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FLUORESCENCE IN COCHROACHES[1]

EDWIN R. WILLIS AND LOUIS M. ROTH
Pioneering Research Division, U. S. Army Quartermaster Research and Development Center, Natick, Massachusetts

We have observed hitherto unreported fluorescence in various tissues, organs, and products of 19 species of cockroaches during irradiation with ultraviolet light.

Fluorescence is a characteristic of many compounds and, by itself, may not be particularly important. However, changes occurring in the fluorescent colors of certain organs, such as accessory reproductive glands, may indicate changes in secretory activity and thus be valuable visual indicators in physiological studies.

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So far as we know, fluorescence in cockroaches has been described for only (1) "pigment-free tissue" (Metcalf and Patton, 1942); (2) the malpighian tubes (Busnel and Drilhon, 1942; Metcalf and Patton, 1942); (3) the secretion of the latero-cervical organ (Pavan, 1954b, 1954c; Pavan and Willis, 1955); and (4) the euplantulae, articular membranes, and unspecified parts of the abdominal organs (Pavan, 1954b).

Except for riboflavin in the malpighian tubes of four species of cockroaches, nothing is known of the chemical composition of the fluorescent materials found in cockroaches. Quite possibly,

TABLE I

COLOR OF THE FLUORESCENCE IN CUTICLE AND PRODUCTS OF COCKROACHES IRRADIATED WITH ULTRA-VIOLET LIGHT
Key: B=blue; G=dull yellowish green; Y=greenish yellow; DG=dark green; DY=dull greenish yellow; OG=olive green; —=structure not present; . . . =not examined.

Family Subfamily Species	Cuticle		Products								
				Eggs		Embryos					
	Sclerotized	Unsclerotized	Oöthecae	Chorions	Contents	Tissues	Gut Contents	Embryonic Membranes	Feces	Secretion of Cervical Organ	Spermatophores
BLATTIDAE											
BLABERINAE											
Blaberus craniifer Burmeister	Y	B[a]	Y	Y	Y	. . .	. . .	. . .	DY	—[a]	. . .
Blaberus giganteus (Linnaeus)	Y	B	. . .	. . .	. . .	. . .	. . .	. . .	DY	. . .	. . .
BLATTINAE											
Blatta orientalis Linnaeus	Y	B[a]	G	DY	Y	B	Y	B	DY	B[a]	B
Eurycotis floridana (Walker)	Y	B	G	DY	Y	B	Y	B	DY	B[b]	B
Neostylopyga rhombifolia (Stoll)	Y	B	G	DY	Y	B	Y	B	DY	B	B
Periplaneta americana (Linnaeus)	Y	B[a]	G	DY	Y	B	Y	B	DY	B[a]	B
Periplaneta australasiae (Fabricius)	Y	B	G	DY	Y	B	Y	B	DY	B[b]	B
Periplaneta brunnea Burmeister	Y	B	G	DY	Y	B	Y	B	DY	B	B
Periplaneta fuliginosa (Serville)	Y	B	G	DY	Y	. . .	. . .	. . .	DY	. . .	. . .
ECTOBIINAE											
Ectobius livens (Turton)	Y	B	G	DY	DG	. . .	. . .	. . .	DY	. . .	. . .
EPILAMPRINAE											
Leucophaea maderae (Fabricius)	Y	B[a]	Y	Y	B, Y	B	Y	B	DY	—[a]	B
Nauphoeta cinerea (Olivier)	Y	B	Y	Y	B, Y	B	Y	B	DY	. . .	B
Pycnoscelus surinamensis (Linnaeus)	Y	B	Y	Y	B, Y	B	Y	B	DY	. . .	. . .
PSEUDOMOPINAE											
Blattella germanica (Linnaeus)	Y	B[a]	DY	DY	OG	B	Y	B	DY	—[a]	B[c]
Blattella vaga Hebard	Y	B	DY	Y	B	B	Y	B	DY	. . .	B[c]
Loboptera decipiens Germar	Y	B[a]	. . .	. . .	. . .	. . .	. . .	. . .	DY	—[a]	. . .
Parcoblatta pensylvanica (Degeer)	Y	B	DY	Y	Y	. . .	. . .	. . .	DY	. . .	. . .
Supella supellectilium (Serville)	Y	B	DY	Y	Y	B	Y	B	DY	—[b]	B
DIPLOPTERIDAE											
DIPLOPTERINAE											
Diploptera dytiscoides (Serville)	Y	B	Y	Y	Y	B	Y	. . .	DY	. . .	B

[a]Pavan, 1954b.
[b]Pavan and Willis, 1955.
[c]Dry spermatophores dropped by females.

the greenish-yellow fluorescence in cockroach eggs is due to riboflavin; fluorescent substances, identified as riboflavin, have been found in the eggs of other insects from several orders (Busnel and Drilhon, 1942; Bodine and Fitzgerald, 1947; DeLerma, 1952).

MATERIALS AND METHODS

We examined the species of Blattaria that are listed alphabetically by subfamily (after Rehn, 1951) in table I.

All species were from cultures maintained on Purina dog chow checkers. Specimens were killed with chloroform just prior to examination or, if scarce, were collected as they died and examined while still moist.

The insects were examined at 9X magnification with long wave (3660 Å) ultraviolet light.

OBSERVATIONS

The fluorescent colors found in the cuticle and products of cockroaches are listed in Table I. The fluorescent colors found in certain internal organs are listed in Table II.

The pale greenish-yellow fluorescence of sclerotized cuticle could be seen best in newly molted insects. Except for intensity of color, the yellow fluorescence of cockroach cuticle seemed to be similar to the brilliant yellow fluorescence described by Pavan (1954, 1954a) for the cuticle of scorpions.

Oöthecae of the so-called viviparous cockroaches (Blaberinae, Diplopterinae, Epilamprinae) fluoresced very bright greenish yellow. However, the darker oöthecae of the oviparous species fluoresced much less distinctly; the oöthecae of the Blattinae fluoresced hardly at all.

TABLE II

COLOR OF THE FLUORESCENCE IN VARIOUS ORGANS OF COCHROACHES IRRADIATED WITH ULTRA-VIOLET LIGHT

Key: B=blue; P=pink; X=structure present but nonfluorescent; Y=greenish yellow; DG=dark green; OG=olive green; LY=very light greenish yellow; YW=yellowish white; —=structure not present; ...=not examined.

Family / Subfamily / Species	Alimentary Canal	Fat Body	Malpighian Tubes	Muscle (Coxal)	Nerve Cord	Salivary Glands: Glands	Salivary Glands: Reservoirs	Tracheae: Outer Surface	Tracheae: Lining[a]	Ventral Abdominal Gland	Reproductive Organs: Male: Testes	Male: Accessory Glands: Utricular	Male: Accessory Glands: Phallic	Female: Ovaries	Female: Corpora lutea	Female: Colleterial Glands
BLATTIDAE																
BLABERINAE																
Blaberus craniifer	B	B	Y	Y	LY	LY	B	Y	B	...	...	...	...	...	...	...
Blaberus giganteus	B	X	Y	LY	LY	LY	B	Y	B	...	...	...	...	...	...	...
BLATTINAE																
Blatta orientalis	B,Y	X	(Y,B)[b,c]	Y	Y	Y	B	Y	B	Y	...	B,Y	B,Y,P	Y	Y	B
Eurycotis floridana	B	X	Y	Y	Y	Y	B	Y	B	Y	...	B,Y,P	B,Y	Y	...	B
Neostylopyga rhombifolia	B,Y	X	Y	Y	Y	Y	B,YW	Y	B	Y	Y	B,Y,P	B,Y	Y	...	B
Periplaneta americana	B,Y	X	(Y,B)[b,c]	Y	Y	Y	B	Y	B	Y	Y	B,Y,P	B,Y,P	Y	Y	B
Periplaneta australasiae	B	X	Y	Y	Y	Y	B	Y	B	Y	Y	B,Y	B,Y,P	Y	...	B
Periplaneta brunnea	B,Y	X	Y	Y	Y	Y	B	Y	B	Y	Y	B	Y	Y	...	B
Periplaneta fuliginosa	B	X	Y	Y	Y	Y	B	Y	B	...	...	...	...	...	...	...
ECTOBIINAE																
Ectobius livens	Y	X	Y	Y	Y	Y	B	Y	B	...	...	...	...	DG,Y	Y	B,Y
EPILAMPRINAE																
Leucophaea maderae	B	X	Y	Y	Y	Y	B	Y	B	—	B,Y	B,Y	B,Y	LY	...	B
Nauphoeta cinerea	B,Y	X	Y	Y	Y	Y	B	Y	B	—	Y	B,Y	B	LY	Y	B,Y
Pycnoscelus surinamensis	B	X	Y	Y	Y	Y	B	Y	B	—	...	...	...	LY	...	B
PSEUDOMOPINAE																
Blattella germanica	B,Y	X	Y[b]	Y	Y	Y	B	Y	B	—	Y	B,Y	Y	OG	Y	B
Blattella vaga	B	X	LY	Y	Y	Y	B	Y	B	—	Y	B	Y	B	...	B
Loboptera decipiens	B,Y	X	Y	LY	Y	Y	B	Y	B	...	...	...	...	...	...	...
Parcoblatta pensylvanica	B	X	Y[b]	Y	...	Y	B	Y	...	...	...	...	...	Y	Y	B,Y
Supella supellectilium	B,Y	X	Y	Y	Y	Y	B	Y	B	—	Y	B	...	Y	Y	B,Y
DIPLOPTERIDAE																
DIPLOPTERINAE																
Diploptera dytiscoides	B	X	Y	Y	Y	Y	B	Y	B	—	Y	B,Y	LY	LY	Y	B

[a]Tracheal linings in exuvia.
[b]Metcalf and Patton, 1942.
[c]Busnel and Drilhon, 1942.

The uncolored anterior ends of partially formed oöthecae of *Blatta orientalis* and *Periplaneta americana* fluoresced blue, but this color disappeared as the oöthecae darkened.

SUMMARY

Fluorescence of several colors is reported for various tissues, organs, and products of 19 species of cockroaches which were irradiated with ultraviolet light. The results of these observations are summarized in Tables I and II. It is suggested that differences in the fluorescent colors of certain organs may indicate changes in secretory activity.

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