PHYSIOLOGICAL FUNCTION AND PARTIAL PURIFICATION OF AN OVARIAN MATURATION INHIBITOR FROM THE HOUSEFLY, MUSCA DOMESTICA

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ABSTRACT

Ovarian maturation in insects involves numerous functional events which occur in a strictly defined sequence within each ovariole. In many insects these events occur synchronously within the ovarioles of each female, suggesting regulation by extraovarian factors, such as hormones and/or neurohormones. Maintenance of this synchrony also involves feedback mechanisms where ovary-induced inhibitory factors either act directly on the ovary to block the action of the regulatory hormones or act indirectly at other levels to block the synthesis and/or release of these hormones. Such inhibitory substances have been studied extensively only in Rhodnius prolixus (see Davey, 1978), Diploptera punctata (see Tobe, 1980), and Musca domestica (see Adams, 1980). In both R. prolixus and D. punctata, the inhibitory substance acts by inhibiting the JH-mediated processes of vitellogenin synthesis and/or uptake. In M. domestica, however, Adams suggests that an extract from mature ovaries inhibits EDNH release. We have begun the isolation and characterization of this substance from mature housefly ovaries utilizing Aedes atropalpus as our test system. We chose this species for the following reasons: (1) the autogenous nature of this species removed the possibility of feeding inhibition by the inhibitory extract; (2) surgical manipulations to remove the corpus cardiacum and the corpora allata, separately, were relatively easy to perform by decapitation and abdominal ligation, respectively; and (3) the hormonal mechanisms controlling ovarian maturation in this species had recently been elucidated (Fuchs et al., 1980, Kelly and Fuchs, 1980, Kelly et al., 1981).

Using an assay for vitellogenic follicles in A. atropalpus in conjunction with low and high pressure liquid chromatography (HPLC), an inhibitor of ovarian maturation has been partially purified from extracts of adult M. domestica. Inhibitory activity was present in extracts from female heads, thoraces, abdomens and mature ovaries, causing 58%, 90%, 100% and 95% inhibition, respectively, when 0.05 tissue equivalents were injected in 1 µl. Treatment of inhibitor-injected females with juvenile hormone, 20-hydroxyecdysone and head extracts from honey-fed Aedes aegypti could not reverse this inhibition, and neither ecdysone nor 20-hydroxyecdysone were inhibitory by themselves. HPLC purified inhibitory extracts inhibited in vitro production of ecdysteroids by vitellogenic follicles. We suggest that in vivo a major site of action of this inhibitor may be the early vitellogenic follicle as previously suggested for mosquitoes by Meola and Lea (1972).

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