Sci. Technol., 9: 421-433.

Cherry, A. J., G. Mercadier, W. Meikle, M. Castelo-Branco and S. Schroer, 2004. The role of entomopathogens in DBM biological control. Proceedings of the International Symposium on Improving Biocontrol of *Plutella xylostella*, Montpellier, France, 21-24 October, 2002, CIRAD Publications, pp: 51-70.

Farrar, R.R. and R.L. Ridgway, 1999. Relative potency of selected nuclear polyhedrosis viruses against five species of Lepidoptera. J. Agric. Urban Entomol., 16: 187-196.

Gelernter, W.D. and J.T. Trumble, 1999. Factors in the success and failure of microbial insecticides in vegetable crops. Integrated Pest Manage. Rev., 4: 301-306.

Grzywacz, D., M.A. Parnell, G. Kibata, G. Oduor, J. Poole and D. Miano, 2004. The granulovirus of *Plutella xylostella* (diamondback moth, DBM) and its potential for control of DBM in Kenya. Proceeding of the International Symposium on Improving Biocontrol of *Plutella xyllstella*. Montpellier, France, 21-24 October, 2002, CIRAD Publications, pp: 179-183.

Hunter-Fujita, F.R., P.F. Entwistle, H.F. Evans and N.E. Crook, 1998. Insect Viruses and Pest Management. 1st Edn. Wiley and Sons Publ., New York, pp: 620.

Ivey, P.W. and S.J. Johnson, 1998. Integrating control tactics for managing cabbage looper (Lepidoptera: Noctuidae) and diamondback moth (Lepidoptera:Yponomeutidae) on cabbage. Trop. Agric., 75: 369-374.

Kariuki, C.W. and A.H. Mcintosch, 1999. Infectivity studies of a new baculovirus isolated for the control of the diamondback moth (Lepidoptera:Plutellidae). J. Econ. Entomol., 92: 1093-1098.

Lacey, L.A., R. Frutos, H.K. Kaya and P. Vail, 2001. Insect pathogens as biological control agents: Do they have a future? Bio. Control., 21: 230-248.

Moscardi, F., 1999. Assessment of the application of baculoviruses for control of Lepidoptera. Annu. Rev. Entomol., 44: 257-289.

Narayanan, K., 2004. Insect defence: Its impact on microbial control of insect pests. Curr. Sci., 86: 800-814.

Parnell, M., D. Grzywacs, K.A. Jones, M. Brawn, G. Oduor and J. Ong'aro, 2002. The strain variation and virulence of granulovirus of diamondback moth (*Plutella xylostella* L., Lep:Yponomeutidae) isolated in Kenya. J. Invert. Pathol., 79: 192-196.

Rabindra, R.J., N. Geethea, S. Renuka, S. Varadhaarajan and A. ReguPatholy, 1997. Occurrence of a granulosis virus from two populations of *Plutella xylostella* in India. Proceedings of the 3rd International Work Shop on Management of Diamondback Moth and other Crucifer Pests, Kuala Lumpur, Malaysia, 29 Oct.-1 Nov. 1996, pp: 113-115.

Rezapanah, M.R., A. Kharrazi-Pakdel, K. Kamali and J. Huber, 2002. Survey on natural occurrence of *Cydia pomonella* granulovirus in apple orchards of Iran. J. Applied Entomol. Phytopathol., 69: 7-9.

Sarfraz, M., A.B. Keddie and L.M. Dosdall, 2005. Biological control of the diamondback moth, *Plutella xyllstella*: A review. Bio. Sci. Technol., 15: 763-789.

Sayyed, A.H., M.R. Rizvi and A.H. Alvi 2002. Management of diamondback moth, *Plutella xylostella* (Lepidoptera:Plutellidae): A lesson from South East Asia for sustainable integrated pest management. Pak. J. Biol. Sci., 5: 234-245.

Vastard, A.S., S. Lingappa and K. Basavangoud, 2004. Stability of insecticide resistance in diamondback moth, *Plutella xylostella* L. Res. Pest Manage. Newsllet., 14: 2-4.

Woodward, D.T., D. Grzywacz and D. Winstanely, 2004. Biological and molecular characterization of granuloviruses isolated from diamondback moth in Kenya. Proceeding of the International Symposium on Improving Biocontrol of *Plutella xyllstella*. Montpellier, France, 21-24 October, 2002, CIRAD Publications, pp: 263-266.