COMPARATIVE VALUE OF BLACK LIGHT AND COOL WHITE LAMPS IN ATTRACTING INSECTS TO AQUATIC TRAPS[1]

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ABSTRACT

Insect collections made by an aquatic trap fitted with a black light and an identical trap fitted with a cool white lamp are compared. Collections of insects from these traps and from surface cone traps are also compared. The black light attracted more *Chaoborus punctipennis* (Say), Diptera adults, and Trichoptera; greater numbers of Hemiptera and Ephemeroptera were attracted to cool white lamps. An improved aquatic trap is described.

Light traps in aquatic environments are varied in design, mode of operation, and attractive powers. Grein (1912) used flashlight bulbs and more recently Zismann (1969), 12 and 24 volt lamps in aquatic traps to sample marine environments, collecting fish, mollusks, and numerous Arthropoda. Studies in fresh water environments have collected gastrotrichs, rotifers, cladocerans, copepods, Hemiptera, Coleoptera, and particularly *Chaoborus* (Hungerford et al. 1955; Washino and Hokama, 1968; Carlson, 1971), using incandescent and, more recently, black light lamps.

In terrestrial traps temperature, wind, relative humidity, and saturation deficit are factors in determining total catches p/solar time (Nimmo, 1966). Emergence in aquatic environments is not even over the surface of a body of water. Various aquatic traps may attract organisms purely because of shelter from wind (Corbet, 1965). The factors influencing emergence are also complicated by turbidity, temperature, wave action, predation, and light penetration in water. The literature on these aspects is large.

Comparisons have been made in terrestrial environments using mercury vapor, incandescent, cool white, and black light fluorescent lamps (Heath, 1966; Belton and Pucat, 1967). Black light proved to be the superior attractant in the terrestrial habitat. No study has been made comparing the effectiveness of cool white and actinic 5 (BL) lamps in aquatic traps. The purpose of this paper is to describe an improved aquatic light trap and to compare photokinetic tendencies of aquatic insects to black light or cool white lamps. Emerging insect collections made in these traps are also compared with such collections by cone traps (Sublette and Dendy, 1959). The aquatic trap was developed for and used in ecological studies at two ponds on the McGraw Wildlife Foundation, Dundee, Illinois, in the summer of 1970.

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MATERIALS AND METHODS

Four traps were made, two fitted with actinic 5 black light bulbs and two with cool white lamps (GE F6T5CW). The trap operation, its placement, and fumigation have been described (Carlson, 1971). The trap[3] (Fig. 1), is made from a six-gallon opaque, polyethylene pail with a leak-proof cover.[3] Two ¼ inch holes are drilled in the cover for the passage of the electric cord from the power unit to the light, and for the air escape when placing the trap (Fig. 2). The latter hole served as the entry of the fumigator after retrieval. The bottom funnel was fastened by nichrome wire in three places and sealed with translucent silicone rubber caulking (Fig. 3). A notch filed in the handle allowed the trap to be hung perpendicular in the water (Fig. 4). Fish were rarely captured when ¼ inch hardware cloth was applied to the bottom and black plastic tape to the submerged sides of the bucket (Fig. 5). In shallow areas, bottom mud and silt stirred up during placement may adhere to the funnel and reduce the light penetration. Generally organisms are alive and in good condition when the trap is retrieved, but care must be taken not to wet down emerged adults. Adult insects are easily picked off the cover, water surface, and inside bucket after fumigation.

Traps were operated two nights per week alternating black light and cool white traps between 4 permanent stations in two research ponds. Sixteen collections were made between 29 June 70 and 28 August 70. Pond 7 data represents 13 collections and pond 6, 16 collections. On three occasions the black light failed in pond 7 because of a faulty fuse connector (Fig. 2 and 6). Trap locations in both ponds were of comparable depth. Floating cone traps (Sublette and Dendy, 1959) (Fig. 7) were operated in the same locations to compare the emergence of aquatic insects in them with that in the light traps. Twenty-six collections using 8 traps measuring 1 ft^2 in area were employed. The diameter of the cone trap is comparable to the light trap funnel opening. Cone traps were operated on a 24-hour set period and placed in the pond in the early afternoon each day of operation. Light traps were placed in the late afternoon and retrieved the next morning using an 8-hour set period.

RESULTS AND DISCUSSION

The first 4 nights of operation (June 29, 30, July 10, 11) the light traps yielded few emerging insects. On these nights large numbers of golden shiners were observed circling the traps in both ponds. A total of 75 shiners were collected by cool white and 14 by black light. These collections contained partly eaten chironomid pupae. Fewer fish were collected when black plastic tape was applied to the submerged sides of the trap; remaining collections contained only 7 and 3 fish for cool

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[3] TorcLok, PNo 31691, available from Les Industries, Provinciales LTee, St. Damien, Belleclasse, Que. Canada.

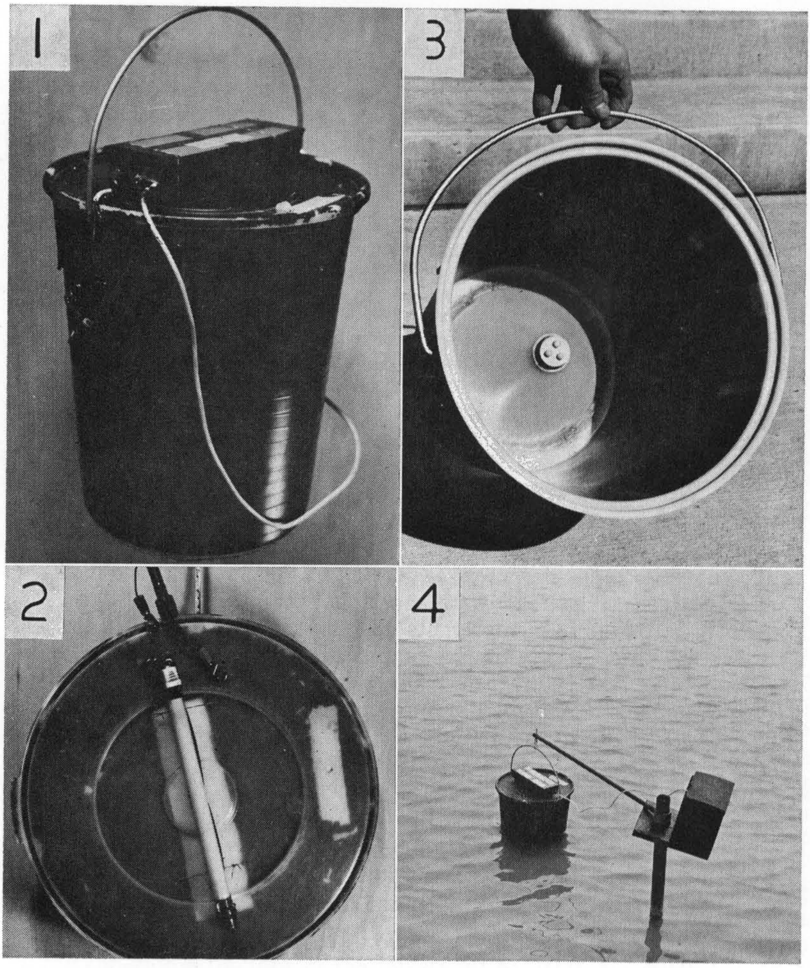
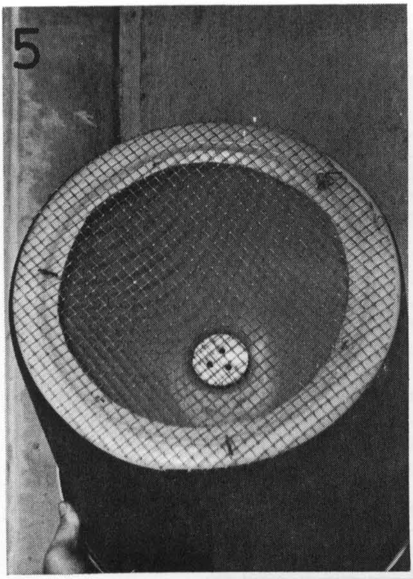
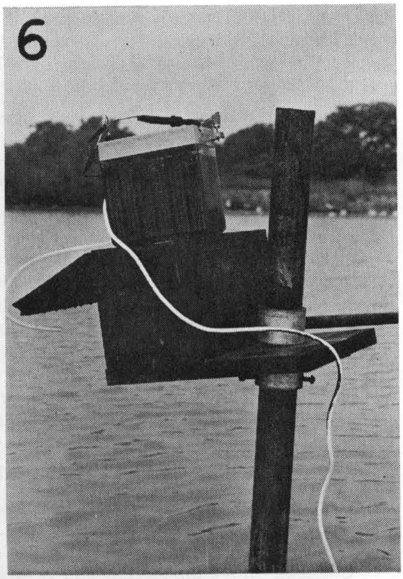


FIG. 1. Light trap assembled showing power unit mounted to the top cover.
FIG. 2. Inside cover showing fused battery connector, taped fumigator hole, and light attachment.
FIG. 3. Bottom bucket showing 8″ inverted funnel with rubber stopper inserted. Nichrome and silicone rubber seal the funnel to the trap bottom.
FIG. 4. Light trap in operation. A notch filed in the handle allowed the trap to hang perpendicular to the water.

white and black light respectively. Trap collections made after 11 July 70 contained many more dipteran pupae and adults, Trichoptera, and Ephemeroptera.

More Hemiptera were collected by cool white traps in pond 6,





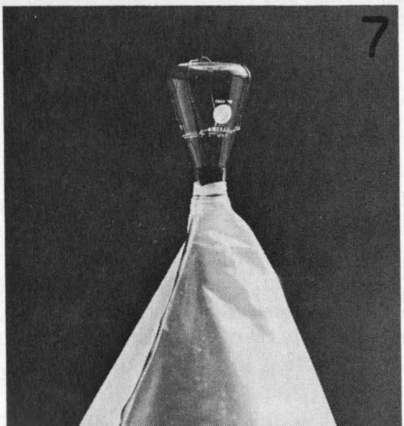


FIG. 5. Bottom of light trap. Hardware cloth decreased the number of fish collected during trap operation.

FIG. 6. Light trap post with locking set screws to elevate the arm and trap to any depth desired. A 12 volt motorcycle battery served as the power source.

FIG. 7. Cone trap showing a 250 ml erlenmeyer flask which when ⅓ full of water will float on the water surface. A rubber band attaches the flask to the plastic cone.

TABLE 1. Organisms collected in aquatic traps fitted w/black light and cool white lamps and in cone traps in two ponds on the McGraw Wildlife Foundation, Dundee, Illinois, 29 June through 28 August 1970. Based upon 13 12-hour sets in pond 7 and 16 12-hour sets in pond 6 and 26 24-hour sets using 4 cone traps per pond.

		No. Collected					
		Black light		Cool white		Cone trap	
Organism	Stage	Pond 6	Pond 7	Pond 6	Pond 7	Pond 6	Pond 7
Ephemeroptera[a]	Subimago	4	20	4	51	4	17
Hemiptera[b]	All	153	86	257	68	0	0
Coleoptera	Adult	1	1	0	2	0	0
Diptera[c]	Adult	720	253	394	275	386	297
	Pupae	80	39	14	141	10	9
C. punctipennis (Say)	Larvae	33,934	5,772	14,176	3,684	0	0
Trichoptera	Adult	66	31	3	9	4	19
Fish (20 mm or less)	Young	11	6	28	22	0	0
Total		34,969	6,208	14,876	4,252	404	342

[a] *Hexagenia limbata* (Serville) and *Caenis* spp.
[b] *Corisella* sp., *Palmacorixa* sp., *Sigara* sp., and *Buenoa* sp.
[c] Ceratopogonidae, Chaoboridae, and Chironomidae.

whereas slightly more were collected by black light in pond 7 (Table 1). Cool white lamps collected 57.6% (Table 2) of the Hemiptera captured. *Chaoborus punctipennis* (Say) were extremely abundant in pond 6 and 68.9% of those captured were by black light traps. More emerging Diptera were collected by black light whereas pupae seem to be attracted more to cool white (Table 2). The black light attracted 57% of the total pupae and adult Diptera. Pupae collected usually transformed to adults by 8:00 p.m. the same day. Contrasting results were obtained with Ephemeroptera and Trichoptera. Cool white lamps collected 69.6% of the emerging subimagos but Trichoptera showed greater photokinetic attraction to black light traps. Larval exuvia of all *Hexagenia* spp. subimago were present in the trap. On two occasions counts were taken of dipterous larval and pupal exuviae. There was always fewer larval and pupal exuviae than adults in the trap. Many pupae by their undulating, limnetic movements seem to shake off their larval exuviae inside the traps.

Black light aquatic traps captured more organisms than cool white traps (Table 2). Definite photokinetic tendencies of aquatic insects to prefer one light over the other was found. Physical environmental factors can influence collecting with aquatic traps at any one time. Generally collections are larger on warm humid nights. Black light proved to be the superior attractant in these studies. With this method of collecting aquatic insects one can determine rapidly the taxonomic

TABLE 2. Collections of emergent and non-emergent insects in aquatic traps fitted with black light and cool white lamps in two ponds on the McGraw Wildlife Foundation, Dundee, Illinois, 29 June through 28 August 1970.

		Black light	Percent	Cool white	Percent
		Emergent			
Ephemeroptera	subimago	24	30.4	55	69.6
Diptera	adult	973	59.3	669	40.7
	pupae	119	43.4	155	56.6
Trichoptera	adult	97	88.9	12	11.1
	Total	1,213	57.7	891	42.3
		Non-Emergent			
Hemiptera		239	42.4	325	57.6
Coleoptera		2	—	2	—
Chaoborus punctipennis (Say)		39,706	68.9	17,860	31.1
	Total	39,947	68.7	18,187	31.3
Totals emergent and non-emergent		41,160	68.4	19,078	31.6

groups represented in a body of water, and associate some aquatic larvae with their adult form.

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