

Guideline specifications for bacterial larvicides for public health use

**Report
of the WHO
Informal
Consultation**

**28-30 April 1999
WHO, Geneva**





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**World Health Organization
Communicable Diseases Prevention and Control
WHO Pesticide Evaluation Scheme (WHOPES)**

World Health Organization
Geneva, Switzerland
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Contents

	Page
1. Introduction	1
2. Role of Bacterial Larvicides in Public Health	1
2.1 Current Uses	2
2.2 Integrated Control	3
2.3 Potential for Resistance	3
2.4 Future Prospects for Bacterial Larvicides	4
3. Registration Requirements, Including Quality Control and Safety Requirements for Bacterial Larvicides	4
4. Guideline Specifications for Bacterial Larvicides	9
4.1. Technical and Formulation-Specific Requirements and Objectives for Their Inclusion in the Specifications	9
4.1.1 Description of the Product	10
4.1.2 Active Ingredient	11
4.1.3 Physical and Physico-chemical Properties	11
4.1.4 Packaging	12
4.1.5 Labelling	13
4.2. Guideline Specifications for Technical Concentrate and Common Formulations of Bacterial Larvicides	13
4.2.1 Technical Concentrate (TK)	13
4.2.2 Aqueous Suspension Concentrate (SC)	15
4.2.3 Water Dispersible Granule (WG)	18
4.2.4 Wettable Powder (WP)	21
4.2.5 Water Dispersible Tablet (WT)	24
5. Recommendations	28
6. Annex 1. Determination of the toxicity of <i>Bacillus thuringiensis</i> subsp. <i>israelensis</i> and <i>B. sphaericus</i> Products	29
Annex 2. List of Participants	32

1	1918年	1
2	1919年	2
3	1920年	3
4	1921年	4
5	1922年	5
6	1923年	6
7	1924年	7
8	1925年	8
9	1926年	9
10	1927年	10
11	1928年	11
12	1929年	12
13	1930年	13
14	1931年	14
15	1932年	15
16	1933年	16
17	1934年	17
18	1935年	18
19	1936年	19
20	1937年	20
21	1938年	21
22	1939年	22
23	1940年	23
24	1941年	24
25	1942年	25
26	1943年	26
27	1944年	27
28	1945年	28
29	1946年	29
30	1947年	30
31	1948年	31
32	1949年	32
33	1950年	33
34	1951年	34
35	1952年	35
36	1953年	36
37	1954年	37
38	1955年	38
39	1956年	39
40	1957年	40
41	1958年	41
42	1959年	42
43	1960年	43
44	1961年	44
45	1962年	45
46	1963年	46
47	1964年	47
48	1965年	48
49	1966年	49
50	1967年	50
51	1968年	51
52	1969年	52
53	1970年	53
54	1971年	54
55	1972年	55
56	1973年	56
57	1974年	57
58	1975年	58
59	1976年	59
60	1977年	60
61	1978年	61
62	1979年	62
63	1980年	63
64	1981年	64
65	1982年	65
66	1983年	66
67	1984年	67
68	1985年	68
69	1986年	69
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74	1991年	74
75	1992年	75
76	1993年	76
77	1994年	77
78	1995年	78
79	1996年	79
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83	2000年	83
84	2001年	84
85	2002年	85
86	2003年	86
87	2004年	87
88	2005年	88
89	2006年	89
90	2007年	90
91	2008年	91
92	2009年	92
93	2010年	93
94	2011年	94
95	2012年	95
96	2013年	96
97	2014年	97
98	2015年	98
99	2016年	99
100	2017年	100

1. Introduction

Dr Arata Kochi, the Director of the Communicable Diseases Prevention and Control of WHO, on behalf of the Director-General opened the Consultation.

Dr Kochi noted that the increasing production and demand for bacterial larvicides, especially *Bacillus thuringiensis israelensis* (*Bti*), would require internationally agreed guideline specifications and test methods which would assure the production of efficient and safe larvicide products, protecting both consumers and manufacturer. Such guidelines would also promote the harmonization of relevant national standards and thus, world trade in such pesticides.

He added that the WHO Pesticide Evaluation Scheme (WHOPES), an international programme which co-ordinates the testing and evaluation of pesticides for public health use, publishes specifications for pesticides to be used as part of the International Code of Conduct on Distribution and Use of Pesticides.

Dr Kochi informed the participants that WHOPES has been traditionally testing/evaluating chemical pesticides for vector control, but is now planning to expand its activities to include a greater variety of pests and pesticides, including microbial larvicides.

Dr M. Zaim, scientist in charge of WHOPES, presented an overview of the Scheme and elaborated on the objectives and the work plan of the meeting. He stated the objective of the meeting as to prepare draft guideline specifications for bacterial larvicides, i.e., *Bti* and *B. sphaericus* (*Bsph*), for consideration by the WHO Expert Committee on Vector Biology and Control "Chemistry and specifications of pesticides". This Expert Committee could recommend their adoption by the World Health Assembly and subsequent publication as official WHO specifications.

The meeting was attended by 3 representatives of national registration authorities, the German Mosquito Control Association, 7 scientists, 9 representatives of industry, representatives of the Food and Agriculture Organization of United Nation (FAO) and the United Nations Environmental Protection, Chemicals (IRPTC), as well as the WHO Secretariat (Annex 2). The meeting reviewed the role and use of bacterial larvicides in public health as well as their registration requirements, including their quality control and safety requirements. The meeting also reviewed the requirements and objectives of their inclusion in the specifications of bacterial larvicides and drafted the guideline specifications for the most common formulations of bacterial larvicides.

2. Role of Bacterial Larvicides in Public Health

Bacterial pathogens of insects have been used to control crop and forest pests for almost five decades. However, it was not until the late 1970's that bacteria effective against insects of public health importance, primarily mosquitoes and blackflies, were discovered. The first of these, *Bacillus thuringiensis* subsp.

israelensis (*Bti*) proved so effective that within a few years of discovery it became a principal component of the Onchocerciasis Control Programme in West Africa, and soon thereafter was being used as an alternative for synthetic chemical insecticides in many mosquito control programmes where larviciding was a traditional control strategy. The second effective bacterium is *B. sphaericus* (*Bsph*), and although its target spectrum is restricted to certain types of mosquito larvae, its high efficacy in polluted waters has made it particularly useful against the ubiquitous *Culex* vectors of filariasis and certain viral encephalitis. In addition to vector control programs, public demand for control of nuisance mosquitoes and blackflies has resulted in widespread use of *Bti* in both developing and developed countries. During the past decade, *Bsph* has been used increasingly in operational control programs directed against polluted water mosquitoes in urban areas.

The rapid and remarkable success of *Bti*, and more recently *Bsph*, can be attributed to several factors. First among these are their remarkable safety, high efficacy and cost-effectiveness. Formulation technology has resulted in *Bti* and *Bsph* products that make them competitive with chemical insecticides in many habitats. In fact, when season-long control costs are evaluated, products based on these bacteria are often more cost-effective than chemical insecticides. Another important factor in the adoption of *Bti* and *Bsph* products is their remarkable environmental friendliness. Both have been shown to be safe to mammals and other vertebrates, and to be highly specific to their targets, controlling mosquito and blackfly larvae, but having little or no effect on non-target insects and other invertebrates breeding in the same habitats. Thus, these bacterial insecticides are better for the environment than synthetic chemical insecticides, which often kill many types of non-target invertebrates. In addition to these factors, *Bti* and *Bsph* have been successful because they have a very different mode of action than chemical insecticides. They selectively destroy the gut lining of mosquito or blackfly larvae, as opposed to being neurotoxins or developmental inhibitors, as are most chemical insecticides. This has made *Bti* and *Bsph* of high value as components of operational vector control programs threatened by the development of resistance to chemicals, the classic example being the use of *Bti* in the Onchocerciasis Control Programme. The use of *Bti* and *Bsph* in rotation with chemical larvicides is a sound strategy to prevent the development and spread of insecticide in mosquito and blackfly populations. This strategy, implemented by the OCP for 15 years was fully successful in solving problems posed by organophosphate resistance by the main vector, *Simulium damnosum*. Lastly, in addition to control of

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