INTRODUCTION

In my PhD thesis I am engaged in determination and evaluation of effects of selected juvenoids and juvenogens[1] of various chemical structures on model insect species. These compounds were tested using topical and *per os* application on the red firebug, *Pyrrhocoris apterus* L., and applied via the broad bean, *Vicia faba* L., root system on the pea aphid, *Acyrthosiphon pisum* Harris. Then, based on result obtained from these assays, I considered the suitability of these compounds for aphid management and their potential impact on aphid predatory beetles (Coleoptera, Coccinelidae).

RESULTS

The most important data obtained from tests on *P. apterus* and *A. pisum* I presented in the article Jedlička et al. (2007):

The systemic effects of juvenoids on the red firebug *Pyrrhocoris apterus* and on the pea aphid *Acyrthosiphon pisum* with data on life table response

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Abstract

A series of juvenoid alcohols and their glycosidic derivatives (juvenogens), synthesized at the Institute of Organic Chemistry and Biochemistry (IOCB) in Prague, commercially used juvenoids and the natural derivatives of juvabione were evaluated for their systemic juvenilizing effect on the red firebug, *Pyrrhocoris apterus* L., and on the pea aphid, *Acyrthosiphon pisum* Harris. A life table response experiment was designed, and demographic characteristics were computed for a cohort of *A. pisum* following chronic exposure to a range of concentrations of the selected *trans*-isomer of carbamate juvenoid **8**.

Using the ratio of topical and *per os* activities, promising effects were found in two alkyl β-D-glucopyranosides (**3** and **9**) and the *trans*-isomer of carbamate juvenoid **8** in tests on *P. apterus*. In *A. pisum*, the highest systemic activity was found in tests

[1] Juvenoids – synthetic functional analogues of natural juvenile hormones; their chemical structure can differ substantially from that of the natural juvenile hormones
Juvenogens – hormonogen complexes composed of secondary juvenoid alcohols and a molecule of common organic compounds (e.g. monosaccharides or fatty acids); they usually display low or no biological activity in themselves and active juvenoid is liberated under abiotic or biotic conditions (Wimmer et al., 1997)

with the *trans*-isomer of carbamate juvenoid **8**. The longevity, the number of offspring per female and the number of offspring per reproducing female significantly decreased with concentrations of 0.05mg mL^{-1} and higher. While the net reproductive rate R_0 and the intrinsic rate of natural increase r_m displayed similar trends, the generation time G varied slightly between 11.6 and 12.8 days.

Expected systemic activity of glycosidic juvenogens in *P. apterus* was not confirmed by exposure of the pea aphid on broad bean treated with aqueous solutions of the compounds. Nevertheless, the carbamate juvenoid alcohol **8** displayed a considerable juvenilizing effect on *A. pisum* in screening tests. Furthermore, this compound indicated a sublethal effect as the realized fecundity *Ux* decreased disproportionately to the age-specific survival *Lx* with increased concentration. The population parameters are compared with the data in similar demographic studies and are discussed together with the possibilities of using the compounds of this structural type in practice.

Further work was published as a part of two articles dealing with synthesis of new juvenogens – Wimmer et al. (2007a, b). My contribution consisted in screening tests of these compounds on *P. apterus*. Therefore I briefly summarize these results together with another data from assays on this insect species in the following paragraph.

Tests of juvenoids and juvenogens on *Pyrrhocoris apterus*

Using both (topical and *per oral*) application methods I determined biological activity of 41 various juvenile hormone analogues (JHAs). Among them were 15 juvenoids (4 commercially available, 2 isolated from the balsam fir, *Abies balsamea* /L./ Mill. and 9 synthesized at IOCB) and 26 derived juvenogens (14 of esteric type and 12 of glycosidic type).

Comparison of efficiencies of juvenoids and their juvenogens of esteric type (derived from fatty acids and unsaturated esters) revealed the same or higher biological activity by topical application and always significantly lower effect when applied *per os*. With respect to the fact that the relative equal efficacy of juvenoids and their juvenogens means better topical action of juvenogens (when compared on molar basis), is esteric type of juvenogens promising for future research.

I confirmed high and solely systemic effect on *P. apterus* in glycosidic juvenogens derived from α,β-unsaturated esters. This phenomenon has been demonstrated already earlier on the cotton stainer, *Dysdercus cingulatus* (Fabricius) by Sláma et al. (1978). On the other hand this kind of derivatives designed from carbamate type of juvenoid showed, beyond relatively high systemic activity and topical effect too. A possible explanation could be a lower physical stability of these glycosidic compounds.

CONCLUSIONS AND FUTURE PROSPECTS

- On the basis of the results presented above I cannot recommend the tested glycosidic juvenogens as promising systemic insecticides against aphids. Their systemic activity exclusively by application in aqueous solution for hemipterous insects *D. cingulatus* and *P. apterus* remains as the sole functional model for future research and application.

- Only the *trans*-isomer of carbamate juvenoid (with marking W-331) proved the good systemic efficiency on *A. pisum*. Nevertheless, few facts emerged against contemplation of the further trials of this compound:

  1. The concentration of juvenoid that is responsible for significant reduction of aphid fertility is very high. This circumstance relates to possibilities of negative influence on aphid's native predators – ladybirds that are sensitive to JHAs.

  2. Biological activity of juvenoid W-331 on *A. pisum* determined in spray residue tests was neglectable in comparison with other assayed compounds (Kuldová, 1989).

  3. Based on first published data on biodegradation and ecotoxicity (Tykva et al., 2004), we cannot consider the juvenoid W-331 as appropriate for incorporation into the Insect Pest Management system.