APPENDIX I - SAMPLING METHODS

There are several sampling methods available to detect insects and arachnids. To collect the greatest variety of beneficials, as many types of sampling methods as possible should be used (117). The following methods were used to collect seasonal occurrence data included in this guide.

Beating Tray

Beating trays take advantage of the behaviour of many insects which feign death and drop down to the ground when vegetation is jarred. The tray or sheet (Fig. 126) is held under a tree branch which is knocked with a stick. The insects are dislodged, fall off the branch, and are easily seen against the light back-ground. This method is especially effective in cold weather, or in the cool air in early morning or late evening, when insects are inactive and hide in the vegetation. I prefer this method because the equipment is easily portable, it detects most of the beneficials listed in this guide, and it is possible to release the live insects once they have been recorded. (13,117)

Figure 126 - Beating sheet.

Collecting Net

Collecting nets are the most common and widely known of insect collecting equipment. There are 3 types - sweep nets, aerial nets and aquatic nets. Aerial nets are used to chase flying insects or catch those resting on vegetation. (Fig. 127) The nets are effective in collecting beetles, neuropterans, dragonflies, damselflies, barklice, true bugs, flies and wasps. (5,13,82)

Figure 127 - Aerial nets.

Malaise Trap

When many insects fly into a barrier such as the mesh wall of a malaise trap (Fig. 128), they tend to crawl or fly upwards while trying to escape, and end up getting caught in the highest part, in the collecting jar. The malaise trap collects strong-flying insects that are attracted to light, such as large wasps, flies, some beetles and some moths. (82)

Figure 128 - Malaise trap.

Pitfall Trap

The pitfall trap (Fig. 129) relies on the insects encountering the trap, falling down into the container and being unable to escape. It is inexpensive, easy to make, easily portable, commonly used and provides excellent results. Bait may be used. One advantage is that one can live trap for mark and recapture studies. The traps catch insects that do not readily fly, such as scarab beetles, rove beetles, ground beetles, springtails, ants, earwigs, some wasps and flies, and spider mites. (5,13,82,117)

Figure 129 - Pitfall trap.

Pan Trap

A pan trap (Fig. 130) is similar to a pitfall trap, but much shallower. Plastic microwave or organizer trays may be used and either dug into the soil or litter surface, or set on top of the ground, although traps sunken into the soil are most effective. Yellow-painted traps attract more wasps and homopterans, while white traps attract more flies. Pan traps can also be set beneath malaise traps to catch insects that crawl down or fall off the mesh netting. They're effective at catching large numbers of small arthropods which live near the ground and may not be collected by sweeping vegetation, such as some spiders, springtails, ground beetles, small flies, winged aphids, leafhoppers, seedbugs and wasps. (13,82)

Figure 130 - Pan trap.

Light Trap

Many insects are attracted to the light source of a light trap (Fig. 131), and are guided by baffles into the centre where they drop down into the collecting container. Most light traps use UV lights which are inexpensive and easily portable. Along with UV light, black lights and mercury vapour lights attract more insects than incandescent lights. It works best on warm, humid, dark nights. Light traps collect mobile insects which are active at night, such as moths, beetles, some flies, neuropterans, wasps and true bugs. (5,13,82,117)

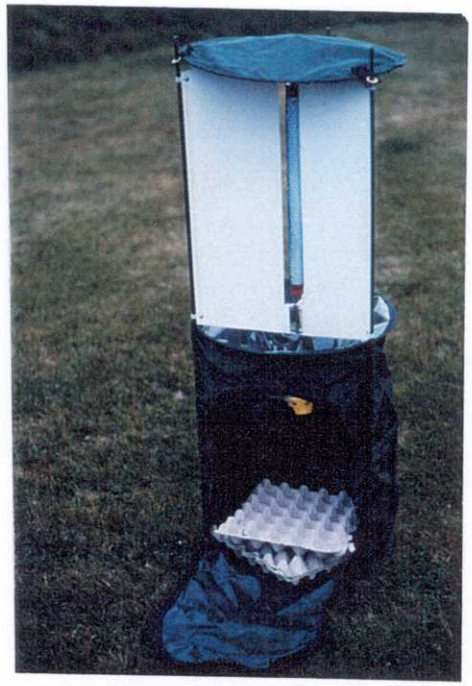

Figure 131 - Light trap.

Seed Orchard Recommendation

It would not be practical or necessary for seed orchard staff to use several types of sampling methods. A beating tray alone would be sufficient to monitor trends in beneficial populations throughout the year. A number of randomly selected trees may be sampled periodically throughout the year. Keeping records is advisable for detecting trends of prevalent beneficials in your orchards. If you are particularly interested in further monitoring, a lot of the collecting equipment and many of these traps are simple enough to be home made; otherwise, they can be ordered through scientific supply companies.

APPENDIX II - PESTICIDE TOXICITIES

PESTICIDE	COLLEM-BOLA	ODONATA	HEMIP-TERA	NEUROP-TERA	COLEOP-TERA	DIPTERA	HYMENOP-TERA	ARACH-NIDA
aldicarb			H	S			M	
azinphos-methyl			H	H	S		M	
B.t. (var. unspecified)			S					
B.t. var. *israeliensis*		S						
B.t. var. *kurstaki*						L	L	
carbaryl			PH	H			H	H
carbofuran			PH	H			H	
carbophenothion				V			M	
Cephalosporium lecanii	T[1]							
chinomethionat			S					
chlorinated insecticides							M	
deltamethrin						H		
demeton			PH	S			M	
diazinon			H		H		H	
dichlorvos							H	
dicrotophos			H	H				
dimethoate			H	V			M	
dioxathion							S/L	
disulfuton			M				H	
endosulfan			S	V			M	
fenitrothion				H	H		H	
fenthion			H					
fenvalerate			H					
ferbam			S					
insecticidal soap	T[2]			S				
malathion			H	H			H	
methidathion			H	S				
methoxychlor				S			M	
methylparathion			H	H			H	
mevinphos			H	H			H	
mexacarbate			H	H			H	
monocrotophos				H			H	
naled			S	S			S/L	
nicotine			M			H	S/L	
nuclear polyhedrosis virus							S	
parathion			H	H	H	H	H	H
permethrin			H		H	H	H	H
petroleum oils			S					
phorate			PH				H	
phosmet			PH	H				
phosphamidon			PH	V	H		H	
pirimicarb						H	S/L	
propoxur			PH				H	
rotenone				V			M	
ryania			PH	S			S/L	
sabadilla							S/L	
simazine	T							
sulphur			H					T
synthetic pyrethroids			M					
tetradifon				S			S/L	
trichlorfon			PH	S			M	

[1] - fungal spores [2] - soil drench application

H = high toxicity (>80% mortality)
PH = potentially high toxicity (environmentally-dependant)
T = toxic (levels not specified)
V = variable toxicity (lower mortality with ultra low volume applicators vs. conventional sprayers)
M = moderate toxicity (40-80% mortality)
S/L = safe to low toxicity (0-40% mortality)
S = safe (no mortality)

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