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The role of compensatory reactions in life-span determining program realization: investigations in model strains of house fly

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Motivation and Aim: The aim of investigation is evaluate the developmental regularities of compensatory reactions to stressors and revealing the role of compensatory reactions in life span determination.
Methods and Algorithms: Objects of investigations: house fly strains selected by life span from strain Cooper (heterogeneous strains *Sh gen* – short-living and *L gen* – long-living flies; homogeneous strains *Sh 28* short-living and *L 2* long-living flies. Experimental stresses – stress of selection and short-term heat stress single or repeated at the each developmental stage (larva, pupa, adult). Registered indices were life span of adults, duration of larval and pupal development, weight of larvae and pupa, frequencies of morphological deviations. Dynamics evaluated of tyrosinase, DOPA-oxidase, acetylcholinesterase activity under the stress conditions and compensatory process. Geometric morphometrics applied for shape and size of adult's wings to detect the delayed consequences of stress. Change of transcriptional activity of genes *hsp70* and transposone hermes transposase *hem* estimated by real time qPCR.
Results: The indirect feedback mechanism revealed limiting life span changes in homogenous housefly strains, clearly displaying under the selection for life span diminishing and early reproduction. Effects of compensatory reactions appeared as the spike of fitness indices variability evidenced the genomic stress, confirmed by transposone *hermes* DNA copy number enhancement in genome of selected strains vs. origin strain. The monitoring of development in the homogenous and heterogeneous housefly strains and analysis of fitness indices changes followed the heat stress at the larval stage showed formation of adaptive ontogenic reactions of two types, distinguished for short-living and long-living strains. Common for all strains inadaptive reactions disclosed followed by compensative changes of development rate and resulted in reproductive disturbances and adult's life span decrease. The longitudinal observations of strains with altered life span undergoing to the repetitive heat stress at each developmental stage allowed revealing compensatory processes at the population level. There is trend of return to the reaction norm of all fitness traits in the origin strain. The biochemical parameters of stress-reaction and their variability dynamics allowed concluding that the repetitive events of stress during ontogenesis caused the adaptive reaction development directed to maintain the stable level of phenoloxidases system activity and catecholamines concentration in haemolymph as well as to suppress the transposone reproduction. Stress-reaction intensity decreased as the variability of its parameters evidenced the metabolic processes synchronization.
Conclusion: The necessity of immediate reaction rearrangement led to the significant developmental changes. The destabilization forced by environmental stress factors influence as showed via the analysis of wing geometric morphometry in undergoing to heat stress laboratory strains of house fly. All results obtained suggested the significance of compensatory adaptive reactions developed after the eustress as the inadaptive reactions for definition of life strategies and homeostasis maintenance at the levels of genome, organism and population or intrapopulation groups.
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