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Genetic regulation of diapause and associated traits in *Chilo partellus* (Swinhoe)

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Diapause is an endocrine controlled arrested metabolic state to delay development or reproduction under unfavorable conditions. To gain an understanding of importance of diapause for ecological adaptation, it is important to study regulation of diapause in insects. We examined genetics of diapause in *Chilo partellus* by crossing the hibernating (HD), aestivating (AD), post-hibernating (PHD), post-aestivating (PAD), and nondiapause (ND) strains. Reciprocal crosses were also made to gain full understanding of diapause regulation and the maternal effects, if any. Data were recorded on fecundity, egg hatching, larval survival, diapause induction and termination, adult emergence, and morphometrics of larvae, pupae and adults in the parents (P_1, P_2), F_1 hybrids, and the reciprocal crosses. Genetic analysis showed that AD strain is general combiner, which also improved egg hatching, larval survival, diapause termination, adult emergence and proportion of females in the progenies. Incidence of diapause was highest in HD × AD, whereas termination was greatest in PHD × AD. However, ND strain and its reciprocal crosses with other strains did not exhibit any noticeable developmental response associated with diapause. Specific combining ability analysis suggested that where PHD and AD strains exist together there will be likely reduction in diapause incidence, increased survival with greater fitness and faster multiplication of their progenies resulting in outbreak of *C. partellus*. Degree of dominance estimates revealed that diapause, developmental and morphometric traits in *C. partellus* are governed by over dominance gene effects, and mainly depend on parental diapause history.

Diapause is an endocrine controlled physiological state of arrested metabolic activity during a particular stage of insect development to survive under predictable adverse climatic conditions[1–4]. This happens to control the physiological processes and morphological development during particular stage of life cycle. The insects undergoing diapause pass through a series of physiological events such as suppression of development and reproductive functions, arrested metabolic activity to conserve the reserves, and resumption of normal developmental process on the onset of optimum climatic conditions[3,5–7]. Differences in genetic basis of various components of diapause also vary in different insect species[8].

Diapause being an adaptive but genetically regulated trait provide phenotypic plasticity to insects in response to environmental conditions[6]. Abiotic factors like cooling and freezing, and rates of temperature change influence developmental and physiological alterations[9–11], which also lead to several morphological changes such as body color, length, weight and width of various hard sclerotized structures like head capsule, mandible and body appendages[12–15]. Moreover, wider geographic distribution leads to behavioral and physiological differences in populations inhabiting different ecological niches[16]. Existence of ecotypes in different insect species is widely prevalent, and the inheritance of such traits may be due to long-term genetic differentiation or direct physiological response to environmental conditions[17,18].

Diapause has been reported to follow a simple Mendelian inheritance (3:1 segregation ratio in the F_1 progenies) in some insect species such as linden bug, *Pyrrhocoris apterus* L[19]., spider mite, *Tetranychus pueraricola* Ehara & Gotoh[20], and flesh fly, *Sarcophaga bullata* (Parker)[21]. The incidence and duration of diapause in many insect species is under polygenic control[6,22]. Sex-linkage, maternal or paternal effects, and epistasis also play a significant role in

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