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Public perception towards Prevention and Control Strategies to Counter Dengue Infection in Malaysia

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Abstract
In Malaysia, vector control method which include source reduction, environmental management, and larviciding with use of chemicals insecticide. This study aimed to determine the perception of the Malaysian public towards control measures of mosquitoes and utilization of biocontrol. A total of 402 responded to questionnaire during the survey activities in Selangor and Putrajaya, Malaysia. Questionnaires for respondents were divided into three sections comprised; i) respondent profile ii) knowledge about prevention of Dengue Fever and insecticide use for mosquito control iii) knowledge about biological control. Most of them reported (83%) concerned that fogging activities may affect their health and (56%) agreed that fogging activities may affect the environment. Public reported fogging (29.2%) method was most frequent method in control of mosquito population. Other control measures reported were the use of ABATE (mosquito larvae insecticide) with (28.9%) and the use of biocontrol; guppy fish were scored (15.5%). The most obvious effect of insecticide reported was negative effect to the environment, the use of insecticide will kill other non target organisms besides mosquitoes; and the use of insecticides is very costly. From the public's perception more than half (56%) knew about biocontrol as method to control mosquito population. In their opinion, the biological method is safe for human health. Based on the majority responded that guppy as the effective biocontrol agent other than other biological agents. The perception of control measures of mosquitoes is important for a successful community program or implementation of new control measures.

Keywords: vector control, perception, dengue, chemical control, biological control

1. Introduction

Mosquitoes such as *Aedes, Culex, Anopheles* and *Mansonia* are anthropophilic which causes them to be responsible for many diseases. Mosquitoes larvae are controlled mechanically, biologically, chemically or environmental management [1, 2]. Dengue is the most important arboviral disease globally and the fastest emerging arboviral infection posing a major public health concern throughout tropical and subtropical region in the world. The global increase of dengue incidence is also experienced by Malaysia with reported incidence of 30.2 cases per 100,000 population (2000) to 261.6 cases per 100,000 population. Dengue has high social and economic impact, affecting not just the patient, but also families. Prevention of dengue in Malaysia was established many years ago using the Integrated Vector Management (IVM) approach. The vector control approaches include chemical, environmental and community participation. This programme was led by the Ministry of Health with collaboration with other government agencies from states and districts all over the country [3]. With no medical cure for dengue currently available. Mosquito vector control remains one of the best tools for dengue prevention. Insecticide-based control plays a major role among other dengue control activities. [4, 5]. Several initiatives have been taken to strengthen dengue control. Some of the alternatives include repriortizing Aedes surveillance aimed at new breeding sites, strengthening information system for effective disease surveillance and response, legislative changes for heavier penalties, strengthening community participation and intersectoral collaboration, changing insecticide fogging formulation, mass abating and reducing case fatality [6].

2. Literature Review

2.1 Mosquito Control in Malaysia

The current strategy is to control the mosquito vectors, Aedes aegypti (L.) (primary vector) and Aedes albopictus Skuse (secondary vector). Mosquito control in a dengue programme generally comprises 3 major components: Vector control & surveillance; community participation and enforcement. In vector control, application of insecticides is often used widely to reduce and kill the infected mosquito population whenever cases are reported. The application of insecticides especially the pyrethroids is effected through space application in the form of cold or thermal fogging [7].

To control an outbreak of disease, fogging should be initiated immediately over a minimum area of 200 m radius around the affected places [8]. The activities carried out by the Ministry of Health and the Ministry of Housing and Local Goverment are house inspection, fogging, larviciding and enforcement of Destruction of Diseases Bearing Insect Act, 1995. House and premises inspection for *Aedes* and 'search and destroy' activities to reduce breeding sites in all premises are carried out regularly by the health personnel. Enforcement of law on those found breeding *Aedes* mosquitoes within their premises is usually taken as last resort, on uncooperative members of the public in the gazetted areas, after all efforts in health education on the need to destroy all potential breeding places of *Aedes*, have failed [9]. The most extensive effort to control of *Ae. albopictus* and *Ae. aegypti* in Singapore were includes environmental management, health education. Legal measures and community participation and chemical control is reserved solely for outbreaks of dengue hemorrhagic fever [10].

2.2 Chemical Control of Mosquito

In order to control and reduce the mosquito population, chemical applications are the main control agents in several countries.This method was used to prevent from mosquito borne diseases.The major classes of insecticide used are pyrethroid, organophosphate, carbamate and organochlorine [11]. All residents in affected area should be encouraged to apply temephos (ABATE ®) in all water- storing containers. For this purpose, sand granule formulation is recommended at a dosage of 10g/90 L water (about 1 mg/ L) [8]. Dengue control in Malaysia is primarily based on case surveillance by notification of suspected dengue cases by doctors and vector control by space spraying of insecticides [12].

Chemical insecticides are dispered by ultra-low-volume or/ and thermal fogging. Operations should be initiated immediately when first cases are reported. Fogging should be conducted within a minimum distance of 200 m radius (flight distance of *Aedes*) from affected house/houses. Two treatments should be conducted at 10-day intervals and the chemical used are preferably pyrethroids [8]. Fogging is done in areas where a case is reported, in outbreak areas, and areas identified as high risk (high density of *Aedes* mosquito) [9]. Larviciding or "focal" control of *Ae. aegypti* is usually limited to domestic-use containers that cannot be destroyed, eliminated, or otherwise managed. It is difficult and expensive to apply chemical larvicides on a long-term basis. Therefore chemical larvicides are best used in situations where the disease and vector surveillance indicate the existence of certain periods of high risk and in localities where outbreaks might occur [13].

2.3 Biological Control of Mosquitoes

Biocontrol or biological control is the method to control populations of pest by using other living organisms [14]. The biological control of mosquitoes and other pests involved introducing into the natural environment, the identified natural enemies, such as parasites, disease organisms and predatory animals. The effective use of these agents required a good understanding of the biology and behaviour of the target pests to be controlled as well as the local environmental conditions. Such methods could be most effective when used in combination with others, such as environmental manipulation or the application of larvicides that would not harm the biological control agents. Several organisms had proved effective against mosquito larvae such as larvivorous fish, mosquito of the genus *Toxorhynchites,* dragonflies, damselflies, cyclopoid copepods, nematode, *Bacillus thuringiensis* H-14 and *B. sphaericus* [10]. Biological control of mosquitoes was very popular during the early part of this century, but with the development and availability of chemicals such as organochlorines and organophosphates it was replaced by insecticidal control. However, because of problems with insecticide resistance and greater awareness of environmental contamination there has been renewed interest in biological methods [15].

3. Methodology

3.1 Questionnaire

Questionnaires were distributed among community in selected study locations in Selangor and Putrajaya. Questionnaires for community in study areas were divided into three sections comprised of: 1) respondent profile 2) knowledge about prevention of Dengue Fever and insecticide use for mosquito control 3) knowledge about biological control. The questionnaires were prepared in both languages English and Bahasa Malaysia to ensure accuracy of understanding and comprehension among the respondents. The questionnaires wer e adapted from [16] field surveys of exposure to pesticides standard protocol with additions and modification to meet the objectives of this research. The sample size calculation for this study is derived from [17]. Based on the [17] sample size of residents in study area were 402.

4. Results

4.1 Demographic Information

Demographic characteristics of residents in study area were shown in Table 4.1. A total of 402 responded to questionnaire during the survey activities. Table 4.1 summarised the social and demographic data of respondents. The public involved in this study was 49% males and 51% females. Most of them 24% aged between 24-29 years old, aged between 30-35 years old were 21, aged between 36-41 years old were (16%), aged between 42-47 years old (12%) and aged between 48 and above were (9%). Among them were Malay (97%) and India (3%). All the residents were completed secondary school and among them 28% had achieved higher education at diploma and 18% were degree holders.

TABLE 4.1: Social and Demographic Characteristics of Respondents in Selected Study Areas

Variables	Respondents (n=402)	
	Frequency(f)	Percentage (%)
Gender		
Male	196	49
Female	206	51
Age(years)		
18- 23	72	18
24-29	98	24
30-35	83	21
36-41	65	16
42-47	48	12
48 and above	36	9
Race		
Malay	390	97
Chinese	0	0
Indian	12	3
Others	0	0
Educational Status		
PMR	32	8
SPM	113	28
STPM	36	9
Certificate	35	9
Diploma	104	28
Degree	74	18

4.2 Perception on Control Measures of Mosquitoes

In scoring the respondents reported that the highest strategy used was fogging (29.2%) method. Other control measures reported by respondents was the use of ABATE (mosquito larvae insecticide) (28.9%). The use of biocontrol; guppy fish were scored to be 15.5% by respondents. There are 83% of the respondents concerned that fogging activities may affect their health and 56.7% agreed that fogging activities may affect the environment.

In the questionnaires the respondents also have to answer question regarding the effect of the use of insecticide apart from causing health problems to humans. The most obvious effect of insecticide reported by respondents was negative effect to the environment (25.7%), the use of insecticide will kill other non target organisms besides mosquitoes (26.7%) and the use of insecticides is very costly (26.9%). Other effects such as effect to animal had small percentage scores (19.8%).

4.3 Perception on Biocontrol Agent uses to Control Mosquito Population

Part D of the questionnaire was about biocontrol use to control mosquito population. From the respondents perception more than half (56%) knew about biocontrol method, do not know were (17%) and not sure (27%). Public was not sure that biological method is effective in controlling mosquitoes (47.9%). Most of public responded that biological method not polluting the environment (52.9%). About (40.7%) respondents were not sure that the biological control does not polluting the environment. In their opinion, (53.6%) responded that the biological method is safe for human health and (42.5%) were not sure. Based on the correspondee, majority responded that guppy as the effective biocontrol agent. This followed by using 14.3% of the public responded the using of toxo mosquito as one the method in controlling mosquito population. In addition, 4.4% of the respondents selected dragonfly nymph.

5. Discussion

5.1 Perception on the use of Control Measures of Mosquitoes

During questionnaires distribution 80% responses of public completed the questionnaires. Richardson [18] revealed when stating that 50% is regarded as an acceptable response rate. Other researchers stated that the response rate should be more than 50% as an acceptable response rate [19, 20,21,22,23]. This study has successfully obtained a good significant rate of response. Public/Community involved in this study were directly exposed with fogging activities. The perception of control measures of mosquitoes is important for a successful community program or implementation of new control measures. WHO [24] stated that in order to measures community program success, it is necessary to know the community's perceptions about mosquitoes, control measures and how the best communities can participate in the control efforts.

Public reported that the most control measure used was fogging. However, [25], revealed that the source reduction or cleaning up mosquito breeding sites was one of the most effective ways to control mosquito population. A study reported by Kumar and Gururaj [26] found that most of community are not aware of control measures of mosquitoes. The present study showed that although the respondent had a good knowledge on source reduction or cleaning up the mosquito breeding site as the control measure of mosquitoes however, they were not practicing what they knew. Davis [27] revealed that search and destroys activities of *Aedes* breeding had been conducted in Malaysia in 2008 and the Ministry of Health (MOH) reported considerable success with an 84% reduction in dengue cases in suburban. Jose and Craig [28] reported that the best approach for controlling *Ae. albopictus* and other *Stegomyia* species is to limit the availability of larval habitat.

According to WHO [29] the approaches to the prevention and control of dengue fever have relied on the control of the *Ae. aegypti* mosquito. "Vector control" refers to actions used to control a "vector" (in this case the mosquito), which can transmit a pathogen (the four dengue viruses). Fogging activity was carried out during outbreak of dengue cases, fogging of insecticides e.g. Malathion, Reslin and other synthetic pyrethroids to killing of adult mosquitoes in the affected area[30].Although fogging has the advantage to kill the adults mosquitoes but at the same time with disadvantages such as large volumes of organic solvents are used as diluents, which may have bad odour and result in staining, high cost of diluent and spray application, householders may object and obstruct penetration of fog into houses by closing windows and doors, fire risk from machinery operating at very high temperatures with flammable solvents, and can cause traffic hazards in urban areas [13]. Karunaratne, [31] reported that the source reduction and use of insecticdes in space spraying/ fogging and larviciding were the primary means of controlling the vector mosquitoes of *Ae. aegypti* and *Ae. albopictus*.

Other control measures reported was the use of ABATE (mosquito larvae insecticide) and using guppy fish. ABATE (mosquito larvae insecticide) was given by health personnel to public/community to control mosquito larvae breeding in container that can't be destroyed. Public responded awareness on the use of ABATE and use as control measure of mosquito larvae population. Similar results found by Koenraadt, [32] where most of the respondent in their study were aware about mosquito control by covering all containers of water storage use ABATE and fish. Temephos (ABATE), an organophosphate, is regularly used in containers for the control of *Ae. aegypti* larvae [33]. Phuanukoonon, [34] summarized that measures that prevent mosquitoes from developing in water-holding containers such as adding ABATE to containers, covering containers and or placing larvivorous fish in containers, were effective in reducing mosquito larvae. In Malaysia, the use of Abate larvicide on a large scale in high-risk areas was also initiated in 1998 to reduce Aedes larval density [6].

Respondent knew that the effect of insecticide besides causing health problem to human such as negative effect to the environment, insecticides will kill the non target organism, costing and effect to animal. Dynah, [35] reported that more than 50% of workers believed that insecticide can also affect the environment. They also stated that the chemical use can cause soil depletion, pollute water and can affect animals found in the community. Pesticide is a term used to describe a range of mixtures used to kill or reduce many types of pests [36]. According to [37] and [38] majority of pesticides is not specifically targeting the pest only also affects plants, animals, and contaminate wide range of environment including groundwater and surface water. Jansamood, [39] who found that the use of pesticides was rated as a high efficiency and they also had environmental impact and health impact. Certain insecticides for example DDT, was restricted, was because chemicals can build up in the oceans, air, soil, food chain, fresh water supplies [40,41,42].

Study conducted in Saudi Arabia found that the respondents had the knowledge on the effects of the use of pesticides. They were aware of the fact that pesticides cause pollution, can affect soil fertility and impose toxic effects on the soil [43]. Cornwall, [44] also reported the risk of pesticides on the environment and public health in the developing countries. Aktar, [45] concluded that the use pesticides have contaminate almost every part of environment such as impact on food commodities, contaminate soil, surface water, ground water and also non target organisms. Moreover, the economic impact of pesticides in non target species (including humans) has been estimated approximately $8 billion annually in developing countries.

5.2 Perception on Biocontrol Agent Uses to Control Mosquito Population

Public/community knew about biocontrol method in control mosquito population. Regarding biocontrol method the awareness of biocontrol method the percentage of not sure of biocontrol method was higher among public. Other study found that the knowledge concerning biocontrol and natural control was low among respondents in Gaza Strip. The lack of knowledge of biocontrol for vector control was the justification for the continuous use of insecticide [46]. Biological control measures were commonly used before the introduction of insecticides in the 1940s. Insecticides dominated vector control approaches after their introduction, but damage to the environment, vector resistance to insecticides, and community resistance to their use have resulted in a new focus on biological control measures [29]. One of the methods suggested by many researchers was use of biocontrol agent to control of vector population [47, 10, 48, 49].

Guppy was reported as the most choice for biological control agent by respondents. Fish are the most extensively used larval bio control agent. According to Chakraborty, [50] fishes have the greatest potential as biocontrol agents against the aquatic stages of mosquitoes and are used as major component of the integrated vector control programme. They also mentioned the most widely used of fish in India were *G.affinis*, *Aplocheilus panchax* and *P. reticulata*. Most commonly and reported of biocontrol agents used in mosquito control was guppy, *P. reticulata* [15]. The use of guppies (*P. reticulata*) to control dengue vector of *Ae. aegypti* in domestic water storage containers in rural areas in Cambodia was proven successfully [51]. The use of more than one biological control agent for the suppression of a vector species may prove feasible and should be encouraged wherever possible, since it may lead to an optimum level of vector suppression [52].

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7. References

[1] K. Herman, and B. Michael. Handbook of Environmental Health, 4th ed, Biological, Chemical, and Physical Agents of Environmentally Related Disease, National Environmental Health Association, USA, Lewis Publishers. 1(5): 313. 2002

[2] P. J., McCall, and P. Kittayapong. Control of dengue vectors: tools and strategies. Working paper for the Scientific Working Group report on dengue by the Special Programme for Research and Training in Tropical Diseases, 1 – 5 October 2006, Geneva, Switzerland. 2007

[3] P.R, Packeriasamy, C.W, Ng, D. Maznah, I. Jonathan, V.K, Balan, Y.A, Halasa, and D.S, Shepard. Cost of Dengue Vector Control activities in Malaysia. Am J Trop Med Hyg. 93(5);1020-1027. 2015

[4] World Health Organization (WHO). Dengue and severe dengue. Global burden of dengue. Geneva: WHO, 2017.

[5] B. Guy, O., Briand, J. Lang, M. Saville, and N. Jackson. Development of the Sanofi Pasteur tetravalent dengue vaccine: One more step forward. Vaccine .33(50):7100–11. pmid:26475445. 2015

[6] A.K., Teng, and S. Singh. Epidemiology and new initiatives in the prevention and control of Dengue in Malaysia. *Dengue Bulletin.* 25: 7-14. 2001

[7] H.L, Lee, A. Rohani. M.S, Khadri, W.A, Nazni, H. Rozilawati., A.H, Nurulhusna, A.H, Nor Afizah, A. Roziah, R. Rosilawati, and C.H., Teh. Dengue Vector Control in Malaysia- Challenges and Recent Advances. Article in International Medical Journal Malaysia. DOI: 10.31436/imjm.v14i1.448. 2015

[8] H.L., Lee. Aedes: mosquitoes that spread dengue fever. In: Mosquitoes and mosquito-borne diseases (ed. F.S.P. Ng and H.S. Yong): 45-61. 2000

[9] R. K., Singh, R. C., Dhiman, V. K., Dua, and B. C,. Joshi. Entomological investigations during an outbreak of dengue fever in Lal Kuan town, Nainital district of Uttarakhand, India. *Journal of Vector Borne Diseases.* 47 : 189–192. 2010

[10] World Health Organization (WHO). Technical report series no.737. Resistance of vectors and reservoirs of disease to pesticides. 10th report of the WHO Expert committee on vector biology and control. 1986

[11] R. Nauen. Insecticide resistance in disease vectors of public health importance, Pest Management Science, 63(7): 628 – 633. 2007

[12] V. Kumarasamry. Dengue fever in Malaysia: Time for review? *Medical Journal of Malaysia.* 61(1): 1-3. 2006

[13] World Health Organization. Space sprays application of insecticides for vector and public health pest control. A practitioner's guide. 2003

[14] N. Becker. Biological Control of Mosquitoes: Management of the Upper Rhine Mosquito Population as a Model Programme. An Ecological and Societal Approach to Biological Control, Springer. 227–245. 2006

[15] M.W., Service. Medical entomology for student. Second edition. University Press, Cambridge. 2000

[16] World Health Organization (WHO). Field Surveys of Exposure to Pesticides. Standard Protocol, Geneva. 2009
[17] R.V. Krejcie, and D.W. Morgan, Education and Physchological Measurement. 30: 607-610. 1970
[18] J.T.E. Richardson, Instruments for obtaining student feedback: a review of the literature. Assessment & Evaluation in Higher Education. 30(4): 387–415. 2005
[19] C. Cook, F. Heath, and R.L. Thompson, A meta-analysis of response rates in web or internet-based surveys. Educational and Psychological Measurement. 60(6): 821–836. 2000
[20] C.J. Dommeyer, P. Baum, K. Chapman, and R.W. Hanna, Attitudes of business faculty towards two methods of collecting teaching evaluations: paper vs. online. Assessment and Evaluation in Higher Education. 27(5): 455–462. 2002
[21] Watt, S., Simpson, C., McKillop, C., and Nunn, V. Electronic course surveys: does automating feedback and reporting give better results? Assessment & Evaluation in Higher Education. 27(4): 325–337. 2002
[22] C. Ballantyne, Measuring quality units: considerations in choosing mandatory questions. Paper presented at the Evaluations and Assessment Conference: A Commitment to Quality, University of South Australia, Adelaide, 2003
[23] C.S. Nair, C. Wayland, and S. Soediro, Evaluating the student experience: a leap into the future. Paper presented at the 2005 Australasian Evaluations Forum: University Learning and Teaching: Evaluating and Enhancing the Experience, UNSW, Sydney, 28–29 November. 2005
[24] World Health Organization, (WHO). Community participation in the prevention and control of DF/DHF. Report of a meeting of the WHO scientific working group, Bangkok, Thailand, 13-17 December 1983
[25] M. Yohannes, M. Haile, T. A., Ghebreyesus, K. H .,Witten, A. Getachew, P. Byass, S.W., Lindsay. Can source reduction of mosquito larval habitat reduce malaria transmission in Tigray, Ethiopia? Trop Med Int Health.10(12):1274-85. 2005 Dec. doi: 10.1111/j.1365-3156.2005.01512.x.
[26] K.R. Kumar, and G. Gururaj, (2005). Community perception regarding mosquito-borne diseases in Karnataka State, India. *Dengue Bulletin*. 29: 157- 164. 2005
[27] M.P. Davis, With DDT spraying, can show the world how to control Dengue. 21st Century Science & Technology. 53-60. 2009
[28] Jose and Craig, Biology, disease relationship and control of *Ae. albopictus*. Technical Paper 42. Pan American Health Organization (PAHO). ISBN 92 75 13042 6. 1995
[29] World Health Organization (WHO), Managing Regional Public Goods for Health Community-Based Dengue Vector Control. Regional Office for the Western Pacific. 2013
[30] H.H. Yap, Vector Control in Malaysia. *Journal of Malays Social Health*: 4: 7-12. 1984
[31] S.H.P.P, Karunaratne, T.C., Weeraratne, M.D.B., Perera, and S.N. Surendran, Insecticide resistance and efficacy of space spraying and larviciding in the control of dengue vectors *Aedes aegypti* and *Aedes albopictus* in Sri Lanka. *Pesticide Biochemistry and Physiology*. 107: 98-105. 2013
[32] C. Koenraadt, W. Tuiten, R. Sithiprasasna, U. Kijchalao, J. Jones, and T. Scott, Dengue Knowledge and Practices and their Impact on *Aedes aegypti* Populations in Kamphaeng Phet, Thailand. *American Journal of Tropical Medicine and Hygiene*. 74(4): 692- 700. 2006
[33] T. Chareonviriyaphap, B.Aum-aung, and S. Rattanatham, Current insecticide resistance patterns in mosquito vectors in Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health*. 30 (1): 184-194. 1999
[34] S. Phuanukoonon, I. Mueller, and J.H. Bryan, Effectiveness of dengue control practice in household water containers in Northeast Thailand. *Tropical Medicine & International Health*. 10: 755-763. 2005
[35] M. K. Dynah, S. M. R. Amoguis, C. D. Bontilao, J. A. W. Galarido, J. N. A. Lumamba, R. M. B. Paelmo, Experiences in Pesticide Used among Farm Workers and its Effect to their Health. *Nursing Research Journal*. 2:127- 139. 2010
[36] A.B. Fait, M. Iversen, S., Tiramani, and M. Maroni, Preventing health risks from the use of pesticides in agriculture. International Centre for Pesticide Safety. 2001
[37] R., Carson, Silent spring. 40th Edn. Houghton Mifflin Co., New York, ISBN 978-0618249060. 378. 2002

[38] S.S. Vega, Note on the toxicity of pesticides used in tropical crops. *Ciencias Ambientales.* 11: 181. 1994.
[39] C. Jansamood, Environmental impact and health impact from pesticides of Para rubber farmers at Phon Subdistrict Kham Muang District Kalasin Province. *Research Journal of Applied Sciences*. 8(5): 268-270. 2013
[40] S. Mansour, Persistent organic pollutants (POPs) in Africa: Egyptian scenario. Human and Experimental Toxicology 28: 531-566. 2009
[41] Y., Ogata, H. Takada, K. Mizukawa, H. Hirai, S. Iwasa, S. Endo, Y. Mato, *et al.* International Pellet Watch: Global monitoring of persistent organic pollutants (POPs) in coastal waters. 1. Initial phase data on PCBs, DDTs and HCHs. Marine Pollution Bulletin 58: 1437-1446. 2009
[42] H. van den Berg, Global status of DDT and its alternatives for use in vector control to prevent disease. Environmental Health Perspectives 117: 1656-1663. 2009
[43] A.A., Al- Zaidi, E.A., Elhag, S.H., Al – Otaibi, and M.B. Baig, Negative effects of pesticides on the environment and the farmers' awareness in Saudi Arabia: A case study. *Journal of Animal & Plant Sciences.* 21(3): 605-611. 2011
[44] J.E. Cornwall, M.L. Ford, T.S. Liyanage, and D.W.K Daw, Risk assessment and health effects of pesticides used in tobacco farming in Malaysia. *Journal of Health Policy Planning*. 10(4) : 431-437. 1995
[45] M.W., Aktar, D., Sengupta, and A. Chowdhury, Impact of pesticides use in agriculture: their benefits and hazards. *Interdisciplinary Toxicology*. 2(1): 1-12. 2009
[46] M.M., Yassin, T.A., Abu Mourad, and J.M. Safi, Knowledge, attitude, practice and toxicity symptoms associated with pesticide use among farm workers in Gaza Strip. *Journal of Occupational Environmental Medicine*. 59: 387-394. 2002
[47] A.W.A. Brown, Countermeasures for insecticide resistance. *Entomological Society American Bulletin*. 27: 198-202. 1981
[48] D.R. Robert, and R.G. Andre, Insecticide resistance issues in vector –borne disease control. *American Journal of Tropical Medicine and Hygiene*. 50 (suppl): 21-34. 1994
[49] T. Chareonviriyaphap, Pesticides avoidance behaviour in Anopheles albimanus. Bethesda, Maryland: Uniformed Services University of the Health Sciences (USUHS), PhD Thesis. 1995
[50] S., Chakraborty, S., Bhattacharya, and S. Bhattacharya, Control of mosquitoes by the use of fish in Asia with special reference to India: Retrospects and Prospects. Journal Manusia dan Lingkungan. 15(3): 147-156. 2008
[51] M. S. Chang, T. Setha, J. Nealon, D. Socheat, N. Chantha, and M.B. Nathan, Community-based use of the larvivorous fish *Poecilia reticulata* to control the dengue vector *Aedes aegypti* in domestic water storage containers in rural Cambodia. *Journal of Vector Ecology.* 33 (1): 139-144. 2008
[52] World Health Organization (WHO). Biological control of vectors disease. Six report of the committee on Vector Biology and Control. Technical Report Series 679. ISBN 9241206799. 1982