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16. Carmine crystals were placed in the regions of the nares, mouth, and spiracle of resting *Cryptobranchus*. Hundreds of observations were made with a magnifying glass to determine whether currents carrying these visible particles could be observed entering or exiting via these possible avenues into the buccal cavity. Our determinations conclusively showed that there were no such movements of water in and out of the buccal cavity; therefore, there is no systematic buccal ventilation and no material aquatic buccal gas exchange in this animal.
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Polymorphism in Plastosciara perniciosa

Abstract. *Two widely divergent morphotypes of both adult males and adult females were found in laboratory colonies of* Plastosciara perniciosa *in Hawaii. Extraordinary modification of all features except the genitalia, with associated behavioral differences, enables the micropterous morphotype to take maximum advantage of a stable larval habitat. Capabilities for migration from adverse habitats, dispersal, and maintenance of gene flow are retained in the macropterous morphotype.*

An unusual degree of behavioral and morphological polymorphism was discovered in laboratory colonies of *Plastosciara perniciosa* Edwards, a small fly (Diptera, Sciaridae) common around potted plants and in greenhouses. Four basic morphotypes are involved: (i) macropterous males; (ii) macropterous females; (iii) micropterous males; and (iv) micropterous females (*1*). Some intermediates were noted but these were rare. Colonies were reared for 4 years and one, started from a single gravid macropterous female, was maintained for 28 generations. The mean developmental time of eggs, larvae, and pupae at 20° ± 2°C was 27.3 days (*2*). The larval, pupal, and adult behavior of the micropterous morphotypes differed significantly from that of the macropterous morphotypes.

The male and female macropterous morphotypes (Fig. 1) resemble most winged Sciaridae, except that they have reduced two-segmented maxillary palpi and are small in size. Sexual dimorphism includes differences in genitalia and minor differences in wing and antennal lengths (*3*).

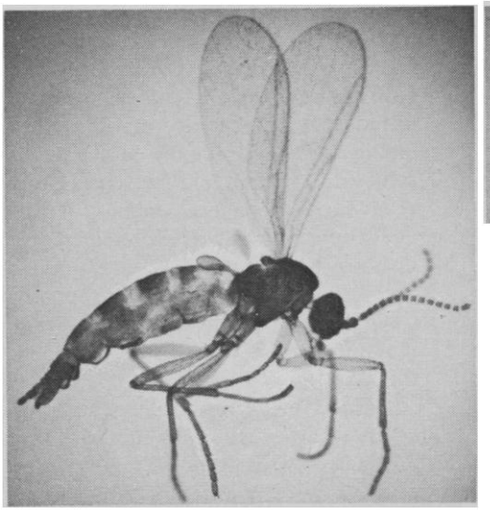
The micropterous morphotype of each sex (Fig. 2) differs so markedly from the corresponding macropterous morphotype that, except for the fortunate circumstance that they were reared from a single macropterous female, they would not be considered conspecific or even congeneric (*3*). In fact, according to most existing keys to families the micropterous morphotypes would not even be placed in Sciaridae. All structures of the head are reduced, especially the antennae, compound eyes, ocelli, maxillary palpi, and proboscis. The thoracic sclerites are greatly reduced in size and are modified to the degree that homologies with those of typical adult Sciaridae, including the macropterous morphotype of the same species and sex, are obscure. The wings, halters, and legs are much reduced and lack most normal structural features. The abdomen is enlarged but discrete sclerites are absent. The genitalia are similar in both morphotypes of each sex. The rare intermediate forms are either macropterous morphotypes with brachypterous wings or micropterous morphotypes with functional legs.

The behavioral differences between the two morphotypes were extreme. The female macropterous morphotype oviposited on the surface of the substrate or between the substrate and the thin layer of organic debris. Larvae generally fed on the surface. Late fourth instar larvae constructed individual pupal chambers near or on the surface of the agar substrate. Pupae forced their way out of the pupal chambers before adult emergence. The adults courted and mated as described by Steffan (*4*).

The female micropterous morphotype oviposited within the pupal chamber. Larvae usually burrowed, fed, and remained beneath the surface of the substrate. Late fourth instar larvae constructed communal pupal chambers, each containing at least one male and one female. Larvae pupated within the chamber, and after eclosion adults mated and females oviposited and died within the chamber. The first instar larvae consumed the dead adults and left the pupal chamber.

Micropterous morphotypes were always produced when an individual pupal chamber containing one or more gravid micropterous females was transferred to fresh agar plates. When a gravid macropterous female was isolated in a fresh agar plate or vial, the F_1 generation also was micropterous (*5*). The macropterous morphotypes were produced only when colonies were maintained in the same plate for more than one generation.

The evolutionary significance of the unusual degree of polymorphism in *P. perniciosa* is related to the apparent ability of this species to take advantage of a favorable microhabitat. The micropterous adult is protected from the danger of predation, inability to find a



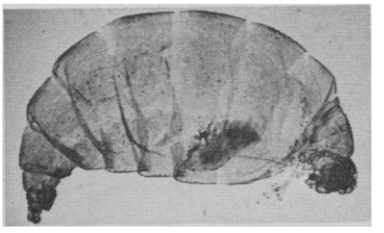


Fig. 1 (left). Macropterous female morphotype of *P. perniciosa*; body length, 1.49 mm; wing length, 1.12 mm. Fig. 2 (right). Micropterous female morphotype of *P. perniciosa*. Excepting the terminalia, note modification of all parts of the body, especially the wings, halters, and legs; body length, 1.76 mm; wing length, 0.15 mm.

food source, or inability to find a mate. When the microhabitat is no longer favorable, the macropterous morphotypes are produced and the winged progeny can seek other favorable habitats. To an unusual degree, this fly has evolved toward an ideal mode of life that takes maximum advantage of a favorable and stable larval habitat without sacrificing capacity for migration from deteriorating habitats (*6*), dispersal, or gene flow. I suspect that other species thought to be micropterous or apterous will also prove to have macropterous morphotypes.

Apparently the differentiation of this polymorphic organism involves the selection of one developmental pathway from two potential routes (*7*). The particular environmental switch mechanism in the *P. perniciosa* system has not been determined, but it appears to be associated with crowding, nutritional requirements, moisture requirements, or any combination of these factors acting on the early instar larvae. The environmental factor or factors would presumably act on the endocrine system of the differentiating individual (*8*). Southwood (*9*) reviewed the information available on alary polymorphism in Heteroptera, concluding that short-wingedness was a juvenile character brought about by excessive influence of the juvenile hormone. Polymorphism in *P. perniciosa* involves considerably more than the wings; in fact, almost every external adult feature is affected. Considering the extraordinary polymorphism found in both sexes of this species and its suitability for laboratory and genetic studies, *P. perniciosa* presents an exceptional laboratory model for elucidating some of the genetic and environmental parameters relating to polymorphism.

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References and Notes

1. The term micropterous, used in the sense of Hackman [*Not. Entomol.* **44**, 73 (1964)], is convenient as applied here but inadequate in that it does not describe the extreme reduction of other external features in this morphotype.
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5. This species is digenic—that is, progeny from a single female include both males and females; monogenic reproduction is commonly found in some other Sciaridae [C. W. Metz, *Am. Nat.* **72**, 485 (1938); H. V. Crouse, *Genetics* **45**, 1429 (1960)].
6. Southwood's discussion [*Biol. Rev. Cambridge Phil. Soc.* **37**, 171 (1962)] of facultative migration as a response by a species to early signs of deterioration of the environment provides some understanding as to the possible evolutionary significance of polymorphism in *P. perniciosa*.
7. The selection mechanism proposed by Lees [*Symp. R. Entomol. Soc. Lond.* **1**, 67 (1961)] in his studies of dual polymorphism in aphids, which suggests that the environment in some way controls the choice of alternate paths of development with nuclear genes participating in the realization of polymorphic characters, offers a possible explanation of the mechanism of differentiation in *P. perniciosa*.
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Neurons of the Hypothalamus Concentrate [^{3}H]Progesterone or Its Metabolites

Abstract. *Selective concentration of [^{3}H]progesterone or its metabolites is observed in nuclei of neurons in certain hypothalamic regions of the guinea pig 15 minutes after injection of [1,2,6,7-^{3}H]progesterone, by use of dry-mount autoradiography. Highest concentrations of progestin target neurons exist in the nucleus arcuatus, the nucleus preopticus periventricularis, and the nucleus preopticus suprachiasmaticus. Previous administration of unlabeled progesterone inhibits the nuclear concentration of radioactivity, but cortisol has no effect. Estradiol priming enhances the nuclear uptake of radioactivity. The results demonstrate the existence of progestin target sites in the hypothalamus and suggest a direct action of progestin on certain hypothalamic structures.*

Progesterone has been shown to exert both stimulatory and inhibitory effects on ovulation (*1*). Intracranial and intrapituitary implants of progestogens suggest a site of action affecting gonadotropin secretion at the level of the hypothalamus and pituitary (*2–6*). Recent studies also indicate that a facilitation of estrous behavior in female rats was induced when intracranial implants of progesterone were placed in the medial basal hypothalamus, but not when placed in the mesencephalic reticular formation (*7*). However, the precise site or sites at which progesterone acts to block ovulation and to facilitate sexual receptivity still remains controversial. In the hypothalamus, no selective accumulation of progesterone or its metabolites could be found (*8*), although in the uterus a specific progesterone binding protein has been demonstrated (*9–11*). Using the dry-mount autoradiographic technique, we have identified progesterone target cells in the uterus (*12*), similar to estrogen and androgen target cells in reproductive organs, brain, and pituitary (*13*). The present report demonstrates for the first time a selective cellular and subcellular concentration of progesterone or its metabolites in certain neurons of the hypothalamus.

Eight 35-day-old female guinea pigs of the Hartley strain, weighing about 350 g, were ovariectomized. Two guinea pigs were injected subcutaneously with 0.2 ml of sesame oil alone, and four guinea pigs were primed with 10 μg of estradiol-17β, dissolved in sesame oil, daily for 5 days. The two nonprimed animals and the four primed with estrogen were injected intravenously with 1 μg per 100 g of body weight of [1,2,6,7-^{3}H]progesterone, specific activity 110 c/mmole, dissolved in 10 percent ethanol in isotonic saline. To show the specificity of progestin localization, 5 minutes prior to the injection of [^{3}H]progesterone, one estrogen-primed guinea pig was injected intravenously with either 500 μg of progesterone or 1 mg of cortisol dissolved in 50 percent ethanol in saline. The animals were decapitated after 15 minutes, since at this time interval nuclear uptake of radioactivity was optimal in progesterone target tissues (*12*). The hypothalamus was excised, mounted on a tissue holder, and frozen in −180°C liquefied propane. Serial frozen sections were cut in a wide range cryostat (Harris Mfg. Co., Cambridge, Mass.) and freeze-dried with a Cryo-pump (Thermovac Industries, Copiague, N.Y.). The freeze-dried sections were dry-mounted on slides coated with desiccated emulsion (Kodak NTB 3). After autoradiographic exposure for 2 to 3 months, the slides were photographically processed and stained with methyl green–pyronin. Autoradiograms of diaphragm prepared in the same way served as controls. The dry-mount autoradiographic technique has been described (*14*).