Glycerol-3-phosphate Dehydrogenase (G-3-PDH; EC 1.1.1.8) Variation in Brazilian Stingless Bees and in Wasp Species

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In only 1 bee species (Tetragona clavipes) of 24 sampled in 145 colonies (0.69%) did we detect the presence of more than one allele for glycerol-3-phosphate dehydrogenase (EC 1.1.1.8), an enzyme that is involved in flight. In 34 colonies containing 9 wasp species, 5 colonies of only 2 species (Polybia paulista and P. sericea) showed variation in larval G-3-PDH (14.7%). The small amount of variation observed for the G-3-PDH-1 locus in the bee and wasp species analyzed in the present study agrees with that reported for the G-3-PDH system in other insects.

KEY WORDS: glycerol-3-phosphate dehydrogenase; social bees; wasp; isozymes; Hymenoptera.

INTRODUCTION

The importance of glycerol-3-phosphate dehydrogenase (G-3-PDH; EC 1.1.1.8) in insect flight activity has led to investigations of this system in several populations, and the data compiled thus far indicate that the G-3-PDH locus has little variability (Powell, 1975; Selander, 1976). Polymorphic variants of G-3-PDH have been described and characterized in Drosophila species (Barnes and Laurie-Ahlberg, 1986; Charles, 1980; Lee et al., 1980), Anopheles (Miles, 1978), Culex pipiens (Pryor and Ferrel, 1981), butterflies (Johnson, 1976), and ants (Hung et al., 1979). However, these

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examples, compared with other enzyme polymorphisms detected in insects in general, may be considered rare. A high level of variation for the G-3-PDH locus has been observed in hemipterans, a fact attributed by Zera (1981) to the reduced importance of flight in these insects. In this case, there may be a relaxation of selective pressure on this locus resulting in an accumulation of a large number of variant alleles.

Few studies have been performed on bees and wasps (Fink et al., 1970; Fink and Brosemer, 1973; McGuffin and Collier, 1982; Yong, 1986). The interest in studying this group of insects resides in the direct relationship of flight to successful reproduction, feeding, mating, and dispersal in both bees and wasps. Preliminary studies (Machado and Contel, 1989) with a bee species (*Plebeia droryana*) have characterized the larval isozyme as G-3-PDH-1 and the isozyme exclusively found in the thorax of adults as G-3-PDH-2.

The objective of the present study was to characterize G-3-PDH in several bee and wasp species and to report the allozyme variation, detected in only one bee species and in two wasp species.

**MATERIALS AND METHODS**

We investigated 24 bee species and 9 wasp species (Table I) collected at different sites in the states of São Paulo, Minas Gerais, and Paraná. These localities are situated in the southeastern, central, and southern regions of Brazil, respectively. At least 15 individuals per colony were analyzed for each bee and wasp species. Individual bee and wasp samples were homogenized with a glass rod in test tubes containing twice-distilled water and centrifuged at room temperature (International Centrifuge, mode K, size 2, rotor No. 250) for 10 min at 3000 rpm. The supernatants were absorbed onto 6 × 5-mm pieces of Watman No. 3 paper, which were inserted vertically in 11% starch gel (Sigma) prepared in 0.005 M Tris-phosphate buffer, pH 7.4. In the electrode chamber we used 0.1 M Tris-phosphate, pH 7.4. The electrophoretic run was carried out at 10°C for 16 hr at 2.5 V/cm. The staining mixture contained 15 ml 0.06 M Tris–HCl buffer, pH 8.0, 420 mg dl-α-glycerophosphate disodium salt, 10 mg NAD, 0.8 ml MTT (5 mg/ml), 0.8 ml PMS (5 mg/ml), and 15 ml 2% agar. The gel was incubated with the staining mixture at 37°C for 20 min.

**RESULTS**

Two zones of G-3-PDH activity were observed in all bee and wasp species analyzed. One, present throughout insect development, was named the larval form (G-3-PDH-1), and the second (a thorax form) was characteristic