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USE OF "CAR-NETS" TO SAMPLE FLYING MICRO-COLEOPTERA

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Abstract *Can. Ent.* 124: 745–749 (1992)

A vehicle-mounted net ("car-net") is a useful tool to sample flying beetles or other insects. Previous authors have used nets on top of the vehicle. A net mounted lower and in front of the vehicle is thought to be superior for catching beetles which fly closer to ground level. Quantified results are given.

Peck, S.B., et J. Cook. 1992. Échantillonnage de micro-coléoptières au vol au moyen d'un filet monté sur une automobile. *Can. Ent.* **124**: 745–749

Résumé

Un filet monté sur un véhicule est un outil très utile pour échantillonner des coléoptères ou d'autres insectes au vol. Des auteurs ont déjà utilisé des filets montés sur le dessus d'un véhicule, mais un filet installé plus bas et en avant du véhicule semble plus approprié à la capture de coléoptères qui volent plus près du sol. Des résultats quantitatifs sont présentés.

[Traduit par la rédaction]

Introduction

The use of nets mounted on moving vehicles to capture flying insects is not a new idea. It dates to at least 1945 (Chamberlin and Lawson 1945). Some uses of such vehicle-mounted nets have been to measure populations of mosquitoes (Chamberlin and Lawson 1945; Sommerman and Simmet 1965; Bidlingmayer 1966); measure circadian activity and dispersal of Simuliidae (Davies and Roberts 1973; Roberts and Irving-Bell 1985); sample Ceratopogonidae to document their role as virus vectors (Dyce et al. 1971); evaluate the effectiveness of aerial spray operations against mosquitoes (Loy et al. 1968); and document the flight activity of Thysanoptera (Takahashi and Matsumura 1988).

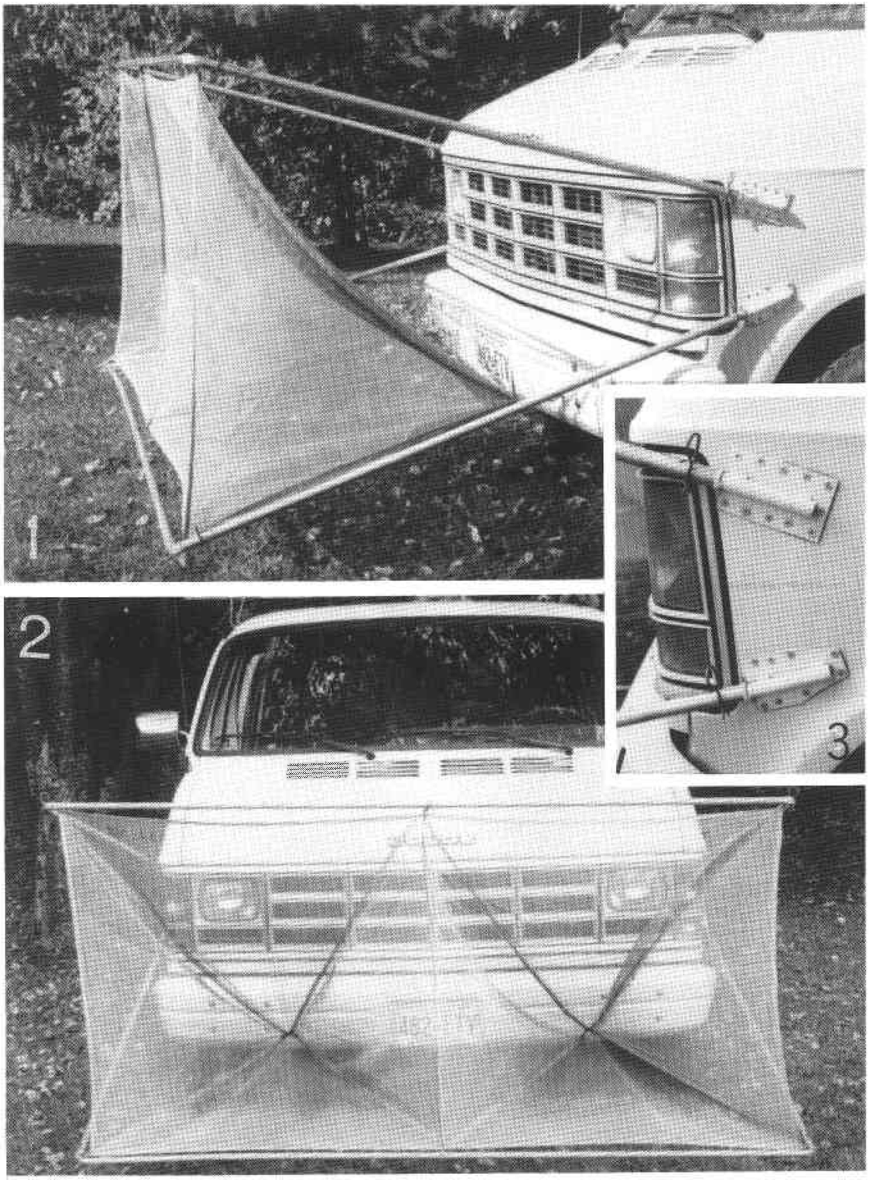
Lohse (in Freude et al. 1965: 109) suggested that the method is useful for sampling beetles. Kronblad and Lundberg (1978) report on new beetle records obtained in Sweden with such nets, and Rutanen and Muona (1982) used a car-net to collect 607 beetle species in 47 families (especially Staphylinidae, Ptiliidae, Cryptophagidae, Leiodidae, Nitidulidae, Scolytidae, and Lathridiidae) in Finland. Takahashi (1988) used a car-net to examine flight seasonality of over 100 species of Staphylinidae in Japan.

All the nets used by the above have one design feature in common. They are mounted on the roof or fender of the vehicle, about 1–3 m above ground level. It is assumed that the air in which the insects are flying is forced up and over the hood of the vehicle, and into the net. We suspect that the air and insects are just as easily forced to the sides of the vehicle.

From field work with flight intercept traps operated at various elevations above ground level, we have become convinced that most beetles fly at 1.5 m or less above ground level (Peck and Davies 1980). The first author sought to take advantage of this fact and develop a lightweight and easily assembled vehicle-mounted net to capture beetles flying at this height. Such a net should be very useful in field work when one cannot stay long in a particular area, but must pass through fairly quickly. The net is based on bicycle and car-mounted models developed by L. Masner and H. Goulet (personal communication) in the early 1980s.

Methods

The net (Figs. 1–3) is mounted in front of the vehicle on permanently fixed side plates. The side arms are aluminium tubes that fit over a prong on each plate, and into an upper and lower transverse tube. Hitch pin clips hold all the tubes together. The net itself is 2 m wide and 1 m high. It is attached to the front tubes, and to a hook about 10 cm in front of the vehicle bumper. Time to set up or take down the net is less than 2 min. The



FIGS. 1–3. 1, side view of car-net assembly; 2, frontal view of car-net assembly; 3, inset to show permanently fixed side plates attached to vehicle, and hitch pin clips holding tubes onto interior prong from side plates.

Table 1. Numbers of individual beetles (by family) collected by evening car-netting in some samples in eastern and northern Ontario in July and August 1991

	Samples*						
	A	B	C	D	E	F	G
Carabidae	6			13	9	13	4
Dytiscidae	9						
Hydraenidae	3				2	2	
Hydrophilidae	92	13	7	2	8	27	3
Histeridae	9	11	1			1	2
Ptiliidae	154	96	62	3	19	321	100
Leiodidae	91	22	17	53	16	3	26
Scydmaenidae	26	3	2	7	2	7	4
Scaphidiidae	8	1	1				
Staphylinidae	3683	813	906	742	530	560	985
Micropeplidae					3		
Pselaphidae	46		8	64	5	1	8
Scarabaeidae	3	8	1			8	4
Helodidae	9	5		6	57	9	1
Clambidae	2						
Byrrhidae	2						
Ptilodactylidae		1					
Heteroceridae			3				2
Elateridae	3	1	1		1		3
Throscidae	1		1				4
Eucnemidae	1		1				
Cantharidae	2						
Lycidae	2						
Anobiidae		2					1
Sphindidae	6	2	5			2	5
Nitidulidae	2			8	19	2	1
Rhizophagidae	4	3	2				3
Cucujidae		1	3			4	15
Cryptophagidae	150	435	59	67	180	24	27
Phalacridae	3	1				3	
Corylophidae	23	1	1				5
Coccinellidae	2						
Lathridiidae	82	140	133	20	56	15	63
Mycetophagidae		5	6			1	1
Ciidae	4	1	2	1			36
Colydiidae	2						
Tenebrionidae				1			
Melandryidae	1		3				
Mordellidae	4						
Anthicidae	6	5	16		1	3	6
Euglenidae	1				3		1
Chrysomelidae	5			5			2
Anthribidae	1						
Scolytidae	3	4	3	5	4	1	2
Curculionidae	433	4	1				
Totals	4884	1578	1245	997	915	1007	1314
Minutes sampling	55	75	80	100	120	60	80
Distance (km)	18.6	36.7	32	48	75	20	32
Air temp. (°C)	34	20	24	29	20	28	25
Air volume ($m^3 \times 10^3$)	37.2	73.4	64.0	96.0	40.0	40.0	64.0
Beetles/m^3	0.131	0.021	0.019	0.010	0.023	0.025	0.021

*A, Marlboro Forest roads, 15 km W North Gower, 18 July; B, Rideau Ferry to Portland road, 26 July; C, Middleville-White Lake road, 2 August; D, Lake Abitibi road, 80 km E Cochrane, 6 August; E, NW Industrial Road, Iroquois Falls, 9 August; F, Marlboro Forest roads, 15 km W North Gower, 26 August; G, Middleville-White Lake road, 29 August.

full assembly weighs only 2.72 kg. Painting the net with an insecticide prevents the insects from escaping when the vehicle stops.

Results and Discussion

Table 1 documents the beetles in some samples made in Ontario. Staphylinidae, Ptiliidae, Cryptophagidae, and Lathridiidae were the most frequently caught beetles in the evening. Diptera (and Coleoptera) are the most abundantly caught orders of insects.

A great advantage of placing a car-net in front of the vehicle is the presence here of a boundary layer in the air (a cushion-like layer) that cushions the impact of the insects with the net, without churning and breaking them. Thickness of the still air in the boundary layer is affected by net material mesh density. The boundary layer in the front-mounted net allows one to collect at much higher speed without damaging the insects in the net. About 70 km per h is acceptable, but on most roads 20–30 km per h is more comfortable. Maximum speed for a top-mounted net is 25 km per h, and damage from churning still affects delicate insects.

A smaller version can be constructed so that it can be disassembled and carried in luggage when doing foreign field work. It can be composed of fibreglass rods, and should be adjustable to all rental car sizes. It can be attached to the car by elastic bungee cords and large rubber suction cups.

The volume of air processed can be calculated by measuring the distance driven. Seasonal and daily activity periods, abundances, effect of humidity, temperature, etc., can be quantified. The best sample (A) took 4884 beetles in a distance of 18.6 km. This is equal to 37 200 m^3 of air filtered by the net, and is the equivalent of one flying beetle per 7.62 m^3 of air, which is a comparatively low density. The main advantage of the method is that large volumes of air can be easily processed.

Maximum flight activity for most small beetles seems to be from about 0.5 h before sunset to about 1 h after sunset. Narrow forest roads, with vegetation right to the road side, seem to be best. The best results are obtained on warm, humid, still evenings in late spring or early summer.

The method is also useful for other taxa, such as Odonata, tiger beetles, and saw flies at mid-day and in the spring. It could also be used to monitor outbreaks of pest species or the appearance of beneficial species.

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