A VISUAL REFERENCE TOOL ON TOXICITY OF ACTIVE SUBSTANCES USED IN ITALY IN AGRICULTURE TOWARDS BEES

INTRODUCTION

Pollinators, in particular bees, play a crucial role in biodiversity conservation and by ensuring agricultural productivity. However, these insects are routinely exposed to a wide range of substances used in agriculture, many of which are potentially harmful. When the application of pesticides is necessary, farmers should be able to know the level of toxicity of different substances in order to adopt conscious choices, thus favouring those substances that are less harmful to bees. In all cases, being aware of the potential toxicity enables farmers to adopt appropriate mitigation measures to minimize risks to bees and other pollinator insects.

To support pollinator health and reduce pesticide-related risks, the following practices are recommended:

- Select active substances with a lower toxicity on pollinators whenever possible.
- Avoid applying insecticides, or other bee-toxic substances, during flowering, including in the days prior to hive placement for pollination services.
- Even when using products classified as low-risk to bees, treatments during flowering should be limited to strictly necessary.
- If spontaneous flowering plants are present within the field, mow the vegetation at least two days before treatment to reduce floral attractiveness to pollinators.
- If anti-hail nets are used during flowering, ensure they are properly installed and do not interfere with pollinator movement or orientation.
- When treatments are necessary, apply them during periods of low pollinator activity, preferably early in the morning or after sunset.
- Avoid applying treatments on windy days to minimize spray drift and unintended exposure.

THE TOOL

To support farmers in choosing less harmful products, we developed a two-part reference tool:

- **TABLE 1** provides data on the acute toxicity and environmental persistence of active substances currently authorized in Italy for use in agriculture, focusing on their effects on *Apis mellifera* L. and, when available, on *Bombus terrestris* L. and *Osmia* spp.
- **TABLE 2** shows the sublethal effects of these substances, as reported in the literature with reference to *A. mellifera*, *B. terrestris* and *Osmia* spp.

Toxicity classes (high, medium, low) were assigned based on LD_{50} values (oral or contact exposure), using the following thresholds for all three species:

- < 2 µg/bee = high toxicity (orange)
- 2–100 µg/bee = medium toxicity (yellow)
- 100 µg/bee = low toxicity (green)

If both contact and oral LD_{50} values were available, the lower value was considered. When toxicity levels differed among species, the value for the most sensitive species was used.

Active substances classified as "high" or "medium" toxicity were further evaluated for their environmental persistence, based on the DT_{50} value (the time required for 50% degradation under specific conditions). The DT_{50} in soil from field trials was considered whenever available. In the absence of such data, the "Typical" DT_{50} value from the literature was used instead and is highlighted in red in the table. Substances with a DT_{50} of 15 days or more were considered "persistent", while those with a DT_{50} below 15 days were considered "non-persistent". Persistence was not assessed for substances classified as having low toxicity. Persistent substances are shown in Tables 1 and 2 with their names written in red, to make them easily identifiable.

KEYWORDS
Pesticide toxicity, Sublethal effects, Bee health, Pollinators, Agricultural practices, Field-use decision tool, Farmer-oriented reference tables

TABLE 1

TOXICITY AND PERSISTENCE TOWARDS ADULT BEES OF THE ACTIVE INGREDIENTS USED IN PESTICIDES IN ITALY

TOXICITY HIGH MEDIUM LOW

ACTIVE SUBSTANCE	FUNCTION	LD_{50} TOPICAL/ORAL (µg/BEE)		DT_{50} (IN-FIELD SOIL / TYPICAL)
		Apis mellifera	*Other bees*	
2,4-D	Herbicide	94		28,8
Acequinocyl	Acaricide	280		Data excluded from analysis
Acetamiprid	Insecticide	8,09	1,72	3
Acibenzolar-S-Methyl[1]	Fungicide, Bactericide	>100		Data excluded from analysis
Aclonifen	Herbicide	>100		Data excluded from analysis
Ametoctradin	Fungicide	>100		Data excluded from analysis
Amidosulfuron	Herbicide	>100	>100	Data excluded from analysis
Aminopyralid	Herbicide	>3,13		12,1
Amisulbrom	Fungicide	>100		Data excluded from analysis
Ampelomyces quisqualis	Fungicide	Non-toxic	70000	Data excluded from analysis
Aureobasidium pullulans	Fungicide	Non-toxic		Data excluded from analysis
Azadirachtin	Insecticide, Fungicide, Acaricide	>8,1		5
Azoxystrobin	Fungicide	>25		180,7
Bacillus amyloliquefaciens QST 713	Fungicide, Bactericide	1,8 x 10^{08} CFU/bee		Data excluded from analysis
Bacillus amyloliquefaciens FZB24	Fungicide	>6000 CFU/ bee*		Data excluded from analysis
Bacillus amyloliquefaciens MBI 600	Fungicide	>100 CFU/ bee*		Data excluded from analysis
Bacillus amyloliquefaciens subs. Plantarum	Fungicide	>320 CFU/ bee*		Data excluded from analysis
Bacillus pumilus QST 2808	Fungicide	Non-toxic		Data excluded from analysis
Bacillus subtilis strain IAB/ BS03	Fungicide, Bactericide	Data not available		Data not available
Bacillus thuringiensis subs. aizawai	Insecticide	>100 CFU/ bee*		Data excluded from analysis
Bacillus thuringiensis subs. kurstaki	Insecticide	> 100 CFU/ bee*		Data excluded from analysis
Beauveria bassiana	Insecticide	>9285 CFU/ bee*	>1,16 x 10^{10} CFU/bee**	Data excluded from analysis
Benalaxyl-M	Fungicide	>100		Data excluded from analysis
Bensulfuron metyl	Herbicide	>51,4		4,5
Bentazone	Herbicide	>200		Data excluded from analysis
Benzovindiflupyr	Fungicide	>100		Data excluded from analysis
Bifenazate[2]	Acaricide	8,5	9,6	4,8
Bifenox	Herbicide	>200		Data excluded from analysis
Bixafen	Fungicide	>100		Data excluded from analysis
Blad polypeptide	Fungicide	>100		Data excluded from analysis
Boscalid	Fungicide	>100		Data excluded from analysis
Bromuconazole	Fungicide	>100		Data excluded from analysis
Bupirimate	Fungicide	>50		34
Buprofezin	Insecticide	>163,5	>69	Data excluded from analysis
Calcium polysulphide	Fungicide, Insecticide	Data not available		Data not available
Captan	Fungicide	>100	100,45	Data excluded from analysis
Carfentrazone-ethyl	Herbicide	>81		0,5
Cerevisane	Fungicide	>100*		Data excluded from analysis
Chitosan hydrocloride	Fungicide, Insecticide	>100*		Data excluded from analysis
Chlorantraniliprole	Insecticide	>4	5,92	204
Chlormequat	Herbicide	>65,2		27,4
Chlorotoluron	Herbicide	>200,2		Data excluded from analysis
Clethodim	Herbicide	>199,2		Data excluded from analysis
Clodinafop-propargyl	Herbicide	>100		Data excluded from analysis
Clomazone	Herbicide	>76,33	>968	27,3
Clopyralid	Herbicide	>98,1		8,2
Copper oxychloride	Fungicide	12,1		0,1
Cos-oga	Fungicide	>10		Data not available
Cyantraniliprole	Insecticide	>0,0934	>0,54	32,4
Cyazofamid	Fungicide	>100		Data excluded from analysis
Cycloxydim	Herbicide	>100		Data excluded from analysis
Cyflufenamid	Fungicide	>100		Data excluded from analysis
Cyflumetofen	Acaricide	>102		Data excluded from analysis
Cyhalofop-butyl	Herbicide	>100		Data excluded from analysis
Cymoxanil	Fungicide	>85,3		3,5
Cypermethrin	Insecticide	0,023	0,119	21,9
Cyprodinil	Fungicide	>75		45
Dazomet	Soil fumigant	>10		1,2
Deltamethrin	Insecticide	0,0015	0,057	21
Dicamba	Herbicide	> 89,5		3,9
Dichlorprop-p	Plant growth regulator	>200		Data excluded from analysis
Diclofop-methyl	Herbicide	>100		Data excluded from analysis
Difenoconazole	Fungicide	> 100		Data excluded from analysis
Diflufenican	Herbicide	>100	>100	Data excluded from analysis
Dimethenamid-p	Herbicide	118,4	>158	Data excluded from analysis
Dimethomorph	Fungicide	>32,4	>283,2	44
Disodium phosphonate	Fungicide	>520		Data excluded from analysis
Dithianon	Fungicide	>25,4		35
Dodemorph	Fungicide	>76,6		41
Dodine	Fungicide	145		Data excluded from analysis
Emamectin	Insecticide	Data not available		Data not available
Esfenvalerate	Insecticide	0,07		19,2
Ethofumesate	Herbicide	>50		37,8
Equisetum arvense	Fungicide	Data not available		Data not available
Etofenprox	Insecticide	>0.038	0,177	11
Etoxazole[2]	Acaricide	>200		Data excluded from analysis
Eugenol+Geraniol+Thymol	Fungicide	>200		Data excluded from analysis
Exythiazox	Acaricide	>112		Data excluded from analysis
Fatty acids	Insecticide, Acaricide	>96,04		3
Fenazaquin	Acaricide	1,21		30,5
Fenhexamid	Fungicide	>102,07		Data excluded from analysis
Fenoxaprop-P-ethyl	Herbicide	>100	>100	Data excluded from analysis
Fenpicoxamid	Fungicide	>202,4		Data excluded from analysis
Fenpirazamine	Fungicide	>100		Data excluded from analysis
Fenpropidin	Fungicide	>10		49,2
Fenpyroximate	Fungicide	>15,8		6,8
Ferric phosphate	Molluscicide	>100		Data excluded from analysis
Flazasulfuron	Herbicide	>100	97,5	Data excluded from analysis
Flonicamid	Insecticide	>100	>75,8	Data excluded from analysis
Florasulam	Herbicide	>100		Data excluded from analysis
Florpyrauxifen-benzyl	Herbicide	>100		Data excluded from analysis
Fluazifop-p-butyl	Herbicide	>200		Data excluded from analysis
Fluazinam	Fungicide	>100	55,8	25,9
Fludioxonil	Fungicide	>100		Data excluded from analysis
Flufenacet	Herbicide	>100	>100	Data excluded from analysis
Fluopicolide	Fungicide	>100		Data excluded from analysis
Fluopyram	Fungicide	>100		Data excluded from analysis
Flupyradifurone	Insecticide	1,2	>1,7	130
Fluroxypyr	Herbicide	37,1		3
Flutolanil	Fungicide	>200		Data excluded from analysis
Fluxapyroxad	Fungicide	> 100		Data excluded from analysis
Folpet	Fungicide	>100	>100	Data excluded from analysis
Foramsulfuron	Herbicide	>100		Data excluded from analysis
Forchlorfenuron	Plant growth regulator	>80,6		1119
Formetanate	Insecticide, Acaricide	0,16	2,55	8
Fosetyl-aluminium	Fungicide	>100	>250	Data excluded from analysis
Fosthiazate	Soil disinfectant, Insecticide, Nematicide	0,256		10,3
Garlic oil	Nematicide, Insecticide	>500		Data excluded from analysis
Geraniol+Thymol	Fungicide, Insecticide	>200		Data excluded from analysis
Giberellic acid	Herbicide, Plant growth regulator	>25		0,31
Glyphosate[4]	Herbicide	>100	>100	Data excluded from analysis
Halauxifen-methyl	Herbicide	>98,1		43
Halosulfuron-methyl	Herbicide	>100		Data excluded from analysis
Hydrolysed proteins	Insect traps	Data not available		Data not available
Hymexazol	Fungicide	>100		Data excluded from analysis
Imazalil	Fungicide	35,1	>67,7	6,4
Imazamox	Herbicide	>40		16,7
Iodosulfuron-methyl-sodium	Herbicide	>80	>100	3,2
Iprovalicarb	Fungicide	>199		Data excluded from analysis
Isofetamid	Fungicide	>30		32,7
Isoxaben	Herbicide	>100		Data excluded from analysis
Isoxaflutole	Herbicide	>100		Data excluded from analysis
Kresoxim-methyl	Fungicide	>100		Data excluded from analysis
Lambda-cyhalothrin	Insecticide	0,038	>0,032	26,9
Laminarin	Elicitor	> 100		Data excluded from analysis
Lecanicillium muscarium	Insecticide	>110*		Data excluded from analysis
Lenacil	Herbicide	>206,2	>195,4	Data excluded from analysis
Maleic hydrazide	Plant growth regulator	>100		Data excluded from analysis
Maltodextrin	Acaricide, Insecticide	>200		Data excluded from analysis
Mandestrobin	Fungicide	>100		Data excluded from analysis
Mandipropamid	Fungicide	>200		Data excluded from analysis
MCPA	Herbicide	> 200		Data excluded from analysis
Mecoprop-P	Herbicide	>83		21
Mefentrifluconazole	Fungicide	>100	>195,4	Data excluded from analysis
Mepanipyrim[3]	Fungicide	51	>100	57
Meptyldinocap	Fungicide	84,8		15
Mesosulfuron-methyl	Herbicide	>100	>100	Data excluded from analysis
Mesotrione	Herbicide	>11		5
Metaflumizone	Insecticide	1,65		13,8
Metalaxyl	Fungicide	200		Data excluded from analysis
Metalaxyl-M	Fungicide	>97,3		14,1
Metaldehyde	limacida	>87,5		5,1
Metam-potassium	Pre-plant soil sterilant	Data not available		0,01
Metam-sodium	Soil disinfectant	>36,2		7
Metamitron	Herbicide	>97,2		11,1
Metarhizium anisopliae	Insecticide	>6000*		Data not available
Metazachlor	Herbicide	>72,2		6,8
Metconazole	Fungicide	85	>100	134,7
Methoxyfenozide[5]	Insecticide	> 100		Data excluded from analysis
Metobromuron	Herbicide	119,1		Data excluded from analysis
Metrafenone	Fungicide	>100		Data excluded from analysis
Metribuzin[6]	Herbicide	>76,7	>100	19
Metschnikowia fructicola strain NRRL Y 27328	Fungicide	>250		Data excluded from analysis
Metsulfuron-methyl	Herbicide	>44,3		13,3
Milbemectin	Acaricide	0,025	>9.7	8,5
Naphtylacetamide	Plant growth regulator	>100		Data excluded from analysis
Naphtylacetic acid	Plant growth regulator	>120		Data excluded from analysis
Napropamide	Herbicide	>100		Data excluded from analysis
Nettle exctract	Insecticide, Acaricide, Fungicide	Data not available		Data not available
Nicosulfuron	Herbicide	>22,4	>35,96	13,5
Orange oil	Insecticide	> 100		Data excluded from analysis
Oxathiapiprolin	Fungicide	>40,26		71,3
Oxyfluorfen	Herbicide	>100		Data excluded from analysis
Paclobutrazol	Plant growth regulator	>2		29,5
Paecilomyces fumosoroseus - strain FE9901	Insecticide	Data not available		Data not available
Paecilomyces lilacinus strain 251	Nematicide	Data not available		Data not available
Paraffin oil	Herbicide adjuvant	>95,5		Data not available
Pelargonic acid	Herbicide	122,1		Data excluded from analysis
Penconazole	Fungicide	>3		89,7
Pendimethalin	Herbicide	100		100,6
Penoxsulam	Herbicide	>100	>72,6	Data excluded from analysis
Penthiopyrad	Fungicide	> 500		Data excluded from analysis
Pethoxamid	Herbicide	>200	>200	Data excluded from analysis
Phenmedipham	Herbicide	>100	>100	Data excluded from analysis
Pinoxaden	Herbicide	>100		Data excluded from analysis
Pirimicarb	Insecticide	4	8,5	9
Pirimiphos-methyl[7]	Insecticide, Acaricide	>0,22		39
Potassium bicarbonate	Fungicide	>368		Data excluded from analysis
Potassium phosphonate	Fungicide	>145		Data excluded from analysis
Prohexadione calcium	Plant growth regulator	>100		Data excluded from analysis
Propamocarb	Fungicide	>84		14
Propaquizafop	Herbicide	>20		85
Propoxycarbazone	Herbicide	>200		Data excluded from analysis
Propyzamide	Herbicide	>100		Data excluded from analysis
Proquinazid	Fungicide	>125		Data excluded from analysis
Prosulfuron	Herbicide	>100		Data excluded from analysis
Prosulfocarb	Herbicide	>80		9,8
Prothioconazole	Fungicide	>71	>100	0,77
Pseudomonas chlororaphis strain MA342	Fungicide	Data not available		Data not available
Pseudomonas sp. strain DSMZ 13134	Fungicide	Low		Data excluded from analysis
Pyraclostrobin	Fungicide	>100	>97,2	Data excluded from analysis
Pyraflufen-ethyl	Herbicide	>100		Data excluded from analysis
Pyrethrins	Insecticide	0,013		12
Pyridaben	Insecticide	0,024		29
Pyridate	Herbicide	>100		Data excluded from analysis
Pyrimethanil	Fungicide	>100	>400	Data excluded from analysis
Pyriofenone	Fungicide	> 100		Data excluded from analysis
Pyriproxyfen	Insecticide	74		4,2
Pyroxsulam	Herbicide	>100		Data excluded from analysis
Pythium oligandrum	Fungicide	>105		Data excluded from analysis
Quinmerac	Herbicide	>100		Data excluded from analysis
Quizalofop-P-ethyl	Herbicide	>100		Data excluded from analysis
Quizalofop-P-tefuryl	Herbicide	>100		Data excluded from analysis
Rimsulfuron	Herbicide	27,9		10,8
Saccharomyces cerevisiae LAS02	Fungicide	Bassa		Data excluded from analysis
Sedaxane	Fungicide	>4		100
Sodium hydrogen carbonate	Fungicide	>537,4		Data excluded from analysis
Spinetoram[8]	Insecticide	0,024	4,97	2,8
Spinosad	Insecticide	0,0036	>0,37	14
Spiromesifen[9]	Acaricide, Insecticide	>200		Data excluded from analysis
Spirotetramat[10]	Insecticide	> 100		Data excluded from analysis
Spiroxamine	Fungicide	4,2		52,4
Sulcotrione	Herbicide	50		3,6
Sulfosulfuron	Herbicide	>25		44,5
Sulfoxaflor[5]	Insecticide	0,146	0,0055	3,54
Sulphur	Fungicide, Acaricide	>100		Data excluded from analysis
Tau-Fluvalinate	Insecticide, Acaricide	12	31,3	3,5
Tebuconazole	Fungicide	>83,05		47,1
Tebufenozide	Insecticide	> 100		Data excluded from analysis
Tebufenpyrad	Acaricide	6,7		4,5
Tefluthrin	Soil disinfectant, Insecticide	0,28		27,1
Tembotrione	Herbicide	>92,8		2,72
Terbuthylazine	Herbicide	>22,6		21,8
Terpenoid Blend QRD-460	Fungicide	>66,7		Data not available
Tetraconazole	Fungicide	63		430
Thiabendazole	Fungicide	>4,0		724
Thiencarbazone-methyl	Herbicide	>199		Data excluded from analysis
Thifensulfuron-methyl	Herbicide	>7,1		10
Tolclofos-methyl	Fungicide	>264,4		Data excluded from analysis
Tri-allate	Herbicide	> 100		Data excluded from analysis
Tribenuron-methyl	Herbicide	9,1		3,6
Trichoderma asperellum	Fungicide	>100		Data not available
Trichoderma atroviride I-1237	Fungicide	1,0x10^{5}		Data excluded from analysis
Trichoderma atroviride SC1	Fungicide	1,0x10^{6}		Data not available
Trichoderma gansii	Fungicide	Data not available		Data not available
Trichoderma harzianum	Fungicide	Dat not available		Data not available
Triclopir	Herbicide	>100		Data excluded from analysis
Trifloxystrobin	Fungicide	>200		Data excluded from analysis
Triticonazole	Fungicide	>92,26		147,7
Tritosulfuron[11]	Herbicide	>200		Data excluded from analysis
Valifenalate	Fungicide	>100		Data excluded from analysis
Ziram	Fungicide	> 100		Data excluded from analysis
Zoxamide	Fungicide	>100		Data excluded from analysis

1. Usable until 07/10/25 • 2. Usable only on floral and ornamental plants • 3. Usable until 05/20/25 • 4. Withdrawn for pre-harvest use and for public areas or areas frequented by vulnerable groups • 5. Only authorized uses are in permanent greenhouses and for endotherapy • 6. Usable until 11/24/25 • 7. Usable only for the disinfestation of storage environments • 8. Usable until 12/30/25 • 9. Usable until 03/31/25 • 10. Usable until 10/30/25 • 11. Usable until 11/07/25 • *Method of determination unknown

DATABASES CONSULTED: ECOTOX, TOXNET, PAN Pesticide Database, PPDB-Pesticide Properties Database, BPDB Bio-pesticide DataBase, EFSA documents, Win BDF-Banca Dati Agroformaci (www.winbdf.it/winbdf.htm).

TABLE 2

LIST OF ACTIVE SUBSTANCES APPROVED FOR USE IN AGRICULTURE FOR WHICH SUBLETHAL EFFECTS ON WILD BEES HAVE BEEN REPORTED

Substances	Physiological disorders	Behavioural disorders/alterations
Acequinocyl	Reproductive dysfunction	
Acetamiprid	Reduction of longevity, alteration of gene expression, alteration of body development, alteration of gut microbiota	Homing, locomotion, learning, memory
Azadirachtin	Alteration of body development, reproductive dysfunction	Physical activity, feeding activity
Azoxystrobin	Biochemical alterations	
Bentazone		Physical activity
Bifenazate	Detoxification dysfunction (*Bombus terrestris*), reproductive dysfunction	
Boscalid	Alteration of metabolism, reduced thoracic mass, immune system dysregulation	Feeding activity, homing (*Osmia lignaria* and *Megachile rotundata*)
Chlorantraniliprole	Alteration of gene expression, alteration of metabolism, reproductive dysfunction	Locomotion
Copper	Pupal mortality	Feeding activity
Cypermethrin	Alteration of gene expression, alteration of body development, biochemical alterations	Locomotion, feeding activity
Deltamethrin	Alteration of gene expression, gut alterations, reduction of fertility, alteration of body development	Waggle dance, feeding activity, memory
Difenoconazole	Oxidative stress, detoxification dysfunction, immune system dysregulation, alteration of metabolism	Motor coordination, physical activity
Dithianon	Alteration of muscle activity	
Emamectin		Feeding activity
Esfenvalerate		Social interaction, feeding activity, physical activity
Etofenprox	Biochemical alterations	Orientation, homing
Etoxazole	Detoxification dysfunction, reproductive dysfunction	
Fenpyroximate	Reproductive dysfunction	Motor coordination
Fludioxonil	Biochemical alterations	
Flupyradifurone	Oxidative stress, alteration of gene expression	Locomotion, grooming, feeding activity, learning, memory, hyperactivity, apathy
Folpet	Biochemical alterations	
Formetanate	Oxidative stress	
Garlic oil	Alteration of body development	Locomotion
Glyphosate	Reduction of royal jelly production, alteration of gut microbiota	feeding activity, learning, olfactory memory, navigation
Lambda-cyhalothrin	Reduction of longevity, histopathological alterations in of hypopharyngeal glands and brain cells, reduction of fertility (*Bombus terrestris*)	Homing, learning, feeding activity (*Bombus terrestris*)
Metaflumizone	Biochemical alterations	
Methoxyfenozide	Histopathological alterations in hypopharyngeal glands, alteration of body development, thermoregulatory dysfunction	Flight activity
Pirimicarb		Feeding activity
Pyraclostrobin	Reduction of longevity, histopathological alterations in intestinal - hypopharyngeal and mandibular gland cells, immune system dysregulation	Homing (*Osmia lignaria* and *Megachile rotundata*)
Pyriproxyfen	Reduction of longevity, alteration of vitellogenin production, adult malformations	Social interaction
Spinetoram	Reproductive dysfunction	
Spinosad	alteration of gut and Malpighian tubules, biochemical alterations, alteration of body development, reduction of longevity, reduction of fertility (*Bombus terrestris*)	Locomotion, physical activity, feeding activity
Spiromesifen	Alteration of intestinal cells	
Sulfoxaflor	Immune system dysregulation, alteration of body development (Bombus terrestris)	Feeding activity, oviposition (*Bombus terrestris*)
Tau-Fluvalinate	Alteration of gene expression, Alteration of vitellogenin production, biochemical alterations	Feeding activity, learning, memory, physical activity
Tebuconazole	Alteration of gut metabolism	
Tebufenozide		Low learning ability
Tebufenpyrad	Reproductive dysfunction	
Tau-Fluvalinate	Espressione genica, alterata produzione di vitellogenina, alterazioni biochimiche	Alimentazione, apprendimento, memoria, attività
Tebuconazolo	Metabolismo intestinale	
Tebufenozide		Basso livello di apprendimento
Tebufenpirad	Riproduzione	

Due to the complexity and extent of the available literature on the topic, this table provides only a representative selection of the sublethal effects reported for the listed bee species. The complete bibliography used to compile the table is available upon request at osservatorio@informamiele.it

DISSEMINATION

The tables are made freely available to farmers, technicians, beekeepers and other stakeholders, both online (A4 format, brochure, poster-ready) and in printed form. This tool aims to support good agricultural practices and promote the protection of both managed and wild bees.

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