

Supplementary material

Table S32.1. Areas under different types of biological control in hectares, per type of pest and crop in Latin America and the Caribbean (file prepared by J.C. van Lenteren on 27 January 2020; if readers see mistakes, please contact joop.vanlenteren@wur.nl and corrections will be made in the next version of this table; if you use material presented in this file, the book editors would appreciate if you refer to this file as follows: van Lenteren JC, Bueno VHP, Luna MG, Colmenarez YC (eds) 2020. Biological control in Latin America and the Caribbean: its rich history and bright future. CABI Publishing, Wallingford, UK. ISBN-13: 9781789242430, supplementary table S32.1).

Country	Main pests/crops with biocontrol	CBC/FBC ¹	ABC	ConsBC	NC
Argentina	Weeds in pastures	3,500,000			
	<i>Sirex</i> wood wasp in pine	648,000			
	Asian citrus aphid in citrus	150,000	1,500		
	Sugarcane borer in sugarcane		25,000		
	Weeds in water		150		
	Various pests in horticulture		128		
Barbados	Sugarcane borers in sugarcane	1,733			
	Mealybugs in sugarcane	1,733			
	Cottony cushion scale in citrus	243			
	Citrus blackfly in citrus	243			
	Citrus leaf miner in citrus	243			
	Asian citrus psyllid in citrus	243			
	Coconut whitefly in coconut	550			
	Pink bollworm in cotton		+ (?)		
	Lepidopterans in cotton				+ (?)
	Lepidopterans in vegetables	part of 600	part of 600		
	Leaf miners in vegetables				+ (?)
	Red palm mite in palm	+ (?)			
	Sago palm scale in ornamentals	+ (?)			
	Scales in fruit and ornamentals				+ (?)
	Pink hibiscus mealybug, various	+ (? large)			+ (? large)
Papaya mealybug in papaya				+ (?)	
Aphids, leaf miners, scales, lepidopterans, mites, thrips in various crops				+ (? large)	
Belize	Asian citrus psyllid, citrus	16,000			
	Pink hibiscus mealybug, various	+ (? large)			
Bolivia	Sugarcane spittlebug, sugarcane		150,000		
	Sugarcane borers, sugarcane		4,500		
	Mole crickets, sugarcane	+ (?)			
	Sugarcane coccid, sugarcane	+ (?)			+ (?)
	Sugarcane smut, sugarcane				+ (?)
	Cottony cushion scale, citrus	54,000			
	Fruit flies, citrus		54,000		
	Potato tuber moths, potato		1,800		
	Potato weevils, potato		180,000		
	Coffee berry borer, coffee		23,000		
	Lepidopterans, cotton				140,000
	Lepidopterans, quinoa		part 118,000		118,000
	Hemipterans, soybean		part 1,300,000		1,300,000
	Lepidopterans, soybean		part 1,300,000		1,300,000
Brazil	Olive scale, olive	+ (?)			
	Woolly apple aphid, apple	+ (?)			
	White peach scale	+ (?)			
	Cassava mealybug in cassava	1,000,000			
	Citrus miner in citrus	450,000			
	Asian citrus psyllid in citrus	12,000	part of 4,000,000		
	Coffee berry borer in coffee		part 4,000,000		

	Two lepidopteran spp. in corn		part 1,300,000		
	Soil-borne nematode in corn		500,000		
	Cotton bollworm in cotton		part 1,300,000		
	Eucalyptus psyllid in eucalyptus	+ (?)			
	Bronze bug in eucalyptus	+ (?)			
	<i>Leptocybe</i> gall wasp in eucalyptus	+ (?)			
	Lepidopterans in eucalyptus		> 20,000		
	Eucalyptus weevil in eucalyptus		11,000		
	Mate tree borer in mate		part 4,000,000		
	Sirex wood wasp in pine	450,000			
	Giant conifer aphid in pine	+ (?)			
	Several wheat aphid spp. in wheat	1,000,000			
	Rhodes grass scale in pastures	> 100,000s			
	Soil-borne disease in soybean		5,500,000		
	Whitefly in soybean		part 4,000,000		
	Soil-borne nematodes in soybean		part 500,000		
	Two lepidopteran spp. in soybean		> 2,000,000		
	Two stink bug spp. in soybean		20,000		
	Leafhoppers in sugarcane		4,000,000		
	Sugarcane borer in sugarcane		3,500,000		
	Billbug in sugarcane		+ (?)		
	Lepidopterans, coleopterans vars crops		200,000		
	Spider mites in apple orchards		1,800		
	Spider mites, gall midges in greenhouses		15,000		
	Banana weevil in banana		6,000		
	<i>Ceratittis</i> , <i>Anastrepha</i> fruit flies in fruit		+ (?)		
	Soil-borne diseases, nematodes vars crops		+ (?)		
Chile	Shrubs/weeds, in agriculture and nature	5,000,000			
	European pine shoot moth in pine	1,434,085			
	Sirex wood wasp in pine	1,419,744			
	Eucalyptus psyllid in eucalyptus	825,000			
	Eucalyptus weevil in eucalyptus	825,000			
	Wheat aphids in wheat	225,042			
	Mealybugs in many crops	130,000			
	Woolly apple aphid in apple	37,000			
	Walnut aphid in walnut	33,434			
	Olive black scale in olive	21,904			
	Scales in citrus, other fruit	20,000			
	Soil diseases in fruit, vegetables	30,548			
	Diseases in fruit, vegetables		24,657		
	Coccinellids in various crops		4,472		
	Lepidopterans in various crops		2,500		
	<i>Tuta absoluta</i> in vegetables		20		
Colombia	Woolly apple aphid in apple	+ (?)			
	Coffee berry borer in coffee	+ (?)	+ (?)		
	<i>Olygonichus</i> red mite in coffee		1,500		
	Cotton aphid in cotton+ (?)				
	Pink bollworm				+ (?)
	Cotton boll weevil in cotton	+ (?)			
	Cotton leafworm in cotton		+ (?)		
	Whiteflies in cotton, melon		+ (?)		
	Tobacco budworm in cotton		+ (?)		
	Armyworms in cotton		+ (?)		
	Soil-borne diseases in cotton		+ (?)		
	Colombian fluted scale vars crops	4,000			
	Colombian fluted scale vars crops	4,000 FBC			
	Green cassava mite in cassava				+ (?)
	Cassava hornworm in cassava		+ (?)		
	Citrus weevil in citrus				+ (?)
	<i>Polyphagotarsonemus</i> mite in citrus				+ (?)

	Asian citrus psyllid in citrus		1,500		
	Black Sikatoga disease in banana		+ (?)		
	Grey mold in blackberry		+ (?)		
	Bean weevil in common bean		+ (?)		
	Lepidopterans in soybean and common bean		+ (?)		
	Whiteflies in eggplant		+ (?)		
	Aphids in ornamentals in field		1,000		
	Aphids in ornamentals and vegs in greenh		2,000		
	Thrips,3 mite spp., whiteflies, aphids, and lepidopterans, in ornamentals and vegs in greenh		6,000		
	Leaf miners in <i>Gypsophila</i> in field		+ (?)		
	Lepidopterans in fruit crops		10,000		
	Aphids in fruit crops		35,000		
	Mites and thrips in fruit crops		1,500		
	3 lepidopteran spp. in maize		+ (?)		
	2 aphid spp. in pepper and vegs		2,000		
	4 lepidopteran spp. in oil palm		> 5,000		
	Lace bug in oil palm		+ (?)	+ (?)	
	Lance flies in passion fruit		+ (?)		
	Lepidopteran and aphid in pinus		+ (?)		
	Andean potato weevil in potato		+ (?)		
	Tuber moth in potato		+ (?)		
	Soil-borne diseases in potato		+ (?)		
	Flies in poultry and life stock		+ (?)		
	Mites, aphids, scales, coccids in rice		5,000		
	<i>Diatraea</i> in rice with <i>Cotesia</i>		5,000		
	<i>Diatraea</i> in rice with <i>Trichogramma</i>		38,000		
	<i>Diatraea</i> spp. in sugarcane with <i>Billaea</i>		56,896		
	<i>Diatraea</i> spp. in sugarcane with <i>Cotesia</i>		86,000		
	<i>Diatraea</i> spp. in sugarcane with <i>Trichogramma</i>		98,000		
	Aphids in sugarcane		5,000		
	Lepidopterans in tomato including <i>Tuta</i>		> 1,000)		
	Whiteflies in tomato in greenhouses		+ (?)		
	Soil-borne diseases in tomato in greenhouses		+ (?)		
	Soil-borne diseases in lettuce		+ (?)		
	Mosquito vectors of human diseases		+ (?)		
Costa Rica	Citrus blackfly in citrus	+ (?)			
	Asian citrus psyllid in citrus		6,000		+ (?)
	Woolly apple aphid in apples	+ (?)			
	Citrus mealybug in coffee	+ (?)			
	Coffee berry borer in coffee	+ (?)	4,000	+ (?)	
	Mediterranean fruit fly in various fruits	+ (?)			
	Fruit flies in various fruit		+ (?)		
	Sugarcane borers, spittlebugs in sugarcane		4,800		
	Aphids in sugarcane			+ (?)	
	Pineapple mealybug in pineapple		+ (?)		
	Dipterans in pineapple		780		
	Spiraling whitefly in banana				+ (?)
	Banana root borer, banana mealybug in banana		+ (?)		
	Cashew nut borer in cashew		70		+ (?)
	Several pests in oil palm			+ (?)	
	Shoot borer in timber trees				+ (?)
	White grubs in various crops				+ (?)
Cuba	Cottony cushion scale in citrus	+ (?)			
	Citrus blackfly in citrus	23,000			
	Sugarcane borer in sugarcane		1,600,000		
	Pseudococcidae in various crops	+ (?)			
	Vars lepidopterans in vars crops with <i>Trichogr.</i>		283,252		
	Vars pests in vars crops with fungi		199,671		
	Vars hemipterans in vars crops		76,733		
	Sweet potato weevil in sweet potato	1,618		140,000	140,000
	Soil borne diseases in various crops	60,032			
Dominica	Fruit flies citrus, banana weevil				+ (?)
	Sugarcane borers in sugarcane	2,500			

	Citrus blackfly in citrus	250			
Dominican Republic	Coffee berry borer in coffee	62,500	62,500		
	Coconut scale in coconut	50,116			
	Red palm mite in coconut				50,116
	Citrus blackfly in citrus	17,588			
	Cottony cushion scale in citrus	17,588			
	Citrus root weevil in citrus	17,588			
	Brown citrus aphid in citrus	17,588 FBC			
	Asian citrus psyllid in citrus	17,588 FBC			
	Citrus leaf miner in citrus	> 1,400			
	Citrus root weevil in citrus		> 1,400		
	Papaya mealybug, ornamentals etc	3,087			
	Pink hibiscus mealybug, ornamentals etc.	+ (? but large) FBC			+ (? but large) NC
	Rice stem stink bug in rice		174,389		
	Sugarcane borer in sugarcane		114,742		
	Lepidopterans in tomato		part 4,543		
	Cassava hornworm in cassava		1,070		
	Melon worm moth in melon		part 1,500		
	Various pests in vegetables		250		
	Banana root borer in banana		+ (testing)		
	Vars fruit flies in fruit trees	>25,000			
	Vars fruit flies in fruit trees	+ (?) FBC			
Ecuador	Woolly apple aphid in apple	1,211			
	Banana rust thrips in banana		10		
	Nematodes in banana		5,000		
	Vars diseases in banana		10,150		
	Frosty pod rot in cacao		1,224		
	Cottony cushion scale in citrus	36,679			
	Citrus blackfly in citrus	+ (?)			
	Purple scale in citrus	+ (?)			
	Citrus leaf miner in citrus	+ (?)			
	Coffee berry borer in coffee	37,260		150,000	
	Stalk borers in maize		+ (?)		
	Fall armyworm in maize and soy		+ (?)		
	Mango scale in mango	15,000			
	Mites and diseases in mango		1,400		
	Pests and diseases in oil palm		5,205		
	Pests and diseases in ornamentals		2,612		
	Diseases in palmito palm		400		
	Soil-borne disease in papaya		160		
	Soil-borne disease in pineapple		300		
	White rice borer in rice	358,100			
	Lepidopterans in rice		360		
	Rice blast disease in rice		360		
	Sugarcane borers in sugarcane	110,603	40,000		
	Sugarcane leafhopper in sugarcane	+ (?)	+ (?)		
	2 species of aphids in sugarcane		part of 110,603		
	Fall armyworm in sugarcane				+ (?)
	Spider mites in vars crops		+ (?)		
	<i>Anastrepha</i> fruit flies in vars crops	+ (?)			
	Woolly whitefly in vars crops	+ (?)			
	Soil-dwelling diseases in vars crops		115		
	Pests and diseases in vegetables		397		
El Salvador	Lepidopterans in fruit and coconut				> 250
	Citrus blackfly in citrus	1,500			+ (?)
	Purple scale in citrus	1,500 FBC			
	Cotton leaf worm in cotton				325
	Leaf hoppers in cotton		+ (?)		
	Mexican bean beetle in lima bean				180
	Soil diseases in various crops		+ (?)		
	Lepidopterans in various crops		+ (?)		
	Nematodes in horticulture and fruit		+ (?)		

	Mosquitos in lakes		+ (?)		
French territories	Sugarcane borers Guadeloupe	14,173			
	Sugarcane borers Martinique	4,046			
	Pink hibiscus mealybug G&M	+ (?)			
	Asian citrus psyllid Guadeloupe	694			
	Asian citrus psyllid Martinique	440			
	Citrus blackfly Guiana	1,650			
	Carambola fruit fly in Guiana	± (?)			
	Pests in vegetables Martinique		+ (?)		
	Various pests in various crops			+ (?)	
Guatemala	Citrus blackfly in citrus	1,500			
	Lepidopterans in cotton and vegs		3,600		
	Cotton leafworm in cotton		14,000		
	Coffee berry borer in coffee		100		~ 275,000
	Sugarcane borer in sugarcane		156		
	Diamondback moth in crucifers		100		
	White grub in corn		20		
Guyana	Sugarcane borer in sugarcane	44,000			
	Pink hibiscus mealybug	+ (? , but large)			
	Palm castniid in palm		12,000		
	Red palm mite in palm		+ (testing)		
	Various pests in rice			part of 150,000	
Haiti	Citrus blackfly in citrus	33,186			
	Sugarcane borer in sugarcane	23,781			
	Pink hibiscus mealybug	+ (? , but large)			
	Coffee berry borer in coffee	+ (testing)			
Honduras	Fruit flies in fruit	+ (?)			
	Lepidopterans, leafhoppers, various crops			+ (?)	
	Lepidopterans, scales, whiteflies, various crops				+ (? , but large)
	Diseases in many crops		8,000		
	Pests in many crops with microbials		16,300		
	Pests in vegetables and other crops with arthropod natural enemies		1,100		
	Microbials against cattle tick		+ (testing)		
	Aquatic weed	1			
Jamaica	Banana root borer in banana	3,000			
	Citrus blackfly in citrus	7,846			
	Cottony cushion scale in citrus	7,846			
	Citrus root weevils in citrus	7,846			
	Citrus root weevils in citrus		7,846		
	Brown citrus aphid in citrus	7,846			
	Citrus red scale in citrus	7,846			
	Lime swallowtail butterfly citrus				7,846
	Asian citrus psyllid in citrus	7,846			7,846
	Asian citrus psyllid in citrus	7,846 FBC			
	Asian citrus psyllid in citrus		7,846		
	Coconut scale in coconut	16,077			
	Red palm mite in coconut				16,077
	Coffee berry borer in coffee	6,498			
	Pink hibiscus mealybug in ornamentals	1,000,000			
	Papaya mealybug in ornamentals/vars crops	1,000,000 FBC			
	Sugarcane borer in sugarcane	26,255			
Mexico	Field rats, mice vars crops	+ (?)			
	Spotted alfalfa aphid in alfalfa	25,290*			
	Woolly apple aphid in apple	5,678*			
	Banana root borer in banana	4,019*			
	Mexican bean beetle in bean	3,981*			
	Cottony cushion scale in citrus	+ (?)			
	California red scale in citrus	36,656*	6,715		+ (?)
	Citrus mealybug in citrus	+ (?)			
	Purple scale in citrus	27,621*			

	Florida red scale in citrus	4,404*			
	Asian citrus psyllid in citrus	266,474	28,356		
	Citrus blackfly in citrus	51,052*			
	Citrus leaf miner in citrus	19,420			
	Citrus rust mite in citrus	+ (?)			
	Brown citrus aphid in citrus		39,678		
	Brown citrus aphid in citrus		12,336		
	Coffee berry borer in coffee	+ (?)	+ (?)		
	Diamondback moth in crucifers		24,355		
	Mexican cotton boll weevil in cotton		+ (?)		
	Pink bollworm in cotton	+ (?)			
	Sugarcane borers in corn	+ (?)			
	Red gum lerp psyllid in eucalyptus	+ (?)			
	Vine mealybug in grape		28,365		
	Mango scale in mango	+ (?)			
	Mexican fruit fly in vars fruit	18,872*			
	<i>Anastrepha</i> fruit flies in vars fruit		10,685		
	Woolly whitefly in vars fruit	+ (?)	2,961*		
	Pink hibiscus mealybugs ornamentals	11,300,000			
	Spittlebugs in pastures	187,454	+ (?)		
	Rhodes grass mealybug in pastures	45,540			
	Potato tuber moth in potato	+ (?)			
	Sugarcane aphid in sorghum		225,925*		
	Sugarcane aphid in sorghum		81,394		
	Brown bug in sorghum		700		
	Soybean caterpillar in soybean		10,000		
	Grasshoppers in soybean, bean, corn sorghum		13,564		
	<i>Lygus</i> bug in strawberry	+ (?)			
	Spittlebugs/froghoppers in sugarcane		35,000		
	Sugarcane borers in sugarcane	+ (?)	1,400*		
	Sugarcane borers in sugarcane		241,608		
	Vars pests in tomato		11,000		
	Common flies in urban areas/livestock		+ (?)		
	Vars pests vars crops in greenhouses		>29,000		
	Mosquito larvae in water		+ (?)		
	Water hyacinth in water	1,516	1,516		
	Giant reed in water		+ (?)		
	* historic data				
Nicaragua	Asian citrus psyllid in citrus	+ (?)			
	Pests in sugarcane		10,000		
	Fall armyworm in maize		21		
	Coffee berry borer in coffee		70		
	Vars pests in horticultural crops		323		
	Diseases in vegetables		70		
Panama	Citrus blackfly in citrus	+ (?)			
	Sugarcane borers in sugarcane		38,629		
	Whitefly in melon and tomato				2,863
	Diamondback moth in cabbages		0.5		
	Leaf miners in horticultural crops				553
	Lepidopterans in cucurbits				+ (?)
	Thrips in cucurbits			+ (?)	
	Coffee berry borer in coffee	19			
	Lepidopterans in rice			177	
Paraguay	Soybean caterpillar in soybean		+ (?)		
	Sugarcane borer in sugarcane		+ (?)		
	Pests and diseases in several crops		+ (?)		
	Pests in several crops			+ (?)	
Peru	Woolly apple aphid in apple	9,672			
	4 pests in citrus	77,200			
	2 pests in olive	21,185			
	Alfalfa green aphid in alfalfa	+ (?)			
	Blue psyllid in eucalyptus	+ (?)			
	Aphids and budworm in cotton		146,000*		
	Sugarcane borers in sugarcane		44,000*		

	Aphids and lepidopterans in alfalfa		4,669		
	Pests and diseases in asparagus		42,715		
	Pests and diseases in avocado		45,100		
	Pest and diseases in blueberry		381		
	Pests and diseases in citrus		3,364		
	Coffee berry borer in coffee		222		
	Lepidopterans and aphids in corn		3,841		
	Pests in cotton		506		
	Pests and diseases in fruit		276		
	Pests in olive		1,784		
	Pests and diseases in pepper		1,224		
	Pests and diseases in pomegranate		1,707		
	Leaf miners in potato		76		
	Pests and diseases in quinoa		183		
	Sugarcane borer in rice		211		
	Pests and diseases in sugarcane		215,130		
	Aphids in tara		5,113		
	Pests and diseases in tomato		814		
	Pests and diseases in vars vegetables		937		
	Pests and diseases in vine		2,036		
Puerto Rico	Sugarcane borer in sugarcane				+ (?)
	Mole crickets in sugarcane and tobacco				+ (?)
	Mealybugs in sugarcane	+ (?)			
	White grubs in sugarcane	+ (?)			+ (?)
	Sugarcane rootstalk weevil		+ (?)		
	Cottony cushion scale in citrus	1,896			
	Black citrus aphid in citrus	1,896			
	Asian citrus psyllid in citrus	1,896 FBC			
	Coffee leaf miner in coffee	6,937			
	Coffee berry borer in coffee		+ (?)	+ (?)	
	Various pests in coffee			6,937	
	Pulse pod borer in pigeon peas	127			
	Melon worm in cucurbits	1,266			
	Pink hibiscus mealybug vars plants	+ (?)			+ (?)
	Papaya mealybug in various fruit	303			
	Harrisia cactus mealybug in cacti	+ (?)			+ (?)
	Hornwort weed in water	+ (?)			
	Water hyacinth	+ (?)			
	Water lettuce	+ (?)			
	Alligator weed in water	+ (?)			
Remaining	3 spp. of Sugarcane borer in sugarcane	+ (?)			
Caribbean Islands	White grub larvae in sugarcane			+ (?)	+ (?)
	West Indian cane fly in sugarcane				+ (?)
	Sugarcane froghopper in sugarcane		+ (?)		
	Coconut mealybug in coconut	+ (?)			
	Coconut scale in coconut	+ (?)			
	Coconut whitefly in coconut				+ (?)
	Citrus blackfly in citrus	+ (?)			
	Cottony cushion scale in citrus	+ (?)			
	Cotton leafworm in cotton			+ (?)	+ (?)
	Arrowroot leaf roller in arrowroot			+ (?)	+ (?)
	Pink hibiscus mealybug in various	+ (?)			
	Papaya mealybug in tropical fruit	+ (?)			
	Passion vine mealybug				+ (?)
	Prickly pear weed on many plants	+ (?)			
Suriname	Lepidopterans in avocado				+ (?)
	Lepidopterans and mites in cassava				+ (?)
	Scales and mites in citrus	+ (?)	+ (?)		
	Scales and lepidopterans in coconut				700
	Lepidopterans in grassland				+ (?)
	Pink hibiscus mealybug, vars fruit	+ (?)			
	Various pests in pineapple				52
	Lepidopterans, snails, vars pest in rice				+ (?)
	Lepidopterans and aphids in sugarcane				+ (?)

	Lepidopterans in tomato				+ (?)
	Various pests in vegetables		0.5		
Trinidad	Giant moth borer in sugarcane			+ (?)	
and	Sugarcane froghopper		15,000		
Tobago	Three spp. of sugarcane borer	15,000			+ (?)
	Citrus blackfly in citrus	2,000			
	Pink hibiscus mealybug, ornamentals etc	15,340			
	Lepidopterans in brassicas	50			
	Pests in vegetables		350		
Uruguay	Weevils in eucalyptus	726,323			
	Sirex wood wasp in pine	257,687			
	Cottony cushion scale in citrus	15,101			
	Citrus leaf miner in citrus	15,101			
	Sugarcane borers in sugarcane	7,100			
	Lepidopterans, scales, aphids, in fruit	9,954			
	Lepidopterans in soybean		1,300		
	Various pests in horticultural crops		36		
	Weevils in eucalyptus		20		
Venezuela	Sugarcane borers, froghoppers, sugarcane		46,000		
	Cottony cushion scale, citrus blackfly in citrus	17,500			
	Woolly apple aphid in fruit	+ (?)			
	Lepidopterans in various crops		+ (?)		
	Plant diseases by antagonists		+ (?)		

¹ CBC = classical, FBC=fortuitous, ABC = augmentative, ConsBC= conservation, NC = natural biological control