IDENTIFICATION OF A NEW APHID ISPOPRENYL DIPHOSPHATE SYNTHASE

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We cloned the cDNAs of five putative aphid farnesyl diphosphate synthases (FPPS), a key enzyme involved in juvenile hormone and E-β-farnesene (alarm pheromone component) biosynthesis. The predicted translated products have the conserved domains present in all short-chain *E*-isoprenyl diphosphate synthases, including the two aspartate-rich motifs. However, the aphid sequences display an apparently rare susbtitution (Phe/Tyr→Gln; Q281) at position -4 relative to the first aspartate-rich motif. Surprisingly, a recombinant *Myzus persicae* isoform of the presumed FPPS produced geranyl diphosphate (as opposed to FPP) as principal product when supplied DMAPP and IPP as substrates, indicating this enzyme has geranyl diphosphate synthase activity.

Aphids are responsible of several types of damage on crop plants due to their sap-sucking activities but also as virus vectors. Chemical control of certain aphid species is becoming extremely difficult due to resistance to insecticides. In this context, disruption of one or more steps in juvenile hormone (JH) and alarm pheromone components biosynthesis seems to be a promising method for developing new pest control agents.

In insects, farnesyl diphosphate synthase (FPPS) is a key enzyme involved in the biosynthetic pathway of juvenile hormone. This hormone plays an important role in maintaining juvenile characters during the development of insects but also in maturation of the reproductive system. In some aphid species, FPPS generates the immediate precursor of E-β-farnesene, a major component of the alarm pheromone. The study of aphid FPPS will allow us to better understand these two important processes of aphid biology and represents a promising target for the development of new biorational insecticides with a reduced impact on non-target organisms.

Using degenerate primers designed from highly conserved regions among FPPS proteins, we isolated full-lenght cDNA clones from four aphid species (*Aphis fabae, Acyrthosiphon pisum, Megoura viciae* and *Myzus persicae*). The predicted translated products have the conserved sequence domains present in all short-chain *E*-isoprenyl diphosphate synthases, including the two aspartate-rich motif. However, the aphid sequences encode proteins displaying an apparently rare susbtitution (Phe/Tyr→Gln; Q281) at position -4 relative to the first aspartate-rich motif, a feature shared with type-I lepidopteran FPPSs.

Our results also indicate that the *M. persicae* FPPS gene encodes two different isoforms, which vary by the presence or absence, in the N-terminus, of a mitochondrial targeting motif. Surprisingly, when expressed in *Escherichia coli*, one of these two isoforms produced geranyl diphosphate as major product, which suggests a gernayl diphosphate synthase activity.