Pyrrolizidine alkaloids: morphogens regulating specifically the growth of androconial organs in several arctiine moths (Lepidoptera)

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... we are in search for co-operation partners ...

Morphogenesis in Creatonotos

While investigating chemical communities of butterflies and moths, Dietrich Schneider and M.B. (‘a while ago, i.e. back in 1981) found that the size of the core mata of the arctiines Creatonotos gangis and C. transiens varies with diet. Males from larvae reared on plants devoid of pyrro-lizidine alkaloids (PAs) or on artificial diet had minute scent organs though obvious (Figs 1, 2). There is a dose-de-pendent morphogenetic effect of these secondary plant metabolites, which is limited to the core mata; all of these secondary plant metabolites, dose-de-pendent morphogenetic effect which had access to PAs core mata do not emit pheromone while big males synthesize amounts of up to 500µg/male.

Creatonotos larvae are pharmacophagous

"Insects are pharmacophagous if they search for certain secondary (plant) substances directly, take them up and utilize them for a specific purpose. They are not primary plant metabolites or merely host recognition." E.g., various adult Lepidoptera forage for PAs independent of the nutritional requirements, store them for protection and use them as pheromone precursors.

For larvae of Creatonotos, pure PAs are feeding stimulants (Fig. 3). It is thus not only possible to bioassay the specificity of the receptor system by detecting PAs but also to make larvae con-some pure PAs in known amounts. It is also possible to use PAs as an in- ingredient of an artificial diet.

Creatonotos store plant PAs (partly modified) for defence, and males – via spermatophores – transfer these chemicals to the females.

Further cases

Teracotona, Aloia and Pericalla are arctiines from Africa and SE-Asia, respectively. Species of these genera have differently structured core mata, and we observe great variation in their size; in contrast to Creatonotos, the morphogenetic effect is less pronounced although obvious (Boppré et al. unpublished). Recently, Davenport & Conner published on a morphogenetic effect in Estigmene and more cases are likely to be found.

Research perspectives

We have four systems of specific and dose-dependent regulation of organ growth by non-nutritional secondary plant metabolites. We can rear them routinely, PAs can be fed quantitatively, pure PAs and metabolites are available for experiments, and methods to analyse PA-metabolites are established.

In our view, these systems are ideal for studying "Shaping Cells into Organs". However, basically, we are chemocologists and have neither experience nor equipment for doing cell cultures, with working with antibiotics, for genetic or enzyme studies etc. We therefore consider it wise to co-operate with a team competent in organogenesis.

If you are interested in co-operating, please, contact us!

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Selected references


